



GARMIN®



**Cirrus Perspective Touch+™ by Garmin
Pilot's Guide**



Cirrus Vision SF50
Integrated Avionics System Pilot's Guide
System Software Version 2881.C6 or later

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This manual reflects the operation of System Software version 2881.C6 or later for the Cirrus Vision SF50. Some differences in operation may be observed when comparing the information in this manual to earlier or later software versions.

Garmin International, Inc.
1200 East 151st Street
Olathe, Kansas 66062, U.S.A.

Garmin (Europe) Ltd.
Liberty House, Hounsdown Business Park
Southampton, Hampshire SO40 9LR U.K.

Garmin AT, Inc.
2345 Turner Road SE
Salem, OR 97302, U.S.A.

Garmin Corporation
No. 68, Zhangshu 2nd Road
Xizhi District, New Taipei City, Taiwan

Contact Garmin Product Support or view warranty information at flygarmin.com.

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



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



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



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



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



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



WARNING: Do not use the indicated data link weather product age to 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 operate the weather radar in a transmitting mode when personnel or objects are within the MPEL boundary.

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

 **WARNING:** Do not consider the overflight of thunderstorms to be safe, as extreme turbulence may exist significantly above observed returns.

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

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

 **WARNING:** Do not 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.



WARNING: Always reset the altimeter setting when the Emergency Autoland system has been deactivated.



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.



CAUTION: Avoid areas on the radar display that appear “shadowed” (gray). The accuracy of the intensity of returns in the shaded areas should be treated as suspect. Exercise extreme caution, making maneuvering decisions with this information in mind.



CAUTION: In Standby mode, the antenna is parked at the center line. It is always a good idea to put the radar in Standby mode before taxiing the aircraft to prevent the antenna from bouncing on the bottom stop and possibly causing damage to the radar assembly.




CAUTION: When all display panes displaying weather radar are set to Standby Mode, the antenna is parked at the center line. It is always a good idea to put the radar in Standby Mode before taxiing the aircraft to prevent the antenna from bouncing on the bottom stop and possibly causing damage to the radar assembly.





NOTE: 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 89° North latitude and south of 89° South latitude. This is due to limitations present within the Terrain database and the system's ability to process the data representing the affected areas.
-
-  **NOTE:** 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:** 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 Emergency Autoland is activated, the system automatically declares an emergency using multiple communication methods.



NOTE: Upon activation, Emergency Autoland may notify Garmin and transmit aircraft flight data using the Iridium satellite network. Garmin will share this data with the aircraft's original equipment manufacturer and/or with relevant aviation authorities upon request.



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 G3000 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				
Part Number	Revision	Date	Page Range	Description
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190-02470-01	A	2/12/20	All	Production Release for GDU 21.20 Added more Notes, Warnings, Cautions to Front Matter Added GRA 55 Radar Altimeter Added 'own ship' note Added Visual Approach note Climb/Cruise/Descent is standard vice optional Added FMS Speed features Added Emergency Autoland
190-02470-02	A	10/19/21	All	Production Release for GDU 21.29 - Added GWX 75, GTC 585, GMU 44B, GTX 335DR throughout book. - Changed Vr speed bug from 90 to 85. - Audio and CNS updated to include 3D Audio and Adding/Selectin/Deleting Favorites. - FMS updated SurfaceWatch figures and procedures due to GTC 585 - AFCS updates including updaing GA Butttion to TO/ GA Button, corrected ALTS mode for Takeoff/Go Around, updated Table 7-5 (TO Pitch Ref, Go Around Ref, updated notes), and text heading differentiating Autothrottle and Autopilot Over/Under Speed Protection. - Additional Features: Moved ESP section before EAL section so that both are included in Autonomi, made Chartview and FlightCharts optional, updated 8.1 Intro section. added EAL Warning and Note, updated multiple figures, changed 'Send Again' to 'Resend' for Outbox msgs, updated to account for coupled go around, and other clerical updates.

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SECTION 1 SYSTEM OVERVIEW

1.1 SYSTEM DESCRIPTION

This section provides an overview of the Cirrus Perspective Touch+™ by Garmin Integrated Avionics System as installed in the Cirrus SF50 aircraft. It is an integrated flight control system that presents flight instrumentation, position, navigation, communication, and identification information to the flight crew using flat-panel color displays and Touchscreen Controllers. The system consists of the following Line Replaceable Units (LRUs):

- **GDU 1450W** (2) – The Garmin Display Unit (GDU) features a 14-inch light emitting diode (LED) Widescreen Ultra Extended Graphics Array (WUXGA) 1920 x 1200 resolution backlit display. The unit installed on the left/pilot side is configured as the Primary Flight Display (PFD). In normal operations, it shows a PFD Display, and may also show a Display Pane. The right/copilot unit is designated as the Multi Function Display (MFD). In normal operations, it shows the Engine Indication System (EIS) Display, in addition to one or two Display Panes. 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.
- **GDC 72** (1) and **GDC 72B** (1) – The Air Data Computer (ADC) processes data from the pitot/static system and outside air temperature (OAT) sensor and provides pressure altitude, density altitude, vertical speed, airspeed, mach number, OAT, and total air temperature data. The GDC 72B is designed to operate in Reduced Vertical Separation Minimum (RVSM) airspace. Each ADC is connected to the on-side GDU using an ARINC 429 connection, to the on-side and cross-side IAU using an ARINC 429 connection. An RS-232 backup path also connects each ADC to each on-side IAU.
- **GTC 580/585** (3) – The Touchscreen Controller provides PFD/MFD control, in addition to Flight Management System (FMS) functions, data entry capability, Standby Flight Display, and NAV/COM/audio control to the system. The unit installed on the left/pilot side is designated as GTC1. The unit installed in the center is designated as GTC2, and the one installed on the right/copilot side is GTC3. GTC1 and GTC3 are connected to the respective on-side GDU and to GTC2 via HSDB. GTC2 is also connected to the GMA with an HSDB connection. Only GTC1 provides the Standby Flight Display.
- **GMA 36B** (1) – The Audio Controller integrates navigation/communication radio (NAV/COM) digital audio, intercom, and marker beacon audio. The GMA is connected to GTC2 using an HSDB interface and to both IAU's via RS-232.
- **GIA 64W** (2) – The Integrated Avionics Units (IAU) function as the main communications hub, linking several LRUs with each on-side GDU. Each IAU 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.
- **GEA 71B** (1) – The Engine Airframe Unit receives and processes signals from the engine and airframe sensors. This unit communicates with both IAUs using an RS-485 digital interface.
- **GTX 345R** (1), **GTX 335DR** (optional as a second transponder) and **GTX 33D with ES** (optional as a second transponder) – The solid-state transponder(s) provide Modes A/C/S capability, 1090 MHz Extended Squitter Automatic Dependent Surveillance-Broadcast (ADS-B) transmission. The GTX 345R provides ADS-B In/Out. The GTX 335DR and the GTX 33D with ES also feature diversity. The transponder(s) communicate with both IAUs through an RS-232 digital interface. The GTX 345R also communicates with the IAUs through an HSDB interface via IAU #2.

- **GRS 79** (2) – The Attitude and Heading Reference System (AHRS) provides aircraft attitude and heading information via ARINC 429 protocol to the on-side and cross-side IAU, and to the on-side GDU. An RS-232 backup path connects each AHRS to each IAU. The AHRS contains advanced sensors (including accelerometers and rate sensors) and interfaces with the Magnetometer to obtain magnetic field information, with the ADC to obtain air data, and with both IAUs to obtain GPS information. AHRS operation is discussed in System Operation, later in this section.
- **GMU 44/44B** (2) – The Magnetometer measures local magnetic field and sends data to the AHRS for processing to determine aircraft magnetic heading. The magnetometer receives power directly from the AHRS and communicates with it via an RS-485 and RS-232 digital interface.
- **GRA 55** (1) – The GRA 55 provides altitude above the ground information to other avionics functions and (optionally) to the displays as radio altitude.
- **GDL 69A SXM** (1) (optional) – The SiriusXM Datalink Receiver receives weather information, as well as digital audio entertainment. The Datalink Receiver communicates with the #3 GTC and optional GDL 59 via a HSDB connection. A subscription to SiriusXM Weather and/or SiriusXM Satellite Radio service is required to enable the GDL 69A SXM capability.
- **GMC 707** (1) – The Automated Flight Control System (AFCS) Controller provides AFCS control through an RS-232 digital interface. The unit connects to both the PFD and MFD.
- **GMC 708** (1) (optional) – The Autothrottle (AT) Controller provides AT control through an RS-232 digital interface. The unit connects to the PFD and MFD.
- **GSA 9000** (1) – The GSA 9000 Servo is used for automatic control of pitch including stick pusher functionality. The GSA 9000 connects to each IAU using an RS-485 interface.
- **GSA 80 HS** (1) – The GSA 80 HS Servo is used for the yaw stability augmentation system (SAS). This servo is connected to each IAU using an RS-485 interface.
- **GSA 81** (4) – The GSA 81 Servos are used for automatic control of roll, pitch trim, throttle, and an optional part-time yaw damper. These servos are connected to each IAU using an RS-485 interface.
- **GWX 70/75** (1) (optional) – The Weather Radar provides airborne real-time weather and ground mapped radar data to the displays. The unit is connected to the MFD with an HSDB connection.
- **GTS 855** (1) (optional) – The GTS 855 Traffic Alert and Collision Avoidance System I (TCAS I) uses active interrogations of Mode S and Mode C transponders to provide traffic data to the pilot independent of the air traffic control system. It is connected to the PFD via HSDB.
- **GDL 59** (1) (optional) – The WiFi Datalink provides a datalink and System Data Logging capability. The unit is connected to the optional SiriusXM Datalink Receiver via HSDB, and to the optional GSR 56 Iridium Transceiver using an RS-232 bus and a digital/analog connection.
- **GSR 56** (1) (optional) – The Iridium Transceiver provides voice communications by means of the pilot and copilot headsets in the cockpit. The transceiver can also send and receive short message service (SMS) text messages. The GSR also receives data link weather products from the optional Garmin Connex weather service through the Iridium satellite network. The transceiver can also send and receive data provided by the optional GDL 59 through the RS-232 bus.
- **Flight Stream 510** (1) – The Bluetooth Transceiver provides wireless Bluetooth® connectivity between a compatible mobile device and the avionics system.

The SF50 is also equipped with a Garmin AFCS and optional AT, which includes the Flight Director (FD), Autopilot (AP), pitch and roll trim, manual electric trim (MET), yaw damper (YD), and throttle control functions.



NOTE: Refer to the Automatic Flight Control System (AFCS) Section for details on the Garmin AFCS and AT.

Figure 1-1 shows interconnection of the LRUs.



NOTE: For information on optional equipment not shown in Figure 1-1, consult the applicable optional interface user's guide. This document assumes the reader is already familiar with the operation of this additional equipment.

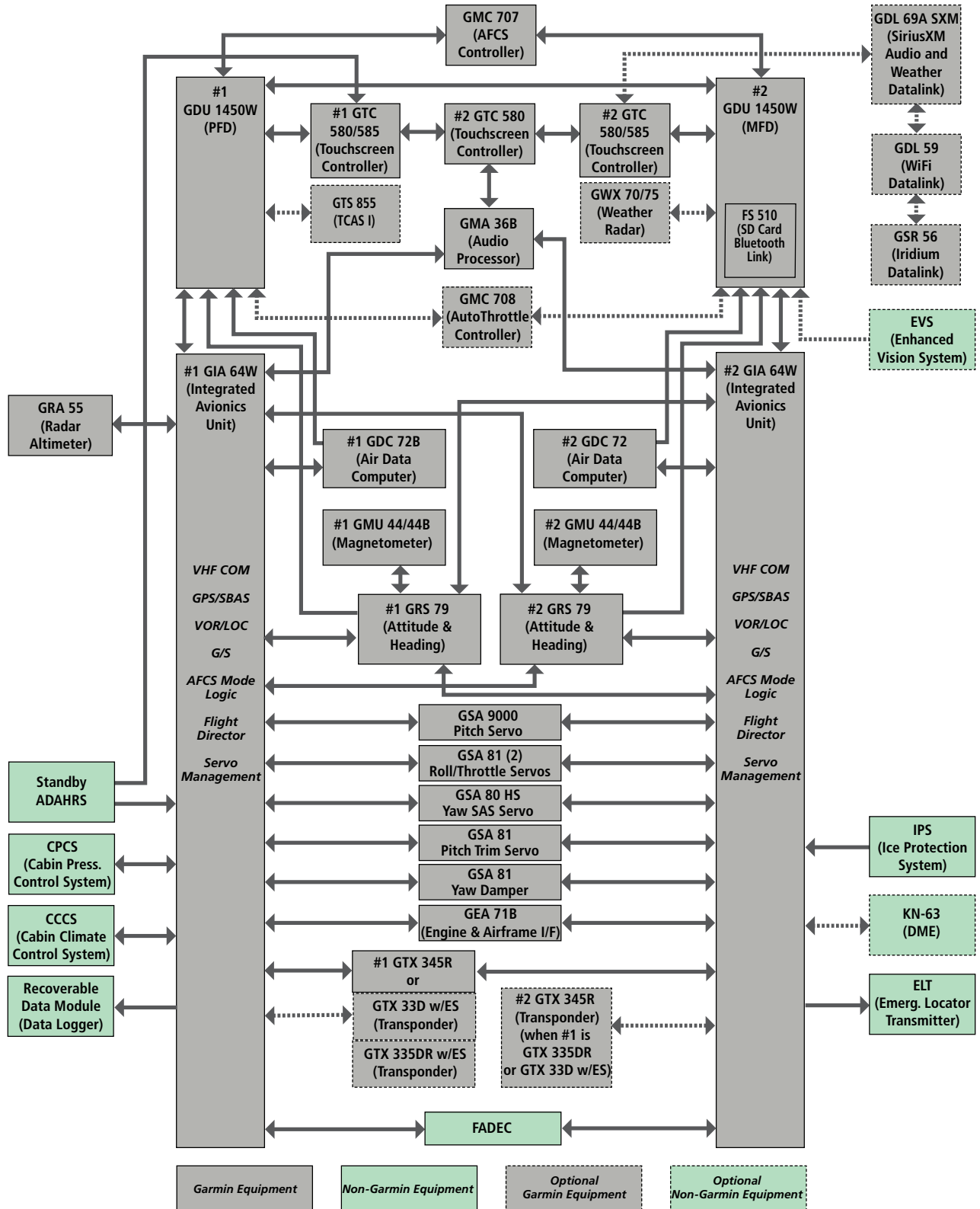


Figure 1-1 LRU Block Diagram

1.2 SYSTEM CONTROLS

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

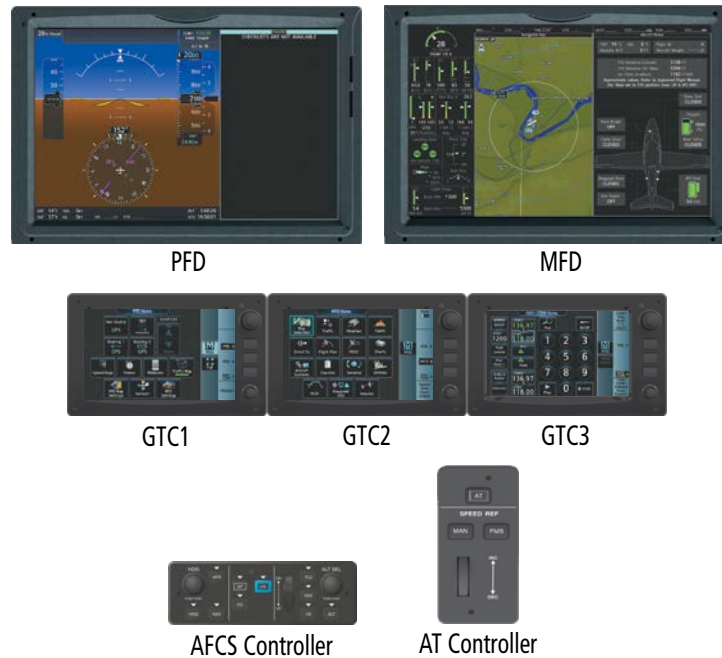


Figure 1-2 Cirrus Perspective Touch+™ by Garmin System Controls

TOUCHSCREEN CONTROLLER

The three Touchscreen Controllers, designated from left to right as GTC1, GTC2, and GTC3, are a pedestal-mounted user interface allowing for ease of data entry, as well as operation of the PFD, Display Panes, and NAV/COM system. Many procedures in this Pilot's Guide are performed using the Touchscreen Controllers. In addition, GTC1 provides a Standby Flight Display in the event of certain display or sensor failure conditions.

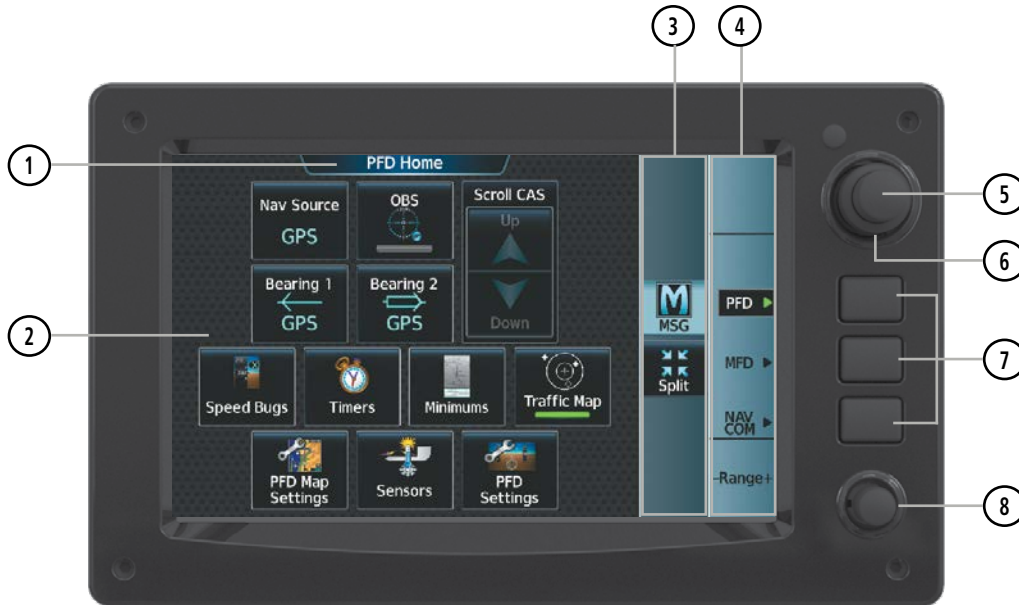


Figure 1-3 Touchscreen Controller

- 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**, etc.)
- 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, Data Entry/map panning)
- ⑦ **Softkeys** Provides functions as labeled on the Label Bar (e.g. PFD/MFD/NAV COM Control Mode 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.






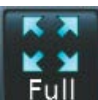







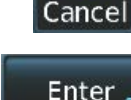

In normal operations, all Touchscreen Controllers can control the PFD and NAV/COM system. In addition, GTC2 can control Display Panes on both the MFD, and on the PFD when the PFD is showing a Display Pane in Split Mode. The pilot selects a control mode for a given controller (i.e. PFD, MFD, NAV/COM) 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's 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 pilot or system input. At the top level of each mode is a corresponding Home Screen containing mode-specific controls. 'PFD Home' is the Home Screen for PFD control mode. 'MFD Home' is the Home Screen for MFD (i.e. Display Pane) control mode. 'NAV/COM Home' is the Home Screen for NAV/COM control mode.

All of the Touchscreen Controller's available functions for the selected control mode are accessible from the Home Screen. The Home Screen may be accessed any time it is not currently displayed by touching the **Home** Button in the Button Bar on the right side of the screen area. Procedures in this Pilot's Guide generally begin from the Home Screen as a reference point; however it is not necessary to return to the 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 Home Screen. If the Home Screen was the previous screen, pressing either the **Back** or **Home** Button will also return to the Home Screen.

If the system issues a message, the **MSG** Button is shown on the Button Bar. Touching this button will display the 'Notifications' Screen. The Button Bar also contains buttons for controlling the size of MFD Display Panes (Full or Half Mode) and whether a Pane is shown on the PFD (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.		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 'MFD 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 Connex 'Notifications' Screen on the Touchscreen Controller. Flashes when a new Connex message is received.		

In addition, the Button Bar displays buttons for Warning and Caution conditions. Refer to the Appendices Section for more information about the alerting system.

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.

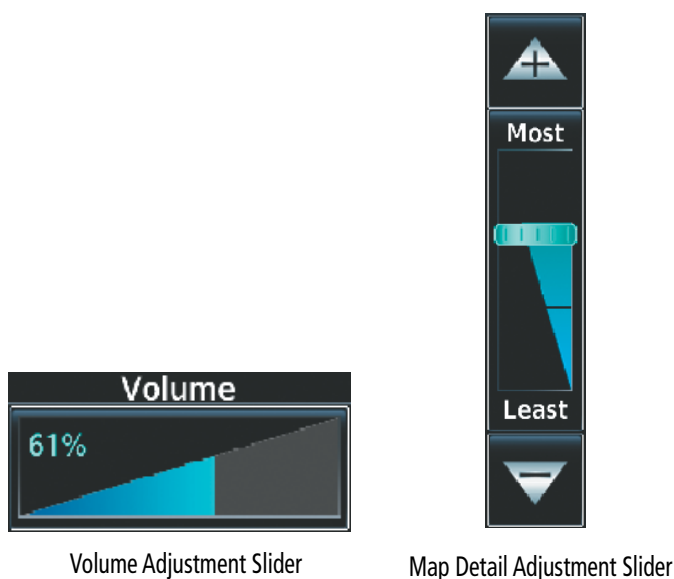


Figure 1-4 Sliders on the Touchscreen Controller

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 1-5 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 1-6 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 1-7 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.

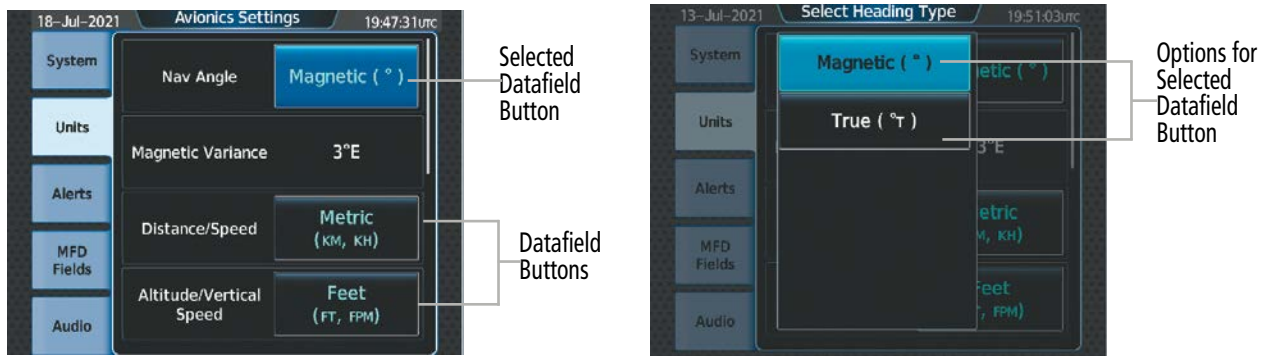


Figure 1-8 Touchscreen Controller Datafield Buttons

If a system failure causes a button’s 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.

MFD MODE TOUCHSCREEN CONTROLLER SCREENS

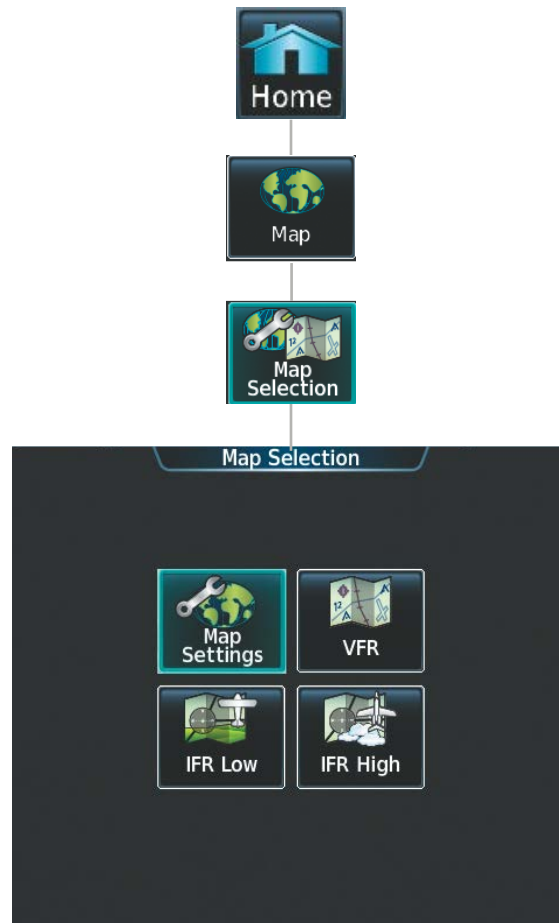
MFD Home



 Map or  Map Selection	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.
 Traffic or  Traffic Settings	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.
 Weather or  Weather Selection	Shows a 'Weather <SiriusXM, Connex, or Radar>' 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.

	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.
<p>or</p>	
	Accesses 'Direct To' Screen on Touchscreen Controller.
	Accesses 'Active Flight Plan' Screen on the Touchscreen Controller. A Flight Plan display is shown on the selected Display Pane.
	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, Position Reports, and Contacts.
	Accesses the 'Utilities' Screen on Touchscreen Controller. Includes Trip Planning functions, Minimums, Trip Statistics, Timer, Scheduled Messages, GPS Status, 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.
	Button shown on MFD Home when SurfaceWatch option is installed. Accesses the 'PERF' Screen. Provides controls for entering takeoff, landing, and weight and balance data and speed bugs.
<p>or</p>	Button shown on MFD Home when SurfaceWatch option is not installed. Shows 'Speed Bugs' Screen for controlling the display of Vspeed Reference Bugs on the PFD.
	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.

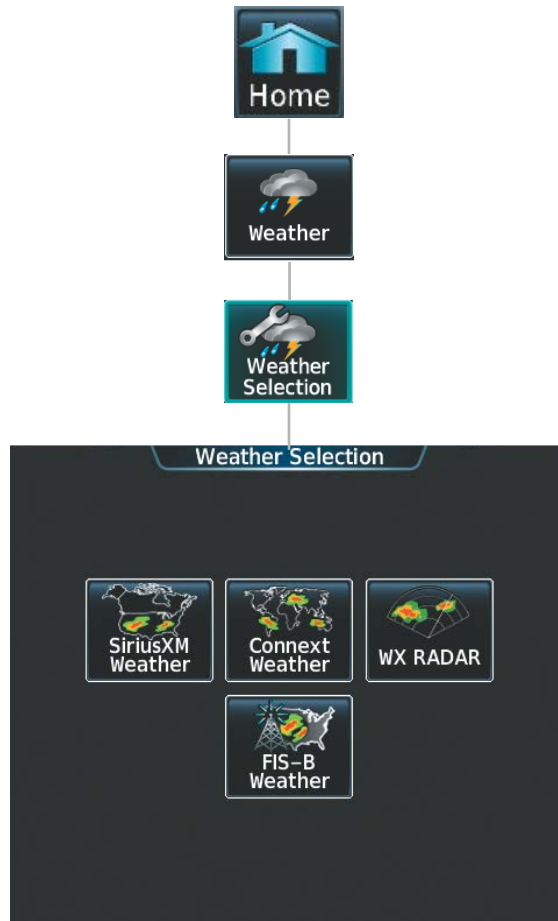
MAP SELECTION SCREEN



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.

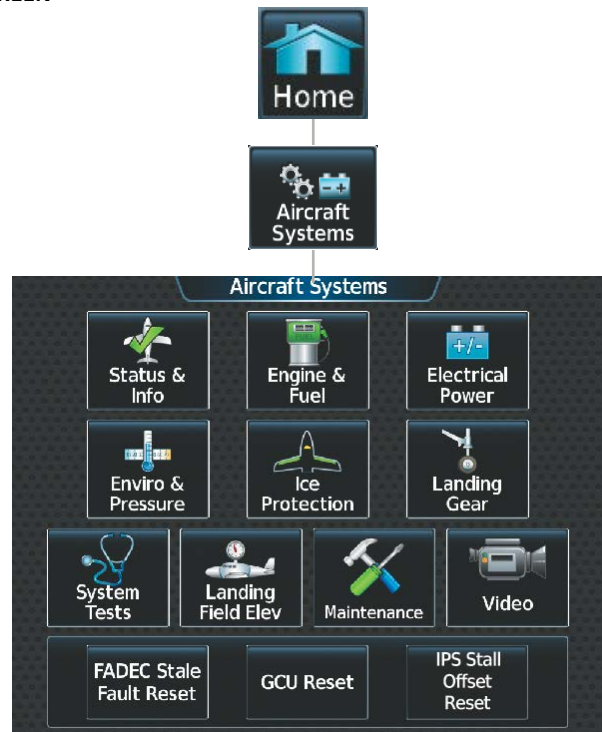
Touching the **VFR**, **IFR Low**, or **IFR High** Buttons will respectively display the 'VFR', 'IFR Low', or 'IFR High' Panes. After touching the **IFR Low** or **IFR High** Button, the button name will change to 'IFR Low Settings' or 'IFR High Settings' respectively. Touching either settings button 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', 'WX RADAR' 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 which are each discussed in the Hazard Avoidance Section.

AIRCRAFT SYSTEMS SCREEN



	<p>Shows the 'Aircraft Status' Pane, with synoptic information about the aircraft doors, brakes, oxygen and IPS fluid quantities. Also shows approximate values and parameters for certain performance calculations.</p>
	<p>Shows the 'Engine/Fuel' Pane, with information about the fuel quantities, flow, pressures, temperatures, valve and pump states, FADEC mode, and filter conditions.</p>
	<p>Shows the 'Electrical' Pane, with information about the batteries, generators, and electrical buses.</p>
	<p>Shows the 'Environmental' Pane, with information about the oxygen system, cabin temperature, bleed systems, condenser, compressor, and fans.</p>
	<p>Shows the 'Ice Protection' Pane, with synoptic information about the ice protection system, pitot and AOA heat.</p>
	<p>Shows the 'Landing Gear' Pane, with synoptic information about the landing gear positions, weight on wheels (WOW) sensor status, pump status, parking brake status, and hydraulic pump fluid temperature.</p>
	<p>Displays the 'System Tests' Screen. This screen provides controls for testing the following systems: Fire, Stall Warning, and optional TAWS.</p>
	<p>Shows the 'Landing Field Elevation' Screen. Provides controls for entering the landing field elevation, and selecting the source of landing field elevation data.</p>
	<p>Provides functions accessible to maintenance personnel with password.</p>

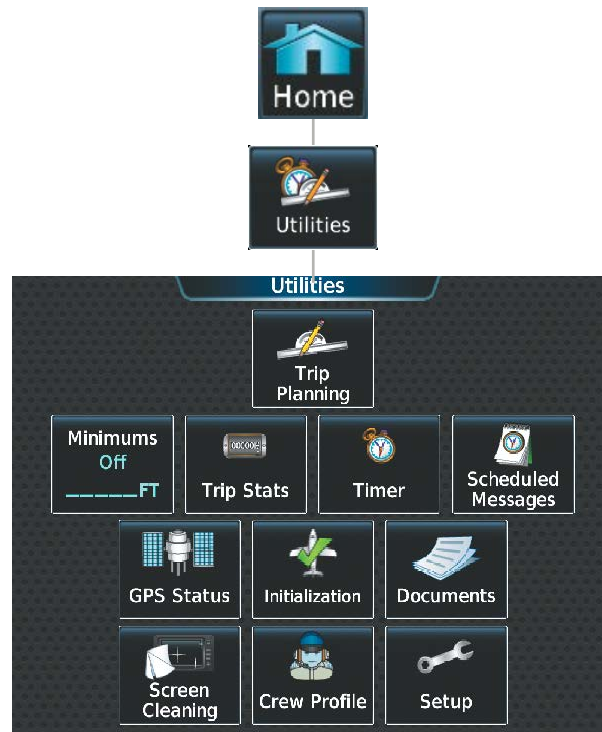
<p>Video</p>	<p>Shows the 'Video' Pane (optional) in the selected Display Pane. Provides controls for adjusting EVS video on the display (brightness, contrast, saturation).</p>
<p>FADEC Stale Fault Reset</p>	<p>Issues a request to reset (clear) all inactive/stale FADEC faults.</p>
<p>GCU Reset</p>	<p>Issues a request to reset the Generator Control Unit (GCU).</p>
<p>IPS Stall Offset Reset</p>	<p>Issues a request to reset the icing configuration stall speed high notification.</p>

SERVICES SCREEN



<p>Music</p>	<p>The 'Music' Screen provides controls for the optional SiriusXM Satellite Radio including channel information, selection, and volume settings.</p>
<p>Position Reports</p>	<p>Accesses the optional 'Connex Position Reports' Screen. Provides controls for sending automatic or manual position reports.</p>
<p>Contacts</p>	<p>Accesses the optional 'Contacts' Screen for management of contact information including phone and email addresses. Also provides quick access to stored contacts via phone, SMS, or email.</p>
<p>Telephone</p>	<p>The 'Telephone' Screen (available with the Iridium voice telephone option) shows the status of the Iridium satellite telephone connection and provides telephone controls.</p>
<p>SMS Text</p>	<p>The 'SMS Text Messaging' Screen (available with the Iridium voice telephone option) provides management of incoming and outgoing SMS (short message service) text messages.</p>

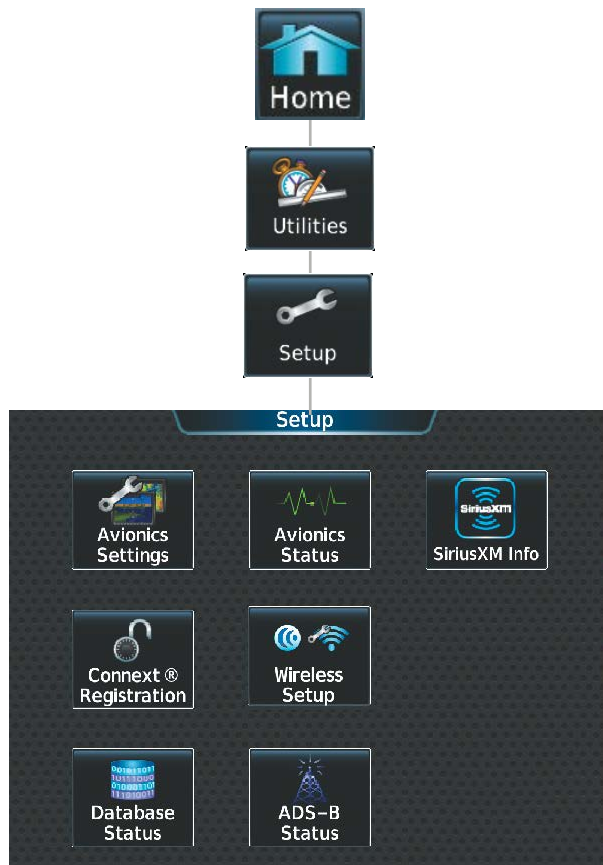
UTILITIES SCREEN






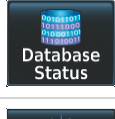

	<p>Button shown on the 'Utilities' Screen when the SurfaceWatch option is not installed. Displays the 'Weight and Balance' Screen for entering weight and fuel information and performing computations. Shows the 'Weight and Balance' Pane on the MFD in Full or Split Mode, whichever is currently selected.</p>
	<p>Shows the 'Trip Planning' Pane in the selected Display Pane, and accesses the 'Trip Planning' Screen on the Touchscreen Controller.</p>
	<p>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.</p>
	<p>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, and Average Wind Direction. Also provides settings for resetting trip statistics.</p>
	<p>Accesses the 'Timer' Screen on the Touchscreen Controller. Controls the timer on the PFD.</p>
	<p>Used to create custom messages to be displayed one-time or periodically. The Touchscreen Controller displays these System Messages on the 'Notifications' Screen.</p>
	<p>Accesses the 'GPS Status' Screen for control of GPS sensors. Shows the 'GPS Status' Pane in the selected Display Pane.</p>
	<p>Displays the 'Initialization' Screen on the Touchscreen Controller. Provides controls for selecting the Crew Profile, checking Database Status, System Tests, Initial Fuel, Weight and Balance, Flight Plan, and optional Takeoff Data.</p>

<p>Documents</p>	Shows optional controls for viewing electronic documents on the Touchscreen Controller, and displays documents in the selected Display Pane.
<p>Screen Cleaning</p>	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.
<p>Crew Profile</p>	Displays 'Crew Profile' Screen, which provides controls for activating and managing crew profiles.
<p>Setup</p>	Displays the 'Setup' Screen, which provides controls for avionics settings and status, data link settings, WiFi settings, and for displaying the status of avionics databases.

SETUP SCREEN



<p>Avionics Settings</p>	Provides controls for changing system avionics settings, such as, time format, units of measure, airspace alert settings, and MFD Data Bar Fields.
<p>Avionics Status</p>	Displays information on the Touchscreen Controller for installed LRUs, system software, and databases.

	<p>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.</p>
	<p>Used to register with the optional Garmin Connex. Also provides information on current Connex registration.</p>
	<p>Provides controls for Connex® settings and for selecting available wireless networks, and for storing favorite wireless hotspots. Also provides controls used to access Connex functionality when configured with the Bluetooth Transceiver.</p>
	<p>Provides access to the 'Database Status' Screen for checking database cycle information.</p>
	<p>Provides access to the optional 'ADS-B' Status Screen for information on the reception of ADS-B services.</p>

PERF SCREEN

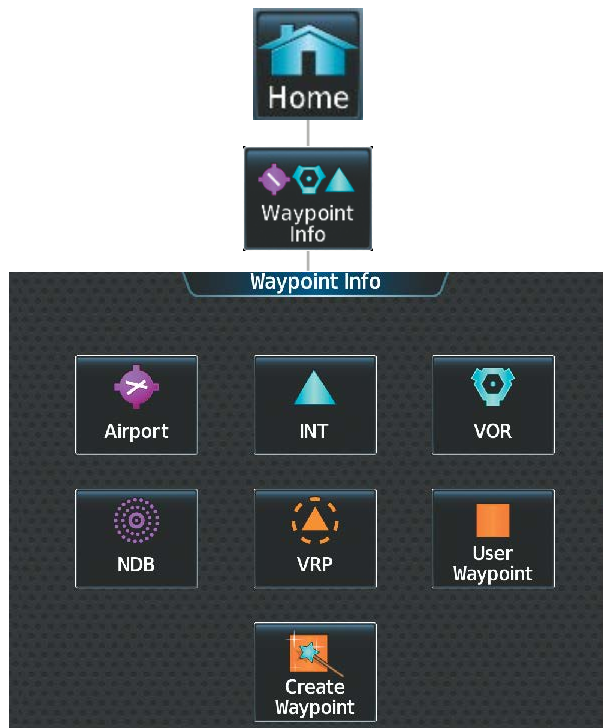


NOTE: SurfaceWatch option required for 'PERF' Screen to be shown.



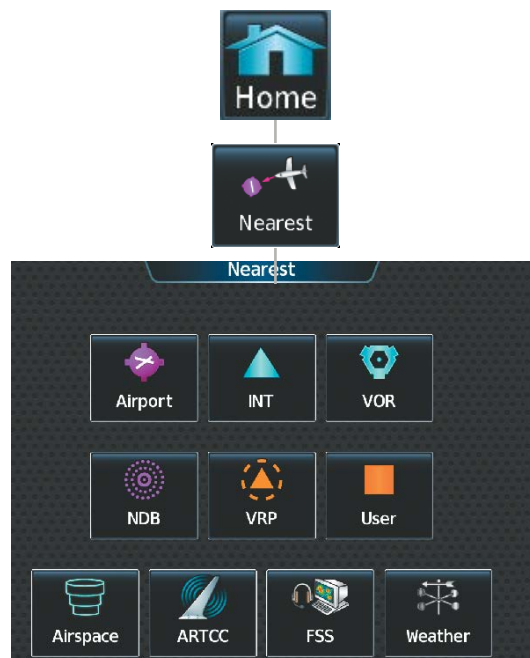
Aircraft takeoff, landing, and performance related functions, settings, and processes for the buttons within the 'PERF' Screen are discussed in the Flight Management Section.

WAYPOINT INFO SCREEN



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

NEAREST SCREEN






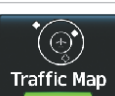
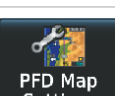
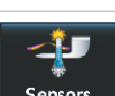

Functions, settings, and processes for the buttons within the ‘Nearest’ Screen are discussed in the Flight Management Section.

PFD MODE TOUCHSCREEN CONTROLLER SCREENS

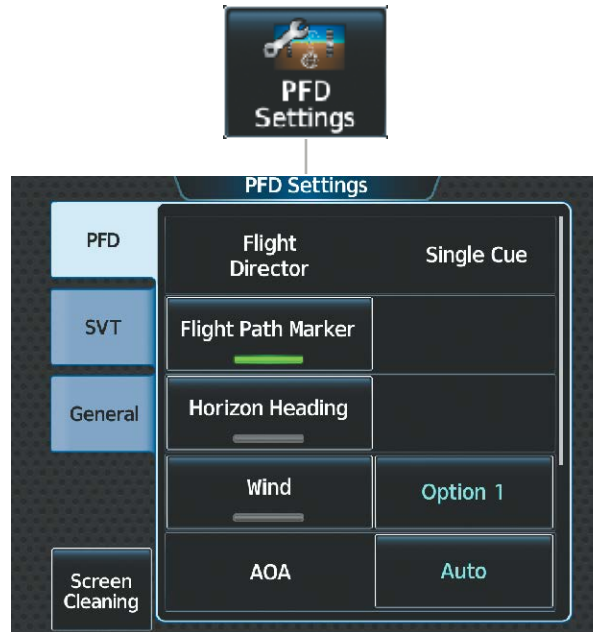
PFD HOME



	<p>Cycles through GPS, LOC1/VOR1 and LOC2/VOR2 navigation modes on the CDI</p>
	<p>Selects OBS mode on the CDI when navigating by GPS (only available with active leg). When OBS is active the annunciator is green.</p>
<p>or</p>	<p>Selects SUSP mode on the CDI when navigating by GPS. When SUSP is active the annunciator is green.</p>
	<p>Cycles the Bearing 1 through OFF, NAV1, NAV2, and GPS.</p>
	<p>Cycles the Bearing 2 through OFF, NAV1, NAV2, and GPS.</p>
	<p>Scrolls CAS messages up and down. Buttons subdued unless scrolling is necessary to see all active CAS messages.</p>

 <p>Speed Bugs</p>	<p>Accesses the 'Speed Bugs' Screen on Touchscreen Controller, where the speed bugs can be configured.</p>
 <p>Timers</p>	<p>Accesses the 'Timer' Screen on the Touchscreen Controller. Controls timer on PFD.</p>
 <p>Minimums</p>	<p>Accesses the 'Minimums' Screen on the Touchscreen Controller. Set MDA or DH.</p>
 <p>Traffic Map</p>	<p>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.</p>
 <p>PFD Map Settings</p>	<p>Accesses the 'PFD Map Settings' Screen on the Touchscreen Controller. The Inset Map is not available when in split mode.</p>
 <p>Sensors</p>	<p>Accesses the 'Sensors' Screen. Allows for manual selection of ADC and AHRS sensors.</p>
 <p>PFD Settings</p>	<p>Accesses the 'PFD Settings' Screen to view or set PFD Mode, AOA, Flight Director Active Format, SVT Terrain, SVT Pathways, Flight Path Marker, Horizon Heading, SVT Airport Signs, Wind, Time Format, Time Offset, COM Channel Spacing, Baro Select Units, Meters Overlay, and Screen Cleaning function.</p>

PFD Settings



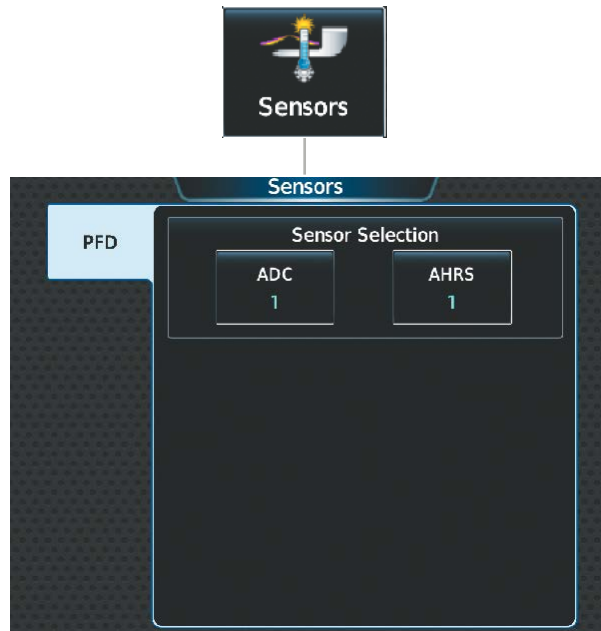
Screen Cleaning Deactivates touch input on the Touchscreen Controller to facilitate cleaning. Press or turn a knob on the controller to resume touch input.

PFD SETTINGS

	<p>Selects the display mode for the Angle of Attack (AOA) indicator on the PFD.</p> <p>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.</p> <p>On: Displays AOA indicator on the PFD.</p> <p>Off: Removes AOA indicator from the PFD.</p>
	<p>Shows the type of Flight Director available. Single Cue is the only available format.</p>
	<p>Enables/disables synthetic terrain depiction. When Enabled, the annunciator is green.</p>
	<p>Enables/disables synthetic terrain pathways depiction. When enabled, the annunciator is green. When synthetic terrain is disabled, button is subdued.</p>
	<p>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.</p>
	<p>Enables/disables the display of position markers for airports within approximately 15 nm of the current aircraft position. Airport identifiers are displayed when the airport is within approximately 9 nm. When Enabled, the annunciator is green. Button is subdued when synthetic terrain is disabled.</p>
	<p>Enables/disables the WireAware depiction on the PFD. When enabled, the annunciator is green. When synthetic terrain is disabled, button is subdued.</p>

	<p>Option 1: Wind direction arrows with headwind and crosswind components Option 2: Wind direction arrow and speed Option 3: Wind direction arrow with direction and speed Off: Wind information not displayed.</p>
	<p>Selects the Time Format: Local 12hr, Local 24hr, or UTC</p>
	<p>Displays the Local and UTC time offset.</p>
	<p>Selects the COM Channel Spacing: 25 kHz or 8.33 kHz</p>
	<p>Inches (IN): Displays the BARO setting as inches of mercury. Hectopascals (HPA): Displays the BARO setting as hectopascals.</p>
	<p>Enables/disables the display of the meter overlay on the Altimeter.</p>

PFD Sensors



	<p>Accesses the 'ADC Sensor' Screen where the #1 or #2 Air Data Computer (ADC) can be manually selected.</p>
	<p>Accesses the 'AHRs Sensor' Screen where the #1 or #2 AHRs sensors can be manually selected.</p>

CONTROLLING DISPLAY PANES

In normal operations, the pilot uses GTC2 to select and control Display Panes in MFD control mode. The system highlights the border of the selected display pane being controlled in cyan. 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 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.

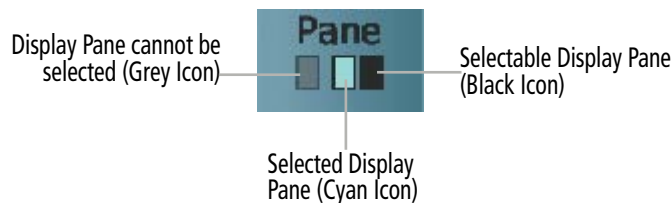


Figure 1-9 Touchscreen Controller Display Pane Control Icons

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). The MFD Full and Half Modes are not available in Reversionary Mode.

When the system is powered-up 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 'MFD Home' Screen on the Touchscreen Controller.

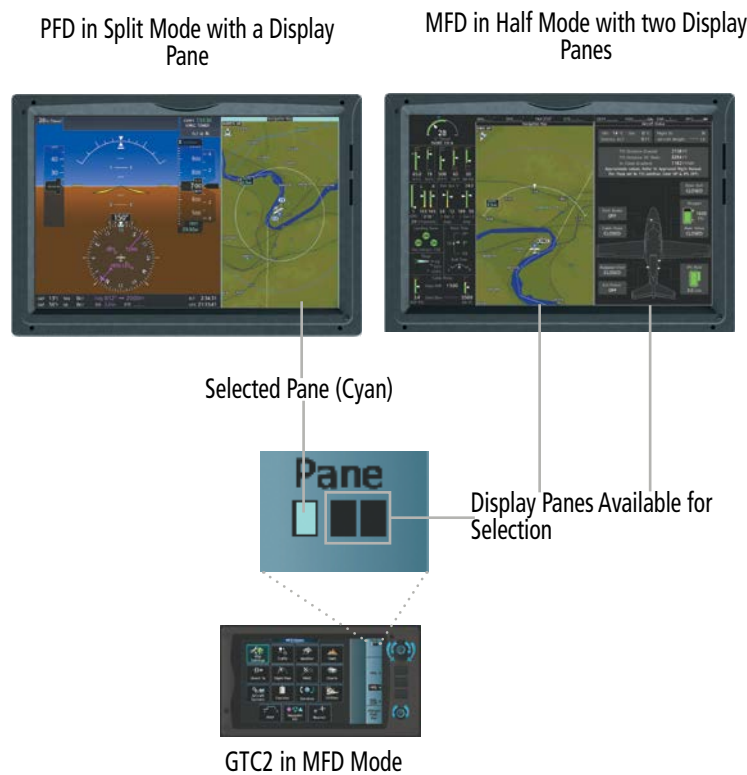


Figure 1-10 GTC2 Display Pane Control from the MFD Home Screen (PFD Split Mode active)

PFD in Full Mode (no Display Pane)

MFD in Half Mode with two Display Panes

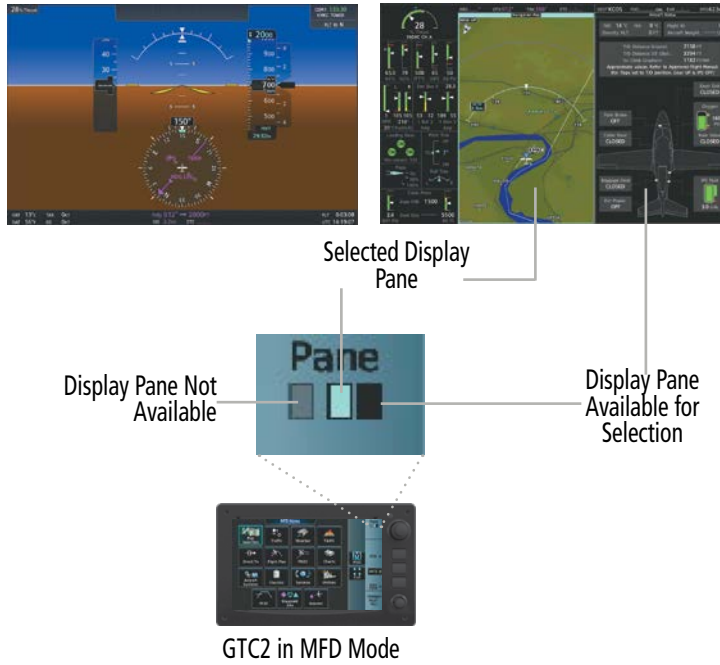


Figure 1-11 GTC2 Display Pane Control from the MFD Home Screen (MFD Half Mode active)

PFD in Full Mode (no Display Pane)

MFD in Full Mode with one Display Pane

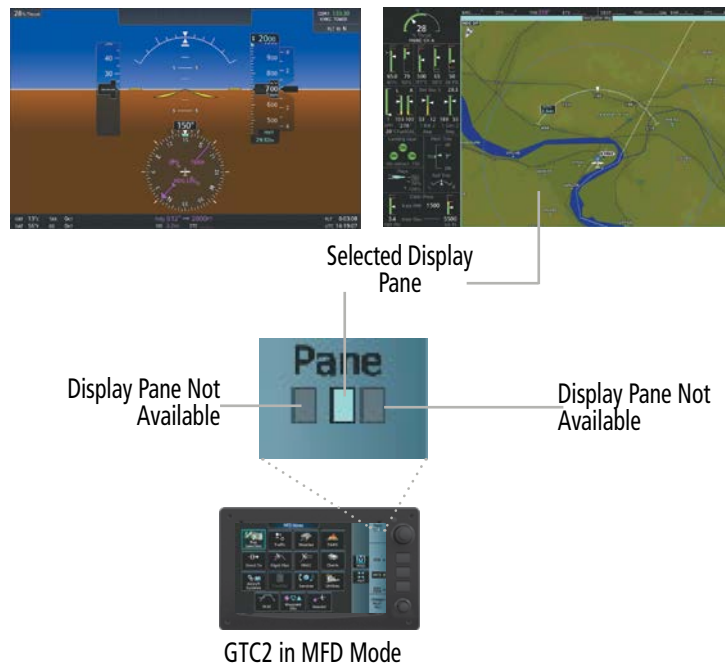


Figure 1-12 GTC2 Display Pane Control from the MFD Home Screen (MFD Full Mode active)

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's 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 1-13 Entering Text on the Keypad

Using the Touchscreen Controller's 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.

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, 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.

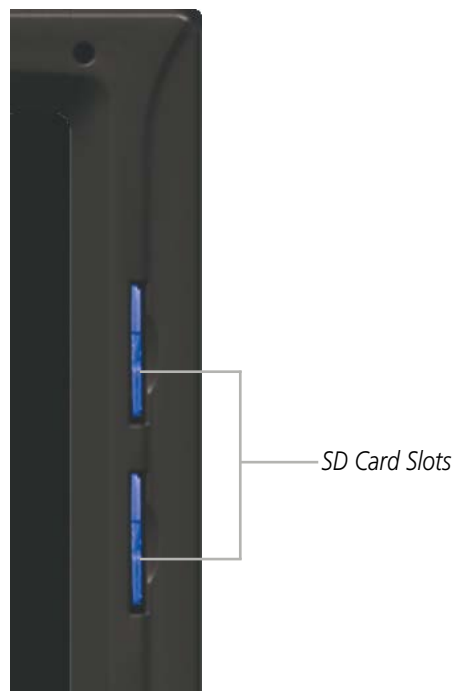


Figure 1-14 Display Bezel SD Card Slots

1.3 SYSTEM OPERATION

The displays are connected via 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, 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 should display valid attitude and altitude typically 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 shows a “NO GPS POSITION” banner announcement. When the system has acquired a sufficient number of satellites, the aircraft’s current position appears on any displayed navigation maps.

GTC1 displays the ‘PFD Home’ Screen. GTC2 displays the ‘Initialization’ Screen. GTC3 shows the ‘NAV/COM Home’ Screen.

NORMAL OPERATION

PFD AND MFD

In normal operations, the PFD presents 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 inboard portion of the PFD.

PFD in Split Mode with a Display Pane



MFD Operating in Half Mode with Two Display Panes




Figure 1-15 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 operations, all Touchscreen Controllers can control the PFD and NAV/COM functions. The middle Touchscreen Controller can also control Display Panes on both the PFD and MFD when MFD Mode is selected on this controller using the **MFD** Softkey. The large and small upper knobs on the middle Touchscreen Controller selects a Display Pane for control in MFD Mode. Turning either knob clockwise moves the cyan pane selection highlight to the right, and turning either 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 PFD 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.

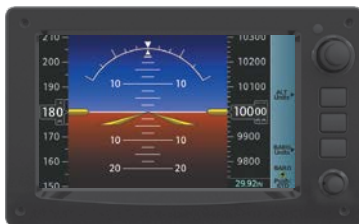
PFD Failed



MFD Operating in Reversionary Mode



GTC1 in Standby Flight Display Mode



GTC2



GTC3



Figure 1-16 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 and GTC3 provide the PFD, MFD pane, 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 'PFD Home' Screen and 'MFD 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 GTC1 or GTC3 fails or is off-line, GTC2 continue to provide the same control modes as were previously available (PFD, MFD, 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 GTC2 fails or is off-line, GTC3 provides MFD control mode in addition to the PFD and NAV/COM control modes available prior to the failure. GTC1 operates normally if GTC2 fails.

If two Touchscreen Controllers have failed or are off-line simultaneously, the PFD, MFD, and NAV COM control modes are available on the remaining Touchscreen Controller. Functions may be limited if this occurs, as data paths may not be available.

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

AHRS OPERATION



NOTE: Refer to Appendix A for specific AHRS alert information.



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

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

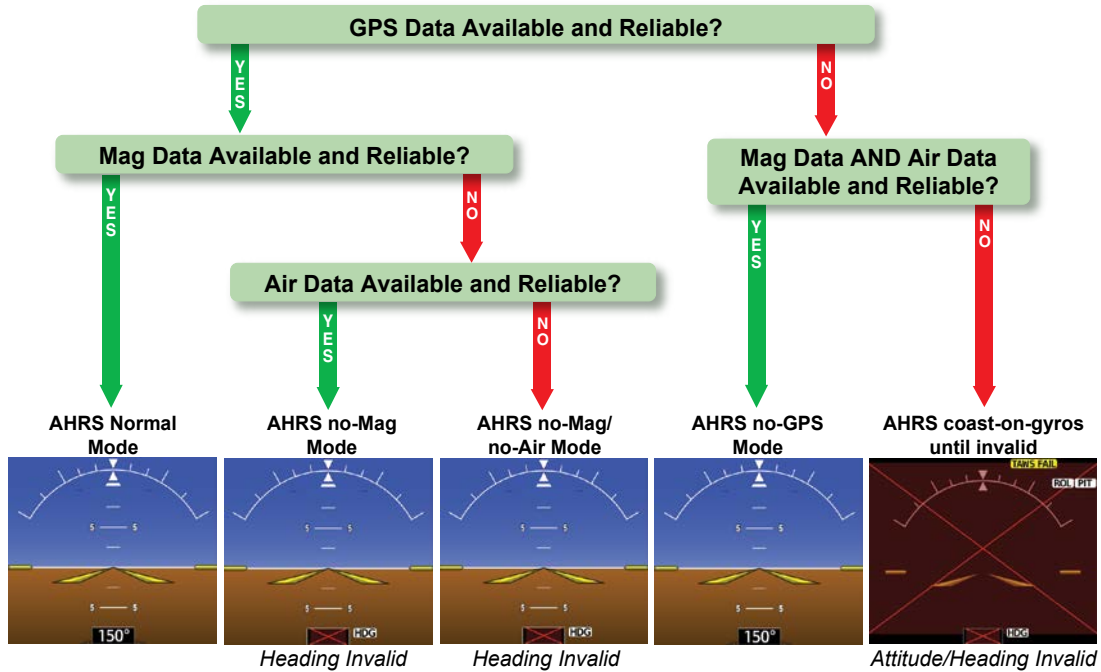


Figure 1-17 AHRS Operation

GPS INPUT FAILURE



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

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

MAGNETOMETER FAILURE

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

AIR DATA INPUT FAILURE

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

MAGNETIC FIELD VARIATION DATABASE

The AHRS corrects for shifts and variations in the Earth's magnetic field by applying the Magnetic Field Variation Database. The Magnetic Field Variation Database is derived from the International Geomagnetic Reference Field (IGRF). The IGRF is a mathematical model that describes the Earth's main magnetic field and its annual rate of change. The database is updated approximately every five years. See the Appendices for information on updating the Magnetic Field Variation Database. The system will prompt the 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.

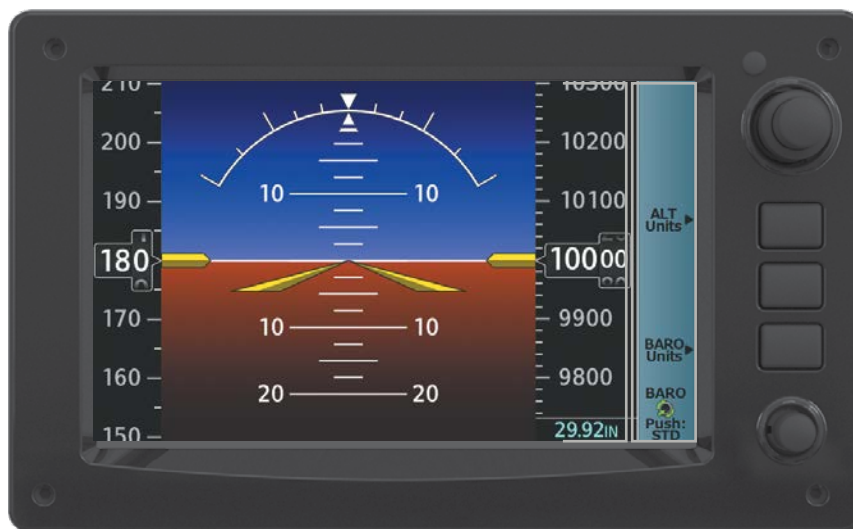


Figure 1-18 GTC1 with Standby Flight Display

The SFD shows the airspeed, altitude and attitude of the aircraft. Standby ADARS (Air Data Attitude Reference System) data is fed to the Standby Flight Display from a non-Garmin standby ADARS 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.

REVERSIONARY AHRS AND ADC SENSOR OPERATIONS

The system monitors AHRS and air data from redundant sensors. In normal operations, the PFD and MFD use attitude/heading data from AHRS1 and air data from ADC1. If another sensor is selected, either manually or automatically, an annunciation appears above the Roll Scale on the PFD.



Figure 1-19 PFD with Reversionary Sensor Annunciations

The ‘Sensors’ Screen on the Touchscreen Controller provides **AHRS1**, **AHRS2**, **ADC1**, and **ADC2** Buttons for selection. Additional buttons for selecting the standby sensor (**STBY**) are not shown in normal operations.



Figure 1-20 Sensors Screen

If the AHRS1 or ADC1 sensors fail, and the aircraft is in the air, the system automatically selects the appropriate AHRS2 or ADC2. If both AHRS sensors fail, or if both ADCs fail, the system automatically selects the appropriate standby sensor, and the **STBY** Button appears on the ‘Sensors’ Screen. The standby sensor remains selected until the flight crew manually select a non-standby AHRS or ADC button.



NOTE: In the case of certain types of sensor failures, the system may make sensor selections automatically. Refer to the Appendices for more information about reversionary AHRS and ADC sensor annunciations.

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.

These GPS sensor annunciations are most often seen after system power is applied when one GPS receiver has acquired satellites before the other, or one of the GPS receivers has not yet acquired an SBAS (Satellite Based Augmentation System) 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.

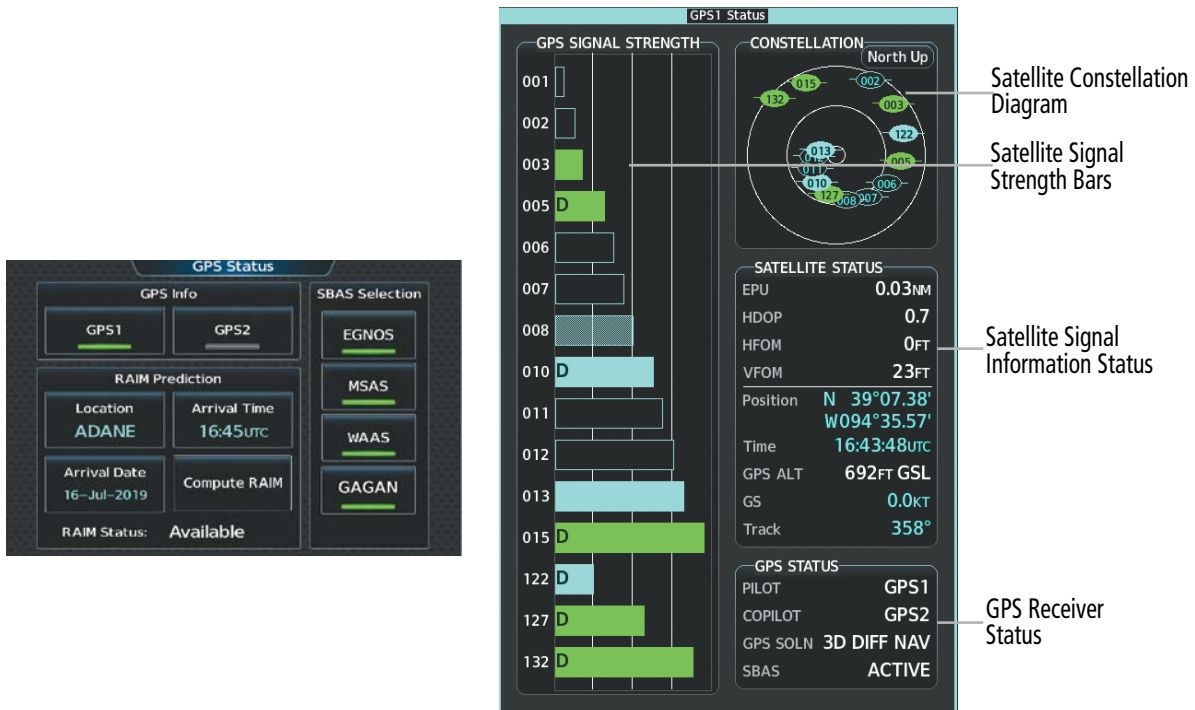


Figure 1-21 GPS Receiver Information

Displaying information for a GPS receiver:

- 1) From MFD Home, touch **Utilities > GPS Status**.
- 2) Touch the **GPS1** Button to select the #1 GPS receiver. The button annunciator is green when enabled, subdued when disabled. The system displays the 'GPS1 Status' Pane.
- 3) Touch the **GPS2** Button to select the #2 GPS receiver. The button annunciator will be green when selected on. The system displays the 'GPS2 Status' Pane.

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

SATELLITE SIGNAL STATUS

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

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

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

GPS RECEIVER STATUS

The GPS solution type (ACQUIRING, 2D NAV, 2D DIFF NAV, 3D NAV, 3D DIFF NAV) for the active GPS receiver (GPS1 or GPS2) is shown in the lower right of the 'GPS1' and 'GPS2 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 determine the satellites that should be in view. 'ACQUIRING' is indicated as the solution until a sufficient number of satellites have been acquired for computing a solution.

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

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 WAAS, EGNOS, MSAS, 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 MFD Home, touch **Utilities > GPS Status**.
- 2) 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 subdued.

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

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

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

Predicting RAIM availability:

- 1) From MFD Home, touch **Utilities** > **GPS Status** > **Location**.
- 2) Touch the **Waypoint** Button to enter the location for which RAIM will be predicted. Touch the **Present Position** Button to enter the aircraft’s current position as the prediction location.
- 3) If the **Waypoint** Button was touched in step 2, enter the waypoint identifier using the alphanumeric buttons or the large and small upper knobs. If the **Present Position** Button was touched in step 2, proceed to step 5.
- 4) Touch the **Enter** Button.
- 5) The location selected for RAIM prediction is now displayed on the **Location** Button.
- 6) Touch the **Arrival Time** Button.
- 7) Enter the planned arrival time for the selected location using the numeric buttons
- 8) Touch the **Enter** Button. The time is now displayed on the **Arrival Time** Button.
- 9) Touch the **Arrival Date** Button.
- 10) 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.
- 11) 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.

- 12) 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.
- 13) 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

ANNUNCIATIONS

When the system issues a message, the **MSG** Button flashes inverse video on the Touchscreen Controllers and a similar annunciator icon flashes in the upper left corner of the PFDs 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, after which, the button no longer flashes and the annunciator on the PFD extinguishes. The number of active messages is shown on the 'System Messages' Tab. Active messages are highlighted by a cyan box. When messages have become inactive, the cyan box is removed.

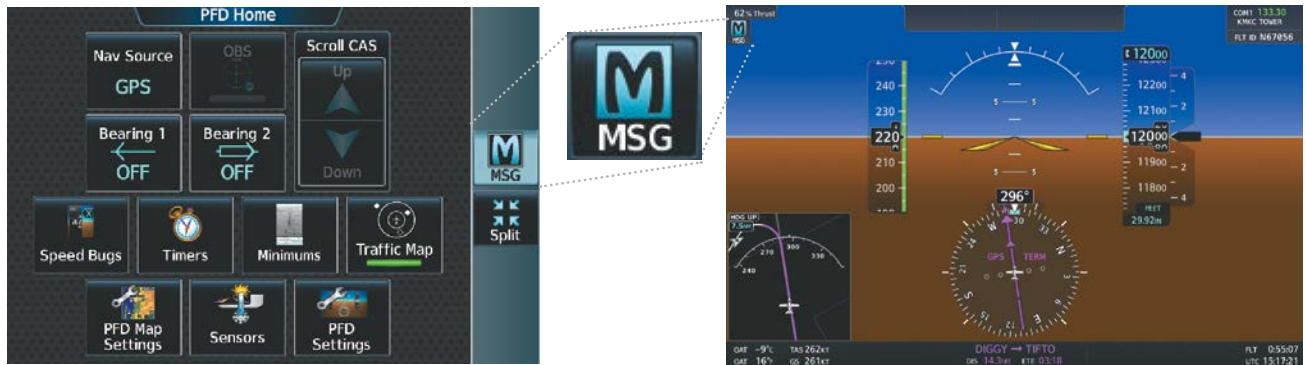


Figure 1-22 Message Annunciation on Touchscreen Controller and PFD

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	System Annunciation	Comment
	AHRS is aligning.		Display system is not receiving valid temperature information from air data computer.
	Display system is not receiving attitude information from the AHRS.		Display system is not receiving airspeed input from air data computer.
	AHRS calibration incomplete or configuration module failure.		Display system is not receiving vertical speed input from the air data computer.
	This annunciation is seen only when the Autopilot is engaged. The annunciation indicates an AFCS monitor has detected an abnormal flight parameter, possibly caused by strong turbulence. In this case, the situation should correct itself within a few seconds. If there is an actual failure, a red "X" soon appears over the Attitude Indicator.		Display system is not receiving altitude input from the air data computer.
	'LOI' Indicates Loss of Integrity of GPS information. GPS information is either not present or is invalid for navigation use. Note that AHRS uses GPS inputs during normal operation. AHRS operation may be degraded if GPS signals are not present (see the current version of the pertinent flight manual). If GPS integrity is subsequently restored, system displays 'GPS INTEG OK' annunciation.		CDI is not receiving valid data from the corresponding IAU. Does not apply when the CDI is set to GPS.
			Display system is not receiving heading input.
			Display system is not receiving valid transponder information.
		Other Various Red or Amber X Indications	A red or amber 'X' through any other display field indicates the field is not receiving valid data.

Table 1-1 System Annunciations

1.4 INITIALIZATION

Initialization is a process that prompts the flight crew to perform system checks and enter flight parameters, and is completed prior to each flight using the Touchscreen Controllers. After powering up the system on the ground, the 'Initialization' Screen appears on GTC2. 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 1-23 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 'MFD Home' Screen. Touching the **Accept Initialization** Button prior to 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 'MFD Home' Screen; touching the **Cancel** Button removes the pop-up.

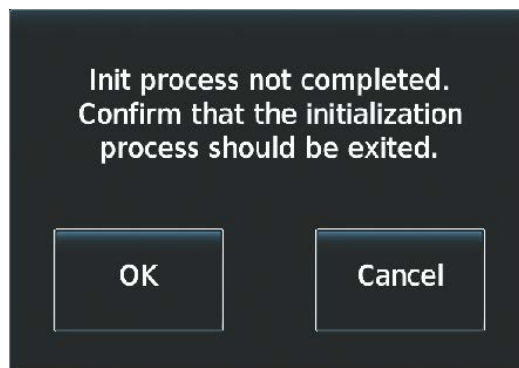


Figure 1-24 System Initialization Exit Confirmation

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 via the 'MFD Home' Screen. The 'Initialization' Screen may also be accessed at any time via **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.

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 (STBY 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)

Database Status		
Databases Ready		
Database	Standby (effective)	Active (expires)
Navigation	2103 25-Mar-2021	2104 20-MAY-2021
Basemap	20M3 N/A	20M3 N/A
Terrain	20T3 N/A	20T3 N/A
Obstacle	21B1 25-FEB-2021	21B2 17-JUN-2021

Figure 1-25 'Database Status' Screen

- 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 **Next** Button to proceed to the 'System Tests' Screen to perform system tests. See the EAS Section for system testing details.
- 5) Touch the **Next** Button to proceed to the 'Initial Fuel' Screen to input initial fuel quantity information.
- 6) 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).
- 7) 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).
- 8) 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.
- 9) 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 1-26 System Initialization Completed Tasks

- 10) Touch **Accept Initialization** to accept the initialization values and proceed to the 'MFD 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

System	<ul style="list-style-type: none"> • Time display format (local 12 hour, local 24 hour, or UTC) • Time offset
Units	<ul style="list-style-type: none"> • Keyboard Format (Alphabetical or QWERTY)
Alerts	<ul style="list-style-type: none"> • Flight Director Active Format (Single Cue) • GPS CDI range (0.30 NM, 1.00 NM, 2.00 NM, or AUTO) • COM transceiver channel spacing (8.33 or 25.0 kHz)
MFD Fields	<ul style="list-style-type: none"> • Stability and Protection (On or Off) • Nearest Airport Runway Surface (Any, Hard Only, or Hard/Soft)
Audio	<ul style="list-style-type: none"> • Nearest Airport Minimum Length • Show Airport Chart on Landing (On or Off)



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 MFD Home, touch **Utilities > Setup > Avionics Settings**.
- 2) If necessary, 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 MFD Home, touch **Utilities > Setup > Avionics Settings**.
- 2) If necessary, from 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.

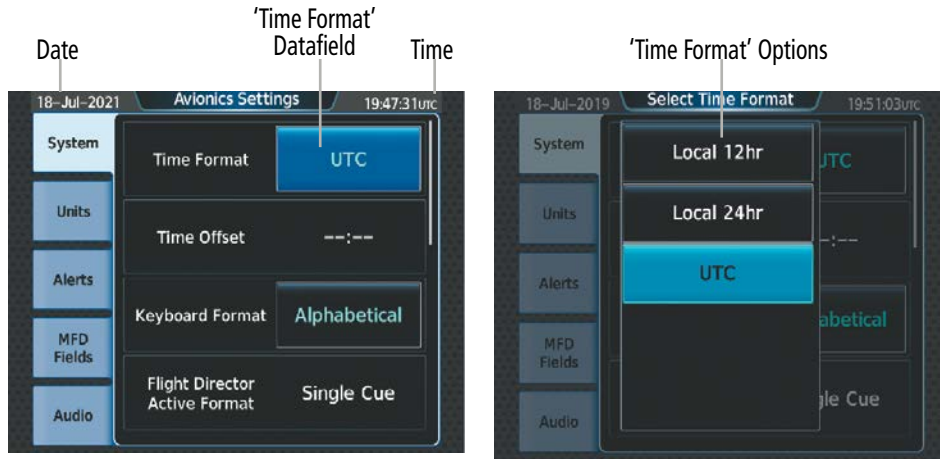


Figure 1-27 Time Format Settings

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.

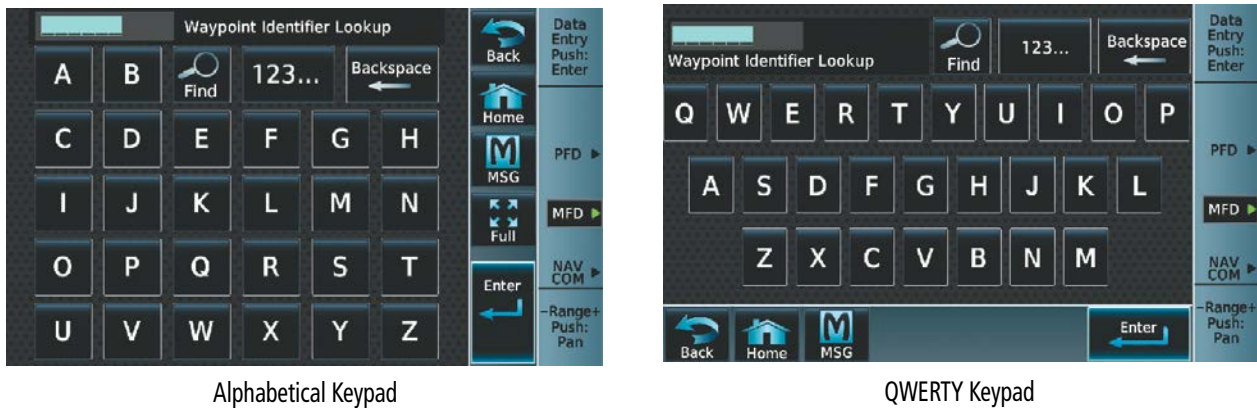


Figure 1-28 Keypad Formats on the Touchscreen Controller

Selecting a keypad format:

- 1) From MFD Home, touch **Utilities > Setup > Avionics Settings**.
- 2) If necessary, 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.

GPS CDI

The GPS CDI setting controls range scale of the CDI when GPS is the active nav source. The flight crew can specify a range to use, or allow the system to automatically determine the CDI range based on the phase of flight or navigation database information. Refer to the Flight Instruments Section for more information on the range of the CDI.

Setting the GPS CDI Range:

- 1) From MFD Home, touch **Utilities > Setup > Avionics Settings**.
- 2) If necessary, touch the **System** Tab.
- 3) Touch the GPS CDI range button.
- 4) Touch a button to select a specific distance used for the CDI range, or touch the **AUTO** Button for the system to adjust the CDI range automatically based on flight parameters.

COM CHANNEL SPACING

The 'COM Channel Spacing' datafield allows the pilot to select 8.33 kHz or 25.0 kHz COM frequency channel spacing.

Setting COM Channel Spacing:

- 1) From PFD Home, touch **PFD Settings**
Or:
 - a) From MFD Home, touch **Utilities > Setup > Avionics Settings**.
 - b) If necessary, touch the **System** Tab.
- 2) Scroll and touch the COM Channel Spacing Button (button displays the current spacing setting in cyan).
- 3) Touch either the **8.33 kHz** or **25.0 kHz** Buttons.

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.

Enabling/disabling ESP:

- 1) From MFD Home, touch **Utilities > Setup > Avionics Settings**.
- 2) If necessary, touch the **System** Tab.
- 3) Scroll and touch the **Stability & Protection** Button. ESP is enabled when button annunciator is green, disabled when subdued.

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.

Setting the Nearest Airport surface matching criteria:

- 1) From MFD Home, touch **Utilities > Setup > Avionics Settings**.
- 2) If necessary, touch the **System** Tab.
- 3) Scroll to and touch the Nearest Airport Runway Surface Button (button displays current runway surface selection in cyan).
- 4) Touch one of the following runway surface buttons: **Any, Hard Only, or Hard/Soft**.

Setting the Nearest Airport Minimum Runway Length matching criteria:

- 1) From MFD Home, touch **Utilities > Setup > Avionics Settings**.
- 2) If necessary, touch the **System** Tab.
- 3) Scroll to and touch the Nearest Airport Min Rwy Length Button (button displays current length setting in cyan).
- 4) Input a minimum runway surface distance using the keypad or the large and small upper knobs, then touch **Enter** or push the upper knob to accept the entry.

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 MFD Home, touch **Utilities > Setup > Avionics Settings**.
- 2) If necessary, 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.

UNITS SETTINGS

System	<ul style="list-style-type: none"> • Nav Angle • Magnetic Variance • Distance/Speed
Units	<ul style="list-style-type: none"> • Altitude/Vertical Speed • External Temperature • Cockpit/Cabin Temperature
Alerts	<ul style="list-style-type: none"> • Fuel • Weight
MFD Fields	<ul style="list-style-type: none"> • Position Format
Audio	

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.

Changing unit settings:

- 1) From MFD Home, touch **Utilities > Setup > Avionics Settings**.
- 2) If necessary, 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.

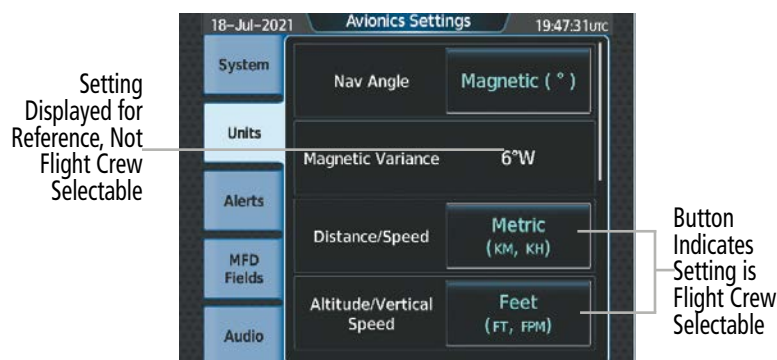


Figure 1-29 Viewing Unit Data on the Avionics Settings Screen

ALERTS SETTINGS

System	<ul style="list-style-type: none"> • BARO Transition ALT Climb • BARO Transition LVL Descent • SurfaceWatch Inhibit
Units	<ul style="list-style-type: none"> • Airspace Alert Alt Buffer • Class B/TMA/AWY • Class C/CTA
Alerts	<ul style="list-style-type: none"> • Class A/D • Restricted • MOA (Military) • Other
MFD Fields	
Audio	

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

- » Baro transition alert (climb and descent)
- » SurfaceWatch alert 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.

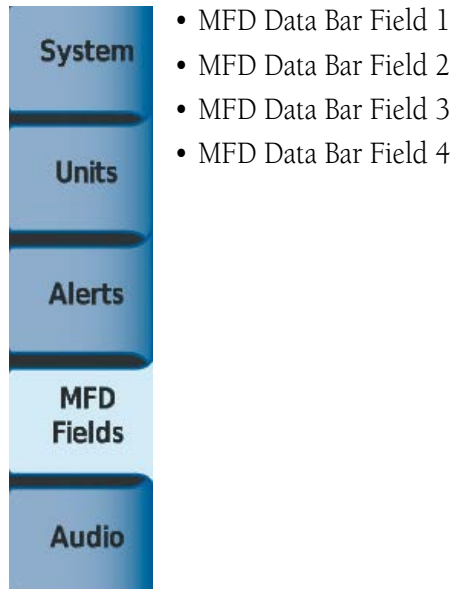
SURFACEWATCH INHIBIT

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.

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



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.

The following data may be selected for display in each of the four fields of the Navigation Data Bar.

- Bearing (BRG)
- Distance (DIS)
- Distance to Destination (DTG)
- Desired Track (DTK)
- Endurance (END)
- Enroute Safe Altitude (ESA)
- Estimated Time of Arrival (ETA)
- Estimated Time Enroute (ETE)
- Flight Timer (FLT)
- Fuel On Board (FOB)
- ETA at Final Destination (LDG)
- Minimum Safe Altitude (MSA)
- Track Angle Error (TKE)
- Track (TRK)
- Vertical Speed Required (VSR)
- Cross-Track Error (XTK)



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

Change the information shown in an MFD Data Bar field:

- 1) From MFD Home, touch **Utilities > Setup > Avionics Settings**.
- 2) If necessary, touch the **MFD Fields** Tab.
- 3) Scroll as needed and touch the MFD Data Bar Field Number to be changed (1 through 4); the current selection for each data bar field displayed in cyan.
- 4) Scroll as needed and touch the button corresponding to the desired data to be shown in the selected MFD Data Bar Field.

AUDIO SETTINGS



- Audio Alert Voice
- Pilot 3D Audio
- Pilot L-R Swap
- Copilot 3D Audio
- Copilot L-R Swap

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.

To change the audio alert voice:

- 1) From MFD Home, touch **Utilities > Setup > Avionics Settings**.
- 2) If necessary, 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**).

Enable/disable the Pilot 3D Audio:

- 1) From MFD Home, touch **Utilities > Setup > Avionics Settings**.
- 2) If necessary, touch the **Audio** Tab.
- 3) Touch the **Pilot 3D Audio** Button. A green annunciator indicates the feature is enabled. If desired, enable the Pilot L-R Swap feature to direct the audio to the desired ear.

Enable/disable the Pilot L-R (Left/Right) Swap:

- 1) From MFD Home, touch **Utilities > Setup > Avionics Settings**.
- 2) If necessary, touch the **Audio** Tab.
- 3) Touch the **Pilot L-R Swap** Button. A green annunciator indicates the feature is enabled.

Enable/disable the Copilot 3D Audio:

- 1) From MFD Home, touch **Utilities > Setup > Avionics Settings**.
- 2) If necessary, touch the **Audio** Tab.
- 3) Touch the **Copilot 3D Audio** Button. A green annunciator indicates the feature is enabled. If desired, enable the Copilot L-R Swap feature to direct the audio to the desired ear.

Enable/disable the Copilot L-R (Left/Right) Swap:

- 1) From MFD Home, touch **Utilities > Setup > Avionics Settings**.
- 2) If necessary, touch the **Audio** Tab.
- 3) Touch the **Copilot L-R** Button. A green annunciator indicates the feature is enabled.

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 MFD Home, touch **Utilities > Setup > Avionics Status**.
- 2) If necessary, 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 1-30 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 MFD Home, touch **Utilities > Setup > Avionics Status**.
- 2) If necessary, 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, GTC2, and GTC3).

Viewing database information:

- 1) From MFD Home, touch **Utilities > Setup > Avionics Status**.
- 2) If necessary, touch the **Database** Tab.
- 3) Touch **MFD1, PFD1, GTC1, GTC2, or GTC3** 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**.

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.

CONNEXT REGISTRATION

For more information on setting up a Connex Weather account, refer to the Hazard Avoidance Section.

WIFI SETUP

The system is capable of connecting to a wireless network. Furthermore, the system is capable of pairing to a mobile device and the Garmin Connex® feature.

For more information on Connex and WiFi Setup, see the Additional Features Section.

DATABASE STATUS

For more information on Database Status, see the Appendix 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

The flight timer can be set to count up from zero starting when power is initially applied to the system or from the time the aircraft lifts off; the timer can also be reset to zero.

Setting the flight timer starting criterion:

- 1) From MFD Home, touch **Utilities** > **Trip Stats**.
- 2) Touch the Flight Time **Start At** Button.
- 3) Touch either the **Power-On** or **In-Air** Button.

Resetting the flight timer:

- 1) From MFD Home, touch **Utilities** > **Trip Stats**.
- 2) Touch the Flight Time timer button (cyan text in button displays flight time).
- 3) Touch the **Reset** Button to reset the flight timer or touch the **Cancel** Button.



Figure 1-31 Trip Statistics Options

DEPARTURE TIME

The system records the time at which departure occurs. The departure time is selectable as either from the time the system was powered-up, or when the aircraft becomes airborne. The displayed departure time can also be reset to display the current time at the point of reset.

Setting the departure timer starting criterion:

- 1) From MFD Home, touch **Utilities > Trip Stats**.
- 2) Touch the Departure Time **Start At** Button.
- 3) Touch either the **Power-On** or **In-Air** Button.

Resetting the departure time:

- 1) From MFD Home, touch **Utilities > Trip Stats**.
- 2) Touch the Departure Time datafield button.
- 3) Touch the **Reset** Button.

ODOMETER

The Odometer presents a total distance traveled since the last reset.

Setting the odometer automatic reset criterion:

- 1) From MFD Home, touch **Utilities > Trip Stats**.
- 2) Touch the Odometer **Reset** Button.
- 3) Touch the **Power-On**, **In-Air**, or **Manually** Button. Manual reset is always available regardless of the option selected for automatic reset.

Manually resetting the odometer:

- 1) From MFD Home, touch **Utilities > Trip Stats**.
- 2) Touch the Odometer distance button (shows current odometer reading in cyan).
- 3) Touch the **Reset** Button to reset the odometer, or touch the **Cancel** Button.

TRIP ODOMETER

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

Setting the Trip Odometer automatic reset criterion:

- 1) From MFD Home, touch **Utilities > Trip Stats**.
- 2) Touch the Trip Odometer **Reset** Button.
- 3) Touch the **Power-On**, **In-Air**, or **Manually** Button. Manual reset is always available regardless of the option selected for automatic reset.

Manually resetting the Trip Odometer:

- 1) From MFD Home, touch **Utilities > Trip Stats**.
- 2) Touch the Trip Odometer distance button (shows current trip odometer reading in cyan.)
- 3) Touch the **Reset** Button to reset the trip odometer, or touch the **Cancel** Button.



NOTE: Operating the system in the vicinity of GPS repeaters, metal buildings, metal structures, or electromagnetic fields on the ground may cause the Average Ground Speed or Maximum Ground Speed Trip Statistics to be calculated incorrectly.

AVERAGE GROUND SPEED

‘Avg Ground Speed’ presents a ground speed average since the last reset.

Setting the average ground speed automatic reset criterion:

- 1) From MFD Home, touch **Utilities > Trip Stats**.
- 2) Scroll to display the ‘Avg Ground Speed’ buttons.
- 3) Touch the Avg Ground Speed **Reset** Button.
- 4) Touch the **Power-On, In-Air, or Manually** Button. Manual reset is always available regardless of the option selected for automatic reset.

Manually resetting the Odometer:

- 1) From MFD Home, touch **Utilities > Trip Stats**.
- 2) Scroll to display the ‘Avg Ground Speed’ buttons.
- 3) Touch the speed button for the ‘Avg Ground Speed’ (button displays average ground speed in cyan).
- 4) Touch the **Reset** Button to reset the average ground speed, or touch the **Cancel** Button.

MAXIMUM GROUND SPEED

‘Max Ground Speed’ shows the highest recorded ground speed since the last reset.

Setting the Maximum Ground Speed automatic reset criterion:

- 1) From MFD Home, touch **Utilities > Trip Stats**.
- 2) Scroll to display the ‘Max Ground Speed’ buttons.
- 3) Touch the Max Ground Speed **Reset** Button.
- 4) Touch the **Power-On, In-Air, or Manually** Button. Manual reset is always available regardless of the option selected for automatic reset.

Manually resetting the Maximum Ground Speed:

- 1) From MFD Home, touch **Utilities > Trip Stats**.
- 2) Scroll to display the ‘Max Ground Speed’ buttons.
- 3) Touch the speed button for the ‘Max Ground Speed’ (button displays maximum speed in cyan).
- 4) Touch the **Reset** Button to reset the Maximum Ground Speed, or touch the **Cancel** Button.

TRIP AIR ODOMETER

The 'Trip Air Odometer' presents the distance traveled while the aircraft was in the air since the last reset.

Setting the Trip Airborne Odometer automatic reset criterion:

- 1) From MFD Home, touch **Utilities > Trip Stats**.
- 2) Scroll to display the 'Trip Air Odometer' buttons.
- 3) Touch the Trip Air Odometer **Reset** Button.
- 4) Touch the **Power-On, In-Air, or Manually** Button. Manual reset is always available regardless of the option selected for automatic reset.

Manually resetting the Trip Air Odometer:

- 1) From MFD Home, touch **Utilities > Trip Stats**.
- 2) Scroll to display the 'Trip Air Odometer' buttons.
- 3) Touch the distance button for the 'Trip Air Odometer' (button displays the distance flown in cyan).
- 4) Touch the **Reset** Button to reset the Trip Air Odometer, or touch the **Cancel** Button.

AVERAGE WIND SPEED

The 'Avg Wind Speed' displays the average wind speed since the last reset.

Setting the Average Wind Speed automatic reset criterion:

- 1) From MFD Home, touch **Utilities > Trip Stats**.
- 2) Scroll to display the 'Avg Wind Speed' buttons.
- 3) Touch the Avg Wind Speed **Reset** Button.
- 4) Touch the **Power-On, In-Air, or Manually** Button. Manual reset is always available regardless of the option selected for automatic reset.

Manually resetting the Average Wind Speed:

- 1) From MFD Home, touch **Utilities > Trip Stats**.
- 2) Scroll to display the 'Avg Wind Speed' buttons.
- 3) Touch the speed button for the 'Avg Wind Speed' (button displays the average wind speed in cyan).
- 4) Touch the **Reset** Button to reset the Average Wind Speed, or touch the **Cancel** Button.

AVERAGE WIND DIRECTION

The 'Avg Wind Direction' displays the average wind direction since the last reset.

Setting the Average Wind Direction automatic reset criterion:

- 1) From MFD Home, touch **Utilities > Trip Stats**.
- 2) Scroll to display the 'Avg Wind Direction' buttons.
- 3) Touch the Avg Wind Direction **Reset** Button.
- 4) Touch the **Power-On, In-Air, or Manually** Button. Manual reset is always available regardless of the option selected for automatic reset.

Manually resetting the Average Wind Direction:

- 1) From MFD Home, touch **Utilities** > **Trip Stats**.
- 2) Scroll to display the 'Avg Wind Speed' buttons.
- 3) Touch the speed button for the 'Avg Wind Speed' (button displays the average wind speed in cyan).
- 4) Touch the **Reset** Button to reset the Average Wind Speed, or touch the **Cancel** Button.

TIMER

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

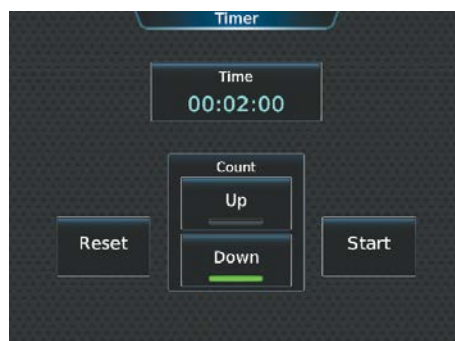


Figure 1-32 Timer (Touchscreen Controller)

Setting the generic timer:

- 1) From MFD Home, touch **Utilities** > **Timer**.
Or:
From PFD Home, touch the **Timers** Button.
- 2) Touch the **Time** Button.
- 3) Input the desired time using the numeric keypad or the large and small upper knobs, then touch the **Enter** Button or press the upper knob.
- 4) Touch the **Start** Button. The button changes to 'Stop'.
- 5) To stop the timer, touch the **Stop** Button.
- 6) To reset the timer, touch the **Reset** Button.

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 MFD 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 LOCAL) 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 MFD 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 message:

- 1) From MFD 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 MFD 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.

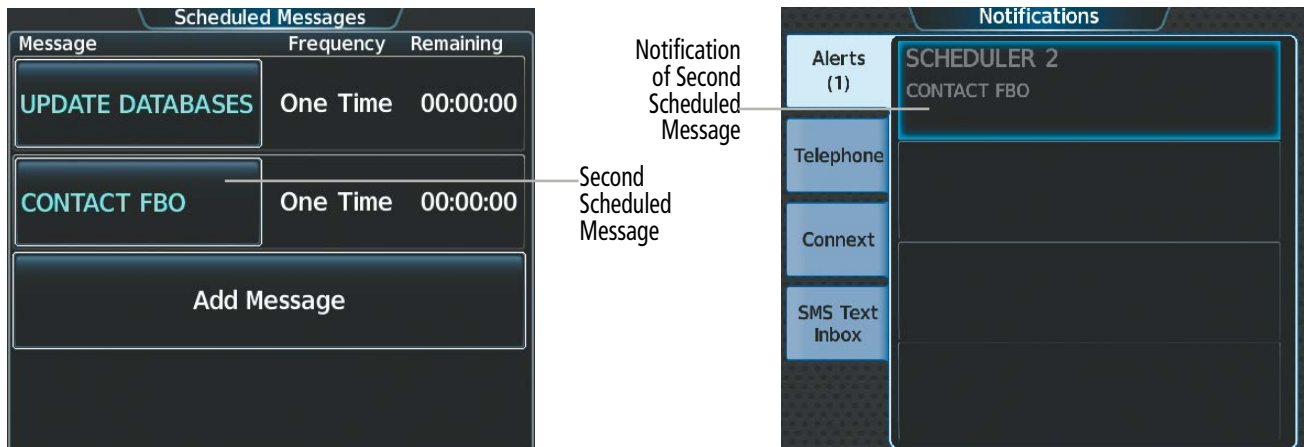


Figure 1-33 Scheduled Message Example

DOCUMENTS

See the Additional Features Section for information on Documents.

SCREEN CLEANING

Screen Cleaning mode temporarily 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 MFD 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 the active crew profile, and retains these settings through power cycles. 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, various softkey selections, and weight and balance information.

After system power application, 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 on the 'Crew Profile' Screen. The Default Profile cannot be deleted or renamed, and after a ground power cycle, the Default Profile returns to the factory settings. The **DEFAULT PROFILE** Button contains an alphanumeric version number. The **DEFAULT PROFILE** Button contains an alphanumeric version number.

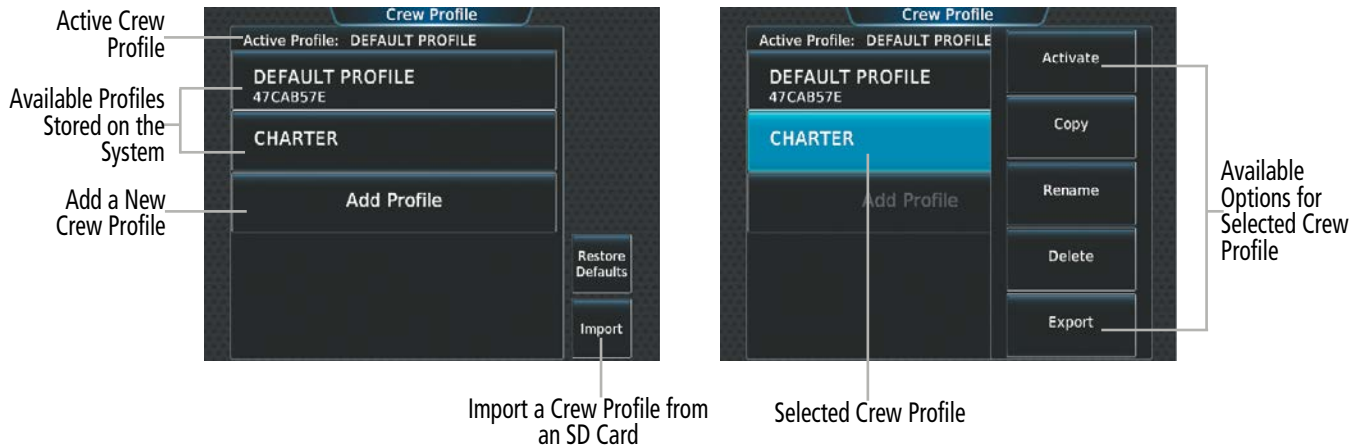


Figure 1-34 Managing Crew Profiles on the Crew Profile Screen

Adding a new crew profile:

- 1) From MFD 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, then touch **Enter** or press the upper knob. Crew Profiles may be up to 16 characters long, and cannot share the exact name of an existing crew profile.

Activating a crew profile:

- 1) From MFD 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.

Copying an existing crew profile:

- 1) From MFD 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, then touch **Enter** or press 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 copied profile in the list.

Renaming an existing crew profile:

- 1) From MFD 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 press 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.

Deleting a crew profile:

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

- 1) From MFD Home, touch **Utilities > Crew Profile**.
- 2) Scroll if necessary, and touch the button for the profile to be deleted.
- 3) Touch the **Delete** Button.
- 4) Touch the **OK** Button to confirm and delete the profile, or touch the **Cancel** Button.

Importing 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 MFD 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.

Exporting 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 MFD 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 1-2 Crew Profile Import/Export Messages

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SECTION 2 FLIGHT INSTRUMENTS



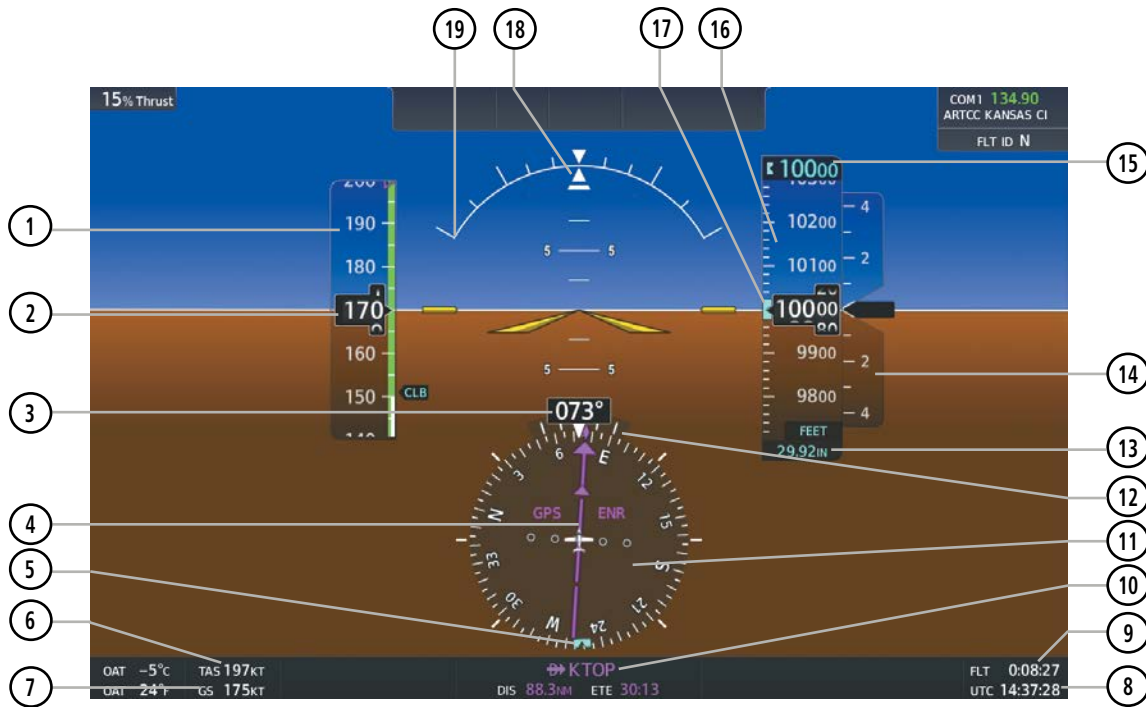
NOTE: *The Automatic Flight Control System (AFCS) provides additional indications such as bugs and annunciations on selected flight instruments during certain AFCS flight director modes. Refer to the AFCS Section for more information about these indications.*

The system increases pilot situational awareness by providing easy-to-scan Primary Flight Displays (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 PFD:

- Airspeed Indicator, showing
 - Indicated airspeed
 - Airspeed awareness ranges
 - Vspeed reference bugs
 - Mach number
- Groundspeed
- 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
- Radar Altimeter (RA)
- Time
- Angle of Attack (AOA) Indicator

The PFD also displays various alerts and annunciations discussed throughout this Pilot's Guide.



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

Figure 2-1 Primary Flight Display



- | | |
|------------------------------------|--|
| ① Reversionary Sensor Annunciation | ⑧ Bearing Information Bar |
| ② Airspeed Indicator | ⑨ Minimum Descent Altitude/Decision Height |
| ③ IAS Comparator Annunciation | ⑩ Selected Course |
| ④ Selected Heading | ⑪ Aircraft Symbol |
| ⑤ Wind Data | ⑫ Current Vertical Speed |
| ⑥ Angle of Attack Indicator | ⑬ Vertical Deviation Indicator (VDI) |
| ⑦ Outside Air Temperature (OAT) | ⑭ Marker Beacon Annunciation |

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 represent intervals of 10 knots. Speed indication starts at 20 knots, with 60 knots of airspeed scale viewable at any time. The indicated airspeed is displayed inside the black pointer. The pointer remains black until reaching maximum operating speed (V_{MO}/M_{MO}), at which point it appears red.

The Mach number is displayed below the Airspeed Indicator at altitudes where the aircraft is Mach limited prior to becoming IAS limited. The color of the display is the same as the color of the airspeed pointer.

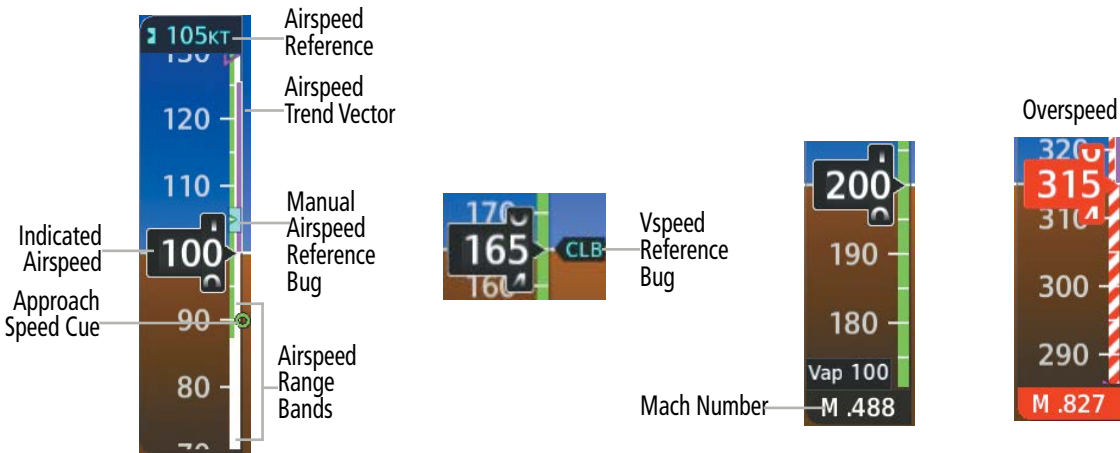


Figure 2-3 Airspeed Indicator

The Airspeed Trend Vector is a vertical magenta line that appears to the right of airspeed indicator 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_{MO}/M_{MO} or enters the Low Speed Awareness (LSA) range, the airspeed or Mach displays changes to amber. The trend vector is absent if the aircraft is on the ground, speed remains constant, or if any data needed to calculate airspeed is not available due to a system failure. If system cannot calculate the LSA range due to missing data or other failure, an amber 'LSA FAIL' annunciation appears on the airspeed tape and the red LSA band is removed from the airspeed tape.

In addition to the red LSA band, additional colored bands appear on the airspeed tape. A half green/half white band represents the landing configuration flaps speed range. A solid white band represents the full flaps operating speed range. A solid green band represents the normal operating range. Just as an amber band on the normalized AOA gauge is used to denote maneuver margin to a 35° bank angle, an amber band on the airspeed tape depicts the same maneuver margin in terms of airspeed. The bottom of the amber band is defined by the top of the red LSA band.

The Airspeed Reference is displayed above the Airspeed Indicator. A bug corresponding to this speed is shown on the airspeed tape. When the aircraft is at altitudes where Mach number is the appropriate reference, the airspeed reference becomes a Mach number reference. The Airspeed Reference appearance and behavior are

different depending on the active Airspeed Reference Mode. If the Airspeed Reference or Mach Reference is not on the current visible range of the airspeed tape, the speed reference bug appears at the upper or lower edge of the tape. See the AFCS Section for more information about the Airspeed Reference.

MANUAL (MAN) AIRSPEED REFERENCE MODE

Manual Airspeed Reference Mode is intended for the pilot to manually control the airspeed reference. This mode is indicated by a cyan Airspeed Reference display and bug as shown in Figure 2-3, which is displayed only when the AFCS or AT are in a mode that can control IAS/Mach. The manual speed reference is displayed when the FD vertical mode is Flight Level Change (FLC) or when the optional auto-throttle is engaged. When the manual speed reference is activated, it initializes to the current airspeed or Mach number, as appropriate. In Manual Airspeed Reference mode, a Mach reference is used when the altitude is above the crossover altitude of V_{mo} (250 kts) and M_{mo} (0.53), which is 18,388 ft, and an IAS reference is used otherwise.

FMS AIRSPEED REFERENCE MODE

FMS Airspeed Reference Mode is normally intended for the FMS to automatically control the airspeed reference based on the phase of flight. This mode is indicated by a magenta Airspeed Reference display and bug. In FMS Airspeed Reference Mode, the FMS selects the appropriate reference type (IAS or Mach) based on altitude, with Mach reference used above an altitude threshold and IAS reference used below the altitude threshold. The altitude threshold used by the FMS for this selection varies based on the situation.

AIRSPEED REFERENCE CONTROLS

The means of interacting with the Airspeed Reference are different between the base SF50 G2 aircraft and the full auto-throttle equipped SF50 G2 aircraft.

BASE SF50 G2 AIRCRAFT

On the base SF50 G2 aircraft, FMS Speed Reference mode is active any time VNAV AFCS mode is active. VNAV AFCS mode is toggled by the VNV button on the GMC 707 AFCS mode controller and is indicated by a green or white “V” on the Flight Mode Annunciator (FMA) and an annunciator on the VNV key on the GMC 707 AFCS mode controller. The magenta FMS speed bug is depicted as a solid triangle when FMS mode is active. In this mode, the Speed Reference is controlled by the FMS.

On the base SF50 G2 aircraft, Manual Airspeed Reference mode is active any time VNAV AFCS mode is not active. VNAV AFCS mode is toggled by the VNV button on the GMC 707 AFCS mode controller. In this mode, the IAS/Mach Reference is controlled by the pilot by dialing the Up/Dn wheel on the GMC 707 AFCS mode controller when the vertical FD mode is FLC.

On the base SF50 G2 aircraft, once powered, the avionics start with the Manual Airspeed Reference Mode active (VNAV AFCS mode off).

FULL AT-EQUIPPED SF50 G2 AIRCRAFT

On the full auto-throttle equipped SF50 G2 aircraft, the Airspeed Reference Mode may be changed at any time by the pilot using the GMC 708 AT controller. Pressing the MAN button activates Manual Airspeed Reference Mode (the annunciator above the MAN button indicates that manual mode is active). Pressing the FMS button activates FMS Airspeed Reference Mode (the annunciator over the FMS button indicates that FMS mode is active). Unlike the base SF50 G2 aircraft, the VNAV AFCS mode state is not linked to the Airspeed Reference Mode in the full AT-equipped aircraft. The pilot is free to use either Manual or FMS Airspeed Reference Mode, regardless of whether VNAV AFCS mode is active.

In the full AT-equipped SF50 G2 aircraft, the currently calculated FMS speed reference bug is shown full-time on the airspeed tape, even when Manual Airspeed Reference Mode is active. When in Manual mode, the FMS speed reference is displayed on the airspeed tape as a hollow magenta triangle.

Note that on the full AT-equipped SF50 G2 aircraft, once powered, the avionics start with VNAV AFCS mode active and with FMS Airspeed Reference Mode active.

AIRSPEED REFERENCE BUGS

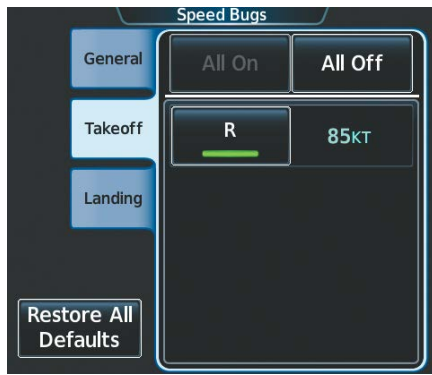
Speeds can be changed and their bugs enabled or disabled. When active (enabled), the Vspeeds are displayed at their respective locations to the right of the airspeed scale. By default, all Vspeed values are reset and all bugs turned off during power application.

	Vspeed	Bug
General	V _x	X
	V _y	CLB
Takeoff	V _r	R

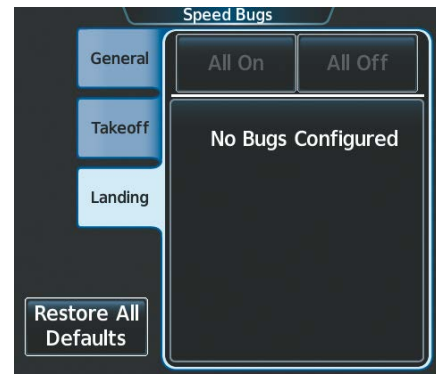
Table 2-1 Vspeed Bug Labels

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. For Vspeed bugs in the takeoff or landing category, enabling a bug in one category automatically disables it in the other category.

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 begins, enabled vspeed 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.



Takeoff Vsps



Landing Vsps

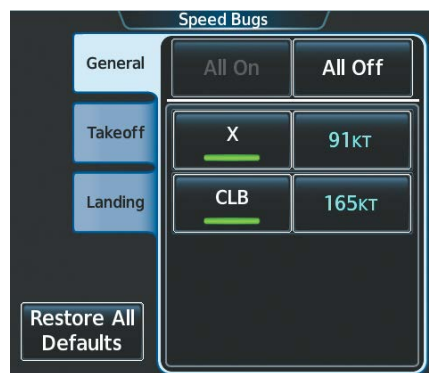


Figure 2-4 Vspeed Settings on the Speed Bugs Screen

Changing Vspeeds and enabling/disabling Vspeed Bugs:

- 1) From PFD 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 annunciator is green when the Vspeed bug is enabled, gray when disabled.
- 4) To set or change a Vspeed value, touch the Data Field for the Vspeed, input a value using the keypad or large and small upper knobs, and touch the **Enter** Button or push the upper knob. The pencil icon next to the Vspeed value indicates that Vspeed is a pilot-selected value that differs from the original value.



Figure 2-5 Pilot-Entered Vspeed

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

- 1) From PFD 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.

Restoring all Vspeed defaults:

- 1) From PFD Home, touch **Speed Bugs**.
- 2) Touch the **Restore All Defaults** Button.

ATTITUDE INDICATOR

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

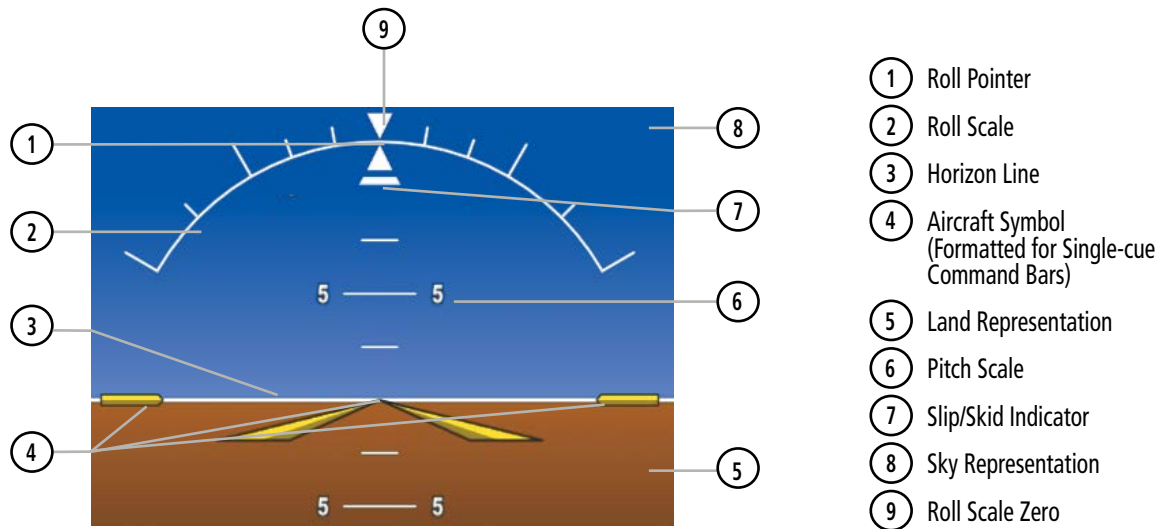


Figure 2-6 Attitude Indicator

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 2-7 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. The pilot can choose display units format for the Altimeter as feet or meters.

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

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

The Indicated Altitude is displayed in the black pointer.

Selecting the Altitude/Vertical Speed Display Units:

- 1) From MFD Home, touch **Utilities > Setup > Avionics Settings**.
- 2) Touch the **Units** Tab.
- 3) Scroll and touch the **Altitude/Vertical Speed Units** 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:

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.

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

If desired, push the **ALT** Knob to synchronize the selected altitude with the displayed altitude to the nearest 10 ft.

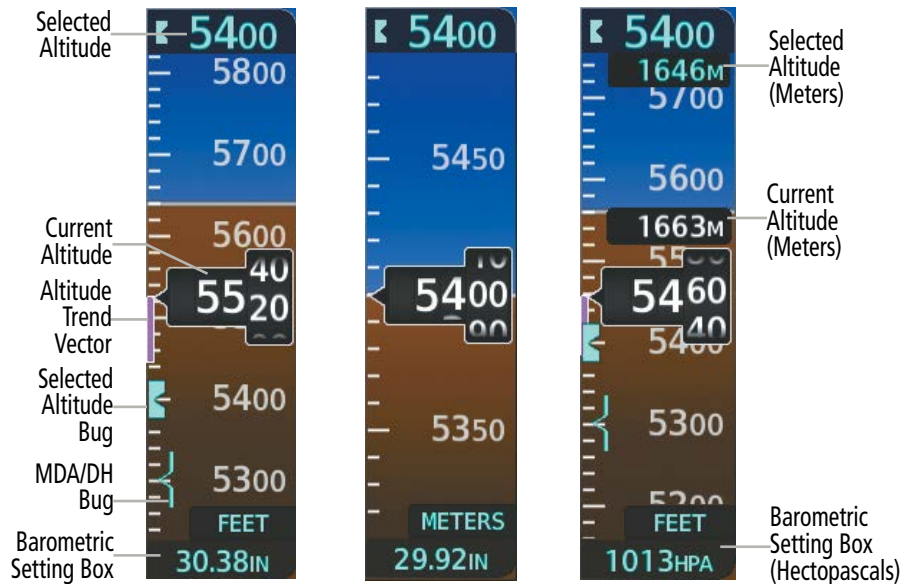


Figure 2-8 Altimeter Settings, In Hg and Metric

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

Enabling/Disabling Metric Overlays on the Altimeter:

- 1) From PFD Home, touch **PFD Settings**.
- 2) Scroll down until Meters Overlay **Enable** becomes visible.
- 3) To turn the function on or off, touch the Meters Overlay **Enable** Button. An illuminated green annunciator below 'Enable' indicates the function is on.

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

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



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.

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 2-9 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 2-10 Standard Barometric Altimeter Setting

Changing Altimeter Barometric Pressure Setting Units:

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

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 crossing up through the transition altitude, and BARO Transition LVL Descent when crossing down 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 MFD Home Screen, touch **Utilities > Setup > Avionics Settings**.
- 2) Touch the **Alerts** Tab.
 - To turn the alert on or off, touch the respective **BARO Transition ALT Climb** or **BARO Transition LVL Descent** Button.
 - 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 **Enter**.



Figure 2-11 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 2000 and 4000 feet per minute. Minor tick marks appear for every 1000 fpm. If the current vertical speed is greater than 100 fpm, digits appear in the pointer. If the rate of ascent/descent exceeds 4000 fpm, the pointer appears at the corresponding edge of the tape while displaying the current vertical speed numerically.

If the VSI is displayed in meters, numeric labels with major tick marks appear at 10 and 20 meters per second. Minor tick marks appear for every five meters per second. If the current vertical speed is at 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.

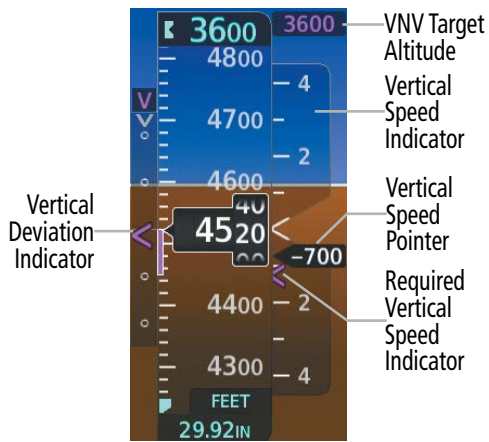


Figure 2-12 Vertical Speed and Deviation Indicators (VSI and VDI)

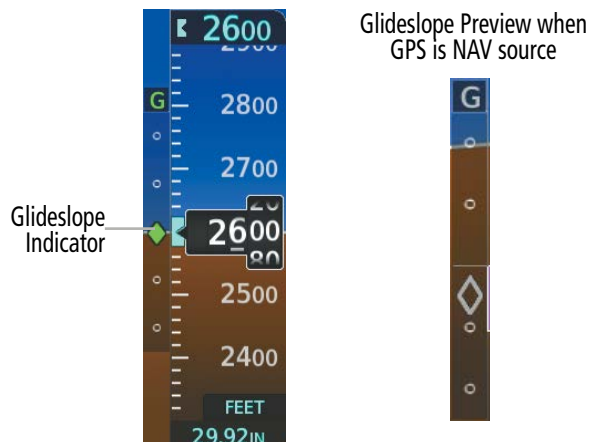


Figure 2-13 Glideslope Indicator



NOTE: The Glideslope 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 glideslope when the Glideslope Indicator appears.

The glidepath is analogous to the glideslope for RNAV approach service levels supporting SBAS vertical guidance (LNAV+V, LNAV/VNAV, LP, LPV, LP+V). When one of these RNAV approaches is loaded into the flight plan, GPS is the selected navigation source, and SBAS is used for vertical approach guidance, the Glideslope Indicator appears as a magenta diamond or a gray diamond prior to being active. Full-scale deflection (two dots), is angular with upper and lower limits. The upper limit is +/-492 feet (150 meters) and lower limits depend on approach service level.

- LNAV/VNAV, LNAV+V, and LP+V, 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 Glideslope Indicator enters an excessive deviation area, the Glideslope and Vertical Deviation Limit Indicators are amber.

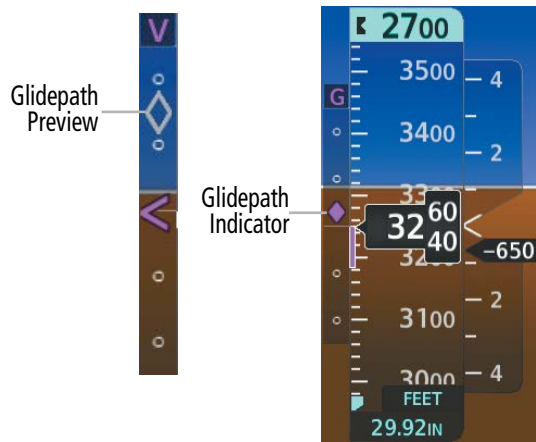


Figure 2-14 Glidepath Indicator

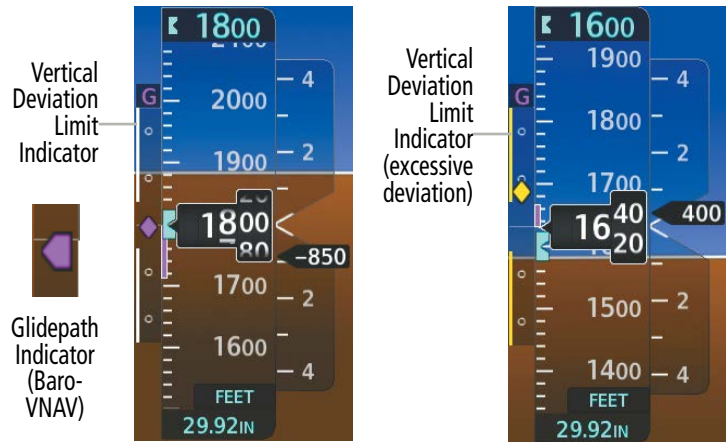


Figure 2-15 Glidepath Indicator with Vertical Deviation Limit Indicators

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.

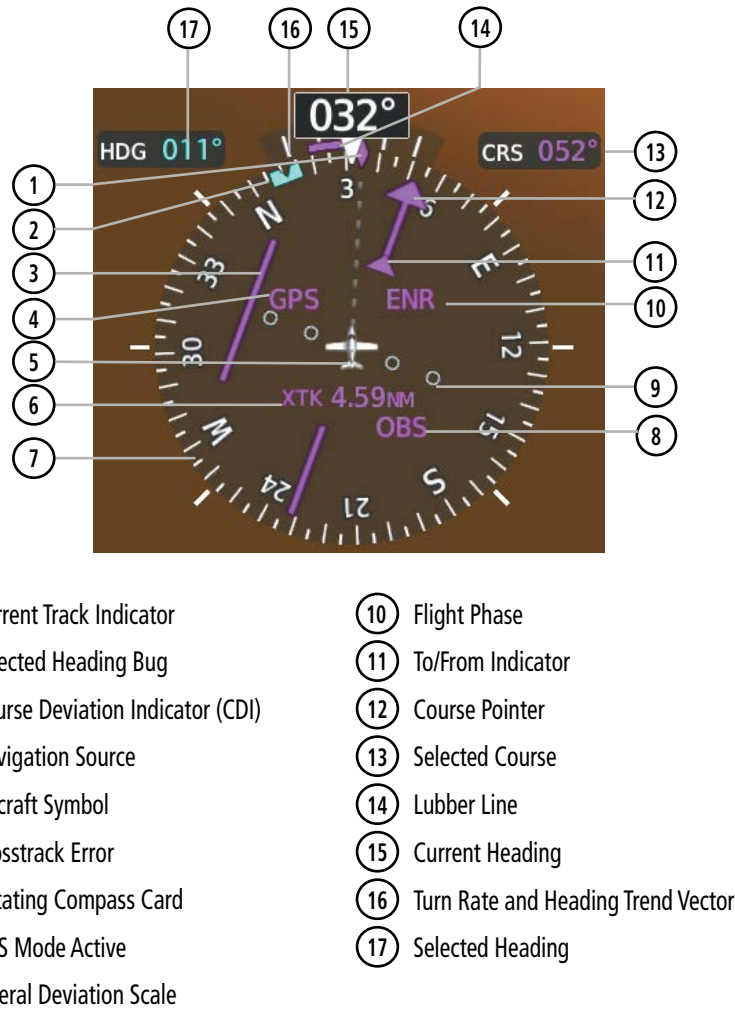


Figure 2-16 Horizontal Situation Indicator

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) as a diamond (LOC). Refer to the Flight Management Section for information about using HSI Map overlays.



Figure 2-17 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, which corresponds to the cyan heading bug on the compass rose. The Desired Track (DTK) is shown in magenta to the upper right of the HSI when the selected navigation source is 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 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 appears above the Current Heading when the HSI Map is enabled:

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

Changing the HSI Display Format:

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

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. The cyan bug on the compass rose corresponds to the Selected Heading. 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:

Turn the **HDG** Knob to set the Selected Heading on the AFCS Controller to set the Selected Heading.

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

Adjusting the Selected Course:

Turn the upper knob to set the Selected Course.

Push the upper knob to re-center the CDI and return the course pointer to the bearing of the active waypoint or navigation station.

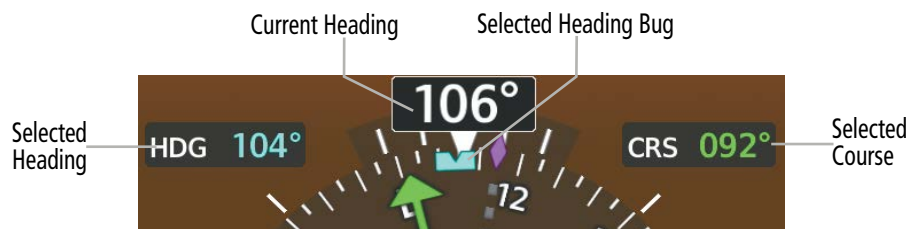


Figure 2-18 Heading and Course Indications (Magnetic)

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 2-19 Heading and Course Indications (True)

Changing the Navigation Angle Setting:

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



Figure 2-20 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 2-21 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 touching the **Bearing 1** Button or the **Bearing 2** Button on the PFD Home Screen. 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.

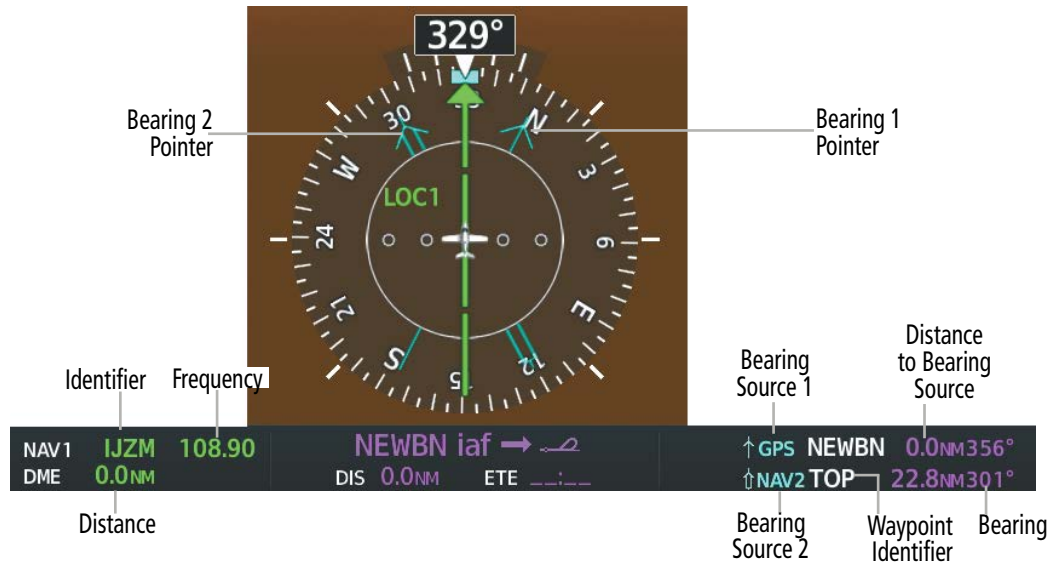


Figure 2-22 HSI with Bearing and Distance Information

When a bearing pointer is displayed, the information associated with it is also displayed. The following information is displayed to the below the HSI:

- » Bearing source (NAV, GPS)
- » Pointer icon (Bearing 1 = single line, Bearing 2 = double line)
- » Frequency (NAV)
- » Station/waypoint identifier (NAV, GPS)
- » GPS-derived great circle distance to bearing source

When the NAV radio is tuned to an ILS frequency, the bearing source and 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 PFD Home, touch the **Bearing 1** Button or the **Bearing 2** Button to display the desired bearing pointer and information and a source.
- 2) Touch the **Bearing 1** Button or the **Bearing 2** Button if desired to change the source with each touch (NAV1, NAV2, GPS).
- 3) To remove the bearing pointer and information, touch the **Bearing 1** or the **Bearing 2** Button again.

COURSE DEVIATION INDICATOR (CDI)

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

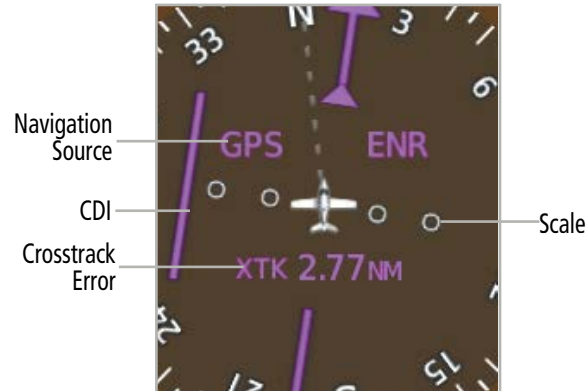


Figure 2-23 Course Deviation Indicator

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 a 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.

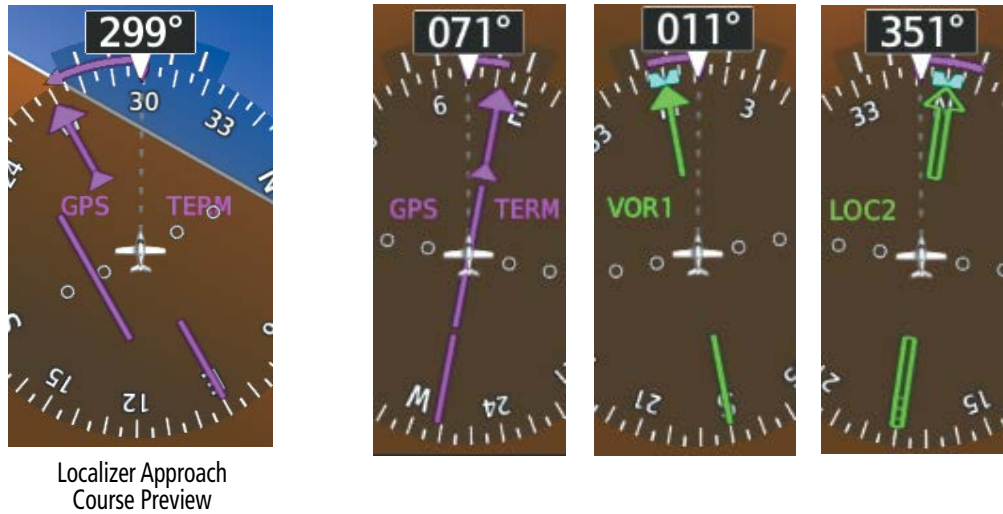


Figure 2-24 Navigation Sources

Changing Navigation Sources:

- 1) From PFD Home, touch the **Nav Source** Button to change from GPS to VOR1.
- 2) Touch the **Nav Source** Button again to change from VOR1 to VOR2.
- 3) Touch the **Nav Source** Button a third time to return to GPS.

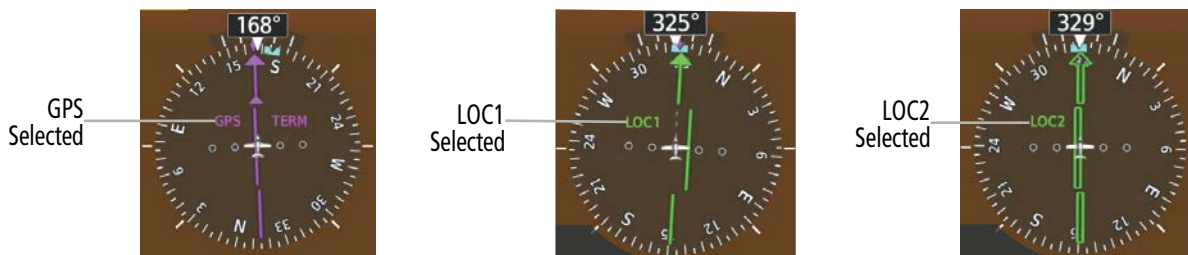


Figure 2-25 Selecting a Navigation Source

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 waypoint, 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

The system does not automatically switch from GPS to LOC navigation source until the AFCS captures the LOC mode. This means that unless the crew arms the LOC mode using the APPR button, the system will not automatically transition to LOC.

Activating a Vector-to-Final (VTF) causes the CDI to switch to LOC navigation source. GPS steering guidance is not provided after this switch.

On some ILS approaches where the glideslope intercept point is at or in close proximity to the fix prior to the FAF, it is possible to be above the glideslope when the navigation source automatically switches from GPS to LOC. The probability of this occurring varies based on air temperature.

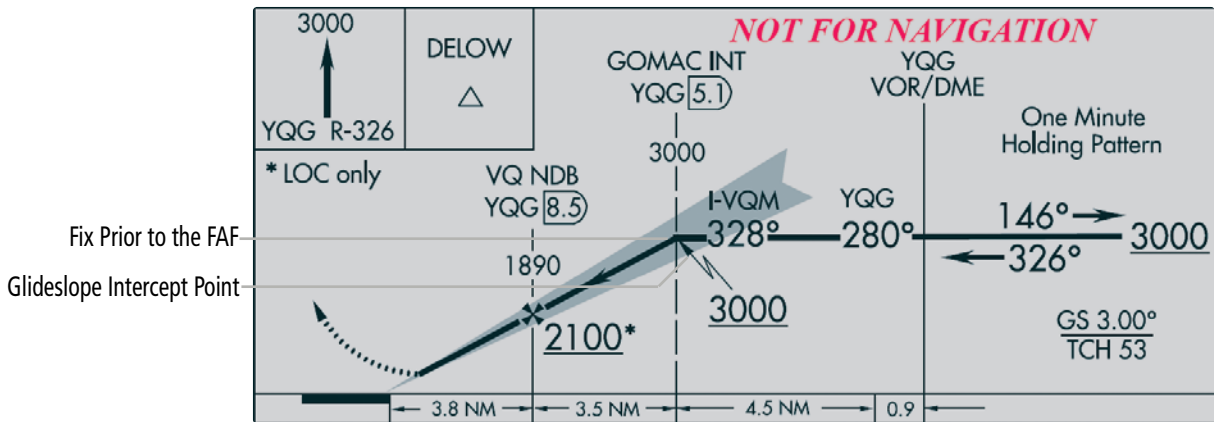


Figure 2-26 ILS Approach with Glideslope Intercept Point at Fix Prior to the FAF

GPS CDI SCALING

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

The current GPS CDI scale setting is displayed on the Avionics Settings Screen and the full-scale deflection setting may also be changed on this screen. If the selected scaling is smaller than the automatic setting for enroute and terminal phases, the CDI is scaled accordingly and the selected setting is displayed rather than the flight phase annunciation.

Changing the selected GPS CDI setting:

- 1) From MFD Home, touch **Utilities > Setup > Avionics Settings**.
- 2) Touch the **System** Tab.
- 3) Scroll if necessary and touch the GPS CDI Data Field.
- 4) Touch a button for the desired setting (**0.30NM**, **1.00NM**, **2.00NM**, or **AUTO**).



Figure 2-27 GPS CDI Settings

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

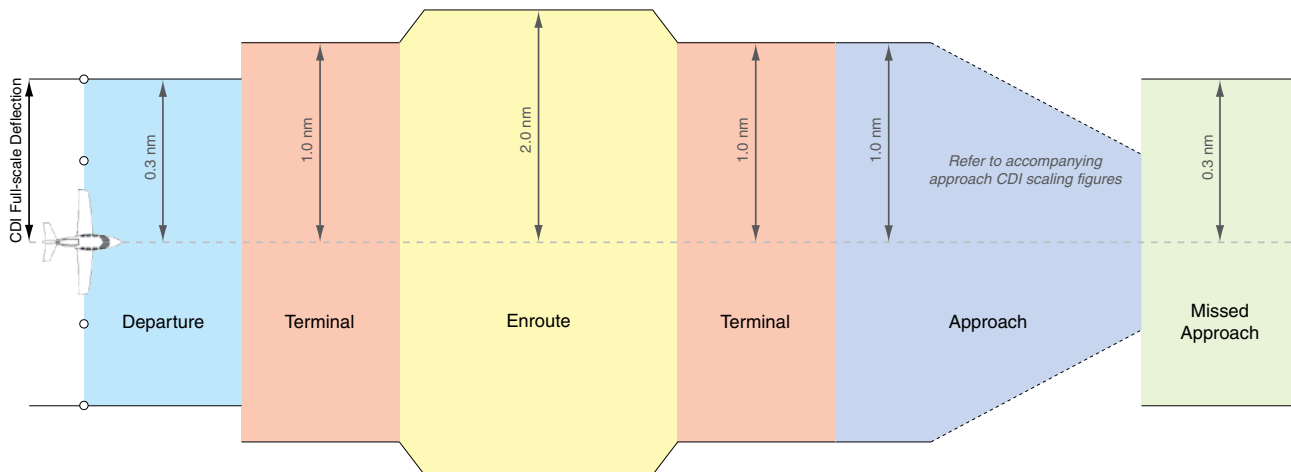


Figure 2-28 Automatic CDI Scaling

- » While on the ground (and no flight plan entered), the system is set to *enroute* scaling. The first time the flight plan is viewed, the departure airport is automatically populated into the active flight plan and the CDI scaling switches to *terminal*.
- » 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 procedure is not aligned with the departure runway
 - The next leg in the departure procedure is not CA, CD, CF, CI, CR, DF, FA, FC, FD, FM, IF, or TF (see Glossary for leg type definitions)
 - After any leg in the departure procedure that is not CA or FA
- » At 30 nm from the departure airport the *enroute* phase of flight is automatically entered and CDI scaling changes to 2.0 nm over a distance of 1.0 nm, except under the following conditions:
- » When navigating with an active departure procedure, the flight phase and CDI scale does not change until the aircraft arrives at the last departure waypoint (if more than 30 nm from the departure airport) or the leg after the last departure waypoint has been activated or a direct-to waypoint is activated.
- » If after completing the departure procedure the nearest airport is more than 200 nm away from the aircraft and the approach procedure has not yet commenced, the CDI is scaled for *oceanic* flight (4.0 nm).
- » Within 31 nm of the destination airport (*terminal* area), the CDI scale gradually ramps down from 2.0 nm to 1.0 nm over a distance of 1.0 nm, except under the following conditions:
- » Upon reaching the first waypoint of an arrival route that is more than 31 nm from the destination airport, the flight phase changes to terminal and the CDI scale begins to transition down from 2.0 nm to 1.0 nm over a distance of 1.0 nm.

- » During *approach*, the CDI scale ramps down even further. This transition normally occurs within 2.0 nm of the final approach fix (FAF). The CDI switches to approach scaling automatically once the approach procedure is activated or if Vector-to-Final (VTF) is selected.
 - If the active waypoint is the FAF, the ground track and the bearing to the FAF must be within 45° of the final approach segment course.
 - If the active waypoint is part of the missed approach procedure, the active leg and preceding missed approach legs must be aligned with the final approach segment course and the aircraft must not have passed the turn initiation point.

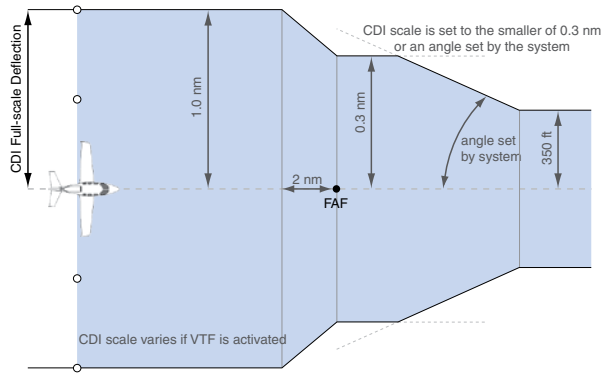


Figure 2-29 Typical LNAV and LNAV+V and Visual Approach CDI Scaling

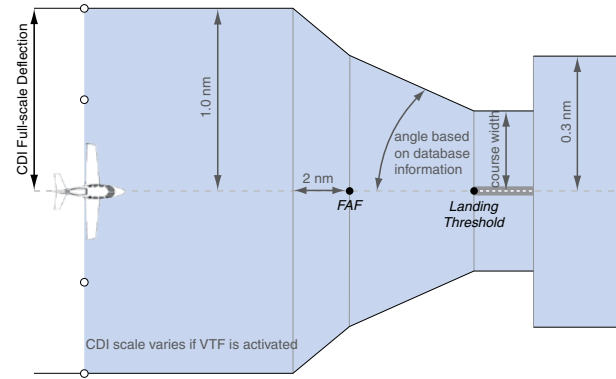


Figure 2-30 Typical LNAV/VNAV, LP, LP+V and LPV Approach CDI Scaling

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

Flight Phase	Annunciation*	Automatic CDI Full-scale Deflection
Departure	DPRT	0.3 nm
Terminal	TERM	1.0 nm
Enroute	ENR	2.0 nm
Oceanic	OCN	4.0 nm
Approach (Non-precision)	LNAV	1.0 nm decreasing to 350 feet depending on variables (Figure 2-29)
Approach (Non-precision with Advisory Vertical Guidance)	LNAV + V	
Approach (Non-precision with Advisory Vertical Guidance)	VISUAL	
Approach (LNAV/VNAV)	L/VNAV	1.0 nm decreasing to a specified course width, then 0.3 nm, depending on variables (Figure 2-30)
Approach (LPV)	LPV	
Approach (Non-precision with Advisory Vertical Guidance)	LP+V	
Approach (LP)	LP	
Missed Approach	MAPR	0.3 nm

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

Table 2-2 Automatic GPS CDI Scaling

OBS MODE

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

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

While OBS 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.

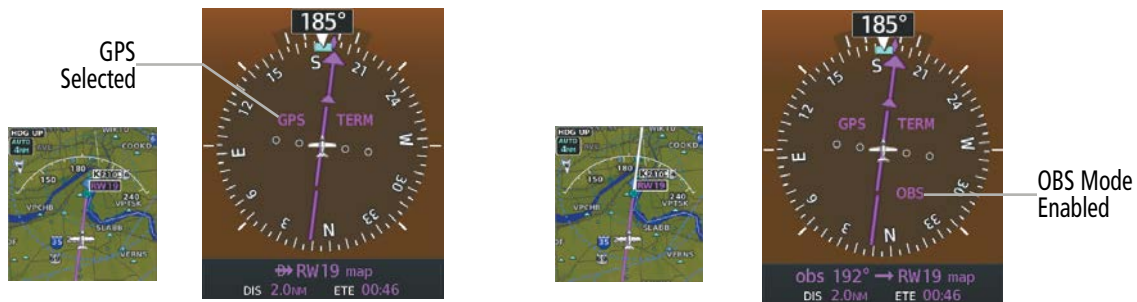


Figure 2-31 Omni-bearing Selector (OBS) Mode

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

- 1) From PFD 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.

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 2-32 Suspension of Automatic Waypoint Sequencing

ANGLE OF ATTACK (AOA) INDICATOR

The Angle of Attack (AOA) Indicator appears on the PFD 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, and will cause the stick pusher to activate if this condition is reached. 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 / Stick Pusher threshold). The amber arc represents maneuvering margin to a 35 degree bank angle. At bank angles of 35 degrees or greater, the amber band has zero thickness. 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 PFD, or select the Auto Mode. In Auto Mode, the AOA Indicator appears when all of the following conditions are met:

- Landing gear is down and locked
- Flaps are extended greater than 10°
- Normalized AOA is greater than 0.35

If these conditions are not met while Auto Mode is selected, then the AOA Indicator is automatically removed from the PFD.

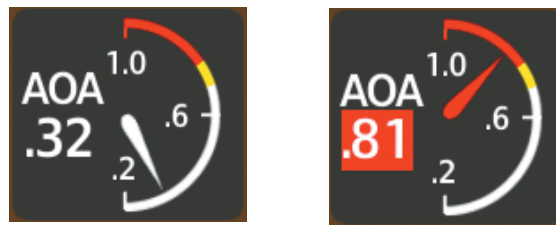


Figure 2-33 Angle of Attack (AOA) Indicator

Selecting the AOA Indicator Display Mode:

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

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. SVT 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



Figure 2-34 Synthetic Vision Imagery

SVT OPERATION

SVT controls are on the PFD Settings Screen. Each SVT feature (SVT Terrain, Horizon Heading, and SVT Airport Signs) has a corresponding **Enable** Button. A green annunciator on the button indicates the feature is enabled; a gray annunciator indicates the feature is disabled.

The Flight Path Marker accompanies the display of SVT Terrain. If desired, SVT Airport Signs and Horizon Heading can be enabled with the display of SVT Terrain. The PFD Settings Screen contains the following SVT controls:

- SVT Terrain **Enable** Button shows SVT Terrain and Flight Path Marker.
- Horizon Heading **Enable** Button shows heading marks and digits on the zero pitch line.
- SVT Airport Signs **Enable** Button shows airport signposts when SVT Terrain is enabled.

Enabling/Disabling SVT Terrain with Flight Path Marker:

- 1) From PFD Home, touch **PFD Settings**.
- 2) Touch the SVT Terrain **Enable** Button. Button annunciator is green when enabled, gray when disabled.

Enabling/Disabling Horizon Headings:

- 1) From PFD Home, touch **PFD Settings**.
- 2) Scroll as necessary, then touch the Horizon Heading **Enable** Button. Button annunciator is green when enabled, gray when disabled.

Enabling/Disabling Airport Signs:

- 1) From PFD Home, touch **PFD Settings**.
- 2) If necessary, touch the SVT Terrain **Enable** Button to enable the display of SVT Terrain (button annunciator is green).
- 3) Scroll and touch the SVT Airport Signs **Enable** Button.

SVT FEATURES



Figure 2-35 SVT on the Primary Flight Display



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 2-36 Flight Path Marker Position is Affected by Wind

ZERO PITCH LINE

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

HORIZON HEADING

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

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 **Enable** Button.



Figure 2-37 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.

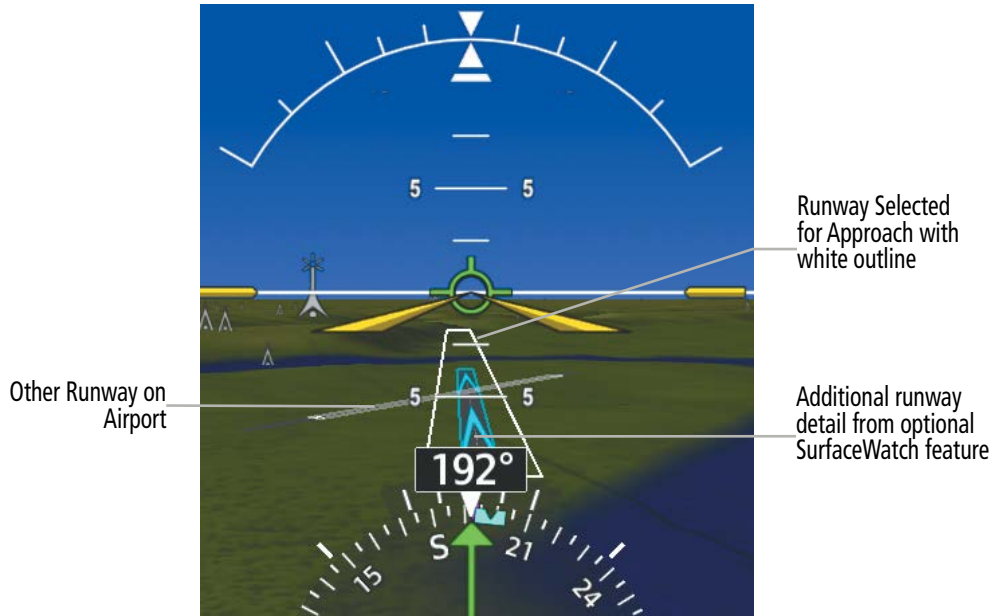


Figure 2-38 Airport Runways

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.

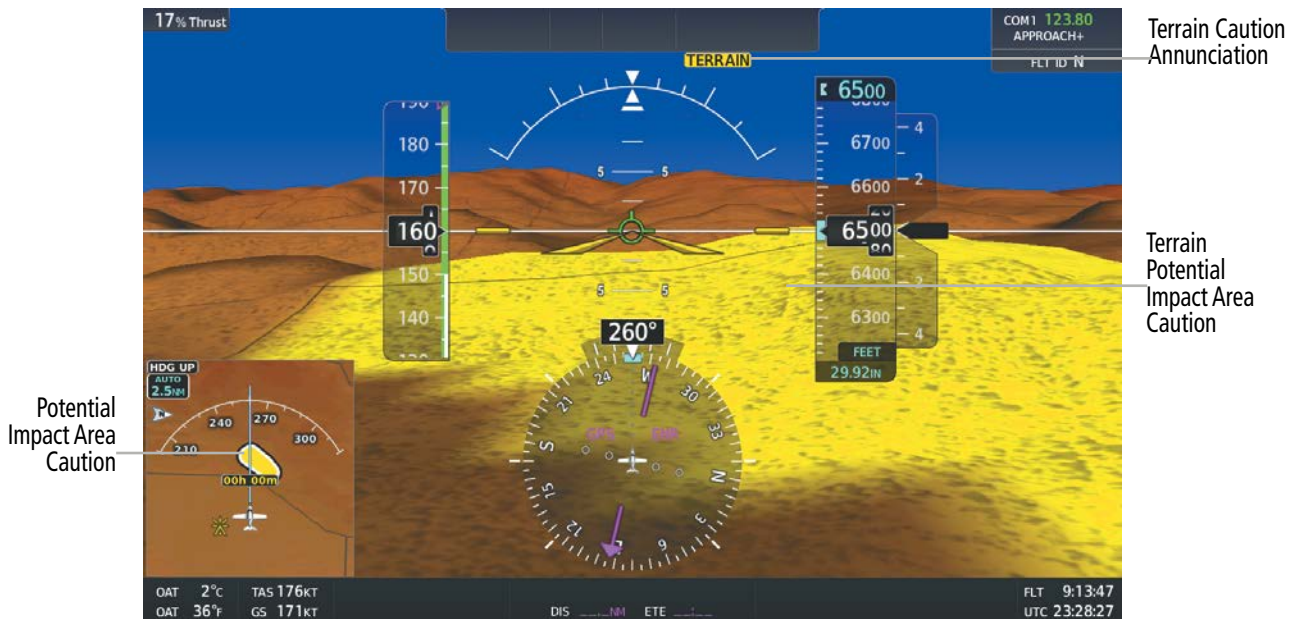


Figure 2-39 Terrain Alert

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.



Figure 2-40 SVT Obstacles

WIREAWARE POWER LINE OBSTACLES



NOTE: 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.

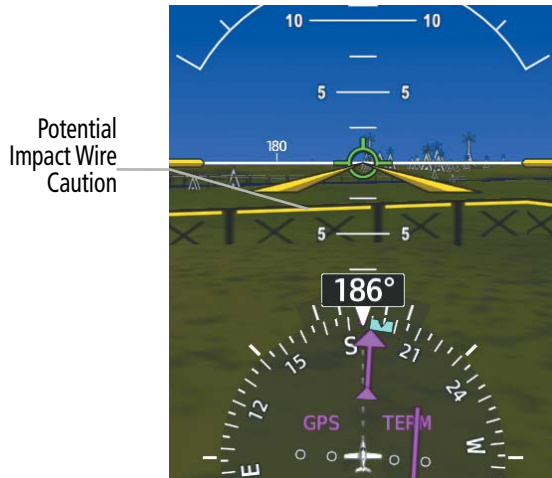


Figure 2-41 Wire Caution

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 MFD Home, touch **Map Settings**.
- 2) Touch the **Other** Tab.
- 3) Scroll and touch the **Field of View** Button to enable or disable the field of view indication. A green annunciator on the button indicates the field of view is enabled. A gray annunciator indicates the field of view is disabled.

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



Figure 2-42 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 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:

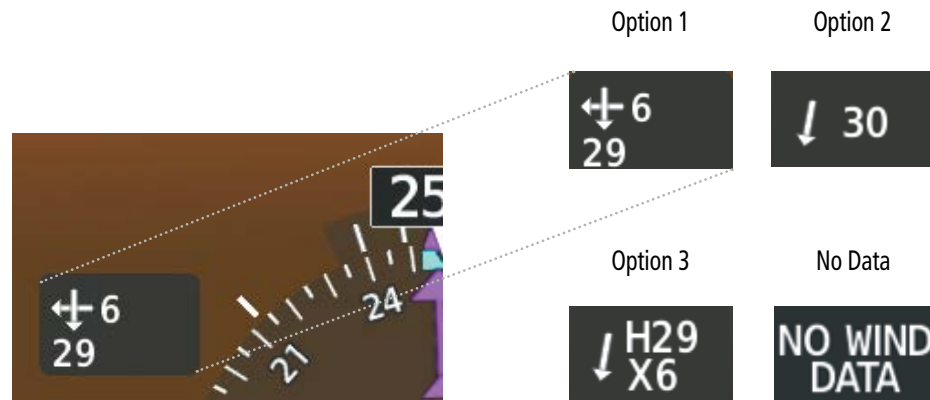


Figure 2-43 Wind Data

Displaying Wind Data:

- 1) From PFD Home, touch **PFD Settings**.
- 2) Scroll as necessary, and touch the **Wind** Button.
- 3) Touch desired wind option button (**Option 1**, **Option 2**, **Option 3**, or **Off**) to change how wind data is displayed.
 - **Option 1:** Wind direction arrows with headwind and crosswind components
 - **Option 2:** Wind direction arrow and speed
 - **Option 3:** Wind direction arrow with numeric headwind (H) or tailwind (T) and crosswind (X) components.
 - **Off:** Removes wind data from the PFD

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 PFD Home, touch the **Timers** Button.
- 2) Touch the **Time** Button.
- 3) Input the desired time using the numeric keypad, then touch the **Enter** Button.
- 4) Touch either **Up** or **Down** Button

- 5) To start timer, touch the **Start** Button. The button changes to **Stop**.
- 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 Table 2-3.

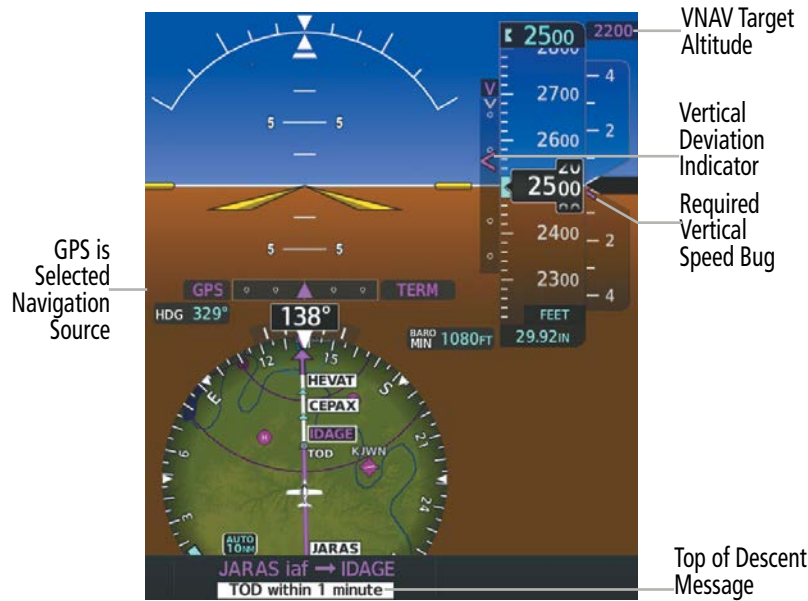


Figure 2-44 Vertical Navigation Indications (PFD)

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 cancelled	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 2-3 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.

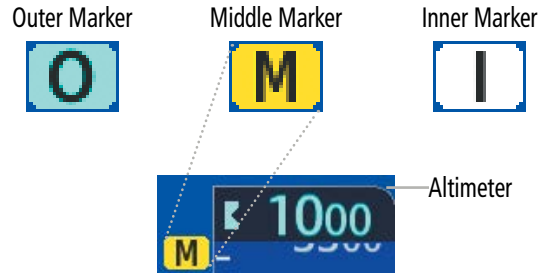


Figure 2-45 Marker Beacon Annunciations

ALTITUDE ALERTING

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

- Upon passing through 1000 feet of the Selected Altitude, the Selected Altitude changes to black text on a cyan background and flashes for five seconds.
- When the aircraft passes within 200 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.

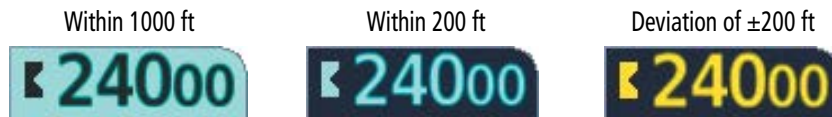


Figure 2-46 Altitude Alerting Visual Annunciations

LOW ALTITUDE ANNUNCIATION



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

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 2-47 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).

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 2-48 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 PFD Home, touch **Minimums**.

Or:

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

- 2) On the Minimums Screen, touch the **Minimums** Button.
- 3) To set the MDA/DH bug, touch either **Baro**, **Temp Comp**, or **Radio Alt** (optional) 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 right 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 on the Minimums Screen using the keypad or large and small knobs. When finished, touch the **Enter** Button or push the right knob.

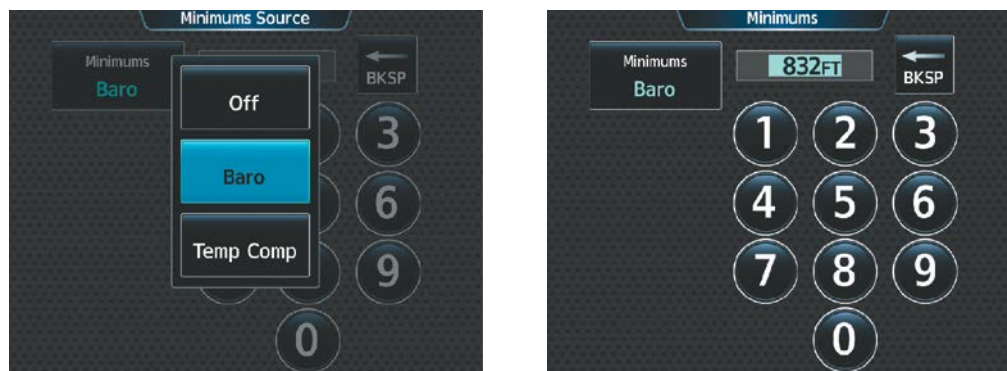


Figure 2-49 Minimum Descent Altitude/Decision Height

RADAR ALTIMETER DISPLAY (OPTIONAL)

If the optional radar altimeter display feature is installed, when the radar height (the aircraft altitude above ground level detected by the radar altimeter) is between zero and 2500 feet, the current value is displayed in white above the selected course/desired track box. Display of radar height becomes more sensitive as the height above ground decreases.



Figure 2-50 Current Radar Height

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

Table 2-4 Radar Altimeter Sensitivity

When the radar altimeter is selected as the altitude source for the minimum descent altitude/decision height alerting function, the radar altimeter numeric display changes to amber upon descending to at or below this altitude. Refer to the Minimum Descent Altitude/Decision Height Alerting discussion in this section for more information about this function.



Figure 2-51 RA as Altitude Source for MDA/DH

A ground line is shown on the Altimeter to display the aircraft's height relative to the ground. Diagonal lines appear below the ground line. If the radar altimeter provides invalid data, the message 'RA FAIL' is displayed in amber in place of the current radar height.

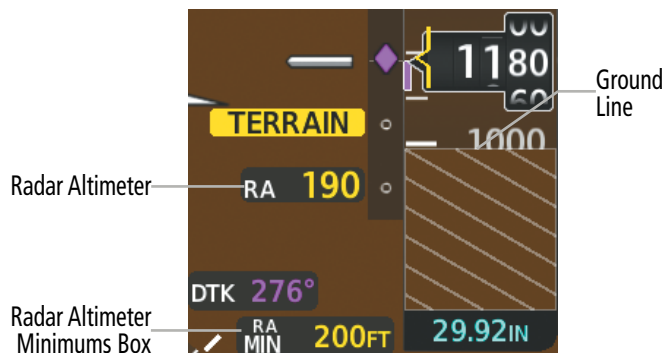


Figure 2-52 Altimeter Displaying the Ground Line



Figure 2-53 Radar Altimeter Invalid Data

2.5 ABNORMAL OPERATIONS

ABNORMAL GPS CONDITIONS

The annunciations listed in Table 2-5 can appear on 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
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 2-54 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 2-55 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 attitude/heading and air data is annunciated in the Reversionary Sensor Windows. Touching the **Sensors** Button from PFD Home accesses the **ADC 1** and **AHRS 1** Buttons. These buttons allow manual switching of the ADC and AHRS sensors. With most types of sensor failures, the system will make sensor selections automatically.



Figure 2-56 Reversionary Attitude/Heading and Air Data Sensor Annunciations (PFD)

Reversionary Sensor Window Text	Condition
USING ADC 2	PFD1 is displaying data from the #2 Air Data Computer.
USING ADC STBY	PFD1 is displaying data from the Standby Air Data Computer.
USING AHRS 2	PFD1 is displaying data from the #2 AHRS.
USING AHRS STBY	PFD1 is displaying data from the AHRS Standby.

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.

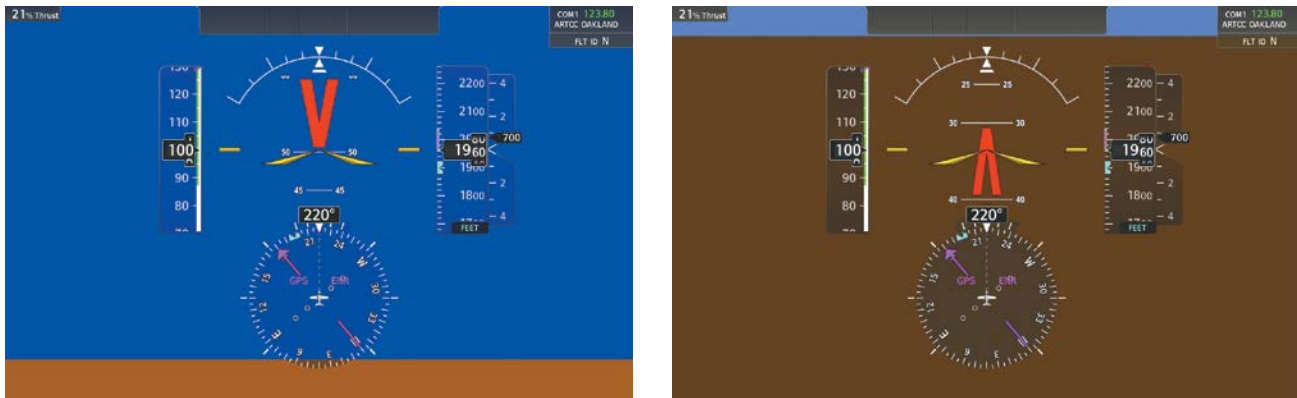


Figure 2-57 Unusual Attitude Display

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



Figure 2-58 Blue Sky Bar with Full Display Terrain

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 (and corresponding GTC buttons are disabled) 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

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 MFD Mode, PFD Mode, and NAV/COM Mode.

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

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.

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

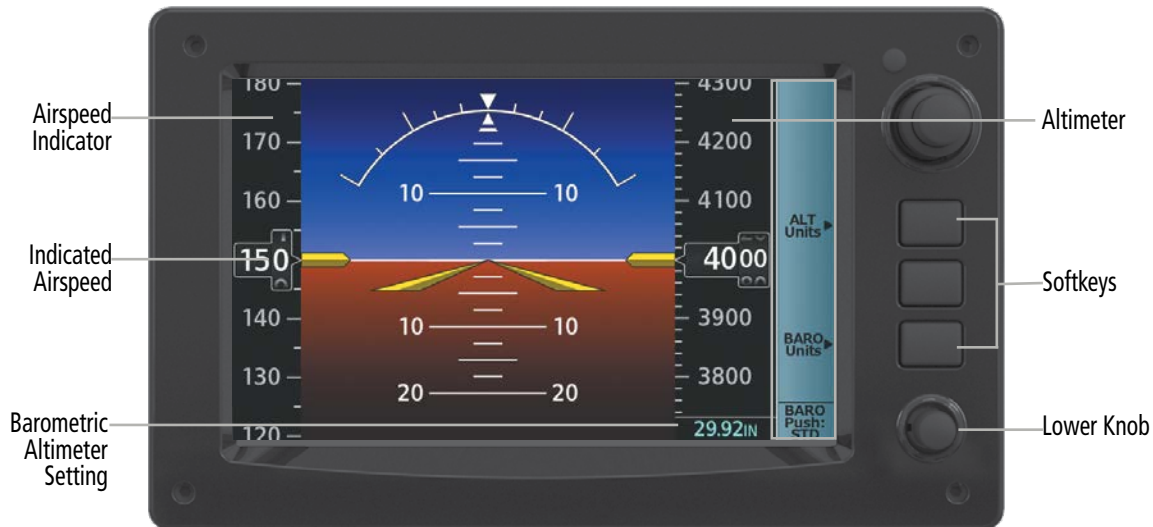


Figure 2-59 Touchscreen Controller

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 the **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.

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, pressurization, landing gear, flaps, and trim information 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, landing field elevation, and synoptics for system status, engine and fuel, environmental and pressure, electrical, ice protection, and landing gear.

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.

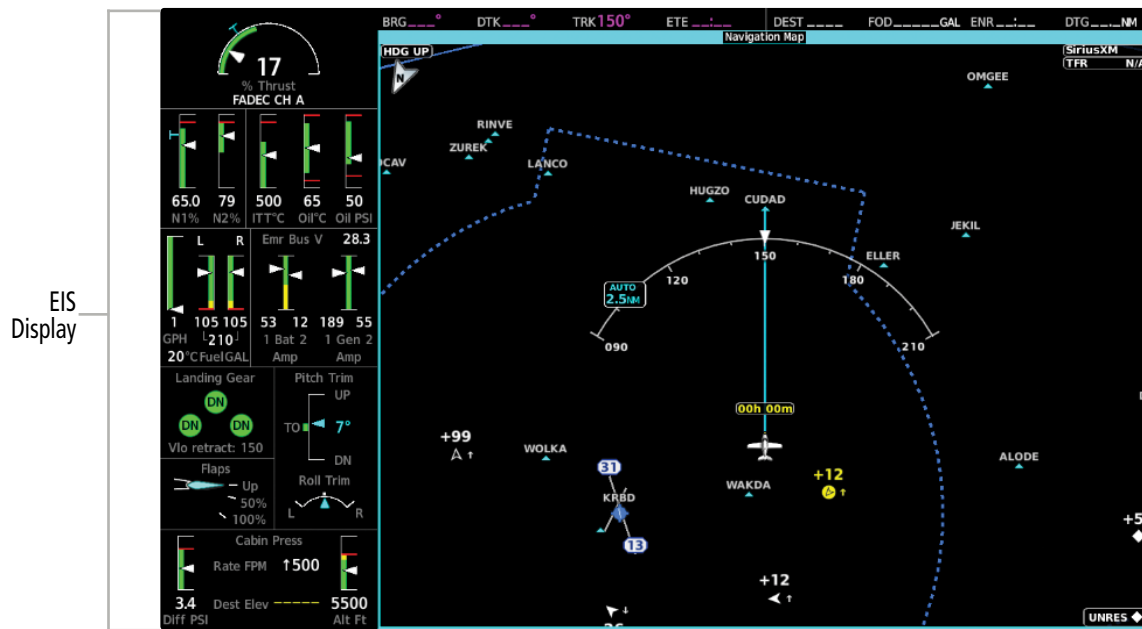


Figure 3-1 EIS (MFD - Normal)

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 a 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, or unavailable, 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.

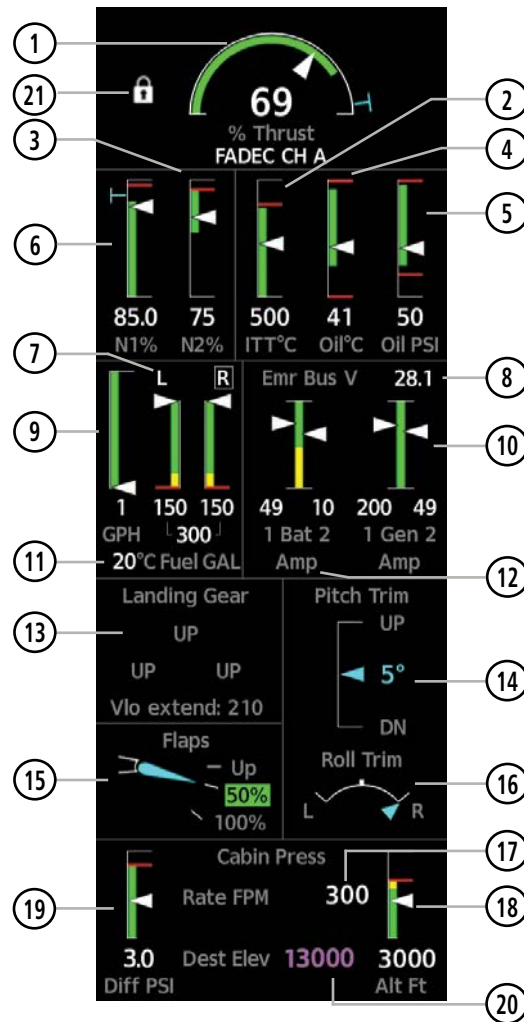


Figure 3-2 EIS Display (Normal)

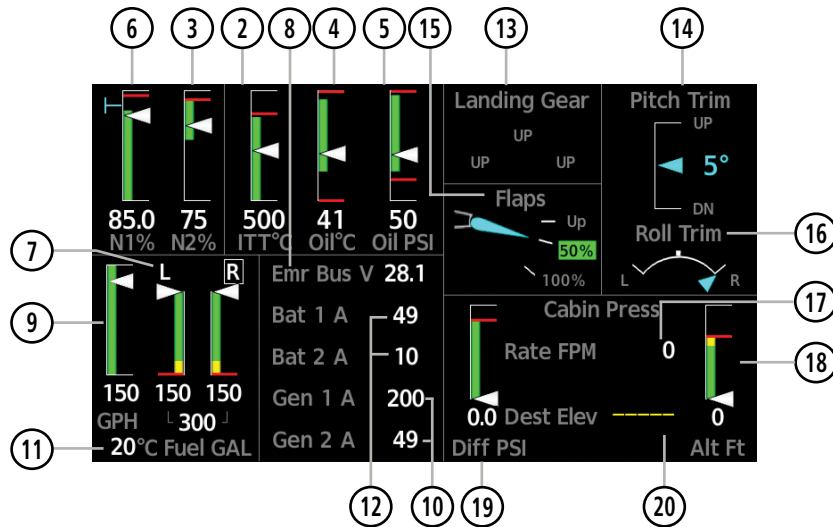


Figure 3-3 EIS Display (Reversionary)

1 % Thrust

A digital display and a white pointer along a green band indicate the % thrust normal operating range; the end of the green band is Max Continuous Thrust (MCT). A cyan Takeoff Bug represents the takeoff thrust level.

2 Interstage Turbine Temperature (ITT °C)

The ITT indication consists of a numeric display as well as an analog display. The displays are in degrees Celsius (°C).

ITT Normal Indications

ITT analog pointer will be white while within the normal operating range and not exceeding the steady state limit red threshold line

ITT Exceedance Indications

A red threshold line is displayed at the ITT Steady State Limit. The ITT pointer will turn from white to red and the analog digits will turn white with a red background (continuously flashing) if the ITT Steady State Limit is at an exceedance level.

3 Engine High Pressure Rotation Compressor Speed (N2%)

Displays Engine High Pressure Rotation Compressor Speed as a percentage. A green band indicates normal operating range. The N2 analog pointer and digits are white during normal operation (including engine start). White digits on a red background (flashing) are displayed when the N2 is at or beyond the red threshold line exceedance level.

4 Oil Temperature (Oil °C)

Oil temperature digits are white during normal operation. White digits on a red background (continuously flashing) are displayed in the event the oil temperature is not within the normal range.

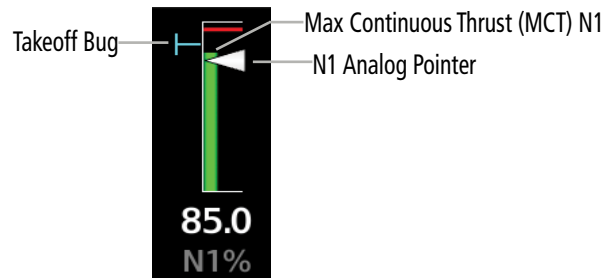
5 Oil Pressure (Oil PSI)

Oil pressure digits are white during normal operation. White digits on a red background (continuously flashing) are displayed in the event the oil pressure is not within the normal range.

- ⑥ **Engine Fan Rotation Speed (N1%)** The N1 gauge indicate the engine fan rotation speeds and are displayed as percentages.

N1 Normal Indications

A green band indicates normal operating range; the end of the band is Max Continuous Thrust (MCT) N1. The N1 analog pointer and digits will be white while within the normal operating range. The cyan takeoff bug indicates N1% at takeoff setting.



N1 Exceedance

A red threshold line is displayed at the N1 Max Steady State Speed. The N1 pointer will turn from white to red and the analog digits will turn white with a red background (continuously flashing) when the N1 Fan Speed is at an exceedance level.

- ⑦ **Fuel Tank Quantity and Selected Fuel Tank**

The fuel quantity is displayed as a total fuel quantity, and individual quantities are shown for the left and right tanks.

Fuel Tank Selection

The left and right fuel tanks can be selected automatically, or manually by the pilot. Automatic selection will be displayed as a white box around the 'L' or 'R' designation in white text. Manual selection will be displayed as a cyan box around the cyan text "L MAN" or "MAN R".

- ⑧ **Emergency Bus Voltage**

Displays emergency bus volts.

- ⑨ **Fuel Flow (GPH)**

Displays current fuel flow in gallons per hour (GPH).

- ⑩ **Generator Current**

Displays Generator 1 and 2 power in amps.

- ⑪ **Fuel Tank Temperature**







Displays fuel temperature in degrees Celsius (°C).

12 Battery Current

Displays Battery 1 and 2 power in amps. When external power is connected with the correct voltage, 'Ext Pwr' will be shown on the display.

13 Landing Gear Position

Displays landing gear position and Vlo extend or retract.

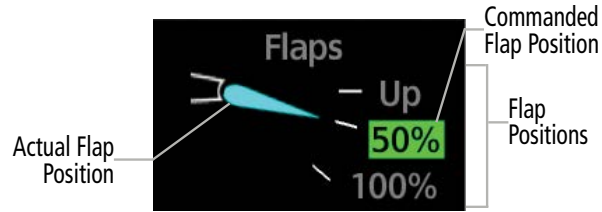
Description	Indication
Landing Gear Down and Locked	
Landing Gear Up	
Landing Gear Transitioning	
Landing Gear Caution	 Abnormal
Landing Gear Warning	
Invalid Landing Gear Indication	

14 Pitch Trim Surface Position

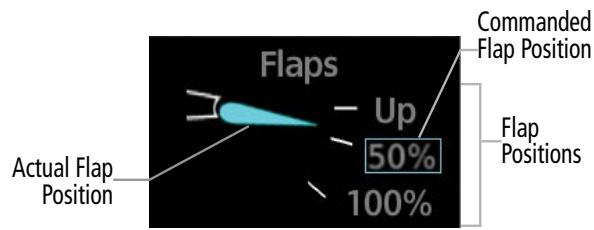
Pitch trim is shown along a scale. When the aircraft is on the ground and the trim positions are in the correct settings for takeoff, the pitch pointer will cyan be and will be within the green band. While in flight, the pointer will be cyan and the green band and 'TO' text on the pitch indicator will be removed. The pitch pointer will turn red and the pitch and angle digital display will flash red and white to indicate a warning condition. The pitch trim angle digital display will be black and white inverse video to indicate an advisory condition.

15 Flap Position

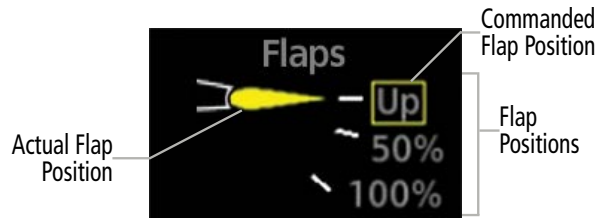
Flap position is normally displayed using a rotating pointer and the flap lever setting (Up, 50%, 100%). When the actual flap position is not the same as the commanded flap position, an amber box will be displayed around the commanded position and the pointer will be amber. When the actual flap position 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 cyan 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

- ⑩ **Roll Trim Surface Position** Displays roll trim position along a scale.
- ⑪ **Cabin Altitude Rate** Cabin Altitude Rate displays the rate at which the Cabin Altitude is changing. With a white arrow that points up or down for increasing or decreasing respectively. If Cabin Altitude Rate is 0, there will be no pointer.
- ⑫ **Cabin Altitude** The Cabin Altitude (Alt Ft) indicates the pressure altitude to which the cabin has been pressurized. When the Cabin Pressurization Control System is operating in High Landing Field Elevation mode, 'HIGH FIELD ELEVATION' is shown in white text surrounded by a white box.
- ⑬ **Cabin Pressure Differential** The Cabin Differential Pressure (Diff PSI) value indicates the cabin pressure differential. Values are displayed in white. White digits on a red background (continuously flashing) are displayed in the event the cabin pressure differential is not within the normal range.
- ⑭ **Destination Elevation** The Landing Field Elevation (Dest Elev) is shown on the Cabin Pressurization Display. FMS entered values appear in magenta. Manually entered values are cyan. If the Landing Field Elevation data has not been entered, or is invalid or not available, magenta dashes will be displayed in auto mode, and cyan dashes are displayed in manual mode. See Aircraft Systems, Landing Field Elevation, for instructions on how to set the Destination Elevation.
- ⑮ **Throttle Friction Lock** When the Throttle Friction Lock is engaged, a lock indicator will be shown on the top of the EIS display by the % Thrust display.

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
- Electrical
- Environmental & Pressure
- Status & Information
- Landing Gear
- Engine & Fuel



Figure 3-4 'Aircraft Systems' Screen

Additionally, FADEC Stale Fault Reset, GCU Reset and IPS Stall Offset Reset are covered in this section. The **Maintenance** Button is to be used by maintenance personnel only. Refer to Additional Features for information on how to use **Video** Button functions.

STATUS & INFO

The Status Synoptics Page shows external power, IPS fluid, oxygen, parking brake, and door status. Synoptic objects and text for doors are red when open. Synoptic icon, status/position text and text color/background may change based on component status.

Accessing the Aircraft Status Synoptics:

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

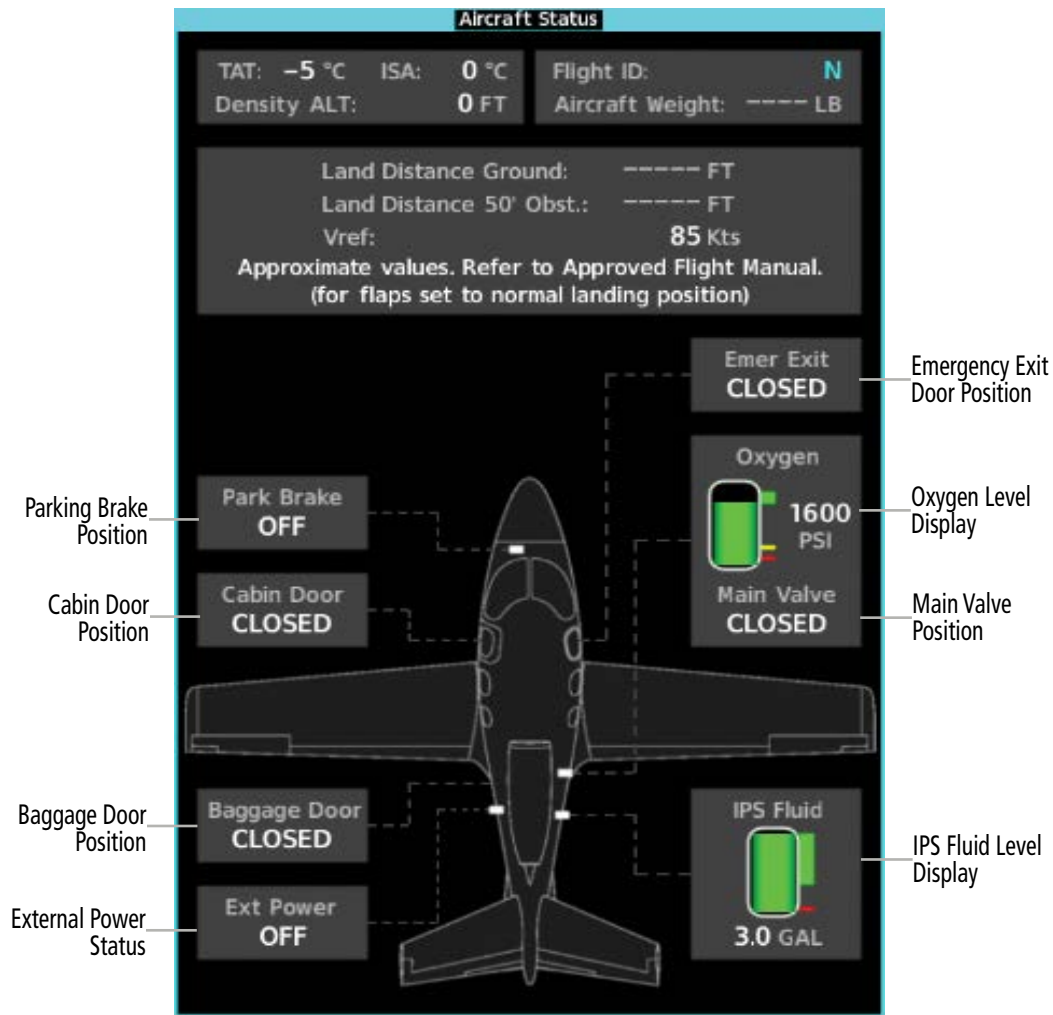


Figure 3-5 Status and Info

LANDING GEAR

The Landing Gear Synoptic Page uses a simplified diagram of the aircraft's hydraulic system to display the system status. When the landing gear system is operating normally, all objects and lines are shown in green on the system diagram. Lines between objects represent hydraulic lines. When the pump is shown in green it is powered on. When the pump is shown in white it is powered off (see Table 3-1). Amber objects, text/background indicate an abnormal or caution state. Red objects, text/background indicate a warning state.

Accessing the Landing Gear Synoptics:

From MFD Home, touch **Aircraft Systems > Landing Gear**.

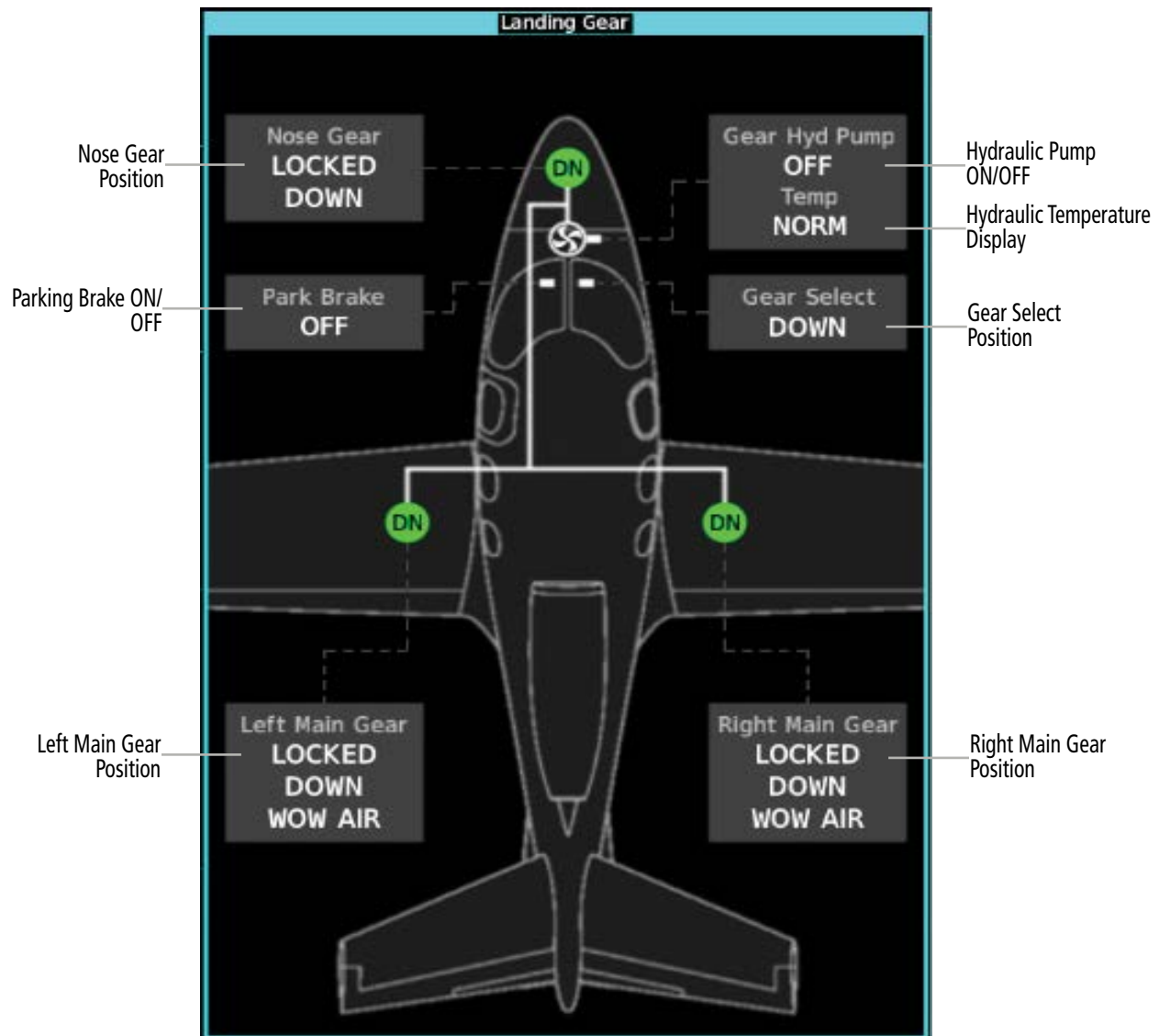


Figure 3-6 Landing Gear Synoptics






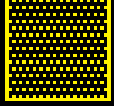



Unit	Icons and Descriptions					
Pumps	 Pump On	 Pump Off	 Caution			
Gear	 Gear Up	 Gear Down	 In Transition	 Caution	 Warning	 Invalid

Table 3-1 Landing Gear Synoptic Objects

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 (see Table 3-2).

Accessing the Engine & Fuel Synoptics:

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

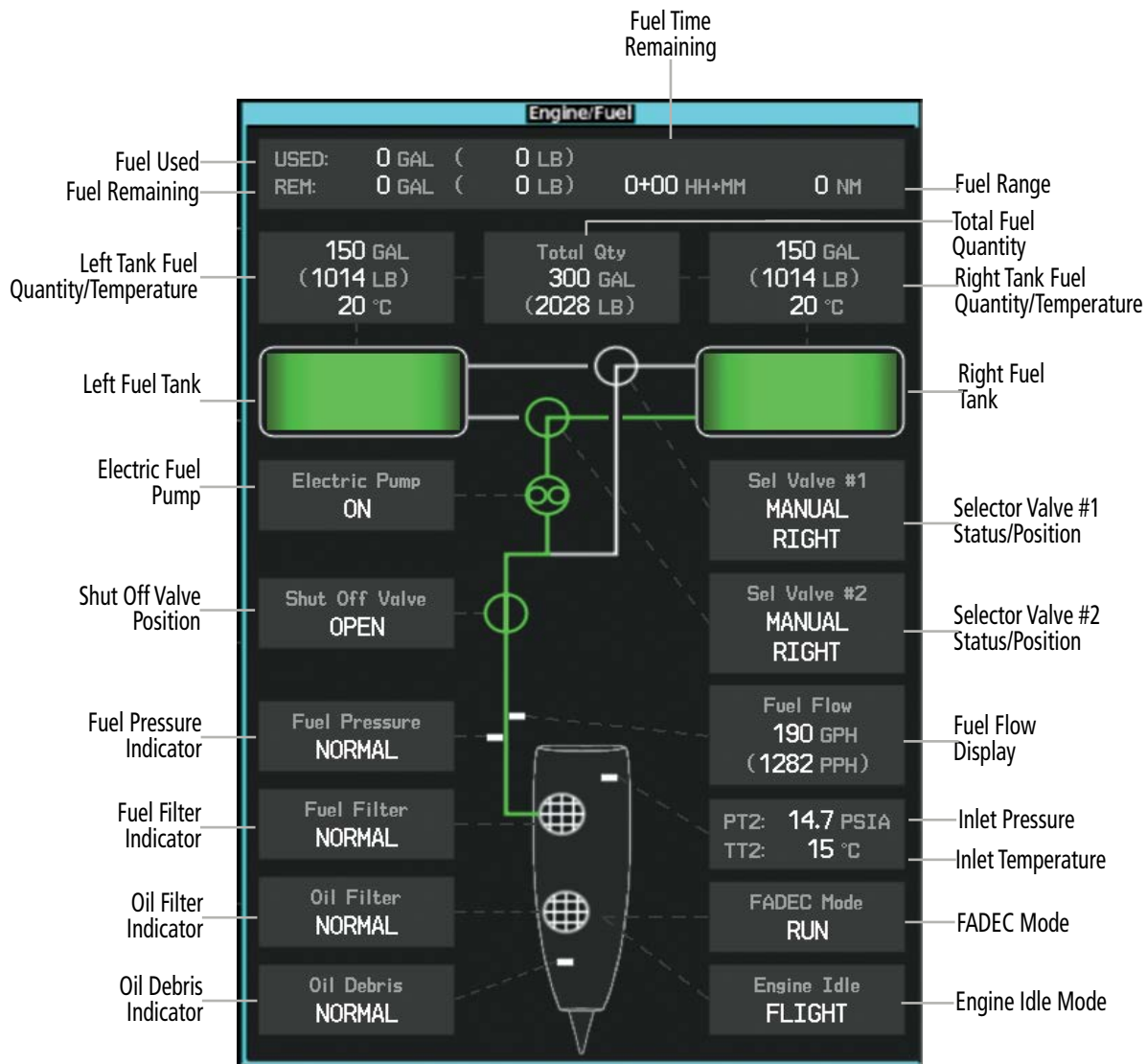


Figure 3-7 Fuel Synoptics




















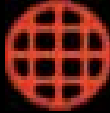







Icons and Descriptions					
Unit/Status	Auto/Normal/On	Manual/Open/On	Off/Closed/Unselected	Caution/Fail	Warning/Fail
Fuel Pump	 Electric Pump ON	 Electric Pump ON	 Electric Pump OFF	 Electric Pump FAIL	
Shut-Off Valve	 Shut Off Valve OPEN	 Shut Off Valve OPEN	 Shut Off Valve CLOSED	 Shut Off Valve VALVE FAIL	
Selector Valves	 Sel Valve #1 AUTO RIGHT	 Sel Valve #1 MANUAL RIGHT	 Valve Closed	 Sel Valve #1 SELECTOR FAIL LEFT	
Fuel Pressure Indicator	 Fuel Pressure NORMAL				 Fuel Pressure LOW
Oil Debris Indicator	 Oil Debris NORMAL			 Oil Debris DEBRIS	 Oil Debris DEBRIS
Oil and Fuel Filters	 Oil Filter NORMAL Fuel Filter NORMAL			 Oil Filter BYPASS	 Oil Filter BYPASS Fuel Filter BYPASS
Fuel Tank Status	 Automatic	 Manual	 Unselected	 Caution	
Fuel Level	 Normal			 Caution	 Warning

Table 3-2 Fuel Synoptic Objects

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 current flow. Green lines indicate there is current flow. White lines indicate there is no current flow. Objects in green are powered on. Objects in white are powered off. Amber objects, text/background, or lines indicates an abnormal or caution state. Red objects or text/background indicates a warning state (see Table 3-3).

Accessing the Electrical Synoptics:

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

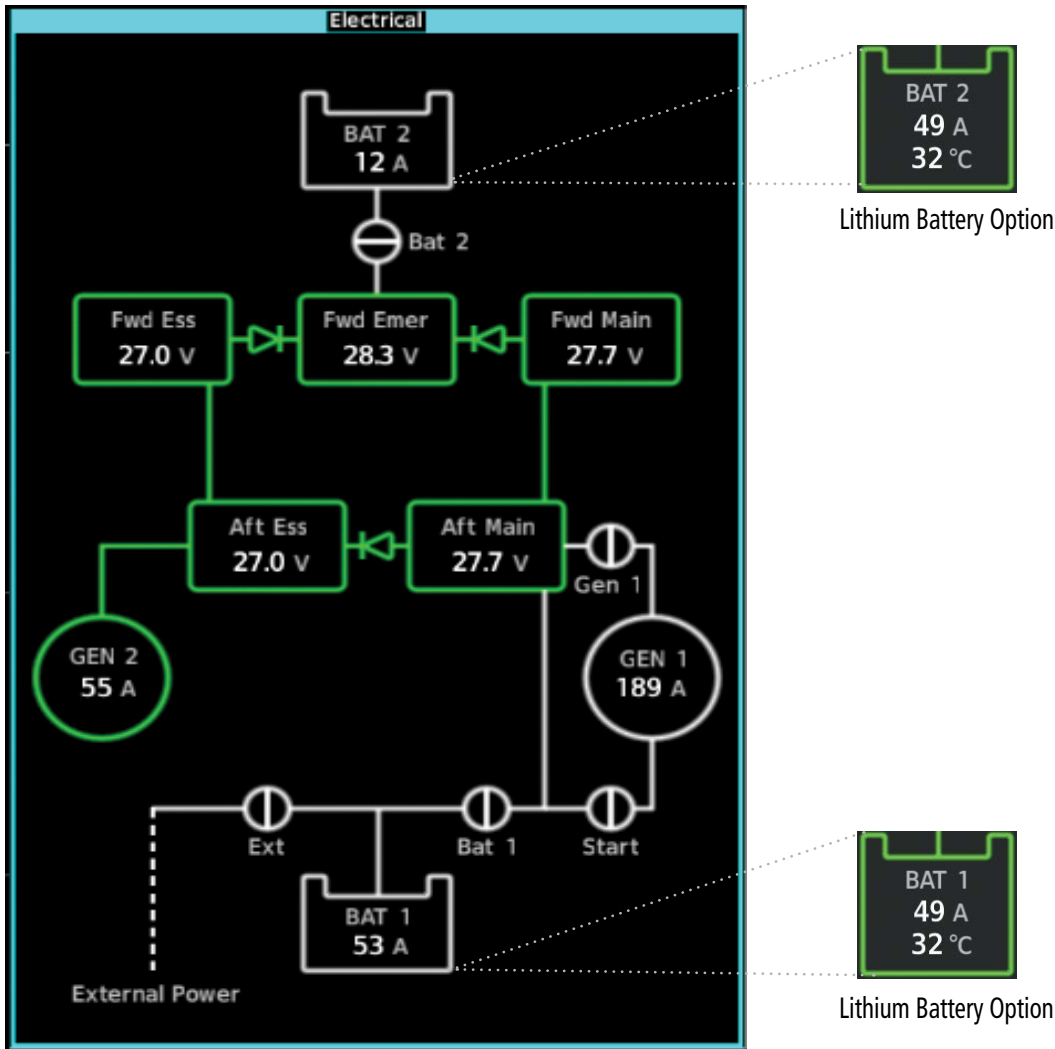
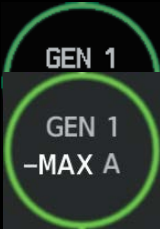
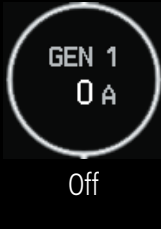












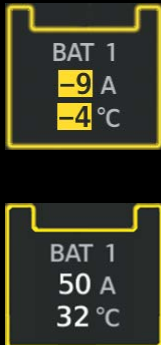







Figure 3-8 Electrical Synoptics

Unit	Icons and Descriptions			
Generator				
Bus				
Battery				
Battery (Lithium)				
Contactor				









Unit	Icons and Descriptions			
Diode	 Normal	 No power	 Caution	 Warning
External Power	 Connected	 Removed	 Caution	 Warning

Table 3-3 Electrical Synoptic Objects

ICE PROTECTION

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 bleed air flow. Green lines indicate flow. White lines indicate there is no flow. Objects in green are open or on. Objects in white are off or closed, with the exception of

sensors, which are white when on. Amber objects, text/background, or lines indicates an abnormal or caution state. Red objects, lines, or text/background indicates a warning state (see Table 3-4).

Accessing the Ice Protection Synoptics:

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

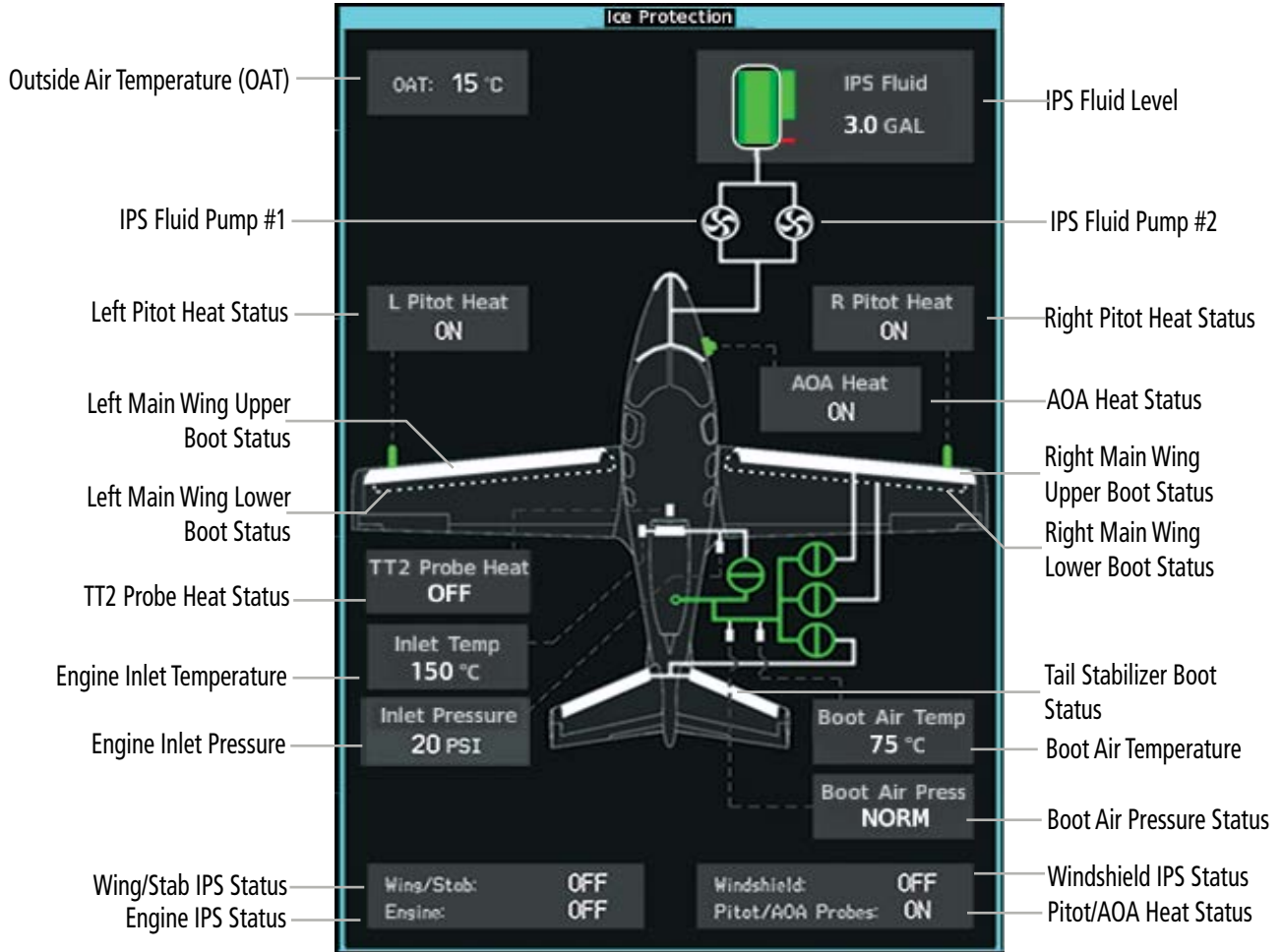


Figure 3-9 Ice Protection Synoptics

Unit	Icons and Descriptions			
Pumps	 Pump On	 Pump Off		
Valves	 Power/Valve Open	 No Power/Valve Closed	 Caution/ Valve Open	 Warn ? losed Warning INOP
Sensors		 Normal	 Caution	 Warning
Pitot Heat	 R Pitot Heat ON	 R Pitot Heat OFF	 R Pitot Heat FAIL	
AOA Heat	 AOA Heat ON	 AOA Heat OFF	 AOA Heat FAIL	
IPS Fluid	 Normal	 Advisory		 Warning
Boot Air Temp		Boot Air Temp 75 °C Normal		Boot Air Temp 101 °C Warning
Boot Air Pressure		Boot Air Press NORM Normal	Boot Air Press FAIL Caution	Boot Air Press FAIL Warning













Unit	Icons and Descriptions			
Main Wing Upper Boot	 On	 Normal	 Caution	 Warning
Main Wing Lower Boot	 On	 Normal	 Caution	 Warning
Tail Stabilizer Boot	 On	 Normal	 Caution	 Warning

Table 3-4 Ice Protection Synoptic Objects

ENVIRONMENTAL & PRESSURE

The Environmental and Pressure Synoptic Page uses a simplified diagram of the aircraft's environmental system to display the system status. Lines between objects indicate bleed air flow. Green lines indicate there is flow. White lines indicate there is no flow. Objects in green are on or open. Objects in white are off or closed. Amber objects, text/background, or lines indicate an abnormal or caution state. Red objects or text/background indicate a warning state (see Table 3-5).

Accessing the Environmental & Pressure Synoptics:

From MFD Home, touch **Aircraft Systems > Enviro & Pressure**.

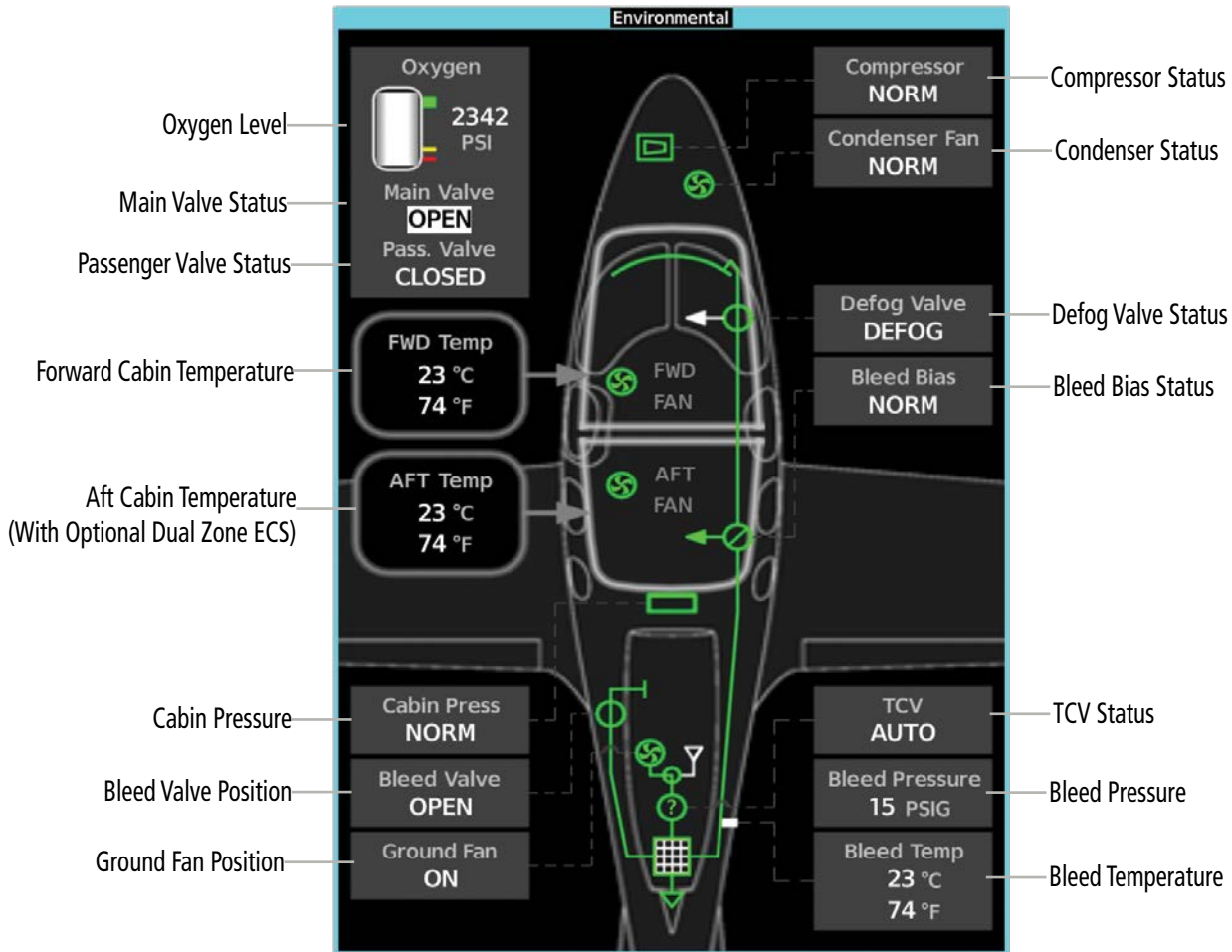





















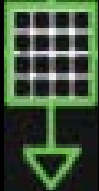
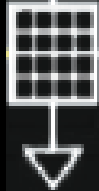









Figure 3-10 Environmental Synoptics

Unit	Icons and Descriptions			
Main Valve	 Main Valve OPEN Main Valve CLOSED Normal, Valve Closed	 Main Valve OPEN Advisory, Open	 Main Valve OPEN Main Valve CLOSED Caution, Valve Closed	
Passenger Valve	 Pass. Valve OPEN Pass. Valve CLOSED Normal, Valve Closed		 Pass. Valve FAIL Valve Fail	
Bleed Valve	 Bleed Valve OPEN Normal Open	 Bleed Valve CLOSED Normal Closed	 Bleed Valve OPEN Underpressure	
Defog Valve	 Defog Valve OPEN Defog Valve DEFOG Bleed Air On Valve Open	 Defog Valve CLOSED Defog Valve DEFOG Bleed Air Off Valve Open	 Defog Valve FAIL Valve Fail	
Defog Indicator	 Valve Open	 Valve Closed	 Overheat Caution	 Overheat Warning Valve Closed

Unit	Icons and Descriptions			
Bleed Air Bias Valve	 Bleed Bias NORM Normal	 Bleed Bias DISABLE Disable	 Bleed Bias FAIL Fail	
TCV Valve	 TCV AUTO Automatic	 TCV TEMP BACKUP Manual	 TCV FAIL Fail	
Heat Exchanger	 On	 Off		
Cabin Pressure	 Cabin Press NORM			 Cabin Press FAIL Cabin Press DUMP
Condenser Fan	 Condenser Fan NORM	 Condenser Fan DISABLE	 Condenser Fan FAIL	
Ground Fan	 Ground Fan ON	 Ground Fan OFF		



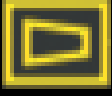




Unit	Icons and Descriptions			
Compressor	 <p>Compressor NORM</p>	 <p>Compressor DISABLE</p>	 <p>Compressor FAIL</p>	
Oxygen Tank	 <p>Normal Green</p>	 <p>Normal White</p>	 <p>Caution</p>	 <p>Warning</p>

Table 3-5 Environmental & Pressure Synoptic Objects

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: Engine Fire, Stall Warn, 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. Prior to a test being 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). Selecting the Preflight Test Button will cause the system to automatically initiate each system test in succession. All tests are mutually exclusive. If a System Test is selected while another test is already running, the currently active test is cancelled and the new test is activated. Pressing an active system test will deactivate that test.

Refer to Table 3-6 for the expected results of each system test.

Accessing the System Tests:

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

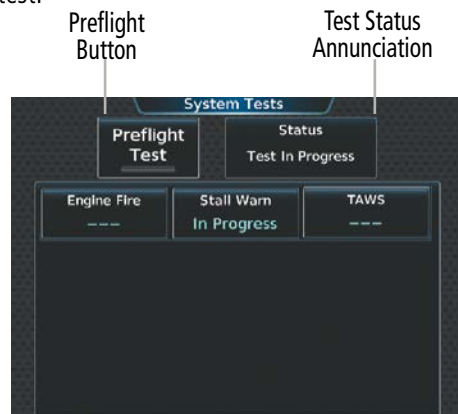


Figure 3-11 Aircraft ‘System Tests’ Screen

System Test	Description
Engine Fire	Tests the engine fire indications.
Stall Warn	Tests the Stall Warning Protection System.
TAWS	Tests the Terrain Awareness and Warning System (TAWS).

Table 3-6 System Tests

LANDING FIELD ELEVATION

The 'Landing Field Elevation' Screen on the Touchscreen Controller allows the pilot to select Manual or FMS Mode. The Landing Field Elevation automatically displays magenta dashes during initial power application. Once a flight plan is entered, the Landing Field Elevation is updated to reflect the new destination elevation. FMS entered values appear in magenta. Manually entered values appear in cyan. If the Landing Field Elevation data is not set while in the air, the digits are replaced with amber dashes. If the Landing Field Elevation data is not set while on the ground, the digits are replaced with magenta dashes.

Adjusting the Landing Field Elevation Settings:

- 1) From MFD Home, touch **Aircraft Systems > Landing Field Elev.**
- 2) Touch the **FMS** or **Manual** Button as desired. If using FMS Destination, the Landing Elevation digits will be magenta. If using Manual Mode, the text will be cyan.
- 3) Touch **Landing Elevation** Button to set the Landing Elevation.
- 4) Input the Landing Elevation by touching the number keys, or touch **Use FMS Destination** Button.



Figure 3-12 Landing Field Elevation - FMS Mode



Figure 3-13 Landing Field Elevation - Manual Mode



Figure 3-14 Landing Elevation - Manual Input

FADEC STALE FAULT RESET

Touching the **FADEC Stale Fault Reset** Button causes a fault reset command to be sent to the FADEC. Refer to the current version of the pertinent flight manual for more information.

Accessing FADEC Stale Fault Reset:

From MFD Home, touch **Aircraft Systems > FADEC Stale Fault Reset**.

GCU RESET

Touching the **GCU Reset** Button causes a reset command to be sent to the GCU. Refer to the current version of the pertinent flight manual for more information.

Accessing GCU Reset:

From MFD Home, touch **Aircraft Systems > GCU Reset**.

IPS STALL OFFSET RESET

If the IPS System has been powered off and the **IPS Stall Offset Reset** Button is touched, the Stall Warning and Protection System (SWPS) will discontinue use of calculations for icing conditions that result in higher stall speed. The **IPS Stall Offset Reset** Button is intended to be used by the crew after visual verification that wings are free of ice contamination. Refer to the current version of the pertinent flight manual for more information.

Accessing IPS Stall Offset Reset:

From MFD Home, touch **Aircraft Systems > IPS Stall Offset Reset**.

3.3 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 3-15 EIS (Reversionary Mode)

Blank Page

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 transponders. 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 passenger(s) as well as a marker beacon receiver, and a COM clearance recorder.

The Mode S transponder is controlled with the Touchscreen Controller. The Transponder Mode/Code Button is located in the upper left corner of the 'NAV/COM Home' Screen, right below the Active Transponder Indication/IDENT Button. The Transponder Mode/Code 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
- Transponder
- Mono/Stereo Headsets
- Cockpit Speaker
- Intercom
- Clearance Recorder and Player
- SiriusXM Radio Entertainment
- Audio Feedback (Clicks)

TOUCHSCREEN CONTROLLER AUDIO AND CNS CONTROLS



Figure 4-1 Touchscreen NAV/COM Home Screen

- ① **STBY Button (COM1)** – Displays/removes the ‘COM1 Standby’ Screen. The ‘COM1 Standby’ Screen is used to enter and transfer COM1 frequencies.
- ② **COM1 Button** – Transfers the standby and active COM1 frequencies.
- ③ **Large/Small Upper Knob** – Function as labeled (see #4). *Data Entry*: Large knob moves the cursor from field to field. Small knob edits character by character. *Frequency Entry*: Large knob increases/decreases MHz; small knob increases/decreases kHz. Push and hold to transfer the standby frequency to the active frequency.
- ④ **Function Label** – Indicates right large and small 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: Enter” 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 Home Softkey** – Selects the Navigation and Communication home screen on the Touchscreen Controller.
- ⑥ **Function Label** – Indicates lower knob function. *Typical:* Pilot COM1/COM2 Volume, Push: Squelch
- ⑦ **Lower Knob** – Function as labeled (see #6).
- ⑧ **XPDR IDENT Button** – Transmits a distinct identity indication to Air Traffic Control (ATC). When touched, the word IDENT is displayed in green on the **Transponder Code/Mode** Button. The green IDENT pulsates for the duration of the transmission.
- ⑨ **Keypad** – Used for finding, entering, and editing the frequency in the selected standby COM Frequency window.
- ⑩ **Play Button** – Used to play the digital COM audio recorded by the clearance recorder. Multiple touches will go back incrementally to the previous message within the clearance recorder.
- ⑪ **COM2 Button** – Transfers the standby and active COM2 frequencies.
- ⑫ **STBY Button (COM2)** – Displays/removes the ‘COM2 Standby’ Screen. The ‘COM2 Standby’ Screen is used to enter and transfer COM2 frequencies.
- ⑬ **Audio & Radios** Button – Displays/removes the ‘Audio & Radios’ Screen. The ‘Audio & Radios’ Screen is used to control the Communication/Navigation/Surveillance (CNS) and Audio settings for the pilot and copilot.
- ⑭ **Intercom** Button – Displays/removes the ‘Intercom’ Screen. The ‘Intercom’ Screen is used to control the intercom isolation, volume, and squelch settings for the pilot, copilot, and passenger.
- ⑮ **MON** Button – Controls which receivers are being explicitly monitored by the pilot.
- ⑯ **Pilot Music 1 Button** – Enables/Disables the entertainment audio selected on the Music 1 input from the ‘Audio & Radios’ Screen.
- ⑰ **Pilot Isolate** Button – Displays the ‘Intercom’ Screen and deselects the intercom link between the pilot and the copilot/passengers. The ‘Intercom’ Screen is used to control the intercom isolation, volume, and squelch settings for the pilot, copilot, and passenger.
- ⑱ **MIC** Button – Switches the pilot’s active COM radio between the #1 COM transceiver and the #2 COM transceiver.
- ⑲ **Transponder Code/Mode** Button – Indicates the current code and mode of the transponder and displays/removes the ‘Transponder’ Screen. The ‘Transponder’ Screen is used to select the transponder mode by selecting a mode button. It is also used to select the code by using the keypad or by touching the **VFR** Button. While the transponder is replying to an interrogation, an R is displayed on the button.
- ⑳ **Active Transponder Indication/IDENT** Button – Indicates which transponder is active and, when touched, transmits a distinct identity indication to Air Traffic Control (ATC). When selected, the word IDENT is displayed in green and pulsates for the duration of the transmission.

PFD COM/NAV DISPLAY



Figure 4-2 Active NAV Window, Active COM Frequency Box, Flight ID

- 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.
- ③ **Flight ID Box** – Displays the Flight ID\Tail number.

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 COM1 and COM2 Frequencies are displayed on the 'NAV/COM Home' Screen, on the 'Audio & Radios' Screen, and also in upper right corner of the PFD. The COM transceiver can be selected for transmitting using the Touchscreen Controller.

The active COM 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 **MIC** Button to select the COM radio for transmission.

Selecting a COM Radio for monitoring:

From NAV/COM Home, touch the **MON** Button to monitor the COM not selected for transmission.

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 to select the COM radio for monitoring.

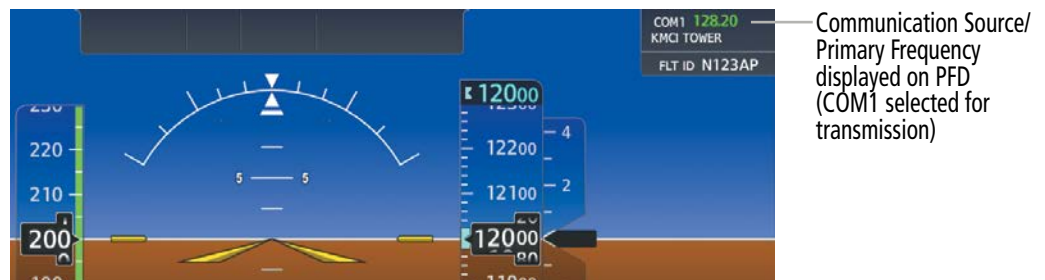


Figure 4-3 Selecting a COM Radio for Transmission

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 COM1/2 frequency from the 'NAV/COM Home' Screen:

- 1) From NAV/COM Home, touch the COM1 **STBY** Button or COM2 **STBY** Button to select that radio for tuning.
- 2) Use the keypad to select the frequency.
- 3) Touch the **Enter** Button to accept the new frequency as the COM1/COM2 standby frequency.

Or:

Touch the **XFER** Button to accept the new frequency as the COM1/COM2 active frequency and transfer the previously active frequency to the standby frequency.

Or:

Touch the COM1/COM2 active frequency on the 'NAV/COM Home' Screen to accept the new frequency as the COM1/COM2 active frequency and transfer the previously active frequency to the standby frequency.

Or:

- 1) Push the small upper knob to select the COM desired for tuning (selected standby frequency is cyan).
- 2) Turn the large and small right knobs to tune the frequency (Large knob increases/decreases MHz; Small knob increases/decreases kHz).
- 3) Push the small upper knob to enter the new frequency as the standby frequency; or push and hold the small upper knob to transfer the new standby frequency to the active frequency.



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 COM/COM2 Standby Screen.
- 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.

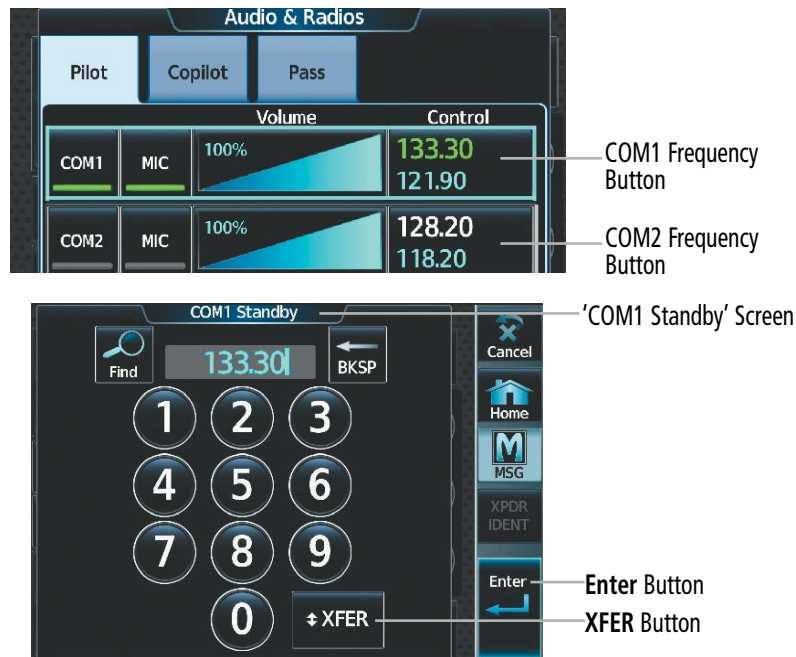


Figure 4-6 'Audio & Radios' Screen COM Frequency Tuning

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.
- 3) Turn the large and small upper knobs to select the frequency (Large knob increases/decreases MHz; Small knob increases/decreases kHz).
- 4) Push the small upper knob to accept the new frequency as 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 4-7 'Audio & Radios' Screen COM Frequency Tuning

Selecting Sync to Pilot Option:

- 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 Synch to Pilot is enabled.



Figure 4-8 Sync to Pilot Button

Finding and selecting a COM frequency from the 'NAV/COM Home' Screen:

- 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/COM2 standby frequency.

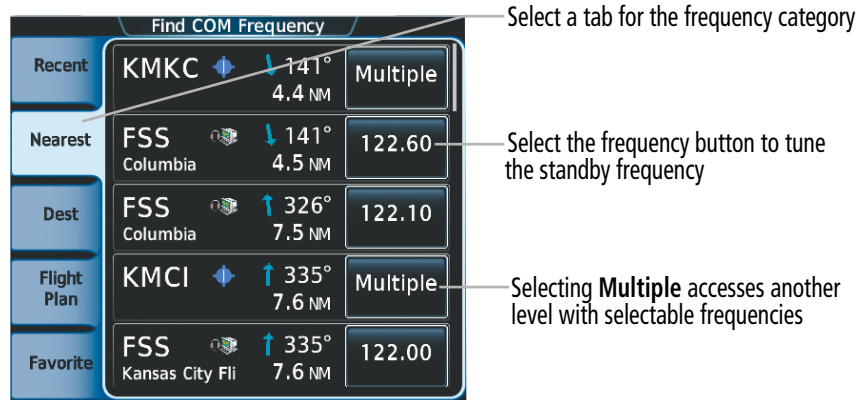


Figure 4-9 Find COM Frequency Screen

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

- 1) From MFD 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 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.

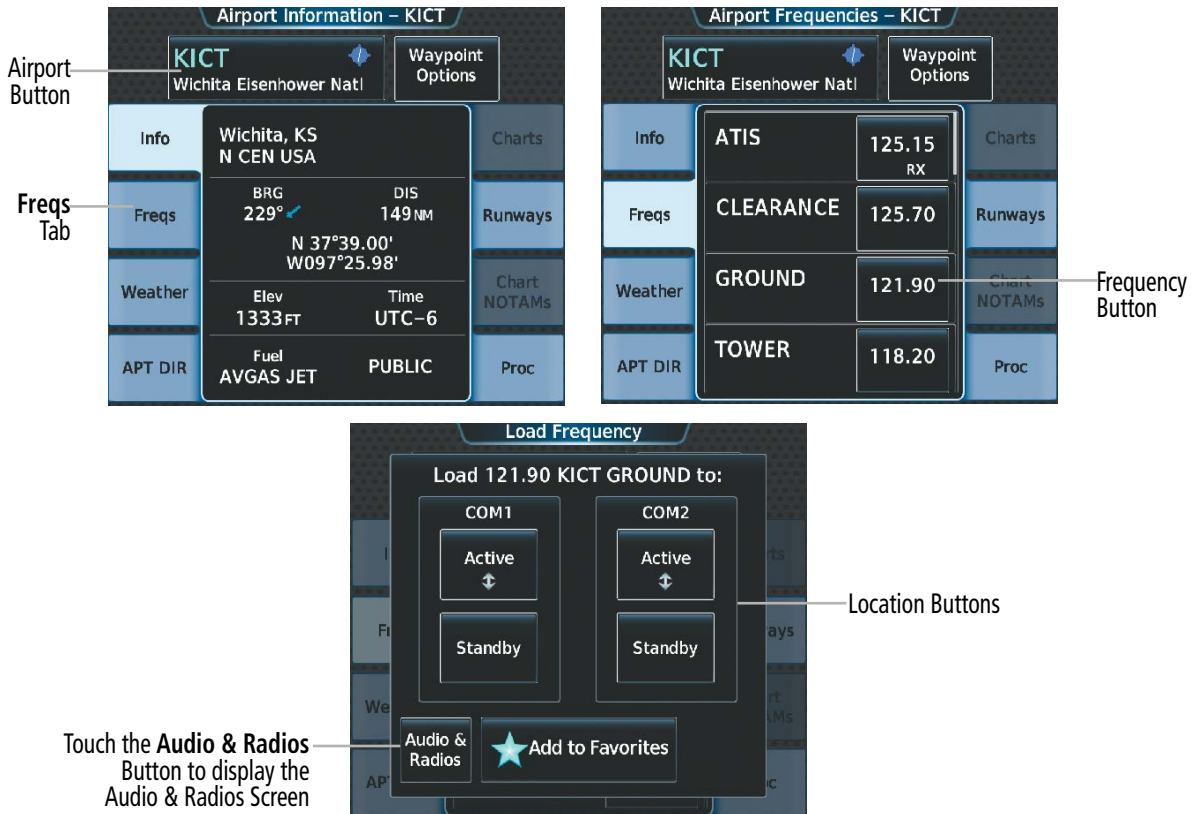


Figure 4-10 Airport Info Screen Tuning

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

- 1) From MFD Home, touch **Nearest > Airport** to display the 'Nearest Airport' Screen.
- 2) Scroll the list to find the desired airport.
- 3) Touch the 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.

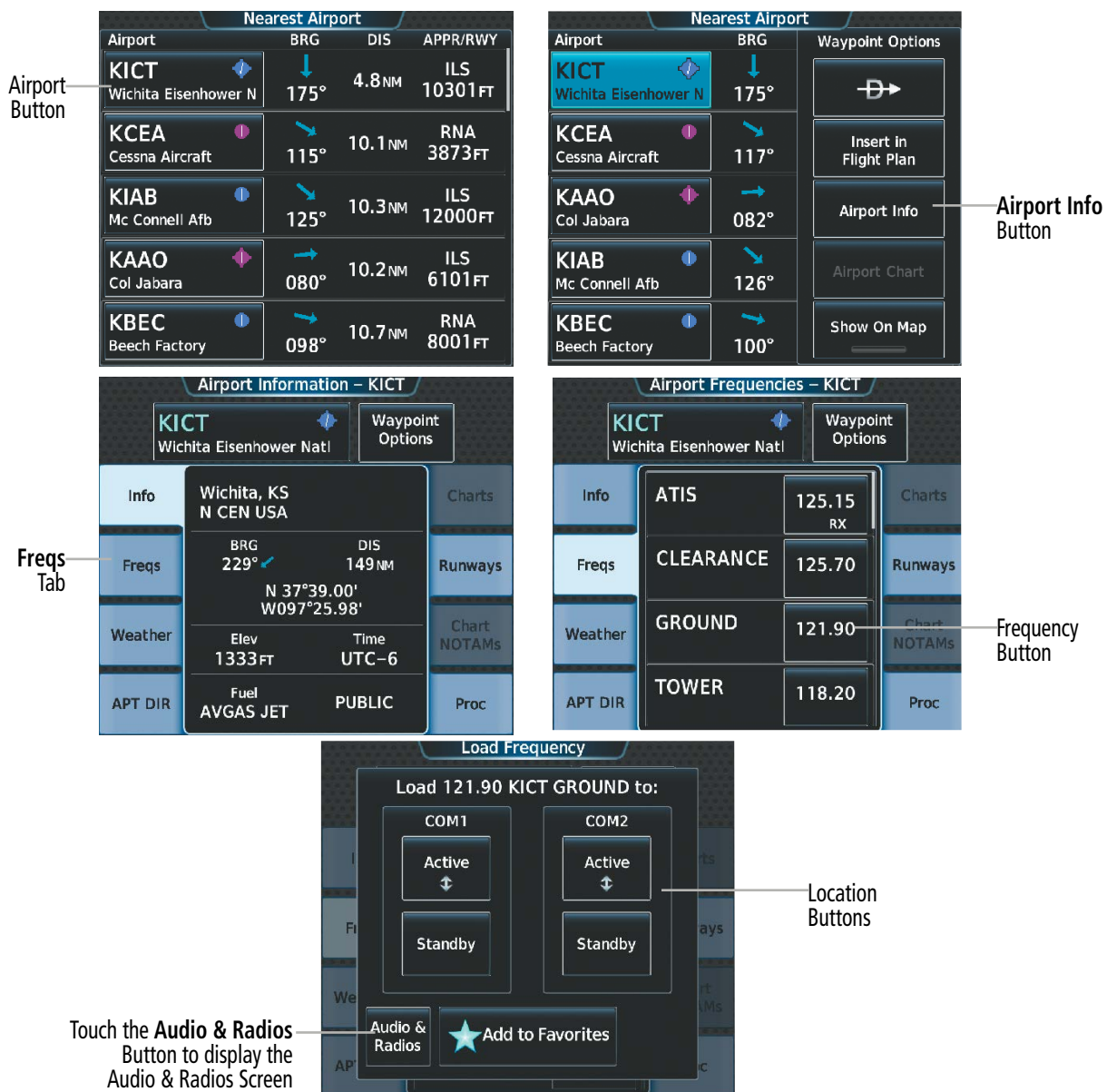


Figure 4-11 Nearest Airport Tuning

Finding and selecting a COM frequency from the Nearest Airspace/ARTCC/FSS/Weather Screen:

- 1) From MFD 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 to COM1/2 Active/Standby or Favorites.

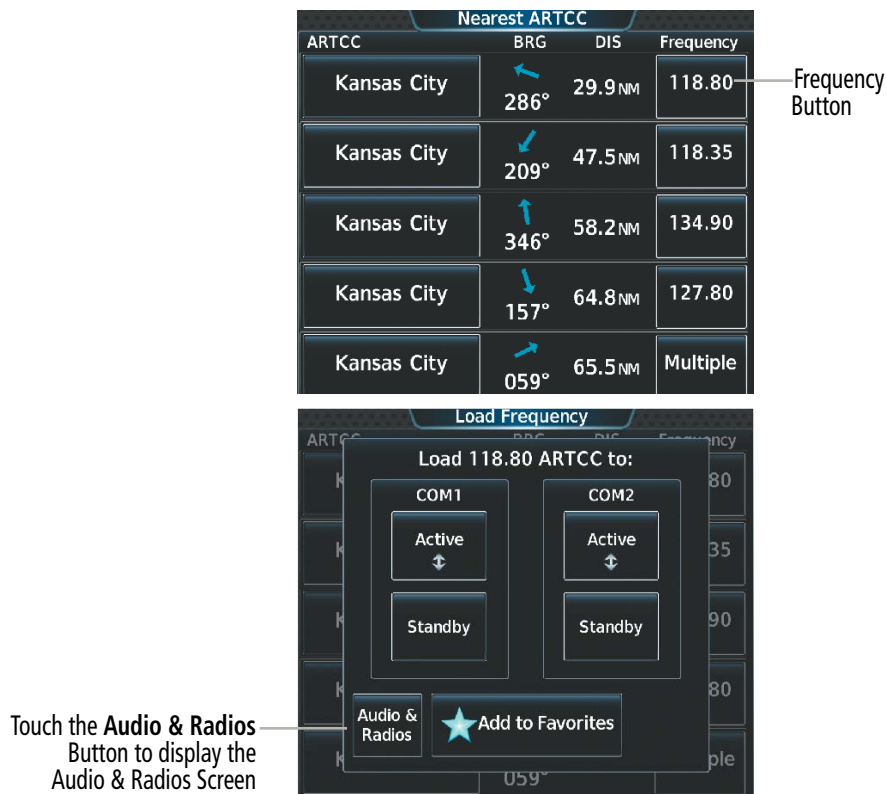


Figure 4-12 Nearest Airspace/ARTCC/FSS/Weather Tuning

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. Touch the COM1/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 4-13 Adding a Frequency to Favorites

Adding a COM frequency to favorites from the '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 Favorite** Button.

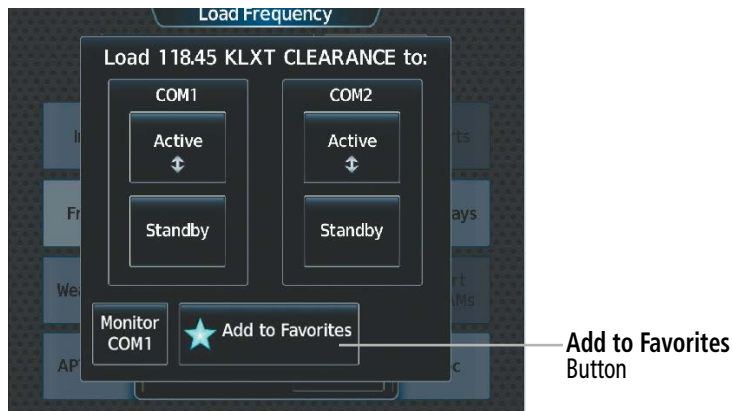


Figure 4-14 'Load Frequency' Screen - Add to Favorites Button

Selecting a COM frequency from favorites:

- 1) From NAV/COM Home, touch the **Find** Button.
- 2) Touch the **Favorite** Tab.
- 3) Touch the desired frequency button to accept it as the new COM1/COM2 standby frequency.

Or:

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

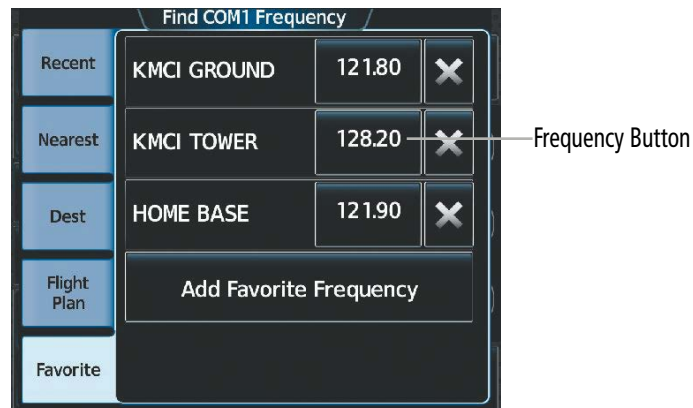


Figure 4-15 Selecting a COM Frequency from Favorites

Deleting a COM frequency from Favorites:

- 1) From NAV/COM Home, touch 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.

Or:

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

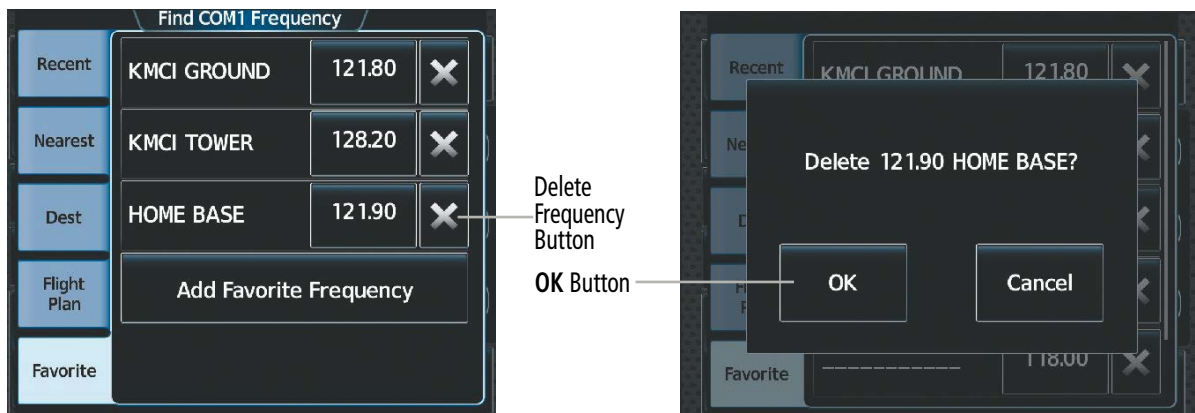


Figure 4-16 Deleting a COM Frequency from Favorites

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.



Figure 4-17 COM Channel Spacing

Changing COM frequency channel spacing from PFD Home:

- 1) From PFD Home, touch **PFD Settings > General > COM Channel Spacing**.
- 2) Touch the COM Channel Spacing Button to display the choice of **25.0 kHz** or **8.33 kHz**.
- 3) Touch the desired channel spacing button.

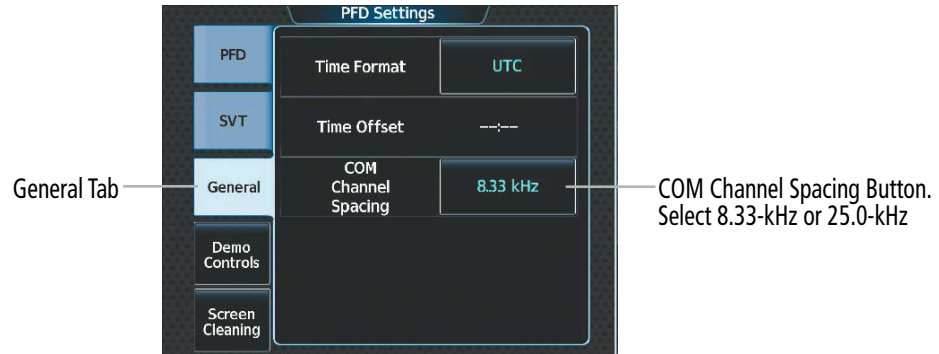


Figure 4-18 Changing COM Frequency Channel Spacing

Changing COM frequency channel spacing from MFD Home:

- 1) From MFD Home, touch **Utilities > Setup > Avionics Settings**.
- 2) Scroll the list to show the COM Channel Spacing button.
- 3) Touch the COM Channel Spacing button to display the choice of **25.0 kHz** or **8.33 kHz**.
- 4) Touch the desired channel spacing button.

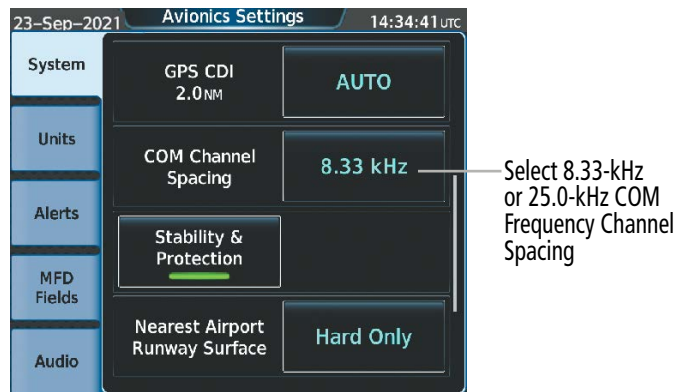


Figure 4-19 Changing COM Frequency Channel Spacing

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 4-20 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.

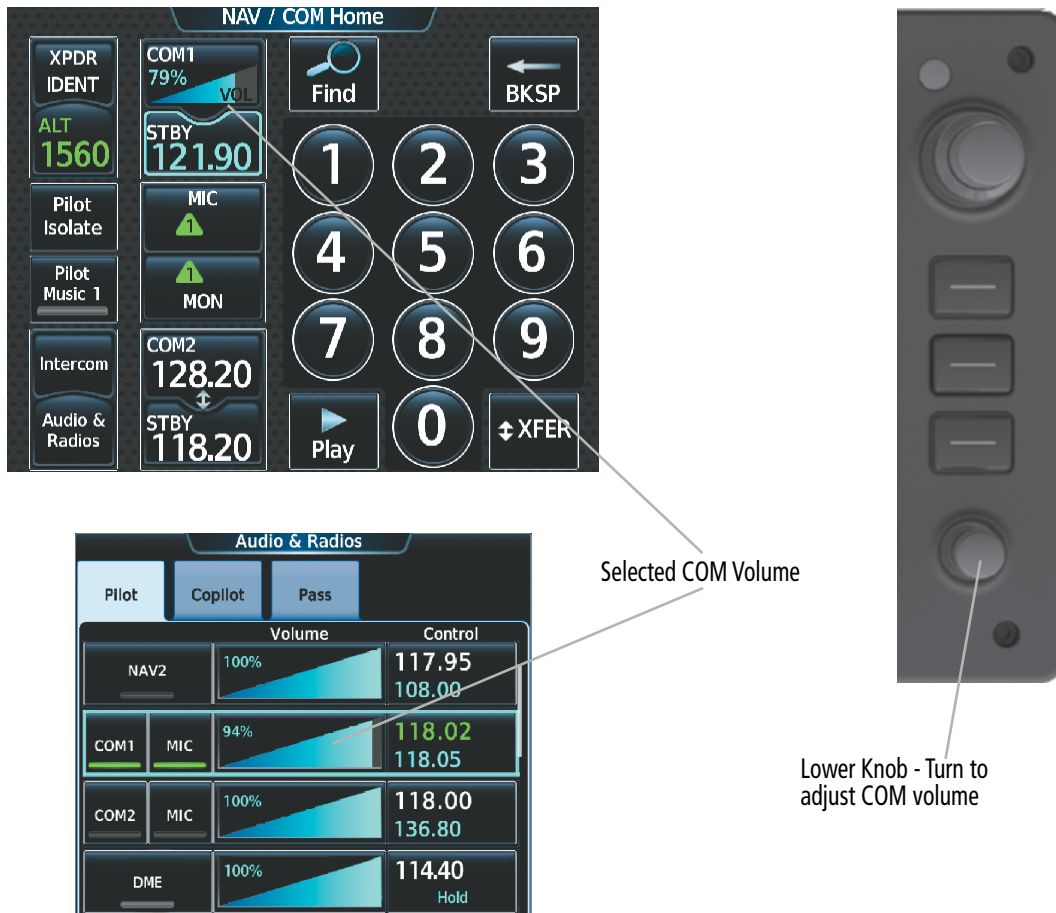


Figure 4-21 COM Volume Level

4.3 NAV OPERATION

NAV RADIO SELECTION AND ACTIVATION

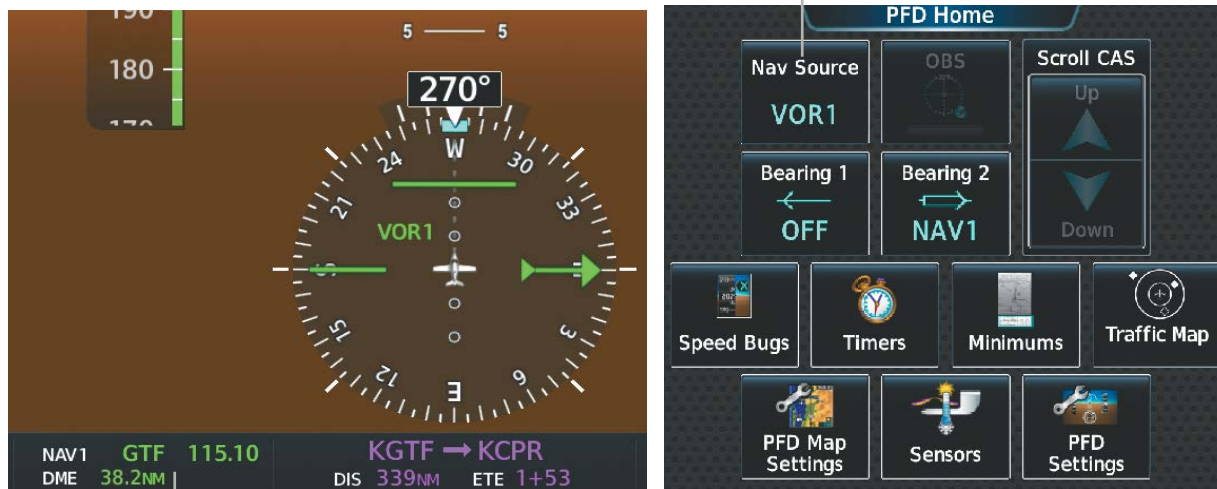
The active NAV frequency selected for navigation is shown on the PFD. Active and Standby NAV frequencies are shown on the NAV/COM Touchscreen Controller.

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

The three navigation modes that can be cycled through are:

- VOR1 (or LOC1) – If NAV1 is selected, a green single line arrow (shown) labeled either VOR1 or LOC1 is displayed on the HSI and the active NAV1 frequency is displayed in green.
- VOR2 (or LOC2) – If NAV2 is selected, a green double line arrow (not shown) labeled either VOR2 or LOC2 is displayed on the HSI and the active NAV2 frequency is displayed in green.
- GPS – If GPS Mode is selected, a magenta single line arrow (not shown) appears on the HSI. Both active NAV frequencies are displayed in white on the Touchscreen Controller.

The NAV Radio is selected by pressing the **NAV Source** button - displayed on the GTC PFD Home Screen



NAV1 Active Frequency and ID - displayed on the PFD

Figure 4-22 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 are selected for listening by touching the corresponding buttons on the Touchscreen Controller. Touching the **NAV1** or **NAV2** Button selects and deselects the navigation radio source. 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** or **NAV2** Button to select/deselect the radio for monitoring.



Figure 4-23 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 4-24 NAV Frequency Buttons and Volume Sliders



Figure 4-25 'NAV 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 or NAV2 frequency button to display the NAV1 or 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 Volume Slider or NAV2 Volume Slider to select the radio for frequency transfer.
 - 3) Push and hold the small upper knob to transfer the frequencies.

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

- 1) From MFD 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 frequency.
- 5) Touch the frequency button to display the 'Load Frequency' Screen.
- 6) Touch the location button to load the frequency to NAV1/2 Active/Standby or Favorites.
- 7) Touch the **Done** Button to return to the Airport Frequencies Screen.

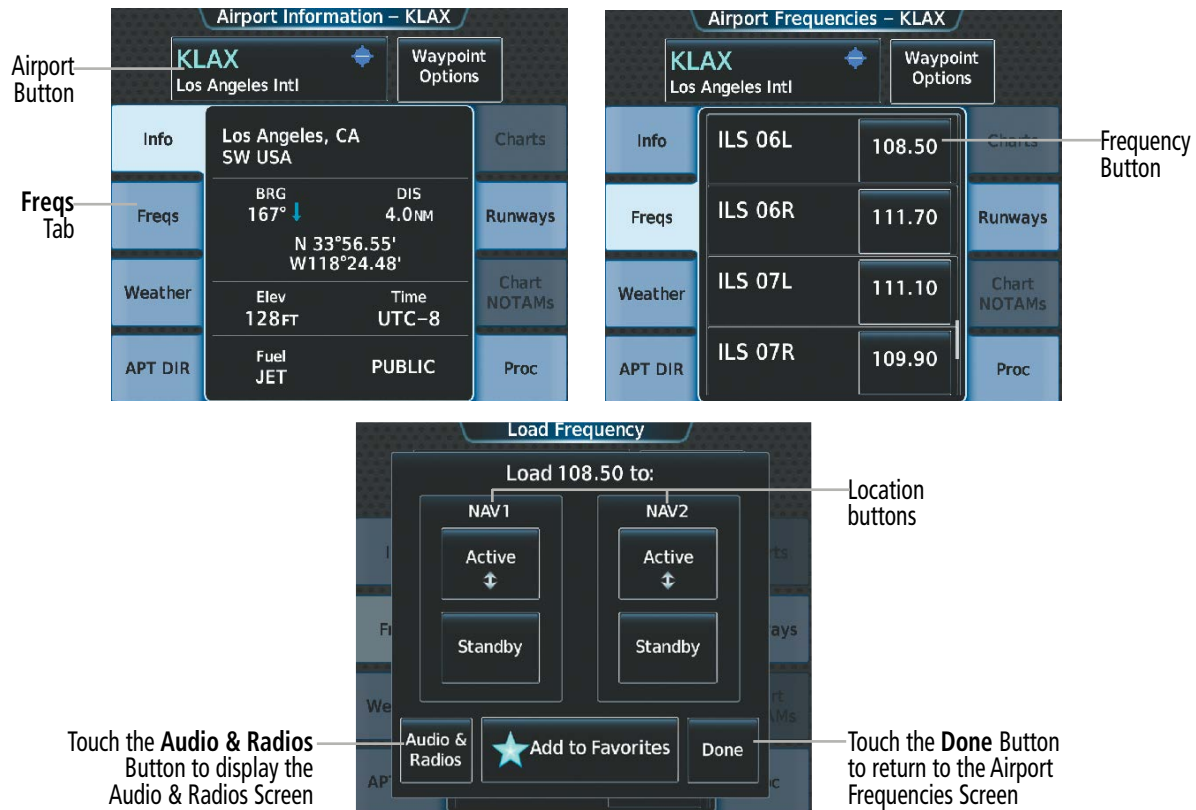


Figure 4-26 Airport Info Screen Tuning

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

- 1) From MFD 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 NAV1/2 Active/Standby or Favorites.
- 5) Touch the **Done** Button to return to the 'Airport Frequencies' Screen.

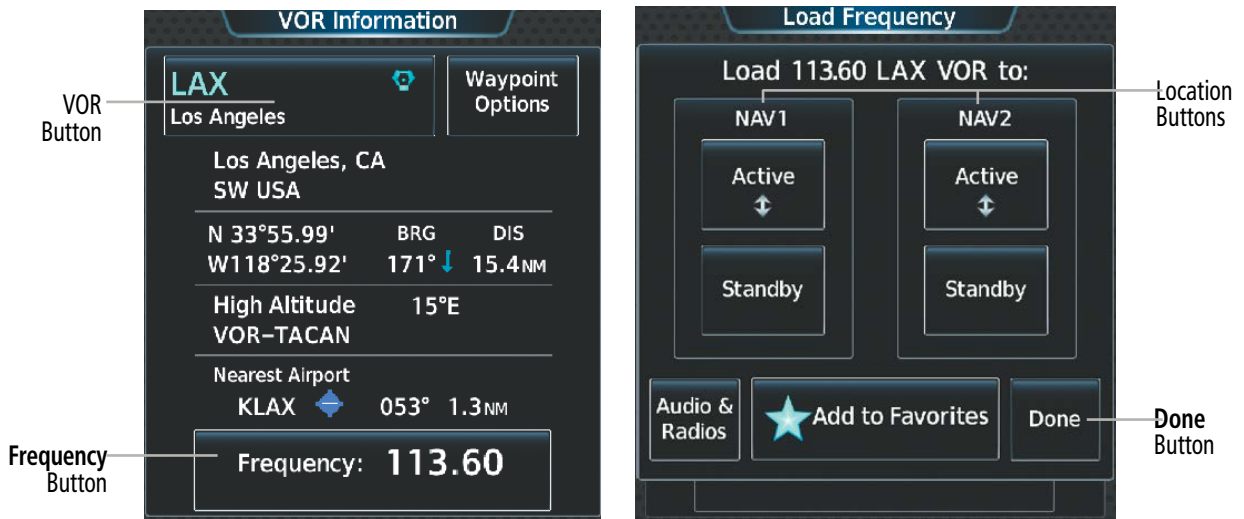


Figure 4-27 VOR Info Screen Tuning

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

- 1) From MFD Home, touch **Nearest > Airport** to display the 'Nearest Airport' Screen.
- 2) Scroll the list to find the desired airport.
- 3) Touch the 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 to NAV1/2 Active/Standby or Favorites.
- 9) Touch the **Done** Button to return to the 'Airport Frequencies' Screen.

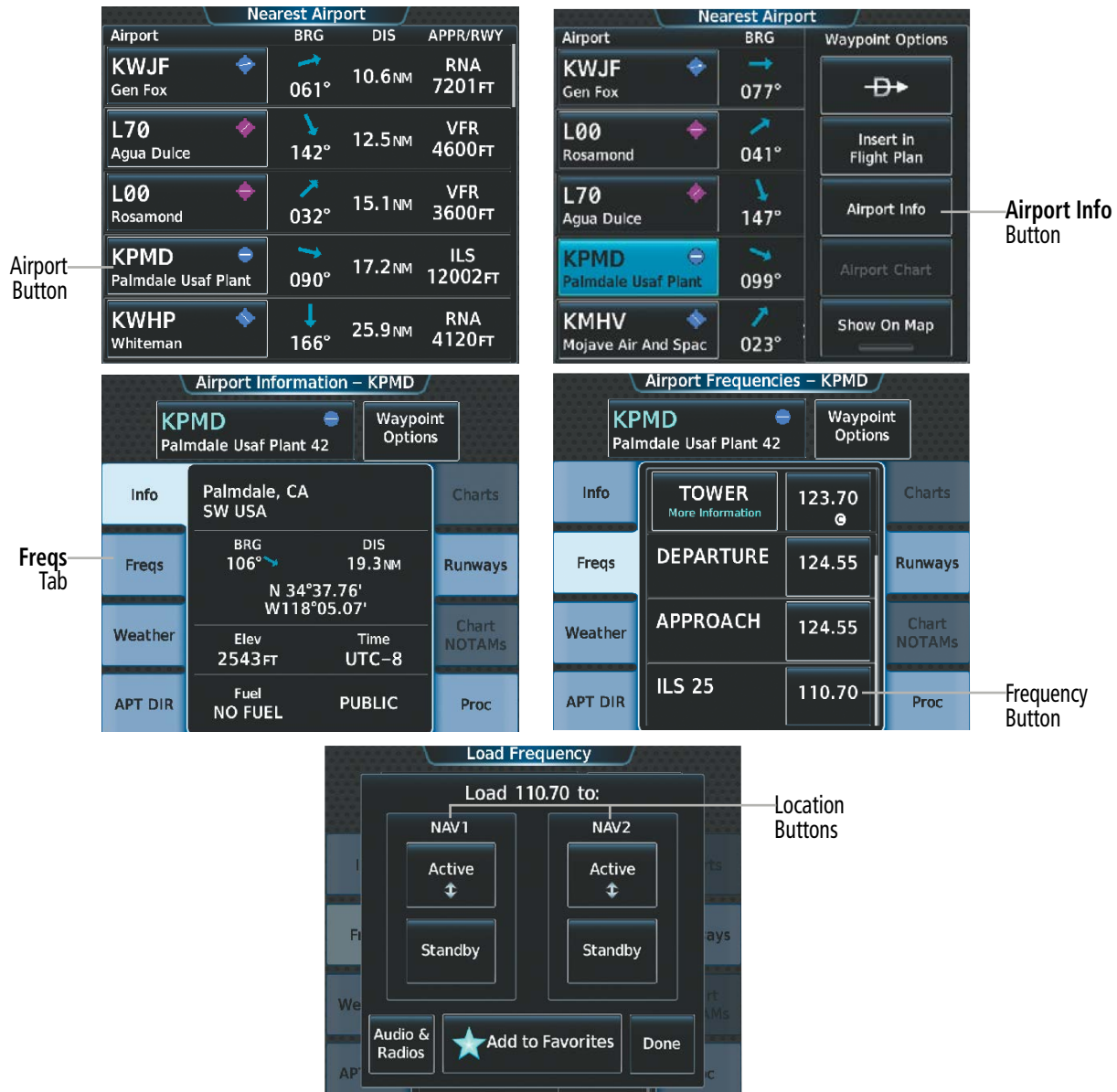


Figure 4-28 Nearest Airport Tuning

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

- 1) From MFD Home, touch the **Nearest > (VOR or Weather)** to display the Nearest (Airspace 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 to NAV1/2 Active/Standby or Favorites.



Figure 4-29 Nearest VOR/FSS/Weather Tuning

Viewing Current NAV selections from any NAV 'Load Frequency' Screen:

- 1) From any NAV 'Load Frequency' Screen, touch the **Audio & Radios** Button on the 'Load Frequency' Screen to display the 'Audio and Radios' Screen with the current NAV selections in view.
- 2) Touch the **Back** Button to return to the 'Load Frequency' Screen.

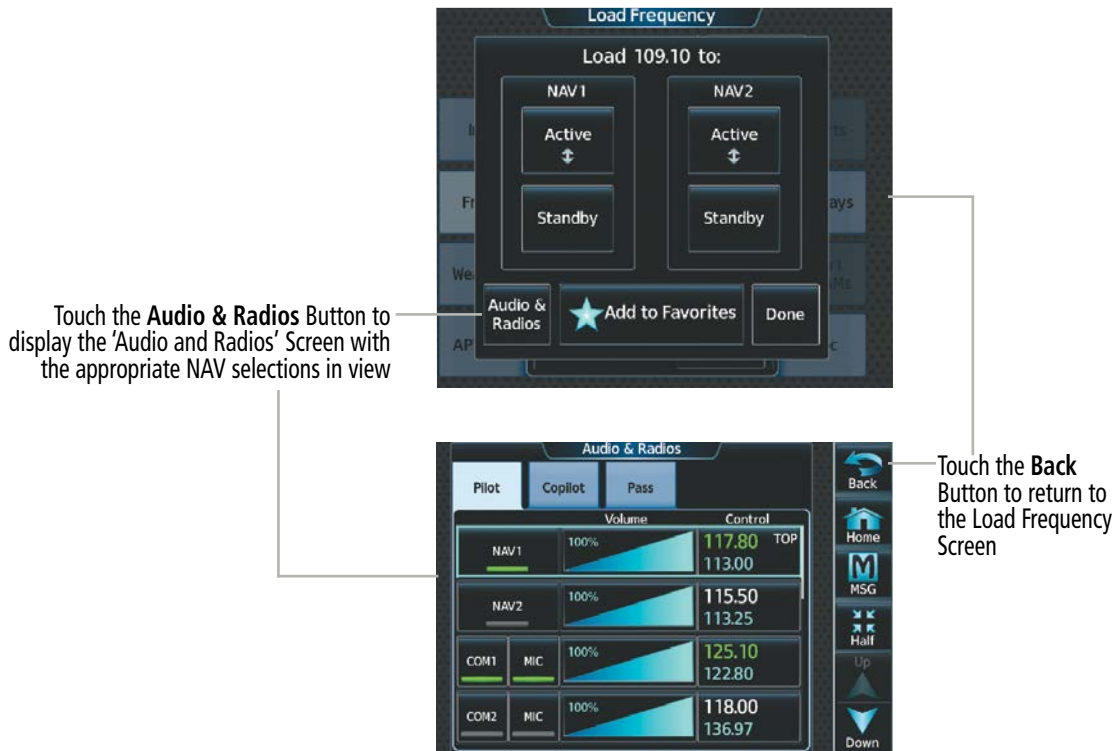


Figure 4-30 Tuning from the Airport Info Screen

Adding a NAV frequency to favorites:

- 1) From NAV/COM Home, touch the **Audio & Radios** Button.
- 2) Touch the NAV1/NAV2 frequency button to display the NAV1/NAV2 Standby Screen.
- 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 4-31 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.

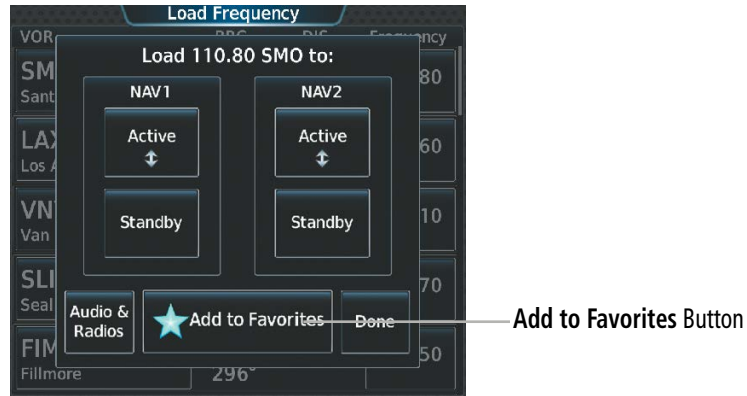


Figure 4-32 'Load Frequency' Screen - Add NAV Frequency to Favorites

Selecting a NAV frequency from favorites:

- 1) From NAV/COM Home, touch the **Audio & Radios** Button.
- 2) Touch the NAV1/NAV2 frequency button to display the NAV1/Nav2 Standby Screen.
- 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 4-33 Selecting a NAV Frequency from Favorites

Removing a frequency from favorites:

- 1) From NAV/COM Home, touch the **Audio & Radios** Button.
- 2) Touch the NAV1 or NAV2 Frequency Button to display the NAV1/Nav2 Standby Screen.
- 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.

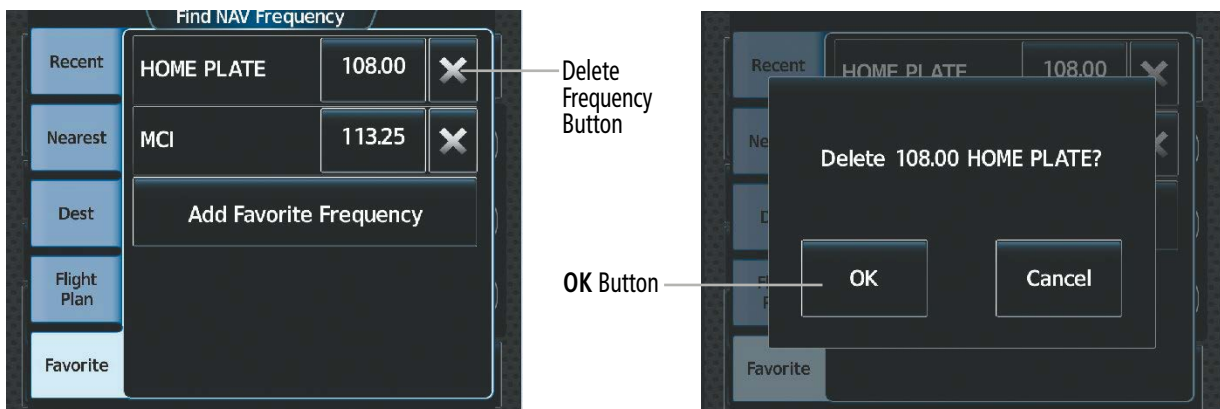


Figure 4-34 Deleting a NAV Frequency from Favorites

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 4-24). Audio verification of the selected station identifier is still required.

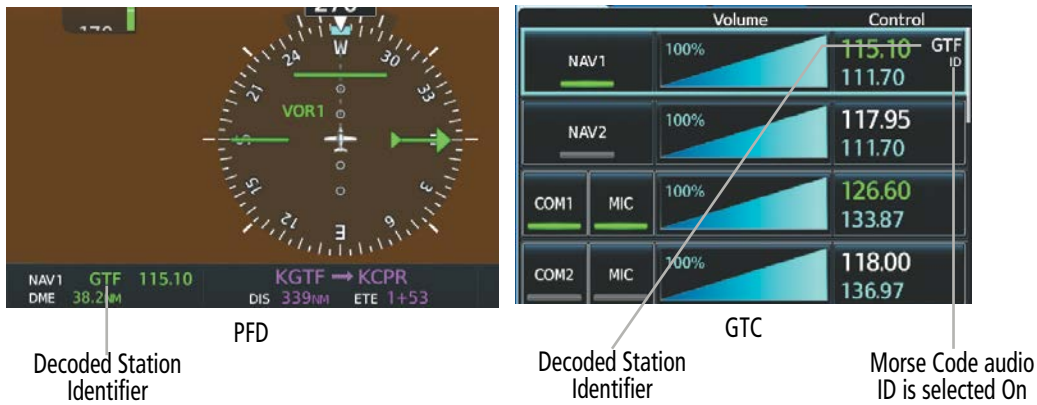


Figure 4-35 Selecting a NAV Radio for Navigation

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 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.

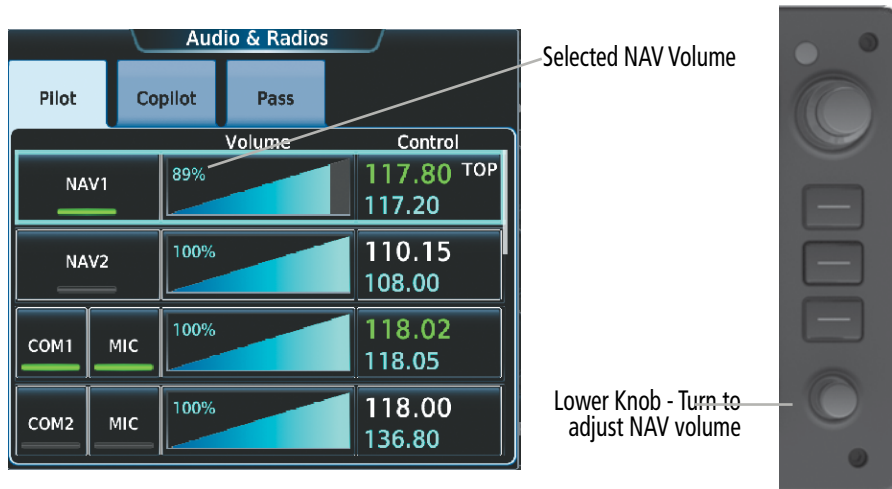





Figure 4-36 NAV Volume Level

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 Management 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:

	If the Current CDI NAV Source is NAV1 or NAV2	If the Current CDI NAV Source is GPS
Approach LOADED	Approach Frequency is transferred to the standby frequency field of the selected CDI NAV radio.	Current NAV1 and NAV2 frequencies will be transferred to the standby field. The approach frequency will be transferred to the ACTIVE NAV1 and NAV2 frequency fields.
Approach ACTIVATED	Approach Frequency is transferred to the active frequency field on both NAV1 and NAV2, and the previously active frequencies will be transferred to standby.	If the approach frequency was already loaded into the NAV1 standby frequency field, it will be transferred to the ACTIVE frequency field.

Table 4-2 Auto-Tuning NAV Frequency Status

MARKER BEACON RECEIVER



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

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

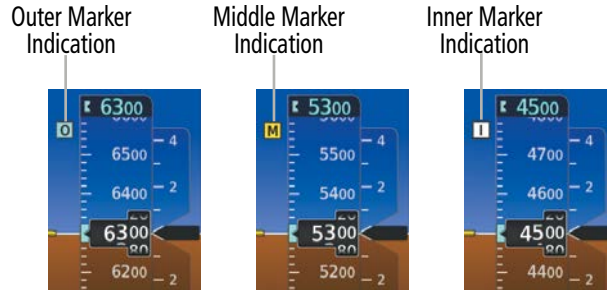


Figure 4-37 Marker Beacon Annunciations on the PFD

The Touchscreen Controller provides three different states of marker beacon audio operation: Selected, Deselected, and Muted. Touching the **Marker** Button on the 'Audio & Radios' Screen selects/deselects marker beacon audio. The button annunciator 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 (annunciator illuminated) is used to provide an earlier indication when nearing a marker during an approach. The Low Sense function (annunciator 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.



Figure 4-38 Marker Beacon Flashing Mute Button

During marker beacon audio reception, touching 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 4-39 Marker Beacon Flashing Mute Button

DME

See the Flight Instruments Section for displaying the DME and bearing information windows.

The system tunes 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.



Figure 4-40 DME Tuning

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 **Audio & Radios** 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' Window.
- 4) Touch the NAV1, NAV2, or HOLD Button to select the DME mode. An 'H' is appended to the end of the frequency on the PFD to represent DME Hold mode.

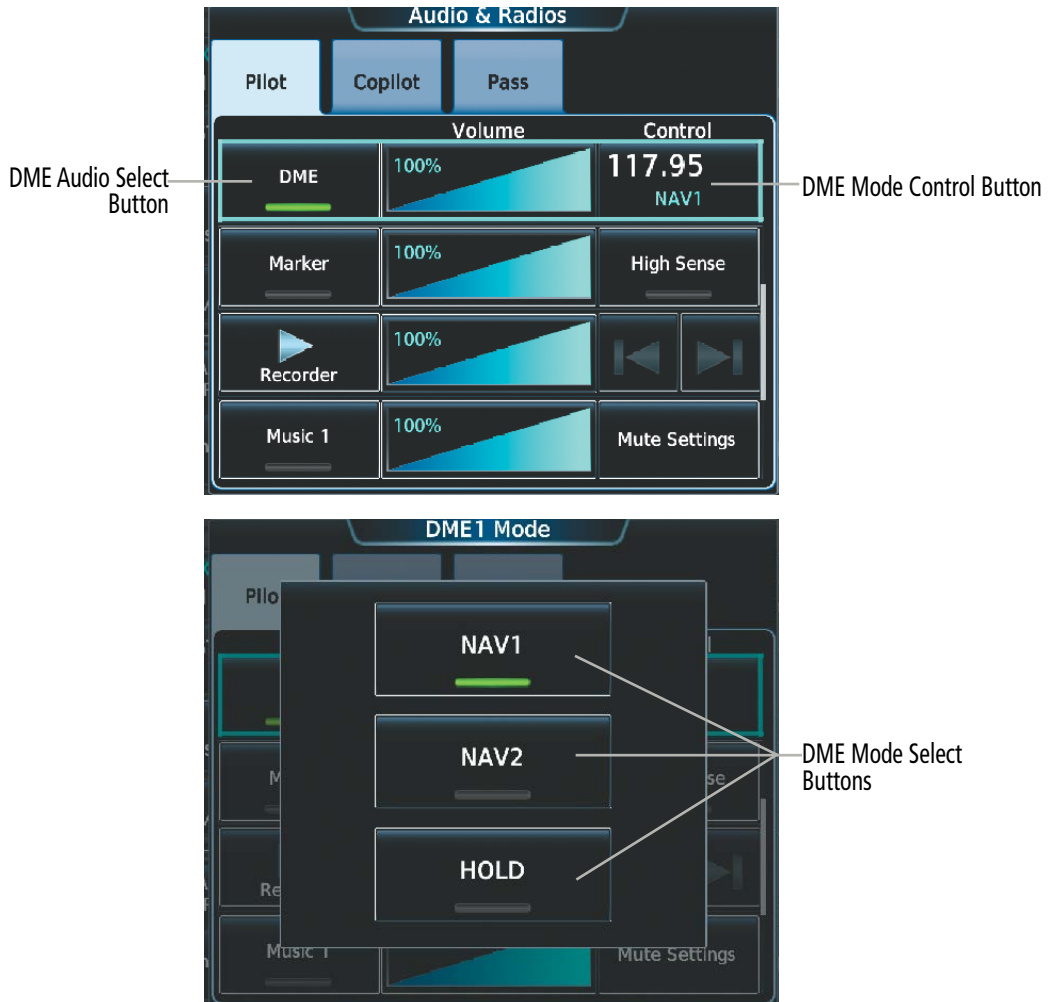


Figure 4-41 DME Mode Selection



Figure 4-42 DME Hold Mode on PFD

4.4 MODE S TRANSPONDER(S)

The system is equipped with one or a combination of Mode S transponders that provide Mode A, Mode C, and Mode S interrogation and reply capabilities. The optional GTX 345DR Diversity configuration incorporates antennas mounted on the top and bottom of the aircraft for dependable operation while maneuvering. 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 'NAV/COM' Screen.



Figure 4-43 Transponder Display and Controls

TRANSPONDER SELECTION

If equipped with an optional second transponder, the active transponder is selected by touching the **Active** Button on the 'Transponder' Screen, and selecting the **XPDR1** Button or **XPDR2** Button. If the optional GTX 345DR is installed, it will always be XPDR1.

Selecting active transponder:

- 1) From NAV/COM Home, touch the Transponder Code/Mode Button to display the 'Transponder' Screen.
- 2) Touch the **Active** Button.
- 3) Touch the **XPDR1** Button or **XPDR2** Button.

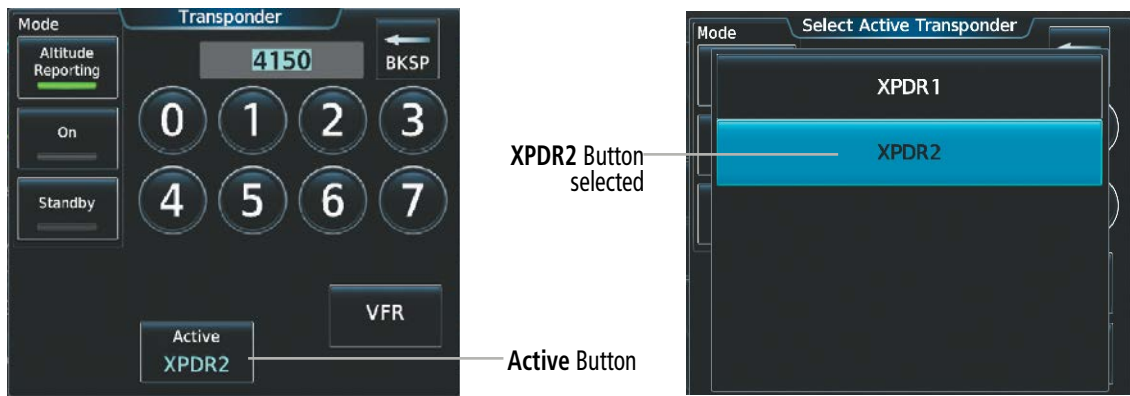


Figure 4-44 Transponder Selection

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.

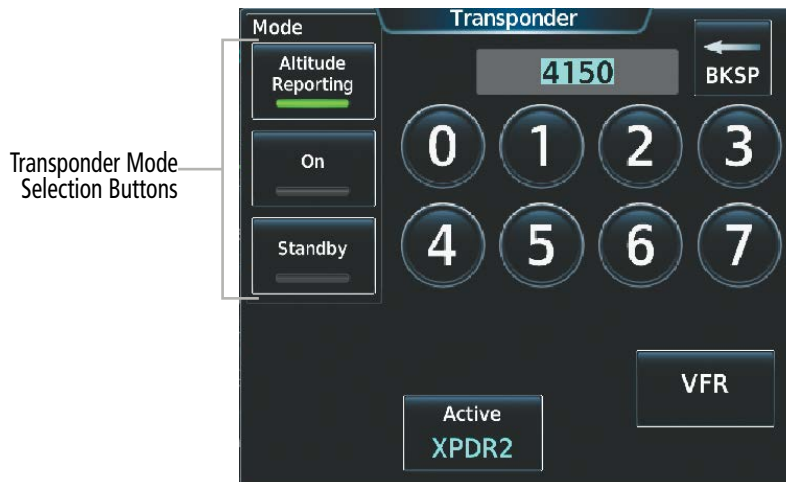


Figure 4-45 Transponder Mode Selection

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 4-46 Standby Mode Indication

MANUAL 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 4-47 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.

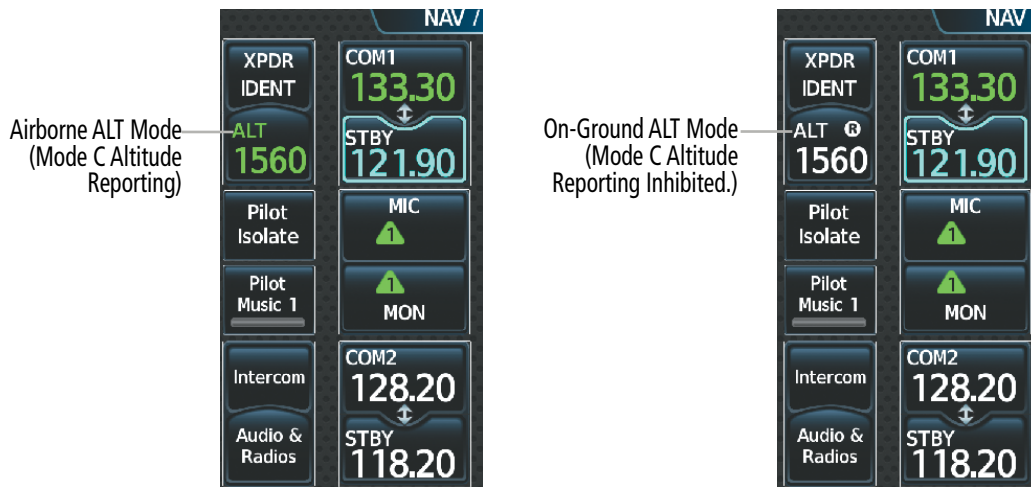


Figure 4-48 Altitude Reporting Mode

REPLY STATUS

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



Figure 4-49 Transponder Reply Indication

ENTERING A TRANSPONDER CODE

Entering a transponder code with the keypad:

- 1) Touch the Transponder Code/Mode Button to display the 'Transponder' Screen.
- 2) Use the keypad to select the desired code.
- 3) Touch the **Enter** Button to enter the new code.



Figure 4-50 Transponder Code Entry

Entering a transponder code with the knobs:

- 1) Touch the Transponder Code/Mode Button to display the 'Transponder' Screen.
- 2) Turn the large upper knob one click either way to place the editing cursor on the first digit of the existing code.
- 3) Turn the small upper knob to enter the first digit.
- 4) Turn the large upper knob to move the cursor to the next digit.
- 5) Turn the small upper knob to enter the next digit, 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.

Or:

- 1) Touch the Transponder Code/Mode Button to display the 'Transponder' Screen.
- 2) Turn the small upper knob one click either way to erase the previous code and place the editing cursor on the first digit.
- 3) Turn the small upper knob to enter the first digit.
- 4) Turn the large upper knob to move the cursor to the next digit.
- 5) Turn the small upper knob to enter the next digit, 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. Touching the **Cancel** Button before code entry is complete cancels code entry and restores the previous code.

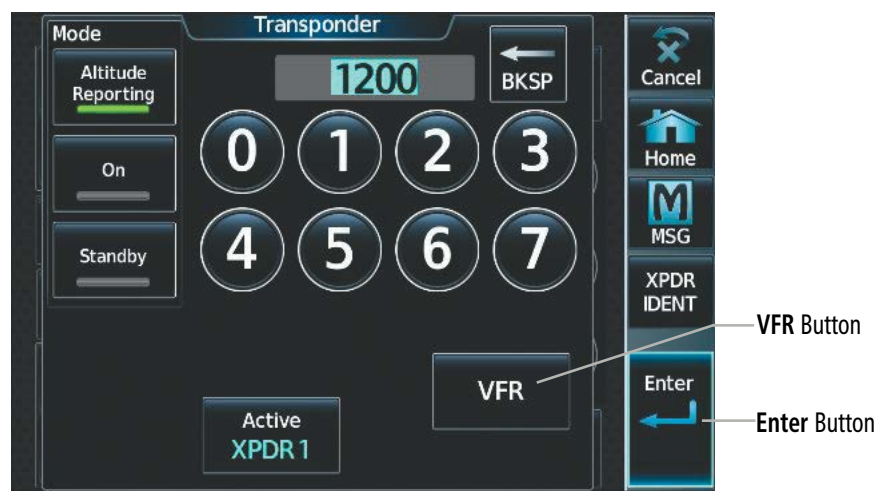


Figure 4-51 Transponder VFR Code Entry

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 indenting 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 4-52 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.

COCKPIT SPEAKER

All of the radios can be heard over the cockpit speaker. Touching the **Speaker** Button selects and deselects the cockpit speaker. Speaker audio is muted when the PTT is pressed.

The speaker volume level can be adjusted from 0 to 100% on the Touchscreen Controller by turning the middle 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.

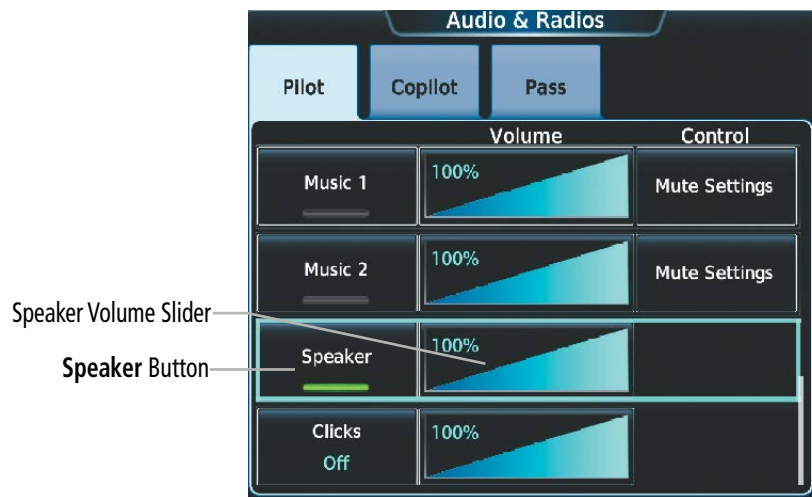


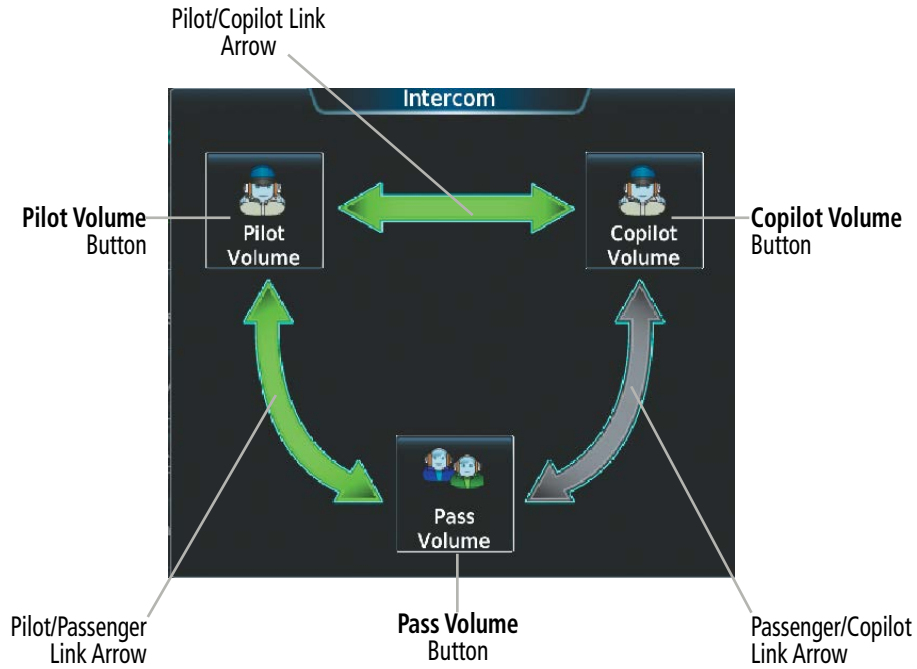
Figure 4-53 Cabin Speaker Audio Selection

INTERCOM

The system includes an eight-mode intercom system (ICS) for the pilot and copilot. The intercom allows for isolation of audio for the Pilot, Copilot, and Passengers. Touch the **Intercom** Button on the 'NAV/COM Home' Screen to bring up the 'Intercom' Screen. The intercom links between the Pilot, Copilot, and Passengers are enabled/disabled by touching the connecting arrows on the 'Intercom' Screen.



Intercom Button



Touch the Link Arrows to enable (green) or disable (gray) the link. When a connecting arrow between two positions is green, the audio between those positions is open. When the arrow is gray, the audio is isolated to each position.

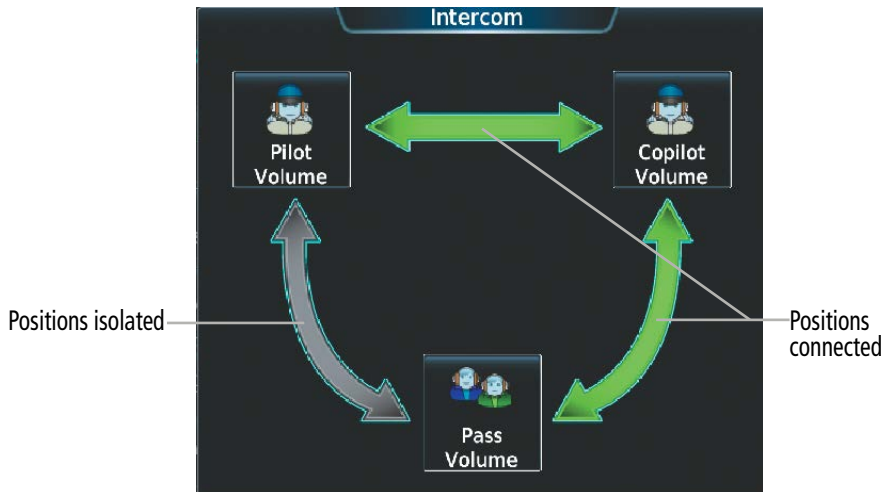


Figure 4-54 Intercom Screen

Touch the **Pilot Isolate** Button on the 'NAV/COM Home' Screen to bring up the 'Intercom' Screen and to automatically isolate the Pilot audio from the Copilot and Passenger audio. Touching the **Pilot Isolate** Button will disable the Pilot/Copilot link and the Pilot/Passenger link.

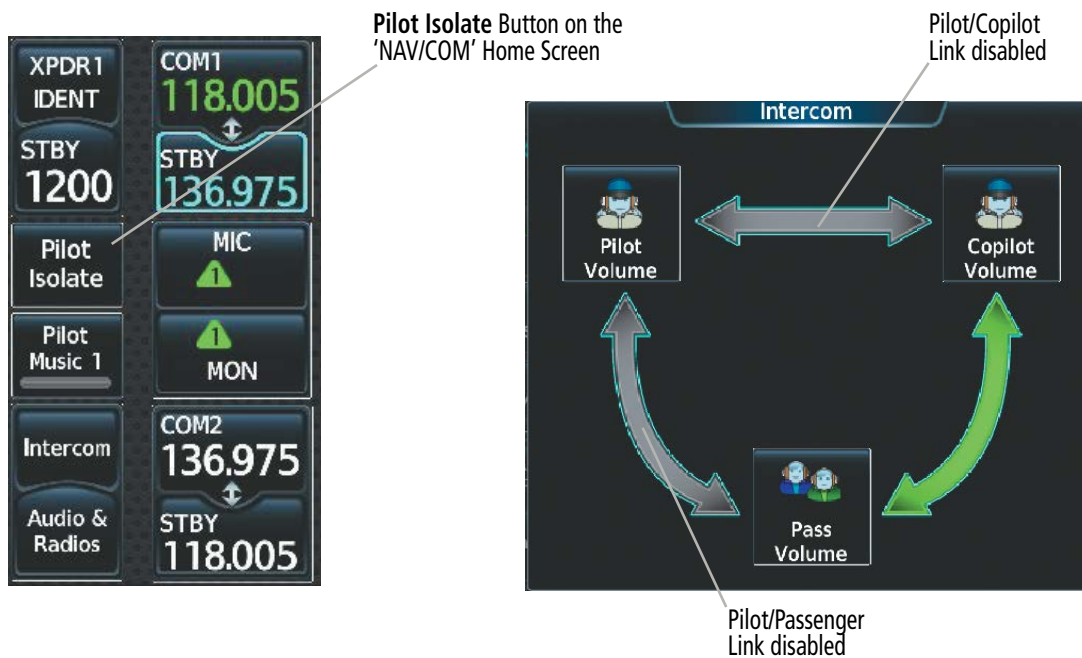


Figure 4-55 Pilot Isolation Controls

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.

By default, the automatic squelch is enabled. Touch the **Auto** Button on the Intercom Settings Screen to disable the automatic squelch and activate the manual squelch controls.

Adjusting the intercom volume:

- 1) Touch the **Intercom** Button on the 'NAV/COM Home' to display the 'Intercom' Screen.
- 2) Touch the **Pilot Volume**, **Copilot Volume**, or **Pass Volume** Button to display the Pilot, Copilot, or Passenger Intercom Settings Screen.
- 3) Adjust the volume by using the lower knob or by sliding your finger on the Volume Slider.

By default, the automatic squelch is enabled. Touch the Auto Button on the Intercom Settings Screen to disable the automatic squelch and activate the manual squelch controls.

Adjusting the squelch:

- 1) Touch the **Intercom** Button on the 'NAV/COM Home' Screen to display the 'Intercom' Screen.
- 2) Touch the **Pilot Volume**, **Copilot Volume**, or **Pass Volume** Button to display the Pilot, Copilot, or Passenger Intercom Settings Screen.
- 3) Touch the **Auto** Squelch button to deselect it.
- 4) Adjust the squelch by using the lower knob or by sliding your finger on the squelch slider.

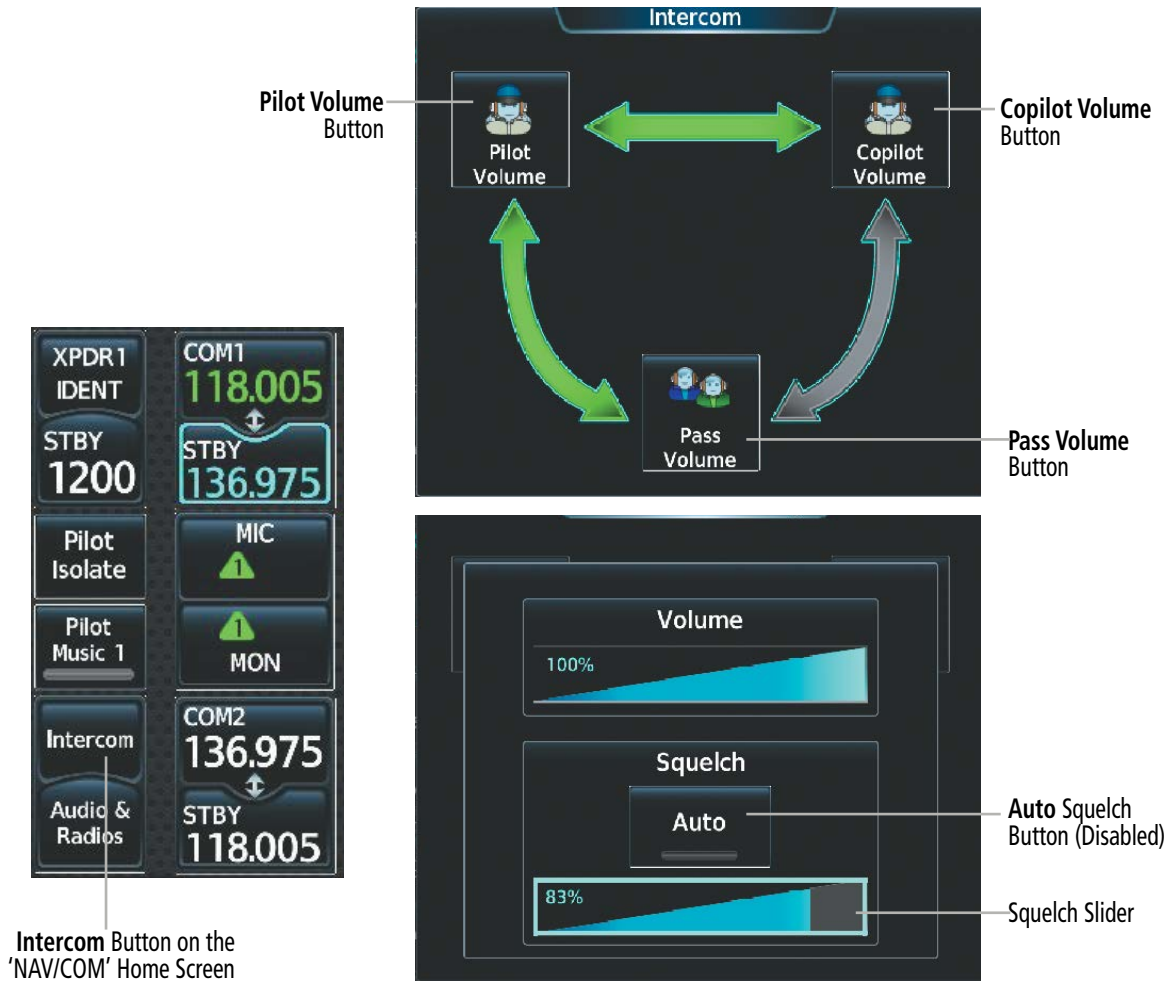


Figure 4-56 Intercom Volume/Squelch Controls

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 4-57 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 MFD 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 MFD 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.

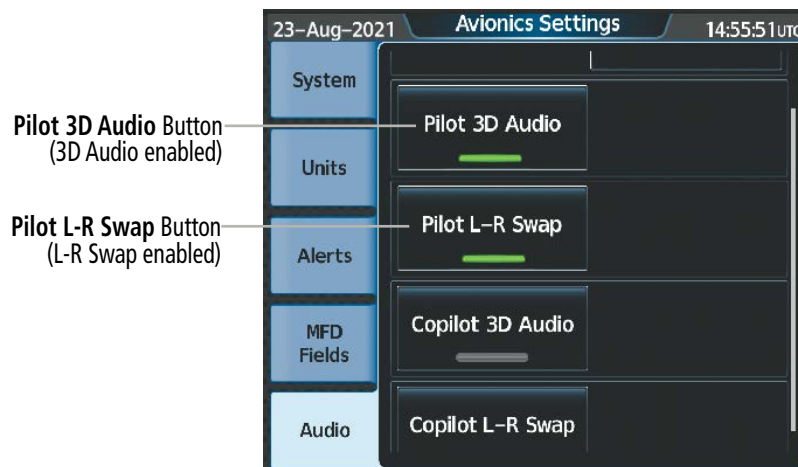


Figure 4-58 3D Audio and L-R Swap

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 the Pilot Tab. 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 4-59 Simultaneous COM Operation

AUXILIARY AUDIO

The Audio Controller provides stereo auxiliary entertainment inputs. These inputs are compatible with popular portable entertainment devices such as MP3 players, cell phones, and tablets. The headphone output of an entertainment device is plugged into one of two auxiliary jacks in the cockpit. Each auxiliary jack is associated with either, the **Music 1** Button or the **Music 2** Button on the ‘Audio & Radios’ Screen.

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.

Selecting/deselecting the Auxiliary Audio input:

From NAV/COM Home, Touch the **Pilot Music 1** Button to select/deselect the Music 1 auxiliary audio input for the pilot position.

Or:

- 1) From NAV/COM Home, touch the **Audio & Radios** Button to display the ‘Audio & Radios’ Screen.
- 2) If selecting for the Copilot or Passengers, touch the **Copilot** Tab or the optional **Pass** Tab.
- 3) Scroll the list to find Music 1 or Music 2.
- 4) Touch the **Music 1** Button or the **Music 2** Button to select/deselect the auxiliary audio input for the selected position (pilot, copilot, or passengers).



Figure 4-60 Auxiliary Audio Controls

AUXILIARY AUDIO MUTING

Auxiliary audio muting occurs when configured activity (intercom, radio inputs, and/or aural alerts) is heard. 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 Auxiliary Audio Mute Settings:

- 1) From NAV/COM Home, touch the **Audio & Radios** Button to display the 'Audio & Radios' Screen.
- 2) If selecting for the Copilot or Passengers, touch the **Copilot** Tab or the optional **Pass** Tab.
- 3) Scroll the list to find **Music 1** Button or **Music 2** Button.
- 4) Touch the **Mute Settings** Button to display the Music 1 or Music 2 Mute Settings Window.
- 5) Touch the **Intercom** Button, **Radio Inputs** Button, and the **Aural Alerts** Button to select which items will mute auxiliary audio.

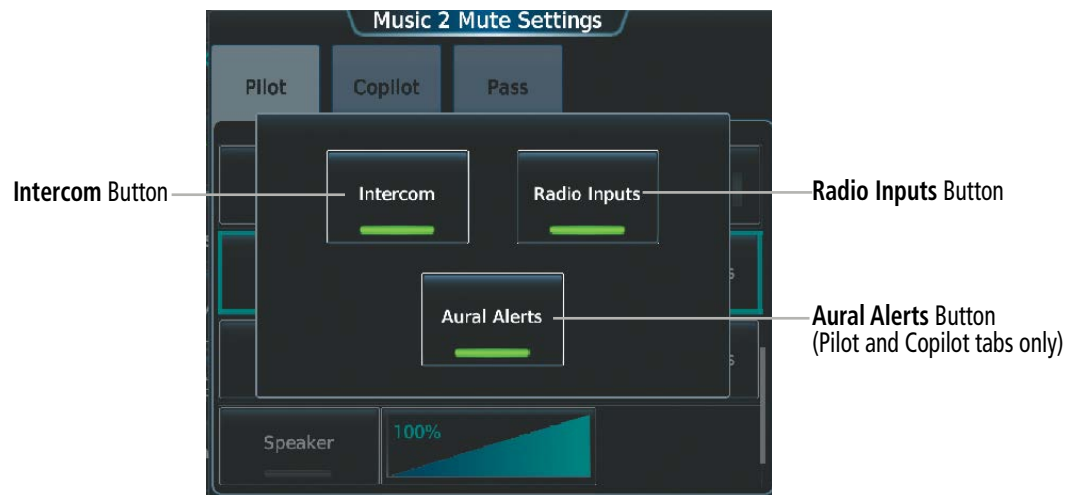


Figure 4-61 Music Mute Controls

SIRIUSXM RADIO AUDIO (OPTIONAL)

The SiriusXM Radio audio is controlled with the **Music 1** Button or **Music 2** Button on the 'Audio & Radios' Screen. To operate the SiriusXM audio, make sure there are no cords plugged into the associated auxiliary audio jack(s) for the Music 1 or Music 2 channel that will be used for the SiriusXM Radio audio.

The SiriusXM 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.

Refer to the Additional Features Section for more details on SiriusXM Radio Audio from the Data Link Receiver.

Selecting/Deselecting SiriusXM Audio:

From NAV/COM Home, touch the **Pilot Music 1** Button to select/deselect the SiriusXM Radio input for the pilot position.

Or:

- 1) From NAV/COM Home, touch the **Audio & Radios** Button to display the 'Audio & Radios' Screen.
- 2) If selecting for the Copilot or Passengers, touch the **Copilot** Tab or the **Pass** Tab.
- 3) Scroll the list to find the **Music 1** Button.
- 4) Touch the **Music 1** Button to select/deselect the SiriusXM Radio input for the selected position (pilot, copilot or passenger).

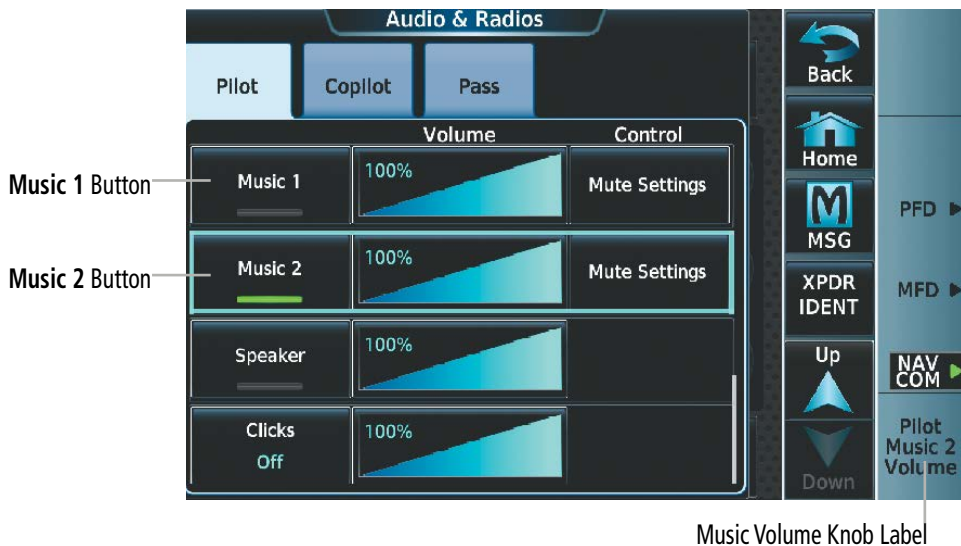


Figure 4-62 Auxiliary Audio Controls

SIRIUSXM AUDIO MUTING

SiriusXM audio muting occurs when the configured activity (intercom, radio inputs, and/or aural alerts) is heard or when there is an alert. SiriusXM audio is always soft muted when an interruption occurs from these sources. Soft muting is the gradual return of SiriusXM audio to its original volume level. The time required for SiriusXM 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 **Audio & Radios** Button to display the 'Audio & Radios' Screen.
- 2) If selecting for the Copilot or Passengers, touch the **Copilot** Tab or the **Pass** Tab.
- 3) Scroll the list to find **Music 1**.
- 4) Touch the **Mute Settings** Button to display the 'Music 1 Mute Settings' Window.
- 5) Select the **Intercom** Button, **Radio Inputs** Button, and/or the **Aural Alerts** Button to select which items will mute SiriusXM audio.

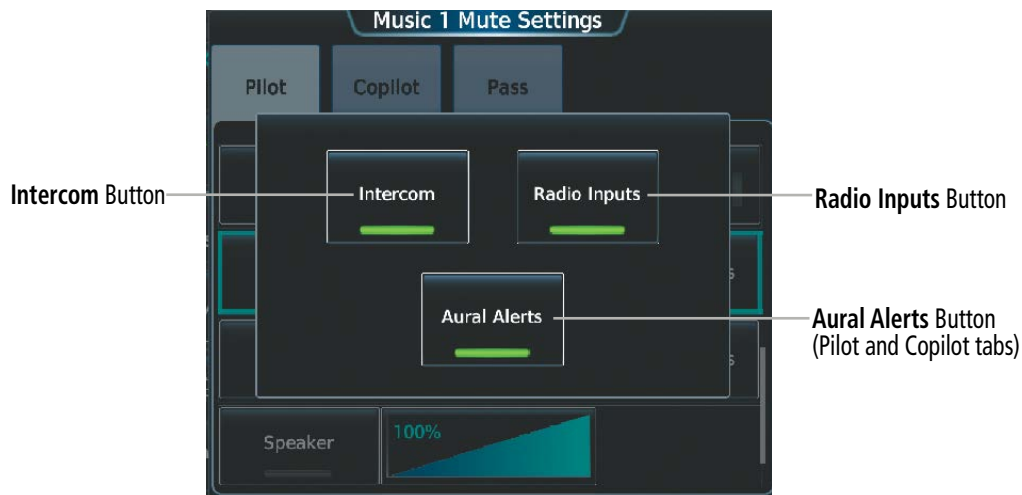


Figure 4-63 Music Mute Controls

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) If selecting for the Copilot, touch the **Copilot** Tab.
- 3) Scroll the list to find Clicks.
- 4) Touch the **Clicks** Button to display the 'Audio Feedback' Settings.
- 5) Touch the desired audio feedback button.

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

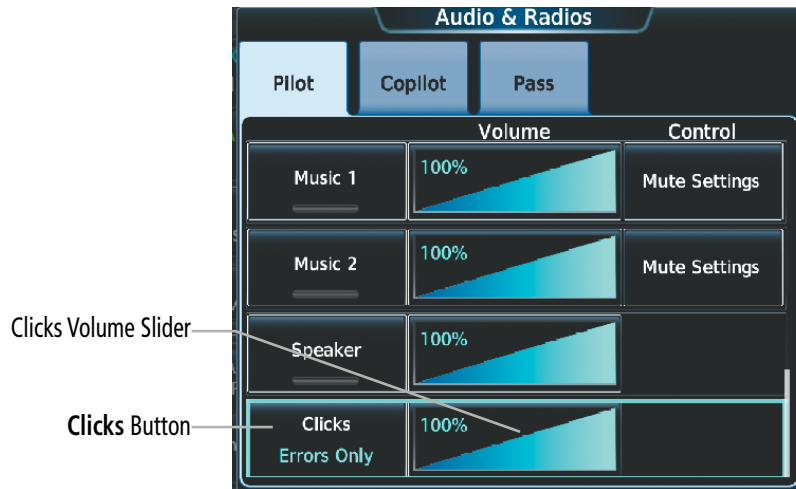


Figure 4-64 Speaker Audio Selection

TELEPHONE AUDIO

The pilot and copilot headsets can be used for telephone communication. Touching 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.

Refer to the Additional Features Section for more details on the Satellite Telephone Data Link Services.

Selecting/deselecting the Satellite Telephone audio:

- 1) From NAV/COM Home, touch the **Audio & Radios** Button to display the 'Audio & Radios' Screen.
- 2) If selecting for the Copilot, touch the **Copilot** Tab.
- 3) Scroll the list to find the **TEL** Button.
- 4) Touch the **TEL** Button to select/deselect the satellite telephone input for the selected position (pilot or copilot).

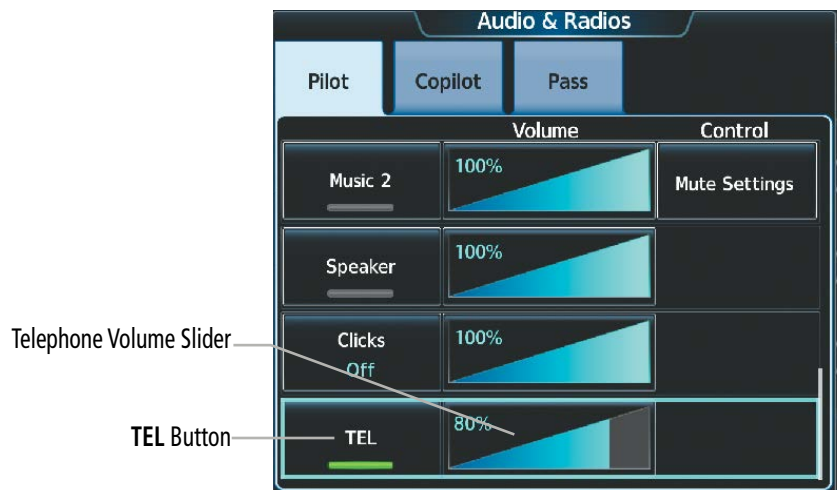


Figure 4-65 Telephone Audio Selection

4.6 ABNORMAL OPERATION

Abnormal operation of the system 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 & Radios' 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.

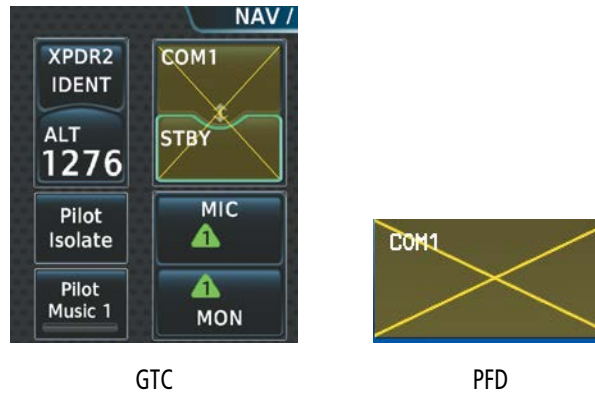


Figure 4-66 COM Failure

COM TUNING FAILURE

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.

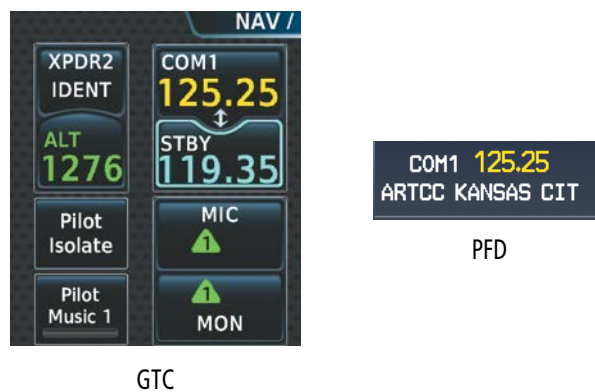


Figure 4-67 COM Tuning Failure

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 4-68 Transponder Fail Indication

SECTION 5 FLIGHT MANAGEMENT

5.1 INTRODUCTION

The Cirrus Perspective Touch+™ by Garmin is an integrated flight, engine, communication, navigation and surveillance system. This section of the Pilot's Guide explains GPS navigation using the system.

The most prominent parts of the system are the Primary Flight Display (PFD), the Multi Function Display (MFD), and the Touchscreen Controllers (GTC). The information to successfully navigate the aircraft using the GPS sensors is displayed on these units. A brief description of the GPS navigation data on the PFD and MFD follows.

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

The Inset Map is a small version of the Navigation Map and can be displayed in the lower left corner of the PFD. However, the inset map cannot be displayed when the PFD is in Split Mode display or when the system is in Reversionary mode. The Inset Map is displayed by touching the **PFD Map Settings** Button on the 'PFD Home' Screen, touching the **Layout** Button, then touching the **Inset Map** Button. Touching the map **Off** Button removes the Inset Map.

The HSI Map is also a small version of the Navigation Map and is displayed in the center of the HSI. The HSI Map is displayed by touching the **PFD Map Settings** Button on the 'PFD Home' Screen, touching the **Layout** Button, then touching the **HSI Map** Button. Touching the **Off** Button removes the HSI Map.

Hereafter, references to the “PFD Map” implies either the Inset Map or the HSI Map.

The Navigation Map 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 reduced by touching the **Map Detail** Button on the PFD for the Inset Map, and by the Map Detail Slider on the Touchscreen Controller for navigation maps. The Navigation Map can be oriented three different ways: North Up, Track Up, or Heading Up.

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

There are 28 different map ranges available, from 250 feet to 1000 nm. 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 **Lower Knob** on the Touchscreen Controller counter-clockwise to decrease the range, or clockwise to increase the range; or (2) touch two fingers on the **Touchpad** and move them apart to decrease range, or pinch using two fingers to increase range.

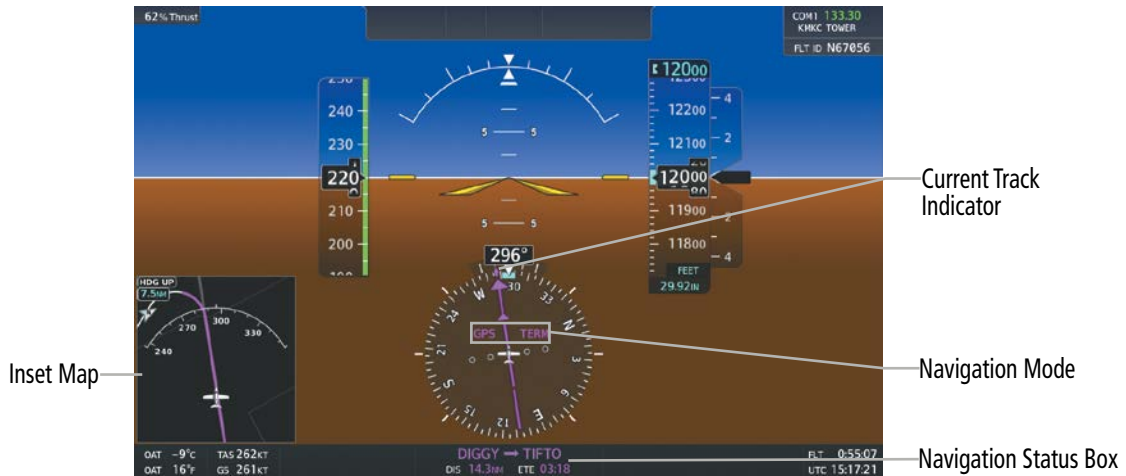


Figure 5-1 GPS Navigation Information on the PFD Inset Map

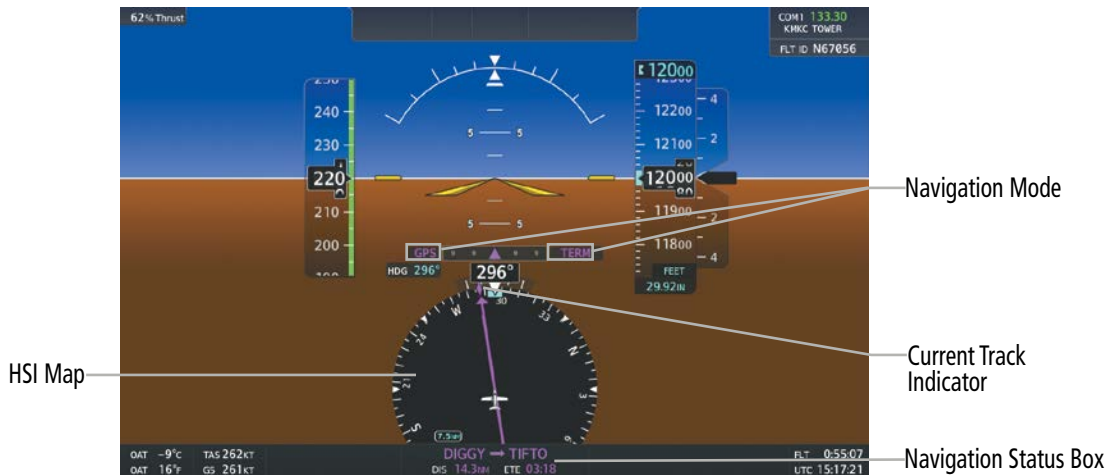


Figure 5-2 GPS Navigation Information on the PFD HSI Map

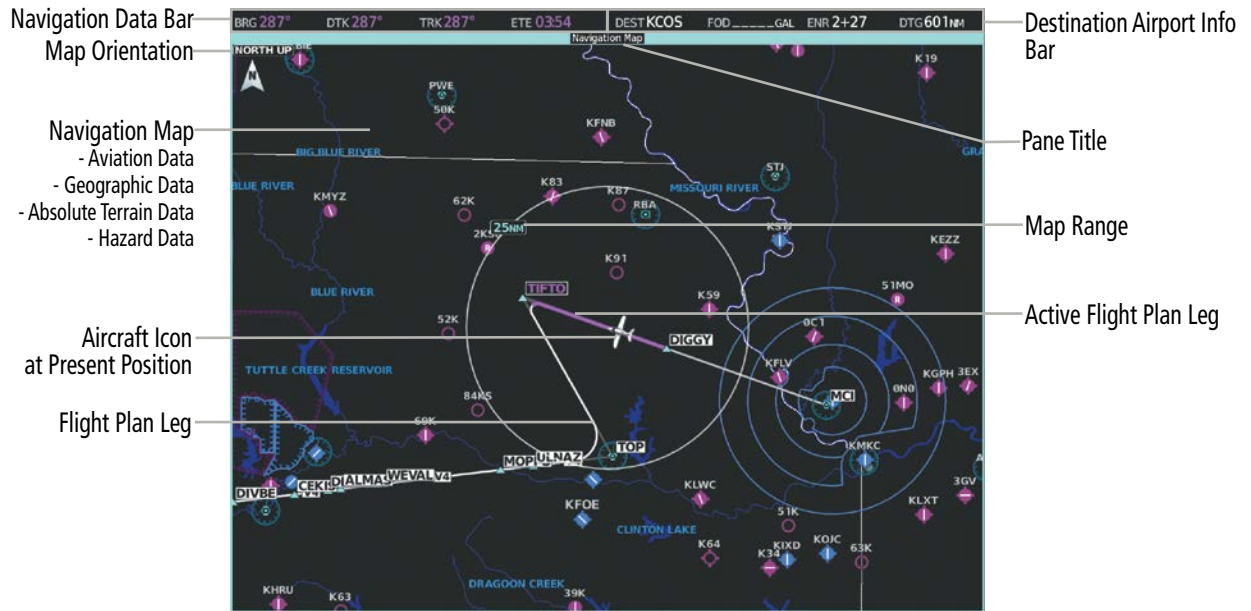


Figure 5-3 GPS Navigation Information on the MFD Navigation Map Display

PFD NAVIGATION STATUS BOX / MFD NAVIGATION DATA BAR

The PFD Navigation Status Box located below the HSI contains two fields displaying the following information:

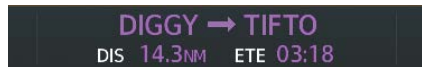


Figure 5-4 PFD Navigation Status Box

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

The symbols used in the PFD Status Box are:

Symbol	Description	Symbol	Description
	Active Leg		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		

BRG 287°	DTK 287°	TRK 287°	ETE 03:54	DEST KCOS	FOD _____ GAL	ENR 2+27	DTG 601 NM
----------	----------	----------	-----------	-----------	---------------	----------	------------

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

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

- | | |
|--|---|
| - BRG (Bearing) | - FLT (Flight timer) |
| - DIS (Distance) | - FOB (Fuel on board) |
| - DTG (Distance to go to destination) | - LDG (ETA at final destination) |
| - DTK (Desired track) | - MSA (Minimum safe altitude) |
| - END (Endurance) | - TKE (Track angle error) |
| - ESA (Enroute safe altitude) | - TRK (Track) |
| - ETA (Estimated time of arrival) | - VSR (Vertical speed required) |
| - ETE (Estimated time enroute) | - XTK (Cross-track error) |

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

Changing a field in the MFD Navigation Data Bar:

- 1) From MFD Home, touch **Utilities > Setup > Avionics Settings**
- 2) Touch the **MFD Fields** Tab.
- 3) Touch the desired MFD Data Bar Field (1-4) 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.

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

The information in this section applies to any panes that show the navigation map.

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 will be for all displays.

Enabling/disabling map settings synchronization:

- 1) From MFD Home, touch **Map > Map Selection > Map Settings > Map Sync**.
- 2) Touch the **All** Button.
- 3) Touch the **MFD1 Left, MFD1 Right** or **PFD1** Button to initially synchronize all map settings with the selected display.

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 Navigation Map orientation:

- 1) From MFD 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 navigation map orientation.

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

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

- 1) From MFD 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 auto North Up.
- 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.

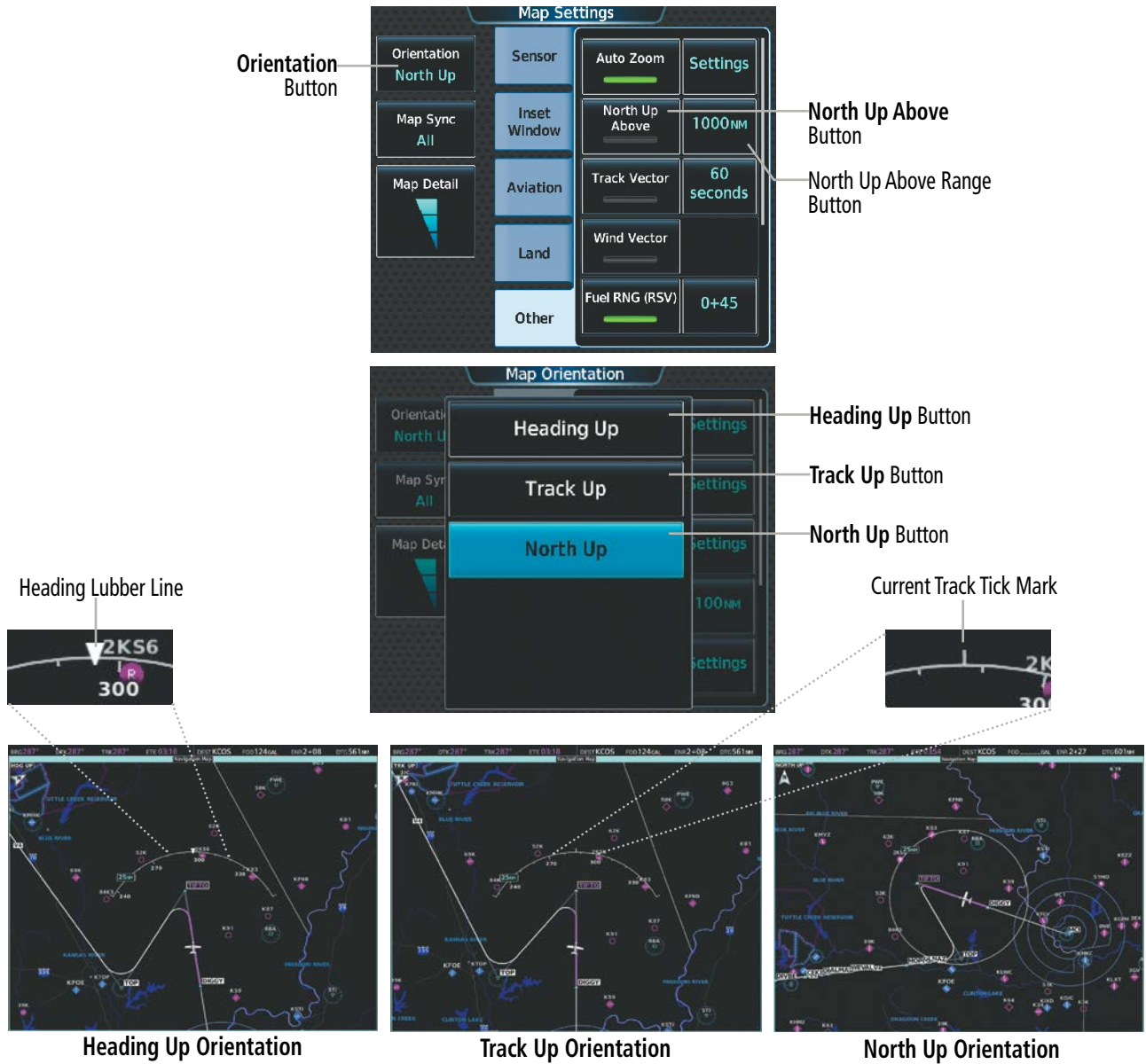


Figure 5-8 Map Orientation Selection

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 **Lower Knob** on the Touchscreen Controller counter-clockwise to decrease the range, or clockwise to increase the range; or (2) push **Lower Knob** on the Touchscreen Controller to activate the **Touchpad** and touch two fingers on the **Touchpad** and move them apart to decrease range, or pinch using two fingers to increase range.

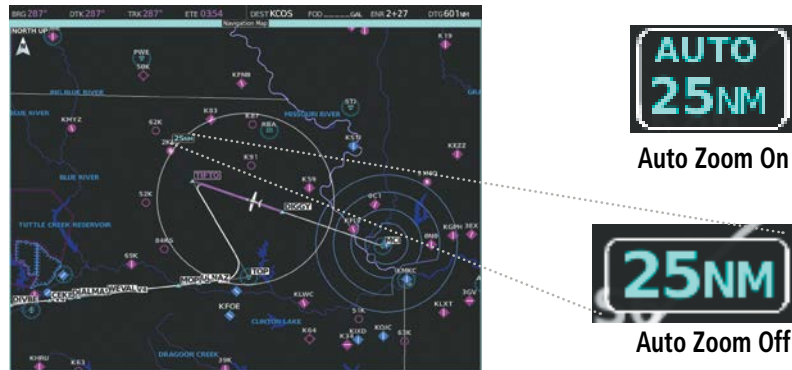


Figure 5-9 Map Range

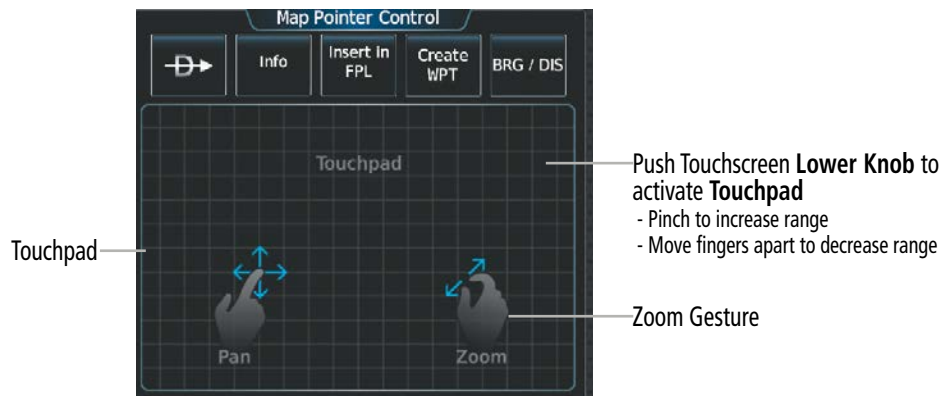


Figure 5-10 Touchpad Map Range Control

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 navigation maps 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 navigation maps 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 settings determine the minimum and maximum distance to display based upon the aircraft's ground speed.

- » Waypoints that are long distances apart cause the map range to increase to a point where many details on the map are decluttered. If this is not acceptable, lower the maximum look ahead time to a value that limits the auto zoom to an acceptable range.
- » Waypoints that are very short distances apart cause the map range to decrease to a point where situational awareness may not be what is desired. Increase the minimum look ahead time to a value that limits the auto zoom to a minimum range that provides acceptable situational awareness.
- » Flight plans that have a combination of long and short legs cause the range to increase and decrease as waypoints sequence. To avoid this, auto zoom can be disabled or the maximum/minimum times can be adjusted.
- » The "Auto Zoom Time Out" time determines how long auto zoom is overridden by a manual adjustment of the range knob. At the expiration of this time, the auto zoom range is restored. Setting the "Auto Zoom Time Out" value to zero causes the manual override to never time out.
- » When the maximum 'look forward' time is set to zero, the upper limit becomes the maximum range available (1000 nm).
- » When the minimum 'look forward' time is set to zero, the lower limit becomes 0.75 nm.

Configuring automatic zoom:

- 1) From MFD 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' Screen.
- 5) Touch the **Auto Zoom Max Look Fwd** Button to display the numeric keyboard.
- 6) Use the keypad 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.

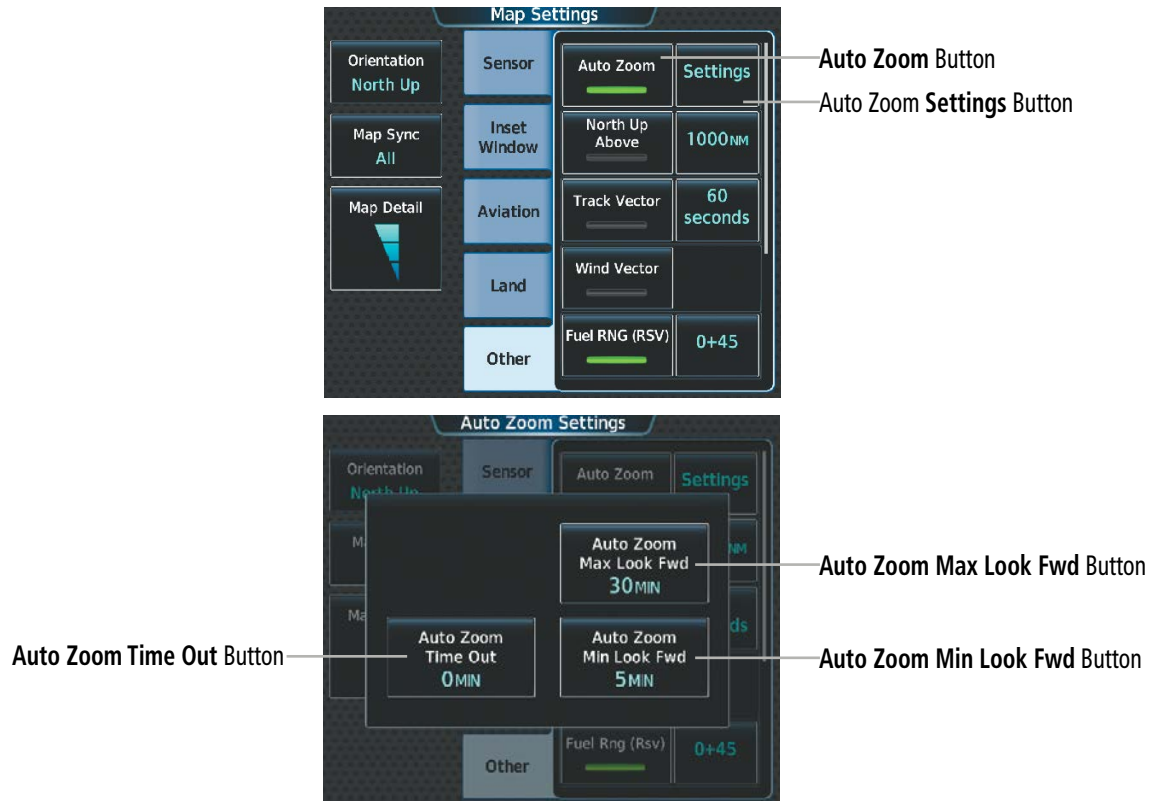


Figure 5-11 Auto Zoom Setup

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 (Upper Knob on the Touchscreen Controller or **Touchpad**)
- Highlight and select locations on the map (Upper Knob on the Touchscreen Controller or **Touchpad**)
- Graphically initiate a Direct To a selected airport, NAVAID (VOR, Intersection, NDB), VRP or user waypoint (**Direct To** Button)
- Display an information screen for a selected airport, NAVAID (VOR, Intersection, NDB), user waypoint, or airspace (**Info** Button)
- Designate locations for use in flight planning (**Insert in FPL** Button)
- Graphically create user waypoints (**Create WPT** Button)
- Measure the bearing and distance from the aircraft present position to any location on the navigation map, or between any two points on the navigation map (**BRG/DIS** Button)
- View obstacle, airspace, and airway information

When the Map Pointer function is selected by pressing the **Lower Knob** on the Touchscreen Controller, 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 pane 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.

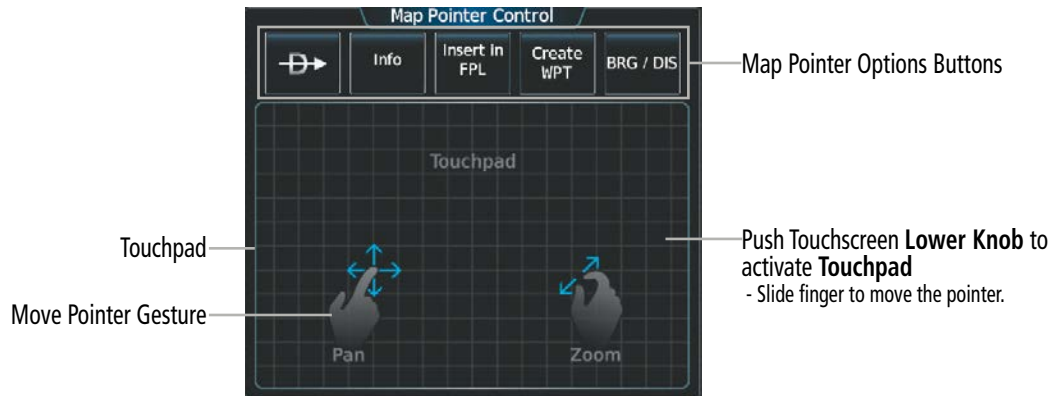


Figure 5-12 Touchpad Map Pointer Control

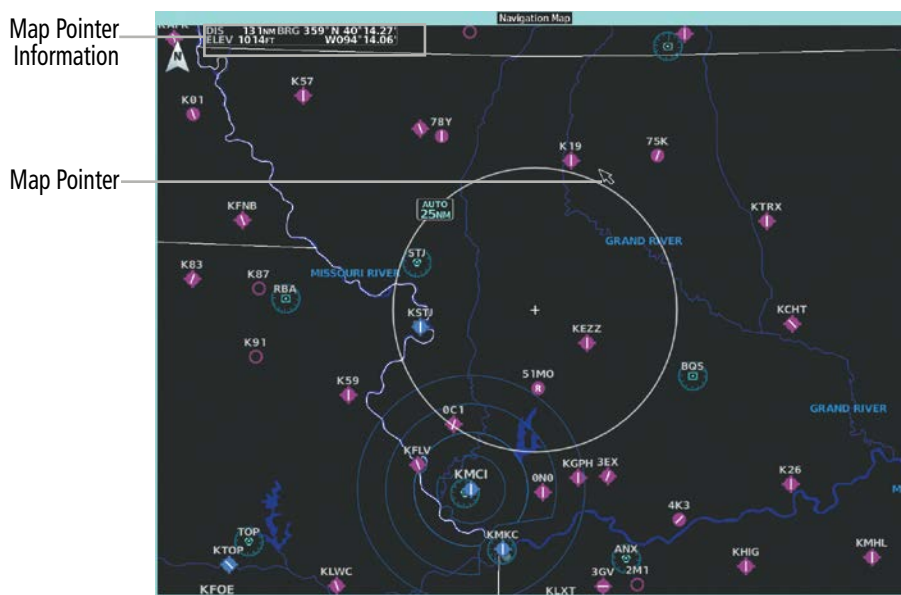


Figure 5-13 Navigation Map - Map Pointer Activated

Panning the map:

- 1) Press the **Lower Knob** on the Touchscreen Controller 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) Press either knob on the Touchscreen Controller, or touch the **Back** Button, to remove the Map Pointer and recenter the map on the aircraft's current position.

When the Map Pointer is placed on a waypoint (airport, intersection, NAVAID, VRP, or user waypoint) 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 highlighted on the map display, pertinent information is available by touching the **Info** Button on the Touchscreen Controller.

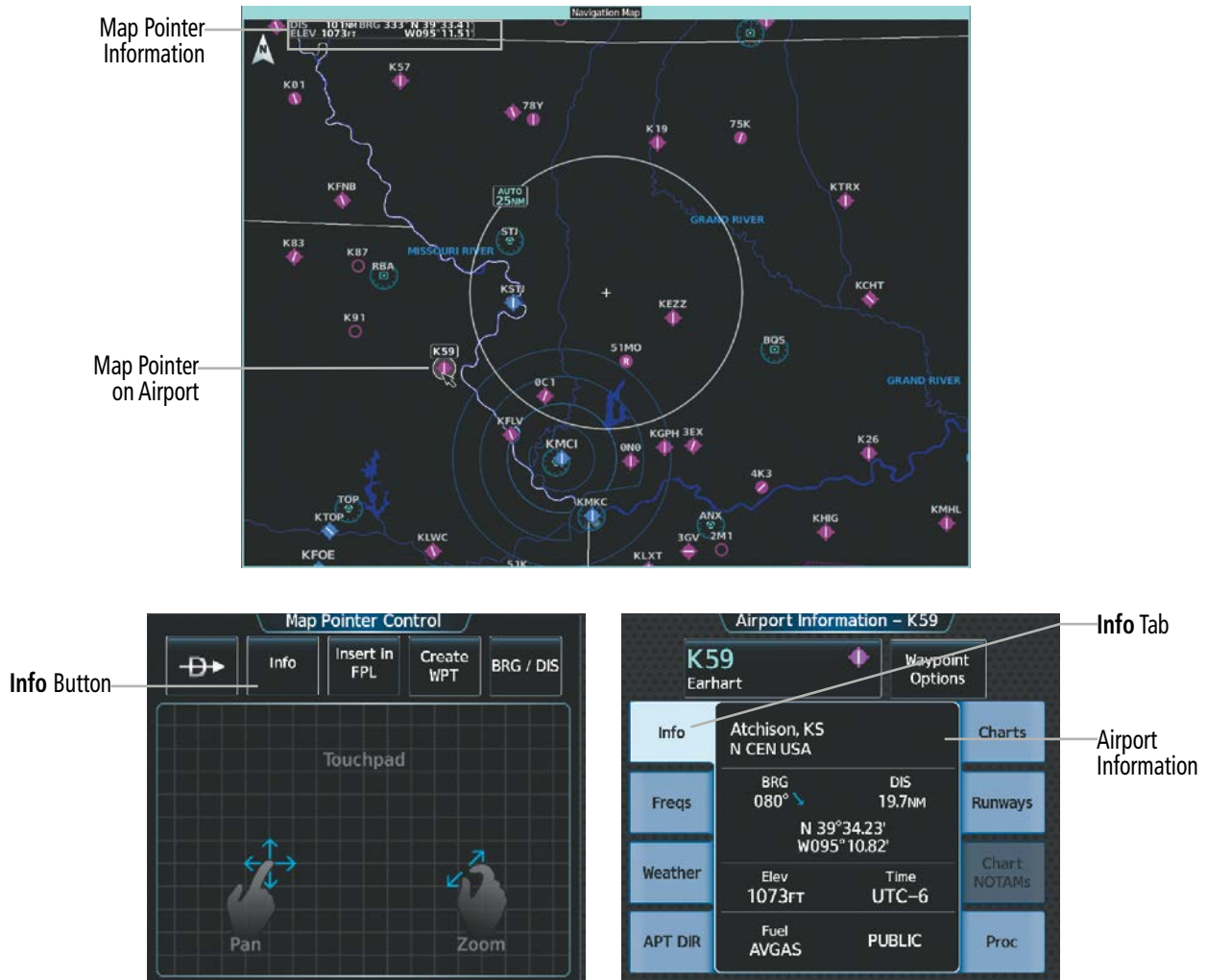


Figure 5-14 Navigation Map - Map Pointer on Airport

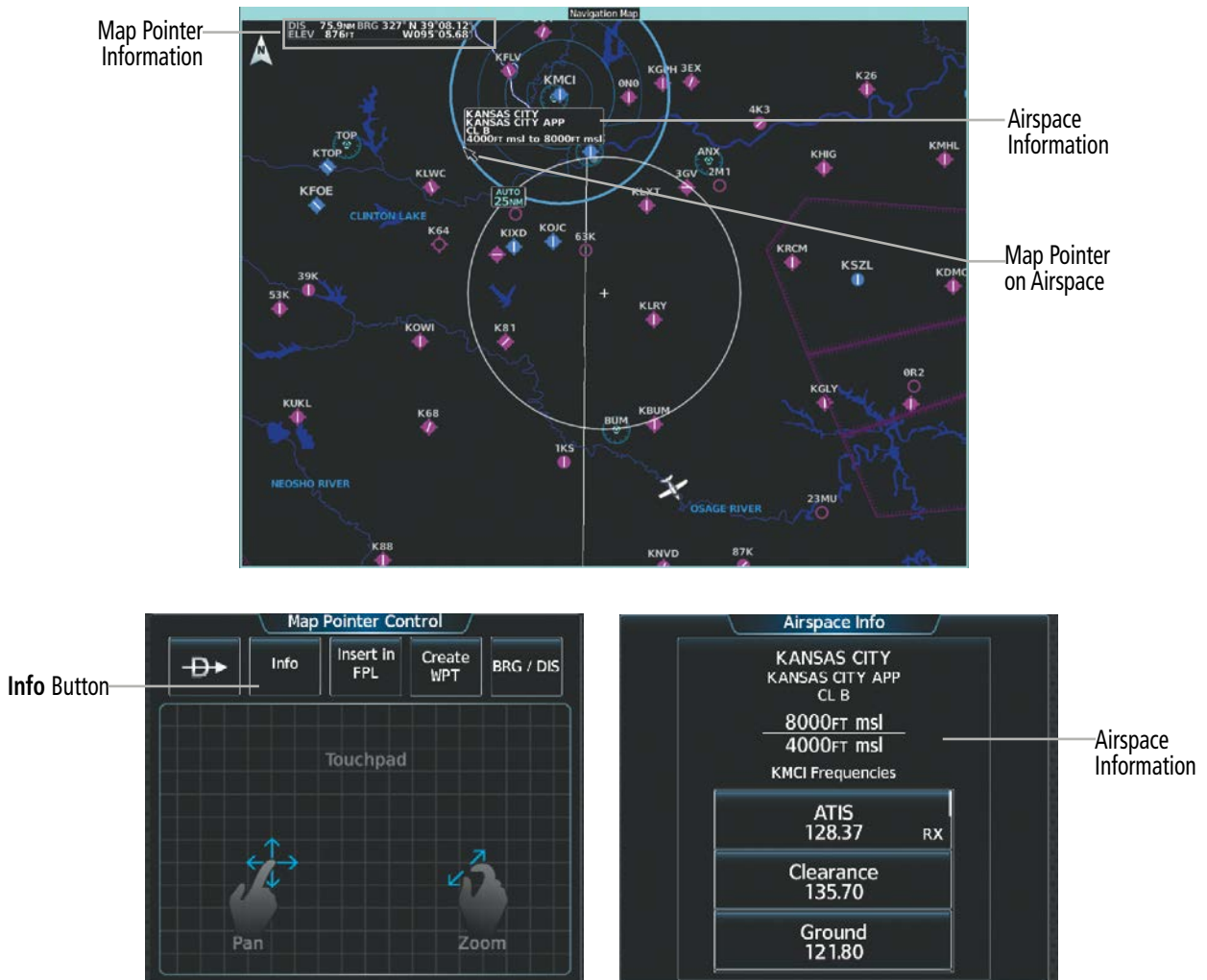


Figure 5-15 Navigation Map - Map Pointer on Airspace

Reviewing information for a waypoint or airspace:

- 1) Place the Map Pointer on an airport, intersection, NAVAID, VFR, user waypoint, or airspace.
- 2) Touch the **Info** Button on the Touchscreen Controller 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 Navigation Map.

Or:

Press either knob on the Touchscreen Controller to exit the waypoint information screen, remove the Map Pointer from the Navigation Map, and recenter the map on the aircraft's current position.

MEASURING BEARING AND DISTANCE

Distance and bearing can be measured on a navigation map or on a data link weather map may be calculated using the knobs on the Touchscreen Controller 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.

Measuring bearing and distance between the aircraft present position and any other point:

- 1) Press the **Lower Knob** on the Touchscreen Controller (with a navigation map or data link weather map displayed).
- 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 Upper Knob on the Touchscreen Controller or 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, press the either knob on the Touchscreen Controller or touch the **Back** Button.



Figure 5-16 Navigation Map - Measuring Bearing/Distance from Aircraft Present Position

Measuring bearing and distance between any two points:

- 1) Press the **Lower Knob** on the Touchscreen Controller (with a navigation map or data link weather map displayed).
- 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 Upper Knob on the Touchscreen Controller or 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 Upper Knob on the Touchscreen Controller or 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, press either knob on the Touchscreen Controller or touch the **Back** Button.

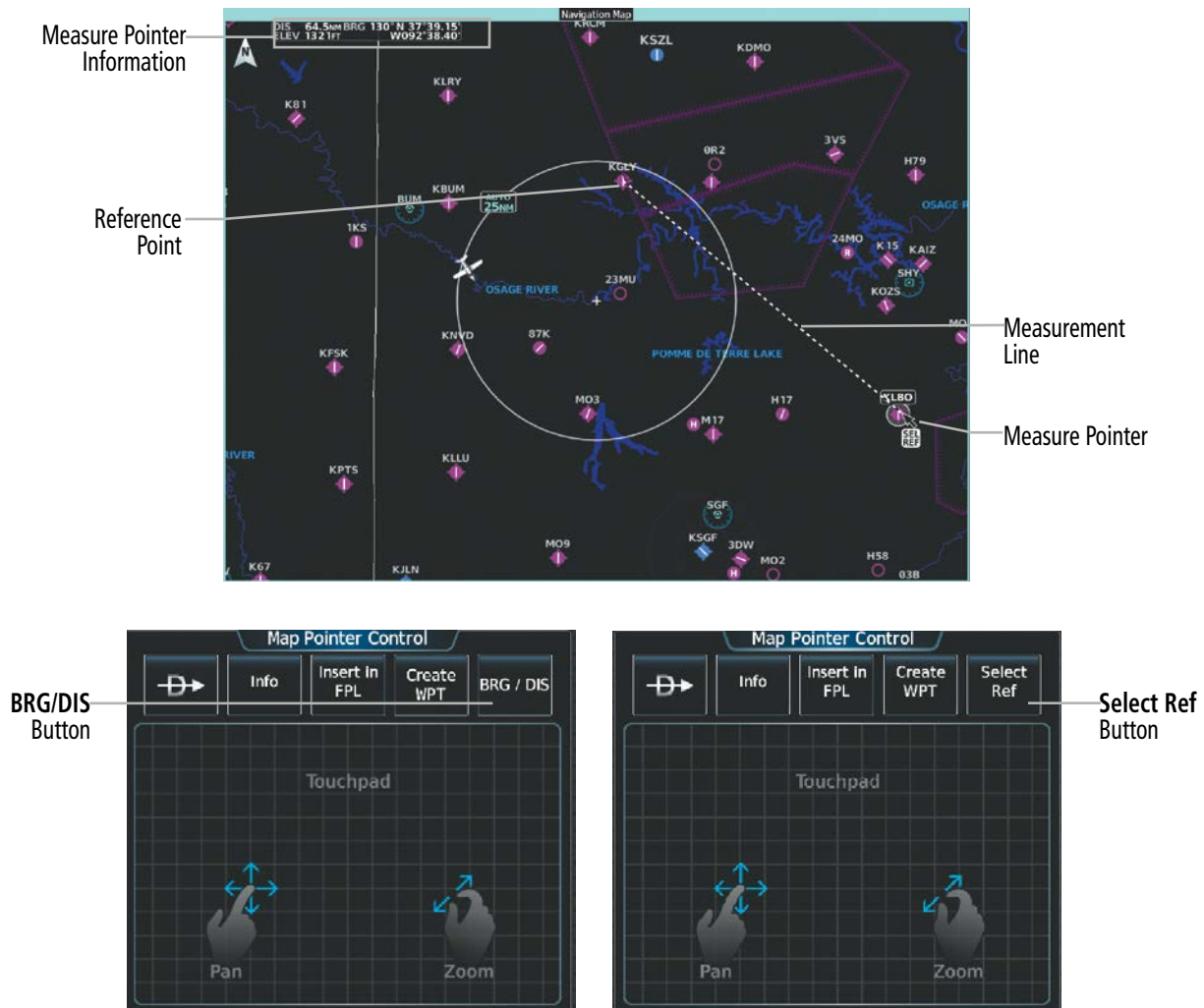


Figure 5-17 Navigation Map - Measuring Bearing/Distance between Two Points

ABSOLUTE TERRAIN

All navigation maps can display 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.

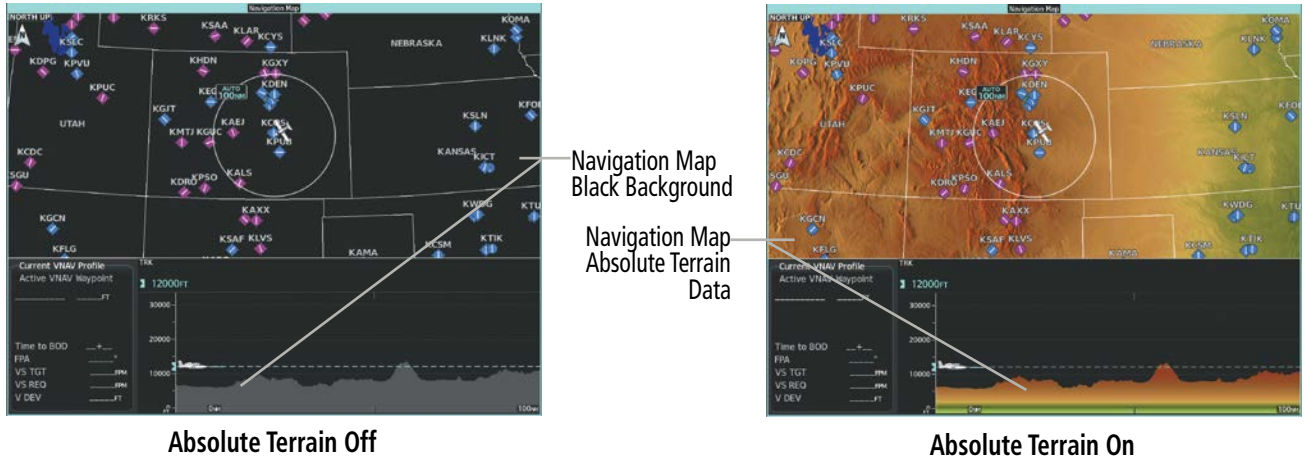


Figure 5-18 Navigation Map - Absolute Terrain Data

Displaying/removing absolute terrain data on navigation maps:

- 1) From MFD 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 on the navigation map.

Or:

Touch the **Off** Button to remove absolute terrain data from the navigation map.

Relative terrain is discussed in the Hazard Avoidance section.

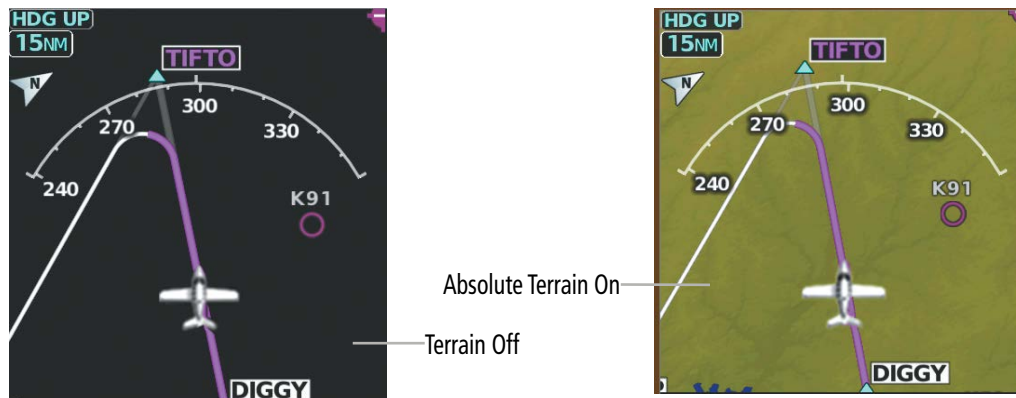


Figure 5-19 Inset Map - Absolute Terrain Data

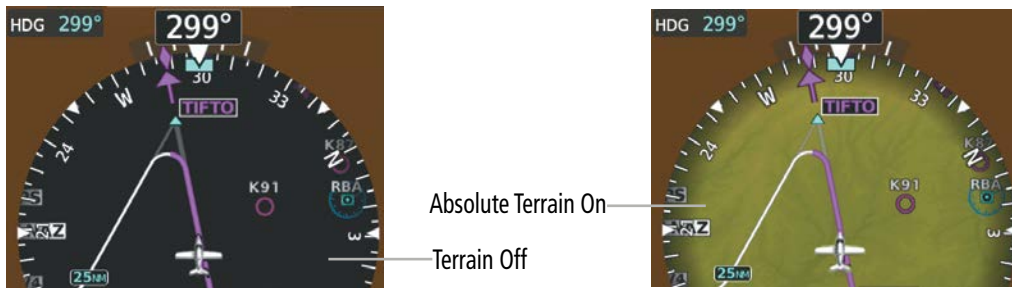


Figure 5-20 HSI Map - Absolute Terrain Data

Displaying/removing absolute terrain data from the PFD Map:

- 1) From PFD Home, touch **PFD Map Settings**.
- 2) Touch the **Layout** Button to choose between the Inset Map or HSI Map layout.
Touch the **Inset Map** Button.
Or:
Touch the **HSI Map** Button.
- 3) Touch the **Terrain** Button to display the 'Inset Terrain Displayed' Window.
- 4) Touch the **Absolute** Button to display absolute terrain data on the PFD Inset Map or the HSI Map.
Or:
Touch the **Off** Button to remove absolute terrain data from the PFD Inset Map or the HSI Map.

The absolute terrain data range is the maximum map range on which absolute terrain data is displayed.

Selecting an absolute terrain data range on navigation map displays:

- 1) From MFD Home, touch **Map > Map Selection > Map Settings**.
- 2) Touch the **Sensor** Tab, if necessary.
- 3) Touch the **Terrain Settings** Button to display the 'TAWS Settings' Window.
- 4) Touch the **Map Settings** Button to display the 'Terrain Settings' Window.
- 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.

Selecting an absolute terrain data range on the PFD Inset Map or the HSI Map:

- 1) From PFD Home, touch **PFD Map Settings**.
- 2) Touch the **Terrain Settings** Button to display the 'TAWS Settings' Window.
- 3) Touch the **Map Settings** Button to display the 'Terrain Settings' Window.
- 4) Touch the **Terrain** Button to display the 'Map Terrain Range' Window.
- 5) Scroll the list if necessary to find the desired range, and touch the range button.

In addition, the Navigation Map can display an absolute terrain scale (located in the lower right hand side of the map) showing a scale of the terrain elevation.

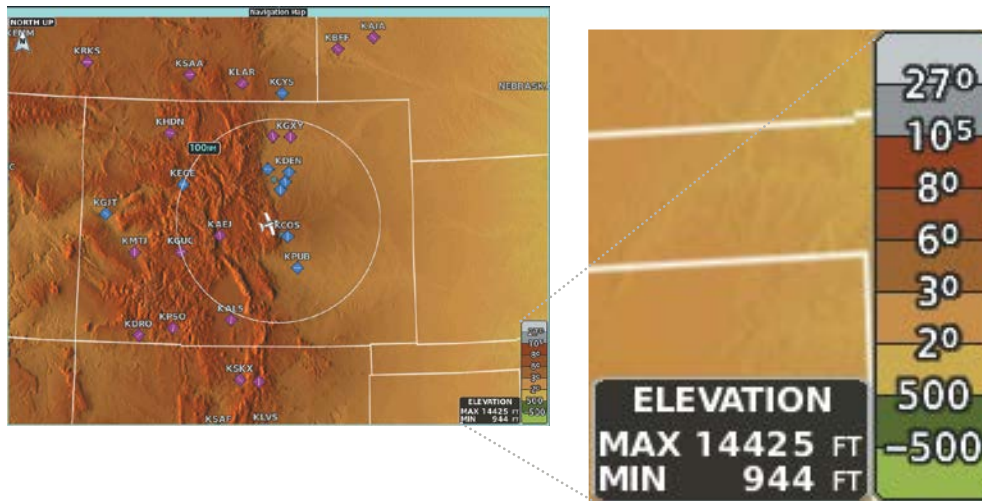


Figure 5-21 Navigation Map - Absolute Terrain Scale

Displaying/removing the absolute terrain scale on navigation map displays:

- 1) From MFD Home, touch **Map > Map Selection > Map Settings**.
- 2) Touch the **Sensor** Tab, if necessary.
- 3) Touch the Terrain **Settings** Button to display the 'TAWS Settings' Window.
- 4) Touch the **Map Settings** Button to display the 'Terrain Settings' Window.
- 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 PFD Map and MFD navigation map 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.











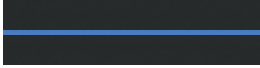





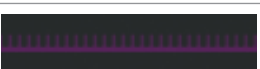






Land Symbols	Symbol	Maximum Range (nm)
Obstacles (Point and Wire)	See Hazard Avoidance Section	25
Roads		
Interstate Highway (Freeway)		400
International Highway (Freeway)		400
US Highway (National Highway)		150
State Highway (Local Highway)		100
Local Road (Local Road)	N/A	25
Railroad		25
Large City (> 200,000)		1000
Medium City (> 50,000)		400
Small City (> 5,000)		100
State/Province		1000
Rivers and Lakes (River/Lake)		100

Table 5-1 Land Symbol Information

AVIATION SYMBOLS

The following items are configured on the **Aviation** Tab, and **Sensors** Tab of the 'Map Settings' Screen.

Aviation Symbols	Symbol	Maximum Range (nm)
Low Altitude Airways		50
High Altitude Airways		75
Class B, Terminal Manoeuvring Area** and Airways** (CL B/TMA/AWY)		150
Class C Airspace/Control Area (CL C/CTA)		100
Class D Airspace (CL A/D)		100
Restricted and Prohibited Areas (Restricted)		100
MOA (Military)		250
Other/ADIZ		250
ADIZ		
Alert		
Danger/Warning		
TFR		1000
Class B Airspace Altitude Label (ceiling/floor)		*
Class C Airspace Altitude Label (ceiling/floor)		*
Class D Airspace Altitude Label (ceiling)		*
Large Airport (Longest Runway ≥ 8100 ft)		1000
Medium Airport (8100 ft > Longest Runway ≥ 5000 ft, or Longest Runway < 5000ft with control tower)		400
Small Airport (Longest Runway < 5000 ft without control tower)		150

Aviation Symbols	Symbol	Maximum Range (nm)
VOR Waypoint		250
INT Waypoint		40
NDB Waypoint		50
VRP Waypoint		40
User Waypoint		1000
SafeTaxi	See Additional Features	5
Runway Extension		150
Missed Approach Preview On/Off		N/A
Altitude/Speed Constraints		1000
Latitude/Longitude Lines		1000

* Label placement and range is determined by the system for best display and minimal clutter

** Applies to European airspace only

Table 5-2 Aviation Symbol Information

SYMBOL SETUP

All navigation maps can display aviation and land symbols. 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 navigation or land symbol type:

- 1) From MFD Home, touch **Map > Map Selection > Map Settings**.
- 2) Touch the **Aviation, Sensor, Land, or Other** Tab, if necessary.
- 3) Scroll the list to find the desired item.
- 4) Touch the annunciator button to display/remove the symbol type from navigation maps.

The range button sets the maximum range at which these items will be displayed on the navigation map.



Figure 5-22 Map Settings Screen - Aviation Data Setup Example



Figure 5-23 Map Settings Screen - Land Data Setup Example

Selecting an Aviation or Land item maximum range:

- 1) From MFD 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 3-6 as necessary.

Displaying/removing the VOR compass rose:

- 1) From MFD 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' Screen.
- 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. The navigation map detail level is displayed on the 'Map Settings' Screen on the Touchscreen Controller and on the navigation map. The PFD Inset Map detail level is shown on the Inset Map and the **Map Detail** Button.



Figure 5-24 Navigation Map - Map Detail



Figure 5-25 PFD Map - Map Detail

Adjusting the navigation map detail:

- 1) From MFD Home, touch **Map > Map Selection > Map Settings > Map Detail**.
- 2) Slide up or down on the **Map Detail** Slider to adjust the navigation map detail.

Adjusting the PFD Inset Map or the HSI Map detail:

- 1) From PFD Home, touch **PFD Map Settings > Map Detail**.
- 2) Slide up or down on the **Map Detail** Slider to adjust the PFD Inset Map or HSI 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
Safe Taxi			X
Runway Labels			X
TFRs			X
Restricted			X
MOA (Military)			X
Intersections (does not declutter if used to define airway)		X	X
NDBs		X	X
VORs (does not declutter if used to define airway)		X	X
VRPs		X	X
User Waypoints		X	X
Latitude/Longitude Grid		X	X
Class B Airspaces/TMA		X	X
Class C Airspaces/CTA		X	X
Class D Airspaces		X	X
Other Airspaces/ADIZ		X	X
Obstacles		X	X
Cities	X	X	X
Roads	X	X	X
Railroads	X	X	X
State/Province Boundaries	X	X	X

Table 5-3 Navigation 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 (Victor Airways or T-Routes) start 1,200 feet above ground level (AGL) and extend up to 18,000 feet mean sea level (MSL). Low Altitude Airways are designated with a "V" or a "T" before the airway number.

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

Low Altitude Airways are drawn in gray (the same shade used for roads). High Altitude Airways are drawn in green. When both types of airways are displayed, High Altitude Airways are drawn on top of Low Altitude Airways.

When airways are selected for display on the map, the airway waypoints (VORs, NDBs and Intersections) are also displayed.

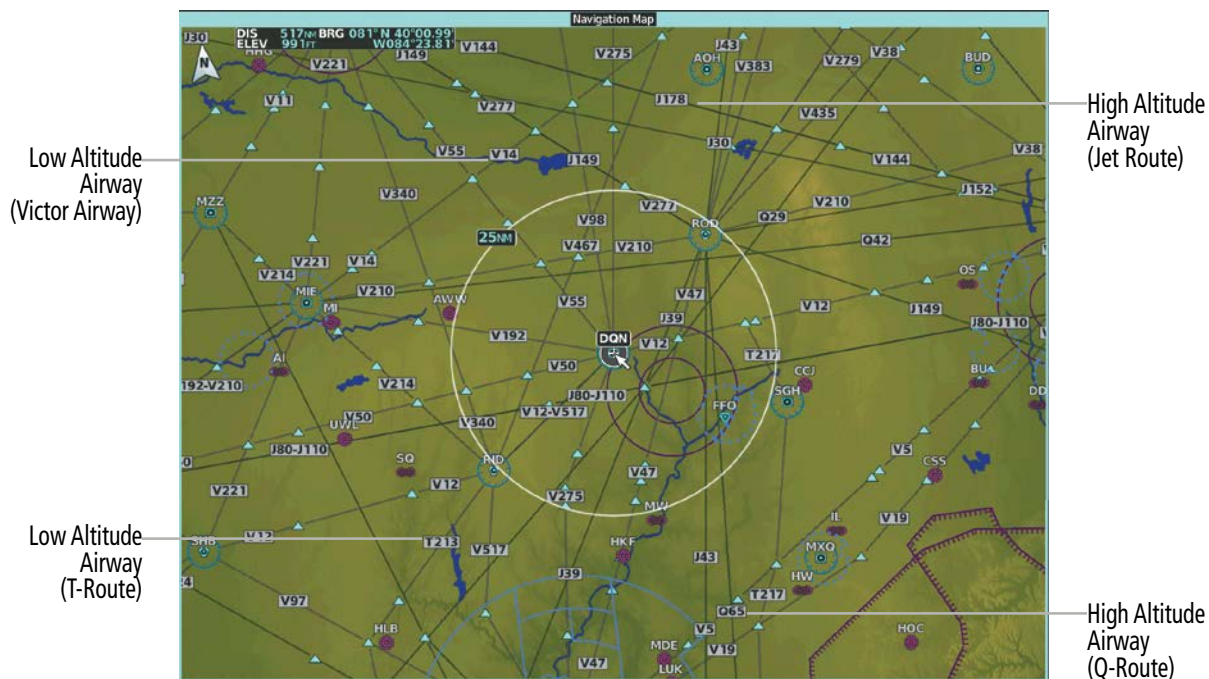


Figure 5-26 Airways on MFD Navigation Map

Airways may be displayed on the map at the pilot's discretion using the Touchscreen Controller. The airway range can also be programmed to only display airways on the navigation map when the map range is at or below a specific value.

Displaying/removing airways:

- 1) From MFD Home, touch **Map** > **Map Selection** > **Map Settings**.
- 2) Touch the **Aviation** Tab, if necessary.
- 3) Touch the **Low Altitude Airways** Button to display/remove the low altitude airways.
- 4) Touch the **High Altitude Airways** Button to display/remove the high altitude airways.

The airway range is the maximum map range at which the airways will be displayed on the navigation map.

Selecting an airway range:

- 1) From MFD Home, touch **Map > Map Selection > Map Settings**.
- 2) Touch the **Aviation** Tab, if necessary.
- 3) Touch the low altitude or high altitude range button to display the range selection buttons.
- 4) Touch a range selection button to select the maximum map display range.





Airway Type	Airway Symbol/Line	Highlighted Airway Information Box	Maximum Range (nm)
Low Altitude Airways (V Routes and T Routes)			100
High Altitude Airways (J Routes and Q Routes)			100

Table 5-4 Airway Symbol/Range Information

ADDITIONAL NAVIGATION MAP ITEMS

The Navigation Map can display additional map items. Track Vector, Wind Vector, Fuel Range Ring, Selected Altitude Range Arc, Field of View, and Latitude/Longitude Lines can be displayed or removed.

Displaying/removing Additional Navigation Map Items:

- 1) From MFD 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

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



Figure 5-27 Navigation Map - Track Vector

Selecting track vector look-ahead time:

- 1) From MFD Home, touch **Map > Map Selection > Map Settings**.
- 2) Touch the **Other** Tab, if necessary.
- 3) Touch the time button to display the time selection buttons.
- 4) Scroll the list, if necessary, and touch a time selection button to select the look-ahead time.

NAVIGATION MAP WIND VECTOR

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



Figure 5-28 Navigation Map - Wind Vector



NOTE: *The wind vector is not displayed until the aircraft is moving.*

Displaying/removing the navigation map wind vector:

- 1) From MFD Home, touch **Map > Map Selection > Map Settings**.
- 2) Touch the **Other** Tab, if necessary.
- 3) Touch the **Wind Vector** Button to display/remove the navigation map wind vector.

FUEL RANGE RING

The map can display a fuel range ring which shows an estimate of the remaining flight distance. A dashed green circle indicates the selected range to reserve fuel. A solid green circle indicates the total endurance range. If only reserve fuel remains, the range is indicated by a solid amber circle. Calculations are based on current fuel flow and ground speed.

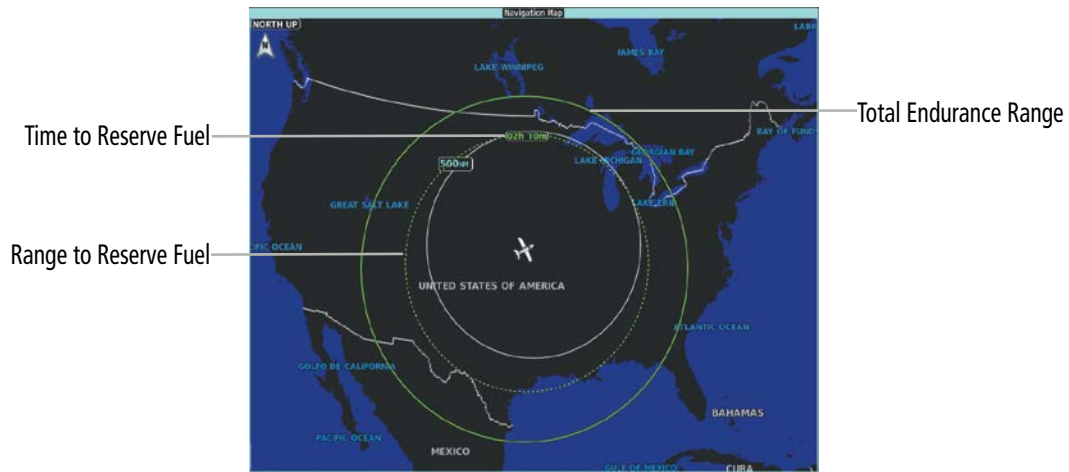


Figure 5-29 Navigation Map - Fuel Range Ring

Displaying/removing the fuel range ring:

- 1) From MFD Home, touch **Map > Map Selection > Map Settings**.
- 2) Touch the **Other** Tab, if necessary.
- 3) Touch the **Fuel RNG (RSV)** Button to display/remove the fuel range ring.

Selecting fuel reserve time:

- 1) From MFD Home, touch **Map > Map Selection > Map Settings**.
- 2) Touch the **Other** Tab, if necessary.
- 3) Touch the fuel reserve time button to display the keypad.
- 4) Use the keypad to enter the fuel reserve time.

SELECTED ALTITUDE INTERCEPT ARC

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

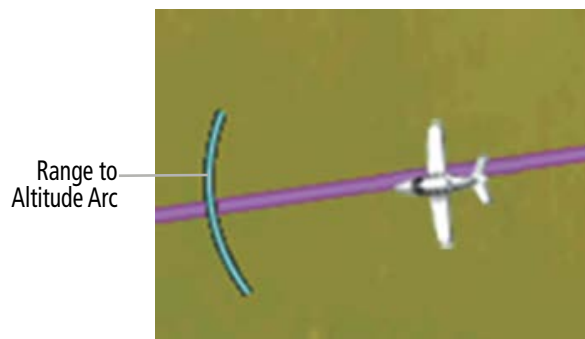


Figure 5-30 Navigation Map - Range to Altitude Arc

Displaying/removing the selected altitude intercept arc:

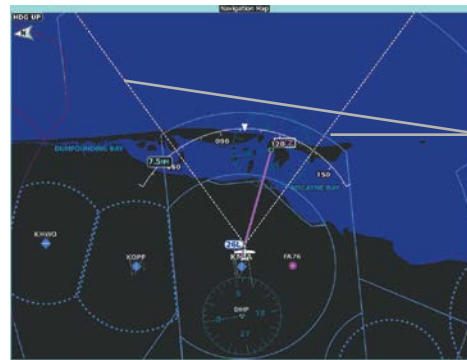
- 1) From MFD Home, touch **Map** > **Map Selection** > **Map Settings**.
- 2) Touch the **Other** Tab, if necessary.
- 3) Touch the **Selected ALT Range Arc** Button to display/remove the selected altitude intercept arc.

FIELD OF VIEW (SVT)

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



SVT View on the PFD



Field of View on the Navigation Map

Figure 5-31 PFD and Navigation Map Field of View Comparison**Displaying/removing the field of view indication on the navigation map:**

- 1) From MFD Home, touch **Map** > **Map Selection** > **Map Settings**.
- 2) Touch the **Other** Tab, if necessary.
- 3) Scroll to display the **Field of View** Button.
- 4) Touch the **Field of View** Button to display/remove the field of view indication on the navigation map.

LATITUDE/LONGITUDE LINES

The navigation map can display 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 navigation map.



Figure 5-32 Navigation Map - Latitude/Longitude Lines

Displaying/removing Lat/Lon lines:

- 1) From MFD Home, touch **Map > Map Selection > Map Settings**.
- 2) Touch the **Other** Tab, if necessary.
- 3) Touch the **LAT/LON Lines** Button to display/remove the lines.

The range button sets the maximum range at which the lines will be displayed on the navigation map.

Selecting the Lat/Lon line maximum range:

- 1) From MFD 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.

5.3 WAYPOINTS

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

Communication and navigation frequencies can be found and tuned from waypoint data. Refer to the Audio and CNS section for details.

Waypoints can be selected by entering the ICAO identifier, entering the name of the facility, or by entering the city name. See the System Overview section for detailed instructions on entering data in the system.

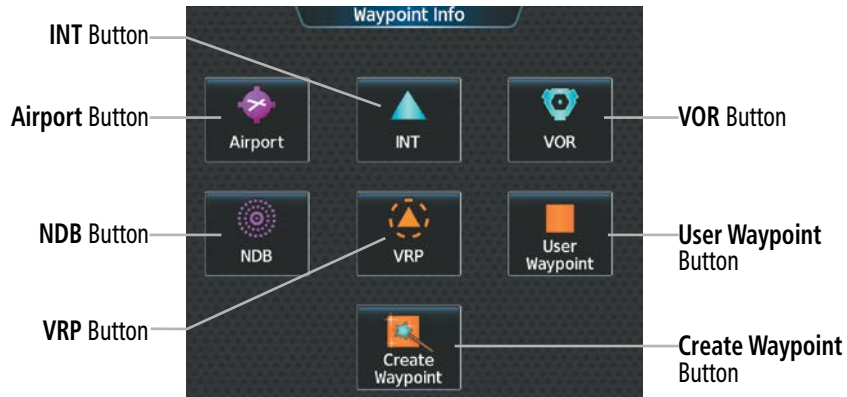


Figure 5-33 'Waypoint Info' Screen

If duplicate entries exist for an identifier, a 'Waypoint Duplicates' Screen is displayed when the **Enter** Button is touched or the small upper knob is pressed.

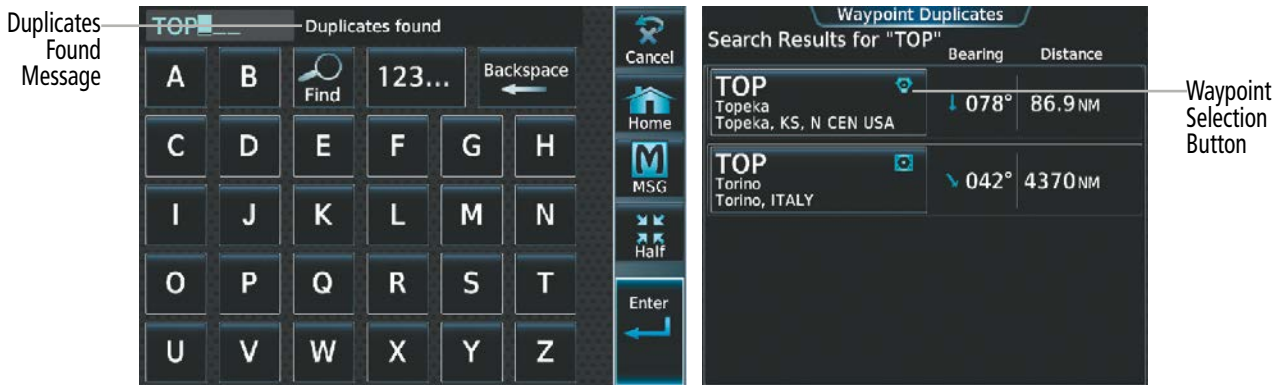


Figure 5-34 Waypoint Duplicates

AIRPORTS

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

The Airport Information Display on the MFD 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 avionics power application and when the aircraft position is known, the Airport Information Display 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 5-35 Airport Information Display on MFD

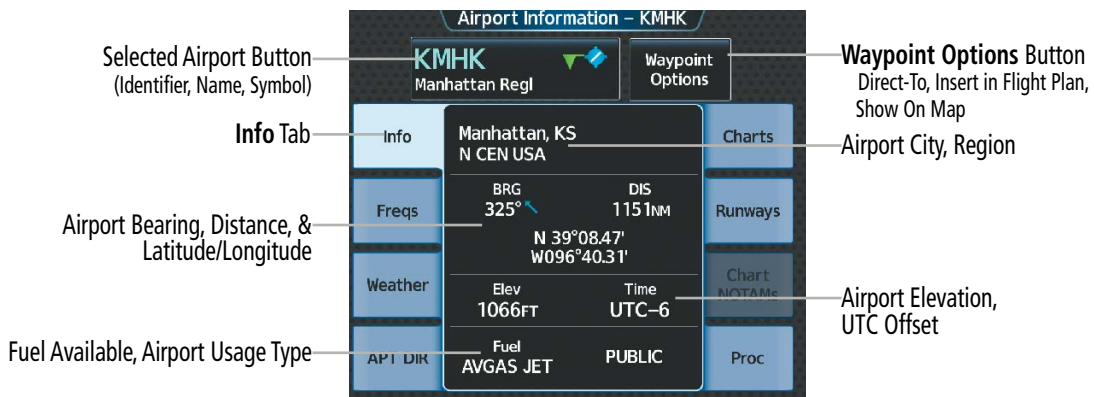


Figure 5-36 Airport Information

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

Usage type: PUBLIC, MILITARY, PRIVATE, or HELIPORT
Fuel Available: AVGAS, JET



Figure 5-37 Airport Frequencies

The following descriptions and abbreviations are used on the 'Airport Frequencies' Screen:

COM Availability: TX (transmit only), RX (receive only), PT (part time), i (additional information available)
COM Frequencies: Approach, Arrival, ASOS, ATIS, AWOS, Center, Class B, Class C, Clearance, Control, CTA, Departure, FSS, Gate, Ground, Helicopter, Multicom, Other, Pre-Taxi, Radar, Ramp, Terminal, TMA, Tower, TRSA, Unicom
NAV Frequencies: ILS, LOC

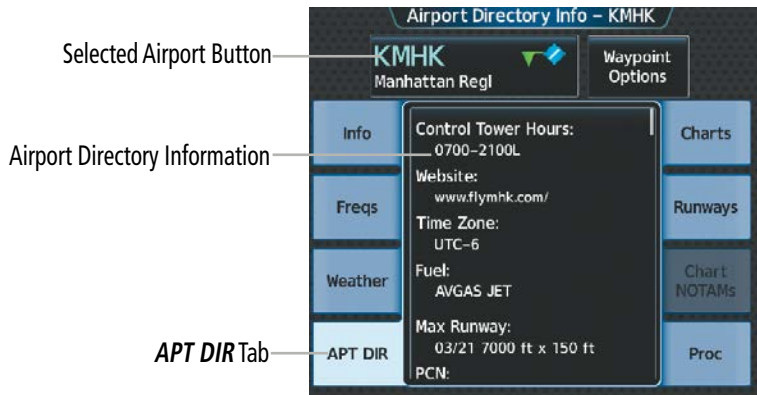


Figure 5-38 Airport Directory Info

The following types of airport directory information are shown (if available):

<ul style="list-style-type: none"> • Airport: Identifier, Type, Name, City, State, Map 	<ul style="list-style-type: none"> • Control Tower: Full/Part-time Hours, Days Open 	<ul style="list-style-type: none"> • Attendance: Annual, weekly, daily, hours
<ul style="list-style-type: none"> • Facility Lighting and Beacon: Hours operating, Type and Location, CTAF, beacon colors 	<ul style="list-style-type: none"> • Noise Abatement: Flying Procedures 	<ul style="list-style-type: none"> • Pattern Altitudes: Aircraft Class/Altitude
<ul style="list-style-type: none"> • Runways: Headings, Length, Width, Facility Obstructions, Surface, Condition, Clearance Slope 	<ul style="list-style-type: none"> • FBO: Name/Type, Frequencies, Services, Fees, Fuel, Credit Cards, Phone/Fax, Hours Internet, Courtesy Car 	<ul style="list-style-type: none"> • Aircraft Businesses/Clubs: Name, Type (sales, training, servicing), Frequencies/Phone/Fax, Credit Cards, Internet, Services
<ul style="list-style-type: none"> • Frequencies: Type/Frequency 	<ul style="list-style-type: none"> • Weather Contacts: Service Type and Frequencies/Phone (AWOS/ASOS) 	<ul style="list-style-type: none"> • Obstructions: General Airport Obstructions
<ul style="list-style-type: none"> • Flight Service Station (FSS): FSS Name, Phone Numbers 	<ul style="list-style-type: none"> • Approaches: Types 	<ul style="list-style-type: none"> • General Information and/or Notes: Fees, Airport Notes, local area information
<ul style="list-style-type: none"> • Special Operations at Airport: Helicopters, etc. 	<ul style="list-style-type: none"> • Restaurants: On the Field and Nearby 	<ul style="list-style-type: none"> • Transportation: Taxi Services, Car Rentals, Type and Availability (public, shuttle, limo, etc.)
<ul style="list-style-type: none"> • Attractions: Hotels, Museums, Raceways, Golfing, etc. 	<ul style="list-style-type: none"> • NAVAIDS: Type, Identifier, Frequency, Radial, Distance 	<ul style="list-style-type: none"> • Charts: VFR Sectional
<ul style="list-style-type: none"> • Elevation: Airfield Elev (ft) 	<ul style="list-style-type: none"> • Mag Var: Airfield Mag Var (degrees) 	<ul style="list-style-type: none"> • Airport Manager: Phone

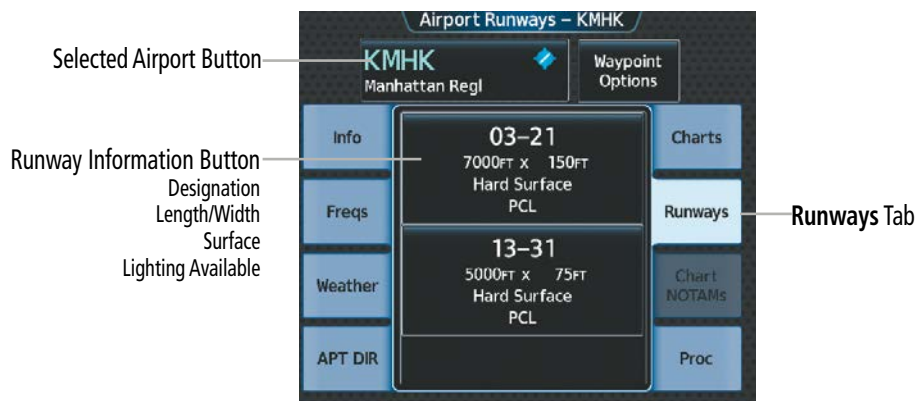


Figure 5-39 Airport Runways

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, or Water

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 MFD 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 Display, if necessary.

Finding and selecting an airport for review by facility name or city name:

- 1) From MFD 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 Display, if necessary.

Finding and selecting an airport for review by category (Recent, Nearest, Flight Plan, or Favorites):

- 1) From MFD 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**, **Nearest**, **Flight Plan**, or **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 Display, if necessary.

Selecting a runway:

- 1) From MFD 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 navigation map, if necessary.

NEAREST AIRPORT

The Nearest Airport Display 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. If there are no airports within 200NM, "No Results found" is displayed.

A dashed white line is drawn on the 'Nearest Airport' Pane from the aircraft position to the selected nearest airport.



Figure 5-40 'Nearest Airport' Pane

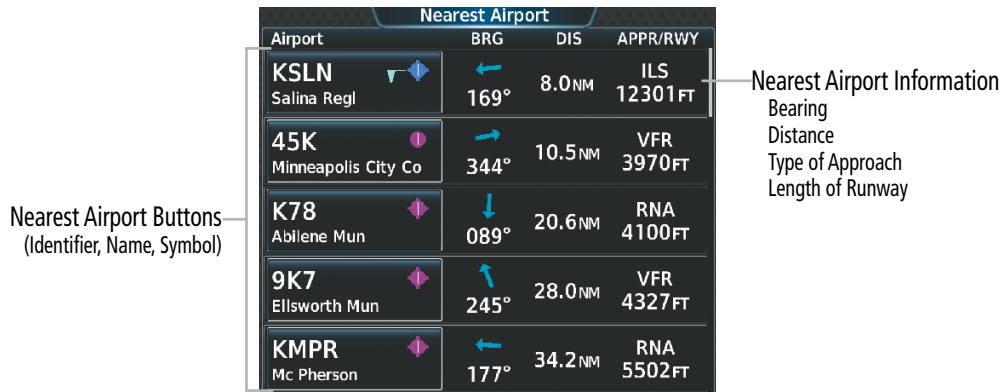


Figure 5-41 'Nearest Airport' Screen

Viewing information for a nearest airport:

- 1) From MFD 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 a Tab to display the desired information on the Touchscreen Controller.

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

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 (or meters) for runway length and “Hard Only” for runway surface type.

Selecting nearest airport surface matching criteria:

- 1) From MFD 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 MFD 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 WAYPOINTS

WAYPOINT INFORMATION

Non-Airport Waypoints are considered to be Intersections, VORs, NDBs, VRPs, and User Waypoints. For each of these waypoints, their respective Information Panes 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.

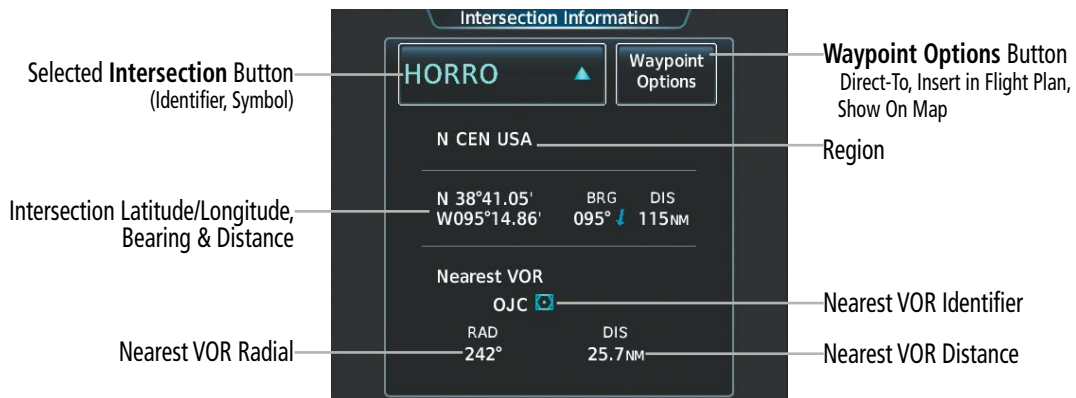


Figure 5-42 Intersection Information

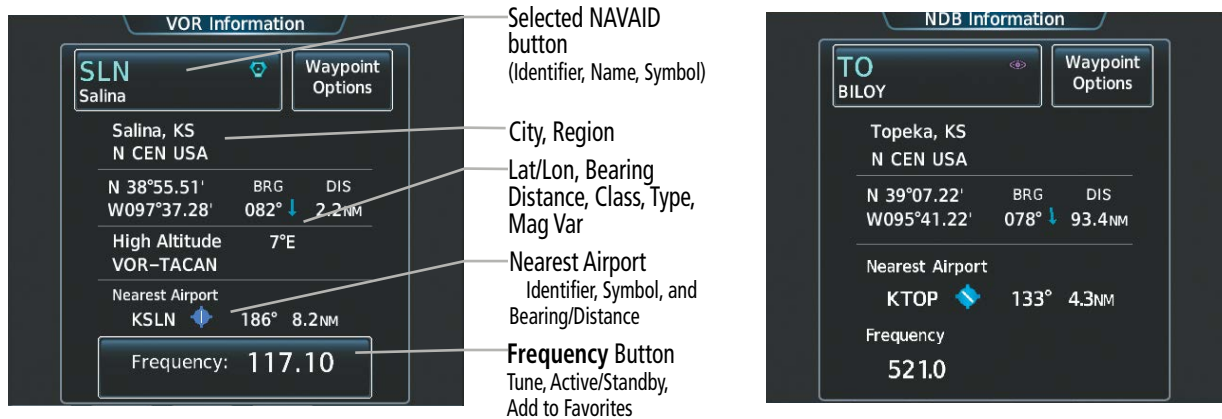


Figure 5-43 VOR and NDB Information

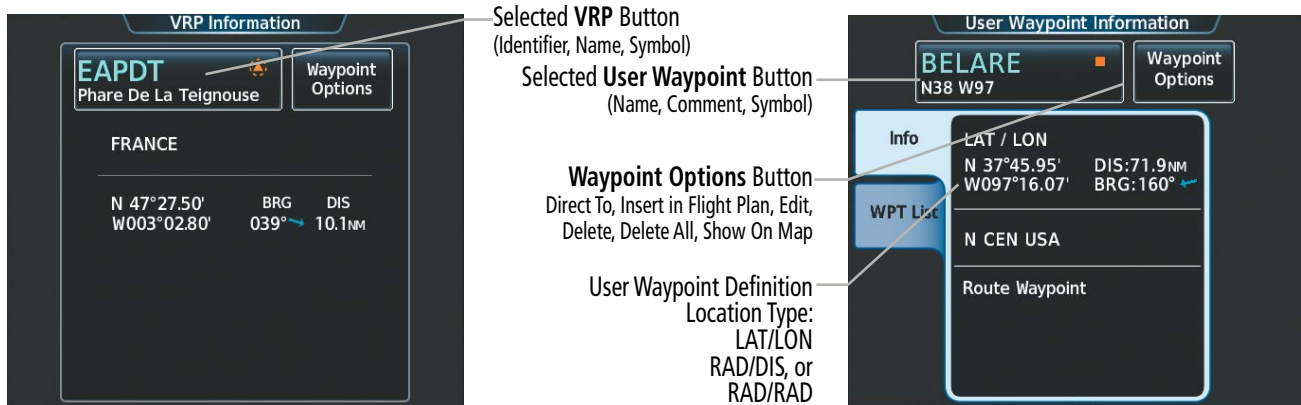


Figure 5-44 VRP and User Waypoint Information



Figure 5-45 Non-Airport Waypoint Pane (shown via "Show on Map")

Selecting an Intersection, VOR, NDB, or VRP:

- 1) From MFD Home, touch the **Waypoint Info** Button.
- 2) Select the **INT, VOR, NDB, or VRP** Button.
- 3) Touch the selected waypoint button to display the keypad.
- 4) Use the keypad to enter the waypoint identifier or name.
- 5) Touch the **Enter** Button to accept the identifier and display the waypoint's information on the Touchscreen Controller.
- 6) Touch the **Waypoint Options** Button, then the **Show on Map** Button to display the 'Intersection, VOR, NDB, or VRP WPT Information' Screen, if needed.

Selecting a User Waypoint:

- 1) From MFD Home, touch **Waypoint Info > User Waypoint**.
- 2) Choose the desired User Waypoint.
 - a) Touch the available user waypoint button to display the keypad.
 - b) Use the keypad to enter the waypoint identifier or name.
 - c) Touch the **Enter** Button to accept the identifier and display the waypoint's information on the Touchscreen Controller.
- Or:**
 - a) Touch the **WPT List** Tab.
 - b) Touch the desired waypoint button.
- 3) Touch the **Waypoint Options** Button, then the **Show on Map** Button to display the 'User WPT Information' Screen, if needed.

Finding and selecting an Intersection, VOR, NDB, VRP, or User Waypoint by category (Recent, Nearest, Flight Plan, or Favorites):

- 1) From MFD Home, touch **Waypoint Info >** select specific non-Airport Waypoint button.
- 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, Nearest, Active Flight Plan, or 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, VOR, NDB, VRP, 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 an VOR, NDB, or VRP for review by facility name or city name:

- 1) From MFD Home, touch **Waypoint Info > VOR, NDB, or VRP**.
- 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 'VOR, NDB, or VRP Information' Pane, if needed.

NEAREST NON-AIRPORT WAYPOINTS

The Nearest Intersection/VOR/NDB/VRP/User pane shows 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/VOR/NDB/VRP/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. If there are no existing waypoints or nearest waypoints available, "No Results Found" is displayed. When shown on a map, a dashed white line is drawn on the 'Nearest Intersection/VOR/NDB/VRP/User' Pane from the aircraft position to the selected nearest waypoint.



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



Figure 5-46 Nearest non-Airport Waypoint Pane (Example: NDB)



Figure 5-47 Nearest VOR/NDB Screen Layouts (Example: VOR)

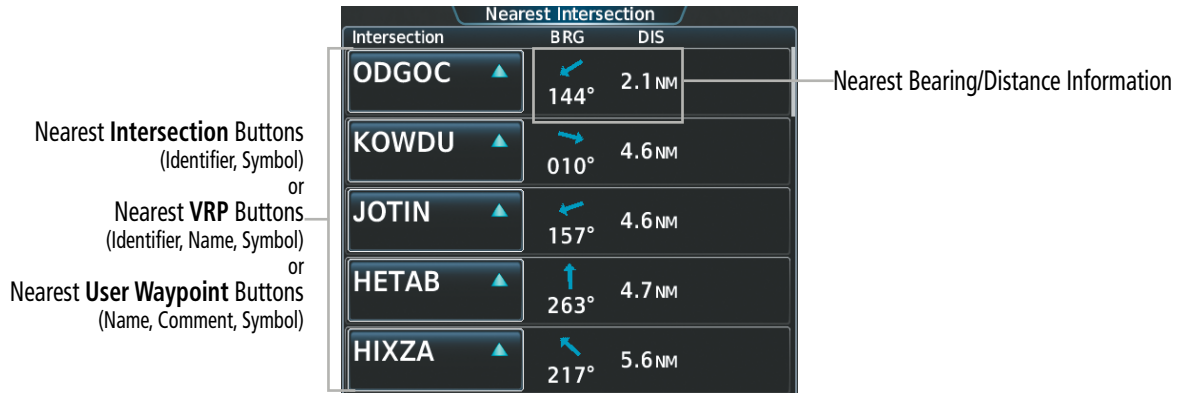


Figure 5-48 Nearest Intersection/VRP/User Screen Layouts (Example: Intersection)

Viewing information for nearest Intersection, VOR, NDB, VRP, or User Waypoint:

- 1) From MFD Home, touch **Nearest** > select specific non-Airport Button.
- 2) Touch a nearest waypoint button to display the 'Waypoint Options' Window.
- 3) Touch the **Show on Map** Button to display the 'Nearest Intersection/NDB/VOR/VRP/User' Pane, if needed.
- 4) Touch the Intersection, VOR, NDB, VRP, or User Waypoint information button to display the selected waypoint's information screen.

CREATING USER WAYPOINTS

The system can create and store up to 1,000 user-defined waypoints. Waypoints can be created as a Route or Airport waypoints using the **Type** Button. User waypoints can be created in two different ways. The first can be done through the 'Waypoint Info' Screen, and the second can be done by selecting a position on a map page using the **Touchpad**. Once a waypoint has been created, it can be renamed, deleted, or moved. Temporary user waypoints are erased upon system power down.

User waypoints can be one of the four Modes as shown on the **Mode** Button in the following figure: Radial/Distance, Radial/Radial, Latitude/Longitude, or Present Position.

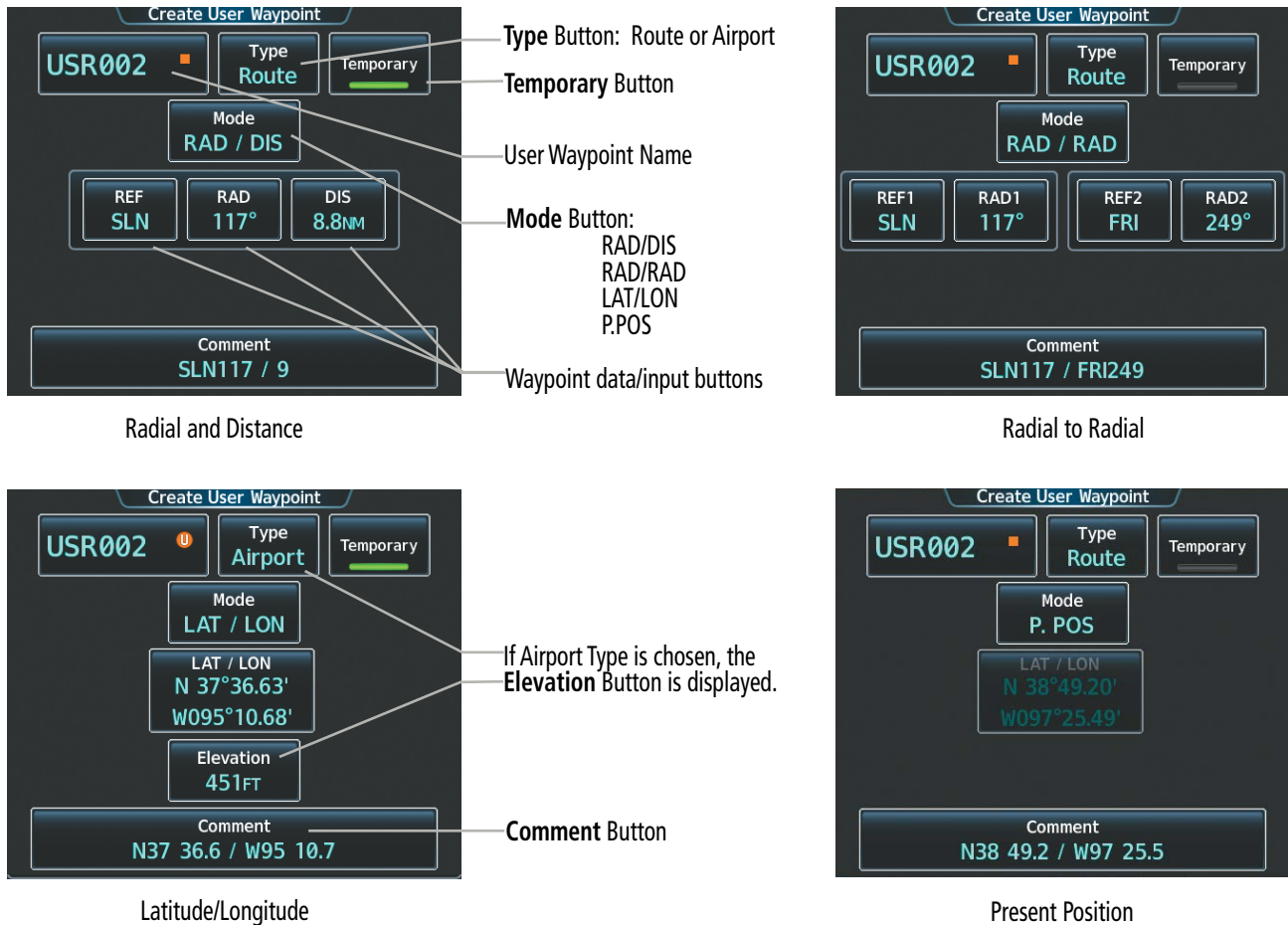


Figure 5-49 'Create User Waypoint' Screens - Mode Options

Creating user waypoints from the 'Create User Waypoint' Screen:

- 1) From MFD Home, touch **Waypoint Info** > **Create Waypoint**. The current aircraft position is the default location of the new waypoint.
- 2) Touch the user waypoint name button to display the keypad.
- 3) Use the keypad and the **Enter** Button to select a user waypoint name (up to six characters).
- 4) If desired, touch the **Type** Button to open the 'Select User Waypoint Type' Screen and change the default 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.
- 5) If desired, define the type and location of the waypoint in one of the following ways:
 - a) Touch the **Mode** Button to display the 'Select User Waypoint Type' Screen.
 - b) Touch the **RAD/DIS** Button to select the bearing/distance from a waypoint type.

- 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 type.
 - 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 steps c – f 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 type.
 - 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.
- 6) 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.
 - 7) 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 subdued, the waypoint is stored until manually erased.
 - 8) 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) Press 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 (up to six characters).
- 6) If desired, Touch the **Type** Button to open the 'Select User Waypoint Type' Screen and change the default 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. The comment defaults to the abbreviated latitude/longitude of the user waypoint.
 - a) Touch the **Comment** Button to display the keypad.
 - b) Use the keypad and the **Enter** Button to select the comment.
- 8) Press 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 USER WAYPOINTS**Editing a user waypoint comment:**

- 1) From MFD 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?".

Editing a user waypoint name:

- 1) From MFD 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 (up to six characters).
- 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?".

Editing a user waypoint mode, type, location, and elevation:

- 1) From MFD 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) If desired, Touch the **Type** Button to open the 'Select User Waypoint Type' Screen and change the waypoint Type and/or airport elevation:
 - Touch the **Route** Button.
 - Or:**
 - 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, touch the **Mode** Button to display the 'Select User Waypoint Mode' Screen to change the waypoint Mode and/or location.
 - Touch the **P. POS** Button to select the aircraft present position as the location.
 - Or:**
 - a) Touch the **RAD/DIS, RAD/RAD, or LAT/LON** Button.
 - b) Touch the **REF** Button, the **RAD** Button, the **DIS** Button, or the **LAT/LON** Button, as required, to bring up the keypad.
 - c) Use the keypad and the **Enter** Button to change the user waypoint location.
- 7) Touch the **Save** Button to accept the new type and location.
- 8) Touch the **OK** Button in response to the question "Are you sure you want to modify this waypoint?".

DELETING USER WAYPOINTS

Deleting a single user waypoint:

- 1) From MFD 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 **Delete** Button.
- 5) Touch the **OK** Button in response to the question "Would you like to delete the user waypoint XXXXXX?".

Deleting all user waypoints:

- 1) From MFD 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 **Delete All** Button.
- 5) Touch the **OK** Button in response to the question "Would you like to delete all user waypoints?".

5.4 AIRSPACES

The system can display the following types of airspaces: Class B/TMA/AWY, Class C/CTA, Class D, Restricted/Prohibited, MOA (Military), Other Airspace, Air Defense Interdiction Zone (ADIZ), and Temporary Flight Restriction (TFR). More information concerning TFRs is contained in the Hazard Avoidance Section.

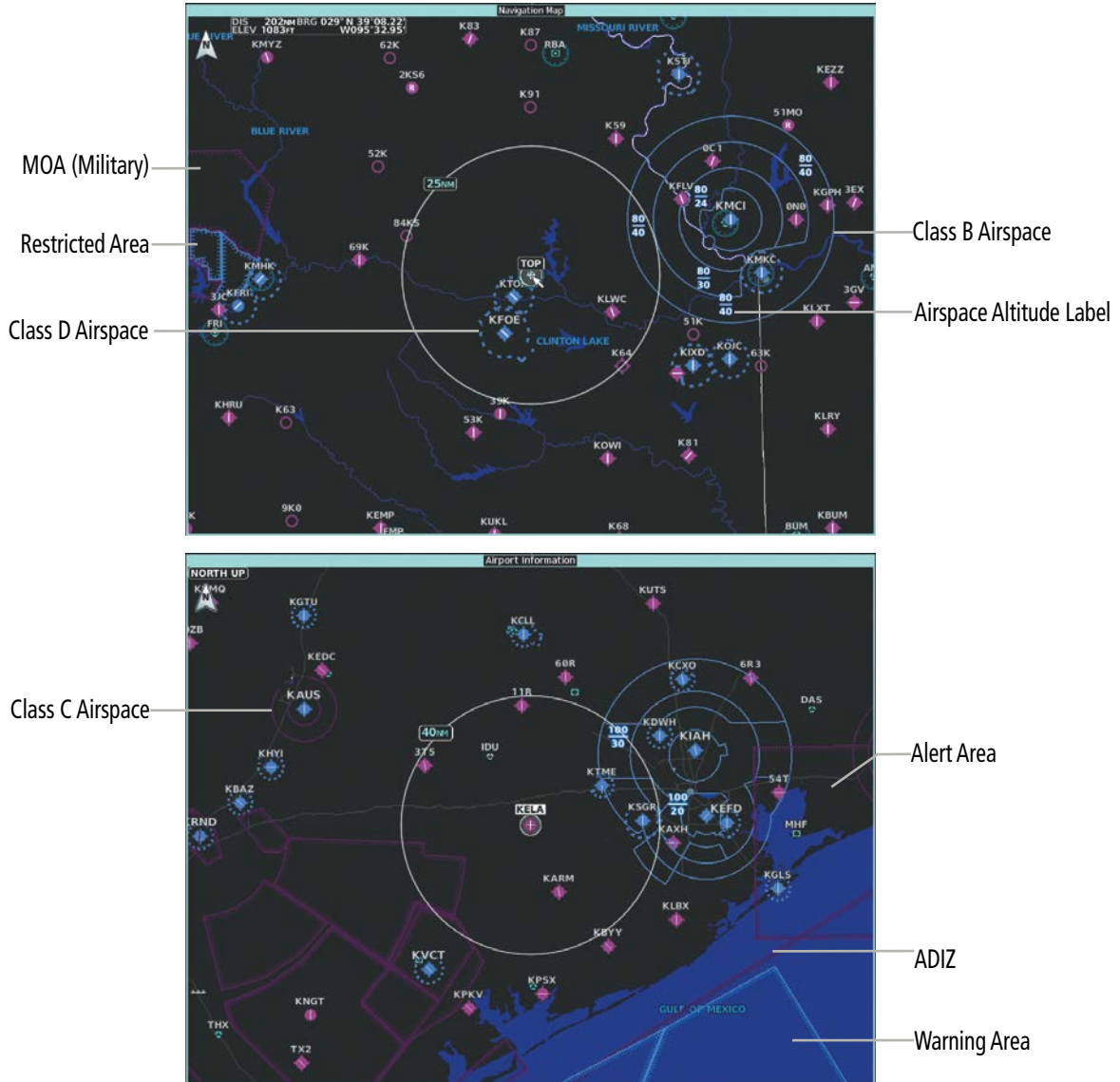


Figure 5-50 Airspaces

Displaying and removing airspace altitude labels:

- 1) From MFD Home, touch **Map** > **Map Selection** > **Map Settings**.
- 2) Touch the **Aviation** Tab.
- 3) Touch the Airspaces **Settings** Button to display the 'Airspace Settings' Screen.
- 4) Touch the **Airspace Altitude Labels** Button to display/remove the labels from the navigation map.

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 the 'Navigation Map' Pane. 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.

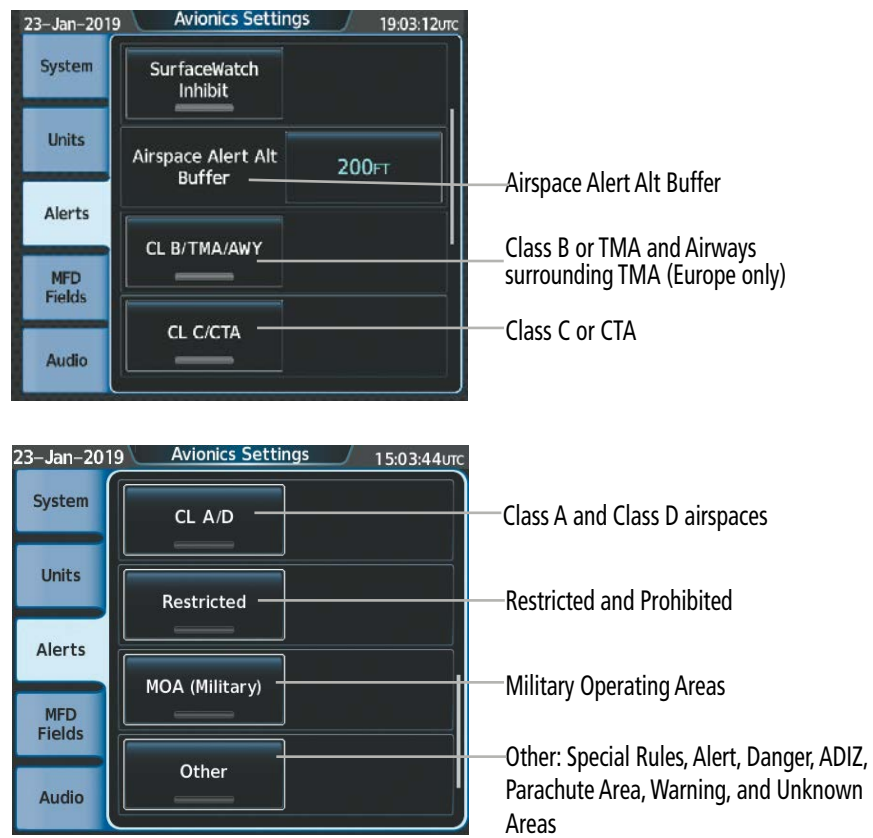


Figure 5-51 Alerts Tab - Airspace/Arrival Alerts

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 MFD Home, touch **Utilities** > **Setup** > **Avionics Settings**.
- 2) Touch the **Alerts** Tab.
- 3) Touch the Airspace Alert Alt Buffer altitude button (displays current selection in cyan).
- 4) Enter the desired altitude buffer using the numeric keypad or the large and small upper knobs, then touch the **Enter** Button or push the upper knob.

Enabling/disabling an airspace alert:

- 1) From MFD Home, touch **Utilities > Setup > Avionics Settings**.
- 2) Touch the **Alerts** Tab.
- 3) Scroll as needed and touch any of the of the following buttons to enable/disable the corresponding alert: **CL B/TMA/Airway, CL C/CTA, CL A/D, Restricted, MOA (Military), Other**. The button annunciator is green when alert is enabled, subdued 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 5-52 'Nearest Airspace' Pane



Figure 5-53 'Nearest Airspace' Screen

***Proximity:** Ahead, Inside, Ahead<2nm, Within 2nm

****Time till Intercept:** Only if Ahead or Ahead < 2nm

Viewing information for the Nearest Airspace:

- 1) From MFD 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' Screen information.

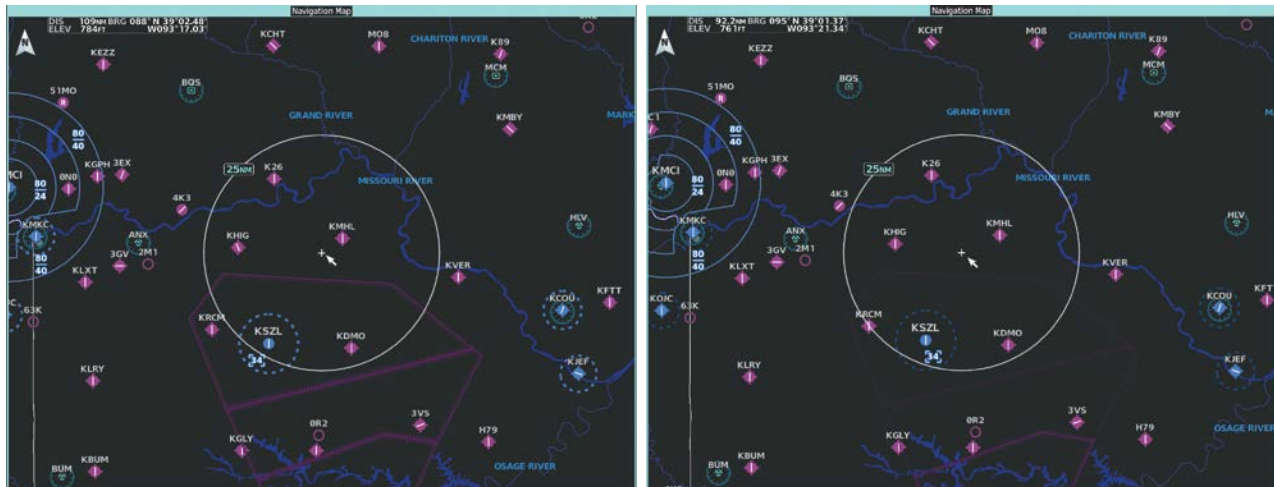
When an airspace alert occurs, the **MSG** Button on the Touchscreen Controller begins flashing. Touch the flashing button to view the list of alerts. The following airspace alerts are displayed in the 'Notifications' Screen:

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 5-5 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 5-54 Smart Airspace

Enabling/disabling the Smart Airspace function:

- 1) From MFD Home, touch **Map** > **Map Selection** > **Map Settings**.
- 2) Touch the **Aviation** Tab, if necessary.
- 3) Scroll the list to find the Airspaces buttons.
- 4) Touch the Airspaces **Settings** Button to display the 'Airspace Settings' Screen.
- 5) Touch the **Smart Airspace** Button to enable/disable the Smart Airspace function.

5.5 DIRECT-TO-NAVIGATION

The Direct-to method of navigation, initiated by touching the **Direct To** Button on the Touchscreen Controller is quicker to use than a flight plan when needing to navigate to a single point such as a nearby airport.

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 cancelled, replaced with a new direct-to, or a new flight plan leg or sequence is activated.

A vertical navigation (VNAV) direct-to creates a descent path (and provides guidance to stay on the path) from the current altitude to a selected altitude at the direct-to waypoint. Vertical navigation direct-to is not available for a climb.

The 'Direct To' Screen on the Touchscreen Controller allows selection and activation of direct-to navigation, and displays selected direct-to waypoint data on the Touchscreen Controller. Any waypoint can be entered as a direct-to destination.

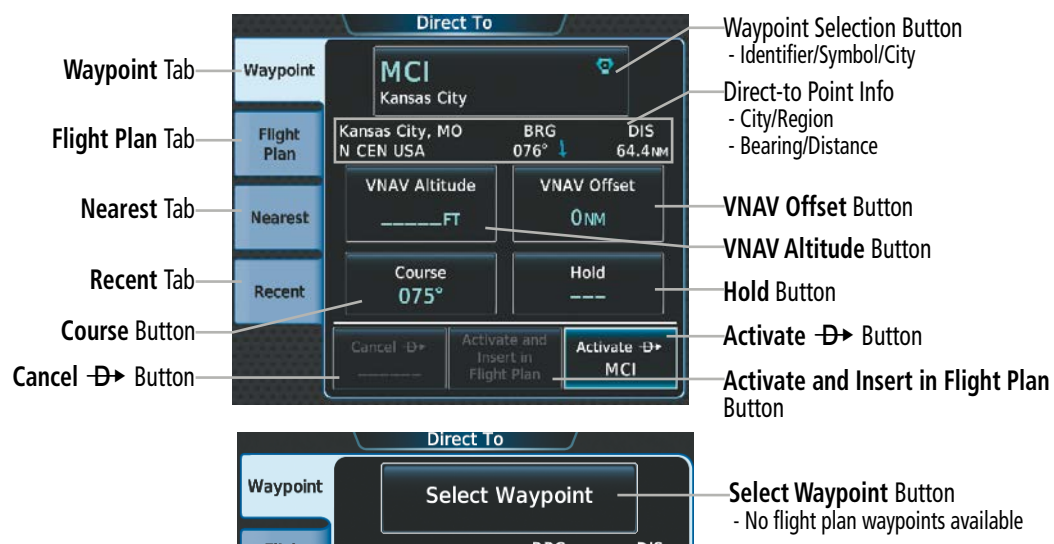


Figure 5-55 'Direct To' Screen





NOTE: The FMS enters *SUSP* mode whenever direct-to is selected to a waypoint that is nearby but slightly behind the airplane. A short magenta segment is drawn preceding the selected waypoint, on the course defined by the next leg. The FMS remains in *SUSP* until the pilot unsuspects the FMS, or selects a new flight plan course.

Selecting a waypoint as the direct-to destination by identifier, facility, or city name:



- 1) From MFD Home, touch **Direct To**.
- 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) Touch the **Activate**  Button to activate the direct-to.
Or:
 - a) Touch the **Activate and 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.

Selecting a waypoint as the direct-to destination by category (Nearest or Recent):

- 1) From MFD Home, touch **Direct To**.
- 2) Touch the **Nearest** Tab or the **Recent** Tab, as necessary.
- 3) Touch a waypoint selection button to choose the waypoint as the direct-to destination, and return to the 'Direct To' Screen.
- 4) Touch the **Activate**  Button to activate the direct-to.
Or:
 - a) Touch the **Activate and 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.

Selecting the active flight plan waypoint as the direct-to destination:

- 1) From MFD Home, touch **Flight Plan**.
- 2) Touch a waypoint selection button to display the 'Waypoint Options' Window.
- 3) Touch the **➔** Button to choose the waypoint as the direct-to destination and display the 'Direct To' Screen.
- 4) Touch the **Activate ➔** Button to activate the direct-to.

Or:

- 1) From MFD Home, touch **Direct To**.
- 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 MFD Home, touch the **➔** Button 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 MFD 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.

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 any waypoint as a direct-to destination:

- 1) Select the screen containing the desired waypoint type and select the desired waypoint.
- 2) If necessary, touch the **Waypoint Options** Button.
- 3) Touch the **➔** Button to choose the waypoint as the direct-to destination, and display the 'Direct To' Screen.
- 4) Touch the **Activate ➔** Button to activate the direct-to.

Or:

- a) Touch the **Activate and 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.

Selecting a nearby airport as a direct-to destination:

- 1) From MFD Home, touch **Nearest > Airport**.
- 2) Touch a nearest airport button to display the 'Waypoint Options' Window. If desired, highlight the airport on the navigation map by touching the **Show On Map** Button.
- 3) Touch the -> Button to choose the waypoint as the direct-to destination, and display the 'Direct To' Screen.
- 4) Touch the **Activate ->** Button to activate the direct-to.

Or:

- a) Touch the **Activate and 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.

Direct-to destinations may also be selected by using the map pointer on the navigation map.

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

- 1) From the navigation map display, press the **Lower Knob** on the Touchscreen Controller to display the pointer.
- 2) Use the Upper Knob on the Touchscreen Controller or the **Touchpad** to place the pointer at the desired destination location.
- 3) If the pointer is placed on an existing airport, NAVAID, or user waypoint, the waypoint ID is highlighted, and the **Direct To** Button is activated.
- 4) Touch the **Direct To** Button to display the 'Direct To' Screen with the selected point entered as the direct-to destination.
- 5) Touch the **Activate ->** Button to activate the direct-to..

Or:

- a) Touch the **Activate and 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.

Cancelling a Direct To:

- 1) From MFD Home, touch **Direct To**.
- 2) Touch the **Cancel ->** Button.
- 3) Touch the **OK** Button in response to the question "Cancel -> XXXXXX".

When navigating a direct-to, the system sets a direct great circle course to the selected destination. The course to a destination can also be manually selected.

Selecting a manual direct-to course:

- 1) From MFD Home, touch **Direct To**.
- 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) Use the keypad to select the course.
- 4) Touch the **Enter** Button to accept the course, and return to the 'Direct To' Screen.
- 5) Touch the **Activate** **→** Button to activate the direct-to using the manually selected course.



Figure 5-56 Direct To - Selecting a Manual Course

Reselecting the direct course from the current position:

- 1) From MFD Home, touch **Direct To**.
- 2) Touch the **Activate** **→** Button to activate the direct-to using the direct course.










A direct-to with an altitude constraint ('VNAV Altitude') creates a descent path (and provides guidance to stay on the path) from the aircraft's current altitude to the altitude of the direct-to waypoint. The altitude is reached at the waypoint, or at the specified distance along the flight path if an offset distance ('VNAV Offset') has been entered. Direct-to vertical navigation is discussed in the Vertical Navigation portion of Flight Management. Offset distances (along track offsets) are discussed in the Flight Planning portion of Flight Management.

5.6 FLIGHT PLANNING

INTRODUCTION

Flight planning consists of building a flight plan by entering waypoints one at a time, adding waypoints along airways, and inserting departures, airways, arrivals, or approaches as needed. The system allows flight planning information to be entered 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.

Flight Plan Leg Type	Symbol
Active Course Leg*	
Active Heading Leg*	
Active Roll Steering Path* †	
Course Leg in the current flight segment	
Course Leg not in the current flight segment	
Heading Leg	
Roll Steering Path †	
Future Roll Steering Path ‡	
Turn Anticipation Arc	

* The active leg or path is the one currently being flown, and is shown in magenta.

† A Roll Steering Path is displayed for: transitions between two disconnected legs (i.e. holding), some procedure turn segments, parallel track segments, or transitions after some fly-over waypoints (discussed later in this section).

‡ A Roll Steering Path that is beyond the next leg will appear as a Future Roll Steering Path. When a Future Roll Steering Path becomes the next leg, it appears as a Roll Steering Path.

Table 5-9 Flight Plan Leg Symbols

Upon power up, the previously active flight plan is retained and automatically repopulated if the aircraft position is at the origin airport and the aircraft is on the ground. If, however, the aircraft is not at the origin, on the ground, or if more than 12 hours have passed since the last active flight plan modification, the previously active flight plan is not retained. One flight plan can be activated at a time and becomes the active flight plan. The active flight plan is overwritten when another flight plan is activated.

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.

Up to 99 flight plans with up to 100 waypoints each can be created and stored in memory. One flight plan can be activated at a time and becomes the active flight plan. A standby flight plan can be created by copying the active flight plan or by manual entry. The standby flight plan can be activated. When the system is powered on, the active flight plan is retained if the aircraft position is at the origin airport. The active flight plan is overwritten when another flight plan is activated. When storing flight plans with an approach, departure, or arrival, the system uses the waypoint information from the current database to define the waypoints. If the database is changed or updated, the system automatically updates the stored procedure information as long as the stored procedure has not been modified by the flight crew. If an approach, departure, or arrival procedure is no longer available, the procedure is deleted from the affected stored flight plan(s), and an alert is displayed (see Miscellaneous Messages in Appendix A) advising that one or more stored flight plans need to be edited.

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 Miscellaneous Messages in Appendix A).

The following could cause the airway update to fail:

- Airway identifier, entry waypoint or exit waypoint not found in the new database.
- Airway entry/exit waypoint is not an acceptable waypoint for the airway – either the waypoint is no longer on the airway, or there is a new directional restriction that prevents it being used.
- Loading the new airway sequence would exceed the capacity of the flight plan.

There are four places to create, modify, or view a flight plan:

- 'Active Flight Plan' Screen on the Touchscreen Controller (create/modify the active flight plan)
- 'Standby Flight Plan' Screen on the Touchscreen Controller (create/modify the standby flight plan)
- 'Flight Plan Catalog' Screen on the Touchscreen Controller (create/modify a stored flight plan)
- Active Flight Plan Text on the 'Navigation Map' Pane (view the active flight plan)

The 'Active Flight Plan' and 'Standby Flight Plan' Screens are shown in the following figures. The Climb, Cruise, and Descent (CCD) VNAV allows the pilot to create manual flight path angle and speed constraints utilizing the buttons provided. More information on CCD VNAV is discussed later in this section.



Flight Path Angle/Speed Constraint Button

Figure 5-57 'Active Flight Plan' Screen



Flight Path Angle/Speed Constraint Button

Figure 5-58 'Standby Flight Plan' Screen



Number of Flight Plans Stored

Number of Available Storage Spots

Stored Flight Plan Options Button

Departure Airport Identifier/Symbol

Cumulative Flight Plan Distance

Destination Airport Identifier/Symbol

Create New Catalog Flight Plan Button

Figure 5-59 'Flight Plan Catalog' Screen



Figure 5-60 Active Flight Plan - Navigation Map



Figure 5-61 'Waypoint Options' Window - Previous/Next Waypoint Buttons



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

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

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

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

If the pilot manually enters the origin, or any other leg of the flight plan before auto-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.

An active, standby or stored flight plan can be previewed on the 'Navigation Map' Pane by selecting the **Show on Map** 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 navigation map.

Displaying/removing the flight plan preview on the navigation map:

- 1) For the active flight plan: From MFD Home, touch **Flight Plan > Flight Plan Options**.
Or:
For the standby flight plan: From MFD Home, touch **Flight Plan > Standby Flight Plan > Flight Plan Options**.
- 2) Touch the **Show on Map** Button. A preview of the flight plan is shown on the 'Flight Plan' 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 **Show on Map** Button again or return to the 'MFD Home' Screen to turn off the **Show on Map** Button and remove the preview from the display.

Displaying/removing flight plan text on the navigation map:

- 1) From MFD 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 active flight plan progress on the navigation map:

- 1) From MFD Home, touch **Map > Map Selection > Map Settings**.
- 2) Touch the **Inset Window** Tab.
- 3) Touch the **Flight Plan Progress** Button to display/remove the active flight plan progress.



Figure 5-62 Active Flight Plan Progress - Navigation Map

CREATING A FLIGHT PLAN

The active flight plan is the flight plan to which the system is currently providing guidance, and is shown on the navigation maps. The standby flight plan is available for activation (becomes 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.

The following procedure is intended to provide a baseline flight plan 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. Departures, arrivals, approaches, and missed approaches are discussed later in the Procedures portion of this section.

Creating an active, standby or stored flight plan:

- 1) For an active flight plan, from MFD Home > **Flight Plan**.

Or:

For a standby flight plan, from MFD Home > **Flight Plan** > **Standby Flight Plan**.

Or:

For a stored flight plan.

- a) From MFD 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 the system correctly auto-designated (populated) the Origin, proceed to Step 4.

Or:

If the system incorrectly auto-designated (populated) the Origin, touch the **Origin** Button; or if displayed, 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) If needed, 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.
- 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) Touch the **Add Enroute Waypoint** Button to display the keypad.
- 9) Select enroute waypoints using one of the methods from step 3 of this procedure.
- 10) Repeat step numbers 8 through 10 until finished adding enroute waypoints.
- 11) Touch the **Done** Button to remove the **Add Enroute Waypoint** 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** Options 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** Options 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.

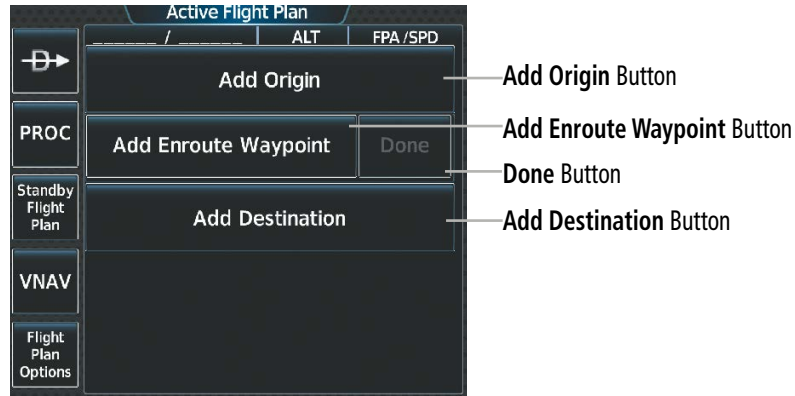
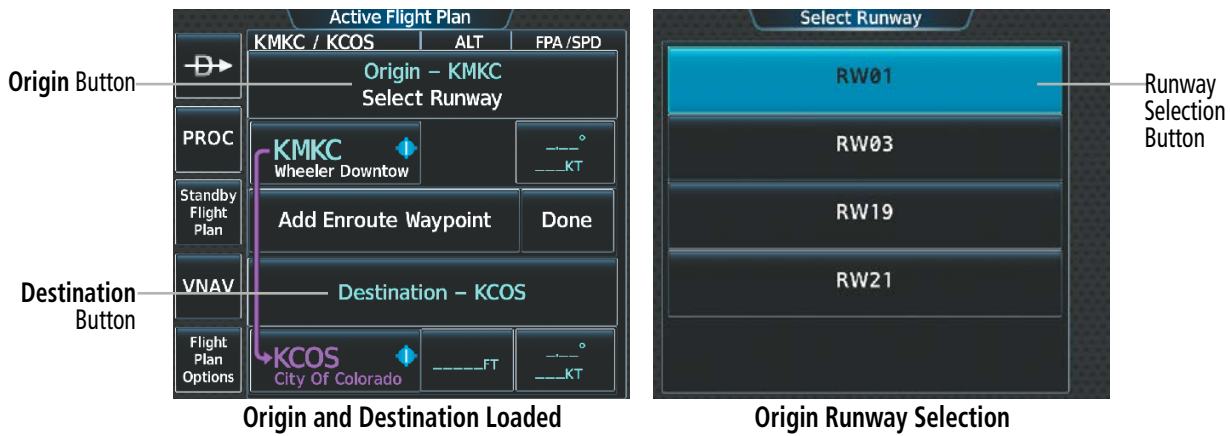


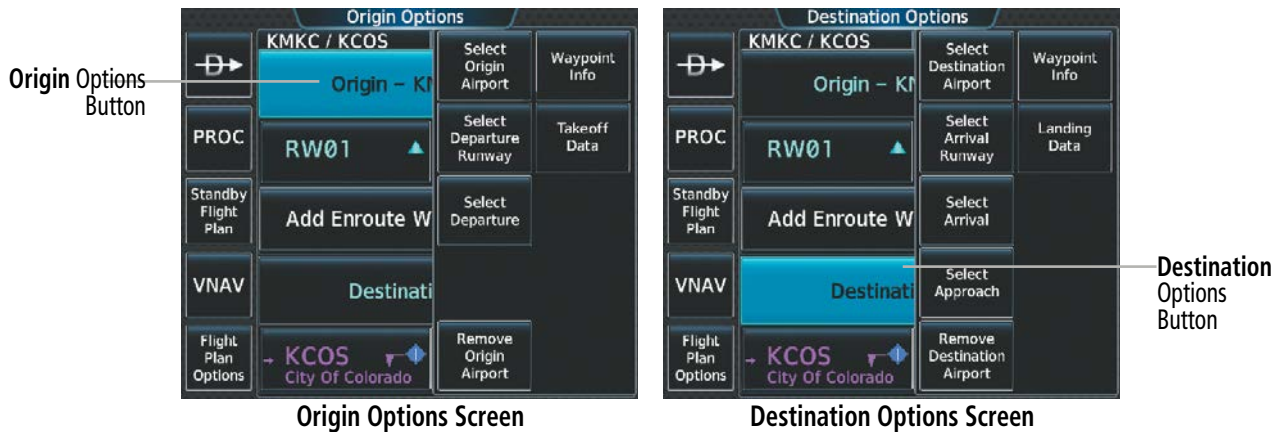
Figure 5-63 Active Flight Plan - Empty



Origin and Destination Loaded

Origin Runway Selection

Figure 5-64 Active Flight Plan - Origin and Destination Loaded



Origin Options Screen

Destination Options Screen

Figure 5-65 Active Flight Plan - Origin and Destination Options

FLIGHT PLAN WAYPOINT AND AIRWAY MODIFICATIONS

Active, standby, and stored flight plans can be edited at any time. Waypoints, airways, or combinations (routes) 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.

WAYPOINT MODIFICATIONS

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. A waypoint or a series of waypoints to include airways can be added to the active flight plan, the standby flight plan, and the stored flight plan using the following procedures. Adding airways is discussed later in this section.

Adding a waypoint to an active or standby flight plan:

- 1) For an active flight plan, from MFD Home > **Flight Plan**.

Or:

For a standby flight plan, from MFD Home > **Flight Plan** > **Standby Flight Plan**.

Or:

For a stored flight plan.

- a) From MFD 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) Insert waypoint:
 - If adding a waypoint to the end of the enroute segment of the flight plan, touch the **Add Enroute Waypoint** 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 will be placed in relation to the selected waypoint. The keypad is displayed.
 - Or:**
 - a) If adding a waypoint 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.
 - 4) Touch the **Enter** Button to accept the waypoint and place it in the flight plan.
 - 5) If you are finished adding enroute waypoints, touch the **Done** Button to remove the **Add Enroute Waypoint** Button and the **Done** Button (This step is only necessary if creating a flight plan on the 'Active Flight Plan' Screen).



Figure 5-66 Waypoint Options - Adding/Removing Waypoints



Figure 5-67 Adding a Waypoint to the beginning of the Enroute Segment of the Flight Plan

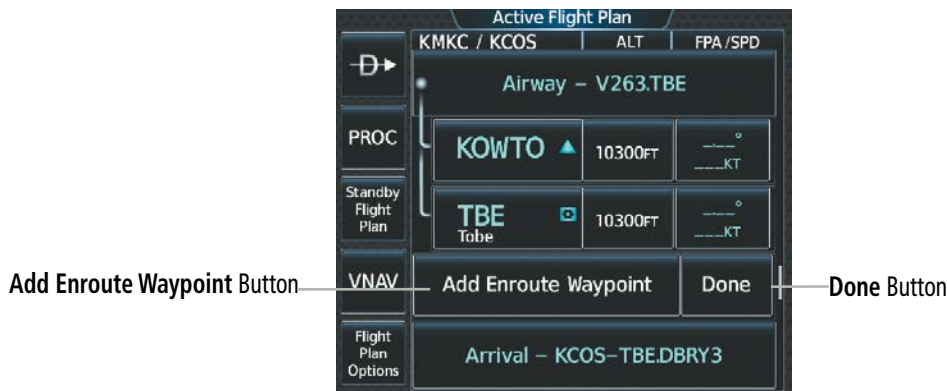


Figure 5-68 Adding a Waypoint to the end of the Enroute Segment of the Flight Plan

Adding a waypoint to a stored flight plan:

- 1) From MFD 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) Insert waypoint:

If adding a waypoint to the end of the enroute segment of the flight plan, touch the **Add Enroute Waypoint** 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 will be placed in relation to the selected waypoint. The keypad is displayed.

Or:

- a) If adding a waypoint 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.

5) Use the keypad, upper knobs, or the Find function to select the new waypoint.

6) Touch the **Enter** Button to accept the waypoint and place it in the flight plan. If you are finished adding enroute waypoints, touch the **Back** Button to return to the 'Flight Plan Catalog' Screen.



Figure 5-69 Waypoint Options - Edit Stored Flight Plan



Figure 5-70 Edit Stored Flight Plan - Adding a Waypoint to the beginning of the Enroute Segment of the Flight Plan

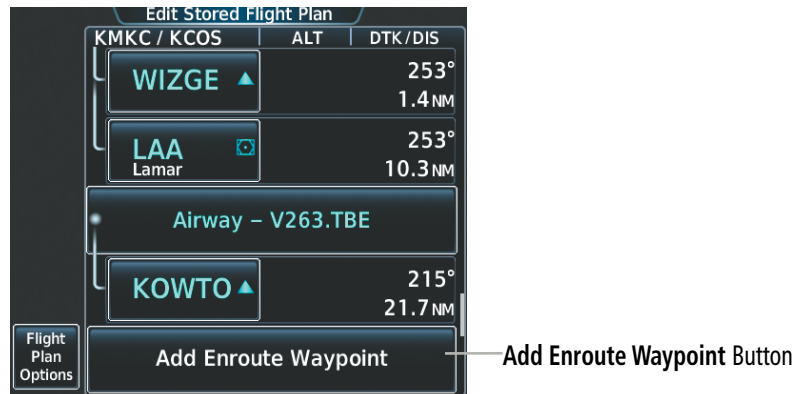


Figure 5-71 Edit Stored Flight Plan - Adding a Waypoint to the end of the Enroute Segment of the Flight Plan

Adding waypoints to the active or standby flight plan using the map pointer:

- 1) For the active flight plan: Go to step 2.

Or:

For the standby flight plan: From MFD Home, touch **Flight Plan** > **Standby Flight Plan**.

- 2) Press the **Lower Knob** on the Touchscreen Controller to the display 'Map Pointer Control' Screen on the Touchscreen Controller, and to activate the map pointer on the 'Navigation Map' Pane. Use the upper knob on the Touchscreen Controller or the **Touchpad** to move the pointer to the map location of the desired waypoint. When the pointer highlights a map location that can be added to the flight plan, the **Insert in FPL** Button is activated.
- 3) Touch the **Insert In FPL** Button. The 'Insert Before Waypoint' Screen is displayed.
- 4) Touch the waypoint selection button to select where to insert the new waypoint. The waypoint is inserted into the flight plan before the selected waypoint, and the Touchscreen Controller returns to the 'Map Pointer Options' Screen. Press the either knob on the Touchscreen Controller to deactivate the map pointer and return to the previous screen.



Figure 5-72 Active Flight Plan - Map Pointer Active



Figure 5-73 Inserting Waypoint in Active Flight Plan



Figure 5-74 KFOE inserted into Flight Plan

REMOVING FLIGHT PLAN WAYPOINTS

Individual waypoints, airways, and entire procedures can be deleted from a flight plan.

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 MFD Home, touch **Flight Plan**.

Or:

For the standby flight plan:

From MFD Home, touch **Flight Plan > Standby Flight Plan**.

Or:

For the stored flight plan:

- a) From MFD 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 options 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 WAYPOINT DESIGNATION

Waypoints entered in the enroute segment of the flight plan may be treated as either fly-by or fly-over waypoints. A fly-by waypoint is a waypoint that marks the intersection of two straight paths, with the transition from one path to another being made by the aircraft using a precisely calculated turn that “flies by” but does not vertically cross the waypoint.

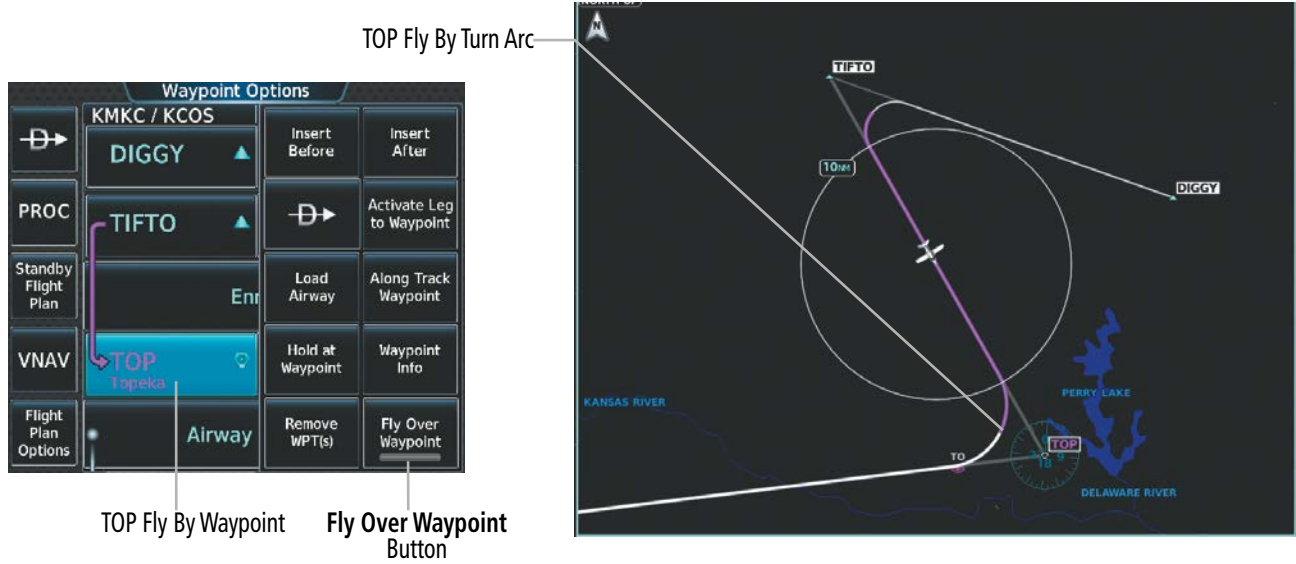


Figure 5-75 TOP Defined as a Fly By Waypoint



Figure 5-76 TOP Defined as a Fly Over Waypoint

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

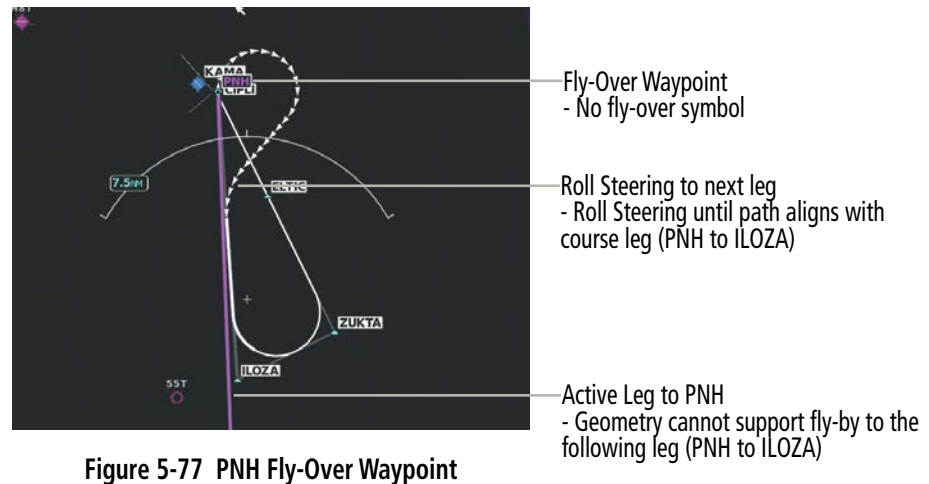


Figure 5-77 PNH Fly-Over Waypoint

A fly-over waypoint may also be manually designated by the pilot, in which case, the fly-over waypoint symbol is displayed.

Enabling/disabling a fly over waypoint:

1) For the active flight plan: From MFD **Home**, touch **Flight Plan**.

Or:

For the standby flight plan: From MFD Home, touch **Flight Plan** > **Standby Flight Plan**.

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.

AIRWAY MODIFICATIONS

Airways can be added or removed from any flight plan. Airways can be individually added, removed, and collapsed/expanded.

ADDING 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 such that it 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 MFD Home, touch **Flight Plan**.

Or:

For the standby flight plan: From MFD Home, touch **Flight Plan > Standby Flight Plan**.

Or:

For the stored flight plan:

- a) From MFD 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 options 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 **Load Airway** Button to insert the airway into the active or standby flight plan.



Figure 5-78 Adding an Airway to the Active Flight Plan

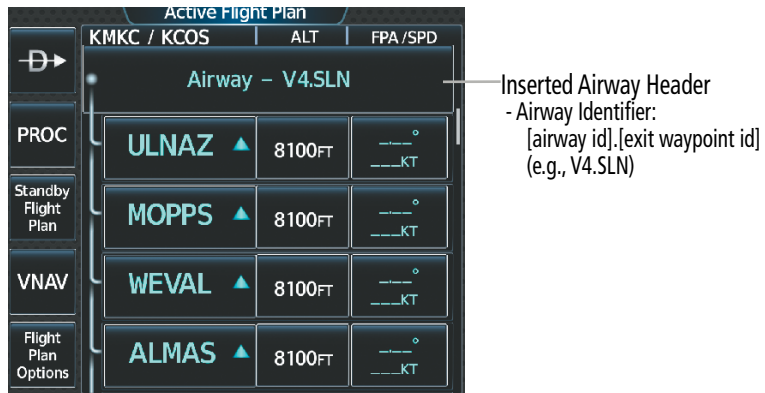


Figure 5-79 Active Flight Plan - V4 Airway Loaded

REMOVING AIRWAYS

Removing an entire airway from the flight plan:

- 1) For the active flight plan: From MFD Home, touch **Flight Plan**.
Or:
 For the standby flight plan: From MFD Home, touch **Flight Plan** > **Standby Flight Plan**.
Or:
 For the stored flight plan:
 - a) From MFD 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 collapse all airways as they are loaded into the flight plan. If instead, it is preferred to have airways expanded within the flight plan as they are loaded, this setting may be changed.



Figure 5-80 Expanded/Collapsed Airways

Collapsing/expanding the airways in the flight plan:

1) For the active flight plan: From MFD Home, touch **Flight Plan**.

Or:

For the standby flight plan: From MFD Home, touch **Flight Plan > Standby Flight Plan**.

Or:

For the stored flight plan:

- a) From MFD 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 desired selection button to collapse/expand an individual airway, or collapse/expand all airways.
 - 4) Touch the **Back** Button to return to the flight plan.

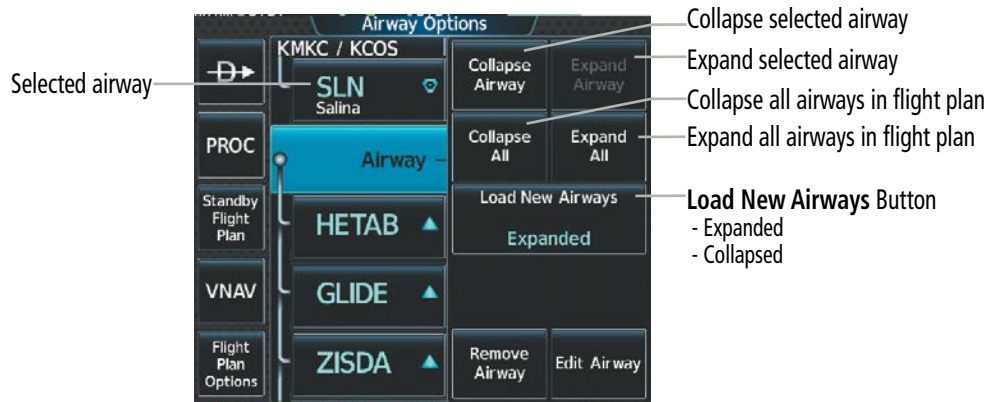


Figure 5-81 'Airway Options' Window

Changing Collapsed/Expanded settings for newly loaded airways:

1) For the active flight plan: From MFD Home, touch **Flight Plan**.

Or:

For the standby flight plan: From MFD 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.

INVERTING A FLIGHT PLAN

Any flight plan may be inverted (reversed) for navigation back to the original origin point. Inverting stored flight plans is discussed within the Flight Plan Operations portion of this section.

Inverting the active or standby flight plan:

- 1) For the active flight plan: From MFD Home, touch **Flight Plan**.

Or:

For the standby flight plan: From MFD 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 MFD 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 flight plan selection 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.

FLIGHT PLAN OPERATIONS

This section will discuss activating a flight plan leg, utilizing the standby flight plan, and conducting enroute operations such as creating a parallel track, along track offset, or user defined hold.

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.



NOTE: A flight plan leg with manual termination projects the path ahead of the aircraft for five nautical miles.

ACTIVATING A FLIGHT PLAN LEG

The system allows selection of a highlighted leg as the “active leg” (the flight plan leg which is currently used for navigation guidance).

Activating a flight plan leg:

- 1) From MFD Home, touch **Flight Plan**.
- 2) Scroll the list, if necessary, and touch the waypoint options 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.



Figure 5-82 Active Flight Plan - Activating a Flight Plan Leg

UTILIZING THE STANDBY FLIGHT PLAN

The standby flight plan is listed on the 'Standby Flight Plan' Screen on the Touchscreen Controller, and is available for activation (becomes the active flight plan). The standby flight plan may be used as a means to create a flight plan for future use. Once a standby flight plan is created, it can be stored to the Flight Plan Catalog.

Switching between the active and standby flight plan screen:

- 1) From MFD 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 5-83 Switching between 'Active' and 'Standby Flight Plan' Screens
Activating the standby flight plan:

- 1) From MFD Home, touch **Flight Plan** > **Standby Flight Plan**.
- 2) Touch the **Activate Standby** Button.
- 3) Touch the **OK** Button in response to "Activate Standby Flight Plan and Replace Current Active Route?". To cancel the request, touch the **Cancel** Button.

The standby flight plan may also be used for diversion planning purposes by linking the standby flight plan to the aircraft's present position (**Join from P. POS** Button). Once linked, or "joined", 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 Show on Map option 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.

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.



NOTE: The **Join from 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.

Linking aircraft present position (Join From P. POS) to the standby flight plan:

- 1) From MFD Home, touch **Flight Plan** > **Standby Flight Plan**.
- 2) Touch a waypoint options button desired for linking the aircraft present position to.
- 3) Touch the **Join From P. POS** 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 2-4 for the desired waypoint.



Figure 5-84 Standby Flight Plan - Join From P. POS

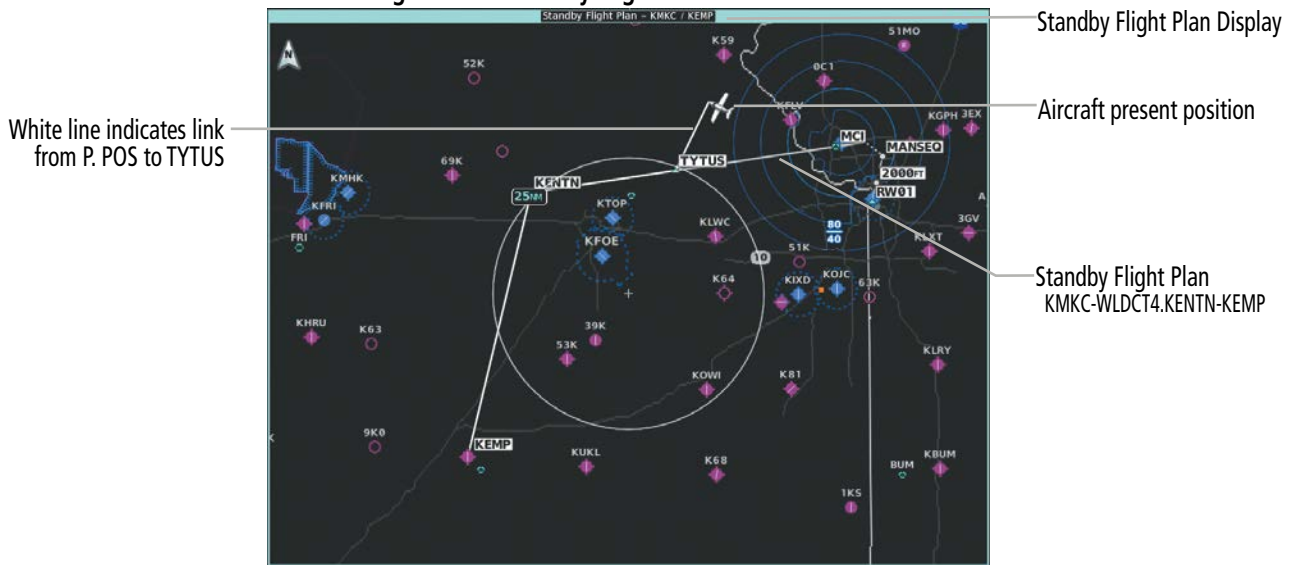


Figure 5-85 Standby Flight Plan - Join From P.POS link active

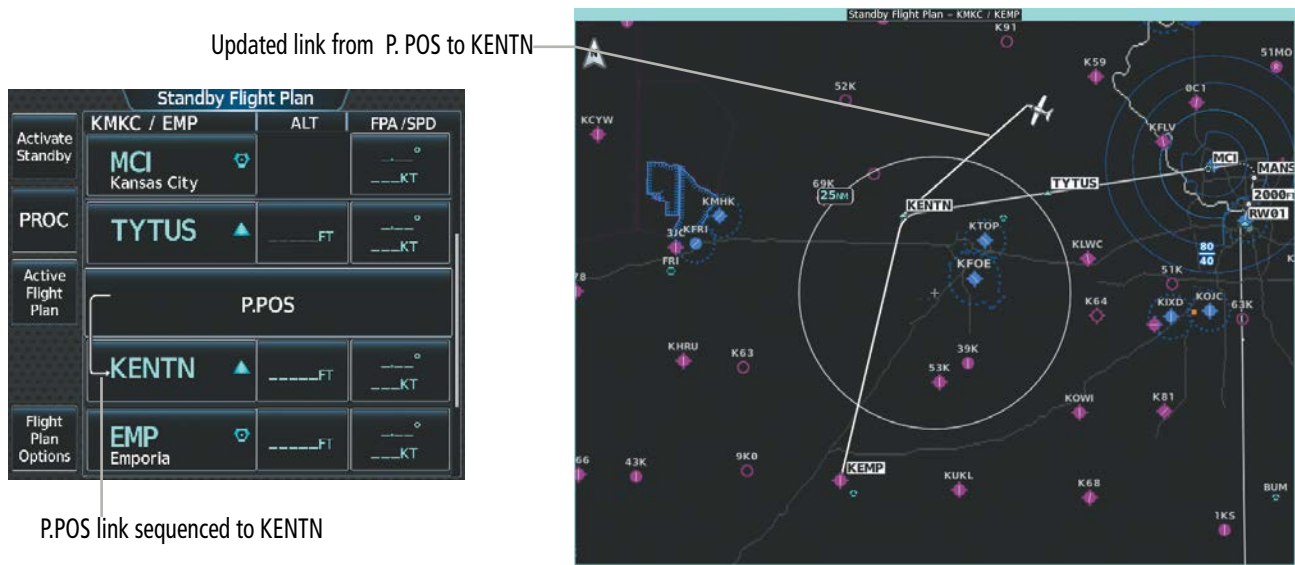


Figure 5-86 P. POS link sequenced to next waypoint in standby flight plan

Removing P. POS link from the standby flight plan:

- 1) From MFD Home, touch **Flight Plan > Standby Flight Plan**.
- 2) Touch the **P. POS** Button.
- 3) Touch the **Remove Link** Button.
- 4) Touch the **OK** Button in response to "Remove link from P. POS?". To cancel the request, touch the **Cancel** Button.

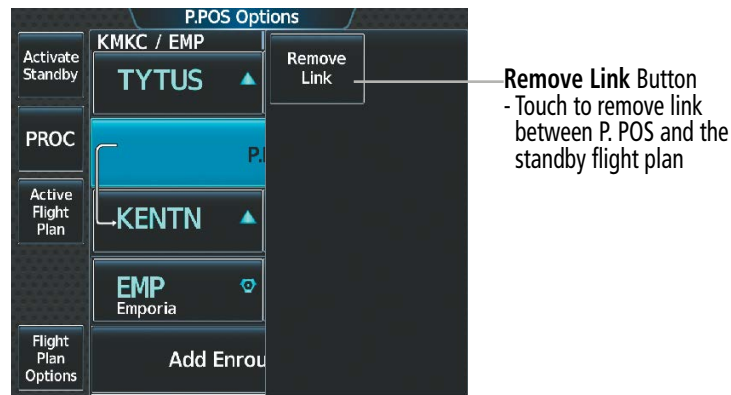


Figure 5-87 Standby Flight Plan - Remove link from P. POS

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 determine 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 waypoint from the navigation map if the along track waypoint is prior to the end of the direct-to segment. However, the along track waypoint will still remain in the flight plan. If it's desired to have the along track waypoint re-displayed on the navigation map, recreate the along track waypoint.

The system limits the along track offset distance such that 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 waypoint, and are modifiable. An along track offset waypoint can also be used for lateral navigation, such as the creation of a user-defined hold or a direct-to destination.

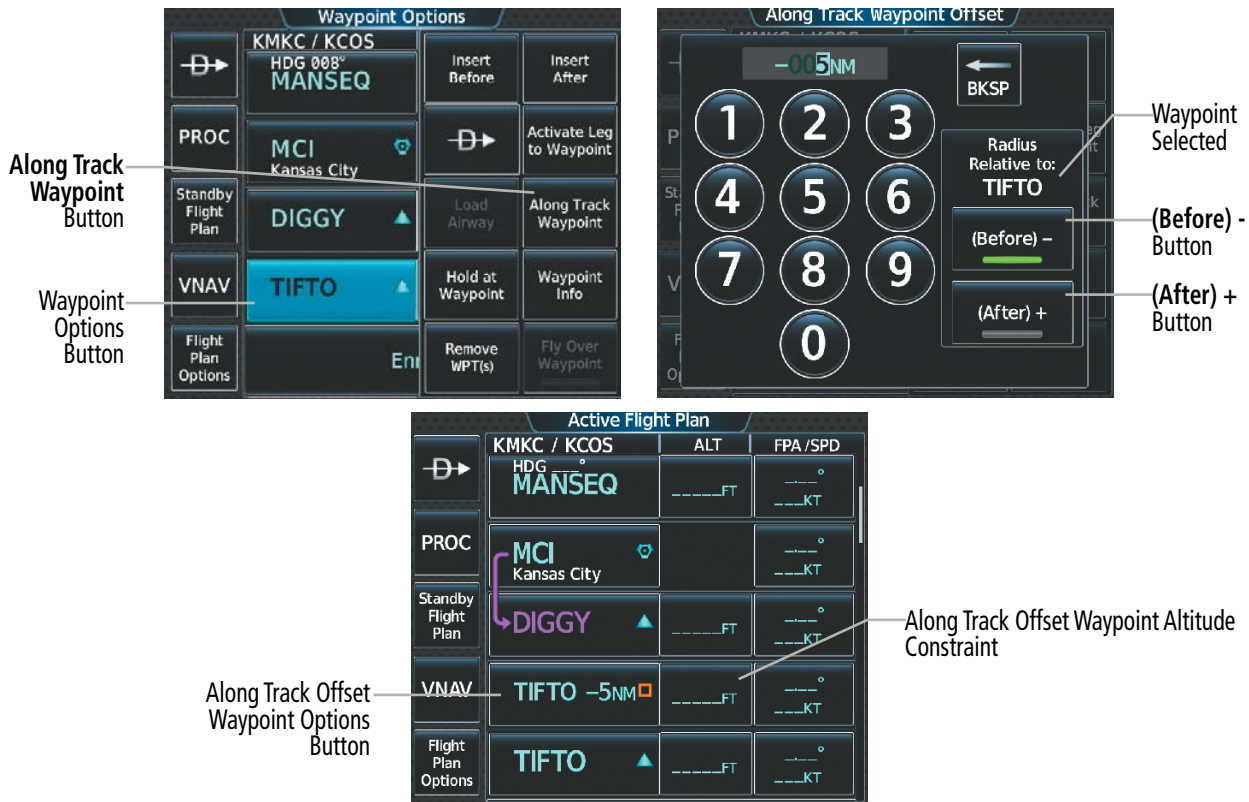


Figure 5-88 Inserting an Along Track Offset Waypoint

Inserting an along track offset waypoint into the active or standby flight plan:

- 1) For the active flight plan: From MFD Home, touch **Flight Plan**.
Or:
 For the standby flight plan: From MFD Home, touch **Flight Plan** > **Standby Flight Plan**.
- 2) Touch a waypoint options button to display the 'Waypoint Options' Screen.
- 3) Touch the **Along Track Waypoint** Button to bring up the 'Along Track Waypoint Offset' Screen.
- 4) Use the keypad to select the 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 MFD Home, touch **Flight Plan**.
- Or:
For the standby flight plan: From MFD Home, touch **Flight Plan** > **Standby Flight Plan**.
- 2) Touch the along track offset waypoint options button to display the 'Waypoint Options' Screen.
- 3) Touch the **Remove Waypoint** Button.
- 4) Touch the **OK** Button to delete the waypoint from the flight plan.



Figure 5-89 Adding an Altitude Constraint

Vertical navigation can be accomplished to a point along the flight path if an offset distance has been entered. See the Vertical Navigation section for information on the vertical navigation direct-to (VNAV ->) function.

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

- 1) From MFD Home, touch **Direct To**.
- 2) Touch the **VNAV Altitude** Button to display the keypad.
- 3) Use the keypad to select the altitude.
- 4) Touch the **Enter** Button to accept the altitude, and return to the 'Direct To' Screen.
- 5) Touch the **VNAV Offset** Button to display the keypad.
- 6) Touch the **(Before) -** Button or the **(After) +** Button, if necessary.

- 7) Use the keypad to select the offset distance.
- 8) Touch the **Enter** Button to accept the offset distance, and return to the 'Direct To' Screen.
- 9) Touch the **Activate** Button to activate the direct-to using the VNAV constraints.

PARALLEL TRACK

The Parallel Track feature allows creation of a parallel course offset of 1 to 50 nm left or right of the current flight plan. When Parallel Track is activated, the course line drawn on the map pages shows the parallel course, and waypoint names have a lower case “-p” placed after the identifier.

While flying a parallel track:

- » Initiating a direct-to will cancel the parallel track and fly direct-to the selected waypoint.
- » Initiating a hold at the present position will cancel the parallel track and fly the holding pattern.
- » Initiating a hold at a waypoint will result in the aircraft flying the parallel track until a turn is required to fly to the hold waypoint. If the hold is removed prior to reaching the hold waypoint, the parallel track will be resumed. Once the holding pattern is active, the parallel track will not be resumed upon exiting the hold.

Parallel Track is also cancelled if a course change occurs greater than 120° or the parallel tracks overlap as a result of the course change.



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

Active Flight Plan prior to Parallel Track



Figure 5-90 Active Flight Plan - Prior to Activating Parallel Track

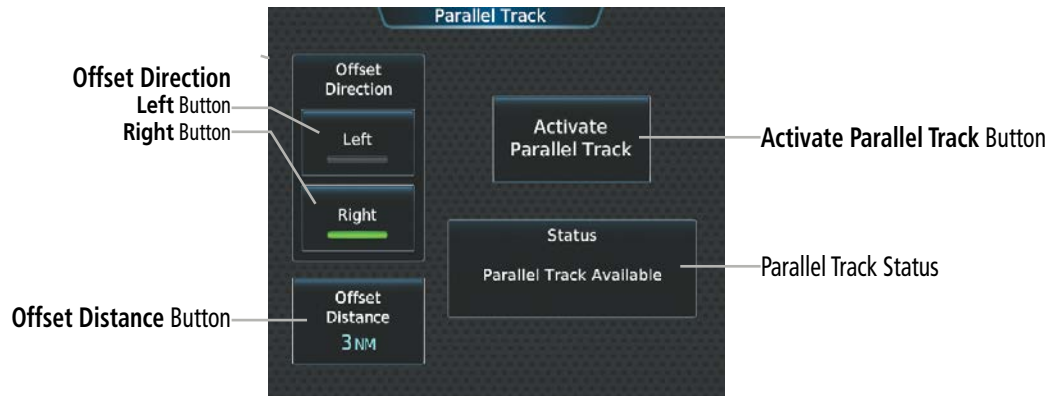


Figure 5-91 Parallel Track - Selecting Parallel Track

Activating parallel track:

- 1) From MFD Home, touch **Flight Plan > Flight Plan Options > Parallel Track**.
- 2) Touch the **Left** Button or the **Right** Button to choose the offset direction.
- 3) Touch the **Offset Distance** Button to display the keypad.
- 4) Use the keypad to select the distance.
- 5) Touch the **Enter** Button to accept the distance, and return to the 'Parallel Track' Screen.
- 6) Touch the **Activate Parallel Track** Button to activate the parallel track function.

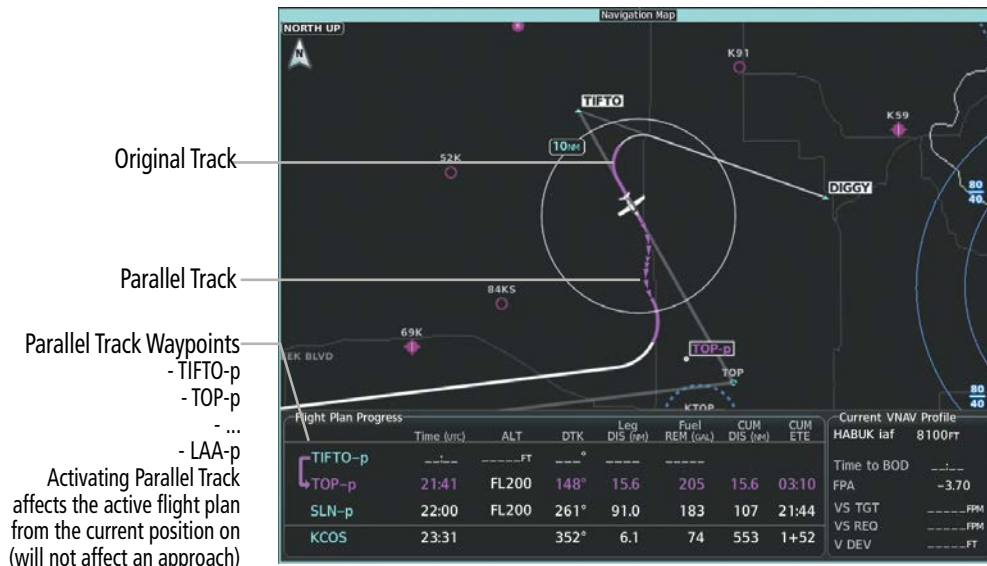


Figure 5-92 Active Flight Plan - Parallel Track Active

If the parallel track proposed by the offset direction and distance is not allowed by the system, the activation prompt is displayed, but disabled. If an approach leg is active, the status indicates that the system is unable to activate the parallel track with the message 'Parallel Track Unavailable Approach Leg Active'. If the offset direction and distance results in an unreasonable route geometry, the status indicates that the system is unable to activate the parallel track because of invalid geometry ('Parallel Track Unavailable Invalid Route Geometry'). If the active leg is not a track between two fixes (TF) or a course to a fix (DF) leg, the status indicates that the system is unable to activate the parallel track because parallel track is not available for the active leg type ('Parallel Track Unavailable Not Allowed for Active Leg').

Canceling parallel track:

- 1) From MFD Home, touch **Flight Plan > Flight Plan Options > Parallel Track**.
- 2) Touch the **Cancel Parallel Track** Button to cancel the parallel track function.

CLOSEST POINT OF FLIGHT PLAN

Closest Point of Flight Plan calculates the bearing and closest distance at which a flight plan passes a selected waypoint, and allows creation of a new user waypoint along the flight plan at the location closest to a chosen reference waypoint.

Determining the closest point along the active or standby flight plan to a selected waypoint:

- 1) For the active flight plan: From MFD Home, touch **Flight Plan**.
- Or:**
- For the standby flight plan: From MFD Home, touch **Flight Plan > Standby Flight Plan**.
- 2) Touch the **Flight Plan Options** Button to display the 'Flight Plan Options' Screen.
 - 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.

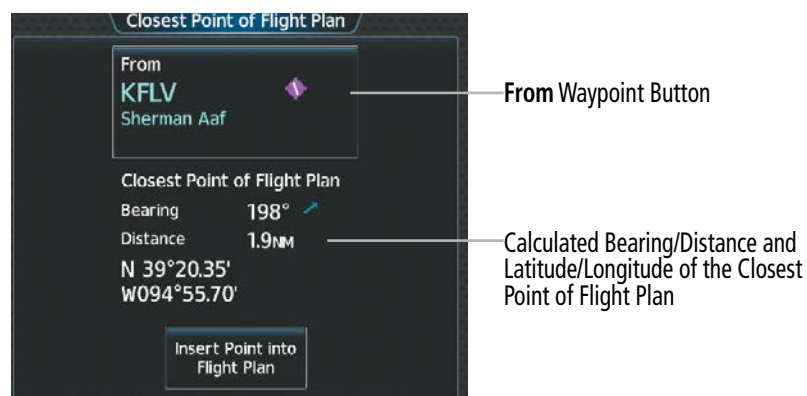


Figure 5-93 Closest Point of Flight Plan

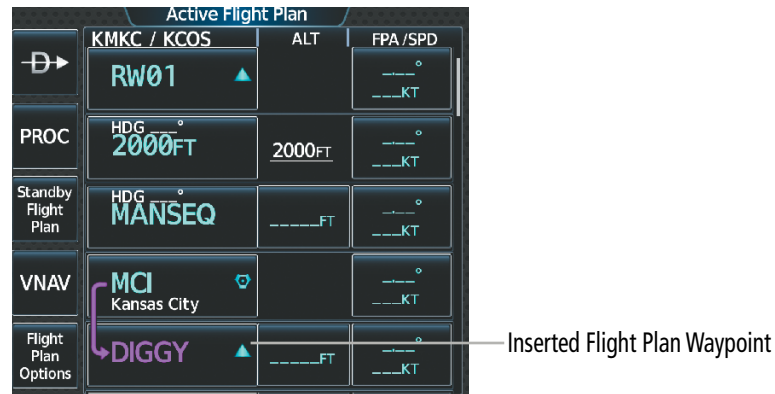


Figure 5-94 Closest Point of Flight Plan inserted into Active Flight Plan

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 or Editing a user-defined hold at an active or standby flight plan waypoint:

- 1) For the active flight plan: From MFD Home, touch **Flight Plan**.
Or:
 For the standby flight plan: From MFD 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.
- 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. A system message (HOLD EXPIRED Holding EFC time expired.) will be triggered at the selected time.
- 10) Touch the **Create** Button to add the hold into the flight plan.

NOTE: The **HOLD EXPIRED** message only remains active for approximately 30 seconds before being removed.

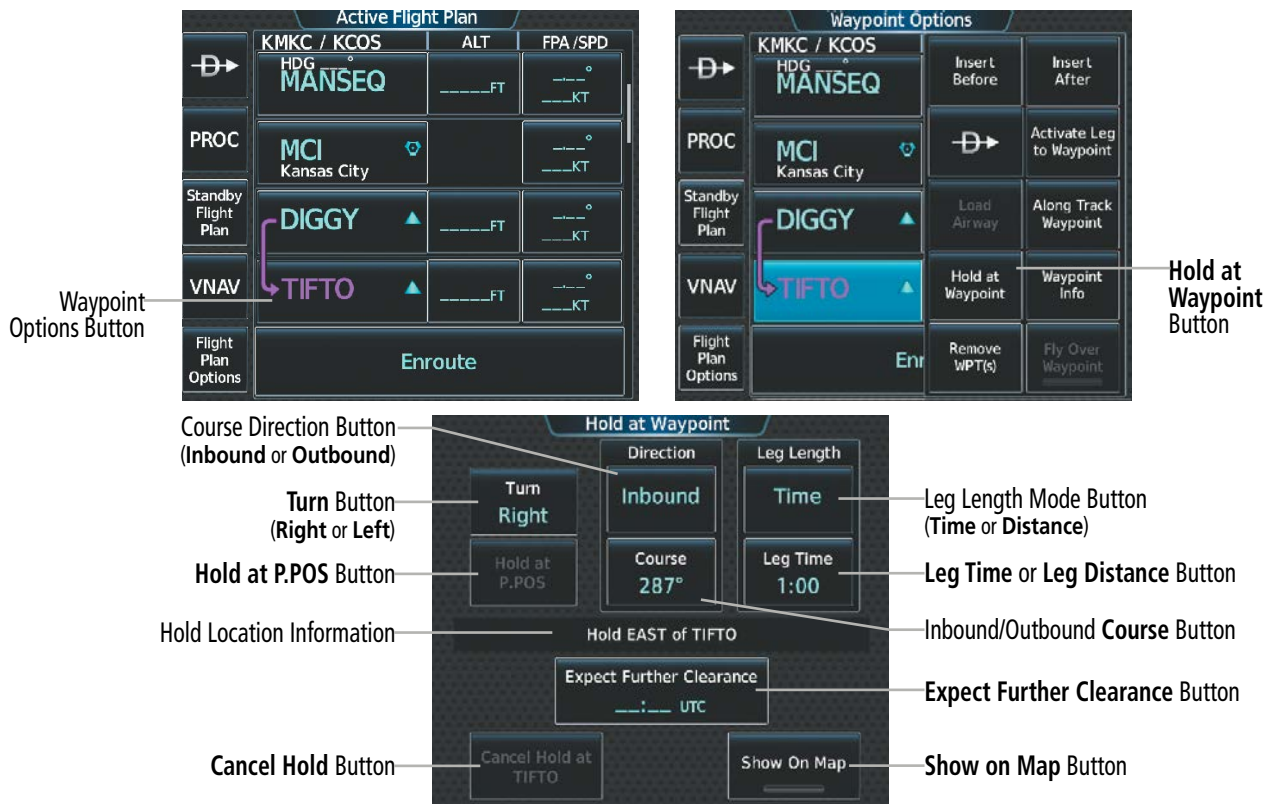


Figure 5-95 Creating a User Defined Holding Pattern at an Active Flight Plan Waypoint

Creating a user-defined hold at the aircraft present position:

- 1) From MFD 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 Button, and touch the **Inbound** Button or the **Outbound** Button to select the course direction.
- 5) Touch the Inbound/Outbound 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 options button to display the 'Direct To' Screen.
- 11) Touch the **Insert in Flight Plan** Button. The 'Insert → PPOS-H Before?' Screen 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 Exit Hold capability.

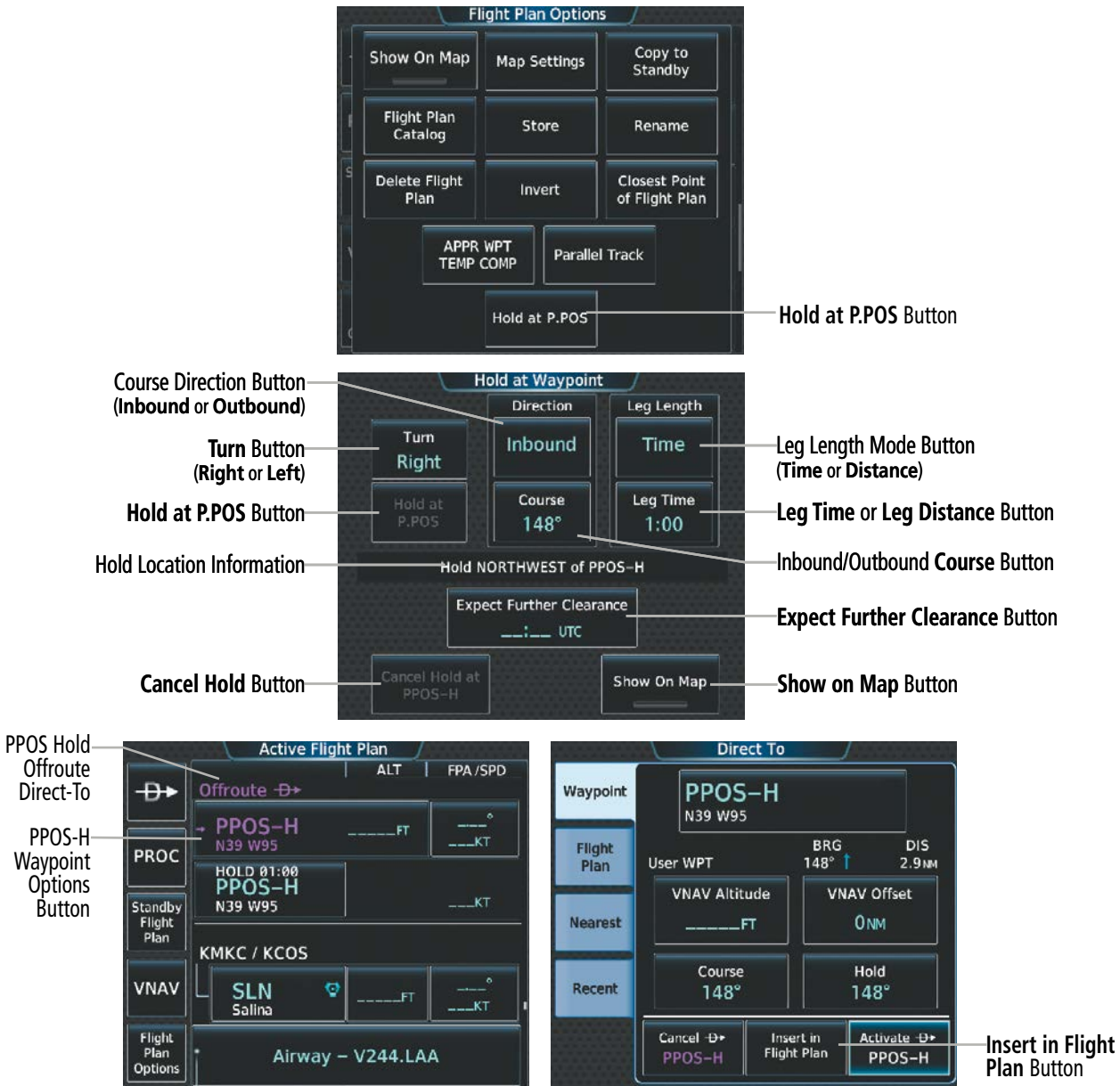


Figure 5-96 Creating a User Defined Holding Pattern at the Aircraft Present Position



NOTE: If a user-defined hold has been created at the aircraft present position (shown as "Offroute →", "→PPOS-H", at the top of the 'Active Flight Plan' Screen), 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.

Creating a user-defined hold at a Direct To waypoint:

- 1) From MFD **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 Button, and touch the **Inbound** Button or the **Outbound** Button to select the course direction.
- 6) Touch the Inbound/Outbound 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** \rightarrow Button to activate the Direct To and add the hold into the flight plan.

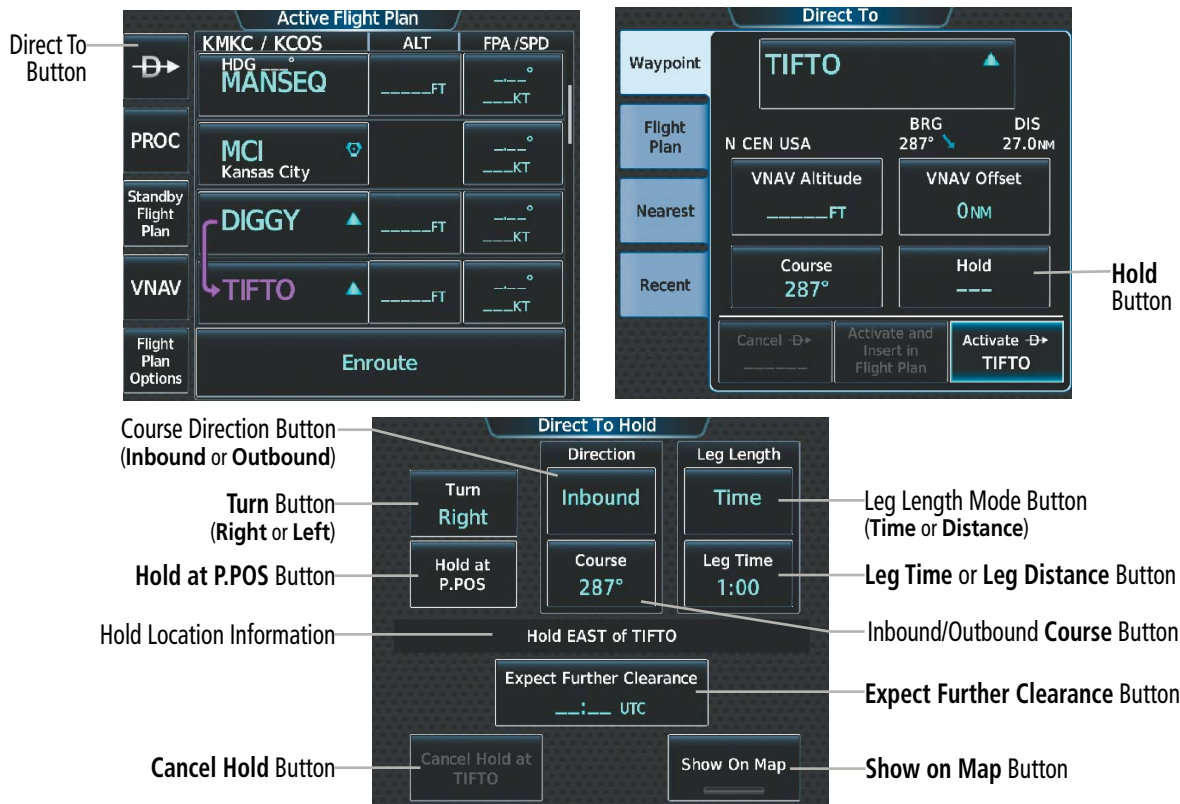


Figure 5-97 Creating a User Defined Holding Pattern at a Direct To Waypoint

Removing a user-defined hold at an active flight plan waypoint or at a Direct-To waypoint (hold not active):

- 1) From MFD 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) Touch the **OK** Button in response to "Remove Holding Pattern?" The holding pattern is removed. To cancel the request, touch the **Cancel** Button.



Figure 5-98 Removing a User Defined Holding Pattern at an Active Flight Plan Waypoint

Exiting a user-defined hold at an active flight plan waypoint or at a Direct-To waypoint (hold active):

- 1) From MFD 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 **Exit Hold** Button.
- 4) Touch the **OK** Button in response to "Exit Hold at <identifier>?" The holding pattern will be exited at the hold waypoint. To cancel the request, touch the **Cancel** Button.



NOTE: The **Remove Hold** Button on the Active Flight Plan 'Waypoint Options' Window, and the **Cancel Hold** Button on the 'Direct To Hold' Screen, immediately remove the holding pattern from the active flight plan, provide guidance to the active leg, and resume automatic waypoint sequencing. Using the **Exit Hold** Button on the Active Flight Plan 'Waypoint Options' Window, or the **SUSP** Button on the Touchscreen Controller will follow the holding pattern to the inbound course and resume automatic waypoint sequencing.

Removing a user-defined hold at the aircraft present position:

- 1) From MFD Home, touch **Flight Plan**.
- 2) Scroll the list, if necessary, and touch the PPOS-H waypoint options button, or touch the **Direct To** Button. The 'Direct To' Window is displayed.
- 3) Touch the **Cancel PPOS-H** Button.
- 4) Touch the **OK** Button in response to "Cancel D-> PPOS-H?". The holding pattern is removed. To cancel the request, touch the **Cancel** Button.

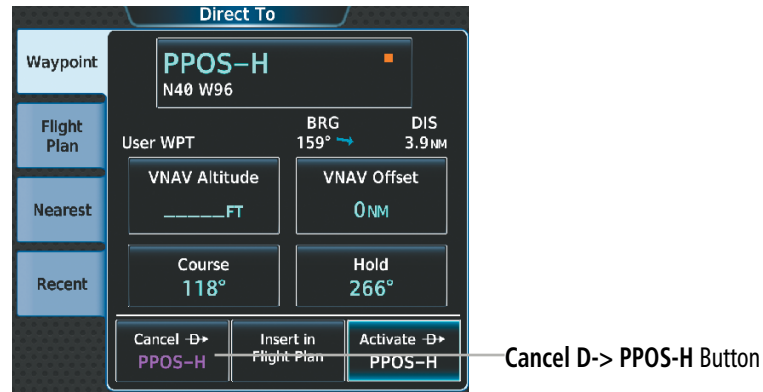


Figure 5-99 Removing a User Defined Holding Pattern at the Aircraft Present Position

MANAGING FLIGHT PLANS

The pilot can manage flight plans by importing/exporting (via mobile device and SD card), storing, copying, and deleting.

IMPORTING AND EXPORTING FLIGHT PLANS

Flight plans can be transferred to or from a mobile device via the Bluetooth Transceiver wireless connection. Transfer of a flight plan to a mobile device is controlled by the mobile device.

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 **Connex** Button on the Touchscreen Controller, and a Connex annunciation appears on the PFD.
- 2) Press the **Connex** Button to see the notification of the pending flight plan on the 'Notifications' Screen.
- 3) Press the **Connex** 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 **Connex** 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.

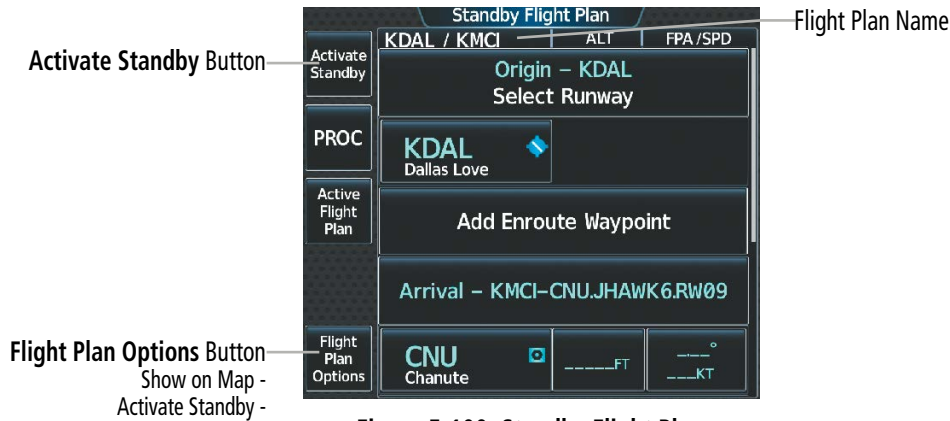


Figure 5-100 Standby Flight Plan

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 **Connex** Button on the Touchscreen Controller, and a Connex annunciation appears on the PFD.
- 2) Touch the **Connex** 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) To activate the standby flight plan, touch the **Activate Standby** Button.

A stored flight plan can be imported from an SD Card or exported to an SD Card.

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 MFD 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 flight plan selection 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 5-101 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 MFD Home, touch **Flight Plan > Flight Plan Options**.
- 3) Touch the **Flight Plan Catalog** Button to display the 'Flight Plan Catalog' Screen.
- 4) Touch a flight plan selection 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 large and small 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' Screen.



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.

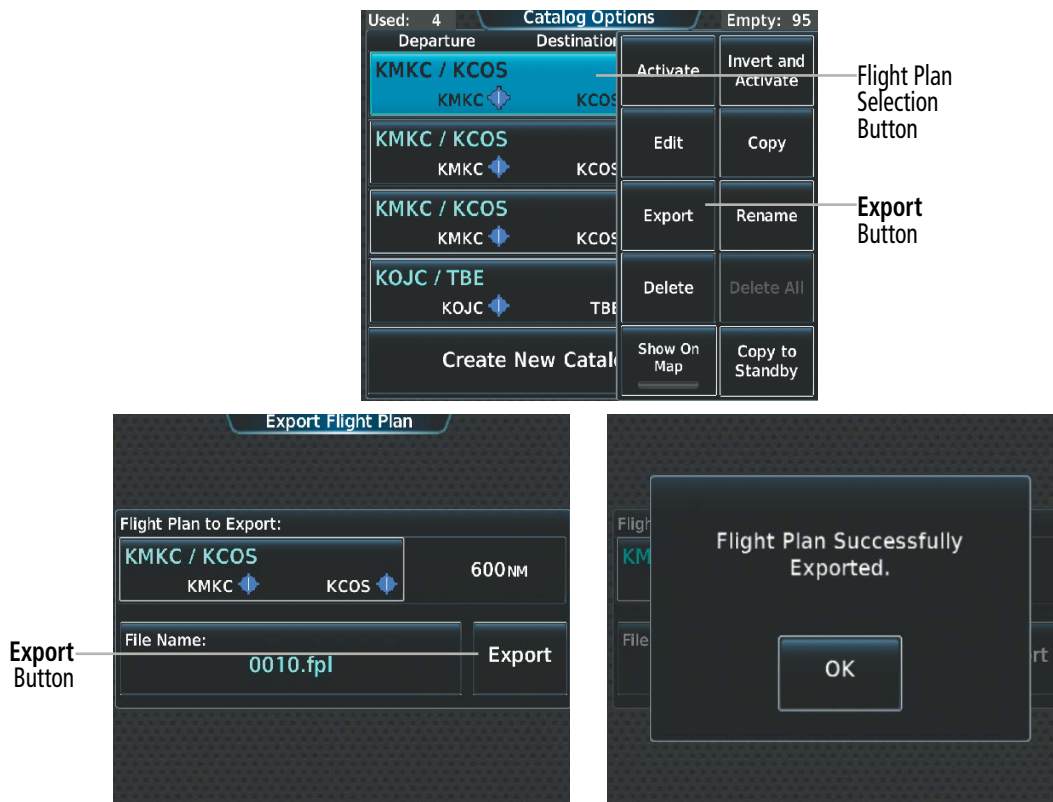


Figure 5-102 Stored Flight Plan Export

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.
'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 5-7 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 MFD Home, touch **Flight Plan** > **Flight Plan Options**.

Or:

For the standby flight plan: From MFD 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). The system can store up to 99 flight plans. Details about each stored flight plan can be viewed on the 'Flight Plan Catalog' Screen.

Viewing information about a stored flight plan:

- 1) From MFD 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) 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 5-103 Flight Plan Catalog



Figure 5-104 Edit Stored Flight Plan

STORING A FLIGHT PLAN FROM THE ACTIVE OR STANDBY FLIGHT PLAN

The standby flight plan may be used as a means to create a flight plan for future use. Once a standby flight plan is created, it can be stored to the Flight Plan Catalog.

Storing a flight plan from the 'Active' or 'Standby Flight Plan' Screen:

- 1) For the active flight plan: From MFD Home, touch **Flight Plan** > **Flight Plan Options**.

Or:

For the standby flight plan: From MFD 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 XXXX/XXXX 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 the standby flight plan swaps the active and standby flight plans. Therefore, the standby flight plan becomes the active flight plan, and the active flight plan becomes the standby flight plan.

Activating a stored flight plan:

- 1) From MFD 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' 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 MFD 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 flight plan selection 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 MFD 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' 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 at the end of 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 MFD 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' 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 MFD 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' 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.

Changing a flight plan comment:

- 1) For the active flight plan: From MFD Home, touch **Flight Plan** > **Flight Plan Options**.
Or:
For the standby flight plan: From MFD Home, touch **Flight Plan** > **Standby Flight Plan** > **Flight Plan Options**.
Or:
For the stored flight plan:
 - a) From MFD 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 necessary 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.

5.7 VERTICAL NAVIGATION



NOTE: The system supports vertical path guidance and altitude constraints for the following leg types: AF, CD, CF, CI, CR, DF, FC, FD, HF, PI, RF, and TF. Vertical constraints are not retained in stored flight plans.

The system Vertical Navigation (VNAV) feature provides vertical profile guidance during the enroute and terminal phases of flight. Guidance based on specified altitudes at waypoints in the active flight plan or to a direct-to waypoint is provided. Vertical navigation is based on barometric altitudes, not on GPS altitude, and is used for Climb, Cruise, Descent (CCD) phases of flight. The system will provide vertical path guidance for descending paths. The guidance is provided as a linear deviation from the desired path. The desired path is defined by a line joining two waypoints with specified altitudes or as a vertical angle from a specified waypoint/altitude. The vertical waypoints are integrated into the active flight plan. Both flight director only and autopilot-coupled guidance are supported. Guidance is also provided for ascending paths, but does not include vertical deviation nor AFCS path coupling.

VNAV is available for flight control operations when valid VNAV data is entered in the flight plan, and the **VNAV Enabled** Button is selected (annunciator bar is green) on the 'VNAV Profile' Screen. Flight plan VNAV data is reflected in the 'Current VNAV Profile' Box within the MFD Flight Plan Progress or Flight Plan Text inset window. The 'VS REQ' and 'V DEV' Fields populate within 1 minute prior to TOD. Refer to the AFCS Section for more information on activating the flight director and using the vertical navigation mode.

VNAV can be enabled or disabled anytime during the flight. Disabling VNAV cancels active waypoint vertical guidance. Canceling vertical navigation results in vertical deviation (V DEV), vertical speed required (VS REQ), time to top of descent/bottom of descent (TIME TO TOD/BOD), and time to top of climb/bottom of climb (TIME TO TOC/BOC) going invalid. The Vertical Deviation Indicator (VDI) and Required Vertical Speed Indicator (RVSI) on the PFD are removed. VNAV remains disabled until manually enabled.

The vertical navigation profile can be modified by directly entering either a vertical speed target (VS Target) or a flight path angle (FPA), on the 'VNAV Profile' Screen.



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 descent 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.



NOTE: The Top of Descent (TOD) vertical track alert will not repeat unless more than 90 seconds have elapsed since the first occurrence or if no other VNAV track change alerts have triggered from the previous Top of Descent (TOD) vertical track alert. If the altitude constraint or the flight path angle constraint is modified so the new TOD is less than 90 seconds away, the vertical track alert will not repeat.

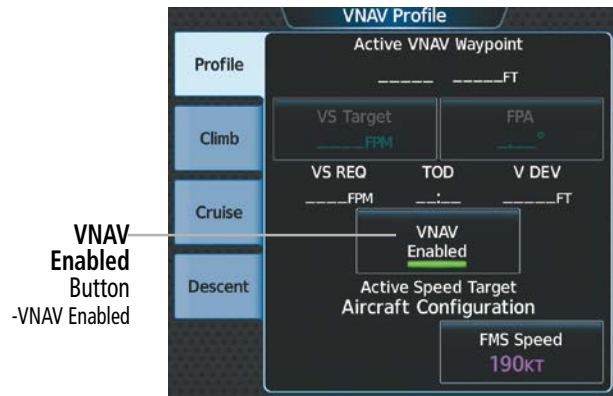


Figure 5-105 VNAV Profile - Enable/Disable VNAV

Active Flight Plan							Current VNAV Profile	
DTK	Leg DIS	ALT	Fuel REM	Leg ETE	ETA	Active VNAV Waypoint	CRZ ALT	Active VNAV Waypoint
TOP	°	NM	FT	GAL	UTC		23500FT	
Airway - V4.SLN								
SLN	260°	69.1NM	FL235	47GAL	21:45	14:16UTC		
Airway - V244.LAA (collapsed)								
LAA	°	243NM	FL235	-21GAL	1+16	15:33UTC		

Current VNAV Flight Phase
Cruise Altitude example

Figure 5-106 Flight Plan Text - VNAV Enabled - Flight Phase (Cruise) displayed

Active Flight Plan							Current VNAV Profile	
DTK	Leg DIS	ALT	Fuel REM	Leg ETE	ETA	Active VNAV Waypoint	CRZ ALT	Active VNAV Waypoint
TOP	°	NM	FT	GAL	UTC			
Airway - V4.SLN								
SLN	260°	69.1NM	FL235	47GAL	21:45	14:16UTC		
Airway - V244.LAA (collapsed)								
LAA	°	243NM	FL235	-21GAL	1+16	15:33UTC		

Current VNAV Flight Phase
Cruise Altitude example

Figure 5-107 Flight Plan Text - VNAV Disabled

Enabling/Disabling VNAV guidance:

- 1) From MFD Home, touch **Flight Plan** > **VNAV**.
- 2) If necessary, touch the **Profile** Tab.
- 3) Touch the **VNAV Enabled** Button to enable/disable vertical navigation.

The vertical navigation profile can be modified by directly entering either a vertical speed target (VS Target) or a flight path angle (FPA), on the 'VNAV Profile' Screen.

Modifying the Vertical Speed Target and Flight Path Angle:

- 1) From MFD Home, touch **Flight Plan** > **VNAV**.
- 2) Touch the **VS Target** Button or the **FPA** Button to display the keypad.
- 3) Use the keypad and the **Enter** Button to select the vertical speed target or the flight path angle.

CLIMB/ CRUISE/ DESCENT PHASES

When in the climb, cruise, or descent flight phase, the FMS speed will utilize the speeds (default or pilot-defined) set in the respective flight phase speed schedule. Schedules can be accessed through tabs each designated to a flight phase.

With VNAV enabled, the aircraft will be in the climb flight phase when the active leg is part of a departure procedure or when a climb constraint is defined in the flight plan on or after the active leg.

The aircraft will enter the cruise flight phase when it has sequenced all climb altitude constraints (excluding those in the missed approach), and the aircraft has reached 500 feet below the cruise altitude. Cruise Altitude is the highest of the current altitude, highest altitude constraint (excluding constraints in the missed approach), or selected altitude. A climb constraint is sequenced once the aircraft is laterally beyond the climb waypoint or has reached at least 250 feet higher than an 'at-or-above' climb constraint.

When VNAV is enabled, the 'Current VNAV Profile' Box on the Active Flight Plan Inset and the Flight Plan Progress Inset ('Navigation Map' Pane) will display CRZ ALT instead of an active VNAV waypoint until the aircraft is within 10 nm of TOD or unless the selected altitude is adjusted 75 feet or below the next active VNAV waypoint. If the preceding conditions are met, then the 'Current VNAV Profile' Box will change to show the active VNAV waypoint ID and altitude. CRZ ALT will not be displayed again unless the selected altitude is adjusted at or above the current altitude, or a climb phase is initiated.

The aircraft will enter the descent flight phase when within 10 nm of TOD. The **VS Target** Button and the **FPA** Button will be subdued until the aircraft is within 10 nm of TOD or if the selected altitude is adjusted below 75 feet of the next active VNAV waypoint.

CLIMB

The VNAV Climb profile for the active flight plan can be modified by directly entering speeds, altitudes, and distance on the **Climb** Tab on the 'VNAV Climb' Screen.

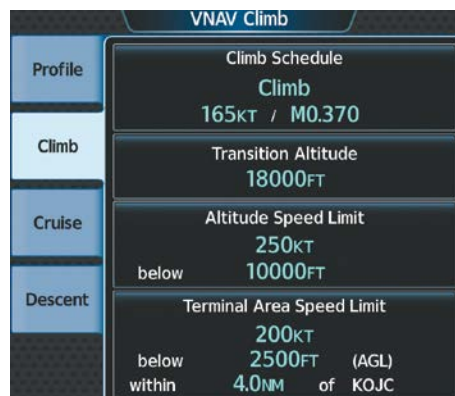


Figure 5-108 VNAV Climb - Climb Schedule Modification

Selecting a pre-defined Climb Schedule:

- 1) From MFD Home, touch **Flight Plan** > **VNAV**.
- 2) Touch the **Climb** Tab.
- 3) Touch the **Climb Schedule** Button to bring up the climb schedule window.
- 4) Touch the button for the desired climb schedule.

Modifying the Climb Schedule:

- 1) From MFD Home, touch **Flight Plan > VNAV**.
- 2) Touch the **Climb** Tab.
- 3) Touch the **Climb Schedule** Button to bring up the climb schedule window.
- 4) Touch the **Pilot-Defined Climb** Button to display the keypad.
- 5) Use the keypad and the **Enter** Button to select the desired climb schedule values. The climb schedule is shown as a Pilot-Defined Climb.
- 6) To reselect a pre-defined schedule, touch the **Climb Schedule** Button to bring up the climb schedule window.
- 7) Touch the button for the desired climb schedule to reset the targets to a pre-defined setting (pilot-defined climb schedules are not saved when a pre-defined climb schedule is selected).

Modifying the Climb Transition Altitude:

- 1) From MFD Home, touch **Flight Plan > VNAV**.
- 2) Touch the **Climb** Tab.
- 3) Touch the **Transition Altitude** Button to display the keypad.
- 4) Use the keypad and the **Enter** Button to select the desired transition altitude.

Reverting the Transition Altitude to the published value:

- 1) From MFD Home, touch **Flight Plan > VNAV**.
- 2) Touch the **Climb** Tab.
- 3) Touch the **Transition Altitude** Button to display the keypad.
- 4) Touch the **Revert to Published** Button.
- 5) Touch the **OK** Button to revert to the published value.

Modifying the Climb Speed Limits:

- 1) From MFD Home, touch **Flight Plan > VNAV**.
- 2) Touch the **Climb** Tab.
- 3) Touch any of the Speed Limits buttons to display the keypad.
- 4) Use the keypad and the **Enter** Button to select the desired speed limit, altitude, and distance values. Repeat steps 3 and 4 as necessary.

CRUISE

The Cruise Schedule for the active flight plan can be modified by directly entering speeds on **Cruise** Tab on the 'VNAV Cruise' Screen.



Figure 5-109 VNAV Cruise - Cruise Schedule Modification

Selecting a pre-defined Cruise Schedule:

- 1) From MFD Home, touch **Flight Plan** > **VNAV**.
- 2) Touch the **Cruise** Tab.
- 3) Touch the **Cruise Schedule** Button to bring up a window with the different cruise schedule options.
- 4) Touch the button for the desired cruise schedule.

Modifying the Cruise Schedule:

- 1) From MFD Home, touch **Flight Plan** > **VNAV**.
- 2) Touch the **Cruise** Tab.
- 3) Touch the **Cruise Schedule** Button to bring up the cruise schedule window.
- 4) Touch the **Pilot-Defined Cruise** Button to display the keypad.
- 5) Use the keypad and the **Enter** Button to select the desired cruise schedule values. The cruise schedule is shown as a Pilot-Defined Climb.
- 6) To reselect a pre-defined schedule, touch the **Cruise Schedule** Button to bring up the cruise schedule window.
- 7) Touch the button for the desired cruise schedule to reset the targets to a pre-defined setting (pilot-defined cruise schedules are not saved when a pre-defined climb schedule is selected).

DESCENT

The VNAV descent profile for the active flight plan can be modified by directly entering speeds, flight path angle, altitudes, and distance on the **Descent** Tab on the 'VNAV Descent' Screen.



NOTE: Changing the FMS VNAV Descent Schedule does not affect an active VNAV descent (indicated by an Active VNAV Waypoint on the 'VNAV Profile' Screen) or a user-defined waypoint VNAV constraint. In this case, the active Flight Path Angle does not change, thus the Top of Descent is not redefined.



Figure 5-110 VNAV Descent - Descent Schedule Modification

Selecting a pre-defined Descent Schedule:

- 1) From MFD Home, touch **Flight Plan > VNAV**.
- 2) Touch the **Descent** Tab.
- 3) Touch the **Descent Schedule** Button to bring up the descent schedule window
- 4) Touch the button for the desired descent schedule.

Modifying the Descent Schedule:

- 1) From MFD Home, touch **Flight Plan > VNAV**.
- 2) Touch the **Descent** Tab.
- 3) Touch the **Descent Schedule** Button to bring up the descent schedule window.
- 4) Touch the **Pilot-Defined Descent** Button to display the keypad.
- 5) Use the keypad and the **Enter** Button to select the desired descent schedule values. The descent schedule is shown as a Pilot-Defined Descent.
- 6) To reselect a pre-defined schedule, touch the **Descent Schedule** Button to bring up the descent schedule window.
- 7) Touch the button for the desired descent schedule to reset the targets to a pre-defined setting (pilot-defined descent schedules are not saved when a pre-defined descent schedule is selected).

Modifying the Descent Transition Level:

- 1) From MFD Home, touch **Flight Plan > VNAV**.
- 2) Touch the **Descent** Tab.
- 3) Touch the **Transition Level** Button to display the keypad.
- 4) Use the keypad and the **Enter** Button to select the desired transition level.

Reverting the Descent Transition Level to the published value:

- 1) From MFD Home, touch **Flight Plan > VNAV**.
- 2) Touch the **Descent** Tab.
- 3) Touch the **Transition Level** Button to display the keypad.
- 4) Touch the **Revert to Published** Button.
- 5) Touch the **OK** Button to revert to the published value.

Modifying the Descent Speed Limits:

- 1) From MFD Home, touch **Flight Plan > VNAV**.
- 2) Touch the **Descent** Tab.
- 3) Touch any of the Speed Limits buttons to display the keypad.
- 4) Use the keypad and the Enter Button to select the desired speed limit, altitude, and distance values. Repeat steps 3 and 4 as necessary.
- 5) Use the keypad and the **Enter** Button to select the desired value.
- 6) Repeat steps 4 & 5 as necessary.
- 7) Touch the **Save** Button to save the selected values for the waypoint.
- 8) Repeat steps 3 through 7 for additional waypoints.

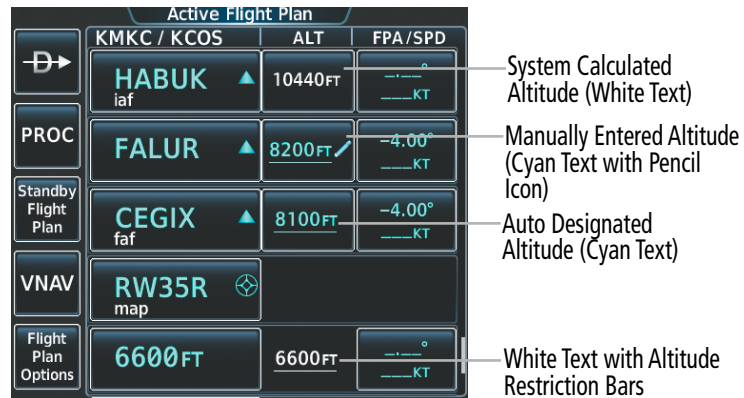
CONSTRAINTS



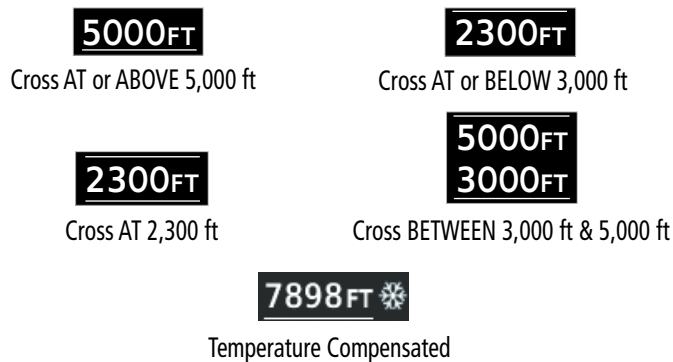
NOTE: *Initiating the VNV direct-to function to the FAF, manually specifying an FPA to the FAF, or manually creating an altitude constraint at the FAF will disrupt the VNV function from creating a lateral offset. Thus, the baro-VNV path may not intersect the approach descent path.*

ALTITUDE CONSTRAINTS

The system can use 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.



Displayed Text Examples



Altitude Constraint Examples

Figure 5-111 Active Flight Plan - Waypoint Altitude Constraints

<p>5000FT</p> <p>Advisory altitudes calculated by the system estimating the altitude of the aircraft as it passes the navigation point.</p> <p>5000FT</p> <p>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.</p>	<p>5000FT</p> <p>Altitude is designated for use in determining vertical guidance. A pencil icon indicates manual designation or manual data entry.</p> <p>5000FT</p> <p>The system cannot use this altitude in determining vertical guidance because of an invalid constraint condition.</p>
--	--

Table 5-8 Altitude Constraint Color Coding

When a procedure is loaded, the system will auto-designate (automatically enter and enable) altitude constraints to be used for vertical 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 available for vertical guidance. Altitudes that are not available for vertical guidance are shown in white text with associated altitude restriction bar(s) 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.

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

Altitudes that have been designated for use in vertical guidance can be “un-designated”. Touching the **Remove Constraint** Button removes the altitude constraint designation. The altitude will not be used for vertical guidance and the text displayed will be shown in white. The system will recalculate advisory altitudes (white text) once any altitude constraint is designated, modified, or un-designated.

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

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

A designated altitude constraint may be rendered invalid if the climb constraints are not sequentially ascending, or the descent constraints are not sequentially descending.



Figure 5-112 Active Flight Plan - Waypoint Altitude Designation

Entering or modifying an altitude constraint:

- 1) For the active flight plan: From MFD Home, touch **Flight Plan**.
Or:
For the standby flight plan: From MFD Home, touch **Flight Plan > Standby Flight Plan**.
- 2) Scroll the list, if necessary, and touch a VNAV ALT button to display the 'VNAV Constraint' Window. Review the constraint information. If it is correct, skip to step 9 to designate the altitude constraint for vertical guidance.
- 3) Touch the Altitude Constraint Button to display the 'Enter Altitude' window.
- 4) If necessary, use the keypad to select the altitude.
- 5) If necessary, touch the **Flight Level** Button or the **MSL** Button to select the altitude mode.
- 6) Touch the **Enter** Button to accept the altitude entry and return to the 'VNAV Constraint' window.
- 7) If necessary, touch the **Phase** Button, then touch the **Climb** Button or the **Descent** Button.
- 8) If necessary, touch the **Type** Button, then touch the **At**, **At or Above**, **At or Below** or **Between** Button. If **Between** is selected, use the keypad to enter the second altitude.
- 9) Touch the **Create** Button to designate the new altitude constraint. The altitude is now shown in cyan, indicating it is usable for vertical guidance.



NOTE: When creating an altitude constraint, the **Phase** Button will default to **Climb** or **Descent** based upon the location in the flight plan of the waypoint being modified. If the waypoint is prior to the last climb constraint, the phase will default to **Climb**. If the waypoint is after a descent constraint, the phase will default to **Descent**. If the waypoint is located between the last climb constraint and the first descent constraint, the default will be **Climb** if the waypoint is in the first half of the flight plan (defined by length in nm), or the default will be **Descent** if the waypoint is in the last half of the flight plan (defined by length in nm).

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 MFD Home, touch **Flight Plan**.
Or:
For the standby flight plan: From MFD Home, touch **Flight Plan > Standby Flight Plan**.
- 2) Scroll the list, if necessary, and touch a VNAV ALT button to display the 'VNAV Constraint' Window.
- 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 MFD Home, touch **Flight Plan**.
Or:
 For the standby flight plan: From MFD Home, touch **Flight Plan** > **Standby Flight Plan**.
- 2) Scroll the list, if necessary, and touch a VNAV ALT button to display the 'VNAV Constraint' Window.
- 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.

FMS SPEED, VERTICAL SPEED, AND FLIGHT PATH ANGLE CONSTRAINTS

FMS SPEED CONSTRAINTS

The FMS Speed, located on the 'VNAV Profile' Screen, is normally determined based on the overall mode (climb, cruise or descent), the speed schedule selected for that mode, and any speed limits that may be active (including speed constraints for aircraft configuration or programmed at flight plan waypoints). The system will limit the FMS Speed to satisfy all speed limits. If there are conflicting constraints, the system will prioritize constraints as follows (highest priority first):

- Airframe or Aircraft Configuration limits/constraints (Vmo/Mmo limits, Flap/Gear extended constraints, etc.)
- Arrival Terminal Area Speed Limit (defined on the 'VNAV Profile' Screen, **Descent** Tab)
- Departure Terminal Area Speed Limit (defined on the 'VNAV Profile' Screen, **Climb** Tab)
- Altitude-based speed limits (separate limits apply to climb and descent)
- Flight Plan Speed constraints (defined at flight plan waypoints via database or pilot-entered)
- Speed Schedule per mode of flight as defined on the VNAV Climb, Cruise, and Descent Screens.

Any of the above conditions will limit the FMS Speed on the 'VNAV Profile' Screen and the FMS Speed Bug on the airspeed tape. Information regarding the condition will also be displayed on the 'VNAV Profile' Screen. For example, if the limiting condition is a speed limit of 200 knots for aircraft configuration, it will state 'Aircraft Configuration' on the 'VNAV Profile' Screen as shown in the following figure.

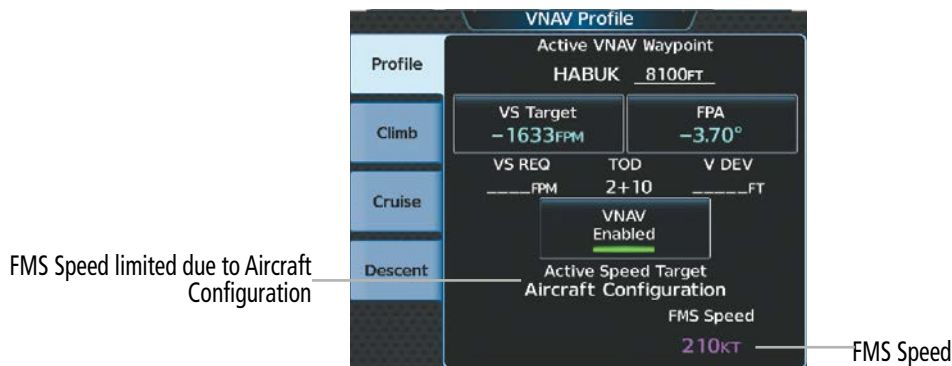


Figure 5-113 VNAV Profile - FMS Speed

As the flight proceeds and speed constraints are sequenced, the FMS Speed will change. In climb, the speed initially may be limited by a flap speed constraint, departure speed limit, or flight plan speed constraint. The FMS Speed will step up to higher speeds as flaps are retracted, the airplane flies out of the departure speed limit volume, and as flight plan speed constraints are sequenced. For climb, the change (to a higher speed) will start after passing the constraint. In descent, FMS Speed changes in a similar fashion but in reverse order (the speed steps down to slower values). For descent, the change (to a slower speed) will start in advance of the constraint so the airplane has sufficient time to slow to the new speed prior to arriving at the altitude or waypoint.

The system can use speed constraints associated with lateral waypoints to give guidance for navigation. These speeds are, depending on the specific instance, manually entered or retrieved from the navigation database.

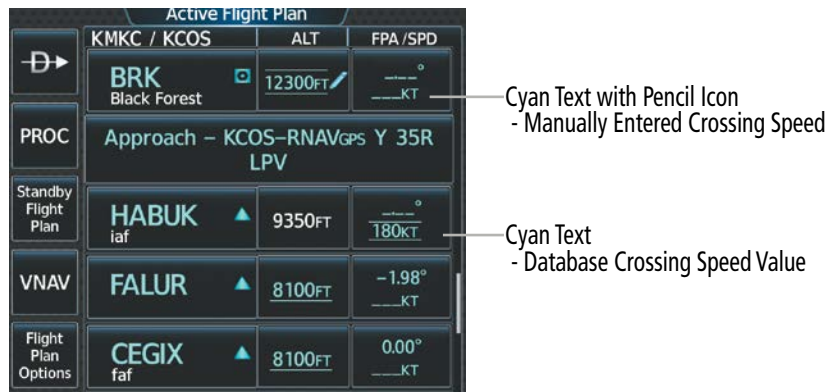


Figure 5-114 Active Flight Plan - Waypoint Speed Constraints



Cyan Text
 <p>Speed is retrieved from the database and is used for crossing speed guidance. A pencil icon indicates manual data entry.</p>
 <p>The system cannot use this speed because of an invalid constraint condition.</p>

Table 5-9 Speed Constraint Color Coding


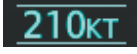
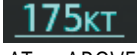
Constraint Type	Departure or Missed Approach	Arrival or Approach
 AT or BELOW	Do not exceed PRIOR	Do not exceed AT and AFTER
 AT	Do not exceed PRIOR, do not go below AFTER, cross AT	Do not go below PRIOR, do not exceed AFTER, cross AT
 AT or ABOVE	Do not go below AT and AFTER	Do not go below PRIOR to and AT

Table 5-10 Speed Constraint Application

Speed constraints are displayed and entered to the nearest knot indicated airspeed (KIAS) or Mach number to the nearest 0.001 Mach. When a database speed restriction is displayed, the system allows entry of a different speed for the waypoint.

A speed constraint is invalid if:

- Meeting a manually entered constraint would require maximum speeds to be exceeded, or minimum speeds to not be met.
- The constraint requires speed to decrease in a climb segment or speed to increase in a descent segment.

Entering or modifying a flight plan waypoint speed constraint:

1) For the active flight plan: From MFD Home, touch **Flight Plan**.

Or:

For the standby flight plan: From MFD Home, touch **Flight Plan** > **Standby Flight Plan**.

- 2) Scroll the list, if needed, and touch an FPA/SPD Button to display the **Speed Constraint** Button.
- 3) Touch the **Speed Constraint** Button to display the 'Enter Speed' Screen.
- 4) Use the keypad to select the speed.
- 5) If needed, touch the **IAS** Button or the **Mach** Button to select the speed units.
- 6) If needed, touch the **At**, **Above**, or **Below** Button to select the constraint type.
- 7) Touch the **Enter** Button to accept the new speed constraint.



Figure 5-115 Active Flight Plan - Adding a Speed Constraint

Speed constraints can be modified or deleted after having been added to the flight plan.

Removing a flight plan waypoint speed constraint:

- 1) For the active flight plan: From MFD Home, touch **Flight Plan**.
Or:
 For the standby flight plan: From MFD Home, touch **Flight Plan** > **Standby Flight Plan**.
- 2) Scroll the list, if needed, and touch a FPA/SPD Button to display the **Speed Constraint** Button.
- 3) Touch the **Speed Constraint** Button. The 'Enter Speed' Window is displayed.
- 4) Touch the **Remove Speed** Button. A 'Remove Speed Constraint?' confirmation window is displayed.
- 5) Touch the **OK** Button. The speed constraint is removed. To cancel the request, touch the **Cancel** Button.

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

- 1) For the active flight plan: From MFD Home, touch **Flight Plan**.
Or:
 For the standby flight plan: From MFD Home, touch **Flight Plan** > **Standby Flight Plan**.
- 2) Scroll the list, if needed, and touch a FPA/SPD Button to display the **Speed Constraint** Button.
- 3) Touch the **Speed Constraint** Button. The 'Enter Speed' Window is displayed.
- 4) Touch the **Remove Speed** Button. A 'Remove or Revert to published speed of nnnKT?' confirmation window is displayed.
- 5) Touch the **Revert** Button.

FLIGHT PATH ANGLE CONSTRAINTS

The system will automatically calculate a descent path that adheres to the designated VNAV altitude constraints. The calculated Flight Path Angle (FPA) will be displayed in the FPA/SPD column next to a designated VNAV descent altitude constraint. The crew may optionally define a specific Flight Path Angle (FPA) constraint for a waypoint with a VNAV descent altitude constraint. The system will automatically convert the altitude to an AT constraint when a crew specified FPA is entered.

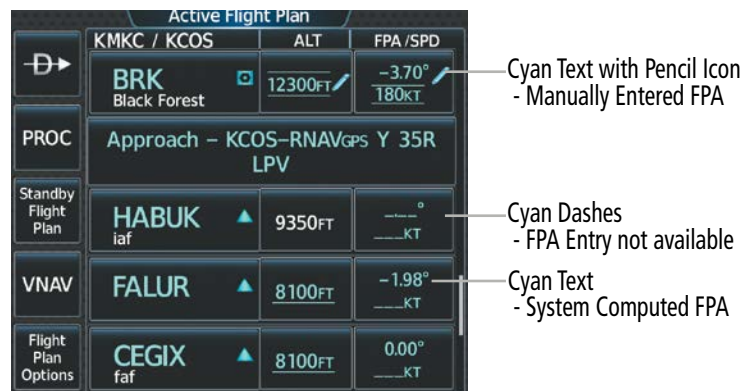


Figure 5-116 Active Flight Plan - Waypoint Flight Path Angle Constraints

Entering or modifying a flight path angle constraint:

1) For the active flight plan: From MFD Home, touch **Flight Plan**.

Or:

For the standby flight plan: From MFD Home, touch **Flight Plan > Standby Flight Plan**.

2) Scroll the list, if necessary, and touch a FPA/SPD button to display the Flight Path Angle/Speed Constraint window.

3) Touch the **Flight Path Angle** Button to display the 'VNAV Flight Path Angle' Window.

4) Use the keypad to select the angle.

5) Touch the **Enter** Button to accept the new FPA constraint.

Manually entered FPA constraints can be modified or deleted after having been added to the flight plan. These modification will redefine the calculated vertical path and may result in movement of the Top of Descent (TOD).

Removing a flight path angle constraint:

1) For the active flight plan: From MFD Home, touch **Flight Plan**.

Or:

For the standby flight plan: From MFD Home, touch **Flight Plan > Standby Flight Plan**.

2) Scroll the list, if necessary, and touch a FPA/SPD button to display the Flight Path Angle/Speed Constraint Window.

3) Touch the **Flight Path Angle** Button. The 'VNAV Flight Path Angle' Window is displayed.

4) Touch the **Remove FPA** Button.

5) Touch the **OK** Button. The FPA reverts to the FMS computed value, or to dashes. To cancel the request, touch the **Cancel** Button.

VERTICAL SITUATION DISPLAY

A Vertical Situation Display (VSD) can be shown on the bottom of the 'Navigation Map' Pane. The terrain, obstacles, vertical track vector, selected altitude, and active flight plan information (active flight plan information consists of waypoints, associated altitude constraints, current VNAV profile, BOC/TOC, TOD/BOD, and destination runway can be displayed on the VSD, depending on the selected mode. See the Hazard Avoidance section for information about winds aloft, obstacles, and relative terrain on the VSD.

The VSD horizontal range is equal to the navigation map indicated range when the VSD is in Track mode. When the VSD is in Flight Plan mode, the horizontal range is the lower of twice the navigation map indicated range or the lowest range the displays all of the remaining active flight plan. The VSD altitude range automatically changes when the navigation map range is changed to keep a constant ratio of altitude range to horizontal range, until both minimum and maximum display limits have been met. At ranges above the maximum, the altitude range remains constant at the maximum.

The aircraft symbol is displayed on the left side of the VSD window. The position of the aircraft symbol on the vertical scale is close to the top for a descent phase, at the bottom for on-ground or a climb phase, and in the middle for a cruise phase or if the phase is unknown.

If two waypoints are close together, and their labels or constraint values overlap enough to obscure any text, one waypoint label/constraint value is removed and the vertical dashed line for that waypoint is displayed as darker gray. The priority for which waypoint remains displayed is: (1) the current TO waypoint, (2) waypoint with an altitude constraint, and (3) waypoint closer to the aircraft.

Terrain/obstacles are available on the VSD, and will be shown if the aircraft altitude is low enough for the terrain/obstacles to be in view (terrain will be subdued if the terrain is selected Off on the Navigation Map). 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 numeric constraint values are displayed below the waypoint label, using the same color and format as on the 'Active Flight Plan' Screen. Advisory altitude values are not shown. The graphical symbols are shown on the descending dashed line at the constraint value altitude(s). The following table shows the numeric representation and the graphical representation of the constraints. The tip of each constraint symbol triangle is placed at the corresponding constraint barometric altitude.

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.

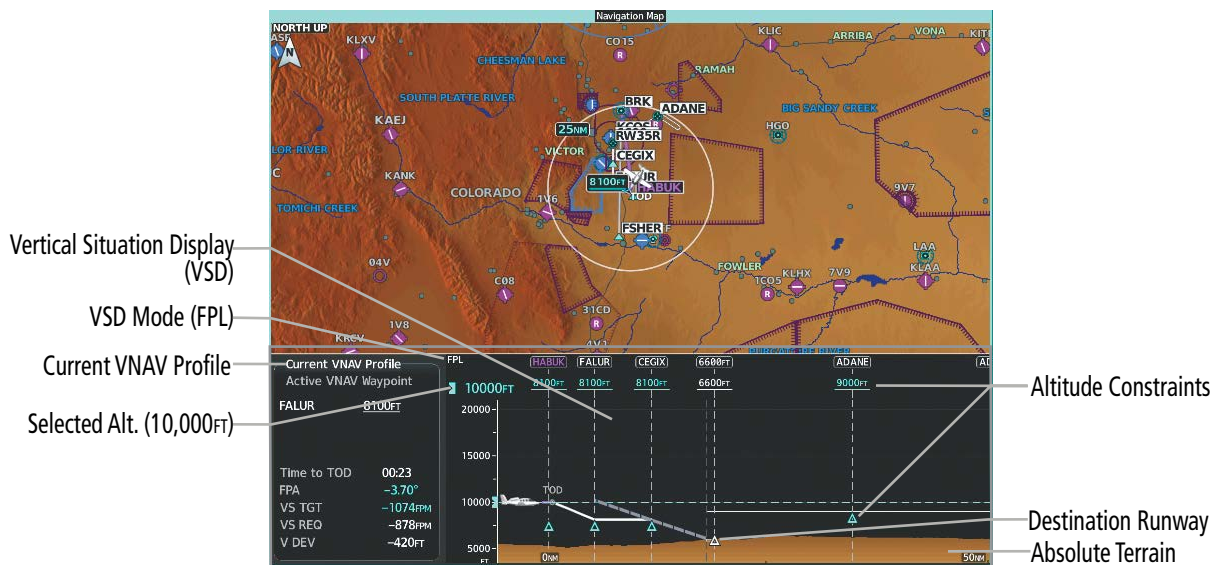


Figure 5-117 Vertical Situation Display

Constraint Type	Numeric Representation	Altitude Constraint Icon
AT (Designated [cyan] or Un-designated [white] Altitude Constraint)	2300FT	
AT or ABOVE (Designated [cyan] or Un-designated [white] Altitude Constraint)	5000FT	
AT or BELOW (Designated [cyan] or Un-designated [white] Altitude Constraint)	2300FT	
BETWEEN (Designated [cyan] or Un-designated [white] Altitude Constraint)	5000FT 3000FT	

Table 5-11 VSD Altitude Constraint Icons

Climb and descend icons are shown on the VSD when the aircraft altitude meets a condition shown in the following table.

Condition	Climb/Descend Icon
If the active leg's flight plan line is above the highest altitude shown on the VSD, a magenta climb icon will be displayed to the right of the ownship symbol	
If a future leg's flight plan line is above the highest altitude shown on the VSD during the climb phase of flight, a white climb icon will be displayed to the right of the last leg visible on the VSD	
If the active leg's flight plan line is below the lowest altitude shown on the VSD, a magenta descend icon will be displayed to the right of the ownship symbol	

Table 5-12 VSD Climb/Descent Icons

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

Active flight plan information consists of waypoints, associated altitude constraints, current VNV profile, TOD/BOD, TOC/BOC, and destination runway

Table 5-13 VSD Mode Descriptions

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

Table 5-14 Swath Width

VSD MESSAGES

Under certain conditions, some messages may appear in conjunction with others:

Message	Description
'Loading...'	VSD is loading data due to a range change, full/half switch, or first being selected for display.
'Flight Plan Not Available'	Flight Plan mode is selected and there is not a flight plan loaded with at least one leg.
'Flight Plan mode unavailable because aircraft off course and active leg over 200 NM'	All of the following are true: - Flight Plan mode is selected - The active leg is greater than 200 nm - The aircraft is outside the swath
'Aircraft Beyond Active Leg'	Flight Plan mode is selected and the aircraft's position, as projected on the flight plan, is past the end of the active leg.
'VSD Not Available'	At least one of the following is true: - Valid terrain database not available - GPS MSL altitude not available - Current barometric altitude not available - Neither current track nor current heading available - GPS position not available - Map range setting is less than 1 nm
'VSD Data is old, disable and enable VSD'	The system has encountered a delay and VSD data has failed to update for 2 seconds or more. This message may be momentarily displayed and then removed as the delay is overcome.

Table 5-15 VSD System Messages

Enabling/disabling the VSD:

- 1) From MFD 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 MFD 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' Screen.
- 5) Touch a Mode button to select the mode and return to the 'Vertical Situation Display Settings' Screen.

VERTICAL NAVIGATION DIRECT TO

The system allows a vertical navigation direct-to to any waypoint in the active flight plan with an altitude descent constraint “designated” for vertical guidance. Initiating the vertical navigation 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. All VNAV altitudes prior to the direct-to destination are removed from the active flight plan upon successful activation of the direct-to. All VNAV altitudes following the direct-to waypoint are retained. As with the previously discussed vertical navigation, the direct to vertical navigation profile can be modified by directly entering either a vertical speed target (VS Target) or a flight path angle (FPA) constraint, on the 'VNAV Profile' Screen.

A lateral direct-to with an altitude constraint (activated by touching the **-D➔** Key) also provides vertical guidance, but would bypass flight plan waypoints between the current position in the flight plan and the direct-to waypoint.



Figure 5-118 VNAV Altitude - VNAV Direct To

Activating a vertical navigation direct to:

- 1) From MFD Home, touch **Flight Plan > VNAV**.
- 2) Touch the **VNAV** \rightarrow Button to display the 'Select VNAV Direct To' Screen with a list of possible Vertical navigation direct to choices.
- 3) Scroll the list, if necessary, and touch a VNAV waypoint selection button.
- 4) Touch the **Activate** Button in response to "Activate Vertical \rightarrow : NNNNNFT at XXXXXX" to initiate the vertical navigation direct to. Vertical guidance begins to the altitude constraint for the selected waypoint. To cancel the request, touch the **Cancel** Button.

Or:

- 1) From MFD Home, touch **Flight Plan**.
- 2) Scroll the list, if necessary, and touch the VNAV ALT button for the desired waypoint to display the 'VNAV Constraint' Window. Review the altitude constraint information. If it is correct, skip to step 5 to initiate the vertical navigation direct to.
- 3) If necessary, touch the **Flight Level** Button or the **MSL** Button to select the altitude mode.
- 4) Use the keypad to select the altitude.
- 5) Touch the VNAV \rightarrow XXXXX Button to activate the vertical navigation direct to. Vertical guidance begins to the altitude constraint for the selected waypoint.

Active Flight Plan							Current VNAV Profile	
	DTK	Leg DIS	ALT	Fuel REM	Leg ETE	ETA	Active VNAV Waypoint	
FSHER	---	---	---	---	---	---	FALUR	8100FT
Approach - KCOS-RNAV _{GPS} Y 35R LPV								
HABUK iaf	012°	12.8NM	9300FT	50GAL	04:07	21:11UTC	Time to TOD	05:35
FALUR	290°	6.5NM	8100FT	48GAL	02:05	21:13UTC	FPA	-3.70°
CEGIX faf	352°	6.4NM	8100FT	45GAL	02:04	21:15UTC	VS TGT	-1226FPM
							VS REQ	-----FPM
							V DEV	-----FT

Current Vertical Navigation Profile
 - Time to TOD is 05:35 and will begin on the leg prior to the constraint

Figure 5-119 Active Flight Plan - VNAV Direct To Not Active

Active Flight Plan							Current VNAV Profile	
	DTK	Leg DIS	ALT	Fuel REM	Leg ETE	ETA	Active VNAV Waypoint	
FSHER	---	---	---	---	---	---	FALUR	8100FT
Approach - KCOS-RNAV _{GPS} Y 35R LPV								
HABUK iaf	012°	12.8NM	8290FT	50GAL	04:07	21:11UTC	Time to TOD	00:16
FALUR	290°	6.5NM	8100FT	48GAL	02:05	21:13UTC	FPA	-0.27°
CEGIX faf	352°	6.4NM	8100FT	45GAL	02:04	21:15UTC	VS TGT	-91FPM
							VS REQ	-98FPM
							V DEV	40FT

Current Vertical Navigation Profile
 - After VNAV Direct To Time to TOD is 00:16 and will begin on the current active leg

Figure 5-120 Active Flight Plan - VNAV Direct To Active

Removing a Direct To VNAV constraint:

- 1) From MFD Home, touch **Direct To**.
- 4) Touch the **VNAV Altitude** Button to display the keypad.
- 5) Touch the **Remove VNAV ALT** Button.
- 6) Touch the **OK** Button in response to the question "Remove VNAV altitude?".
- 5) Touch the Activate **→** Button to activate the direct to without the VNAV constraints.

Or:

- 1) From MFD Home, touch **Flight Plan**.
- 2) Scroll the active flight plan to display the direct-to waypoint.
- 3) Touch the VNAV Altitude Button for the direct-to waypoint to display the 'VNAV Constraint' Window.
- 4) Touch the **Remove Constraint** Button.
- 5) Touch the **OK** Button in response to the question "Remove Altitude Constraint?".

5.8 PROCEDURES

The system can access the whole range of instrument procedures available. Departures (DPs), arrivals (STARS), and non-precision and precision approaches (APPRs) are stored within the database and can be loaded using the Touchscreen Controller.

The selected procedure for the origin or destination airport is added to the active or standby flight plan. The steps for loading procedures into the standby flight plan are similar to the active flight plan. No waypoints are required to be in the flight plan to load procedures; however, if the origin and destination airport (or runway) are already loaded, the procedure selection screen defaults to the appropriate airport, saving some time selecting the correct airport. Whenever an approach is selected, the choice to either “Load” and/or “Load & Activate” is given (“Load & Activate” is only available for the active flight plan, and is the only choice available if the active flight plan is completely empty). “Loading” adds the approach to the end of the flight plan without immediately using it for navigation guidance. This allows continued navigation via the intermediate waypoints in the original flight plan, but keeps the procedure available for quick activation when needed. “Activating” also adds the procedure to the end of the flight plan but immediately begins to provide guidance to the first waypoint in the approach.

The system adds terminal procedures to the flight plan based on leg types coded within that procedure in the navigation database. If the terminal procedure in the flight plan contains an identifier like ‘2000FT’, that 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.

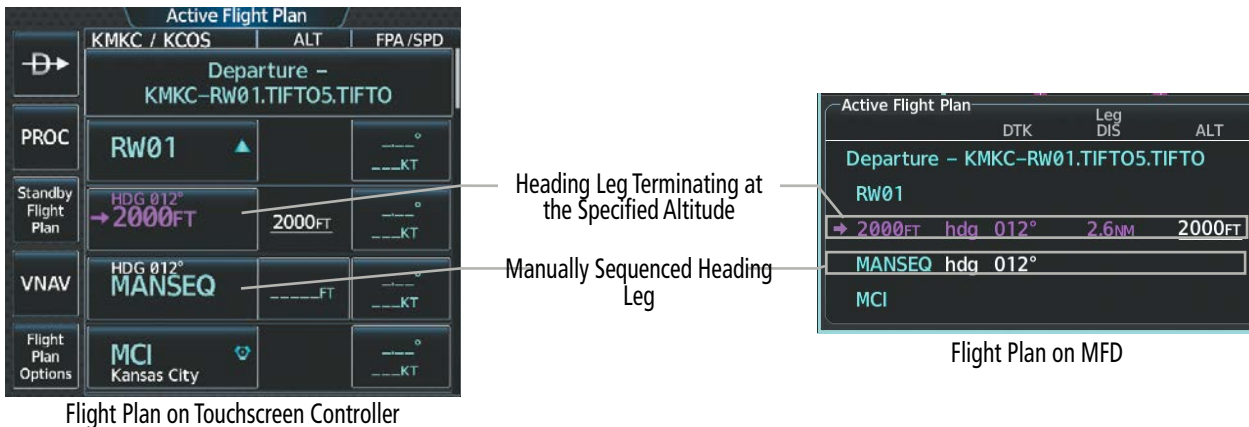


Figure 5-121 Procedure Leg Identifiers

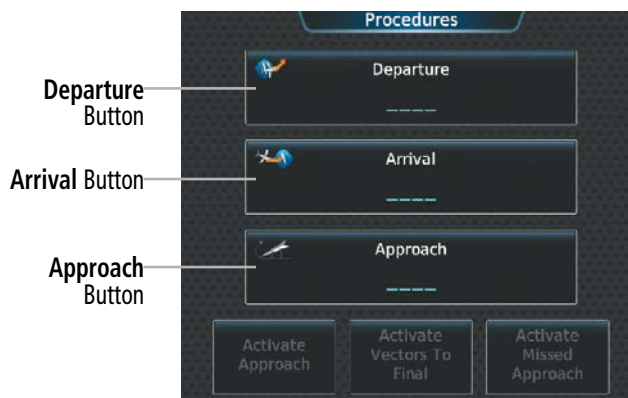


Figure 5-122 Loading Procedures on the Touchscreen Controller

Viewing available procedures at an airport:

- 1) From MFD 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 procedure on the navigation map or touch the **Show Chart** Button to show the chart instead of the navigation map.
- 6) Touch the **Back** 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 MFD 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 navigation map or touch the **Show Chart** Button to show the procedure chart instead of the navigation map.
- 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 MFD Home, touch **Nearest > Airport**.
- 2) If necessary, scroll the list to find the airport and touch the airport selection button to display the 'Waypoint Options' Window for the selected airport. If the airport is not listed, touch any airport selection button to display the 'Waypoint Options' Window.
- 3) Touch the **Airport Info** Button to display the 'Airport Information' Screen. If in the previous step, the airport was not listed, touch the airport button and use the keypad to select the destination airport.
- 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 navigation map or touch the **Show Chart** Button to show the procedure chart instead of the navigation map.
- 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 the active or standby flight plan:

1) For the active flight plan: From MFD Home, touch **Flight Plan**.

Or:

For the standby flight plan: From MFD Home, touch **Flight Plan > Standby Flight Plan**.

- 2) Scroll the list if necessary and touch a departure, arrival, or approach selection 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.



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.

Removing an entire procedure from a stored flight plan:

- 1) From MFD 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' Screen.
- 3) Touch the **Edit** Button.
- 4) Scroll the list if needed and touch a departure, arrival, or approach selection button to display the Departure, Arrival, or Approach Options window.
- 5) Touch the **Remove Departure** Button, the **Remove Arrival** Button, or the **Remove Approach** Button.
- 6) 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 Procedure (DP) is loaded 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 transition waypoints, and a runway.

LOADING A DEPARTURE INTO A FLIGHT PLAN

Loading a departure into the active/standby flight plan using the Touchscreen Controller:

- 1) For the active flight plan: From MFD Home, touch **PROC**.
Or:
 For the standby flight plan: From MFD Home, touch **Flight Plan > PROC**.
- 2) Touch the **Departure** Button to display the 'Departure Selection' Screen.
- 3) If needed, touch the **Airport** Button to display the keypad and use it to select the origin airport.
- 4) Touch the **Enter** Button to accept the origin airport.
- 5) Touch the **Departure** Button to display the 'Select Departure' Screen with a list of available departures.
- 6) Scroll the list if needed and touch a departure selection button to select a departure. The 'Select Transition' Screen will open.
- 7) Scroll the list if needed and touch a transition selection button to select the transition. The 'Select Runway' Screen will open.
- 8) Scroll the list if needed and touch a runway selection button to select the runway and return to the 'Departure Selection' Screen.
- 9) Touch the **Preview** Button, then the **Show on Map** Button to show the preview of the departure on the navigation map or touch the **Show Chart** Button to show the departure chart instead of the navigation map.
- 10) Touch the **Load** Button to insert the departure into the active 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 you choose.

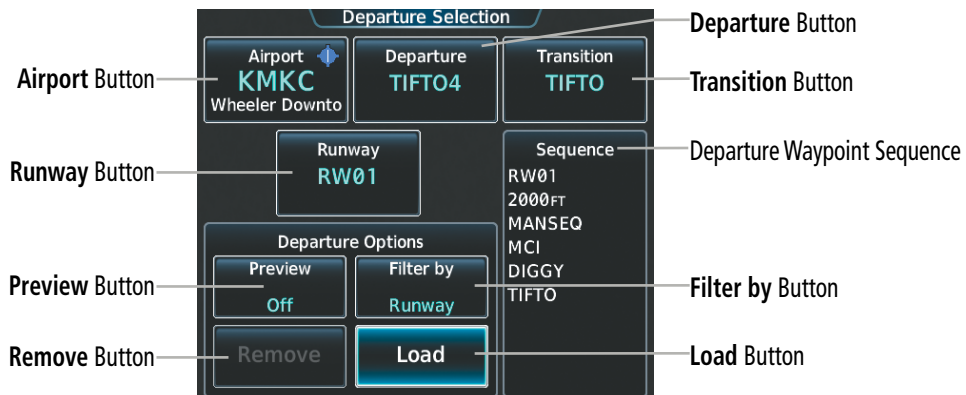


Figure 5-123 'Departure Selection' Screen

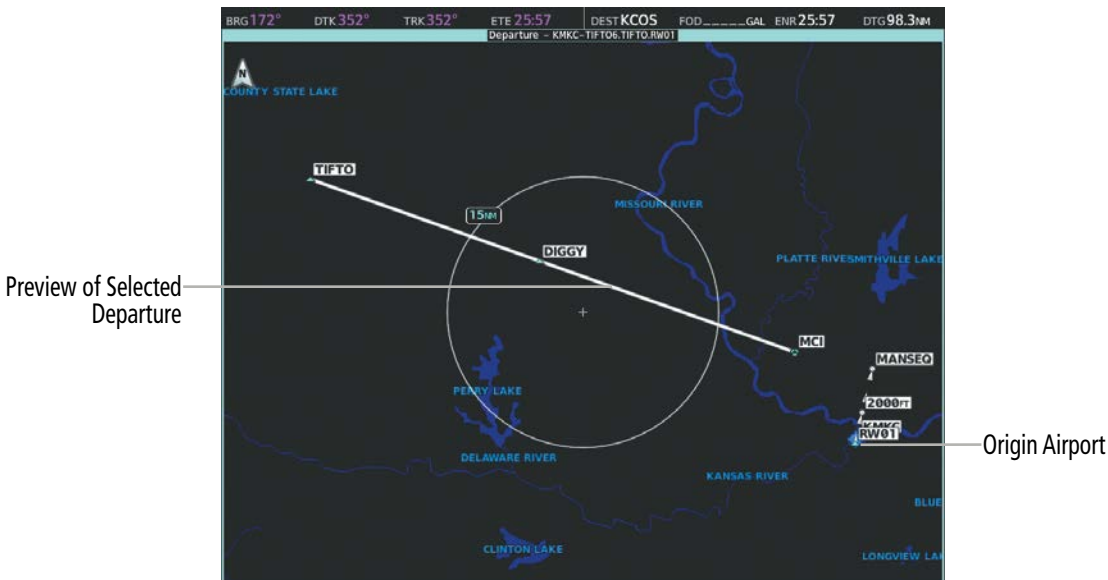


Figure 5-124 Departure - Preview of the Selected Departure

Loading a departure procedure into a stored flight plan:

- 1) From MFD Home, touch **Flight Plan > Flight Plan Options > Flight Plan Catalog** to display the 'Flight Plan Catalog' Screen.
- 2) Touch a flight plan selection button to display the 'Catalog Options' Screen.
- 3) Touch the **Edit** Button to display the 'Edit Stored Flight Plan' Screen.
- 4) Touch the **Flight Plan Options** Button to display the 'Flight Plan Options' Screen.
- 5) Touch the **Load Departure** Button to display the 'Departure Selection' Screen.
- 6) Touch the **Departure** Button to display the 'Select Departure' Screen with a list of available departures.
- 7) Scroll the list as needed and touch a departure selection button. The 'Select Transition' Screen is opened.
- 8) Scroll the list as needed and touch a transition selection button to select the transition. The 'Select Runway' Screen is opened.
- 9) Scroll the list if needed and touch a runway selection button to select the runway and return to the 'Departure Selection' Screen.
- 10) Touch the **Preview** Button, then the **Show on Map** Button to show the preview of the arrival on the navigation map or touch the **Show Chart** Button to show the arrival chart instead of the navigation map.
- 11) Touch the **Load** Button to insert the arrival into the stored flight plan.



Figure 5-125 Loading a Procedure into a Stored Flight Plan - 'Flight Plan Options' Window

REMOVING A DEPARTURE FROM THE ACTIVE/STANDBY FLIGHT PLAN

Some waypoints in the final approach segment (such as the FAF or MAP) can not be deleted individually. Attempting to delete a waypoint that is not allowed results in a window displaying 'Invalid flight plan modification.'



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

When plans change while flying IFR, departures can be easily removed from the flight plan.

Removing a departure from the active/standby flight plan using the Touchscreen Controller:

- 1) For the active flight plan: From MFD Home, touch **PROC**.
Or:
 For the standby flight plan: From MFD Home, touch **Flight Plan** > **PROC**.
- 2) Touch the **Departure** Button to display the 'Departure Selection' Screen.
- 3) Touch the **Remove** Button. A 'Remove Departure- <departure identifier> from flight plan?' Window is displayed.
- 4) Touch the **OK** Button. The departure is removed from the flight plan. To cancel the request, touch the **Cancel** Button.
Or:
- 1) For the active flight plan: From MFD Home, touch **Flight Plan**.
Or:
 For the standby flight plan: From MFD Home, touch **Flight Plan** > **Standby Flight Plan**.
- 2) Touch the Departure Header Button to display the 'Departure Options' Screen.
- 3) Touch the **Remove Departure** Button. A 'Remove Departure- <departure identifier> from flight plan?' Window is displayed.
- 4) Touch the **OK** Button. The departure is removed from the flight plan. To cancel the request, touch the **Cancel** Button.

ARRIVALS

A Standard Terminal Arrival (STAR) can be loaded at any airport that has one available. Only one arrival can be loaded at a time in a flight plan. If an arrival is loaded when another arrival is already in the 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

Loading an arrival into the active/standby flight plan using the Touchscreen Controller:

- 1) For the active flight plan: From MFD Home, touch **PROC**.
Or:
 For the standby flight plan: From MFD Home, touch **Flight Plan > Standby Flight Plan > PROC**.
- 2) Touch the **Arrival** Button to display the 'Arrival Selection' Screen.
- 3) If needed, touch the **Airport** Button to display the keypad and use it to select the destination airport.
- 4) Touch the **Enter** Button to accept the destination airport.
- 5) Touch the **Arrival** Button to display the 'Select Arrival' Screen with a list of available arrivals.
- 6) Scroll the list if needed and touch an arrival selection button to select the arrival. The 'Select Transition' Screen will open.
- 7) Scroll the list if needed and touch a transition selection button to select the transition. The 'Select Runway' Screen will open.
- 8) Scroll the list if needed and touch a runway selection button to select the runway and return to the 'Arrival Selection' Screen.
- 9) Touch the **Preview** Button, then the **Show on Map** Button to show the preview of the arrival on the navigation map or touch the **Show Chart** Button to show the arrival chart instead of the navigation map.
- 10) 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 you choose.

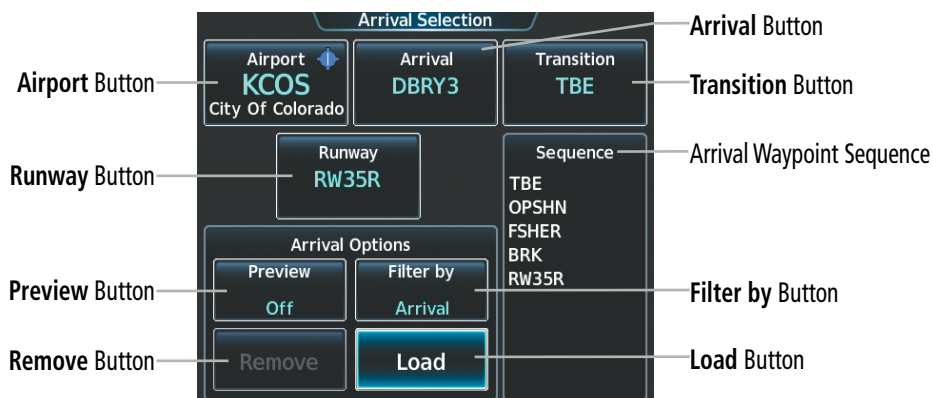


Figure 5-126 'Arrival Selection' Screen

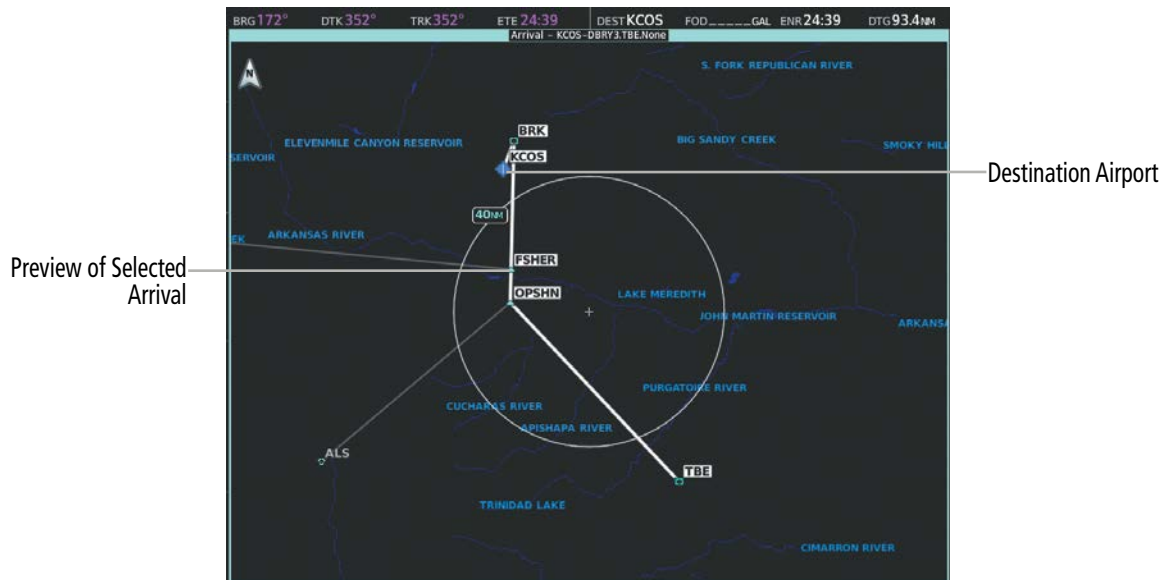


Figure 5-127 Arrival - Preview of the Selected Arrival

Loading an arrival procedure into a stored flight plan:

- 1) From MFD Home, touch **Flight Plan > Flight Plan Options > Flight Plan Catalog** to display the 'Flight Plan Catalog' Screen.
- 2) Touch a flight plan selection button to display the 'Catalog Options' Screen.
- 3) Touch the **Edit** Button to display the 'Edit Stored Flight Plan' Screen.
- 4) Touch the **Flight Plan Options** Button to display the 'Flight Plan Options' Screen.
- 5) Touch the **Load Arrival** Button to display the 'Arrival Selection' Screen.
- 6) Touch the **Arrival** Button to display the 'Select Arrival' Screen with a list of available arrivals.
- 7) Scroll the list as needed and touch an arrival selection button. The 'Select Transition' Screen is opened.
- 8) Scroll the list as needed and touch a transition selection button to select the transition. The 'Select Runway' Screen is opened.
- 9) Scroll the list if needed and touch a runway selection button to select the runway and return to the 'Arrival Selection' Screen.
- 10) Touch the **Preview** Button, then the **Show on Map** Button to show the preview of the arrival on the navigation map or touch the **Show Chart** Button to show the arrival chart instead of the navigation map.
- 11) Touch the **Load** Button to insert the arrival into the stored flight plan.

REMOVING AN ARRIVAL FROM THE ACTIVE/STANDBY FLIGHT PLAN

When plans change while flying IFR, arrivals can be easily removed from the flight plan.

Removing an arrival from the active/standby flight plan using the Touchscreen Controller:

- 1) For the active flight plan: From MFD Home, touch **PROC**.

Or:

For the standby flight plan: From MFD Home, touch **Flight Plan > Standby Flight Plan > PROC**.

- 2) Touch the **Arrival** Button to display the 'Arrival Selection' Screen.
- 3) Touch the **Remove** Button. A 'Remove Arrival - <arrival> from flight plan?' Window is displayed.
- 4) Touch the **OK** Button. The arrival is removed from the flight plan. To cancel the request, touch the **Cancel** Button.

Or:

- 1) For the active flight plan: From MFD Home, touch **Flight Plan**.

Or:

For the standby flight plan: From MFD Home, touch **Flight Plan > Standby Flight Plan**.

- 2) Touch the Arrival Header Button to display the 'Arrival Options' Screen.
- 3) Touch the **Remove Arrival** Button. A 'Remove Arrival- <arrival> from flight plan?' Window is displayed.
- 4) Touch the **OK** Button. The arrival is removed from the flight plan. To cancel the request, touch the **Cancel** Button.

APPROACHES

INSTRUMENT APPROACH



NOTE: *If certain GPS parameters (SBAS, RAIM, etc.) are not available, some published approach procedures for the desired airport may not be displayed in the list of available approaches.*

An Approach Procedure can be loaded at any airport that has one available, and provides guidance for non-precision and precision approaches to airports with published instrument approach procedures. Only one approach can be loaded at a time in a flight plan. If an approach is loaded when another approach is already in the active flight plan, the new approach replaces the previous approach. The route is defined by selection of an approach and the transition waypoints.

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

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

When selecting an approach, a “GPS” designation to the right of the procedure name indicates the procedure can be flown using the GPS receiver. Some procedures do not have this designation, meaning the GPS receiver can be used for supplemental navigation guidance only. If the GPS receiver cannot be used for primary guidance, the appropriate navigation receiver must be used for the selected approach. The final course segment of ILS approaches, for example, must be flown by tuning the NAV receiver to the proper frequency and selecting that NAV receiver on the CDI. For information on changing the navigation source of the CDI, and for information on the display of vertical deviation on the PFD, see the Flight Instruments Section. See the Audio Panel & CNS Section for information on selecting and tuning a NAV receiver.

When ‘GPS’ is indicated in the charted approach title, the approach is approved for GPS navigation. For published approach titles including an 'or' between 'GPS' and a NAVAID (i.e. "NDB or GPS RWY 19R"), only one listed navigation source is necessary to fly the approach. If GPS is utilized as the source, it is not necessary to tune, monitor, or utilize the NAVAID source associated with the approach. These approaches are referred to as Overlay Approaches, and they are indicated in the system by the presence of ‘GPS’ after the NDB, VOR or VOR/DME prefix in the list of available approaches.

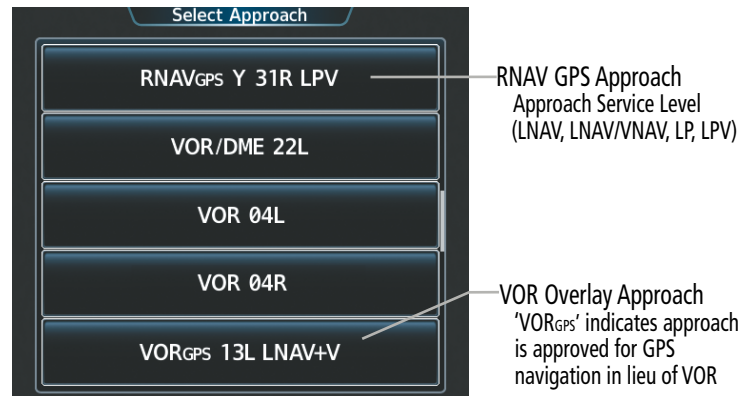


Figure 5-128 Example of Available Approaches with GPS Guidance

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

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

Table 5-16 Approach Service Levels



NOTE: The system requires 30 seconds of valid SBAS integrity monitoring prior to selecting an approach that requires SBAS vertical guidance.

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)
LNAV/VNAV	GPS	GPS* or Baro VNAV**
LP	GPS*	N/A
LP+V	GPS*	GPS* (advisory only)
LPV	GPS*	GPS* or Baro VNAV**

*SBAS required

**See Approach Downgrade Behavior Table

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

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 downgrade behavior:



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

Approach with SBAS	SBAS Becomes Unavailable	Description	System Message Generated	Action Required	Approach Downgrade
LNAV	Approach phase not specified	SBAS not required.	None	None*	N/A
LNAV+V		The approach is continued.			
LNAV/VNAV	Prior to the FAF	HSI displays 'L/VNAV' in amber VDI displays 'NO GP'	APR ADVISORY - SBAS VNAV not available. Using Baro VNAV.	Acknowledge message to display Baro VNAV Glidepath	N/A
	At/after the FAF	HSI displays 'LNAV' in magenta VDI displays 'No GP'	None	None	LNAV**
LP	More than 1 min. prior to the FAF	HSI displays 'LP' in amber	None	None	N/A
	Within 1 min. prior to the FAF	HSI displays 'LNAV' in magenta CDI is removed	APR DWNGRADE - Approach downgraded. Use LNAV minimums.	Acknowledge message to redisplay CDI with LNAV	LNAV**
	At/after the FAF	CDI is removed	ABORT APR - Loss of GPS navigation. Abort approach.	Abort	N/A
LP+V	More than 1 min. prior to the FAF	HSI displays 'LP+V' in amber VDI displays 'No GP'	None	None	N/A
	Within 1 min. prior to the FAF	HSI displays 'LNAV' in magenta CDI is removed VDI displays 'No GP'	APR DWNGRADE - Approach downgraded. Use LNAV minimums.	Acknowledge message to redisplay CDI with LNAV	LNAV**
	At/after the FAF	CDI is removed VDI displays 'No GP'	ABORT APR - Loss of GPS navigation. Abort approach.	Abort	N/A
LPV	More than 1 min. prior to the FAF	HSI displays 'LPV' in amber	None	None	N/A
	Within 1 min. prior to the FAF	HSI displays 'L/VNAV' in magenta VDI displays 'NO GP'	APR DWNGRADE - Use LNAV/VNAV minimums.	Acknowledge message to display Baro VNAV Glidepath	LNAV/VNAV
	At/after the FAF	HSI displays 'LNAV' in magenta VDI displays 'NO GP'	None	None	LNAV**

*If total loss of GPS occurs, abort.

**If there is no LNAV minimums available for the approach, abort.

Table 5-18 Approach Downgrade Behavior

VISUAL APPROACH

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

Each visual approach will have two transitions, the straight in transition (STRAIGHT) and the Vectors-to-Final transition (VECTORS). The visual approach waypoints (fixes) consist of the initial fix (STRGHT), the final approach fix (FINAL), and the missed approach point (RWxx). A 3 degree glide path is calculated from the missed approach point up to each waypoint along the extended straight-in path.



Figure 5-129 Loading a Visual Approach on the Touchscreen Controller



NOTE: When flying Direct-To the visual Final Approach Fix (FINAL), 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 FAF will be provided.

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

For some airports, a Charted Visual Flight Procedure (CVFP) may be defined in the chart database. CVFPs do follow a precise prescribed path and are classified as Instrument Approach Procedures. CVFPs may be selected for Preview Only and are not available for navigation guidance.

LOADING AN APPROACH INTO THE FLIGHT PLAN

For approaches that can be loaded into the flight plan, the choice to either “Load” and/or “Load & Activate” is given. “Load & Activate” is only available for the active flight plan and is the only choice available if the active flight plan is completely empty. “Loading” adds the approach to the end of the flight plan without immediately using it for navigation guidance. This allows continued navigation via the intermediate waypoints in the original flight plan, but keeps the procedure available for quick activation when needed. “Activating” also adds the procedure to the end of the flight plan but immediately begins to provide guidance to the first waypoint in the approach.

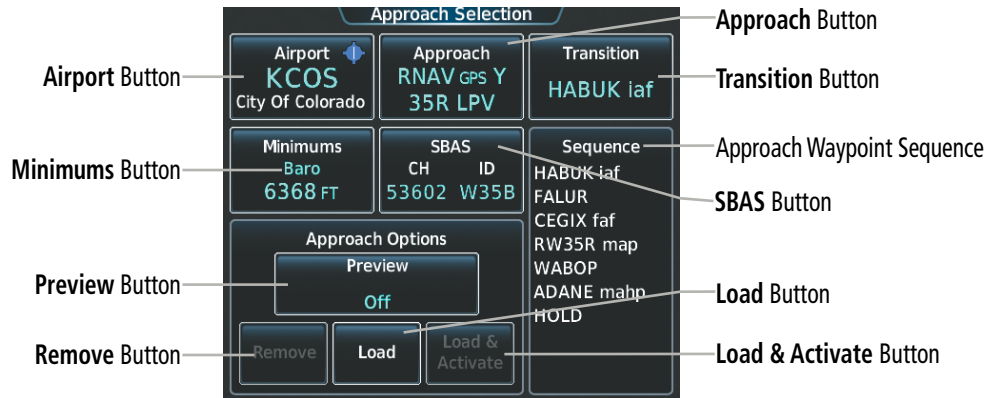


Figure 5-130 Approach Selection - Example



Figure 5-131 Approach - Preview of the Selected Approach

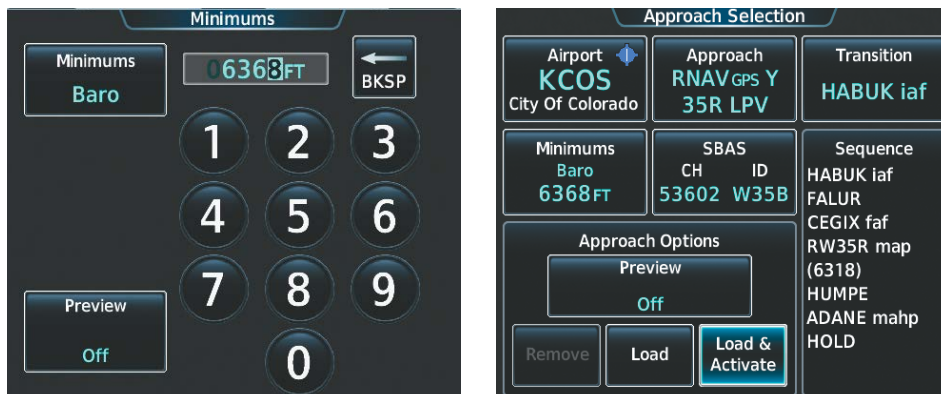


Figure 5-132 Loading an Approach - Setting Minimums

Loading an approach into the active/standby flight plan using the Touchscreen Controller:

- 1) For the active flight plan: From MFD Home, touch **PROC**.
Or:
For the standby flight plan: From MFD Home, touch **Flight Plan > Standby Flight Plan > PROC**.
- 2) Touch the **Approach** Button to display the 'Approach Selection' Screen.
- 3) 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.
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.
- 4) If needed, touch the **Transition** Button to display the 'Select Transition' Screen with a list of available transitions. Normally, this screen will automatically appear with transition options.
- 5) Scroll the list if needed and touch a transition selection button to select the transition.
- 6) To set the minimums, touch the **Minimums** Button to display the 'Minimums' Screen. If the minimums were Off, then Baro is automatically selected.
 - a) If Baro is desired, touch the **Minimums** Button to display the 'Minimums Source' Screen.
 - 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 a radar altitude minimum is desired, touch the **Minimums** Button to display the 'Minimums Source' Screen.
 - b) Touch the **Radio Alt** Button to select radar altitude minimums and return to the 'Minimums' Screen.

- c) Use the keypad to select the minimums altitude.
- d) Touch the **Enter** Button to accept the radar altitude minimums and return to the 'Approach Selection' Screen.
Or:
 - a) If temperature compensated minimum is desired, touch the **Minimums** Button to display the 'Minimums Source' Screen.
 - b) Touch the **Temp Comp** Button to select temperature compensated minimums and return to the 'Minimums' Screen.
 - c) Touch the **Temp at Dest** Button to display the numeric keypad.
 - d) Use the keypad to select the temperature.
 - e) Touch the **Enter** Button to accept the destination temperature and return to the 'Minimums' Screen.
 - f) Use the keypad to select the minimums altitude.
 - g) Touch the **Enter** Button to accept the temperature compensated minimums and return to the 'Approach Selection' Screen.
- 7) Touch the **Preview** Button, then the **Show on Map** Button to show the preview of the approach on the navigation map or touch the **Show Chart** Button to show the approach chart instead of the navigation map.
- 8) Touch the **Load** Button to insert the approach into the flight plan.
If a visual approach was selected, the message 'Obstacle clearance is not provided for visual approaches' is 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.



NOTE: When GPS is not approved for the selected final approach course, the FMS provides guidance to the approach, but the HSI must to be switched to a NAV receiver to fly the final course of the approach, either manually or automatically. Refer to the Flight Instruments section for details on CDI switching.

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 MFD Home, touch **Flight Plan > Flight Plan Options**.
- 2) Touch the **Flight Plan Catalog** Button to display the 'Flight Plan Catalog' Screen.
- 3) Touch a flight plan selection 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' Screen.
- 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 a 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.

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) Touch the **Preview** Button, then the **Show on Map** Button to show the preview of the approach on the navigation map or touch the **Show Chart** Button to show the approach chart instead of the navigation map.
- 9) Touch the **Load** Button to insert the approach into the stored flight plan.



NOTE: The **SBAS** Button may change to an approach **Primary Frequency** Button for NAVAID-based approaches. For more information, see the Audio & CNS Section.



Figure 5-133 Edit Stored Flight Plan - Approach Inserted

ACTIVATING AN APPROACH

“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 using the Touchscreen Controller:

- 1) From MFD Home, touch **PROC**.
- 2) Touch the **Activate Approach** Button to activate the approach.

Or:

- 1) From MFD 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.

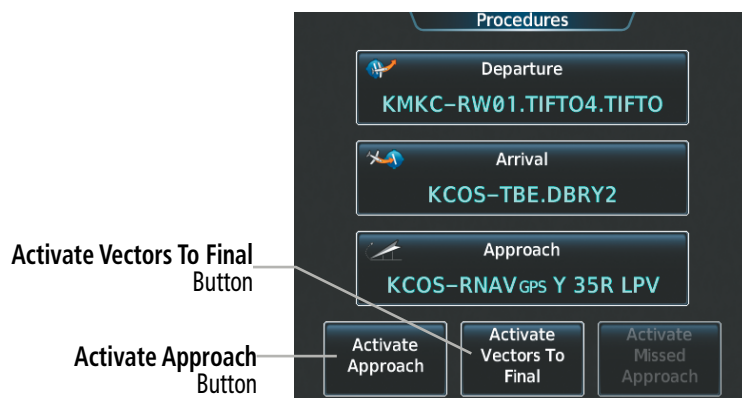


Figure 5-134 Activating an Approach on the Touchscreen Controller

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 using the Touchscreen Controller:

- 1) From MFD Home, touch **PROC**.
- 2) Touch the **Activate Vectors To Final** Button to activate vectors to final.

Or:

- 1) From MFD 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 FROM THE ACTIVE/STANDBY FLIGHT PLAN

When plans change while flying IFR, approaches can be easily removed from the flight plan.

Removing an approach from the active/standby flight plan using the Touchscreen Controller:

- 1) For the active flight plan: From MFD Home, touch **PROC**.

Or:

For the standby flight plan: From MFD 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 MFD Home, touch **Flight Plan**.

Or:

For the standby flight plan: From MFD 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.

MISSED APPROACH

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

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

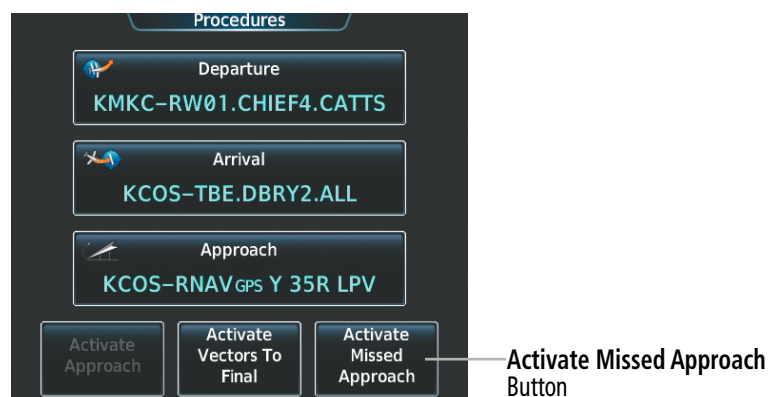


Figure 5-135 Activating a Missed Approach on the Touchscreen Controller

In the missed approach procedure shown in the following figure, the altitude immediately following the MAP is not part of the published procedure. It is simply a Course to Altitude (CA) leg which guides the aircraft along the runway centerline until the required altitude required to safely make the first turn toward the MAHP is exceeded. In this case, 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 5-136 Course to Altitude

In some missed approach procedures this Course to Altitude leg may be part of the published procedure. For example, the procedure dictates a climb to 5,500 feet, then turn left and proceed to the Missed Approach Hold Point (MAHP). In this case, the altitude would be appear in the list of waypoints as "(5500)". Again, if the aircraft altitude is lower than the prescribed altitude after crossing the MAP, a direct-to is established on a Course to Altitude leg when the missed approach procedure is activated.

Activating a missed approach in the active flight plan:

Press the TO/GA 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 press the **SUSP** Softkey on PFD Home.

Or:

- 1) From MFD Home, touch **PROC**.
- 2) Touch the **Activate Missed Approach** Button to activate the missed approach (only on RNAV approaches). The system begins automatic sequencing through the missed approach waypoints to the MAHP.

Or:

- 1) From MFD Home, touch **Flight Plan**.
- 2) Touch the **Approach Header** Button to display the 'Approach Options' Screen.
- 3) Touch the **Activate Missed Approach** Button to activate the missed approach (only on RNAV approaches). The system begins automatic sequencing through the missed approach waypoints to the MAHP.

TEMPERATURE COMPENSATED ALTITUDE

If desired, the system can compensate the loaded approach altitudes based on a manual temperature input at the destination. For example, if the pilot enters a destination temperature of -40°C , the system increases the approach altitudes accordingly, and the snowflake icon (❄) is displayed next to those altitudes.

Manually inputting the temperature for compensation is explained in the following procedures. However, the system already automatically accounts for temperatures warmer and colder than ISA by adjusting the lateral position of the FAF altitude constraint. Once the flight plan waypoint prior to the FAF becomes the active VNAV waypoint (or the FAF becomes the active VNAV waypoint in the case the previous waypoint does not contain a valid altitude constraint), a lateral offset distance is calculated for the FAF altitude constraint. Once calculated, the VNAV function seamlessly applies the offset such that a smooth vertical transition onto the approach descent path occurs.

NOTE: Manually specifying temperature compensation for an approach will disrupt the system from automatically creating a lateral offset of the VNAV function in use.

NOTE: Manually specifying an FPA at the FAF will disrupt the system VNAV function from automatically creating a lateral offset. Thus, temperature is not compensated for and the approach path may not intersect the approach descent path.

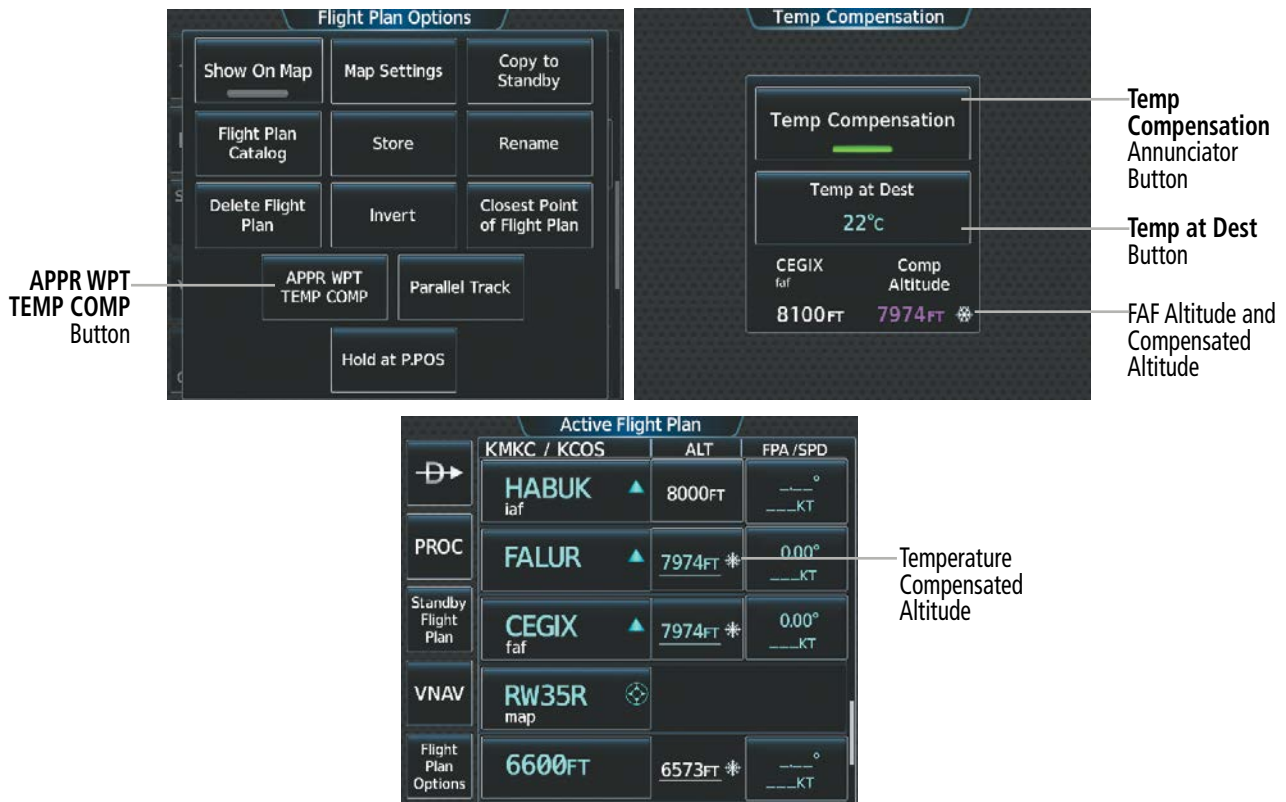


Figure 5-137 Temperature Compensation for Approach Waypoints



NOTE: Enabling/disabling temperature compensation for the loaded approach altitudes does not enable/disable temperature compensated minimums (MDA/DH), nor does enabling/disabling temperature compensated minimums enable/disable temperature compensated approach altitudes.



NOTE: The temperature at the destination can be entered on the 'Temp Compensation' Screen or the 'Minimums' Screen on the Touchscreen Controller. There is only one compensation temperature for the system, therefore, changing the temperature will affect both the loaded approach altitudes and the minimums. Refer to the Flight Instruments Section for information about applying temperature compensation to the MDA/DH.

Manually enabling/disabling temperature compensated waypoint altitude:

1) For the active flight plan: From MFD Home, touch **Flight Plan** > **Flight Plan Options**.

Or:

For the standby flight plan: From MFD Home, touch **Flight Plan** > **Standby 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) Once temperature compensation is enabled, touch the **Temp at Dest** Button. Use the keypad and the **Enter** Button to select the temperature at the <airport>.

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

Entering a temperature compensated minimum into an approach using the Touchscreen Controller:

1) From MFD Home, touch **PROC** > **Approach** to display the 'Approach Selection' Screen.

Or:

a) From MFD 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 to select temperature compensated minimums and return to the 'Minimums' Screen.

5) Touch the **Temp at Dest** Button to display the numeric keypad.

6) Use the keypad to select the temperature.

7) Touch the **Enter** Button to accept the destination temperature and return to the 'Minimums' Screen.

8) If not already entered, use the keypad to select the minimums altitude.

9) Touch the **Enter** Button to return to the 'Approach Selection' Screen.

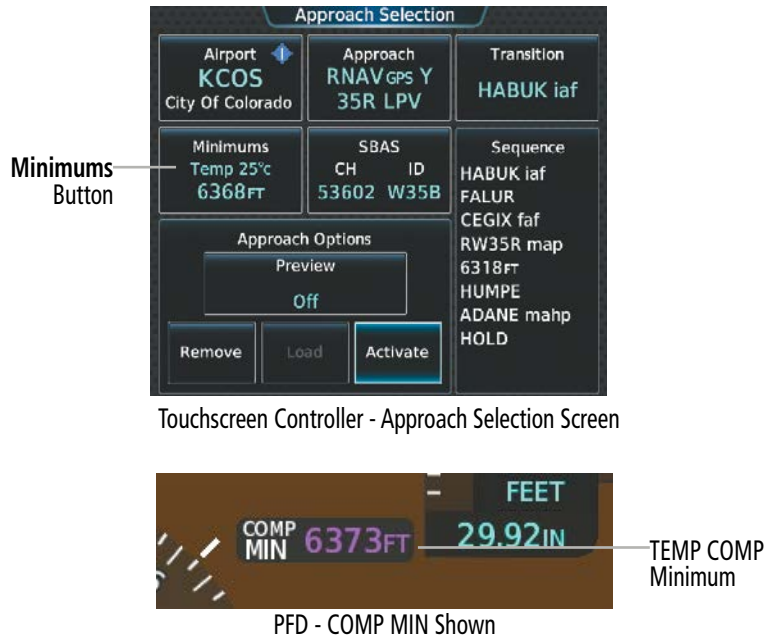


Figure 5-138 Entering Temp Comp Minimums - PFD

When pilot input for approach waypoint temperature compensation is not used, the system will utilize the VNAV function in use to offset the lateral position of the baro-VNAV bottom of descent (calculated by the Transition to Approach feature). Once calculated, the VNAV function seamlessly applies the lateral adjustment to the baro-VNAV descent path so that a smooth transition onto the approach vertical path occurs. For example, on a day with temperatures warmer than ISA, the baro-VNAV path will typically be above the actual approach descent path. The system will automatically adjust for this by calculating a lateral distance prior to the FAF which is applied to ensure the baro-VNAV path intersects the approach descent path.

NOTE: Manually specifying an FPA at the FAF will disrupt the VNAV function from creating a lateral offset. Thus, temperature is not compensated for and the baro-VNAV path may not intersect the approach descent path.

PREVIEW ONLY PROCEDURES

Certain procedures that are provided by the charts database but are not supported for navigation guidance by the system may be listed on the 'Select <Procedure>' Screen. These procedures are selectable for Preview Only.

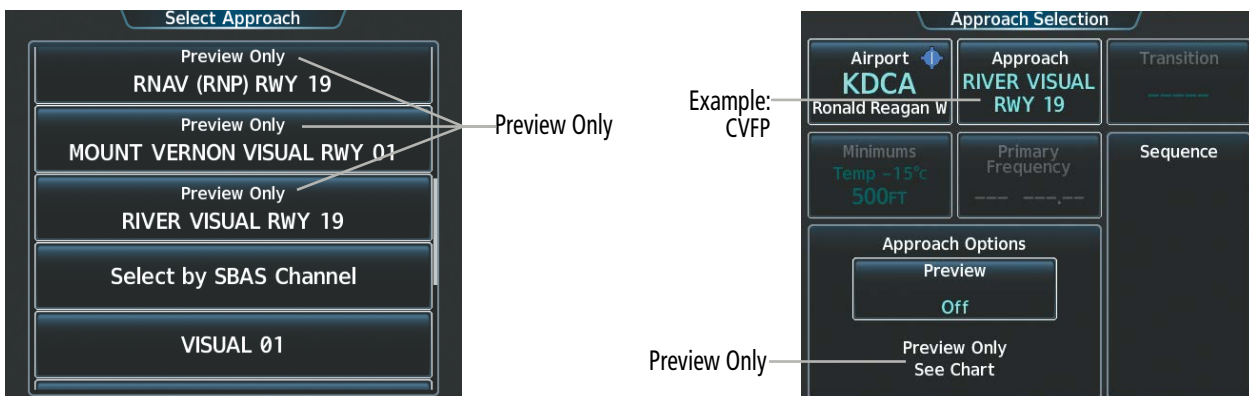


Figure 5-139 Procedure Selection - Preview Only (Approach example)

5.9 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.

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. To access the 'Trip Planning' Screen, start at Home, touch **Utilities**, then **Trip Planning**.

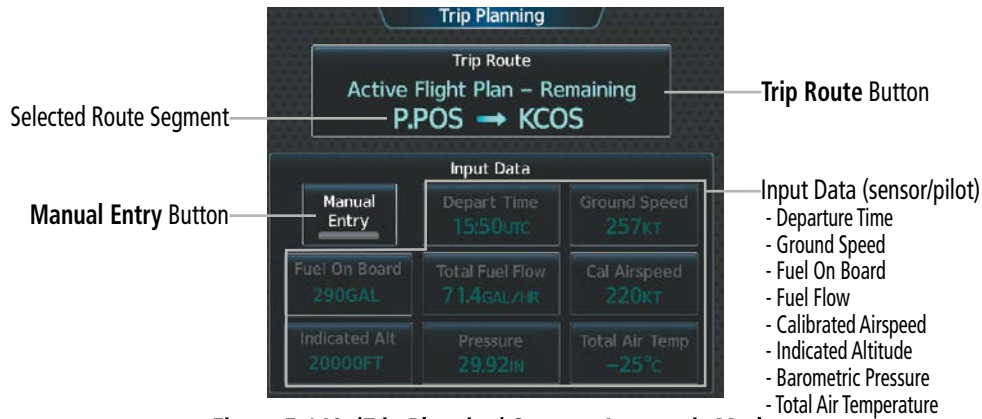


Figure 5-140 'Trip Planning' Screen - Automatic Mode

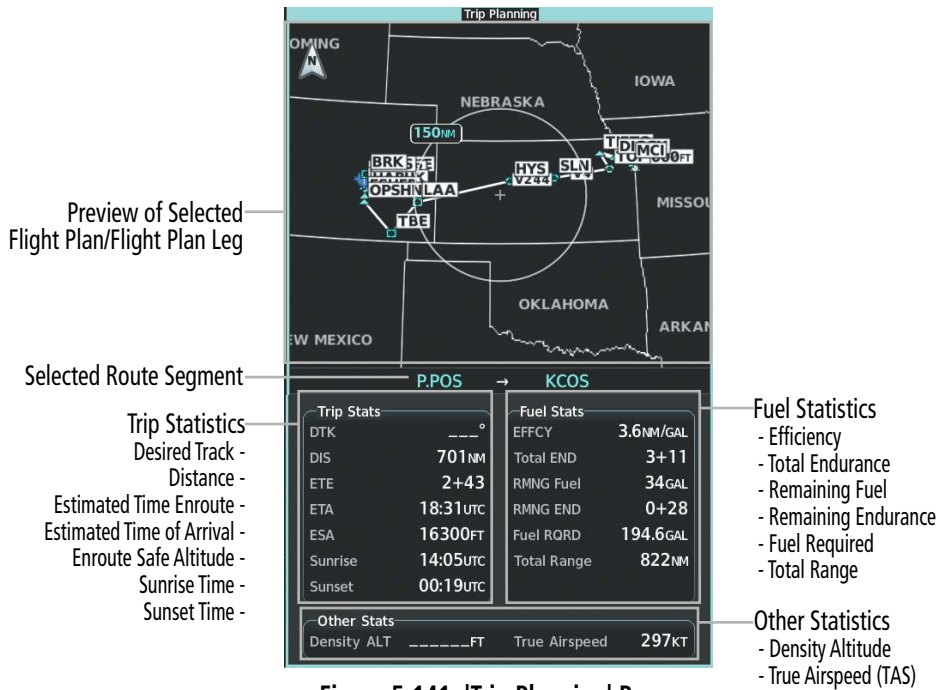


Figure 5-141 'Trip Planning' Pane

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. If the time is denoted as LCL, then the time is shown based on the time zone of the aircraft present position
- 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 aircraft present position, and the 'to' waypoint is the endpoint of the active flight plan.
Active Flight Plan - Leg Mode		The 'from' waypoint is the aircraft present position or a selected waypoint, and the 'to' waypoint is the endpoint of the selected leg. In automatic mode, the 'from' waypoint is always present position.
Waypoint Mode		Manually selected waypoints (if there is an active flight plan, these default to the endpoints of the active leg).

Table 5-19 Trip Route Buttons

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. If the time is denoted as LCL, then the time is shown based on the time zone of 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) - The ESA is shown as nnnnnFT
- Destination sunrise and sunset times (SUNRISE, SUNSET) - These times are shown as hours:minutes. If the time is denoted as LCL, then the time is shown based on the time zone of the aircraft present position.

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 (True Airspeed)

Selecting the Stored Flight Plan - Cumulative trip route mode:

- 1) From MFD 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 MFD 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 MFD 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 MFD 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 (P. POS → Waypoint or Waypoint → Waypoint) to select the mode and return to the 'Trip Planning' Screen.

Selecting the waypoints trip route mode:

- 1) From MFD 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) Select the starting waypoint:
 - 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 MFD 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. Repeat steps 3 and 4 for each of the data fields.

5.10 WEIGHT AND BALANCE PLANNING

The system includes a weight and balance planning function. The weight and balance planning function allows the pilot to enter aircraft weight, operating weight, aircraft loading, and fuel data, which is used with the active flight plan to estimate takeoff and landing weights, landing fuel, and excess fuel. 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 to landing for a given flight plan, plus the remaining fuel burn. The takeoff CG icon is represented as a triangle, current CG as a diamond, landing CG as a square, 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.



NOTE: If Surface Watch is not configured, there will be no **PERF** Button. The **Weight and Balance** Button will be found under the **Utilities** Button. Utilities will replace **PERF** in all weight and balance procedures.



Figure 5-142 'Weight & Balance' Pane in Full Mode

Selecting the Weight and Balance Display Type:

- 1) From MFD Home, touch **PERF** > **Weight and Balance**.
- 2) Touch the **Display** Button to display the 'Select Display Type' Window.
- 3) Touch the button corresponding to the desired display type.
- 4) If necessary, press the **Full** Button to display a full sized display pane showing the Station vs. Weight graph, 'Aircraft Weight and Balance' Box, 'Estimated Weight' Box, and Aircraft Load configuration.

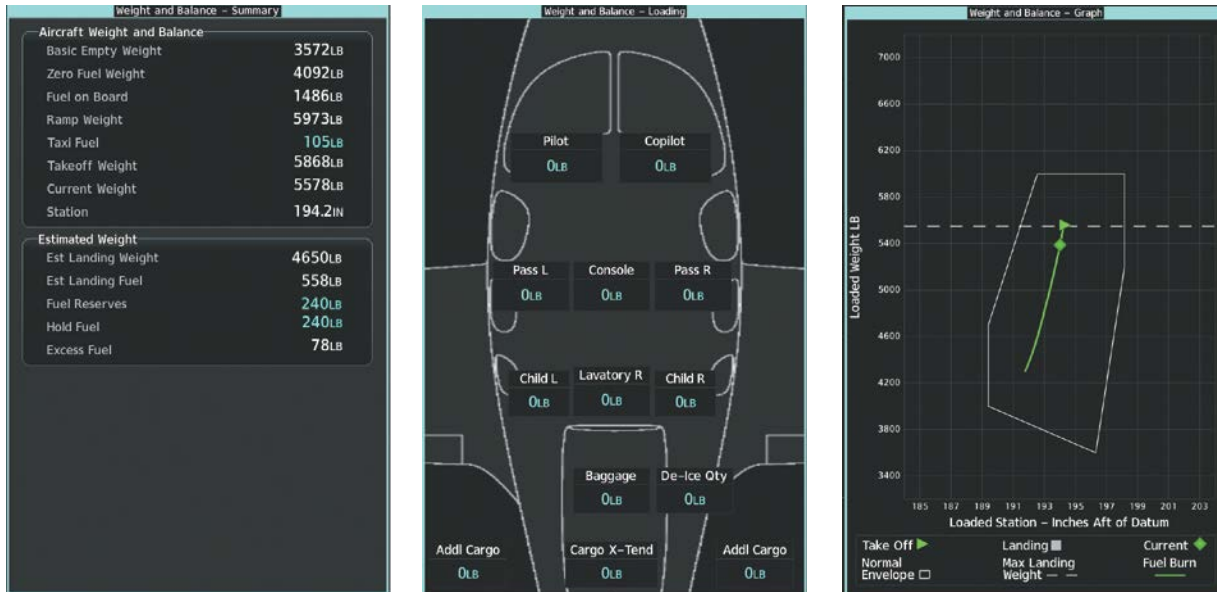


Figure 5-143 'Weight and Balance Pane' - Display Types in Half Mode

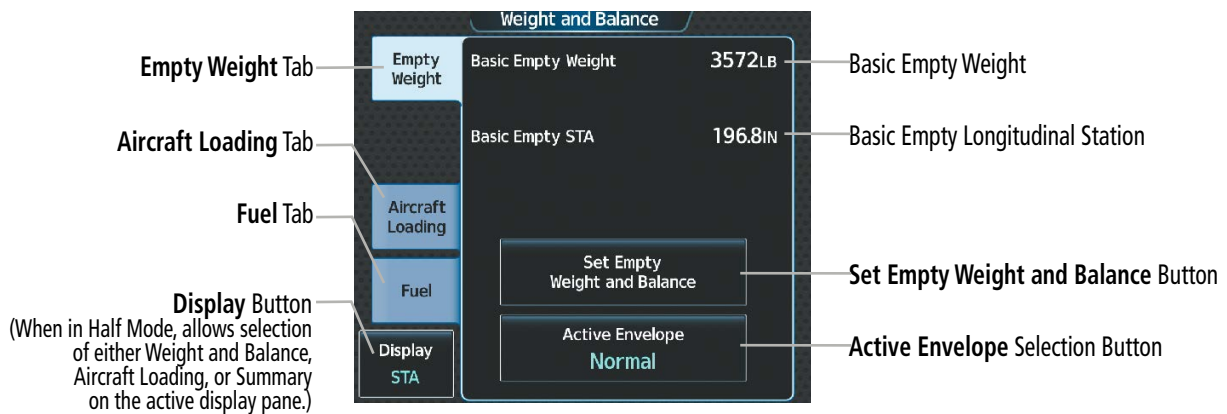


Figure 5-144 Weight and Balance - Empty Weight Tab

CALCULATIONS

The Weight and Balance Configuration item weights on the 'Weight and Balance Configuration' Screen are included in the zero fuel weight when their respective green annunciator is illuminated, but do not change the similar aircraft loading weights (entered on the Aircraft Loading Tab on the 'Weight and Balance' Screen, and shown on the Weight and Balance Display). The Weight and Balance Configuration items correspond to actual installed hardware (e.g. Seat, Cargo Bin, etc.) The aircraft loading entries indicate the crew, passengers, or baggage occupying those locations.

Weight calculations use 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 and items used by the crew.
- 'Zero Fuel Weight' = Operating Empty Weight + Aircraft Load (Passengers + Baggage)
- 'Fuel on Board' = Weight in pounds via the **FOB Sync** Button (current fuel remaining) or by manually entering the fuel on board via the **Fuel On Board** Button.
- 'Ramp Weight' = Zero fuel weight + Fuel on Board weight
- 'Taxi Fuel' = Ramp Weight - estimated fuel burned for start, taxi, and run-up (manually entered via the **Taxi Fuel** Button)
- 'Takeoff Weight' = Ramp Weight - Taxi Fuel weight
- 'Gross Weight' (Current Weight) = Zero Fuel Weight + Fuel on Board (synchronized with fuel burn throughout flight).
- 'Est Landing Weight' = Zero Fuel Weight + Estimated Landing Fuel weight
- 'Est Landing Fuel' weight = Fuel on Board weight - (fuel flow x ETE)
- 'Excess Fuel' weight = Estimated Landing Fuel Weight - Fuel Reserves weight

If the aircraft is on the ground or a destination waypoint has not been entered, the following fields display invalid values consisting of four dashes:

- 'Est Landing Weight'
- 'Est Landing Fuel'
- 'Excess Fuel'

CONFIGURATION

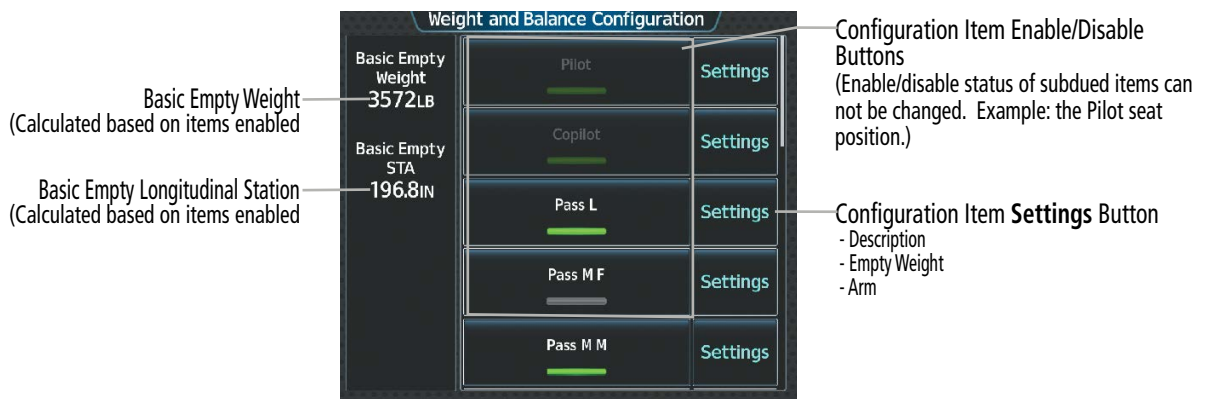


Figure 5-145 Weight and Balance Configuration

The Basic Empty Weight is calculated by summing the weights of all enabled items. The Basic Empty STA is calculated by applying the weights and moment arms of all enabled items. A subdued enable/disable button indicates an item that cannot be enabled or disabled.

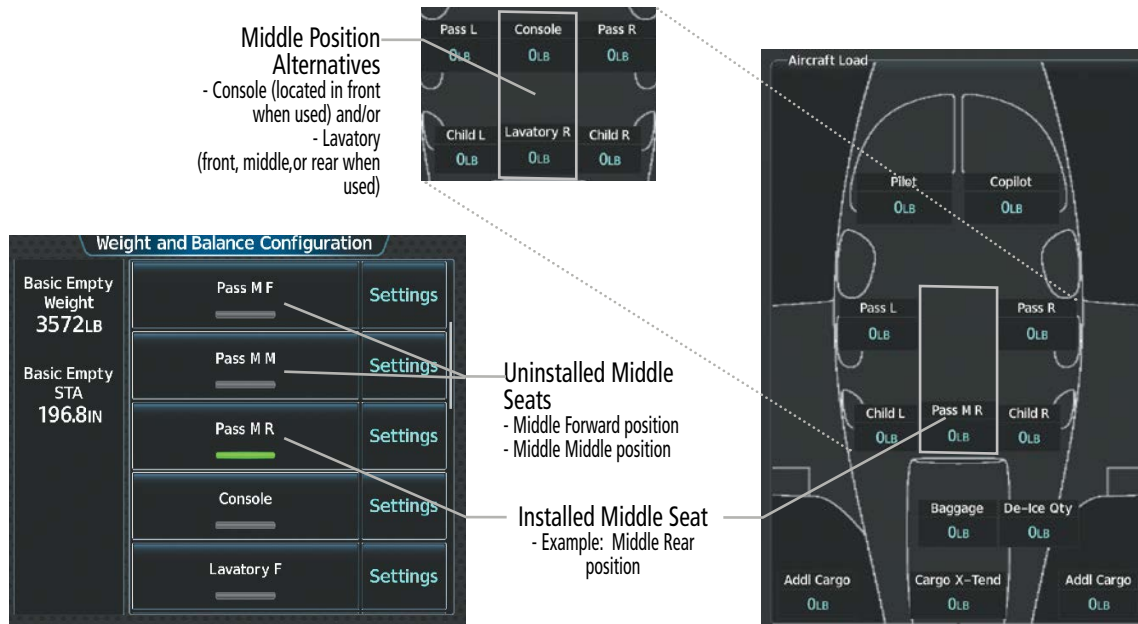


Figure 5-146 Configurations for Middle Stations (Seat, Console, Lavatory)

Up to five passenger seats, lavatory, and console can be configured. The passenger middle seat can be placed in either the forward, middle or rear position (labelled 'Pass M F', 'Pass M M', and 'Pass M R' respectively on the 'Aircraft Load' Pane or Box) as shown in the preceding figure. If the seat is configured, the console and lavatory cannot also be configured. When configured, the console can only be placed in the middle-forward center seat position. Also, if the lavatory is configured, it can be placed in any of the three middle seat positions ('Lavatory F', 'Lavatory M', and 'Lavatory R'). Additionally, the console and lavatory can be installed at the same time.



NOTE: Only one middle seat can be installed at a time. The pilot must disable any seats not installed, or the weight and balance calculations will be inaccurate.

The two additional cargo items allow entry of a custom description and moment arm, but do not allow entry of an empty weight.

Modifying basic empty weight:

- 1) From MFD Home, touch **PERF > Weight and Balance**.
- 2) If necessary, touch the **Empty Weight** Tab. Touch the **Set Empty Weight and Balance** Button to display the 'Weight and Balance Configuration' Screen.
- 3) Touch a configuration item enable/disable button to enable/disable the item.
- 4) Touch a configuration item **Settings** Button to display the item settings screen.
- 5) Touch the **Empty Weight** Button to display the keypad.
- 6) Use the keypad to enter the item empty weight.
- 7) Touch the **Enter** Button to accept the entry, and return to the item settings screen.
- 8) Touch the **Back** Button to return to the 'Weight and Balance Configuration' Screen.
- 9) Repeat steps 3 - 8 as necessary.

LOAD AND FUEL

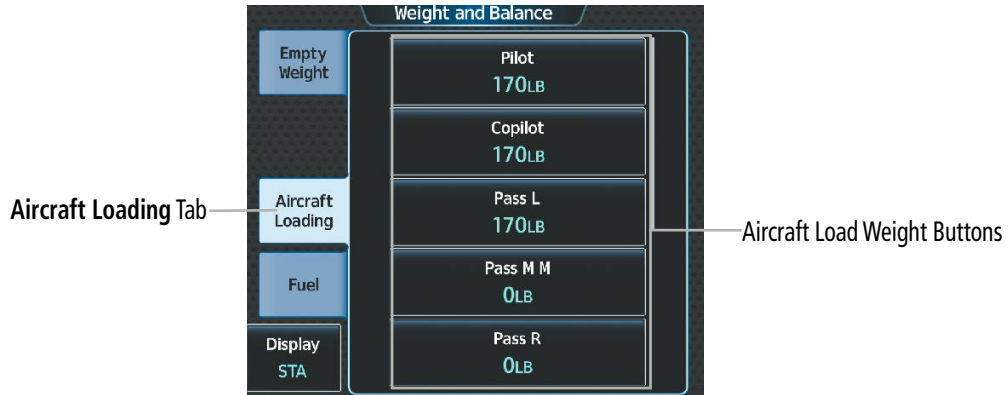


Figure 5-147 Weight and Balance - Aircraft Loading Tab

Entering the aircraft load weights:

- 1) From MFD 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.

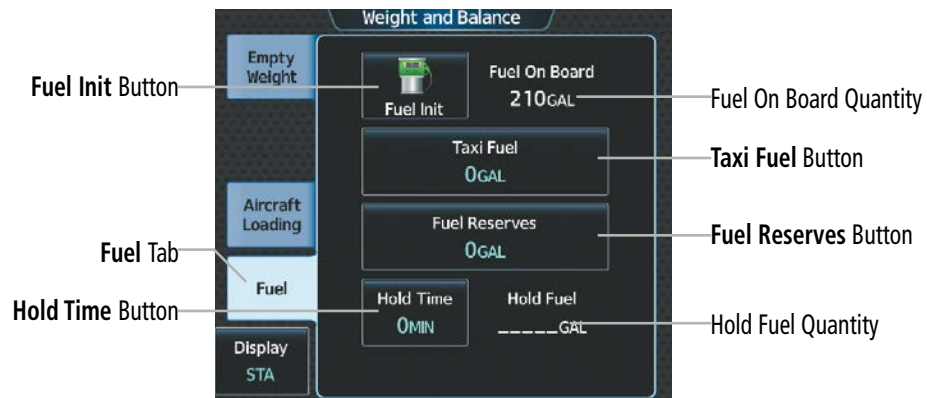


Figure 5-148 Weight and Balance - Fuel Tab

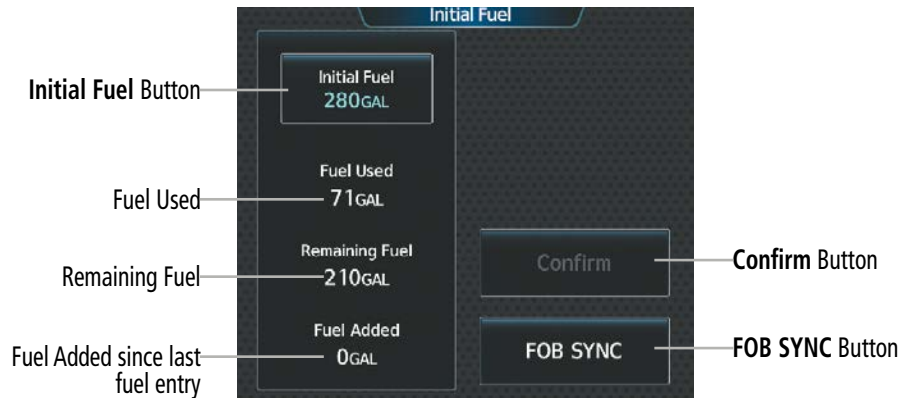


Figure 5-149 Initial Fuel

Entering the fuel on board quantity:

- 1) From MFD 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 MFD 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.

Both the fuel on board and current weight decrease as fuel is burned, providing the current value for each.

Entering taxi fuel quantity, fuel reserves quantity, and estimated holding time:

- 1) From MFD 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 keypad.
- 4) Use the keypad to enter the taxi fuel quantity.
- 5) Touch the **Enter** Button to accept the entry, and return to the 'Weight and Balance' Screen.
- 6) Touch the **Fuel Reserves** Button to display the keypad.
- 7) Use the keypad to enter the fuel reserves quantity.
- 8) Touch the **Enter** Button to accept the entry, and return to the 'Weight and Balance' Screen.
- 9) Touch the **Hold Time** Button to display the keypad.
- 10) Use the keypad to enter the estimated holding time.
- 11) Touch the **Enter** Button to accept the entry, and return to the 'Weight and Balance' Screen.

If the aircraft is on the ground or a destination waypoint has not been entered, Est. Landing Weight, Est. Landing Fuel, Hold Fuel Weight, and Excess Fuel display invalid values consisting of four dashes.

When the aircraft is in the air and a destination waypoint has been entered, the fuel calculations can be completed.

WEIGHT AND BALANCE CAUTION AND WARNING CONDITIONS

If the Zero Fuel Weight is greater than the maximum allowable zero fuel weight, then the zero fuel weight is displayed in amber.

If the Ramp Weight is greater than the maximum allowable takeoff weight, then the ramp weight is displayed in amber.

If the Estimated Landing Weight is greater than the maximum allowable landing weight, then the estimated landing fuel weight is displayed in amber.

If the Estimated Landing Fuel weight is positive, but less than or equal to the fuel reserves weight, the following values are displayed in amber:

- Est Landing Fuel weight
- Excess Fuel weight

If the Estimated Landing fuel weight is zero or negative, then the following values are displayed in red:

- Est Landing Fuel weight
- Excess Fuel weight

If the Station value is outside the specified envelope, then the value is displayed in amber.

5.11 TAKEOFF/LANDING DATA (WITH SURFACEWATCH)

The SurfaceWatch function allows the pilot to manually enter the airport, runway, and required takeoff/landing distances in order to increase situational awareness and avoid potential runway incursions and excursions.

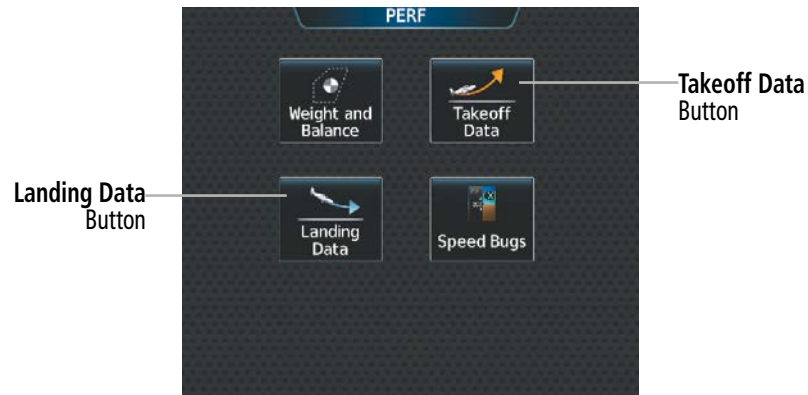


Figure 5-150 'PERF' Screen (only available if SurfaceWatch is installed)

TAKEOFF DATA

The 'Takeoff Data' Screen allows entry of the origin airport, origin runway, required takeoff distance, and takeoff run available. The origin airport and runway default to the active flight plan selections, if available.

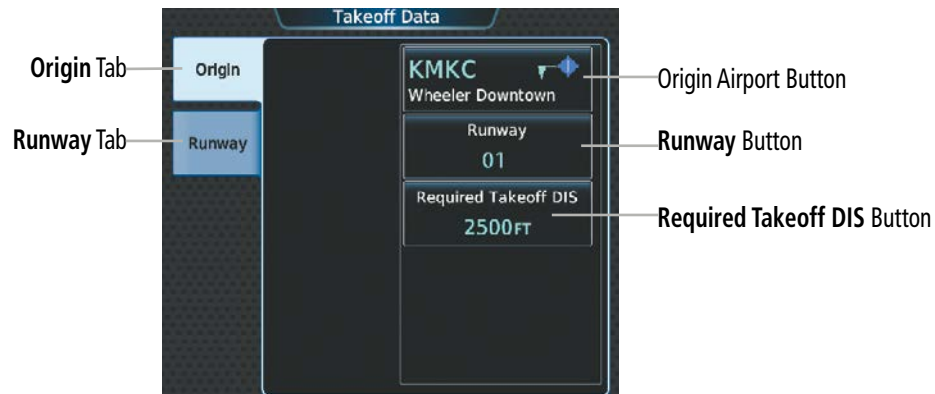


Figure 5-151 Takeoff Data - Origin Tab

Selecting an origin airport, runway, and required takeoff distance on the 'Takeoff Data' Screen:

- 1) From MFD Home, touch **PERF** > **Takeoff Data**.
- 2) Touch the **Origin** Tab, if necessary, to display the origin airport and runway data.
- 3) If adding or changing the origin airport is necessary, touch the origin airport button to display the keypad.
- 4) Use the keypad to enter the origin 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' Window.
- 7) Touch the desired runway selection button, and return to the 'Takeoff Data' Screen.

- 8) Touch the **Required Takeoff DIS** Button to display the keypad.
- 9) Use the keypad to enter the required takeoff distance.
- 10) Touch the **Enter** Button to accept the entry, and return to the 'Takeoff Data' Screen.

Origin runway information can be viewed on the **Runway** Tab.

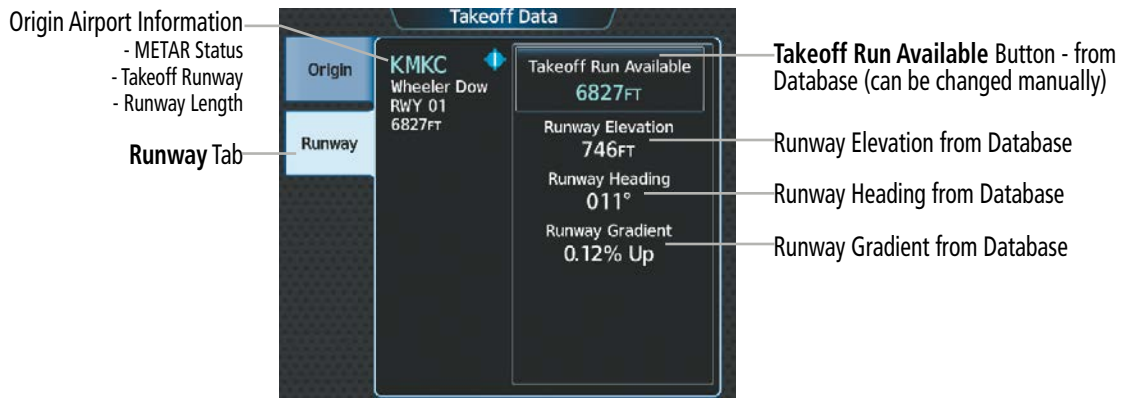


Figure 5-152 Takeoff Data - Runway Tab

The takeoff run available can be manually entered, or the database takeoff run available distance can be manually reduced specifically at the approach and/or departure end.



Figure 5-153 Takeoff Run Available - No Origin Runway Selected



Figure 5-154 Takeoff Run Available - Normal

Manually entering takeoff run available:

- 1) From MFD Home, touch **PERF > Takeoff Data**.
- 2) Touch the **Runway** Tab.
- 3) Touch the **Takeoff Run 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 reduced takeoff run available distance.
 - c) 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.

LANDING DATA

The 'Landing Data' Screen allows entry of the destination airport, destination runway, required landing distance, and landing distance available. The destination airport and runway default to the active flight plan selections, if available.

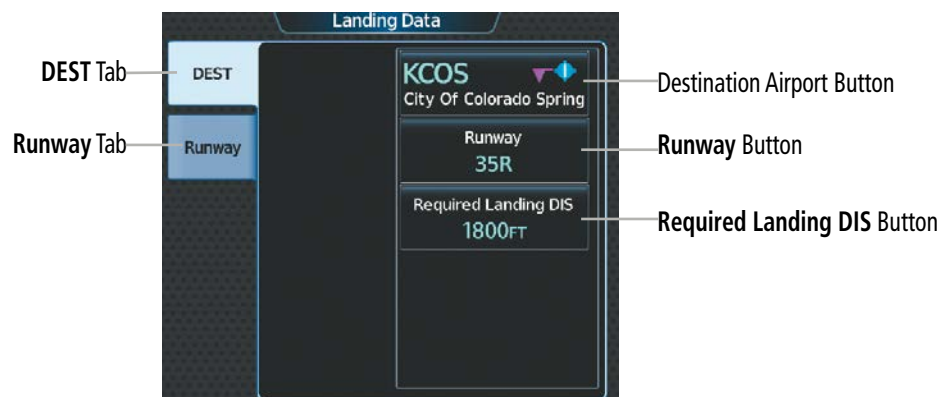


Figure 5-156 Landing Data - DEST Tab

Selecting a destination airport, runway, and required landing distance on the 'Landing Data' Screen:

- 1) From MFD Home, touch **PERF > Landing Data**.
- 2) Touch the **DEST** Tab, if necessary, to display the destination airport and runway data.
- 3) Touch the destination airport button to display the keypad.
- 4) Use the keypad to enter the origin airport.
- 5) Touch the **Enter** Button to accept the entry, and return to the 'Landing Data' Screen.
- 6) Touch the **Runway** Button to display the 'Select Runway' Window.
- 7) Touch the desired runway selection button, and return to the 'Landing Data' Screen.
- 8) Touch the **Required Landing DIS** Button to display the keypad.
- 9) Use the keypad to enter the required landing distance.
- 10) Touch the **Enter** Button to accept the entry, and return to the 'Landing Data' Screen.

Destination runway information can be viewed on the **Runway** Tab.

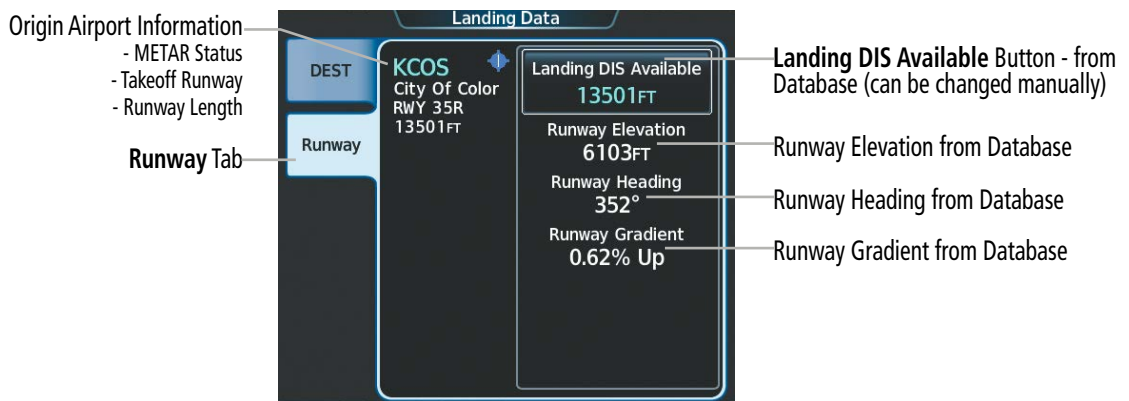


Figure 5-157 Landing Data - Runway Tab

The landing distance available can be manually entered, or the database landing distance available can be manually reduced specifically at the approach and/or departure end.



Figure 5-158 Landing Distance Available - No Destination Runway Selected

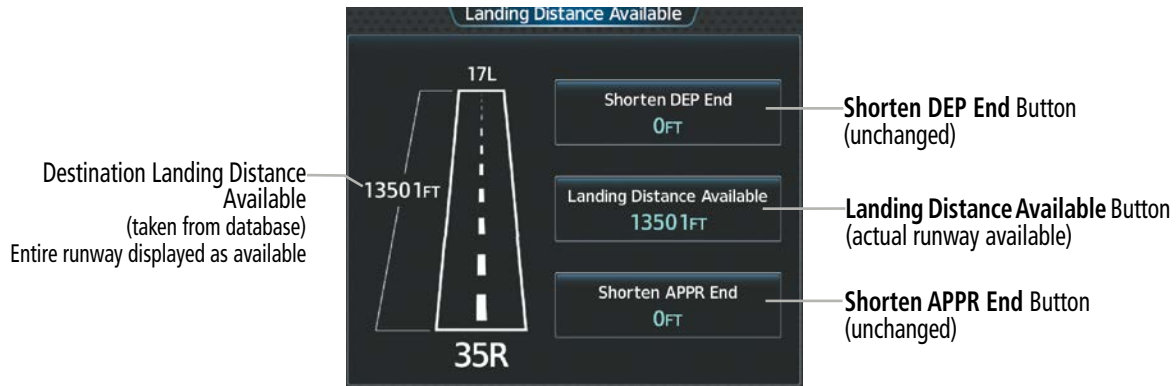


Figure 5-159 Landing Distance Available - Normal

Manually entering landing distance available:

- 1) From MFD Home, touch **PERF** > **Landing Data**.
- 2) Touch the **Runway** Tab.
- 3) Touch the **Landing DIS 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) 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 'Landing Data' Screen.

5.12 ABNORMAL OPERATION

DEAD RECKONING NAVIGATION

This section discusses loss of GPS position, Dead Reckoning (DR) mode of operation, and the subsequent indications.

Loss of GPS position is indicated on the system by the message 'Loss of GPS Navigation' and by the GPS Loss of Integrity annunciation on the PFD: 'GPS LOI', displayed in amber to the left of the HSI as shown in following figure. Normal navigation using GPS/SBAS source data resumes automatically once a valid GPS solution is restored.



NOTE: *Dead Reckoning Mode only functions in Enroute (ENR) or Oceanic (OCN) phase of flight. In all other phases, an invalid GPS solution produces a "NO FMS POSITION" annunciation on the map and the system stops using GPS.*

In DR mode, the system uses its last-known position combined with continuously updated airspeed and heading data (when available) to calculate and display the aircraft's current estimated position.

It is important to note that estimated navigation data supplied by the system in DR mode may become increasingly unreliable and must not be used as a sole means of navigation. If while in DR mode airspeed and/or heading data is also lost or not available, the DR function may not be capable of accurately tracking estimated position and, consequently, the system may display a path that is different than the actual movement of the aircraft. Estimated position information displayed by the system through DR while there is no heading and/or airspeed data available should not be used for navigation.

DR mode is inherently less accurate than the other modes due to the lack of satellite measurements or DME inputs needed to determine a position. Changes in wind speed and/or wind direction compound the relative inaccuracy of DR mode. Because of this degraded accuracy, other navigation equipment must be relied upon for position awareness until other position data is restored.

DR mode is indicated on the system by the appearance of the letters 'DR' displayed in amber on the HSI below and to the left of the aircraft symbol on the CDI, and on top of the aircraft symbol on navigation maps, as shown in following figure. The CDI deviation bar is displayed in amber. The autopilot will remain coupled in DR mode as long as the deviation info is available. Lastly, but at the same time, a 'GPS NAV LOST' notification appears on the GTC. Normal navigation using GPS/SBAS source data resumes automatically once a valid GPS solution is restored.

As a result of operating in DR Mode, all GPS-derived data is computed based upon an estimated position and is displayed in amber to denote degraded navigation source information. If the VSD Inset is selected on the MFD, 'VSD Not Available' will be displayed.



NOTE: *GPS derived information will remain displayed in magenta (not amber) on the Flight Plan Text inset and on the 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 GPS-derived data on the PFD and MFD is computed based upon an estimated position, and is displayed as amber text to denote degraded navigation source information. The accuracy of all bearing and distance information on nearest screens (airports, airspaces, and waypoints), and on waypoint information screens is questionable, and is displayed in amber. Airspace alerts continue to function, but with degraded accuracy. Lastly, while the system is in DR mode, TAWS is disabled.

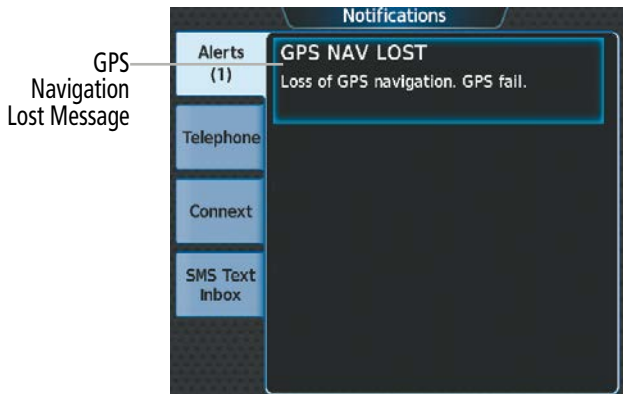
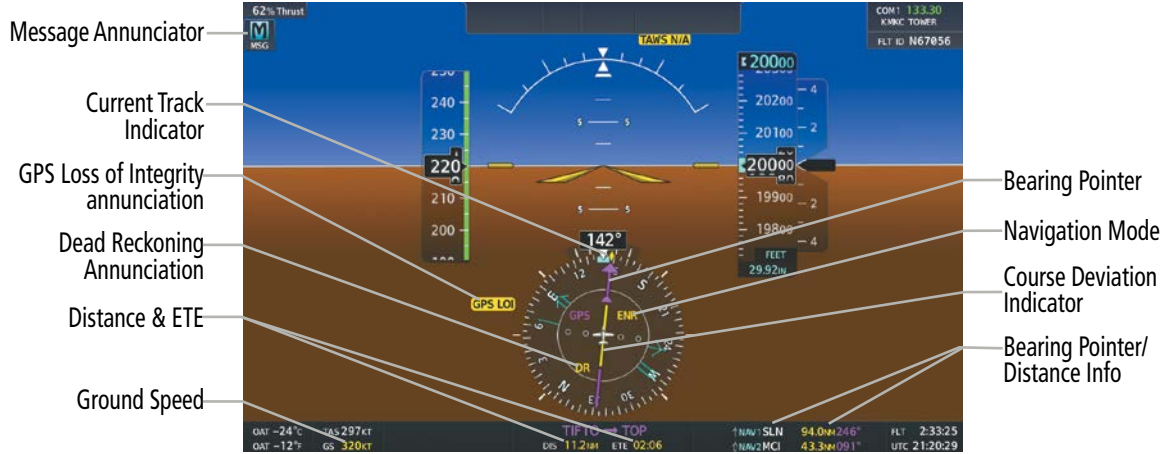


Figure 5-161 Dead Reckoning Mode - GPS Derived Data Shown in Amber

SECTION 6 HAZARD AVOIDANCE

Hazard Avoidance features available for the Cirrus Perspective Touch+™ 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 69A SXM SiriusXM Weather (Optional).
 - GSR 56 Garmin Connex Weather (Optional).
 - Flight Information Services-Broadcast (Optional).
 - GWX 70 Airborne Color Weather Radar (Optional).
 - GWX 75 Airborne Color Weather Radar (Optional).
- **Terrain Avoidance**
 - Terrain SVT
 - Terrain Awareness and Warning System Class-B (TAWS-B) (Optional).
- **Traffic**
 - GTS 855 Traffic Alert and Collision Avoidance System I (TCAS I) (Optional).
 - Garmin GTX 345R Automatic Dependent Surveillance-Broadcast (ADS-B) Traffic.

6.1 DATA LINK WEATHER



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



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

The Data Link Weather feature enables the system to receive weather information from a variety of weather sources, depending on the equipment installed in the aircraft. These sources may include SiriusXM Weather, Garmin Connex 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 69A or 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 via satellite on the S-Band frequency. This service provides continuous reception capabilities at any altitude throughout North America.

The FIS-B Weather service, available when equipped with a capable transponder or data link receiver which can receive 978 MHz Universal Access Transceiver (UAT) data, delivers subscription-free weather information periodically and automatically to the aircraft. FIS-B uses a network of FAA-operated Ground-Based Transceivers (GBTs) to transmit the information to the aircraft's receiver. Reception is limited to line-of-sight, and is available below 24,000 feet MSL in the United States. FIS-B broadcasts provide weather data in a repeating cycle which may take approximately ten minutes to transmit all available weather data. Therefore, not all weather data may be present immediately upon initial FIS-B signal acquisition. FIS-B is a component of the Automatic Dependent Surveillance (ADS-B) system, which offers both weather and traffic data; refer to the ADS-B Traffic discussion later in this section for a more detailed discussion of the ADS-B system and its capabilities.

The Garmin Connex 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 Connex Data Request. The transceiver then contacts the Garmin Connex Weather service using the Iridium Satellite telephone system and retrieves the weather data for the specified area. The Garmin Connex 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 Connex 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 (Figure 6-1).
- 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 MFD Home, touch **Utilities > Setup > SiriusXM Info**.
- 2) Note the ID shown in the Data Radio Window as seen in Figure 6-1.
- 3) Contact SiriusXM customer service. Follow the instructions provided by SiriusXM customer service.

Verifying SiriusXM Weather services:

- 1) Ensure the aircraft is outside, and the SiriusXM antenna away from obstructions such as buildings.
- 2) From MFD Home, touch **Utilities > Setup > SiriusXM Info**.
- 3) View the Service Class window and verify the displayed Service Class corresponds to the chosen SiriusXM subscription type.
- 4) View the Weather Products window, scrolling as needed to see all supported products. Available weather product names appear in white text; unavailable weather products appear with subdued text. When all weather products in the selected Service Class are available, activation is successful.



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 Connex weather data.

Registering the system to receive Garmin Connex Weather:

- 1) Ensure the aircraft is outside and has a clear view of the sky (if connecting via the Iridium network).
- 2) From MFD Home, touch **Utilities > Setup > Connex Registration**. If the Registration Information Window indicates 'Not Registered', continue with this procedure.
- 3) Touch the **Register** Button.
- 4) Use the keypad or large and small upper knobs to supply the access code provided from Garmin Connex customer service.
- 5) Touch the **Enter** Button or push the upper knob. The system contacts the Garmin Connex 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.

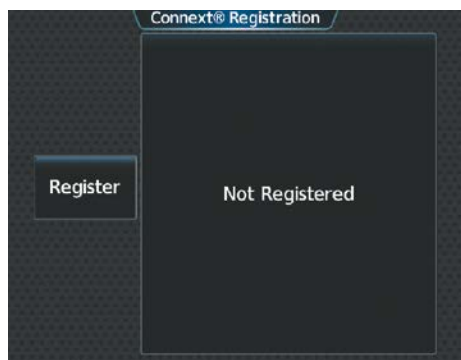


Figure 6-2 Connex Registration Screen Prior to Registration



Figure 6-3 Enter Access Code Provided by Garmin Aviation Product Support

ACCESSING FIS-B WEATHER INFORMATION

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.

From MFD 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 overlays enable/disable buttons 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 MFD 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.

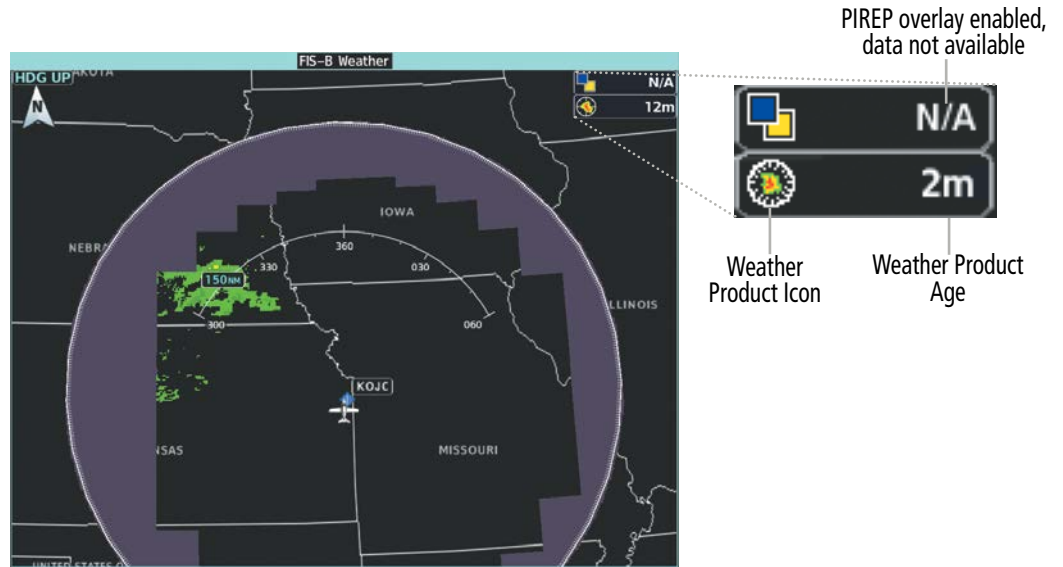


Figure 6-4 FIS-B Weather with PIREPs and Regional NEXRAD Enabled



Figure 6-5 Weather Selection Screen

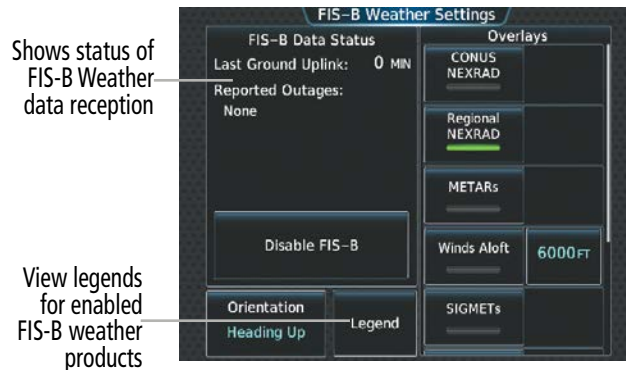


Figure 6-6 FIS-B Weather Settings Screen

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 METARs, the system can also show a weather product age. This age represents the elapsed time, in minutes, since the weather service provider compiled the weather product and the current time. It does not represent the age of the information contained within the weather product itself. For example, a single mosaic of radar precipitation is comprised data from multiple radar sites providing data at differing scan rates or intervals. The weather service provider periodically compiles this data to create a single composite image, and assigns one time to this image which becomes the basis of the product age. The service provider then makes this weather product available for data link transmission at the next scheduled update time. The actual age of the weather data contained within the mosaic is therefore older than its weather product age and should never be considered current. 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 Connex 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 PFD Home, touch **PFD Map Settings**.
- 2) If necessary, touch either the **HSI Map** or **Inset Map** Buttons in order to allow selection of the buttons in the Overlays Tab.
- 3) Touch the **Weather Legend** Button.

Tables 6-1 and 6-2 show the weather product symbols where applicable, and expiration times, for SiriusXM Weather and FIS-B Weather, respectively. The data link weather service providers and their respective weather data vendors define and control the data update intervals, which are subject to change. These update intervals represents the interval at which the service provider transmits new signals that may or may not contain updated weather product information. It does not represent the rate at which the weather information is updated or when the Data Link Receiver receives new data.

SiriusXM Weather Product	Product Symbol	Expiration Time (Minutes)
Next-generation Radar (NEXRAD)		30
Cloud Tops		60
Echo Tops		30
SiriusXM Lightning		30
Storm Cell Movement		30
SIGMETs	SIGM	60
AIRMETs	AIRM	60
METARs		90
City Forecast		90
Surface Analysis		60
Freezing Levels		120
Winds Aloft		90
County Warnings		60
Cyclone (Hurricane) Warnings		60
Icing Potential (CIP and SLD)		90
Pilot Weather Report (PIREPs)		90
Air Report (AIREPs)		90
Turbulence		180
No Radar Coverage	no product symbol	30
Temporary Flight Restrictions (TFRs)	TFR	60
Terminal Aerodrome Reports (TAFs)	no product symbol	60

Table 6-1 SiriusXM Weather Product Symbols and Data Timing



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

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

* The Winds Aloft product no longer issues an expiration time. It uses the best applicable model data for the time given, if one is available, to set an expiration time.

Table 6-2 FIS-B Weather Product Symbols and Data Timing

The following table shows the Garmin Connex Weather product symbols and expiration times. Weather data vendors supply, define, and control the data update intervals to Garmin Connex Weather, which are subject to change. It does not necessarily represent the rate at which the Garmin Connex Weather receives new weather data from various weather sources. The pilot chooses how often to contact the Garmin Connex Weather service in order to retrieve weather data through the Connex Data Request that may or may not contain updated weather product information.



NOTE: The availability of specific Garmin Connex Weather products varies by region and by subscription type. For Garmin Connex weather product coverage information, refer to flygarmin.com.










Garmin Connex Weather Product	Symbol	Expiration Time (Minutes)
Connex Radar		30
Cloud Tops		60
Connex 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 Connex Weather Product Symbols and Data Timing

DISPLAYING DATA LINK WEATHER PRODUCTS

WEATHER DATA LINK PANE

The Weather Data Link (SiriusXM/Connex/B/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”, “Connex” or “FIS-B”).

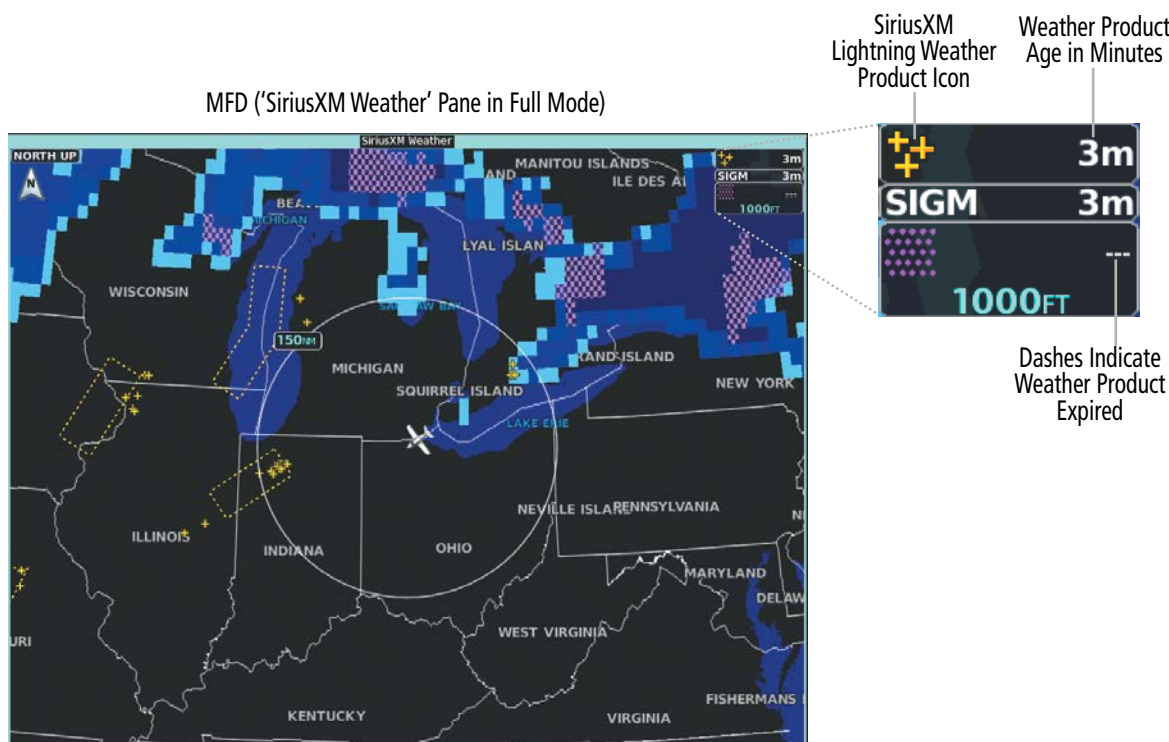


Figure 6-7 SiriusXM Weather with Product Icons and Age Information

Viewing the Weather Data Link Pane and changing the data link weather source, if applicable:

- 1) From MFD 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 Connex)
- 2) Touch the **Weather Selection** Button. The Weather Selection Screen appears.
- 3) Touch either **SiriusXM Weather, Connex 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 necessary, touch either the **SiriusXM, Connex, 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 Connex 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 MFD Home, touch **Map > Map Selection > Map Settings**.
- 2) If necessary, 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 **Connex**, if installed).

Navigation Maps displaying data link weather products show the name of the selected source ('Connex WX', 'FIS-B', or 'SiriusXM') in a window on the 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 PFD Home, touch the **PFD Map Settings** Button.
- 2) Scroll in the **Overlays** Tab and touch the **WX Source** Button.
- 3) Touch a button for the desired data link weather source (**SiriusXM**, **FIS-B**, or **Connex**).

Table 6-4 shows which Datalink 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	VSD Inset Window
NEXRAD/Radar Precipitation	+	+	+	
Cloud Tops			+	
Echo Tops			+	
Infrared Satellite			+	
Data Link Lightning	+	+	+	
Cell Movement	+	+	+	
SIGMETs/AIRMETs			+	
METARs	+	+	+	
City Forecast			+	
Surface Analysis			+	
Freezing Levels			+	
Winds Aloft		+*	+	+
County Warnings			+	
Cyclone Warnings			+	
Icing Potential			+	
PIREPs			+	
AIREPs			+	
Turbulence			+	
No Radar Coverage	+	+	+	
TFRs	+	+	+	
TAFs			+	

* Winds Aloft data is available inside the VSD when VSD is enabled on the Navigation Map Pane.
Table 6-4 Weather Product Display Maps

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 power application 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.

Enabling/disabling weather product information on the Inset Navigation Map and HSI Map:

- 1) From PFD Home, touch **PFD Map Settings**.
- 2) If necessary, touch either the **HSI Map** or **Inset Map** Buttons in order to allow selection of the buttons in the Overlays Tab.
- 3) Touch the **Weather Legend** Button.

The Touchscreen Controller, when operating in MFD Mode, controls the display of weather information on display panes.

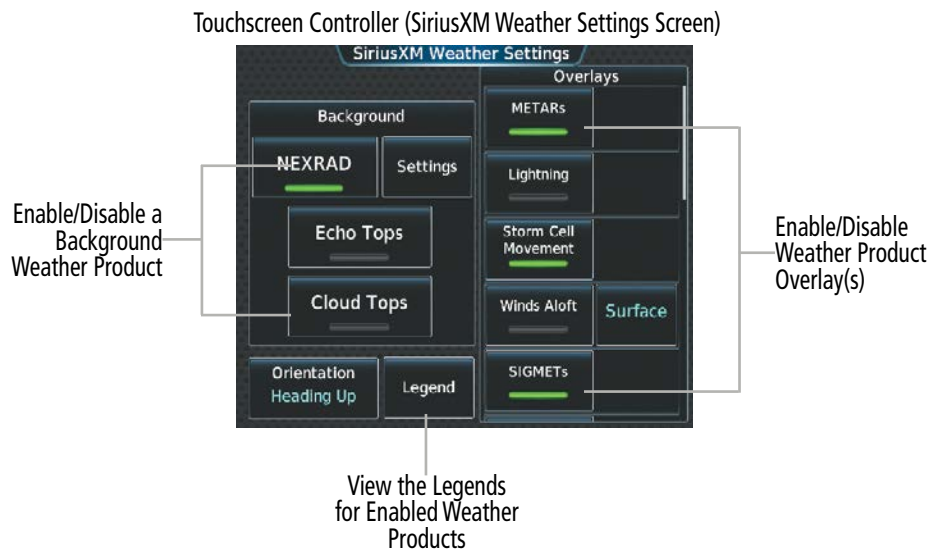


Figure 6-9 SiriusXM Weather Settings Screen

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.

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 (remove) the weather product from the map.

Setting up and customizing 'Data Link' Weather Products on navigation maps:

- 1) From MFD Home, touch **Map > Map Selection > Map Settings**.
- 2) If necessary, 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 necessary, 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.

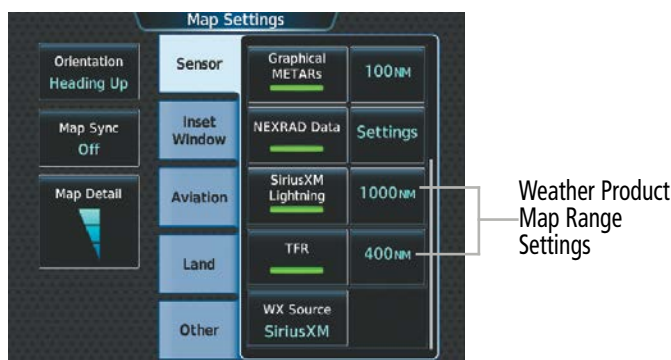


Figure 6-10 Map Settings Screen (Sensor Tab Selected)

The SiriusXM Settings Screen can display a legend for each weather product currently enabled on the SiriusXM Weather Pane.

Viewing legends for weather products enabled on the 'Data Link' (SiriusXM, Connex, or FIS-B) Weather Pane:

- 1) From MFD Home, touch **Weather > Weather Selection > 'Data Link' Weather > 'Data Link' Weather Settings**
- 2) 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**.

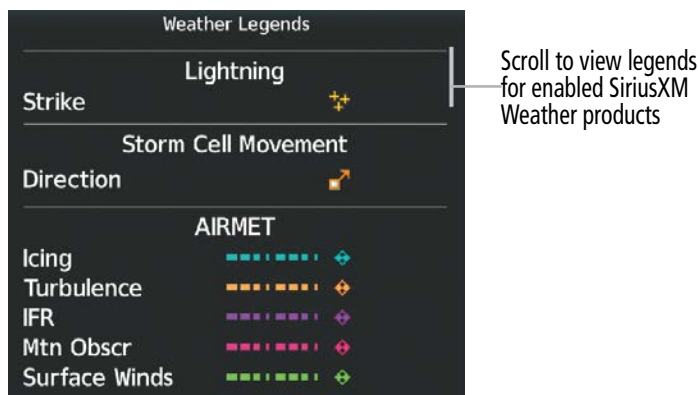


Figure 6-11 'Weather Legends' Window (SiriusXM)

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)
- TFRs
- PIREPSs
- AIREPs
- Infrared (IR) Satellite (Connex)

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.

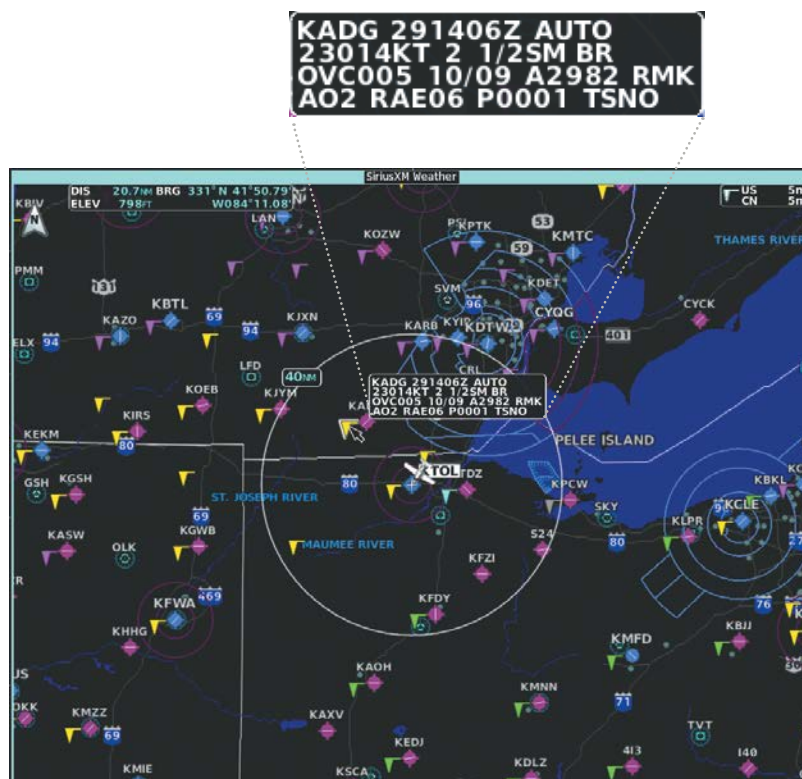


Figure 6-12 Panning on the 'SiriusXM Weather' Pane

The system provides the ability to select a map orientation for the SiriusXM 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 'SiriusXM Weather' Pane orientation to the 'Navigation Map' Pane orientation.

Selecting a map orientation for the Data Link (SiriusXM, Connex, or FIS-B) Weather Pane:

- 1) From MFD 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**).

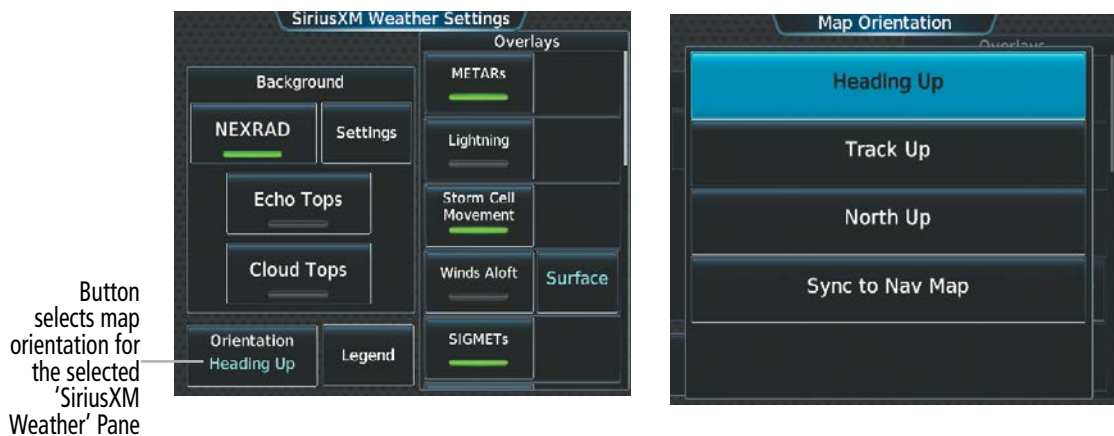


Figure 6-13 Selecting a Map Orientation for the 'SiriusXM Weather' Pane

CONNEXT WEATHER DATA REQUESTS

The Data Request Window on the Connex 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 Connex Data Request process.

Before the system can retrieve weather information, a valid coverage area must be defined from which all available Garmin Connex 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 prior to enabling these buttons. However, if none of this information is supplied, the present position must be included in the Connex 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 MFD Home, touch **Weather > Weather Selection > Connex Weather > Connex 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 push the small upper knob.
- 9) When finished, touch the **Back** Button to return to the Connex Weather Settings Screen, or touch the **Home** Button.

Sending/Cancelling an Immediate Weather Data Request:

- 1) From MFD Home, touch **Weather > Weather Selection > Connex Weather > Connex Settings**.
- 2) Touch the **Send Immediate Request** Button. The system contacts Garmin Connex 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 'Cancelled'.

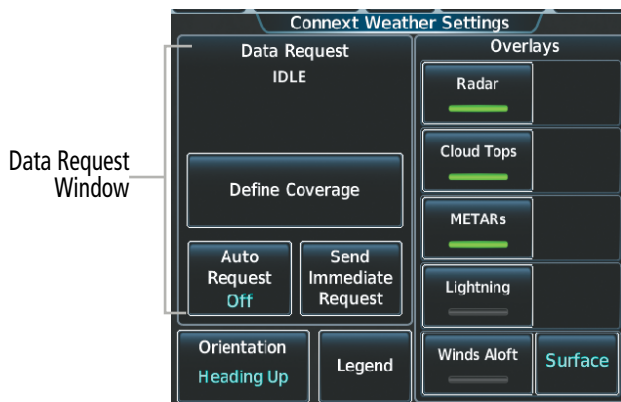


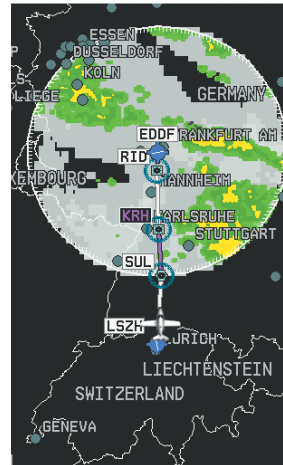
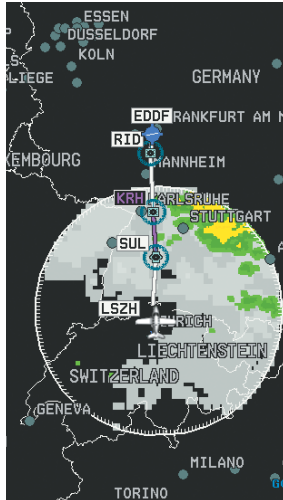
Figure 6-14 'Connex Weather Settings' Screen



Figure 6-15 Selecting coverage area for Connex Data Request

During a weather data request, the Data Request Window initially displays “Contacting Connex...”. 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). Connex 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 Connex 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.

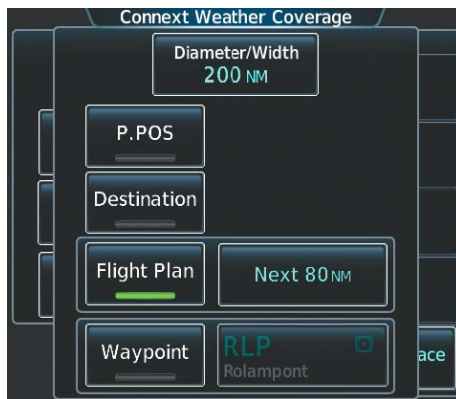
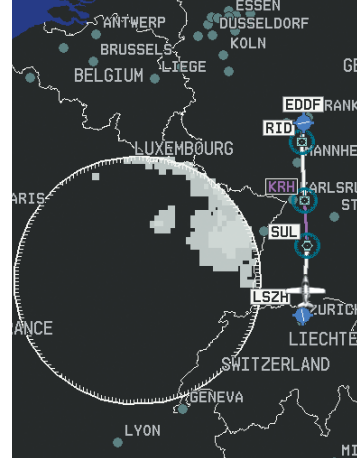
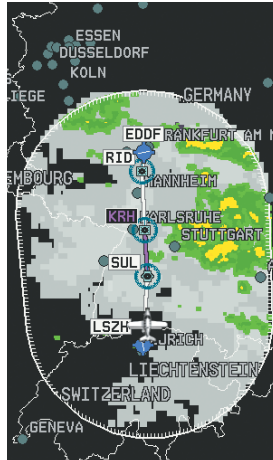


Present Position Selected, 200 nm Diameter Requested



Destination Selected, 200 nm Diameter Requested

Figure 6-16 Connex 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 6-17 Connex Weather Coverage Options based on Flight Plan and Waypoint Selections

The flight crew can schedule Connex 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 Connex Data Request occurs. Performing an immediate data request resets the timer until the next Automatic data request occurs.

Enabling/disabling automatic Connex Data Requests:

- 1) From MFD Home, touch **Weather > Weather Selection > Connex Weather > Connex 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 Connex 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 determine the age of the weather information shown by the data link weather product. Due to time delays inherent in gathering and processing weather data for data link transmission, the weather information shown by the data link weather product may be significantly 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.

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.

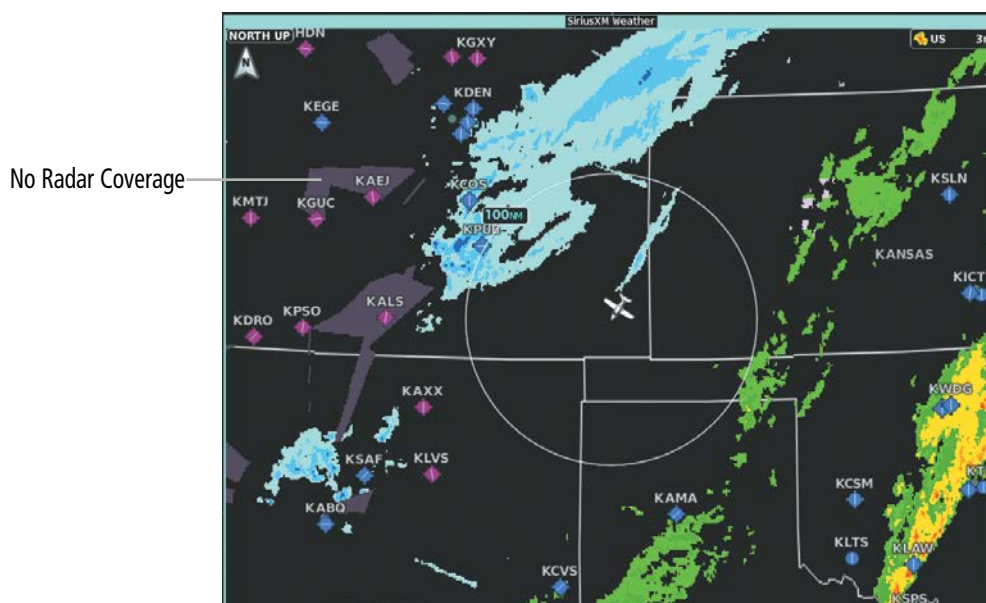


Figure 6-18 NEXRAD Data on the 'SiriusXM Weather' Pane

Displaying NEXRAD weather information (SiriusXM Weather Pane):

- 1) From MFD 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 (SiriusXM Weather Pane):

- 1) From MFD Home, touch **Weather > Weather Selection > SiriusXM Weather > SiriusXM Settings**.
- 2) Touch the **NEXRAD Settings** Button. The NEXRAD Options window appears.
- 3) Touch the **NEXRAD** 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.

Displaying NEXRAD weather information (Navigation Map Pane):

- 1) From MFD Home, touch **Map > Map Selection > Map Settings**.
- 2) If necessary, touch the **Sensor** Tab.
- 3) Scroll as needed and touch the **NEXRAD Data** 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 (Navigation Map Pane):

- 1) From MFD Home, touch **Map > Map Selection > Map Settings**.
- 2) If necessary, touch the **Sensor** Tab.
- 3) Scroll as needed and touch the NEXRAD Data **Settings** Button in the Overlays Tab.
- 4) Touch the **NEXRAD Data** coverage Button (displaying either 'USA' or 'Canada' 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 NEXRAD weather information (PFD Inset Map or HSI Map):

- 1) If necessary, enable the Inset Map or HSI Map.
- 2) From PFD Home, touch **PFD Map Settings**.
- 3) Scroll and touch the **NEXRAD Data** Button to enable/disable the display of NEXRAD Data.

Changing the NEXRAD coverage area (PFD Inset Map or HSI Map):

- 1) From PFD Home, touch the **PFD Map Settings** Button.
- 2) Scroll in the Overlays Tab, and touch the NEXRAD Data **Settings** Button.
- 3) Touch the **NEXRAD Data** 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.

The display shows composite data from all available NEXRAD radar sites in the selected coverage area (either United States or Canada.) This data is composed of the maximum reflectivity from the individual radar sweeps. The display of the information is color-coded to indicate the strength of the radar returns. All

weather product legends can be viewed on the Touchscreen Controllers. For the NEXRAD legend, touch the **Legend** Button on the 'SiriusXM Weather Settings' Screen when NEXRAD is enabled for display.

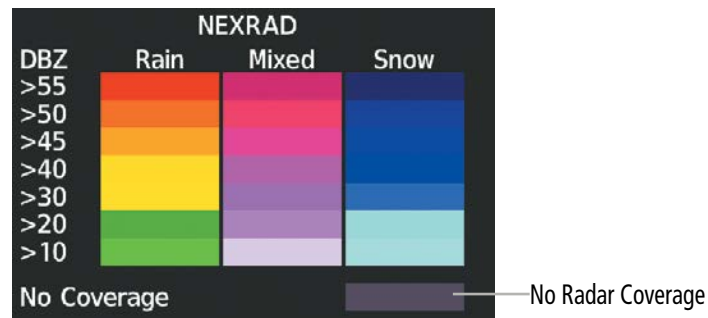


Figure 6-19 NEXRAD Legend

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 MFD Home, touch **Weather > Weather Selection > SiriusXM Weather > SiriusXM Settings**.
- 2) If necessary, 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 Pane:

- 1) From MFD Home, touch **Map > Map Selection > Map Settings**.
- 2) If necessary, touch the **Sensor** Tab.
- 3) Scroll if necessary and touch the **NEXRAD Data 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 PFD Home, touch the **PFD Map Settings** Button.
- 3) Scroll and touch the **NEXRAD Data Settings** Button.
- 4) Touch the **NEXRAD Animation** Button to enable/disable the animated NEXRAD information on the Inset Map

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 determine cloud layers or precipitation characteristics (wet hail vs. rain). For example, it is not possible to distinguish between wet snow, wet hail, and rain.
- 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 terrain.*

The National Weather Service (NWS) operates the WSR-88D, or NEXRAD (NEXt-generation RADar) system, an extensive network of 156 high-resolution Doppler radar systems. The NEXRAD network provides centralized meteorological information for the continental United States and selected overseas locations. The maximum range of a single NEXRAD site is 250 nm.

Individual NEXRAD sites supply the network with radar images, and the images from each radar site may arrive at the network at different rates and times. Periodically, the weather data provider to FIS-B compiles the available individual site images from the network to form a composite image, and assigns a single time to indicate when it created the image. This image becomes the NEXRAD weather product. Individual images--gathered from each NEXRAD site--differ in age, and are always older than the displayed NEXRAD weather product age. The data provider then sends the NEXRAD data to the FIS-B GBTs, which transmit this information during the next designated broadcast time for the NEXRAD weather product.

Because of the time required to detect, assemble, and distribute the NEXRAD weather product, the displayed weather information contained within the product may be significantly older than the current radar synopsis and may not depict the current weather conditions. NEXRAD information should never be used as a basis for maneuvering in, near, or around areas of hazardous weather regardless of the information it contains.

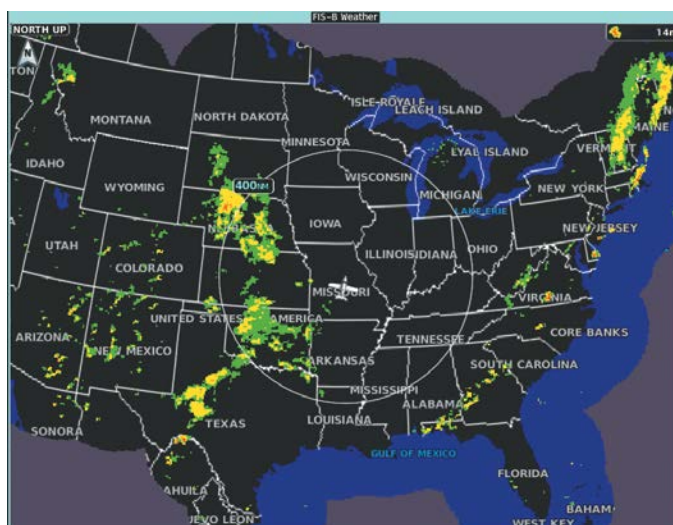


Figure 6-20 CONUS NEXRAD Weather Product on the 'FIS-B Weather' Pane

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.

Displaying the NEXRAD weather product on the FIS-B Weather Pane (CONUS or Regional):

- 1) From MFD 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.

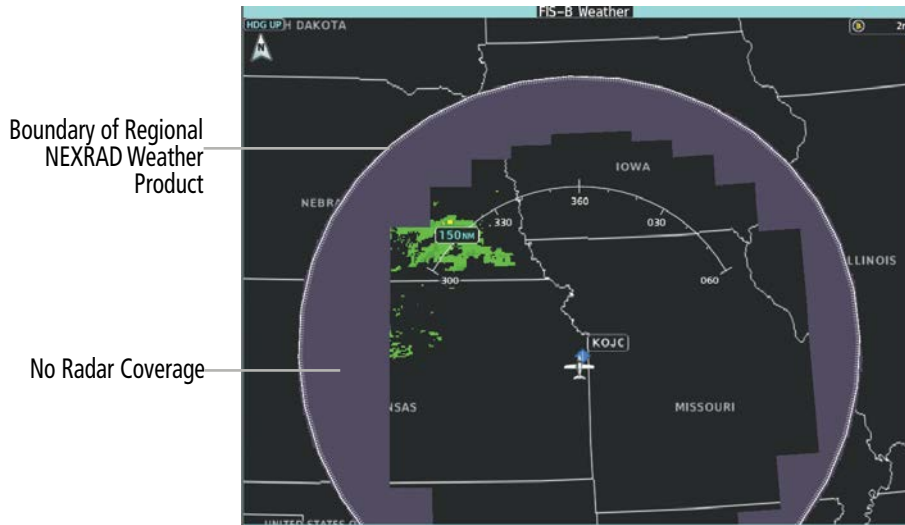


Figure 6-21 Regional NEXRAD Weather Product on the 'FIS-B Weather' Pane

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.

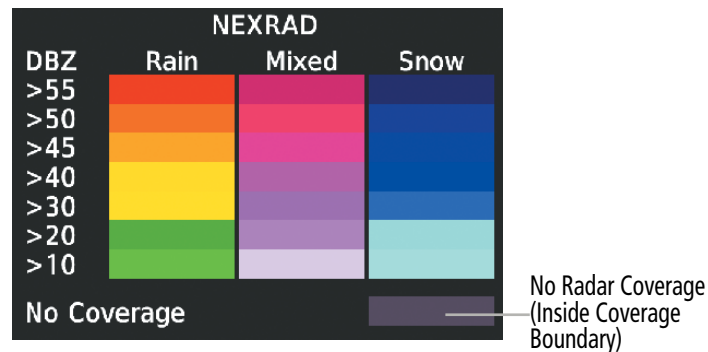


Figure 6-22 NEXRAD Weather Product Legend

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 gray shade of purple.



NOTE: If the system has not received all available NEXRAD weather data (such as during initial FIS-B signal acquisition or in areas of marginal or poor signal reception), the system may display areas of no radar coverage which are subsequently removed as radar data is received. It may take up to approximately ten minutes to receive all FIS-B data, when adequate reception is available.

REFLECTIVITY

Reflectivity is the amount of transmitted power returned to the radar receiver. Colors on the NEXRAD display are directly correlative to the level of detected reflectivity. Reflectivity as it relates to hazardous weather can be very complex.

The role of radar is essentially to detect moisture in the atmosphere. Simply put, certain types of weather reflect radar better than others. The intensity of a radar reflection is not necessarily an indication of the weather hazard level. For instance, wet hail returns a strong radar reflection, while dry hail does not. Both wet and dry hail can be extremely hazardous.

The different NEXRAD echo intensities are measured in decibels (dB) relative to reflectivity (Z). NEXRAD measures the radar reflectivity ratio, or the energy reflected *back to* the radar receiver (designated by the letter Z). The value of Z increases as the returned signal strength increases.

NEXRAD LIMITATIONS

NEXRAD radar images may have certain limitations:

- At 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 60° 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)

The Garmin Connex 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 Connex Weather service collects these images, and assigns a single time to indicate when it created the image. This composite image becomes the Garmin Connex 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 Connex 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.

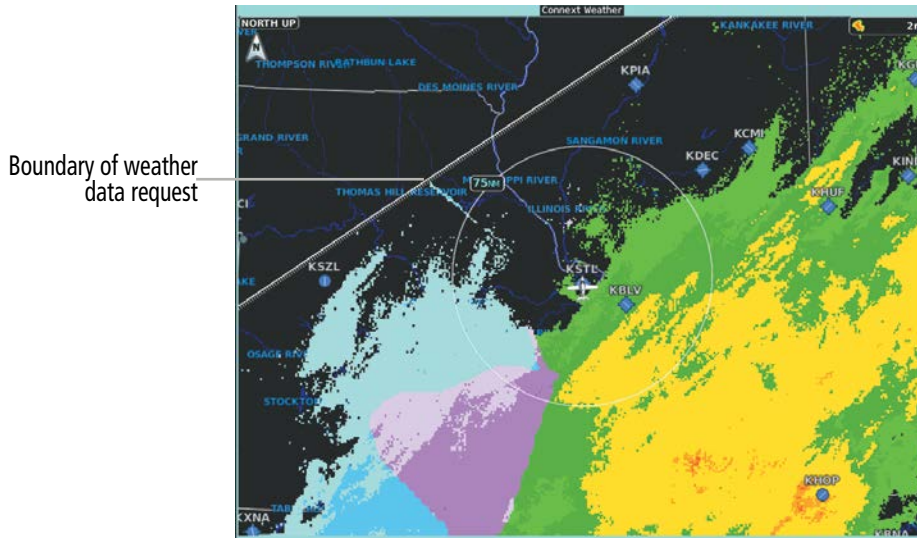


Figure 6-23 'Connex Weather' Pane with Connex Radar Enabled

Displaying Garmin Connex Radar information (Connex Weather Pane):

- 1) From MFD Home, touch **Weather > Weather Selection > Connex Weather > Connex Settings**.
- 2) Touch the **Radar** Button in the 'Overlays' Window.

Connex 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 Connex Weather Pane. For the Connex Radar legend, touch the **Legend** Button on the Connex Weather Settings Screen when Connex Weather is enabled for display.

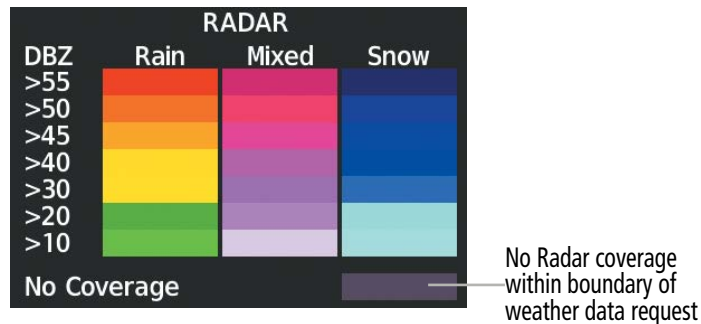


Figure 6-24 Connex Weather Radar Legend

The display of no radar coverage is enabled when Garmin Connex 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 Connex 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 Connex Data Request coverage area.

Displaying Garmin Connex Radar information (Navigation Map Pane):

- 1) From MFD Home, Touch **Map > Map Selection > Map Settings**.
- 2) If necessary, touch the **Sensor** tab.
- 3) Scroll if needed and touch the **Connex Radar** Button.

Displaying Garmin Connex Radar information (PFD Inset Map or HSI Map):

- 1) From PFD Home, touch **PFD Map Settings**.
- 2) Scroll in the Overlays Tab, and touch the **Connex Radar** Button.

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 determine cloud layers or precipitation characteristics (wet hail vs. rain). For example, it is not possible to distinguish between wet snow, wet hail, and rain.
- Radar base reflectivity is sampled at the minimum antenna elevation angle. An individual radar site cannot depict high altitude storms at close ranges. It has no information about storms directly over the site.
- When zoomed in to a range of 30 nm, each square block on the display represents an area of four square kilometers.
- Colors displayed from NEXRAD and airborne weather radar systems are not interchangeable. Refer to the applicable legends based on the weather source.

The following may cause abnormalities in displayed radar images:

- Ground clutter.
- 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.

DATALINK 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 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.

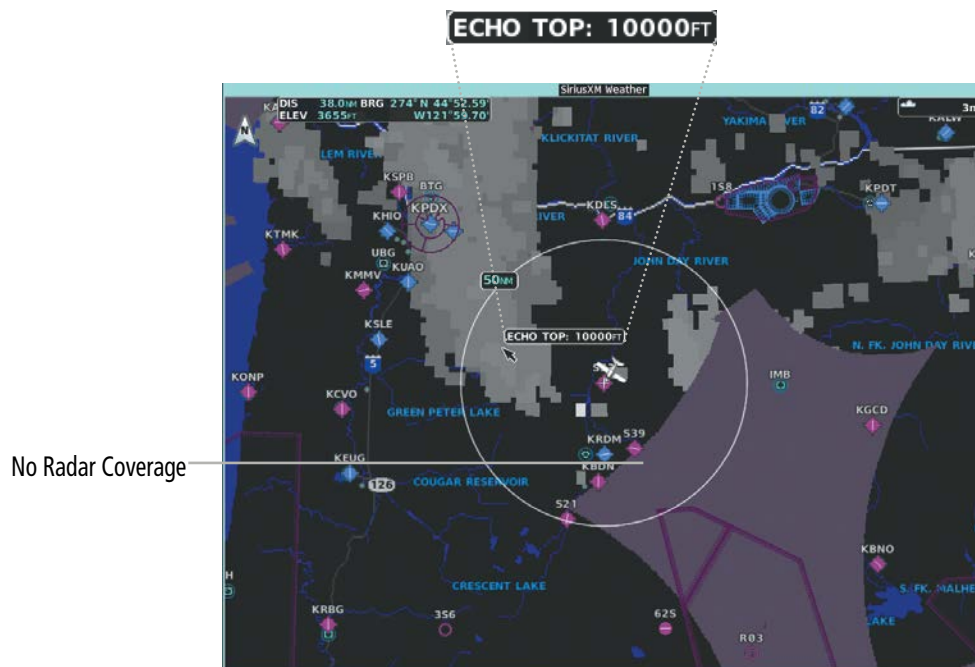


Figure 6-25 Echo Tops Weather Product

Enabling/Disabling Echo Tops information:

- 1) From MFD Home, touch **Weather > Weather Selection > SiriusXM Weather > SiriusXM Settings**.
- 2) Touch the **Echo Tops** Button in the 'Background' window.

Touch the **Legend** Button on the 'SiriusXM Weather Settings' Screen to display the Echo Tops legend when Echo Tops is enabled. 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.

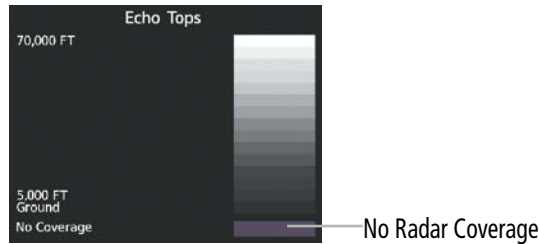


Figure 6-26 Echo Tops Legend

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)



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.

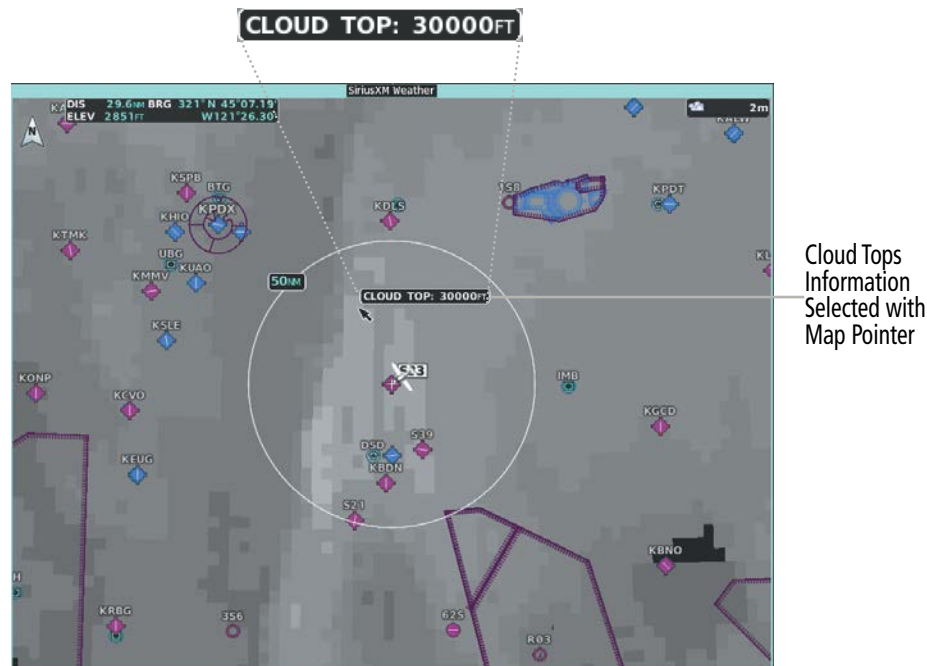


Figure 6-27 Cloud Tops Weather Product

Enabling/Disabling Cloud Tops information:

- 1) From MFD Home, touch **Weather** > **Weather Selection** > **SiriusXM Weather** > **SiriusXM Settings**.
- 2) Touch the **Cloud Tops** Button in the 'Background' 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 6-28 Cloud Tops Legend

DATA LINK LIGHTNING (SIRIUSXM, GARMIN CONNEXT)

The Lightning weather product shows the approximate location of 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.

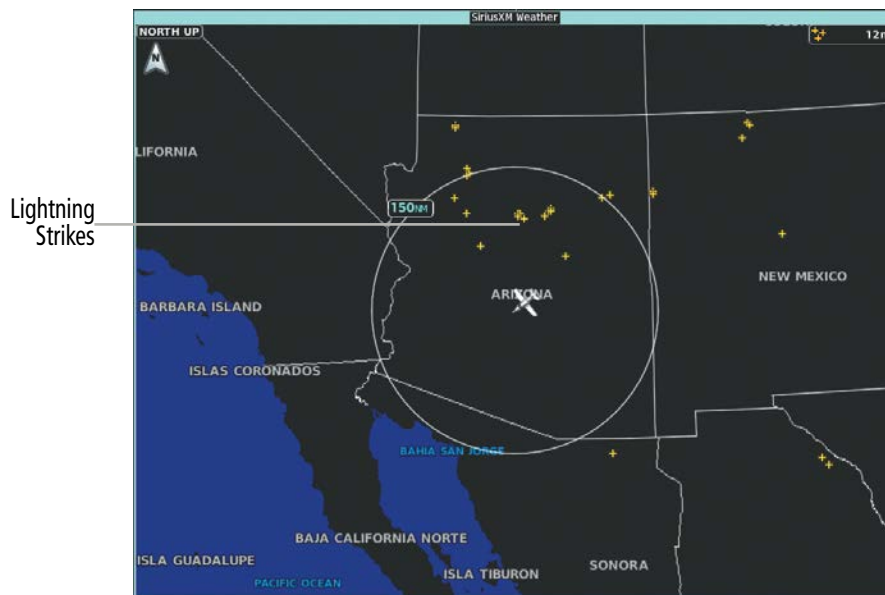


Figure 6-29 SiriusXM Lightning Weather Product

Enabling/Disabling ‘Data Link’ Lightning information (SiriusXM or Connex Weather Pane):

- 1) From Home, touch **Weather** > **Weather Selection** > **‘Data Link’ Weather** > **‘Data Link’ Weather Settings**.
- 2) Touch the **Lightning** Button in the ‘Overlays’ 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**.

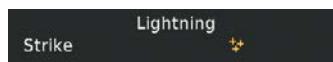


Figure 6-30 SiriusXM Lightning Legend

Displaying 'Data Link' Lightning information on the 'Navigation Map' Page:

- 1) From MFD Home, touch **Map** > **Map Selection** > **Map Settings**.
- 2) If necessary, touch the **Sensor** Tab.
- 3) Scroll as needed and touch the **SiriusXM Lightning** or **Connex Lightning** Button.

Displaying 'Data Link' Lightning information on PFD maps:

- 1) From PFD Home, touch **PFD Map Settings**.
- 2) If necessary, 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 **SiriusXM Lightning** or **Connex Lightning** Button.

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.

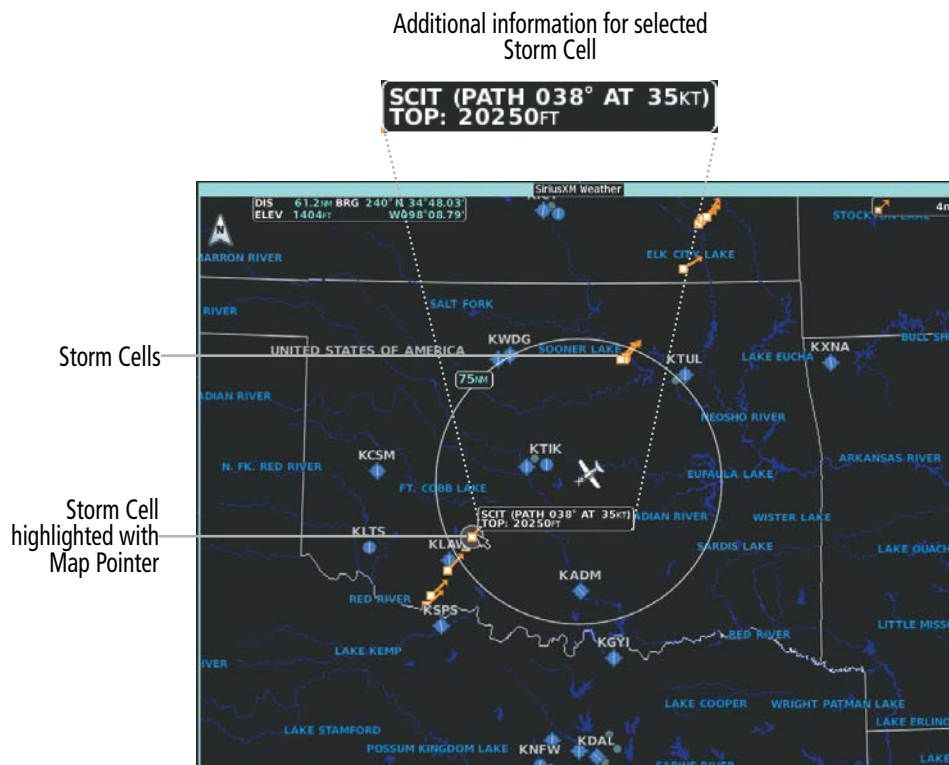


Figure 6-31 Storm Cell Movement Weather Product

Enabling/Disabling Storm Cell Movement Information (SiriusXM Weather Pane):

- 1) From MFD Home, touch **Weather > Weather Selection > SiriusXM Weather > SiriusXM Settings**.
- 2) Touch the **Storm Cell Movement** Button in the 'Overlays' 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 the **Back** Button or the **Home** Button.

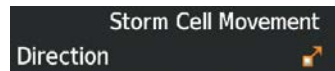


Figure 6-32 Cell Movement Legend

Displaying Storm Cell Movement Information (Navigation Map Panes):

- 1) From MFD Home, touch **Map > Map Selection > Map Settings**.
- 2) If necessary, touch the **Sensor** Tab.
- 3) Scroll as needed and touch the NEXRAD Data **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 PFD Home, touch **PFD Map Settings**.
- 2) If necessary, touch either the **HSI Map** or **Inset Map** Button to access overlays buttons.
- 3) Touch the NEXRAD Data **Settings** Button.
- 4) Touch the **Storm Cell Movement** Button.
- 5) When finished, touch **Back** or **Home**.

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.

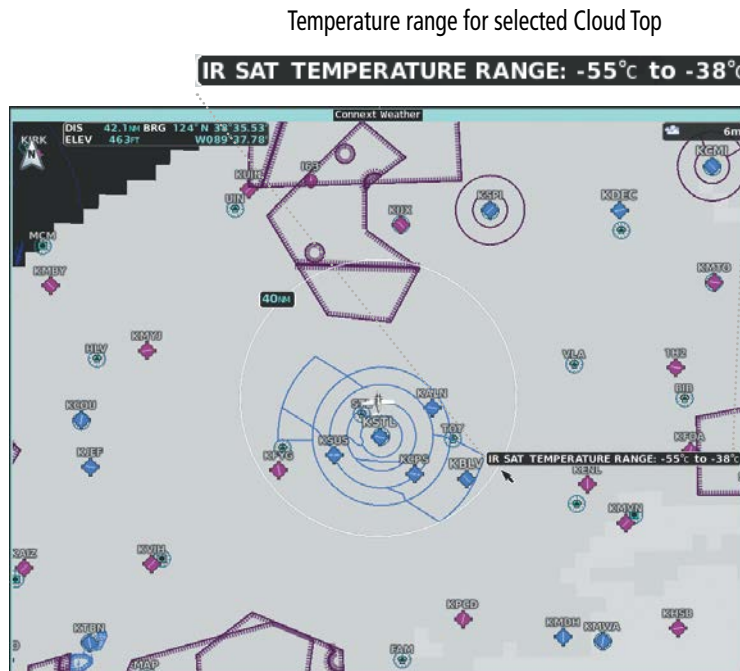


Figure 6-33 Infrared Satellite Weather Product on Connex Weather Pane

Displaying Cloud Tops information (Connex Weather Pane):

- 1) From MFD Home, touch **Weather** > **Weather Selection** > **Connex Weather** > **Connex Settings**.
- 2) Touch the **IR Satellite** Button in the 'Overlays' Window.

To display the Cloud Tops legend, touch the **Legend** Button on the 'Connex Weather Settings' Screen when the Infrared Satellite weather product is enabled for display.

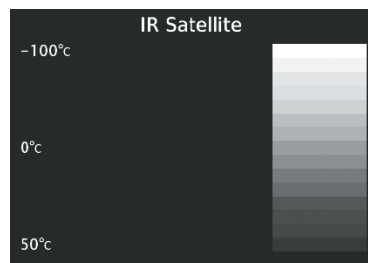


Figure 6-34 Infrared Satellite Legend

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 SiriusXM 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.



Figure 6-35 SIGMET Weather Products

Enabling/disabling AIRMET and SIGMET information:

- 1) From MFD Home, touch **Weather > Weather Selection > ‘Data Link’ Weather > ‘Data Link’ Weather Settings**.
- 2) Scroll as needed and touch the **AIRMETS** and/or **SIGMETs** Buttons in the Overlays Window.
- 3) To view the text of an AIRMET or SIGMET, push the lower knob and move the map pointer with the large and small upper knobs or **Touchpad** over the SIGMET or AIRMET until it is highlighted.
- 4) Touch the **Info** Button to show the AIRMET / SIGMET Information Screen for 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.

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.

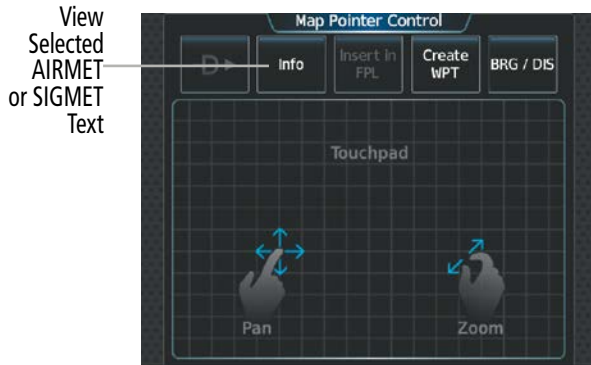


Figure 6-36 Map Pointer Control Screen

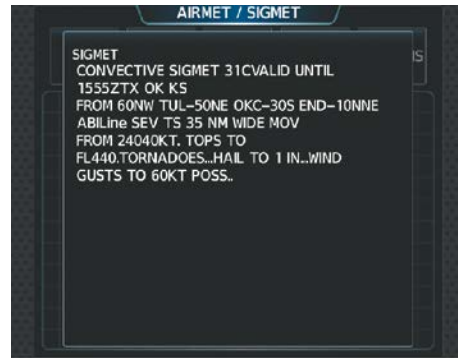


Figure 6-37 'AIRMET/SIGMET' Screen



Figure 6-38 SIGMET/AIRMET 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.

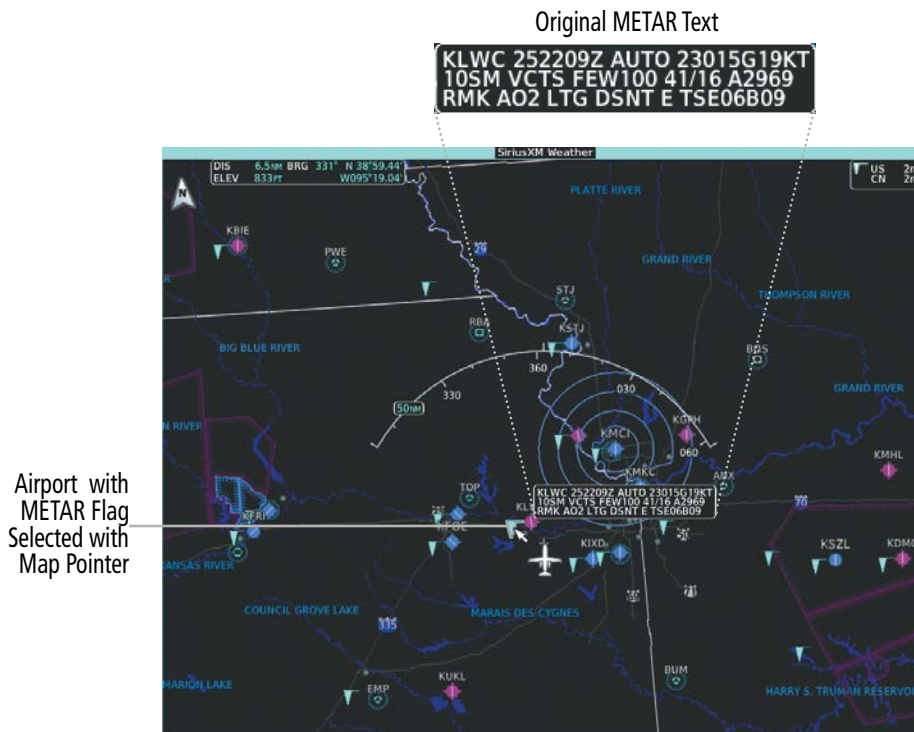


Figure 6-39 Displaying METARS on the 'SiriusXM Weather' Pane

Showing METAR text ('Data Link' Weather Pane):

- 1) From MFD 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, push 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.

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.

METAR	
VFR	Blue flag
MVFR	Green flag
IFR	Yellow flag
LIFR	Purple flag
UNKNOWN	Gray flag

Figure 6-40 METAR Legend

Showing METAR information (Navigation Map Pane):

- 1) From MFD Home, touch **Map > Map Selection > Map Settings**.
- 2) If necessary, 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, push 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.

Showing METAR information (PFD maps):

- 1) From PFD Home, touch **PFD Map Settings**.
- 2) Touch the **Graphical METARs** Button.

Textual METAR/TAF information is available on the Airport Information Screen on the Touchscreen Controller for airports with a requested METAR/TAF available. This textual METAR/TAF information may come from any data link weather source available to the system (such as SiriusXM, FIS-B, or Garmin Connex), 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, Garmin Connex.

The pilot can select to view the raw, original METAR or TAF text, or decoded 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 MFD 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.

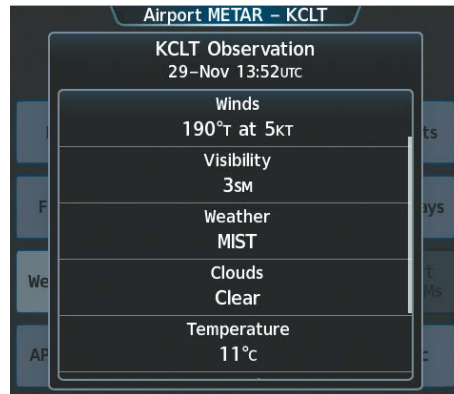


Figure 6-41 Decoded METAR information on the Airport Weather Screen

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 6-42 Current Surface Analysis Weather Product

Displaying Surface Analysis and City Forecast information:

- 1) From MFD Home, touch **Weather > Weather Selection > SiriusXM Weather > SiriusXM Settings**.
- 2) Scroll as needed in the 'Overlays' Window and touch the **Surface Analysis** Button.
- 3) If needed, touch the Surface Conditions forecast period button (to the right of the **Surface Analysis** Button) 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 6-43 Surface Analysis and City Forecast 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 6-44 Freezing Level Weather Product

Displaying Freezing Level information:

- 1) From MFD Home, touch **Weather** > **Weather Selection** > **SiriusXM Weather** > **SiriusXM Settings**.
- 2) Scroll as needed in the 'Overlays' Window and touch the **Freezing Level** Button.

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 6-45 Freezing Level Legend

WINDS ALOFT

The Winds Aloft weather product shows the predicted wind speed and direction at the surface and at selected altitudes. Altitude can be displayed in 3,000-foot increments from the surface up to 42,000 feet MSL.

Displaying Winds Aloft data:

- 1) From MFD 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 Surface to 42,000 feet MSL.

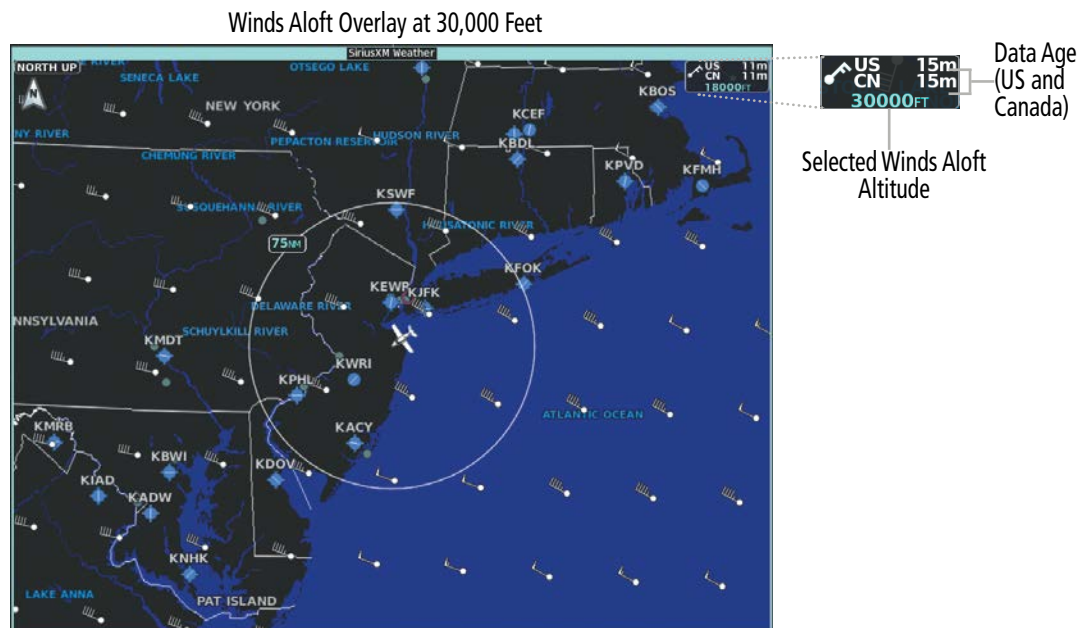


Figure 6-46 Selecting a Winds Aloft Altitude on the 'SiriusXM Weather Settings' Screen

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**.

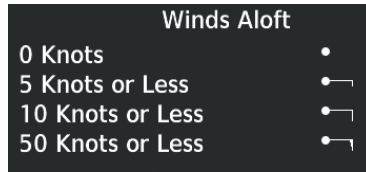


Figure 6-47 Winds Aloft Data Legend

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.

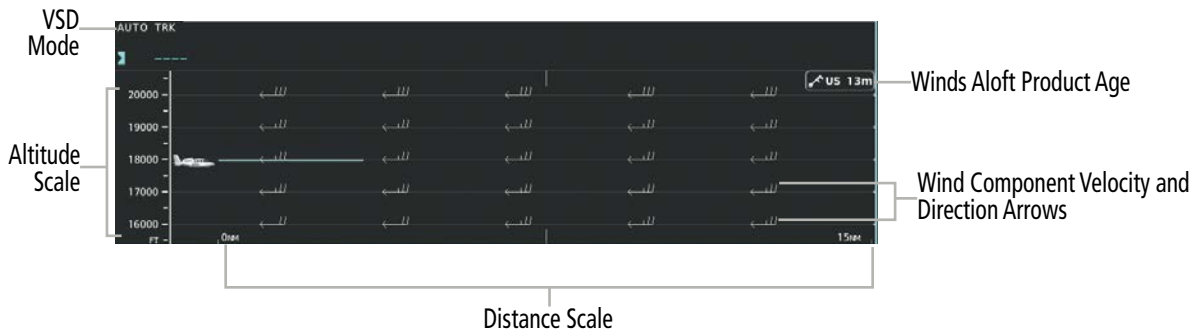


Figure 6-48 VSD Inset Window with Winds Aloft Information

Arrows pointing to the left indicate headwind components; tailwind component arrows point to the right.

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 MFD Home, touch **Map > Map Selection > Map Settings**.
- 2) If necessary, 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.

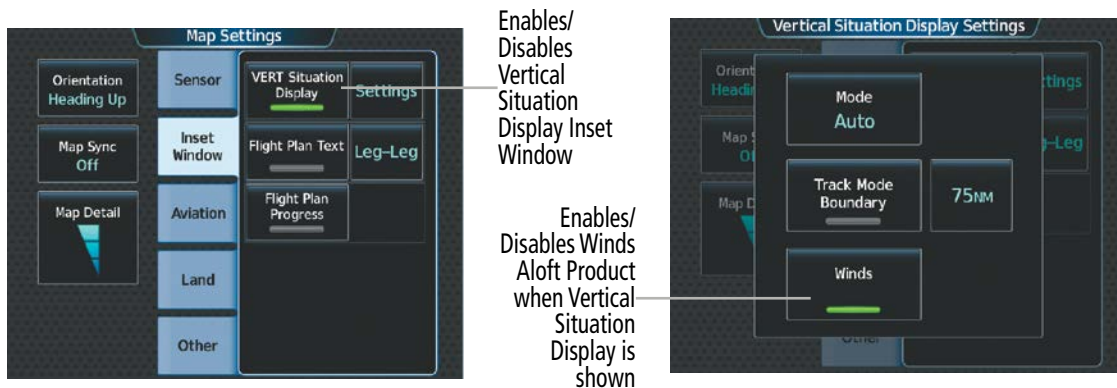


Figure 6-49 Controlling the display of Winds Aloft information for VSD Inset Window

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.

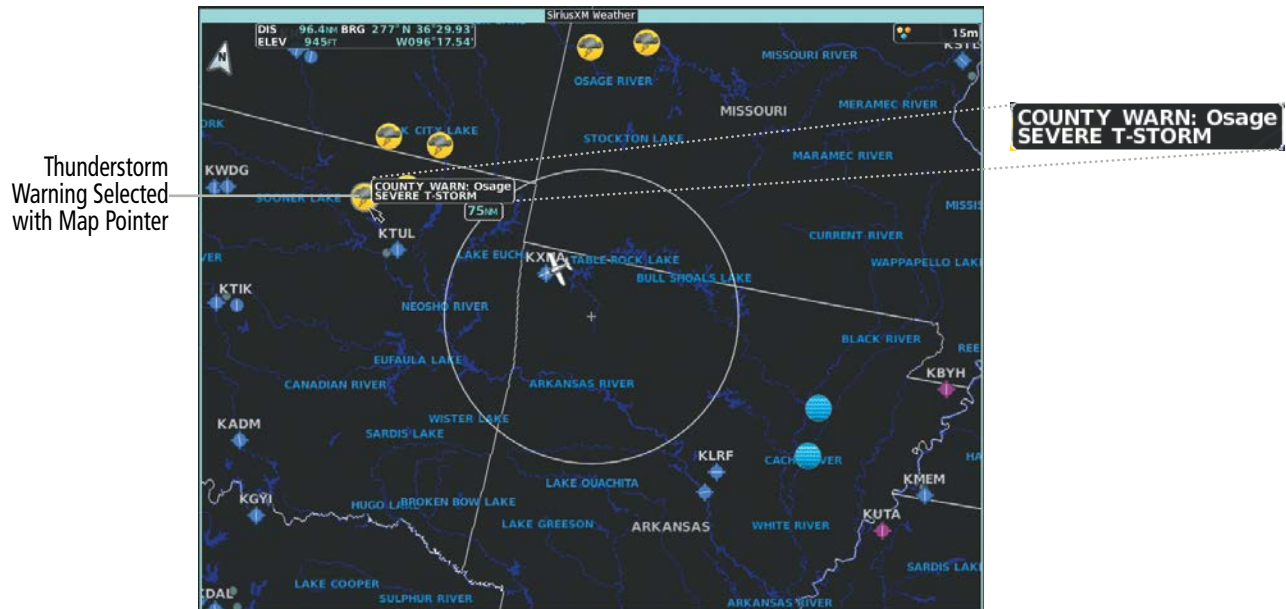


Figure 6-50 County Warnings Weather Product

Displaying County Warning information:

- 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), push 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.

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 6-51 County Warnings 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.

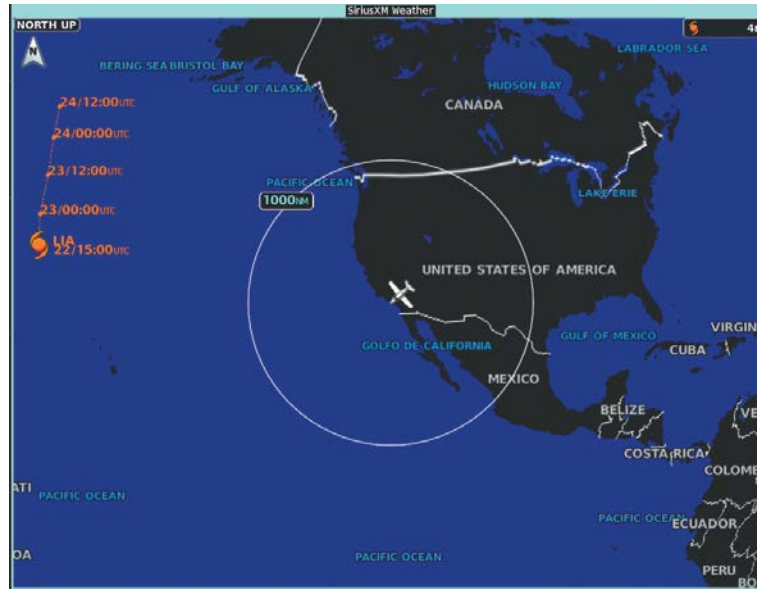


Figure 6-52 Cyclone (Hurricane) Weather Product with Track Information

Enabling/Disabling cyclone (hurricane) weather product:

- 1) From MFD Home, touch **Weather > Weather Selection > SiriusXM Weather > SiriusXM Settings**.
- 2) Scroll as needed in the 'Overlays' Window and touch the **Cyclone Warnings** Button.

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**.

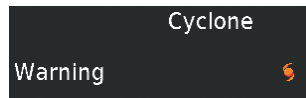


Figure 6-53 Cyclone Legend

ICING (CIP & SLD) (SIRIUSXM)



NOTE: Icing data cannot be displayed at the same time as NEXRAD data.

The Current Icing Potential (CIP) weather product shows a graphical view of the icing environment. Icing severity is displayed in four categories: light, moderate, severe, and extreme (not specific to aircraft type). The CIP product is not a forecast, but a presentation of the current conditions at the time of the analysis.

Supercooled Large Droplet (SLD) icing conditions are characterized by the presence of relatively large, super cooled water droplets indicative of freezing drizzle and freezing rain aloft. SLD threat areas are depicted as magenta dots over the CIP colors.

Displaying Icing data:

- 1) From MFD Home, touch **Weather > Weather Selection > SiriusXM Weather > SiriusXM Settings**.
- 2) Scroll as needed in the 'Overlays' Window and touch the **Current Icing Potential** Button to enable/disable icing information.
- 3) Touch the altitude button (to the right of the **Current Icing Potential** annunciator Button) and scroll to and touch the desired altitude Button (from 1,000 feet up to 30,000 feet.)

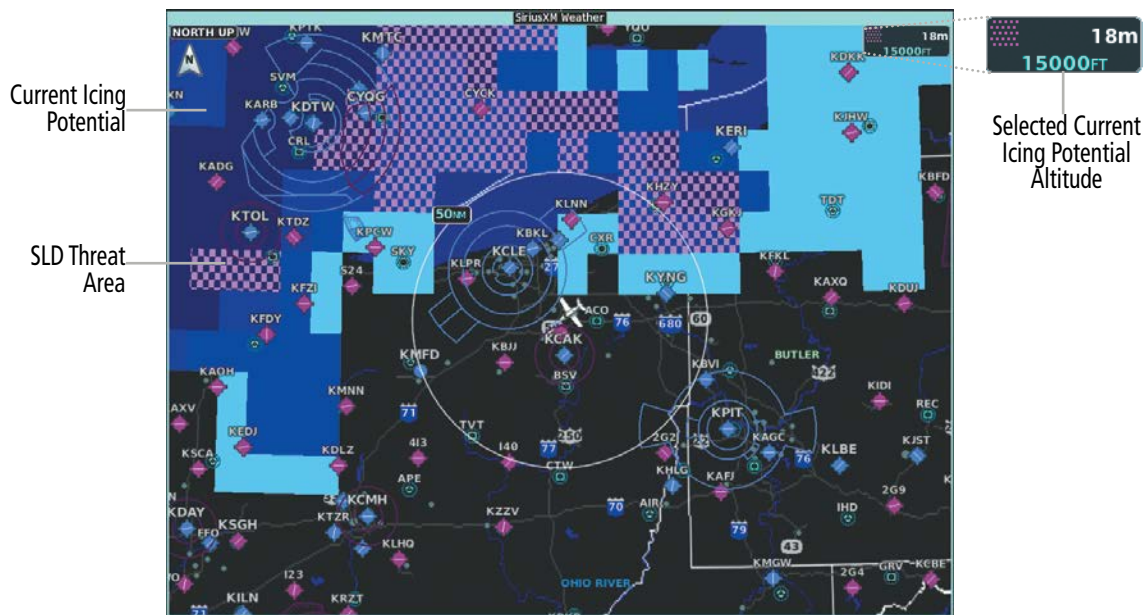


Figure 6-54 Current Icing Potential Overlay at 15,000 Feet

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.

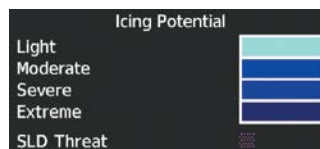


Figure 6-55 Icing Legend

TURBULENCE (SIRIUSXM)

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. Turbulence data is intended to supplement AIRMETs and SIGMETs.

Displaying Turbulence data:

- 1) From MFD Home, touch **Weather > Weather Selection > SiriusXM Weather > SiriusXM 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 (from 21,000 feet up to 45,000 feet).



Figure 6-56 Turbulence Weather Product at 21,000 Feet

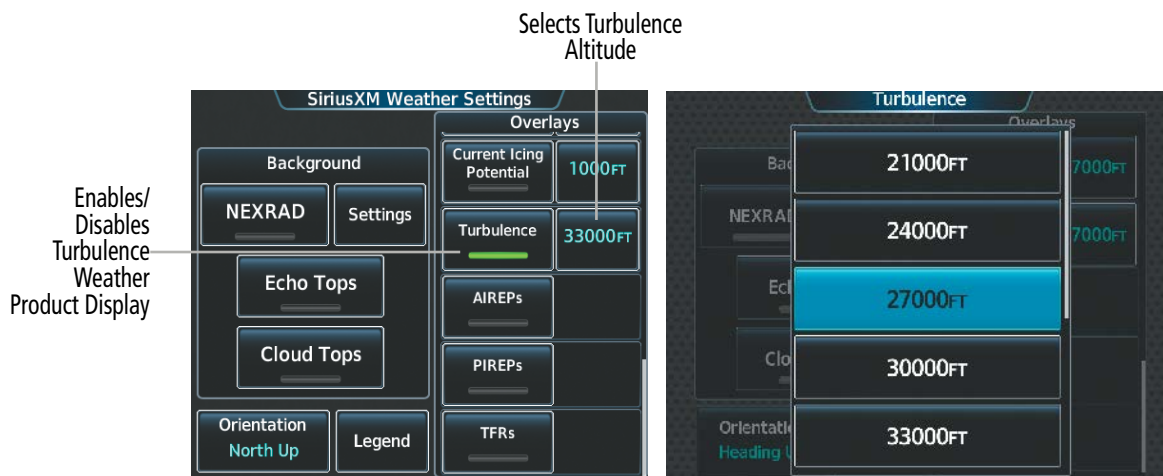


Figure 6-57 Selecting a Turbulence Altitude on the 'SiriusXM Weather Settings' Screen

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**.

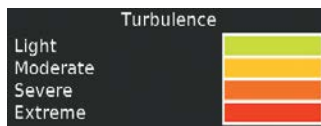


Figure 6-58 Turbulence Legend

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.

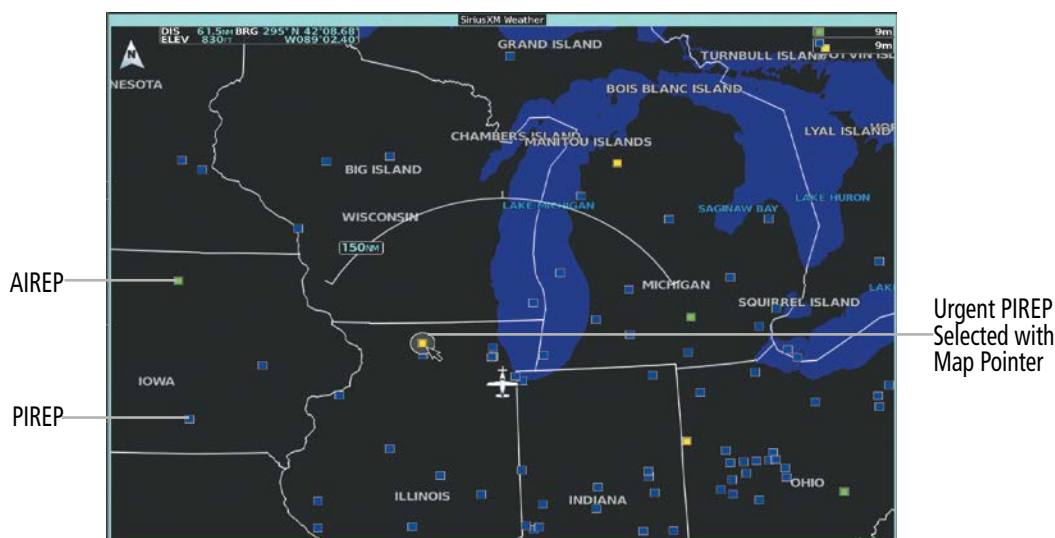


Figure 6-59 AIREPs and PIREPs on the 'SiriusXM Weather' Pane

Displaying PIREP or AIREP information:

- 1) From MFD Home, touch **Weather > Weather Selection > 'Data Link' Weather > 'Data Link' Weather Settings**.
- 2) Scroll in the 'Overlays' Window as needed and touch the **AIREPs** 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 6-60 Displaying PIREPS/AIREPS on the Touchscreen Controller

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 **Back** or **Home**.
 The PIREP color is determined by the type (routine or urgent).

PIREPS	
Urgent	■
Routine	■
AIREPS	
All AIREPS	■

Figure 6-61 AIREPs & PIREPs 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.

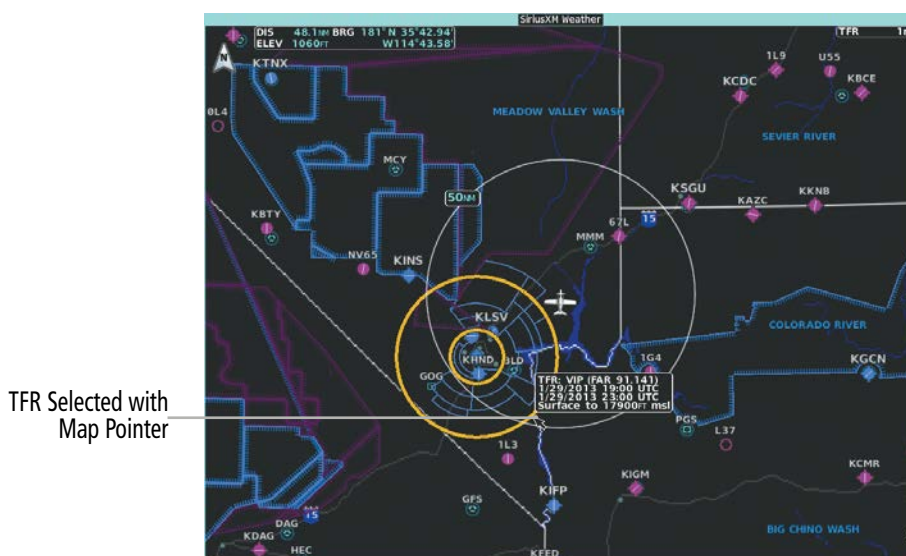


Figure 6-62 TFR Text for TFR Selected with Map Pointer

Enabling/disabling TFR information (Data link Weather Pane):

- 1) From MFD 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.

Enabling/disabling TFR information (Navigation Map Pane):

- 1) From MFD Home, touch **Map > Map Selection > Map Settings**.
- 2) If necessary, touch the **Sensor** Tab.
- 3) Scroll to find the **TFR** Button, and touch to enable/disable TFR information.

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.

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 MFD Home, touch **Map > Map Selection > Map Settings**.
- 2) If necessary, 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.

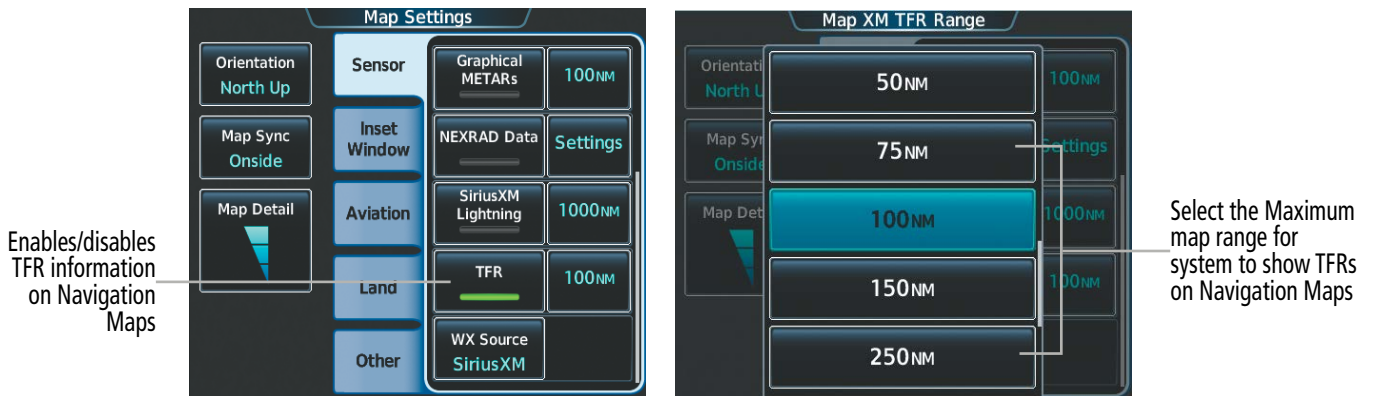


Figure 6-63 Customizing TFR display settings for Navigation Maps

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.
Connex Comm Error [2]	A communications error has occurred with the GIA. The system should be serviced.
Connex Comm Error [4]	This occurs if multiple automatic weather data requests have recently failed, or the GIA is off-line.
Connex Comm Error [5]	The Iridium or Garmin Connex services are not accessible. Check Iridium signal strength. If this error persists, the system should be serviced.
Connex Comm Error [6]	A communications error has occurred. If this error persists, the system should be serviced.
Connex Comm Error [7]	A weather data transfer has timed out. Check Iridium signal strength and re-send the Connex Data Request.
Connex Comm Error [8]	A server error has occurred or invalid data received.
Connex Login Invalid	There is a problem with the Garmin Connex registration. Contact Garmin Aviation Product Support using the information at flygarmin.com .
Connex Server Temporarily Inop	The Garmin Connex weather data server is temporarily out of service, but is expected to return to service in less than 30 minutes.
Connex Server Inop	The Garmin Connex weather data server will be out of service for at least 30 minutes.
Invalid Coverage Area	The Connex Data Request does not sufficiently define a coverage area on which to retrieve weather data. Verify the selections in the Connex Weather Coverage Window, then issue another Connex Data Request.
No Connex Subscription	The system is not currently subscribed to the Garmin Connex 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 Cancelled	The user has cancelled 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 6-6 Abnormal Weather Data Request Status Messages

6.2 AIRBORNE COLOR WEATHER RADAR

WEATHER RADAR INTRODUCTION

The following discussion involves the basic fundamental operation of the Garmin airborne weather radar systems. The main goal of airborne weather radar is to find the distance, direction, and the reflective characteristics (intensity) of the convective weather ahead of the aircraft. When properly applied by the flight crew, airborne weather radar systems allows for strategic and tactical planning for a safe flight. Additionally, workloads will be significantly reduced, while at the same time encounters with adverse weather will be reduced.

In order for the flight crew to obtain the maximum benefits provided from the airborne weather radar system requires both a thorough knowledge and understanding of the onboard airborne radar system functions and meteorological knowledge of adverse weather. Therefore it is the position of Garmin that all flight crews receive training from an appropriate training provider in the practical usage and application of the installed airborne weather radar system.



NOTE: *Garmin recommends the user obtain instruction in the effective operation of airborne weather radar.*

PRINCIPLES OF AIRBORNE WEATHER RADAR

The term RADAR is an acronym for RAdio Detecting And Ranging. Pulsed radar locates targets by transmitting a microwave pulse beam that, upon encountering a target, is reflected back to the radar receiver as a return echo. The microwave pulses are focused and radiated by the antenna, with the most intense energy in the center of the beam and decreasing intensity near the edge. The same antenna is used for both transmitting and receiving.

Radar detection is a two-way process that requires 12.36 μ s for the transmitted microwave pulses to travel out and back for each nautical mile of target range. For example, it takes 123.6 μ s for a transmitted pulse to make the round trip if a target is ten nautical miles away.

The airborne weather radar has the capability to detect the velocity of precipitation moving toward or away from the radar antenna. As the radar pulse beam strikes a moving object, the frequency of the returned echo shifts in relation to the speed at which the object is moving. This effect is analogous to the audible pitch change observed when an emergency vehicle's siren gets closer or moves away. Doppler radar employs this effect to detect areas of precipitation moving at a high rate of speed (indicative of turbulence), Doppler information can also be used to ascertain when an object is stationary, such as the ground. The use of Doppler information can be incorporated to suppress the display of ground clutter.

Airborne weather radar should be used to avoid severe weather. The decision to fly into an area of radar targets depends on target intensity, spacing between the targets, aircraft capabilities, and crew experience. Airborne weather radar is efficient at detecting wet precipitation such as rain, wet snow, and water coated hail, however it will not detect clouds or mist. The display may indicate clear areas between intense returns, but this does not necessarily mean it is safe to fly between them, as these areas may contain severe turbulence or other hazards such as hail. In addition, Doppler radar measurement of precipitation velocity only occurs when rain or hail is moving along the radar beam and either toward or away from the antenna. Airborne weather radar systems cannot detect Clear Air Turbulence (CAT) as there are no particulate for the radar to detect.

NEXRAD AND AIRBORNE WEATHER RADAR

Both Airborne Weather Radar and NEXRAD display weather reflectivity in decibels (dB). A decibel is a logarithmic expression of the ratio of two quantities. Airborne Weather Radar and NEXRAD measure the energy reflected back to the radar over the energy transmitted out, or the radar reflectivity ratio.

Although both radar systems use colors to identify the different echo intensities, the thresholds and colors are not interchangeable. Airborne color radar values must not be confused with NEXRAD radar values. In addition, NEXRAD has the capability to detect lower intensity returns than airborne weather radar. Airborne weather radar return images will not appear the same as NEXRAD return images.

Convective weather activity is known to develop rapidly, with cell growth capable of exceeding several thousand feet per minute. Airborne weather radar provides the flight crew with real-time weather avoidance information for precipitation detected within the airborne weather radar's beam. NEXRAD information is **not** real-time. It is intended to assist the flight crew with hazardous weather avoidance planning. NEXRAD images are comprised of individual radar scans arriving at a network at different rates and times, which are periodically compiled into a mosaic (the NEXRAD weather product) and transmitted through data link. Due to inherent delays in this process, it is common for the displayed NEXRAD images to be significantly older than the current weather situation, and therefore may also differ from information the airborne weather radar presents.



WARNING: *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 significantly older than the indicated weather product age. Images from the data link weather transmission may not match those of the airborne weather radar system. Airborne weather radar image are to be considered real-time when making tactical weather avoidance decisions.*

Because NEXRAD operates from an extensive network of ground-based radar antennas performing 360° scans, it is capable of providing information on large-scale weather patterns such as precipitation associated with significant frontal activity from multiple radar locations. Airborne weather radar can perform up to 120° scan, but is more affected by distance and precipitation attenuation discussed later in this section. Other factors including curvature of the earth (particularly at map ranges greater than 150 miles), antenna tilt setting, and aircraft altitude may also cause the airborne weather radar's antenna beam to miss areas of precipitation which are detected by NEXRAD. In addition, since the airborne weather radar's beam often produces ground returns, it may be difficult to distinguish precipitation from ground returns in manual mode, especially stratus rain when the aircraft is above the precipitation.

Both airborne weather radar and the NEXRAD system can detect a radar top of a storm cell. Airborne weather radar can display this information in vertical scan mode, while NEXRAD radar top information appears in the Echo Tops SiriusXM Weather Product (Refer to Section 6.1 for more information about SiriusXM Weather). Because airborne weather radar and NEXRAD use different detection thresholds, a radar top from airborne weather radar may appear 5,000 feet or more below the NEXRAD-derived Echo Top. Furthermore, radar top information provided from either source is not the actual or true top of the storm, which is only observable with the eyes in clear air and may be much higher than the radar top detected by either system.

Because airborne weather radar and NEXRAD present information using similar (but not interchangeable colors), only one radar source may be shown on a map Display Pane at a time. Pilots should carefully consider information from airborne and data link weather sources, in addition to other available resources to avoid flight into hazardous weather conditions.

ANTENNA BEAM ILLUMINATION

Radar beams are much like the beam of a flashlight, they will illuminate targets within the beam. Just as with a flashlight, the further the beam travels, the wider it becomes and the less effective it is at illuminating targets. The certified beam width contains 90% of the energy of the radar signal, with the strongest part of the beam in the center. Pointing the center of the beam at targets to investigate provides the best returns for a particular target.

The remaining 10% of beam energy (outside the certified beam) has sufficient strength and the antenna has the sensitivity to display highly reflective targets, including additional weather and ground returns. Weather returns from this portion of the beam energy will most likely be under representative of the true intensity of the hazards, because they are so far from the center of the beam (and outside of the certified beam width). The strong reflective nature of terrain features will cause the display of ground clutter well short of where the certified beam width intersects the ground. For the 12-inch antenna this additional beam energy represents approximately four additional degrees at the top and bottom of the certified beam width of 8 degrees.

The following figure depicts the 8 degree radar beam as seen from the side, with both the certified beam width and the additional beam energy illustrated. With the aircraft at 30,000 ft. AGL and a radar tilt angle of zero degrees, ground clutter may be observed starting at approximately 36 NM. The cell located 20 NM from own ship would be over-scanned by the beam, and as a result would not be represented on the radar display. The cell located 80 NM from own ship displays radar tops of 22,000 ft. AGL which is relatively close to the beam center, so this cell would be represented on the display. However, utilizing a lower radar tilt angle would better depict the precipitation intensities of this cell. The cell located at approximately 190 NM displays radar tops of 28,000 ft. AGL, while the center of the beam is at about 65,500 ft. AGL (due to the Earth's curvature at that distance). While this particular cell may appear on the display due to being within the certified beam width, it would most likely be under-represented due to being so distant from the beam center. The radar tilt angle would need to be adjusted downwards to properly explore this cell's precipitation intensity.

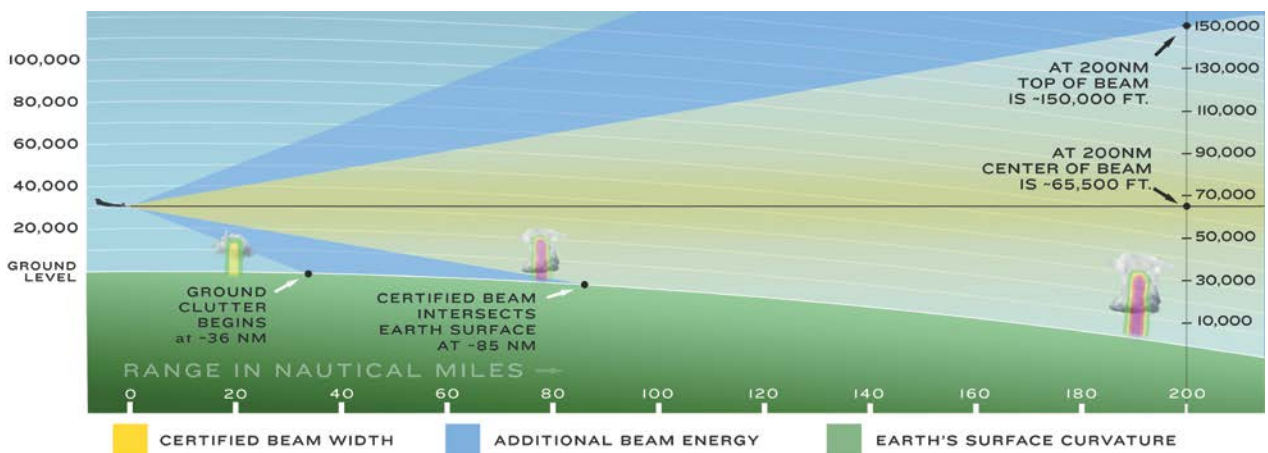


Figure 6-64 Radar Beam in Relation to the Curvature of the Earth from a 12 inch Antenna

RADAR SIGNAL ATTENUATION

The phenomenon of radar signal attenuation affects the operation of weather radar. When the radar signal is transmitted, it is progressively absorbed and scattered, making the signal weaker. This weakening, or attenuation, is caused by two primary sources, distance and precipitation.

Distance attenuation occurs due to the fact the radar energy leaving the antenna is inversely proportional to the square of the distance. The reflected radar energy from a target 40 miles away that fills the radar beam is one fourth the energy reflected from an equivalent target 20 miles away. This would appear to the operator the storm is gaining intensity as the aircraft gets closer. Internal signal processing within the equipped weather radar system compensates for much of this distance attenuation.

Attenuation due to precipitation is not as predictable as distance attenuation. It is also more intense. As the radar signal passes through moisture, a portion of the radar energy is reflected back to the antenna. However, much of the energy is absorbed. If precipitation is very heavy, or covers a large area, the signal may not reach completely through the area of precipitation. The weather radar system cannot distinguish between an attenuated signal and an area of no precipitation. If the signal has been fully attenuated, the radar displays a radar shadow. This appears as an end to the precipitation when, in fact, the heavy rain may extend much further. A cell containing heavy precipitation may block another cell located behind the first, preventing it from being displayed on the radar. Never fly into these shadowed areas and never assume that all of the heavy precipitation is being displayed unless another cell or a ground target can be seen beyond the heavy cell. The WATCH[®] feature of the installed weather radar system can help to identify these shadowed areas. Areas in question appear as shadowed or gray on the radar display. Proper use of the antenna tilt control can also help detect radar shadows.

Attenuation can also be due to poor maintenance or degradation of the radome. Even the smallest amount of wear and scratching, pitting, and pinholes on the radome surface can cause damage and system inefficiency.

RADAR SIGNAL REFLECTIVITY

PRECIPITATION

Precipitation and physical objects, such as solid natural and man-made structures and the surface of the earth, are all detected by the weather radar. The weather radar does not detect thunderstorms or turbulence directly but instead detects precipitation associated with clouds, thunderstorms, and turbulence. The best radar signal reflectors are raindrops, wet snow, or wet hail because liquid water is more reflective than ice. The larger the raindrop, the better the reflectivity. The size of the precipitation droplet is the most important factor in radar reflectivity. Because large drops in a small concentrated area are characteristic of a severe thunderstorm, the radar displays the storm as a strong return. Ice crystals, dry snow, and dry hail have low levels of reflectivity, and often are not detected by the radar. Clouds, fog, mist and light precipitation events such as drizzle contain only small particles and do not reflect enough energy to produce a measurable target return.

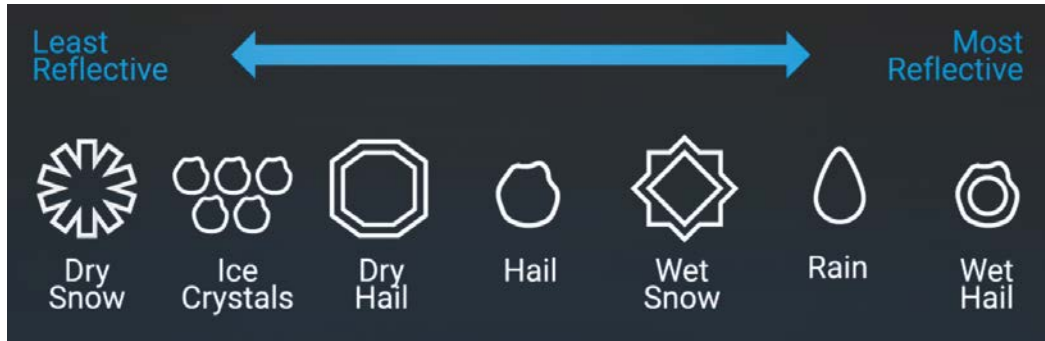


Figure 6-65 Precipitation Type and Reflectivity

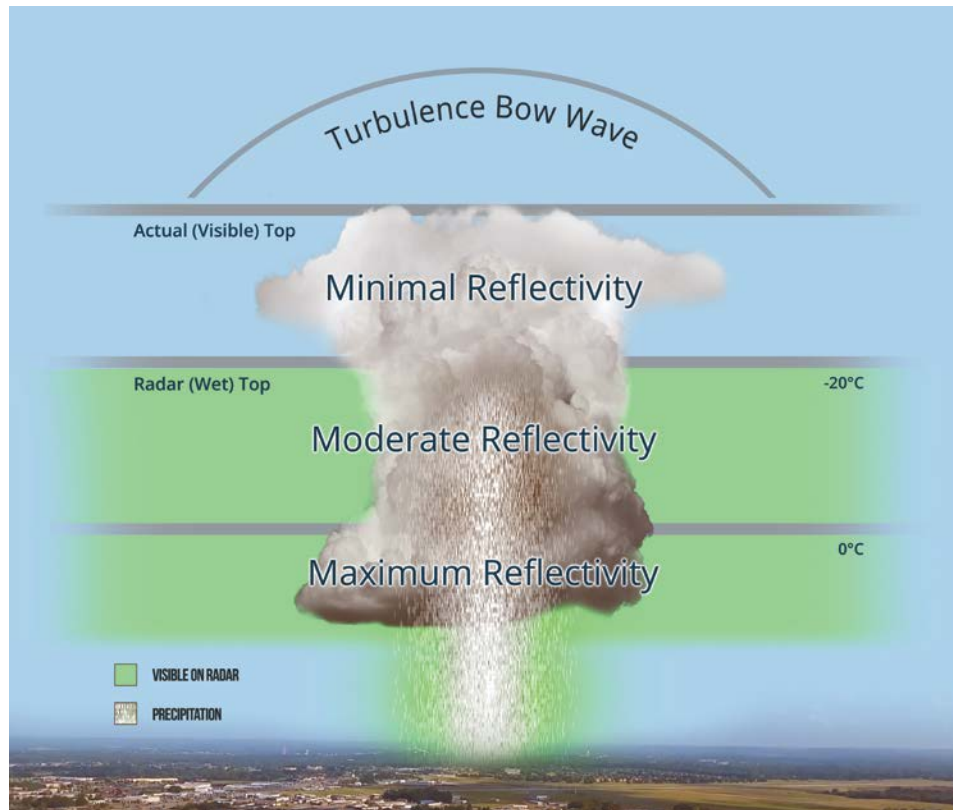


Figure 6-66 Precipitation Reflectivity by Altitude

When using the airborne weather radar to explore a more intense thunderstorm cell, it is critical to understand where radar returns can be expected to be intense, and where they can be expected to decrease to a point where no returns will be displayed. Since liquid precipitation reflects radar energy far better than frozen precipitation, strong radar returns can be expected at lower altitudes, with the strongest radar returns commonly found near the melting level. At higher altitudes, precipitation typically becomes frozen, and reflectivity is significantly reduced; however it is possible to have a column of frozen precipitation consisting of hail and super cooled water droplets to the top of a thunderstorm cell. At a certain altitude within in a thunderstorm cell, returns will begin to diminish. This is the “echo top” of a cell, where radar can no longer detect the frozen precipitation, but this is not the actual cloud top of the cell, which could extend significantly further into the atmosphere. Since it is difficult to detect the actual tops of a thunderstorm cell

with radar, and invisible bow waves may extend beyond visible tops, overflight of thunderstorms should never be attempted. Areas that appear to be clear may actually contain dry hail that has been ejected from the top of the thunderstorm cell or severe turbulence may be encountered.

GROUND

The intensity of ground target returns depends upon the angle at which the radar beam strikes the ground target (Angle of Incidence) and the reflective properties of that target. The gain can be manually adjusted so shorelines, rivers, lakes, and cities are well defined. Increasing the gain too much causes the display to fill in between targets, thus obscuring some landmarks.

Cities normally provide a strong return signal. While large buildings and structures provide good returns, small buildings can be shadowed from the radar beam by the taller buildings. As the aircraft approaches and shorter ranges are selected, details become more noticeable as the highly reflective regular lines and edges of the city become more defined.

Bodies of water such as lakes, rivers, and oceans are not good reflectors and normally do not provide good returns. The energy is reflected in a forward scatter angle with inadequate energy being returned. They can appear as dark areas on the display. However, rough or choppy water is a better reflector and provides stronger returns from the downwind sides of the waves.

Mountains also provide strong return signals to the antenna, but also block the areas behind. However, over mountainous terrain, the radar beam can be reflected back and forth in the mountain passes or off canyon walls, using up all or most of the radar energy. In this case, no return signal is received from this area, causing the display to show a dark spot which could indicate a pass where no pass exists.

SAFE OPERATING DISTANCE



WARNING: Do not operate the weather radar in transmitting mode when personnel or objects are within the MPEL boundary.

The following information establishes a minimum safe distance from the antenna for personnel near operating weather radar. The minimum safe distance is based on the FCC's exposure limit at 9.3 to 9.5 GHz for general population/uncontrolled environments, which is 1 mW/cm². See Advisory Circular 20-68B for more information on safe distance determination.

MAXIMUM PERMISSIBLE EXPOSURE LEVEL (MPEL)

The zone in which the radiation level exceeds the US Government standard of 1 mW/cm² is the semicircular area of at least 14 feet from the 12-inch antenna. All personnel must remain outside of this zone. This recommendation slightly exceeds the calculation methods defined in Advisory Circular 20-68B.



NOTE: The previously published MPEL values are still valid and beyond the minimum safe distances as determined by AC 20-68B. For elevated safety margins, Garmin recommends minimum safe distance values that exercise further caution than those determined in AC 20-68B.

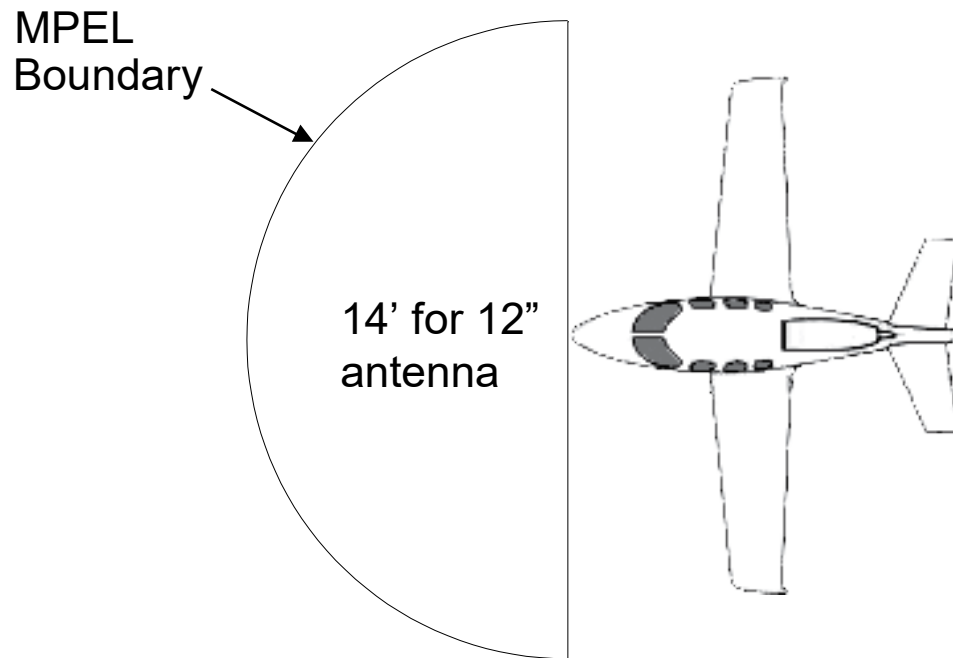


Figure 6-67 MPEL Boundary

BASIC ANTENNA TILT AND RANGE SETUP

Proper antenna tilt management techniques are a major factor for the successful use of any airborne weather system. If the antenna tilt angle is set too low, the radar display will show excessive ground returns, making it difficult for the pilot to distinguish adverse weather phenomena from ground clutter. If the antenna tilt angle is set too high, the radar beam will overscan the top of the adverse weather. In either of these examples, the flight crew would be unable to adequately recognize critical weather information.

The following discussion is a simple method for setting up the weather radar antenna tilt for most situations. It is not to be considered an all encompassing setup that works in all situations, but this method does provide good overall parameters for the monitoring of intense weather threats. Correct application of tilt angle is directly dependent on the height and intensity of the storm and its relative distance from own ship. Adjusting the airborne weather radar tilt angle setting until minimal ground clutter is displayed is the simplest setup method for general surveillance of precipitation returns. For ranges of up to 80 NM this ground clutter should appear on the outer portion of the radar display. At ranges greater than 80 NM, the displayed ground clutter will move lower on the radar display due to the curvature of the earth. By displaying a minimal amount of ground clutter on the installed weather radar system the flight crew can ensure the system is operating and the air mass above the ground clutter is being scanned.

When a strong a weather return is detected within the ground clutter it must be further investigated to ascertain the source of this return. Further tilt angle adjustment of the airborne radar may be required to explore this return. Adjusting the radar tilt angle upwards can reveal the radar tops of this return, while adjusting the tilt angle downwards may be necessary to investigate the strongest intensity of a particular return.

Effective airborne weather radar range management during all phases of flight should be based on the volume of air to be scanned for returns ahead of own ship, to allow sufficient time needed to investigate, analyze, decide, and tactically maneuver around these hazardous weather returns. Longer ranges may be used to strategically identify intense weather returns that may warrant further investigation, and closer ranges may be used during the tactical investigation process.

There is no one tilt or range setting that works for all situations. It is best to remember that active tilt and range management is necessary to identify and then investigate returns.



NOTE: When a strong weather return is displayed on the weather radar, the tilt angle may be adjusted to explore return intensities at various altitudes to aid in determination of radar tops.



WARNING: Overflight of thunderstorms should not be considered safe, as extreme turbulence may exist significantly above observed returns.



NOTE: It is the sole responsibility of the flight crew to avoid areas of hazardous weather by adequate margins.

MANAGING TILT ANGLE AND RANGE

There are many factors to be considered in order to become proficient at using airborne weather radar in all situations. The following setup provides a good starting point for the practical application of radar tilt management.

Radar tilt management can easily be remembered by use of the 1-10-1000 rule. The summary of this rule is the fact that when the flight crew changes the radar tilt angle by 1 degree the resulting change will displace the center of the beam 1000 feet vertically at a range of 10 nautical miles. Applying the 1-10-1000 rule to various distances provides the flight crew with the ability to ascertain how much a 1-degree change in tilt will move the beam vertically. The radar tilt angle is capable of being adjusted in one-quarter degree increments, allowing for greater accuracy in the placement of the beam center at desired altitudes.

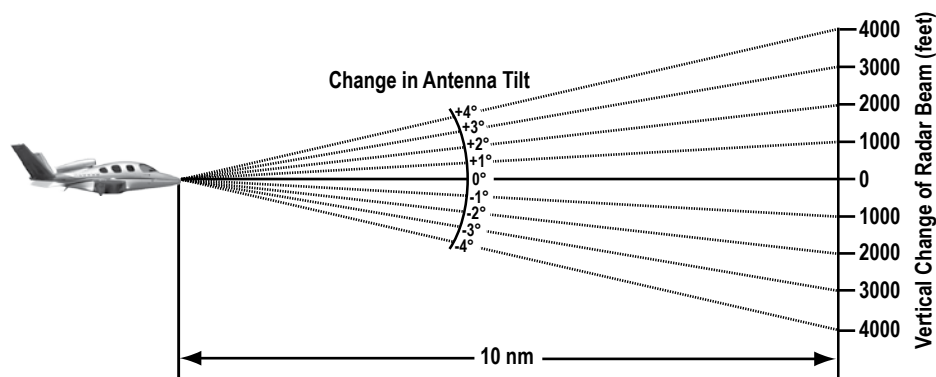


Figure 6-68 Vertical Change in Radar Beam per Nautical Mile

The 12-inch phased array antenna has a certified beam width of 8 degrees, which means the beam is 8,000 feet in height (and width) at 10 NM and 80,000 feet in height (and width) at 100 NM.

- At 20 NM range the beam height changes by 2,000 ft. per degree of tilt change.
- At 40 NM range the beam height changes by 4,000 ft. per degree of tilt change.
- At 100 NM range the beam height changes by 10,000 ft. per degree of tilt change.

Additionally, setting the tilt to UP 4.00 degrees places the bottom of the certified beam at the same altitude as the aircraft, which is a technique used to determine whether radar tops reach your current altitude

Phase of Flight	Tilt Angle	Range Setting	Notes
Taxi	Up 7.50° to 10.00°	20 NM	Activate weather mode when clear of ramp area.
Takeoff / Initial Climb	Up 7.50° to 10.00° Altitude Compensated Tilt On	60 NM	If precipitation is observed in the departure path, gain can be reduced to aid in identification of intense returns.
10,000 Ft. AGL	Up 5.00° Altitude Compensated Tilt On	60 - 80 NM	Range setting is dependent upon ground speed and time available for deviations.
Cruise	Tilt to Minimize Clutter Altitude Compensated Tilt On	60 - 120 NM	Range setting is dependent upon ground speed and time available for deviations. Tilt angle set to show minimal ground clutter.
Descent To 10,000 FT	Tilt to Minimize Clutter Altitude Compensated Tilt On	60 - 120 NM	Range setting is dependent upon ground speed and time available for deviation.
Descent Below 10,000 FT	Up 7.50° to 10.00° Altitude Compensated Tilt On	40 - 60 NM	Range setting is dependent upon ground speed and time available for deviation. Tilt angle set to show ground clutter in outer 1/3 of radar display.
Approach	Up 7.50° to 10.00° Altitude Compensated Tilt On	20 NM	These settings allow for observation of the approach area and the missed approach holding area.

Table 6-7 Typical Tilt Settings by Phase of Flight



NOTE: Garmin recommends the user obtain instruction in the proper operation of airborne weather radar.

ALTITUDE COMPENSATED TILT (ACT)

The Altitude Compensated Tilt feature of the GWX 75 and GWX 8000 (Manual Mode Only) enables automatic management of the antenna tilt angle function as the aircraft altitude changes. When ACT is enabled, the altitude of the center of the radar beam located at three-fourths (3/4) of the selected current map range is determined by the system and the angle required to maintain this altitude at that part of the beam is calculated and used by the radar. To better understand the function of ACT, it might be helpful for the flight crew to think of the point that is located within the center of the beam at three-fourths (3/4) of the currently selected map range as a pivot point. When ACT is enabled, and an altitude change occurs, ACT will recalculate the angle to this original point from the new altitude and adjust the antenna tilt angle to position the beam appropriately.

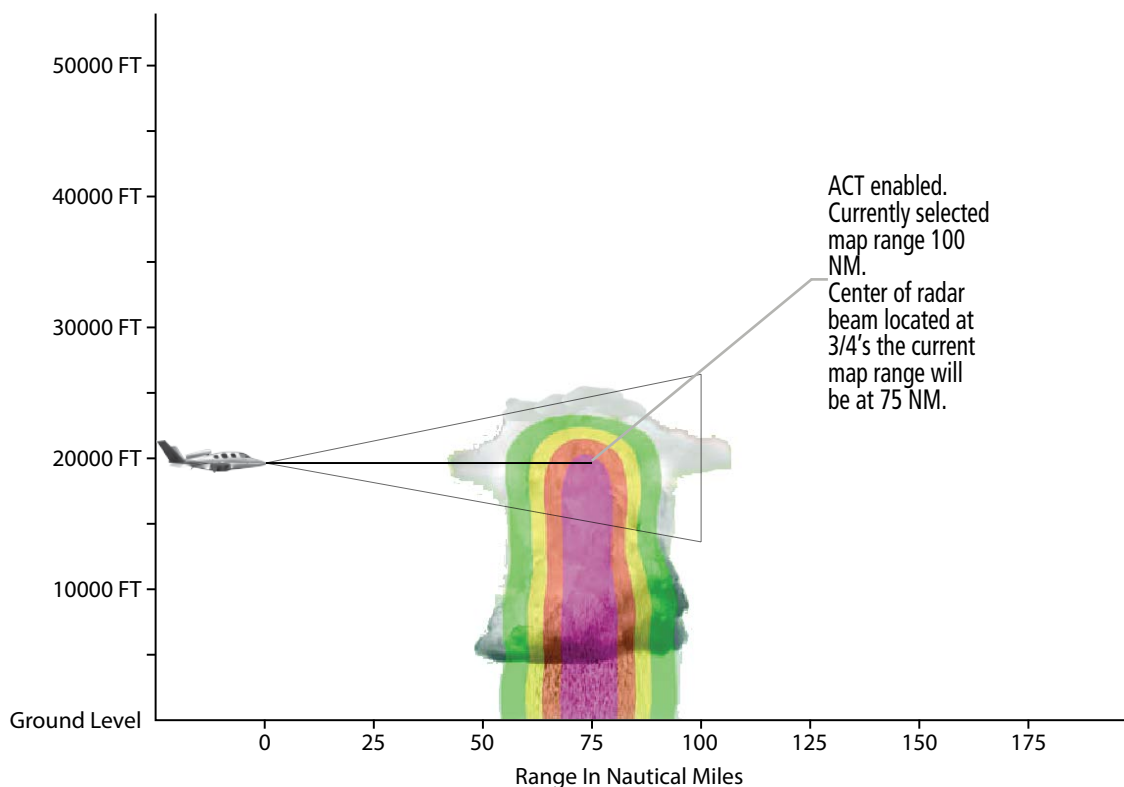


Figure 6-69 Altitude Compensated Tilt Enabled During Level Flight (Manual Mode Enabled)

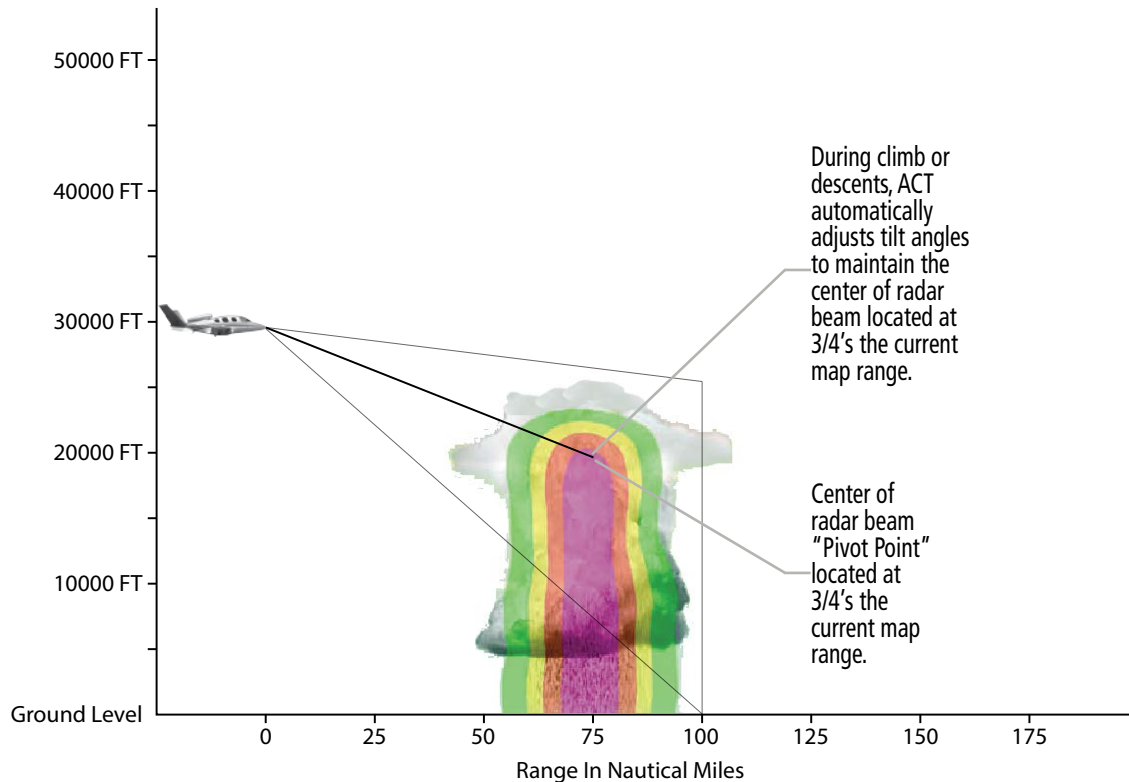


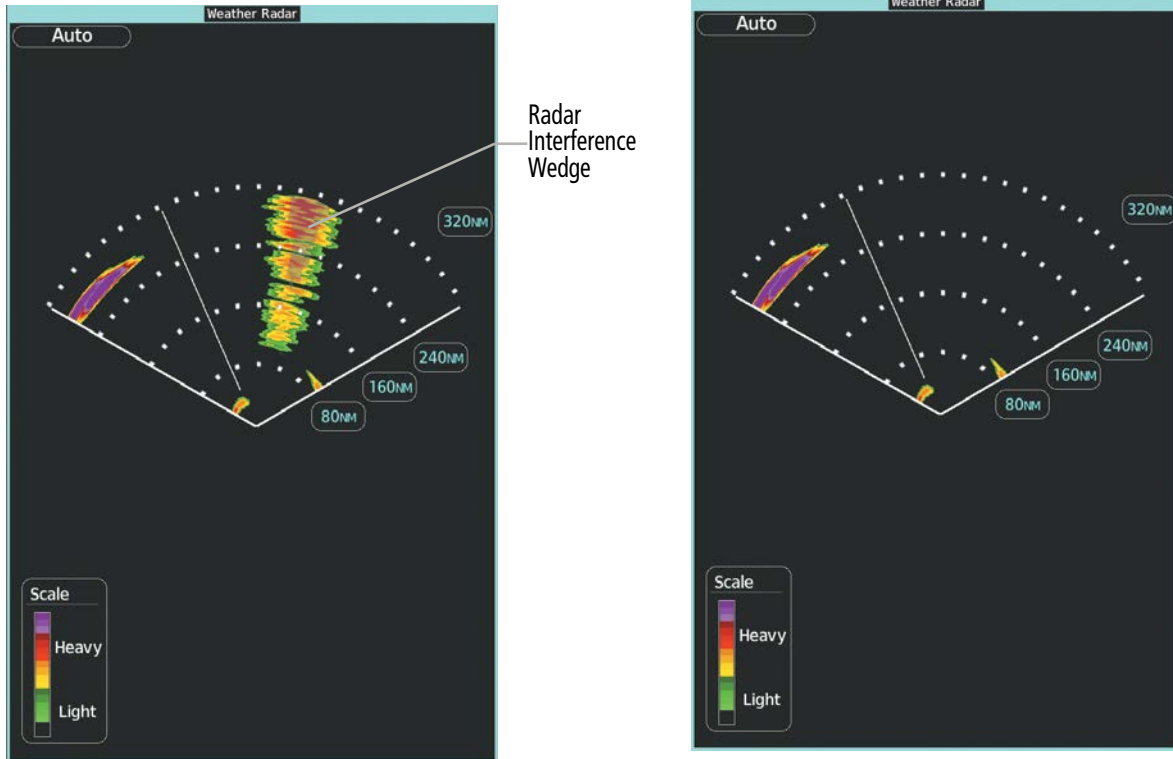
Figure 6-70 Altitude Compensated Tilt Enabled before aircraft altitude has changed (Manual Mode Enabled)

Selection of an appropriate initial range and tilt angle combination is crucial to satisfactory use of the ACT feature. Improper utilization of ACT by the flight crew will result in reduced ability to detect and identify weather hazards and may result in inadvertent thunderstorm penetration. ACT is not intended to be utilized continuously for all phases of flight. ACT is available in the Horizontal Scan Mode when the system is operating in Weather Display and GPS altitude is available.

RADAR INTERFERENCE

Radar interference occurs when either the GWX 70 or GWX 75 airborne weather radar receives radar signals from other radars operating in the same frequency band. Interference can result in false weather returns being displayed on the radar display. Interference sources can include ground radars and other airborne weather radars, including other GWX 70 or GWX 75 equipped aircraft operating in the vicinity of ownship. However, interference from high power radars, such as military radars, are sometimes impossible to suppress.

The optionally equipped Garmin airborne weather radars constantly detects and automatically suppresses radar interference. The Garmin airborne weather radar systems employ a frequency-hopping technique to mitigate radar interference. When the weather airborne radar processor's detects interference, frequency-hopping will take place at the end of each radar sweep. It is not uncommon for Garmin airborne weather radars to make multiple radar sweeps before the detected radar interference disappears as it attempts to switch to a quiet operating frequency.



Radar Interference detected by GWX 75 displayed on the 'Weather Radar' Pane

GWX 75 operating on a quiet frequency and radar interference removed from the 'Weather Radar' Pane

Figure 6-71 'Weather Radar' Pane Displaying Radar Interference

WEATHER DISPLAY AND INTERPRETATION

When evaluating various target returns on the weather radar displays, the colors denote precipitation intensity shown in the following table.



NOTE: *The color magenta (GWX 70) only represents turbulence when the turbulence detection option is installed.*

Weather Mode Color	Intensity (in dBz)	Description
Black	< 23 dBZ	Light
Green	23 dBZ to < 33 dBZ	
Yellow	33 dBZ to < 41 dBZ	Moderate
Red	41 dBZ and greater	Heavy
Magenta (Optional)	TURB- (Optional) Turbulence Detection uses the color magenta to show areas of rain or hail that may also contain turbulence	

Table 6-8 Precipitation Intensity Levels (GWX-70)

Weather Mode Color	Intensity (in dBZ)	Description
Black	< 23 dBZ	Light
Green	23 dBZ or 24 dBZ	
Green	25 dBZ or 26 dBZ	
Green	27 dBZ or 28 dBZ	
Green	29 dBZ or 30 dBZ	
Green	31 dBZ or 32 dBZ	
Yellow	33 dBZ or 34 dBZ	Moderate
Yellow	35 dBZ or 36 dBZ	
Yellow	37 dBZ or 38 dBZ	
Yellow	39 dBZ or 40 dBZ	
Red	41 dBZ or 42 dBZ	Heavy
Red	43 dBZ or 44 dBZ	
Red	45 dBZ or 46 dBZ	
Red	47 dBZ or 48 dBZ	
Magenta	49 dBZ or 50 dBZ	Extreme
Magenta	51, 52, or 53 dBZ	
Magenta	> 53 dBZ	
White	TURB- Turbulence Detection uses the color white to show areas that may also contain turbulence	

Table 6-9 Precipitation Intensity Levels (GWX-75)

THUNDERSTORMS

Updrafts and downdrafts in thunderstorms carry water through the cloud. The more severe the drafts, the greater the number and size of the precipitation droplets. With this in mind, the following interpretations can be made from what is displayed on the weather radar. Avoid these areas by at least 20 nautical miles.

- In areas where the displayed target intensity is red or magenta (indicating large amounts of precipitation), the turbulence (areas of white) is considered severe.
- Areas that show steep color gradients (intense color changes) over thin bands or short distances suggest irregular rainfall rate and strong turbulence.
- Areas that show red or magenta are associated with hail, as well as heavy precipitation. While areas of turbulence will be displayed as white. Vertical scanning and antenna tilt management (Manual Mode) may be necessary to identify areas of maximum intensity.
- Areas of radar shadowing which can result from an attenuated (weakened) signal from a nearby storm, bodies of water, or mountainous terrain, hiding a larger and more dangerous storm which may exist in the apparently benign area directly behind the nearby return.



WARNING: Areas of radar shadowing should be avoided and never flown through as uncertain weather conditions may exist in these areas.

Along squall lines (a group of multiple cells or clusters of cells in a line) individual cells may be in different stages of development. Characteristics of squall line thunderstorms: they tend to move quickly, typically only 20 miles wide, but can be stretched out hundreds of miles long.

Irregularities in the target return may also indicate turbulence, appearing fingers, scalloped edges, steep rainfall gradients, and echoes that bow toward the radar antenna. These irregularities may also be present in green areas with no yellow, red, or magenta areas and should be treated as highly dangerous areas.

Additionally, thunderstorms can rapidly develop into much larger and more dangerous supercell thunderstorms. A characteristic that sets supercell thunderstorms apart from other thunderstorms is the presence of a deep and persistent rotating updraft. This rotating updraft is known a mesocyclone and it has the potential to create extreme turbulence, very large hail, and tornadoes. Radar returns indicating the presence of any of these characteristics are signs that a violent thunderstorm is in progress and the area should be avoided. Supercell thunderstorms can be long lived (greater than 1 hour in duration) and are most common in the central part of the United States, but they can occur in other regions as well.

Areas between closely spaced, intense targets may contain developing clouds not having enough moisture to produce a return. However, these areas could have strong updrafts or downdrafts. Targets showing wide areas of green are generally precipitation without severe turbulence.



WARNING: Overflight of thunderstorms should not be considered safe, as extreme turbulence or hail may exist significantly above observed returns.

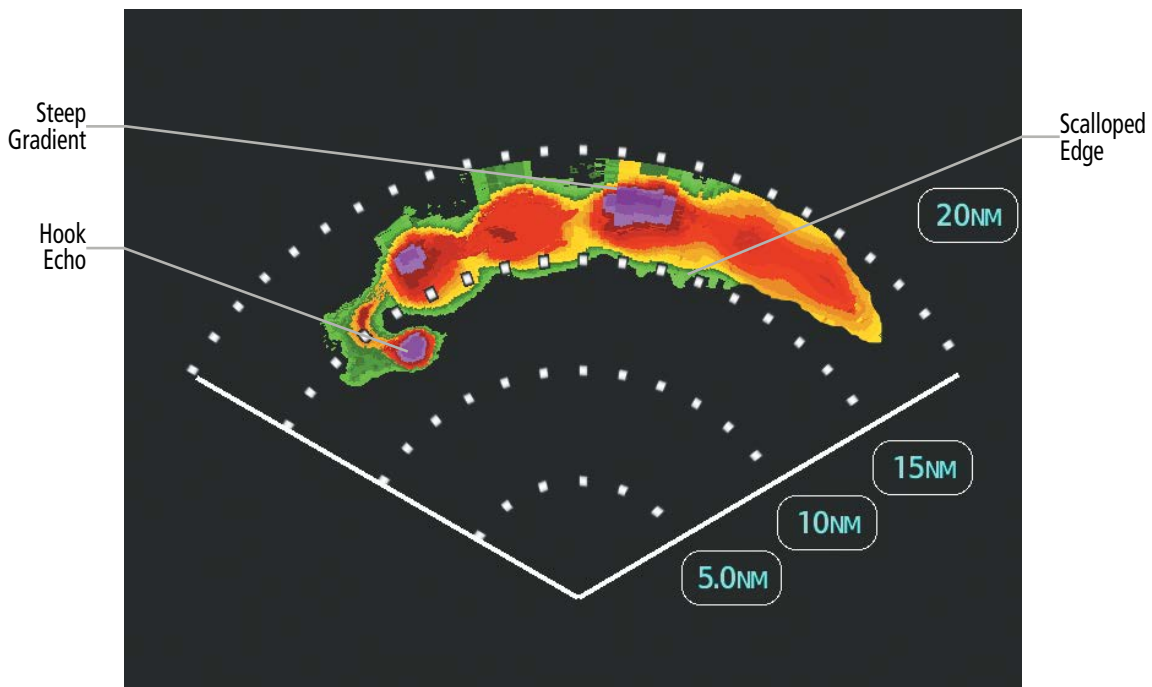
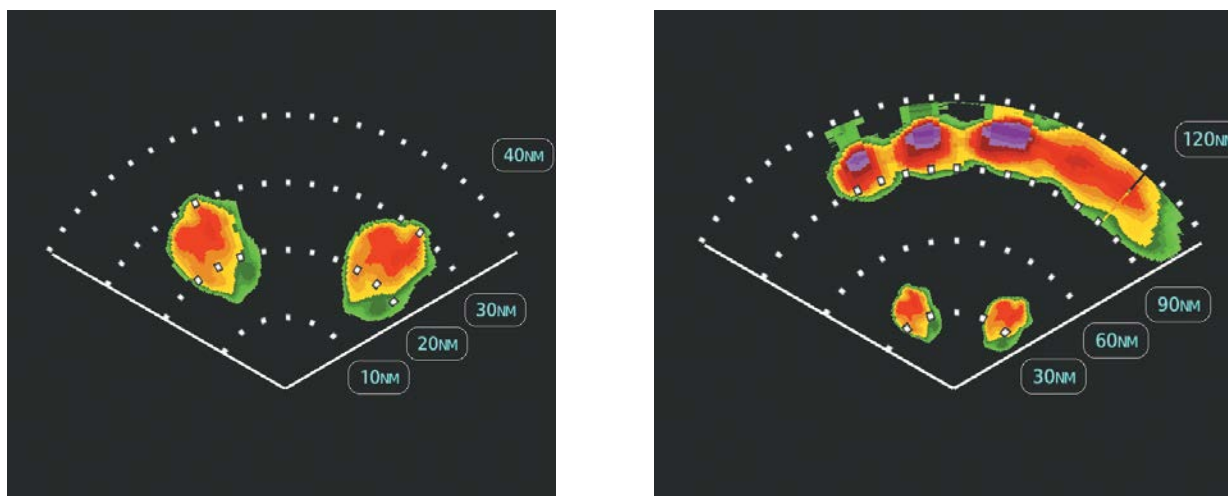


Figure 6-72 Cell Irregularities

Thunderstorm development is rapid. A course may become blocked within a short time. When displaying shorter ranges, periodically select a longer range to see if problems are developing further out. That can help prevent getting trapped in a blind alley or an area that is closed at one end by convective weather.



The Blind Alley at Close Range

The Large Storm Behind

Figure 6-73 The Blind Alley - Horizontal Scan

In areas of multiple heavy cells, use the Vertical Scan feature along with antenna tilt management (Manual Mode) to examine the areas. Remember to avoid shadowed areas behind targets.

TORNADOES

As discussed previously, some thunderstorms can develop into supercell thunderstorms. Some of these supercell thunderstorms may present a distinct radar signature in the form of a hook-echo. A hook echo develops when the counter-clockwise winds that encircle the rotating updrafts are significantly strong enough that precipitation is wrapped around the rain free back side of the updraft of the supercell. Within this area of the hook-echo the possibility exists for a tornado to form. Radar returns containing a hook echo are signs that a violent thunderstorm is in progress and should be avoided.

The identification of tornados become more challenging when the tornado has become rain wrapped. A rain wrapped tornado may be impossible to differentiate from the surrounding precipitation on the radar display.

There are no conclusive radar target return characteristics which identify a tornado. However, tornadoes may be present if the following characteristics are observed:

- A narrow, finger-like portion extends and in a short time curls into a hook echo and closes on itself.
- A hook echo, which may be in the general shape of the numeral 6 (numeral 9 in the southern hemisphere), especially if bright and projecting from the southwest quadrant (northeast quadrant in the southern hemisphere) of a major thunderstorm.
- V-shaped notches.
- Doughnut shapes.

These shapes do not always indicate tornadoes, and tornado returns are not limited to these characteristics. Confirmed radar observations of tornadoes most often have not shown shapes different from those of a normal thunderstorm display.

HAIL AND RADAR TOPS

Hail results from updrafts carrying water high enough to freeze. Therefore, the higher the top of a thunderstorm, the greater the probability the thunderstorm contains hail. Vertically scanning the target return can give the radar top of a thunderstorm that contains hail. Radar top is the top of a storm cell as detected by radar. It is not the actual top, or true top of the storm. The actual top of a storm cell is seen with the eyes in clear air and may be much higher than the radar top. Neither the radar top nor the actual top necessarily indicate the top of the hazardous area, which may be much higher.

Hail can be divided into two states: 'wet' or 'dry'. Wet hail can have a film of water on its surface, making its reflective characteristics similar to a very large water droplet. Because of this film of water, and because hail stones usually are larger than water droplets, thunderstorms with large amounts of wet hail return stronger signals than those with rain. Wet hail will have high-reflectivity properties.

Some hail shafts are extremely narrow (100 yards or less) and make poor radar targets. In the upper regions of a cell where ice particles are dry (no liquid coating), target returns are less intense. At these altitudes, dry hail can fall below the minimum reflectivity threshold for radar detection.

Hail shafts are associated with the same radar target return characteristics as tornados. U-shaped cloud edges three to seven miles across can also indicate hail. These target returns appear quite suddenly along any edge of the cell outline. They also change in intensity and shape in a matter of seconds, making vigilant monitoring essential.



WARNING: *Overflight of thunderstorms should not be considered safe, as extreme turbulence or hail may exist significantly above observed returns.*

STRATUS PRECIPITATION

Detecting areas of low altitude, stratus precipitation while the aircraft altitude is significantly above the precipitation is difficult to accomplish with airborne weather radar. This is because as the radar beam detects the low altitude precipitation, it also receives significant ground returns which are displayed with the precipitation. Raising the antenna tilt angle may reduce the ground returns, however the radar beam is likely to overshoot the low-altitude precipitation when the aircraft is at a high altitude above the precipitation.

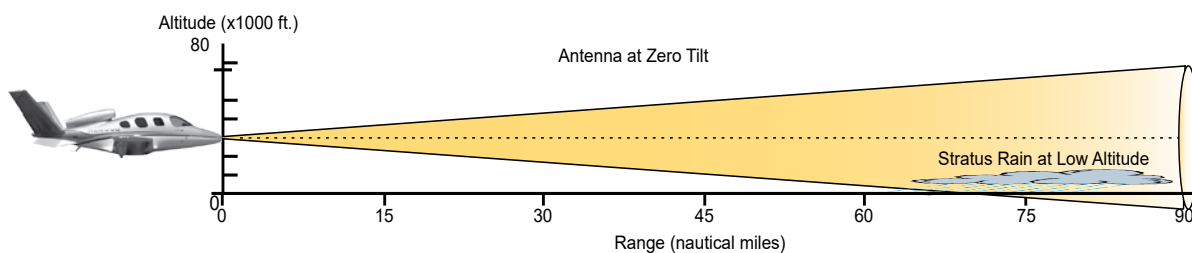


Figure 6-74 Stratus Rain Combines with Ground Returns when Aircraft is at Higher Altitudes

As the aircraft descends to a lower altitude, increasing the antenna tilt angle may help to reduce unwanted ground returns and make the display of stratus precipitation more apparent.

GARMIN WEATHER RADAR SYSTEMS

The following discussion describes the optional airborne weather radars and their specific operation. Please refer to your airframes current aircraft equipment list to ascertain which specific airborne weather radar is installed.

GWX 70 SYSTEM DESCRIPTION

The Garmin GWX 70 Airborne Color Weather Radar is a solid-state pulsed-Doppler radar. It combines excellent range, sensitivity, and adjustable scanning profiles with high-definition, real-time target information.

The Cirrus SF50 when equipped with a GWX 70 utilizes a 12-inch antenna that is fully stabilized to accommodate 30° of pitch and roll.

Key GWX 70 capabilities include:

- Range of 320 nautical miles.
- 120 degree wide Horizontal Scan Mode.
- Weather Display uses a 5-color palette for improved weather contouring distinction.
- Map Display uses a 4-color palette.
- Vertical Scanning Mode helps to analyze storm tops, gradients, and cell buildup activity at various altitudes.
- Sector Scanning Mode allows crew-adjustable horizontal scan angles of 20°, 40°, 60°, 90°, or select a full 120° scan.
- Ability to display radar images overlaid on 4 different Navigation Map displays or on 3 dedicated display panes.
- Extended Sensitivity Time Constant (STC) logic automatically correlates distance of the return echo with intensity, so cells do not suddenly appear to get larger as they get closer.
- Independent control of weather radar Gain and Tilt for each display pane.
- Altitude-Compensated Tilt (ACT) management, which automatically adjusts the antenna tilt angle as the aircraft altitude changes.
- Doppler enabled Ground Clutter Suppression (GCS) (optional), to remove ground clutter from the displays.
- Turbulence Detection (optional) which presents areas of turbulence associated with precipitation using Doppler measurements.
- WATCH[®] (Weather ATtenuated Color Highlight) feature identifies areas where weather returns are underrepresented or not visible due to attenuation from intervening precipitation.
- Weather Alert that looks ahead for intense cell activity in the 80-320 nm range, even if these ranges are beyond the currently selected map range.



NOTE: *Garmin recommends the user obtain instruction in the effective operation of airborne weather radar.*

GWX 75 SYSTEM DESCRIPTION

The Garmin GWX 75 Airborne Color Weather Radar is a solid-state pulsed-Doppler radar. It combines excellent range, sensitivity, and adjustable scanning profiles with high-definition, real-time target information.

The Cirrus SF50 when equipped with a GWX 75 utilizes a 12-inch antenna that is fully stabilized to accommodate 30° of pitch and roll.

Key GWX 75 capabilities include:

- Range of 320 nautical miles.
- 120 degree wide Horizontal Scan Mode.
- Weather Display uses a 16-color palette for improved weather contouring distinction.
- Map Display uses a 4-color palette.
- Vertical Scanning Mode helps to analyze storm tops, gradients, and cell buildup activity at various altitudes.
- Sector Scanning Mode allows crew-adjustable horizontal scan angles of 20°, 40°, 60°, 90°, or select a full 120° scan.
- Ability to display radar images overlaid on 4 different Navigation Map displays or on 3 dedicated display panes.
- Extended Sensitivity Time Constant (STC) logic automatically correlates distance of the return echo with intensity, so cells do not suddenly appear to get larger as they get closer.
- Independent control of weather radar Gain and Tilt for each display pane.
- Altitude-Compensated Tilt (ACT) management, which automatically adjusts the antenna tilt angle as the aircraft altitude changes.
- Doppler enabled Ground Clutter Suppression (GCS) (*optional*), to remove ground clutter from the displays.
- Turbulence Detection (*optional*) which presents areas of turbulence associated with precipitation using Doppler measurements.
- WATCH[®] (Weather ATtenuated Color Highlight) feature identifies areas where weather returns are underrepresented or not visible due to attenuation from intervening precipitation.
- Weather Alert that looks ahead for intense cell activity in the 80-320 nm range, even if these ranges are beyond the currently selected map range.



NOTE: *Garmin recommends the user obtain instruction in the effective operation of airborne weather radar.*

GWX 70/75 WEATHER RADAR OPERATION



WARNING: *Do not operate the weather radar in a transmitting mode when personnel or objects are within the MPEL boundary.*



WARNING: *Do not assume weather radar transmission is disabled unless all display panes displaying weather radar are set to Standby Mode, and are displaying 'STANDBY' in the center of each weather radar display.*



CAUTION: *When all display panes displaying weather radar are set to Standby Mode, the antenna is parked at the center line. It is always a good idea to ensure the radar is in Standby Mode before taxiing the aircraft to prevent the antenna from bouncing on the bottom stop and possibly causing damage to the radar assembly.*



NOTE: *Garmin recommends the user obtain instruction in the effective operation of airborne weather radar.*

The airborne weather radar allows the flight crew to show weather radar information on multiple display panes, and to customize each display independently. For example, if three radar displays are shown (including navigation map overlays or Weather Radar Panes), the flight crew may select Weather Mode with a horizontal scan for the first display, Weather Mode with a vertical scan for the second display, and Ground Mode with a horizontal scan for the third display. Additionally, if any of the selected pane displaying weather radar data is placed into Standby Mode then all remaining panes displaying radar data will be placed in Standby Mode.

The weather radar updates each display as it performs a scan with the given parameters for that display. If more than one display has identical scan parameters, the system uses information from one antenna sweep to update the applicable displays simultaneously. Otherwise, the antenna performs multiple scans, one at a time, in a repeating cycle. This results in longer duration between scans for a given display until the next available scan refreshes that display.

For discussion purposes, it may be helpful to think of the weather radar system as having up to four separate radars. Each radar has an independent display and controls, therefore, operating independently of one another. All radar functions and operations may be performed on any, or all radar displays. As stated previously, since scanning is “shared” between radar displays, the greater the number of radars displayed, the slower the scan update for each display.

As power is supplied to the system, the weather radar performs an antenna clearance check to ensure proper antenna movement within the radome before entering Standby Mode. When the aircraft is on the ground if the flight crew enables the **Radar On** Button (green annunciator), all display panes or map overlays showing weather radar information will remain in Standby Mode until the weather radar system caution annunciation is acknowledged on one of the Touchscreen Controllers. After the flight crew acknowledges the weather radar system caution annunciation, all panes displaying weather radar data will begin a horizontal weather scan. When the **Radar On** Button is disabled (gray annunciator), all display panes or map overlays showing weather radar imagery are placed in Standby Mode.

When the weather radar system is in the Weather or Ground Map mode, the system automatically places the radar in Standby Mode on landing.

The weather radar system will continue to operate in all modes as long as at least one Touchscreen Controller is operating this includes when the system is operating in Reversionary Modes. If both Touchscreen Controllers fail, the radar system automatically changes to Standby Mode and cannot be controlled. The weather radar will automatically go into Standby Mode if the unit detects a fault.

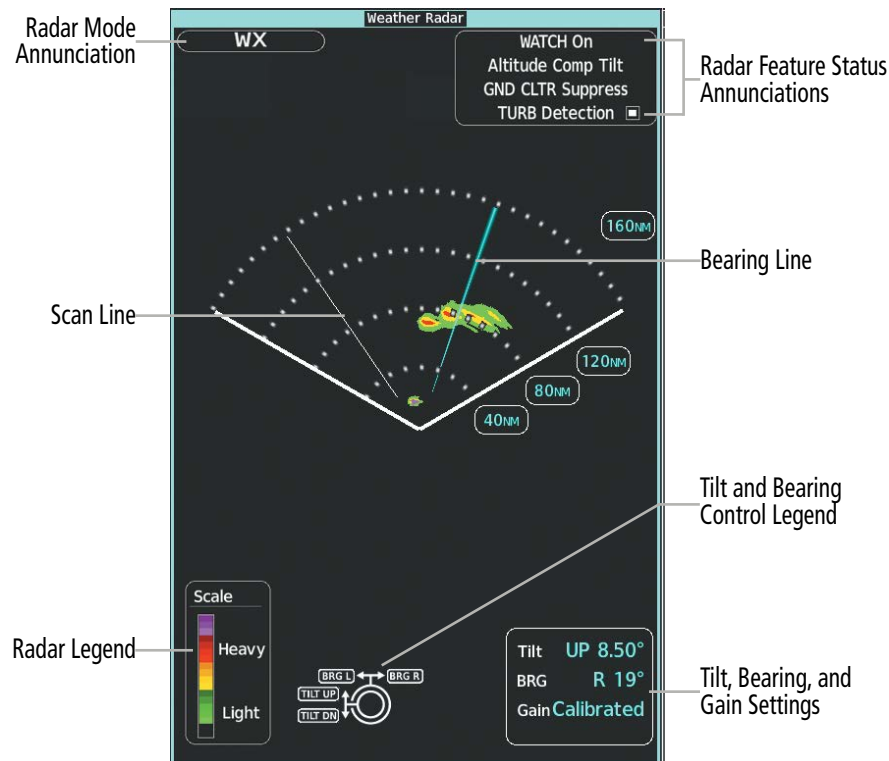


Figure 6-75 'Weather Radar' Pane with a Horizontal Scan (GWX-75)

Showing Weather Radar Information on the Weather Radar Pane:

- 1) From MFD Home, touch **Weather > Weather Selection > WX RADAR > WX RADAR Settings**.
- 2) Touch the **Radar On** Button. Radar options are enabled when button annunciator is green, off when gray.
- 3) Touch the **Display** Button.
- 4) Touch the **Weather** Button. If the aircraft is airborne, the radar begins transmitting, and the Radar Mode indicates 'WEATHER'.
- 5) If the aircraft is on the ground, the Touchscreen Controller displays a prompt shown in the following figure to confirm radar activation. Touch the **OK** Button to begin transmitting, or touch the **Cancel** Button to return to the Weather Radar Settings screen, and the radar remains in Standby Mode.
- 6) Turn the lower knob to select the desired map range.
- 7) The system displays a horizontal scan. To change to a vertical scan, refer to the following procedure, "Vertically scanning a storm cell."



Figure 6-76 Confirming Activating Radar



NOTE: Vertical scanning of a storm cell should be done with the aircraft wings level to avoid constant adjustment of the Bearing Line.

Vertically scanning a storm cell:

- 1) From MFD Home, touch **Weather > Weather Selection > WX RADAR > WX RADAR Settings**.
- 2) While on a Horizontal Scan view, touch the **Bearing Line** Button if necessary to show the Bearing Line on the Weather Radar Pane.
- 3) Push the upper knob. This enables the large upper knob to set the Bearing Line position and displays a bearing and tilt legend.
- 4) Turn the large upper knob to place the Bearing Line on the desired storm cell or other area to be vertically scanned.
- 5) Touch the **Scan** Button.
- 6) Touch the **Vertical** Button. The Weather Radar Pane shows a vertical scan.
- 7) Turn the large upper knob to move the bearing line a few degrees left or right. When finished, push the knob to disable bearing line adjustment.
- 8) Turn the lower knob to adjust the map range as needed.
- 9) To select a new area to be vertically scanned, return to the Horizontal scan mode.
 - a) Touch the **Scan** Button.
 - b) Touch the **Horizontal** Button.
 - c) Return to Step 2 of this procedure.

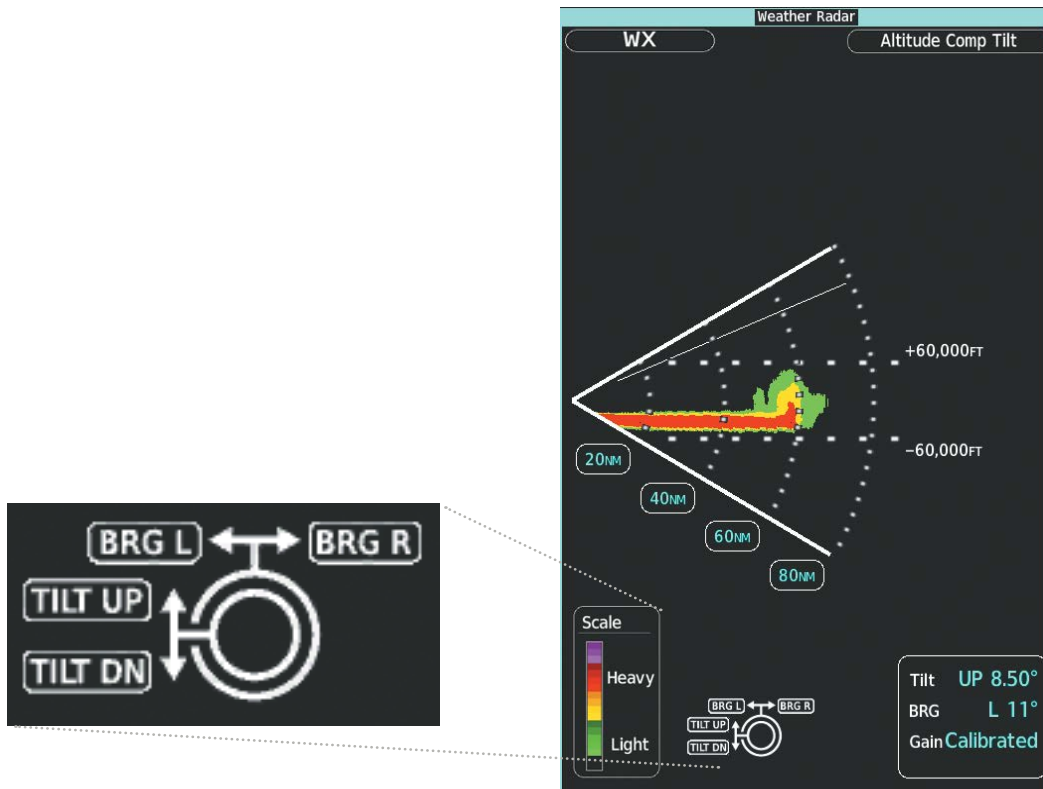


Figure 6-77 Weather Radar Display with Vertical Scan Mode Selected (GWX-75)

ADJUSTING ANTENNA TILT ANGLE

Managing the tilt angle is critical to effective employment of airborne weather radar. The flight crew should actively manage tilt to explore radar returns. The tilt angle may be adjusted when employing either Horizontal Scan Mode or Vertical Scan Mode.

Adjusting antenna tilt on the Weather Radar Pane:

- 1) Push the upper knob to activate the tilt adjustment function. The Weather Radar displays a bearing and tilt knob legend.
- 2) Turn the small upper knob to adjust the antenna tilt angle.
- 3) When finished, push the upper knob to disable the tilt adjustment function and remove the legend.

ALTITUDE COMPENSATED TILT (ACT) ANGLE ADJUSTMENT

The Altitude Compensated Tilt feature enables automatic management of the antenna tilt angle as the aircraft altitude changes. With ACT enabled, the antenna beam position remains centered at the set position for the current map range. The system automatically decreases the tilt angle as the aircraft climbs, and increases the tilt angle as the aircraft descends. The ACT feature is available in the Horizontal Scan Mode when the system is operating in Weather Mode, and requires the system to be operating with the GPS-derived altitude.

Enabling/Disabling Altitude Compensated Tilt (ACT):

- 1) If necessary, refer to the previous procedures to initially set the antenna tilt angle to the desired setting.
- 2) From MFD Home, touch **Weather > Weather Selection > WX RADAR > WX RADAR Settings**.
- 3) Touch the **Altitude Comp Tilt** Button. The Radar Status indicator shows 'Altitude Comp Tilt On'.

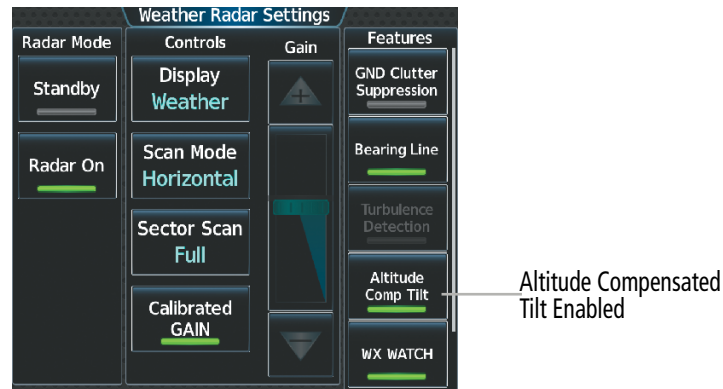


Figure 6-78 Enabling Altitude Compensated Tilt

ADJUSTING GAIN

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

The Weather Radar Gain is set to calibrated gain setting when the Weather Radar is powered on.

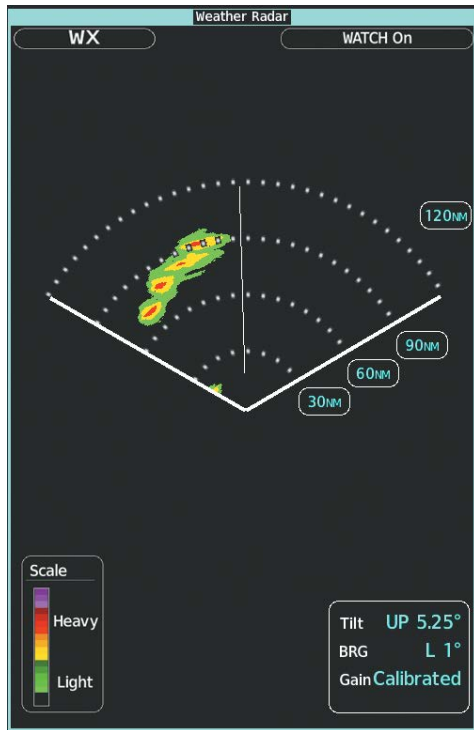
Adjusting gain on the Weather Radar Pane:

- 1) From MFD Home, touch **Weather > Weather Selection > WX RADAR > WX RADAR Settings**.
- 2) If the **Calibrated Gain** button annunciator is green (enabled), touch the **Calibrated Gain** Button to disable Calibrated Gain. **Calibrated Gain** Button annunciator is gray when disabled.
- 3) Touch and slide the Gain slider.

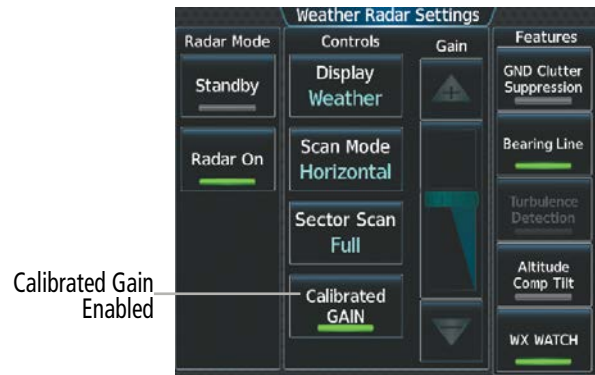
Or:

Touch the + pointer to increase gain, or - pointer to decrease gain. Each touch increases or decreases the gain by one increment. A gray bar across the slider bar serves as a reference to the calibrated gain setting position.

- 4) To return to the calibrated gain setting, touch the **Calibrated Gain** Button.



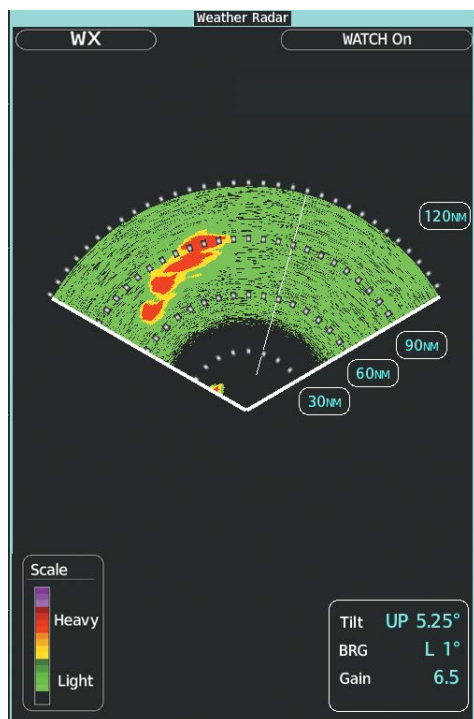
'Weather Radar' Pane with Calibrated Gain Setting



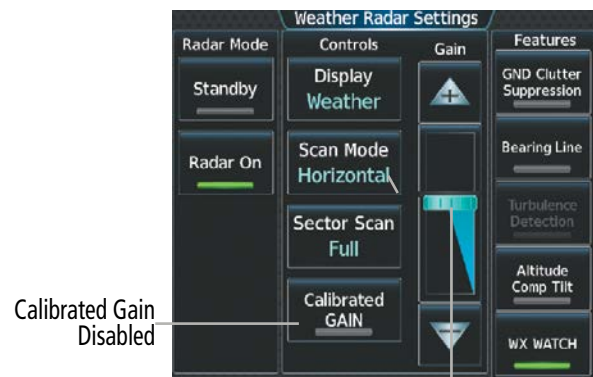
Calibrated Gain Enabled

Manual Gain Adjustment subdued when Calibrated Gain is enabled

Figure 6-79 Calibrated Gain (GWX-75)



'Weather Radar' Pane set Above Calibrated Gain Setting



Calibrated Gain Disabled

Current Manual Gain Setting

Figure 6-80 Manual Gain (GWX-75)

SECTOR SCAN

Enabling Sector Scanning:

- 1) From MFD Home, touch **Weather** > **Weather Selection** > **WX RADAR** > **WX RADAR Settings**.
- 2) While in Horizontal Scan Mode, touch the **Bearing Line** Button if necessary to show the Bearing Line on the Weather Radar Pane.
- 3) Push the upper knob to enable bearing pointer adjustment.
- 4) Turn the large upper knob to place the Bearing Line in the desired position. The location of the Bearing Line will become the center point of the Sector Scan.
- 5) Touch the **Sector Scan** Button.
- 6) Touch a button to select a 20°, 40°, 60°, 90° scan, or touch the **FULL** Button to resume a 120° degree scan.
- 7) If desired, readjust the Bearing Line as discussed previously to change the center of the Sector Scan.
- 8) Push the upper knob again to remove the bearing selection function.

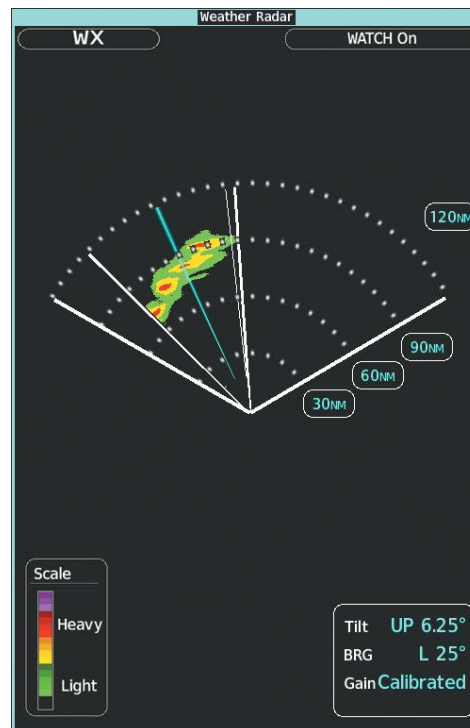


Figure 6-81 'Weather Radar' Pane on a 40 Degree Sector Scan (GWX-75)

TURBULENCE DETECTION

The optional Turbulence Detection feature, available with the GWX 70/75, identifies areas of turbulence associated with precipitation during a horizontal scan. The areas of turbulence displayed by the GWX70/75 represent precipitation moving at a high rate of speed either toward or away from the radar antenna, using Doppler radar measurements. The Turbulence Detection feature cannot detect areas of Clear Air Turbulence.

The Turbulence Detection feature is only available in Weather Mode while a horizontal scan is selected. The GWX 70/75 can detect turbulence up to 40 nm in front of the aircraft. However, while the optional Turbulence Detection is enabled on the GWX 70, if the radar range is 160 nm or greater, or a vertical scan is selected, the system automatically removes turbulence information and shows a 'TURB Detection Inactive' annunciation on the 'Map - Weather Radar' Page. The GWX 75 does not share this limitation as the GWX 70, turbulence detection will be shown regardless of the range selected beyond 40 nm. If the system is missing information needed to detect turbulence, a 'TURB Detection Unavailable' annunciation appears on the "Map - Weather Radar' Page.

Enabling/Disabling Turbulence Detection during a Horizontal Scan:

- 1) From MFD Home, touch **Weather > Weather Selection > WX RADAR > WX RADAR Settings**.
- 2) To activate or deactivate the turbulence detection feature, touch the **Turbulence Detection** Button. Turbulence detection is enabled when button annunciator is green; turbulence detection is disabled when button annunciator is gray. The system indicates the current turbulence detection feature status in the upper right of the Weather Radar Pane.

WEATHER ATTENUATED COLOR HIGHLIGHT (WATCH®)

WATCH® identifies deceptively strong or unknown intensity parts of a storm. While in horizontal scan mode, this feature can be used as a tool to determine areas of possible inaccuracies in displayed intensity due to weakening of the radar energy. This weakening is known as attenuation. The radar energy weakens as it passes through areas of intense precipitation, large areas of lesser precipitation, and distance. Issues with the radome attenuates the radar energy. All these factors have an effect on the return intensity. The more energy that dissipates, the lesser the displayed intensity of the return. Accuracy of the displayed intensity of returns located in the shaded areas are suspect. Make maneuvering decisions with this information in mind. Proper antenna tilt management should still be employed to determine the extent of attenuation in a shaded area.



NOTE: The WATCH feature is unavailable on the Navigation Map Pane.

Enabling/Disabling WATCH display feature:

- 1) From MFD Home, touch **Weather > Weather Selection > WX RADAR > WX RADAR Settings**.
- 2) To activate or deactivate the WATCH feature, touch the **WX Watch** Button.

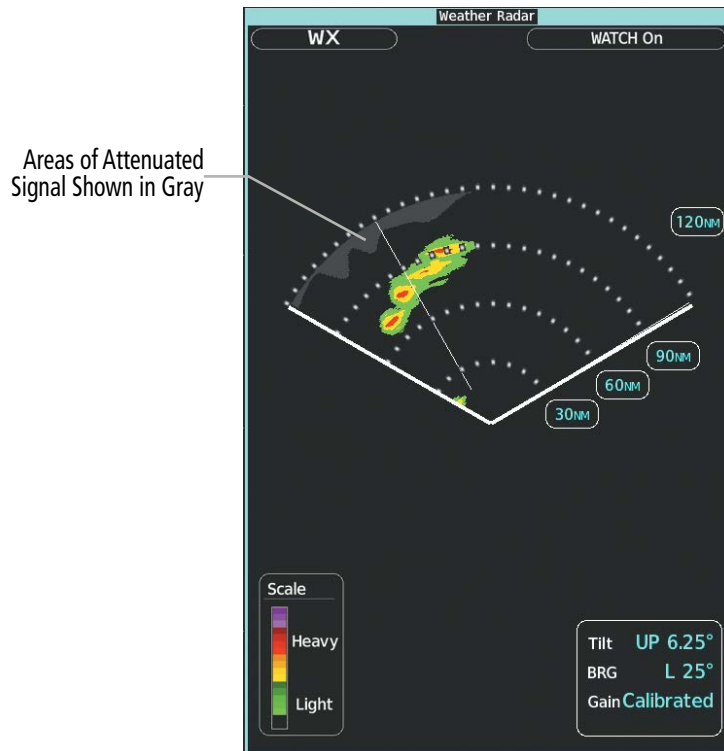


Figure 6-82 Horizontal Scan with WATCH® Enabled (GWX-75)

WEATHER ALERT INDICATION AND SYSTEM MESSAGE

The Weather Alert feature indicates the presence of heavy precipitation between the ranges of 80 and 320 nm regardless of the currently displayed range. Weather Alert appear as red arcs along the outer range ring at the approximate azimuth of the detected returns on the Weather Radar Pane.

If a Weather Alert is detected within $\pm 10^\circ$ of the aircraft heading, and the **WX Alert** Button is enabled on the Weather Radar Settings Screen, a System Message appears on the Touchscreen Controllers. The red Weather Alert arc appears on the Weather Radar Pane regardless of whether the **WX Alert** Button is enabled or disabled. The arcs do not appear on navigation maps overlays.

If the antenna tilt is adjusted too low, ground returns may also trigger a Weather Alert System Message. To avoid unwanted Weather Alert System Messages, ensure the **WX Alert** Button is disabled (button annunciator is gray.)

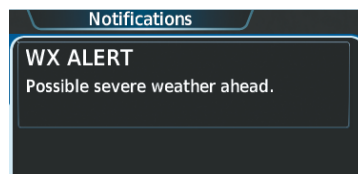


Figure 6-83 WX Alert System Message on the Notifications Screen

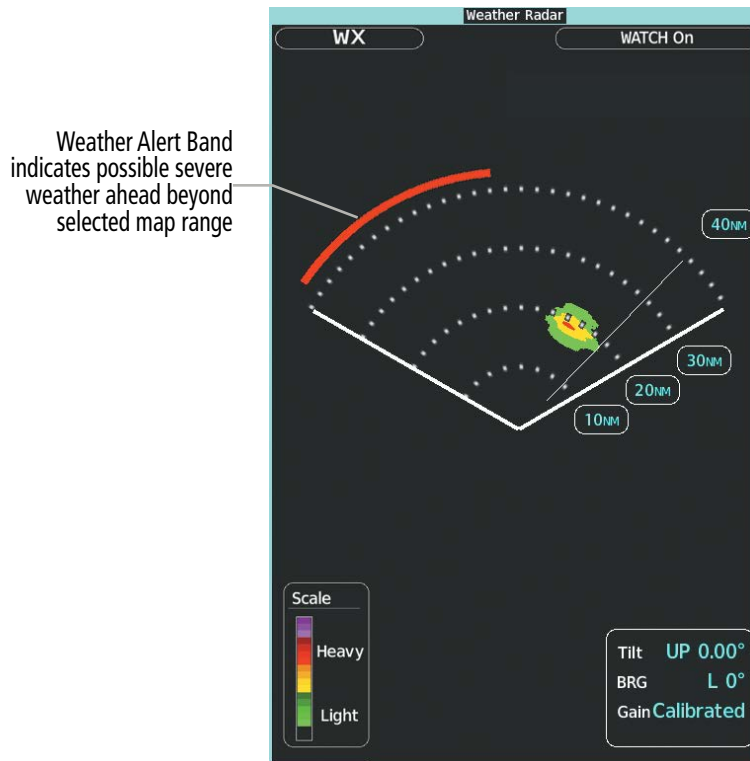


Figure 6-84 Horizontal Scan with WATCH® Enabled (GWX-75)

Enabling/disabling WX Alert Indication and System Message:

- 1) From Home, touch **Weather > Weather Selection > WX RADAR > WX RADAR Settings**.
- 2) To enable or disable the WX Alert system message, touch the **WX Alert** Button. WX Alert system messages are enabled when button annunciator is green, and disabled when annunciator is gray.

REMOVING GROUND CLUTTER



NOTE: The GCS feature of the airborne weather radar may remove the display of low-intensity precipitation in addition to ground returns when the feature is enabled.

The system can distinguish between reflected ground returns (such as terrain features and buildings) and airborne weather phenomena. Ground clutter may be most pronounced when using a low antenna tilt angle, or when approaching mountainous terrain.

The optional Ground Clutter Suppression (GCS) feature is available while the weather radar Sector Scan is set to **FULL**. When Ground Clutter Suppression is enabled, the system removes echoes determined to be ground clutter from the display. While viewing a map with GCS enabled, adjustment of the map range or antenna tilt angle will momentarily cause the display of ground clutter to return.

Enabling/Disabling Ground Clutter Suppression:

- 1) From MFD Home, touch **Weather > Weather Selection > WX RADAR > WX RADAR Settings**.
- 2) To enable or disable the ground clutter suppression feature, touch the **GND Clutter Suppression** Button. Ground clutter suppression is enabled when button annunciator is green; ground clutter suppression is disabled when annunciator is gray.

GROUND MAPPING AND INTERPRETATION

A secondary use of the weather radar system is for the presentation of terrain. This can be a useful tool for verifying aircraft position. A picture of the ground is represented much like a topographical map that can supplement terrain information shown on a navigation map.

Ground Map mode uses a different gain range than Weather mode. Different colors represent the intensity levels. The displayed intensity of ground returns are defined in the table below. Use of the Gain and Tilt controls help improve contrast so that specific ground returns can be recognized more easily. As previously discussed, the type and orientation of the radar return in relation to the aircraft affects the intensity displayed.

When the weather radar system is in either the Weather or Ground Map mode, the system automatically switches to Standby mode upon landing.

Ground Map Mode Color	Intensity
Black	0 to 2 dB
Cyan	3 dB to < 13 dB
Yellow	13 dB to less than 21 dB
Magenta	21 dB to less than 29 dB
Blue	29 dB and greater

Table 6-10 Ground Radar Return Intensity Levels

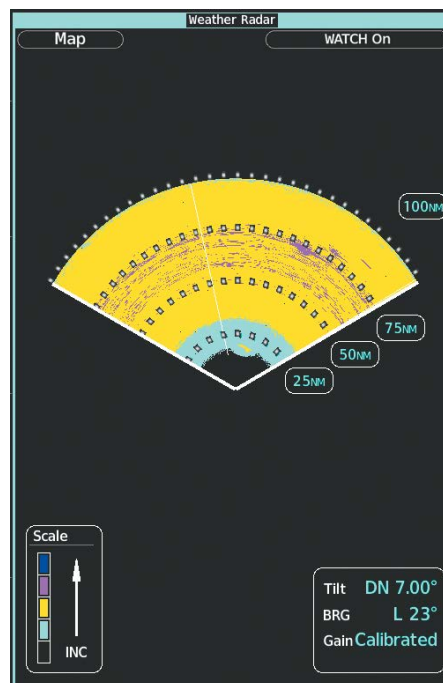


Figure 6-85 Weather Radar Pane with Ground Map Mode Enabled (GWX-75)

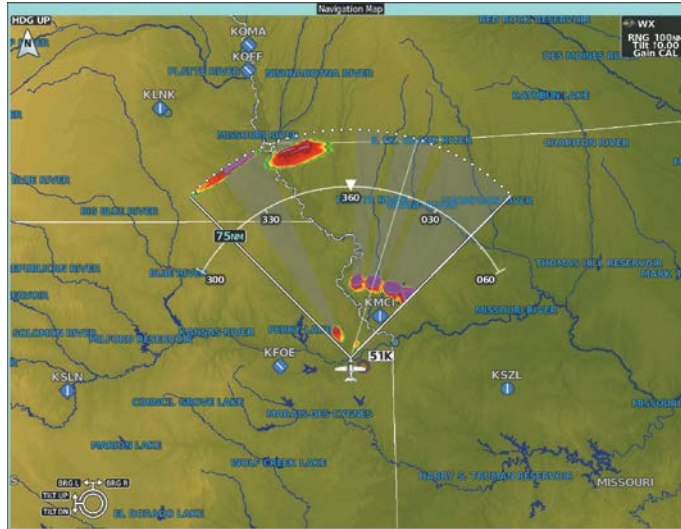
Operation in Ground Map Mode:

- 1) From MFD Home, touch **Weather > Weather Selection > WX RADAR > WX RADAR Settings**.
- 2) Touch the **Display** Button.
- 3) Touch the **Map** Button to place the radar in Ground Map mode.
- 4) Push the upper knob to activate the antenna tilt selection function.
- 5) Turn the small upper knob to select the desired antenna tilt angle.
- 6) When ground returns are shown at the desired distance, push the upper knob to disable the tilt adjustment function.

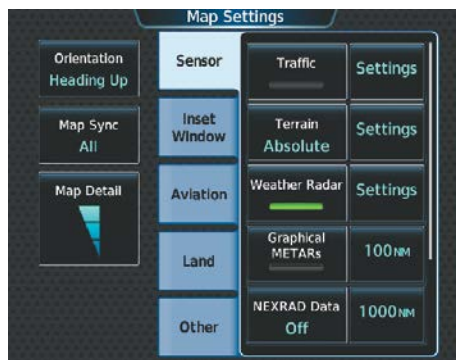
ADDITIONAL RADAR DISPLAYS

The 'Weather Radar' Pane is the principal map for viewing weather radar information. It is the only map display pane capable of showing information for all weather radar features. Airborne weather radar information is also available on the navigation maps (with the exception of the Inset Map) as an additional reference to the 'Weather Radar' Pane. The weather radar display mode ('Standby', 'Weather', or 'Ground') appears in the upper right of the selected 'Navigation Map' Pane, in addition to the antenna tilt direction, tilt angle, and radar range. The radar range increases or decreases as the 'Navigation Map' Pane's range is adjusted.

The pilot may enable Weather Radar information with other map overlays on navigation maps (such as traffic, absolute terrain information, nav aids, etc.). However, relative terrain information cannot be displayed simultaneously with airborne weather radar information, since both features use the identical colors to depict certain terrain and weather conditions. Enabling either the airborne weather radar or relative terrain overlays on the 'Navigation Map' Pane disables the other feature on the same display pane. In addition, NEXRAD cannot be shown on the same pane at the same time as airborne weather radar information.



Weather Radar information shown on the 'Navigation Map' Pane



'Map Settings' Screen with Weather Radar on Navigation Maps Enabled



Weather Radar Settings for the Navigation Maps

Figure 6-86 Displaying Weather Radar Information on the 'Navigation Map' Pane

Controlling the display of Weather Radar information on Navigation Map Panes:

- 1) From MFD Home, touch **Map** > **Map Selection** > **Map Settings**.
- 2) If necessary, touch the **Sensor** Tab.
- 3) Touch the **Weather Radar** Button to enable or disable the display of weather radar information on the selected navigation map pane.
- 4) To access controls for weather radar information on the Navigation Map Pane, touch the **Weather Radar Settings** Button.

Adjusting antenna tilt angle or radar bearing on the Navigation Map Pane:

- 1) With the airborne weather overlay enabled on the 'Navigation Map' Pane, push the upper knob. The tilt and bearing legend appears in the lower-left corner of the maps. The Touchscreen Controller displays the Weather Radar Settings Screen.
- 2) To adjust radar bearing, turn the large upper knob. A dashed white bearing line appears during adjustment and momentarily after adjustment.
- 3) To increase antenna tilt angle, turn the small upper knob clockwise. To decrease antenna tilt angle, turn the small upper knob counter-clockwise.
- 4) When finished with these adjustments, push the upper knob. The Touchscreen Controller returns to the Map Settings Screen.

Controlling the display of Weather Radar information on the HSI Map:

- 1) If necessary, enable the HSI Map on the PFD.
- 2) From PFD Home, touch the **PFD Map Settings** Button.
- 3) In the Overlays Window, touch the **Weather Radar** Button to enable/disable the display of weather radar information on the Inset Map.
- 4) To access controls for weather radar information on the HSI Map, touch the Weather Radar **Settings** Button.

Adjusting radar range on the HSI Map:

Turn the lower knob clockwise to increase range, or counter-clockwise to decrease range. Note the radar range increases or decreases in proportion to the HSI Map range.

Adjusting antenna tilt angle or radar bearing on the HSI Map:

- 1) If the Weather Radar Settings Screen is not displayed on the Touchscreen Controller, push the lower knob.
- 2) To adjust radar bearing, turn the large upper knob on the Touchscreen Controller. A dashed white bearing line appears during adjustment and momentarily after adjustment.
- 3) To increase antenna tilt angle, turn the small upper knob clockwise. To decrease antenna tilt angle, turn the small upper knob counter-clockwise.
- 4) When finished with these adjustments, push the upper knob.

The weather radar mode, range, antenna tilt angle setting, and gain setting appear for 3 seconds on the HSI map during radar adjustments performed with the knobs on the Touchscreen Controller. If preferred, the pilot can also show this information on the HSI Map whenever the Weather Legend Button is enabled and the weather radar information is within maximum display range setting limits.

Displaying the weather radar status window on the HSI Map:

- 1) From PFD Home, touch **PFD Map Settings**.
- 2) Touch the **Weather Legend** Button.

SYSTEM STATUS

The system displays the radar mode annunciation in the upper left corner of the 'Weather Radar' Pane. Additional information may be displayed in the center of the 'Weather Radar' Pane as a center banner annunciation. Refer to the following tables for a list of annunciations and their locations for airborne weather radar.

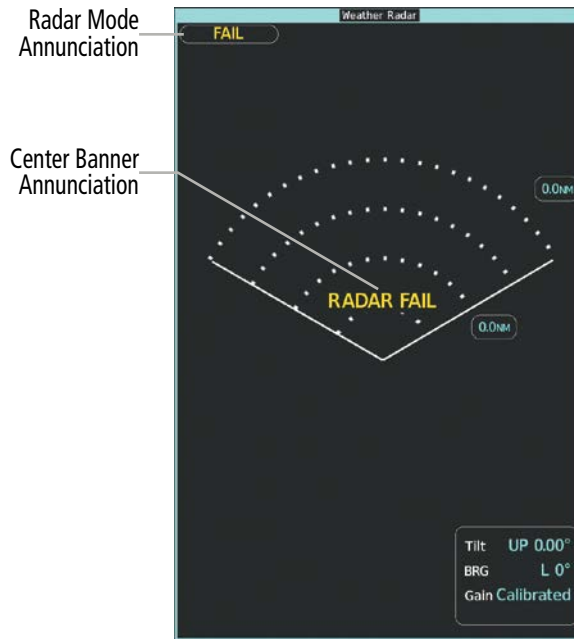


Figure 6-87 Radar System Status Indications on 'Weather Radar' Pane (GWX-75)

Radar Mode	Radar Mode Annunciation Box	Center Banner Annunciation
Standby	Standby	STANDBY
Weather	WX	None
Ground Mapping	Map	None
Radar Failed*	FAIL	RADAR FAIL

* See Table 6-13 for additional failure annunciations.

Table 6-11 Radar Modes on the 'Weather Radar' Pane

The system displays the status of the weather radar features in the upper-right corner of the ‘Weather Radar’ Pane.


Radar Feature Status	Description
STAB INOP	The radar is not receiving pitch and roll information. The antenna stabilization feature is inoperative.
Altitude Comp Tilt	The altitude-compensated tilt feature is selected on.
GND CLTR Suppress	The ground clutter suppression feature is selected on.
GND CLTR Suppress Inactive	The ground clutter suppression feature is enabled, but the radar is in a mode which cannot support ground clutter suppression (e.g. vertical scan or sector scan).
GND CLTR Suppress Unavailable	The radar is missing data needed to suppress ground clutter.
TURB DETECTION 	The turbulence detection feature is selected on.
TURB Detection Inactive	Turbulence detection is inactive when map range is greater than 160 nm, or radar is in a mode which cannot support turbulence detection.
TURB Detection Unavailable	The radar is missing data needed to detect turbulence.
WATCH On	The WATCH feature is selected on.

Table 6-12 Radar Feature Status Annunciations on the ‘Weather Radar’ Pane

If the radar unit fails, an annunciation as to the cause of the failure is shown as a banner in the center of the ‘Weather Radar’ Pane.

Weather Radar Pane Center Banner Annunciation	Description
BAD CONFIG	The radar configuration is invalid. The radar should be serviced.
RDR FAULT	The radar unit is reporting a fault. The radar should be serviced.
RADAR FAIL	The system is not receiving valid data from the radar unit. The system should be serviced.

Table 6-13 Abnormal Radar Status Annunciations on the ‘Weather Radar’ Pane

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.

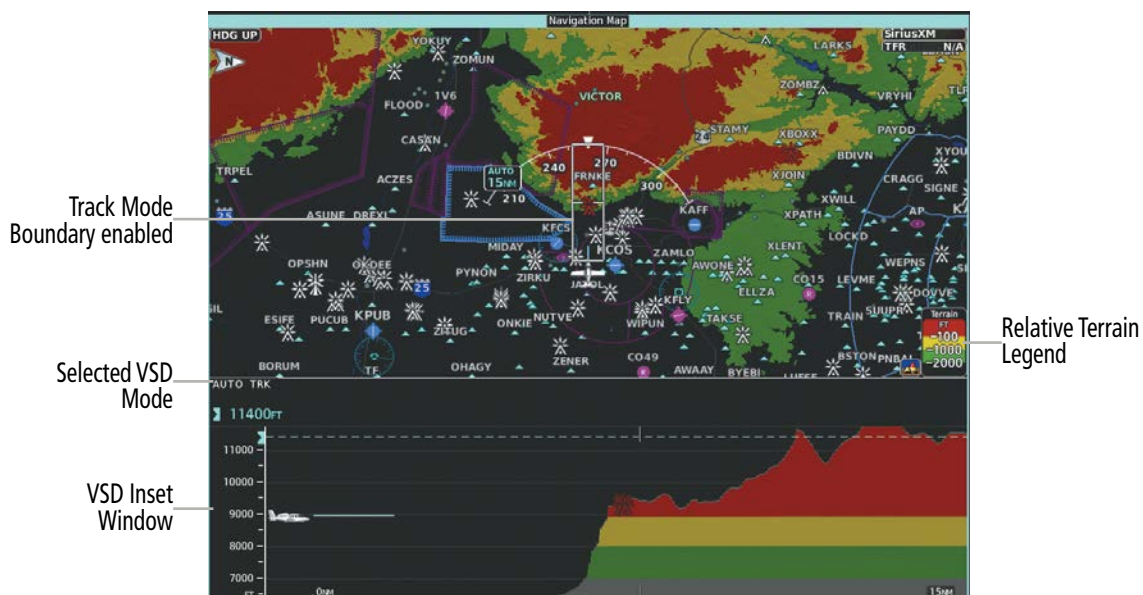


Figure 6-88 'Navigation Map' Pane with VSD Inset Window and Relative Terrain Enabled

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 MFD Home, touch **Map > Map Selection > Map Settings**.
- 2) If necessary, touch the **Inset Window** Tab.
- 3) Touch the **VERT Situation Display** Button to enable/disable the VSD Inset Window.



Figure 6-89 Enabling Vertical Situation Display Inset Window on the Map Settings Screen

The same controls which enable/disable the display of relative terrain and 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 MFD Home, touch **Map > Map Selection > Map Settings**.
- 2) If necessary, touch the **Sensor** Tab.
- 3) Touch the **Terrain** Button.
- 4) Touch the **Relative** Button to enable the display of Relative Terrain information on the 'Navigation Map' Pane and VSD, or touch the **Off** Button to remove this information.



Figure 6-90 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 MFD Home, touch **Map > Map Selection > Map Settings**.
- 2) If necessary, touch the **Land** Tab.
- 3) Touch the **Point Obstacle** Button to enable the display of Point Obstacle information on the Navigation Map Pane and VSD, or touch the **Off** Button to remove this information.



Figure 6-91 Enabling Obstacle information for the VSD and 'Navigation Map' Pane

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.

Flight Phase	Width of Swath
Approach, Departure	0.6 nm
Terminal	2.0 nm
En Route, Oceanic	4.0 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, and if no active flight plan is present, the VSD Inset Window displays 'Flight Plan Not Available'. In Track Mode, the contour is based on the aircraft ground track. In Auto Mode, the contour is based on the active flight plan, when available, otherwise, it is based on the ground track.

VSD Mode Selected	Annunciation
Flight Plan	FPL
Track	TRK
Auto	AUTO FPL or AUTO TRK

Changing the Vertical Situation Display Mode:

- 1) From MFD 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.

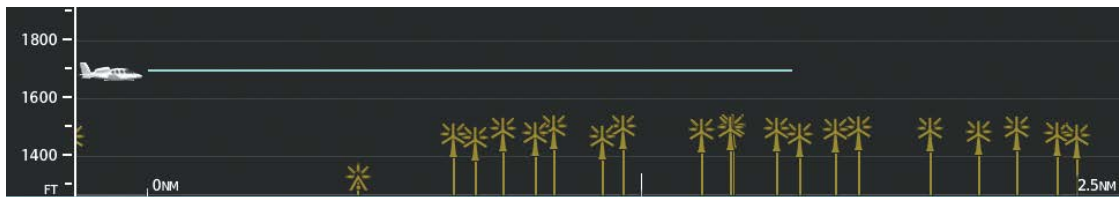


Figure 6-92 Lines raise obstacle symbols to their heights AGL along the altitude scale, if necessary

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.

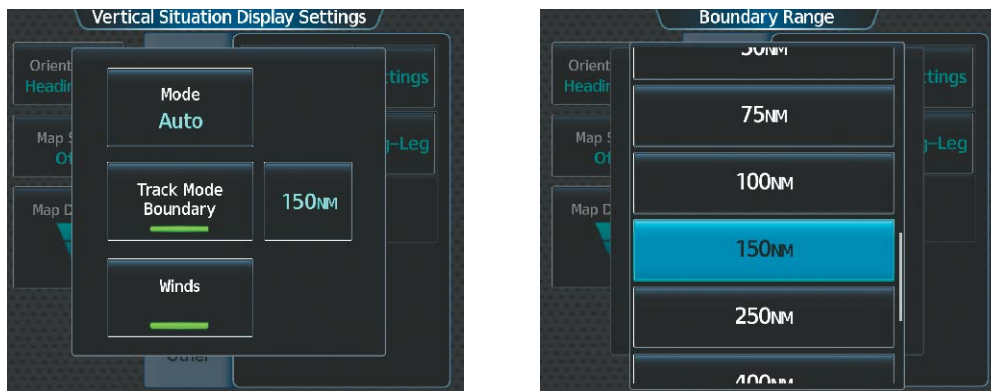


Figure 6-93 Customizing the Track Mode Boundary Navigation Maximum Map Range

Enabling/disabling the Track Mode Boundary:

- 1) From MFD Home, touch **Map > Map Selection > Map Settings**.
- 2) Touch the **Inset 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 89° North latitude and south of 89° South latitude. This is due to limitations present within the Terrain database and the system's ability to process the data representing the affected areas.



NOTE: Terrain and obstacle alerting requires the Terrain-SVT or TAWS-B option.

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 determine alerts for the Terrain-SVT and TAWS-B systems. GSL altitude accuracy is affected by satellite geometry, but is not subject to variations in pressure and temperature that normally affect pressure altitude sensors. GSL altitude does not require local altimeter settings to determine MSL altitude. It is a widely-used MSL altitude source. Therefore, GSL altitude provides a highly accurate and reliable MSL altitude source to calculate terrain and obstacle alerts.

The terrain and obstacle databases used by the terrain system are referenced to MSL. Using the GPS position and GSL altitude, terrain system displays a 2-D picture of the surrounding terrain and obstacles relative to the position and altitude of the aircraft. Furthermore, for the Terrain-SVT or TAWS-B systems, the system uses the GPS position and GSL altitude to calculate and “predict” the aircraft’s flight path in relation to the surrounding terrain and obstacles. In this manner, the Terrain-SVT or TAWS-B systems can provide advanced alerts of predicted dangerous terrain conditions.

Baro-corrected altitude (or indicated altitude) is derived by adjusting the altimeter setting for local atmospheric conditions. The most accurate baro-corrected altitude can be achieved by frequently updating the altimeter setting to the nearest reporting station along the flight path. However, because actual atmospheric conditions seldom match the standard conditions defined by the International Standard Atmosphere (ISA) model (where pressure, temperature, and lapse rates have fixed values), it is common for the baro-corrected altitude (as read from the altimeter) to differ from the GSL altitude. This variation results in the aircraft’s GSL altitude differing from the baro-corrected altitude.

RELATIVE TERRAIN SYMBOLOGY

The terrain system uses colors and symbols to represent terrain and 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 6-94 Terrain SVT Relative Terrain Legends

The following figure shows relative terrain coloring for the Terrain-SVT and TAWS-B systems.

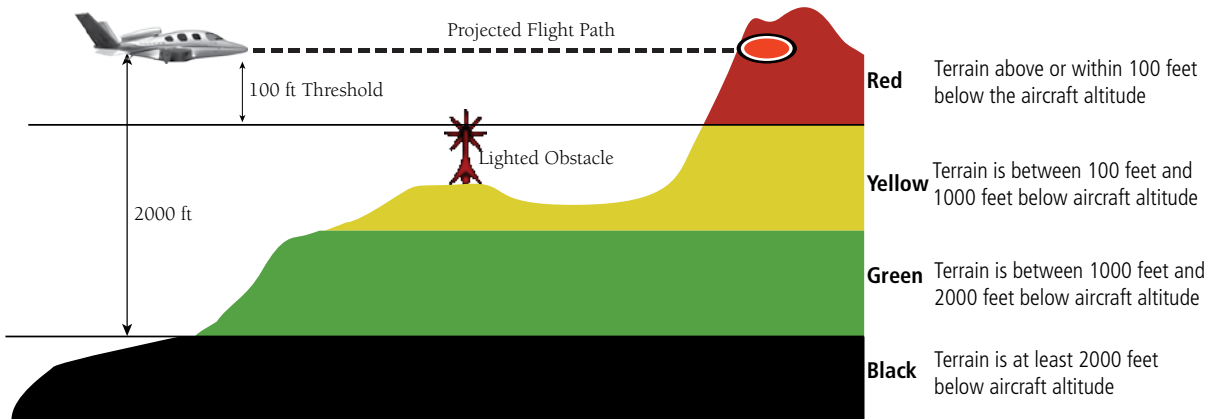


Figure 6-95 Terrain Altitude/Color Correlation for Terrain-SVT or TAWS-B Systems

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 6-14 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 6-15 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 6-16 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 6-17 Terrain-SVT and TAWS-B Potential Impact Area with Annunciations

TERRAIN PANE

The Terrain-SVT/TAWS Pane is specialized to show terrain, and obstacle in relation to the aircraft’s current altitude, without clutter from the basemap. This pane is the principal page for viewing terrain information. Aviation data (airports, VORs, and other NAVAIDs) can be enabled for reference.

For Terrain-SVT and TAWS-B systems only, this pane also shows potential impact areas. If terrain or obstacles (including wire obstacles) and the projected flight path of the aircraft intersect, the display automatically adjusts to a map range if necessary to emphasize the display of the potential impact area.

Aircraft orientation on this map is always heading up unless there is no valid heading, in which case the orientation is track up. Map range is adjustable with the **Joystick** from 250 feet to 1000 nm, which is indicated on the map range arc.

The ‘Terrain SVT’ Pane also displays annunciations in the lower-left corner of the pane, in addition to banner annunciations in the center of the pane.

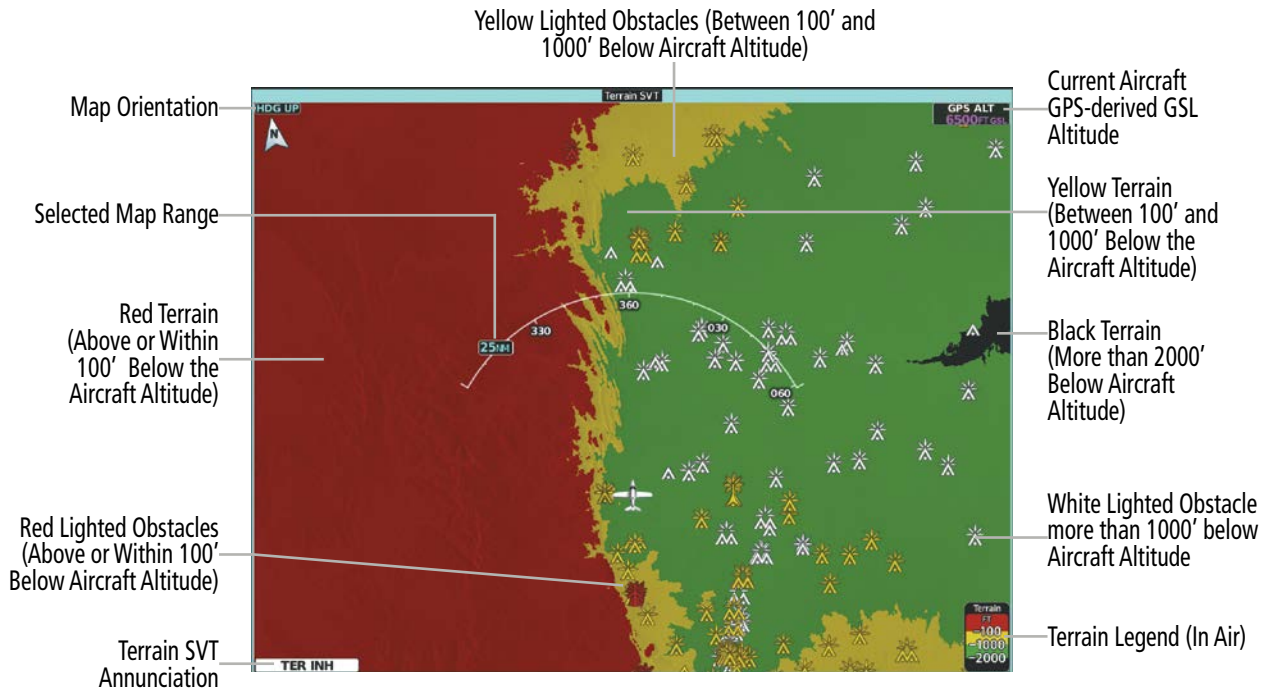


Figure 6-96 'Terrain SVT' Pane with Aircraft in the Air



Figure 6-97 Terrain SVT Settings Screen

Showing the Terrain SVT Pane:

From MFD 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 MFD Home, touch the [Terrain] Button. [Terrain] can be **Terrain-SVT**, or **TAWS**.
- 2) To enable/disable aviation information (airports, VORs, NDBs, Intersections) for the terrain pane, touch > [Terrain] **Settings > Show Aviation Data** Button.

RELATIVE TERRAIN MAP OVERLAYS

The 'Terrain Proximity/Terrain-SVT/TAWS' Pane is the principal map page for viewing terrain information. Relative terrain information is also available for display on navigation maps.

Controlling Relative Terrain Information (Navigation Map Panes):

- 1) From MFD Home, touch **Map > Map Selection > Map Settings**.
- 2) If necessary, 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 PFD 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.

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' Page. 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 MFD Home, touch **Map > Map Selection > Map Settings**.
- 2) If necessary, 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 twice 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) The Point Obstacle Range Button displays the maximum map range to show point obstacles in cyan. Touch this button to change the value.
- 11) Scroll as needed, and touch a maximum navigation map range to display point obstacle information.
- 12) Touch the **Wire Obstacle** Button to enable/disable the display of wire obstacles on navigation maps.
- 13) The Wire Obstacle Range Button displays the maximum map range to show wire obstacles in cyan. Touch this button to change the value.
- 14) Scroll as needed, and touch a maximum navigation map range to display wire obstacle information.
- 15) When finished, touch the **Back** Button or the **Home** 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 pressing the **Joystick**. The map range is adjusted by turning the **Joystick**. If the map range is adjusted while panning is enabled, the map is re-centered on the Map Pointer.



Figure 6-98 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 ALERTING DISPLAYS

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 PFDs, the ‘Terrain-SVT’ Pane or ‘TAWS’ Pane, and on the Touchscreen Controllers. The PFD 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:

- Touch the **Terrain-SVT** or **TAWS** Button to the terrain pane and terrain settings screen.
- Touch the **OK** Button to remove the pop-up alert.
- Touch the **Inhibit Terrain** or **Inhibit TAWS** Button to inhibit the terrain system from issuing alerts.

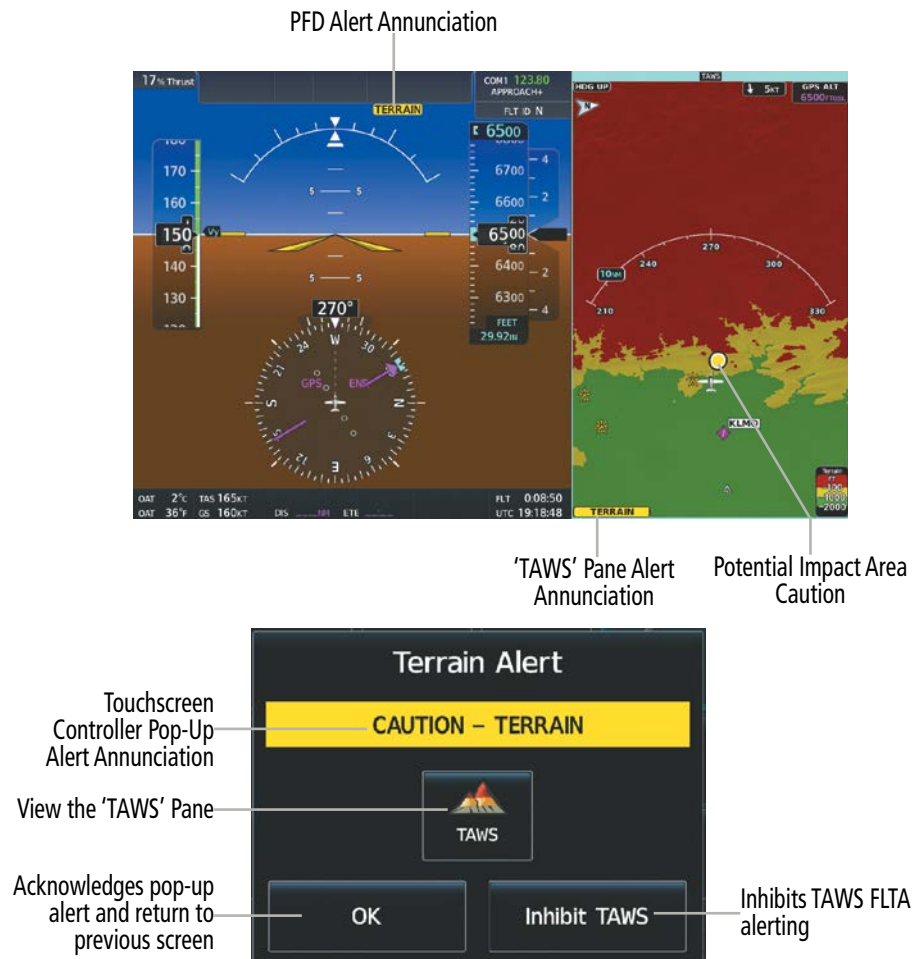


Figure 6-99 TAWS-B Alert Annunciations

The following table lists the possible Terrain-SVT alerts.

Alert Type	PFD/Terrain-SVT Pane Alert	Touchscreen Controller Pop-Up Alert	Voice Alert
Reduced Required Terrain Clearance Warning (RTC)	TERRAIN	WARNING – TERRAIN	“Warning; Terrain, Terrain”
Imminent Terrain Impact Warning (ITI)	TERRAIN	WARNING – TERRAIN	“Warning; Terrain, Terrain”
Reduced Required Obstacle Clearance Warning (ROC)	TERRAIN	WARNING – OBSTACLE	“Warning; Obstacle, Obstacle”
Imminent Obstacle Impact Warning (IOI)	TERRAIN	WARNING – OBSTACLE	“Warning; Obstacle, Obstacle”
Reduced Required Line Clearance Warning (RLC)	TERRAIN	WARNING – WIRE	“Warning; Wire, Wire”
Imminent Line Impact Warning (ILI)	TERRAIN	WARNING – WIRE	“Warning; Wire, Wire”
Reduced Required Terrain Clearance Caution (RTC)	TERRAIN	CAUTION – TERRAIN	“Caution; Terrain, Terrain”
Imminent Terrain Impact Caution (ITI)	TERRAIN	CAUTION – TERRAIN	“Caution; Terrain, Terrain”
Reduced Required Obstacle Clearance Caution (ROC)	TERRAIN	CAUTION – OBSTACLE	“Caution; Obstacle, Obstacle”
Imminent Terrain Impact Caution (ILI)	TERRAIN	CAUTION – WIRE	“Caution; Wire, Wire”
Required Reduced Line Clearance Impact Caution (RLCI)	TERRAIN	CAUTION – WIRE	“Caution; Wire, Wire”
Imminent Obstacle Impact Caution (IOI)	TERRAIN	CAUTION – OBSTACLE	“Caution; Obstacle, Obstacle”

Table 6-18 Terrain SVT Alerts Summary

The following table lists the TAWS-B alerts.

Alert Type	PFD/ TAWS Pane Annunciation	Touchscreen Controller Pop-Up Alert	Voice Alerts
Excessive Descent Rate Warning (EDR)	PULL UP	PULL-UP	"Pull Up"
Reduced Required Terrain Clearance Warning (RTC)	PULL UP	TERRAIN – PULL-UP * or TERRAIN AHEAD – PULL-UP	"Terrain, Terrain; Pull Up, Pull Up" * or "Terrain Ahead, Pull Up; Terrain Ahead, Pull Up"
Imminent Line Impact Warning (ILI)	PULL UP	WIRE – PULL-UP or WIRE AHEAD – PULL-UP	"Wire, Wire; Pull Up, Pull Up" or "Wire Ahead; Pull Up; Wire Ahead, Pull Up"
Reduced Required Line Clearance Warning (RLC)	PULL UP	WIRE – PULL-UP	"Wire, Wire; Pull Up, Pull Up"
Imminent Terrain Impact Warning (ITI)	PULL UP	TERRAIN – PULL-UP or TERRAIN AHEAD – PULL-UP *	"Terrain, Terrain; Pull Up, Pull Up" or "Terrain Ahead, Pull Up; Terrain Ahead, Pull Up" *
Reduced Required Obstacle Clearance Warning (ROC)	PULL UP	OBSTACLE – PULL-UP * or OBSTACLE AHEAD – PULL-UP	"Obstacle, Obstacle; Pull Up, Pull Up" * or "Obstacle Ahead, Pull Up; Obstacle Ahead, Pull Up"
Imminent Obstacle Impact Warning (IOI)	PULL UP	OBSTACLE – PULL-UP or OBSTACLE AHEAD – PULL-UP *	"Obstacle, Obstacle; Pull Up, Pull Up" or "Obstacle Ahead, Pull Up; Obstacle Ahead, Pull Up" *
Reduced Required Terrain Clearance Caution (RTC)	TERRAIN	CAUTION – TERRAIN or TERRAIN AHEAD	"Caution, Terrain; Caution, Terrain" * or "Terrain Ahead; Terrain Ahead"
Imminent Terrain Impact Caution (ITI)	TERRAIN	CAUTION – TERRAIN or TERRAIN AHEAD *	"Caution, Terrain; Caution, Terrain" or "Terrain Ahead; Terrain Ahead" *
Required Reduced Line Clearance Impact Caution	TERRAIN	CAUTION – WIRE or WIRE – AHEAD	"Caution, Wire; Caution, Wire" or "Wire Ahead; Wire Ahead"
Imminent Line Clearance Impact Caution (ILI)	TERRAIN	WIRE – AHEAD or CAUTION – WIRE	"Wire Ahead; Wire Ahead" or "Caution, Wire; Caution, Wire"

Alert Type	PFD/ TAWS Pane Annunciation	Touchscreen Controller Pop-Up Alert	Voice Alerts
Reduced Required Obstacle Clearance Caution (ROC)	TERRAIN	CAUTION – OBSTACLE * or OBSTACLE AHEAD	“Caution, Obstacle; Caution, Obstacle” * or “Obstacle Ahead; Obstacle Ahead”
Imminent Obstacle Impact Caution (IOI)	TERRAIN	CAUTION – OBSTACLE or OBSTACLE AHEAD *	“Caution, Obstacle; Caution, Obstacle” or “Obstacle Ahead; Obstacle Ahead” *
Premature Descent Alert Caution (PDA)	TERRAIN	TOO LOW – TERRAIN	“Too Low, Terrain”
Altitude Callout “500”	None	None	“Five-Hundred”
Excessive Descent Rate Caution (EDR)	TERRAIN	SINK RATE	“Sink Rate”
Negative Climb Rate Caution (NCR)	TERRAIN	DONT SINK * or TOO LOW – TERRAIN	“Don’t Sink” * or “Too Low, Terrain”

* Alerts with multiple messages are configurable at installation and are installation-dependent. Alerts for the default configuration when more than one option is available are indicated with asterisks.

Table 6-19 TAWS-B Alerts Summary

FORWARD LOOKING TERRAIN AVOIDANCE

The Forward Looking Terrain Avoidance (FLTA) feature of Terrain-SVT or TAWS-B compares the projected flight path as derived from GPS data with terrain features and obstacles from the terrain and obstacle databases. The system issues FLTA alerts when the projected flight path conflicts with terrain or obstacles.

The projected flight path is a calculated area ahead of, to the sides, and below the aircraft. The size of the projected flight path varies based on factors including ground speed (the path ahead is larger when the ground speed is higher), whether the aircraft is level, turning, or descending, and the proximity to the nearest 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 in the following figure. When an RTC alert is issued, the system displays a potential impact area on navigation maps and the ‘Terrain SVT’ 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. The alert occurs when the projected vertical flight path is calculated to come within minimum clearance altitudes in the following figure.

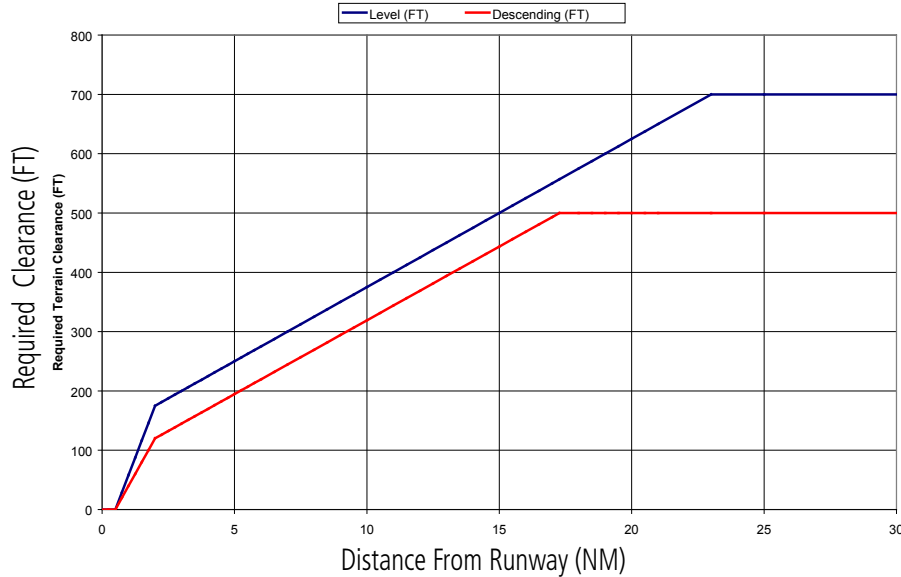


Figure 6-100 FLTA Alert Minimum Terrain and Obstacle Clearance Values

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 ‘TAWNS INH’ appears on the TAWS Pane and on the PFD.



NOTE: Inhibiting TAWS alerts inhibits FLTA and PDA alerts only. EDR and VCO alerts remain enabled even when TAWS is inhibited.



Figure 6-101 Alerting is Inhibited when Annunciation is displayed

Inhibiting/enabling Terrain SVT alerting:

- 1) From MFD **Home**, touch **Terrain SVT** > **Terrain SVT Settings**.
- Or:
 - a) From MFD Home, touch **Map** > **Map Selection** > **Map Settings**.
 - b) If necessary, touch the **Sensor** Tab.
 - c) Touch the Terrain **Settings** Button.
- Or:

- a) From PFD Home, touch **Inset Map Settings**.
 - b) If necessary, 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 **Inhibit Terrain** Button on the Terrain SVT pop-up window.

Inhibiting/enabling TAWS-B FLTA and PDA alerting:

- 1) From MFD 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 MFD Home, touch **Map > Map Selection > Map Settings**.
- 2) If necessary, 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 PFD 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 **Inhibit TAWS** 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.

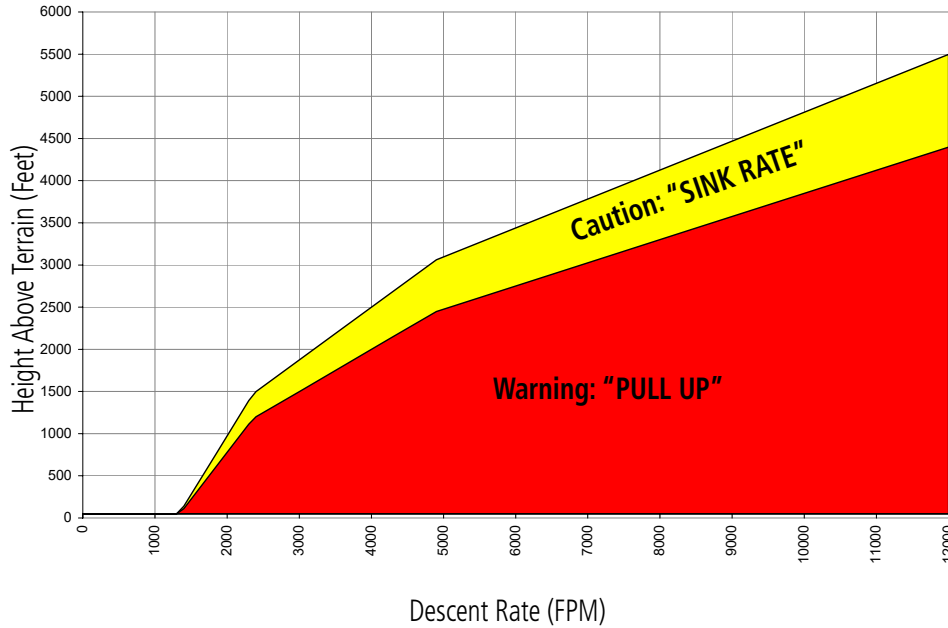


Figure 6-102 Excessive Descent Rate Alert Criteria

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.

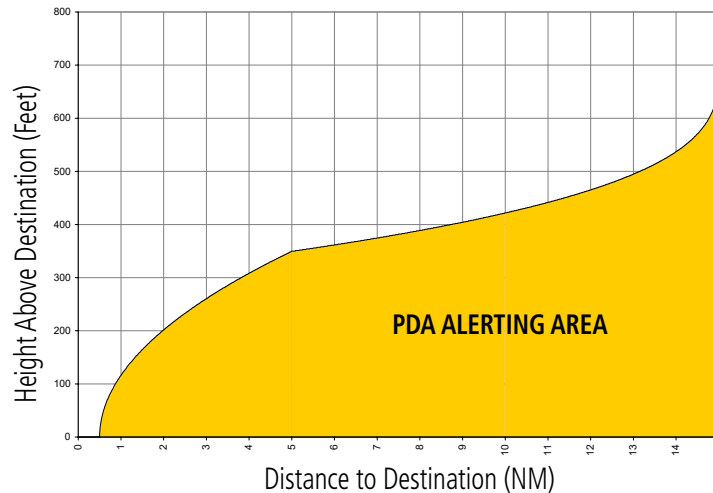


Figure 6-103 PDA Alerting Threshold

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.

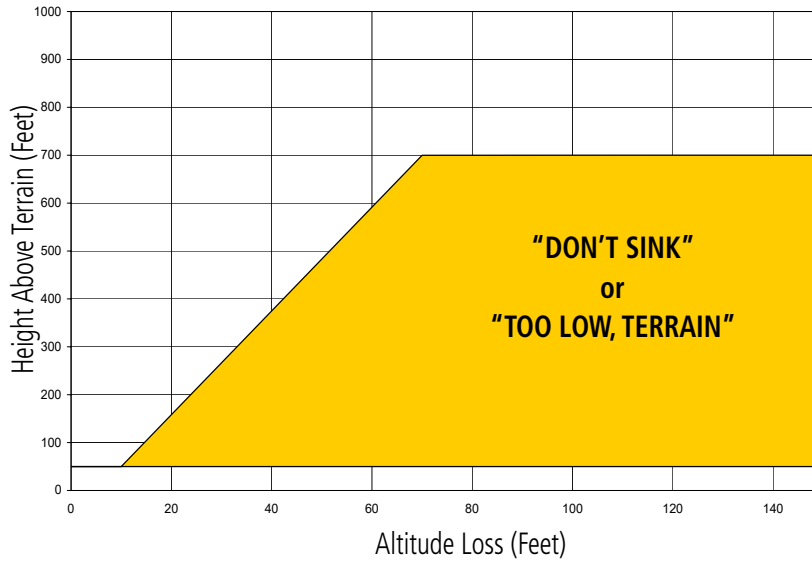


Figure 6-104 Negative Climb Rate (NCR) Altitude Loss

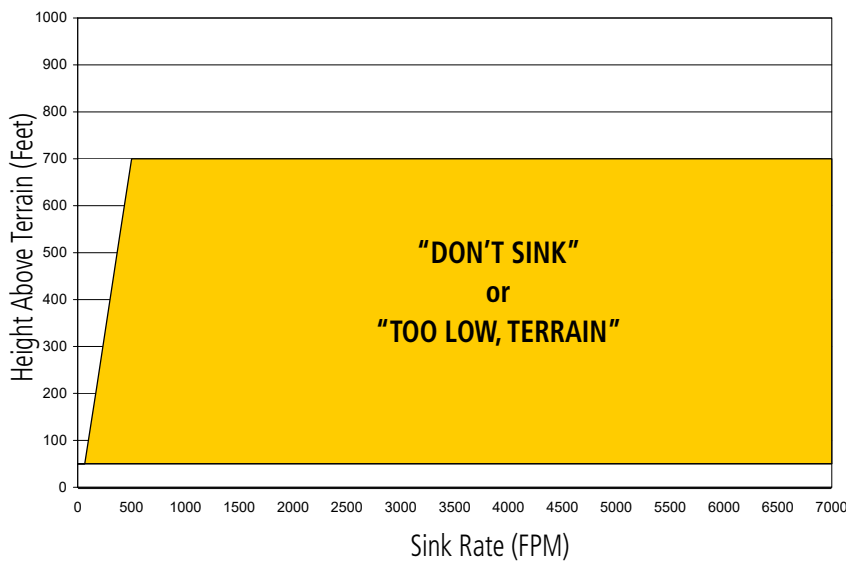


Figure 6-105 Negative Climb Rate (NCR) Sink Rate

FIVE-HUNDRED VOICE ALERT

The purpose of the TAWS-B “Five-hundred” voice alert is to provide an advisory alert of when the aircraft descends to within 500 feet above the terrain or runway threshold. When the aircraft is within 5 nm of an airport, the “Five Hundred” voice alert is based on the nearest runway threshold elevation. When the aircraft is more than 5 nm of the nearest airport, the “Five Hundred” voice alert is based on the height above terrain (as determined by the GPS altitude and Terrain Database).

There are no display annunciations or pop-up alerts that accompany the 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 FMS position.	TER N/A	NO GPS POSITION	“Terrain System Not Available”*
Excessively degraded GPS signal; or Out of database coverage area.	TER N/A	None	“Terrain System Not Available”*
Terrain System Test Fail; Terrain or Obstacle database unavailable or invalid; Invalid software configuration; or System audio fault.	TER FAIL	TERRAIN FAIL	“Terrain System Failure”
MFD Terrain or Obstacle database unavailable or invalid, and Terrain SVT operating with PFD Terrain or Obstacle databases.	None	TERRAIN DATABASE FAILURE	None

* “Terrain System Available” will be heard when sufficient GPS signal is received, or terrain database coverage area re-entered.

Table 6-20 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 MFD 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 6-21 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
MFD 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 FMS POSITION	FLTA, PDA, VCO
Excessively degraded GPS signal, or out of database coverage area.	TAWS N/A	FLTA, PDA

Table 6-22 TAWS-B Abnormal Status Alerts

6.5 TCAS I TRAFFIC



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



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



NOTE: Pilots should be aware of traffic system limitations. Traffic systems require transponders of other aircraft to respond to system interrogations. If the transponders do not respond to interrogations due to phenomena such as antenna shading or marginal transponder performance, traffic may be displayed intermittently, or not at all. Aircraft without altitude reporting capability are shown without altitude separation data or climb descent indication. Pilots should remain vigilant for traffic at all times.



NOTE: Refer to the Automatic Dependent Surveillance-Broadcast (ADS-B) traffic discussion for more information about ADS-B traffic displays.

The optional Garmin GTS 855 is a Traffic Alert and Collision Avoidance System I (TCAS I). It enhances flight crew situational awareness by monitoring the airspace for transponder-equipped aircraft. The system also provides visual annunciations and voice alerts to assist the flight crew with the visual acquisition of traffic.

The TCAS I system is capable of tracking up to 75 intruding aircraft equipped with 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.

TCAS I THEORY OF OPERATION

When the traffic system is in Operating Mode, the system interrogates the transponders of other 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 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 system provides visual and voice alerting.

TRAFFIC SURVEILLANCE VOLUME AND SYMBOLOGY

The TCAS I system monitors the airspace within $\pm 10,000$ feet of own altitude, and up to 40 nm in the forward direction. Traffic system range is somewhat reduced to the sides and aft of own aircraft due to the directional interrogation signal patterns. The symbols in the following table depict TCAS I traffic, and include Automatic Dependent Surveillance-Broadcast (ADS-B) traffic symbols. Refer to the ADS-B Traffic discussion later in this section for more information about ADS-B.













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 6-23 Traffic Symbols with TCAS I and ADS-B

A Traffic Advisory (TA), displayed as an amber circle, or an amber circle with a directional arrow inside of it, alerts the flight crew to a potentially hazardous intruding aircraft, if the closing rate, distance, and vertical separation meet TA criteria. A TA occurring 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 white arrow, 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 open white arrow, is displayed for traffic beyond six nautical miles that is neither a TA or PA.

Relative altitude, when available, is labeled 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.

A vertical trend arrow to the right of the intruder symbol indicates traffic is climbing or descending at least 500 feet per minute with an upward or downward-pointing arrow respectively.

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.

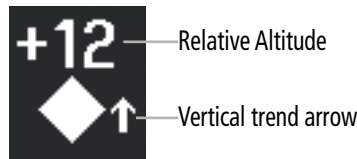


Figure 6-106 Intruder Altitude and Vertical Trend Arrow

Motion Vector Line indicates intruder aircraft track



Figure 6-107 Intruder Traffic with ADS-B Directional Information and Motion Vector

The traffic system automatically suppresses the display of other altitude-reporting aircraft on the ground under either of the following conditions:

- » On-ground aircraft is equipped with a Mode S transponder.
- » On-ground aircraft is equipped with a Mode C transponder, and own aircraft's radar altimeter (if installed) is displaying 1700' AGL or less.

TCAS TA ALERTING CONDITIONS

The traffic system automatically adjusts its TA sensitivity level to reduce the likelihood of nuisance TA alerting during flight phases likely to be near airports. Level A (less) TA sensitivity is used when own aircraft's height AGL is below 400 feet. Above this height, Level B (higher) sensitivity evaluates 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 15 seconds of separation or intruder range is less than 0.55 NM.

Table 6-24 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.

Bearing	Relative Altitude	Approximate Distance (nm)
"One o'clock" through "Twelve o'clock" or "No Bearing"	"High", "Low", "Same Altitude" (if within 200 feet of own altitude), or "Altitude not available"	"Less than one mile", "One Mile" through "Ten Miles", or "More than ten miles"

Table 6-25 TA Descriptive Voice Alert



NOTE: The system mutes TA voice alerts below 400 feet AGL.

- 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.



Figure 6-108 Traffic Annunciation (PFD)

- 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 Split Mode, no map automatically appears.
- If the system cannot determine the bearing of TA traffic, an amber text banner appears in the center of the Traffic Map instead of a TA symbol. The text indicates 'TA' followed by the distance, relative altitude, and vertical trend of '<UP>' or '<DN>', if a vertical trend of at least 500 fpm is detected.

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.

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 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.

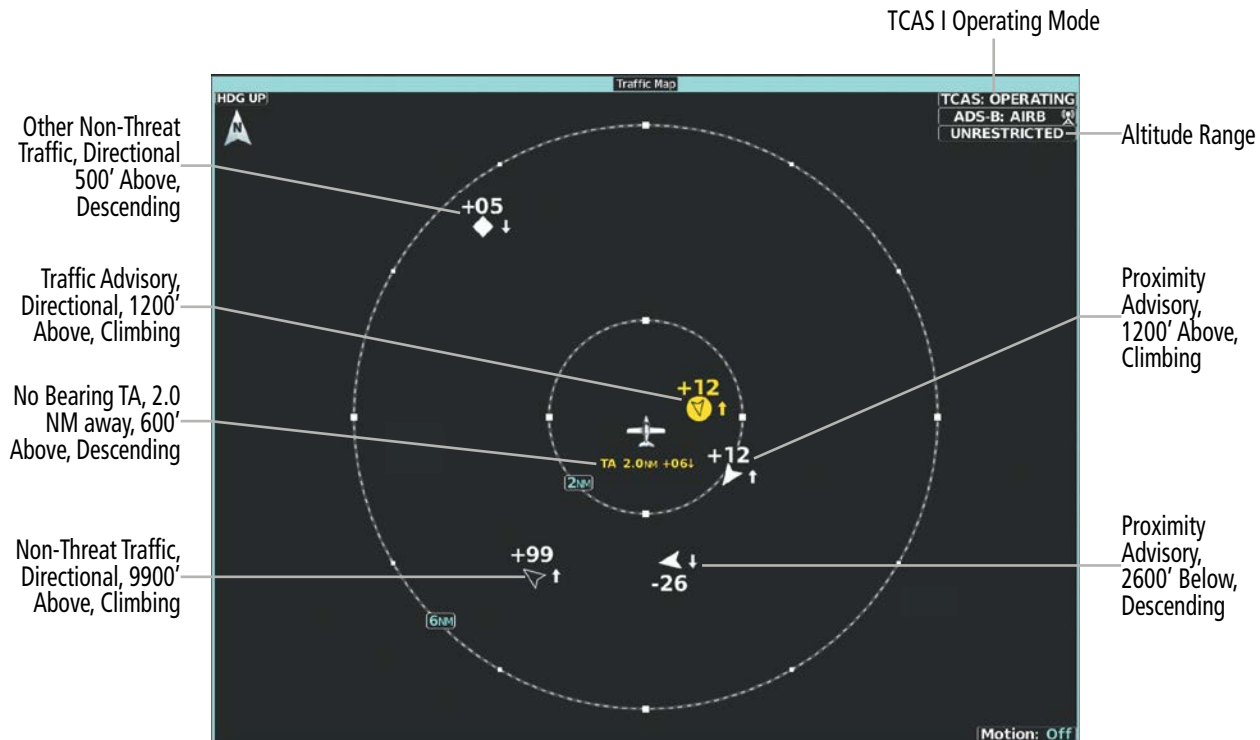


Figure 6-109 'Traffic Map' Pane with TAS and ADS-B Traffic Display Enabled

OPERATIONS

Displaying the 'Traffic Map' Pane:

From MFD Home on the Touchscreen Controller, touch the **Traffic** Button.

Or:

If the PFD is in Split Mode, touch the **Traffic Map** Button from PFD Home.

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:

- 1) From MFD Home, touch **Traffic > Traffic Settings**.

Or:

From MFD Home, touch **Map > Map Selection > Map Settings > Traffic Settings** Button.

Or:

- a) From PFD Home, touch **PFD Map Settings**.

- b) Touch the **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.

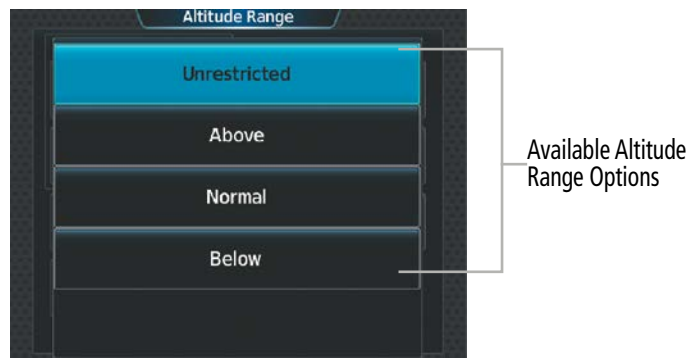


Figure 6-110 Selecting an Altitude Mode on the Traffic Settings Screen



NOTE: Refer to the *ADS-B Traffic Section* for more information for controlling the display of ADS-B traffic information.

The pilot can test the traffic system on the System Tests screen when the aircraft is on the ground. If ADS-B In traffic is installed, the pilot will first need to disable the **ADS-B Display** Button on the Traffic Settings Screen before the test mode is available.

Testing the Traffic System:

- 1) From MFD Home, touch **Traffic > Traffic Settings**.
- 2) If the **ADS-B Display** Button is present, and the button is enabled, touch the ADS-B Button to disable the display of ADS-B traffic.
- 3) Turn the lower knob if necessary to adjust the Traffic Map Pane range so the outer range ring is set to 6 NM.
- 4) Touch the **Home** Button.
- 5) Touch the **Aircraft Systems** Button.
- 6) Touch the **System Tests** Button.
- 7) Touch the **Traffic** Button to test only the traffic systems.

Or:

Touch the **Preflight Test** Button to test all systems shown on the System Tests Screen.

- 8) To enable the ADS-B Traffic display after conducting the traffic system test, touch **> Traffic Settings**.
- 9) Touch the **ADS-B** Button to enable the display of ADS-B traffic.

The system displays a pattern of traffic symbols on the traffic maps during the test.

With ADS-B In traffic installed, the test pattern corresponds to the current aircraft heading. A climbing TA is shown to the west. Other Non-Threat traffic is shown to the northwest, and a descending Proximity Advisory is in the northeast, relative to own aircraft.

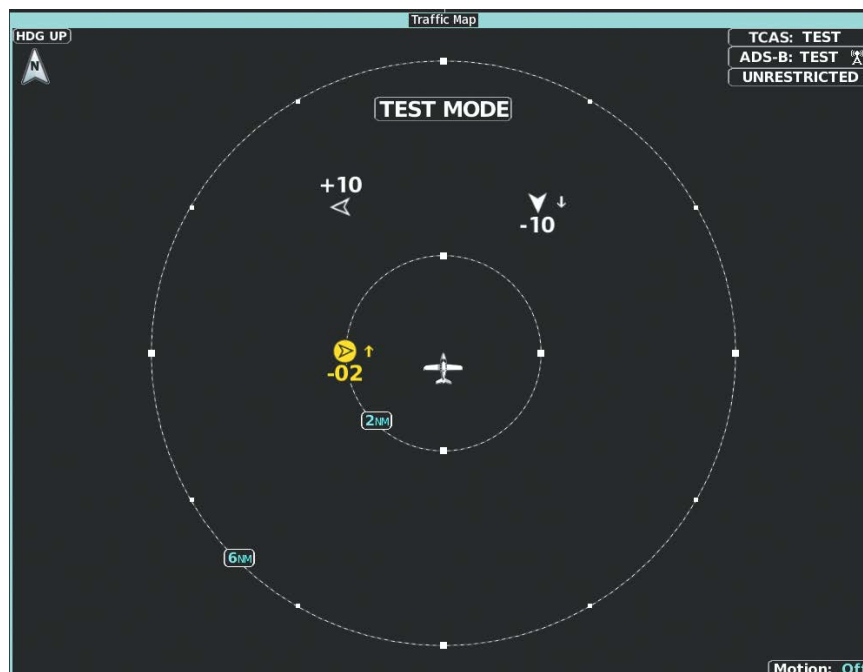


Figure 6-111 Example Traffic Test Pattern with ADS-B In Traffic Installed, Own Aircraft Heading is 360°

If a TCAS I system is installed the voice alert “TCAS One System Test Passed” or “TCAS One System Test Failed” occurs. If the traffic system test fails, failure annunciation(s) appear on traffic maps, or as a banner annunciation on navigation maps with a traffic overlay enabled.

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 (Navigation Map Pane):

- 1) From MFD Home, touch **Map > Map Selection > Map Settings**.
- 2) If necessary, touch the Sensor Tab.
- 3) Touch the **Traffic** Button.

Enabling/disabling the display of traffic information (HSI Map or Inset Map):

- 1) From PFD Home, touch **PFD Map Settings**.
- 2) If necessary, 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.

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. The HSI Map shows the traffic status icon without the altitude mode.

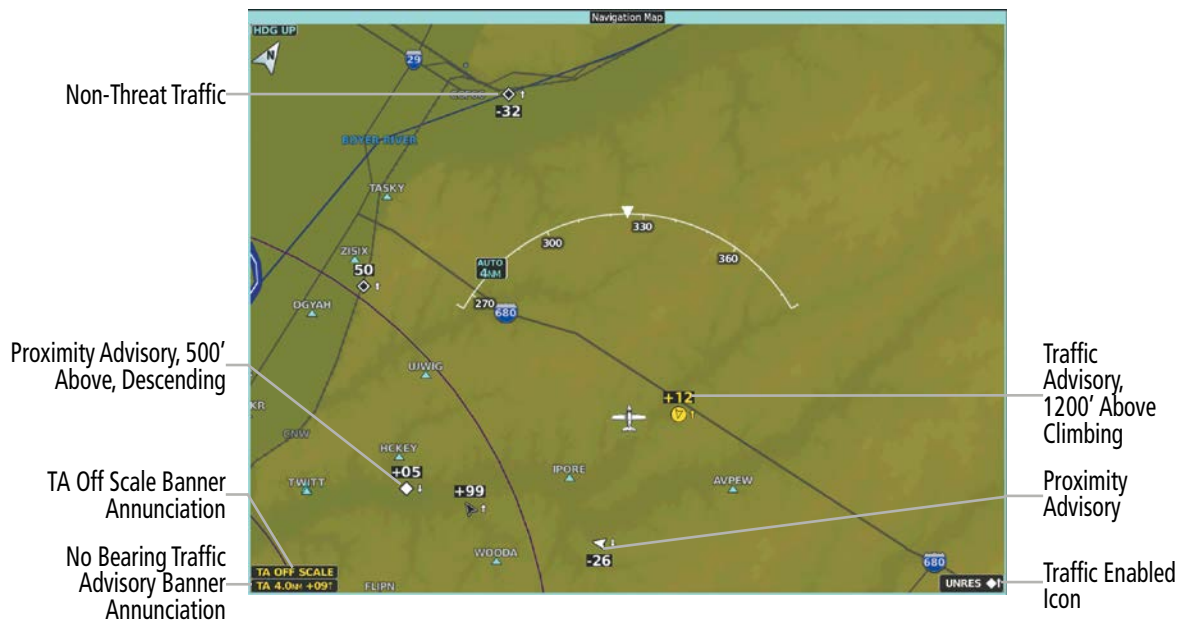


Figure 6-112 Traffic on the ‘Navigation Map’ Pane

The system provides controls to customize the display of traffic information on navigation maps. Traffic symbols and labels (such as climbing or descending 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 the display of traffic on the navigation maps:

- 1) From MFD Home, touch **Map > Map Selection > Map Settings**.
- 2) If necessary, 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 labels on traffic (such as relative altitude).
- 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.
- 8) When finished, touch the **Back** Button or the **Home** Button.

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:

- 1) From PFD Home, touch **PFD Map Settings**.
- 2) Touch the **Layout** Button.
- 3) Touch the **Traffic Inset** Button.




The HSI can also present a version of the 'Traffic Map' Pane. 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 PFD Home, touch **PFD Map Settings**.
- 2) Touch the **Layout** Button.
- 3) Touch the **HSI Traffic** Button.

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	OPERATING	
Standby	STANDBY (‘TCAS STANDBY’ shown in center of Traffic Maps)	
Failed*	FAIL	

* See Table 6-27 for additional failure annunciations.

Table 6-26 TCAS I 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 6-27 TCAS I 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.* Annunciation is removed when traffic comes within the selected display range.
TA X.X ± XX <UP> or <DN>	System cannot determine bearing of Traffic Advisory.** Annunciation indicates distance in nm, altitude separation in hundreds of feet, and an altitude trend (‘<UP>’ indicates climbing, ‘<DN>’ indicates descending), if a trend of at least 500 fpm is detected.
TRFC FAIL	The traffic unit has failed (unit is self-reporting a failure or sending incorrectly formatted data).
NO TRFC DATA	Data is not being received from the traffic unit.

*Shown as symbol on ‘Traffic Map’ Pane.
**Shown in center of ‘Traffic Map’ Pane.

Table 6-28 TCAS I 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.

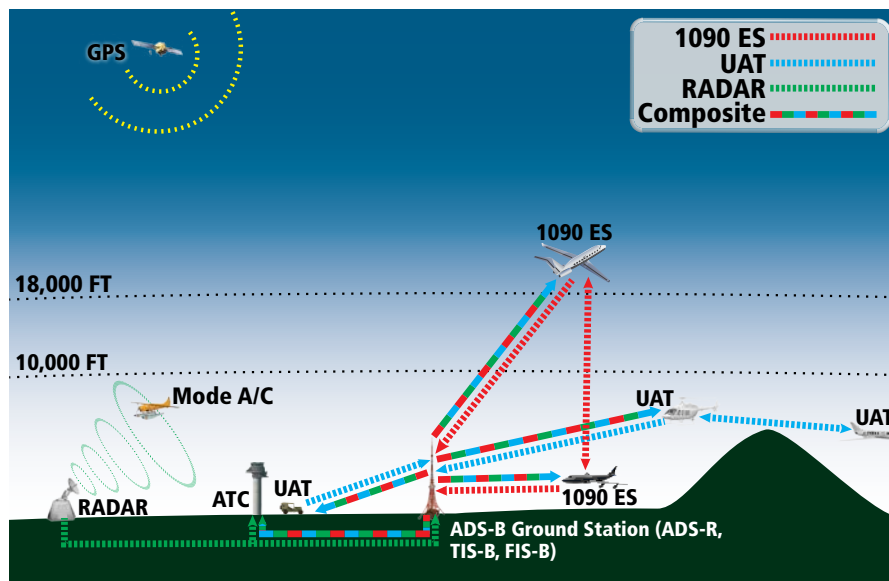


Figure 6-113 ADS-B System

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 33D or GTX 335DR transponder provides ADS-B Out functions using the 1090 ES data link. When the GTS 855 TCAS I is installed with a GTX 33D or GTX 335DR, the GTS 855 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 $\pm 3,500$ feet and 15 NM of the participant, to include altitude, position, ground speed, and ground track. TIS-B broadcasts occur once every three to thirteen seconds, depending on the characteristics of the ground station providing the TIS-B service.

The following table 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 33D 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 via 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/TCAS I System is also installed, or ATC is providing the traffic via a TIS-B ground uplink.	

Table 6-29 Aircraft Available for Viewing by an ADS-B Equipped Own Aircraft

ADS-B WITH TCAS I

When the display of ADS-B traffic is enabled, and the TCAS I system is in an operating mode (i.e. actively interrogating the transponders of other aircraft, the system attempts to match (or “correlate”) data the two traffic sources. When a correlation is made, the system displays the traffic information for the tracked aircraft determined to be the most accurate. 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 may occur, for example, if another aircraft is beyond the active surveillance range of the TCAS I system, but own aircraft is receiving information via an ADS-B In signal for the other aircraft. The traffic correlation feature improves the accuracy of the traffic displayed, while reducing the occurrence of displaying the same traffic for a given aircraft 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.*



NOTE: *The TCAS I system issues alerts for traffic it is tracking using TCAS I alerting criteria. The ADS-B system issues alerts for traffic it is tracking using the Conflict Situational Awareness & Alerting (CSA) criteria.*

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/TCAS-I Traffic system discussed previously.

When a TA occurs, the system displays an amber ‘TRAFFIC’ annunciation on the PFD and provides a voice alert. The TA voice alert corresponds to the installed traffic system. For example, if a TAS/TCAS-I system is installed, the voice alert is “Traffic”, which is followed by additional voice information about the bearing, relative altitude, and approximate distance from the intruder that caused the TA. For alerting purposes, the altitude own aircraft above terrain determines the sensitivity of the ATAS algorithm to minimize nuisance alerts to the flight crew.



NOTE: *The system mutes TA voice alerts when own aircraft is below 400’ AGL.*

Sensitivity Level	Height Above Airport Reference Point (Feet)	Radar Altitude (Feet)	Height Above Terrain (HAT)	Own Altitude (Feet)	Look-ahead time (sec)	Vertical Threshold for Alert (Feet)	Protected Volume (NM)
4	< = 1500 and within 5 NM of airport reference point	Any	Any	Any	30	400	0.20
4	Unavailable	< = 1500	Any	Any	30	400	0.20
4	Unavailable	Unavailable	< = 1500	Any	30	400	0.20
5	Unavailable or > 1500	Unavailable or > 1500	Unavailable or > 1500	< = 5000	35	700	0.35
6	Unavailable or > 1500	Unavailable or > 1500	Unavailable or > 1500	> 5000 < = 10,000	40	700	0.55
7	Unavailable or > 1500	Unavailable or > 1500	Unavailable or > 1500	> 10,000 < = 20,000	45	700	0.80
8	Unavailable or > 1500	Unavailable or > 1500	Unavailable or > 1500	> 20,000	48	700	1.10

Table 6-30 ATAS Alerting Thresholds for ADS-B Traffic

AIRBORNE AND SURFACE APPLICATIONS

ADS-B traffic can help the pilot visually acquire traffic both in the air and on-the-ground. There are two ADS-B applications or modes: Airborne Situational Awareness (AIRB) and Surface Situational Awareness (SURF). The system automatically selects the appropriate application based on conditions.

The AIRB application is on when the aircraft is more than five 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 determine the runway alignment of traffic, especially when runways are in close proximity to each other.


Due to the varying precision of the data received via ADS-B, ADS-R, and TIS-B services, not all traffic symbols may not be depicted on the traffic display. Because higher data precision is required for traffic to be displayed in the SURF environment, some traffic eligible for AIRB will not be displayed while SURF is on. Availability for AIRB and SURF is depicted on the ADS-B Status Screen, discussed later in this section.



Figure 6-114 'Traffic Map' Pane with SURF Mode On

 **NOTE:** Refer to the TCAS I Traffic section for a table of ADS-B and TCAS I traffic symbols the system can display.

OPERATION

 **NOTE:** Refer to the TCAS I Traffic Section for information about testing the traffic system(s).

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.



Figure 6-115 'Traffic Map' Pane with ADS-B Traffic Enabled

Enabling/disabling the display of ADS-B traffic:

- 1) From MFD Home, touch **Traffic > Traffic Settings**.
 - Or:
 - a) From MFD Home, touch **Map > Map Selection > Map Settings**.
 - b) Touch the **Traffic Settings** Button on the Sensor Tab.
 - Or:
 - a) From PFD Home, touch **PFD Map Settings**.
 - b) Touch the Traffic **Settings** Button.
- 2) Touch the **ADS-B Display** Button.



NOTE: If a TCAS I system is installed, and the TCAS I 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 TCAS I 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 Type Selected

Figure 6-116 'Traffic Map' Pane with Absolute Motion Vectors Enabled



Relative Motion Vector Type Selected

Figure 6-117 'Traffic Map' Pane with Relative Motion Vectors Enabled

Selecting a Motion Vector display:

- 1) From MFD Home, touch **Traffic > Traffic Settings**.
Or:
 - a) From MFD Home, touch **Map > Map Selection > Map Settings**.
 - b) Touch the Traffic **Settings** Button.
- Or:
 - a) From PFD Home, touch **PFD Map Settings**.
 - b) Touch the Traffic **Settings** Button.
- 2) Touch the ADS-B **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**.

DISPLAYING ADDITIONAL TRAFFIC INFORMATION

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, groundspeed, and other information.

Showing additional traffic information on the Traffic Map Pane:

- 1) From MFD Home, touch **Traffic > Traffic Settings**.
- 2) Touch the ADS-B **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.

TRAFFIC MAP PANE DISPLAY RANGE

The pilot can adjust the range of traffic displayed on the 'Traffic Map' Pane. Range indications appear on rings shown on the page. The minimum map range is 750 feet. A maximum map range of 40 nautical miles is available.

Selecting the 'Traffic Map' Pane display range:

- 1) From MFD Home, touch the **Traffic > Traffic Settings** Button.
- 2) Turn the lower knob clockwise to increase map range, or counter-clockwise to decrease map range.



NOTE: ADS-B traffic can be displayed as an overlay to navigation maps. Refer to the previous TCAS I discussion for information about these additional traffic displays.

ADS-B SYSTEM STATUS

The traffic mode is annunciated in the upper right corner of the ‘Traffic Map’ 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: AIRB	None	
ADS-B Operating in Surface Mode	ADS-B: SURF	None	
ADS-B Traffic Off	ADS-B: OFF	ADS-B TRFC OFF	
ADS-B Traffic Not Available	ADS-B: N/A	NO TRK/HDG	
ADS-B Failed*	ADS-B: FAIL	ADS-B TRFC FAIL	

* 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 that 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.* Annunciation is removed when traffic comes within the selected display range.
TA X.X ± XX ↓	System cannot determine bearing of Traffic Advisory.** Annunciation indicates distance in nm, altitude separation in hundreds of feet, and altitude trend arrow (climbing/descending).
TRFC FAIL	Traffic unit has failed (unit is self-reporting a failure or sending incorrectly formatted data).
NO TRFC DATA	Data is not being received from the traffic unit.

*Shown as symbol on 'Traffic Map' Pane.

**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 6-118 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) determine the application should be active. Required input data is available, and it meets performance requirements.
	Not Available	Traffic application is not available. Required input data is available, but it does not meet performance requirements.
	Fault	Traffic application is not available. Required input data is not available or the application has failed.
	Not Configured	Traffic application is not available, because it has not been configured. If this annunciation persists, the system should be serviced.
	-----	Traffic application status is invalid or unknown.

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.



NOTE: In addition to the discussion throughout this section, the Appendix provides an example of navigating a flight plan while employing some of the features of the Automatic Flight Control System. Referring to the Appendix will aid in putting the following information into context.

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 (2)
- GIA 64W (2) IAUs
- GSA 81 (4) Roll, Pitch-Trim, Yaw Damper, and Throttle Servos
- GSA 80 HS (1) YawSAS Servo
- GSA 9000 (1) Pitch Servo
- GSM 86 (5) Servo Gearboxes
- GSM 9100 (1) Pitch Servo Gearbox

The AFCS can be divided into these main operating functions:

- **Flight Director (FD)** — The Garmin AFCS Flight Director function can be coupled to PFD data. Commands for the Flight Director can be calculated by either Integrated Avionics Unit (IAU). 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 and roll servos. It provides automatic flight control in response to Flight Director steering commands, Attitude and Heading Reference System (AHRS), altitude and rate information, and airspeed.
- **Yaw Stability Augmentation System (YSAS)** - The YSAS servo operates from Takeoff to Landing. It provides Dutch Roll damping in response to yaw rate and true airspeed.
- **Yaw Damper (YD)** — The Yaw Damper controls the primary yaw control surfaces that are controlled by the rudder pedals, and has greater authority than the YSAS. Because of this, the Yaw Damper is only engaged above 200ft AGL. When GPS altitude exceeds 200ft AGL (or, if GPS is unavailable, when flaps and gear are both fully retracted), the Yaw Damper engages automatically. When the aircraft descends below 200ft AGL, the Yaw Damper automatically disengages. The YSAS stays engaged at all times when the aircraft is airborne.
- **Trim (TRIM)** — The trim system provides manual electric pitch trim capability.
- **Automatic Pitch Trim (APT)** — The pitch trim system provides automatic pitch trim when the Autopilot is engaged.

BASIC AUTOPILOT OPERATION

The following provides an overview for Autopilot engagement and disengagement. A more detailed description follows.

- **Autopilot Engagement** — The Autopilot may be engaged by pushing the **AP** Key on the AFCS Control Unit. Annunciations regarding the engagement are indicated on the PFD.
- **Autopilot Engagement with Flight Director Off** — Upon engagement, the Autopilot will be set to hold the current attitude of the airplane, if the Flight Director was not previously on. In this case, 'PIT' and 'ROL' will be annunciated.
- **Autopilot Engagement with Flight Director On** — If the Flight Director is on, the Autopilot will smoothly pitch and roll the airplane to capture the FD command bars. The prior Flight Director modes remain unchanged.
- **Autopilot Disengagement** — The most common way to disconnect the Autopilot (which also removes the FD) is to press and release the **A/P DISC** Switch, which is located on either control stick. An Autopilot disconnect tone will be heard and annunciated on the PFD until the disconnect is acknowledged by a second press of the **A/P DISC**. Other ways to disconnect the Autopilot include:
 - » Pressing the **AP** Key on the AFCS Control Unit
 - » Pulling the Autopilot circuit breaker
 - » The stick pusher will also disconnect the Autopilot

In the event of unexpected Autopilot behavior, pressing and holding the **A/P DISC** Switch will disconnect the Autopilot and remove all power to the servo motors, with the exception of the YSAS servo. The YSAS can easily be overpowered by using the main rudder controls.

7.2 AFCS CONTROLS

AFCS CONTROLLER

The AFCS Controller has the following controls:

- ① **HDG** Knob Adjusts the Selected Heading and bug in 1° increments on the HSI.
- Press to synchronize the Selected Heading to the current heading.
- ② **APR** Key Selects/deselects Approach Mode.
- ③ **AP** Key Engages/disengages the Autopilot.
- 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, and Altitude Hold modes (see Table 7-2) 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. Press 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.

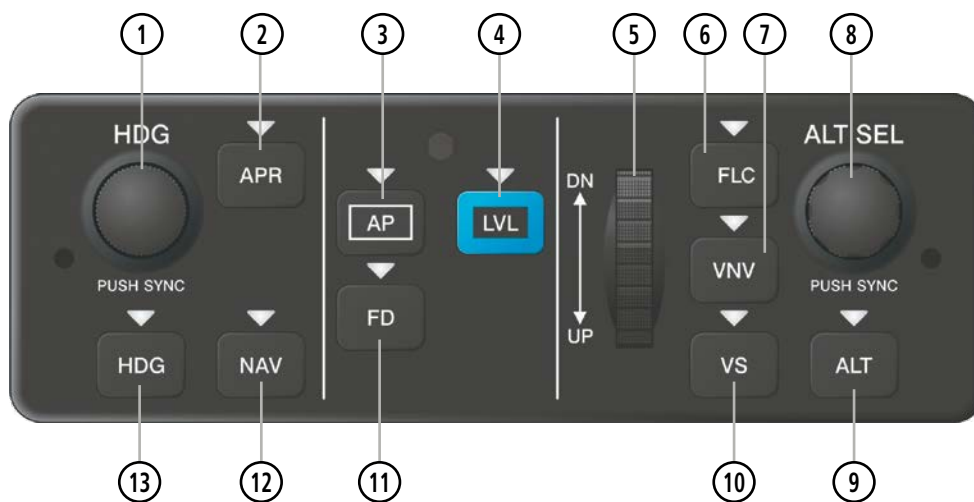


Figure 7-1 GMC 707 AFCS Controller

ADDITIONAL AFCS CONTROLS

The following AFCS controls are located separately from the AFCS Control Unit:

- | | |
|--|---|
| A/P DISC Switch
(Autopilot Disconnect) | Disengages the Autopilot, Yaw Damper, Autothrottle, Throttle Friction Lock, and Flight Director and interrupts pitch trim, stick pusher, and Throttle Electronic Stability Protection (ESP) operation (if installed). <ul style="list-style-type: none">- An A/P DISC Switch is located on each control stick.- This switch may be used to acknowledge an Autopilot disconnect alert and mute the associated aural alert. |
| TO/GA Switch
(Takeoff/Go Around) | Selects Flight Director Takeoff Mode (on ground) or Go Around Mode (in air). AFCS stays engaged through Go Around. <ul style="list-style-type: none">- This switch also activates the missed approach when the selected navigation source is GPS or when the aircraft navigation source is VOR/LOC and a valid frequency has been tuned.- The TO/GA Switch is located on the underside of the throttle lever. |
| AT DISC Button
(Autothrottle) | Disengages the Throttle Servo. <ul style="list-style-type: none">- The AT DISC Button is located on the left side of the throttle. The AT DISC Button also disengages the Throttle Friction Lock and interrupts throttle ESP operation (if installed). |
| TRIM Switch | Used to command manual electric pitch trim. <ul style="list-style-type: none">- A TRIM Switch is located on each control stick.- The pilot side TRIM Switch has priority over the copilot side TRIM Switch.- Pushing either TRIM Switch will also mute the Autopilot Disconnect Alert. |

7.3 FLIGHT DIRECTOR OPERATION

The Flight Director function provides pitch and roll commands to the AFCS and displays them on the PFD. With the Flight Director active, the aircraft can be hand-flown to follow the path shown by the Command Bars. Maximum commanded pitch (30°) and roll (30° or 20° when low bank mode is active) 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 activates the Flight Director in the listed modes.

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
VS Key	Roll Hold (default)	ROL	Vertical Speed	VS
VNV Key	Roll Hold (default)	ROL	VNAV Path Descent*	V PATH
NAV Key	Navigation**	GPS VOR LOC	Pitch Hold (default)	PIT
APR Key	Approach**	GPS VAPP LOC	Pitch Hold (default)***	PIT
HDG Key	Heading Select	HDG	Pitch Hold (default)	PIT
LVL Key	Level Hold	LVL	Level Hold	LVL

*When the **VNV** Key is pressed in conjunction with another mode selection, a 'V' is displayed with the selected mode annunciation.

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.

***GS or GP armed if available.

Table 7-1 Flight Director Activation

AFCS STATUS BOX

Flight Director mode annunciations are displayed on the PFD when the Flight Director is active. Autopilot and Yaw Damper status are shown in the center of the AFCS Status Box. Lateral Flight Director modes are displayed on the left and vertical modes on the right. Armed modes are displayed in white and active in green.

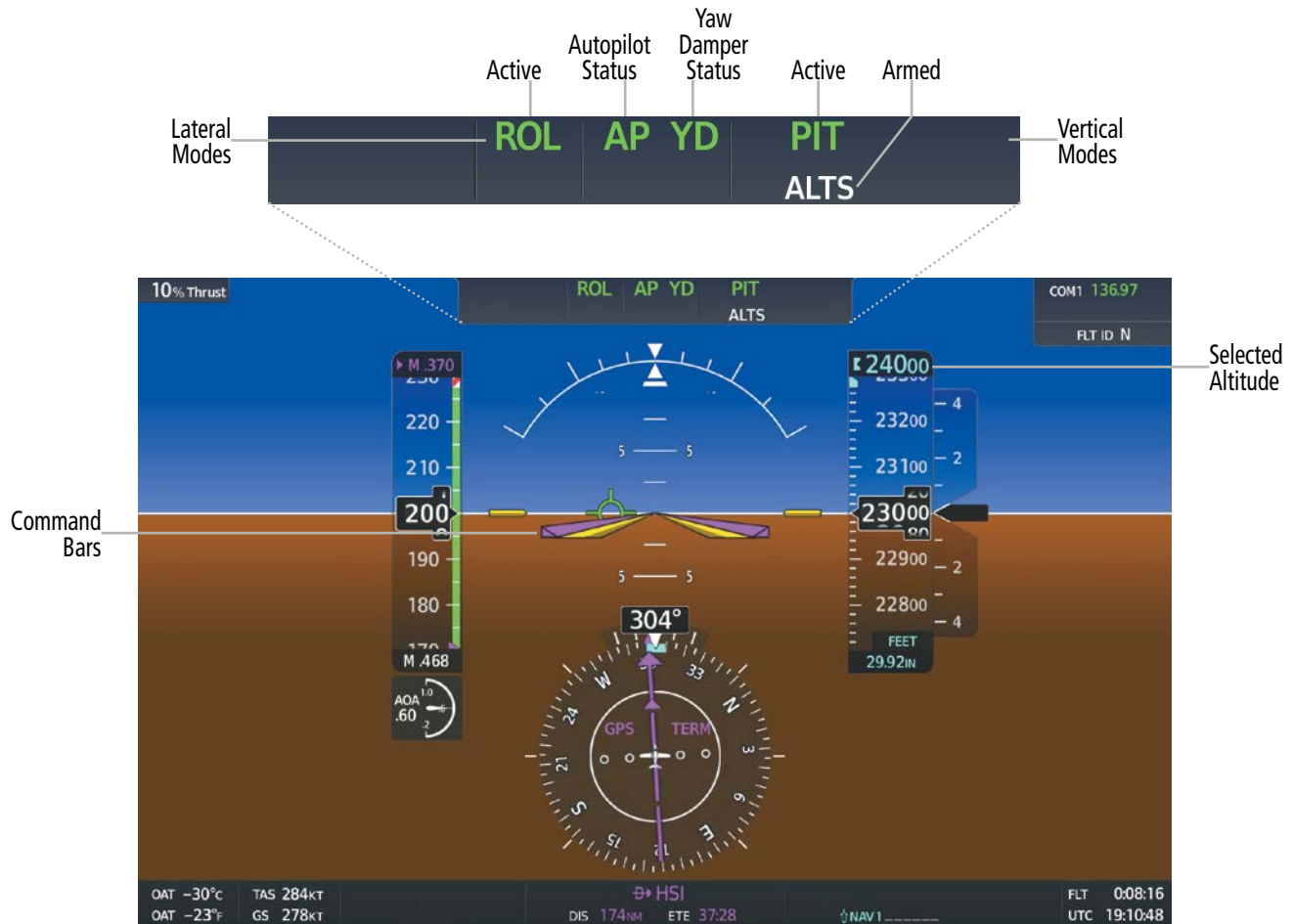


Figure 7-2 PFD AFCS Display

FLIGHT DIRECTOR MODES

Flight Director modes are normally selected independently for the pitch and roll axes. Unless otherwise specified, all mode keys are alternate action (i.e., press on, press off). In the absence of specific mode selection, the Flight Director reverts to the default pitch and/or roll mode(s).

Armed modes are annunciated in white and active in green in the AFCS Status Box. 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, GPS) 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.

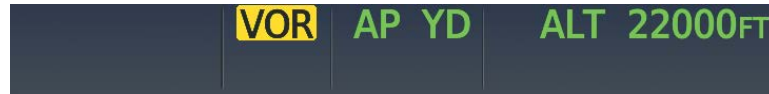


Figure 7-3 Loss of VOR Signal

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 PFD as single cue. If the aircraft is being flown by hand, the command bars are displayed hollow. The aircraft symbol (in amber) changes to accommodate the Command Bar format. The single cue Command Bars move together vertically to indicate pitch commands and bank left or right to indicate roll commands.

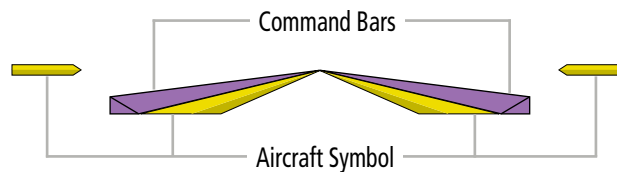


Figure 7-4 Command Bars

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 with their corresponding controls and annunciations. The mode reference (Altitude, Vertical Speed, Air Speed, or GPS Speed Target) is displayed next to the active mode annunciation for Altitude Hold, Vertical Speed, and Flight Level Change modes. The **UP/DN** Wheel can be used to change the vertical mode reference while operating under Pitch Hold, Vertical Speed, Flight Level Change Mode or Altitude Hold 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 where applicable.

Vertical Mode	Description	Control	Annunciation	Reference Range	Reference Change Increment
Pitch Hold	Holds aircraft pitch attitude; may be used to climb/descend to the Selected Altitude	(default)	PIT	30°	0.25°
Selected Altitude Capture	Captures the Selected Altitude	*	ALTS		
Altitude Hold**	Holds current Altitude Reference	ALT Key	ALT nnnnnFT		
Vertical Speed	Holds aircraft vertical speed; may be used to climb/descend to the Selected Altitude	VS Key	VS nnnnFPM	-6000 to +6000 fpm	100 fpm
Flight Level Change	Holds aircraft airspeed while aircraft is climbing/descending to the Selected Altitude	FLC Key	FLC nnnKT	85 to 250 kts [†]	1 kt
		FLC Key	FLC M .NNN	.XXX to .53 Mach***	.002

*ALTS is armed automatically when the Selected Altitude is to be captured instead of the VNAV Target Altitude.

**While in ALT mode, the UP/DN wheel will change the altitude ref in 10 ft increments up to a maximum of 180 ft from the initial ref.

***Minimum Mach displayed (.XXX) is the equivalent Mach for 105 kts for a given altitude and temperature.

† Reference Range is displayed as Mach for specified speeds and altitudes which are flap and gear position dependent.

Table 7-2 Flight Director Vertical Modes

PITCH HOLD MODE (PIT)

When the Flight Director is activated (e.g., the **FD** or **AP** Key is pressed), Pitch Hold Mode is selected by default. Pitch Hold Mode is indicated as the active vertical mode by the green ‘PIT’ annunciation. This mode may be used for climb or descent to the Selected Altitude (shown above the Altimeter), since Selected Altitude Capture Mode is automatically armed when Pitch Hold Mode is activated.

In Pitch Hold Mode, the Flight Director maintains a constant pitch attitude, the pitch reference. The pitch reference is set to the aircraft pitch attitude at the moment of mode selection. If the aircraft pitch attitude exceeds the Flight Director pitch command limitations, the Flight Director commands a pitch angle equal to the nose-up/down limit.

CHANGING THE PITCH REFERENCE

When operating in Pitch Hold Mode, the pitch reference can be adjusted by using the **UP/DN** Wheel.

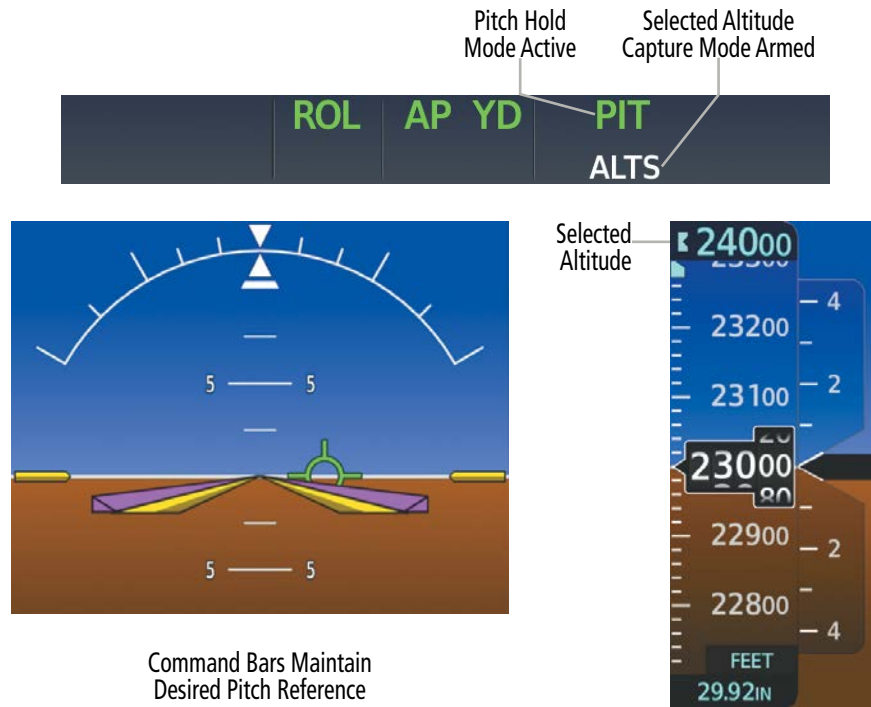


Figure 7-5 Pitch Hold Mode

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 VNV Target Altitude)

The white 'ALTS' annunciation indicates Selected Altitude Capture Mode is armed. The **ALT SEL** Knob is used to set the Selected Altitude (shown above the Altimeter) until Selected Altitude Capture Mode becomes active.

As the aircraft nears the Selected Altitude, the Flight Director automatically transitions to Selected Altitude Capture Mode with Altitude Hold Mode armed (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. 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.

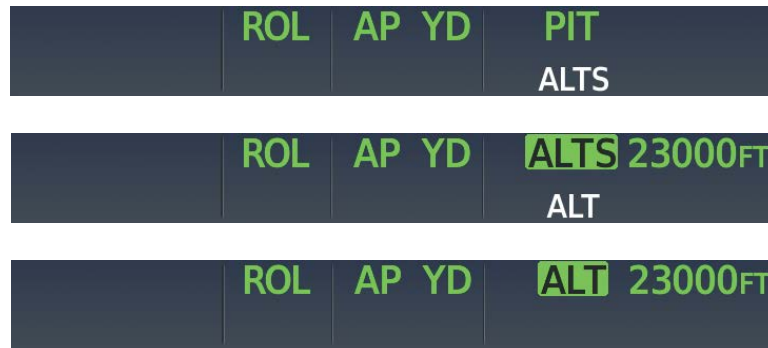


Figure 7-6 Automatic Mode Transitions During Altitude Capture

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)

Altitude Hold Mode can be activated by pressing the **ALT** Key; the flight director maintains the current aircraft altitude (to the nearest one foot) 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.

CHANGING THE ALTITUDE REFERENCE



NOTE: Turning the **ALT SEL** Knob while in Altitude Hold Mode changes the Selected Altitude, but not the Flight Director's altitude reference, and does not cancel the mode.

The Altitude Reference may also be changed by using the **UP/DN** Wheel. The Altitude Reference will change in increments of 10' to a maximum of 180' from current altitude. This will command the FD to climb/descend as appropriate.

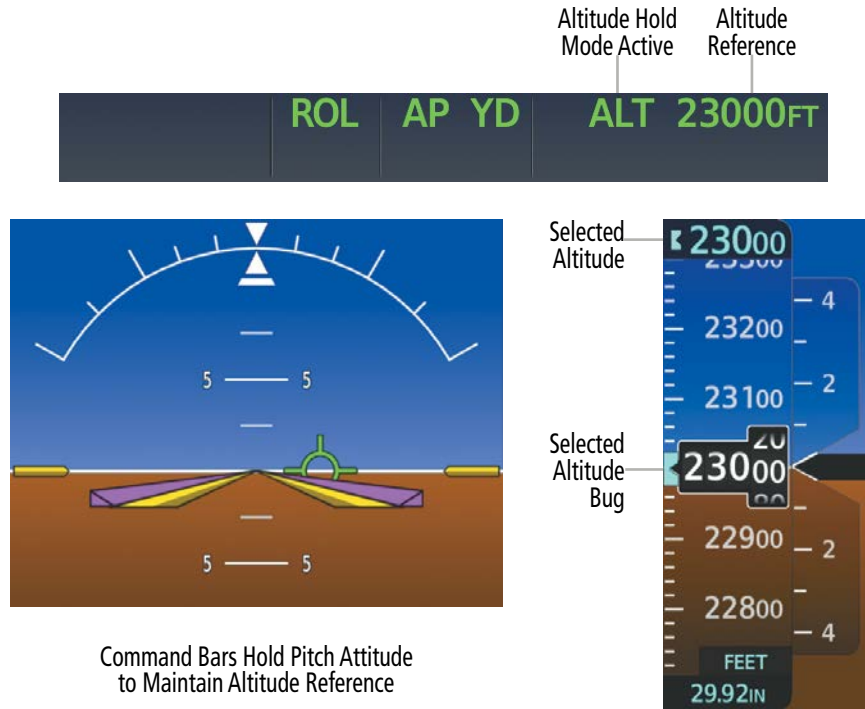


Figure 7-7 Altitude Hold Mode

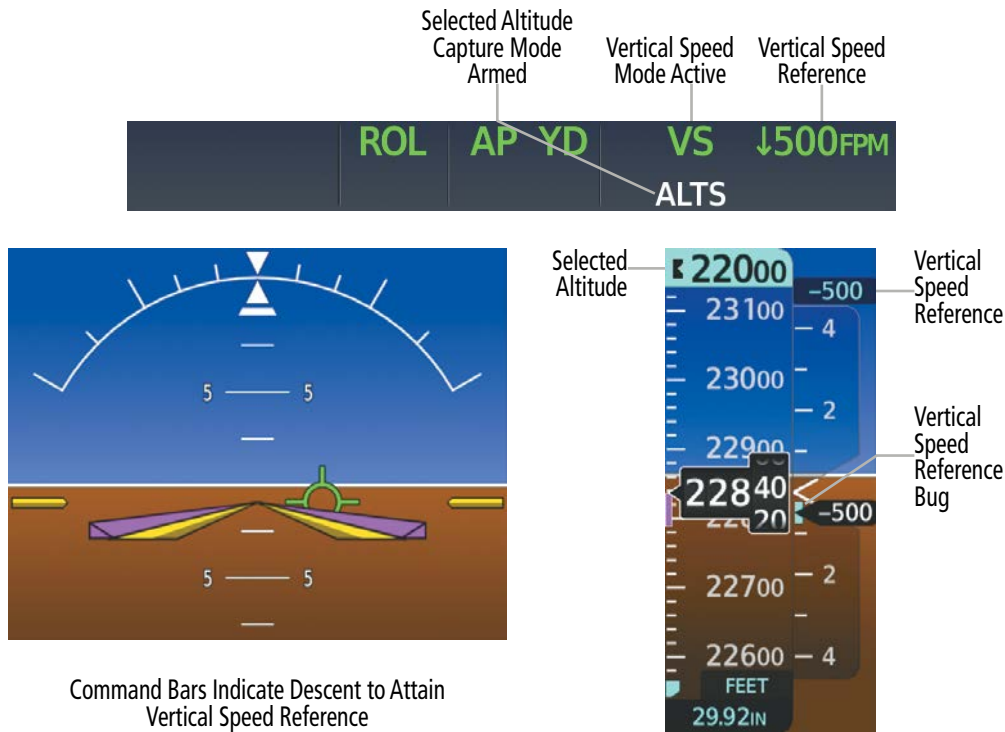
VERTICAL SPEED MODE (VS)

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), 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 using the **UP/DN** Wheel



Command Bars Indicate Descent to Attain Vertical Speed Reference

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 (in IAS or Mach) while climbing or descending to the Selected Altitude (shown above the Altimeter). When Flight Level Change Mode is active, the Flight Director continuously monitors Selected Altitude, airspeed/Mach, and altitude.

The Airspeed Reference is set to the current airspeed upon mode activation (see following figure). Flight Level Change Mode is indicated by a green 'FLC' annunciation in the AFCS Status Box (GPS mode may be selected with full autothrottle equipped aircraft). The Airspeed Reference is displayed in cyan directly above the Airspeed Indicator, along with a cyan Airspeed Reference Bug corresponding to the Airspeed Reference along the tape. Airspeed can be adjusted by using the **UP/DN** Wheel on the AFCS Controller.

Engine power must be adjusted to allow the Autopilot to fly the aircraft at a pitch attitude corresponding to the desired flight profile (climb or descent) while maintaining the Airspeed Reference. The Flight Director maintains the current altitude until either engine power or the Airspeed Reference are adjusted and does not allow the aircraft to climb or descend away from the Selected Altitude.

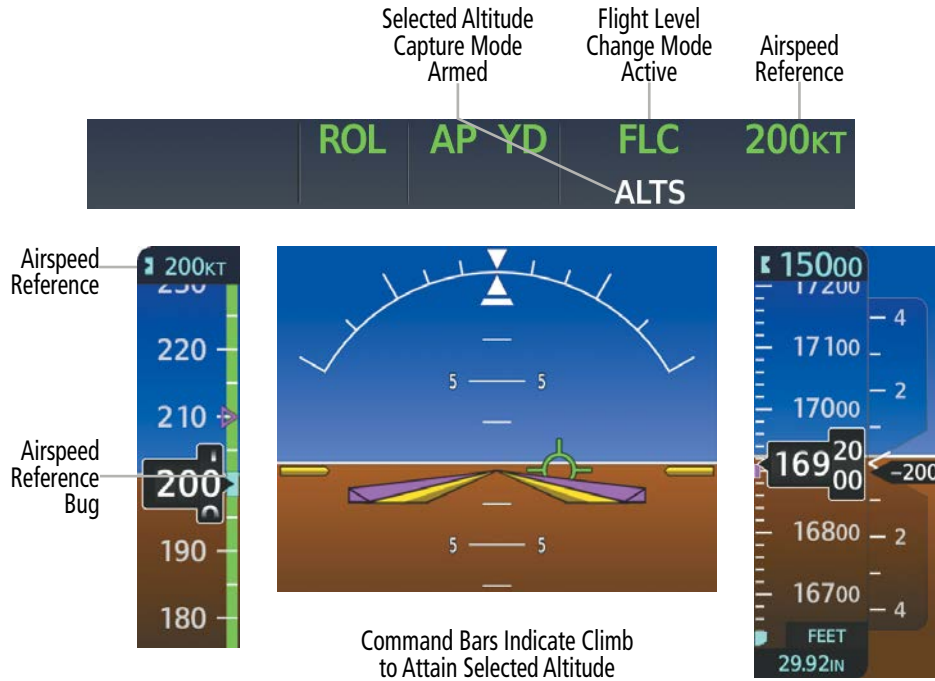


Figure 7-9 Flight Level Change Mode

CHANGING THE AIRSPEED REFERENCE (FLC MODE)

The Airspeed Reference units automatically change from IAS to Mach or Mach to IAS as the aircraft passes 18,386 feet MSL.

When the FLC Airspeed Reference is displayed in Mach, the Airspeed Reference Bug is displayed on the Airspeed Indicator at the IAS corresponding to the selected Mach target speed and the current Mach number is shown below the Airspeed Indicator.

The Airspeed Reference (shown above the Airspeed Indicator in cyan) may be adjusted by:

- Using the **UP/DN** Wheel to adjust the Airspeed Reference Bug.
- Using the **INC/DEC Speed** Wheel on the Autothrottle Controller to adjust the Airspeed Reference Bug.

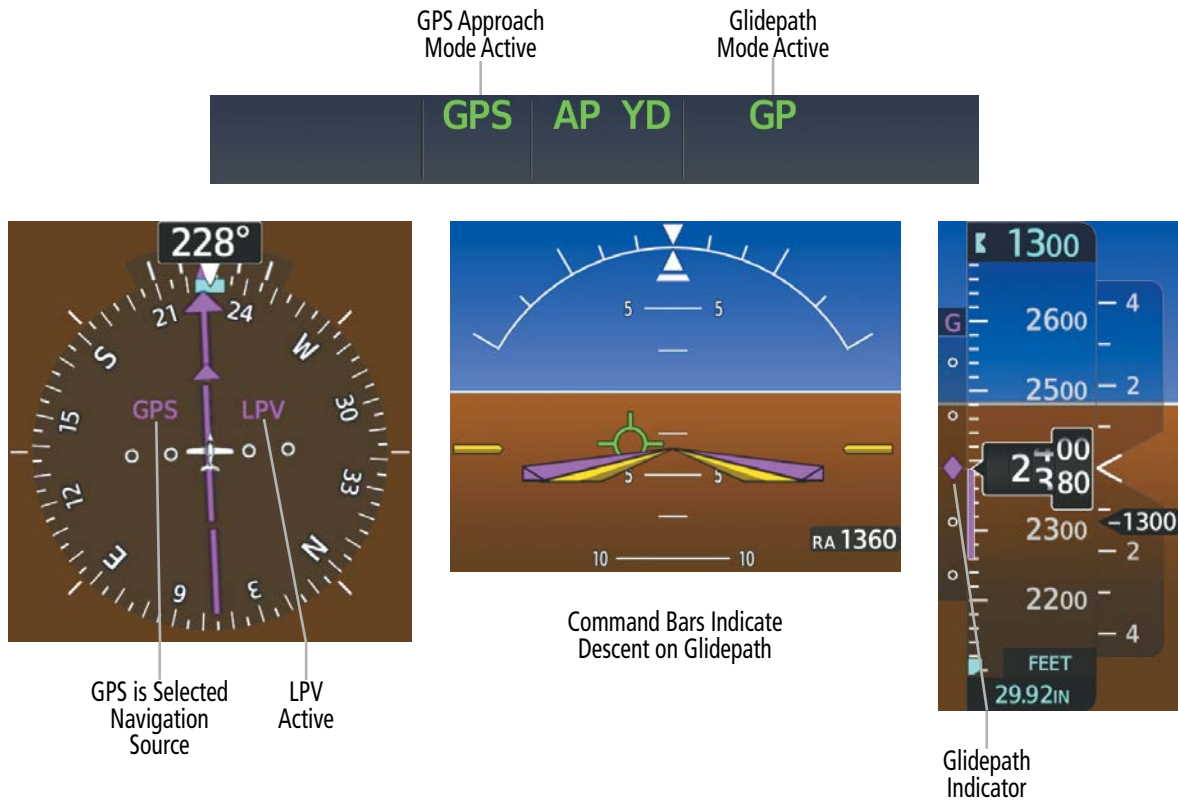


Figure 7-10 Glidepath Mode

LATERAL MODES

The following table relates each AFCS lateral mode to its respective control and annunciation.

Lateral Mode	Description	Control	Annunciation	Maximum Roll Command Limit*
Roll Hold	Holds the current aircraft roll attitude or rolls the wings level, depending on the commanded bank angle	(default)	ROL	30°
Low Bank Mode	Limits the maximum commanded roll angle.	**	***	20°
Heading Select	Captures and tracks the Selected Heading	HDG Key	HDG	30°
Navigation Mode				
GPS Arm/Capture/Track	Captures and tracks the selected navigation source (GPS, VOR, LOC)	NAV Key	GPS	30°
VOR Enroute Capture/Track			VOR	30° Capture 10° Track
LOC Capture/Track (No Glideslope)			LOC	30° Capture 10° Track
Backcourse Arm/Capture/Track			BC	30° Capture 10° Track

*The AFCS limits turn rate to 3 degrees per second (standard rate turn), therefore, the maximum roll angle may not reach the command limit at slower speeds.

**Low Bank Mode is automatically engaged if in HDG, GPS, or VOR mode and the aircraft climbs through 18,000 feet. Low Bank Mode is automatically disengaged if the aircraft descends through 18,000 feet or is no longer in HDG, GPS, or VOR mode.

***No annunciation appears in the AFCS Status Box. The acceptable bank angle range is indicated in green along the Roll Scale of the Attitude Indicator.

Table 7-3 Flight Director Lateral Modes

ROLL HOLD MODE (ROL)



NOTE: If Roll Hold Mode is activated as a result of a mode reversion, the Flight Director rolls the wings level.

When the Flight Director is activated, 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.

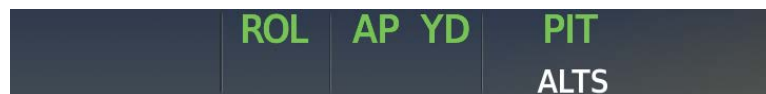


Figure 7-11 Roll Hold Mode Annunciation

Bank Angle	Flight Director Response
< 6°	Rolls wings level
6° to 30°	Maintains current aircraft roll attitude
> 30°	Limits bank to 30°

Table 7-4 Roll Hold Mode Responses

LOW BANK MODE



NOTE: The automatic switching for Low Bank Mode will not occur if aircraft is in a bank greater than 6° when crossing the trigger altitude.

When in Low Bank Mode, the Flight Director limits the maximum commanded roll angle to 20°. Low bank arc limits are displayed in green along the Roll Scale.

Low Bank Mode is automatically engaged if while in Heading Select or a Navigation Mode (GPS or VOR) the aircraft climbs through 18,000 feet. Low Bank Mode is automatically disengaged if the aircraft descends through 18,000 feet or is no longer in Heading Select or a Navigation Mode (GPS or VOR).

When Low Bank Mode is engaged, and a STEEP TURN AHEAD System Message is displayed, the computed bank angle will exceed the Low Bank limit during the next turn.

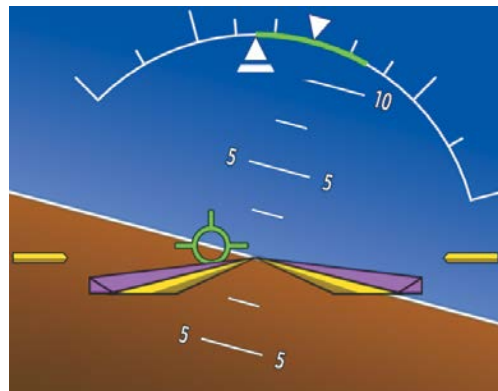


Figure 7-12 Low Bank Mode

HEADING SELECT MODE (HDG)

Heading Select Mode is activated by pressing the **HDG** Key. Heading Select Mode acquires and maintains the Selected Heading. The Selected Heading is shown by a cyan bug on the HSI and in the box to the upper left of the HSI.

CHANGING THE SELECTED HEADING

The Selected Heading is adjusted using the **HDG** Knob. Pressing the **HDG** Knob synchronizes the Selected Heading to the current heading. When the **HDG** Knob is pressed while the aircraft is in a turn, the Heading Bug moves to the current heading, but continues to adjust as heading changes until the airplane rolls to wings level.

When NAV is the active lateral AFCS mode (GPS or a short range NAV source), pressing **HDG** Knob activates HDG SYNC MODE, which automatically keeps the HDG bug centered until 1) NAV is no longer the active lateral mode, 2) HDG Knob is pressed again, or 3) a different heading is selected by turning the HDG Knob. When active, SYNC MODE is annunciated on the PFD next to the HDG indication.

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.

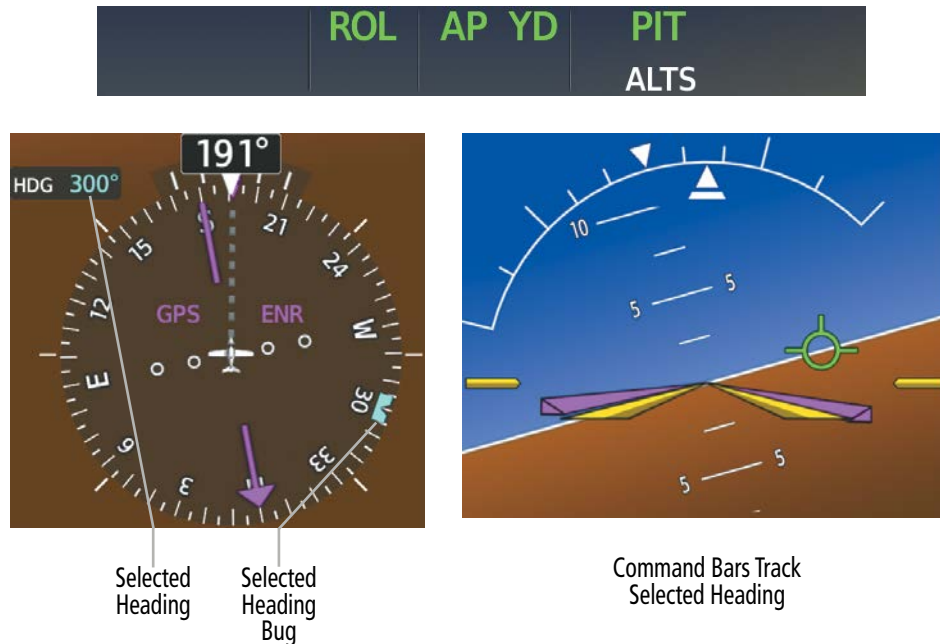


Figure 7-13 Heading Select Mode

NAVIGATION MODE

NOTE: The selected navigation receiver must have a valid VOR or LOC signal or active GPS course for the Flight Director to enter Navigation Mode.

NOTE: When intercepting a flight plan leg, the Flight Director gives commands to capture the active leg at approximately a 45° angle to the track between the waypoints defining the active leg. The Flight Director does not give commands to fly to the starting waypoint of the active leg.

Pressing the **NAV** Key selects Navigation Mode. Navigation Mode acquires and tracks the selected navigation source (GPS, VOR, LOC). The Flight Director follows GPS roll steering commands when GPS is the selected navigation source. When the navigation source is VOR or LOC, the Flight Director creates roll steering guidance from the Selected Course and deviation. Navigation Mode can also be used to fly non-precision approaches where glideslope/glidepath capture is not required.

If the Course Deviation Indicator (CDI) shows greater than ¼ dot when the **NAV** Key is pressed, the selected mode is armed. If the CDI is less than ¼ dot, the active leg or course is automatically captured when the **NAV** Key is pressed. The armed annunciation appears in white below the active roll mode.

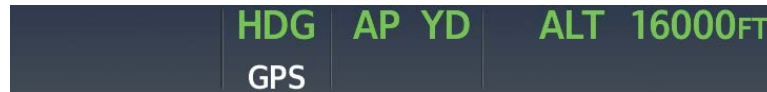


Figure 7-14 GPS Navigation Mode Armed

When the CDI has automatically switched from GPS to LOC during a LOC/ILS approach, GPS Navigation Mode remains active, providing GPS steering guidance until the localizer signal is captured. LOC Navigation Mode is activated when the automatic navigation source switch takes place. If the **APR** Key is pressed before the automatic navigation source switch, LOC Navigation Mode is armed.

If Navigation Mode is active and either of the following occur, the Flight Director reverts to Roll Hold Mode (wings rolled level):

- » Different VOR tuned while in VOR Navigation Mode (VOR Navigation Mode reverts to armed)
- » Navigation source manually switched
- » During a LOC/ILS approach, GPS Navigation Mode is active and the FAF is crossed after the automatic navigation source transition from GPS to LOC

CHANGING THE SELECTED COURSE

If the navigation source is VOR or LOC, or OBS Mode has been enabled when using GPS, the Selected Course is controlled using the **CRS** Knob by using the upper knob on the PFD Controller.

COMBINATION MODES

The following table lists the modes that operating by using both Vertical and Lateral Modes with their corresponding controls and annunciations.

Mode	Description	Control	Annunciation	Max Roll Command Limit	Reference Range
Vertical Navigation Modes					
VNAV Path Tracking Mode	Captures and tracks descent legs of an active vertical profile	VNV Key	VPTH		
VNV Target Altitude Capture Mode	Captures the Vertical Navigation (VNV) Target Altitude	*	ALTV		
VOR Approach Mode					
VOR Arm/Capture/Track	Captures and tracks VOR navigation source	APR Key	VAPP	25°	
GPS Approach Mode					
GPS Arm/Capture/Track	Captures and tracks GPS navigation source	APR Key	GPS	25°	
Glidepath Mode	Captures and tracks the SBAS glidepath on approach		GP		
LOC Approach Mode					
Approach, ILS Arm/Capture/Track	Captures and tracks the LOC navigation source	APR Key	LOC	25°	
Glideslope	Captures and tracks the ILS glideslope on approach		GS		
Backcourse Arm/Capture/Track	Captures and tracks the LOC source for backcourse approaches	N/A	BC	25°	
Additional Modes					
Takeoff	Commands a constant pitch angle on the ground in preparation for takeoff	TO/GA Switch	TO	0°	+10°
Go Around	Commands a constant pitch angle in the air	TO/GA Switch	GA	0°	+7°
Level	Autopilot engages and commands pitch angle necessary to establish zero vertical fpm	**	LVL	N/A	N/A

*ALTV is armed automatically under VPTH when VNV Target Altitude is to be captured instead of Selected Altitude.

**Level mode can become activated as a function of Electronic Stability and Protection (ESP) or by pressing the LVL Button located on the AFCS Controller. 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)

Climb, Cruise, Descent (CCD) Vertical Navigation is a standard feature on this aircraft.



NOTE: VNV is disabled when parallel track or Dead Reckoning Mode is active, or when waypoint sequencing is suspended.



NOTE: The Selected Altitude takes precedence over any other vertical constraints.

Vertical Navigation (VNAV) flight control is available for enroute/terminal climb, cruise, and descent operations any time that VNV flight planning is available. Refer to the Flight Management Section for more information on VNAV flight plans.

The Flight Director may be armed for VNAV at any time. However, VNAV may not become active until certain conditions for VNAV availability are satisfied. Conditions for availability include, but are not limited to:

- » The selected navigation source is GPS
- » A VNAV flight plan (with at least one altitude-constrained waypoint) or vertical direct-to is active
- » VNAV is enabled
- » Crosstrack error is valid and within limits
- » Desired/actual track are valid and track angle error not exceeding 75 degrees off the desired track for the current leg
- » The VNV Target Altitude of the active waypoint is no more than 250 ft above the current aircraft altitude
- » Parallel track is not active

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 VNAV 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 VNAV 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 VNAV is armed) or a 'green 'V' in the upper field (indicating VNAV is active). The VNAV indication may change between armed and active indications depending on the conditions for VNAV availability. When an AFCS mode is armed, pressing the **VNV** Key displays a white 'V' to the left of the armed mode, indicating VNAV is also armed. The following figures show examples of armed and active VNAV annunciations.

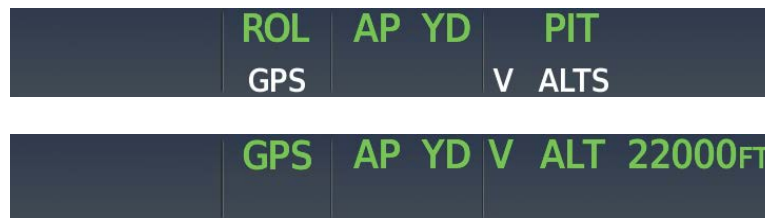


Figure 7-15 VNAV Annunciations

VNAV can be active in combination with any Flight Director vertical mode except for Glidepath (GP) and Glideslope (GS). There are also three additional vertical modes FLC, PATH, and ALTV.

VNAV CLIMB (V FLC)

Before starting a VNAV climb, the Selected Altitude must be set above the current aircraft altitude by at least 75 feet. ALT V will be armed to capture the next AT or AT-or-BELOW VNAV Climb Target Altitude.

NOTE: The system does not level off at "AT-or-ABOVE" Target Altitudes while climbing.

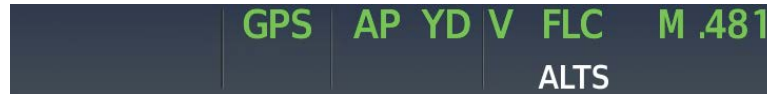


Figure 7-16 V FLC Mode Active With ALTS Mode Armed

NOTE: For small altitude changes, V FLC mode commands a small vertical rate in conjunction with AT (if installed) usage to avoid excessive pitch changes. If a small altitude climb is required over a short distance, this vertical rate may be insufficient to meet a vertical constraint. This may lead to an "UNABLE VNAV ALTITUDE" system message. It is the pilot's responsibility to add enough thrust manually to ensure the altitude constraint is met.

If the active VNAV Target Altitude is defined as "AT" or "AT-or-ABOVE", the vertical speed required to make the target altitude before the VNAV waypoint is provided on the vertical speed indicator. If the current vertical speed is insufficient to make the target altitude, the UNABLE VNAV ALTITUDE system message will be shown.

Climb to "AT" or "AT-or-ABOVE" Target Altitude, Required Vertical Speed is displayed

Climb to "AT-or-BELOW" Target Altitude, Required Vertical Speed is not shown

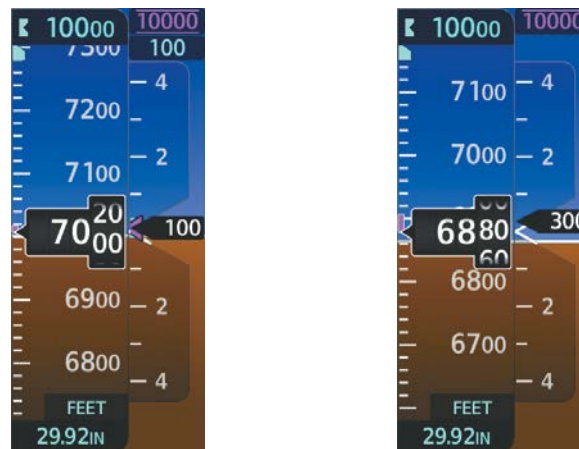


Figure 7-17 Required Vertical Speed in Climb

When the aircraft is to level off at a VNAV Target Altitude at the end of the climb, the Navigation Status Box provides the 'TOC (top of climb) within 1 minute' annunciation and the Vertical Track Alert "Vertical Track" is heard as the aircraft approaches the VNAV Target Altitude.

After leveling off at the VNAV Target Altitude, FLC mode is armed to resume the climb when the VNAV waypoint is sequenced. The Navigation Status Box provides the 'BOC (Bottom of climb) within 1 minute' annunciation and the Vertical Track Alert "Vertical Track" is heard as the aircraft approaches the VNAV waypoint.

As the waypoint is crossed, FLC Mode becomes active automatically. If Selected Altitude was not set before crossing the waypoint, the climb must be resumed manually.

Vertical modes other than FLC (e.g., PIT or VS) can also be used for VNAV climbs, but must be selected manually.

VNAV PATH DESCENT MODE (V PATH)



NOTE: *If another pitch mode key is pressed while VNAV Path Descent Mode is selected, VNAV Path Descent Mode reverts to armed.*

When a vertical profile (VNAV flight plan) is active and the **VNV** Key is pressed, VNAV Path Descent Mode is armed in preparation for the 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. This may be performed at any point prior in the flight, and would result in a “V” on the AFCS Status Box at the top of the PFD.

When descending, the appropriate altitude capture mode is armed for capture of the next VNAV Target Altitude (ALTV) or the Selected Altitude (ALTS), whichever is greater. 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.

Before descent path interception, the Selected Altitude must be set below the current aircraft altitude by at least 75 feet.

In conjunction with the ‘TOD (top of descent) within 1 minute’ annunciation in the Navigation Status Box and the Vertical Track Voice Alert, VNAV indications (VNAV Target Altitude, Vertical Deviation Indicator, Vertical Speed Required Indicator, and green ‘V’ in the AFCS Mode annunciation field) appear on the PFDs (see following figure).

While on an approach and transitioning from GPS 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.

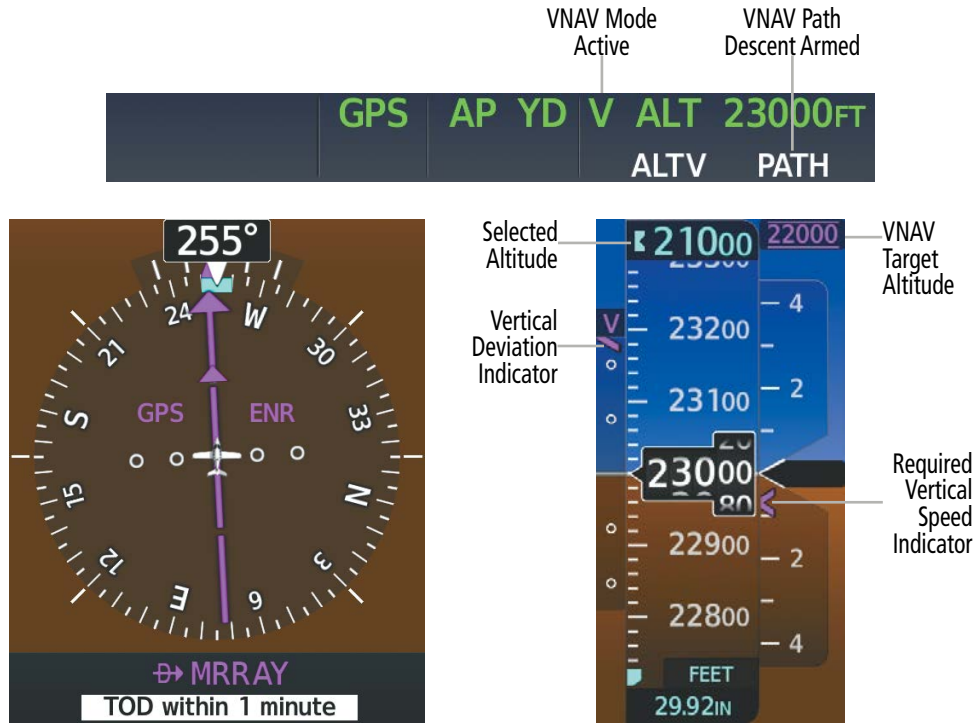


Figure 7-18 Vertical Path Capture

When a descent leg is captured, VNAV Path Descent becomes active and tracks the descent profile (see following figure). An altitude capture mode ('ALTS' or 'ALTV') is armed as appropriate. In the following figure, the VNAV Target Altitude (22,000 ft.) will be captured.

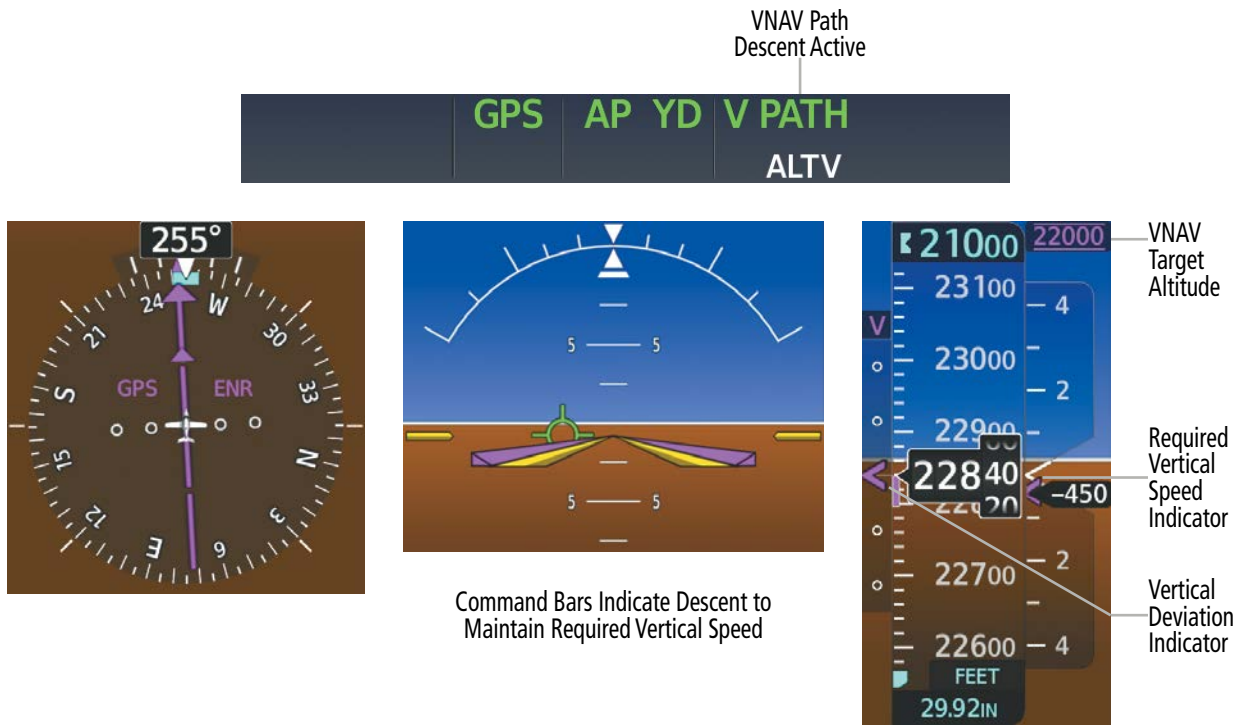


Figure 7-19 VNAV Path Descent Mode

If the Altimeter's barometric setting is adjusted while VNAV Path Descent 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.

Automatic Reversion to Pitch Hold Mode

Several situations can occur while VNAV Path Descent Mode is active which cause the Flight Director to revert to Pitch Hold Mode:

- ➔ Vertical deviation exceeds 200 feet during an overspeed condition.
- ➔ Vertical deviation experiences a discontinuity that both exceeds 200 feet in magnitude and results in the vertical deviation exceeding 200 feet in magnitude. Such discontinuities are usually caused by flight plan changes that affect the vertical profile.
- ➔ Vertical deviation becomes invalid (the Vertical Deviation Indicator is removed from the PFD).
- ➔ A display enters Reversionary Mode (this does not apply to an active vertical direct-to).

Unless VNAV is disabled, VNAV Path Descent Mode and the appropriate altitude capture mode become armed following the reversion to Pitch Hold Mode to allow for possible profile recapture.

Non-Path Descents

Pitch Hold, Vertical Speed, and Flight Level Change modes can also be used to fly non-path descents while VNAV is selected. If the **VS** or **FLC** Key is pressed while VNAV Path Descent Mode is selected, VNAV Path Descent Mode reverts to armed along with the appropriate altitude capture mode to allow profile re-capture.

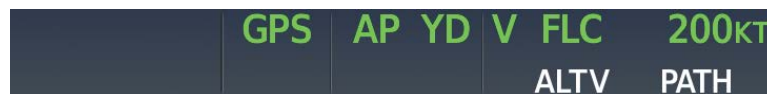


Figure 7-20 Flight Level Change VNV Non-Path Descent

To prevent immediate profile re-capture, the following must be satisfied before profile re-capture:

- ➔ At least 10 seconds have passed since the non-path transition was initiated
- ➔ Vertical deviation from the profile has exceeded 250 feet, but is now less than 200 feet

Pressing the **VNV** Key twice re-arms VNAV Path Descent for immediate profile re-capture.

VNAV TARGET ALTITUDE CAPTURE MODE (ALTV)



NOTE: Armed VNAV Target Altitude and Selected Altitude capture modes are mutually exclusive. However, Selected Altitude Capture Mode is armed implicitly (not annunciated) whenever VNAV Target Altitude Capture Mode is armed.

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. TO, GA, 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 which will have different behavior depending on whether the airplane is climbing or descending to the target altitude as shown in the following table.

VNAV Target Altitude Type	VNAV Target Altitude Indication	Climb Behavior	Descent Behavior
"AT"	22000	Arms ALTV	Arms ALTV
"AT or BELOW"	22000	Arms ALTV	Arms ALTV only if the displayed VNAV Target Altitude is the Bottom of Descent (BOD) altitude*†.
"AT or ABOVE"	22000	Does not arm ALTV*	Arms ALTV

*Even if ALTV is not armed, the UNABLE VNAV ALTITUDE system message will be shown if the airplane vertical speed is not sufficient to meet the targeted altitude before crossing the waypoint..

† 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 ALTV and VNAV Target Altitudes

The flight plan can also define a VNAV Target Altitude as a BETWEEN constraint which effectively defines both an "AT-or-ABOVE" and a higher "AT-or-BELOW" target altitude at the same waypoint. ALTV will be armed for one of these target altitudes based on the context of climbing ("AT-or-BELOW") or descending ("AT-or-ABOVE").

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 VNAV climbs or 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.

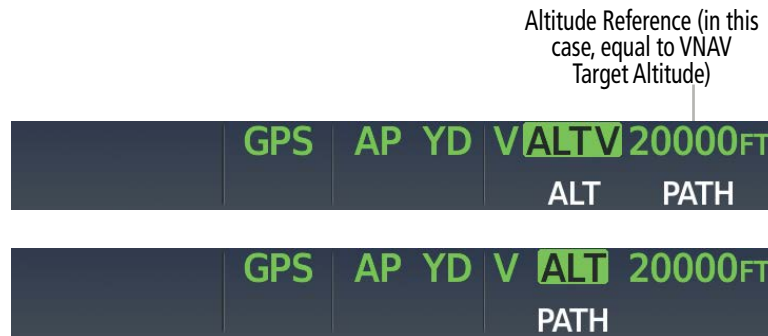


Figure 7-21 Automatic Mode Transitions During Altitude Capture

Changing the VNAV Target Altitude

Changing the current VNAV Target Altitude while VNAV Target Altitude Capture Mode is active causes the Flight Director to revert to Pitch Hold Mode. VNAV Path Descent and the appropriate altitude capture mode are armed in preparation to capture the new VNAV Target Altitude or the Selected Altitude, depending on which altitude is to be intercepted first.

VNAV Target Altitudes can be changed while editing the active flight plan (see the Flight Management Section for details).

APPROACH MODE



NOTE: The selected navigation receiver must have a valid VOR or LOC signal or active GPS course for the Flight Director to enter Approach Mode.

Approach Mode is activated when the **APR** Key is pressed. Approach Mode acquires and tracks the selected navigation source (GPS, VOR, or LOC), depending on the loaded approach. This mode uses the selected navigation receiver deviation and desired course inputs to fly the approach. Pressing the **APR** Key when the CDI is greater than one dot arms the selected approach mode (annunciated in white). If the CDI is less than one dot, the LOC, GPS, or VAPP Mode is automatically captured when the **APR** Key is pressed.

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, GPS Navigation Mode is active and the FAF is crossed after the automatic navigation source switch from GPS to LOC

VOR APPROACH MODE (VAPP)

VOR Approach Mode (VAPP) provides greater sensitivity for signal tracking than VOR Navigation Mode.

Selecting VOR Approach Mode:

- 1) Ensure a valid VOR frequency is tuned.
- 2) Ensure that VOR is the selected navigation source (cycle through navigation sources if necessary).
- 3) Press the **APR** Key.

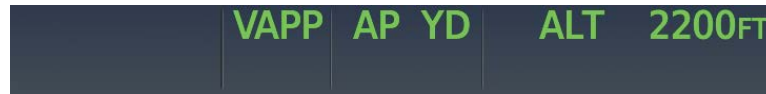


Figure 7-22 VOR Approach Mode

GPS APPROACH MODE

When GPS Approach Mode is armed, Glidepath Mode is also armed. GPS Approach Mode can be utilized to fly non-precision and precision approaches (Glidepath Mode).

Selecting GPS Approach Mode Without a Glidepath:

- 1) Ensure an GPS Approach is loaded into the active flight plan. The active waypoint must be part of the flight plan (cannot be a direct-to a waypoint not in the flight plan).
- 2) Ensure that GPS is the selected navigation source (cycle through navigation sources if necessary).
- 3) Press the **NAV** Key.

Glidepath Mode (GP)

Glidepath Mode is used to track the glidepath when executing an approach procedure in GPS Approach Mode. When Glidepath Mode is armed, ‘GP’ is annunciated in white in the AFCS Status Box.

Selecting GPS Approach Mode with a Glidepath:

- 1) Ensure a GPS approach with vertical guidance (LPV, LNAV/VNAV, LP+V, LNAV+V) is loaded into the active flight plan. The active waypoint must be part of the flight plan (cannot be a direct-to a waypoint not in the flight plan).
- 2) Ensure that GPS is the selected navigation source (cycle through navigation sources if necessary).
- 3) Press the **APR** Key.

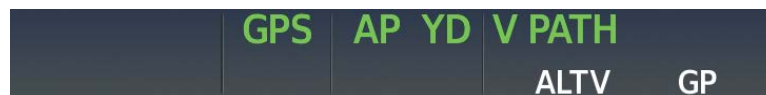




Figure 7-23 Glidepath Mode Armed

 **NOTE:** Some RNAV (GPS) approaches provide a vertical descent angle as an aid in flying a stabilized approach. These approaches are NOT considered Approaches with Vertical Guidance (APV). Approaches that are annunciated on the HSI as LNAV or LNAV+V are considered Non-precision Approaches (NPA). These approaches are flown to an MDA, until visual contact is made with the runway environment, even though vertical glidepath (GP) information may be provided. If it is desired for the AFCS to capture the MDA, it is recommended another vertical mode be selected to arm ALTS.

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

Upon reaching the glidepath, the flight director transitions to Glidepath Mode and begins to capture and track the glidepath. Once the following conditions have been met, the glidepath can be captured:

- A GPS approach with vertical guidance (LPV, LNAV/VNAV, LNAV+V, LP+V) is loaded into the active flight plan.
- The active waypoint is at or after the final approach fix (FAF).
- Vertical deviation is valid.
- The CDI is at less than full scale deviation.
- Automatic sequencing of waypoints has not been suspended (no ‘SUSP’ annunciation on the HSI).

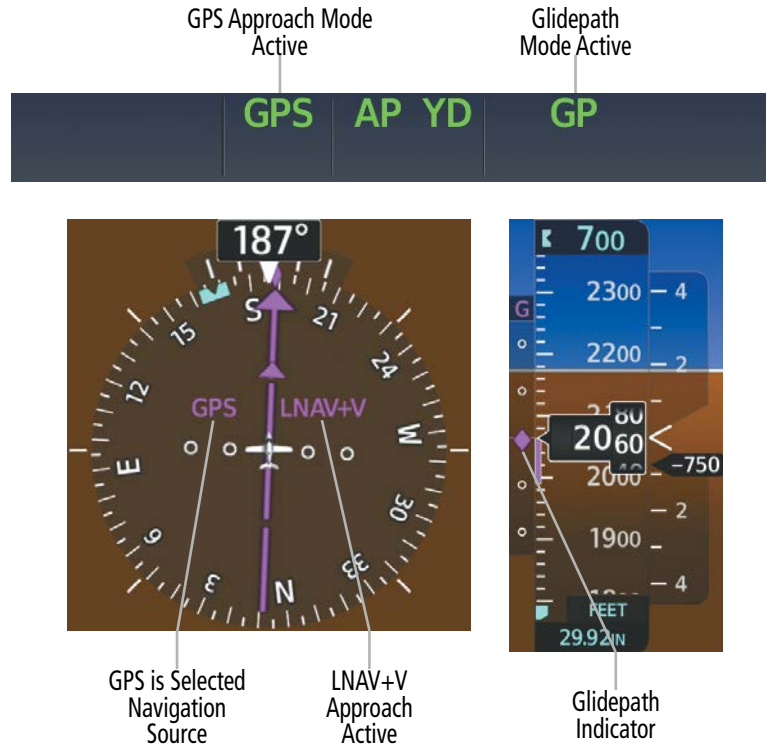


Figure 7-24 Glidepath Mode

LOCALIZER APPROACH MODE

LOC Approach Mode allows the autopilot to fly a LOC approach (i.e., without a glideslope). LOC Approach Mode (annunciated as ‘LOC’ in white) 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:

- 1) Ensure a valid localizer frequency is tuned.
- 2) Ensure that LOC is the selected navigation source (cycle through navigation sources if necessary).
- 3) Press the **NAV** Key.

Glideslope Mode (GS)

Glideslope Mode is available for LOC/ILS approaches to capture and track the glideslope. When Glideslope Mode is armed (annunciated as ‘GS’ in white), LOC Approach Mode is armed as the lateral Flight Director mode. LOC captures are inhibited if the difference between aircraft heading and localizer course exceeds 105°.

Selecting Glideslope Mode:

- 1) Ensure a valid localizer frequency is tuned.
 - 2) Ensure that LOC is the selected navigation source (cycle through navigation sources if necessary).
 - 3) Press the **APR** Key.
- Or:**
- 1) Ensure that GPS is the selected navigation source (cycle through navigation sources if necessary).
 - 2) Ensure a ILS approach is loaded into the active flight plan.
 - 3) Ensure the corresponding LOC frequency is tuned.
 - 4) Press the **APR** Key.

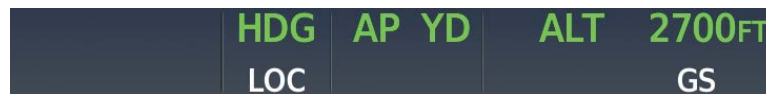


Figure 7-25 Glideslope Mode Armed

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.

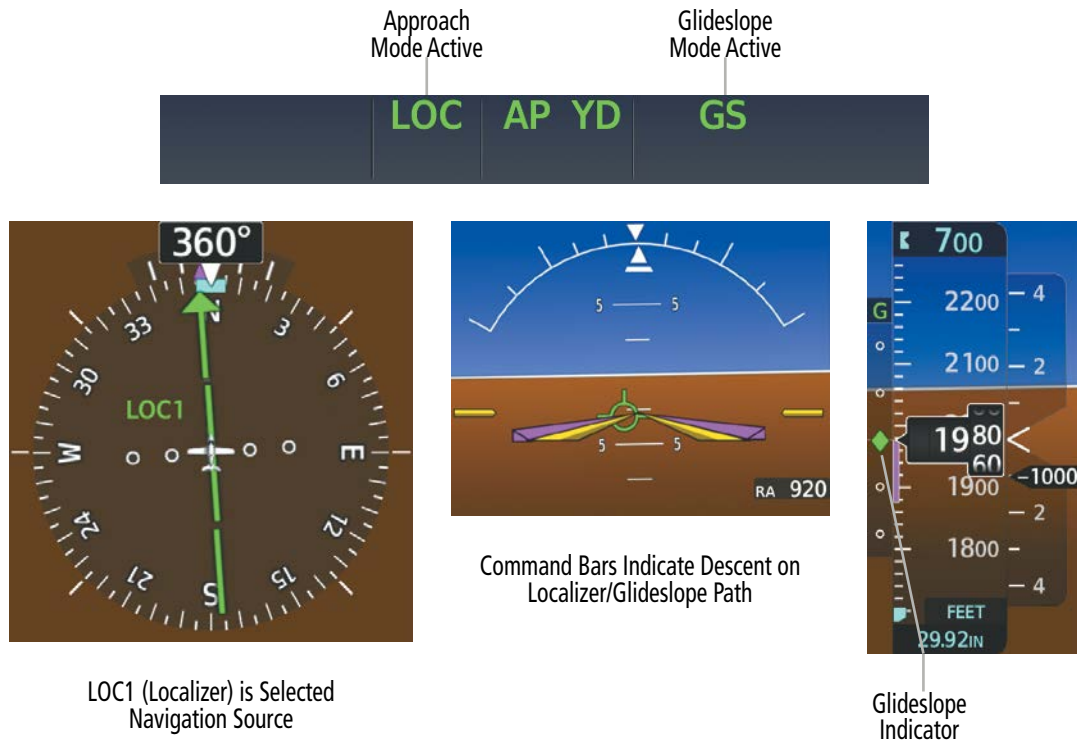


Figure 7-26 Glideslope Mode

Backcourse Mode (BC)



NOTE: In order to Arm a LOC Backcourse, the aircraft heading must be within 75 degrees of the LOC Backcourse.

Backcourse Mode captures and tracks a localizer signal in the backcourse direction. The mode may be selected by pressing the **NAV** Key. 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.

If the Course Deviation Indicator (CDI) shows greater than one dot when the **NAV** Key is pressed, the selected mode is armed (pilot must initiate intercept manually). If the CDI is less than one dot, Navigation Mode is automatically captured when the **NAV** Key is pressed. The armed annunciation appears in white to the left of the active roll mode.

CHANGING THE SELECTED COURSE

If the navigation source is VOR or LOC, or OBS Mode has been enabled when using GPS, the Selected Course is controlled using the **CRS** Knob by using the upper knob on the PFD Controller.

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 based on flap configuration. The **TO/GA** Switch (located on the thrust 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 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, HDG or NAV modes may also be armed while TO mode is active and automatically couples at 400 ft above ground level.



Figure 7-27 Takeoff Mode

GO AROUND MODE (GA)

Pressing the **TO/GA** Switch while the aircraft is in the air activates a coupled go around (i.e., the autopilot does not disconnect when the **TO/GA** Switch is activated). The Flight Director Command Bars assume a wings-level, pitch-up attitude, providing for the execution of a missed approach or a go around. If there is a valid flight plan loaded with GPS lateral guidance, GPS Mode becomes the active lateral mode in preparation for proceeding to the Missed Approach Hold Point. If no approach has been loaded, or if there is no GPS lateral guidance, GA will be the active lateral mode.



Figure 7-28 Takeoff and Go Around Modes

LEVEL MODE (LVL)

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) in level vertical and lateral modes. Level Mode does not track altitude or heading. When the **LVL** Key is pressed all armed and active modes are cancelled and the autopilot and flight director revert to LVL Mode for pitch and roll. While in level mode, all other modes are available by pressing the corresponding button.

When the normal flight envelope thresholds have been exceeded for more than 50% of the last 40 seconds, Level mode is activated. The autopilot will engage and provide input to bring the aircraft back into straight and level flight based on zero degrees roll angle and zero feet per minute vertical speed. An aural “ENGAGING AUTOPILOT” alert sounds and the lateral and vertical flight director annunciations will display “LVL.” The AFCS will remain in Level mode until the pilot selects another mode.

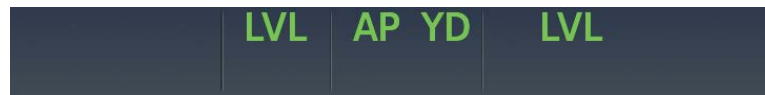


Figure 7-29 Level Mode

7.5 AUTOPILOT AND YAW DAMPER OPERATION



NOTE: Refer to the current version of the pertinent flight manual for specific instructions regarding emergency procedures.

The autopilot and yaw damper operate the flight control surface servos to provide automatic flight control. The autopilot controls the aircraft pitch and roll attitudes following commands received from the flight director. Pitch autotrim provides trim commands to the pitch trim actuator to relieve any sustained effort required by the pitch servo. The Yaw Damper and YSAS reduce Dutch Roll tendencies and coordinate turns.

FLIGHT CONTROL

Pitch and roll commands are provided to the servos based on the active Flight Director modes. Yaw damping is provided by the YSAS Servo and/or Yaw Damper Servo. Servo motor control limits the maximum servo speed and torque. The servo gearboxes allow the servos to be overridden in case of an emergency

PITCH AXIS AND TRIM

The Autopilot pitch axis uses pitch rate to stabilize the aircraft pitch attitude during upsets and flight director maneuvers. Flight Director pitch commands are rate- and attitude-limited, combined with pitch damper control, and sent to the pitch servo motor.

When the Autopilot is engaged, the automatic pitch trim (APT) function commands the pitch trim actuator to limit the pitch servo effort.

When the Autopilot is not engaged, trim functionality is available at any time by using the pilot and copilot **TRIM** Switches. Trim speeds are scheduled with airspeed to provide more consistent response. The pilot side **TRIM** Switch has priority over the copilot side **TRIM** Switch.

ROLL AXIS

The Autopilot roll axis uses roll rate to stabilize aircraft roll attitude during upsets and 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 YSAS uses yaw rate and roll attitude to dampen the aircraft's natural Dutch roll response. The Yaw Damper uses lateral acceleration to coordinate turns. The YSAS engages and disengages automatically based on the aircraft being airborne (i.e., weight on wheels). The Yaw Damper engages and disengages automatically based on above ground level (AGL) altitude. The Yaw Damper is always engaged if the AP is engaged. If the AP is engaged on the ground to test the ability to manually override the servo forces, the Yaw Damper is also engaged.

Yaw Damper status is displayed in the center of the AFCS Status Box. Engagement is indicated by green 'YD' annunciation. There is no annunciation associated with YSAS.

ENGAGING THE AUTOPILOT AND YAW DAMPER

When the **AP** Key is pressed, the autopilot, yaw damper, and flight director (if not already active) are activated. The Flight Director engages in Pitch and Roll Hold Modes when initially activated. 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.

The AP must be disconnected before takeoff until the minimum use height has been achieved and before landing before descending below the minimum use height (consult the current version of the pertinent flight manual).

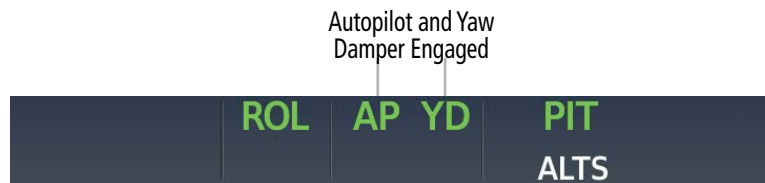


Figure 7-30 Autopilot and Yaw Damper Engaged

DISENGAGING THE AUTOPILOT AND YAW DAMPER



NOTE: Pressing the **AP** Key does not disengage the Yaw Damper, except when on the ground.

MANUAL DISENGAGEMENT

The Autopilot is manually disengaged by pushing the **AP** Key on the AFCS Control Unit or the **A/P DISC** Switch. Pressing the **AP** Key while airborne does not disengage the yaw damper. Manual autopilot disengagement is indicated by an amber and black ‘AP’ annunciation and an autopilot disconnect alert tone.



Figure 7-31 Manual Autopilot Disengagement

Pushing the **AP DISC** Switch disengages both the yaw damper and the autopilot simultaneously. When the yaw damper and autopilot are manually disengaged, both the ‘AP’ and ‘YD’ annunciation turn amber and flash for 5 seconds and a three-second autopilot disconnect aural alert is generated.



Figure 7-32 AP DISC Switch Disengagement

After manual disengagement, the autopilot disconnect aural alert may be cancelled by pushing the **A/P DISC** Switch (**A/P DISC** Switch also cancels the flashing ‘AP’ annunciation).

AUTOMATIC DISENGAGEMENT

Automatic autopilot disengagement is indicated by a flashing red and white ‘AP’ annunciation. The autopilot disconnect aural alert will continue until acknowledged by pushing the **A/P DISC** Switch. Automatic Autopilot disengagement occurs due to:

- » System failure
- » Invalid sensor data
- » Inability to compute default Flight Director modes (FD also disengages automatically)

Automatic yaw damper disengagement is indicated by a five-second flashing amber 'YD' annunciation. Automatic yaw damper disengagement occurs when autopilot disengagement is caused by failure in a parameter also affecting the yaw damper. This means the yaw damper can remain operational in some cases where the autopilot automatically disengages. A localized failure in the yaw damper system or invalid sensor data also cause yaw damper disengagement.

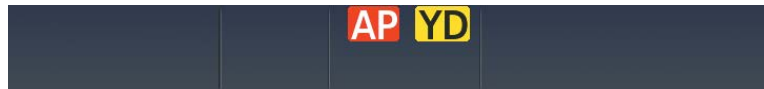


Figure 7-33 Automatic Autopilot and Yaw Damper Disengagement

7.6 AUTOTHROTTLE (AT)

OVERVIEW

The Garmin Autothrottle (AT) System is designed to fly the airplane the same way that a pilot would fly it. It automatically sets the throttle based on phase of flight and flight director mode. It also protects the airplane from exceeding over speed, or under speed limits. The Garmin Autothrottle and Autopilot are tightly integrated and designed to complement each other. The autothrottle can be armed independently of the autopilot.

AUTOTHROTTLE CONTROLS

The autothrottle system has the following pilot controls:

- **AT** Button — Located on the AT Controller, this button toggles the autothrottle state between off and armed/engaged.
- **FMS/MAN** Button — Located on the AT Controller, this button is used to select MAN or FMS speed mode
- **INC/DEC Speed** Wheel — Located on the AT Controller, this wheel is used to set the desired speed while in Manual (MAN) Speed Mode. In FMS Speed Mode, the autothrottle follows the airspeed reference calculated by the FMS.
- **AT DISC** Button — Located on the throttle, this button disengages the autothrottle and takes it out of arm mode.
- **Engine Throttle** — The pilot may move the throttle at any time to override the autothrottle system. When the pilot moves the throttle, autothrottle disconnects and the throttle remains at the new setting. Autothrottle may also be disengaged by disengaging the autopilot.



Figure 7-34 GMC 708 Autothrottle Controller

ANNUNCIATIONS

Autothrottle mode annunciations are displayed along with flight director, autopilot, and yaw damper annunciations in the AFCS Status Box. The active mode is displayed in green, and the armed mode is displayed in white. When autothrottle is engaged the green ‘AT’ annunciation is displayed in the AFCS Status Box. When Throttle ESP is active, a green ‘ESP’ is annunciated where ‘AT’ is normally annunciated.

When the AT is engaged or armed by pressing the **AT** Button on the Autothrottle Controller, the annunciator light above the **AT** Button is illuminated on the Autothrottle Controller.

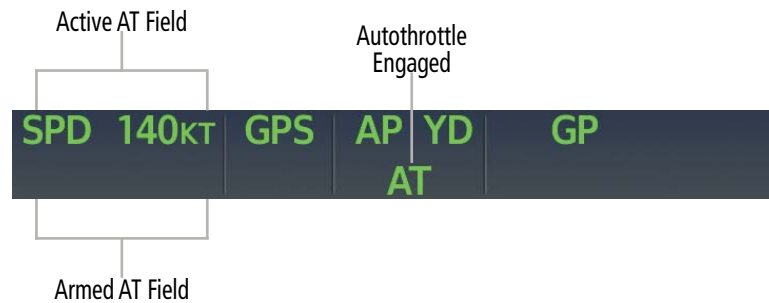


Figure 7-35 Autothrottle Annunciations

AUTOTHROTTLE OPERATION



NOTE: All navigation and altitude changes are accomplished through the autopilot. Autothrottle Mode is slaved to the vertical flight director mode.

The autothrottle can be manually engaged/disengaged and provides automated speed management based on the active flight plan.

MANUAL ENGAGEMENT

To engage the autothrottle press the **AT** Button. The autothrottle can be armed on the ground or any time the autopilot is disengaged. When the AT is armed, the armed mode (the mode that AT will activate into if the AT becomes engaged) is annunciated in the Flight Mode Annunciator panel.

When the autothrottle is armed, it will engage automatically when the autopilot is engaged (if the aircraft is airborne).

MANUAL DISENGAGEMENT

To disengage the autothrottle, press the **AT DISC** Button. If an autothrottle mode is armed, pressing the **AT DISC** Button will remove the armed mode. If the **AT DISC** Button is pressed when Throttle Electronic Stability Protection (ESP) is engaged, Throttle ESP will disengage, but it will re-engage upon release of the button if the conditions still warrant it. If the friction lock is engaged, pressing the **AT DISC** Button will disengage the friction lock. If autothrottle is not engaged or armed, or if friction lock is not engaged, pressing the **AT DISC** Button will have no effect.

The autothrottle may also be disengaged by pressing the **AT** Button on the AT Controller, or by any means of disengaging the autopilot (since the autothrottle may only be engaged if the autopilot is engaged). While autopilot disengagement does not automatically disengage Throttle ESP or Throttle Friction Lock, pressing the **AP/DISC** Button on the control stick will always disconnect the throttle servo, regardless of the mode.

SPEED MANAGEMENT

The Airspeed Hold Autothrottle Mode will manage thrust to meet the active Airspeed Reference. This can either be a manual (cyan) speed reference that is selected by the pilot, or an FMS (magenta) speed reference that is calculated by the FMS using phase of flight, aircraft speed limits and approach targets, flight plan speed constraints, and crew-selected speed profiles. These profiles are programmable by the pilot on the VNAV Page. In the absence of VNAV constraints, the FMS speed reference will follow the selected speed profile. See the Flight Management Section for further discussion on Flight Plan Management.

CLIMB, CRUISE, AND DESCENT (CCD) SPEEDS

The autothrottle system is designed to integrate with the CCD VNAV system so the flight plan defines the navigation, speeds, and altitudes to be flown. The autopilot and autothrottle work together to fly the flight plan. CCD VNAV also manages speed changes due to airspace restrictions, configuration changes and manages the deceleration as the airplane approaches the destination. CCD VNAV automatically changes FD modes as required to follow the flight plan.

The pilot can override the navigation, speed, and altitude if required. This is done by deselecting VNAV on the AFCS Control Panel. It is also possible to manually control speed but let the FMS control navigation and altitude. This is done by pressing the **MAN** Button on the Autothrottle Controller, which changes the speed reference mode from FMS Mode to Manual Mode. The manual speed reference can then be adjusted with the **INC/DEC Speed** Wheel on the Autothrottle Controller.

AUTOTHROTTLE MODES OVERVIEW

The Garmin Autothrottle System operates in three basic modes: Airspeed Hold Mode, Climb/Descent Mode, and Reference Thrust Mode.

AIRSPEED HOLD MODE (SPD)



NOTE: *The means of interacting with the Speed Reference are different between the base aircraft and the full autothrottle equipped aircraft.*

Airspeed Hold Mode will move the throttle as required to hold the selected indicated airspeed. On full autothrottle equipped aircraft, the Speed Reference Mode may be changed at any time by the pilot by using the AT Controller. Base model differences are discussed specifically below.

For additional discussion on Airspeed Bugs, see the Flight Instrument Section.

FMS SPEED MODE

FMS Speed Reference Mode is used to allow the FMS to automatically control the IAS/Mach reference based on the phase of flight. In FMS Speed Reference Mode, the FMS selects the appropriate reference type (IAS or Mach) based on altitude.

On the base aircraft, FMS Speed Reference mode is active any time VNAV AFCS mode is armed or active. Unlike the base aircraft, the VNAV AFCS Mode in full autothrottle aircraft is not linked to the Speed Reference Mode. The pilot is free to use either Speed Reference Mode, regardless of VNAV status.

To engage FMS Speed Mode, press the **FMS** Button on the Autothrottle Controller. While in FMS Speed Mode, a solid magenta speed bug in the shape of a triangle is displayed on the airspeed indicator. The magenta speed bug is driven by the flight management system and depends on altitude, phase of flight, and aircraft configuration. The magenta speed bug can be changed by editing the Active Flight Plan (e.g., in adhering to a speed constraint, etc). Refer to the Flight Management Section for more information on FMS Speed Modes and the Flight Instrument Section for further discussion on airspeed bugs.

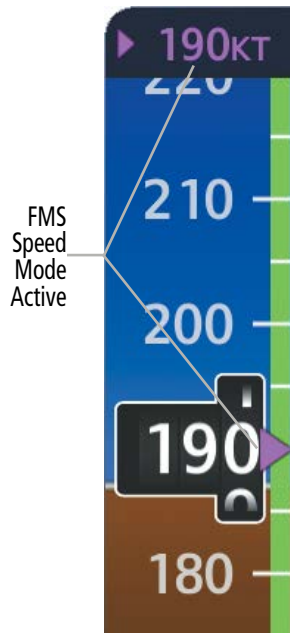


Figure 7-36 FMS Speed Mode

MANUAL SPEED REFERENCE MODE

Manual Speed Reference Mode is intended for the pilot to manually control the IAS/Mach speed reference. The manual speed reference is displayed when the FD vertical mode is Flight Level Change (FLC) or when the optional auto-throttle is engaged. When the manual speed reference is activated, it initializes to the current airspeed or Mach number, as appropriate.

To engage Manual Speed Reference Mode, press the **MAN** Button on the Autothrottle Controller. While in Manual Speed Reference Mode, a cyan speed bug is displayed on the airspeed indicator. The speed is set with either the **INC/DEC Speed** Wheel on the Autothrottle Controller or the **UP/DN** Wheel on the AFCS Controller (FLC Mode only). This selected speed is used as the source for the desired airspeed reference.

When Manual Airspeed Hold Mode is active, the active speed bug is displayed as a solid cyan rectangle (the manual speed reference is not displayed otherwise). The FMS speed is still displayed as a hollow magenta triangle. When the speed reference mode is changed to Manual, the cyan bug syncs to the current airspeed. The crew can move the cyan bug to select an airspeed with the **INC/DEC Speed** Wheel on the Autothrottle Controller. If the flight director is in FLC mode, the **UP/DN** Wheel on the AFCS Controller can also be used to change the selected airspeed.

On the base aircraft, Manual Speed Reference Mode is active any time VNAV AFCS mode is not active. Unlike the base aircraft, the VNAV AFCS Mode in full autothrottle aircraft is not linked to the Speed Reference Mode. The pilot is free to use either Speed Reference Mode, regardless of whether VNAV AFCS mode is active.

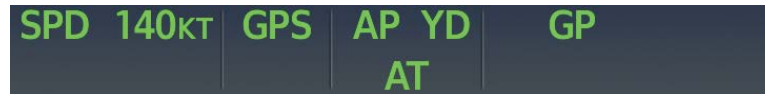


Figure 7-37 Airspeed Hold Mode Active

CLIMB/DESCENT MODE (CLB/DESC)

The Climb/Descent Mode of autothrottle is used when the active vertical flight director mode is FLC. If the selected altitude is above the current altitude, 'CLB' is annunciated as the AT mode, and the AT will (after a transition period) move the throttle lever to the Thrust Lever Angle (TLA) for climb power.

If the selected altitude is below the current altitude, 'DESC' is annunciated as the AT mode and the AT will (after a transition period) move the throttle lever to the TLA for descent power. Note that unlike the climb power setting, the descent power setting is scheduled with altitude. The thrust change is limited to produce a lower target climb rate when short climbs are commanded.

REFERENCE THRUST MODE (TO, GA, & CAPS)

The Reference Thrust Mode will control the thrust to one of the pre-selected levels as defined by the manufacturer.

Takeoff and Go-around Modes target a Thrust Lever Angle (TLA) setting in the takeoff detent.

CIRRUS AIRFRAME PARACHUTE SYSTEM (CAPS) MODE

When the system detects that CAPS activation has been initiated, the AP and AT automatically engage into CAPS Mode. Cirrus Airframe Parachute System (CAPS) Mode targets TLA setting of approximately idle thrust. A detailed discussion of CAPS Mode can be found in Section 7.8.

AUTOMATIC SAFETY MODE SELECTION

The autothrottle system also incorporates its own safety features: Electronic Stability Protection (ESP), Overspeed Protection (OSP), Underspeed Protection (USP), and Emergency Descent Mode (EDM). Throttle based ESP is only available when autothrottle is not engaged. Autothrottle ESP, USP, and OSP systems are designed to work with autopilot ESP, USP, and OSP so the first line of defense against an underspeed or overspeed condition is throttle motion. If throttle motion is not adequate, then autopilot ESP, USP or OSP is engaged.

All autothrottle mode selection are activated automatically and there are no provisions for the pilot to manually select an AT mode.

THROTTLE ESP (OPTIONAL)



NOTE: Automatic mode selection and operation when autothrottle is off (Throttle ESP) is independent of flight director/autopilot modes.

Throttle ESP (if installed) does not require full autothrottle enablement or the Autothrottle Controller. Throttle ESP is designed to be active only when the AT is not already engaged. When Throttle ESP is engaged, 'ESP' is annunciated in green in the center of the AFCS Status Box, in the same location that displays 'AT' when the autothrottle is engaged.

While engaged, Throttle ESP is designed to offer no resistance to the crew moving the throttle in the same direction that Throttle ESP is trying to move it (so the pilot can react faster than Throttle ESP without interference).

Throttle ESP is inhibited below 200 ft AGL (determined by GPS and the terrain database), but it is not inhibited if AGL height is unavailable.

AUTOTHROTTLE OVERSPEED PROTECTION

If an overspeed condition occurs, the autothrottle will automatically engage and reduce thrust to slow the aircraft. When the overspeed condition is resolved, the autothrottle is automatically disconnected. If Throttle ESP is reacting to a high-speed condition, ‘VMAX’ is displayed in green in the active autothrottle mode field of the AFCS Status Box.

Condition*	Speed Limit**
Landing Flaps	150 kts
Takeoff Flaps	190 kts
Landing Gear Extended	210 kts

*For all other conditions the speed limit is the lower of 250 kts or Mach 0.53.

**If flap or gear state is unknown, the system will assume the most conservative state.

Table 7-7 SF50 Structural Speed Limits

AUTOTHROTTLE UNDERSPEED PROTECTION

If an underspeed condition occurs, the autothrottle will automatically engage and increase thrust to accelerate the aircraft. When the underspeed condition is resolved, the autothrottle is automatically disconnected. If Throttle ESP is reacting to a low-speed/high AOA condition, ‘VMIN’ is displayed in green in the active autothrottle mode field of the AFCS Status Box.

The minimum speed is a function of angle of attack (AOA) for the current configuration. It is equivalent to the start of the amber maneuver margin band on the airspeed tape.

FLIGHT PHASE MODES

AT EMERGENCY DESCENT MODE (EDM)

When the system detects that a non-intentional cabin de-pressurization has occurred, the AT response is to engage (if not already engaged), and to manage power to a low enough level to facilitate a rapid descent.

Upon EDM engagement, AT engages commands idle thrust with immediate transition to a target speed of V_{MO}/M_{MO} minus 10 kts.

If EDM is not disengaged by the crew, Emergency Autoland (if installed) is activated when the aircraft descends through 15,000’ MSL. See the Additional Features Section for a full discussion on Emergency Autoland.

TAKEOFF (TO) /GO AROUND (GA) MODE

When on the ground, pressing the **AT** Button causes the appropriate mode to be annunciated as the armed autothrottle mode. If AT is armed when AP engages (i.e., when airborne), autothrottle automatically engages to the appropriate mode (based on the active FD vertical mode) as the autopilot engages.

When autothrottle has been engaged in TO or GA Mode for more than 2 minutes, autothrottle transitions to CLB Mode, which reduces power to Maximum Continuous Thrust (MCT).

Autothrottle switches from TO Mode when the pilot changes FD modes or when the vertical FD mode automatically transitions from TO Mode to FLC Mode, if armed.

If the flight director mode is changed to Go Around Mode when AT is engaged, AT will remain engaged and annunciate 'GA' for Go Around Mode. If the flight director mode is changed to Go Around Mode when AT is not engaged, AT will remain unengaged (but will enter GA mode if engaged by the pilot).

CLIMB MODE

When the flight director transitions to an AFCS Climb Mode, the autothrottle mode will correspond as follows:

- » FLC Climb Mode: the autothrottle will annunciate CLB mode
- » VS Climb Mode: the autothrottle will annunciate SPD mode
- » PIT Hold Mode: the autothrottle annunciates SPD mode



Figure 7-38 Climb Mode Active

DESCENT MODE

When the flight director transitions to an AFCS Decent Mode, the autothrottle mode will correspond as follows:

- » FLC Descent Mode: the autothrottle will annunciate DESC Mode.
- » PATH, GS, GP, or VS Descent Mode: the autothrottle will annunciate SPD mode.
- » PIT Hold Mode: the autothrottle annunciates SPD mode.



Figure 7-39 Descent Mode Active

LEVEL FLIGHT MODE

When the flight director prepares to capture an altitude from a climb or descent (using ALTS or ALTV Mode), the AT will transition to (or stays in) Speed Hold Mode. Once the altitude is captured and the flight director transitions to Altitude Hold Mode, the autothrottle stays in Speed Hold Mode.

If the speed reference mode is changed to FMS, the CCD VNAV system will automatically transition from the climb or descent speed schedule to the cruise speed schedule when the altitude is captured. The speed reference will automatically change and the AT will react appropriately. If Manual Speed Reference Mode is selected, the pilot is responsible for adjusting the desired speed throughout the transition from the climb/descent to level flight, but the AT will still track the speed reference.

THROTTLE FRICTION LOCK

The throttle friction lock (located forward of the throttle) can be activated to hold the throttle steady during extended segments at a constant power setting. Pressing the **Friction Lock** Button toggles it on and off. When engaged, a lock icon will appear on the Engine Indication System (EIS) strip on the MFD. The Friction Lock is also disengaged by pressing the **AT DISC** Button or **A/P DISC** Button. Engaging the autothrottle automatically deactivates the friction lock.



Figure 7-40 Friction Lock

7.7 AFCS ANNUNCIATIONS AND ALERTS

AFCS STATUS ALERTS

The following alert annunciations appear in the AFCS System Status field on the PFD.

Condition	Annunciation	Description
Pitch Failure	PTCH	Pitch axis control failure.
Roll Failure	ROLL	Roll axis control failure.
Yaw Damper Failure	YAW	YD control failure.
Pitch Trim Failure (or stuck TRIM Switch)	PTRM	If AP engaged, take control of the aircraft and disengage AP. If AP disengaged, move TRIM switch to unstick.
System Failure	AFCS	AP and MEPT are unavailable. FD may still be available.
Elevator Mistrim Down	↓ELE	A condition has developed causing the pitch servo to provide a sustained force. Be prepared to apply nose down control force upon autopilot disconnect.
Elevator Mistrim Up	↑ELE	A condition has developed causing the pitch servo to provide a sustained force. Be prepared to apply nose up control force upon autopilot disconnect.
Aileron Mistrim Right	AIL→	A condition has developed causing the roll servo to provide a sustained right force. Ensure the slip/skid indicator is centered and observe any maximum fuel imbalance limits.
Aileron Mistrim Left	←AIL	A condition has developed causing the roll servo to provide a sustained left force. Ensure the slip/skid indicator is centered and observe any maximum fuel imbalance limits.
Rudder Mistrim Right	RUD→	A condition has developed causing the yaw servo to provide a sustained force. Ensure the slip/skid indicator is centered and observe any maximum fuel imbalance limits.
Rudder Mistrim Left	←RUD	A condition has developed causing the yaw servo to provide a sustained force. Ensure the slip/skid indicator is centered and observe any maximum fuel imbalance limits.
Preflight Test	PFT	Performing preflight system test; aural alert sounds at completion.
	PFT	Preflight system test failed; aural alert sounds at failure.

Table 7-8 AFCS Alerts

AFCS VOICE ALERTS

The voice alerts listed in the following table relate to AFCS; for a complete list of voice alerts, see Appendix A.

Voice Alert	Description
"Autopilot"	Warning – Autopilot is disengaged Single alert for manual AP disengagement Continuous alert for automatic AP disengagement; cancelled with AP DISC Switch
"Flight Director"	Single warning – Flight director has reverted to a default mode
"Trim, Trim, Trim"	Continuous advisory (stops after 6 seconds) – TRIM Switch malfunction

Table 7-9 AFCS Voice Alerts

AUTOPILOT OVERSPEED PROTECTION

Airspeed is monitored by the Flight Director and pitch commands are limited for overspeed protection. Overspeed protection is provided in situations where the Flight Director cannot acquire and maintain the mode reference for the selected vertical mode without exceeding the certified maximum Autopilot airspeed.

When an Autopilot overspeed condition occurs, a flashing amber 'MAXSPD' annunciation appears above the Airspeed Indicator. Engine power should be reduced and/or the pitch reference adjusted to slow the aircraft. The annunciation disappears when the overspeed condition is resolved.

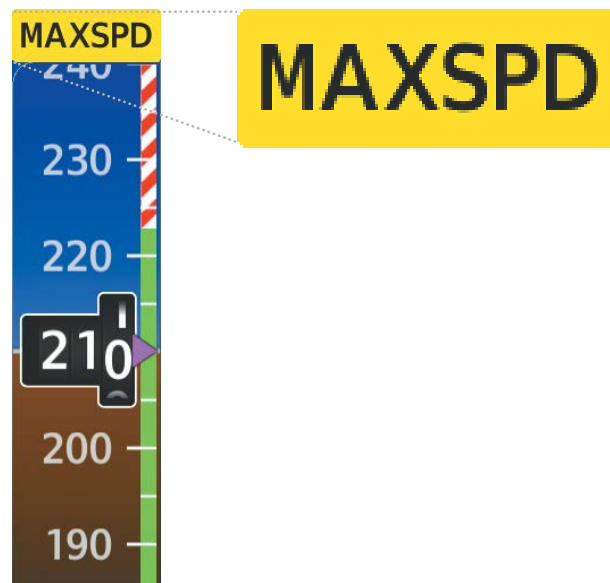


Figure 7-41 Overspeed Annunciation

AUTOPILOT UNDERSPEED PROTECTION

Underspeed Protection is designed to discourage aircraft operation below minimum established airspeeds and is available when the Flight Director is on.



NOTE: Underspeed protection does not activate if CAPS mode is active, since CAPS mode has a separate algorithm to avoid stall conditions while decelerating.

When the aircraft reaches a predetermined airspeed, an amber MINSPD annunciation (see following figure) will appear above the airspeed indicator. When the airspeed trend vector reaches a predetermined airspeed, a single aural "AIRSPEED" will sound, alerting the pilot to the impending underspeed condition.

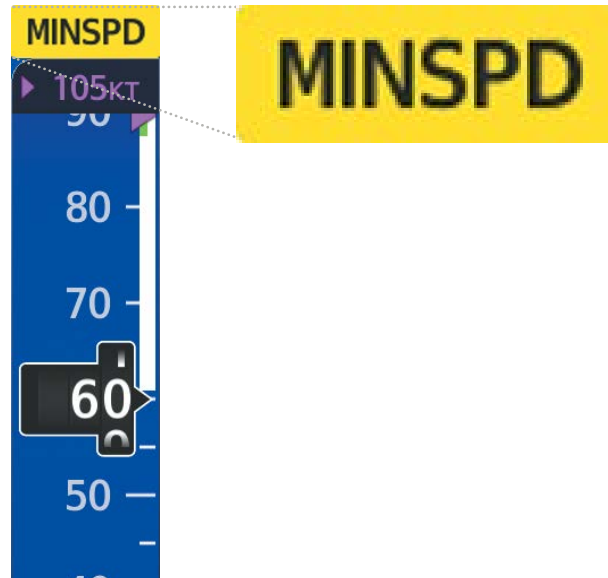


Figure 7-42 MINSPD Annunciation

If the aircraft continues to decelerate, Underspeed Protection functionality depends on which vertical flight director mode is selected. For the purpose of this discussion, the vertical flight director modes can be divided into two categories: Those in which it is important to maintain altitude for as long as possible (altitude-critical modes), and those in which maintaining altitude is less crucial (non-altitude critical modes).

ALTITUDE-CRITICAL MODES (ALT, GS, GP, TO, GA, FLC CLIMB)

If the aircraft decelerates to stall warning, the lateral and vertical flight director modes will change from active to armed. The autopilot will provide input causing the aircraft to pitch down to maintain an airspeed no less than stall warning activation speed plus two knots, and the wings to level.

When airspeed increases (as a result of adding power/thrust) to above the IAS at which stall warning turns off, plus two knots, the autopilot will cause the aircraft to pitch up until recapturing the vertical reference. The vertical and lateral flight director modes will change from armed to active.

NON-ALTITUDE CRITICAL MODES (LVL, VS, PATH, PIT, FLC DESCENT)

If the aircraft decelerates to an IAS below the minimum commandable autopilot airspeed will appear to the right of the vertical speed indicator. The vertical flight director mode will change from active to armed, and the autopilot will cause the aircraft to pitch down until reaching a pitch attitude at which IAS equals the minimum commandable autopilot airspeed.

When sufficient power/thrust is available, the autopilot will recapture the previously selected vertical reference and the flight director mode will change from armed to active.



NOTE: When the autopilot is outside normal operating limits, it uses more aggressive commands to return to normal limits.

7.8 ABNORMAL OPERATION

CIRRUS AIRFRAME PARACHUTE SYSTEM (CAPS)

NOTE: Please refer to the current version of the pertinent flight manual for a complete description and procedures regarding the activation of CAPS. Full AT functionality is not required for this feature.

When the CAPS system is engaged the system engages the **AP** and **AT** to prepare the aircraft for parachute deployment by rolling wings level, pitching up to 30 degrees, and reducing throttle to idle. Once the CAPS system has been initiated, a green CAPS appears in the Status Bar. Within the first 30 seconds of CAPS initiation, the AP/AT will continuously try to re-engage into CAPS Mode if it is disengaged (in order to protect against inadvertent disengagement by the pilot).

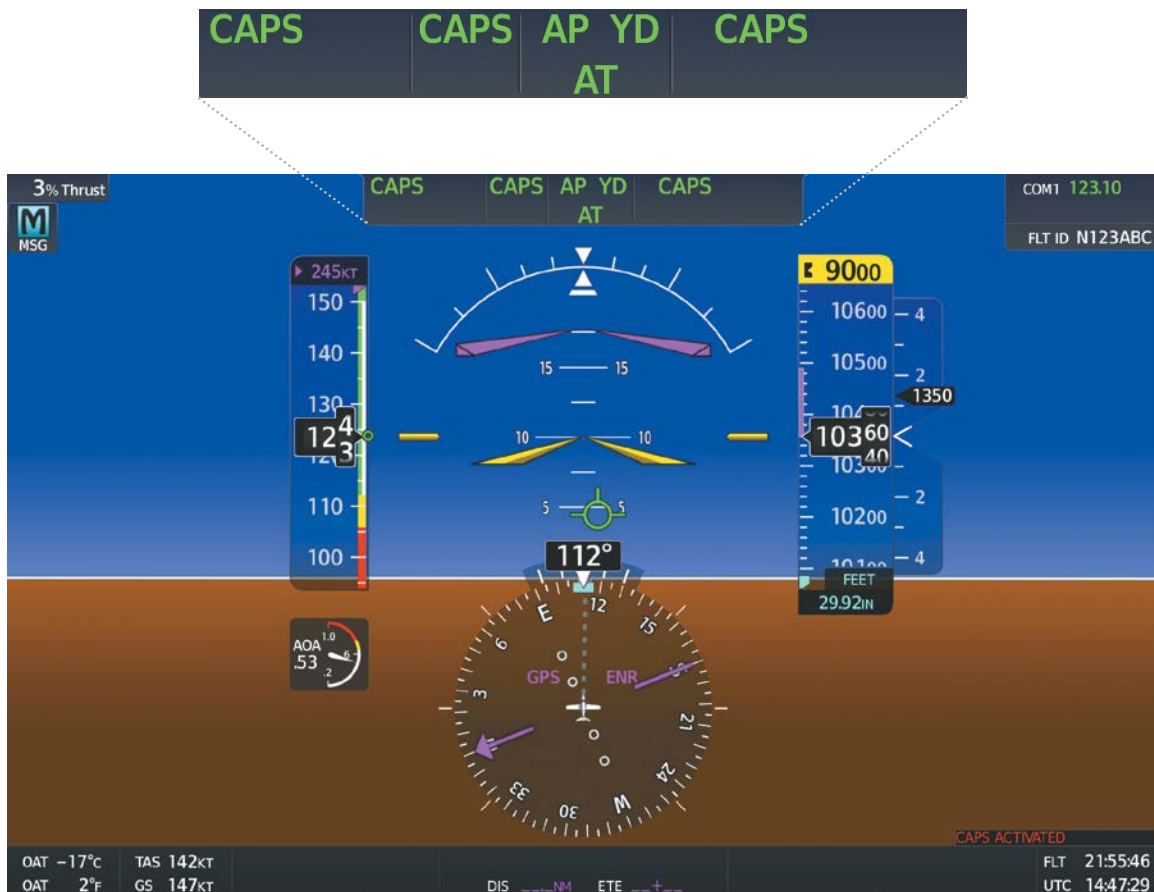


Figure 7-43 PFD AFCS Display

SUSPECTED AUTOPILOT MALFUNCTION



NOTE: Consult the current version of the pertinent flight manual 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 **A/P DISC** Switch. The Autopilot will disconnect and power is removed. Note the visual and aural alerting indicating Autopilot disconnect.
- 3) Retrim the aircraft as needed. Substantial trim adjustment may be needed.
- 4) Pull the appropriate circuit breaker(s) to electrically isolate the servo components.
- 5) Release the **A/P 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.



NOTE: The YSAS servo does not disengage when the **A/P DISC** Button is pressed. This servo has low authority, and any malfunction should be countered by the pilot using the main rudder, which has much greater authority than the YSAS.

EMERGENCY DESCENT MODE (EDM)

ACTIVATION

Emergency Descent Mode (EDM) consists of two descent phases – a primary descent to an altitude capture and 4 minute hold at 14,000 feet, followed by a secondary descent to an altitude capture and hold at 12,500 feet. The descent phase consists of a high-speed FLC descent performed at an automatically managed speed reference. EDM is automatically activated when the autopilot is engaged and:

- » Pressure Altitude is at least 14,900 feet MSL.
AND
- » Cabin pressure altitude greater than or equal to 15,000 feet for at least 1 second.
AND
- » A manual cabin dump is not in progress.

An ‘AUTO DESCENT’ warning message will be annunciated and a corresponding warning aural is played until acknowledged. Once EDM has activated, a red annunciation is displayed on the PFD above the airspeed tape. EDM that has been activated automatically due to cabin depressurization will in turn initiate Emergency Autoland (if installed) if EDM has not been deactivated before the aircraft descending through 15,000 ft MSL.

When EDM is activated, the AFCS automatically sets the altitude preselect to 14,000 feet, the speed reference to the EDM descent speed, and the throttle to idle. These references cannot be manually changed until EDM is disengaged by pressing the **A/P DISC** Button. The AFCS logic waits 3-5 seconds for the GDU to establish these references before selecting the appropriate FD/AT modes for EDM.

The autothrottle engages to manage power while EDM is active. This safety AT mode does not require the full autothrottle feature to be installed.



'AUTO DESCENT' Annunciated

Figure 7-44 Emergency Descent Mode Activated

EDM OVERRIDE

Once active, EDM can only be aborted by disconnecting the autopilot. FD mode changes are precluded while EDM is active.



NOTE: Refer to the current version of the pertinent flight manual for specific instructions regarding emergency procedures.

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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)
- WiFi Connections (Optional)
- Connex® Setup
- SiriusXM® Satellite Radio (Optional)
- Flight Data Logging
- Auxiliary Video (EVS) (Optional)
- Electronic Documents
- Electronic Checklists
- **Autonomi™**
 - Electronic Stability & Protection (ESP)
 - Emergency Autoland
- Position Reporting (Optional)

SafeTaxi diagrams provide detailed taxiway, runway, and ramp information at more than 700 airports in the United States. By decreasing range on an airport that has a SafeTaxi diagram available, a close up view of the airport layout can be seen.

The optional 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) provides on-board electronic terminal procedures charts. 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 WiFi Connections feature allows for the transmission of aircraft data as well as weather information while aircraft is on ground over wireless connections.

The Connex feature allows for setting up the 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 optional 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 optional Auxiliary Video feature provides a control and display interface for the optional EVS.

The Electronic Document function allows viewing of electronic documents on selected GDU displays.

The Electronic Checklists feature helps to quickly find the proper checklist procedure on the ground or during flight.

Autonomi™ is a family of Autonomous Safety-Enhancing Technology solutions that are designed to help make flying safer. Autonomi products for this aircraft consist of Electronic Stability and Protection (ESP™) and Emergency Autoland.

- 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 Emergency Autoland feature allows the aircraft to perform a completely autonomous landing in an emergency situation due to pilot incapacitation or other condition resulting in the pilot being unable to control the aircraft.

The optional Position Reporting feature allows the system to send position reporting information to a provider, such as FlightAware.com.

8.2 SAFETAXI

SafeTaxi is an enhanced feature that gives greater map detail when viewing airports at close range on the Navigation Map or the Inset Map on the PFD. 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. To view the full capability of the SafeTaxi feature, 'Airports' must be enabled in the Map Settings menu on the Touchscreen Controller.



NOTE: When obstacles are displayed on the Navigation Map in the vicinity of an airport being viewed with SafeTaxi, the obstacle symbols may be obscured by SafeTaxi feature labels.

Designated Hot Spots are recognized at airports with many intersecting taxiways and runways, and/or complex ramp areas. Airport Hot Spots are outlined to caution pilots of areas on an airport surface where positional awareness confusion or runway incursions happen most often. Hot Spots are defined with a magenta circle or outline around the region of possible confusion.

Any map 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
- Inset Map (PFD)
- Weather Datalink Pane
- Trip Planning Pane

During ground operations the aircraft's position is displayed in reference to taxiways, runways, and airport features. In the example shown, the aircraft is on 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.



Figure 8-1 SafeTaxi Depiction on the Navigation Map Display

Enabling/Disabling SafeTaxi:

- 1) From MFD 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 (see below) to enable or disable the display of SafeTaxi on the Navigation and Inset maps. A green annunciator on the button indicates SafeTaxi is enabled.

Configuring SafeTaxi range:

- 1) From MFD 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 is 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 for range settings up to, and including 1.5 nm.

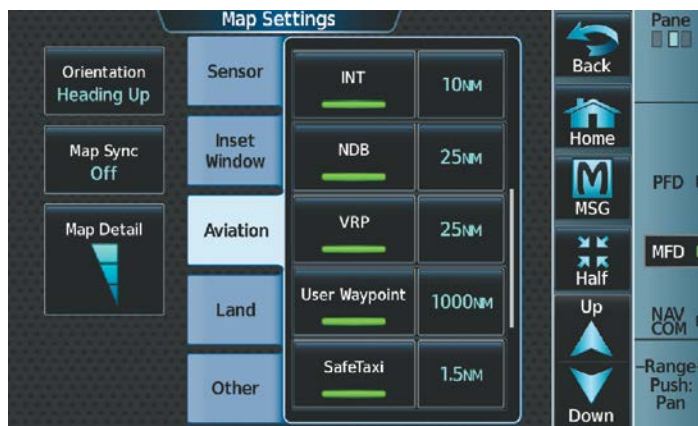


Figure 8-2 SafeTaxi Map Settings

8.3 SURFACEWATCH (OPTIONAL)

The SurfaceWatch™ feature provides aural and visual annunciations to help the pilot maintain situational awareness and avoid potential runway incursions during ground and air operations in the airport environment. The SurfaceWatch feature is comprised of the following key components:

- Alert Annunciations
 - Taxiway Takeoff
 - Runway Too Short (during takeoff or landing)
 - Check Runway (during takeoff or landing)
 - Taxiway Landing
- Provides the pilot with voice alerts at key transition points and runway distance remaining callouts
- Provides information on the Primary Flight Display (PFD) that contains runway and taxiway information that changes as the aircraft moves through the airport environment

The SurfaceWatch feature is not available in Reversionary Mode.



Figure 8-3 SurfaceWatch Information on the PFD

Enabling/disabling SurfaceWatch:

- 1) From MFD Home, touch **Utilities > Setup > Avionics Settings**.
- 2) If not already selected, touch the **Alerts** Tab and scroll to view SurfaceWatch.
- 3) Touch the **SurfaceWatch Inhibit** Button to enable or disable SurfaceWatch. A green annunciator indicates SurfaceWatch is inhibited, or disabled. A system message is also displayed indicating SurfaceWatch is inhibited. The inhibit setting will be canceled after a power cycle.

INFORMATION DISPLAY

The SurfaceWatch™ Information Box is displayed on the PFD 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.

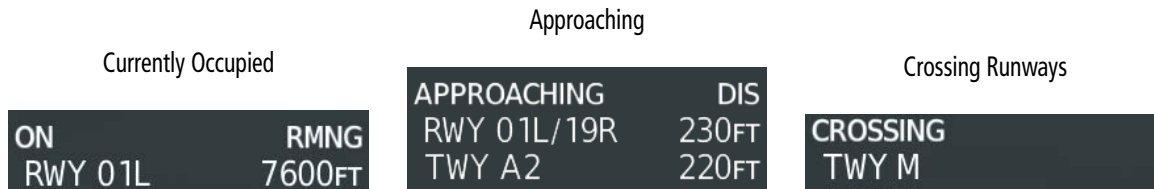


Figure 8-4 Information Types Displayed in the Information Box

CURRENTLY OCCUPIED

This component indicates the aircraft is ‘ON’ the indicated apron, taxiway, or runway. In the previous figure, the aircraft is currently ‘ON’ runway 01 left (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’ runway 01 left / 19 right (RWY 01L/19R) and taxiway A two (TWY A2).. The distance to each is also shown.

When the aircraft is taxiing and approaching an intersection of multiple taxiways, the taxiway identifiers will be listed in order of proximity and the distance to the nearest is displayed.

When the aircraft is taxiing and crossing an intersection of multiple taxiways, ‘CROSSING’ will be displayed and no distance will be shown.

CROSSING RUNWAYS

This component lists the runways, from closest to furthest, that are ‘CROSSING’ the runway the aircraft currently occupies, as seen in the previous figure. The distance to each runway is also shown in order of closest distance. Runways behind the aircraft are not depicted.

The Crossing Runways component is shown in conjunction with the Currently Occupied component of the Information Box.

ALERTS

The SurfaceWatch alert annunciations are displayed in the central portion of the PFD. The alert annunciations are accompanied by a corresponding voice alert. 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	"Taxiway"	Issued when the aircraft is taking off from a non-runway (e.g., a taxiway).
RWY TOO SHORT	"Runway too short"	Issued when the aircraft is taking off from or landing on a runway with a length less than needed as calculated by the PERF function.
CHECK RUNWAY	"Check runway"	Issued when the aircraft is taking off from or landing on a runway different than that entered in PERF.
TWY LANDING	"Taxiway"	Issued when the aircraft is landing on a non-runway (e.g., a taxiway).

Table 8-1 SurfaceWatch Alert Annunciations

TAKEOFF ALERTS

The Takeoff phase-of-flight, as determined by the system, must be valid in order for the system to issue Takeoff Alerts.

TAXIWAY TAKEOFF

The Taxiway Takeoff alert is issued when the aircraft attempts to takeoff from a non-runway (e.g., a taxiway). The system determines this when the Takeoff 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 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 the system PERF function has calculated to be too short.

Note that while the Runway Too Short alert may be issued for any runway from which the aircraft is taking off, the system will always calculate the runway length for the specific runway entered in 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 as shown in the following figure.

CHECK RUNWAY

The Check Runway alert is issued when the aircraft attempts to takeoff from a runway that does not match the departure runway in PERF. The system determines this when the Takeoff phase-of-flight is valid while the aircraft is aligned with a runway that is not the departure runway entered in the PERF function.

In addition to the visual and voice alert, the Information Box contains a textual description of the currently occupied runway as shown in the previous figure.

LANDING ALERTS

The On-Final phase-of-flight, as determined by the system, must be valid in order for the system to issue Landing Alerts.

TAXIWAY LANDING

The Taxiway Landing alert is issued when the aircraft attempts to land on a non-runway (e.g., a taxiway). 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 (see following figure).

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 system PERF function has calculated to be too short.

Note that 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 as indicated in the following figure.

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 while the aircraft is aligned with a runway that is not the arrival runway entered in the PERF function.

Additionally, the Information Box will display the destination airport identifier, the runway with which the aircraft is aligned, and the distance to the runway (see the following figure).

DISTANCE REMAINING CALLOUTS

With a rejected takeoff, distance remaining voice callouts are issued for the remaining runway distances of 5,000', 4,000', 3,000', 2,000', 1,000', and 500'.

8.4 ELECTRONIC CHARTS

Electronic charts that resemble the paper versions of AeroNav Services terminal procedures charts (FliteCharts) and Jeppesen terminal procedures charts (ChartView) can be displayed on the MFD or PFD.

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 Preferred Charts Source:

- 1) From MFD Home, touch **Charts > Chart Selection > Charts Options > Preferred Source**.
- 2) Touch either **ChartView** or **FliteCharts** to set as the preferred chart source



Figure 8-5 Charts Options Preferred Source Button

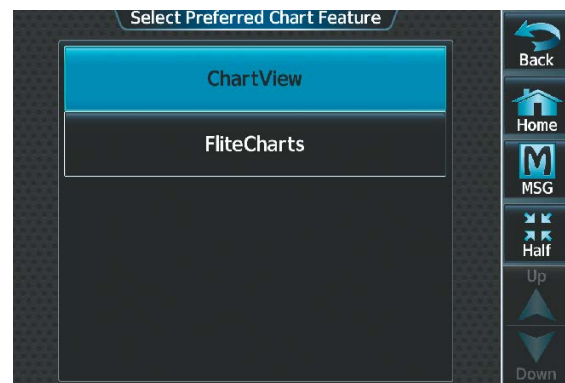


Figure 8-6 Select Preferred Chart Screen

CHARTVIEW (OPTIONAL)

ChartView resembles the paper version of Jeppesen terminal procedures charts. 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. Airport Hot Spots are outlined in magenta.

The geo-referenced aircraft position is indicated by an aircraft symbol displayed on the chart when the current position is within the boundaries of the chart. Inset boxes (see following figure) are not considered within the chart boundaries. Therefore, when the aircraft symbol reaches a chart boundary line, or inset box, the aircraft symbol is removed from the display.

The following figure shows examples of off-scale areas, indicated by the grey shading. Note, the grey shading is for illustrative purposes only and will not appear on the published chart or 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.

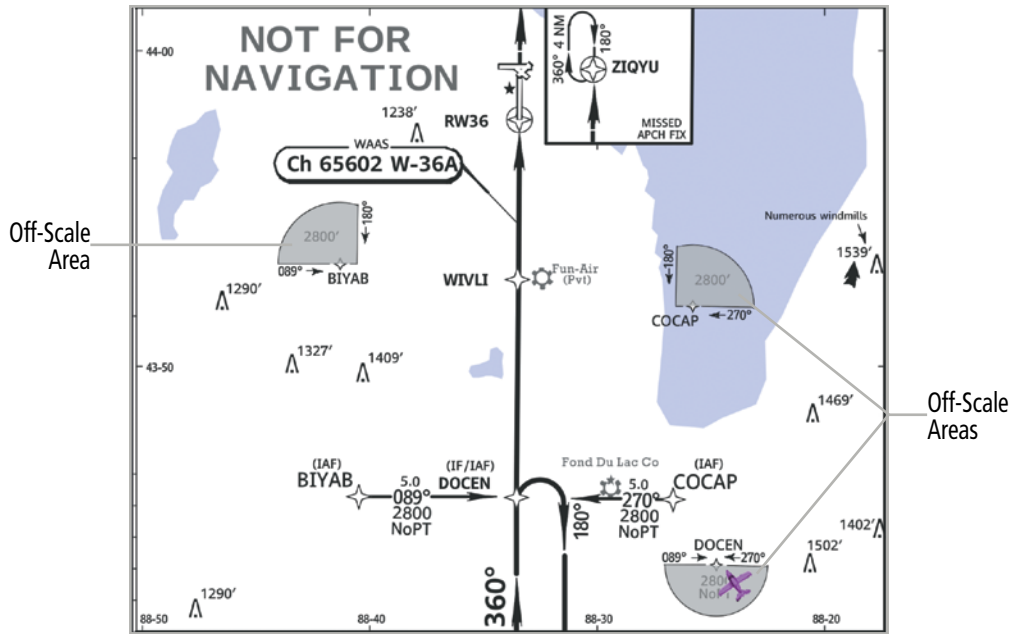


Figure 8-7 Sample Chart Indicating Off-Scale Areas



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



NOTE: Only NOTAMs applicable to specific information conveyed on the displayed Jeppesen chart are available. There may be other NOTAMs available pertaining to the flight that may not be displayed. Contact Jeppesen for more information regarding Jeppesen database-published NOTAMs.

CHART SELECTION

When a flight plan is active, or when flying direct-to a destination, the initial set of charts made available pertain to the departure airport. After departing the airport environment, the initial chart set made available pertains to the destination airport. When no flight plan is active, or when not flying to a direct-to destination, the initial chart set is made available for the nearest airport.

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 MFD 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 (the following figure).
 - **Departure** Tab to display a list of possible departures for the selected airport.
 - **Arrival** Tab to display a list of possible arrivals for the selected airport.
 - **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.

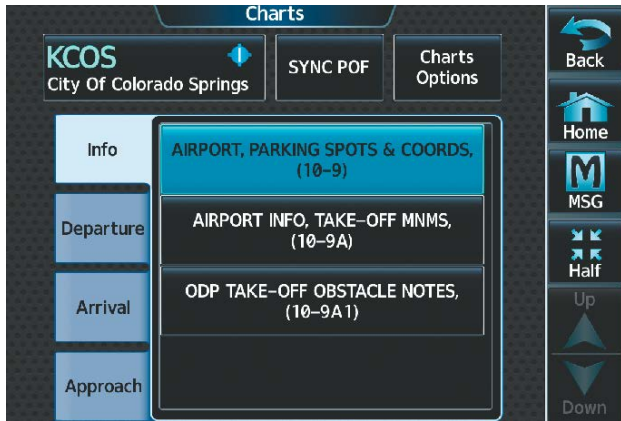


Figure 8-8 Airport Diagram Selection

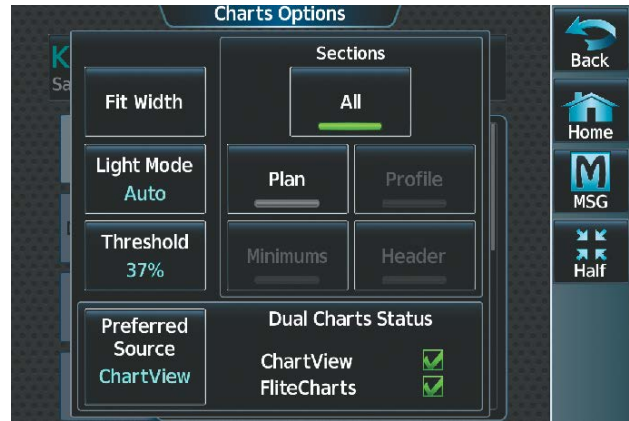


Figure 8-9 'Charts Options' Screen

- 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 **Back** to return to the Charts Screen.

Zooming-in, zooming-out, panning, and rotating the displayed chart:

- 1) From MFD 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.

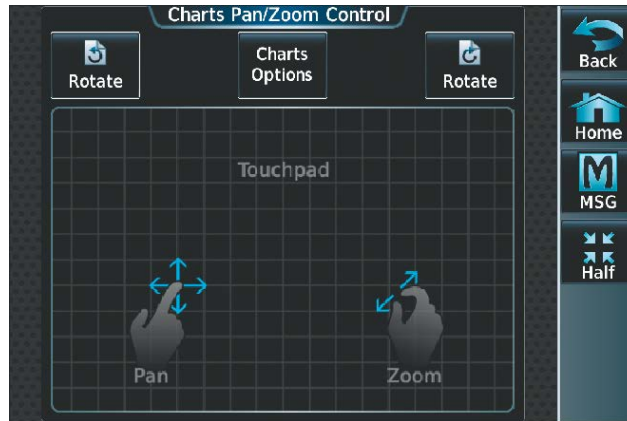


Figure 8-10 Pan and Zoom Touchpad

- 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 MFD 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.

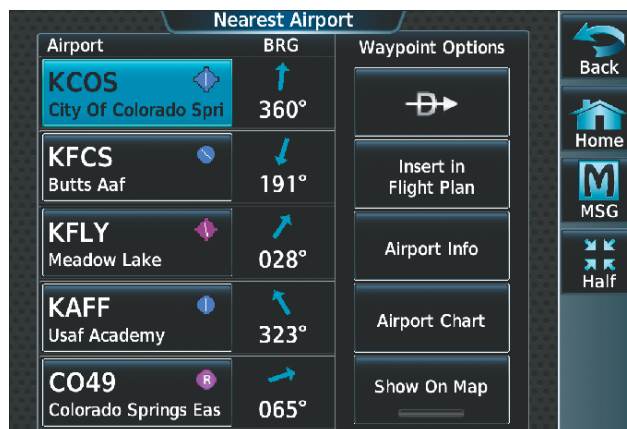


Figure 8-11 Airport Diagram Selection

- 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 (see following figure).

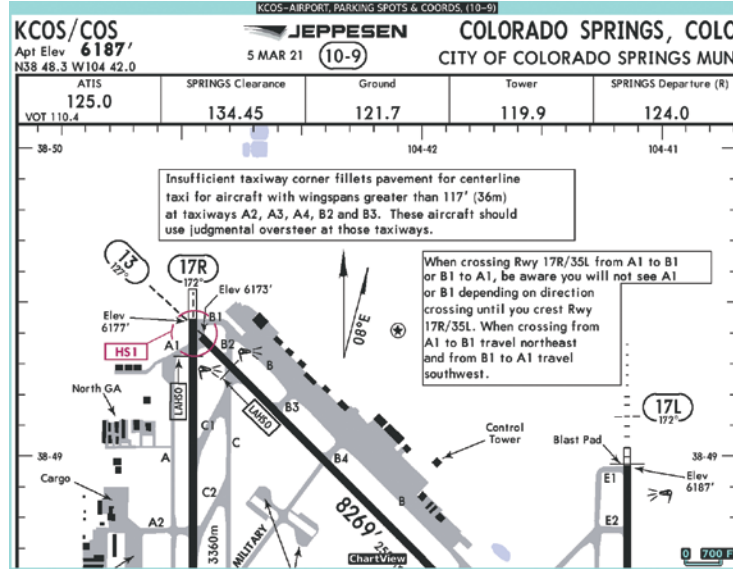


Figure 8-12 Airport Chart for Selected Airport

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. 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 does not refer to the Jeppesen subscription, but rather the availability of a particular airport chart selection or procedure for a selected airport.

No Available Charts

Figure 8-13 No Available Charts Banner

If there is a problem in rendering the data (such as a data error or a failure of an individual chart), the banner ‘Unable To Display Chart’ is then displayed.

Unable To Display Chart

Figure 8-14 Unable To Display Chart Banner

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 Day, Night, or Auto View:

- 1) From MFD Home, touch **Charts > Chart Selection > Charts Options**.
- 2) Touch the **Light Mode** Button (see following figure).

- 3) Touch the **Day**, **Night**, or **Auto** Button (see following figure). The selection is announced on the **Light Mode** Button. When **Auto** is selected, the display will change to the appropriate day or night setting, dependent on ambient lighting.

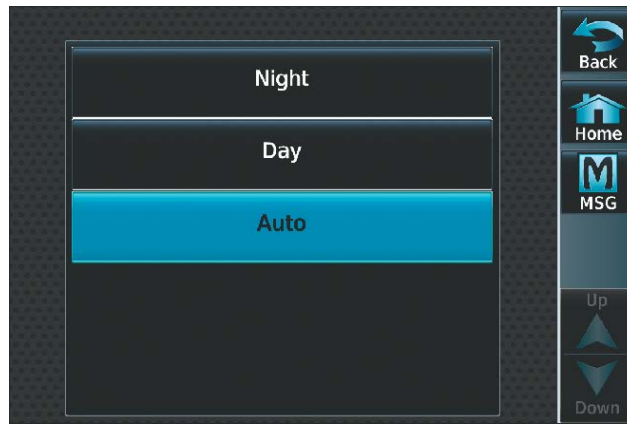
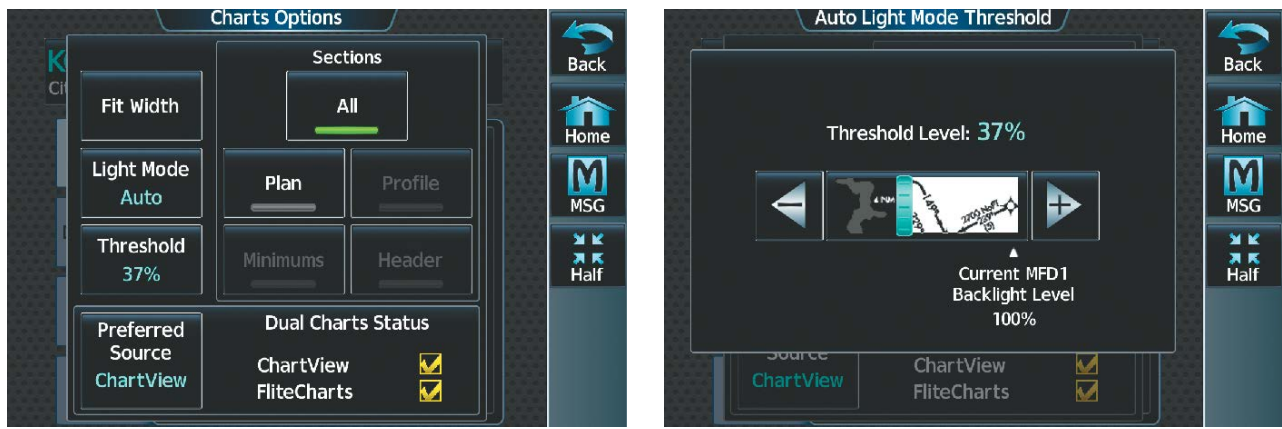


Figure 8-15 Selecting Day/Night View

- 4) Touch the **Threshold** Button (see following figure). The Auto Light Mode Threshold window is displayed.



'Charts Options' Screen

Adjust Threshold Setting

Figure 8-16 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.

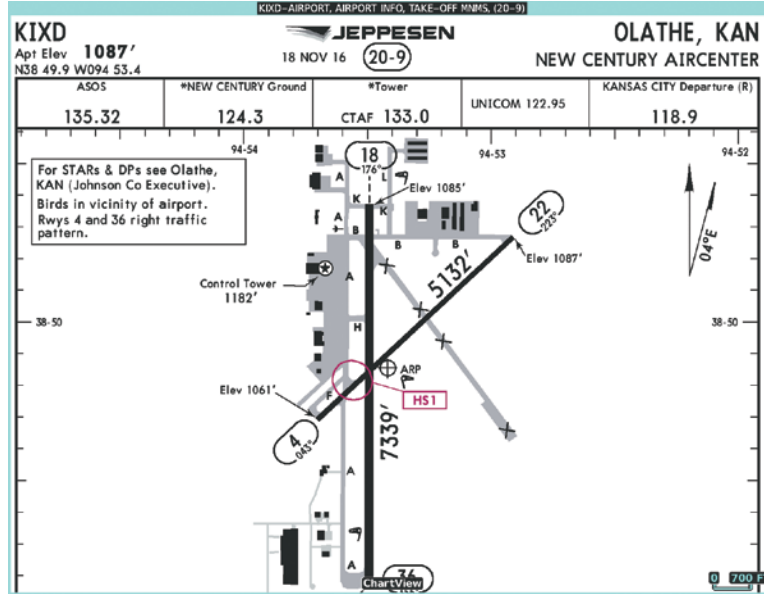


Figure 8-17 Airport Diagram, Day View

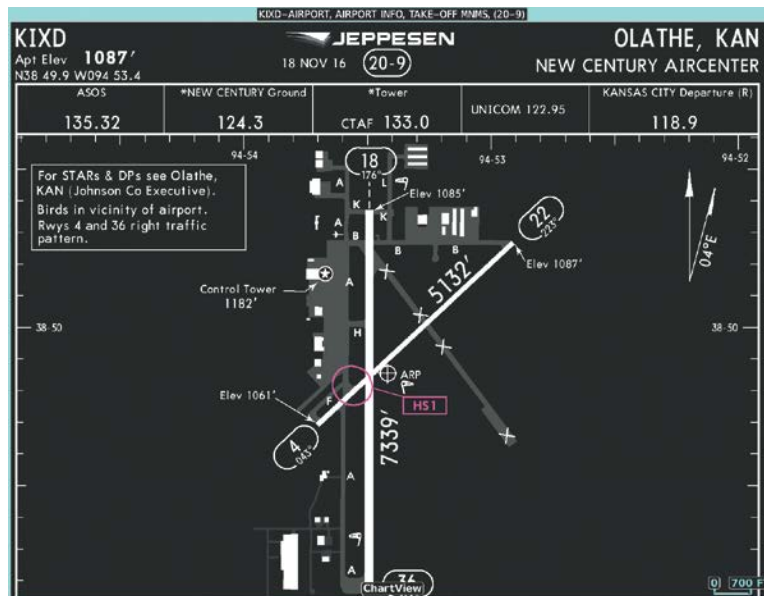


Figure 8-18 Airport Diagram, Night View

FLITECHARTS (OPTIONAL)

FliteCharts resemble the paper version of AeroNav Services terminal procedures charts. The charts are displayed with high-resolution and in color for applicable charts.

The geo-referenced aircraft position is indicated by an aircraft symbol displayed on the chart when the current position is within the boundaries of the chart. An aircraft symbol may be displayed within an off-scale area depicted on some charts.

The following figure shows examples of off-scale areas, indicated by the grey shading. Note, these areas are not shaded on the published chart. These off-scale areas appear on the chart to convey supplemental information. However, the depicted geographical position of this information, as it relates to the chart plan view, is not the actual geographic position. Therefore, when the aircraft symbol appears within one of these areas, the aircraft position indicated is relative to the chart plan view, not to the off-scale area. The FliteCharts database subscription is available from Garmin. Available data includes:

- Arrivals (STAR)
- Approaches
- Departure Procedures (DP)
- Airport Diagrams

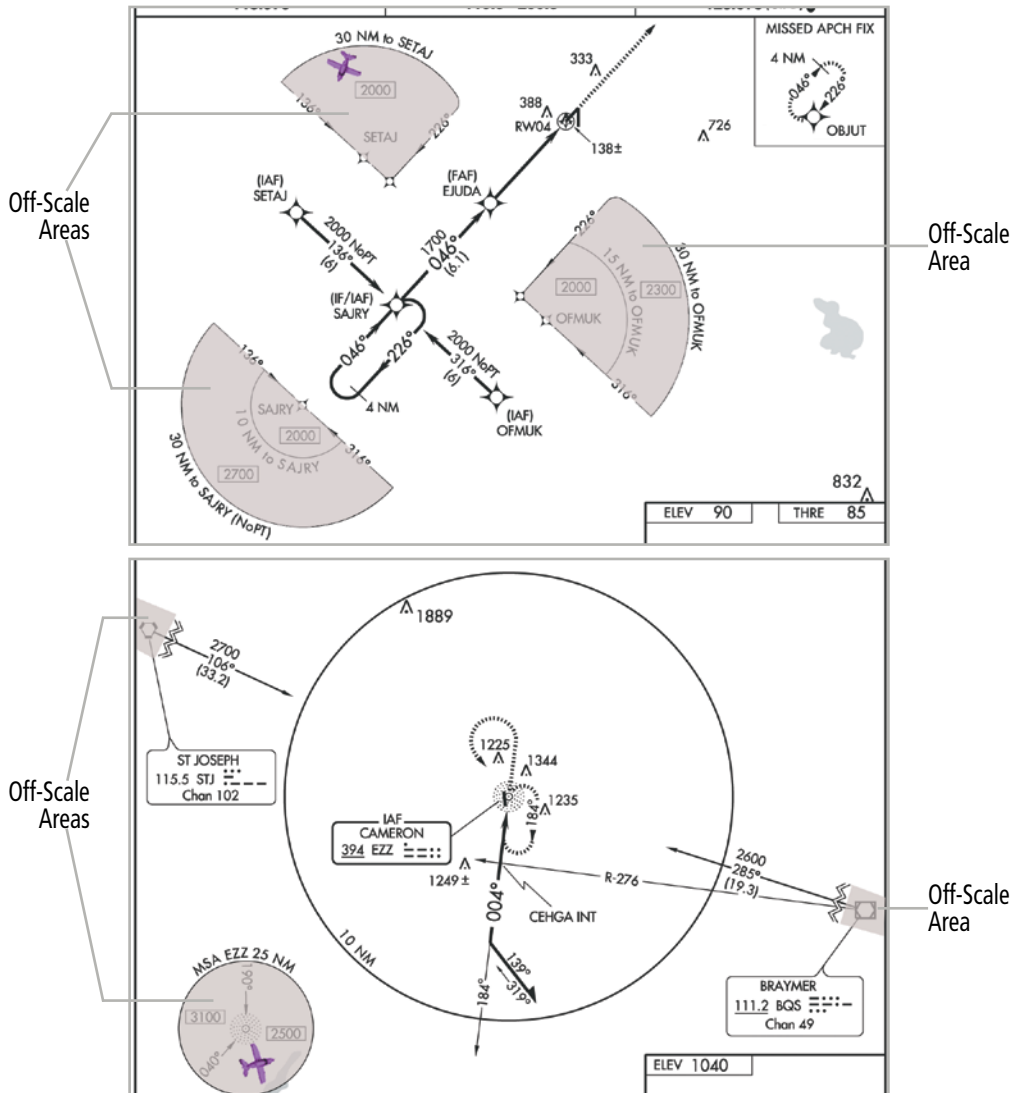


Figure 8-19 Sample Chart Indicating Off-Scale Areas



NOTE: Do not maneuver the aircraft based solely upon the geo-referenced aircraft symbol.

CHART SELECTION

When a flight plan is active, or when flying direct-to a destination, the initial set of charts made available pertains to the departure airport. After departing the airport environment, the initial chart set made available pertains to the destination airport. When no flight plan is active, or when not flying to a direct-to destination, the initial chart set is made available for the nearest airport.

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 MFD 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).
 - **Departure** Tab to display a list of possible departures for the selected airport.
 - **Arrival** Tab to display a list of possible arrivals for the selected airport.
 - **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.

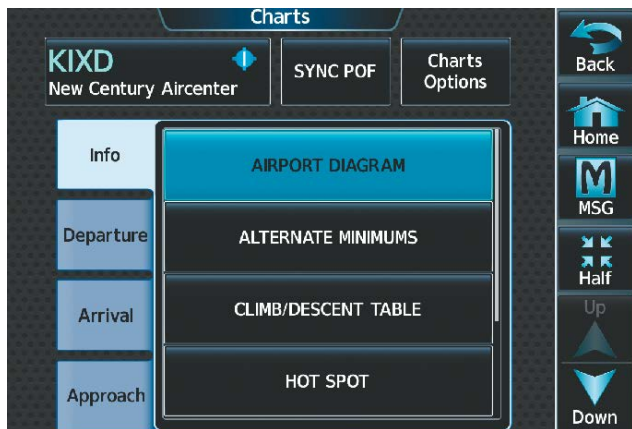


Figure 8-20 Airport Diagram Selection

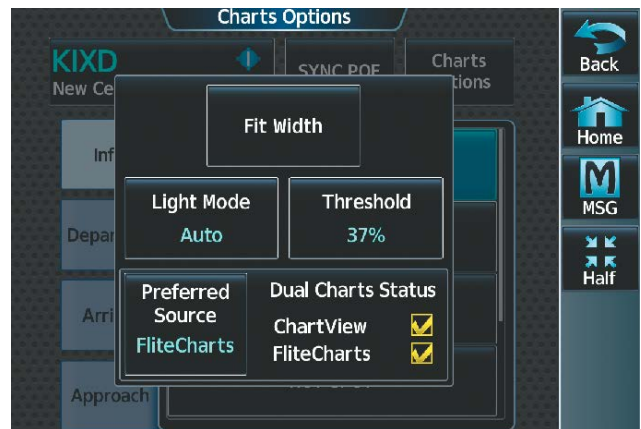


Figure 8-21 Airport Diagram View Options

- 5) Touch the **Charts Options** Button to display the viewing options available for the selected chart (see previous figure).
- 6) Touch **Fit Width** to display the full width of the chart.
- 7) Touch **Back** to return to the Charts Screen.

Selecting Airport Diagrams from the Nearest Airports Screen:

- 1) From MFD Home, touch **Nearest > Airport**.
- 2) Touch the desired airport button. KCOS is selected in the following figure. The Waypoint Options Buttons are now displayed.

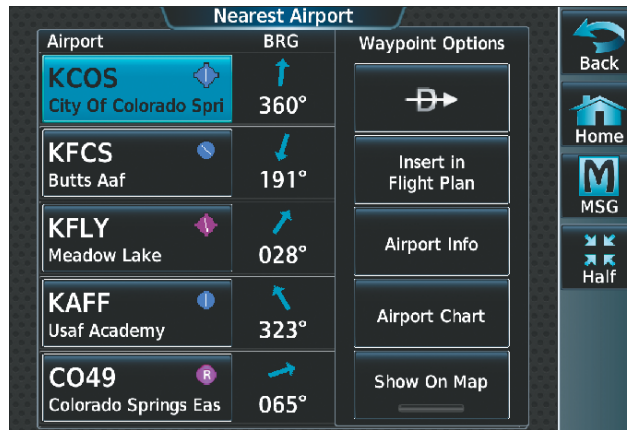


Figure 8-22 Airport Diagram Selection

- 3) Touch the **Airport Chart** Button. The **Info** Tab selections are displayed on the Touchscreen Controller (see previous figure) and the Airport Diagram is displayed on the selected Display Pane (see following figure).

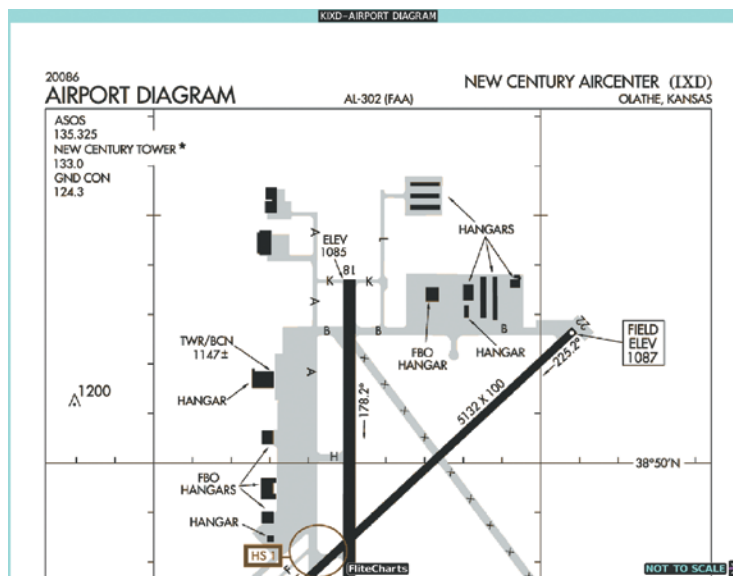


Figure 8-23 Airport Chart for Selected Airport

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. 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 does not refer to the Jeppesen subscription, but rather the availability of a particular airport chart selection or procedure for a selected airport.

No Available Charts

Figure 8-24 No Available Charts Banner

If there is a problem in rendering the data (such as a data error or a failure of an individual chart), the banner 'Unable To Display Chart' is then displayed.

Unable To Display Chart

Figure 8-25 Unable To Display Chart Banner

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 Day, Night, or Auto View:

- 1) From MFD Home, touch **Charts** > **Chart Selection** > **Charts Options**.
- 2) Touch the **Light Mode** Button.
- 3) Touch the **Day**, **Night**, or **Auto** Button. The selection is announced on the **Light Mode** Button. When **Auto** is selected, the display will change to the appropriate day or night setting, dependent on ambient lighting.

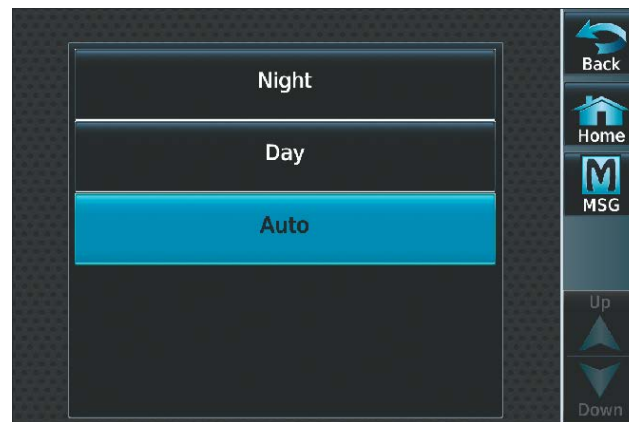
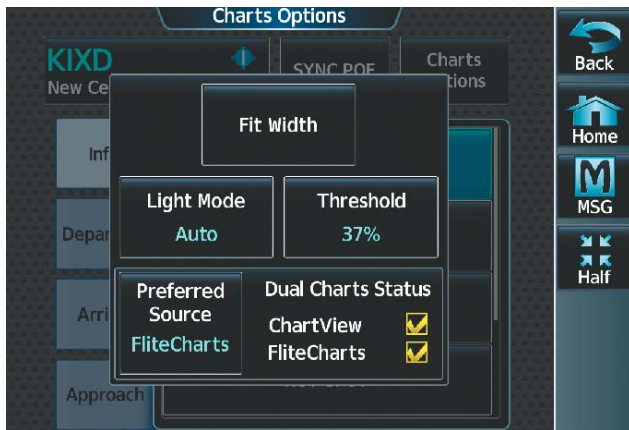
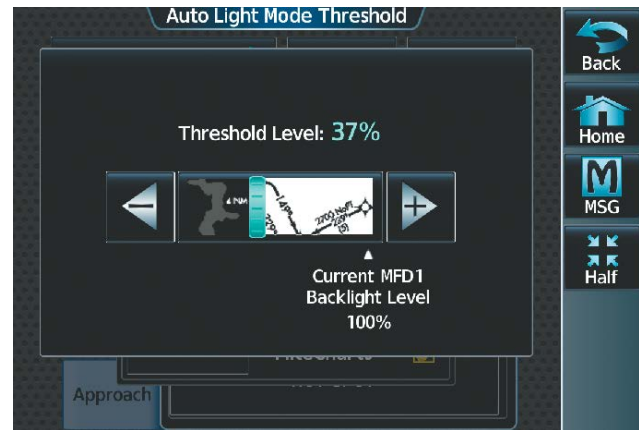


Figure 8-26 Selecting Day/Night View

- 4) Touch the **Threshold** Button (see following figure). The Auto Light Mode Threshold window is displayed.



Select Charts Options



Adjust Threshold Setting

Figure 8-27 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.

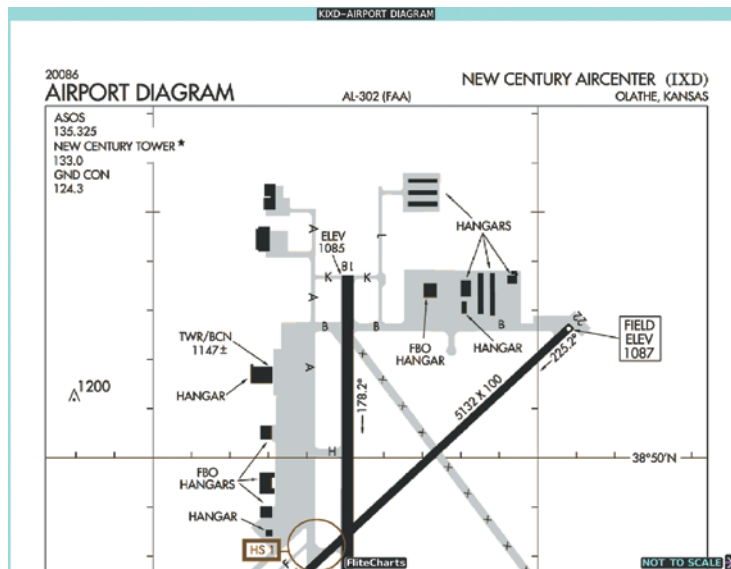


Figure 8-28 Airport Diagram, Day View

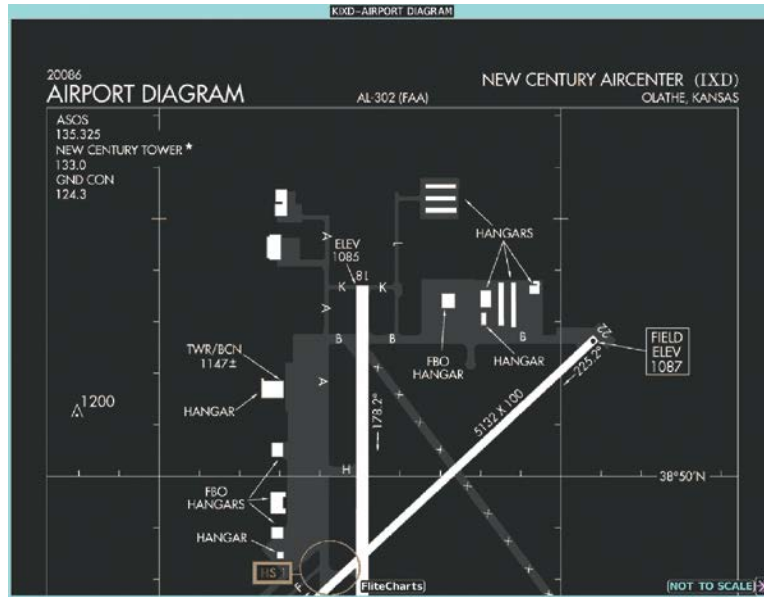


Figure 8-29 Airport Diagram, Night View

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 7.5 nm.

When different VFR charts exist for the same area the chart type will automatically display according to the range chosen. For example, in an area where both a Sectional and a Terminal Area Chart (TAC) are available, a range 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.

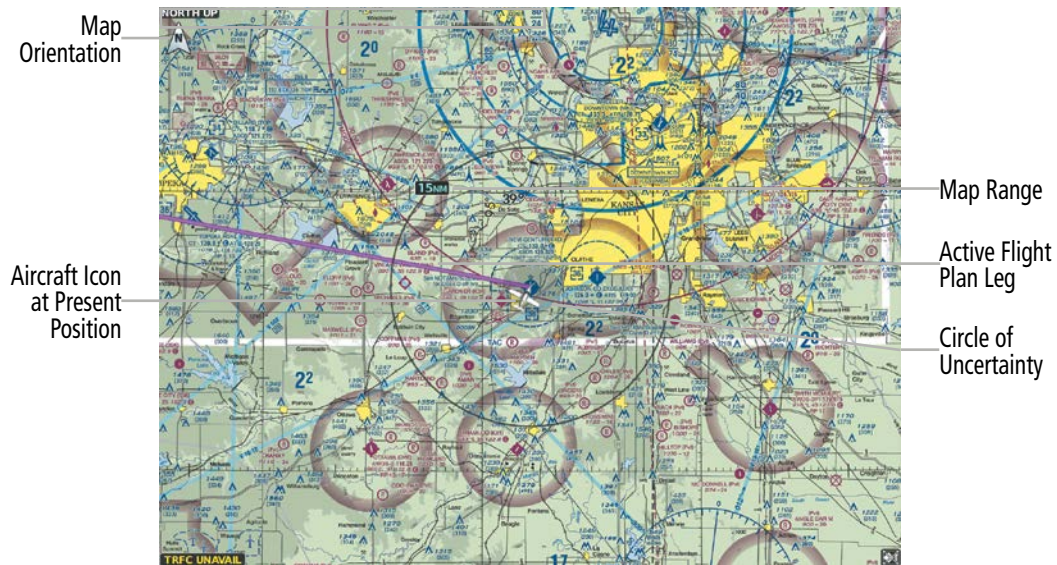


Figure 8-30 GPS Navigation Information on the VFR Chart

Selecting the chart to display:

- 1) From MFD Home, touch **Map > Map Selection**.
- 2) Touch the desired Chart Button (**VFR**, **IFR Low**, or **IFR High**).

Modifying the Low IFR and High IFR Chart settings:

- 1) From MFD 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 'IFR/VFR Charts Settings' Screen.
- 4) Touch the desired Light Mode Button. If the **Auto** Button is selected, the Threshold Level for the light mode may be adjusted by moving the slider left or right, or by touching the **+** Button, the **-** Button, or moving the slider.

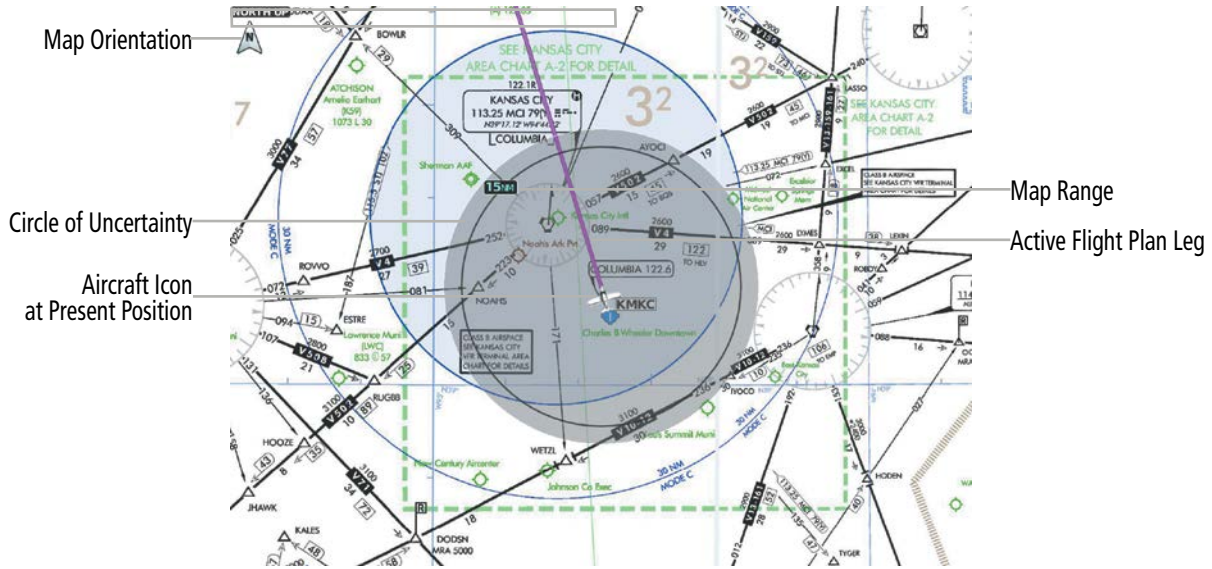


Figure 8-31 GPS Navigation Information on the IFR Low Altitude Chart

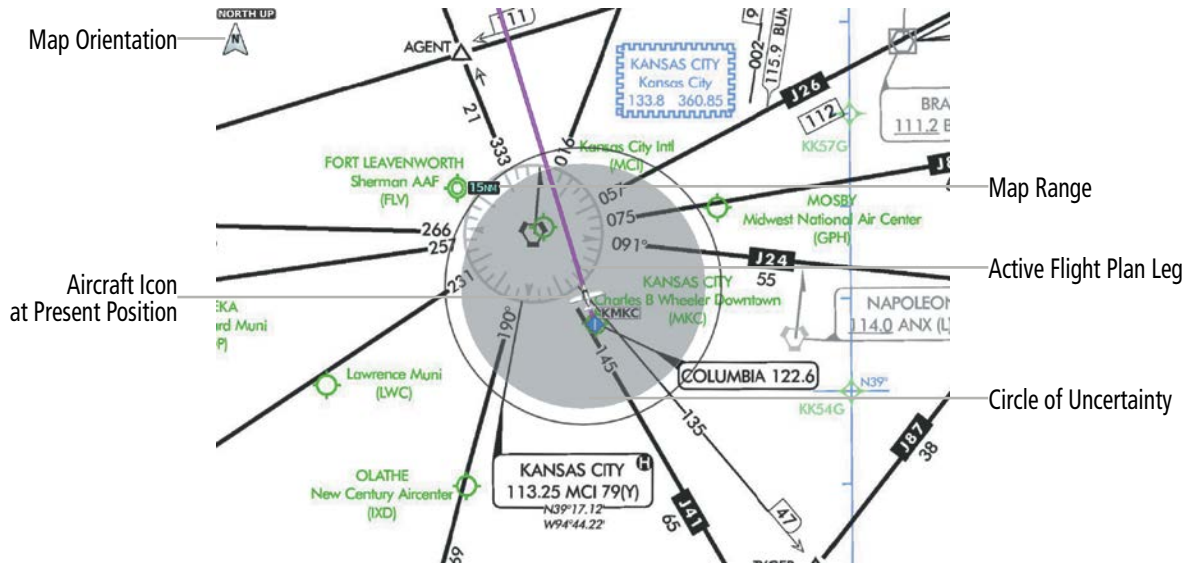


Figure 8-32 GPS Navigation Information on the IFR High Altitude Chart

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

8.5 DATABASE CYCLE NUMBER AND REVISIONS

CYCLE NUMBER AND REVISION

Databases that may be available include Basemap, Obstacle, Terrain, Navigation, ChartView, FliteCharts, SafeTaxi, Checklist, IFR/VFR Charts, and Airport Directory. Data is revised and expiration dates vary. 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 MFD Home Screen appears subdued and is disabled until a new issue of ChartView is installed.

Database Condition	SafeTaxi	ChartView	Airport Directory
Current date is before Effective Date	Safetaxi Region US Version 2.71 Cycle YITI Effective DD-MMM-YYYY Expires DD-MMM-YYYY GARMIN LTD. AND ITS SUBSIDIARIES	Not Applicable	Airport Directory Region WORLDWIDE Version 1.01 Cycle YITI Effective DD-MMM-YYYY Expires DD-MMM-YYYY Copyright YYYY AC-U-KNIK® - Penton Media, Inc
Database is current	Safetaxi Region US Version 2.71 Cycle YITI Effective DD-MMM-YYYY Expires DD-MMM-YYYY GARMIN LTD. AND ITS SUBSIDIARIES	Chart Chart Jeppesen ChartView Cycle YIIT Expires DD-MMM-YYYY Disables DD-MMM-YYYY Copyright YYYY Jeppesen Sanderson, Inc.	Airport Directory Region WORLDWIDE Version 1.01 Cycle YITI Effective DD-MMM-YYYY Expires DD-MMM-YYYY Copyright YYYY AC-U-KNIK® - Penton Media, Inc
Database has expired	Safetaxi Region US Version 2.71 Cycle YITI Effective DD-MMM-YYYY Expires DD-MMM-YYYY GARMIN LTD. AND ITS SUBSIDIARIES	Chart Chart Jeppesen ChartView Cycle YIIT Expires DD-MMM-YYYY Disables DD-MMM-YYYY Copyright YYYY Jeppesen Sanderson, Inc.	Airport Directory Region WORLDWIDE Version 1.01 Cycle YITI Effective DD-MMM-YYYY Expires DD-MMM-YYYY Copyright YYYY AC-U-KNIK® - Penton Media, Inc
Database is disabled	Not Applicable	Chart Chart Jeppesen ChartView Cycle YIIT Expires DD-MMM-YYYY Disables DD-MMM-YYYY Copyright YYYY Jeppesen Sanderson, Inc.	Not Applicable
Database is not installed	Safetaxi Region NOT AVAILABLE Version Cycle Effective Expires GARMIN LTD. AND ITS SUBSIDIARIES	Chart Chart NOT AVAILABLE Cycle Expires Disables	Airport Directory Region NOT AVAILABLE Version Cycle Effective Expires Copyright YYYY AC-U-KNIK® - Penton Media, Inc

Table 8-2 Database Status Examples

Viewing Database Information:

- 1) From MFD Home, touch **Utilities > Setup > Avionics Status**.
- 2) Touch the **Database** Tab.
- 3) Touch the button corresponding to the display (**MFD1, PFD1, GTC1, GTC2, or GTC3**) for which the database information will be viewed.
- 4) Scroll to display the appropriate database information.

Database cycle numbers are in a format such as YYTI or YYII, which are deciphered as follows:

YYTI

- » YY – Indicates the last two digits of the year (ex. 21 represents 2021)
- » T – Indicates the database type (ex. S is for SafeTaxi, D is for Airport Directory)
- » I – Indicates the numerical issue of the database for the year (ex. 5 is the fifth issue of the year)

YYII

- » YY – Indicates the last two digits of the year (ex. 21 represents 2021)
- » II – Indicates the numerical issue of the database for the year (ex. 05 is the fifth issue of the year)
- » Refer to Updating Garmin Databases in Appendix for instructions on revising databases.

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

Table 8-3 Database Cycle Number Format and Revision Cycle

8.6 SATELLITE TELEPHONE & DATALINK SERVICES (OPTIONAL)

NOTE: Separate accounts must be established to access the Iridium satellite network for voice and Garmin Connex 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.

If installed, the WiFi Datalink (GDL 59) provides a means for passengers to initiate and receive phone calls using a Plain Old Telephone System (POTS) interface over the Iridium Satellite Network. This allows for cabin-cockpit communication, transfer of phone calls, and conference calls.

REGISTERING THE SYSTEM WITH GARMIN CONNEX

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 Connex at: flygarmin.com.

Registering the system for datalink services:

- 1) From MFD Home, touch **Utilities > Setup > Avionics Status**.
- 2) If necessary, touch the **Airframe** Tab. Note the System ID number as seen in the following figure. This number will be needed when contacting Garmin Connex to establish the account.

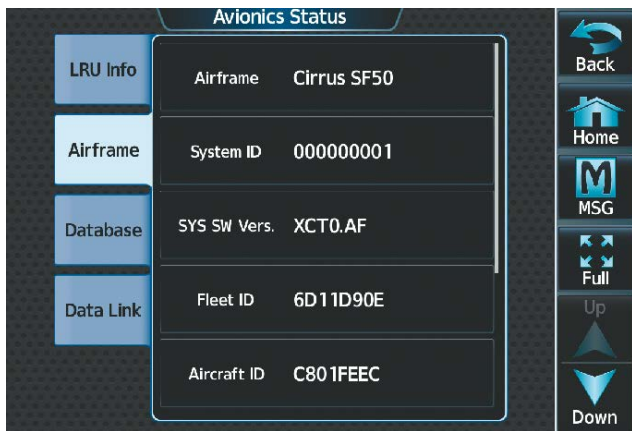


Figure 8-33 System ID Number

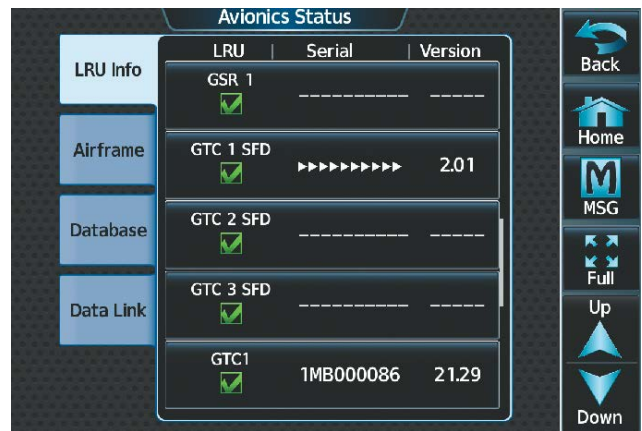


Figure 8-34 Iridium Transceiver Serial Number (GSR1)

- 3) Touch the **LRU Info** Tab. Scroll to view 'GSR1' and note the serial number (see previous figure), which will also be needed when contacting Garmin Connex.
- 4) Contact Garmin Connex to establish an account and receive an access code.
- 5) From MFD Home, touch **Utilities > Setup > Connex Registration**.
- 6) Press the **Register** Button (see following figure).



Figure 8-35 Connex Registration Display



Figure 8-36 Entering the Access Code

- 7) Enter the access code as shown in the previous figure.
- 8) Touch the **Enter** Button.

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 contact:

- 1) From MFD Home, touch **Services** > **Contacts**.
- 2) The Contacts Screen is displayed as shown in the following figure.



Figure 8-37 Services Menu



Figure 8-38 Contact List

- 3) Touch the **Create New** Button (see previous figure).
- 4) Touch the **Name** Button shown in the following figure. The Contact Name entry screen is displayed.



Figure 8-39 Enter New Contact Information



Figure 8-40 Enter Name

- 5) Enter the name of the new contact as the example shows in the previous figure.
- 6) Touch **Enter**.
- 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, as shown in the following figure.
- 8) Touch **Telephone Number**. The Telephone Number entry screen is displayed.



Figure 8-41 Select Telephone Number



Figure 8-42 Enter Telephone Number

- 9) Enter the telephone number of the new contact as the example shows in the previous figure.
- 10) Touch **Enter**.
- 11) Touch **Email Address** (scroll down as required). The Email Address entry screen is displayed.



Figure 8-43 Select Email Address



Figure 8-44 Enter Email Address

- 12) Enter the email address of the new contact as the example shows in the previous figure.
- 13) Touch **Enter**.
- 14) Touch **Create**. The new contact is created and appears in the list of contacts as shown in the following figure. The star symbol displayed on the right side of the contact button indicates this contact is designated as a favorite.



Figure 8-45 New Contact Info Complete



Figure 8-46 Enter Email Address

TELEPHONE COMMUNICATION

The pilot or copilot can place and answer calls on the Iridium satellite network. Ensure telephone audio is enabled for the pilot and/or copilot when using the satellite telephone feature. See the Audio & CNS section for information regarding enabling and disabling the telephone audio.

Viewing the Telephone Status:

- 1) From MFD Home, touch **Services** > **Telephone**.
- 2) The Telephone Screen is displayed as shown in the following figure.



Figure 8-47 Telephone Service Selection



Figure 8-48 Telephone Status Information

ENABLING/DISABLING THE IRIDIUM TELEPHONE SYSTEM

The Iridium Satellite Telephone System may be disabled by the pilot. When disabled, incoming calls will not be received and outgoing calls will not be possible from the cockpit or cabin.

Enabling/disabling the Iridium telephone system:

- 1) From MFD Home, touch **Services > Telephone**.
- 2) Touch the **Iridium #1** Button to display the Iridium #1 Transceiver Screen, as shown in the following figure.
- 3) Touch the **Disable Iridium Transmission** Annunciator Button to disable (green annunciator as in the following figure) the transceiver. Touch the button again to enable (gray annunciator) the transceiver.



Figure 8-49 Iridium Transceiver Enabled



Figure 8-50 Iridium Transceiver Disabled

INCOMING CALLS

Incoming voice calls from an external telephone phone through the Iridium Satellite Network are annunciated by a ring tone and flashing **TEL** Button on the GTC Button Bar, as shown in the following figure, as well as a flashing TEL annunciation in the upper left corner of the PFD display.

Answering a call:

- 1) Touch the flashing **TEL** Button. The Notifications Screen is displayed as in the following figure.
- 2) Touch the **Answer** Button. The call is now connected as indicated in the following figure. Touching the **Ignore** Button extinguishes the new call annunciation and the call remains disconnected.



Figure 8-51 Incoming Call Notification

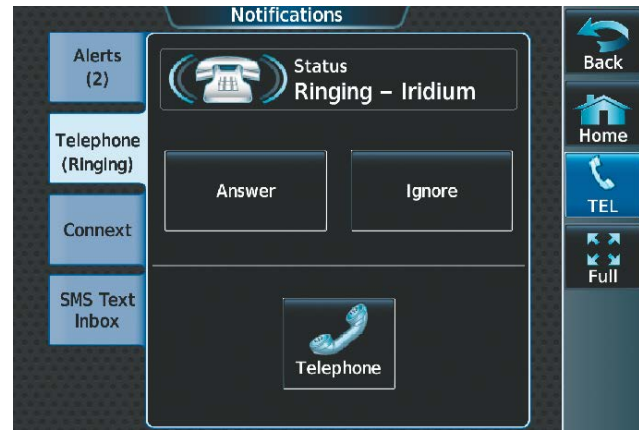


Figure 8-52 Telephone Notification Selected

- 3) When the call is finished, touch **End Call** to disconnect the call.



Figure 8-53 Call Answered

OUTGOING CALLS

Voice calls can be made from the cockpit to an external telephone through the Iridium Satellite Network.

Making a call by entering the telephone number:

- 1) From MFD Home, touch **Services > Telephone**.
- 2) Touch the **Cockpit** Phone Button. The Cockpit Phone Screen is displayed as shown in the following figure.
- 3) Touch **Dial**. The phone number entry screen is displayed.



Figure 8-54 Cockpit Telephone Status



Figure 8-55 Telephone Number Entry

- 4) Using the number keys, enter the phone number. Touch the **Find** Button to select a number from the Contacts list.

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 **Enter**. The system initiates the call (see following figure). The system indicates a completed connection when the telephone is answered.



Figure 8-56 Establishing a Connection

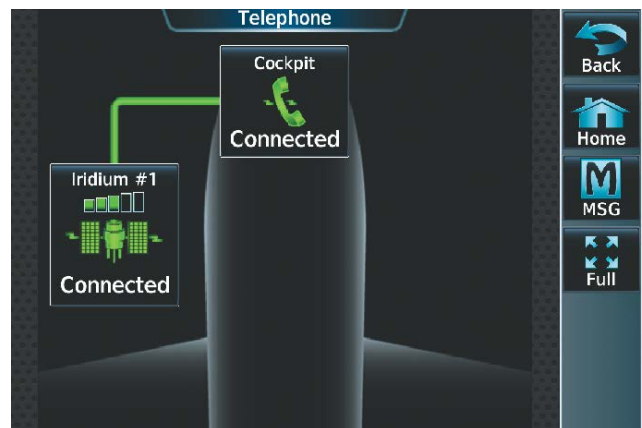


Figure 8-57 Telephone Connected

Making a call by selecting a contact:

- 1) From MFD Home, touch **Services > Contacts**.
- 2) Touch the button corresponding to the desired contact. The selected contact is displayed (see following figure).



Figure 8-58 Contact List

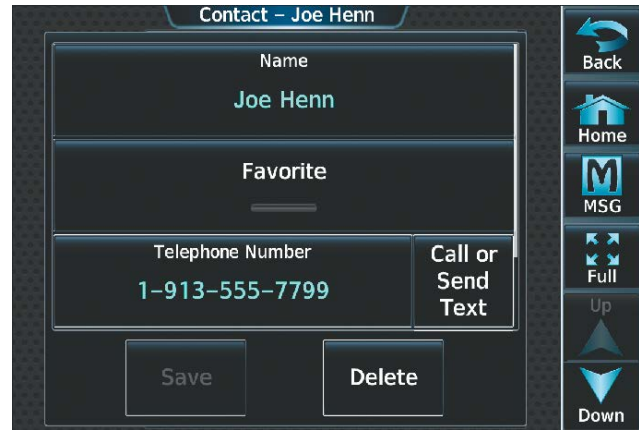


Figure 8-59 Contact Chosen

- 3) Touch the **Call or Send Text** Button. A selection screen, as shown in the following figure, is displayed.

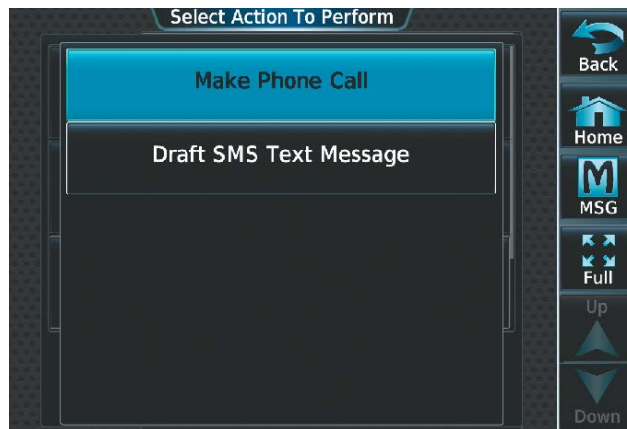


Figure 8-60 Select Action To Perform

- 4) Touch the **Make Phone Call** Button. The system initiates the call (see following figure). The system indicates a completed connection when the telephone is answered.



Figure 8-61 Establishing a Connection

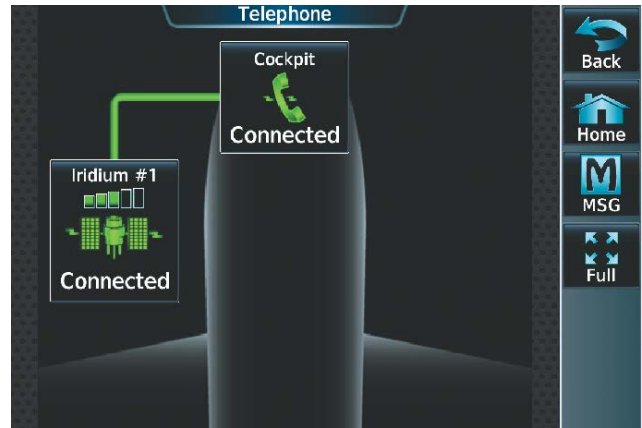


Figure 8-62 Telephone Connected

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 buttons.

Entering numbers during a call:

- 1) From MFD Home, touch **Services** > **Telephone**.
- 2) Touch the **Cockpit** Phone Button. The Cockpit Phone Screen is displayed (see following figure).
- 3) Touch the **Dial** Button. The Phone Keypad Screen is displayed.
- 4) Touch the desired numeric button to send the number. Repeat as necessary.



Figure 8-63 Dial Button



Figure 8-64 Phone Keypad

Ending a call:

- 1) From MFD Home, touch **Services** > **Telephone**.
- 2) Touch the **Cockpit** Phone Button. The Cockpit Phone Screen is displayed (see following figure).
- 3) Touch the **End Call** Button.



Figure 8-65 Ending the Call



Figure 8-66 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.

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 appropriate Touchscreen Controller. When the call is ended, telephone audio is automatically disabled. The green **Pilot Audio** Annunciator Button in the following figure indicates the enabled pilot audio on the pilot-side Touchscreen Controller. Pilot and copilot telephone audio can be enabled and disabled manually by performing the following steps.

Enabling/disabling telephone audio and adjusting volume:

- 1) From MFD Home, touch **Services > Telephone**.
- 2) Touch the **Cockpit** Phone Button. The Cockpit Phone Screen is displayed as shown in the following figure.



Figure 8-67 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 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 shown in the following figure, as well as a flashing SMS annunciation in the upper left corner of the PFD display.

Viewing a Text Message When Received:

- 1) Touch the flashing **SMS** Button as shown in the following figure. The **SMS Text Inbox** Tab is automatically selected and the newly received text message is shown at the top of the list, as in the following figure.



Figure 8-68 New SMS Text Message Annunciation

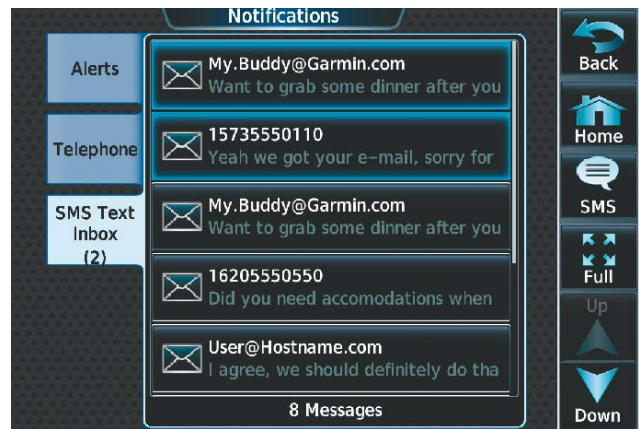


Figure 8-69 New Text Message at Top of List

- 2) Touch the desired message to display its contents as seen in the following figure.



Figure 8-70 New Text Message Contents

- 3) If desired, touch **Reply** to create a reply to the message.
- 4) Touch **Delete** to delete the message from the list.
- 5) Touching **Save Contact** 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 MFD Home, touch **Services** > **SMS Text** (see following figure).

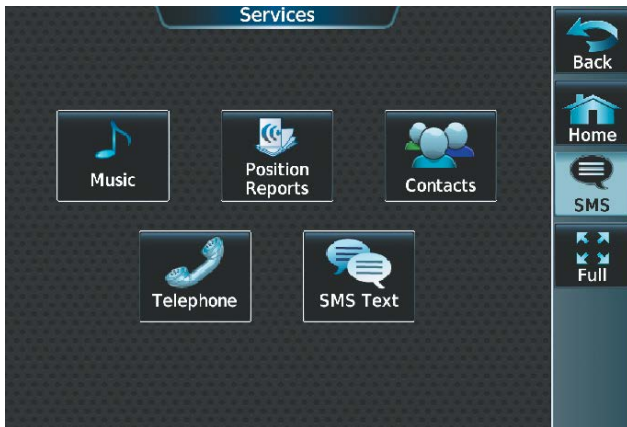


Figure 8-71 SMS Text Services Selection

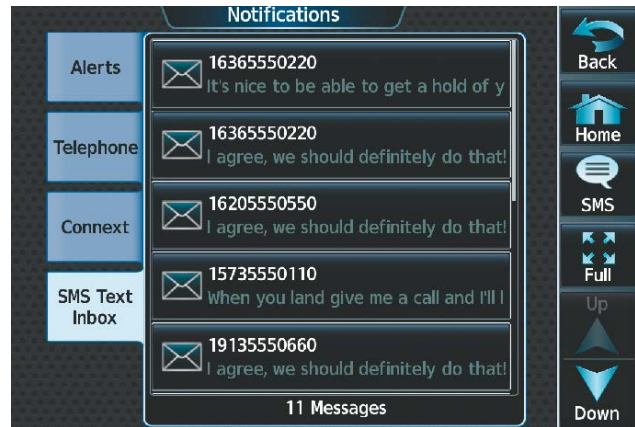


Figure 8-72 Touch Desired Message

- 2) Touch the desired text message in the Inbox list (see previous figure). If necessary, scroll to the desired message. The text message is displayed (see following figure).
- 3) Touch the **Reply** Button. The SMS Text Message Draft Screen is displayed.

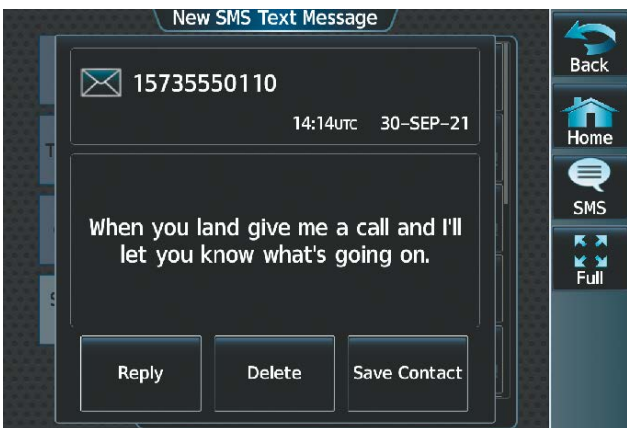


Figure 8-73 Message Content



Figure 8-74 New Reply Message Screen

- 4) Touch the 'Message' Window to display the alphanumeric buttons.



Figure 8-75 Message Content

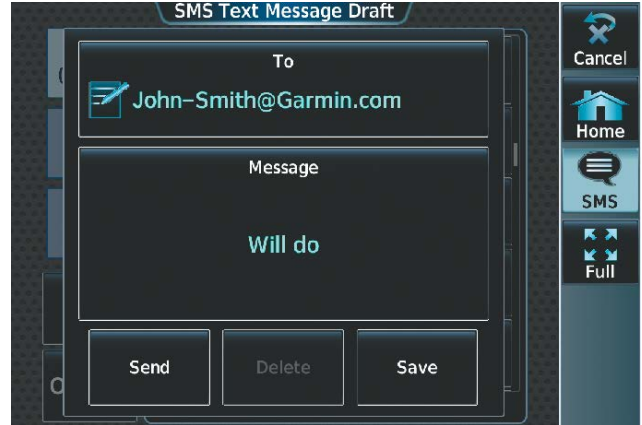


Figure 8-76 Reply Message

- 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 as in the previous figure.
- 7) Touch the **Send** Button. The SMS Text Message Replied To Screen is displayed as seen in the following figure.

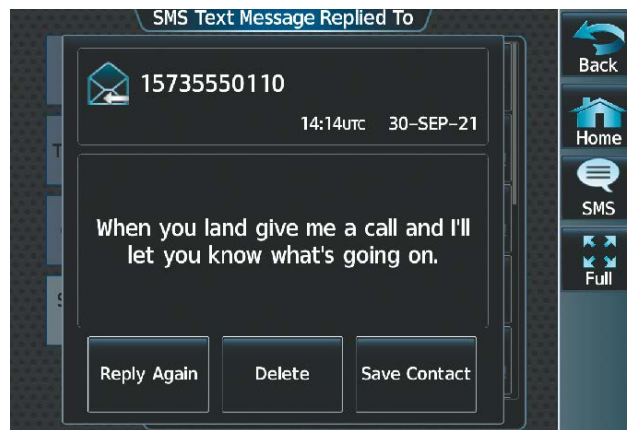


Figure 8-77 Reply Message Sent

- 8) If desired, touch the **Reply Again** Button to send another reply.
- 9) Touch **Delete** to delete the message from the list.
- 10) Touching **Save Contact** saves the contact information in the system contact list.

Sending a Text Message:

- 1) From MFD Home, touch **Services > SMS Text**.



Figure 8-78 SMS Text Services Selection



Figure 8-79 Touch Desired Message

- 2) Touch the **Draft New** Button. The Opened SMS Text Message Draft Screen is displayed as shown in the following figure. The **Draft New** Button is also available from within the **Drafts** and **Outbox** Tabs.

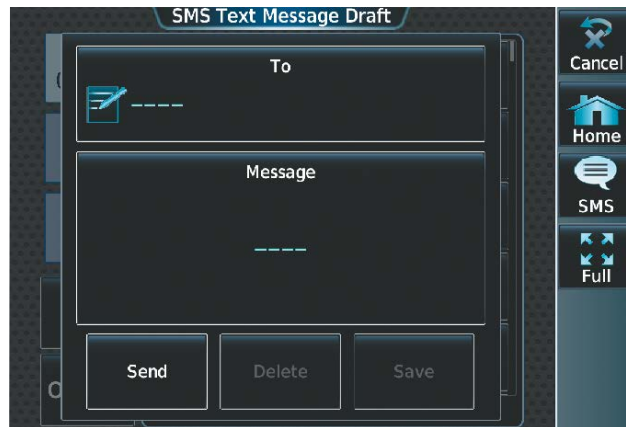
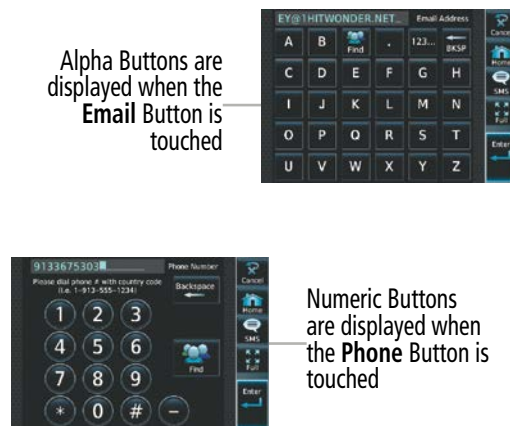


Figure 8-80 Touch 'To' Window

- 3) Touch the 'To' Window. A selection screen is displayed like in the following figure. If the text message is to be sent to SMS compatible telephone, touch the **Phone** Button. If the message is to be sent to an email address, touch the **Email** Button.



Figure 8-81 Select Message Destination



Alpha Buttons are displayed when the **Email** Button is touched

Numeric Buttons are displayed when the **Phone** Button is touched

Figure 8-82 Enter Number or Address

- 4) Enter the telephone number or email address as seen in the previous figure. The number or address may be obtained from the Contacts by touching the **Find** Button.
- 5) Touch the **Enter** Button. The number or address is now displayed as in the following figure.
- 6) Touch the 'Message' Window. The alphanumeric buttons are displayed as in the following figure.

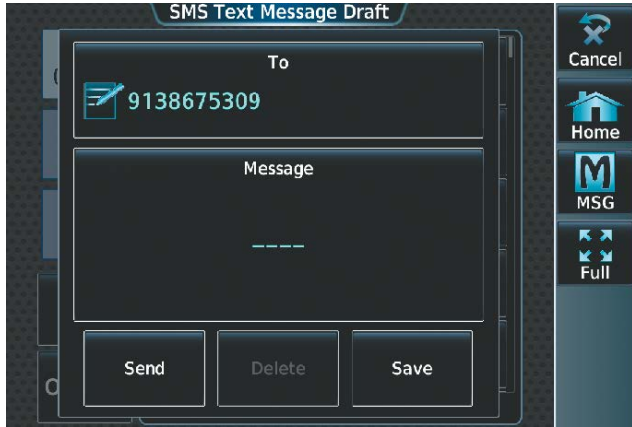


Figure 8-83 Touch Message Window



Figure 8-84 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 as shown in the following figure.

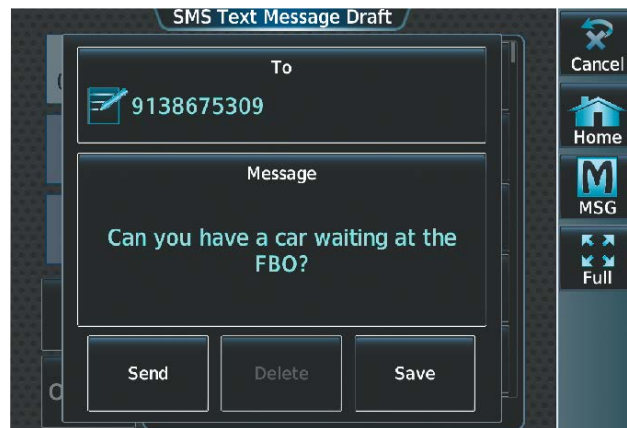


Figure 8-85 Message Ready to Send

- 9) Touch the **Send** Button.

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 MFD Home, touch **Services** > **SMS Text**.
- 2) Touch the **Inbox** Tab. A list of received messages is displayed as in the following figure. The **Inbox** Tab is selected by default when accessing the SMS Text Messaging Screen.



Figure 8-86 SMS Text Inbox

Viewing Draft messages:

- 1) From MFD Home, touch **Services** > **SMS Text**.
- 2) Touch the **Draft** Tab. A list of draft messages is displayed as in the following figure, provided messages have been previously saved.
- 3) Touch a message to access the **Send** or **Delete** Buttons.



Figure 8-87 SMS Text Drafts

Viewing Outbox messages:

- 1) From MFD Home, touch **Services** > **SMS Text**.
- 2) Touch the **Outbox** Tab. A list of sent or unsent messages is displayed as in the following figure.
- 3) Touch a message to access the **Resend**, **Delete**, and **Save Contact** Buttons.

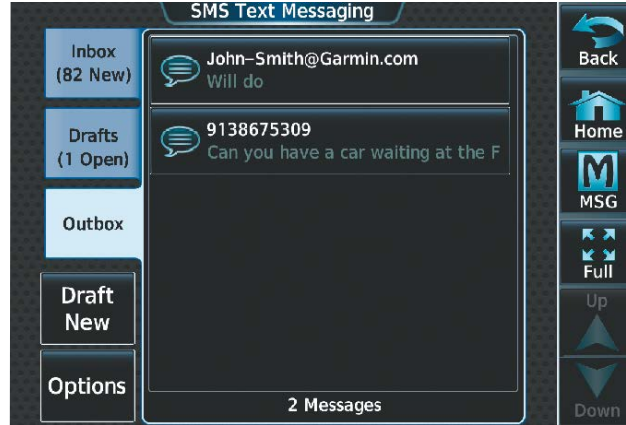


Figure 8-88 SMS Text Outbox

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 MFD Home, touch **Services** > **SMS Text**.
- 2) Touch the **Options** Button. The 'Sort Messages By' selections are displayed as in the following figure.

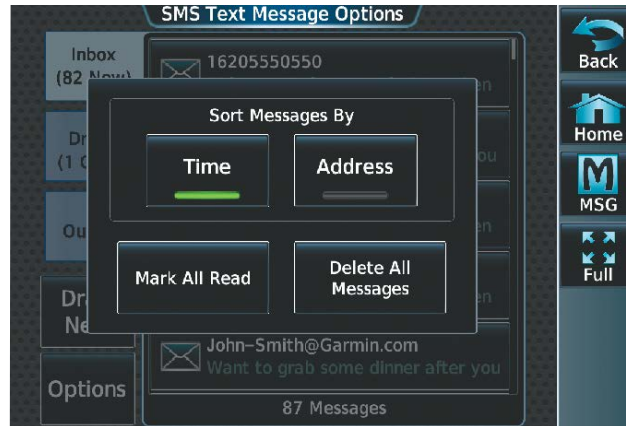


Figure 8-89 Message Sort Options

- 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 MFD Home, touch **Services** > **SMS Text**.
- 2) Touch the **Options** Button. The 'Sort Messages By' selections are displayed as in the previous figure.
- 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 MFD Home, touch **Services** > **SMS Text**.
- 2) Touch the **Options** Button. The selection buttons are displayed as in the previous figure.
- 3) Touch the **Mark All Read** Button to mark all messages as read, and return to the Inbox. All messages in the Inbox now indicate they have been opened.

Deleting all messages:

- 1) From MFD Home, touch **Services** > **SMS Text**.
- 2) Touch the **Options** Button. The selection buttons are displayed as in the previous figure.
- 3) Touch the **Delete All Messages** Button. A confirmation screen is displayed as in the following figure.

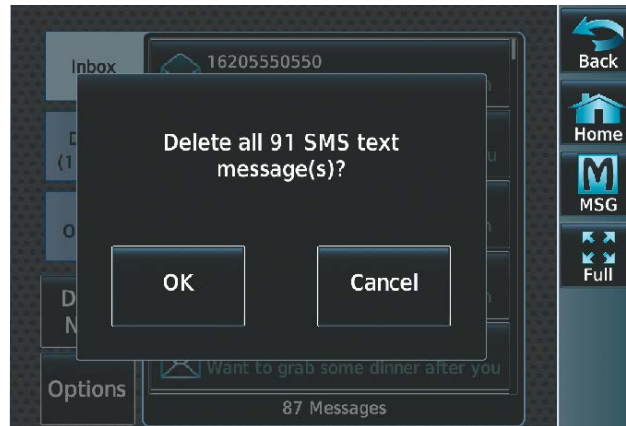


Figure 8-90 Confirm Deletion of Messages

- 4) Touch the **OK** Button.

8.7 WIFI CONNECTIONS (OPTIONAL)

If installed, WiFi connections are used for transferring maintenance data to the aircraft manufacturer. The system can connect to a IEEE 802.11g compatible network provided the aircraft is on the ground and located within range of a network. The system is capable of WEP64, WEP128, WPA-PSK, and WPA2-PSK encryption formats. WPA-Enterprise and WPA2-Enterprise are not supported. Connections that require web proxies, captive portals, or other elements that require user credentials, including a username and password or a redemption or access code; or require action such as accepting a user agreement, are not supported.

Connecting to a WiFi network:

- 1) From MFD Home, touch **Utilities > Setup > Wireless Setup > WiFi Setup**.
- 2) A list of available WiFi networks is displayed as in the following figure. If necessary, scroll the displayed list of networks to find the desired network. If a specific network is expected to be present in the list, but is not displayed, try rescanning networks by performing the following steps:
 - a) Touch the **WiFi Options** Button.
 - b) Touch the **Rescan** Button as seen in the following figure.



Figure 8-91 WiFi Networks Available for Connection



Figure 8-92 Rescan Networks

- 3) Touch the network to be connected. In this example, GarminGuests is selected. A confirmation screen is displayed as in the following figure.

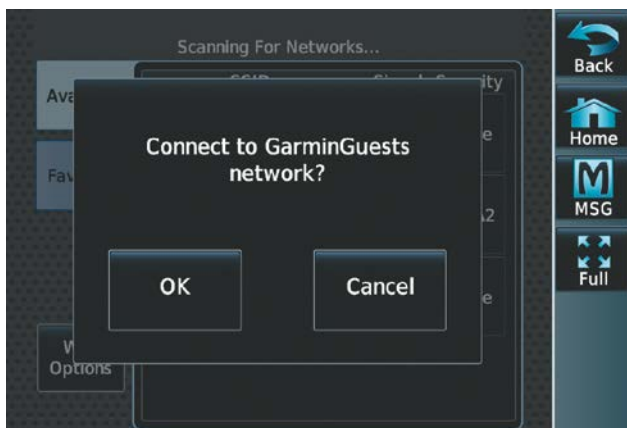


Figure 8-93 Confirm Network Connection

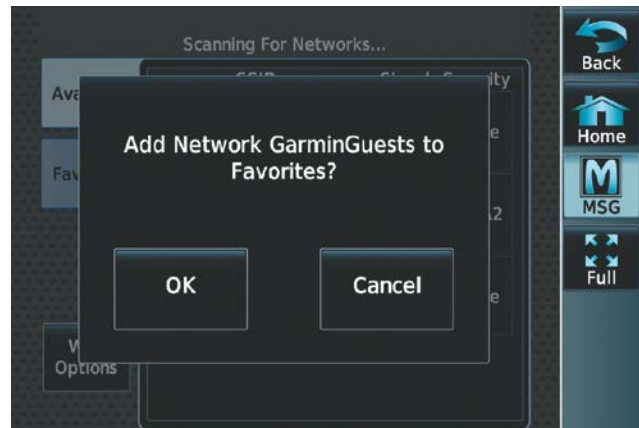


Figure 8-94 Confirm Favorite Selection

- 4) Touch **OK**. If there is not an airport associated with this network, the system will ask if an airport should be associated with this network. Answer **Yes** to associate the closest airport to the current position to the network, or **No** to not associate an airport. The system now asks if it is desired to make the connected network a Favorite, as shown in the previous figure.
- 5) Touch **OK** to place the network in the Favorites list, or touch **Cancel** to connect to the selected network without making it a Favorite network. Networks shown in the Available networks list which have been designated as a Favorite network are indicated by a star, as shown in the following figure. Connected networks are indicated by a green antenna symbol as seen in the following figure.



Figure 8-95 Favorite Network Indication



Figure 8-96 Connected Network Indication

Disconnecting a WiFi network:

- 1) From MFD Home, touch **Utilities > Setup > Wireless Setup > WiFi Setup**.
- 2) Touch the **WiFi Options** Button.
- 3) Touch **Disconnect**.

Making changes to a Favorite network:

- 1) From MFD Home, touch **Utilities > Setup > Wireless Setup > WiFi Setup**.
- 2) Touch the **Favorites** Tab to display the Favorite networks list, as in the following figure.
- 3) Touch the network to which changes will be made. The Network Options are displayed as shown.



Figure 8-97 Favorite Networks List



Figure 8-98 Network Options

- 4) Touch **Auto Connect**, as in the previous figure to enable (green annunciator) an automatic connection to this network whenever the aircraft is on the ground and in range of the network.
- 5) Touch **Edit** to display the edit screen as in the following figure.



Figure 8-99 Edit Favorite Network

- 6) Touch the desired parameter for editing and make selections accordingly.
- 7) When finished making desired changes, touch **Save**.

8.8 CONNEXT SETUP

The Connex Setup Screen allows for setting up the installed Flight Stream device for a Bluetooth connection between the system and a mobile device running the Garmin Pilot™ application.

The mobile device must be ‘paired’ with the system in order to use the various functions. Pairing is accomplished by first placing the system in pairing mode by displaying the Connex 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. See the device Bluetooth pairing instructions and the connection instructions in the Garmin Pilot application.

Viewing the Connex Setup Page:

- 1) From MFD Home, touch **Utilities > Setup > Wireless Setup**.
- 2) Touch **Connex**.

Changing the Bluetooth Name:

- 1) From the Connex Setup Screen, touch the **Bluetooth** Tab.
- 2) Touch the **Bluetooth Device Name** window to display the alphanumeric buttons.
- 3) Enter the desired name using the alphanumeric buttons.



Figure 8-100 Connex Setup Bluetooth Device Info



Figure 8-101 Edit Bluetooth Device Name

Enabling/Disabling Flight Plan Importing from Garmin Pilot:

- 1) While viewing the Connex Setup Screen, touch **Import Functions**.
- 2) Touch **Enable** to enable (green annunciator) Flight Plan Import from Garmin Pilot (see following figure).



Figure 8-102 Enable/Disable Database and/or Flight Plan Import

Enabling/Disabling WiFi Database Importing from Garmin Pilot:

- 1) While viewing the Connex Setup screen, touch **Import Functions**.
- 2) Touch **Enable** to enable (green annunciator) WiFi Database Import from Garmin Pilot (see previous figure).

Enabling/Disabling Automatic Reconnection of a Specific Paired Device:

- 1) While viewing the Connex Setup Screen, touch the **Paired Devices** Tab.
- 2) Touch **Enable** to enable (green annunciator) Auto Reconnect to the desired paired device (see following figure).



Figure 8-103 Bluetooth Device Info.

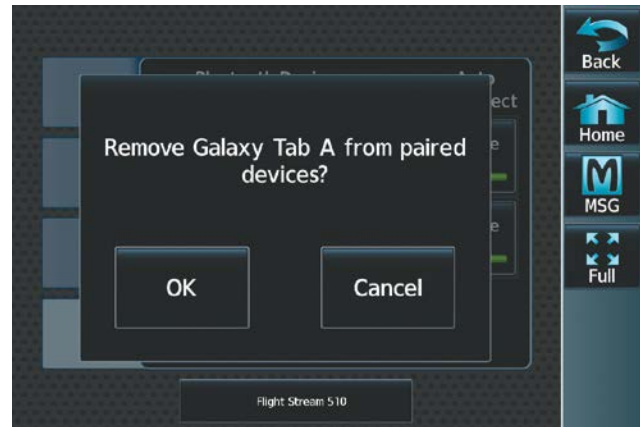


Figure 8-104 Editing the Bluetooth Name.

Removing a Specific Paired Device from the List of Paired Devices:

- 1) While viewing the Connex Setup Screen, touch **Paired Devices** Tab.
- 2) Touch the Bluetooth Device Name to be removed.
- 3) A confirmation screen is displayed asking to remove the paired Bluetooth device.
- 4) Touch **OK** to remove the device from the list of paired devices (see previous figure).

8.9 SIRIUSXM SATELLITE RADIO (OPTIONAL)



NOTE: Refer to the Hazard Avoidance Section for information and activation of SiriusXM Weather products.

The optional SiriusXM Satellite Radio entertainment feature of the SiriusXM Datalink Receiver provides audio entertainment for the flight. 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.

ACTIVATING SIRIUSXM SATELLITE SERVICES

The SiriusXM Radio services are activated by first establishing an account with SiriusXM Satellite Radio. The Audio 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.

The Audio Radio ID is located:

- On the label on the back of the Datalink Receiver.
- On the XM Information 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 MFD Home, touch **Utilities > Setup > SiriusXM Info**.
- 2) Note the Audio Radio ID and Data Radio ID as seen in the following figure.
- 3) Contact SiriusXM Satellite Radio. Follow the instructions provided by SiriusXM Satellite Radio services.



Figure 8-105 XM Information Display

USING SIRIUSXM RADIO

The Music Screen provides information and control of the cockpit audio entertainment features of the SiriusXM Satellite Radio. The in-flight entertainment is a separate system and is controlled separately.



Figure 8-106 SiriusXM Satellite Radio Controls

SELECTING CHANNELS

The Channel field 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 MFD 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 MFD 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, such as jazz, rock, talk/news, sports, etc., can be selected to list the available channels for a type of music or other contents.

Selecting a category:

- 1) From MFD Home, touch **Services > Music > Category**.
- 2) The list of categories is displayed as shown in the following figure.

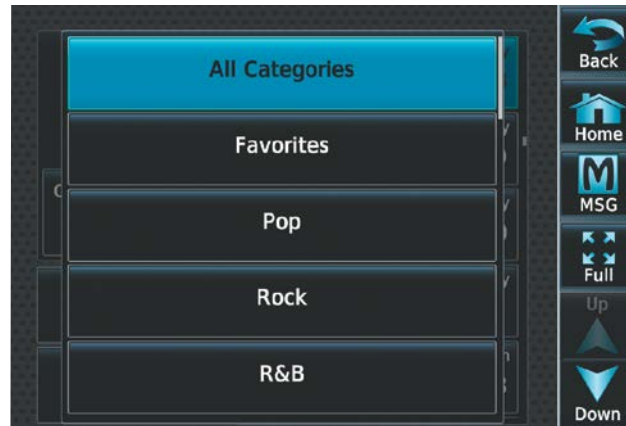


Figure 8-107 Channel Categories

- 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 MFD Home, touch **Services > Music** to access the Music Screen.
- 2) Select a desired channel 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 MFD 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 favorite channel list.
- 5) Touch the desired channel in the list. The channel is now displayed in the Now Playing field.

ADJUSTING VOLUME

Pilot SiriusXM entertainment audio volume is shown on the **Volume** Button on the Music Screen 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, is present.

Adjusting the SiriusXM audio volume:

- 1) From MFD Home, touch **Services > Music > Volume**.
- 2) The volume adjustment slider is displayed as shown in the following figure.

- 3) Touch and drag the slider to the right or left to adjust the volume. Drag to the right increases volume. Drag to the left to decrease the volume.

Or:

Turn the **Volume** Knob on the Touchscreen Controller.

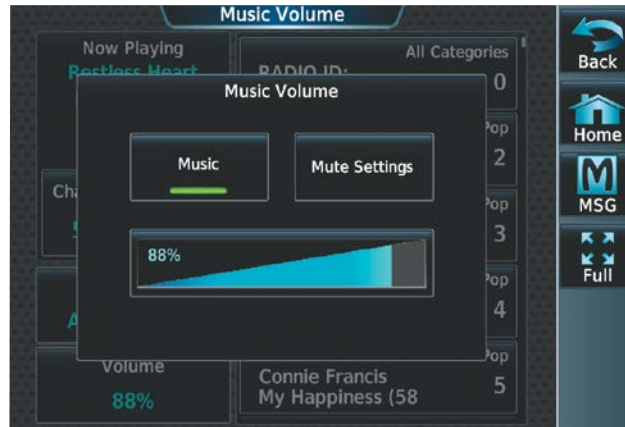


Figure 8-108 Adjusting Volume

Muting or unmuting the SiriusXM audio volume:

- 1) From MFD 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 Volume field.

AUTOMATIC MUSIC MUTING

Cockpit music is automatically muted when power is applied to the system. Music may be unmuted by the pilot or copilot at any time, but the system will again mute cockpit music when any of the following occur.

- » Aircraft is on the ground and accelerates to greater than 40 KIAS
- » Aircraft descends below 10,000 feet MSL or 2000 feet AGL
- » Aircraft decelerates to less than 150 KIAS
- » Aircraft enters an unusual pitch or roll attitude sufficient to cause PFD display decluttering
- » MFD enters reversionary mode

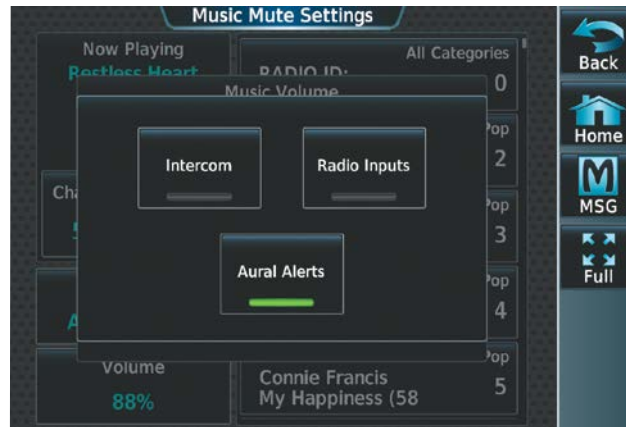
When enabled, the system will decrease music volume to a very low level (soft mute) when the following occur:

- » **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 MFD 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 8-109 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.

8.10 FLIGHT DATA LOGGING



NOTE: Some aircraft installations may not provide all aircraft/engine data capable of being logged by the system.

The Flight Data Logging feature will automatically store critical flight and engine data on an SD data card (up to 16GB) inserted into the top card slot of the MFD. Approximately 1,000 flight hours can be recorded for each 1GB of available space on the card. 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.

The following is a list of data parameters the system is capable of logging for the aircraft.

- Date
- Time
- GPS altitude (MSL)
- GPS altitude (WGS84 datum)
- Baro-Corrected altitude (feet)
- Baro Correction (in/Hg)
- Indicated airspeed (kts)
- Vertical speed (fpm)
- GPS vertical speed (fpm)
- OAT (degrees C)
- True airspeed (knots)
- Pitch Attitude Angle (degrees)
- Roll Attitude Angle (degrees)
- Lateral and Vertical G Force (g)
- Ground Speed (kts)
- Ground Track (degrees magnetic)
- Latitude (degrees; geodetic; +North)
- Longitude (degrees; geodetic; +East)
- Magnetic Heading (degrees)
- HSI source
- Selected course
- Com1/Com2 frequency
- Nav1/Nav2 frequency
- CDI deflection
- VDI/GP/GS deflection
- Wind Direction (degrees)
- Wind Speed (knots)
- Active Waypoint Identifier
- Distance to next waypoint (nm)
- Bearing to next waypoint (degrees)
- Magnetic variation (degrees)
- Autopilot On/Off
- AFCS roll/pitch modes
- AFCS roll/pitch commands
- GPS fix
- GPS horizontal alert limit
- GPS vertical alert limit
- SBAS GPS horizontal protection level
- SBAS GPS vertical protection level
- Fuel Qty (lbs)
- Fuel Flow (pph)
- Fuel Temperature (deg. C)
- Oil Pressure (psi)
- Oil Temperature (deg. C)
- N1, N2 (percent)
- ITT (deg. C)

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.

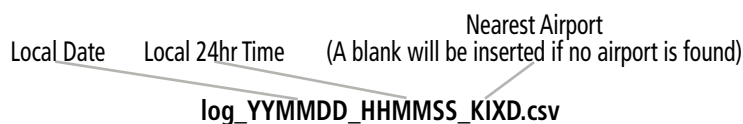


Figure 8-110 Flight Data Log File Format

8.11 AUXILIARY VIDEO (OPTIONAL)

If installed, the system provides a control and display interface for an Enhanced Vision System.

Displaying auxiliary video:

From MFD Home, touch **Aircraft Systems > Video > Video Settings**. The Video Settings Screen is displayed on the Touchscreen Controller, as shown in the following figure. Video is displayed on the selected Display Pane.

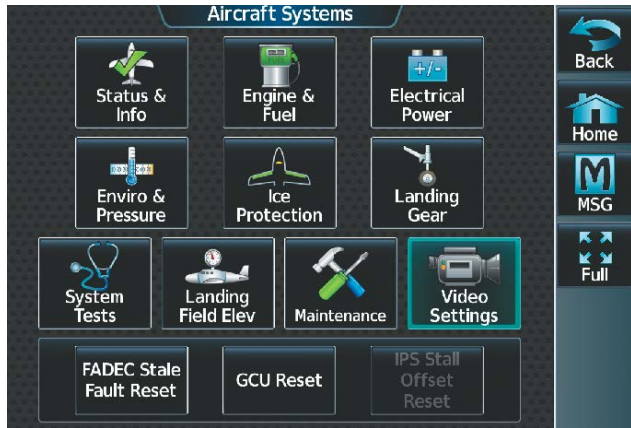


Figure 8-111 Aircraft Systems Screen

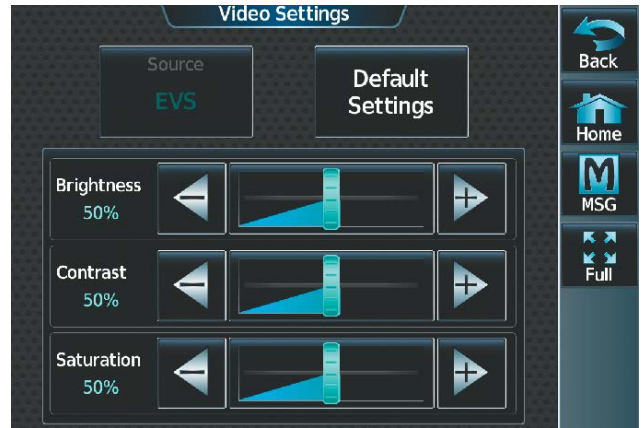


Figure 8-112 Video Controls

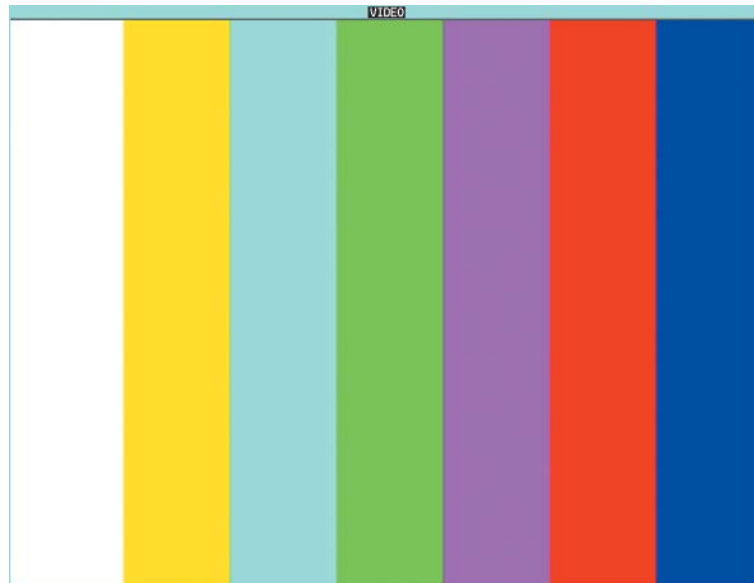


Figure 8-113 Video Display

Adjusting the video settings:

- 1) From MFD Home, touch **Aircraft Systems > Video > Video Settings**.
- 2) To adjust the Video Display brightness, touch and slide the **Brightness** Slider on the Touchscreen Controller.

Or:

Touch the **+** pointer to increase brightness, or **-** pointer to decrease brightness. Each touch increases or decreases one percent. The brightness setting is displayed in the **Brightness** field as a percent of maximum brightness.

- 3) To adjust the Video Display contrast, touch and slide the **Contrast** Slider on the Touchscreen Controller.

Or:

Touch the **+** pointer to increase contrast, or **-** pointer to decrease contrast. Each touch increases or decreases one percent. The contrast setting is displayed in the **Contrast** field as a percent of maximum contrast.

- 4) To adjust the Video Display saturation, touch and slide the **Saturation** Slider on the Touchscreen Controller.

Or:

Touch the **+** pointer to increase saturation, or **-** pointer to decrease saturation. Each touch increases or decreases one percent. The saturation setting is displayed in the **Saturation** field as a percent of maximum saturation.

- 5) Touch the **Default Settings** Button to return the video settings to the factory settings.

Adjusting the Video Display zoom:

Turning the lower knob increases or decreases video display magnification between 1x and 2x.

8.12 ELECTRONIC DOCUMENTS

If 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 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 with large and/or numerous images may exceed RAM memory limits, therefore, may not be displayed correctly or not displayed at all.

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 Card inserted in that display.

User Documents can be 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., for 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 MFD Home, touch **Utilities > Documents**. The Document Viewer is now displayed as in the following figure.

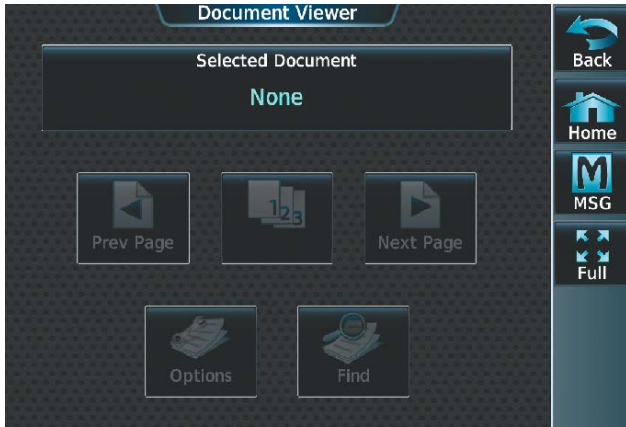


Figure 8-114 Electronic Document Viewer

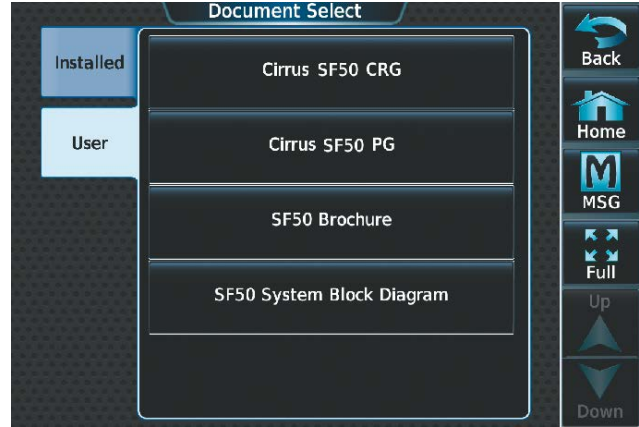


Figure 8-115 Document Selection

- 2) Touch the **Selected Document** Button.
- 3) Touch the **Installed** Tab or the **User** Tab to select the desired document source as seen in the previous figure. In this example, User documents are selected.
- 4) Touch the desired document button. The selected document name is displayed in the **Selected Document** Button, as shown in the following figure. The document is displayed in the selected pane.



Figure 8-116 Selected Document Indicated

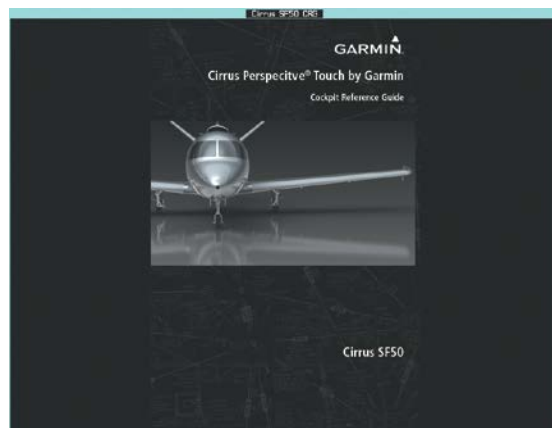


Figure 8-117 Document Viewed on Selected Display Pane

Changing document viewer options:

- 1) From MFD Home, touch **Utilities > Documents > Options**. The Document Viewer Options Screen is displayed as in the following figure.
- 2) Touch the **Document Info** Button to view information pertaining to the document, such as files size and creation date.



Figure 8-118 Document Viewer Options

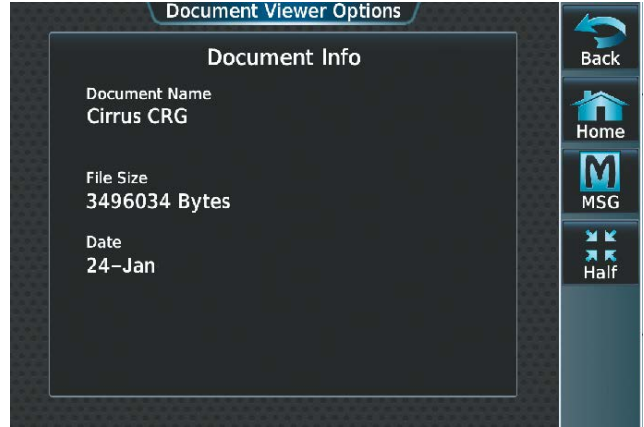


Figure 8-119 Document Information

- 3) Touch the **Fit Page** Button to view the complete page in the selected pane (see previous figure).
- 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 rotate the displayed page 90 degrees to the right or left (depending on button touched) within the selected pane. Each subsequent touch will rotate the page another 90 degrees.
- 6) Touch and move 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 approximately five percent.

Browsing the document:

- 1) After selecting the desired document, touch the **Next Page** Button to increment one page or the **Prev Page** Button to decrement one page.
- 2) The Page Select Button (see following figure) 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.

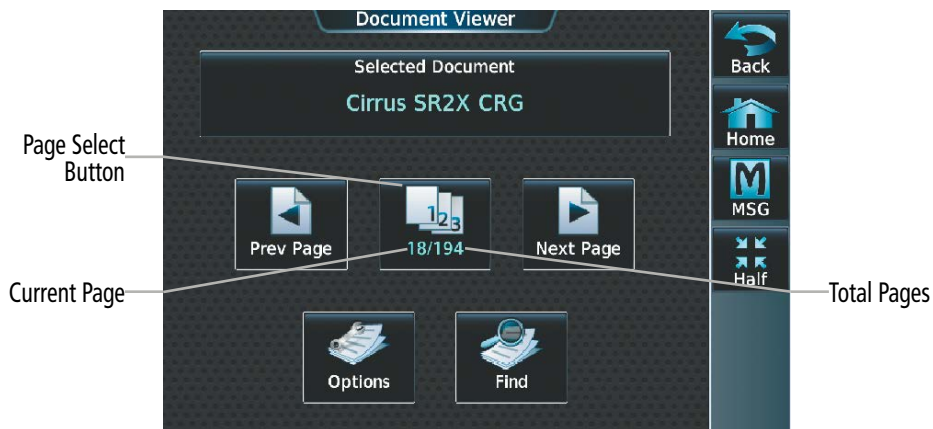


Figure 8-120 Document Browsing Options

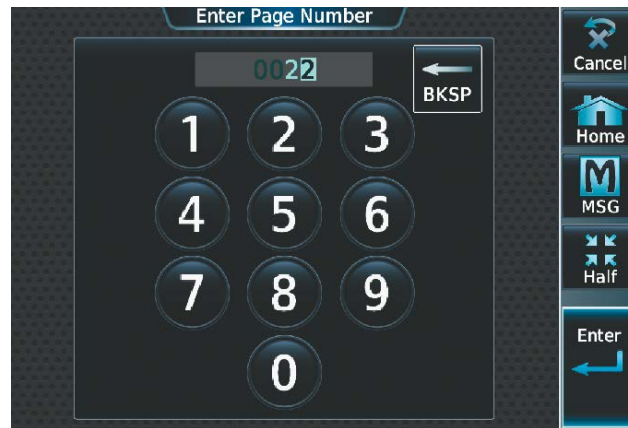


Figure 8-121 Enter Document Page Number

- 3) Touch the **Find** Button to display the Document Viewer Find screen as shown in the following figure.

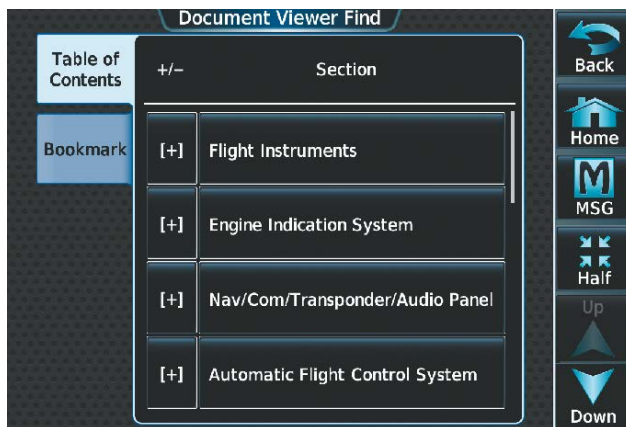


Figure 8-122 Table of Contents

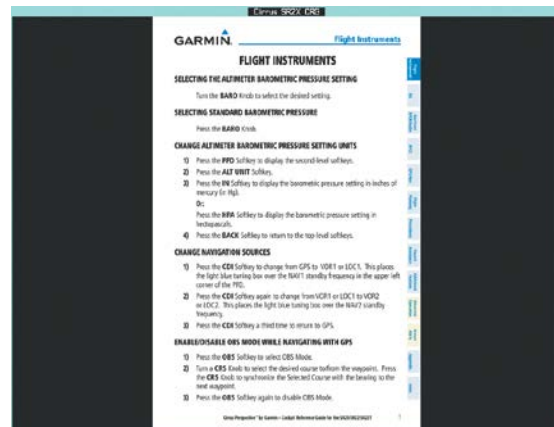


Figure 8-123 Flight Instruments Section Displayed

- 4) If necessary, touch the **Table of Contents** Tab to display the document Table of Contents.
- 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 button to jump to that portion of the document. In this example, Flight Instruments is selected and the Flight Instruments section is displayed (see previous figure).

Zooming in and out on a document page:

- 1) With the document displayed, press 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 following figure.
- 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 as illustrated in the following figure.
- 3) Turn the upper knobs, or move a finger across the Touchpad as indicated in the following figure to move the pointer within the document. When the pointer reaches the edge of the display, the display will scroll to show more the document page.

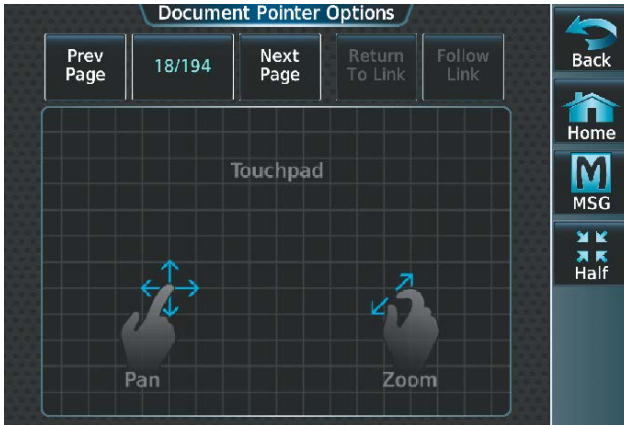


Figure 8-124 Touchpad

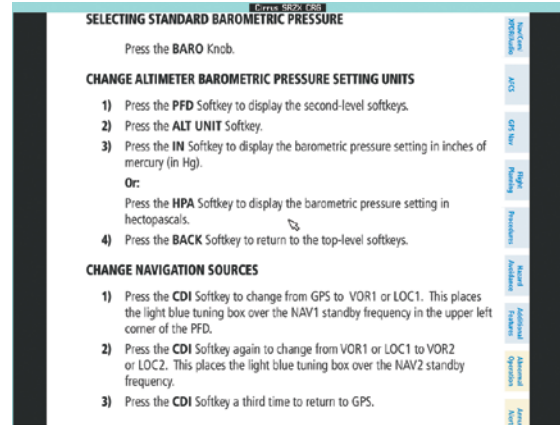


Figure 8-125 Page Zoom

Navigating links within the document:

- 1) With the document displayed, press 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.

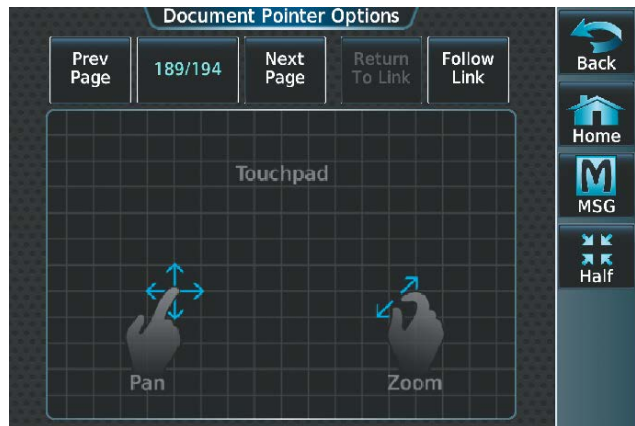
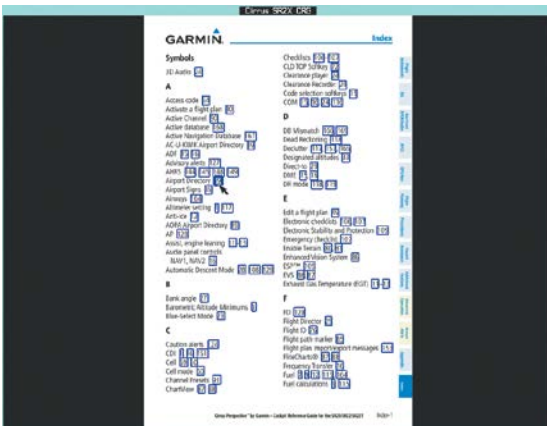


Figure 8-126 Link Selected

- 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 as indicated in the following figure.

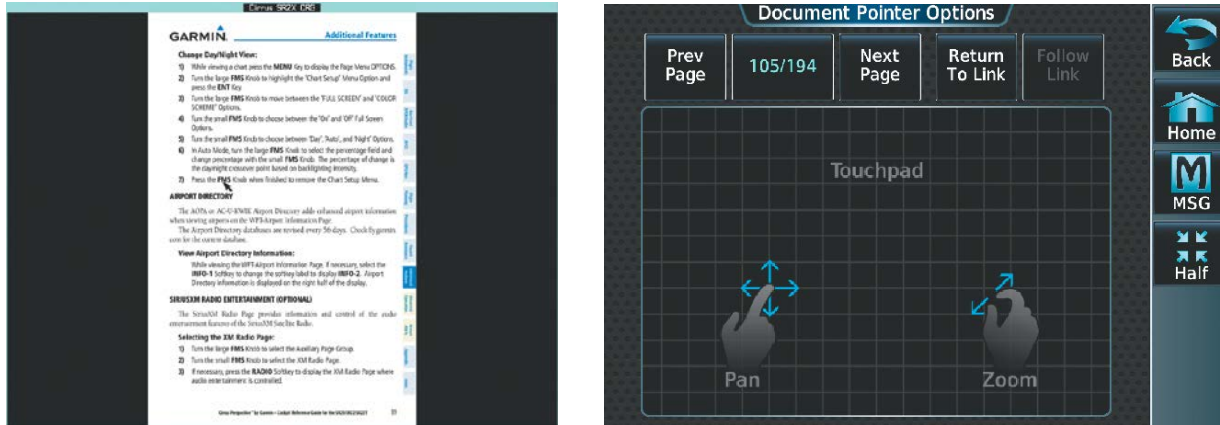


Figure 8-127 Follow Displayed Link

- 4) Touch the **Return To Link** Button (see previous figure) to return to the link origin.
- 5) Touch the **Back** Button, press the upper knob, or press the lower knob to remove the pointer from the display and return to the Document Viewer Screen.

Creating bookmarks in the document:

- 1) While viewing the page to bookmark, touch the **Find** Button on the appropriate Touchscreen Controller.
- 2) Touch the **Bookmark** Tab to display the Bookmark Window as in the following figure.

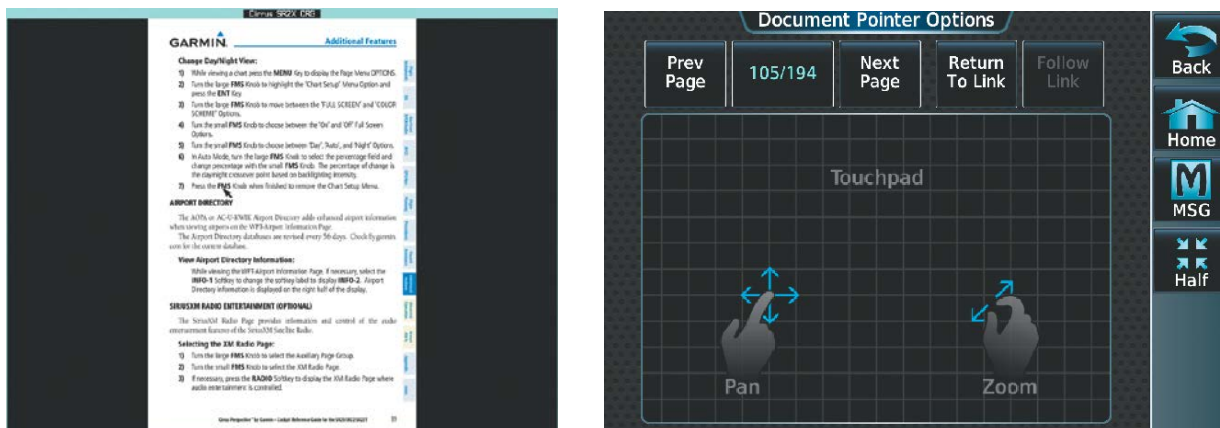


Figure 8-128 Follow Displayed Link

- 3) Touch the **Bookmark Current Page** Button. The Enter Bookmark Name Screen is displayed as shown in the previous figure.
- 4) Touch **Enter**. A confirmation screen is displayed as seen in the following figure.

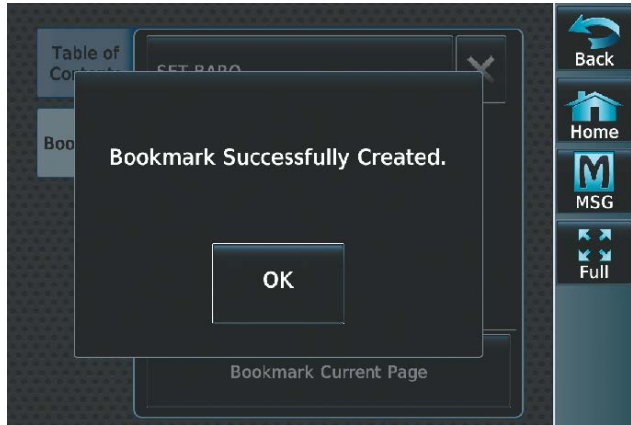


Figure 8-129 Create Bookmark



Figure 8-130 Bookmark Created

- 5) Touch **OK**. 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 to display the Bookmark Window.
- 3) Touch the **X** Button next to the bookmark to be deleted (see previous figure).

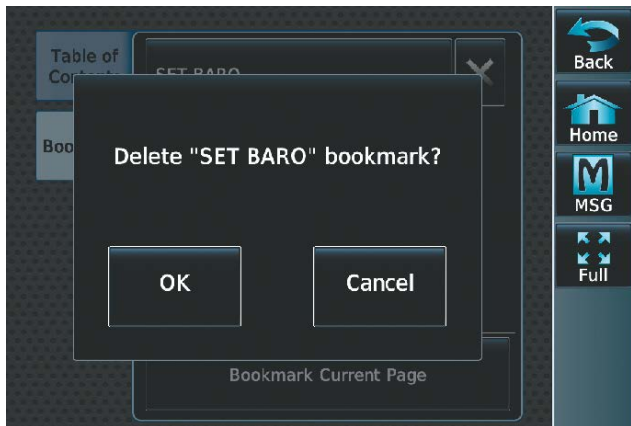


Figure 8-131 Delete Bookmark

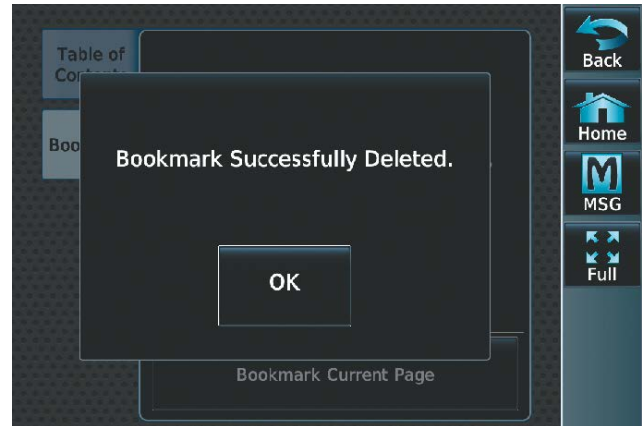


Figure 8-132 Bookmark Deleted

- 4) Touch **OK** on the confirmation screen as in the previous figure.
- 5) Touch **OK** to acknowledge deletion of the bookmark (see previous figure), and return to the Document Viewer Find Screen.

8.13 ELECTRONIC CHECKLISTS



NOTE: The checklist shown in the following illustrations are examples only.

The Display Panes are able to display optional electronic checklists which allow the pilot to quickly find the proper procedure on the ground and during each phase of flight. The system accesses the checklists from the Secure Digital (SD) cards located in the top card slot of each GDU. In addition to the system controls, the **Checklist Advance** Button located between the PFD and MFD may be used to check/advance or uncheck/advance checklist items.

The following colors are used for checklist items:

- **Cyan:** Used for checklist titles and links to other checklists
- **White:** Item not checked
- **Green:** Item has been checked
- **Gray:** General notes
- **Amber:** Caution item
- **Red:** Warning item

Accessing and navigating checklists:

1) From MFD Home, touch the **Checklist** Button. The checklist structure is displayed as shown in the following figure.

Or:

Press the dedicated checklist button. The checklist structure is displayed below.

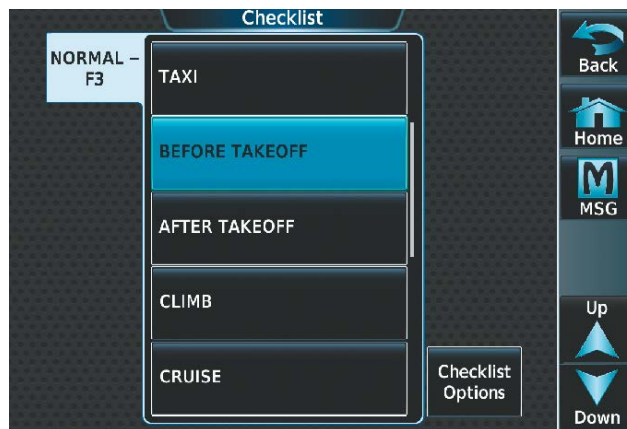


Figure 8-133 List of Checklists

2) Touch the desired checklist from those listed in the center of the screen. If necessary, scroll through the list to see all the available checklists for the selected group. In the previous figure, **BEFORE TAKEOFF** is selected and the checklist is displayed in the previously selected display pane as in the following figure. The first checklist item is selected as indicated by the white text surrounded by a cyan box.



Figure 8-134 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 checkmark is placed in the associated box as shown in the following figure. The next line item is automatically selected for checking.



Figure 8-135 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 checkmark 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 8-136 Checklist Complete

- 5) While the 'Go to Next Checklist?' text is highlighted, press the lower knob on the Touchscreen Controller or the **Checklist Advance** Button to display the next checklist in the group or choose another by touching the desired checklist on the Touchscreen Controller.

Resetting a specific checklist:

- 1) From MFD Home, touch **Checklist**.
- 2) Touch the desired checklist to reset. **TAXI** is selected in the following figure.
- 3) Touch the **Checklist Options** Button.
- 4) Touch the **Reset Current Checklist** Button (see the following figure).



Figure 8-137 Checklist Screen

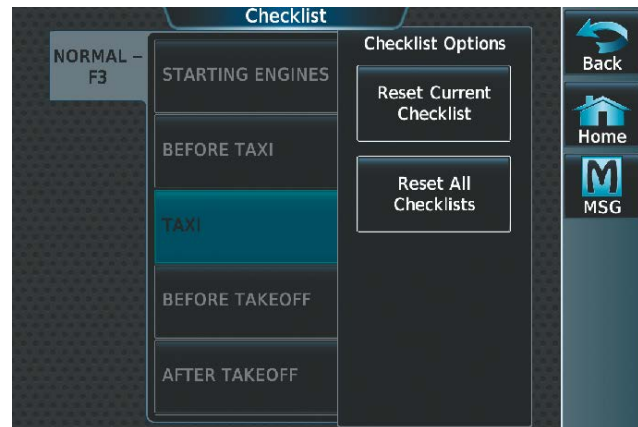


Figure 8-138 Checklist Options

Resetting all checklists:

- 1) From MFD Home, touch **Checklist**.
- 2) Touch the **Checklist Options** Button.
- 3) Touch **Reset All Checklists**.

8.14 ELECTRONIC STABILITY & PROTECTION (ESP)

Electronic Stability and Protection (ESP™) is a feature that is part of the Garmin Autonomi™ 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 (e.g., pitch, roll, V_{MO}, M_{MO}, and/or angle of attack) beyond the normal flight parameters. Enhanced stability for each condition is provided by applying a force to the appropriate control surface to return the aircraft to the normal flight envelope. This is perceived by the pilot as resistance to control movement in the undesired direction when the aircraft approaches a steep attitude, high airspeed, or when a stall is imminent.

As the aircraft deviates further from the normal attitude, angle of attack, or airspeed continues to increase, the force increases (up to an established maximum) to encourage control movement in the direction necessary to return to the normal attitude and/or airspeed range. Except in the case of high airspeed, when maximum force is reached, force remains constant up to the maximum engagement limit. Above the maximum engagement limit, forces are no longer applied. There is no maximum engagement related to a high airspeed condition.

The pilot can interrupt ESP by pressing and holding Autopilot Disconnect (**A/P DISC**) Switch. Upon releasing the **A/P TRIM 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 in the roll axis by overpowering the servo's mechanical torque limit.

ESP can be enabled or disabled on the **System** Tab of the Avionics Settings Screen on the MFD Touchscreen Controller.

Enabling/disabling ESP:

- 1) From MFD Home, touch **Utilities > Setup > Avionics Settings**.
- 2) If necessary, 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 on system power application.

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.

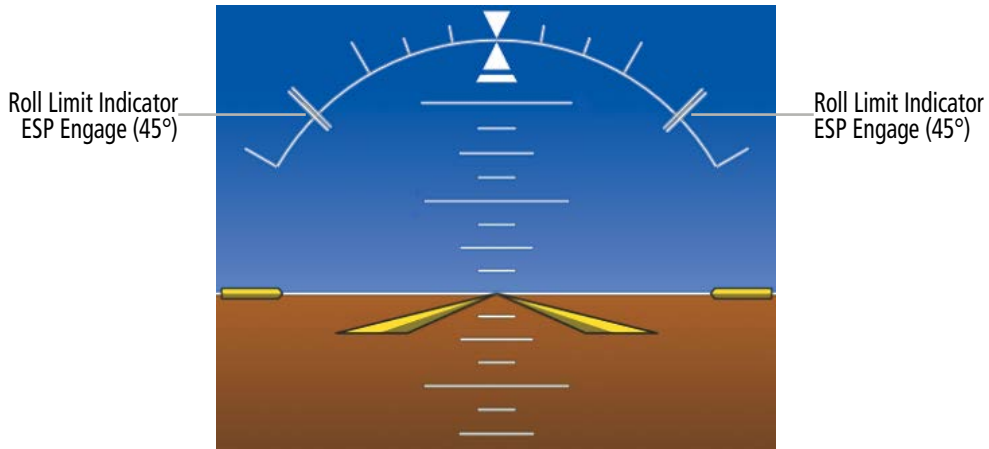


Figure 8-139 ESP Roll Engagement Indication (ESP NOT Engaged)

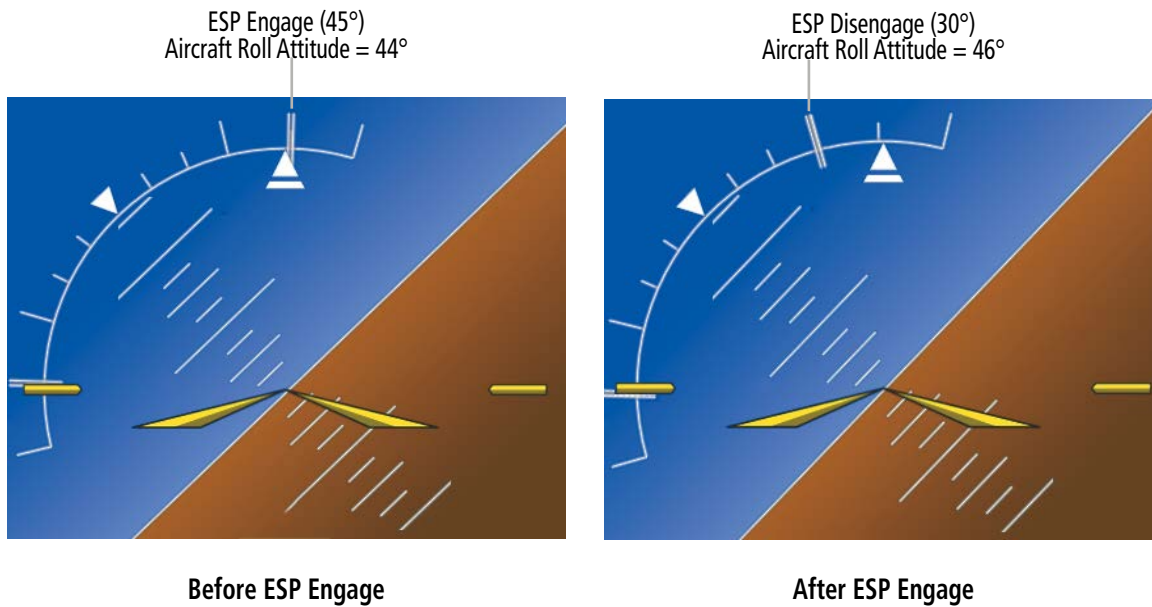
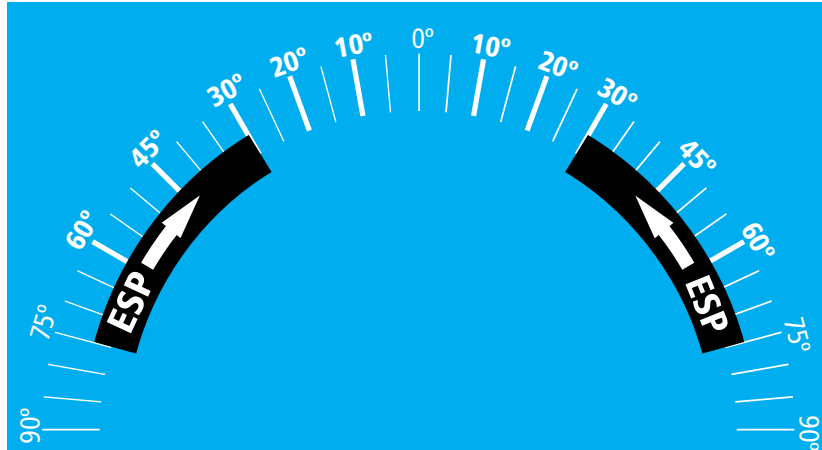


Figure 8-140 Roll Increasing to ESP Engagement

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 8-141 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).

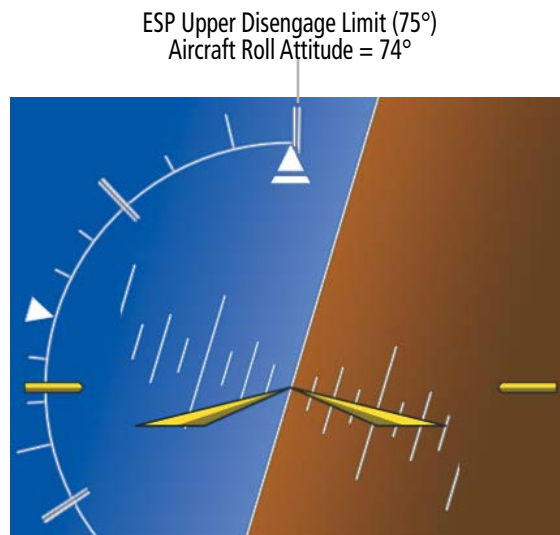


Figure 8-142 Roll Attitude Autopilot Engagement Limit (ESP Engaged)

PITCH ENGAGEMENT

ESP engages at 20° nose-up. Once ESP is engaged, it will apply opposing force between 17° and 50° nose-up, as indicated in the following figure. Maximum opposing force is applied between 25° and 50° nose-up.

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 conditions.

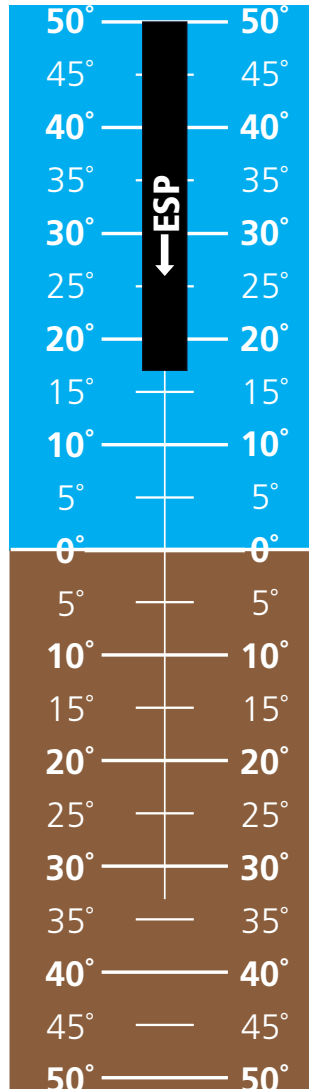


Figure 8-143 ESP Pitch Operating Range When Engaged
 (Force Increases as Pitch Increases & Decreases as Pitch Decreases)

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.

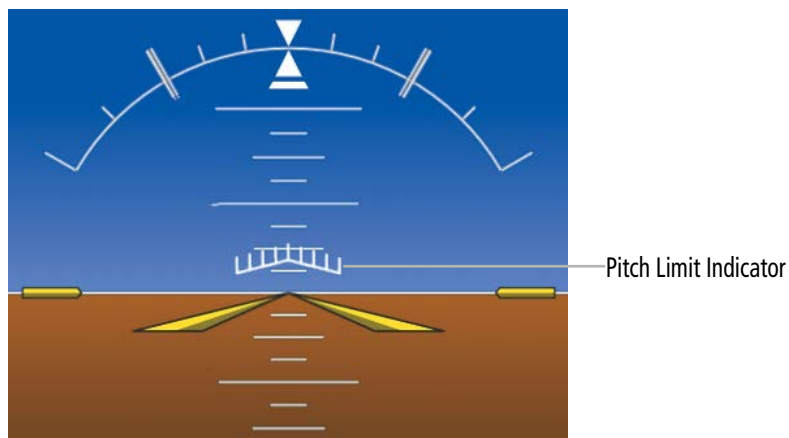


Figure 8-144 Pitch Limit Indicator

HIGH AIRSPEED PROTECTION

Exceeding V_{MO} or M_{MO} will result in ESP applying force to raise the nose of the aircraft. When the high airspeed condition is remedied, ESP force is no longer applied.

8.15 EMERGENCY AUTOLAND



NOTE: Do not use the Emergency Autoland feature for a non-emergency approach or landing. Upon activation, the system will automatically declare an emergency using multiple communication methods.

The Emergency Autoland (EAL) function allows the aircraft to perform a completely autonomous landing in an emergency situation due to pilot incapacitation or other condition resulting in the pilot being unable to operate the aircraft. Emergency Autoland may be engaged automatically or manually. The system automatically performs airport and runway selection, automatic Ice Protection System (IPS) management, automatic barometric altimeter setting adjustment, optimized routing for terrain, obstacle, and weather avoidance, descent path and speed management, aircraft configuration (e.g., flaps, gear) management, automated communication with occupants and ATC, landing of the aircraft, runway steering, and braking to a stop for passenger egress. This feature is to be used only in an emergency.

CONTRIBUTING SYSTEMS

There are multiple technologies required to support the Emergency Autoland capability. The following systems are utilized by Emergency Autoland:

- Garmin AFCS
 - » Autopilot
 - » Autothrottle
 - » Yaw Damper
- FMS
- Iridium Datalink Radio/Weather (Optional)
- Fuel Quantity
- Landing Gear Control
- Flap Control
- Radar Altimeter
- Wheel Speed Sensors
- Braking System

PHASES OF OPERATION

The Emergency Autoland feature is comprised of the following key phases of operation:

- Initiation, Preactivation, Activation, and Deactivation
- Airport and Runway Selection
- Flight Path Routing
- Aircraft Configuration Management
- Aircraft Automated Communication
- Approach, Flare, and Touchdown
- Rudder Steering and Braking
- Engine Shutdown

INITIATION

Emergency Autoland is an Emergency Only function that is intended to be used when a condition has caused the pilot to be incapable of safely operating and landing the aircraft. As such, there are a few simple procedures that should be clearly communicated to all passengers during the pre-flight safety briefing:



NOTE: *There is a ten second delay before the Emergency Autoland feature is fully activated.*

Emergency Autoland may be activated manually by an aircraft occupant by pressing the cabin ceiling-mounted **Safe Return Autoland** Button.

Initiating Emergency Autoland:

Press the **Safe Return Autoland** Button.

Emergency Autoland may also be automatically enabled by the system after certain criteria are detected that identifies an emergency condition based on aircraft operating mode:

- » Operating in Automatically Initiated Level Mode for a minimum of 60 seconds. Automatically Initiated Level Mode is Level Mode that has been activated due to Electronic Stability & Protection (ESP) having been active for a given amount of time, indicating possible pilot incapacitation or disorientation.



NOTE: *Level Mode activation by using the cyan LVL Button will not initiate Emergency Autoland.*

- » Emergency Descent Mode (EDM) which is activated automatically due to cabin depressurization will in turn initiate Emergency Autoland if EDM has not been deactivated before the aircraft descends through 15,000 ft MSL.

PREACTIVATION

Upon Emergency Autoland initiation, the Preactivation Phase begins, and the autopilot immediately engages (if not previously engaged) and the lateral and vertical FD modes couple to LVL Mode. An aural alert in the pilot’s headset, copilot’s headset, and cockpit speaker will announce “Emergency Autoland Activating,” and a warning message will provide visual confirmation of the initiation to the occupants (an annunciator on the activation switch also provides confirmation that Emergency Autoland has been initiated). At this point, with the aircraft under control of the AFCS in level flight, the system waits 10 seconds before proceeding with further actions. This is to allow time for the crew to disengage the Emergency Autoland function if it was activated unintentionally.

ACTIVATION

After 10 seconds and if Emergency Autoland was not deactivated, the Emergency Autoland function is activated. The autothrottle is engaged (if not previously engaged) and will adjust engine thrust settings to achieve preset speed references. The plane will declare an emergency and maneuver as required to the nearest suitable airfield after the system has determined the most suitable runway and terrain and weather avoidance. The following figure shows an image of the first informational screen that displays to the passengers after Emergency Autoland is activated.

Safe Return Autoland Activated
Press and hold the talk button on the center screen to talk to air traffic control. See passenger briefing card for additional information.
Mantener pulsado el botón de hablar en el centro de la pantalla para hablar con el control de tráfico aéreo Consultar la tarjeta identificativa del pasajero para obtener información adicional
Maintenir enfoncé le bouton Talk sur l'écran central pour parler au contrôle du trafic aérien Consulter la carte de consignes des passagers pour plus d'informations
Die Sprechtaaste auf dem mittleren Bildschirm gedrückt halten, um mit der Flugsicherung zu sprechen Siehe Passagier-Hinweiskarte für weitere Informationen
Pressione e mantenha pressionado o botão para conversar no ecrã central para falar com o controlo de tráfego aéreo Para obter mais informações, consulte o cartão de instruções para passageiros
Нажмите и удерживайте кнопку Talk (Говорить) в центре экрана, чтобы начать переговоры со службой управления воздушным движением Для получения дополнительной информации ознакомьтесь с брошюрой, где содержатся инструкции для пассажиров
按住中央屏幕上的通话按钮，与空中交通管制人员进行通话 请参阅乘客指南，了解其他信息
中央の画面の通話ボタンを押している間航空管制と会話できません 詳細な情報は乗客ブリーフィングカードを参照してください
יש לחוץ ממושכות על לחצן הדיבור שבמסך המרכזי כדי לדבר עם בקרת התנועה האווירית יש לעיין בכרטיס המידע למסעים לקבלת מידע נוסף
اضغط بشكل متواصل على زر الحديث الموجود على الشاشة المركزية للتحدث إلى مراقبة الحركة الجوية راجع بطاقة معلومات المسافرين للحصول على معلومات إضافية



Figure 8-145 Emergency Autoland Activated

DEACTIVATION

Emergency Autoland may be deactivated at any time by pressing the **AP** Button on the AFCS Controller or the red **A/P DISC** Button on a control stick (the AFCS will be able to be immediately engaged again if needed). The following figure will be displayed upon deactivation.

Deactivating Emergency Autoland:

Press the **AP** Button on the AFCS Controller.

Or:

Press the red **A/P DISC** Button on the control stick.

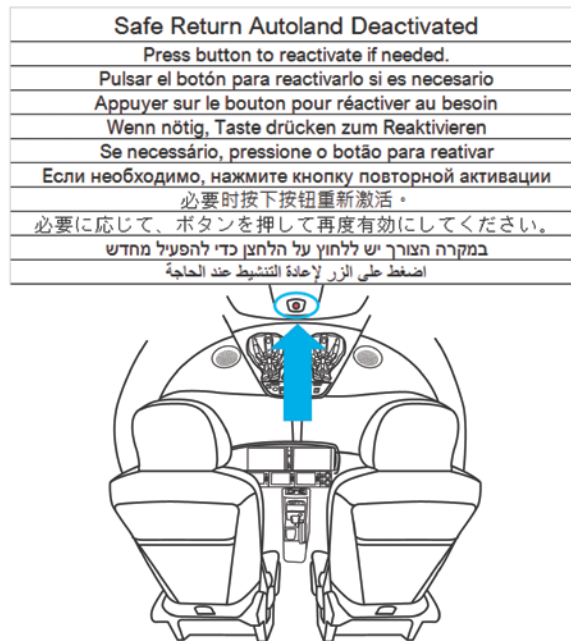


Figure 8-146 Emergency Autoland Deactivation

RECOVERY FROM EMERGENCY AUTOLAND ACTIVATION

If Emergency Autoland has been deactivated 10 seconds after initiation, several cockpit settings may need to be checked due to changes made by the Emergency Autoland system: throttle, flap position and lever, landing gear position and lever, altimeter, flight director mode, transponder code, active and standby COM frequencies, and flight plan.



WARNING: Always reset the altimeter setting when the Emergency Autoland system has been deactivated.



NOTE: MFD remains in Passenger Information Mode for 1 minute with instructions on how to re-activate if Emergency Autoland was deactivated unintentionally.

AIRPORT AND RUNWAY SELECTION

After Emergency Autoland has been initiated, the airport and runway selection occurs over the next 3-8 seconds. Emergency Autoland searches to find the most desirable airport and runway in the vicinity, and calculates a route to the landing that avoids terrain and significant weather. The flight plan is cleared and replaced with information for this route.



NOTE: *Emergency Autoland uses the barometric altimeter correction for vertical navigation, which may result in significant changes to the altimeter setting.*

The airport and runway selection system will examine a list of nearest airports along the flight path, including the origin and destination. It selects the most appropriate airfield that is equipped with an RNAV (GPS) approach procedure which includes vertical guidance to a runway. The system prefers towered airports but tries to avoid Class 'B' major airports.

The Emergency Autoland system will select the airport and runway based on runway attributes, wind conditions, flight plan distance, fuel remaining, and available instrument approaches. The system has been configured to utilize:

- » Hard Runways at an Airport
- » Minimum Runway Length of 6,300'
- » Minimum Runway Width of 75'

FLIGHT PATH ROUTING

The goal of the routing system is to determine a path to the selected Final Approach Fix (FAF) that avoids terrain, obstacles, and significant weather. Because the emergency condition may be time-critical, the routing system computes the most direct route given multiple constraints as follows.



NOTE: *The routing system always includes a holding pattern at the Final Approach Fix. Each time the aircraft nears the FAF, the system evaluates whether the aircraft is laterally and vertically stabilized on the navigation path and speed is stabilized. If so, the system proceeds with the approach. If not, the system commands the aircraft onto the holding pattern and will check again after the hold lap has completed.*

TERRAIN AND OBSTACLE AVOIDANCE

The Emergency Autoland feature utilizes Garmin's terrain and obstacle databases in order to determine the route to the chosen airport. For database update procedures, see the Appendices.

During flight path generation, the system will route around terrain rather than climbing to go over it whenever possible. Obstacles along the flight route are also considered. The following figure shows an example of a route generated around terrain.



Figure 8-147 Terrain Avoidance Routing Example

If the aircraft needs to climb (e.g., aircraft is surrounded by obstacles or terrain), it will create short climb legs while routing until a descending route can be generated.

SIGNIFICANT WEATHER AVOIDANCE

When available, the Emergency Autoland function will use weather data as an input to routing systems with the intent of avoiding hazardous weather conditions (e.g., heavy precipitation). The Emergency Autoland function employs a forecasting technique to update weather along the current route. Forecasting makes use of storm attributes and winds aloft data to estimate the future direction of precipitation movement. The forecast is periodically updated and when the current flight route is blocked by weather, a new path to the destination is generated. The following figure shows an example of a route generated around moderate precipitation.



Figure 8-148 Weather Avoidance Routing Example

Once a route has been identified, the FMS generates a flight plan to the FAF for the selected RNAV (GPS) approach utilizing the VNAV function. Autopilot and Autothrottle (AT) modes are enabled to follow the path and manage aircraft speed.

AIRCRAFT CONFIGURATION MANAGEMENT

The Emergency Autoland function will monitor and manage the aircraft configuration as needed to be in an appropriate configuration for approach and landing.

FLAP CONFIGURATION MANAGEMENT

The system automatically configures the flaps as appropriate for the phase of flight.

ICE PROTECTION SYSTEM MANAGEMENT

The Wing-Tail Ice Protection System and Engine Inlet Ice Protection System are automatically activated at low temperatures.

FUEL TANK CONFIGURATION MANAGEMENT

The system will prompt the passenger to manually perform certain tasks which the avionics cannot automatically control. This will include switching tanks when Automated Fuel Tank Switching was not selected by the pilot. If Emergency Autoland has been activated for 60 seconds and the fuel control is set to “LEFT” or “RIGHT,” the following figure will be displayed immediately. The image will remain until the fuel control has been set to “AUTO.”

Fuel Control Set fuel control to "AUTO"
Control de combustible Configurar el control de combustible en "AUTO"
Contrôle du carburant Régler le contrôle du carburant sur "AUTO"
Treibstoffkontrolle Treibstoffkontrolle auf „AUTO“ stellen
Verificação de combustível Configure o controle de combustível para "AUTO"
Регулятор подачи топлива Переведите регулятор подачи топлива в режим AUTO (АВТОМАТИЧЕСКИЙ)
燃料控制 将燃料控制调至'自动模式'
燃料制御 燃料制御を「オート」に設定します
בקרת דלק יש להגדיר את בקרת הדלק ל-AUTO
التحكم في الوقود اضبط التحكم في الوقود على "AUTO"

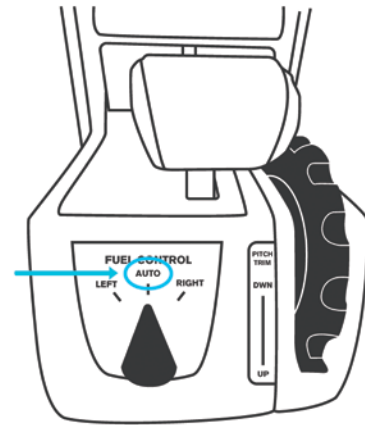


Figure 8-149 Manual Fuel Selection

APPROACH, FLARE, AND TOUCHDOWN

After reaching the FAF, the Emergency Autoland function flies the aircraft on the published approach path as shown in the following figure. At 500 feet AGL, the FMS establishes a course that is defined by the end of the runway and transitions to following this course.

Approaching destination airport. Ensure seatbelts are tight. Stow loose articles.
Acercándose al aeropuerto de destino Confirmar que los cinturones están bien abrochados Guardar los artículos sueltos
En approche de l'aéroport de destination Veiller à ce que les ceintures de sécurité soient bouclées Ranger tous les objets non fixes
in Annäherung an Zielflughafen Sicherstellen, dass die Sicherheitsgurte fest angelegt sind Lose Sachen verstauen
A aproximar-se do aeroporto de destino Verifique se os cintos de segurança estão apertados Guarde artigos soltos
Заход на посадку в аэропорту назначения Убедитесь в том, что ремни безопасности надежно пристегнуты Аккуратно уложите незакрепленные предметы
接近目的地机场 确保系紧安全带 妥善放置不牢固的物品
目的地空港に近づいています シートベルトをしっかりとお締めください 手荷物が動かないよう収納してください
הגעה לנמל היעד יש לוודא שהחגורות הדוקות יש לאחסן חפצים רופפים
الاقتراب من مطار المقصد تأكد من أن أحزمة الأمان مربوطة بإحكام احزم العناصر الحرة

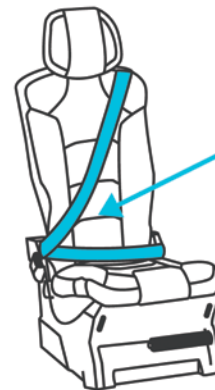


Figure 8-150 Approaching Destination Airport

The system transitions to flare mode at a height below 50 feet AGL based on descent profile and then lands the aircraft.

BRAKING AND STEERING

After touchdown the system will utilize rudder control to steer and braking commands to stop the aircraft. After landing, the following figure will be displayed regarding instructions for seat belt removal, opening the door, and exiting the aircraft safely.

Exit after the aircraft has come to a complete stop
Salir cuando el avión se haya detenido por completo
Ne sortir qu'après l'arrêt complet de l'avion
Das Flugzeug verlassen, nachdem es zum völligen Stillstand gekommen ist
Saia após a aeronave ter parado completamente
Выход разрешен только после полной остановки воздушного судна
飞机完全停稳后再出舱
飛行機が完全に止まってからお降りください
יש לצאת לאחר עצירה מלאה של המטוס
اخرج بعد أن تكون الطائرة قد توقفت تماماً

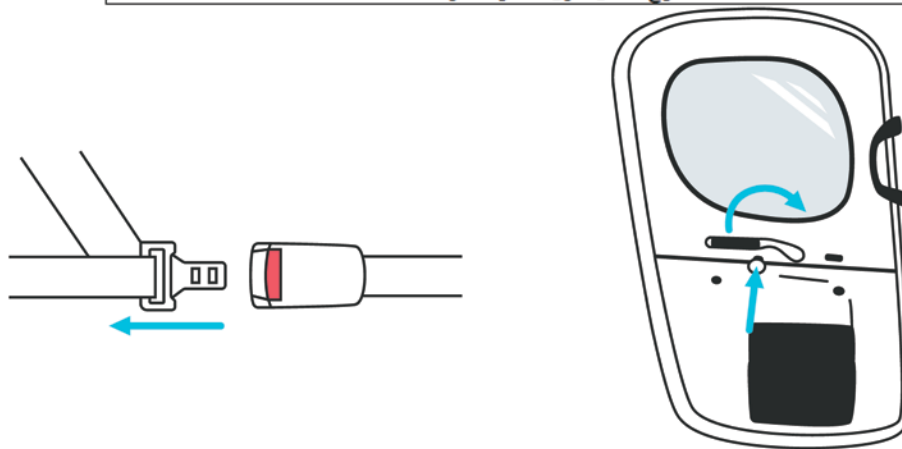


Figure 8-151 Egress Instructions After Landing

ENGINE SHUTDOWN

After the aircraft has been brought to a complete stop for 60 seconds (and after the passengers have been assumed to have egressed), the system will display instructions for shutting down the engine (see the following figure). This procedure is intended to be performed by maintenance personnel. This is intended to allow ground crews to safely and quickly clear the aircraft from the runway. Refer to the current version of the pertinent flight manual for engine shutdown and aircraft recovery procedures after an emergency autoland landing.

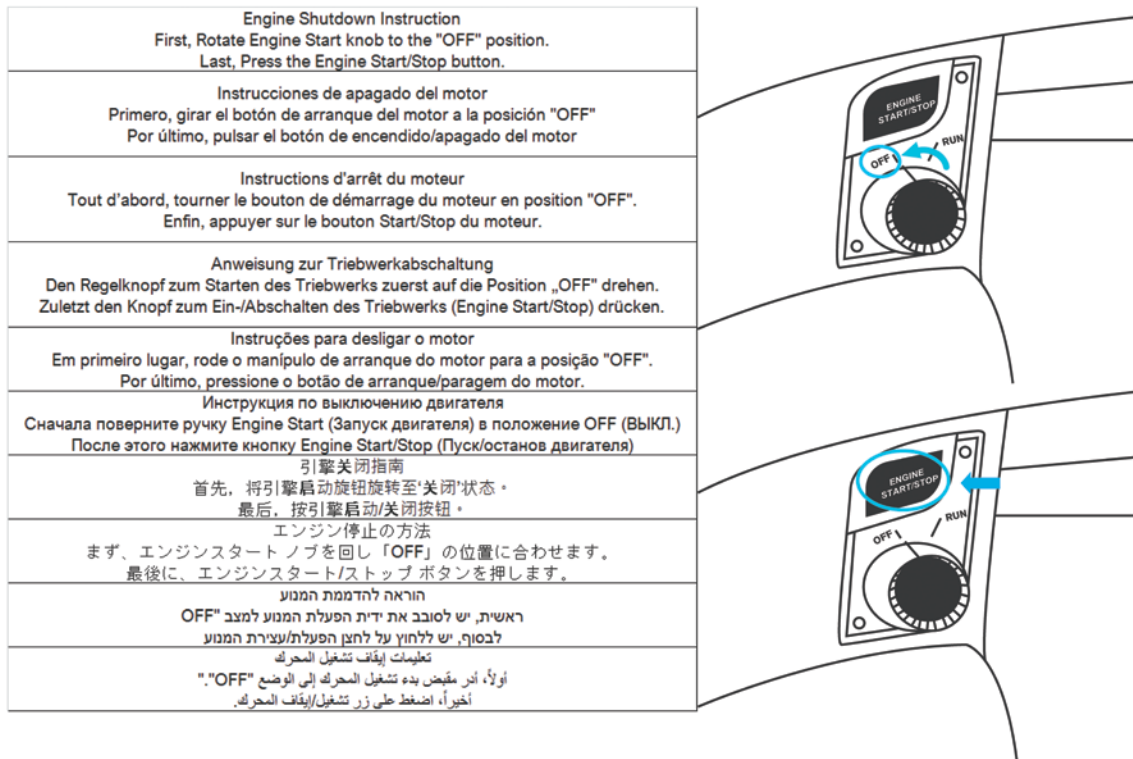


Figure 8-152 Engine Shutdown

AIRCRAFT COMMUNICATION

Upon engagement of the Emergency Autoland function, the system will automatically configure audio and radio sources, intercom, and cockpit speakers to provide aural messages and annunciations to the occupants and allow communication with ATC. Messages automatically broadcast on the emergency frequency on the VHF COM radio can also be heard by the passengers through the cockpit speaker. However, if passengers opt to contact ATC directly, they must use a front seat headset and the GTC interface.

AUTOMATIC COMMUNICATION

The system provides automatic communication to notify ATC and other pilots of the emergency situation and the aircraft's destination. The system supports communication through both the transponder and VHF COM radios.



NOTE: Do not use the Emergency Autoland feature for a non-emergency approach or landing. Upon activation, the system will automatically declare an emergency using multiple communication methods.

TRANSPONDER

When the Emergency Autoland function is active, the system automatically sets the active transponder to the appropriate emergency squawk code (7700).

VHF COM

Automatic Communication broadcasts to ATC/CTAF and Emergency frequencies using both COMs. Text-to-Speech (TTS) technology is used to create audio messages for automatic transmission. The messages include registration number, current location, landing airport, and estimated time enroute.



NOTE: Any occupant transmission will override or delay an automated transmission and will occur on the emergency frequency.

Once the automatic landing is completed, the transmission will change to convey that an aircraft is stopped on runway. This transmission will repeat until power is removed from the system.

IRIDIUM TRANSCEIVER

The Iridium Transceiver (if installed) communicates a text message to an on-call network that Emergency Autoland has been activated. This message contains the date and time, the tail number, the latitude and longitude, the altitude, and the destination airport that was selected.

PASSENGER COMMUNICATION

The Touchscreen Controller (GTC) interface will enable occupants to communicate with ATC. The GTC will display the following while Emergency Autoland is active:



Figure 8-153 GTC Emergency Autoland

- ① 'Emergency Autoland Active' Banner The activation of the Emergency Autoland feature indicated with amber text on black background is located at the top.
- ② Aircraft Identification Banner Displays the Aircraft ID number indicated with white and cyan text on black background is located immediately below the top banner.
- ③ Informational Text Displays the status of communication indicated with white text on black background is located below both banners.
- ④ Graphical Push-to-Talk button A button which includes a graphic of a microphone is located in the middle lower portion of the GTC. When the button is touched and held, "Radio Transmission Active" is displayed in the Informational Text area. Transmitted and received voice communication is conducted through the headset.
- ⑤ ATC Volume and Lower Knob Radio can be adjusted from 0 to 100% on the touchscreen controller by turning the Lower Knob or by sliding your finger up or down on the NAV volume slider.

Communicating with ATC:

- 1) Don pilot or copilot headset to transmit and receive voice communication.
- 2) Press and hold the graphical Push-to-Talk button on the GTC.
- 3) Talk to ATC.
- 4) Release the graphical microphone button when done talking.

AVIONICS DISPLAY

The Emergency Autoland system assumes the pilot is no longer able to control the aircraft and the remaining occupants are not trained pilots. Therefore, only essential information about Emergency Autoland is displayed to the passengers in order to allow passengers to focus only on the basic information related to the landing. This information includes:

- Clear indication that Emergency Autoland is active and that no occupant action is necessary.
- Simplified graphical and 'plain English' depiction of aircraft current location, where it is going including the destination airport, and how long it will take to arrive.
- Audio messages to help occupants correlate the information seen on the displays.
- Graphical indication of what will happen next regarding aircraft maneuvering and configuration (e.g., descent, turn).

PRIMARY FLIGHT DISPLAY (PFD)

When Emergency Autoland becomes active, the Primary Flight Display (PFD) will display the following:



Figure 8-154 PFD Emergency Autoland

- ① 'Emergency Autoland Active' Banner The activation of the Emergency Autoland feature indicated with amber text on black background is located at the top.
- ② Time to Landing Banner The time to landing in minutes indicated with white text on black background is located immediately below the top banner.
- ③ Aircraft Destination Banner Destination airfield indicated with white text on black background is located at the bottom.
- ④ Primary Flight Information Basic primary flight information (attitude, airspeed, altitude, heading, & synthetic vision) on 60% portion of display.
- ⑤ Navigation Map Map showing the auto-generated flight plan route on 40% portion of display. The map is oriented in a track up and auto-ranges to provide situational awareness.
- ⑥ Vertical Messages and Aligning with Runway Messages Dedicated field for the next vertical action is located in upper right of display.
- ⑦ Lateral Messages Dedicated field for the next lateral action is located in upper left of display.

MULTI-FUNCTION DISPLAY (MFD)

The MFD will display the following while Emergency Autoland is active:

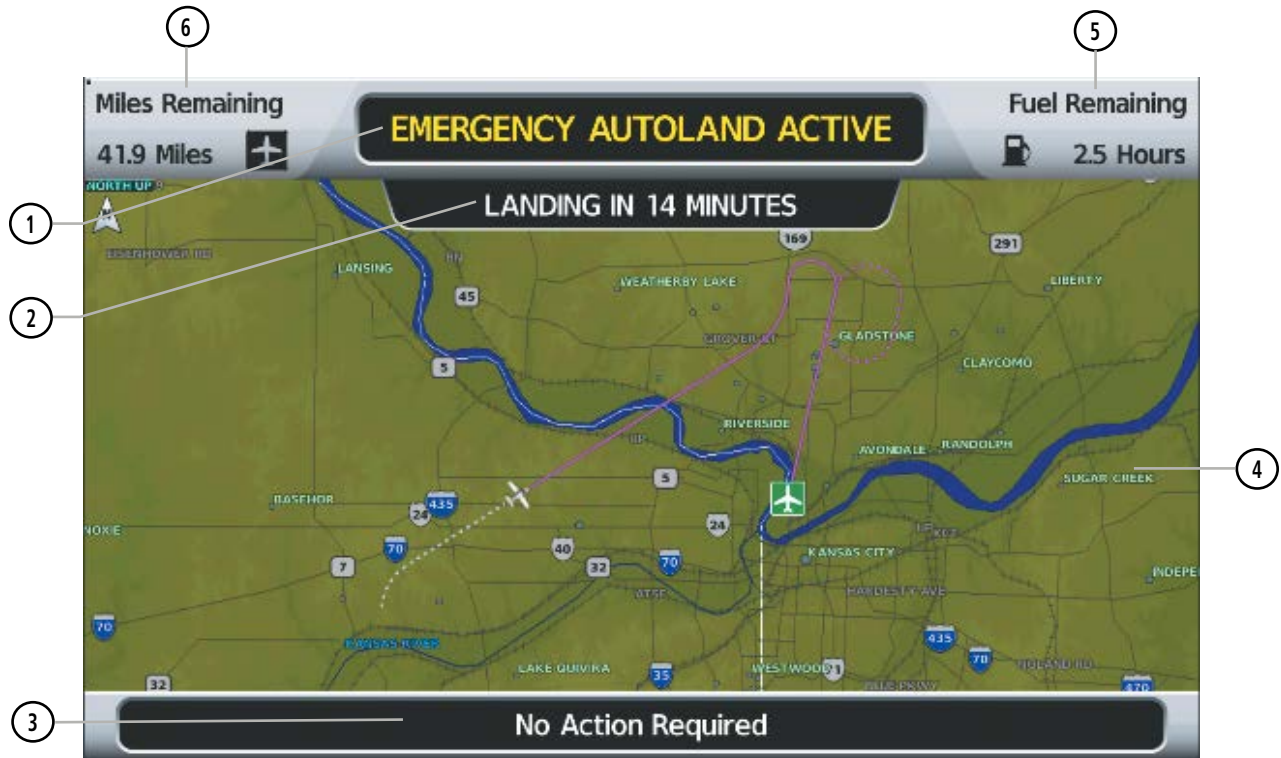


Figure 8-155 MFD Emergency Autoland

- ① 'Emergency Autoland Active' Banner
The activation of the Emergency Autoland feature indicated with amber text on black background is located at the top.
- ② Time to Landing Banner
The time to landing in minutes indicated with white text on black background is located immediately below the top banner.
- ③ Information Banner
Context-sensitive information indicated with white text on black background is located at the bottom. Information such as:
- ④ Primary Information
A display that supports several formats is located between the lower two banners mentioned above, including:
 - North up map showing the auto-generated flight plan route
 - » The MFD map range will not change so that progress can be inferred as the ownship moves across the screen
 - » Map will also show a digital 'bread crumb' trail to aid in showing progress
 - Static images and text that can provide context-sensitive information such as reminder to fasten seat belts, instructions for fuel management, how to exit the aircraft, etc.
- ⑤ Fuel Remaining
Dedicated field for Fuel Remaining in hours is located in upper right.
- ⑥ Miles Remaining
Dedicated field for Miles Remaining is located in upper left.

ALERTS AND ANNUNCIATIONS

EMERGENCY AUTOLAND ANNUNCIATIONS

Below are example messages that may be seen when the Emergency Autoland feature is active.

Message	Description
	This message is displayed on the PFD and indicates a right turn will automatically be initiated in 13 minutes.
	This message is displayed on the PFD and indicates the aircraft will begin descending automatically in 6 minutes.
	This message is displayed on the MFD and indicates there is 117 miles remaining until landing.
	This message is displayed on the MFD and indicates there is 0.2 hours of total fuel remaining.
	This message is displayed on the PFD after the aircraft automatically initiates a descent and indicates the aircraft will descend for a total of 8 minutes.
	This message is displayed on the PFD and indicates the aircraft is turning to final and is automatically aligning with the selected runway.

Table 8-6 Emergency Autoland Annunciations



NOTE: There is the potential to not be turning at all while the message “Aligning with Runway” is displayed (e.g., in the case of having to hold due to not achieving speed, course, and altitude alignment).


AURAL MESSAGES

The Emergency Autoland function will utilize the following message. Normal audio messages are inhibited during Emergency Autoland activation.

Action	Frequency	Voice Alert
Emergency Autoland Initiated	Repeated 3 times during the 10s preactivation phase	"Emergency Autoland Activating"

Table 8-7 Emergency Autoland Aural Alert

DEGRADED MODES

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

 **NOTE:** See the current version of the Airplane Flight Manual for Cirrus guidance on Emergency Autoland degradations. Below is intended only as an overview of the Emergency Autoland degraded modes.

The Emergency Autoland function requires certain avionics inputs in order to function but has a fault tolerant architecture with the intent of providing some capability even if avionics systems are not fully functional.

The following list of equipment represents minimum required equipment for Emergency Autoland to function normally:

- One display and one GTC controller with functional NAV and Terrain Databases
- One GPS receiver
- Two Integrated Avionics Units (IAUs)
- One AHRS
- One Air Data Computer (ADC)
- Pitch, Roll, and Yaw Servos
- Throttle Servo
- AFCS Controller

In the event of a failure that may prevent the Emergency Autoland feature from safely landing the airplane, the Safe Return Emergency Autoland control panel and MFD will communicate that Emergency Autoland is in a degraded state.

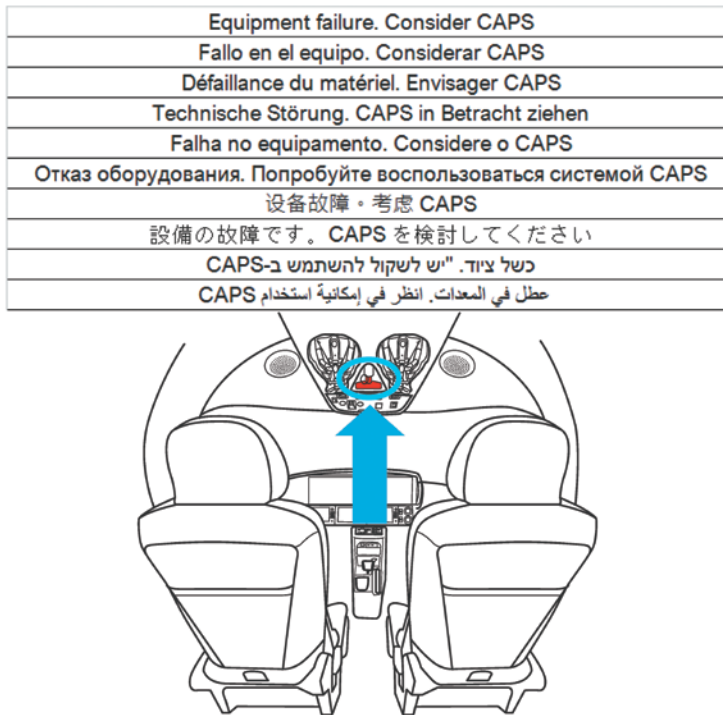


Figure 8-156 Equipment Failure Detected

LOSS OF DISPLAYS

The loss of all displays will result in a complete loss of the Emergency Autoland function. With at least one display remaining, the function will continue to provide passenger prompts and status updates. If only one display remains, the system will auto-revert the format to the MFD mode.



NOTE: *If the displays recover, Emergency Autoland will not automatically attempt to re-engage. If activation is desired, manual re-engagement is required.*

LOSS OF TOUCHSCREEN CONTROLLER

Loss of all GTCs will result in the passenger PTT touchscreen user interface being unavailable.

LOSS OF GPS DATA

The loss of all GPS data will result in the inability for the Emergency Autoland function to generate a route and navigate. The autopilot will revert to flying the current heading and airspeed. Limited capability to provide passenger prompts remains, including instructions on how passengers can communicate with ATC.

Emergency Autoland should be considered failed in this situation. The passenger display will reveal a graphic instructing the passengers to consider activating CAPS (see previous figure). Emergency Autoland will resume the mission with no action if GPS is subsequently recovered.

LOSS OF AHRS OR DEGRADED AHRS PERFORMANCE

Loss of all AHRS sensors will result in the autopilot disconnecting and a loss of the Emergency Autoland function.

Emergency Autoland should be considered failed in this situation. The passenger display will reveal a graphic instructing the passengers to consider activating CAPS (see previous figure). Emergency Autoland will resume the mission automatically if an AHRS subsequently recovers.

When Emergency Autoland is active, the autopilot remains engaged beyond the normal threshold and waits for the selected AHRS to flag itself as failed at which time the system automatically switches to the operational AHRS.

LOSS OF AFCS

Complete loss of the AFCS function due to system failure or the aircraft being outside the engagement limits will result in loss of the Emergency Autoland capability. Emergency Autoland is considered failed in this situation. The passenger display will reveal a graphic instructing the passengers to consider activating CAPS. Emergency Autoland will resume the mission automatically if the failure subsequently recovers.

PITCH SERVO FAILURE

If the pitch servo fails, the roll axis will remain engaged to keep the wings level. Emergency Autoland is considered failed in this situation. The passenger display will reveal a graphic instructing the passengers to consider activating CAPS. Emergency Autoland will resume the mission automatically if the pitch servo subsequently recovers.

ROLL SERVO FAILURE

If the roll servo fails, the system's ability to maintain lateral control is lost. Emergency Autoland is considered failed in this situation. The passenger display will reveal a graphic instructing the passengers to consider activating CAPS. Emergency Autoland will resume the mission automatically if the roll servo subsequently recovers.

YAW SERVO FAILURE

If the yaw servo fails, Emergency Autoland can still function although performance may be degraded on approach during crosswinds. Emergency Autoland is considered severely degraded in this situation. The passenger display will reveal a graphic instructing the passengers to consider activating CAPS. Yaw control will resume automatically if the yaw servo subsequently recovers.

THROTTLE SERVO FAILURE

If the throttle servo fails, the Emergency Autoland function will still attempt to complete its mission, but will be unable to adjust engine power. Emergency Autoland is considered severely degraded in this situation. The passenger display will reveal a graphic instructing the passengers to consider activating CAPS. Thrust control will resume automatically if the throttle servo subsequently recovers.



NOTE: *If a fault occurs that results in abnormal AFCS disconnect, the Emergency Autoland System continually attempts to re-engage the autopilot automatically. This increases the probability of a successful outcome in cases where there is a temporary fault or short-term loss of data needed to keep the autopilot engaged.*

LOSS OF NAVIGATION DATABASE

The Emergency Autoland system requires availability of a NAV database to safely land the aircraft. If the NAV database is missing or becomes corrupted, the Emergency Autoland is unable to complete a safe landing. The passenger display will reveal a graphic instructing the passengers to consider activating CAPS.

LOSS OF TERRAIN DATABASE

The Emergency Autoland system requires a Terrain database in order to be activated.

If the Terrain database becomes corrupted after Emergency Autoland is activated, the Emergency Autoland is unable to complete a safe landing. The passenger display will reveal a graphic instructing the passengers to consider activating CAPS.

LOSS OF OBSTACLE DATABASE

The Emergency Autoland system requires an Obstacle database in order to be activated.

If the Obstacle database becomes corrupted after Emergency Autoland is activated, the Emergency Autoland may be unable to complete a safe landing. The passenger display will reveal a graphic instructing the passengers to consider activating CAPS.

LOSS OF WEATHER DATA

Weather data is not a required input for the Emergency Autoland function to operate. The loss of weather data may result in a less optimal FMS route being generated by the routing system, potentially encountering severe weather.

LOSS OF GEAR CONTROL/MONITORING

If the Emergency Autoland function cannot successfully determine if the landing gear has been properly extended, the system will continue the landing with the landing gear in its current state.

LOSS OF FLAPS CONTROL/MONITORING

If the Emergency Autoland function cannot successfully monitor or manage the flaps position (Emergency Autoland uses Flaps 50% for landing), the system will continue the landing using the appropriate approach speed for the current flap setting, or 110 kts if the flap setting cannot be determined. This may cause degraded landing performance.

LOSS OF BRAKING CONTROL

The system will still perform an automatic landing even if the braking system has failed. Landing performance will be significantly degraded in this scenario.

8.16 POSITION REPORTING (OPTIONAL)



NOTE: An account must be established with Garmin ConnexTM 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 activated or deactivated by the pilot. 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. The minimum automatic transmission period between reports is two minutes with more frequent transmissions possible by manually sending reports with 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 Connex 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
- 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 Passenger Onboard field changes state.

Enabling/disabling position reporting:

- 1) From MFD Home, touch **Services > Position Reports**.
- 2) Touch the **Automatic Reporting** Button to enable or disable automatic transmission of position reports. A green annunciator on the button indicates automatic reporting is enabled (see following figure).



Figure 8-157 Automatic Reporting Disabled



Figure 8-158 Automatic Reporting Enabled

Setting up automatic position reporting:

- 1) From MFD Home, touch **Services** > **Position Reports**.
- 2) Touch the **Automatic Reporting** Button to enable automatic transmission of position reports. A green annunciator on the button indicates automatic reporting is enabled.
- 3) Touch the **Interval** Button. The Interval Entry Screen is shown (see previous figure).
- 4) Use the keypad to enter the time (2 - 60 minutes) between automatic reports, and touch the **Enter** Button to return to the Connex Position Reports Screen (see following figure).

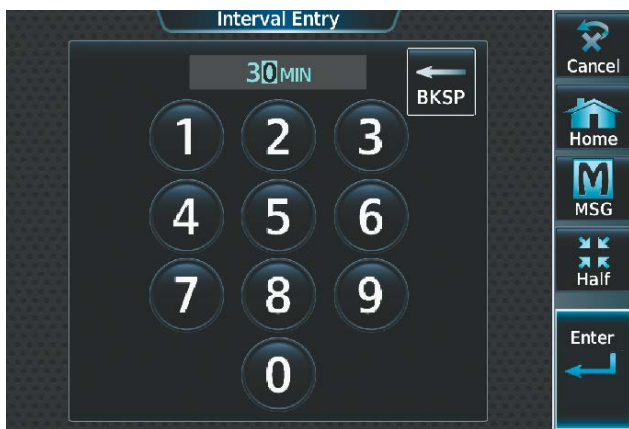


Figure 8-159 Automatic Reporting Disabled



Figure 8-160 Automatic Reporting Enabled

- 5) Touch the **Passengers Onboard** Button to indicate passengers are or are not on the aircraft. A green annunciator on the button indicates passengers are on the aircraft.



Figure 8-161 Passengers Onboard

Sending a position report manually:

- 1) From MFD Home, touch **Services > Position Reports**.
- 2) Touch the **Send Report** Button to send a report as soon as the link is available.

8.17 ABNORMAL OPERATION

SIRIUSXM DATALINK RECEIVER TROUBLESHOOTING

Some quick troubleshooting steps listed below can be performed to find the possible cause of a failure.

- Ensure the owner/operator of the aircraft in which the Datalink Receiver is installed has subscribed to SiriusXM. See the SiriusXM Satellite Radio portion of this section for subscription information.
- Ensure the SiriusXM subscription has been activated.
- Check the circuit breakers to ensure that power is applied to the Datalink Receiver
- For troubleshooting purposes, check the LRU Information for SiriusXM Datalink Receiver (GDL 69A) status, serial number, and software version number. If a failure has been detected in the GDL 69A the status is marked with an amber X.

Checking LRU status:

- 1) From MFD Home, touch **Utilities > Setup > Avionics Status**.
- 2) If necessary, touch the **LRU Info** Tab.
- 3) Scroll to display the **GDL69A** field as shown in the following figure.

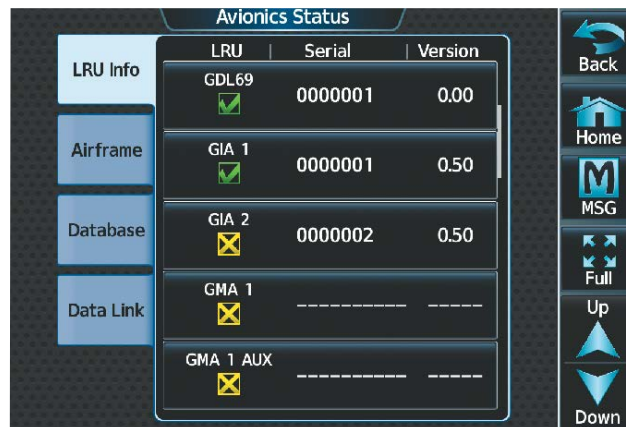


Figure 8-162 'Avionics Status' Page

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
WEATHER DATA LINK FAILED	Weather Datalink Display (selected Display Pane)	No communication from Datalink Receiver within last 5 minutes
ACTIVATION REQUIRED	XM Information Screen (Touchscreen Controller) Weather Datalink Display (selected Display Pane)	SiriusXM subscription is not activated

Table 8-8 GDL 69A Datalink Receiver Messages

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ANNUNCIATIONS AND ALERTS

NOTE: The current version of the pertinent flight manual supersedes information found in this document. Refer to the current version of the pertinent flight manual for recommended pilot actions.

When the system issues a CAS message, a CAS window appears in the lower right corner of the PFD, and a Warning or Caution (WARN or CAUT) annunciation appears in the upper left corner of 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. The CAS messages, annunciation, and button flash until the messages are acknowledged by touching the button. CAS messages that are auto-acknowledged by the system will not flash, and will not trigger the **WARN** or **CAUT** Button and Annunciation to appear. Alerts may include an aural or voice alert; refer to the CAS Message tables.

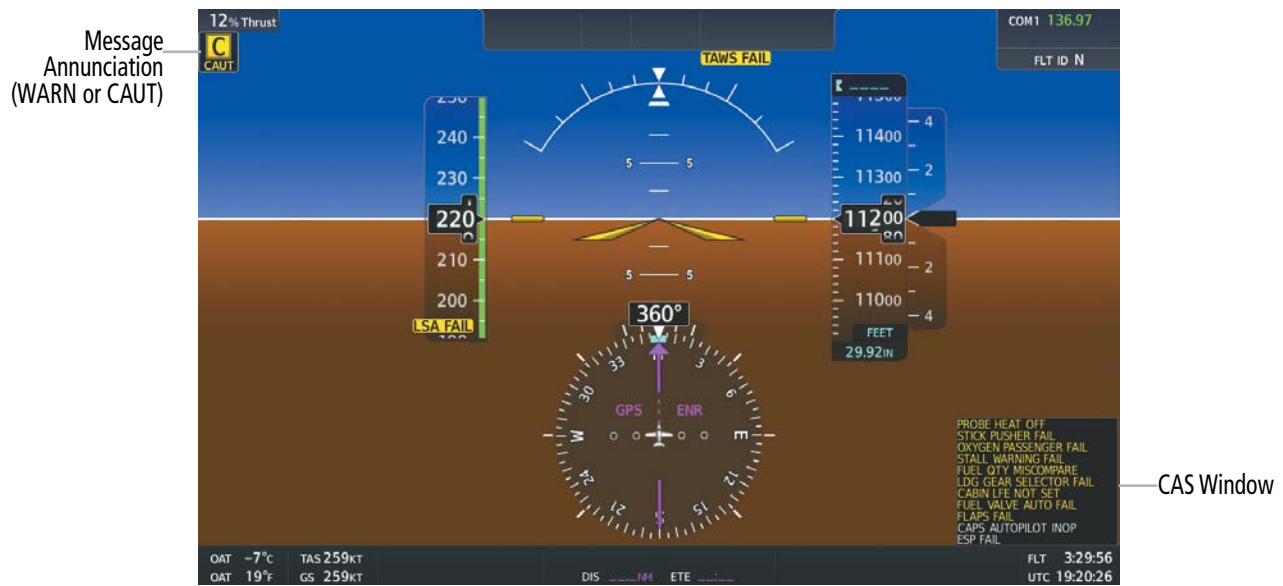


Figure A-1 PFD CAS Window and Message Annunciation



Figure A-2 Touchscreen Controller Warning/ Caution Button

Up to 26 messages can be displayed in the CAS window with the PFD in Full Mode, while a maximum of 12 messages can be displayed in Split and Reversionary Modes respectively. When more than the maximum number of messages accumulate, the Scroll CAS Buttons (Up and Down) become available on the PFD Home Screen, and a scroll bar appears in the CAS window. CAS scrolling in the PFD window will only be available for Caution (amber) and Advisory (white) messages. All active Warning messages will appear in the upper portion of the CAS window. Subdued Scroll CAS Buttons indicate that scrolling is not available. Any active CAS messages can be viewed on the Touchscreen Controller by touching the **MSG** Button on the 'PFD Home' Screen, then touching the **UP** or **DOWN** Buttons to scroll through the displayed messages.



Figure A-3 CAS Window Scrolling



Figure A-4 Scrolling - 'Notifications' Window

CAS MESSAGE PRIORITIZATION

CAS messages are grouped by criticality (warning, caution, advisory) 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 and/or voice alert. 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. Touching the **WARN** Button on the Touchscreen Controller acknowledges the presence of the Warning message and removes the **WARN** Button and Annunciation.
- **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. Touching the **CAUT** Button acknowledges the presence of the Caution message, stops any aural chime, and removes the **CAUT** Button and Annunciation.
- **Advisory** (white) – Crew awareness and subsequent action may be required. Advisory CAS messages do not flash.

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.

WARNING MESSAGES

Message	Description	Aural Alert
AUTO DESCENT	Aircraft descending to 14,000FT.	Repeating Double Chime
AUTO DESCENT	Aircraft descending to 12,500FT.	
CABIN ALTITUDE HIGH	Cabin high altitude detected.	"Cabin Altitude, Cabin Altitude,..."
CABIN DIFF PRESSURE HIGH	Cabin differential pressure is too high.	Repeating Double Chime
CABIN DUMP	Cabin pressure dump activated.	None
CAPS ACTIVATED	CAPS sequence has been activated.	Double Chime
DOOR OPEN BAGGAGE	Baggage door is open.	None
DOOR OPEN MAIN	Main door is open.	
EMER AUTOLAND ACTIVATING	Emergency Autoland is activating. (if Emergency Autoland installed)	"Emergency Autoland Activating, Emergency Autoland Activating...."
EMER AUTOLAND BRAKES	Do not dispatch, autoland brakes in test mode.	None
EMER BUS VOLTS	Operating on emergency power.	Repeating Double Chime
ENGINE FIRE	Engine fire detected.	"Fire, Fire, ..."
ENGINE START N1	N1 is not indicating rotation.	Repeating Double Chime
EXTERNAL POWER CONNECTED	External power is connected, set park brake.	None
FADEC CTRL DEGRADED	Reference FADEC Fault Code Messages.	Repeating Double Chime
FADEC NO DISPATCH	Reference FADEC Fault Code Messages.	
FLAPS CAL MODE	Do not dispatch, flaps system needs service.	None
FLAPS ICE	Full flaps prohibited in icing conditions.	Repeating Double Chime
FUEL FILTER BYPASS	Fuel filter diff press too high, bypass impending.	
FUEL IMBALANCE	Fuel imbalance is >= 50 Gallons.	
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.	
FUEL PRESSURE LOW	FDU fuel inlet pressure is low.	
FUEL TEMP LOW	Fuel temperature below operating limit.	
FUEL VALVES BOTH FAIL	Both fuel control valves have failed.	None
GENERATOR 1 CURRENT	Generator 1 current is too high.	
GENERATOR 1 OVERVOLTAGE	Generator 1 voltage is high.	
GENERATOR 2 CURRENT	Generator 2 current is too high.	
GENERATOR 2 OVERVOLTAGE	Generator 2 voltage is high.	Repeating Double Chime
ITT	ITT limits exceeded.	
LDG GEAR IS UP	Landing gear is not down and locked for landing.	*"Landing Gear, Landing Gear, ..."
LDG GEAR IS UP	Landing gear is not down and locked for landing.	Repeating Tone
LDG GEAR SELECTED UP	Landing gear should be selected down while on ground.	Repeating Double Chime
N1	N1 speed exceeded.	
N2	N2 speed exceeded.	None
OIL CHIP DETECT	Engine oil debris detected.	
OIL FILTER BYPASS	Oil filter diff press too high, bypass impending.	Repeating Double Chime
OIL PRESSURE	Engine oil pressure exceedance.	None
OIL TEMPERATURE	Engine oil temperature exceedance.	
STALL WARNING	Stall warning active.	*"Stall, Stall, Stall..."
STICK PUSHER	Stick pusher active.	
TAKEOFF PITCH TRIM	Pitch trim not in takeoff configuration.	Repeating Double Chime
THR LEVER CALIBRATION	FADEC is in TLA rigging mode.	None
TT2 OVERHEAT	TT2 probes pending overheat.	Repeating Double Chime

*Cannot be cancelled with the **WARN** Button on the touchscreen controller.

CAUTION MESSAGES

Message	Description	Aural Alert
AOA FAIL	AOA signal is invalid.	Double Chime
AOA HEAT FAIL	AOA heat failure.	
BLEED AIR	ECS bleed air system pressure low or failed.	None
BLEED LEAK	Bleed leak detected in tailcone.	
BLEED OFF	Bleed air is switched to OFF/FRESH.	None (Ground) Double Chime (Entering Takeoff/In Air)
BLEED OPEN	Shutoff solenoid failed to close.	None
BLEED OVERPRESSURE	ECS bleed air system pressure high.	
CABIN LFE NOT SET	Landing field elevation is not set.	
CABIN PRESSURE CTRL FAIL	Detected failure of CPCS Controller.	
DOOR OPEN EMER EXIT	Emergency exit door is open.	
ECS BLEED HOT	Bleed supply temperature is too hot.	None
ECS BLEED OVERHEAT	Bleed supply temperature is too hot.	Double Chime
ECS CONTROL FAIL	ECS controller has failed.	None
ECS CONTROL FAIL	Bleed duct temperature sensor has failed.	
ECS CONTROL FAIL	All ECS fans in cabin have failed.	
ECS CONTROL FAIL	All cabin temperature sensors have failed.	
ECS TEMP BACKUP	Environmental control temperature backup mode.	
EMER BATTERY FAIL	Emergency battery (Bat 2) service is required.	
EMER BATTERY FAULT	Emergency battery (Bat 2) fault detected.	Double Chime
EMER BUS VOLTS	Loss of forward emergency power bus voltage.	
ENGINE START BAT TEMP	Main battery (Bat 1) is below minimum start temp.	Double Chime (After Engine Start)
ENGINE START VOLTS	Main battery (Bat 1) is below min start voltage.	Double Chime
ENGINE START VOLTS	(Lithium Ion Battery Option) Battery 1 not adequately charged for engine start.	
ESS BUS VOLTS	Essential power bus voltage is low.	None
ESS BUS VOLTS	Loss of forward essential power bus voltage.	
EXTERNAL POWER CONNECTED	External power is connected.	
FADEC NO DISPATCH	Reference FADEC Fault Code Messages.	
FIRE DETECTOR FAIL	Engine fire detector loop low pressure.	
FIRE EXT LOW L-R	Pressure is low in both fire extinguishers.	Double Chime
FLAPS AIRSPEED INHIBIT	Flaps motion inhibited.	
FLAPS DISAGREE	Flaps are not within commanded position limits.	Double Chime
FLAPS FAIL	Flaps position sensor miscompare.	None
FLAPS FAIL	Flaps sensors failed, position unknown.	
FLAPS FAIL	Flaps system inoperative.	
FLAPS FAIL	Flaps have not reached the selected position.	Double Chime
FLAPS SELECTOR FAIL	Cannot determine flaps selector position.	None
FLIGHT IDLE FAIL	Engine idle N2 is too low.	Double Chime
FUEL IMBALANCE	Fuel imbalance is ≥ 15 Gallons.	None
FUEL LOW LEFT	Left fuel quantity is low.	
FUEL LOW RIGHT	Right fuel quantity is low.	
FUEL LOW TOTAL	Total fuel quantity is low.	

Message	Description	Aural Alert
FUEL PUMP FAIL	Fuel pump has failed.	None
FUEL PUMP ON	Fuel pump is ON due to low fuel pressure.	
FUEL QTY MISCOMPARE	Sensed and totalized fuel quantity disagreement.	
FUEL SELECTOR FAIL	Cannot determine fuel selector position.	Double Chime
FUEL SHUTOFF FAIL	Fuel shutoff valve not in commanded position.	
FUEL TEMP LOW	Fuel temperature is low, increase OAT.	None
FUEL VALVE #1 FAIL	Fuel Control Valve #1 has failed.	Double Chime
FUEL VALVE #2 FAIL	Fuel Control Valve #2 has failed.	None
FUEL VALVE AUTO FAIL	Auto fuel tank selection failure, use Manual mode.	
GENERATOR 1 CURRENT	Generator 1 current is low.	Double Chime
GENERATOR 2 CURRENT	Generator 2 current is low.	
GROUND IDLE FAIL	Ground idle is unavailable.	None
HYDRAULIC OVERHEAT	Landing gear hydraulic power pack has overheated.	Double Chime
IPS BLEED OVERHEAT	Ice protection bleed cooling failure.	None
IPS ENG INLET OFF	Engine IPS should be on.	
IPS ENG INLET ON	Engine IPS should be off.	
IPS ENG INLET ON	Shutoff solenoid failed to close.	
IPS ENG INLET OVERHEAT	Inlet temp higher than required for anti-ice.	Double Chime
IPS ENG INLET OVERHEAT	Inlet temp higher than safe levels.	
IPS ENG INLET UNDERPRESS	Engine IPS bleed flow low.	
IPS FLUID LOW	Less than 15 minutes of IPS fluid remaining.	None
IPS WINDSHLD TEMP LOW	Minimum temperature for IPS fluid is -30°C	Double Chime
IPS WINDSHLD TIMER	Loss of WS/Rad pump automatic timer control.	
IPS WING/STAB FAIL	Wing/Stabilizer IPS controller failure.	
IPS WING/STAB FAIL	Wing/Stabilizer IPS zonal pressure failure.	
IPS WING/STAB FAIL	Wing/Stabilizer IPS low system pressure.	None
IPS WING/STAB FAIL	Low system pressure, Wing/Stab IPS inoperative.	
IPS WING/STAB TEMP LOW	Minimum temperature for boot operation is -40°C.	None
LDG GEAR FAIL	Landing gear didn't reach the selected position.	
LDG GEAR SELECTOR FAIL	Cannot determine landing gear selector position.	None
MAIN BATTERY FAIL	Main battery (Bat 1) service is required.	
MAIN BATTERY FAULT	Main battery (Bat 1) fault detected.	
MAIN BUS VOLTS	Main power bus voltage is low.	
MAIN BUS VOLTS	Loss of forward main power bus voltage.	
NO ADC MODES	Autopilot air data modes are not available.	None
NO VERT MODES	Autopilot vertical modes are not available.	
OIL FILTER BYPASS	Oil filter diff press too high, bypass impending.	Double Chime
OXYGEN OFF	Oxygen has not been turned on.	None (Ground) Double Chime (Air)
OXYGEN ON	Oxygen is on.	Double Chime
OXYGEN PASSENGER FAIL	Passenger oxygen valve has failed closed.	
OXYGEN PRESSURE LOW	Oxygen pressure below regulator control.	Double Chime
OXYGEN PRESSURE LOW	Oxygen pressure low.	
PARK BRAKE	Parking brake is set.	None (Ground) Double Chime (Air)
PITCH MET ACTIVE	Pitch manual electric trim is active.	Double Chime
PROBE HEAT FAIL L	Left probe heat failure.	Double Chime
PROBE HEAT FAIL R	Right probe heat failure.	

Message	Description	Aural Alert
PROBE HEAT OFF	Probe heat is required.	None (Ground) Double Chime (Air)
SFD ALT MISCOMPARE	SFD altitude miscompare.	Double Chime
SFD IAS MISCOMPARE	SFD airspeed miscompare.	
SFD PITCH MISCOMPARE	SFD pitch miscompare.	
SFD ROLL MISCOMPARE	SFD roll miscompare.	
STALL WARNING FAIL	Stall warning failure.	None
STARTER ENGAGED	Starter will not disengage (start relay stuck).	Double Chime
STICK PUSHER FAIL	Stick pusher fail.	None
TAKEOFF EMER BATT	Emergency battery (Bat 2) is cold.	None/Double Chime
TAKEOFF EMER BATT	Emergency battery (Bat 2) is not charged.	Double Chime
TAKEOFF FLAPS	Flaps not in takeoff configuration.	Double Chime
TAKEOFF THRUST	5 minute takeoff thrust limitation exceeded.	None
TCV CONTROL FAIL	TCV motor controller has failed.	
THROTTLE SERVO	Throttle servo has failed.	
TT2 HEAT FAIL	TT2 probe heater failure.	Double Chime
WOW FAIL	WOW indicating on ground state.	None
YAW SAS SERVO	Yaw SAS servo has failed.	

ADVISORY MESSAGES

Message	Description	Aural Alert	
CAPS AUTOPILOT INOP	Minimize CAPS deployment speed.	None	
CAPS MISCOMPARE	CAPS service required.		
DOOR OPEN	One or more doors are open.		
EDM DISABLED	Emergency Descent Mode is disabled.		
ESP FAIL	ESP is inoperative.		
ESP OFF	ESP selected off.		
FIRE EXT LOW L	Pressure is low in the left fire extinguisher.		
FIRE EXT LOW R	Pressure is low in the right fire extinguisher.		
FUEL PUMP ON	Fuel pump is ON for normal operations.		
FUEL SHUTOFF	Fuel shutoff valve is closed.		
FUEL TANK BALANCED	Fuel tank quantity balance has been detected.		
ICING DETECTED	Icing conditions have been detected.		
IPS ENG INLET UNDERPRESS	Engine IPS bleed flow low with engine at idle.		
IPS FLUID LOW	IPS fluid below minimum dispatch quantity.		
MASK MICROPHONE	A crew mask microphone is switched on.		
OXYGEN ON	Oxygen is on.		
SFD NO COMPARE	SFD comparison data missing.		
STALL SPEED HIGH	Stall protection system adjusted for icing.		
STARTER ENGAGED	Engine start in progress.		
SURFACEWATCH FAIL	SurfaceWatch failed.		
TAKEOFF PITCH TRIM	Pitch trim not in takeoff configuration.		
TAKEOFF THRUST	Engine is in takeoff thrust.		None/Single Chime
WHEEL SPEED FAULT	Wheel speed sensor fault detected.		None
WOW DISAGREE	WOW is indicating opposite on ground/in air states.		

VOICE ALERTS

The following audio alerts are announced by the system using a voice of male or female gender (see SELECTING THE ALERT VOICE section to change the audio alert voice). If the optional Terrain Awareness and Warning System is installed, voice alerts are also generated (refer to the TAWS Alerts section).

Voice Alert	Alert Trigger
"Airspeed"	Airspeed has exceeded minimum or maximum speed.
"Cabin Altitude"	Cabin high altitude detected.
"Emergency Autoland Activating, Emergency Autoland Activating"	Emergency Autoland is activating. (if Emergency Autoland installed)
"Fire"	Engine fire detected.
"Incoming Call"	A call has been received via the Iridium system.
"Landing Gear"	Landing gear is not down and locked for landing.
"Minimums, Minimums"	The aircraft has descended below the preset minimum descent altitude or decision altitude.
"Stall"	Stall warning is active.
"Timer Expired"	Countdown timer on the PFD has reached zero.
"Vertical Track"	The aircraft is one minute from Top of Descent (only if vertical navigation is enabled).
"Traffic"	Played when a Traffic Advisory (TA) is issued for the optional TCAS I system. See the Hazard Avoidance section for additional details on GTS 855 voice alerts.
"TCAS One System Test Passed"	Played when the optional TCAS I system passes a pilot-initiated self test.
"TCAS One System Test Failed"	Played when the optional TCAS I system fails a pilot-initiated self test.
"One o'clock" through "Twelve o'clock" or "No Bearing"	Intruder bearing (GTS 855 only).
"High", "Low", "Same Altitude" (if within 200 feet of own altitude), or "Altitude not available"	Intruder relative altitude (GTS 855 only).
"Less than one mile", "One Mile" through "Ten Miles", or "More than ten miles"	Intruder distance (GTS 855 only).

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 flashes 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.

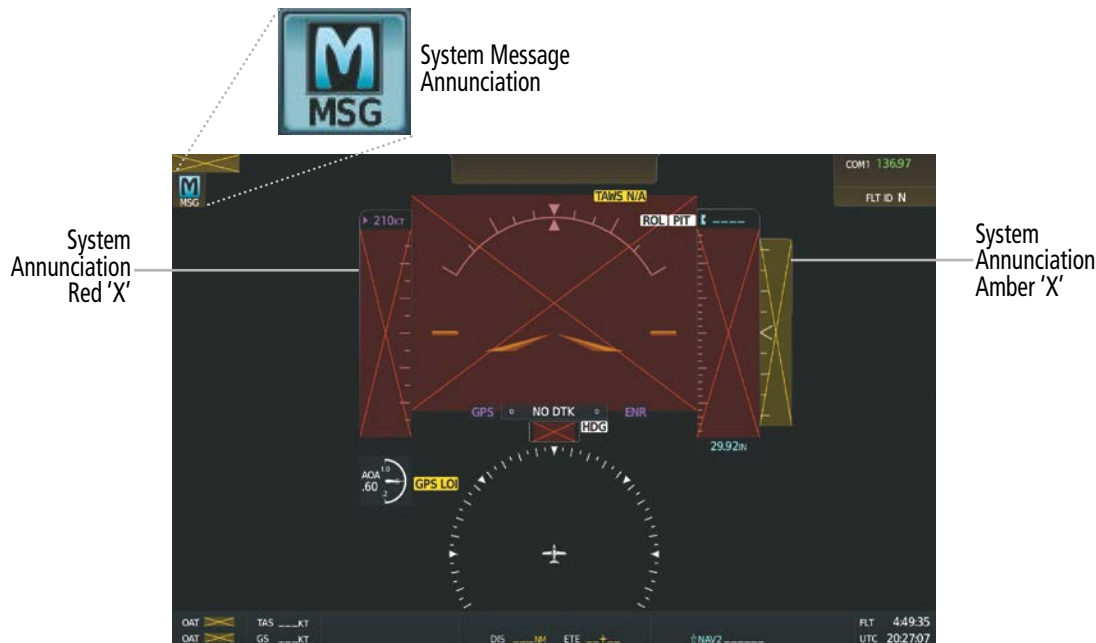


Figure A-5 System Annunciations (PFD)



Figure A-6 System Messages Annunciation (Touchscreen Controller)

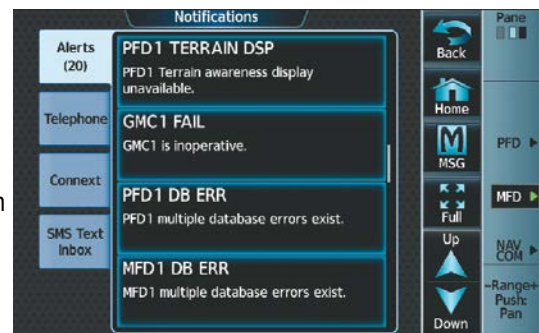


Figure A-7 'Notifications' Screen After MSG Button Touched (Touchscreen Controller)

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 APR – Loss of GPS navigation. Abort approach.	Abort approach due to loss of GPS navigation. This message may also be displayed if the active flight plan is deleted while an RNAV approach that requires SBAS is active.
ADC1 ALT EC – ADC1 altitude error correction is unavailable.	GDC1 is reporting that the altitude error correction is unavailable.
ADC1 AS EC – ADC1 airspeed error correction is unavailable.	GDC1 is reporting that the airspeed error correction is unavailable.
ADC1 SERVICE – ADC1 needs service. Return unit for repair.	A failure has been detected in the GDC1. The system should be serviced.
ADC2 ALT EC – ADC2 altitude error correction is unavailable.	GDC2 is reporting that the altitude error correction is unavailable.
ADC2 AS EC – ADC2 airspeed error correction is unavailable.	GDC2 is reporting that the airspeed error correction is unavailable.
ADC2 SERVICE – ADC2 needs service. Return unit for repair.	A failure has been detected in the GDC2. The system should be serviced.
AFT AV FAN FAIL – The cooling fan for aft avionics has failed.	The cooling fan for the aft remote avionics has failed.
AHRS MAG DB – AHRS magnetic model database version mismatch.	The #1 AHRS and #2 AHRS magnetic model database versions do not match.
AHRS1 CAL – AHRS1 calibration version error. SRVC REQ'D.	The AHRS1 calibration version error. The system should be serviced.
AHRS1 CONFIG – AHRS1 config error. Config service REQ'D.	AHRS configuration settings do not match those of backup configuration memory. The system should be serviced.
AHRS1 GPS – AHRS1 not receiving any GPS information.	AHRS1 is not receiving any or any useful GPS information. Check the current version of the pertinent flight manual limitations. The system should be serviced.
AHRS1 GPS – AHRS1 not receiving backup GPS information.	The AHRS1 is not receiving backup GPS information. The system should be serviced.
AHRS1 GPS – AHRS1 operating exclusively in no-GPS mode.	The AHRS1 is operating exclusively in no-GPS mode. The system should be serviced.
AHRS1 GPS – AHRS1 using backup GPS source.	The AHRS1 is using the backup GPS path. Primary GPS path has failed. The system should be serviced when practical.
AHRS1 SERVICE – AHRS1 needs service. Return unit for repair.	A failure has been detected in the #1 AHRS. The system should be serviced.
AHRS1 SRVC – AHRS1 Magnetic-field model needs update.	The AHRS1 earth magnetic field model is out of date. Update magnetic field model when practical.

System Message	Comments
AHRS1 TAS – AHRS1 not receiving valid airspeed.	The 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 REQ'D.	The AHRS2 calibration version error. The system should be serviced.
AHRS2 CONFIG – AHRS2 config error. Config service REQ'D.	AHRS configuration settings do not match those of backup configuration memory. The system should be serviced.
AHRS2 GPS – AHRS2 not receiving any GPS information.	The AHRS2 is not receiving any or any useful GPS information. Check the current version of the pertinent flight manual limitations. The system should be serviced.
AHRS2 GPS – AHRS2 not receiving backup GPS information.	The AHRS2 is not receiving backup GPS information. The system should be serviced.
AHRS2 GPS – AHRS2 operating exclusively in no-GPS mode.	The AHRS2 is operating exclusively in no-GPS mode. The system should be serviced.
AHRS2 GPS – AHRS2 using backup GPS source.	The 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 the #2 AHRS. The system should be serviced.
AHRS2 SRVC – AHRS2 Magnetic-field model needs update.	The AHRS2 earth magnetic field model is out of date. Update magnetic field model when practical.
AHRS2 TAS – AHRS2 not receiving valid airspeed.	The 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.
APR ADVISORY – SBAS VNAV not available. Using Baro VNAV.	SBAS VNAV not available. Check GPS signal.
APR ADVISORY – GPS VNAV not available. Using Baro VNAV.	GPS not available. The system is calculating the VNAV profile using BARO VNAV.
APR DWNGRADE – Apr downgraded.	Vertical guidance generated by SBAS is unavailable. Use only 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.
CHECK ARRIVAL SPEED – [Arrival Speed] KT AT [LOC ID] exceeds Mmo	The arrival speed loaded exceeds Mmo.
CHECK ARRIVAL SPEED – [Arrival Speed] KT AT [LOC ID] exceeds Vmo	The arrival speed loaded exceeds Vmo.
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 DEPARTURE SPEED – [Departure Speed] KT AT [LOC ID] exceeds Vmo	The departure speed loaded exceeds Vmo.
CHECK NAV – Approach ID mismatch / <LOC>	Selected course for LOC2 differs from published localizer course by more than 10 degrees.

System Message	Comments
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 #1 REDUCED TX POWER – Reduced COM transmit power.	COM 1 has a reduced transmission power.
COM #2 INOP: CAL – Factory COM Calibration Lost or Corrupted.	COM 2 calibration version error. Check COM calibration.
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 MANIFEST – COM1 software mismatch, communication halted.	COM 1 has incorrect software installed. The system should be serviced.
COM1 PTT – COM1 push-to-talk key is stuck.	The COM1 external push-to-talk switch is stuck in the enable (or “pressed”) position. Press the PTT switch again to cycle its operation. If the problem persists, the system should be serviced.
COM1 RMT XFR – COM1 remote transfer key is stuck.	The COM1 transfer switch is stuck in the enabled (or “pressed”) position. Press the transfer switch again to cycle its operation. If the problem persists, the system should be serviced.
COM2 MANIFEST – COM2 software mismatch, communication halted.	COM 2 has incorrect software installed. The system should be serviced.
COM2 PTT – COM2 push-to-talk key is stuck.	The COM2 external push-to-talk switch is stuck in the enable (or “pressed”) position. Press the PTT switch again to cycle its operation. If the problem persists, the system should be serviced.
COM2 RMT XFR – COM2 remote transfer key is stuck.	The COM2 transfer switch is stuck in the enabled (or “pressed”) position. Press the transfer switch again to cycle its operation. If the problem persists, the system should be serviced.
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.

System Message	Comments
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 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 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 determine 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 determine 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 determine 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.
DIG GMA1 MANIFEST – DIG GMA 1 software mismatch, communication halted.	The digital audio controller has incorrect software installed. The system should be serviced.
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.
EMER AUTOLAND UNAVAIL – Autoland unavailable. Configuration error.	The Emergency Autoland has a configuration error. The system should be serviced. (if Emergency Autoland installed)
FAILED PATH – A data path has failed.	A data path between two or more LRUs has failed. The system should be serviced when practical.
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 application, 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.
FS 510 MANIFEST – FS 510 software mismatch.	Incorrect software version. The system should be serviced.
FS510 CARD ERROR – FS510 not detected in MFD Bottom Slot.	The FS 510 Wireless Transceiver card was removed from the bottom card slot of the MFD. The card needs to be reinserted.
GDC1 MANIFEST – GDC1 software mismatch, communication halted.	The GDC1 has incorrect software installed. The system should be serviced.

System Message	Comments
GDC2 MANIFEST – GDC2 software mismatch, communication halted.	The GDC2 has incorrect software installed. The system should be serviced.
GDL59 CONFIG – GDL 59 config error. Config service req'd.	GDL 59 configuration settings do not match those of backup configuration memory. The system should be serviced.
GDL59 FAIL – GDL 59 has failed.	A failure has been detected in the GDL 59. The receiver is unavailable. The system should be serviced.
GDL59 MANIFEST – GDL59 software mismatch, communication halted.	The GDL 59 has incorrect software installed. The system should be serviced.
GDL59 RTR FAIL – The GDL 59 router has failed.	A failure has been detected in the GDL 59 router. The system should be serviced.
GDL59 SERVICE – GDL 59 needs service. Return unit for repair.	A failure has been detected in the GDL 59. The system should be serviced.
GDL69 CONFIG – GDL 69 config error. Config service req'd.	GDL 69A configuration settings do not match those of backup configuration memory. The system should be serviced.
GDL69 FAIL – GDL 69 has failed.	A failure has been detected in the GDL 69A. The receiver is unavailable. The system should be serviced.
GDL69 MANIFEST – GDL69 software mismatch, communication halted.	The GDL 69A has incorrect software installed. The system should be serviced.
GEA # 1 INOP: CAL – Check GEA rigging.	There is a problem with the GEA 1 and/or GEA 2 and/or GEA 3 rigging. Check the rigging.
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 a problem with the GEA 1 software configuration. Check the configuration. If the problem persists, the system should be serviced.
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 MANIFEST – GEA1 software mismatch, communication halted.	GEA1 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 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.

System Message	Comments
GIA #1 OVER TEMP – Check GIA Temperature.	GIA 1 is reporting an over-temperature condition.
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.
GIA1 MANIFEST – GIA1 software mismatch, communication halted.	The GIA1 has incorrect software installed. The system should be serviced.
GIA2 MANIFEST – GIA2 software mismatch, communication halted.	The GIA 2 has incorrect software installed. The system should be serviced.
GMA1 AUX MANIFEST – GMA 1 AUX software mismatch, communication halted.	The digital audio controller has incorrect software installed. The system should be serviced.
GMA1 CONFIG – GMA1 config error. Config service REQ'D.	The audio controller configuration settings do not match backup configuration memory. The system should be serviced.
GMA1 FAIL – GMA1 is inoperative.	The audio controller has detected a failure. The audio controller is unavailable. 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 CHK RQRD: BATT – GPS Battery Needs Replacement.	The GPS battery needs to be replaced.
GPS #1 INOP: CAL – Factory GPS Calibration Lost Or Corrupted.	GPS 1 factory calibration lost or corrupted. Check GPS calibration. Check GPS calibration.
GPS #2 CHK RQRD: BATT – GPS Battery Needs Replacement.	The GPS battery needs to be replaced.
GPS #2 INOP: CAL – Factory GPS Calibration Lost Or Corrupted.	GPS 2 factory calibration lost or corrupted. Check GPS calibration. Check GPS calibration.
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.	A difference has been detected in the current position. Check position sensors.
GPS2 CHECK POSITION – Position difference. Check position sensors.	A difference has been detected in the current position. Check position sensors.
GRA1 CAL – GRA1 calibration. Service req'd.	GRA1 has improper calibration. The system should be serviced.
GRA1 CONFIG – GRA1 config error. Config service req'd.	The GRA and GDU have incompatible configurations.
GRA1 MANIFEST – GRA1 software mismatch, communication halted.	The GRA has incorrect software installed. The system should be serviced.
GRA1 SERVICE – GRA1 needs service. Return unit for repair	The GRA self-test has detected a problem in the unit. The system should be serviced.
GRA1 TEMP – GRA1 over temperature.	The system has detected an over temperature condition in GRA1.
GRS1 MANIFEST – GRS1 software mismatch, communication halted.	The AHRS1 has incorrect software installed. The system should be serviced.
GRS1 FAIL – GSR1 has failed.	A failure has been detected in GSR1. The system should be serviced.
GRS2 MANIFEST – GRS1 software mismatch, communication halted.	The AHRS2 has incorrect software installed. The system should be serviced.
GRS2 FAIL – GSR2 has failed.	A failure has been detected in GSR2. The system should be serviced.
GRS1 MANIFEST – GRS1 software mismatch, communication halted.	The AHRS1 has incorrect software installed. 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 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 COOLING – GTC1 has poor cooling. Reducing power usage.	The Touchscreen Controller has insufficient cooling. If the problem persists, the system should be serviced.
GTC1 DB ERR – GTC1 database error exists.	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 FAN FAIL – GTC1 internal fan failure. Unit needs service.	The internal fan in the Touchscreen Controller has failed. The system should be serviced.
GTC1 KEYSTK – GTC1 [key name] key is stuck.	A knob or joystick is stuck on the Touchscreen Controller bezel. Attempt to free the stuck control by pushing or turning it several times. The system should be serviced if the problem persists.
GTC1 MANIFEST – GTC 1 software mismatch, communication halted.	The Touchscreen Controller has incorrect software installed. The system should be serviced.
GTC1 PERF TABLE ERR – Airframe mismatch.	Airframe identifier mismatch. The system should be serviced.
GTC1 PERF TABLE ERR – CRC Failure.	TOLD files inaccessible. The system should be serviced.
GTC1 PERF TABLE ERR – Unable to read table.	TOLD files missing. The system should be serviced.

System Message	Comments
GTC1 PERF TABLE ERR – Unable to read table header.	The Table-of-Contents (TOC) file is missing from the PERF files, is corrupted, or otherwise cannot be read. The system should be serviced.
GTC1 PERF TABLE ERR – Software compatibility error.	Software incompatibility error. The system should be serviced.
GTC1 PERF TABLE ERR – Table mismatch.	TOLD file mismatch. The system should be serviced.
GTC1 SERVICE – GTC1 needs service. Return unit for repair.	The Touchscreen Controller should be serviced.
GTC1 VOLTAGE – GTC1 has low voltage. Reducing power usage	The Touchscreen Controller voltage is low. The system should be serviced.
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 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 COOLING – GTC2 has poor cooling. Reducing power usage.	The Touchscreen Controller has insufficient cooling. If the problem persists, the system should be serviced.
GTC2 DB ERR – GTC2 database error exists.	The Touchscreen Controller detected a failure in one or more databases. Ensure the data card is properly programmed if present. If problem persists, the system should be serviced.
GTC2 FAN FAIL – GTC2 internal fan failure. Unit needs service.	The internal fan in the Touchscreen Controller has failed. The system should be serviced.
GTC2 KEYSTK – GTC2 [key name] key is stuck.	A knob or joystick is stuck on the Touchscreen Controller 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 – GTC 2 software mismatch, communication halted.	The Touchscreen Controller has incorrect software installed. The system should be serviced.
GTC2 PERF TABLE ERR – Airframe mismatch.	Airframe identifier mismatch. The system should be serviced.
GTC2 PERF TABLE ERR – CRC Failure.	TOLD files inaccessible. The system should be serviced.
GTC2 PERF TABLE ERR – Unable to read table.	TOLD files missing. The system should be serviced.
GTC2 PERF TABLE ERR – Unable to read table header.	The Table-of-Contents (TOC) file is missing from the PERF files, is corrupted, or otherwise cannot be read. The system should be serviced.
GTC2 PERF TABLE ERR – Software compatibility error.	Software incompatibility error. The system should be serviced.
GTC2 PERF TABLE ERR – Table mismatch.	TOLD file mismatch. The system should be serviced.
GTC2 SERVICE – GTC2 needs service. Return unit for repair.	The Touchscreen Controller should be serviced.
GTC2 VOLTAGE – GTC2 has low voltage. Reducing power usage	The Touchscreen Controller voltage is low. The system should be serviced.
GTC3 CARD1 ERR – GTC3 card 1 is invalid.	The internal SD card in the Touchscreen Controller contains invalid data. The system should be serviced.
GTC3 CARD1 REM – GTC3 card 1 was removed. Reinsert card.	The internal SD card in the Touchscreen Controller was removed. The system should be serviced.

System Message	Comments
GTC3 CONFIG – GTC3 config error. Config service req'd.	Touchscreen Controller configuration settings do not match those of backup configuration memory. The system should be serviced.
GTC3 COOLING – GTC3 has poor cooling. Reducing power usage.	The Touchscreen Controller has insufficient cooling. If the problem persists, the system should be serviced.
GTC3 DB ERR – GTC3 database error exists.	The Touchscreen Controller detected a failure in one or more databases. Ensure the data card is properly programmed if present. If problem persists, the system should be serviced.
GTC3 FAN FAIL – GTC3 internal fan failure. Unit needs service.	The internal fan in the Touchscreen Controller has failed. The system should be serviced.
GTC3 KEYSTK – GTC3 [key name] key is stuck.	A knob or joystick is stuck on the Touchscreen Controller bezel. Attempt to free the stuck control by pushing or turning it several times. The system should be serviced if the problem persists.
GTC3 MANIFEST – GTC3 software mismatch, communication halted.	The Touchscreen Controller has incorrect software installed. The system should be serviced.
GTC2 PERF TABLE ERR – Airframe mismatch.	Airframe identifier mismatch. The system should be serviced.
GTC2 PERF TABLE ERR – CRC Failure.	TOLD files inaccessible. The system should be serviced.
GTC2 PERF TABLE ERR – Unable to read table.	TOLD files missing. The system should be serviced.
GTC2 PERF TABLE ERR – Unable to read table header.	The Table-of-Contents (TOC) file is missing from the PERF files, is corrupted, or otherwise cannot be read. The system should be serviced.
GTC2 PERF TABLE ERR – Software compatibility error.	Software incompatibility error. The system should be serviced.
GTC2 PERF TABLE ERR – Table mismatch.	TOLD file mismatch. The system should be serviced.
GTC3 SERVICE – GTC3 needs service. Return unit for repair.	The Touchscreen Controller should be serviced.
GTC3 VOLTAGE – GTC3 has low voltage. Reducing power usage	The Touchscreen Controller voltage is low. The system should be serviced.
GTS CONFIG – GTS Config error. Config service req'd.	The GTS and GDU have different copies of the GTS configuration, or the Mode S address is invalid. The system should be serviced.
GTS MANIFEST – GTS software mismatch, communication halted.	The GTS has incorrect software installed. The system should be serviced.
GTX1 MANIFEST – GTX1 software mismatch, communication halted.	The transponder has incorrect software installed. The system should be serviced.
GTX2 MANIFEST – GTX2 software mismatch, communication halted.	The transponder has incorrect software installed. The system should be serviced.
GWX CONFIG – GWX config error. Config service req'd.	GWX configuration settings do not match those of the GDU configuration. The system should be serviced.
GWX FAIL – GWX is inoperative.	The GDU is not receiving status packet from the GWX or the GWX is reporting a fault. The radar system should be serviced.
GWX MANIFEST – GWX software mismatch, communication halted.	The GWX has incorrect software installed. The system should be serviced.
GWX SERVICE – GWX needs service. Return unit for repair.	A failure has been detected in the GWX. The GWX may still be usable.

System Message	Comments
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.
LRG MAG VAR – Verify all course angles.	The GDU's internal model cannot determine the exact magnetic variance for geographic locations near the magnetic poles. Displayed magnetic course angles may differ from the actual magnetic heading by more than 2°.
LRU REPLACEMENT – [LRU name].	The system has detected an LRU replacement. Perform LRU replacement software or full configuration loading procedure.
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 REQ: BTM SD – Bottom SD card error.	The GDU's bottom SD card is inoperative.
MFD1 CHK REQ: INT SD – Internal SD card error.	The GDU's internal SD card is inoperative.
MFD1 CHK REQ: TOP SD – Top SD card error.	The GDU's top SD card is inoperative.
MFD1 CMC INOP: CONFIG – CMC system inop due to invalid config.	The CMC system's logging capability is inoperative due to file invalid configuration.
MFD1 CMC INOP: CORRUPT – CMC INOP due to file system corruption.	The CMC system's logging capability is inoperative due to file system corruption.
MFD1 CMC INOP: MEM FULL – Internal SD card full.	The CMC system's 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 COOLING – MFD1 has poor cooling. Reducing power usage.	The MFD is overheating and is reducing power consumption by dimming the display. If problem persists, the system should be serviced.
MFD1 DB ERR – MFD1 multiple database errors exists.	The MFD detected a failure in more than one database. If problem persists, the system should be serviced.

System Message	Comments
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 missing.	The terrain database is present on another LRU, but is missing on the specified LRU.
MFD1 FAN FAIL – The cooling fan for the MFD is inoperative.	The cooling fan in the MFD has failed. The system should be serviced.
MFD1 HEAT TIME EXT – 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 - ECC ERROR – Internal memory unstable: needs repair.	The internal memory of the specified GDU is unstable. The system should be serviced.
MFD1 INOP - LED STR FAULT – Reduced backlight level: needs repair.	The specified GDU has reduced backlight levels. The system should be serviced.
MFD1 OVER TEMP – Check MFD1 temperature.	The specified GDU is over-temperature. 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 – MFD 1 software mismatch, communication halted.	The MFD has incorrect software installed. The system should be serviced.
MFD1 SERVICE – MFD1 needs service. Return unit for repair.	The MFD self-test has detected a problem. The system should be serviced.
MFD1 SOFTWARE – MFD1 mismatch, communication halted.	The MFD has different software versions installed. 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.
MFD1 VOLTAGE – MFD1 has low voltage. Reducing power usage	The MFD voltage is low. The system should be serviced.
NAV #[1, 2] INOP - CAL – Factory NAV Calibration Lost or Corrupted.	NAV 1 and/or NAV 2 calibration lost or corrupted. Check COM calibration.
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.

System Message	Comments
NAV #2 INOP: SERL – Internal NAV Serial Communication Fault.	NAV 2 serial communication fault. Check NAV serial communication.
NAV #2 INOP: SYNTH – NAV Synthesiser Lock Fault.	NAV 2 has a synthesizer lock fault.
NAV DB UPDATED – Active navigation database updated.	System has updated the active navigation database from the standby navigation database.
NAV1 MANIFEST – NAV1 software mismatch, communication halted.	The NAV 1 has incorrect software installed. The system should be serviced.
NAV1 RMT XFR – NAV1 remote transfer key is stuck.	The remote NAV1 transfer switch is stuck in the enabled (or “pressed”) state. Press the transfer switch again to cycle its operation. If the problem persists, the system should be serviced.
NAV2 MANIFEST – NAV2 software mismatch, communication halted.	The NAV 2 has incorrect software installed. The system should be serviced.
NAV2 RMT XFR – NAV2 remote transfer key is stuck.	The remote NAV2 transfer switch is stuck in the enabled (or “pressed”) state. Press the transfer switch again to cycle its operation. If the problem persists, the system should be serviced.
NON-MAG UNITS – Non-MAG NAV angle display units are active.	Navigation angle is not set to MAGNETIC at power-up.
NON WGS84 WPT – Do not use GPS for navigation to [xxxx]	The position of the selected waypoint [xxxx] is not calculated based on the WGS84 map reference datum and may be positioned in error as displayed. Do not use GPS to navigate to the selected non-WGS84 waypoint.
NO RUNWAY POSITION DATA – Inhibit SurfaceWatch. No runway position data.	Inhibit SurfaceWatch.
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 REQ: BTM SD – Bottom SD card error.	The GDU bottom SD card is inoperative.
PFD1 CHK REQ: INT SD – Internal SD card error.	The GDU internal SD card is inoperative.
PFD1 CHK REQ: 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’s logging capability is inoperative due to file invalid configuration.
PFD1 CMC INOP: CORRUPT – CMC INOP due to file system corruption.	The CMC system’s logging capability is inoperative due to file system corruption.
PFD1 CMC INOP: MEM FULL – Internal SD card full.	The CMC system’s 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.

System Message	Comments
PFD1 COOLING – PFD1 has poor cooling. Reducing power usage.	The PFD is overheating and is reducing power consumption by dimming the display. If problem persists, the system should be serviced.
PFD1 DB ERR – PFD1 multiple database errors exists.	The PFD detected a failure in more than one database. If problem persists, the system should be serviced.
PFD1 DB ERR – PFD1 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 FAN FAIL – The cooling fan for the PFD is inoperative.	The cooling fan in the PFD has failed. The system should be serviced.
PFD1 HEAT TIME EXT – 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 - ECC ERROR – Internal memory unstable: needs repair.	The internal memory of the specified GDU is unstable. The system should be serviced.
PFD1 INOP - LED STR FAULT – Reduced backlight level: needs repair.	The specified GDU has reduced backlight levels. The system should be serviced.
PFD1 OVER TEMP – Check PFD1 temperature.	The specified GDU is over-temperature. The system should be serviced.
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 MANIFEST – PFD 1 software mismatch, communication halted.	The PFD has incorrect software installed. The system should be serviced.
PFD1 SERVICE – PFD1 needs service. Return unit for repair.	The PFD self-test has detected a problem. The system should be serviced.
PFD1 SOFTWARE – PFD1 mismatch, communication halted.	The PFD has different software versions installed. 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.
PFD1 VOLTAGE – PFD1 has low voltage. Reducing power usage	The PFD voltage is low. The system should be serviced.
PILOT PRIM PTT KEYSTK – Pilot primary push-to-talk key is stuck.	The GMA 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.
PILOT SEC PTT KEYSTK – Pilot secondary push-to-talk key is stuck.	The GMA 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.
REGISTER CONNEXT – Data services inop, register w/ Connex.	The system is not registered with Garmin Connex, or its current registration data has failed authentication.
SCHEDULER [#] – <message>.	Message criteria entered by the user.
SLCT FREQ – Select appropriate frequency for approach.	The system notifies the pilot to load the approach frequency for the appropriate NAV receiver. Select the correct frequency for the approach.
SLCT MAG – Select MAGNETIC NAV ANGLE display units.	The system notifies the pilot to set the Nav Angle units on the ‘Avionics Settings’ Screen to Magnetic.

System Message	Comments
SLCT NAV – Select NAV on CDI for approach.	The system notifies the pilot to set the CDI to the correct NAV receiver. Set the CDI to the correct NAV receiver.
SLCT NON-MAG – Select alternate NAV ANGLE display units.	The system notifies the pilot to set the Nav Angle units on the 'Avionics Settings' Screen to True.
STEEP TURN – Steep turn ahead.	The computed bank angle needed to execute the turn ahead may exceed the current bank angle limit.
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.
TCAS FAIL – TCAS system is inoperative.	The TCAS or TAS system is not operational.
TERRAIN AUD CFG – Trn Awareness audio config error. Service req'd.	TAWS is disabled because the audio configuration is invalid. The system should be serviced.
TERRAIN DISABLED – Terrain Awareness DB resolution too low.	TAWS is disabled because a terrain database of sufficient resolution (9 arc-second or better) is not currently installed.
TIMER EXPIRD – Timer has expired.	The system notifies the pilot the timer has expired.
TRAFFIC FAIL – Traffic device has failed.	The system is no longer receiving data from the traffic system. The traffic device should be serviced.
TRN AUD FAIL – Trn Awareness audio source unavailable.	TAWS is disabled because an aural alert audio source is unavailable.
UNABLE CRUISE ALTITUDE – Cruise altitude cannot be reached.	The selected PERF cruise altitude cannot be achieved.
UNABLE V WPT – Can't reach current vertical waypoint.	The current vertical waypoint can not be reached within the maximum flight path angle and vertical speed constraints. The system automatically transitions to the next vertical waypoint.
UNABLE VNAV – Excessive cross-track error.	The current cross-track exceeds the limit, causing vertical deviation to go invalid.
UNABLE VNAV – Excessive track angle error.	The current track angle error exceeds the limit, causing the vertical deviation to go invalid.
UNABLE VNAV – Reverted to PIT.	The current VNAV is not supported, the Flight Director has reverted to PIT mode.
UNABLE VNAV – Parallel course selected.	A parallel course has been selected, causing the vertical deviation to go invalid.
UNABLE VNAV – 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.
UNABLE VNAV ALTITUDE – Cannot meet VNAV altitude constraint.	The current vertical speed is insufficient to make the active flight plan altitude constraint prior to crossing the waypoint.

System Message	Comments
VNAV CONFIG – VNAV config error Config service req'd.	VNAV configuration error. The system should be serviced.
VOR1 APR DEV NOT AVAIL – Approach NAVAID deviation not available.	VOR-based deviation is not available.
VOR2 APR DEV NOT AVAIL – Approach 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.
WX ALERT – Possible severe weather ahead.	The GWX 70 indicates severe weather within ± 10 degrees of the aircraft heading at a range of 80 to 320 nm.
XPDR1 ADS-B 1090 – Datalink: ADS-B 1090 receiver has failed.	A failure has been detected in the 1090 receiver.
XPDR1 ADS-B NO POS – ADS-B is not transmitting position.	The transponder is not able to receive position information.
XPDR1 ADS-B NO TX – Transponder: ADS-B out failed.	ADS-B is inoperative. The transponder may not be receiving a valid GPS position. Other transponder functions may be available. Service when possible.
XPDR1 ADS-B TRFC – Datalink: Traffic failed.	The Transponder is incapable of processing traffic information.
XPDR1 ADS-B UAT – Datalink: ADS-B in UAT receiver has failed.	A failure has been detected in the UAT receiver.
XPDR1 CONFIG – XPDR1 config error. Config service REQ'D.	The transponder configuration settings do not match those of backup configuration memory. The system should be serviced.
XPDR1 CSA FAIL – Traffic: ADS-B In traffic alerting has failed.	ADS-B Conflict Situational Awareness (CSA) is unavailable.
XPDR1 FAIL – XPDR1 is inoperative.	There is no communication with the #1 transponder.
XPDR1 FAULT – Datalink: ADS-B in has failed.	The transponder is unable to receive ADS-B information.
XPDR1 FIS-B WX – Datalink: FIS-B Weather has failed.	The transponder is unable to receive FIS-B weather information.
XPDR1 GND TEST – Transponder: Ground test mode active.	Transponder ground test active.
XPDR1 OVER TEMP – Transponder: Transponder over temp.	The system has detected an over temperature condition in XPDR1. The transmitter operates at reduced power. If the problem persists, the system should be serviced.
XPDR1 PRES ALT – Transponder: ADS-B no pressure altitude.	Unable to provide pressure altitude information.
XPDR1 SERVICE – XPDR1 needs service. Return unit for repair.	The #1 transponder should be serviced when possible.
XPDR1 TEST MODE – Transponder: Test mode active.	Transponder test mode active.
XPDR1 UNDER TEMP – Transponder: Transponder under temp.	The system has detected an under temperature condition in XPDR1. The transmitter operates at reduced power. If the problem persists, the system should be serviced.
XPDR2 ADS-B 1090 – Datalink: ADS-B 2090 receiver has failed.	A failure has been detected in the 1090 receiver.

System Message	Comments
XPDR2 ADS-B NO POS – ADS-B is not transmitting position.	The transponder is not able to receive position information.
XPDR2 ADS-B NO TX – Transponder: ADS-B out failed.	ADS-B is inoperative. The transponder may not be receiving a valid GPS position. Other transponder functions may be available. Service when possible.
XPDR2 ADS-B TRFC – Datalink: Traffic failed.	The Transponder is incapable of processing traffic information.
XPDR2 ADS-B UAT – Datalink: ADS-B in UAT receiver has failed.	A failure has been detected in the UAT receiver.
XPDR2 CONFIG – XPDR2 config error. Config service REQ'D.	The transponder configuration settings do not match those of backup configuration memory. The system should be serviced.
XPDR2 CSA FAIL – Traffic: ADS-B In traffic alerting has failed.	ADS-B Conflict Situational Awareness (CSA) is unavailable.
XPDR2 FAIL – XPDR2 is inoperative.	There is no communication with the #2 transponder.
XPDR2 FAULT – Datalink: ADS-B in has failed.	The transponder is unable to receive ADS-B information.
XPDR2 FIS-B WX – Datalink: FIS-B Weather has failed.	The transponder is unable to receive FIS-B weather information.
XPDR2 GND TEST – Transponder: Ground test mode active.	Transponder ground test active.
XPDR2 OVER TEMP – Transponder: Transponder over temp.	The system has detected an over temperature condition in XPDR2. The transmitter operates at reduced power. If the problem persists, the system should be serviced.
XPDR2 PRES ALT –Transponder: ADS-B no pressure altitude.	Unable to provide pressure altitude information.
XPDR2 SERVICE – XPDR2 needs service. Return unit for repair.	The #2 transponder should be serviced when possible.
XPDR2 TEST MODE – Transponder: Test mode active.	Transponder test mode active.
XPDR2 UNDER TEMP – Transponder: Transponder under temp.	The system has detected an under temperature condition in XPDR2. The transmitter operates at reduced power. If the problem persists, the system should be serviced.
XTALK ERROR – Flight display crosstalk error has occurred.	The GDUs and/or GTCs are not communicating with each other. The system should be serviced.

AIRFRAME SYSTEM MESSAGES

Message
AOA SENSOR FAIL - The AOA 2 signal is out of range.
ECS AIR COND FAIL - Air conditioning system has failed.
ECS BIAS VALVE FAIL - Bleed bias valve actuator has failed.
ECS DEFOG VALVE FAIL - Defog valve actuator has failed.
ECS TEMP SENSOR FAIL - Backup bleed duct temperature sensor has failed.
FADEC DATA MISSING - FADEC data missing from Channel A.
FADEC DATA MISSING - FADEC data missing from Channel B.
FADEC CTRL DEGRADED 1 - Loss of N2 signal to both FADEC channels.
FADEC CTRL DEGRADED 4 - Loss of N1 signal to both FADEC channels.

Message
FADEC CTRL DEGRADED 6 - Loss of TLA signal to both FADEC channels.
FADEC CTRL DEGRADED 18 - Inability to control FSOV in both FADEC channels.
FADEC CTRL DEGRADED 22 - Unable to control engine inducer bleed valve.
FADEC CTRL DEGRADED 58 - Unable to control fuel metering valve.
FADEC CTRL DEGRADED 68 - Loss of engine power setting validation.
FADEC NO DISPATCH 2 - N2 software threshold exceedance fault.
FADEC NO DISPATCH 5 - N1 software threshold exceedance fault.
FADEC NO DISPATCH 7 - Loss of TT2 signal to both FADEC channels.
FADEC NO DISPATCH 8 - Loss of PT2 signal to both FADEC channels.
FADEC NO DISPATCH 9 - Invalid ITT cold junction temp signal.
FADEC NO DISPATCH 10 - Loss of ITT signal to both FADEC channels.
FADEC NO DISPATCH 13 - Internal hardware fault detected.
FADEC NO DISPATCH 14 - Loss of FMV position to both FADEC channels.
FADEC NO DISPATCH 19 - Overspeed Protection System test failure.
FADEC NO DISPATCH 20 - Loss of cross-channel data.
FADEC NO DISPATCH 28 - Inlet pressure split.
FADEC NO DISPATCH 29 - Inlet temperature split.
FADEC NO DISPATCH 38 - Engine shutdown discrete split.
FADEC NO DISPATCH 39 - Failure detected with aircraft power input.
FADEC NO DISPATCH 40 - Permanent Magnet Alternator failure.
FADEC NO DISPATCH 44 - Loss of N1 signal to a single FADEC channel.
FADEC NO DISPATCH 45 - Loss of N2 signal to a single FADEC channel.
FADEC NO DISPATCH 46 - Loss of PT2 signal to a single FADEC channel.
FADEC NO DISPATCH 47 - Loss of TT2 signal to a single FADEC channel.
FADEC NO DISPATCH 49 - Loss of TLA signal to a single FADEC channel.
FADEC NO DISPATCH 52 - Invalid N2 PMA speed or split with gearbox N2.
FADEC NO DISPATCH 53 - Invalid Overspeed Protection Sys reference signal.
FADEC NO DISPATCH 54 - Software version mismatch.
FADEC NO DISPATCH 57 - Channel switch-over/active failure.
FADEC NO DISPATCH 59 - Bleed level mismatch/intermittent anti-ice input.
FADEC NO DISPATCH 62 - Aircraft TAT or Total Press not received on ARINC.
FADEC NO DISPATCH 64 - Aircraft TAT split between channels.
FADEC NO DISPATCH 67 - Cross-channel health monitor split.
FADEC NO DISPATCH 75 - N1, N2 or ITT exceedance has occurred.
FLAPS POSITION SENSOR - A flaps position sensor has failed.
FUEL FLOW INVALID - Automatic tank change every minute.
FUEL FLOW TEMPERATURE - Fuel flow temperature sensor fault.
IPS FLUID QTY FAIL - IPS fluid quantity failure, out of range.
MASTER SILENCE KEY STUCK - Master silence key stuck, function not available.

Message
OIL CHIP DETECT - Engine oil debris detected.
OIL CHIP DETECT FAIL - Engine oil debris sensor signal is out of range.
OIL PRESSURE SENSOR FAIL - Oil pressure transducer signal is out of range.
OIL PRESSURE SENSOR FAIL - Oil pressure transducer and switch disagreement.
STALL WARN 1 - GIA1 indicating stall warning.
STALL WARN 1-2 - GIAs indicating stall warning.
STALL WARN 2 - GIA2 indicating stall warning.
STALL WARN FAIL 1 - GIA1 indicating stall warning failure.
STALL WARN FAIL 1-2 - GIAs indicating stall warning failure.
STALL WARN FAIL 2 - GIA2 indicating stall warning failure.
STICK PUSHER 1 - GIA1 commanding stick push.
STICK PUSHER 2 - GIA2 commanding stick push.
STICK PUSHER ACT 1-2 - GIAs commanding stick push.
STICK PUSHER FAIL 1 - GIA 1 indicating stall protection failure.
STICK PUSHER FAIL 1-2 - GIAs indicating stall protection failure.
STICK PUSHER FAIL 2 - GIA 2 indicating stall protection failure.

DATABASE MANAGEMENT

Database information is obtained from third party sources. Inaccuracies in the data may be discovered from time to time. Garmin communicates this information by issuing a Database Alert. These notifications are available on flygarmin.com.

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

A 32 GB Supplemental Data (SD) card (including FS 510 Wireless Transceiver card when used as a storage device) is required to perform database updates. Only cards provided by Garmin or the OEM should be used. In the event there is a file corruption problem with the SD card or Wireless Transceiver card, it may be necessary to reformat the card. This can cause an issue when formatting using Mac OS, where the newly formatted device will not be recognized by the avionics system. When using a Macintosh computer to format the SD card or Wireless Transceiver card, Garmin recommends using the SD Memory Card Formatter application made available by the SD Association as a download from sdcard.org. When running the application, use the Quick Format option.



NOTE: Use of SD cards that are not Garmin or OEM provided may cause system malfunctions when left in the MFD after the databases are loaded.

In addition to SD card loading, databases may be loaded through Garmin Pilot™ and FS 510 Wireless Transceiver. When loading databases through Garmin Pilot™ and the Wireless Transceiver, it must be enabled on the system and the Wireless Transceiver card inserted in the bottom SD slot of the MFD.



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



NOTE: When loading database updates, the 'DB Mismatch' system message will be displayed until database synchronization is complete, followed by turning system power off, then on. Synchronization can be monitored on the 'Database Status' Screen.





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.
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 **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.'*

LOADING UPDATED DATABASES

The cycles and dates for both standby and active databases are displayed on the 'Database Status' Screen on the Touchscreen Controller. Any active databases with expiration dates in the past will be highlighted with amber text. When an expired active database has a standby database that is ready to become effective, a cyan double-sided arrow will be displayed between the database cycles. When this arrow is visible, it indicates the standby and active databases in that row will be switched on the next power cycle, activating the current standby database. Databases can also be manually selected (or deselected) by touching the database list item, then touching the **Swap** Button.


In some cases it may be necessary to obtain an unlock code from Garmin in order to make the database product functional. It may also be necessary to have the system configured by a Garmin authorized service facility in order to use some database features.

The navigation database contains the aeronautical data used by the system for the flight management and flight planning functions. Included is detailed data for waypoints, procedures (arrivals, departures, approaches), and airways. The navigation database is updated every 28 days. 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.

UPDATING DATABASES WITH SD CARD OR WIRELESS TRANSCEIVER CARD

All databases are updated through a single SD card or Wireless Transceiver Card in the bottom slot of the MFD. When the card is inserted, the databases on the card will be copied to standby and synchronized across all powered, configured units. After update, the card is removed and the databases are stored on the system. When in standby, databases are not immediately available for use, but stored to be activated at a later time.

Database updates can be obtained by following the instructions detailed in the 'Aviation Databases' section of the Garmin website (flygarmin.com). Once the updated files have been downloaded from the website, a personal computer equipped with an appropriate 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.
- Garmin SD card Reader for Wireless Transceiver cards.
- Updated databases obtained from the Garmin website.
- Garmin or OEM provided 32 GB SD card or Wireless Transceiver card.

Updating databases using an SD or Wireless Transceiver card:

- 1) Download and install the databases on the SD card or Wireless Transceiver card.
- 2) Put the card in the bottom SD card slot of the MFD.
- 3) Turn the system ON.
- 4) Press the right most softkey on MFD display to acknowledge the power-on screen.
- 5) From Home, touch **Utilities > Setup > Database Status**.
- 6) Monitor the Sync Status on the 'Database Status' Screen. Wait for all databases to complete synchronization, indicated by 'Sync Complete' being displayed adjacent to the database title for each database being updated.
- 7) The database update status will appear in the status window at the top of the screen. The load is complete when 'Databases Ready' is displayed.
- 8) A cyan double-arrow will appear between the 'Standby' and 'Active' columns to show which standby databases will be transferred to 'Active' at the next power cycle. For any databases not selected to load with cyan double-arrows, touch the database title and then touch **Swap > OK**.

Database Status		
Database Out of Date Activate databases with on ground restart.		
Database	Standby (effective)	Active (expires)
Navigation	2104 22-APR-2021	2103 22-APR-2021
Basemap	20M3 N/A	20M3 N/A
Terrain	20T3 N/A	20T3 N/A
Obstacle	21B2 22-APR-2021	21B1 22-APR-2021

Figure B-1 'Database Status' Screen before Activation of Standby Databases

- 9) The system will display the message 'Activate databases with on ground restart.'
- 10) Scroll down and touch **Database Options > Restart Displays**.
- 11) Remove the SD card from the bottom slot of the MFD, if desired. Wireless Transceiver Cards should not be removed from the bottom slot.
- 12) Press the right most softkey on MFD display to acknowledge the power-on screen.
- 13) From Home, touch **Utilities > Setup > Database Status**.
- 14) Verify the standby databases transferred and are now in the 'Active' Column.

Database Status		
Databases Ready		
Database	Standby (effective)	Active (expires)
Navigation	2103 25-Mar-2021	2104 20-MAY-2021
Basemap	20M3 N/A	20M3 N/A
Terrain	20T3 N/A	20T3 N/A
Obstacle	21B1 25-FEB-2021	21B2 17-JUN-2021

Figure B-2 'Database Status' Screen after Activation of Standby Databases

- 15) To manually activate any databases that did not transfer to the 'Active' Column:
 - a) From Home, touch **Utilities > Setup > Database Status**.
 - b) Scroll down and touch the database title.
 - c) Touch **Swap > OK**. The cyan double-arrows will now appear beside the selected databases. Repeat steps b) and c) for any additional databases.
 - d) Scroll down and touch **Database Options > Restart Displays**.
 - e) Press the right most softkey on MFD display to acknowledge the power-on screen.
 - f) From Home, touch **Utilities > Setup > Database Status**.
 - g) Verify the standby databases transferred and are now in the 'Active' Column.

- 16) To view database status:
 - a) From Home, touch **Utilities > Setup > Database Status**.
 - b) To view database status for an individual display, scroll down and touch **Database Options > LRU Database Info**.
Or:
 To view database status from the 'Avionics Status' Screen, touch **Utilities > Setup > Avionics Status**. Touch the **Database** Tab.
 - c) Touch a button from the list to view database information associated with that display.
 - d) Scroll through the database information to view database status.

UPDATING DATABASES WITH GARMIN PILOT / WIRELESS TRANSCEIVER

In order to load databases through Garmin Pilot™ and the Wireless Transceiver, the Wireless Transceiver must be enabled on the system with the Wireless Transceiver card inserted in the bottom SD slot of the MFD. A Portable Electronic Device (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 WiFi 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 WiFi connection if new databases have been detected for download on Garmin Pilot™ with a valid Bluetooth connection. If there are no database updates required, the system will not provide a WiFi signal.*



NOTE: *If the PED has previously connected to the Wireless Transceiver, and is not connected to another WiFi source (i.e. hangar WiFi), the PED should connect automatically to the Wireless Transceiver. If the PED is connected to another WiFi source or has not previously connected to the Wireless Transceiver, then the Wireless Transceiver will not connect automatically.*

Updating databases using the Wireless Transceiver:

- 1) With the system OFF, insert the Wireless Transceiver card in the bottom slot of the MFD if not already inserted.
- 2) Turn the system on.



NOTE: *The Wireless Transceiver card should not be removed while the system is powered on. If the card is removed while the system is powered on, reinsert the card after the 'FS510 Card Error' System Message appears on the 'Notifications' Screen of the Touchscreen Controller.*

- 3) Press the right-most softkey on the MFD display to acknowledge the power-on screen.
- 4) From Home, touch **Utilities** > **Setup** > **Connex Setup**.
- 5) On the PED, start Garmin Pilot™ and touch **Home** > **Connex Setup** > **Database Concierge**.
- 6) On the Touchscreen Controller, touch the **Functions** Tab and ensure the **Enable** Button is selected.



Figure B-3 Wifi Enabled

- 7) Touch the **Bluetooth** Tab to ensure pairing mode is enabled.



Figure B-4 Bluetooth Setup

- 8) On the PED, connect with Bluetooth to the Wireless Transceiver.
- 9) From Home on the Touchscreen Controller, touch **Utilities > Setup > Database Status > Device Databases**.
- 10) 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, touch the database title and then touch **Swap > OK**.
- 11) The **CNXT** Button will flash on the Touchscreen Controller. Touch the **CNXT** Button and then touch the displayed 'Database Update Available' message if it is desired to skip to step 14.

Database	Standby (effective)	Device (expires)
Navigation	2103 25-MAR-2021	2104 Worl... 22-APR-2021
Basemap	20M3 N/A	20M3 N/A
Terrain	20T3 N/A	20T3 N/A

Active Databases Select Preferred Device (AvnSysTest3) Start Transfer

Figure B-5 Database Start Transfer

- 12) If required, select the Preferred Device.
 - a) Touch the **Select Preferred Device** Button.
 - b) Touch the button for the desired PED from the list.
- 13) If desired, change the Preferred Region for the database.
 - a) Touch a database button from the list.
 - b) Touch the **Select Preferred Region** Button.
 - c) Touch the button for the desired database region from the list. The database for the region selected will be loaded at the next power cycle.
 - d) Touch **Load > OK**.
 - e) Repeat steps **a)** through **d)** above for additional databases.

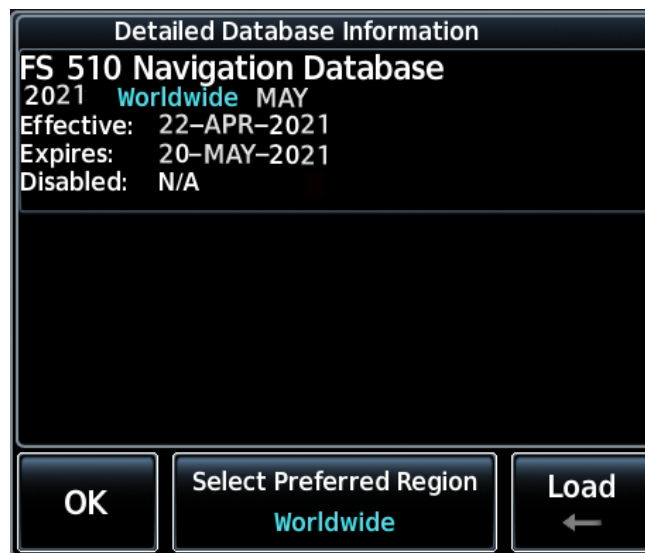


Figure B-6 Selecting Preferred Region

- 14) Touch the **Start Transfer** Button on the 'Database Status' Screen.
- 15) On the PED, connect to the indicated SSID WiFi network shown on the **WiFi** Tab of the 'Connex Setup' Screen on the Touchscreen Controller.

Or:

If using a device that has not been previously paired with the system, a password prompt will appear on the PED. Enter the password shown in the 'SSID' Field of the 'Connex Setup' Screen.



Figure B-7 WiFi Setup

- 16) Monitor the Sync Status on the 'Database Status' Screen. Wait for all databases to complete syncing, indicated by 'Sync Complete' being displayed adjacent to the database title for each database being updated.
- 17) The database update status will appear in the status window at the top of the screen. The load is complete when 'Databases Ready' is displayed.
- 18) A cyan double-arrow will appear between the 'Standby' and 'Active' Columns to show which standby databases will be transferred to Active at the next power cycle. For any databases not selected to load with cyan double-arrows, touch the database title and then touch **Swap > OK**.

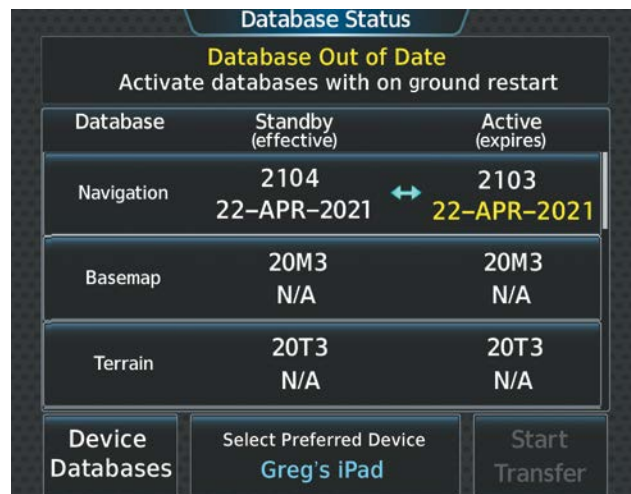


Figure B-8 'Database Status' Screen before Activation of Standby Databases

- 19) The system will display the message 'Activate databases with on ground restart.'
- 20) Scroll down and touch **Database Options > Restart Displays**.
- 21) Press the right-most softkey on MFD display to acknowledge the power-on screen.
- 22) From Home, touch **Utilities > Setup > Database Status**.

Database	Standby (effective)	Active (expires)
Navigation	2103 25-MAR-2021	2104 20-MAY-2021
Basemap	20M3 N/A	20M3 N/A
Terrain	20T1 N/A	20T1 N/A

Device Databases Select Preferred Device
AvnSysTest3 Start Transfer

Figure B-9 'Database Status' Screen after Activation of Standby Databases

- 23) Verify the standby databases transferred and are now in the 'Active' Column.
- 24) To manually activate any databases that did not transfer to the 'Active' Column:
- From Home, touch **Utilities > Setup > Database Status**.
 - Scroll down and touch the database title.
 - Touch **Swap > OK**. The cyan double-arrows will now appear beside the selected databases.
 - Scroll down and touch **Database Options > Restart Displays**.
 - Press the right-most softkey on MFD display to acknowledge the power-on screen.
 - From Home, touch **Utilities > Setup > Database Status**.
 - Verify the standby databases transferred and are now in the 'Active' Column.
- 25) To view database status:
- From Home, touch **Utilities > Setup > Database Status**.
 - To view database status for an individual display, touch **Database Options > LRU Database Info**.
- Or:**
- To view database status from the 'Avionics Status' Screen, touch **Utilities > Setup > Avionics Status**. Touch the **Database** Tab.
- Touch a button from the list to view database information associated with that display.
 - Scroll through the database information to view database status.

DELETING DATABASES

If databases are not properly loading or functioning, and an attempt has been made to load the databases using a new SD card or Wireless Transceiver card, it may be necessary to delete the databases from the system.

Deleting the databases:

- From Home, touch **Utilities > Setup > Database Status**.
- Scroll down and touch **Database Options > Delete Databases**.

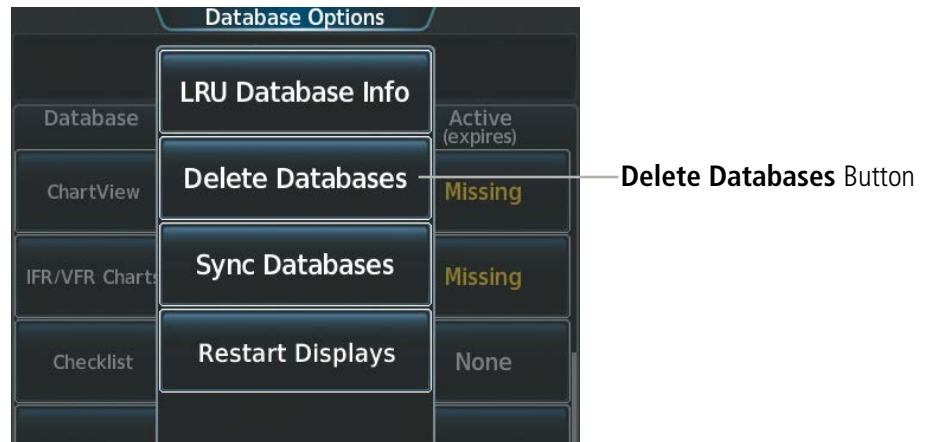


Figure B-10 Delete Databases

- 3) A prompt will appear to confirm deletion of all internal databases. Touch the **OK** Button.

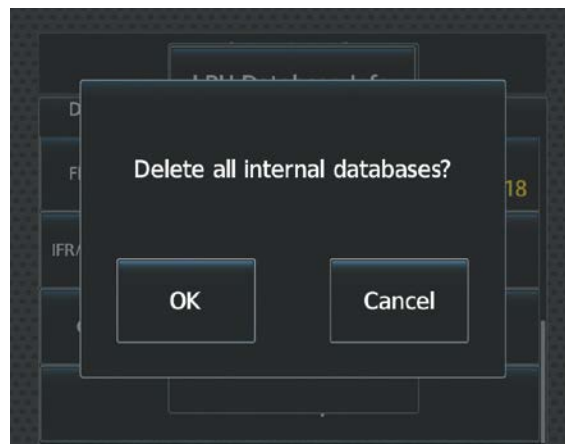


Figure B-11 Confirm Deletion

- 4) Another confirmation prompt will appear. Touch the **OK** Button.
- 5) Scroll down and touch **Database Options > Restart Displays**.
- 6) Press the right most softkey on MFD display to acknowledge the power-on screen.
- 7) From Home, touch **Utilities > Setup > Database Status**.
- 8) Confirm that all databases have been deleted from the system.

DATABASE SYNCHRONIZATION WITH A FAILED DISPLAY

Normally, databases are synchronized across all displays from an SD card or Wireless Transceiver card located in the bottom slot of the MFD. When one of the displays has failed, any database updates cannot be automatically synchronized to the other displays. Should a display failure occur, the database synchronization feature allows the process to be completed from any of the remaining, functional displays. For example, with MFD 1 failed, databases can be synchronized from PFD 1 to PFD 2. For that to be performed, the SD card must be placed in the bottom slot of PFD 1. The Wireless Transceiver card may only be used in the bottom slot of the MFD. When the MFD is still functional, it is the recommended display from which to perform the database synchronization.

Synchronizing databases:



NOTE: The Wireless Transceiver card may only be used in the bottom slot of the MFD. *It may not be used in either PFD.*

- 1) Turn the system ON.
- 2) If the MFD is available, press the right-most softkey on MFD display to acknowledge the power-on screen.
- 3) From MFD Home, touch **Utilities > Setup > Database Status.**
- 4) Scroll down and touch **Database Options > Sync Databases.**

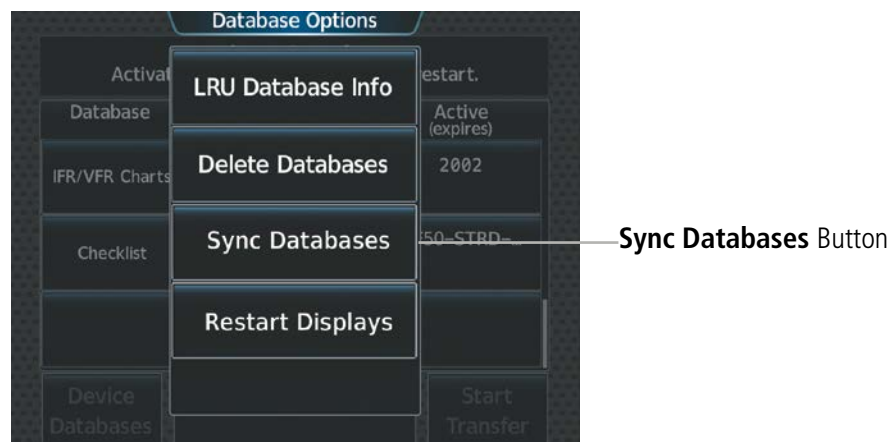


Figure B-12 Sync Databases

- 5) Touch the **PFD1**, **MFD1**, or **PFD2** Button for the display from which the databases will be synchronized. This will be the display that will contain the SD card or Wireless Transceiver card (MFD only). The button for the failed display will be subdued.
- 6) Put the SD card or Wireless Transceiver card in the bottom slot of the MFD.

Or:

If the MFD is not functional, put the SD card in the bottom slot of PFD 1 or PFD 2.

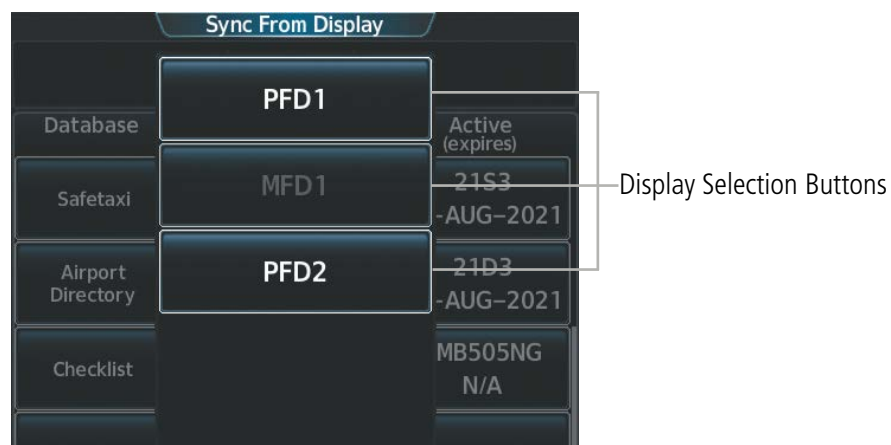


Figure B-13 'Sync From Display' Screen

- 7) The database synchronization process will begin. Follow the procedures for loading databases in this section to complete the database updates.

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), as shown in Figure B-14. 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-14 GRS1 Magnetic Field Variation Database Update Prompt (Touchscreen Controller)

Loading the Magnetic Field Variation Database update:

- 1) With the MV DB prompt displayed, as shown in Figure B-14, touch the **OK** Button. A progress monitor is displayed as shown in Figure B-15.



Figure B-15 Uploading Database to GRS1

- 2) When the upload is complete, the prompt for the next GRS upload is displayed, as seen in Figure B-16. A database mismatch message, as seen in Figure B-17 indicates the second GRS has not yet been updated.



Figure B-16 GRS2 Magnetic Field Variation Database Update Prompt

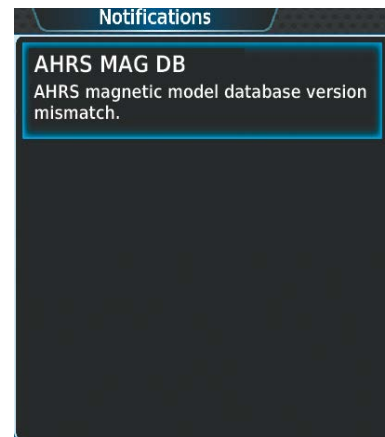


Figure B-17 Database Mismatch Message is Annunciated Before Second GRS is Updated

- 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.

AVIATION ABBREVIATIONS, TERMS, AND ACRONYMS

A	Amps, Amperes	ALTM	Altimeter
ABN	Abnormal	ALTS	Altitude Select, Selected Altitude Capture Mode
AC	Advisory Circular, Alternating Current	ALTV	VNAV Altitude Capture Mode
ACARS	Aircraft Communications Addressing and Reporting System	AM	Amplitude Modulation
ACC	Accuracy	AMP	Amplifier, Ampere
ACFT	Aircraft	AMPS	Amperes
ACK	Acknowledge	ANN/ANNUNC	Annunciation/Annunciator
ACT, ACTV	Active, Activate, Altitude Compensated Tilt	ANSP	Air Navigation Service Provider
ADAHRS	Air Data, Attitude and Heading Reference System	ANT	Antenna
ADC	Air Data Computer	AOA	Angle of Attack, ACARS Over AVLIC
ADF	Automatic Direction Finder	AOC	Aeronautical Operational Control
ADI	Attitude Direction Indicator	AOG	Aircraft On Ground
ADIZ	Air Defense Identification Zone	AOPA	Aircraft Owners and Pilots Association
ADM	Administrative Domain	AP	Autopilot
ADS-B	Automatic Dependent Surveillance-Broadcast	AP DISC	Autopilot Disconnect
ADS-C	Automatic Dependent Surveillance-Contract	APPR, APR	Approach, Approach Control
ADS-R	Automatic Dependent Surveillance-Rebroadcast	APT	Airport, Aerodrome, Automatic Pitch Trim
AEA	Aircraft Electronic Association	APTSIGNS	Airport Signs
AF	Arc to Fix Leg	APU	Auxiliary Power Unit
AFCS	Automatic Flight Control System	APV	Approaches with Vertical Guidance
AFM	Airplane Flight Manual	ARINC	Aeronautical Radio Incorporated
AFMS	Airplane Flight Manual Supplement	ARM	Arm, Armed
AFN	ATS Facilities Notification	ARSPC	Airspace
AFRM	Airframe	ARTCC	Air Route Traffic Control Center
AFTN	Aeronautical Fixed Telecommunication Network	ARV	Arrival
A/G	Air-to-Ground	AS	Airspeed
AGL	Above Ground Level	ASB	Aviation Support Branch
AHRS	Attitude and Heading Reference System	ASDA	Accelerate-Stop Distance Available
AIM	Aeronautical Information Manual	ASI	Airspeed Indicator
AIRB	Airborne	ASOS	Automated Surface Observing System
AIRMET, AIRM	Airman's Meteorological Information	AT	Auto Throttle
AIRREP	Air Reports	ATAS	ADS-B Traffic Advisory System
ALRT	Alert, Alerting	ATC	Air Traffic Control
ALT	Altitude	ATCRBS	ATC Radar Beacon System
ALT, ALTN	Alternator, Alternate	ATD	Along-Track Distance
		ATE	Along-Track Error, Automatic Test Equipment
		ATIS	Automatic Terminal Information Service

ATK	Along Track	CAS	Crew Alerting System
ATN	Aeronautical Telecommunications Network	CAT	Clear Air Turbulence
ATS	Air Traffic Services	CLB	Climb
ATT	Attitude	CB	Circuit Breaker
ATZ	Aerodrome Traffic Zone	CCG	Current Climb Gradient
AUD	Audio	CD	Course to DME Distance Leg
AUTO	Automatic	CDA	Current Data Authority
AUTOSEQ	Automatic Sequence	CDI	Course Deviation Indicator
AUX	Auxiliary	CDU	Control Display Unit
AVAIL	Available	CF	Course to Fix Leg
AVG	Average	CFG	Configuration
AVLC	Aviation VHF Link Control	CFIT	Controlled Flight into Terrain
AWOS	Automated Weather Observing System	CG	Center of Gravity
AWY	Airway	CH, CHNL	Channel
AZ	Azimuth	CHK	Check
B	Both Runways	CHKLIST	Checklist
B ALT	Barometric Altitude	CHRG	Charge
BC, B/C	Back Course	CHT	Cylinder Head Temperature
BARO	Barometer, Barometric Setting	CI	Course to Intercept Leg
BATT	Battery	CIP	Current Icing Potential
Bearing	The compass direction from the present position to a destination waypoint.	CL	Class, Centerline
BFO	Beat Frequency Oscillator	CLB	Climb
BKLT	Backlight	CLD	Cloud
BKSP	Backspace	CLG	Ceiling
BKUP	Backup	CLR	Clear
BLKHD	Bulkhead	CLS	Close
Bluetooth	Wireless standard for data exchange over short distances	CLTR	Clutter
BOC	Bottom of Climb	CM	Centimeter, Context Management
BOD	Bottom of Descent	CMC	Central Maintenance Computer
BRG	see also Bearing	CMPTR	Comparator
BRK	Brake	CN	Canada
BTM	Bottom	CNCL	Cancel
°C	Degrees Celsius	CNFM	Confirm
C	Center Runway	CNI	Communication, Navigation, & Identification
CA	Course to Altitude Leg	CNS	Communication, Navigation, & Surveillance
CAL	Calibrated	CNXT	Connext
CALC	Calculator	CO	Carbon Monoxide
Calibrated Airspeed	Indicated airspeed corrected for installation and instrument errors.	COM	Communication Radio
		COMP	Compensated, Compensation

CONFIG	Configuration	D/A	Digital to Analog Converter
CONUS	Continental United States	D ALT	Density Altitude
COOL	Coolant	D-ATIS	Digital Automatic Terminal Info Service
COPLT	Copilot	DA	Decision Altitude, Drift Angle
CORR	Correct, Corrected, Correction	DB, DBASE	Database
Course	The line between two points to be followed by the aircraft.	DBZ	Decibels 'Z' (Radar Return)
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.	DCL	Departure Clearance
CP	Copilot, Control Panel	DCLTR, DECLTR	Declutter
CPDLC	Controller Pilot Datalink Communications	DEC	Declination
CPL	Couple	DEC FUEL	Decrease Fuel
CR	Course to Radial Leg	DEG	Degree
CRC	Cyclic Redundancy Check	DEIC, DEICE	De-icing
CRG	Cockpit Reference Guide	DEL	Delete
CRNT	Current	DEP	Departure, Departure Control
Crosstrack Error	The distance the aircraft is off a desired course in either direction, left or right.	DESC	Descent
CRS	see also Course, Course to Steer	Desired Track	The desired course between the active "from" and "to" waypoints.
CRSR	Cursor	DEST, DES	Destination, Destination Airport Identifier
CRU, CRZ	Cruise	DET	Detect, Detected, Detection, Detector
CSA	Conflict Situational Awareness	DEV	Deviation
CSC	Current Speed Control	DF	Direction Finder, Direct to Fix Leg
CSTR	Constraint	DFLT	Default
CTA	Control Area	DG	Directional Gyro
CTAF	Common Traffic Advisory Frequency	DGPS	Differential GPS
CTR	Center, Controlled Traffic Region	DGRD	Degrade
CTRL	Control	DH	Decision Height
Cumulative, CUM	The total of all legs in a flight plan.	DIFF	Differential
CVDR	Cockpit Voice Data Recorder	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).
CVFP	Chartered Visual Flight Procedure	DIR	Direction
CVR	Cockpit Voice Recorder	DIS	Distance
CVRG	Coverage	DISENG	Disengage
CWS	Control Wheel Steering	DISP	Display
CYC CTR	Cyclic Centering	Distance	The 'great circle' distance from the present position to a destination waypoint.
CYL	Cylinder	DIV	Divert, Diversion
CZ	Control Zone	DL LTNG	Datalink Lightning
D->, -D➔	Direct-To	DLS	Data Link System
		DME	Distance Measuring Equipment

DN	Down	ELT	Emergency Locator Transmitter
DNALT	Density Altitude	EMER, EMERG, EMERGENCY	Emergency
DNGR	Danger	EMI	Electromagnetic Interference
DNLK	Downlink	END, ENDUR	Endurance
DOD	Department of Defense	Endurance	Flight endurance, or total possible flight time based on available fuel on board.
DOP	see also Dilution of Precision	ENG	Engine
DOPP	Doppler	ENGA	Engage
DP	Departure Procedure, Differential Pressure	ENGD	Engaged
DPRT	Departure	ENR	Enroute; ETE to Final Destination
DQR	Data Quality Requirements	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.
DR	Dead Reckoning	ENT	Enter
DSBL	Disabled	EP	Envelope Protection
DSP	Display, Datalink Service Provider, Digital Signal Processor	EPE	see also Estimated Position Error
DTG	Distance To Go, Remaining distance to last active FPL waypoint	EPU	Estimated Position Uncertainty
DTK	see also Desired Track	ERR	Error
DWNGRADE	Downgrade	ES	Extended Squitter
E	Empty, East	ESA	Emergency Safe Altitude, see also Enroute Safe Altitude
EAS	Engine and Airframe Systems	ESOSP	Electronic Stability Overspeed Protection
EC	Error Correction	ESP	Electronic Stability and Protection
ECC	Error Correcting Code	Estimated Position Error (EPE)	A measure of horizontal GPS position error derived by satellite geometry conditions and other factors.
ECL	Electronic Checklist	Estimated Time Enroute (ETE)	The estimated time it takes to reach the destination waypoint from the present position, based upon current groundspeed.
ECR	Excessive Closure Rate	Estimated Time of Arrival (ETA)	The estimated time at which the aircraft should reach the destination waypoint, based upon current speed and track.
ECS	Environmental Control System	ET	Elapsed Time
ECU	Engine Control Unit	ETA	see also Estimated Time of Arrival
EDM	Emergency Descent Mode	ETD	Estimated Time of Departure
EDR	Excessive Descent Rate	ETE	see also Estimated Time Enroute
EEP	Expanded Envelope Protection	EVS	Enhanced Vision System
EFB	Electronic Flight Bag	EXP	Expand
EFC	Expected Further Clearance	EXPIRD	Expired
Efficiency	A measure of fuel consumption, expressed in distance per unit of fuel.	EXT	External
EGNOS	European Geostationary Navigation Overlay Service	EXTD	Extend
EGT	Exhaust Gas Temperature		
EHS	Enhanced Surveillance		
EICAS	Engine Indication and Crew Alerting System		
EIS	Engine Indication System		
ELEC	Electrical		
ELEV	Elevation, Elevator		

EXTING	Extinguish, Extinguisher	FRMT	Format
EXTR	Extract, Extraction	FRT	Front
°F	Degrees Fahrenheit	FRZ	Freezing
FA	Course From Fix to Altitude Leg	FS	Flight Stream
FAA	Federal Aviation Administration	FSD	Full-Scale Deflection
FADEC	Full Authority Digital Engine Control	FSM	Flight System Messages
FAF	Final Approach Fix	FSS	Flight Service Station
FAIL	Failure	FT	Foot/Feet
FANS	Future Air Navigation System	Fuel Flow	The fuel flow rate, expressed in units of fuel per hour.
FAP	Final Approach Point	Fuel On Board	The total amount of usable fuel on board the aircraft.
FAPP	Final Approach	Fuel Over Destination	The estimated fuel remaining when the aircraft reaches the destination waypoint, based upon current fuel flow.
FAR	Federal Aviation Regulations	FWD	Forward
FBO	Fixed Base Operator	G/A	Ground to Air
F/C	Flight Crew	G/S	Glideslope
FC	Course From Fix to Distance Leg	GA	Go-Around
FCC	Federal Communication Commission	GAGAN	GPS Aided GEO Augmented Navigation
FCST	Forecast	GAGL	GPS AGL Altitude
FCTN	Function	GAL, GL	Gallon(s)
FD	Flight Director, Course From Fix to DME Distance Leg	GBAS	Ground Based Augmentation System
FDE	Fault Detection and Exclusion	GBOX	Gearbox
FDR	Flight Data Recorder	GBT	Ground Based Transceiver
FF, FFLOW	see also Fuel Flow	GCS	Ground Clutter Suppression
FIS-B	Flight Information Services-Broadcast	GCSS	Garmin Connex Satellite Services
FISDL	Flight Information Service Data Link	GCU	Garmin Control Unit
FIT	Flight Into Terrain	GDC	Garmin Air Data Computer
FL	Flight Level	GDL	Garmin Satellite Data Link
FLC, FLCH	Flight Level Change	GDR	Garmin Data Radio
FLT	Flight, Flight Timer	GDU	Garmin Display Unit
FLTA	Forward Looking Terrain Avoidance	GEA	Garmin Engine/Airframe Unit
FLW	Follow, Following	GEAR	Landing Gear
FM	Course From Fix to Manual Termination Leg	GEN	Generator
FMS	Flight Management System	GEO	Geographic
FOB	see also Fuel On Board	GFC	Garmin Flight Control
FOD	see also Fuel Over Destination	GHZ	Gigahertz
FPA	Flight Path Angle	GIA	Garmin Integrated Avionics Unit
FPL	Flight Plan	GLONASS	Global Orbiting Navigation Satellite Landing System
FPM	Feet Per Minute, Flight Path Marker		
FR	From		
FREQ	Frequency		

GLS	Global Navigation Satellite Landing System	HAL	Horizontal Alert Limit
GMA	Garmin Audio Panel System	HAT	Height Above Threshold
GMC	Garmin Mode Controller	HDG	see also Heading
GMT	Greenwich Mean Time	HDOP	Horizontal Dilution of Precision
GMU	Garmin Magnetometer Unit	Heading	The direction an aircraft is pointed, based upon indications from a magnetic compass or a properly set directional gyro.
GND	Ground	HF	High Frequency, Hold Terminating at Fix Leg
GNSS	Global Navigation Satellite System	HFOM	see also Horizontal Figure of Merit
GOLD	Global Operational Data Link	HG	Mercury
GP	Glidepath	HI	High
GPH	Gallons per Hour	HI SENS	High Sensitivity
GPN	Garmin Part Number	HLD	Hold, Holding, Holding Pattern
GPS	Global Positioning System	HM	Hold with Manual Termination Leg
GPWS	Ground Proximity Warning System	HNS	Hybrid Navigation Sensor
GRA	Garmin Radar Altimeter	Horizontal Figure of Merit	A measure of the uncertainty in the aircraft's horizontal position.
GRC	Garmin Remote Control	HOV	Hover
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	HOV-P	Hover Prediction
Ground Track	See Track	HP	High Pressure, Horsepower
Groundspeed	The velocity the aircraft is travelling relative to a ground position.	HPA	Hectopascal
GRP	Geographic/Ground Reference Point	HPI	Hover Power Indicator
GRS	Garmin Reference System	HPL	Horizontal Protection Level
GRT	Garmin Radio Transceiver	HR	Hour
GS	Ground Speed, Glideslope	HRZN HDG	Horizon Heading
GSA	Garmin Servo Adapter	HSDB	High-Speed Data Bus
GSD	Glideslope/Glidepath Deviation, Garmin Data Concentrator	HSI	Horizontal Situation Indicator
GSL	Geometric/Geodetic Sea Level	HT	Heat, Height
GSR	Garmin Satellite Radio	HTR	Heater
GSU	Garmin Sensor Unit	HUL	Horizontal Uncertainty Level
GTC	Garmin Touchscreen Controller	HWND	Headwind
GTS	Garmin Traffic System	HYD	Hydraulic
GTX	Garmin Transponder	HZ	Hertz (cycles per second)
GW	Gross Weight	HZN	Horizon
GWX	Garmin Weather Radar	I	Inner Marker
H	Hours	IAF	Initial Approach Fix
H+MM	Hours and Minutes	IAP	Instrument Approach Procedure
HA	Hold Terminating at Altitude Leg	IAS	Indicated Air Speed
		IAT	Indicated Air Temperature
		IATA	International Air Transport Association

IAU	Integrated Avionics Unit	IRST	Infrared Surveillance and Tracking
IBD, INBD	Inboard	ISA	International Standard Atmosphere; ISA Relative Temperature
ICAO	International Civil Aviation Organization	ISO	International Standards Organization
ICE	Icing	ISOL	Isolation
ICS	Intercom System	ITI	Imminent Terrain Impact
ID	Identification/Morse Code Identifier	ITT	Inter-Turbine Temperature, Interstage Turbine Temperature
IDENT, IDNT	Identification	KEYSTK	Key Stuck
IEEE	Institute of Electrical & Electronics Engineers	KG	Kilogram
IF	Initial Fix	KHZ	Kilohertz
IFR	Instrument Flight Rules	KIAS	Knots Indicated Airspeed
IG	Imperial Gallon	KM	Kilometer
IGE	In Ground Effect	KT	Knot
ILI	Imminent Line Impact	L	Left, Left Runway
ILS	Instrument Landing System	LAT	Latitude, Lateral
IM	Inner Marker	LB	Pound
IMC	Instrument Meteorological Conditions	LBL	Label
IN	Inch	LCD	Liquid Crystal Display
IN HG, "HG	Inches of Mercury	LCL	Local
INACTV	Inactive	LDA	Landing Distance Available, Localizer Type Directional Aid
INBD	Inboard	LDG	Landing, ETA at Final Destination
INBND	Inbound	LED	Light Emitting Diode
INC FUEL	Increase Fuel	Leg	The portion of a flight plan between two waypoints.
IND	Indicator, Indicated	LEN	Length
Indicated	Information provided by properly calibrated and set instrumentation on the aircraft panel.	LGND	Legend
INDX	Index	LIFR	Low Instrument Flight Rules
INFO	Information	LI-ION	Lithium Ion
INH, INHIB	Inhibit	LIM	Limit
INIT	Initialization	LMM	Locator Middle Marker
INOP	Inoperative	LNAV	Lateral Navigation
INS	Inertial Navigation System	LO	Low
INSTR	Instrument	LOA	Letter of Authorization
INT	Intersection(s)	LOC	Localizer
INTEG	Integrity (RAIM unavailable)	LOI	Loss of Integrity (GPS)
INTERN, INTRL	Internal	LOM	Locator Outer Marker
INV	Invalid	LON, LONG	Longitude, Longitudinal
IOI	Imminent Obstacle Impact	LP	Localizer Performance, Low Pressure
IR	Infrared	LPV	Localizer Performance with Vertical Guidance
IrDA, IRDA	Infrared Data Association		

LRU	Line Replaceable Unit	MIC	Microphone
LSB V	Lower Sideband Voice	MID	Middle
LT	Left, Light	MIN	Minimum, Minute
LTNG	Lightning	MKR	Marker Beacon
LVL	Level	MM	Middle Marker
M	Meter, Middle Marker, Mach	MMO (VMO)	Maximum Speed
Mach Number	Mach number is the ratio of the true airspeed to the speed of sound.	MOA	Military Operations Area
MAG	Magnetic	MOD	Modification, Modify
MAG VAR	Magnetic Variation	MON	Monitor, Monitored, Monitoring
MAHP	Missed Approach Hold Point	MORA	Minimum Off-Route Altitude
MAINT	Maintain	MOV	Movement
MAL	Malfunction	MPEL	Maximum Permissible Exposure Level
MAN	Manual	MPM	Meters per Minute
MAN IN	Manifold Pressure (inches Hg)	MSA	Minimum Safe Altitude
MAN SQ	Manual Squelch	MSAS	Multi-functional Satellite Augmentation System
MANSEQ	Manual Sequence	MSG	Message
MAP	Missed Approach Point	MSL	Mean Sea Level
MAPROC	Missed Approach Procedure	MT, M	Meter
MASQ	Master Avionics Squelch	MTG	Mounting
MAX	Maximum	MTN	Mountain
MAXSPD	Maximum Speed (overspeed)	MTOGW	Maximum Takeoff Gross Weight
MB	Marker Beacon, Millibar(s)	MTOW	Maximum Takeoff Weight
MCDU	Multifunction Control and Display Unit	MV	Millivolt(s)
MCLB	Maximum Climb Thrust	MVFR	Marginal Visual Flight Rules
MCP	Maximum Continuous Power	N	North
MCRZ	Maximum Cruise Thrust	NATS	North Atlantic Tracks System
MCT	Maximum Continuous Thrust	NAV	Navigation
MDA	Barometric Minimum Descent Altitude	NAVAID	Navigation Aid
MEA	Minimum Enroute Altitude	NCR	Negative Climb Rate
MEM	Memory	NDA	Next Data Authority
MEPT	Manual Electric Pitch Trim	NDB	Non-Directional Beacon
MET	Manual Electric Trim	NEG	Negative
METAR	Aviation Routine Weather Report	NEXRAD	Next Generation Radar
METRO	Metropolitan	NG	Gas Producer Rotation Speed
MFI	Multi-Function Instrument	NM	Nautical Mile(s)
MFD	Multi Function Display	NMPG	Nautical Miles per Gallon
MFW	Multi Function Window	NoPT	No Procedure Turn Required (procedure shall not be executed without ATC clearance)
MGRS	Military Grid Reference System	NORM	Normal
MGT	Measured Gas Temperature	NOTAM	Notice To Airman
MHz	Megahertz		

NP	Power Turbine Speed	PASS, PAX	Passenger(s)
NPA	Non-Precision Approach	PC	Personal Computer
NR	Rotor Speed	PCL	Pilot Controlled Lighting
NRST	Nearest	PDA	Premature Descent Alerting
NWHL	Nosewheel	PDC	Pre-Departure Clearance
NWS	National Weather Service, Nosewheel Steering	PED	Portable Electronic Device
O	Outer Marker	PERF	Performance
OAT	Outside Air Temperature	PFD	Primary Flight Display
OBD, OUTBD	Outboard	PFT	Preflight Test
OBS	Omni Bearing Selector, Observation, Observe, Observed	PFW	Primary Flight Window
OBSCR	Obscuration	PG	Pilot's Guide
OCL	Oceanic Clearance	PI	Procedure Turn to Course Intercept Leg
OEM	Original Equipment Manufacturer	PIREP	Pilot Report
OFST	Offset	PIT, PTCH	Pitch
OGE	Out of Ground Effect	PLT	Pilot
OM	Outer Marker	PNR	Prior Notice Required
OOOI	Out of the gate, Off the ground, On the ground, and In the gate	POA	Plain Old ACARS
OROCA	Off Route Obstacle Clearance Altitude	POB	Persons (Souls) on Board
OSP	Overspeed Protection	POF	Phase of Flight
OUTBD	Outboard	POH	Pilot's Operating Handbook
OUTBND	Outbound	POHS	Pilot's Operating Handbook Supplement
OVBD	Overboard	POS, POSN	Position
OVFL	Overflow	POSS	Possible
OVFLY	Overfly, Overflying	PPH	Pounds per Hour
OVHD	Overhead	PPM	Parts per Million
OVHT	Overheat	PPOS, P. POS	Present Position
OVLIM	Overlimit	PREFLT	Preflight
OVLN	Overload	PRES, PRESS, P	Pressure
OVPR	Overpressure	PREV	Previous
OVR, OVRD	Override	PRI	Primary
OVRN	Overrun	PRL	Parallel
OVSPD	Overspeed	PRN	Pseudo Random Noise
OVTMP	Overtemperature	PROC	Procedure(s), Procedure Turn
OXY	Oxygen	PROP	Propeller
P ALT	Pressure Altitude	PROX	Proximity
P-ATT	Pitch Attitude	PSI	Pounds per Square Inch, Power Situation Indicator
PA	Precision Approach, Passenger Address, Proximity Advisory	PT	Procedure Turn, Part Time
PB	Push Button	PTK	Parallel Track
		PTT	Push-to-Talk
		PWR	Power

Q	Engine Torque	ROC	Required Obstacle Clearance, Rate of Climb
QFE	Field Elevation Pressure	ROD	Rate of Descent
QNE	Pressure Altitude	ROL	Roll
QNH	Sea Level Pressure	ROM	Read Only Memory
QTY	Quantity	ROT	Rotary
R	Right, Right Runway	RPM	Revolutions Per Minute
RA	Resolution Advisory, Radio Altimeter, Radar Altimeter	RQRD	Required
RAD	Radial	RST FUEL	Reset Fuel
RAD ALT	Radio Altimeter, Radar Altimeter	RSV	Reserve (fuel reserve entered by pilot)
RAIM	Receiver Autonomous Integrity Monitoring	RT	Right
RAM	Random Access Memory	RTC	Required Terrain Clearance
RAT	Ram Air Temperature	RTE	Route
RCVR	Receiver	RTR	Router
R/D	Radial/Distance	RUDICS	Router-Based Unrestricted Digital Interworking Connectivity Solution
RDR	Radar	RVRSNRY	Reversionary
REC	Record, Recorder	RVSI	Required Vertical Speed Indicator
RECIRC	Recirculate/Recirculating	RVSM	Reduced Vertical Separation Minimums
REF	Reference	RX	Receive
REGL	Regulator	S	South
REM	Remaining (fuel remaining), Reminder, Removed, Remote	SA	Selective Availability
REQ	Request	SAIB	Special Airworthiness Information Bulletin
REQD	Required	SAR	Search and Rescue
RES	Reserve (fuel reserve entered by pilot)	SAT	Static Air Temperature
REST	Restricted, Restriction	SATCOM	Satellite Communication
RET	Return	SBAS	Satellite-Based Augmentation System
REV	Reverse, Revision, Revise	S-CLB	Step Climb
RF	Radio Frequency, Constant Radius Turn to Fix Leg	SC	Short Circuit
RFM	Rotorcraft Flight Manual	SCIT	Storm Cell Identification and Tracking
RLC	Required Line Clearance	S-DES	Step Descent
RMI	Radio Magnetic Indicator	SD	Secure Digital
RMT	Remote	SDF	Simplified Directional Facility
RNAV	Area Navigation	SEC	Second(s)
RNG	Range	SECT	Section
RNP	Required Navigation Performance	SEG	Segment
RNWX, RWY	Runway	SEL, SLCT	Select
ROASS	Runway Overrun Awareness and Alerting System	SELCAL	Selective Calling
		SENS	Sense, Sensitivity
		SEQ	Sequence, Sequencing
		SERL	Serial

SERV	Service, Servicing, Served	STN	Station
SET	Setup	STR	Strip
SFC	Surface	STRMSCP	Stormscope
SHT	Short	SUA	Special Use Airspace
SIAP	Standard Instrument Approach Procedures	SUB	Substitute
SID	Standard Instrument Departure	SUPPRESS	Suppression
SIG	Signal	SURF	Surface
SIG/AIR	SIGMET/AIRMET	SUSP	Suspend
SIGM	SIGMET	SVBL	Serviceable
SIGMET	Significant Meteorological Information	SVT	Synthetic Vision Technology
SIM	Simulator	SW	Software
SITA	Societe Internationale de Telecommunications	SYN TERR	Synthetic Terrain
SLD	Supercooled Large Droplet	SYN VIS	Synthetic Vision
SLP/SKD	Slip/Skid	SYNC	Synchronize
SLW	Slow	SYNTH	Synthesizer
SM	Statute Mile	SYS	System
SMBL	Symbol	T	True
SMK	Smoke	T HDG	True Heading
SMS	Short Message System	T/R	Thrust Reverser
SNGL	Single	TA	Traffic Advisory, Transition Altitude
SOB	Souls on Board	TAC	Tactical, Terminal Area Chart
SPBK	Speed Brake	TACAN, TCN	Tactical Air Navigation System
SPC	Space	TAF	Terminal Aerodrome Forecast
SPD	Speed	TAS	True Airspeed, Traffic Advisory System
SPI	Special Position Identification	TAT	Total Air Temperature
SPKR	Speaker	TAWS	Terrain Awareness and Warning System
SQ, SQL	Squelch	TC	Table of Contents
SRVC, SVC	Service	TCA	Terminal Control Area
SSEC	Static Source Error Correction	TCAS	Traffic Alert Collision Avoidance System
SSID	Wireless Service Set Identifier	TCH	Threshold Crossing Height
SSR	Secondary Surveillance Radar	TD	Touchdown
STAB	Stabilization	TEL	Telephone
STAL	Stall	TEMP, TMP	Temperature
STAR	Standard Terminal Arrival Route	TERM	Terminal
STAT	Status	TERR	Terrain
STATS	Statistics	T/F	To/From
STBY	Standby	TF	Track Between Two Fixes Leg
STC	Sensitivity Time Constant, Supplemental Type Certificate	TFR	Temporary Flight Restriction
STD	Standard	TGT	Target
		TH	True Heading

THLD	Threshold	TWIP	Terminal Weather Information for Pilots
THR	Thrust	TWR	Tower
TIS	Traffic Information Service	TWY	Taxiway
TIS-B	Traffic Information Service-Broadcast	TX	Transmit
TIT	Turbine Inlet Temperature	UA	Routine PIREP
TIZ	Traffic Information Zone	UAT	Universal Access Transceiver
TKE	see also Track Angle Error	UAV	Unmanned Airborne Vehicle
TL	Transition Level	UHF	Ultra-High Frequency
TLA	Throttle Lever Angle, Thrust Lever Angle	UNABL	Unable
TMA	Terminal Maneuvering Area	UNAVAIL	Unavailable
TMR/REF	Timer/Reference	UNLIM	Unlimited
TNK	Tank	UPLK	Uplink
TO	To, Takeoff	US	United States
TOC	Top of Climb, Table of Contents	USB V	Upper Sideband Voice
TOD	Top of Descent, Time to TOD	USP	Underspeed Protection
TOGA, TO/GA	Take-Off, Go-Around	USR	User
TOLD	Takeoff and Landing Data	UTC	Coordinated Universal Time
TOPO	Topographic	UTM/UPS	Universal Transverse Mercator/ Universal Polar Stereographic Grid
TORA	Takeoff Run Available	UUA	Urgent PIREP
TOT	Total	V	Volts, Vertical
TPA	Traffic Pattern Altitude	V DEV	Vertical Deviation
Track	Direction of aircraft movement relative to a ground position; also 'Ground Track'.	V, Vspeed	Velocity (airspeed)
Track Angle Error	The angle difference between the desired track and the current track.	V₁	Takeoff Decision Speed
TRFC	Traffic	V₂	Takeoff Safety Speed
TRK	see also Track	V_A	Maneuvering Speed
TRM	Trim	VA	Heading Vector to Altitude Leg
TRN	Terrain	VAC	Volts Alternating Current
TRSA	Terminal Radar Service Area	VAL	Vertical Alert Limit
TRUNC	Truncated	VAPP	VOR Approach Mode
TSO	Technical Standard Order	V_{APP}, V_{AC}	Approach Climb Speed
TST	Test	VAR	Variable, Variation
TTA	Time-to-Alert	VCO	Voice Call Out
TTK	True Track	VD	Heading Vector to DME Distance Leg
TTL	Total	VDC	Volts Direct Current
TTS	Text to Speech	VDI	Vertical Deviation Indicator
TUR	Turbine	VDL	VHF Datalink
TURB	Turbulence	V_E, V_{ENR}	Enroute Climb Speed
TURN	Procedure Turn	VECT	Vector
TWND	Tailwind	VERT	Vertical

Vertical Figure of Merit	A measure of the uncertainty in the aircraft's vertical position.	VSM	Vertical Separation Minima
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_{SR}	Stall Speed
V_{FE}	Maximum Flap Extended Speed	VSR, VS REQ	see also Vertical Speed Required
VFOM	see also Vertical Figure of Merit	V_T	Takeoff Flap Retraction Speed
VFR	Visual Flight Rules	VTE	Vertical Track Error
VHF	Very High Frequency	VTF	Vector to Final
VI	Heading Vector to Intercept Leg	VTK	Vertical Track
VIB	Vibration	V_{TIRE}	Maximum Tire Speed
V_{LE}	Maximum Landing Gear Extended Speed	V_X	Best Angle of Climb Speed
V_{LNDx}	Approach Speed (Flaps at x°)	V_Y	Best Rate of Climb Speed
V_{LO}	Maximum Landing Gear Operating Speed	V_{YSE}	Best Single-Engine Rate of Climb Speed
VLD	Valid	W	Watt(s), West
VLOC, VOR/L	VOR/Localizer Receiver	WAAS	Wide Area Augmentation System
VM	Heading Vector to Manual Termination Leg	WARN	Warning
V_{MC}	Minimum Control Speed	WATCH	Weather Attenuated Color Highlight
VMC	Visual Meteorological Conditions	WDIR	Wind Direction
V_{MO} (M_{MO})	Maximum Operating Speed	WEP	Wired Equivalent Privacy
VNAV, VNV	Vertical Navigation	WSPD	Wind Speed
V_{NE}	Never-Exceed Speed	WGS-84	World Geodetic System - 1984
VOL	Volume	WI-FI, WIFI	Wireless Local Area Network based on IEEE 802.11
VOR	VHF Omnidirectional Range	WILCO	Will Comply
VOR/D	VOR/DME	WNSHR, WSHEAR	Windshear
VOR/I	VOR/ILS	WL	Wings Level
VORTAC	VHF Omnidirectional Range Station and Tactical Air Navigation	WOG	Weight on Gear
VPATH, VPTH	Vertical Path	WOW	Weight on Wheels
VPL	Vertical Protection Level	WPA	Wi-Fi Protected Access
VPROF	VNAV Profile, Vertical Profile	WPT	Waypoint(s)
V_R	Takeoff Rotate Speed	WT	Weight
VR	Heading Vector to Radial Leg	WUXGA	Widescreen Ultra Extended Graphics Array
V_{REF}	Landing Approach Speed, Reference Landing Speed	W/V	Wind Velocity
VRP	Visual Reporting Point	WW	World Wide
VS	Vertical Speed	WX	Weather
V_{SB}	Maximum Speedbrake Speed	WXR	Weather Radar
VSD	Vertical Situation Display	XFD	Crossfeed
VSI	Vertical Speed Indicator	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 "RAIM not available from FAF to MAP" message and 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). The

system monitors RAIM and issues an alert message when RAIM is not available (see Appendix A). Without RAIM, GPS position accuracy cannot be monitored. If RAIM is not available when crossing the FAF, the pilot must fly the missed approach procedure.

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.

CAN “SLANT GOLF” (‘G’) AND “SLANT LIMA” (‘L’) BE FILED USING THE CIRRUS PERSPECTIVE TOUCH+™?

Yes, ‘G’ may be filed for a flight plan. ‘L’ may also be filed if the operator is authorized by the FAA for RVSM operation. GPS approaches are not to be flown with an expired database. See the current version of the pertinent flight manual as well as the Aeronautical Information Manual (AIM) for more information.

The **OBS** Button is used to select manual sequencing of waypoints. Activating OBS mode sets the current active-to waypoint as the primary navigation reference and prevents the system from sequencing to the next waypoint in a flight plan. When OBS mode is cancelled, automatic waypoint sequencing is continued, and the system automatically activates the next waypoint in the flight plan once the aircraft has crossed the present active waypoint.

Normal (OBS not activated)	OBS
• Automatic sequencing of waypoints	• Manual sequencing - ‘holds’ on selected waypoint
• Manual course change on HSI not possible	• Manually select course to waypoint from HSI
• Always navigates ‘TO’ the active waypoint	• Indicates ‘TO’ or ‘FROM’ waypoint
• Must be in this mode for final approach course	• Cannot be set for final approach course or published holding patterns

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's 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.

MAP SYMBOLS

MISCELLANEOUS

Item	Symbol
ARTCC Frequency or FSS Frequency	
Map Pointer (when panning)	
Elevation Pointer (on Topography Scale when panning)	
Measuring Pointer	
Wind Vector	
Overzoom Indicator	
User Waypoint	
Vertical Navigation Along Track Waypoint	
Parallel Track Waypoint	
Unanchored Flight Path Waypoint	
Top of Descent (TOD)	
Bottom of Descent (BOD)	
Navigating using Dead Reckoning	

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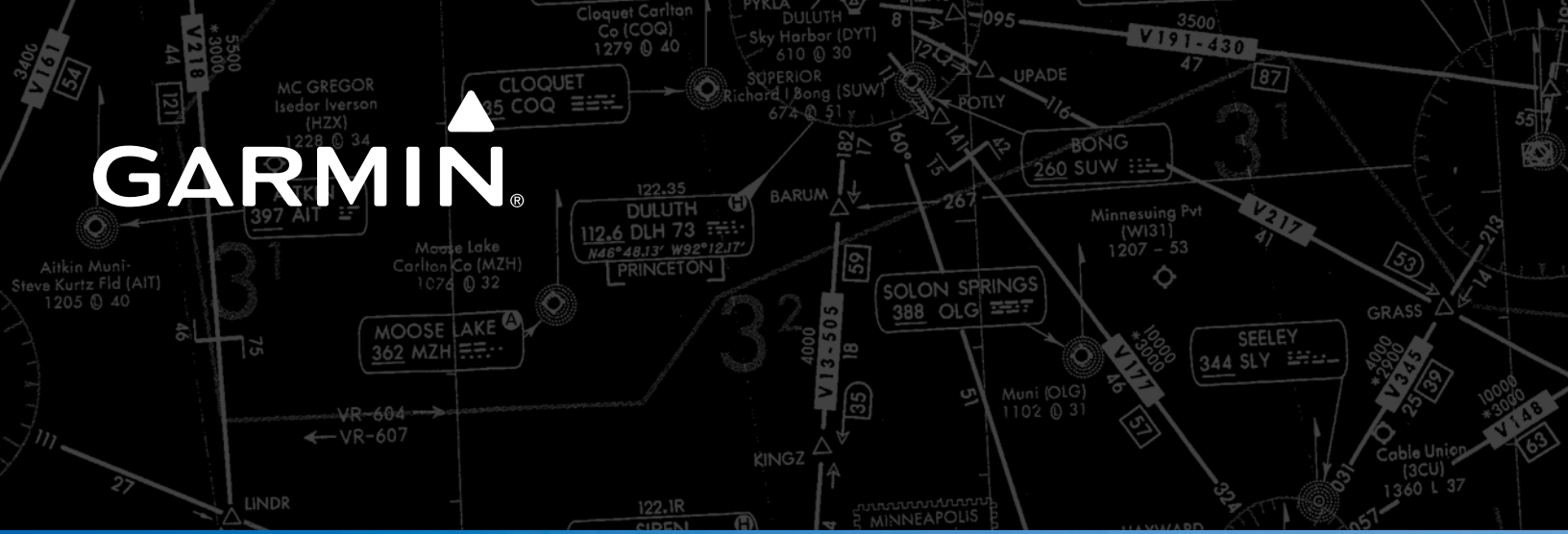
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GARMIN®



Garmin International, Inc.
1200 East 151st Street
Olathe, Kansas 66062, U.S.A.

Garmin AT, Inc.
2345 Turner Road SE
Salem, OR 97302, U.S.A.

Garmin (Europe) Ltd.
Liberty House, Hounsdown Business Park
Southampton, Hampshire SO40 9LR U.K.

Garmin Corporation
No. 68, Zhangshu 2nd Road
Xizhi District,
New Taipei City, Taiwan

Contact Garmin Product Support or view warranty information at flygarmin.com.

