

**GARMIN**

# G3000<sup>®</sup> Integrated Avionics System

## Pilot's Guide



**Daher TBM 930**

System Software Version 2234.05 or later





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This manual reflects the operation of System Software version 2234.05 or later for the Daher TBM 930. Some differences in operation may be observed when comparing the information in this manual to earlier or later software versions.

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

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**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.

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**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.

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**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.

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**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.

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**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.

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**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.

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

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**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.

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**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.

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**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 rely only on the Turbulence Detection function for hazardous weather avoidance, or to maneuver in, near, or around areas of hazardous weather.



**WARNING:** Do not rely on information from a lightning detection system display as the sole basis for hazardous weather avoidance. Range limitations and interference may cause the system to display inaccurate or incomplete information. Refer to documentation from the lightning detection system manufacturer for detailed information about the system.





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



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



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



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



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



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



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



**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:** 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](http://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](http://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.


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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](http://flygarmin.com) by selecting 'Database Exclusions List.'


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 **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](http://flygarmin.com) by selecting 'Aviation Database Alerts.'


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


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 **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](http://flygarmin.com) and select 'Aviation Data Error Report'.


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 **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.


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


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 **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.

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

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

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

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**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.

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**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
190-02046-00	A	2/16	All	Production release.
	B	3/16	All	Removed references to Baro-VNAV Removed reference to takeoff configuration of landing gear and flaps from the Negative Climb Rate TAWS discussion Removed references to GDL 59 Removed references to Wi-Fi Removed APR Advisory System Message Added Animated NEXRAD for SiriusXM Weather
190-02046-01	A	5/25	All	Added support for HF Radio Added SELCAL Added other GDU 6.56 parameters Removed references to CCD VNAV functions.
190-02046-02	A	5/29/20	All	Updated to GDU 20.92

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## SECTION 1 SYSTEM OVERVIEW

### 1.1 SYSTEM DESCRIPTION

This section provides an overview of the Garmin G3000 as installed in the Daher TBM 930 aircraft. It is 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 1200W** (3) – Each GDU is configured as one of two Primary Flight Displays (PFDs) or one Multi-function Display (MFD). The GDU 1200W features a 12-inch light emitting diode (LED) backlit widescreen display with a 1280 x 800 resolution. The unit installed on the left/pilot side is designated as PFD1, and the one installed on the right/copilot side is designated as PFD2. The unit installed in the center is designated as the MFD. The displays communicate with each other and the Touchscreen Controllers through a High-Speed Data Bus (HSDB) Ethernet connection
- **GTC 580** (2) – The Touchscreen Controller provides MFD control, Display Pane control on the PFD, in addition to FMS functions, data entry capability, and communications control to the system. The unit installed on the left/pilot side is designated as GTC1, and the one installed on the right/copilot side is designated as GTC2. Each touchscreen controller communicates with the on-side PFD, the MFD. GTC1 communicates with the GMA 36 using an HSDB connection.
- **GMA 36** (1) – The Remote Audio Unit integrates navigation/communication radio (NAV/COM) digital audio, intercom, and marker beacon audio. The GMA 36 is connected to GTC1 using an HSDB interface and to the each IAU using an RS-232 and digital audio connections.
- **GIA 63W** (2) – The Integrated Avionics Units (IAU) function as the main communications hub, linking several LRUs with each on-side GDU 1200W. 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. The IAUs communicate with each other through using HSDB and additional backup paths.
- **GDC 74B** – Processes data from the pitot/static system as well as the OAT probe. This unit provides pressure altitude, airspeed, vertical speed and OAT information to the G3000 system, and it communicates with the on-side GIA 63W, on-side GDU 1200W and on-side GRS 77, using an ARINC 429 digital interface (it also interfaces directly with the OAT). The GDC 74B is designed to operate in Reduced Vertical Separation Minimum (RVSM) airspace.
- **GEA 71** (2) – The Engine Airframe Unit receives and processes signals from the engine and airframe sensors. This unit communicate with both IAUs using an RS-485 digital interface.
- **GTX 33 with ES** (1) (standard) **GTX 345R** (1) (standard) or **GTX 33D with ES** (1) (standard) and **GTX 33 with ES** (1) (optional) or **GTX 345R** (1) (optional) – One or two transponders are installed (see the following figure). These solid-state transponders provide Modes A/C/S and ADS-B Out capability. The GTX 345R also provides ADS-B In capability. The GTX 33 with ES and GTX 33D with ES feature extended squitter capabilities. The GTX 33D also features diversity. The transponder(s) communicate with the on-side IAU(s).
- **GRS 77** (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 1200W. 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** (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.
- **GDL 69A SXM** (1 optional) – The Satellite Data Link Radio Receiver receives weather information, as well as digital audio entertainment. The Data Link Receiver communicates with the MFD via a HSDB connection. A subscription to SiriusXM Weather and/or SiriusXM Satellite Radio service is required to enable the GDL 69A capability.
- **GMC 710** – The AFCS Controller provides AFCS control through an RS-232 digital interface. The unit connects to PFD1 and PFD2.
- **GRA 55** (1 optional) – The Radar Altimeter provides altitude above the ground information and rate of change of radar altitude information.
- **GTA 82** – The GTA 82 Trim Adapter is a remote mounted device that is used to allow the AFCS to drive the yaw trim actuator.
- **GTS 820** – The GTS 820 Traffic Advisory System (TAS) uses active interrogations of Mode S and Mode C transponders to provide Traffic Advisories to the pilot independent of the air traffic control system.
- **GSA 81** (4) – The GSA 81 servos are used for the automatic control of roll, yaw, pitch, and pitch trim. These units interface with each GIA 63W.
- **GWX 70** (1 optional) – The GWX 70 provides airborne real-time weather and ground mapped radar data to the displays. The unit is connected to the MFD with an HSDB connection.
- **GSR 56** (1 optional) – The Iridium Transceiver operation for voice communication is by means of pilot and copilot headsets in the cockpit. The system is also capable of SMS text messaging. Connection to the system is through the RS-232 bus.

The Daher TBM 930 is also equipped with a Garmin Automated Flight Control System (AFCS), which includes the Flight Director (FD), Autopilot (AP), manual electric trim, and control wheel steering (CWS) functions of the G3000 system.



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

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Figure 1-1 shows interconnection of the LRUs.



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**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

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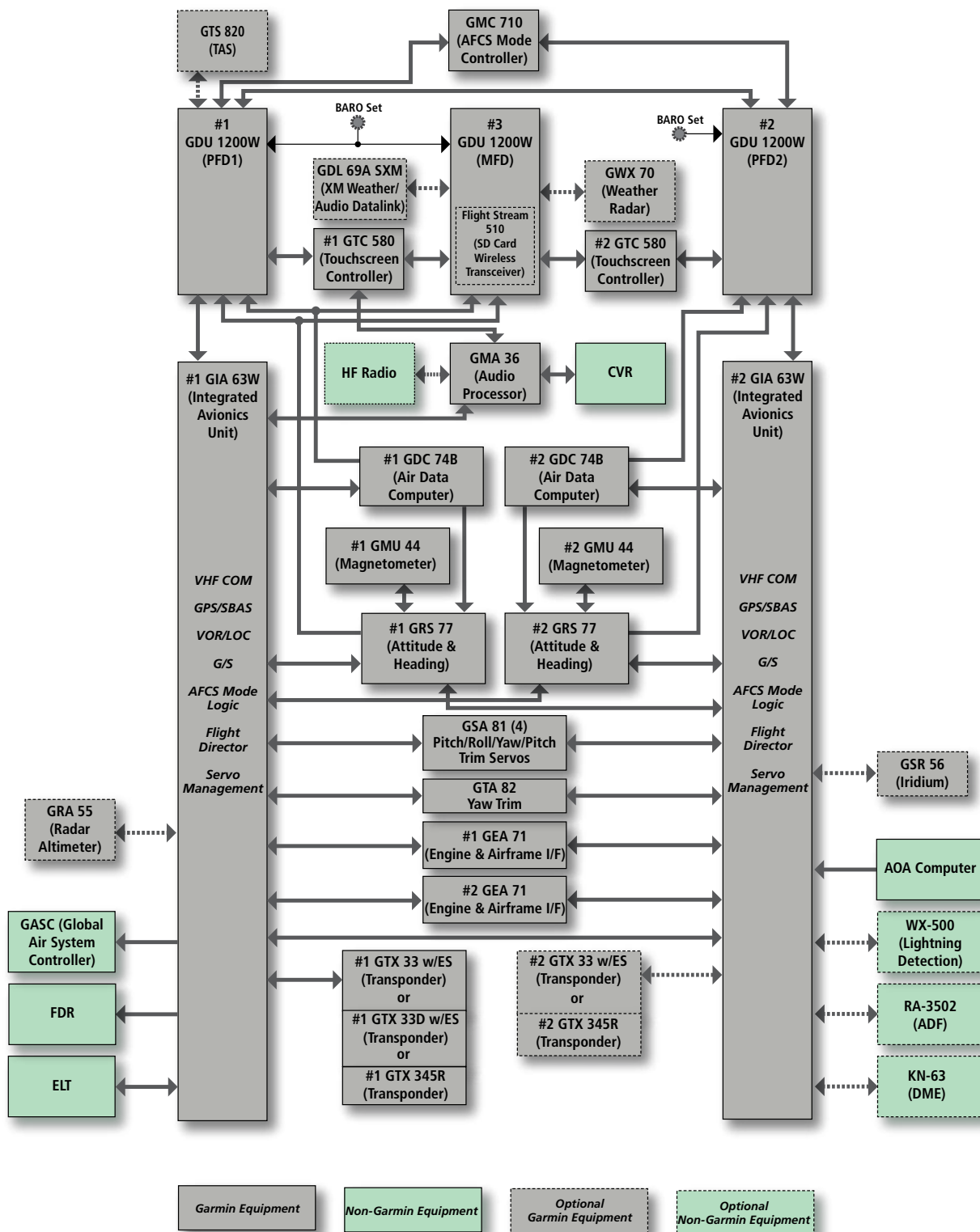


Figure 1-1 Basic System Block Diagram

## 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 PFD bezels, Touchscreen Controllers and on the Automatic Flight Control System (AFCS) Controller. The PFD bezels and Touchscreen Controllers are discussed in this section. AFCS controls are described in the AFCS section. See the Audio and Communication/Navigation/Surveillance (CNS) Section for detailed information about NAV/COM controls.



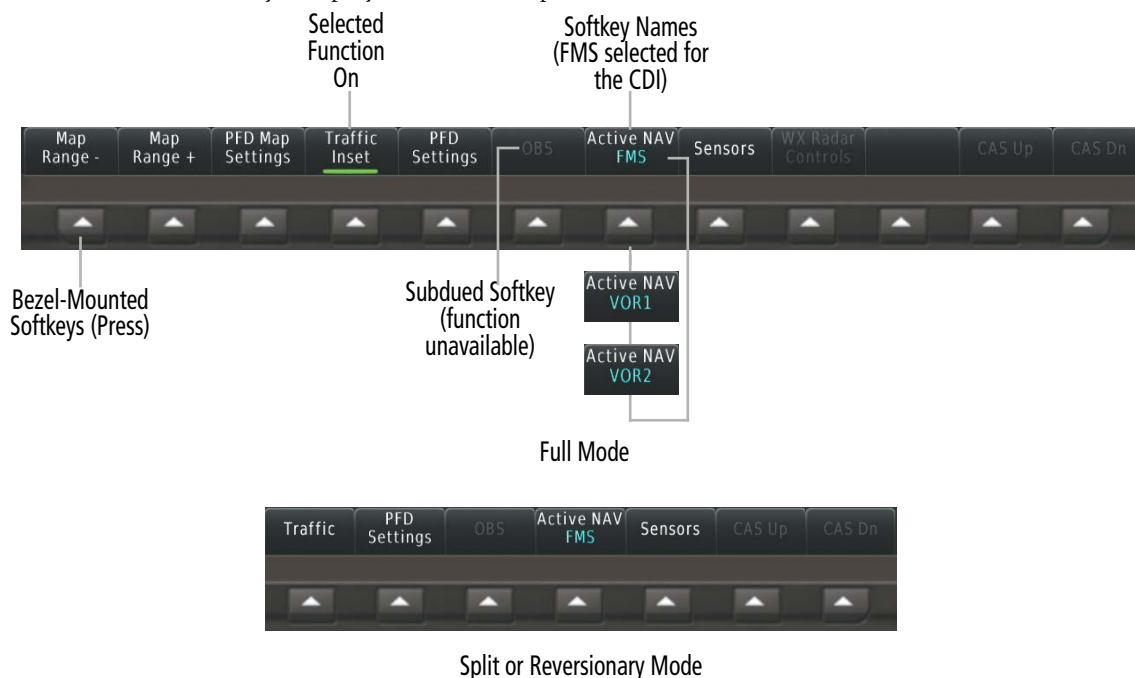
Figure 1-2 Garmin System Controls

### PFD CONTROLS



Figure 1-3 PFD Controls

Selection softkeys are located along the bottom of PFD1. The softkeys shown depend on the softkey level previously selected. The bezel keys below the softkey labels can be used to select the appropriate softkey. There are three types of softkeys. One selects a simple on/off state, indicated by an annunciator on the softkey label displayed as green (on) or gray (off). The next type of softkey selects among several options, indicated by the softkey label changing (with the exception of the Map Range keys) to reflect the name of the chosen option. The last type of softkey, when pressed displays another set of softkeys available for the selected function. Also, these softkeys revert to the previous level after 45 seconds of inactivity. When a softkey function is disabled, the softkey label is subdued. When the PFD is in split mode, an alternate softkey configuration is shown with a reduced number of softkeys displayed on the left pane.



**Figure 1-4 Top Level PFD Softkeys**

Each softkey sublevel has a **BACK** Softkey which can be selected to return to the previous level.

Level 1	Level 2	Level 3	Level 4	Description
Map Range -				Decreases the PFD Map display range
Map Range +				Increases the PFD Map display range
PFD Map Settings				Displays the PFD Map display settings softkeys
	Map Layout			Displays softkeys used to select map layouts
		Map Off		Removes the PFD Map from the display
		Inset Map		• Displays the Inset Map
		HSI Map		• Displays the HSI Map

Level 1	Level 2	Level 3	Level 4	Description
		<b>Inset Traffic</b>		Overlays a dedicated traffic display on the Inset Map.
		<b>HSI Traffic</b>		Overlays a dedicated traffic display on the HSI.
	<b>Detail</b>			<p>Selects desired amount of map detail; cycles through declutter levels:</p> <ul style="list-style-type: none"> <li>• <b>All</b> (No Declutter): All map features visible</li> <li>• <b>DCLTR 1</b>: Declutters land data</li> <li>• <b>DCLTR 2</b>: Declutters land and SUA data</li> <li>• <b>Least</b>: Removes everything except for the active flight plan</li> </ul>
	<b>Weather Legend</b>			Displays/removes the name of the selected data link weather provider (SiriusXM, Connex, FIS-B) and the weather product icon and age box (for enabled weather products).
	<b>Traffic</b>			Adds or removes the display of traffic on the PFD Map. The softkey annunciator is green when the traffic function is on. When the traffic function is off, the annunciator is gray.
	<b>Storm-scope</b>			Adds or removes the display of Stormscope information on the PFD Map. The softkey annunciator is green when the function is on. When the function is off, the annunciator is gray.
	<b>Terrain</b>			<ul style="list-style-type: none"> <li>• <b>Off</b>: Removes terrain information from the PFD Map.</li> <li>• <b>Absolute</b>: Displays Absolute terrain information on the PFD Map.</li> <li>• <b>Relative</b>: Displays relative terrain information on the PFD Map.</li> </ul>
	<b>Data Link Settings</b>			<ul style="list-style-type: none"> <li>• Displays Data Link settings softkeys.</li> </ul>
		<b>Data Link</b>		<p>Selects the data link source for the PFD Map:</p> <ul style="list-style-type: none"> <li>• <b>Connex</b>: Selects Garmin Connex (optional) as the weather source for the display of weather data on the PFD Map.</li> <li>• <b>SiriusXM</b>: Selects SiriusXM (optional) as the weather source for the display of weather data on the PFD Map.</li> <li>• <b>FIS-B</b>: Selects FIS-B (optional) as the weather source for the display of weather data on the PFD Map.</li> </ul>
		<b>NEXRAD</b>		<p>Selects type of NEXRAD coverage:</p> <ul style="list-style-type: none"> <li>• <b>CONUS</b>: Selects NEXRAD coverage for continental U.S.</li> <li>• <b>Regional</b>: Selects NEXRAD coverage for a region which provides a higher resolution.</li> <li>• <b>Combined</b>: Combines CONUS and Regional coverages.</li> </ul>
		<b>Source</b>		Selects <b>USA</b> or <b>Canada</b> as the source when SiriusXM is enabled as the datalink setting.
		<b>Storm Cell Movement</b>		Adds or removes the display of storm cell movement. Available when SiriusXM is selected as the weather source.
		<b>NEXRAD Animation</b>		Animates NEXRAD Data. Available when SiriusXM is selected as the weather source.

Level 1	Level 2	Level 3	Level 4	Description
	WX Overlay			<p>Selects the display of weather information on the PFD Map:</p> <ul style="list-style-type: none"> <li><b>SiriusXM:</b> Selects SiriusXM as the weather source for the display of weather data when SiriusXM is selected as the weather source using the Data Link softkey.</li> <li><b>Connex:</b> Selects Connex as the weather source for the display of weather data when Connex is selected as the weather source using the Data Link softkey.</li> <li><b>WX Radar:</b> Displays airborne weather radar map overlay on the Inset or HSI Map.</li> <li><b>FIS-B:</b> Selects FIS-B as the weather source for the display of weather data when FIS-B is selected as the weather source using the Data Link softkey.</li> <li><b>Off:</b> Removes weather data from HSI Map.</li> </ul>
	SiriusXM Lightning  Or  Connex Lightning			<p>Softkey is available when SiriusXM is selected as the weather source under Data Link Settings. Adds/removes the display of SiriusXM information on the PFD Map. The softkey annunciator is green when the lightning function is on. When the lightning function is off, the annunciator is gray.</p> <p>Softkey is available when Connex is selected as the weather source Data Link Settings. Adds/removes the display of Connex information on the PFD Map. The softkey annunciator is green when the lightning function is on. When the lightning function is off, the annunciator is gray.</p>
	METAR			Adds or removes the display of SiriusXM, Connex, or FIS-B sourced METAR data on the PFD Map. The softkey annunciator is green when the METAR data is enabled. When the METAR data is off, the annunciator is gray.
Traffic Map				Replaces the PFD Map with a dedicated traffic display. The softkey annunciator is green when the dedicated traffic display on. When the PFD Map is on, the softkey annunciator is gray.
PFD Settings				Displays the PFD settings softkeys.
	Attitude Overlays			Displays the softkeys for enabling or disabling Synthetic Vision features.
		Pathways		Displays Pathway Boxes on the Synthetic Vision Display.
		Synthetic Terrain		Enables synthetic terrain depiction.
		Horizon Heading		Displays compass heading along the Zero-Pitch line.
		Airport Signs		Displays position markers for airports within approximately 15 nm of the current aircraft position. Airport identifiers are displayed when the airport is within approximately 9 nm.

Level 1	Level 2	Level 3	Level 4	Description
	PFD Mode			Enables or disables a multi-function Display Pane to the right or left (depending on pilot-side or copilot-side) on the PFD. <ul style="list-style-type: none"> <li><b>FULL:</b> Display Pane is disabled. The PFD display occupies the full screen.</li> <li><b>Split:</b> Display Pane is enabled. The PFD screen is split between the PFD display and the Display Pane.</li> </ul>
	Bearing 1			Cycles the Bearing 1 Information Window through NAV1, NAV2, FMS/waypoint identifier and GPS-derived distance information, ADF1/frequency, and Off.
	Bearing 2			Cycles the Bearing 2 Information Window through NAV1, NAV2, FMS/waypoint identifier and GPS-derived distance information, ADF1/frequency, and Off.
	Other PFD Settings			Displays additional PFD settings softkeys.
		Wind		Displays the wind option softkeys
			Option 1	Headwind/tailwind and crosswind arrows with numeric speed components.
			Option 2	Total wind direction arrow with numeric speed.
			Option 3	Total wind direction arrow with digital numeric direction and speed.
			Off	Information not displayed.
		AOA		Selects the display mode for the Angle of Attack (AOA) indicator on the PFD <ul style="list-style-type: none"> <li><b>On:</b> Displays AOA indicator on the PFD</li> <li><b>Off:</b> Removes AOA indicator from the PFD</li> </ul>
		Altitude Units		Displays softkeys to select altitude unit parameters.
			Meters	When enabled, adds altimeter meters overlay.
			IN	Press to display the BARO setting as inches of mercury
			HPA	Press to display the BARO setting as hectopascals.
		COM1 121.5		Sets COM1 to 121.50 MHz.
OBS				Selects OBS mode on the CDI when navigating by FMS (only available with active leg). When OBS is on, the softkey annunciator is green.
Active NAV				Cycles through FMS, VOR1, and VOR2 navigation modes on the CDI.
Sensors				Displays the sensor selection softkeys.
	ADC Settings			Displays the ADC selection softkeys.
		ADC 1		Selects the number 1 ADC. The softkey annunciator is green when selected.

Level 1	Level 2	Level 3	Level 4	Description
		ADC 2		Selects the number 2 ADC. The softkey annunciator is green when selected.
	AHRS Settings			Displays the AHRS selection softkeys.
		AHRS 1		Selects the number 1 AHRS. The softkey annunciator is green when selected.
		AHRS 2		Selects the number 2 AHRS. The softkey annunciator is green when selected.
WX Radar Controls				Displays the WX Radar softkeys.
	Mode			Selects the display mode for the display of weather radar on the HSI map: <ul style="list-style-type: none"> <li><b>Standby:</b> Sets the weather radar displayed on the HSI map to Standby when airborne.</li> <li><b>On:</b> Enables display of weather radar on the HSI Map.</li> </ul>
	Display			If enabled (Mode Softkey <b>On</b> ), selects the mode of weather radar displayed. If not enabled, this softkey is subdued. <ul style="list-style-type: none"> <li><b>Ground:</b> Allows ground mapping returns to be displayed on the HSI map.</li> <li><b>Weather:</b> Allows weather returns to be displayed on the HSI map.</li> </ul>
	Tilt Down			Pressing the softkey once adjusts the antenna tilt angle down in 0.25° increments. Pressing and holding the softkey continues adjustment.
	Tilt Up			Pressing the softkey once adjusts the antenna tilt angle up in 0.25° increments. Pressing and holding the softkey continues adjustment.
	Gain -			Pressing the softkey once decreases the gain in increments of 0.5. Pressing and holding the softkey continues adjustment. A manual setting of '0.0' is equivalent to the calibrated gain setting.
	Gain +			Pressing the softkey once increases the gain in increments of 0.5. Pressing and holding the softkey continues adjustment. A manual setting of '0.0' is equivalent to the calibrated gain setting. NEXRAD
	GND Clutter Suppression			(Optional) Toggles ground clutter suppression.
	Features			Displays softkeys for enabling/disabling Altitude Compensated Tilt and Antenna Stabilization.
		WX WATCH		Toggles the Weather Attenuated Color Highlight feature.
		Altitude COMP Tilt		Toggles the Altitude Compensated Tilt (ACT) feature. Used to automatically adjust tilt as aircraft climbs or descends.
		Turbulence Detection		(Optional) Toggles Turbulence Detection.



## TOUCHSCREEN CONTROLLER

The two Touchscreen Controllers, designated from left to right as GTC1 and GTC2 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.

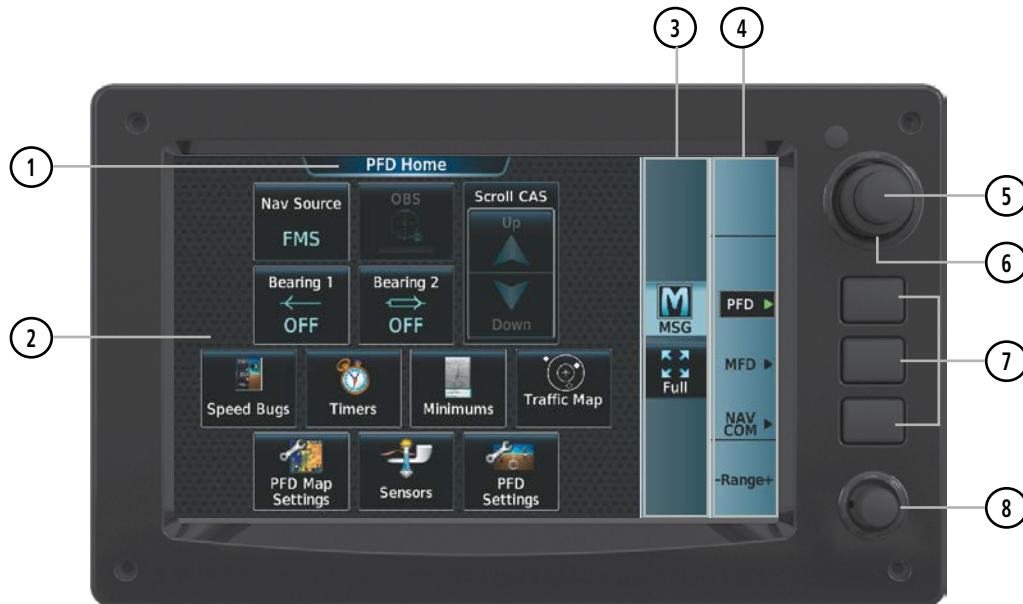


Figure 1-5 GTC 580 Touchscreen Controller

- 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. MFD Home, **MSG**, **Full/Half/Split**, Scroll **Up/Down**, **Back**, **Enter**, **Cancel**)
- ④ **Label Bar** Displays labels to show status and current functions of knobs and softkeys, when functions are available.
- ⑤ **Small Upper Knob** Provides functions as labeled on the Label Bar (e.g. Display Pane selection, COM Freq/switching/Hold, Data Entry/map panning)
- ⑥ **Large Upper Knob** Provides functions as labeled on the Label Bar (e.g. Display Pane selection, COM Freq/switching, 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, both Touchscreen Controllers can control the PFD, MFD and NAV/COM system. 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 MFD Home containing mode-specific controls. PFD Home is MFD Home for PFD control mode. MFD Home is MFD Home for MFD (i.e. Display Pane) control mode. 'NAV/COM' Home is MFD Home for NAV/COM control mode.

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

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

	Returns to MFD Home		Selects split display mode on the PFD.
	Returns to the previous screen		Selects half-display mode on the MFD.
	Displays the System Messages Window on Touchscreen Controller. Flashes when a new system message is issued.		Scrolls up in a list
	Displays the Telephone Window on Touchscreen Controller. Flashes when a new telephone call is received.		Scrolls down in a list
	Displays the 'Initialization' Screen on Touchscreen Controller. Button appears on MFD Home if initialization tasks have not been completed.		Cancels data entry and returns to the previous screen
	Displays the SMS Text Inbox Window on Touchscreen Controller. Flashes when a new SMS message is received.		Accepts entered data into the system.



Selects full-display mode when controlling the MFD. Selects full display mode when controlling the PFD.



Displays the Connex Notifications Window on the Touchscreen Controller. Flashes when a new Connex message is received.

Table 1-1 Button Bar Buttons with Functions

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 alphanumeric data entry, which are controlled using the Touchscreen Controller knob.

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 released within the boundary of the button, otherwise the input is considered invalid. If enabled, an aural ‘doink’ 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. 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.

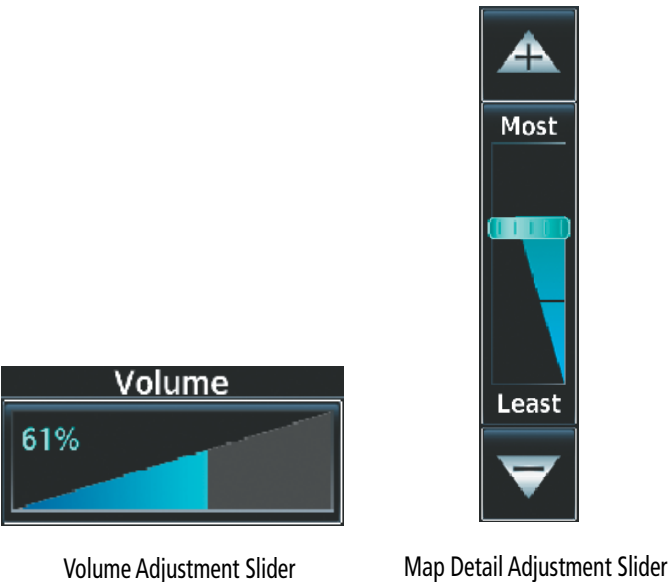


Figure 1-6 Sliders on the Touchscreen Controller

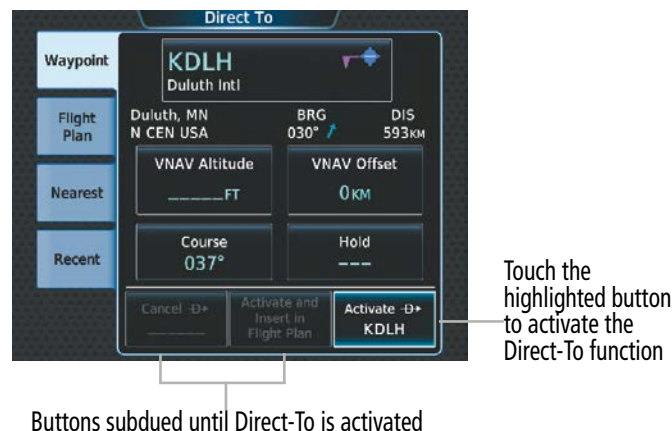
When a Touchscreen Controller screen window contains more information than the window can currently show, a scroll bar and scroll buttons appear. To scroll inside of a window, touch the controller while moving the finger up or down accordingly or touch and drag the finger up or down. To scroll more quickly, move the finger up or down rapidly in a flicking motion. 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 1-7 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 1-8 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 gray annunciator. Touch the annunciator button to change its state.



**Figure 1-9 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.

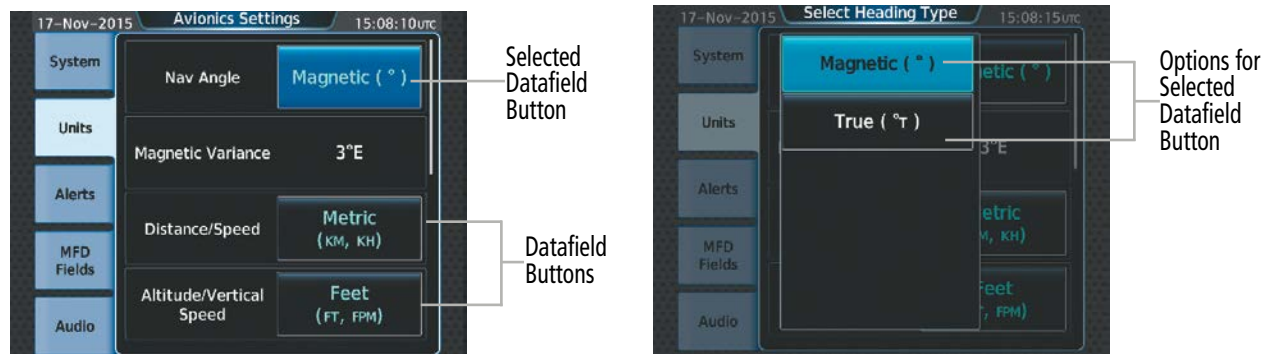


Figure 1-10 Touchscreen Controller Datafield Buttons

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.

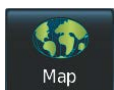
## SCREEN OVERVIEW

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 varies based on the installed options.

### MFD HOME

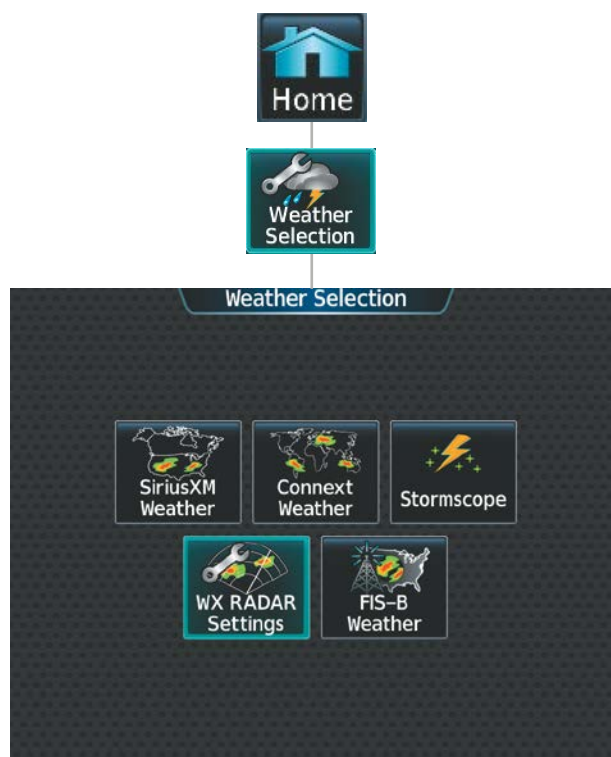







Shows 'Navigation Map' Pane in the selected display Pane. Touch the button again to access the 'Map Settings' Screen on the Touchscreen Controller.

	Shows 'Traffic Map' Pane in the selected Display Pane. Touch the button again to access the 'Traffic Settings' Screen on the Touchscreen Controller.
	Shows a Weather (SiriusXM, Connex, Stormscope, Radar, FIS-B) Pane in the selected Display Pane. Touch the button again to access Weather Selection Screen on Touchscreen Controller.
	Shows the Terrain SVT or TAWS Pane (optional) in the selected Display Pane. Touch the button again to access TAWS Settings screen on Touchscreen Controller.
	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 'Aircraft 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 (if electronic checklists are available).
	Accesses the 'Services' Screen on Touchscreen Controller. Includes Music, optional Iridium phone and text messaging services, and Contacts.
	Accesses the 'Utilities' Screen on Touchscreen Controller. Includes Weight and Fuel, Trip Planning functions, Minimums, Trip Statistics, Timer, Scheduled Messages, GPS Status, Initialization, Electronic Documents (optional), Screen Cleaning, Crew Profile, and Setup.
	Accesses the 'PERF' Screen. Provides controls for entering takeoff, landing, and weight data as well as enabling and disabling speed bugs.
	Provides information about Airports, Intersections, VORs, NDBs, User Waypoints. Also allows creation of User Waypoints.
	Provides information about the nearest Airports, Intersections, VORs, NDBs, User Waypoints, Airspace, ARTCC facilities, Flight Service Stations, and Weather reporting stations.



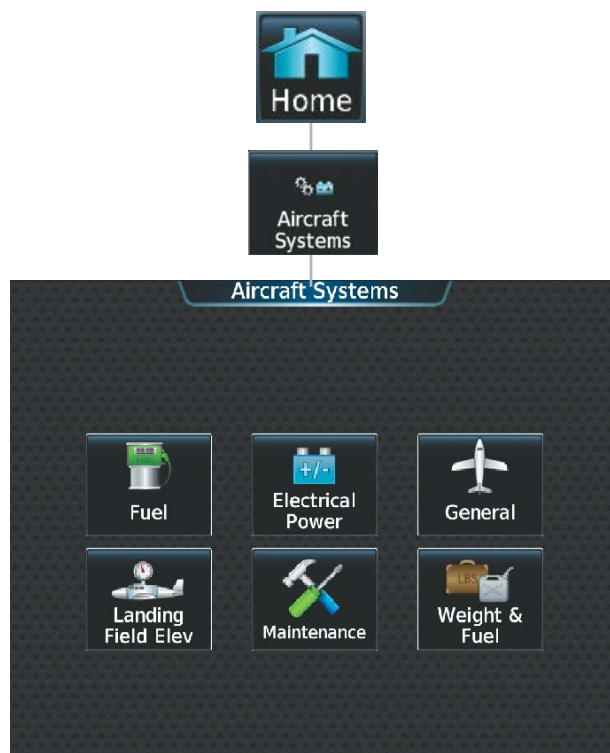
## 'WEATHER SELECTION' SCREEN










	Shows optional SiriusXM Weather data in the selected Display Pane. When the 'SiriusXM Weather' Pane is displayed, the button becomes the <b>SiriusXM Settings</b> Button. Touch the button again to access the 'SiriusXM Weather Settings' Screen on the Touchscreen Controller.
	Shows optional Connex Weather data in the selected Display Pane. When the 'Connex Weather' Pane is displayed, the button becomes the <b>Connex Settings</b> Button. Touch the button again to access the 'Connex Weather Settings' Screen on the Touchscreen Controller.
	Shows optional Stormscope data in the selected Display Pane. When the 'Stormscope' Pane is displayed, the button becomes the <b>Stormscope Settings</b> Button. Touch the button again to access the 'Stormscope Settings' Screen on the Touchscreen Controller.
	Shows optional Weather Radar data in the selected Display Pane. When the 'Weather Radar' Pane is displayed, the button becomes the <b>Weather Radar Settings</b> Button. Touch the button again to access the 'Weather Radar Settings' Screen on the Touchscreen Controller.
	Shows optional Flight Information System-Broadcast data in the selected Display Pane. When the 'FIS-B Weather' Pane is displayed, the button becomes the <b>FIS-B Settings</b> Button. Touch the button again to access the 'FIS-B Weather Settings' Screen on the Touchscreen Controller.

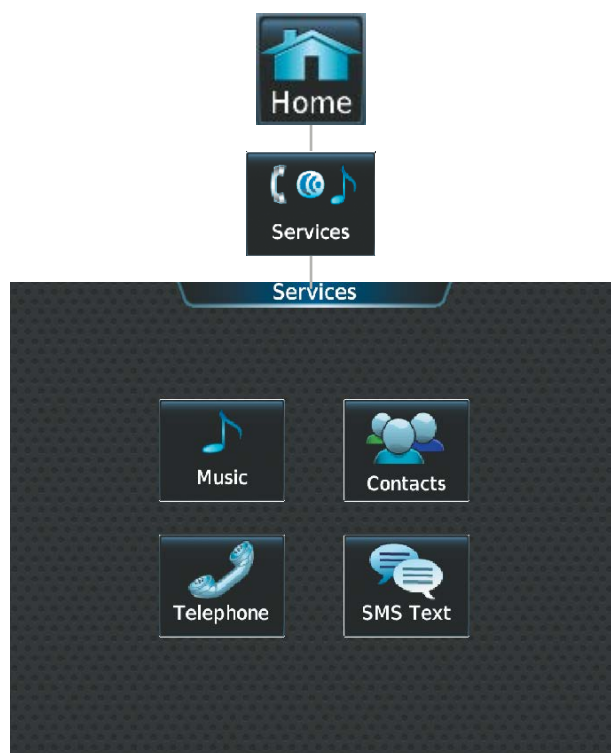






### 'AIRCRAFT SYSTEMS' SCREEN



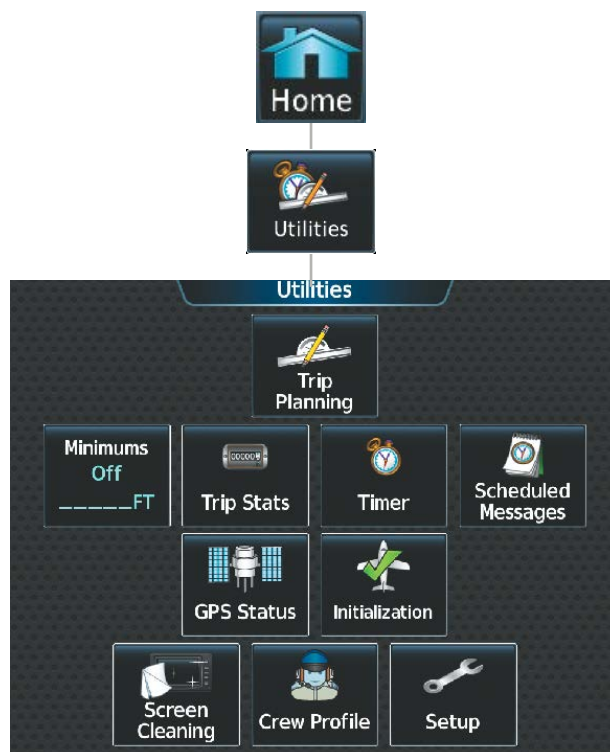
	Shows the status of the fuel tanks and feed system on the selected Display Pane. Fuel quantity is depicted graphically.
	Shows information about the batteries, generators, and electrical busses on the selected Display Pane.
	Shows open doors in red (CAS messages also generated) on the selected Display Pane as well as statuses of stall sensor, propeller, pitot probes, and windshield heat
	Shows the 'Landing Field Elevation' Screen. Provides controls for entering the landing field elevation, and selecting the source of landing field elevation data.
	Provides functions accessible to maintenance personnel.
	Shows the 'Weight and Fuel' Screen for entering weight and fuel information and performing computations.
	Provides control for master lighting setting, which affects display brightness on the 'Lighting Configuration' Screen. .

## 'SERVICES' SCREEN



	The 'Music' Screen provides controls for the optional SiriusXM Satellite Radio including channel information, selection, and volume settings.
	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.
	The 'Telephone' Screen (available with the Iridium voice telephone option) shows the status of the Iridium satellite telephone connection and provides telephone controls.
	The 'SMS Text Messaging' Screen (available with the Iridium voice telephone option) provides management of incoming and outgoing SMS (short message service) text messages.

### 'UTILITIES' SCREEN





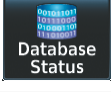


	Shows the Trip 'Planning' Pane in the selected Display Pane, and accesses the 'Trip Planning' Screen on the Touchscreen Controller.
	Accesses the 'Minimums' Screen on the Touchscreen Controller. Provides controls for the Minimum Descent Altitude/Decision Height alerting function. Button displays the current minimums altitude and source if provided.
	Accesses the 'Trip Statistics' Screen on the Touchscreen Controller. Shows information regarding Flight Time, Departure/Arrival Time, Odometer, Trip Odometer, Fuel Used, Average Ground Speed, Maximum Ground Speed, Trip Air Odometer, Average Wind Speed, and Average Wind Direction. Also provides settings for resetting trip statistics.
	Accesses the 'Timer' Screen on the Touchscreen Controller. Controls the timer on PFD1.
	Used to create custom messages to be displayed one-time or periodically. The Touchscreen Controller displays these System Messages on the 'Notifications' Screen.
	Accesses the GPS1 and GPS 2 Status screens for control of GPS sensors. Shows the GPS Status Pane in the Selected Display Pane.
	Displays the 'Initialization' Screen on the Touchscreen Controller. Provides controls for selecting the Crew Profile, and checking Database Status, Weight and Fuel, and Flight Plan.
	Feature temporarily disables touchscreen glass input to allow for manual cleaning. Turn or press any knob or softkey on the Touchscreen Controller to exit Screen Cleaning Mode.
	Displays 'Crew Profile' Screen, which provides controls for activating and managing crew profiles.

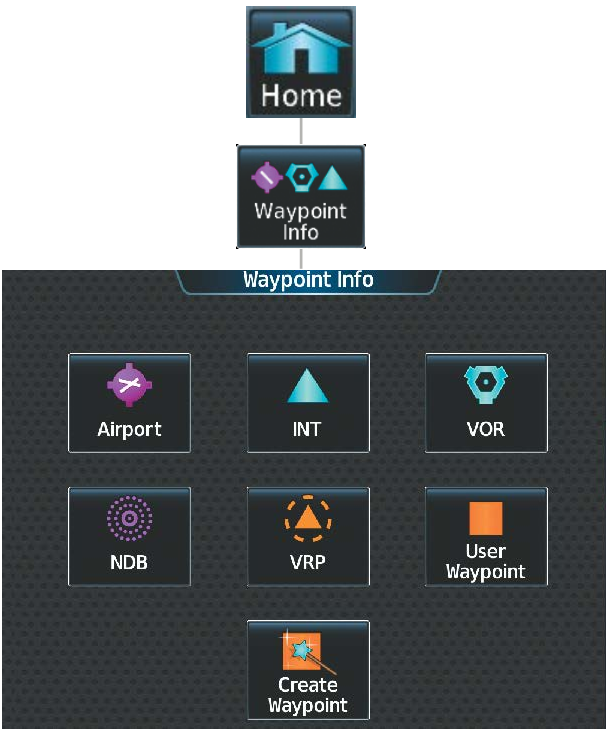
	Displays the 'Setup' Screen, which provides controls for avionics settings, avionics status, data link settings, and for displaying the status of avionics databases and ADS-B.
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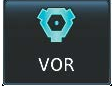

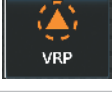
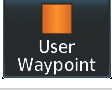
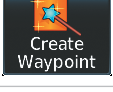
'SETUP' SCREEN



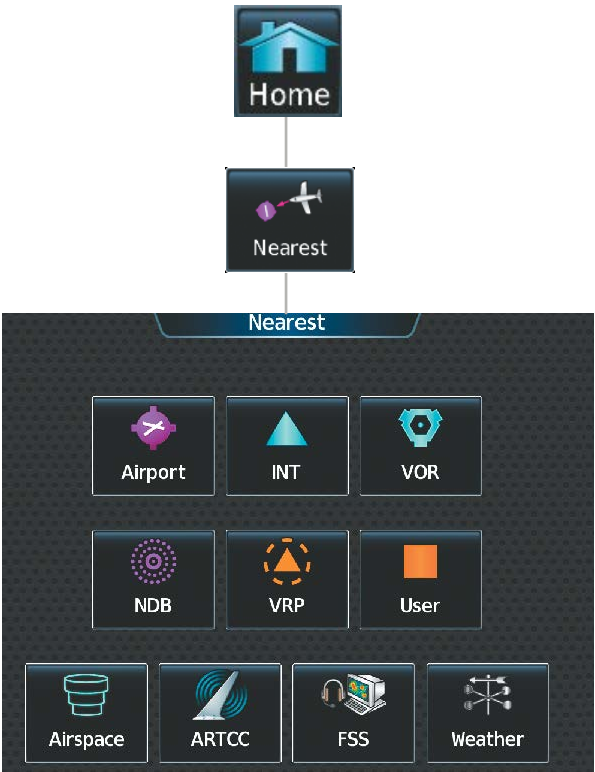
	Provides controls for changing system avionics settings, such as time format, units of measure, airspace alert settings, MFD Data Bar Fields, and Audio.
	Displays information on the Touchscreen Controller for installed LRUs, system software, and databases.
	Shows the 'SiriusXM Info' Screen on the Touchscreen Controller. Used to activate audio and data services from SiriusXM Satellite Radio and to verify subscriptions of SiriusXM Weather products.
	Used to register with the optional Garmin Connex. Also provides information on current Connex registration.
	Provides access to the 'Database Status' Screen for checking database cycle information.

Waypoint Info Screen



	Accesses airport information including frequencies, weather, procedures, charts, runways, and airport directory data.
	Shows information for a selected intersection including bearing, distance, and location.
	Provides VOR information including frequencies and location.
	Provides NDB information including frequencies and locations.
	Provides location information for Visual Reporting Points including a list of VRPs.
	Provides location information for User Waypoints including a list of User Waypoints.
	Create User Waypoints based on present position or a designated location.

'Nearest' Screen



	Displays a list of the nearest airports, with runway, bearing, and distance information.
	Displays a list of the nearest intersections with bearing and distance information.
	Displays a list of the nearest VORs with bearing, distance, and frequency information.
	Displays a list of the nearest NDBs with bearing, distance, and frequency information.
	Displays a list of the nearest Visual Reporting Points with bearing and distance information.
	Displays a list of the nearest User Waypoints with bearing and distance information.
	Displays information about the nearest airspace and status.
	Displays information about the nearest ARTCC facilities including bearing, distance, and frequencies.
	Displays the nearest Flight Service Stations with bearing, distance, and frequency information.



Displays the nearest weather reporting sources, bearings, distances, and frequencies.






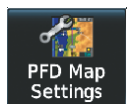
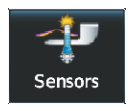

PFD MODE TOUCHSCREEN CONTROLLER SCREENS

PFD HOME



	Cycles through FMS, LOC1/VOR1 and LOC2/VOR2 navigation modes on the CDI
 or 	Selects OBS mode on the CDI when navigating by FMS (only available with active leg). When OBS is active the annunciator is green.  Selects SUSP mode on the CDI when navigating by FMS. When SUSP is active the annunciator is green.
	Cycles the Bearing 1 through OFF, NAV1, NAV2, FMS, and ADF1 (if installed)
	Cycles the Bearing 2 through OFF, NAV1, NAV2, FMS, and ADF1 (if installed).



	<p>Scrolls CAS messages up and down.</p>
	<p>Accesses the 'Speed Bugs' Screen on Touchscreen Controller, where the speed bugs can be configured.</p>
	<p>Accesses the 'Timer' Screen on the Touchscreen Controller. Controls timer on PFD.</p>
	<p>Accesses the 'Minimums' Screen on the Touchscreen Controller. Set Minimum Altitude Alerting.</p>
	<p>Shows the Traffic Map on the PFD in inset format when the PFD is in Full Mode. Shows the 'Traffic Map' Pane on the PFD when the PFD is in Split Mode.</p>
	<p>Accesses the 'PFD Map Settings' Screen on the Touchscreen Controller. The Inset Map or HSI Map is not available when in split mode.</p>
	<p>Accesses the 'Sensors' Screen. Allows for selection of ADC and AHRS sensors.</p>
	<p>Accesses the 'PFD Settings' Screen to view or set PFD Mode, AOA, Flight Director Active Format, SVT Terrain, SVT Pathways, Horizon Heading, SVT Airport Signs, Wind, Time Format, Time Offset, COM Channel Spacing, Baro Select Units, Meters Overlay, and Screen Cleaning function.</p>

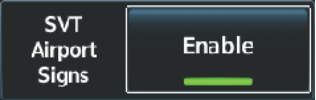
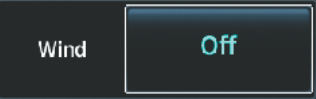
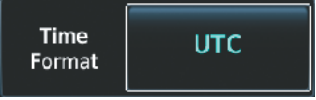
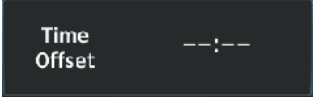
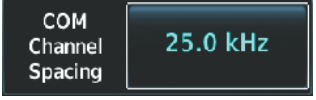
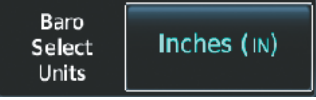
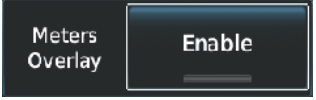
PFD Settings



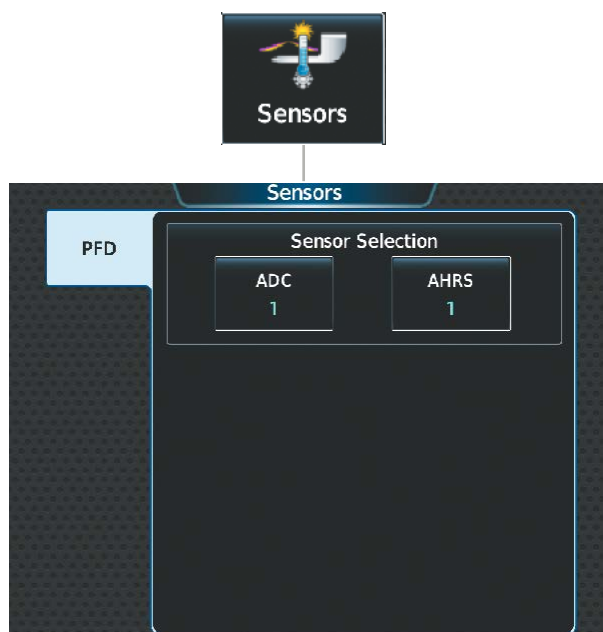
Deactivates touch input on the Touchscreen Controller to facilitate cleaning. Press or turn a knob on the controller to resume touch input.



PFD SETTINGS

<div>PFD Mode</div> <div>Full</div>	<p>Allows the GDU to be split into a condensed PFD and Display Pane, which appears on the inboard portion of the screen.</p> <p><b>Full:</b> Selects full size PFD display.</p> <p><b>Split:</b> Selects a condensed PFD and a display pane</p>
<div>AOA</div> <div>On</div>	<p>Selects the display mode for the Angle of Attack (AOA) indicator on the PFD.</p> <p><b>On:</b> Displays AOA indicator on the PFD.</p> <p><b>Off:</b> Removes AOA indicator from the PFD.</p>
<div>Flight Director Active Format</div> <div>Single Cue</div>	<p>Shows the type of Flight Director available.</p>
<div>SVT Terrain</div> <div>Enable</div>	<p>Enables/disables synthetic terrain depiction. When Enabled, the annunciator is green.</p>
<div>SVT Pathways</div> <div>Enable</div>	<p>Enables/disables synthetic terrain pathways depiction. When enabled., the annunciator is green. When synthetic terrain is disabled, button is subdued.</p>
<div>Horizon Heading</div> <div>Enable</div>	<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>

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

## PFD Sensors



	Accesses the 'ADC Sensor' Screen where the Air Data Computer (ADC) used by the on-side PFD can be manually selected.
	Accesses the 'AHRS Sensor' Screen where the Attitude and Heading reference system sensors used can be manually selected.

## CONTROLLING DISPLAY PANES

Either Touchscreen Controller may be used to select and control Display Panes in MFD control mode; however, both Touchscreen Controllers may not select, display or control MFD function at the same time. When selecting the MFD mode from one Touchscreen Controller while the other is already on an MFD page, the latter switches automatically to the 'NAV/COM Home' Screen.

The system highlights the border of the selected Display Pane. The Label Bar indicates when the upper knobs may be used to select a Display Pane by displaying the word 'Pane', with four icons below it that represent each possible display screen. The number of screens available for selection is determined by the configuration of each GDU (Full, Half or Split Modes). A cyan (GTC1) or purple (GTC2) icon represents the selected Display Pane. A black icon represents a Display Pane which is available for selection, but is not currently selected. A gray icon depicts a Display Pane which is not currently shown, and is therefore unavailable for selection. See the following two figures for examples of Touchscreen Controller selection of display panes.

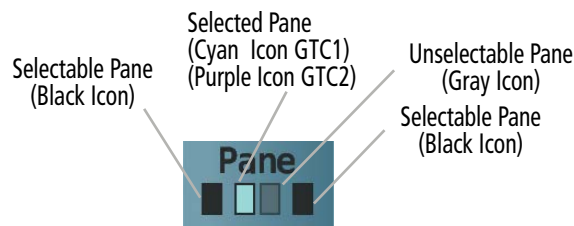


Figure 1-11 Touchscreen Controller Display Pane Controller Icons

The MFD shows the EICAS Display, and either one Display Pane in Full Mode, or two Display Panes in Half Mode. The presence of either the **Full** or **Half** Mode Button on a Touchscreen Controller indicates the availability of one of these modes for the selected Display Pane. Some MFD Display Panes are only displayed in Half Mode format, and the **Full** button is therefore unavailable until another Display Pane capable of supporting Full Mode is selected.

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. Either Touchscreen Controller in PFD Control Mode can select Full or Split. A **Full** or **Split** Button in the Button Bar indicates which display mode is available for the PFD. Additionally, a **PFD Mode** Softkey is available under the **PFD Settings** Softkeys, which can be used to select Full or Split Mode on the PFD.

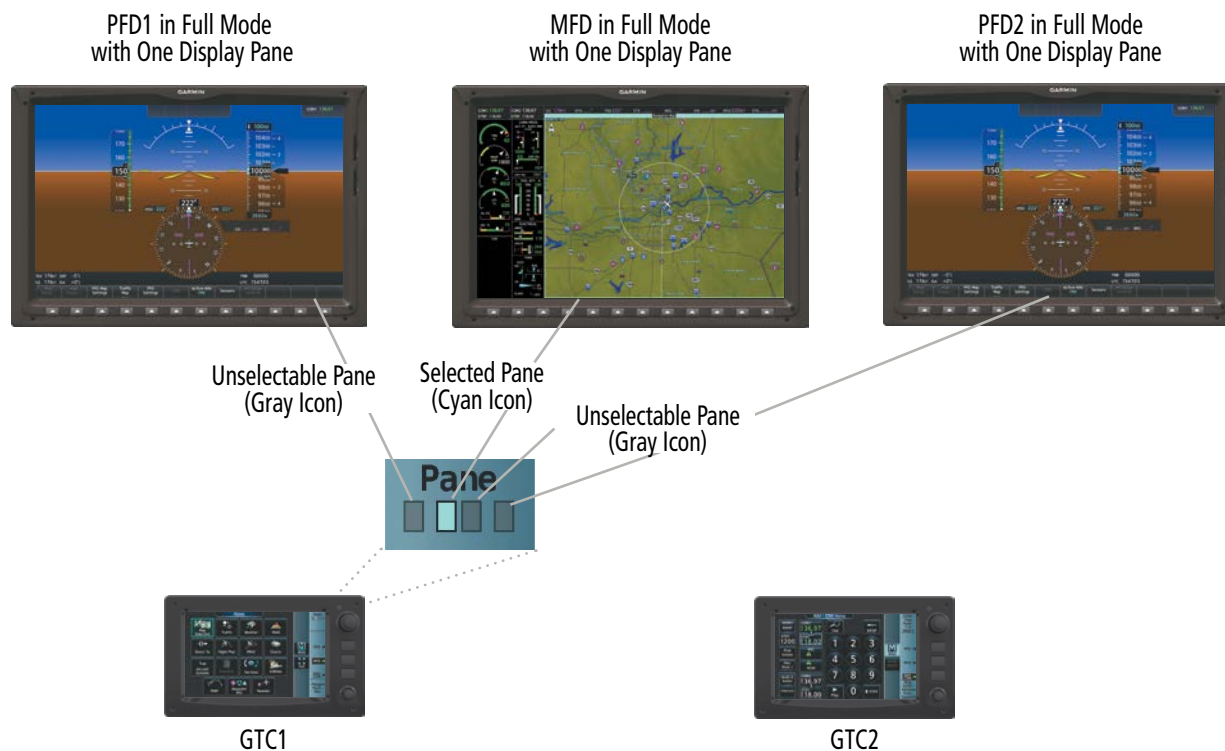


Figure 1-12 GTC1 Control with PFD 1 in Full Mode, MFD in Full Mode and PFD2 in Full Mode

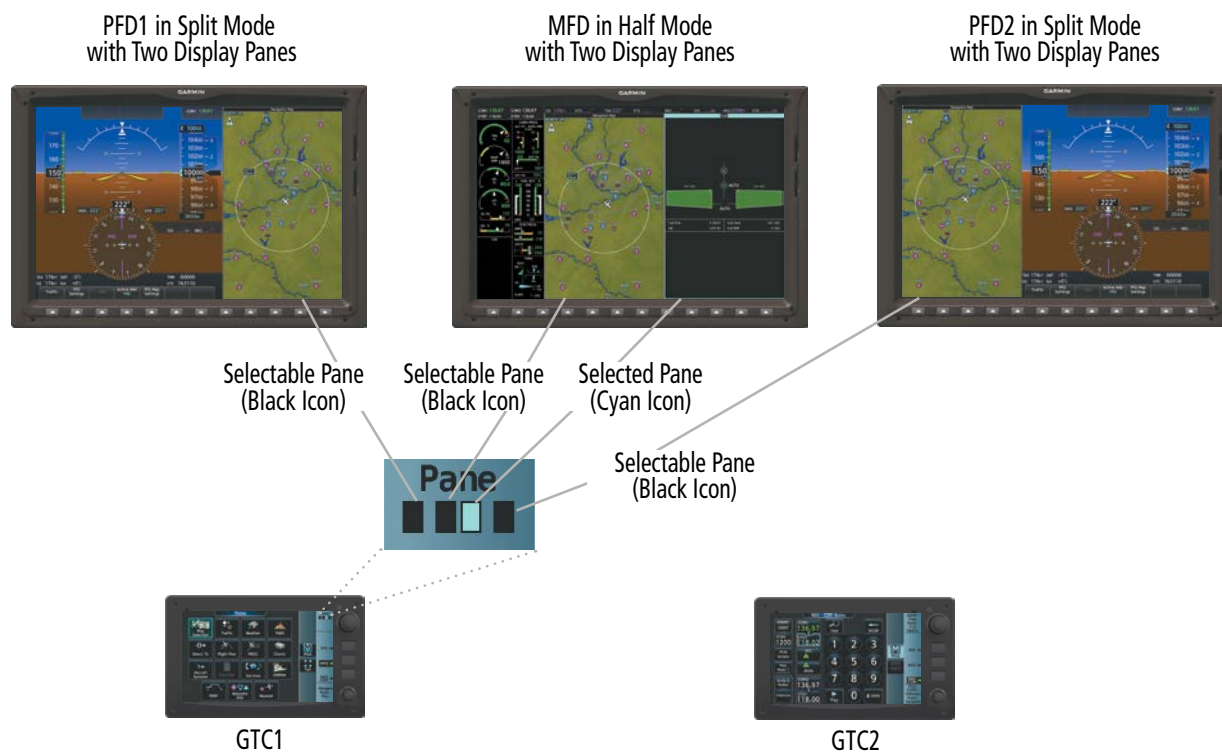


Figure 1-13 GTC1 Control with PFD1 in Split Mode, MFD in Half Mode and PFD2 in Split Mode

## 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. In Full Mode, the MFD shows the EICAS Display and a single, enlarged Display Pane. In Half Mode, the MFD shows the EICAS Display and two Display Panes (mode selections do not affect the EICAS Display formatting).

When the system is powered-up on the ground, the MFD begins operation in Half Mode with a cyan (GTC1 in control) or purple (GTC2 in control) border around the selected Display Pane.

When the Pane Selector highlights an MFD Display Pane in Half Mode, and Full Mode is available for that Display Pane, the Touchscreen Controller shows a **Full** Button in the Button Bar.

Touch the **Full** Button to show the selected Display Pane in Full Mode. Touch the **Half** Button to return to Half Mode.

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

## 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 MFD Home Button (on the Button Bar) to exit the datafield without saving the entry.



Figure 1-14 Entering Text on the Keypad

### Using the Touchscreen Controller's large and small right knob 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 MFD Home Button to exit the field without saving the entry.

## SECURE DIGITAL CARDS



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



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

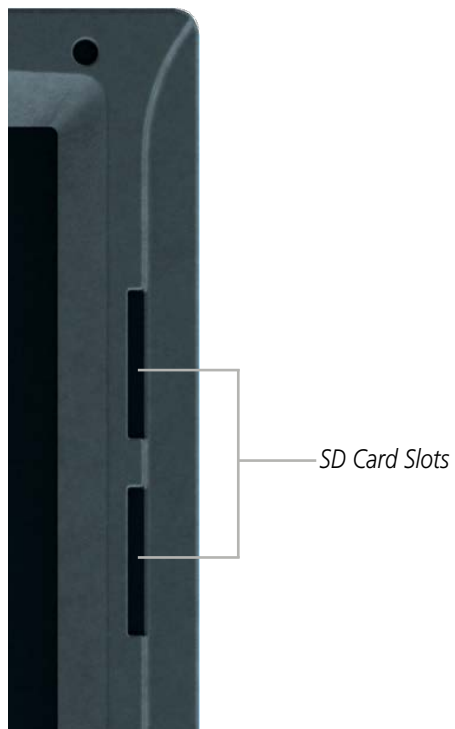
### Install an SD card

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 1-15** Display Bezel SD Card Slots

## 1.3 SYSTEM OPERATION

The displays are connected via a single Ethernet bus for high-speed communication. Each IAU is connected to a single display. This allows the units to share information, enabling true system integration.

### SYSTEM POWER-ON



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



**NOTE:** Refer to Appendix A for system-specific annunciations and alerts.

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 power-on, annunciator lights on the AFCS Controller illuminate momentarily.

On the PFD, the Attitude and Heading Reference System (AHRS) initializes and briefly displays “AHRS ALIGN: Keep Wings Level”. The AHRS should display valid attitude and altitude typically within the first minute of power-on.

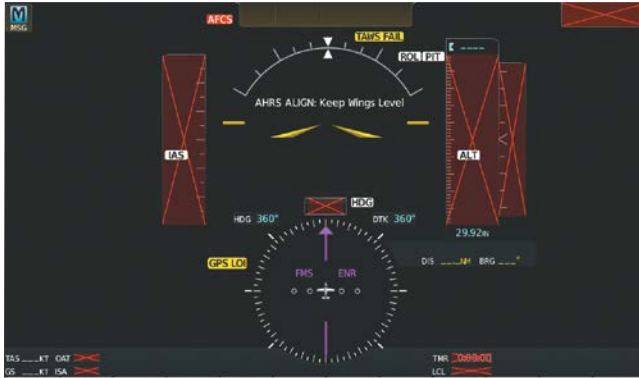
When the MFD powers-on, the start-up screen displays the following information:

- |                                     |  |
|-------------------------------------|--|
| - System version                    | - Obstacle database name and version                     |
| - Copyright                         | - Navigation database name, version, and effective dates |
| - Checklist name and version        | - Airport Directory name, version and effective dates    |
| - Land database name and version    | - FliteCharts/ChartView database information             |
| - SafeTaxi database information     | - IFR/VFR chart information                              |
| - Terrain database name and version |  |

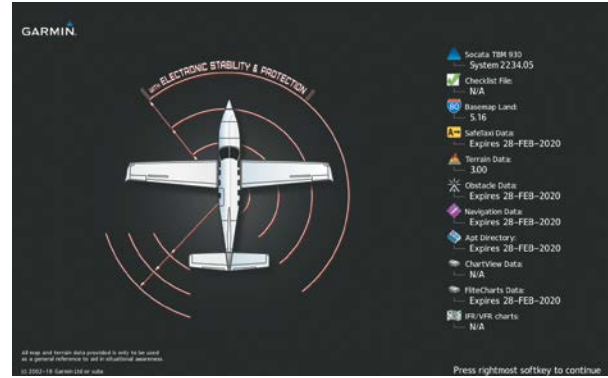
Current database information includes database type, cycle number, or valid operating dates. Review the listed information for currency (to ensure that no databases have expired).

Pressing the right-most softkey on the MFD acknowledges this information, and the MFD then shows the EICAS (Engine Indication Crew Alerting System) Display, the ‘Navigation Map’ Pane (in Half Mode), and the ‘Traffic Map’ Pane (in Half Mode).

When the system has acquired a sufficient number of satellites to determine a position, the system displays the aircraft’s current position on the ‘Navigation Map’ Pane.



**Figure 1-16 PFD Power-On**



**Figure 1-17 MFD Power-On**



**GTC1 PFD Home Screen**



**GTC2 Screen**

**Figure 1-18 Touchscreen Controller Power-On**

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

The displays are connected via a single Ethernet bus for high-speed communication. Each IAU is connected to a single display. This allows the units to share information, enabling true system integration.

## **NORMAL OPERATION**

### **GDU**

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 occupies the entire display portion of the GDU. In Split Mode, the PFD is condensed to accommodate a Display Pane on the inboard portion of the GDU.



**Figure 1-19 Various Normal Display Operating Modes**

The MFD shows an Engine Indications on the left portion of the GDU. It also shows two Display Panes side-by-side in Half Mode. In normal operations, either Touchscreen Controller can select the Full and Half Modes for the MFD.

## TOUCHSCREEN CONTROLLERS

Each GTC can display any of the modes upon selection with the **PFD**, **MFD** and **NAV/COM** softkeys. When selecting the MFD mode from one Touchscreen Controller while the other is already on an MFD page, the latter reverts automatically to the 'NAV/COM Home' Screen.

A button on the Touchscreen Controller indicates when Full Mode or Half Mode is available for the currently selected MFD Display Pane.

The Touchscreen Controller upper knob selects Display Panes for control. Turning the knob left or right as applicable moves the cyan or dark purple highlight.

## REVERSIONARY DISPLAY OPERATION



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

Reversionary mode is a mode of operation in which all important flight information is presented on at least one of the operating display. If a PFD or MFD fails or is offline, the system can combine a PFD, a condensed EICAS display, and a condensed Display Pane on another display in reversionary mode. The following discussion illustrates some of the various reversionary mode display combinations.

The flight crew can manually activate reversionary mode on PFD1 or the MFD by activating the red left or right **DISPLAY BACKUP** Switch. Entering reversionary mode is initiated by the crew. The system does not automatically switch to reversionary mode.

- **PFD1 failure** – MFD is switched to reversionary Full Mode and PFD2 enters Split Mode.



Figure 1-20 Reversionary Mode - PFD1 Failure

- **MFD failure** – PFD1 is switched to reversionary mode and PFD2 enters Split Mode.



Figure 1-21 Reversionary Mode - MFD Failure

- **PFD2 failure** – PFD1 and MFD continue to operate normally.



Figure 1-22 Reversionary Mode - PFD2 Failure

## TOUCHSCREEN CONTROLLER FAILURE

If a Touchscreen Controller fails or is off-line, the operating Touchscreen Controller controls the on-side PFD and the MFD. Control of the cross-side PFD is lost. In addition, the single Touchscreen Controller provides audio and CNS control for both the pilot and copilot. If both 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 GRS 77 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 (see Figure 1-26) and depend upon the combination of available sensor inputs. Loss of air data, GPS, or magnetometer sensor inputs is communicated to the pilot by System Messages.

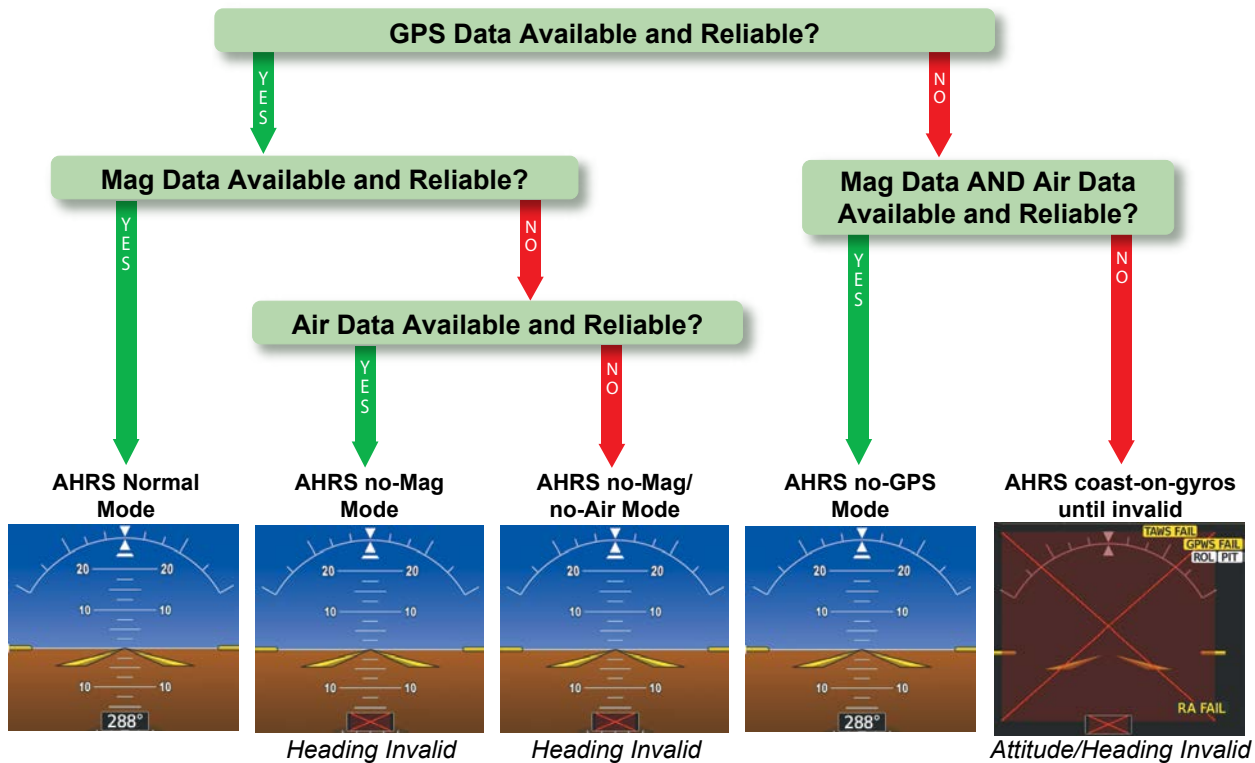


Figure 1-23 AHRS Operation

## 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 attitude and heading 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 an amber "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 attitude and heading information on the PFD.





**NOTE:** Refer to the *Flight Instruments* section for information about operating the Standby Flight Display.

## GPS RECEIVER OPERATION

Each GIA 63W Integrated Avionics Unit (IAU) contains a GPS receiver. Information collected by the specified receiver (GPS 1 for the left/pilot side or GPS 2 for the right/copilot side) may be viewed on the GPS 1 or GPS 2 Status Pane and the 'GPS Status' Screen on the Touchscreen Controller.

These GPS sensor annunciations are most often seen after applying power to the system 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 Touchscreen Controller. If no failure message exists, check the GPS Status Screen and compare the information for GPS 1 and GPS 2. Discrepancies may indicate a problem.



Figure 1-24 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, gray when disabled. The system displays the 'GPS1 Status' Pane.
- 3) Touch the **GPS2** Button to select the #2 GPS receiver. The button annunciator is green when enabled, gray when disabled. 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 (GPS 1 or GPS 2) is shown in the lower right of the GPS 1 and GPS 2 Status Pane. When the receiver is in the process of acquiring enough satellite signals for navigation, the receiver uses satellite orbital data (collected continuously from the satellites) and last known position to determine the satellites that should be in view. 'ACQUIRING' is indicated as the solution until a sufficient number of satellites have been acquired for computing a solution.

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

## 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, or MSAS 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** (any combination) Annunciator Button(s) to enable or disable. A green annunciation indicates an enabled SBAS selection, disabled selections are gray.

## RAIM (RECEIVER AUTONOMOUS INTEGRITY MONITORING) PREDICTION

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

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

The RAIM prediction function also indicates whether RAIM is available at a specified date and time. RAIM computations predict satellite coverage within  $\pm 15$  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 right 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



**NOTE:** For a detailed description of all annunciations and alerts, refer to Appendix A. Refer to the aircraft flight manual for additional information regarding crew responses to these 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 crew 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.

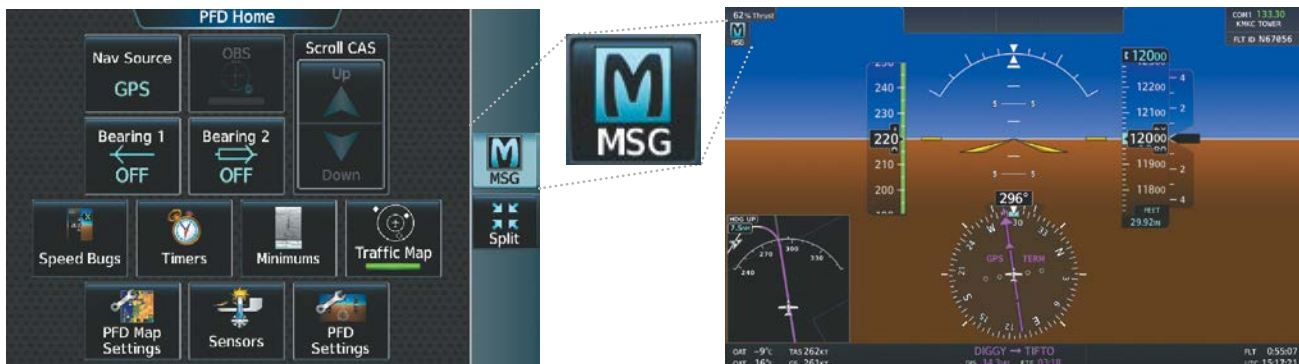


Figure 1-25 Message Annunciation on Touchscreen Controller and PFD

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 crew responses to these annunciations.



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

## 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 GTC1 or GTC2 when MFD Home has been selected. On this screen, the pilot can select a Crew Profile, verify database statuses, view initialization information from the aircraft manufacturer, enter weight, fuel, and flight plan information.



Figure 1-26 '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. There are no system tests to perform so the System Tests initialization task will not complete nor display a green check mark. Proceed with other tasks and accept initialization.

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

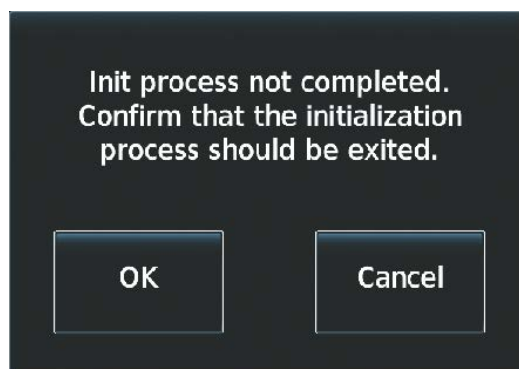


Figure 1-27 System Initialization Exit Confirmation

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 MFD Home. 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. (See Crew Profiles in section 1.5 for more information on creating, importing, and exporting Crew Profiles)
- 2) Touch **Next** to proceed to the 'Active Flight Plan' Screen to **Add Origin, Add Enroute Waypoints** and **Add Destination**. (See Flight Planning for details).
- 3) Touch **Next** Button to proceed to the 'System Tests' Screen. There are no system tests to complete.
- 4) Touch the **Next** Button to proceed to the 'Weight and Fuel' Screen to input values for Empty Weight, Aircraft Loading, and Fuel Information. (See Trip Planning - Weight and Fuel Planning details).
- 5) Touch **INIT** to return the 'Initialization' Screen. As each task is completed a green checkmark appears in the completed column on the 'Initialization' Screen. System tests cannot be completed.



Figure 1-28 'Initialization' Screen

- 6) Touch **Accept Initialization** to accept the initialization values and proceed to MFD Home. 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 which can be changed by the flight crew are accompanied by buttons. Settings which cannot be changed by the flight crew are displayed for informational purposes, without corresponding buttons.

#### SYSTEM SETTINGS

<b>System</b>	<ul style="list-style-type: none"><li>• Time display format (local 12 hour, local 24 hour, or UTC )</li><li>• Time offset</li></ul>
<b>Units</b>	<ul style="list-style-type: none"><li>• Keyboard Format</li></ul>
<b>Alerts</b>	<ul style="list-style-type: none"><li>• Flight Director Active Format (Single Cue or Dual Cue)</li><li>• GPS CDI range</li><li>• COM transceiver channel spacing</li></ul>
<b>MFD Fields</b>	<ul style="list-style-type: none"><li>• Stability and Protection</li><li>• Nearest Airport Runway Surface</li><li>• Nearest Airport Minimum Runway Length</li></ul>
<b>Audio</b>	<ul style="list-style-type: none"><li>• Show Airport Chart on Landing</li><li>• Sync CDI</li><li>• Sync Altimeter Baro Pressure</li></ul>



**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**).



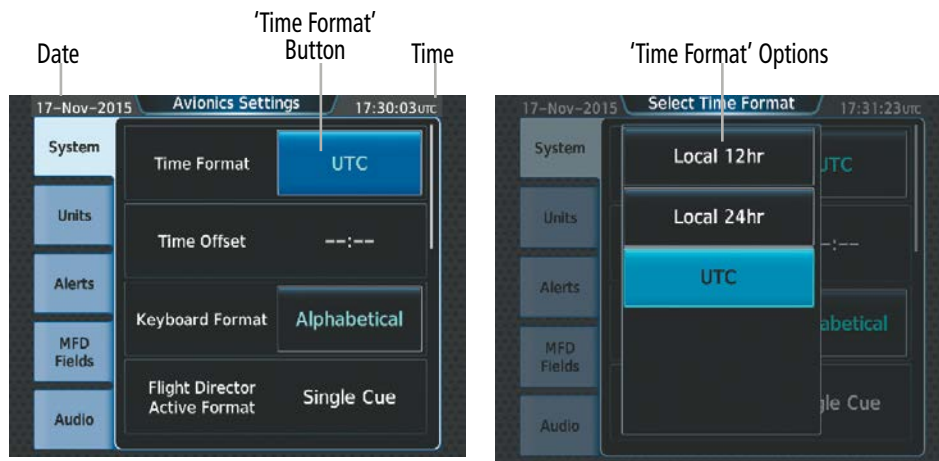


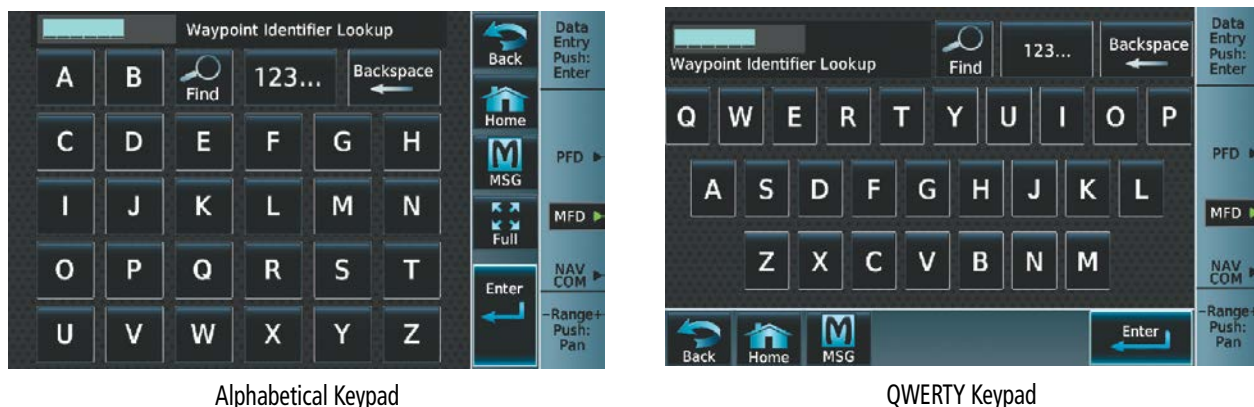
Figure 1-29 Time Format Settings

### 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.
- 4) Input the desired value using the numeric keypad or the large and small right knobs and touch the **ENTER** Button.

### KEYPAD FORMAT

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



Alphabetical Keypad

QWERTY Keypad

Figure 1-30 Keypad Formats on the Touchscreen Controller

### Selecting a keypad format:

- 1) From 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 FMS 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 (displays currently selected time format in cyan).
- 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 MFD Home, touch **Utilities > Setup > Avionics Settings**.
- 2) If necessary, touch the **System** Tab.
- 3) Scroll and touch the COM Channel Spacing Button (button displays the current spacing setting in cyan).
- 4) Touch either the **8.33 kHz** or **25.0 kHz** Buttons.

## ELECTRONIC STABILITY AND PROTECTION

Garmin Electronic Stability and Protection (ESP™) is an optional feature 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 gray.

## 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**, **Hard/Soft**, or **Water**.

### 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 datafield button.
- 4) Touch the **On** Button to enable the feature or the **Off** Button to disable the feature.

## SYNCHRONIZE COURSE DEVIATION INDICATORS (CDI)

CDI Sync will set the active navigation source on PFD 2 to the currently active source on PFD 1.

### Turn CDI synchronization on:

- 1) From MFD Home, touch **Utilities > Setup > Avionics Settings**.
- 2) If necessary, touch the **System** Tab.
- 3) Scroll to and touch the Sync CDI button to display the On or Off option.
- 4) Touch **On**.

### Turn CDI synchronization off:

- 1) From MFD Home, touch **Utilities > Setup > Avionics Settings**.
- 2) If necessary, touch the **System** Tab.
- 3) Scroll to and touch the Sync CDI button to display the On or Off option.
- 4) Touch **Off**.

### SYNCHRONIZE ALTIMETER SETTING

When enabled, setting the altimeter setting on either PFD will also enter the setting on the other PFD.

#### Turn altimeter setting synchronization on:

- 1) From MFD Home, touch **Utilities > Setup > Avionics Settings**.
- 2) If necessary, touch the **System** tab.
- 3) Scroll to and touch the Sync Altimeter Baro Pressure button to display the On or Off option.
- 4) Touch **On**.

#### Turn altimeter setting synchronization off:

- 1) From MFD Home, touch **Utilities > Setup > Avionics Settings**.
- 2) If necessary, touch the **System** tab.
- 3) Scroll to and touch the Sync Altimeter Baro Pressure button to display the On or Off option.
- 4) Touch **Off**.

### UNITS SETTINGS

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

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, 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, nautical)
- Altitude/Vertical Speed (feet, meters)
- External Temperature (Celsius or Fahrenheit)
- Cockpit/Cabin Temperature (Fahrenheit)
- Fuel (gallons, imperial gallons, kilograms, liters, pounds)
- Weight (pounds or kilograms)
- Position Format (HDDD°MM.MM')
- 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.

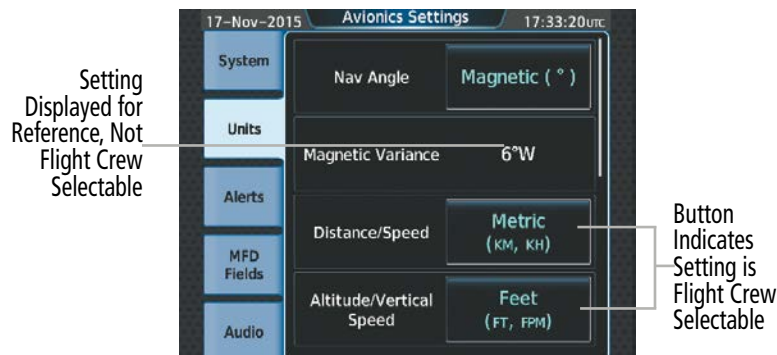
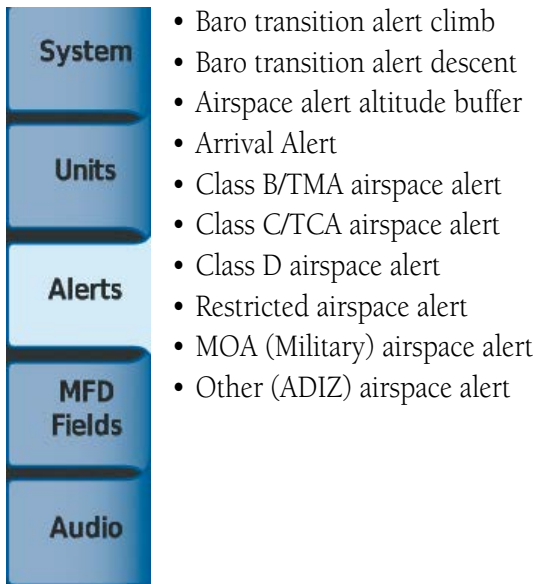


Figure 1-31 Viewing Unit Data on the 'Avionics Settings' Screen

## ALERTS SETTINGS



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

- » Baro transition alert (climb and descent)
- » Altitude buffer distance alert
- » Arrival alerts
- » 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.

#### Configuring the Baro Transition Alerts:

- 1) From MFD Home, touch **Utilities > Setup > Avionics Settings**.
- 2) If necessary, touch the **Alerts** Tab.
- 3) Touch the **Baro Transition ALT Climb** Button. Button annunciator is green when alert is enabled, gray when disabled.
- 4) Touch the Baro Transition ALT Climb datafield button. Use the keypad or large and small upper knobs to select the desired altitude at which the system will issue an alert if the aircraft climbs through this altitude while the altimeter setting has **not** been set **to** standard. Touch **Enter** or push the upper knob to accept the selection.
- 5) Touch the **Baro Transition LVL Descent** Button. Button annunciator is green when alert is enabled, gray when disabled.
- 6) Touch the Baro Transition LVL Descent datafield button. Use the keypad or large and small upper knobs to select the desired flight level at which the system will issue an alert if the aircraft descends through this flight level while the altimeter setting has **not** been changed **from** standard. Touch **Enter** or push the upper knob to accept the selection.

## ARRIVAL ALERT SETTINGS

### Enabling/disabling Arrival Alerts:

- 1) From MFD Home, touch **Utilities > Setup > Avionics Settings**.
- 2) If necessary, touch the **Alerts** Tab.
- 3) Touch the Arrival Alert **Enable** Button. Button annunciator is green when alert is enabled, gray when disabled.

### Setting the Arrival Alert distance:

- 1) From MFD Home, touch **Utilities > Setup > Avionics Settings**.
- 2) If necessary, touch the **Alerts** Tab.
- 3) Touch the Arrival Alert distance button.
- 4) Input the desired distance using the numeric keypad or the large and small right knobs, then touch the **ENTER** Button or press the right knob.

## AIRSPACE ALERTS

The Airspace Alerts allow the pilot to turn the controlled/special-use airspace message alerts on or off. This does not affect the Nearest Airspace alerts or the airspace boundaries depicted on the Navigation Map pane. It simply enabled/disables the warning provided when the aircraft is approaching or near an airspace.

Alerts for the following airspaces can be enabled/disabled:

- Class B/TMA
- Class C/TCA
- Class D
- Restricted
- MOA (Military)
- Other airspaces/ADIZ

### Enabling/disabling an airspace alert:

- 1) From MFD Home, touch **Utilities > Setup > Avionics Settings**.
- 2) If necessary, touch the **Alerts** Tab.
- 3) Scroll as necessary and touch any of the of the following buttons to enable/disable the corresponding alert: **CLASS B/TMA**, **CLASS C/TCA**, **CLASS D**, **RESTRICTED**, **MOA (MILITARY)**, **OTHER/ADIZ**. Button annunciator is green when alert is enabled, gray when disabled.

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) If necessary, 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 right knobs, then touch the **ENTER** Button or press the right knob.

## MFD FIELDS SETTINGS



- MFD Data Bar Field 1
- MFD Data Bar Field 2
- MFD Data Bar Field 3
- MFD Data Bar Field 4
- MFD Data Bar Field 5
- MFD Data Bar Field 6
- MFD Data Bar Field 7
- MFD Data Bar Field 8

The MFD Navigation Status Bar displays eight navigation data bar fields. The system assigns each data bar field a corresponding number, 1 through 8 as displayed from left-to-right in the MFD Navigation Status Bar. The following data may be selected for display in each of the four fields of the Navigation Status Bar.

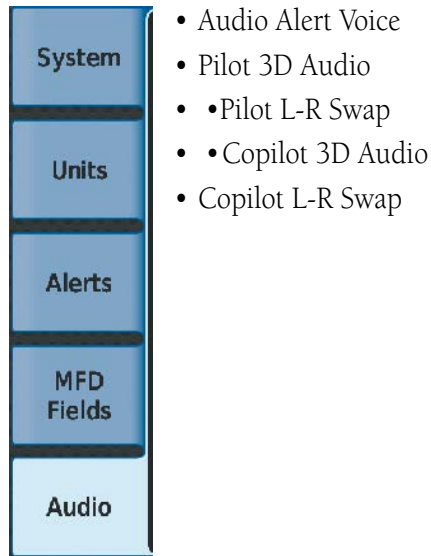
- |                                   |                                  |
|-----------------------------------|----------------------------------|
| ▪ Bearing (BRG)                   | ▪ Fuel Over Destination (FOD)    |
| ▪ Destination Airport (DES)       | ▪ Ground Speed (GS)              |
| ▪ Distance (DIS)                  | ▪ ETA at Final Destination (LDG) |
| ▪ Distance to Destination (DTG)   | ▪ Minimum Safe Altitude (MSA)    |
| ▪ Desired Track (DTK)             | ▪ True Airspeed (TAS)            |
| ▪ Endurance (END)                 | ▪ Track Angle Error (TKE)        |
| ▪ ETE to Final Destination (ENR)  | ▪ Track (TRK)                    |
| ▪ Enroute Safe Altitude (ESA)     | ▪ Vertical Speed Required (VSR)  |
| ▪ Estimated Time of Arrival (ETA) | ▪ Cross-Track Error (XTK)        |
| ▪ Estimated Time Enroute (ETE)    |                                  |
| ▪ Flight Timer (FLT)              |                                  |
| ▪ Fuel On Board (FOB)             |                                  |

### 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

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 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 a 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 MFD Home.

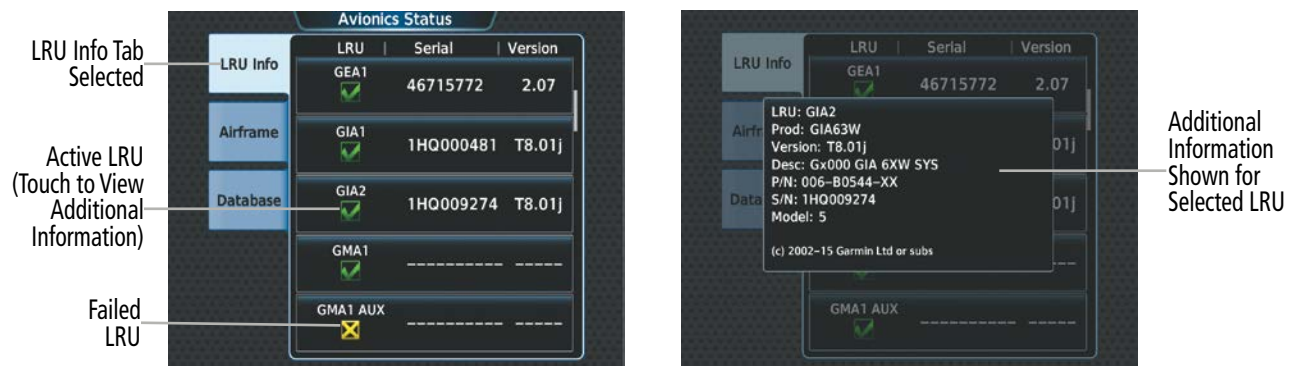


Figure 1-32 Viewing LRU Info Information on the Touchscreen Controller

### AIRFRAME

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

**Viewing airframe information:**

- 1) From 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, PFD2, MFD1, GTC1, or GTC2).

**Viewing database information:**

- 1) From MFD Home, touch **Utilities > Setup > Avionics Status**.
- 2) If necessary, touch the **Database** Tab.
- 3) Touch **MFD1, PFD1, PFD2, GTC1, or GTC2** Buttons to view database information for the selected LRU.
- 4) Scroll as needed to view the database information for the selected LRU, then touch **Back** or MFD Home.

**SIRIUSXM INFORMATION**

**NOTE:** Refer to the Hazard Avoidance Section for information about SiriusXM Weather products or the Additional Features Section for information about SiriusXM Satellite Radio.

**Viewing SiriusXM Information:**

From MFD Home, touch **Utilities > Setup > SiriusXM Info**

SiriusXM Satellite Radio services are subscription-based. The service is activated by providing SiriusXM Satellite Radio with either one or two coded IDs, depending on the equipment. Either the Audio Radio ID or the Data Radio ID, or both, must be provided to SiriusXM to activate the subscription(s).

It is not required to activate both the entertainment and weather service subscriptions. Either or both services can be activated. SiriusXM uses one or both of the coded IDs to send an activation signal to the system.

These IDs are located:

- On the label on the back of the Data Link Receiver
- On the SiriusXM Information Screen
- On the XM Satellite Radio Activation Instructions included with the unit (available at [www.garmin.com](http://www.garmin.com), P/N 190-00355-04)

**Activating SiriusXM Weather and SiriusXM Satellite Radio:**

- 1) Position the aircraft so the data link receiver antenna has an unobstructed view of the sky.
- 2) From MFD Home, touch **Utilities > Setup > SiriusXM Info > Start**. The Touchscreen Controller displays 'ACTIVATING'.
- 3) When system indicates activation has completed, touch the **Lock** Button to save the activation changes, or touch the **Cancel** Button to exit without saving changes.

## 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.

### 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 1-33 Generic Timer on the PFD

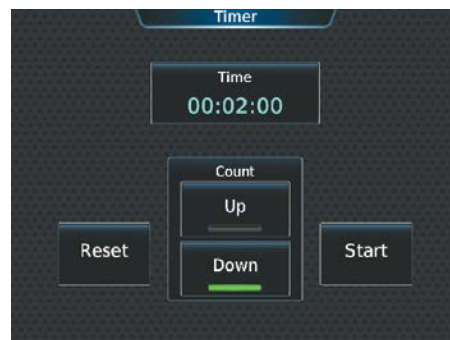


Figure 1-34 Timer (Touchscreen Controller)

#### 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 right knobs, then touch the **Enter** Button or press the right 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.

## TRIP STATISTICS

### FLIGHT TIME

The flight timer can be set to count up from zero starting when system power is applied 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** Button 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 1-35 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. Note 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 Avg Ground Speed Button (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 Max Ground Speed Button (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. Note 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 Trip Air Odometer Button (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. Note 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 Avg Wind Speed Button (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. Note 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 Avg Wind Speed Button (button displays the average wind speed in cyan).
- 4) Touch the **Reset** Button to reset the Average Wind Speed, or touch the **Cancel** Button.

## SCHEDULED MESSAGES

The Scheduled Messages feature can be used to enter and display reminder messages (e.g., Switch tanks, RVSM checks, or Altimeter-transponder check) on the 'Notifications' Screen of the GTC 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.

When a scheduled message is activated, the **MSG** Button flashes and the 'MSG' icon flashes on the PFD. Touching the **MSG** Button on the Touchscreen Controller opens the 'Notifications' Screen and acknowledges the message, indicated by the removal of the message annunciation on the PFD and the **MSG** Button ceasing to flash. Touching the **MSG** Button again removes the 'Notifications' Screen from view, and the scheduled message is deleted from the message queue.

### Entering a scheduled message:

- 1) From 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 right 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 LC) 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 Home, touch **Utilities > Scheduled Messages**.
- 2) Touch 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.

### 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.

## 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**.

Or:

From PFD Home, touch **PFD Settings > Screen Cleaning**.

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

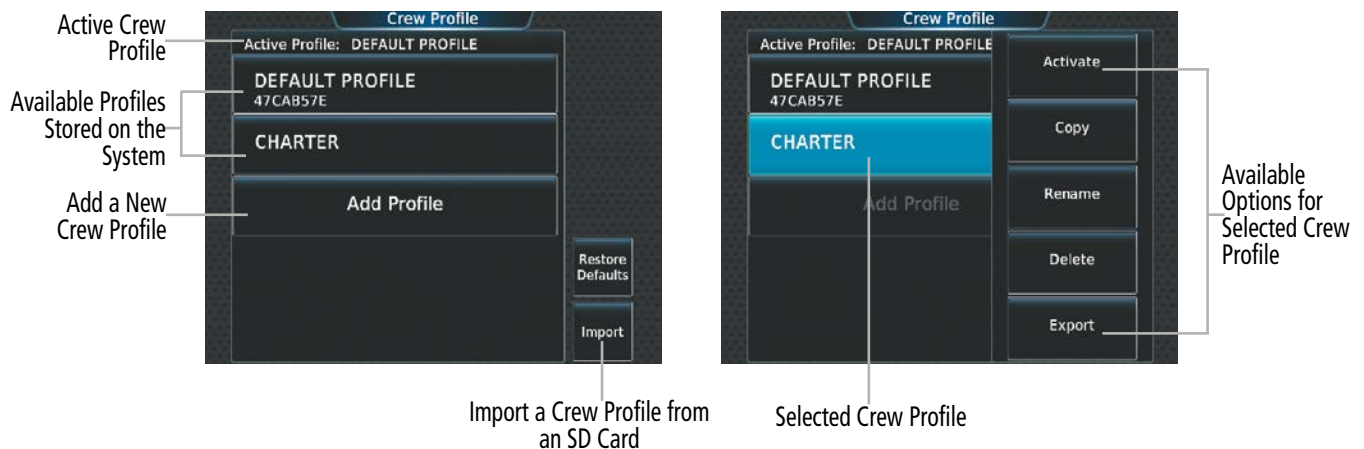
3) Press or turn any knob or softkey to return to the 'Utilities' Screen.

## CREW PROFILES

Crew Profiles may be created which 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 a profile has been created and activated, the system automatically stores changes made to various settings and selections within the active profile, and retains these settings through power cycles. When a stored (closed) profile is activated, the system applies any changes made to settings and selections from the last active session of that profile. A profile is considered to be closed when the pilot activates a different profile or the avionics is powered down. Changes made to settings while the Default Profile is active will not be retained through power cycles.

After applying system power, 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. By default, 'DEFAULT PROFILE' is the active crew profile. This profile cannot be deleted or renamed. The **DEFAULT PROFILE** Button contains an alphanumeric version number.



**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 right 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.

## 1.7 DISPLAY BACKLIGHTING

The PFD and MFD backlighting, Touchscreen Controller backlighting, PFD and MFD bezel keys, Touchscreen Controller bezel controls, AFCS Controller keys, and Audio Panel keys are continually automatically adjusted via built-in photocells. If automatic adjustment is inadequate, display and key brightness can be adjusted manually via the Touchscreen Controller.

### Adjusting display and key backlighting:

- 1) From MFD Home, touch **Aircraft Systems > Lighting Config.**
- 2) Drag the master slider or touch the (–) or (+) buttons to adjust lighting levels.



Figure 1-37 'Lighting Configuration' Screen

## SECTION 2 FLIGHT INSTRUMENTS



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

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

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

- Airspeed Indicator, showing
  - Indicated airspeed
  - Airspeed awareness ranges
  - Vspeed reference bugs
  - Mach number
- Attitude Indicator with slip/skid indication
- Altimeter, showing
  - Trend vector
  - Barometric setting
  - Selected altitude
- Vertical Deviation, Glideslope, and Glidepath Indicators
- Vertical Navigation (VNV) indications
- Vertical Speed Indicator (VSI)
- Outside air temperature (OAT)
- Horizontal Situation Indicator, showing
  - Turn Rate Indicator
  - Bearing pointers and information windows
  - Navigation source
  - Course Deviation Indicator (CDI)
  - Bearing pointers and information windows
- Transponder Mode, Code, and Ident/Reply
- Minimum Altitude Alerting
- Wind data
- Radar Altimeter (Optional)
- Angle of Attack (AOA) Indicator

The PFDs also displays various alerts and annunciations.



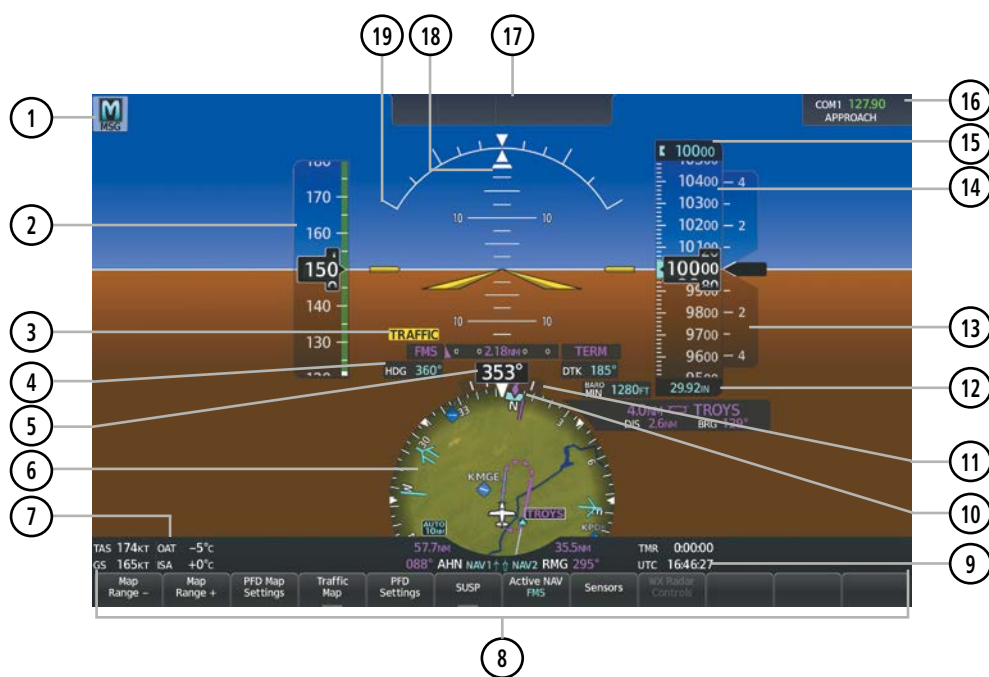


Figure 2-1 Primary Flight Display (Default)

- |                                 |                                  |
|---------------------------------|----------------------------------|
| ① System Message Alert          | ⑪ Turn Rate Indicator            |
| ② Airspeed Indicator            | ⑫ Barometric Altimeter Setting   |
| ③ Traffic Annunciation          | ⑬ Vertical Speed Indicator (VSI) |
| ④ Selected Heading              | ⑭ Altimeter                      |
| ⑤ Current Heading               | ⑮ Selected Altitude              |
| ⑥ HSI Map                       | ⑯ COM Frequency Box              |
| ⑦ Outside Air Temperature (OAT) | ⑰ AFCS Status Box                |
| ⑧ Softkeys                      | ⑱ Slip/Skid Indicator            |
| ⑨ System Time                   | ⑲ Attitude Indicator             |
| ⑩ Selected Heading Bug          |                                  |

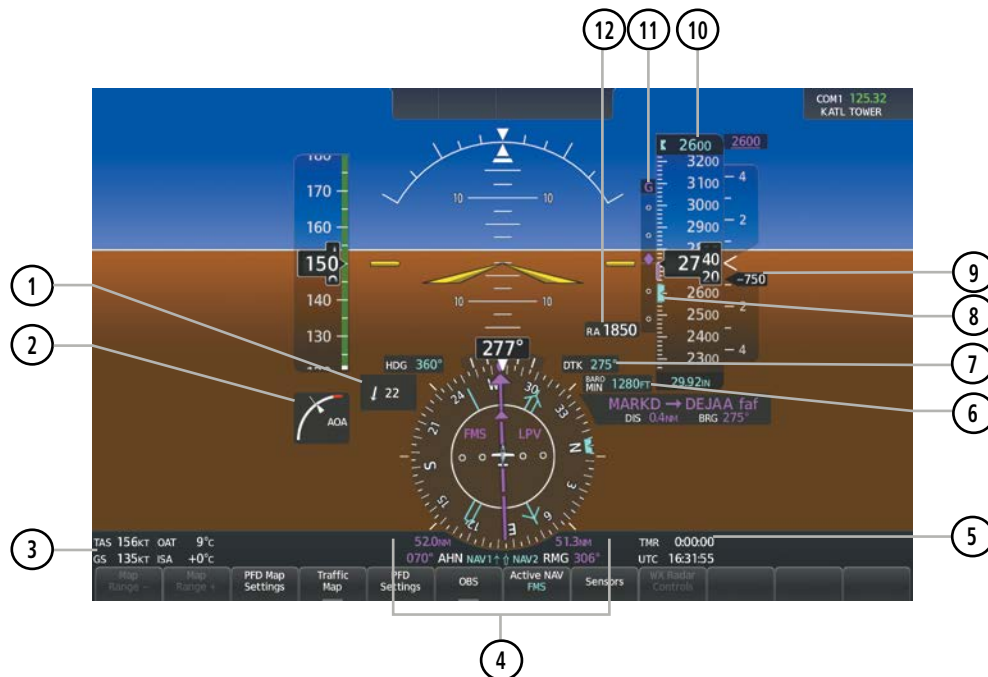


Figure 2-2 Primary Flight Display (Additional Information)

- |                                  |                              |
|----------------------------------|------------------------------|
| ① Wind Data                      | ⑦ Selected Course            |
| ② Angle of Attack Indicator      | ⑧ Selected Altitude Bug      |
| ③ True Air Speed, Ground Speed   | ⑨ Current Vertical Speed     |
| ④ Bearing Information Windows    | ⑩ Selected Altitude          |
| ⑤ Timer                          | ⑪ Glidepath Indicator        |
| ⑥ Minimum Altitude Alert Setting | ⑫ Radio Altimeter (optional) |

## 2.1 FLIGHT INSTRUMENTS

### AIRSPEED INDICATOR



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

The Airspeed Indicator displays airspeed on a moving tape rolling number gauge. The numeric labels and major tick marks on the moving tape are shown at intervals of 10 knots. The minor tick marks on the moving tape are marked at intervals of five knots. Speed indication starts at 20 knots, with 60 knots of airspeed viewable at any time. The indicated airspeed is displayed inside the black pointer. The pointer remains black until reaching maximum operating speed ( $V_{MO}$ ), at which point it becomes red. The Mach number appears below the Airspeed Indicator at or above Mach 0.3. The Mach number appears white within a red background when the airspeed enters  $M_{MO}$ .

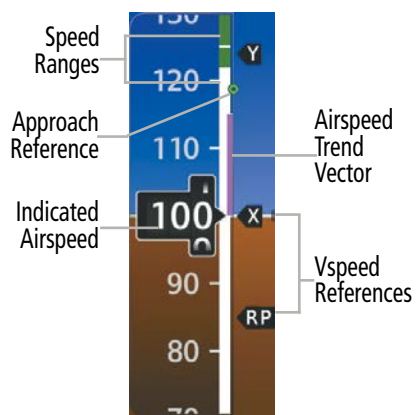


Figure 2-3 Airspeed Indicator

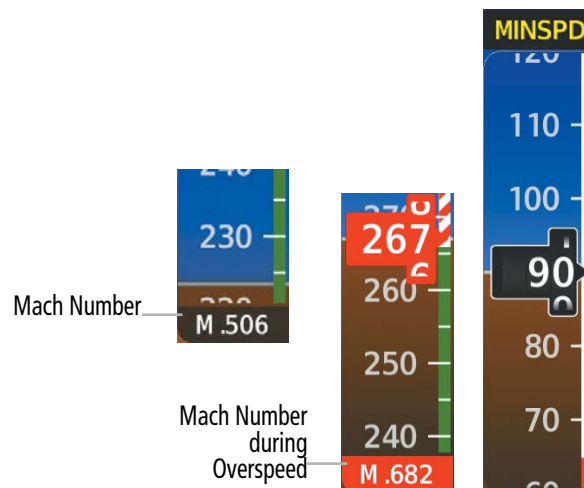


Figure 2-4 Overspeed/Minimum Speed Indications

A color-coded (white, green, and red/white barber pole) speed range strip is located on the moving tape. The colors denote flaps operating range, normal operating range, and maximum operating speed ( $V_{MO}$ ). A red range is also present for low speed awareness.

The Approach Reference is a hollow green circle controlled by the AOA computer. It indicates an approximate airspeed of 1.3 times the stall speed for the current weight, g loading, and aircraft configuration. The Approach Reference may be used as a general reference for  $V_{ref}$ . It is not actually  $V_{ref}$ , but will indicate approximately what  $V_{ref}$  is. This approximation is most accurate when the airplane is near approach speed. The Approach Reference will move based on aircraft attitude and flap position. When the aircraft turns, it indicates a speed that provides a safety margin over stall speed, as approach speed provides in level flight.

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

Vspeed ( $V_R$ ,  $V_X$ ,  $V_Y$ , and  $V_{APP}$ ) values can be changed and the Vspeed bugs can be turned on/off from the 'Speed Bugs' Screen. When active (on), the Vspseds are displayed at their respective locations to the right of the airspeed scale. All Vspeed values are reset and all Vspeed bugs are turned off when applying system power.

### Manually changing Vspseds and enabling/disabling Vspeed bugs:

- 1) From PFD Home, touch **Speed Bugs**.
- 2) Touch the enable/disable button for the corresponding Vspeed. If the enable/disabled button is disabled, a Vspeed value must be provided before the Vspeed bug can be enabled.
- 3) To change a Vspeed value, touch datafield button for the corresponding Vspeed. Then enter a value for the selected Vspeed using either the Keypad or the large and small upper knobs. When finished, touch **Enter**. The pencil icon next to the Vspeed value indicates the Vspeed is a pilot-entered value.



Figure 2-5 Speed Bugs



Figure 2-6 Manual Entry of Speed Bugs

### Enabling/disabling Vspeed bugs as a group:

- 1) From PFD Home, touch **Speed Bugs**.
- 2) To enable all Vspeed bugs, touch the **All On** Button. To disable all Vspeed bugs, touch the **All Off** Button.

### Restoring all Vspeed default values:

- 1) From PFD Home, touch **Speed Bugs**.
- 2) Touch the **Restore All Defaults** Button. The system restores all takeoff and landing Vspeed reference settings to their default values, and disables the display of all Vspeed bugs.

## ATTITUDE INDICATOR

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

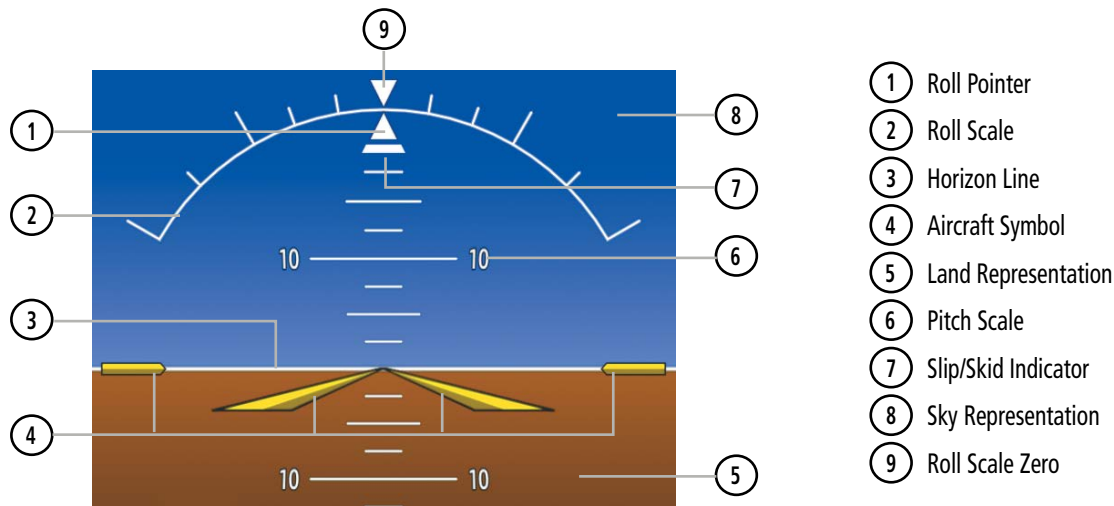


Figure 2-7 Attitude Indicator

The horizon line is part of the pitch scale. Above and below the horizon line, major pitch marks and numeric labels are shown for every 10°, up to 80°. Minor pitch marks are shown for intervening 5° increments, up to 25° below and 45° above the horizon line. Between 20° below to 20° above the horizon line, minor pitch marks occur every 2.5°. Refer to Additional Features section for details regarding attitude indicator operation when the optional Garmin ESP™ or Synthetic Vision Technology System (SVT™) is installed.

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

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

When the optional Garmin ESP system is available, additional indications may appear on the pitch and roll scales; refer to the Additional Features Section for more information about Garmin ESP.



Figure 2-8 Slip/Skid Indication

## ALTIMETER

The Altimeter displays 1,000 feet of barometric altitude values at a time on a moving tape rolling number gauge. Numeric labels and major tick marks are shown at intervals of 100 feet. Minor tick marks are at intervals of 20 feet. The current altitude is displayed in the black pointer.

The Altimeter also displays a reference to the height above the ground; refer to Radio Altimeter discussion later in this section for more information.

### SELECTED ALTITUDE

The Selected Altitude is displayed above the Altimeter in the box indicated by a selection bug symbol. A bug corresponding to this altitude is shown on the tape; if the Selected Altitude exceeds the range shown on the tape, the bug appears at the upper or lower edge of the tape.

The **ALT SEL** Knob has a stop-altitude feature that is related to vertical navigation altitudes in the flight plan. While turning the **ALT SEL** Knob, the Selected Altitude can stop at intermediate values corresponding to vertical navigation altitudes. top-altitudes include valid VNAV constraints which include all auto-designated, manually entered and published VNAV constraints. When temperature compensation is applied to a stop-altitude waypoint, the Selected Altitude will stop at the temperature corrected altitude. Refer to the Flight Management Section for a discussion on both VNAV Constraints and Temperature Compensation, and see the AFCS Section for more information about the Selected Altitude.

#### Setting the Selected Altitude:

Turn the **ALT SEL** Knob to set the Selected Altitude in 100-ft increments up to the aircraft's service ceiling. When meters are displayed, Selected Altitude is adjusted in 50-meter increments.

If set, the Minimum Altitude Alert value is also available for the Selected Altitude.

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

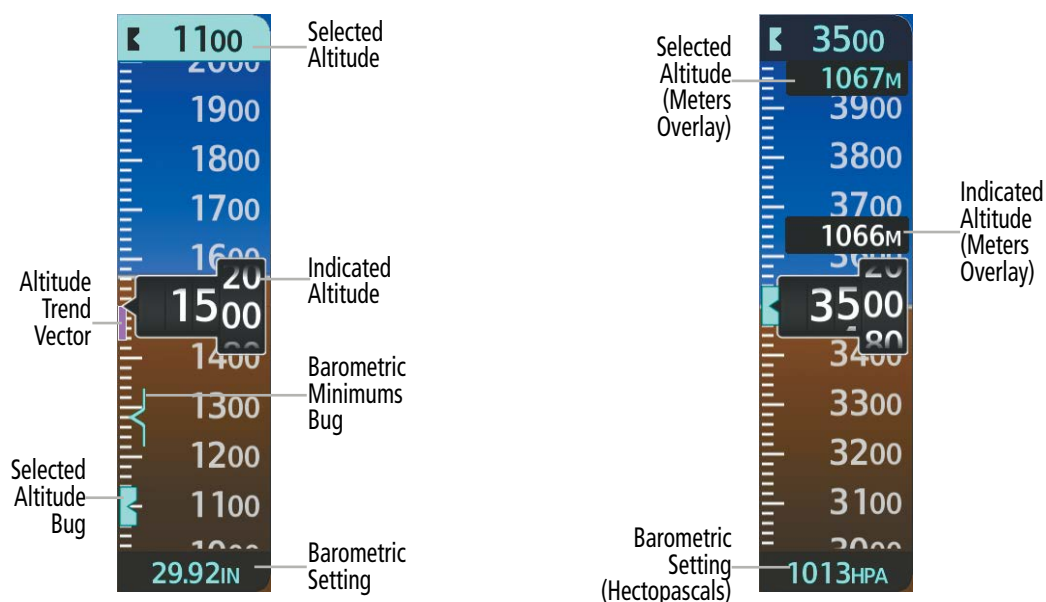


Figure 2-9 Altimeter (Standard and Metric)

Altitudes can also be displayed in meters as an overlay. Note the altitude tape does not change scale.

**Displaying metric altitude overlay:**

- 1) Press the **PFD Settings** Softkey to display the second-level softkeys.
- 2) Press the **Other PFD Settings** Softkey.
- 3) Press the **Altitude Units** Softkey.
- 4) Press the **Meters** Softkey to enable metric altitude overlay.
- 5) Press the **Back** Softkey three times to return to the top-level softkeys.

**Or:**

- 1) From PFD Home, touch the **PFD Settings** Button.
- 2) Touch the **Meters Overlay** datafield to enable or disable metric altitude overlay.

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

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



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

**Selecting the altimeter barometric pressure setting:**

Turn the applicable **BARO** Knob (located on either side of the AFCS Controller) to select the desired setting.

**Selecting standard barometric pressure (STD BARO):**

Push the **BARO** Knob to select standard pressure.

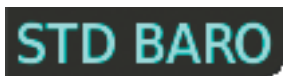


Figure 2-10 Standard Barometric Altimeter Setting

**Changing altimeter barometric pressure setting units:**

- 1) Press the **PFD Settings** Softkey to display the second-level softkeys.
- 2) Press the **Other PFD Settings** Softkey.
- 3) Press the **Altitude Units** Softkey.
- 4) Press the **IN** Softkey to display the barometric pressure setting in inches of mercury (in Hg), or press the **HPA** Softkey to display the barometric pressure setting in hectopascals (hPa).
- 5) Press the **Back** Softkey three times to return to the top-level softkeys.



Or:

- 1) From PFD Home, touch the **PFD Settings** Button.
- 2) Touch the **BARO Select Units** datafield to select barometric pressure setting units.

### Synchronizing the altimeter barometric pressure settings:

- 1) From MFD Home, touch **Utilities > Setup > Avionics Settings**.
- 2) Touch the **System** Tab.
- 3) Scroll until Sync Altimeter Baro Pressure becomes visible.
- 4) To turn the function on or off, touch the Sync Altimeter Baro Pressure data field.
- 5) Touch the button for the desired synchronization setting (**On** or **Off**).

If the barometric altimeter settings differ between PFDs by more than 0.02 in Hg, the indications turn amber. The settings can be synchronized from the GTC 'Avionics Settings' Screen. Once the settings are synchronized (Baro Synchronization turned on), they remain synchronized for the entire flight.



Figure 2-11 Sync Altimeter Baro Pressure

## BAROMETRIC TRANSITION ALTITUDE ALERTS

The Baro Transition Alerts flash the barometric pressure setting to remind the pilot to change the barometric pressure setting to or from standard. Two alerts are available. The climb Baro Transition Alert occurs when climbing through the transition altitude beginning at 200 feet below this altitude. The descent flight level Baro Transition Alert occurs when descending through the transition flight level beginning at 200 feet above this flight level. The barometric pressure setting stops flashing after the pilot changes the barometric pressure setting.

The flight crew can enable/disable each of the baro transition alerts on the GTC 'Avionics Settings' Screen. If the active flight plan contains an origin airport, the system uses the published transition altitude at the origin for the climb Baro Transition Alert. If the active flight plan also contains a destination airport, the system uses the published transition flight level at the destination for the descent baro transition alert. If desired, the flight crew can also manually change the altitude/flight level for these alerts; a pencil icon next to the corresponding button indicates a crew-edited value. If the origin or destination airport are unavailable, or database information is missing, and the flight crew has not manually supplied an altitude/flight level, dashes appear for the corresponding altitude/flight level buttons until the flight crew enters these values.

**Setting the Baro Transition Alert:**

- 1) From MFD Home, touch **Utilities > Setup > Avionics Settings**.
- 2) Touch the **Alerts** Tab.
- 3) To enable/disable the climbing baro transition alert, touch the **Baro Transition ALT Climb** Button.
- 4) If desired, touch the transition alert altitude button to change the value displayed on the button. Use the keypad or large and small upper knobs to provide a new transition altitude, then touch **Enter** or push the upper knob.
- 5) To enable/disable the descending flight level baro transition alert, touch the **BARO Transition LVL Descent** Button.
- 6) If desired, touch the transition alert flight level button to change the value displayed on the button. Use the keypad or large and small upper knobs to provide a new transition altitude, then touch **Enter** or push the upper knob.



Figure 2-12 Baro Transition Alert

**Reverting to the published Baro Transition Alert altitude or flight level:**

- 1) From MFD Home, touch **Utilities > Setup > Avionics Settings**.
- 2) Touch the **Alerts** Tab.
- 3) Touch a datafield button for the transition altitude/flight level that was crew-modified, as indicated by a pencil icon.
- 4) Touch the **Revert to Published** Button.
- 5) Touch the **OK** Button to confirm or touch **Cancel** Button to return to the previous screen.

**VERTICAL SPEED INDICATOR (VSI)**

The Vertical Speed Indicator (VSI) displays the aircraft vertical speed on a fixed scale with labels at 2000 and 4000 fpm and minor tick marks every 1000 fpm. Digits appear in the pointer when the climb or descent rate is greater than 100 fpm. If the rate of ascent/descent exceeds 4000 fpm, the pointer appears at the edge of the tape and the rate appears inside the pointer.

A magenta chevron is displayed on the VSI as the Required Vertical Speed for reaching a VNV Target Altitude once the “TOD [Top of Descent] within 1 minute” alert has been generated. See the Flight Management and AFCS sections for details on VNV features and refer to Supplemental Flight Data in this chapter for more information about VNV indications on the PFD.

## VERTICAL DEVIATION INDICATOR (VDI)

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

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

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

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



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



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

A hollow gray diamond represents a preview of the glidepath/glideslope indicator. This is shown while inbound to the FAF waypoint, but before the FAF waypoint is the next active waypoint. The preview is also shown when the AFCS is coupled to the Vertical Path Tracking Mode (VPTH) while inbound to the FAF waypoint, until the AFCS captures the glidepath/glideslope; refer to the AFCS section for more information about Vertical Path Tracking Mode.

The hollow gray preview diamond changes to a solid magenta/green diamond to indicate the glidepath/glideslope indicator is active.

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

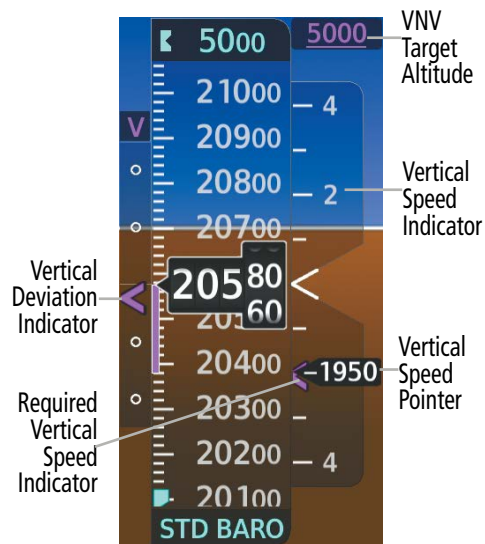


Figure 2-13 Vertical Speed and Deviation Indicators (VSI and VDI)

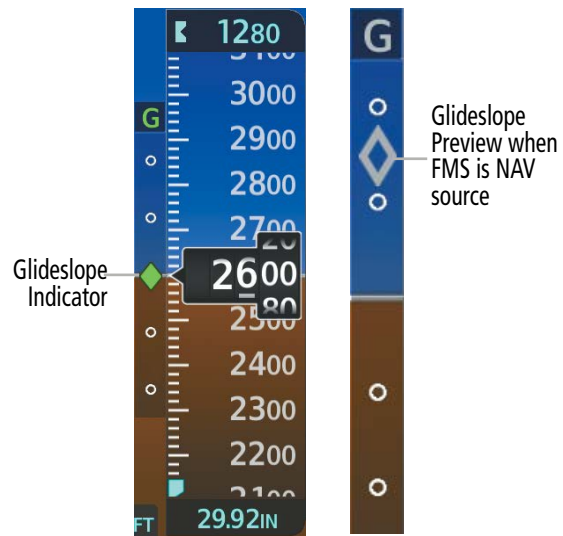


Figure 2-14 Glideslope Indicator

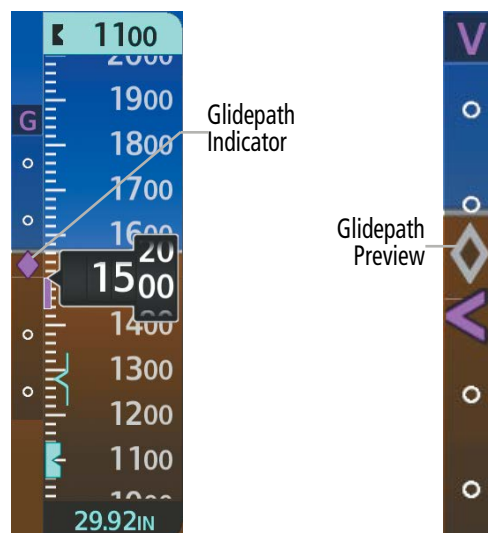


Figure 2-15 Glidepath Indicator

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

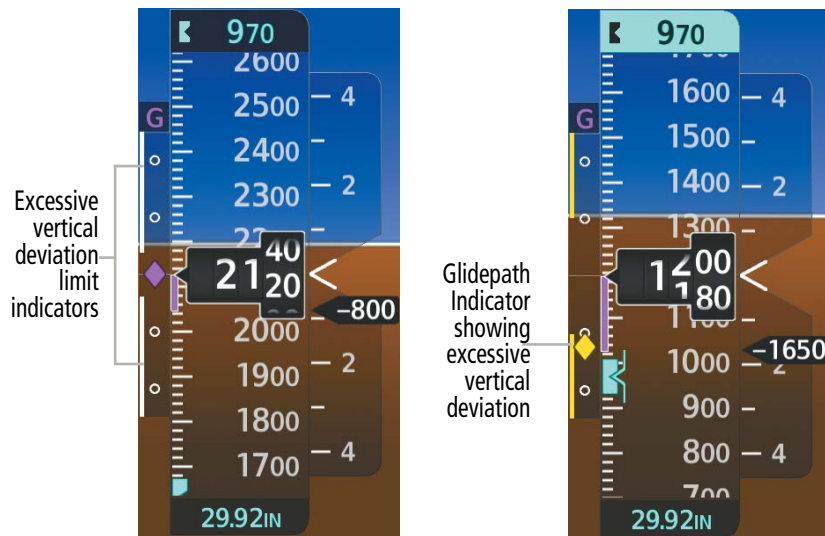


Figure 2-16 Glidepath Indicator (LNAV/VNAV) and Vertical Deviation Limit Indicators

While executing an LNAV/VNAV, LNAV+V, or VISUAL approach and SBAS is unavailable or disabled, baro VNAV (barometric vertical navigation) is used for vertical guidance. See the Flight Management section for more details. 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 GTC 'GPS Status' Screen.

Baro VNAV is also the source of vertical approach guidance if the LNAV/VNAV, LNAV+V, or VISUAL procedure does not support SBAS vertical guidance.



**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.

While baro VNAV is in use, the Glidepath Indicator appears as a magenta irregular pentagon as shown in the following figure. A baro VNAV glidepath preview appears under the same conditions as a preview SBAS glidepath. If the approach downgrades past the final approach fix (FAF), "NO GP" is displayed in place of the glidepath indicator.

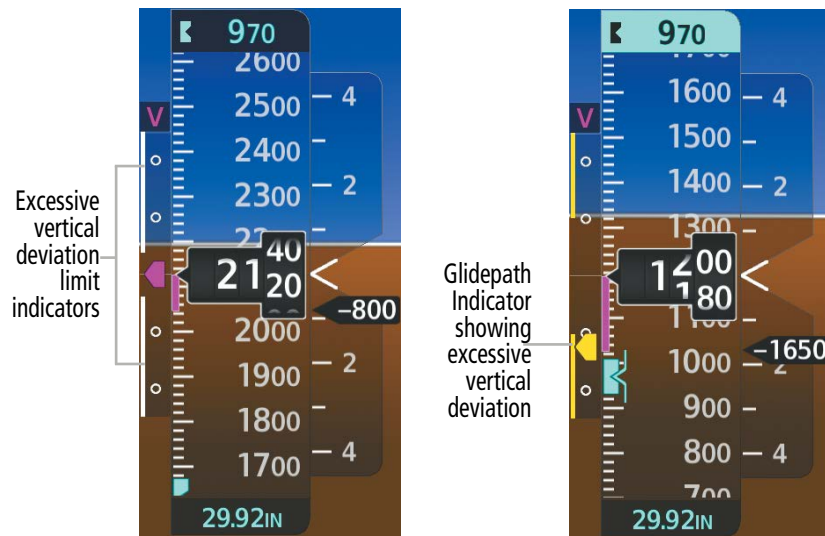


Figure 2-17 Glidepath Indicator (Baro VNAV) and Vertical Deviation Limit Indicators

## 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. 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 (FMS, 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.



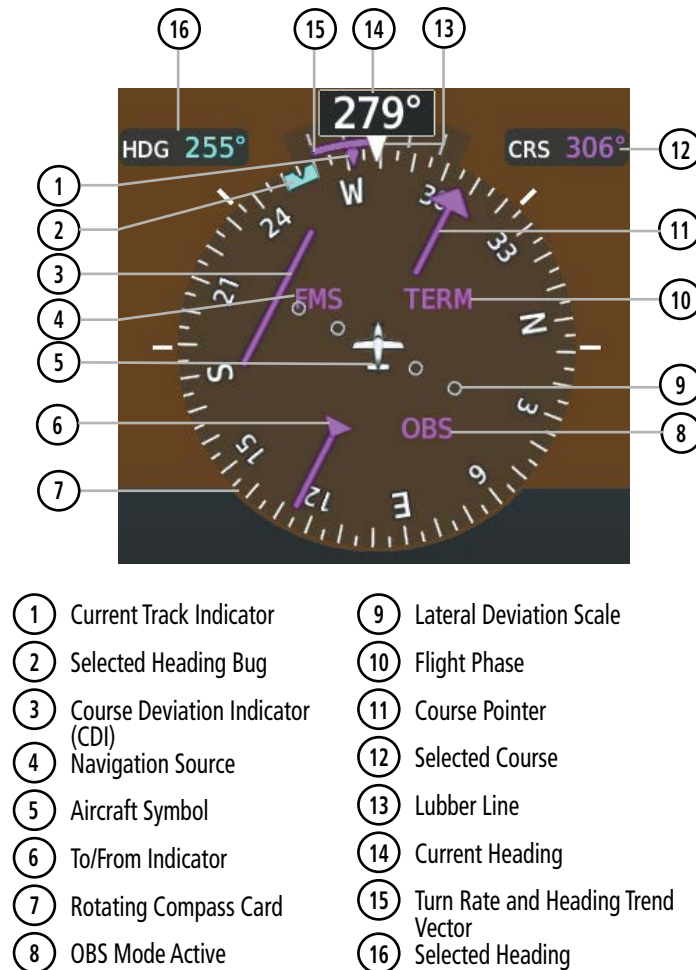


Figure 2-18 Horizontal Situation Indicator

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





Figure 2-19 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 FMS and OBS Mode is not active. The Selected Course (CRS) is shown to the upper right of the HSI when the selected navigation source is VOR or LOC and in magenta when the selected navigation source is FMS with OBS Mode active. 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 (FMS, 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, press the **PFD Map Settings** button.
- 2) Press the **Layout** button.
- 3) Press the **HSI Map** button.

Or:

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

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 (FMS, VOR, OBS) or a diamond (LOC).

The Selected Heading is shown to the upper left of the HSI. 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.

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

The Selected Course is shown to the upper right of the HSI. While the HSI is displayed as a map, the Selected Course is displayed whenever the Course Pointer is not within the 210° currently shown.

### Adjusting the Selected Course:

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

Push the **CRS** Knob to re-center the CDI and return the course pointer to the bearing of the active waypoint or navigation station (see OBS Mode for adjusting a GPS course).



**Figure 2-20 Heading and Course Indications**

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

Navigation angles (track, heading, course, bearing) are corrected to the computed magnetic variation (Mag Var) or referenced to true north (T), set on the GTC '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 2-21 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** Data Field.
- 4) Touch either the **Magnetic ( ° )** or **True ( °T )** Button.

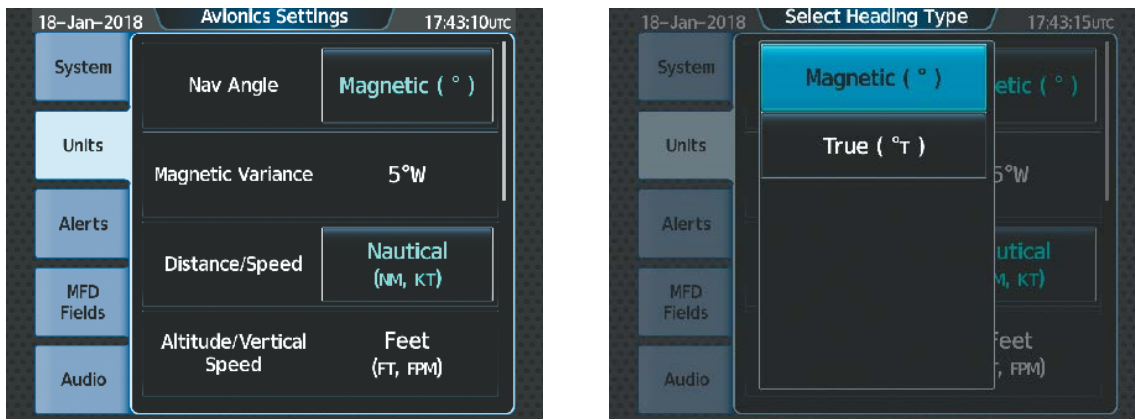


Figure 2-22 Navigation Angle Settings

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



Figure 2-23 Turn Rate Indicator and Trend Vector

**BEARING POINTERS AND INFORMATION WINDOWS**

Two bearing pointers and associated information can be displayed on the HSI for NAV, FMS, and ADF sources by pressing the **PFD Settings** Softkey then the **Bearing 1** or **Bearing 2** Softkey. The bearing pointers are cyan and are single-line (Bearing 1) or double-line (Bearing 2). A pointer symbol is shown in the information 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.

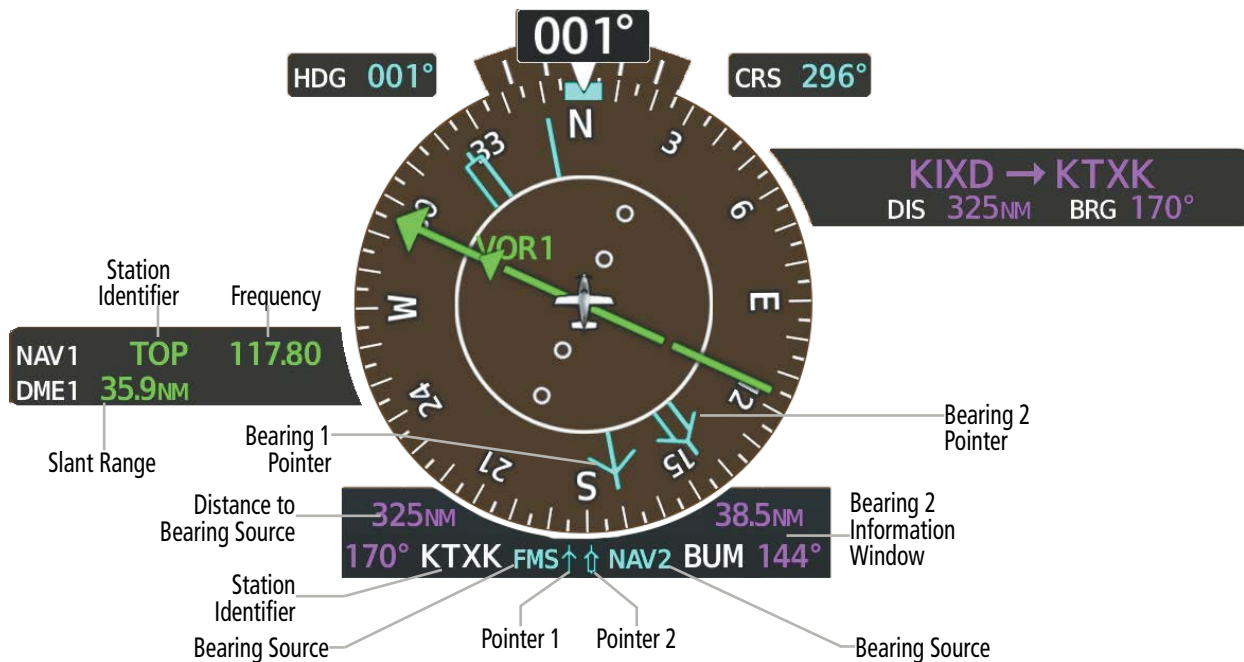


Figure 2-24 HSI with Bearing and Distance Information

When a bearing pointer is displayed, its associated information window is also displayed. The Bearing Information window is displayed below the HSI and displays the following information:

- » Bearing source (NAV, FMS, ADF)
- » Pointer icon (Bearing 1 = single line, Bearing 2 = double line)
- » Frequency (ADF)
- » Station/waypoint identifier (NAV, FMS)
- » 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 FMS is the bearing source, the active waypoint identifier is displayed in lieu of a frequency.

The bearing pointer is removed from the HSI and “NO DATA” is displayed in the information window if the NAV radio is not receiving the tuned VOR station or if FMS is the bearing source and an active waypoint is not selected.

### Selecting bearing display and changing sources:

- 1) Press the **PFD Settings** Softkey.
- 2) Press a **Bearing** Softkey to display the desired bearing pointer and information window with a NAV source.
- 3) Press the **Bearing** Softkey again to change the bearing source to FMS or ADF (optional).
- 4) To remove the bearing pointer and information window, press the **Bearing** Softkey again.

Or:

- 1) From PFD Home, touch the **Bearing 1** Button or **Bearing 2** Button to display the desired bearing pointer and information with a NAV source.
- 2) Touch the **Bearing** Button again to change the bearing source to FMS.
- 3) Touch the **Bearing** Button again to change the bearing source to ADF (optional).
- 4) To remove the bearing pointer and information, touch the **Bearing** Button again.

## DME INFORMATION WINDOW

The DME Information Window is displayed in to the left of the HSI when NAV1 or NAV2 is the active navigation source and shows the DME tuning mode (NAV1, NAV2, or HOLD), frequency, and distance. When a signal is invalid, the distance is replaced by “\_ \_ \_ NM”. Refer to the Audio Panel and CNS Section for information on tuning the radios.

## 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.

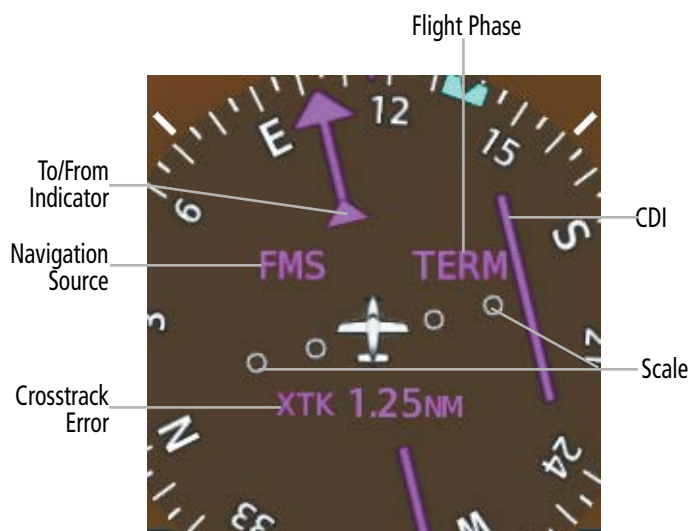


Figure 2-25 Course Deviation Indicator

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



Figure 2-26 Navigation Sources

### Changing navigation sources:

- 1) From PFD Home, touch the **Nav Source** Button to change from FMS 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 FMS.

### Or:

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

To automatically use the same navigation source on both PFDs, use CDI Synchronization.

### Turn CDI synchronization on:

- 1) From the MFD Home Screen, touch **Utilities > Setup > Avionics Settings**.
- 2) If necessary, touch the **System** Tab.
- 3) Scroll to and touch the Sync CDI Button to display the On or Off option.
- 4) Touch **On**.

### Turn CDI synchronization off:

- 1) From the MFD Home Screen, touch **Utilities > Setup > Avionics Settings**.
- 2) If necessary, touch the **System** Tab.
- 3) Scroll to and touch the Sync CDI Button to display the On or Off option.
- 4) Touch **Off**.



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

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

The system does not automatically switch from FMS 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. FMS steering guidance is not provided after this switch.

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

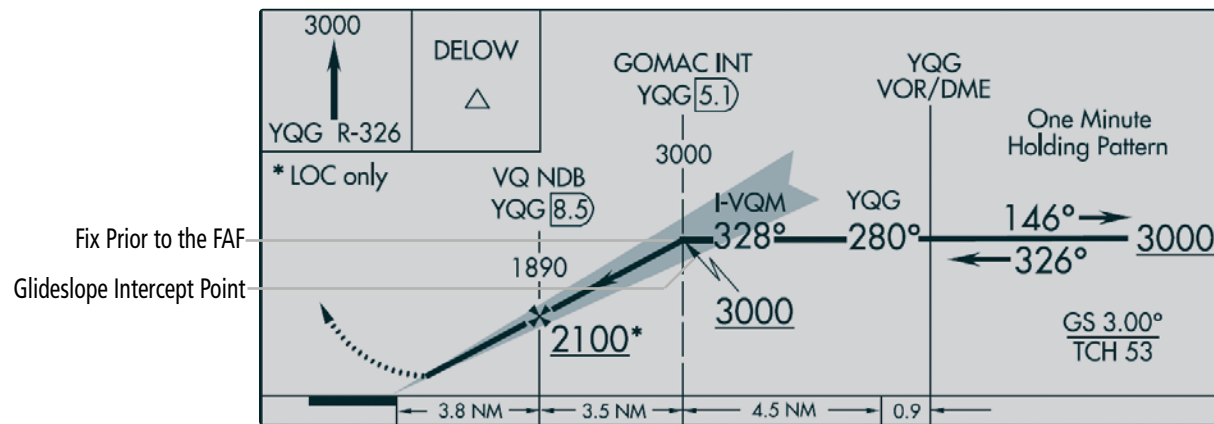


Figure 2-27 ILS Approach with Glideslope Intercept Point at Fix Prior to the FAF

## GPS CDI SCALING

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

The current FMS CDI scale setting is displayed on the GTC '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 FMS 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 2-28 GPS CDI Settings

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

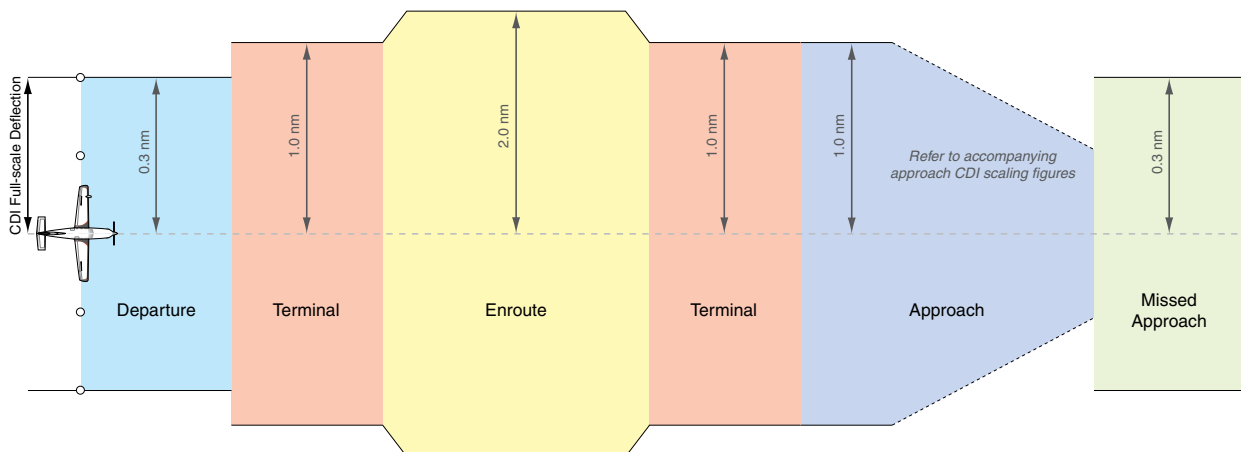


Figure 2-29 Automatic CDI Scaling

- » Once a departure procedure is activated, the CDI is scaled for departure (0.3 nm).
- » The system switches from departure to *terminal* CDI scaling (1.0 nm) under the following conditions:
  - The next leg in the departure procedure is not aligned with the departure runway
  - The next leg in the departure procedure is not a CA, CD, CF, CI, CR, DF, FA, FC, FD, FM, IF, or TF (see Aviation Terms and Acronyms for leg type definitions)
  - After any leg in the departure procedure that is not a CA or FA
- » At 30 nm from the departure airport, the *enroute* phase of flight is automatically entered and CDI scaling changes to 2.0 nm over a distance of 1.0 nm, except under the following conditions:
- » When navigating with an active departure procedure, the flight phase and CDI scale does not change until the aircraft arrives at the last departure waypoint (if more than 30 nm from the departure airport) or the leg after the last departure waypoint has been activated or a direct-to waypoint is activated.

- » If after completing the departure procedure the nearest airport is more than 200 nm away from the aircraft and the approach procedure has not yet commenced, the CDI is scaled for *oceanic* flight (4.0 nm).
- » Within 31 nm of the destination airport (*terminal* area), the CDI scale gradually ramps down from 2.0 nm to 1.0 nm over a distance of 1.0 nm; except under the following conditions:
- » Upon reaching the first waypoint of an arrival route that is more than 31 nm from the destination airport, the flight phase changes to terminal and the CDI scale begins to transition down from 2.0 nm to 1.0 nm over a distance of 1.0 nm.
- » During *approach*, the CDI scale ramps down even further. This transition normally occurs within 2.0 nm of the final approach fix (FAF). The CDI switches to approach scaling automatically once the approach procedure is activated or if Vectors-To-Final (VTF) are selected.
  - If the active waypoint is the FAF, the ground track and the bearing to the FAF must be within 45° of the final approach segment course.
  - If the active waypoint is part of the missed approach procedure, the active leg and the preceding missed approach legs must be aligned with the final approach segment course and the aircraft must not have passed the turn initiation point.

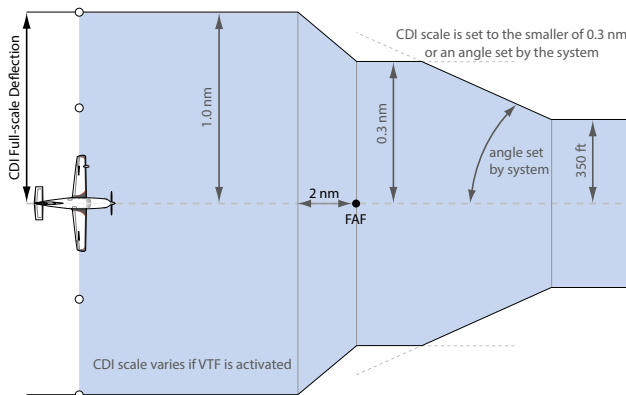


Figure 2-30 Typical LNAV, LNAV+V, and Visual Approach Service Level CDI Scaling

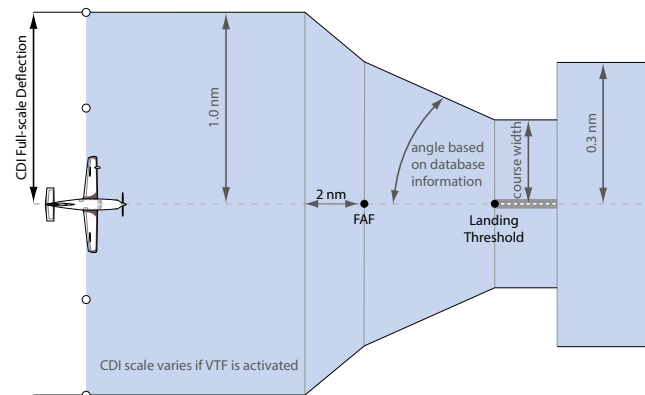


Figure 2-31 Typical LNAV/VNAV, LP, LP+V, and LPV Approach Service Level CDI Scaling

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

Flight Phase	Annunciation*	Automatic CDI Full-scale Deflection
Departure	DPRT	0.3 nm
Terminal	TERM	1.0 nm
Enroute	ENR	2.0 nm
Oceanic	OCN	4.0 nm

Flight Phase	Annunciation*	Automatic CDI Full-scale Deflection
Approach (Non-precision)	LNAV	1.0 nm decreasing to 350 feet depending on variables
Approach (Non-precision with Advisory Vertical Guidance)	LNAV+V	
Approach (Non-precision with Advisory Vertical Guidance)	VISUAL	
Approach (LNAV/VNAV)	L/VNAV	1.0 nm decreasing to a specified course width, then 0.3 nm, depending on variables
Approach (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 2-1 Automatic GPS CDI Scaling

## OBS MODE



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

Enabling Omni-bearing Selector (OBS) Mode suspends the automatic sequencing of waypoints in a FMS flight plan (FMS 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 flight plan returns to normal operation with automatic sequencing of waypoints, following the course set in OBS Mode. The flight path on the moving map retains the modified course line.



Figure 2-32 Omni-bearing Selector (OBS) Mode Enabled



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

### Enabling/disabling OBS Mode while navigating a FMS flight plan:

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

Or:

- 1) From PFD Home, touch the **OBS** button to select OBS Mode.
- 2) Turn a **CRS** Knob to select the desired course to/from the waypoint. Push the **CRS** Knob to synchronize the Selected Course with the bearing to the next waypoint.
- 3) 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 and Softkey label changes to indicate the suspension is active. Touching or pressing the **SUSP** Button or Softkey deactivates the suspension and resumes automatic sequencing of approach waypoints.

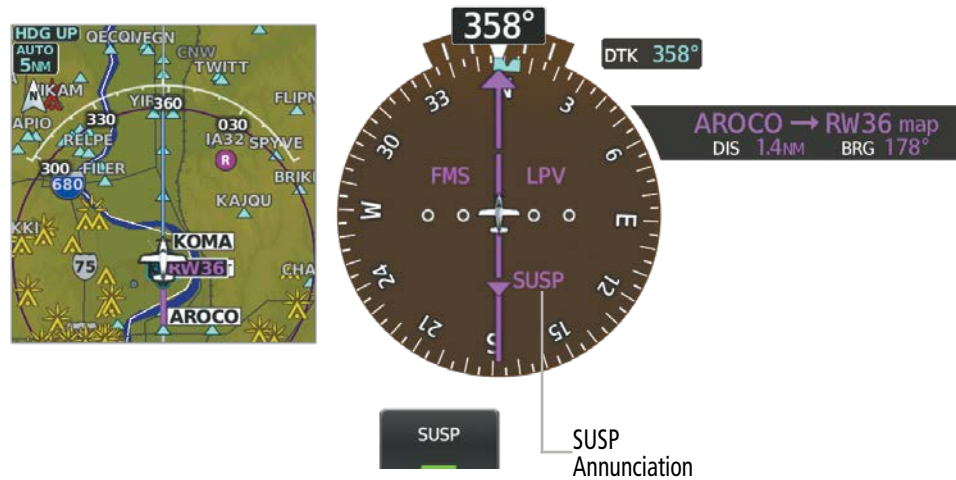


Figure 2-34 Suspending Automatic Waypoint Sequencing

## 2.2 GARMIN SVT (SYNTHETIC VISION TECHNOLOGY)



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



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



Figure 2-35 Synthetic Vision Imagery

Garmin SVT™ (Synthetic Vision Technology) is a visual enhancement to the system. SVT depicts a forward-looking attitude display of the topography immediately in front of the aircraft. The vertical field of view is 48 degrees. The horizontal field of view is 71 degrees in full screen and 50 degrees in split mode. SVT information is shown on the Primary Flight Display (PFD), or on the Multifunction Display (MFD) in Reversionary Mode. The depicted imagery is derived from the aircraft attitude, heading, GPS three-dimensional position, and a 4.9 arc-second database of terrain, obstacles, and other relevant features. The terrain data resolution of 4.9 arc-seconds, meaning the terrain elevation contours are stored in squares measuring 4.9 arc-seconds on each side, is required for the operation of SVT. Loss of any of the required data, including temporary loss of the GPS signal, will cause SVT to be disabled (although the softkeys will still appear functional) until the required data is restored.

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

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

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

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

The following SVT enhancements appear on the PFD:

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

## SVT OPERATION

---

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

SVT functions are displayed on three levels of softkeys. The **PFD Settings** Softkey leads into the PFD function Softkeys, including synthetic vision. Pressing the **Attitude Overlays** Softkey displays the SVT feature softkeys. The softkeys are labeled **Pathways**, **Synthetic Terrain**, **Horizon Heading**, and **Airport Signs**. The **Back** Softkey returns to the previous level of softkeys. Synthetic Terrain must be active before any other SVT feature may be activated. A green annunciator on the softkey label indicates the feature is activated.

The **Airport Signs**, **Horizon Heading**, and **Pathways** functions are only available when the **Synthetic Terrain** function is activated (annunciator is green). When the **Synthetic Terrain** function is activated the Flight Path Marker is automatically displayed on the PFD.

- **Synthetic Terrain** enables synthetic terrain depiction.
- **Horizon Heading** enables the display of heading marks and digits on the zero pitch line.
- **Airport Signs** enables airport signposts.
- **Pathways** enables display of rectangular boxes that represent course guidance.
- The crew profile defines the state (on or off) of these features.

### Activating and deactivating SVT:

- 1) Press the **PFD Settings** Softkey.
- 2) Press the **Attitude Overlays** Softkey.
- 3) Press the **Synthetic Terrain** Softkey. The SVT display will cycle on or off with each press of the **Synthetic Terrain** Softkey.

Or:

From PFD Home, touch **PFD Settings > SVT Terrain**.



**Activating and deactivating Pathways:**

- 1) Press the **PFD Settings** Softkey.
- 2) Press the **Attitude Overlays** Softkey.
- 3) Press the **Pathways** Softkey. The horizon heading display will cycle on or off with each press of the **Pathways** Softkey.

**Or:**

From PFD Home, touch **PFD Settings > SVT Pathways**.

**Activating and deactivating Horizon Heading:**

- 1) Press the **PFD Settings** Softkey.
- 2) Press the **Attitude Overlays** Softkey.
- 3) Press the **Horizon Heading** Softkey. The horizon heading display will cycle on or off with each press of the **Horizon Heading** Softkey.

**Or:**

From PFD Home, touch **PFD Settings > Horizon Heading**.

**Activating and deactivating Airport Signs:**

- 1) Press the **PFD Settings** Softkey.
- 2) Press the **Attitude Overlays** Softkey.
- 3) Press the **Airport Signs** Softkey. Display of airport signs will cycle on or off with each press of the **Airport Signs** Softkey.

**Or:**

From PFD Home, touch **PFD Settings > SVT Airport Signs**.

## SVT FEATURES



Figure 2-36 SVT on the Primary Flight Display

## AIRPORT SIGNS

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



Figure 2-37 Airport Signs

## FLIGHT PATH MARKER

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

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

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



Figure 2-38 Flight Path Marker Position is Affected by Wind

## ZERO PITCH LINE

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

## HORIZON HEADING

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

## PATHWAYS

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

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

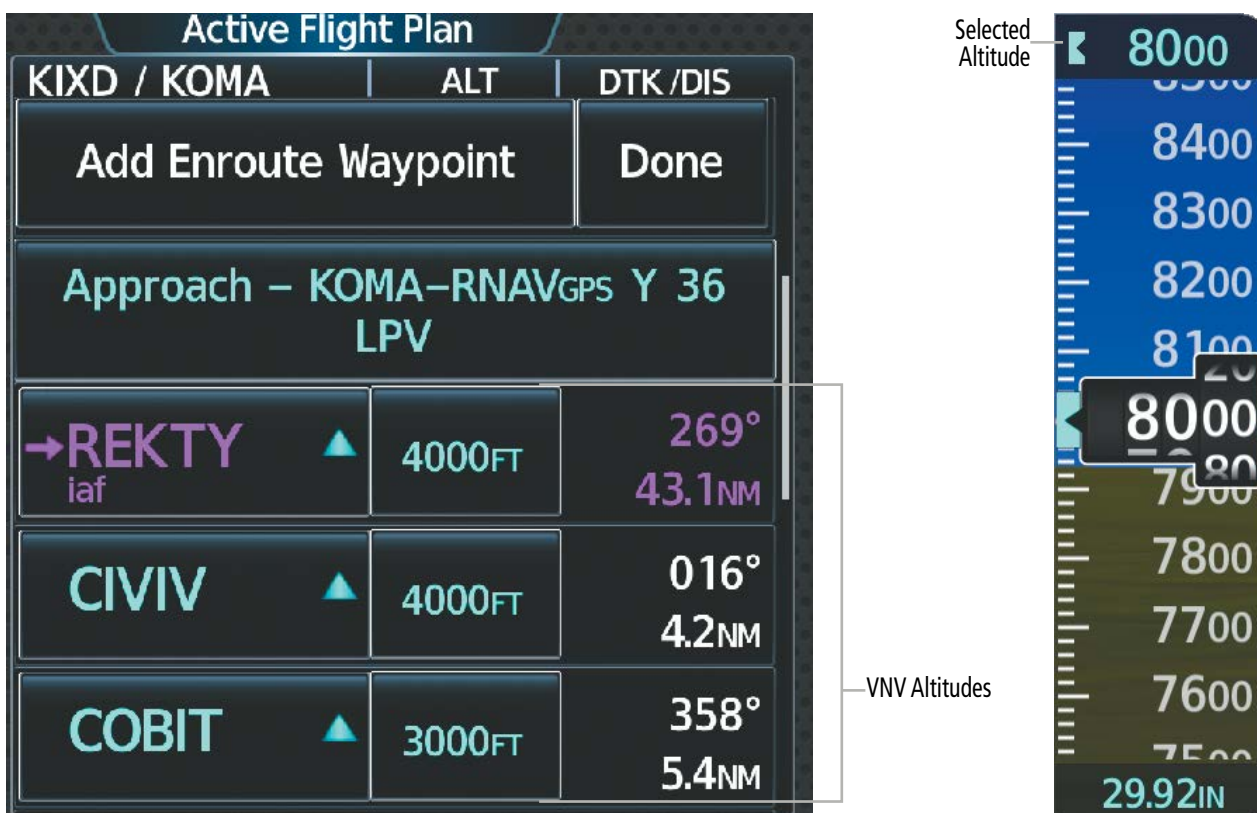


Figure 2-39 VNV and Selected Altitude

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

## DEPARTURE AND ENROUTE

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

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

## DESCENT AND APPROACH

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

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

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



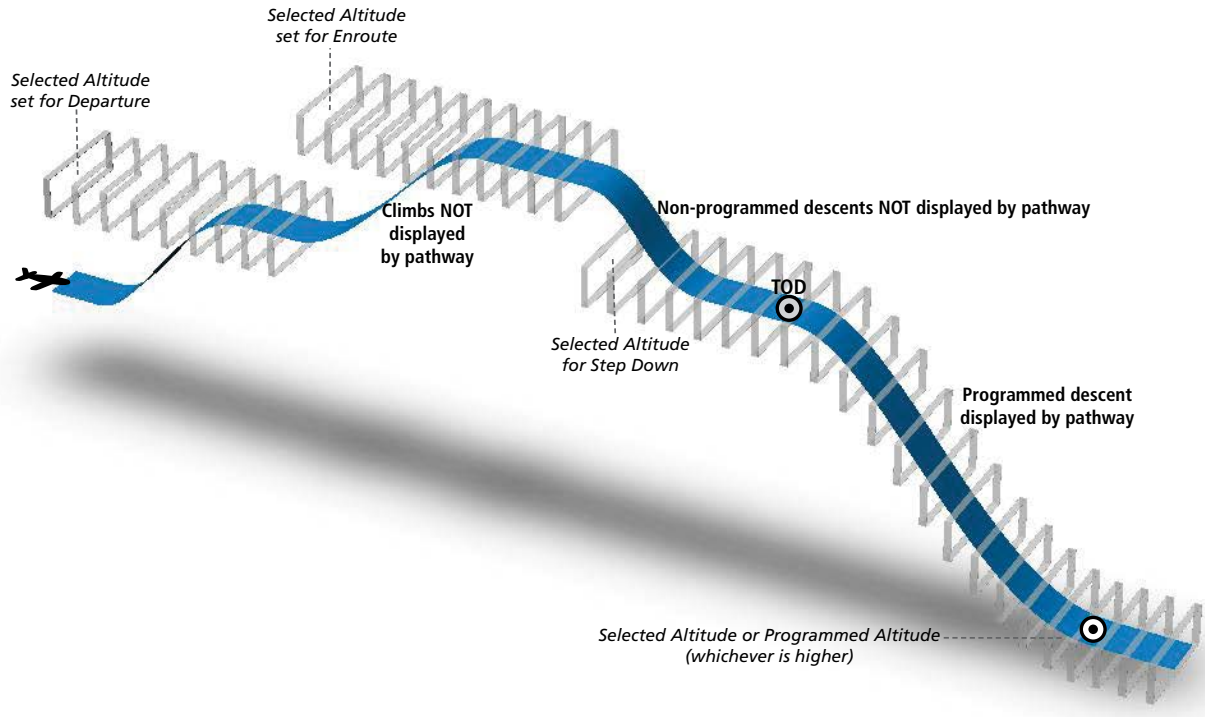


Figure 2-40 SVT Pathways, Enroute and Descent

## MISSED APPROACH

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

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

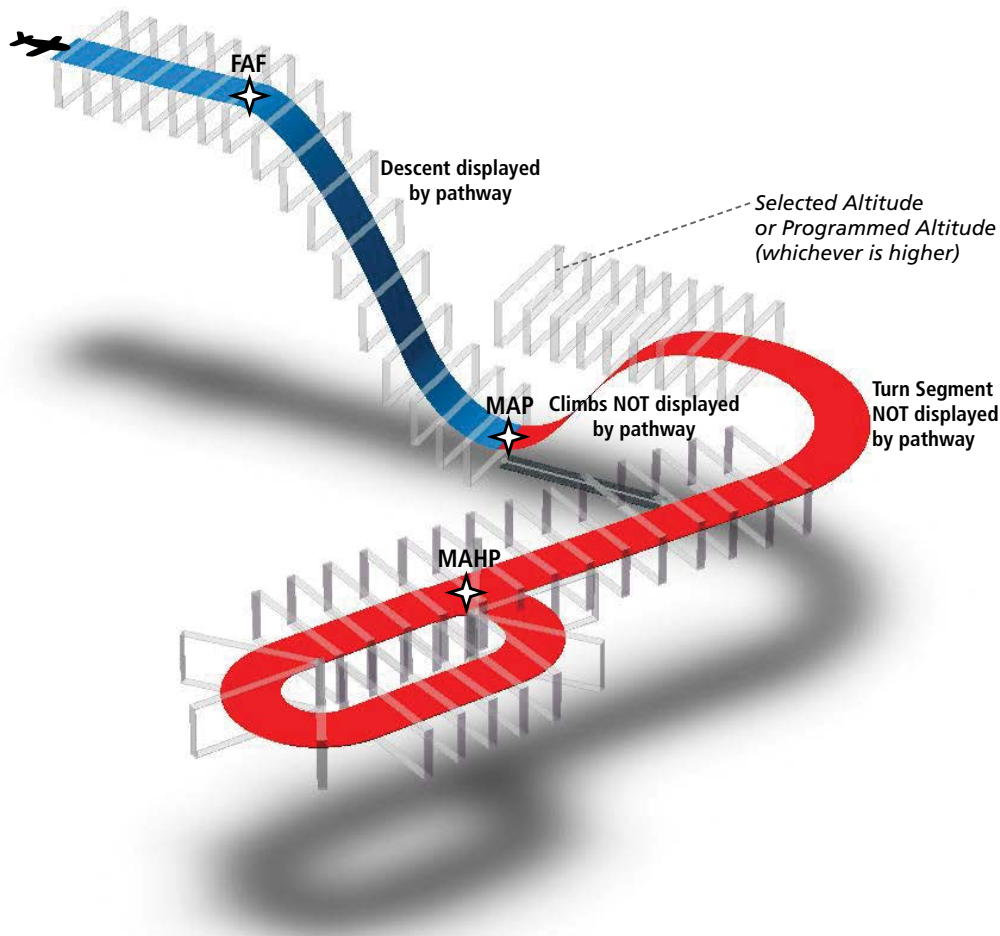


Figure 2-41 SVT Pathways, Approach, Missed Approach, and Holding

## RUNWAYS



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



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

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





Figure 2-42 Airport Runways

## TRAFFIC



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

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

## TERRAIN AND OBSTACLE 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, terrain alerting will also indicate potential impact areas. The potential impact area is depicted as a red or yellow blob on the PFD Inset Map, MFD 'Navigation Map' Pane, and MFD Terrain Pane. For more detailed information regarding Terrain Alerting, refer to the Hazard Avoidance Section.

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



Figure 2-43 Terrain Caution

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

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

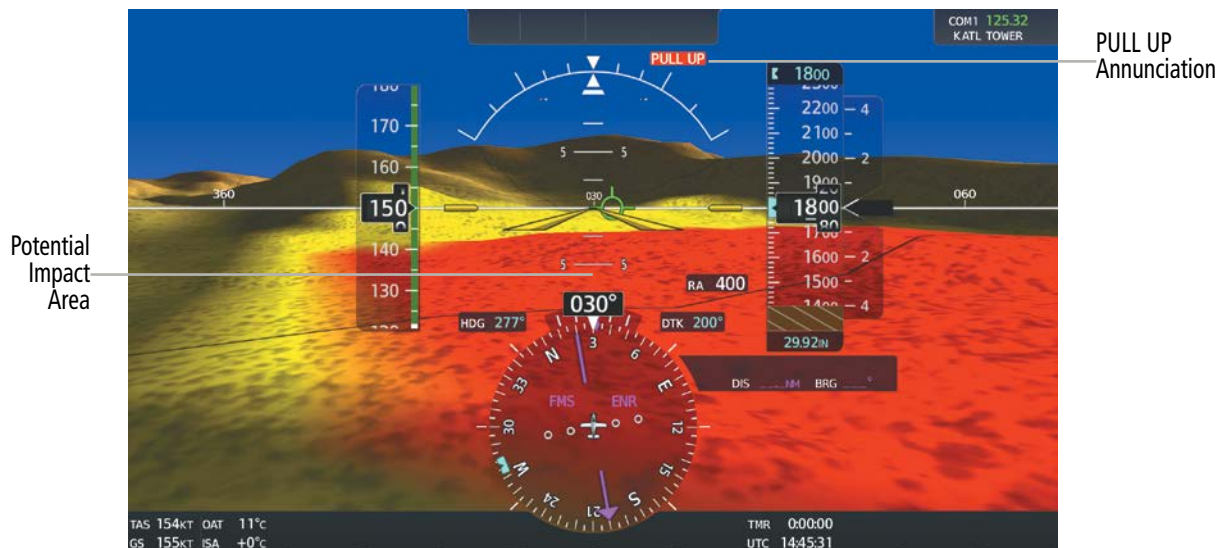


Figure 2-44 Terrain Warning

## FIELD OF VIEW

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

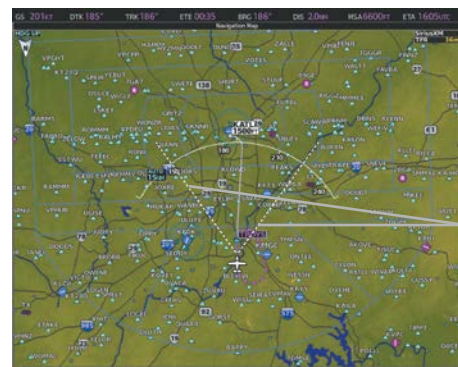
### Enabling or Disabling the field of view indication:

- 1) From MFD Home, touch **Map > Map Selection > Map Settings**.
- 2) If not already selected, touch the **Other** Tab.
- 3) Scroll to display the **Field of View** Annunciator Button.
- 4) 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.



SVT View on the PFD



Field of View on the MFD

Lines  
Depict PFD  
Field of  
View

Figure 2-45 PFD and MFD Field of View Comparison

## 2.3 SUPPLEMENTAL FLIGHT DATA

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

### TEMPERATURE DISPLAYS

The Outside Air Temperature (OAT) and temperature deviation from International Standard Atmosphere (ISA) are displayed in the lower left of the PFD. The pilot can choose either degrees Celsius (°C) or Fahrenheit (°F) for the display units.

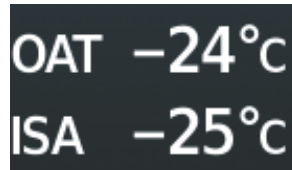


Figure 2-46 Air Temperatures Displayed on the PFD

#### Changing temperature display units:

- 1) From MFD Home, touch **Utilities** > **Setup** > **Avionics Settings**.
- 2) If not already selected, touch the **Units** tab.
- 3) Scroll if necessary and touch the **External Temperature** datafield and select preferred units, Celsius or Fahrenheit.

### GENERIC TIMER

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

#### Setting the generic timer:

- 1) From PFD Home, touch **Timers**.
  - 2) To start timer, touch the **Start** button. The button changes to **Stop**.
- Or:**
- 1) Touch the **Time** datafield.
  - 2) Input the desired time using the numeric keypad or upper knobs and touch the Enter button.
  - 3) Touch either **Up** or **Down** button.
  - 4) To start timer, 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.

When the timer hits zero during a countdown, a system message is generated and visible on the 'Notifications' Screen. The timer also starts counting up after hitting zero until stopped or reset.

## WIND DATA

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

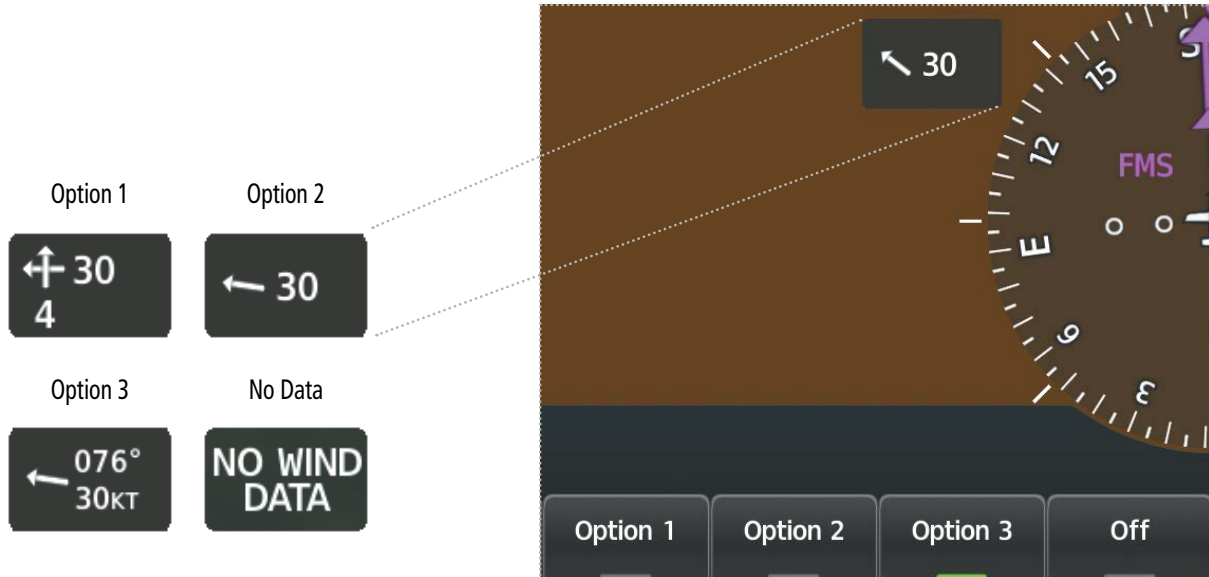


Figure 2-47 Wind Data

### Displaying wind data:

- 1) Press the **PFD Settings** Softkey.
  - 2) Press the **Other PFD Settings** Softkey.
  - 3) Press the **Wind** Softkey to display wind data display options.
  - 4) Press one of the **Option** softkeys to change how wind data is displayed:
    - **Option 1:** Headwind/tailwind and crosswind arrows with numeric speed components
    - **Option 2:** Total wind direction arrow with numeric speed
    - **Option 3:** Total wind direction arrow with digital numeric direction and speed
  - 5) To remove the window, press the **Off** Softkey.
- Or:**
- 1) From PFD Home, touch **PFD Settings > Wind**.
  - 2) Select **Option 1**, **Option 2**, **Option 3**, or **Off**.

## 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 and red arcs indicate AOA ranges. The pointer color matches the color of the arc associated with the current AOA value.

The pilot can enable/disable the display of the AOA Indicator on the PFD.



Figure 2-48 Angle of Attack (AOA) Indicator

### Displaying the AOA Indicator:

- 1) Press the **PFD Settings** Softkey.
- 2) Press the **Other PFD Settings** Softkey.
- 3) Press the **AOA** Softkey to toggle Angle of Attack display options.

**Or:**

- 1) From PFD Home, touch **PFD Settings > AOA**.
- 2) Touch the **On** or **Off** Button.

If the angle of attack is within four degrees of a stall condition, a Pitch Limit Indicator appears on the Attitude Indicator at the corresponding pitch attitude. The Pitch Limit Indicator is subsequently removed when the angle of attack is five degrees or greater from a stall condition. Refer to the Additional Features Section for additional information on the Pitch Limit Indicator.



## VERTICAL NAVIGATION (VNV) INDICATIONS

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



**Figure 2-49 Vertical Navigation Indications (PFD)**

Criteria	VNV Indication Removed		
	Required Vertical Speed (RVSI)	Vertical Deviation (VDI)	VNV Target Altitude
Aircraft > 1 min before the next TOD due to flight plan change	X	X	X
VNV cancelled	X	X	X
Distance to active waypoint cannot be computed due to unsupported flight plan leg type (see Flight Management Section)	X	X	X
Aircraft > 250 feet below active VNV Target Altitude	X	X	X
Current crosstrack or track angle error has exceeded limit	X	X	X
Active altitude-constrained waypoint cannot be reached within maximum allowed flight path angle and vertical speed	X	X	
Last altitude-constrained waypoint in active flight plan reached	X	X (30 sec before)	X

**Table 2-2 VNV Indication Removal Criteria**



## 2.4 PFD ANNUNCIATIONS AND ALERTING FUNCTIONS

The following annunciations and alerting functions are displayed on the PFD. Refer to the Engine/Airframe Systems Section for information on the Crew Alerting System (CAS) and 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 blue, middle in amber, and inner in white. Refer to the Audio and CNS Section for more information on Marker Beacon Annunciations.

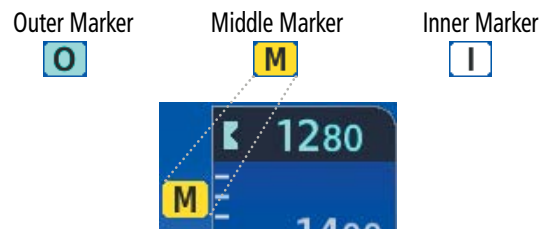


Figure 2-50 Marker Beacon Annunciations

### ALTITUDE ALERTING

The Altitude Alerting function provides visual alerts when approaching the Selected Altitude, and visual and audio alerts when deviating from the selected altitude. Whenever the Selected Altitude on the PFD is changed, Altitude Alerting is reset. Altitude Alerting is independent of the AFCS.

The following occur when approaching the Selected Altitude:

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



Figure 2-51 Altitude Alerting Visual Annunciations

## LOW ALTITUDE ANNUNCIATION



**NOTE:** The Low Altitude Annunciation is available only when SBAS is available. This annunciation only appears if terrain alerting is inhibited, is 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, flashes for several seconds, then remains displayed until the condition is resolved.

**LOW ALT**

Figure 2-52 Low Altitude Annunciation on PFD

## MINIMUM ALTITUDE ALERTING

For altitude awareness, a Minimum Altitude Alert based on barometric, temperature compensated, or Radio 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 alert setting:

- When the aircraft altitude descends to within 2500 feet of the alert setting, the 'BARO MIN', 'RA MIN', 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 enters within 100 feet of the alert, the bug and text turn white.
- Once the aircraft reaches the alert altitude, the bug and text turn amber and the voice alert, "Minimums Minimums", is heard.



Figure 2-53 Barometric Minimum Altitude Alerting Visual Annunciations

Alerting is inhibited while the aircraft is on the ground and until the aircraft reaches 150 feet above the setting for the alert. If the aircraft proceeds to climb after having reached the alert settings, once it reaches 50 feet above the setting, alerting is disabled. The alerting altitude is synchronized on both PFDs. The function is reset (set to "Off") when the power is cycled or another approach is activated.

### Setting the Baro/Temp Comp/Radio Alt Minimum Altitude Alert and bug:

- 1) From MFD Home, touch **Utilities > Minimums > Minimums**.
- 2) Touch **Baro**, **Temp Comp**, or **Radio Alt** (**OFF** is selected by default.)
  - If **Temp Comp** is selected, touch **Temp at Dest**. Use the keypad to enter desired temperature, and touch **Enter**.
- 3) Use the keypad to enter the desired altitude from zero to 16,000 feet (zero to 2,500 feet for RA) and touch **Enter**.

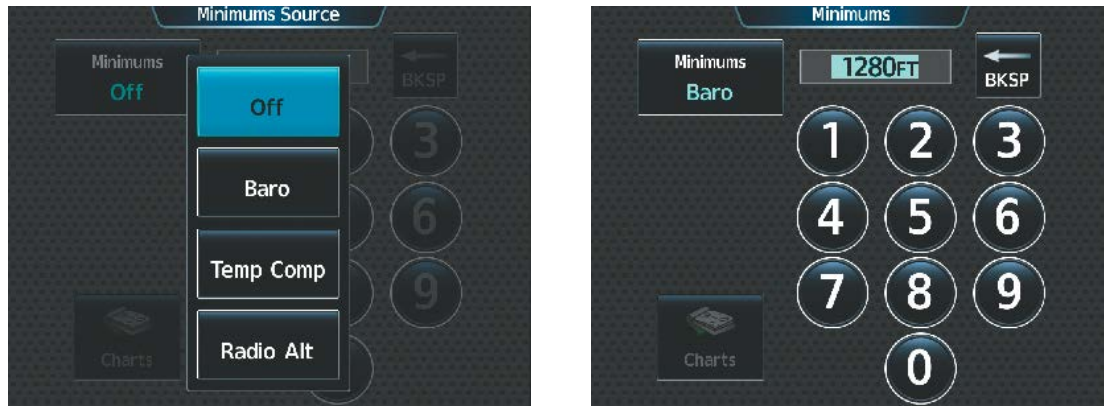


Figure 2-54 Minimum Altitude Alerting

## RADIO ALTIMETER (RA)

When the RA height (the aircraft altitude above ground level detected by the RA) is between zero and 2500 feet, the current value is displayed in green to the upper right of the HSI. Display of RA height becomes more sensitive as the height above ground decreases (following table).

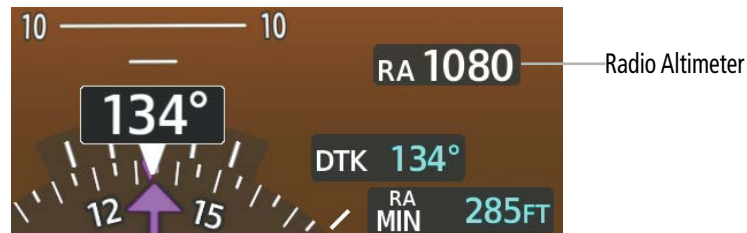


Figure 2-55 Current Radio Height

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

Table 2-3 Radio Altimeter Sensitivity

When the RA is selected as the altitude source for the minimum altitude alerting function, the color of the RA height changes to amber upon reaching (or descending below) the altitude entered.

RA 185

Figure 2-56 RA as Altitude Source for Minimum Altitude Alerting

A ground line with diagonal stripes below it appears on the Altimeter to show the aircraft's height above the ground. If the RA data becomes invalid, the message 'RA FAIL' is displayed in amber in place of the current RA height. The RA test is done on the MFD, and the 'RA TEST' annunciation appears on the PFD directly above the Radio Altimeter box.



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

RA FAIL

Figure 2-58 Radio Altimeter with Invalid Data

## 2.5 ABNORMAL OPERATIONS

## ABNORMAL GPS CONDITIONS

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

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

### Table 2-4 Abnormal GPS Conditions Annunciated on HSI



**Figure 2-59 Example of HSI Annunciations**

Dead Reckoning (DR) Mode causes the following items on the PFD to be shown in amber when FMS is the selected navigation source:

- CDI (removed after 20 minutes)
- Current Track Bug
- Wind Data (calculated based on GPS information)
- Distances in the Bearing Information windows
- GPS bearing pointers

It is important to note that estimated navigation data supplied by the system in DR Mode may become increasingly unreliable and must not be used as a sole means of navigation. See the Flight Management section for more information about DR mode.

## COMPARATOR ANNUNCIATIONS

The Comparator monitors critical values generated by redundant sensors. If differences in the sensors exceed a specified amount, a miscompare annunciation is displayed in black text on an amber background. If one or both of the sensed values are unavailable, a no compare annunciation is displayed with black text on a white background. Refer to the Appendix A for more information on alerts and annunciations.



**Figure 2-60 Sensor Comparator Annunciations on the PFD**

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

**Table 2-5 Sensor Comparator Annunciations**

## REVERSIONARY SENSOR ANNUNCIATIONS

The system monitors AHRS and air data from redundant sensors. In normal operations, PFD1 uses attitude/heading data from AHRS1 and air data from ADC1 and PFD2 uses data from AHRS2 and ADC2. If another sensor is selected, either manually or automatically, an annunciation appears above the Roll Scale on the PFD. The GTC 'Sensors' Screen provides **AHRS1**, **AHRS2**, **ADC1**, and **ADC2** Buttons for selection. If the primary sensors for the display fail, and the aircraft is in the air, the system automatically selects the appropriate reversionary sensors.



Figure 2-61 Reversionary Sensor Annunciations

Reversionary Sensor Window Text	Condition
<b>BOTH ON ADC1</b>	Both PFDs are displaying data from ADC1.
<b>BOTH ON ADC2</b>	Both PFDs are displaying data from ADC2
<b>BOTH ON AHRS1</b>	Both PFDs are displaying data from AHRS1.
<b>BOTH ON AHRS2</b>	Both PFDs are displaying data from AHRS2.
<b>BOTH ON GPS1</b>	Both PFDs are displaying data from GPS1.
<b>BOTH ON GPS2</b>	Both PFDs are displaying data from GPS2.
<b>USING ADC1</b>	PFD2 is displaying data from ADC1. Shown while PFD1 is displaying data from ADC2.
<b>USING ADC2</b>	PFD1 is displaying data from ADC2. Shown while PFD2 is displaying data from ADC1.
<b>USING AHRS1</b>	PFD2 is displaying data from AHRS1. Shown while PFD1 is displaying data from AHRS2.
<b>USING AHRS2</b>	PFD1 is displaying data from AHRS2. Shown while PFD2 is displaying data from AHRS1.
<b>USING GPS1</b>	PFD2 is displaying data from the #1 GPS.
<b>USING GPS2</b>	PFD1 is displaying data from the #2 GPS.

Table 2-6 Reversionary Sensor Annunciations



## GARMIN SVT TROUBLESHOOTING

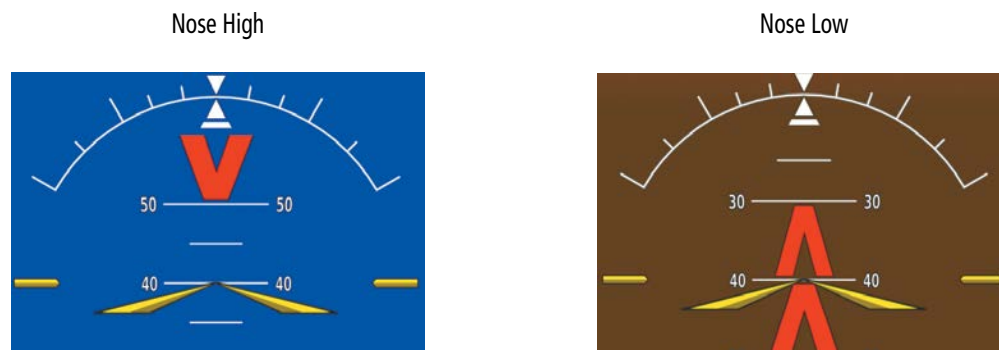
Garmin SVT™ is intended to be used with traditional attitude, heading, obstacle, terrain, and traffic inputs. SVT is disabled when valid attitude or heading data is not available for the display. In case of invalid SVT data, the PFD display reverts to the standard blue-over-brown attitude display.

SVT becomes disabled without the following data resources:

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

## UNUSUAL ATTITUDES

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



**Figure 2-62 Pitch Attitude Warnings**

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

- |                                 |  |  |
|---------------------------------|--|--|
| - Traffic Annunciations         | - Wind data                            | - Vertical Deviation, Glideslope, and Glidepath Indicators |
| - AFCS Annunciations            | - Selected Heading indication          | - Altimeter Barometric Setting                             |
| - Flight director Command Bars  | - Selected Course indication           | - Selected Altitude  |
| - Inset Map                     | - System Time                          | - VNV Target Altitude                                      |
| - Outside air temperature (OAT) | - Minimum Altitude Alerting indication |  |
| - DME Information Window        |  |  |

## SVT UNUSUAL ATTITUDES

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



Figure 2-63 Blue Sky Bar with Full Display Terrain

## SECTION 3 ENGINE INDICATION & CREW ALERTING 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:

- **Engine Indication and Crew Alerting System (EICAS):**

- The **Engine Indication System** (EIS) displays electrical, fuel, engine, pressurization, and flight control information on the left side of the Multi Function Display (MFD).
- The **Crew Alerting System** (CAS) displays advisories, cautions, and warnings to communicate conditions, statuses, and system failures. CAS messages are grouped by level of importance and color-coded based on urgency and appear in the CAS window on the EICAS display.

- **Synoptics** panes are provided for monitoring the status of the doors, de-icing systems, electrical, and fuel.

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



Figure 3-1 Multi Function Display

### 3.1 ENGINE INDICATION SYSTEM (EIS)



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

EIS information is presented on the EICAS display using gauges, horizontal and vertical bar indicators, slide bars, and digital displays. Green ranges on the instrument scales indicate normal ranges of operation; amber and red bands indicate caution and warning, respectively. During normal operating conditions, an instrument's pointer appears in white and the display text is green. When data is out of the range of the indicator or gauge, the pointer moves to the end of the scale; digital displays are shown as "---" (dashes).

When an unsafe operating condition occurs, the pointer and display color change to amber or flash red, indicating a caution or warning. If a cautionary time limit is exceeded, the sliders, pointers, and digits may flash red, even if the parameter is still within in the cautionary range (refer to each display description for details). If the sensor data for a parameter becomes invalid or unavailable, a red "X" is shown across the indicator and/or display.

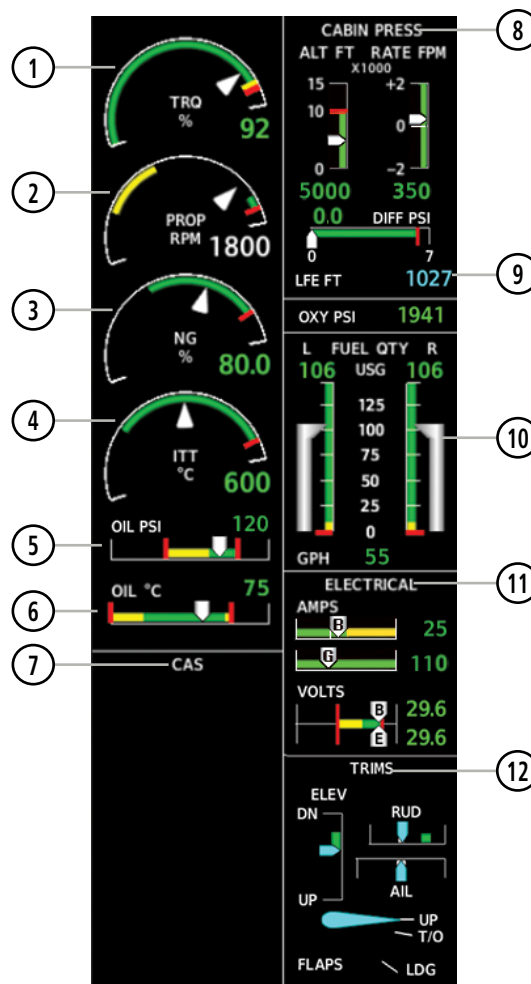


Figure 3-2 EICAS Display (Normal Mode)

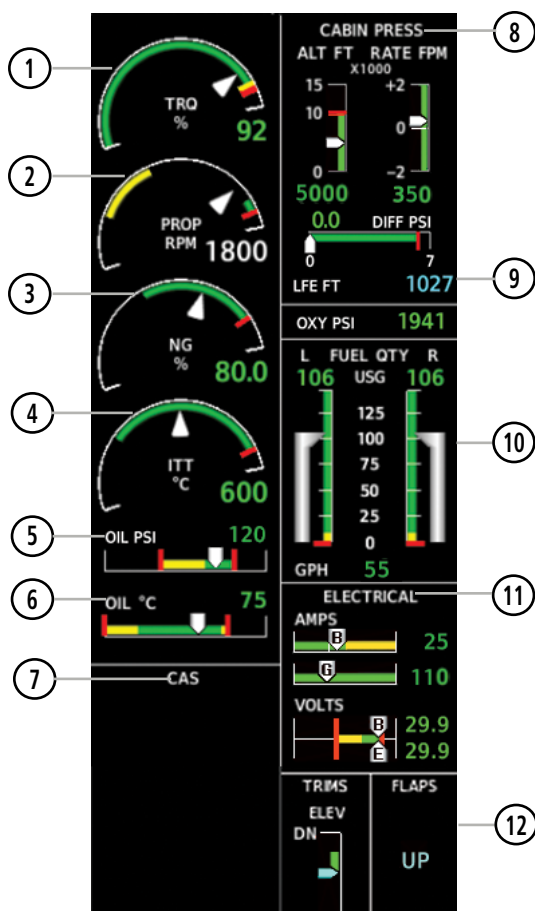
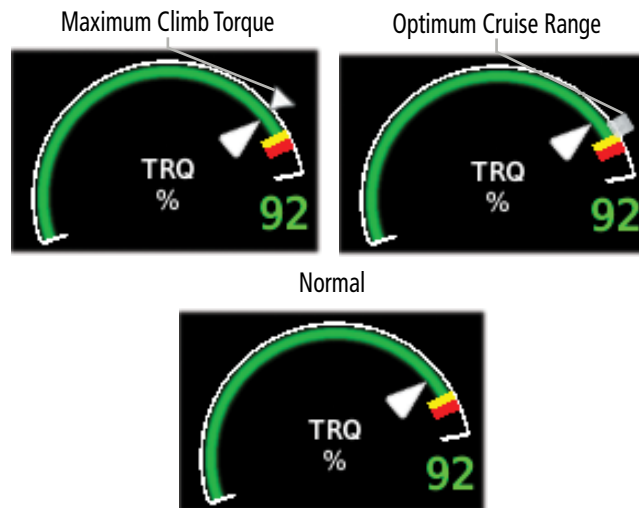


Figure 3-3 EICAS Display (Reversionary Mode)

**① Torque**

The Torque Gauge displays values from 0 to 130% of maximum safe torque. If the torque remains above 100% for more than 5 seconds or exceeds the value indicated by the red tick mark, a warning condition occurs. The maximum climb torque is displayed as a white triangle (bug) while the optimum cruise range is displayed as a gray band on the Torque Gauge. When bleed pressure reaches its upper limit, 'BLEED HI' is annunciated above the Torque Gauge.

**② Propeller Speed**

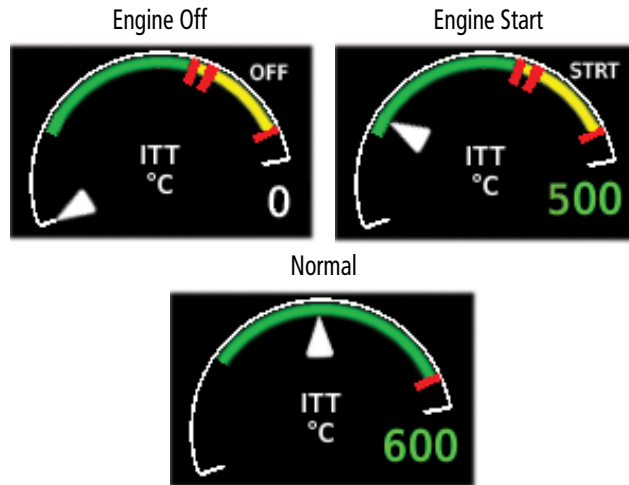
Propeller speed is shown in revolutions per minute (rpm) from zero to 2200. If propeller speed slows to where the gauge pointer enters the amber range, a caution is issued. A propeller overspeed warning is indicated if propeller speed exceeds the maximum safe operating speed.

**③ Generator Speed**

Generator speed is indicated as a percentage of maximum safe operating speed (rpm), from 0 to 120%. If generator speed exceeds 104% a warning condition occurs.

**④ Interturbine Temperature**

The Interturbine Temperature (ITT) Gauge ranges differ for engine off/start and running conditions. Values between 200 and 1200 degrees Celsius (°C) are shown at engine start; values change to 200 to 900°C when the engine starts running. When the engine is not running, 'OFF' is annunciated above the ITT display; this changes to 'STRT' upon engine start. No annunciation is shown when the engine is running normally.



**⑤ Oil Pressure**

Engine oil pressure is shown along horizontal bar indicators below the engine gauges. Oil pressure is shown in pounds per square inch (psi).

**⑥ Oil Temperature**

Engine oil temperature is shown along horizontal bar indicators below the engine gauges. Oil temperature in degrees Celsius (°C).

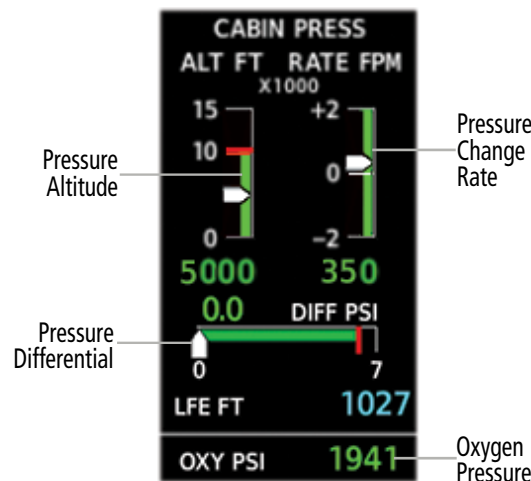
**⑦ CAS Display**

Crew alerting messages are displayed here. (See Section 3.4 for more information.)



## 8 Cabin Pressurization

Cabin pressurization information (cabin altitude, rate of change, and differential cabin pressure) is shown at the top of the right EICAS Display. Cabin altitude (ALT FT) is shown on a color-coded scale labeled in 5,000-ft increments with a display (in feet) below. Cabin altitude change rate (RATE FPM) is displayed on a scale in terms of 2,000 fpm increments with a display (in fpm) below. Cabin pressure differential (DIFF PSI), in pounds per square inch (psi), is indicated on a color-coded scale with a display.



The pressure (in psi) for the oxygen system is shown below the cabin pressurization display under normal display conditions.

## 9 Landing Elevation

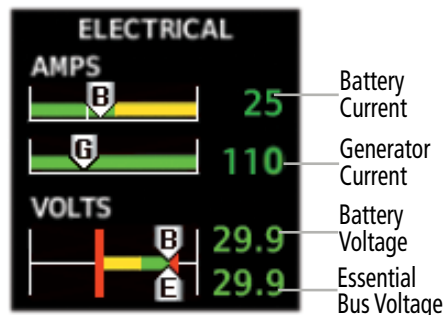
The Landing Elevation is displayed as magenta dashes until a flight plan destination is entered. Once a flight plan is entered, the Landing Elevation is updated to reflect the new destination elevation. Automatically entered values appear in magenta. Manually entered values are cyan. If the Landing Elevation data is invalid or not available, the digits are replaced with amber dashes. (See Section 3.3 for more information.)

## 10 Fuel Group

The fuel display is located beneath the oxygen pressure display and shows the fuel quantity in each tank (in United States gallons, USG), and fuel flow (gallons per hour, gph). Fuel quantity for each tank is normally shown along a slider scale. Displays for fuel quantity and fuel flow are shown in Reversionary Mode.

## ⑪ Electrical Group

Electrical Information shows currents for the battery (pointers labeled "B") and generator (pointer labeled "G" for primary generator and "S" for standby generator) and voltages for the battery and essential bus (pointer labeled "E") are shown along color-coded scales, with displays to the right.



## ⑫ Flap and Trims

Elevator, rudder, and aileron trim indications are shown along slide bar scales next to the CAS messages in normal display mode. Flap deflection is normally displayed beneath the trim indications using a rotating pointer. Flap positions for takeoff, landing, and up positions are labeled. In Reversionary Mode, only elevator trim is indicated. Rudder trim is not shown in Reversionary Mode. Flap position (UP, T/O, LDG) is provided as a digital display in Reversionary Mode and when CAS scrolling is enabled.

## 3.2 SYNOPTICS

The Synoptics pages show current conditions of certain aircraft functionality on aviation system diagrams, reducing workload by allowing the flight crew to rapidly analyze the situation. Aircraft systems graphically depicted in the synoptic diagrams include:

- Electrical system
- Fuel system
- Doors/De-ice system



Figure 3-4 Systems Overview

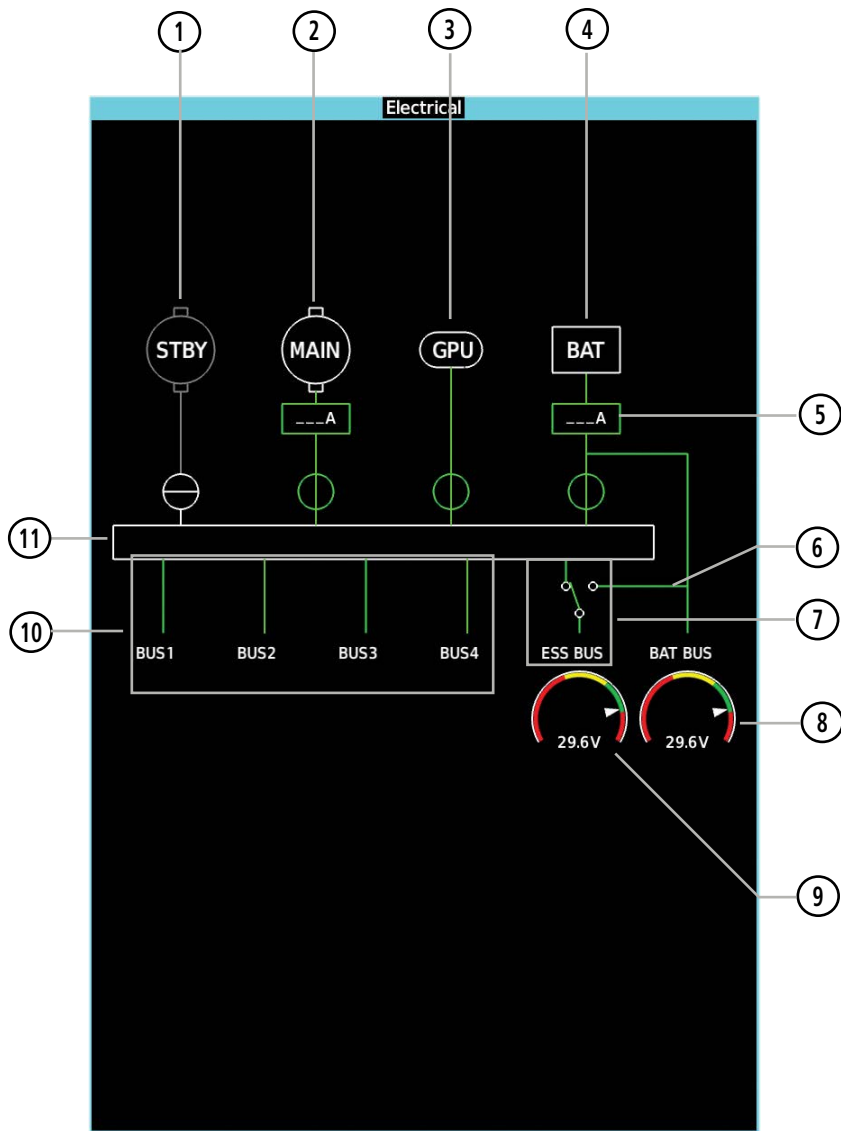
Refer to the Flight Management Section for information on how to use the **Weight and Fuel** Button functions. Refer to the System Overview for more information on how to use the **Lighting Config** Button functions.

### ELECTRICAL SYSTEM

The 'Electrical' Pane uses a diagram of the aircraft's electrical system to display the system status. The generators, ground power supply (GPU), batteries, and buses are shown in green to denote normal operation. Color of the units change depending on the condition.

#### Accessing the Electrical System Synoptics:

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



- |                          |                         |
|--------------------------|-------------------------|
| ① Standby Generator      | ⑦ Essential Bus         |
| ② Main Generator         | ⑧ Battery Bus Voltage   |
| ③ Ground Power Unit Door | ⑨ Essential Bus Voltage |
| ④ Battery                | ⑩ DC Buses 1 through 4  |
| ⑤ Amperage               | ⑪ Main Bus              |
| ⑥ Battery Bus            |                         |

Figure 3-5 Electrical Synoptics Page

Active generator currents are displayed below the generator icons. A disconnected generator is indicated in gray; the current is removed from the display and the switch symbol is closed.

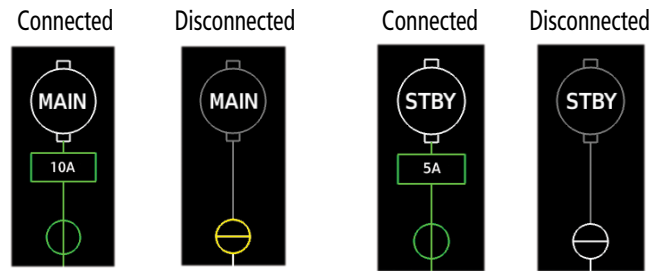


Figure 3-6 Generator Status

GPU status information is removed from the electrical diagram when the GPU door is closed. If the GPU door is open and selected, the GPU status is shown in green; when the door is open, but not selected, the status is shown in gray with the switch closed. A CAS message, 'GPU DOOR' is generated if the GPU door is open.

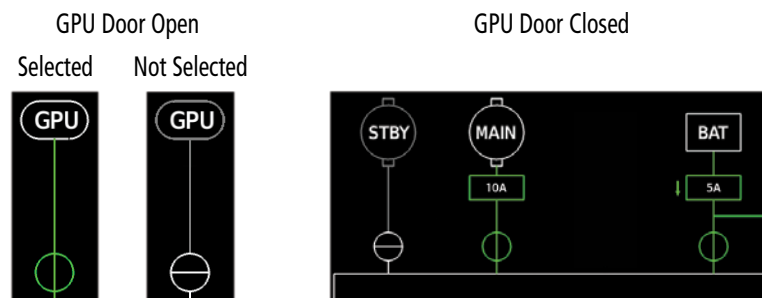


Figure 3-7 GPU Door Status

Battery connection status to the main bus is indicated in green; direction of current flow is indicated with an arrow next to the current display. If the battery is disconnected from the main bus, the switch is closed.

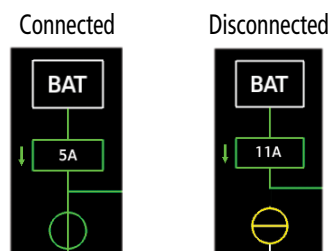


Figure 3-8 Battery Status

Battery and essential bus voltages are displayed using gauges. DC buses are shown in green when energized. When not energized, the connection line to the main bus is removed and the bus label is displayed in red.



Figure 3-9 Essential Bus and Battery Over Voltage

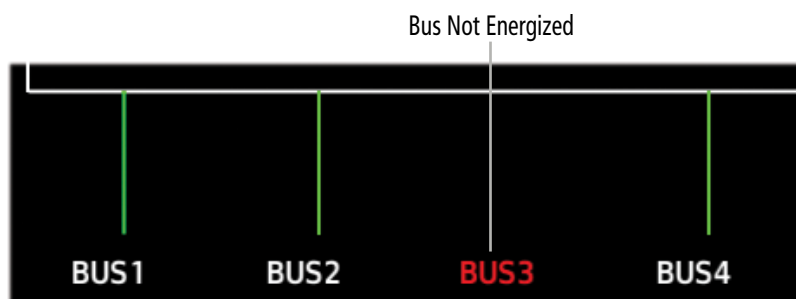


Figure 3-10 DC Bus Status

The Emergency Buses switch has two positions, UP (open) and DN (ground). If the switch is in the UP position, the essential bus is connected to the battery bus. If the switch is in the DN position, the essential bus is connected to the main bus.

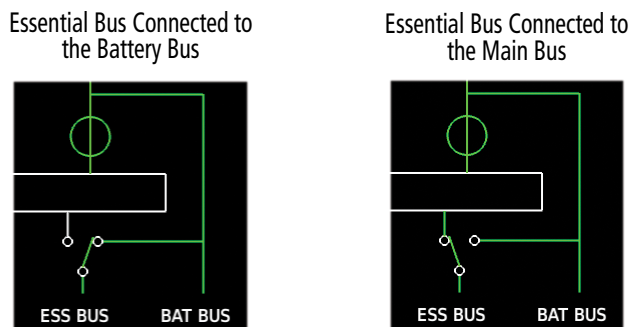


Figure 3-11 Essential Bus Connections

A red “X” over a component indicates invalid data or a failed unit.

## FUEL SYSTEM

The Fuel Synoptics Page displays the status of the fuel tanks and feed system. Fuel quantity is depicted graphically; the color changes to amber if the fuel quantity drops below the threshold level.

### Accessing the Fuel System Synoptics:

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

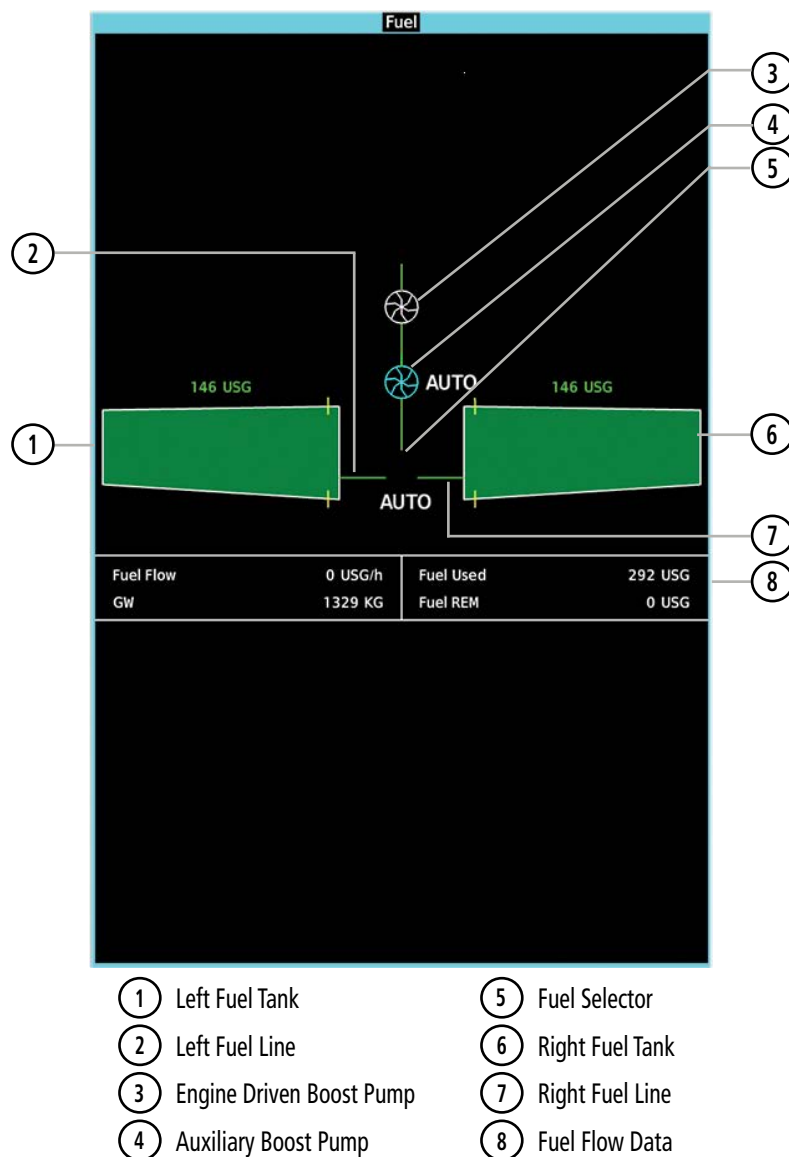


Figure 3-12 'Fuel' Pane








Left Fuel Tank Selected	Switching Fuel Tank Selection	Right Fuel Tank Selected	Manual or Unknown Fuel Tank Selection	Fuel Selector Off
				

Table 3-1 Fuel Selector Status

If the auxiliary fuel boost pump is on, the symbol is displayed in green. The mode, automatic (AUTO) or manual (MAN) is displayed next to the pump symbol. If the boost pump is off, the symbol is shown in cyan (automatic mode) or red (manual mode).




Fuel Boost Pump On	Fuel Boost Pump Off (Auto)	Fuel Boost Pump Off (Manual)
		

Table 3-2 Auxiliary Boost Pump Status

Fuel used and remaining are based on the fuel flow. The aircraft's weight is entered on the Weight and Fuel screen under Aircraft Systems on the Touchscreen Controller (see the Flight Management Section).

Fuel Flow	0 USG/h	Fuel Used	292 USG
GW	1329 KG	Fuel REM	0 USG

Figure 3-13 Fuel Flow Data

A red “X” over a component indicated invalid data or a failed unit.

GENERAL SYSTEMS

The General Synoptics Page aircraft diagram displays open doors in red (CAS messages also generated). Statuses of stall sensor, propeller, pitot probes, and windshield heat are also indicated on the diagram:

- White indicates that heat is off (propeller and windshield)
- Cyan indicates heat has been selected (windshield)
- Green indicates heat is on
- Amber indicates heat has failed (stall sensor, propeller and pitot tube).
- Invalid sensor information is indicated with a red ‘X’.

Accessing the General Systems Synoptics:

From MFD Home, touch **Aircraft Systems > General**.

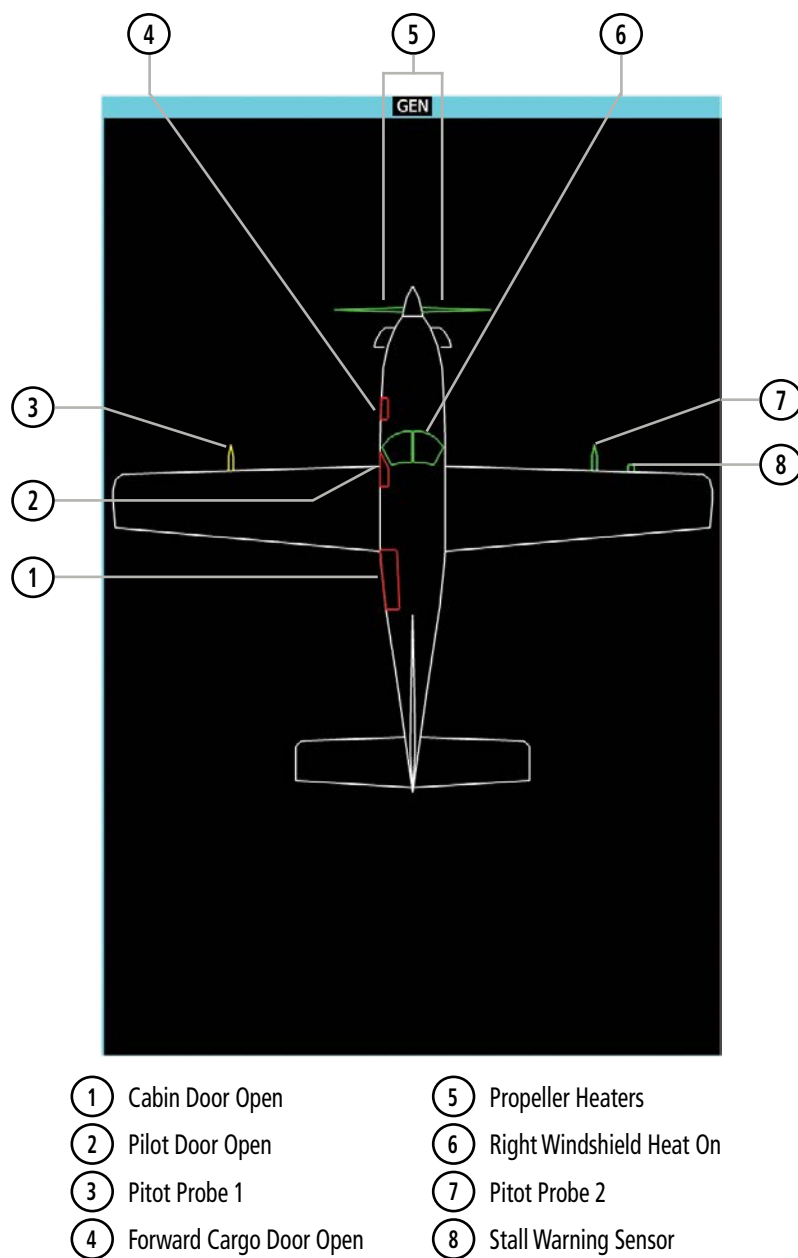


Figure 3-14 'GEN' Pane



Figure 3-15 Windshield Heat Status

## 3.3 LANDING FIELD ELEVATION

### 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 the **Use FMS Destination** Button.



Figure 3-16 Landing Field Elevation - FMS Mode



Figure 3-17 Landing Field Elevation - Manual Mode



Figure 3-18 Landing Elevation - Manual Input



**NOTE:** Manual adjustments to the landing field elevation are done from the previously selected or default LFE value.

### 3.4 CREW ALERTING SYSTEM (CAS)



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



**NOTE:** Aural alerts associated with abnormal conditions and advisories are managed through the audio controllers. Refer to the Audio and CNS Section for more information.



**NOTE:** Refer to the Appendices for a list of CAS messages.

The Crew Alerting System (CAS) Display is located in the lower left corner of the EICAS Display (on the MFD) under normal display conditions. Up to 11 messages can be displayed; when more than 11 messages accumulate, the **CAS** scrolling softkeys become available on the MFD. In Reversionary Mode, CAS scrolling softkeys are also available on the 'PFD Home' screen.

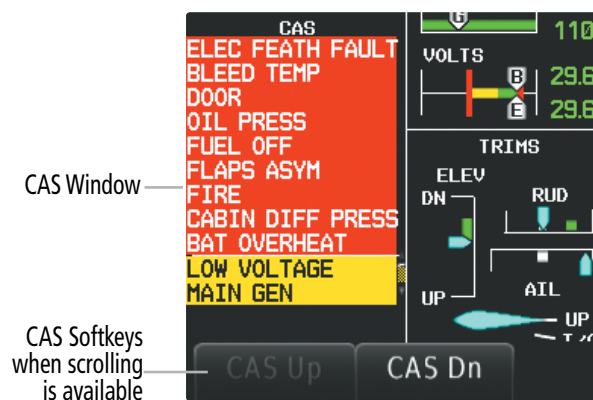


Figure 3-19 CAS Message Window (MFD)

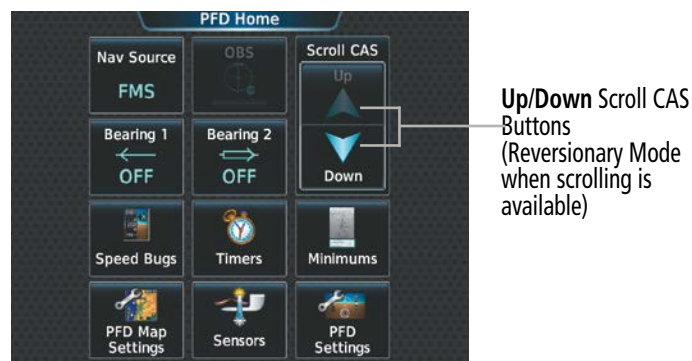


Figure 3-20 CAS Message Scrolling - PFD Home Screen

## CAS MESSAGES AND PRIORITIZATION



**NOTE:** Refer to the current version of the pertinent flight manual for corrective pilot actions.



**NOTE:** Red warning messages cannot be scrolled through and remain at the top of the CAS display. The scroll bar changes to amber if more than ten caution messages exist to be scrolled through.

CAS messages are grouped by criticality (warning and caution) and sorted by order of appearance (most recent messages on top). Messages flash inverse video until acknowledged by depressing the Master Caution or Master Warning switches respectively. The color of the message is based on its urgency and on required action:

- **Warning** (red) – Immediate crew awareness and action required; Master Warning triggered
- **Caution** (amber) – Immediate crew awareness and possible future corrective action required; Master Caution triggered
- **Advisory** (white) – Crew awareness required and subsequent action may be required.

Two momentary switch/indicators are located above PFD1 for CAS message acknowledgment: Master Warning and Master Caution.

Master Caution and Warning Indicators



PFD1

**Figure 3-21 Panel Layout**

A CAS message does not appear more than once at a given time. Warning and Caution CAS messages flash when they are generated. Amber (Caution) messages continue to flash until acknowledged, or until the condition(s) that caused the alert to display no longer exist. Red (Warning) messages continue to flash until acknowledged, even when the condition(s) that caused the alert to display no longer exist.

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.

### 3.5 REVERSIONARY MODE

In the event of a display failure, depending on the failed display(s), the functioning display(s) may be re-configured to present Primary Flight Display (PFD) symbology together with engine and CAS information (refer to the System Overview for more information about Reversionary Mode). In Reversionary Mode, the flap display is presented in an abbreviated format. The rudder trim display is not shown.



Figure 3-22 Reversionary Mode

## SECTION 4 AUDIO AND CNS

### 4.1 OVERVIEW



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

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

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

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

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

- COM
- NAV
- Marker Beacon Receiver
- ADF/DME
- Transponder
- Mono/Stereo Headsets
- Speaker
- Intercom
- Clearance Recorder and Player
- Auxiliary Audio (Music)
- SiriusXM Radio Entertainment
- Audio Feedback (Clicks)
- HF Radio
- SELCAL



## TOUCHSCREEN CONTROLLER AUDIO AND CNS CONTROLS



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



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

① **STBY** Button (COM1) – Selects the COM1 standby frequency for tuning or transfer.

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 the small knob to confirm the frequency. Push and hold the small knob to transfer the standby frequency to the active frequency.

④ Function Label – Indicates Large/Small Upper Knob function.

*Typical Frequency Entry:* COM1/COM2 Frequency, 'Push:1-2' indicates that pushing the small knob will change the cursor between COM1 and COM2. 'Hold:↑' indicates that pushing, holding, and releasing 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, holding and releasing the small knob will switch the standby and active data fields.

- ⑤ **NAV/COM** Softkey – Selects the ‘NAV/COM Home’ Screen on the Touchscreen Controller.
- ⑥ **Function Label** – Indicates lower knob function.  
*Typical:* Pilot COM1/COM2 Volume, Push: Squelch
- ⑦ **Lower Knob** – Functions as labeled (see #6).
- ⑧ **XPDR IDENT** Button – Transmits a distinct identity indication to Air Traffic Control (ATC).
- ⑨ **Keypad** – Used to find, enter, and edit the frequency in the selected standby COM frequency window.
- ⑩ **Play** Button – Used to playback or stop the COM audio recorded by the clearance recorder.
- ⑪ **COM2** Button– Transfers the standby and active COM2 frequencies.
- ⑫ **STBY** Button (COM2) – Selects the COM2 standby frequency for tuning or transfer.
- ⑬ **Intercom** Button – Displays the ‘Intercom’ Screen used to connect or isolate pilot, copilot, and passengers and to control volume and squelch settings.
- ⑭ **Audio & Radios** Button – Displays the ‘Audio & Radios’ Screen used to control the Communication/ Navigation/Surveillance (CNS) and audio settings for the pilot, copilot, and passengers.
- ⑮ **MON** Button – Controls which COM transceiver is being monitored.
- ⑯ **Pilot Music 1** Button – Enables/Disables entertainment audio selected on the Music input from the ‘Audio & Radios’ Screen.
- ⑰ **Pilot Isolate** Button – Displays the ‘Intercom’ Screen and automatically deselects the intercom link between the pilot and the copilot/passengers.
- ⑱ **MIC** Button – Switches between the #1 COM transceiver and the #2 COM transceiver.
- ⑲ **Transponder Code/Mode** Button – Displays the current Code and Mode of the transponder. Touch to display the ‘Transponder’ Screen. Select transponder mode using the mode buttons. Enter desired codes using the keypad or touch the **VFR** Button. While the transponder is replying to interrogation, a white R pulsates on the Transponder Code/Mode Button.
- ⑳ **XPDR1 IDENT** Button – Indicates which transponder is active and, when pressed, 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

- 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).

## MFD COM DISPLAY



Figure 4-3 COM1 and COM2 Frequency Boxes on the MFD

- ① **COM1 Frequency Box** – Displays the tuned and standby communication frequencies for COM1. The tuned frequency in the COM1 Frequency Box will be green when COM1 is the active communication radio source.
- ② **COM2 Frequency Box** – Displays the tuned and standby communication frequencies for COM2. The tuned frequency in the COM2 Frequency Box will be green when COM2 is the active communication radio source.

## COM OPERATION

### COM TRANSCEIVER SELECTION AND ACTIVATION



**NOTE:** When turning on the G3000 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 shown on the 'NAV/COM Home' Screen and also on the 'Audio & Radios' Screen. COM transceivers 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 desired **MIC** Button on the 'Audio & Radios' Screen 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 radio 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 desired COM radio for monitoring.



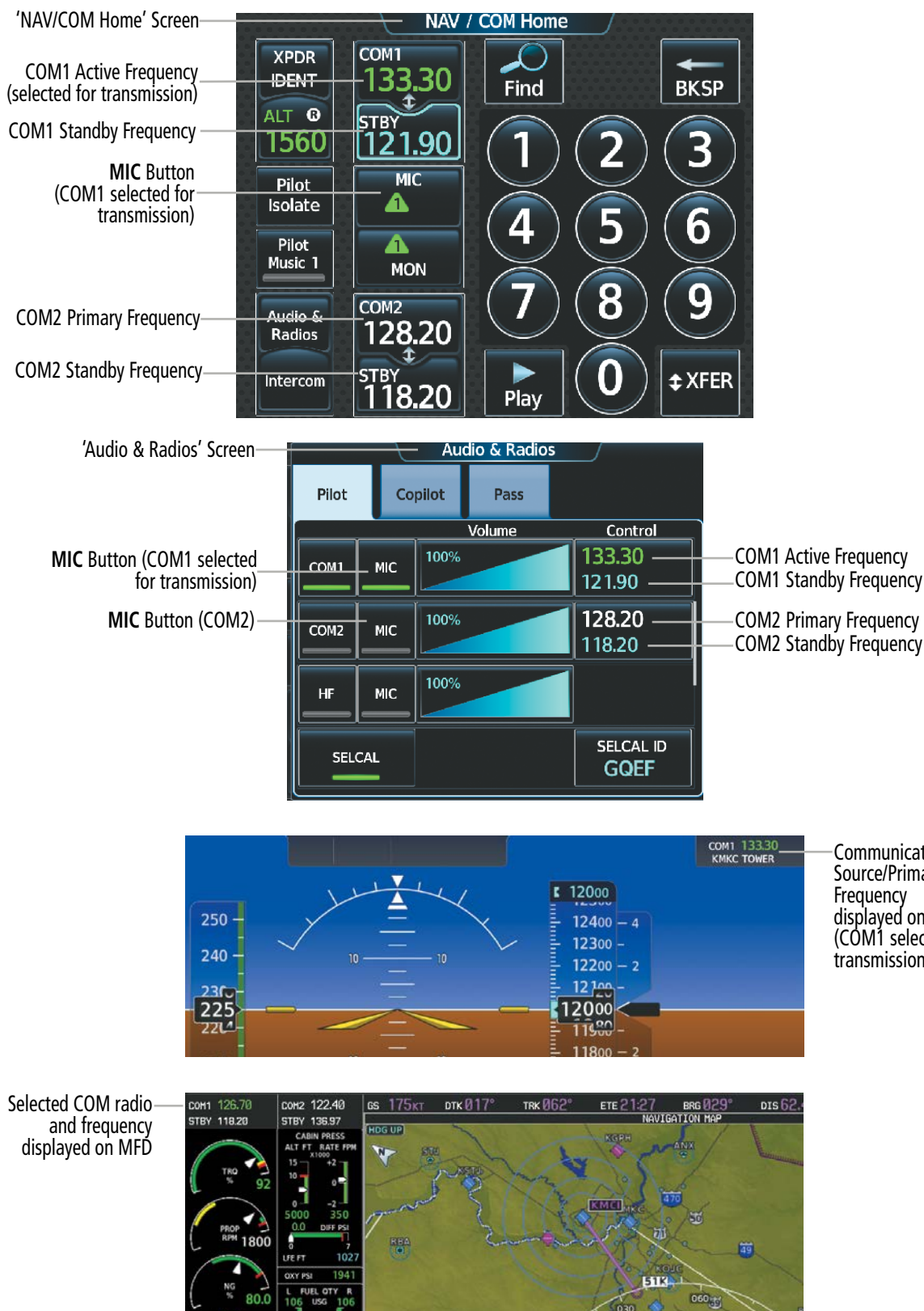


Figure 4-4 Selecting a COM Radio for Transmission



CNS Bar Symbol	Description
	COM1 selected for transmission/monitoring
	COM2 selected for transmission/monitoring
<b>MULTI</b>	An additional audio source is manually selected for monitoring
<b>HF</b>	HF COM selected for transmission/monitoring
<b>PA</b>	Passenger Address (PA) system is active

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 4-5 COM Radio Transmit and Receive Indicators



## COM FREQUENCY TUNING

### Tuning a standby COM frequency from the 'NAV/COM Home' Screen:

- 1) From NAV/COM Home, touch the COM1 or COM2 **STBY** Button to select radio for tuning.  
**Or:**  
 Push the small upper knob to select the desired STBY COM for tuning (selected STBY COM turns cyan).
- 2) Use the keypad to select the frequency.  
**Or:**  
 Turn the large and small upper knobs to tune the frequency (Large knob increases/decreases MHz; Small knob increases/decreases kHz).
- 3) Touch the **Enter** Button to accept the new frequency as the COM1 or COM2 standby frequency (not required if tuning with the upper knobs).  
**Or:**  
 Push the small upper knob.  
**Or:**  
 Touch the COM1 or COM2 standby frequency button.
- 4) To accept the new frequency as the active frequency and transfer the previously active frequency to the standby frequency touch the **XFER** Button.  
**Or:**  
 Push and hold the small upper knob.  
**Or:**  
 Touch the COM1 or COM2 active frequency button.



Figure 4-6 'NAV/COM Home' Screen - COM Frequency Tuning

**Tuning a standby COM 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 COM1 or COM2 frequency button to display the COM1/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 COM1 or COM2 standby frequency.

**Or:**

Push the small upper knob.

- 5) To accept the new frequency as the active frequency and transfer the previously active frequency to the standby frequency touch the **XFER** Button.

**Or:**

Push and hold the small upper knob.



Figure 4-7 'Audio & Radios' Screen - COM Frequency Tuning



Figure 4-8 COM Frequency Tuning Keypad

#### COM frequency tuning using the COM volume slider buttons:

- 1) From NAV/COM Home, touch the **Audio & Radios** Button to display the 'Audio & Radios' Screen.
- 2) Touch the COM1 or COM2 volume slider button to select desired COM for tuning.

Or:

Push the small upper knob to select desired COM.

- 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 transfer the new frequency from standby to active COM.



Figure 4-9 COM Frequency Tuning - COM Volume Slider Buttons

### Selecting the Sync to Pilot Button:

- 1) From the 'NAV/COM Home' Screen, 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. Pilot 'Audio & Radios' Screen selections now change both Touchscreen Controllers.



Figure 4-10 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 COM1/COM2 Frequency Screen.
- 2) Touch desired tab for frequency type (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. Selecting a **Multiple** Button accesses another level of selectable frequencies.

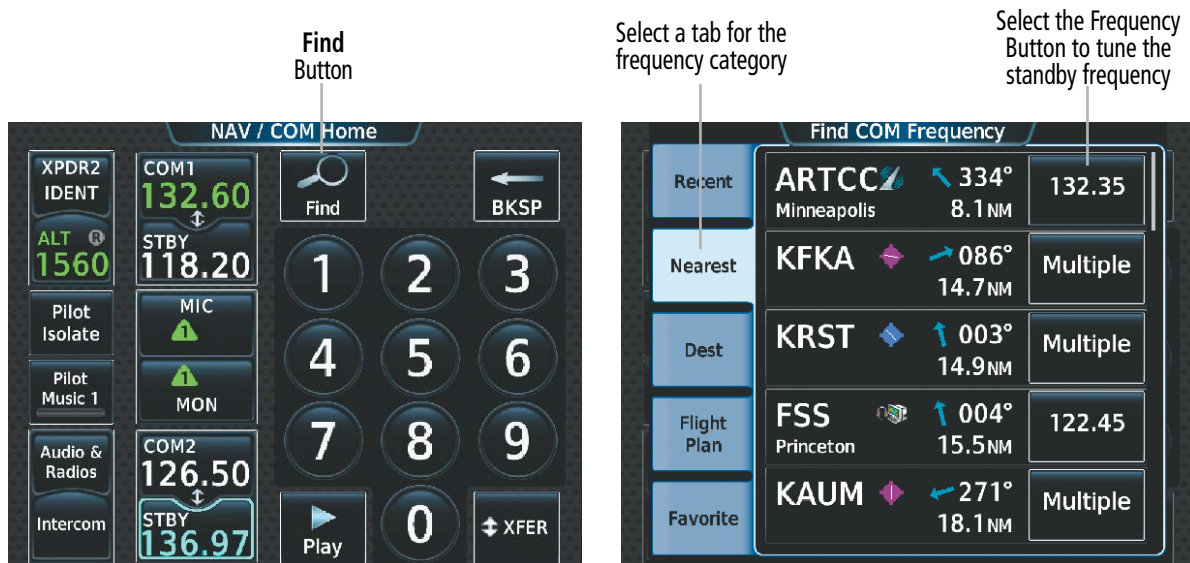


Figure 4-11 'Find COM Frequency' Screen COM Tuning

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

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

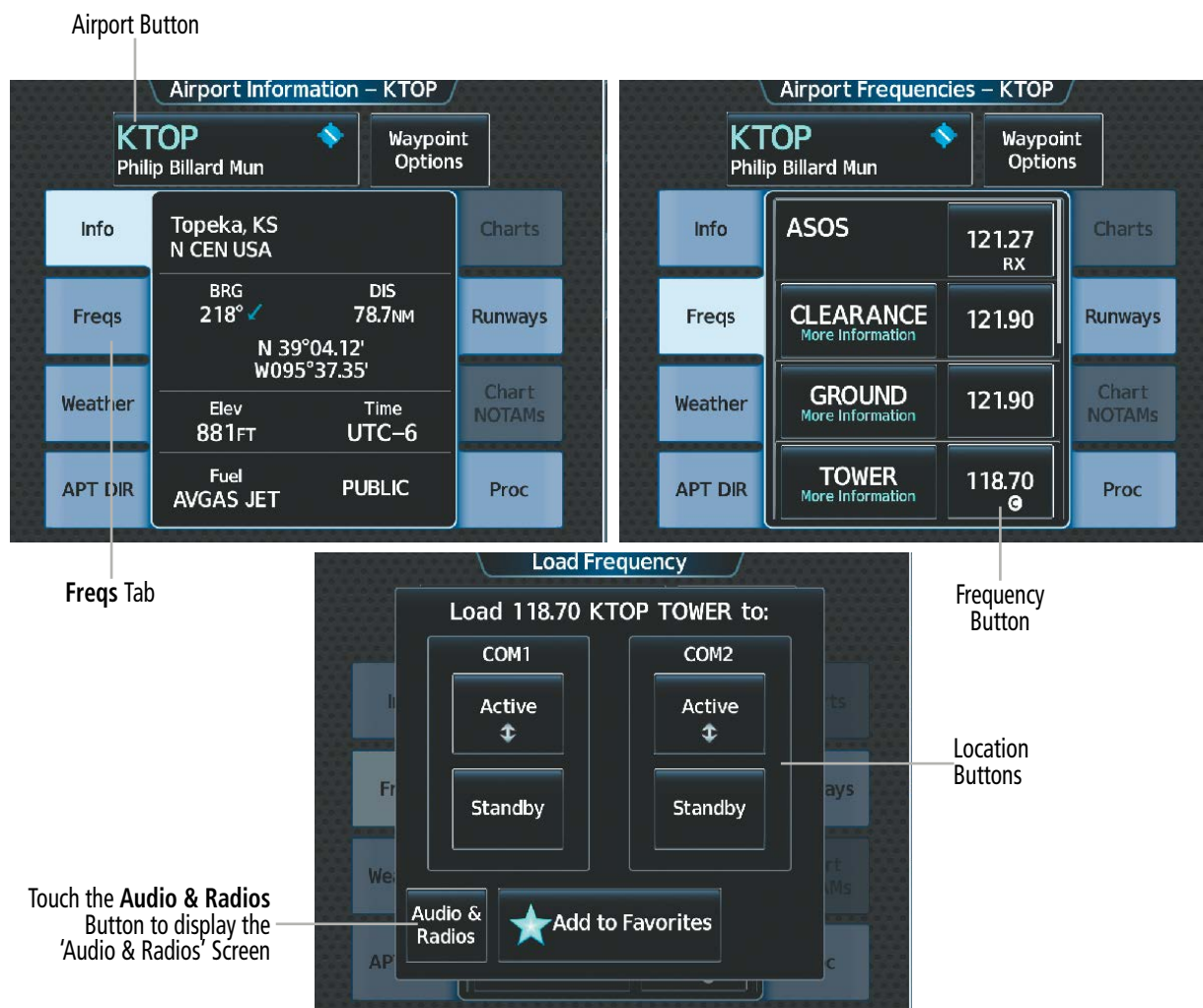


Figure 4-12 'Airport Info' Screen COM Tuning

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

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



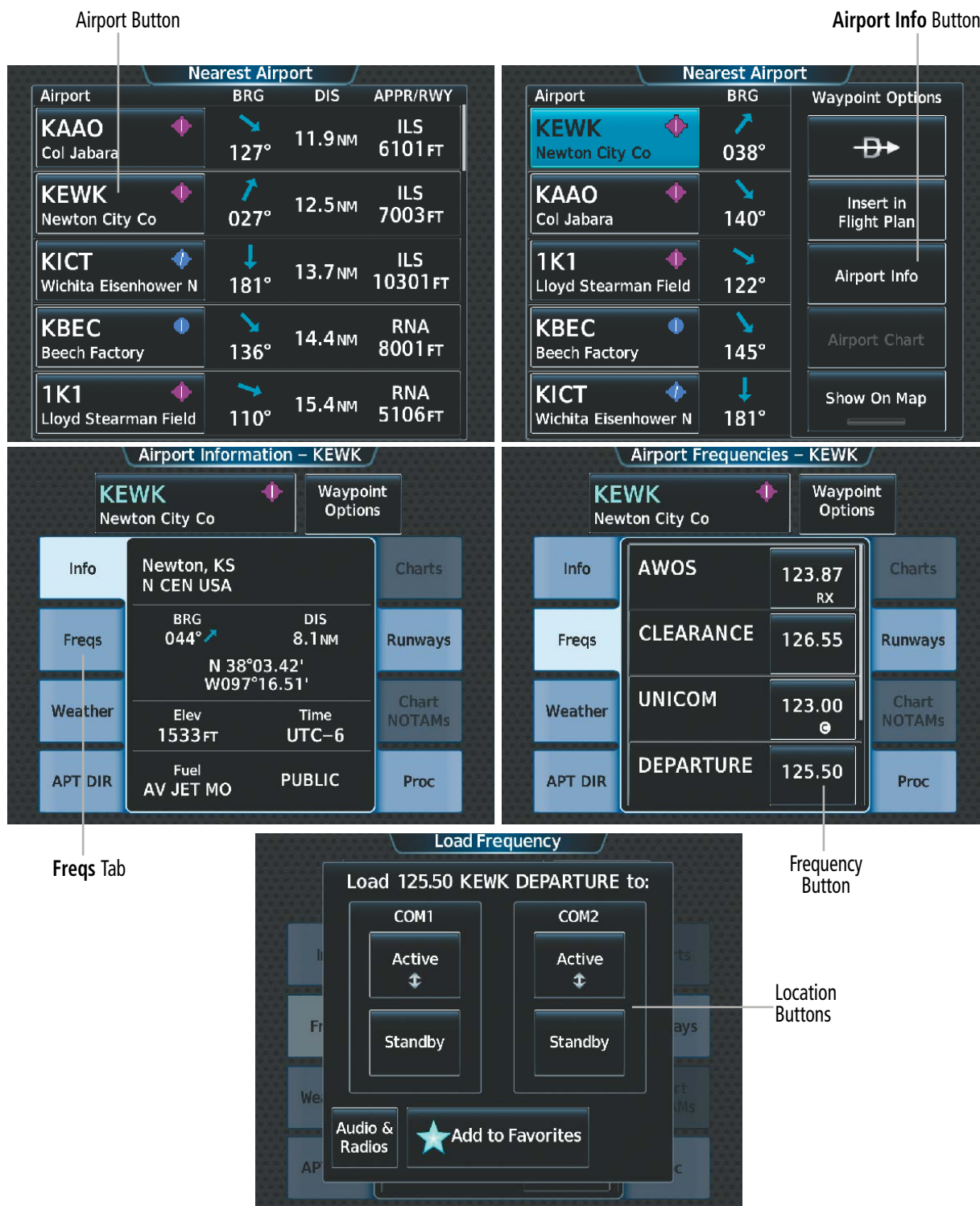


Figure 4-13 'Nearest Airport' Screen COM Tuning



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

- 1) From MFD Home, touch the **Nearest** Button to display the 'Nearest' Screen.
- 2) Select the **Airspace**, **ARTCC**, **FSS**, or **Weather** Button.
- 3) Scroll the list to find desired frequency.
- 4) Touch the frequency button to display the 'Load Frequency' Screen.
- 5) Touch the Location Button to load the frequency into COM1/COM2 Active, Standby, or Favorites.

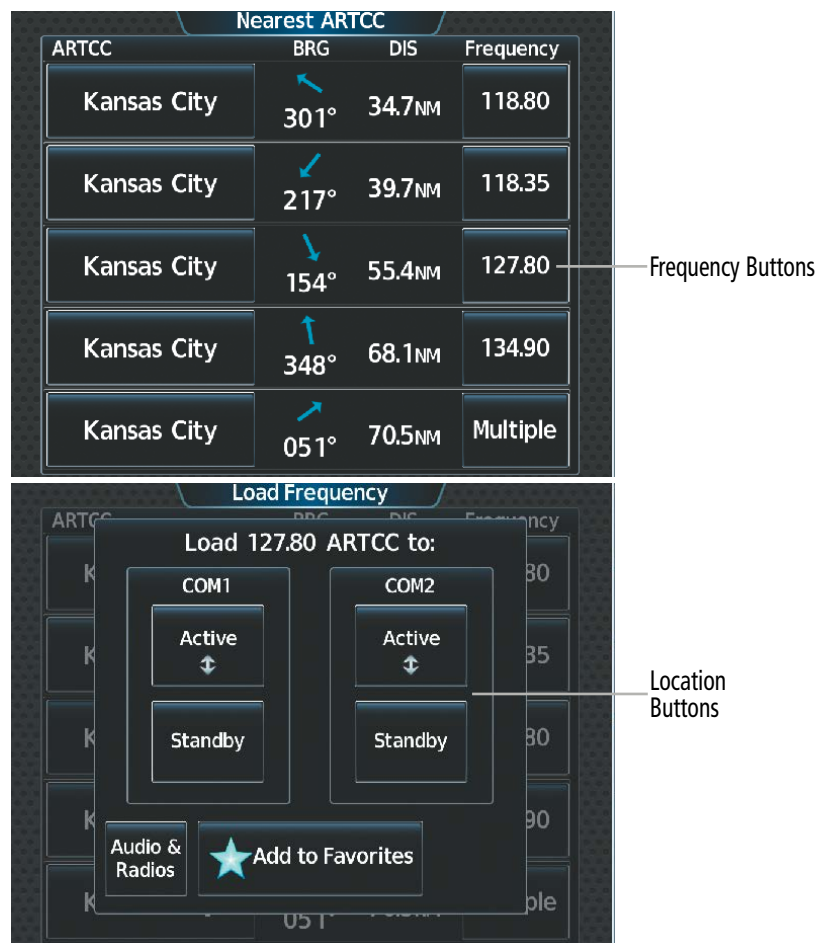


Figure 4-14 'Nearest ARTCC' Screen COM Tuning

## Viewing Current COM selections from any COM 'Load Frequency' Screen:

- 1) From any COM 'Load Frequency' Screen, touch the **Audio & Radios** Button to display current COM selections.
- 2) Touch the **Back** Button to return to the 'Load Frequency' Screen.

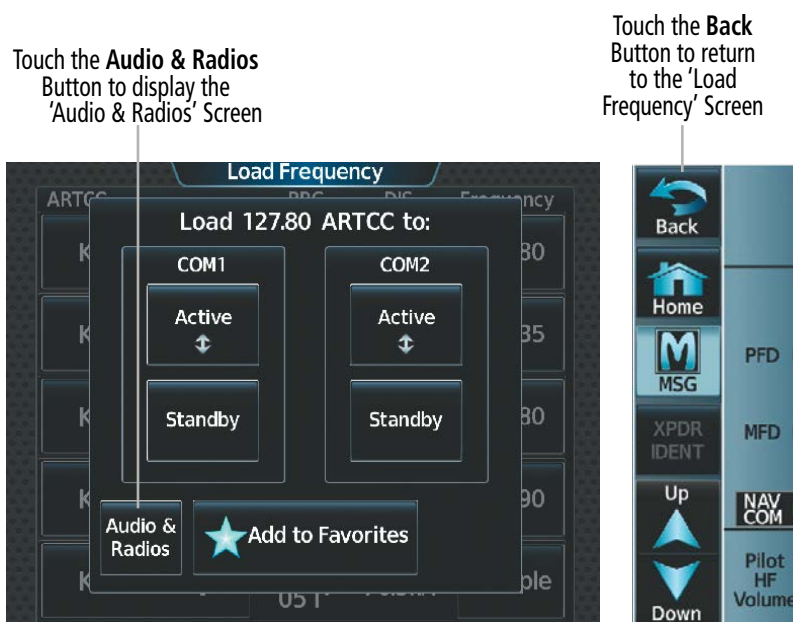


Figure 4-15 'Load Frequency' Screen COM Tuning

## 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 4-16 COM Channel Spacing

**Changing COM frequency channel spacing:**

- 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 **25.0 kHz** and **8.33 kHz** Buttons.
- 4) Touch the desired channel Spacing Button.



Figure 4-17 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 4-18 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 from the 'NAV/COM Home' Screen, the volume level is displayed in place of the active frequency on the active COM Button, and remains for two seconds after the change.

The pilot, copilot, and passenger COM volume can be controlled independently provided the **Sync to Pilot** Button is not selected. Select the Pilot, Copilot, or Pass 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.



Lower knob Function Label - Indicates when Pilot/Copilot and COM1/COM2 volume is being controlled.

Lower knob - Turn to adjust COM volume



Selected COM Volume

Figure 4-19 COM Volume Level



## HF COM TRANSCEIVER

The optional High Frequency (HF) COM transceiver can be selected for monitoring and transmitting using the Touchscreen Controller. During reception of audio from the HF COM radio selected for transmission, audio from the other COM radios are muted.

### Selecting the HF COM Radio for monitoring and transmitting:

- 1) From NAV/COM Home, touch the **Audio & Radios** Button
- 2) Touch the **HF** Button to select the HF COM radio for monitoring.
- 3) Touch the **HF MIC** Button to select the HF COM radio for transmission.

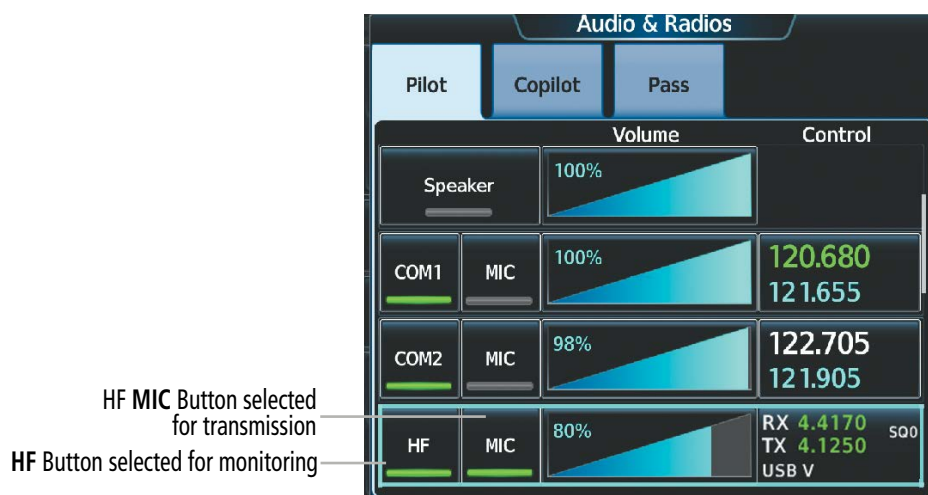


Figure 4-20 Selecting the HF COM for monitoring and transmission

## HF COM VOLUME

The selected HF COM radio volume level can be adjusted from 0 to 100% on the Touchscreen Controller by turning the bottom 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.



Figure 4-21 HF COM Volume Level

## SELCAL

SELCAL (Selective Calling) allows a crew to enter a previously assigned 4 character code, which when received by the SELCAL decoder, will provide the crew with an annunciation of an incoming call. Incoming calls will be accompanied by an aural alert and a visual annunciation. This feature allows the crew to stop monitoring the radio until the decoder indicates a call is incoming. SELCAL is generally used on oceanic or lengthy flights and a specific code will be assigned to aircraft participating in the SELCAL system.

A SELCAL code consists of two pairs of letters (e.g. 'GQ-EF') within the range of A through S. The characters 'T', 'N', and 'O' are excluded. Within each pair, the letters must be ordered alphabetically (GQ, not QG) and no letters may be repeated. If an invalid SELCAL code is entered, a pop up window will notify the flight crew of the error and the code will be rejected.

### Entering the SELCAL Code

- 1) From NAV/COM Home, touch **Audio & Radios** Button.
- 2) Touch the **Pilot** Tab or **Copilot** Tab.
- 3) Scroll the list to find **SELCAL**.
- 4) Touch the **SELCAL ID** Button.
- 5) Enter the assigned 4 character SELCAL Code and touch the **ENTER** Button.
- 6) Touch the **OK** Button to confirm.

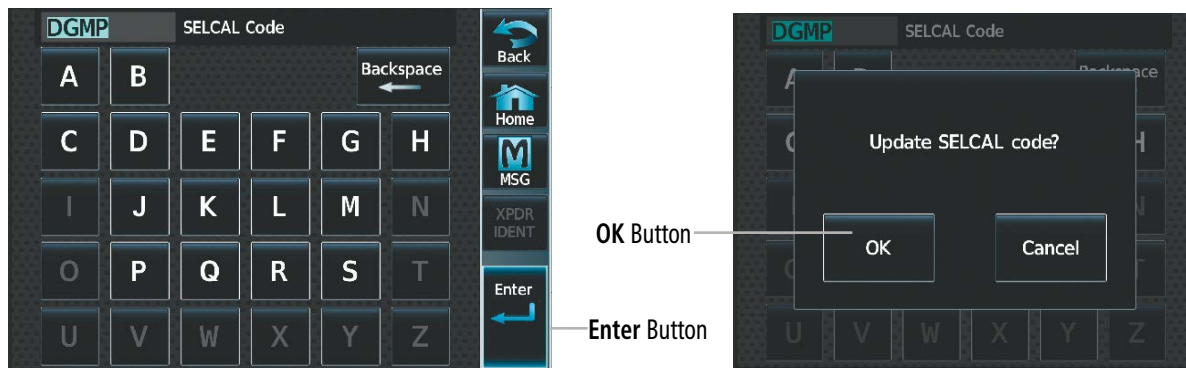


Figure 4-22 'SELCAL Code' Screen

### Selecting/deselecting SELCAL

- 1) From NAV/COM Home, touch **Audio & Radios** Button.
- 2) Touch the **Pilot** Tab or **Copilot** Tab.
- 3) Scroll the list to find **SELCAL**.
- 4) Touch the **SELCAL** Button.





Figure 4-23 SELCAL on 'Audio & Radios' Screen

## RECEIVING AND ACKNOWLEDGING SELCAL TRANSMISSIONS

Incoming SELCAL transmissions are accompanied by an aural alert and a visual annunciation. If SELCAL visual annunciations are not acknowledged, subsequent aural alerts for incoming SELCAL transmissions will be inhibited. If a SELCAL transmission is received, a flashing **SELCAL** will display over the **Audio & Radios** Button on the 'NAV/COM Home' Screen.



Figure 4-24 SELCAL indication on the 'NAV/COM Home' Screen

Pressing the **SELCAL** Button will open the 'Audio & Radios' Screen. If a SELCAL transmission is received while viewing the 'Audio & Radios' Screen, there will be no **SECAL** Button displayed over the **Audio & Radios** Button on the 'NAV/COM Home' Screen.

Once the 'Audio & Radios' screen is open a **SELCAL ACK** Button will display over the control field of the HF radio. Touching the **SELCAL ACK** Button will clear the annunciation for the applicable incoming SELCAL transmission.

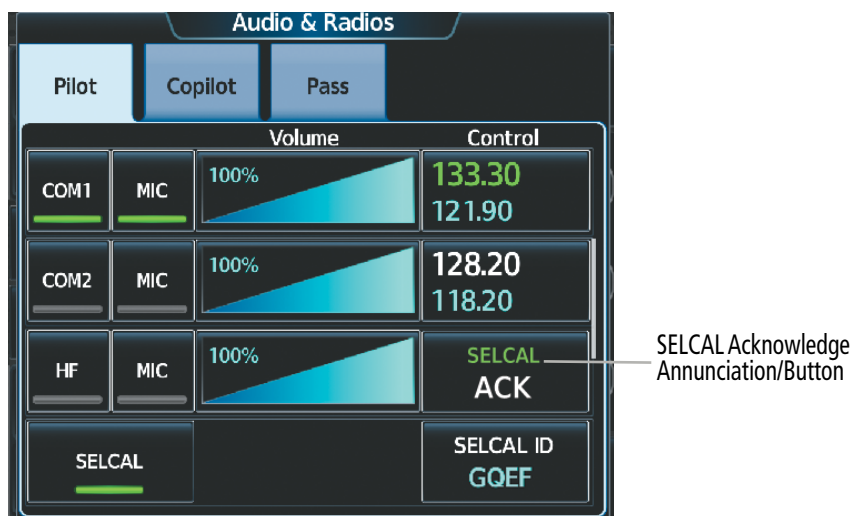


Figure 4-25 SELCAL Acknowledge Annunciation

#### Receiving and Acknowledging a SELCAL transmission:

- 1) Touch the **SELCAL** Button to display the 'Audio & Radios' Screen.
- 2) Touch the **Pilot** Tab or **Copilot** Tab.
- 3) Scroll the list to find the **SELCAL ACK** Button.
- 4) Touch the **SELCAL ACK** Button.
- 5) Touch the **HF** Button and **MIC** Buttons to receive and transmit on this radio.

## 4.2 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 or by pressing the **Active NAV** Softkey on the PFD. The NAV frequency selected for navigation is displayed in green. Touching the **Nav Source** Button/**Active NAV** Softkey once selects NAV1 as the navigation radio. Touching the **Nav Source** Button/**Active NAV** Softkey a second time selects NAV2 as the navigation radio. Touching the **Nav Source** Button/**Active NAV** Softkey a third time activates FMS mode. Touching the **Nav Source** Button/**Active NAV** Softkey again cycles back to NAV1.

The three navigation modes that can be selected are:

- VOR1 (or LOC1) – If NAV1 is selected, a green single line arrow (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.
- FMS – If FMS 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.

NAV1 Active Frequency and ID displayed on the PFD



Active NAV Softkey on the PFD.

NAV Source Button

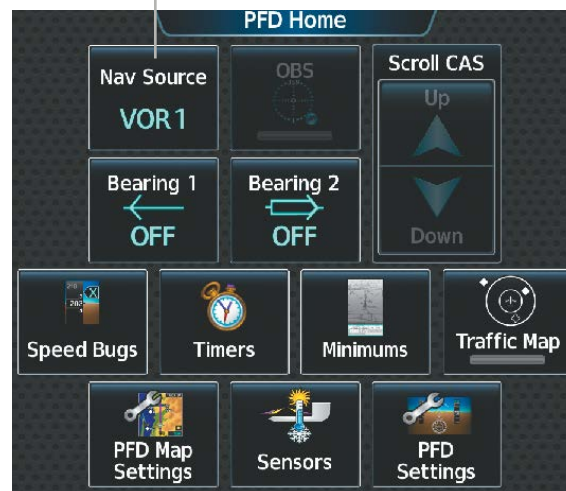


Figure 4-26 Selecting a NAV Radio for Navigation

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 pressing 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.



Figure 4-27 Selecting a NAV Radio for Monitoring

**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.

**NAV RECEIVER TUNING**

The NAV frequencies are tuned from the Touchscreen Controller.

**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/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) To accept the new frequency as the NAV1 or NAV2 standby frequency touch the **Enter** Button.

**Or:**

Push the small upper knob.

- 5) To accept the new frequency as the active frequency and transfer the previously active frequency to the standby frequency touch the **XFER** Button.

**Or:**

Push and hold the small upper knob.



**Figure 4-28 'Audio & Radios' Screen - NAV1 and NAV2 Frequency Tuning**



**Figure 4-29 NAV Frequency Tuning Window**

**NAV frequency tuning using the NAV volume slider buttons:**

- 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.



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

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

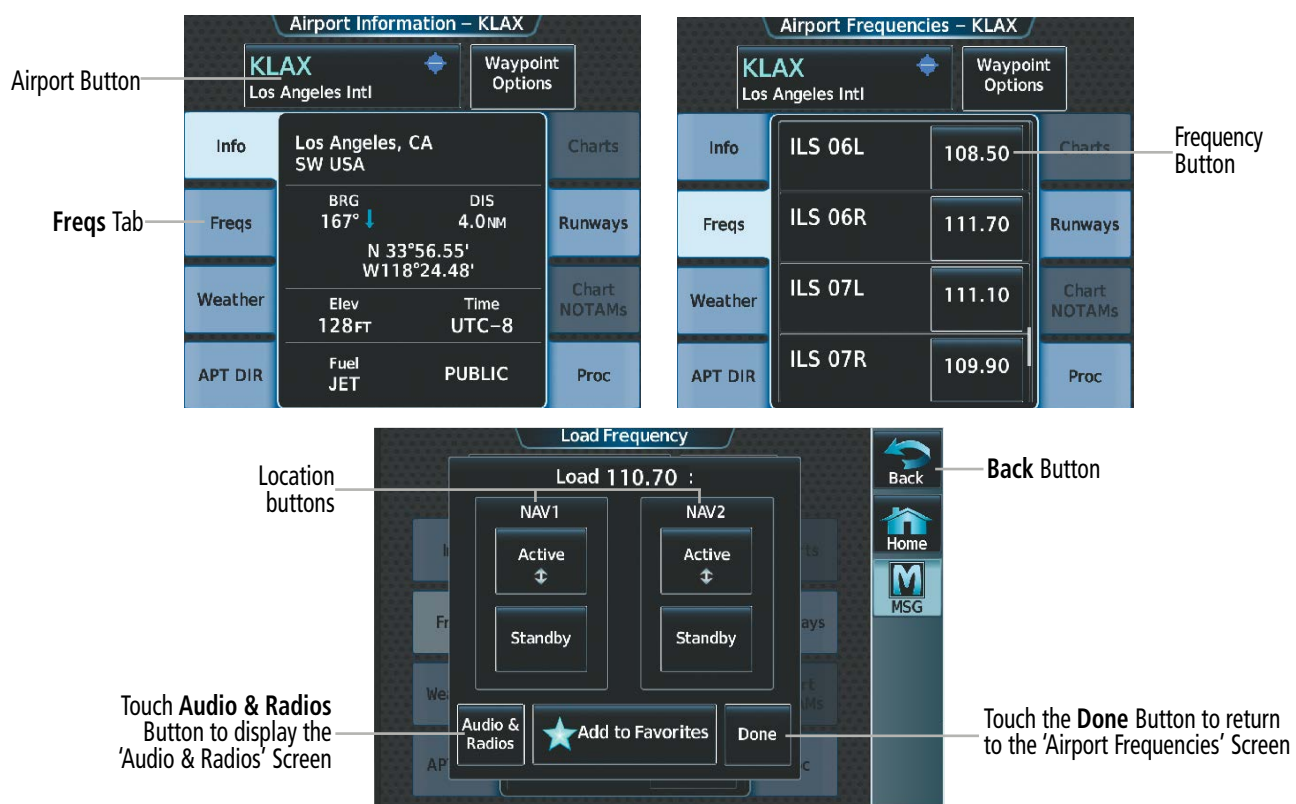


Figure 4-30 Airport Information Tuning

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

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

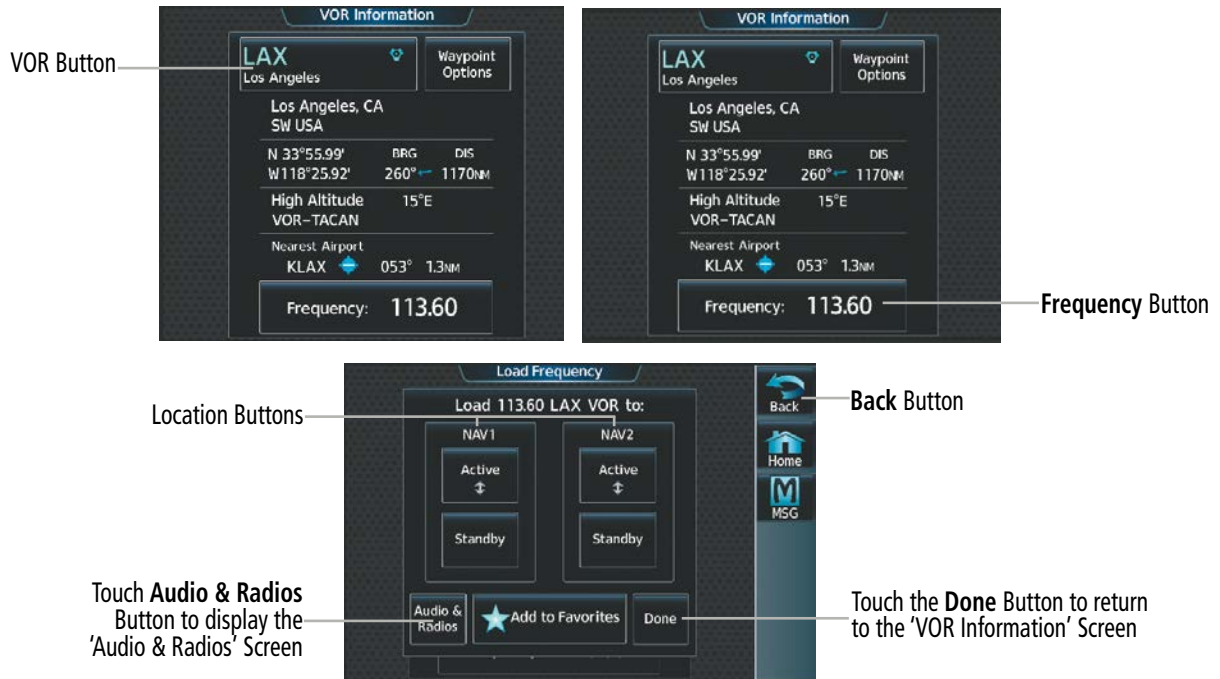


Figure 4-31 VOR Information Tuning



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

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

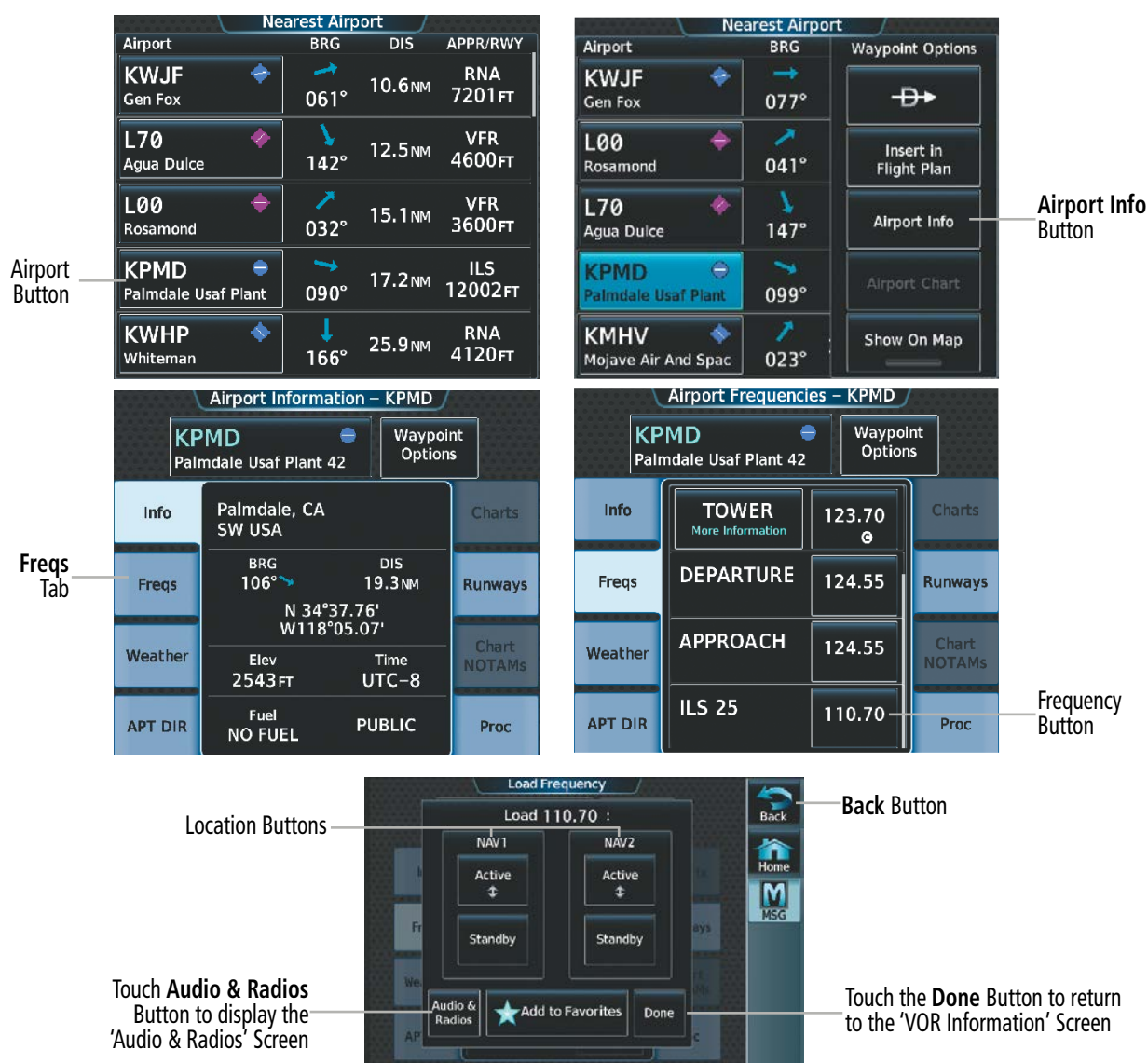


Figure 4-32 Nearest Airport Tuning

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

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

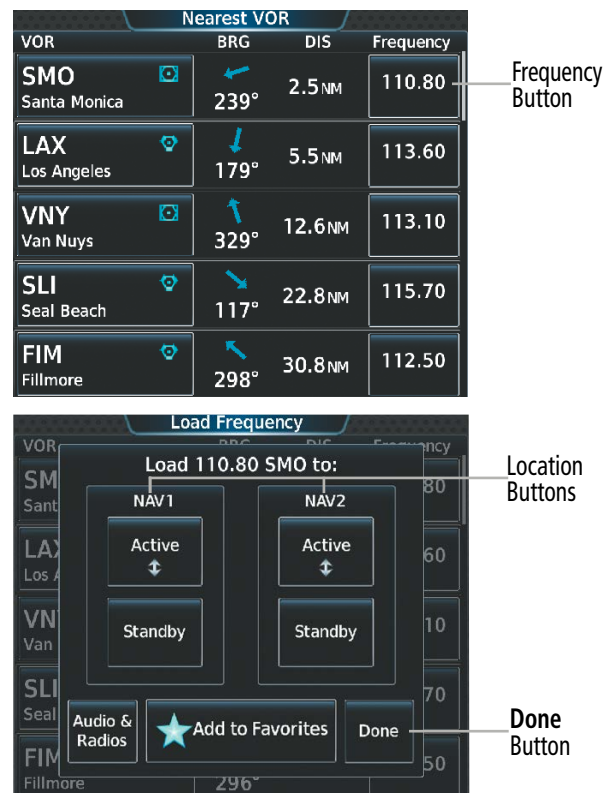


Figure 4-33 Nearest VOR Tuning

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

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

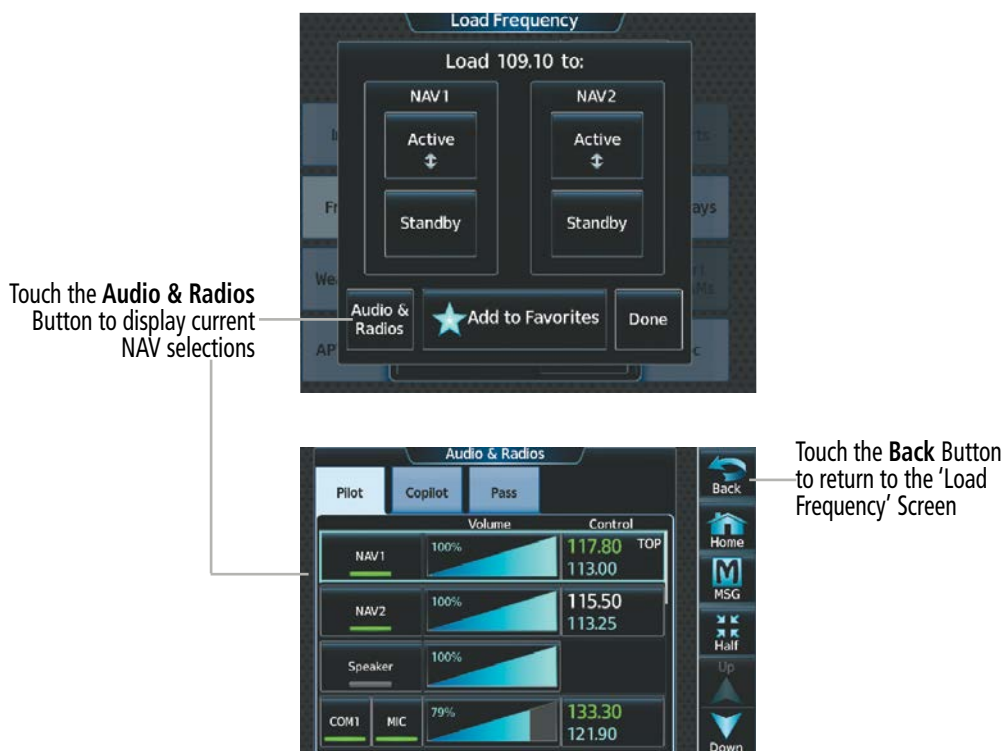


Figure 4-34 Viewing current NAV selections before loading a new Frequency

## VOR/LOC ID

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

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

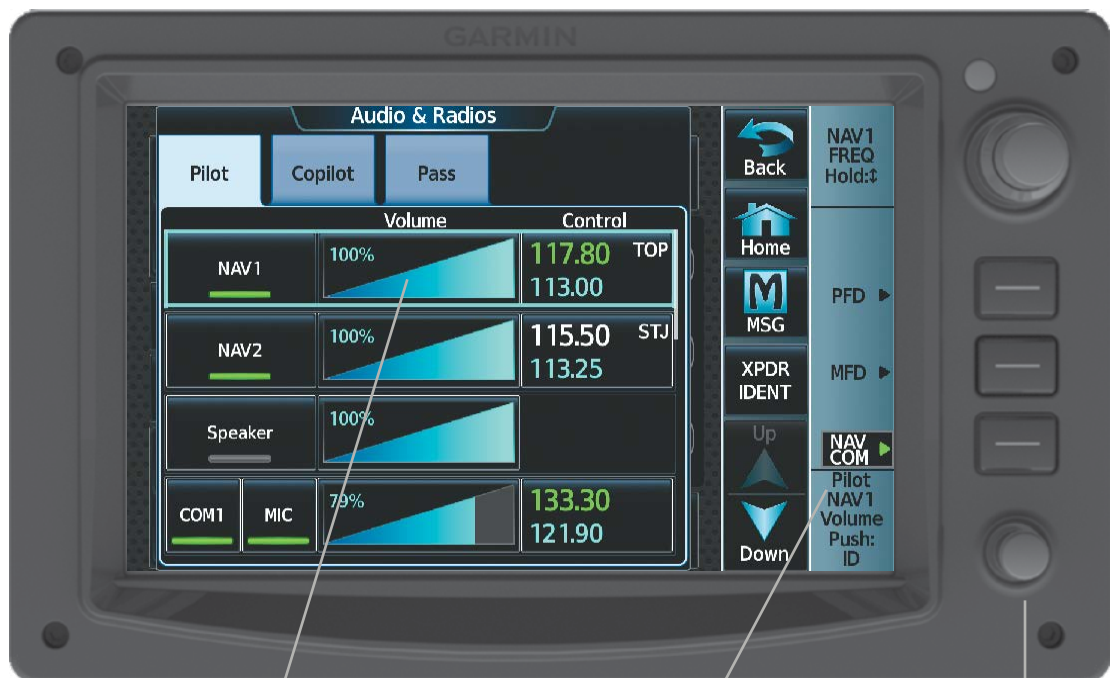


Figure 4-35 VOR/LOC ID Locations

## VOLUME

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

NAV Radio volume for the pilot and copilot can be controlled independently. Select the Pilot or Copilot Tab 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.




Selected NAV volume


Lower knob Function Label - Indicates when Pilot/Copilot and NAV1/NAV2 volume is being controlled.

Lower Knob - Turn to adjust COM volume

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 FMS Mode, the system switches to NAV Mode as the final approach course is intercepted (within 15 nm of the FAF). See the Flight Management Section for details.

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

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

Table 4-2

MARKER BEACON RECEIVER

- 

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

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

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

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

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





Figure 4-37 Marker Beacon Controls

During marker beacon audio reception, pressing the flashing **MUTE** Button on the 'NAV/COM Home' Screen mutes the audio but does not affect the marker annunciations on the PFD. 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 4-38 Marker Beacon Flashing Mute Button

## ADF/DME TUNING

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

The system tunes the optional ADF receiver and DME transceiver. The ADF is tuned by entering the frequency in the ADF standby frequency field of the Audio & Radios Screen on the Touchscreen Controller.

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

The following ADF/DME information is displayed on the Touchscreen Controller:

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



Figure 4-39 ADF/DME Tuning

The selected ADF/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.



## ADF TUNING

ADF frequencies in the 190.0-kHz to 1799.5-kHz range are entered in the standby ADF frequency field. The system does not tune the ADF emergency frequency, 2182.0-kHz.

### Selecting an ADF frequency:

- 1) From NAV/COM Home, touch the **Audio & Radios** Button to display the 'Audio & Radios' Screen.
- 2) Scroll the list to find the ADF.
- 3) Touch the ADF Control Button to display the 'ADF Standby' Screen.
- 4) Use the keypad to select the desired frequency.

#### Or:

Turn the large and small upper knobs to tune the frequency (Large knob increases/decreases kHz; Small knob selects .5 kHz).

- 5) Touch the **Enter** Button to enter the new frequency as the ADF standby frequency.

#### Or:

Push the small upper knob to enter the new frequency as the ADF standby frequency.

#### Or:

Touch the **XFER** Button to transfer the new standby frequency to the active frequency.

#### Or:

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



Figure 4-40 ADF Mode/Tuning Window

**Finding and selecting an ADF frequency:**

- 1) From NAV/COM Home, touch the **Audio & Radios** Button to display the 'Audio & Radios' Screen.
- 2) Scroll the list to find the ADF.
- 3) Touch the ADF Control Button to display the 'ADF Standby' Screen.
- 4) Touch the **Find** Button to display the 'Find ADF Frequency' Screen.
- 5) Touch the tab for the desired type of frequency (Recent, Nearest, Dest, Flight Plan, or Favorite).
- 6) Scroll the list to find the desired frequency.
- 7) Touch the frequency button to load the new frequency into the standby frequency field on the 'ADF Standby' Screen.
- 8) Touch the **Enter** Button to enter the new frequency as the ADF standby frequency.

**Or:**

Push the small upper knob to enter the new frequency as the ADF standby frequency.

**Or:**

Touch the **XFER** Button to transfer the new standby frequency to the active frequency.

**Or:**

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

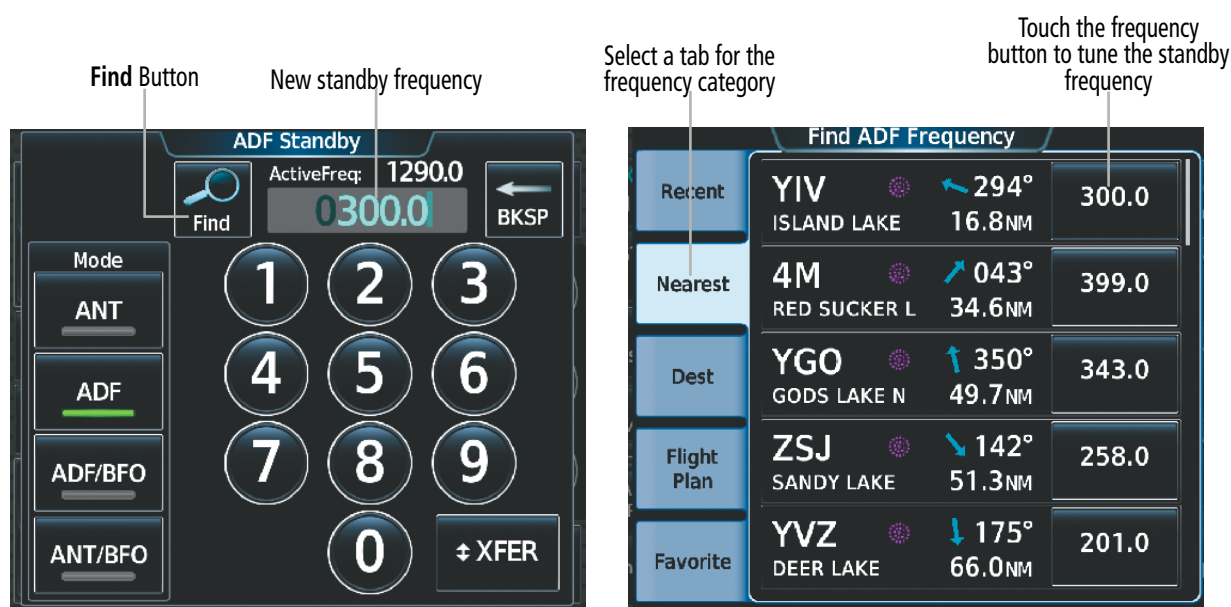


Figure 4-41 ADF Frequency Tuning

**Transferring the active and standby ADF frequencies:**

- 1) From NAV/COM Home, touch the **Audio & Radios** Button to display the 'Audio & Radios' Screen.
- 2) Scroll the list to find the ADF.
- 3) Touch the ADF volume slider to select the ADF for transfer.
- 4) Push and hold the small upper knob to transfer the frequencies.

**SELECTING ADF RECEIVER MODE**

The following modes can be selected: (In all modes NDB audio can be heard by selecting the **ADF** Button on the Touchscreen Controller.)

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

**Selecting an ADF receiver mode:**

- 1) From NAV/COM Home, touch the **Audio & Radios** Button to display the 'Audio & Radios' Screen.
- 2) Scroll the list to find the ADF.
- 3) Touch the ADF Control Button to display the 'ADF Standby' Screen.
- 4) Touch the **ANT**, **ADF**, **ADF/BFO**, or **ANT/BFO** Button to select the ADF mode.

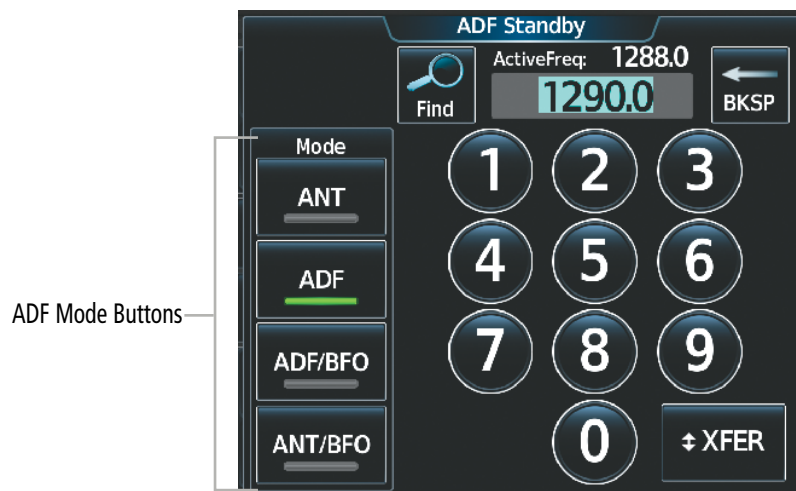


Figure 4-42 ADF Mode Selection

## 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.

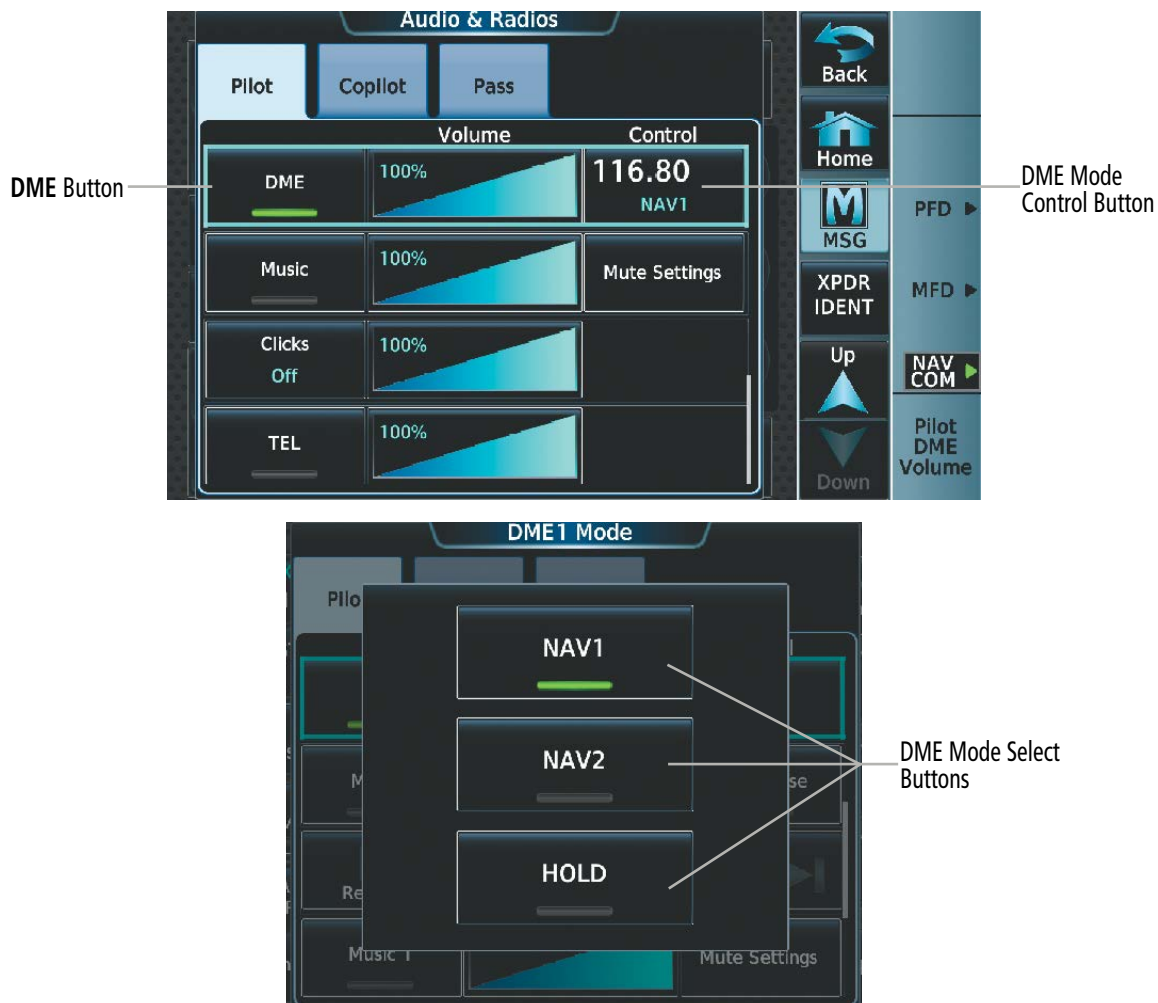


Figure 4-43 DME Mode Selection

**Selecting a DME mode:**

- 1) From NAV/COM Home Screen, touch the **Audio & Radios** Button to display the 'Audio & Radios' Screen.
- 2) Scroll the list to find the **DME** Button.
- 3) Touch the DME Mode Control Button to display the 'DME1 Mode' Screen.
- 4) Touch the **NAV1**, **NAV2**, or **HOLD** Button to select desired DME mode. DME information will be displayed on the PFD in the Active NAV Source/Frequency Box. An 'H' next to the frequency indicates DME Hold mode.



**Figure 4-44 DME Hold Mode on PFD**

## 4.3 TRANSPONDER(S)

The system is equipped with one or two Mode S transponders. One of the transponders can be equipped with the optional Diversity configuration which incorporates antennas mounted on the top and bottom of the aircraft for dependable operation while maneuvering. The Mode S Transponder provides Mode A, Mode C, and Mode S interrogation and reply capabilities. Selective addressing or Mode Select (Mode S) capability includes the following features:

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

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

### TRANSPONDER CONTROLS

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



Figure 4-45 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 **XPDR1** or **XPDR2**.

### Selecting active transponder:

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

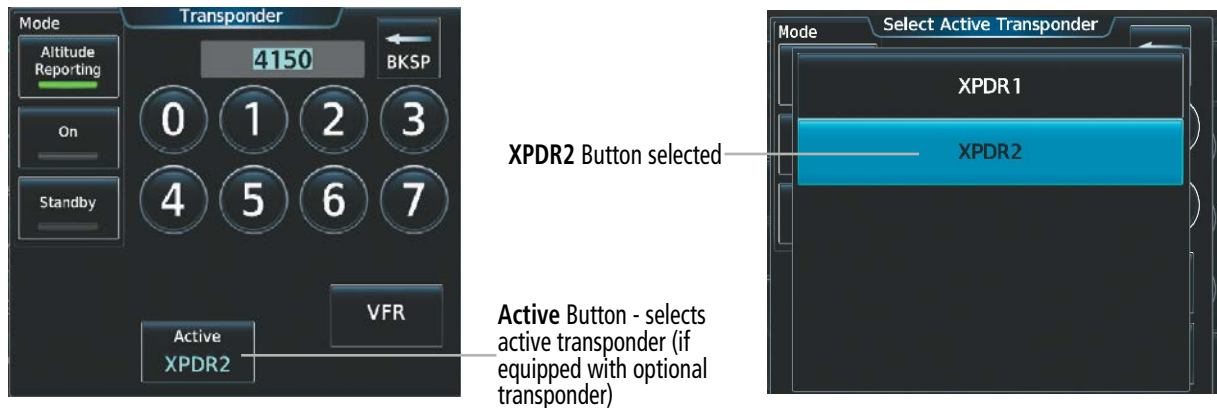


Figure 4-46 Transponder Selection

## 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 desired transponder mode.

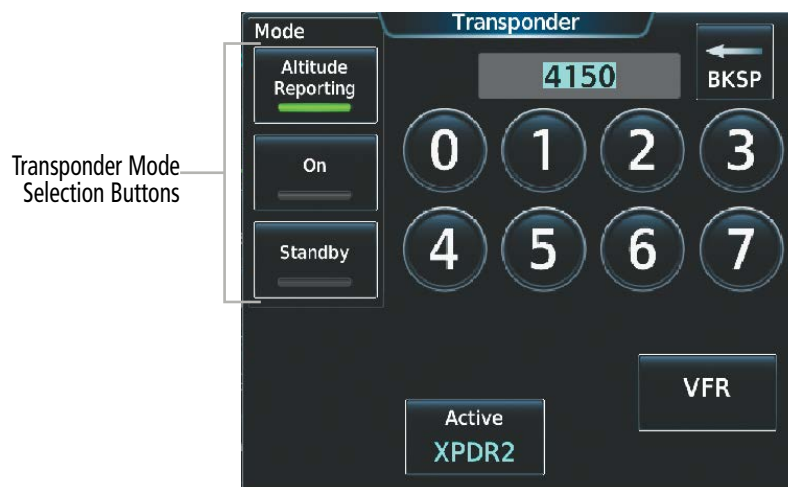


Figure 4-47 Active Transponder and Transponder Mode Selection



## STANDBY MODE



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

Standby Mode can be selected at any time by selecting 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 4-48 Standby Mode

## MANUAL ON MODE

ON Mode can be selected at any time by touching the **ON** Button. 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 4-49 On Mode

## ALTITUDE REPORTING MODES

The white ALT Mode is normally selected automatically when the aircraft is on the ground or airborne. ALT mode can also be selected manually by touching the **Altitude Reporting** Button on the 'Transponder' Screen. When ALT mode is selected, an ALT indication will appear on Transponder Code/Mode Button. Selecting ALT 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.

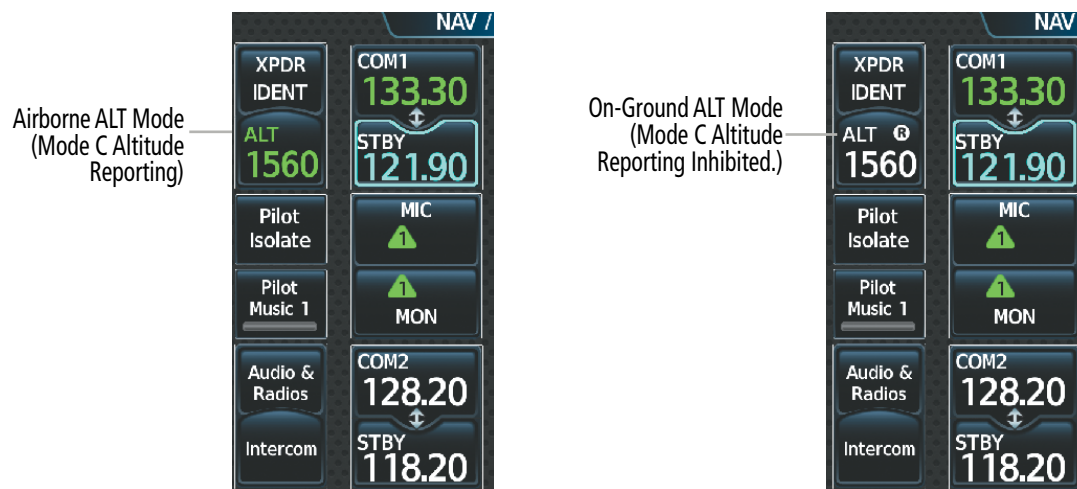


Figure 4-50 Altitude Reporting Mode

## REPLY STATUS

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

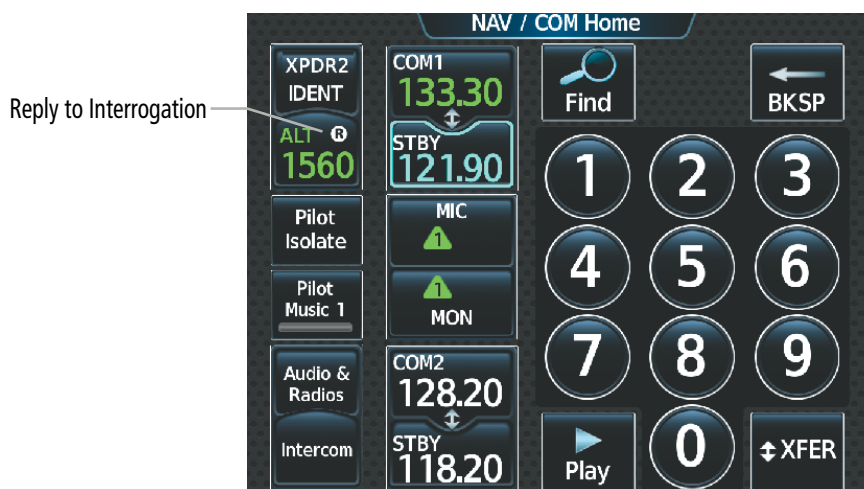


Figure 4-51 Transponder Reply Indication

## ENTERING A TRANSPONDER CODE

### Entering a transponder code with the keypad:

- 1) From NAV/COM Home, 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 4-52 Transponder Code Entry

### Entering a transponder code with the knobs:

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

Pressing 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 selecting the **VFR** Button. When the **VFR** Button is selected, the pre-programmed VFR code is automatically displayed in the Transponder Code/Mode 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.



Figure 4-53 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 'NAV/COM Home' Screen 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 the **IDENT** or **XPDR IDENT** Button is touched, the word IDENT appears in green on the Active Transponder **IDENT** Button and pulsates for the duration of the identity indication.

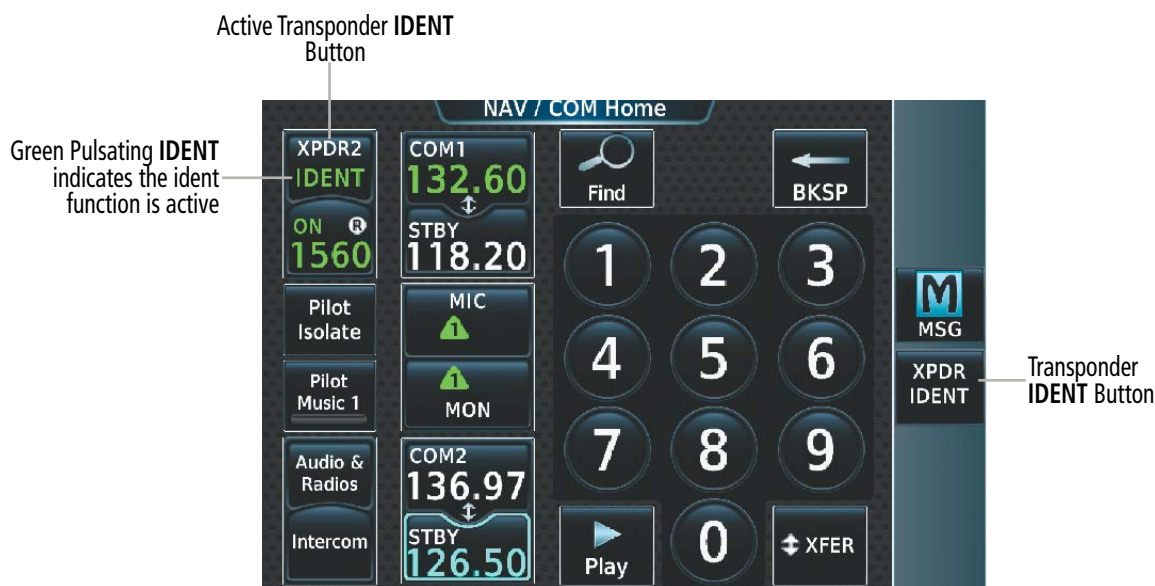


Figure 4-54 Transponder IDENT Controls

## 4.4 ADDITIONAL AUDIO FUNCTIONS

### MONO/STEREO HEADSETS

Stereo headsets are recommended for use in this aircraft.

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

### SPEAKER

All of the radios can be heard over the speaker. Pressing the **Speaker** Button selects and deselects the cockpit speaker. Speaker audio is muted when the PTT is pushed. Certain aural alerts and warnings are always heard on the speaker, even when the speaker is not selected.

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



Figure 4-55 Cockpit Speaker Audio Selection

### INTERCOM

The G3000 includes an eight-mode intercom system (ICS) that connects or isolates the pilot, copilot, and passengers. Touch the **Intercom** Button on the 'NAV/COM Home' Screen to display the 'Intercom' Screen. The intercom links between the Pilot, Copilot, and Passengers are enabled/disabled by touching the connecting arrows. A green arrow indicates positions are connected. A gray arrow indicates positions are not connected.

#### Enabling/Disabling Intercom Connections:

- 1) From NAV/COM Home, touch the **Intercom** Button.
- 2) Touch link arrow to enable/disable connection between desired positions.



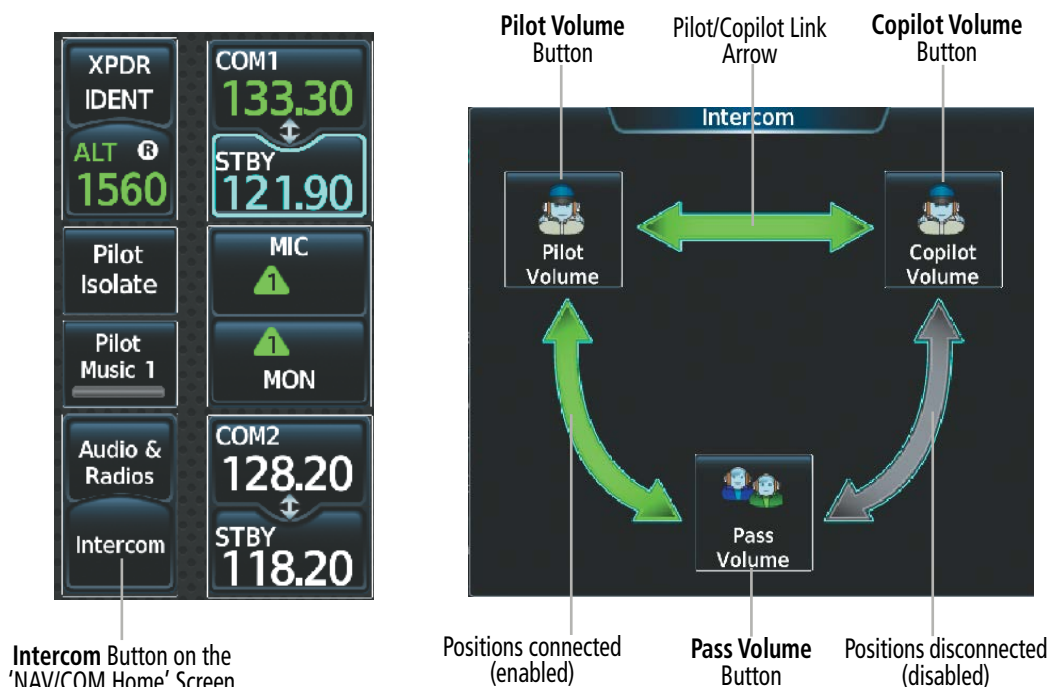


Figure 4-56 Intercom Controls

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

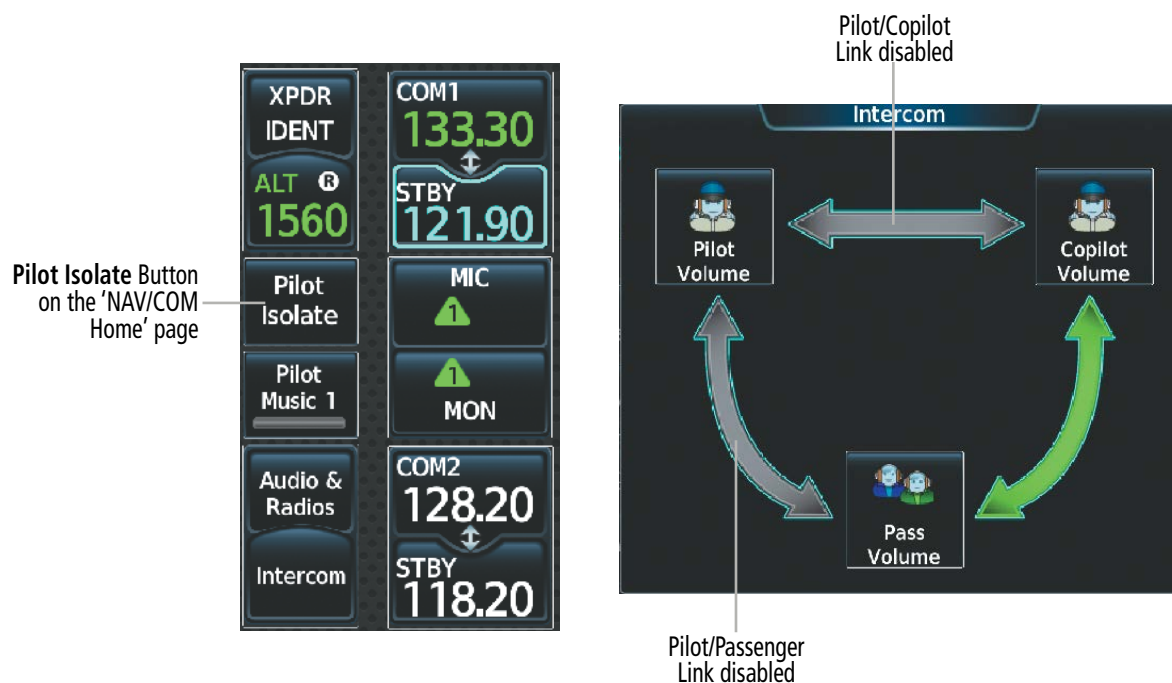


Figure 4-57 Pilot Isolation Button

## INTERCOM VOLUME AND SQUELCH

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

### Adjusting the intercom volume:

- 1) From NAV/COM Home, touch the **Intercom** Button to display the 'Intercom' Screen.
- 2) Touch the **Pilot Volume**, **Copilot Volume**, or **Pass Volume** Button to display the intercom settings screen.
- 3) Adjust the volume by using the middle knob.

#### Or:

Slide your finger on the volume slider.

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

### Adjusting the intercom squelch:

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

#### Or:

Slide your finger on the squelch adjustment slider.



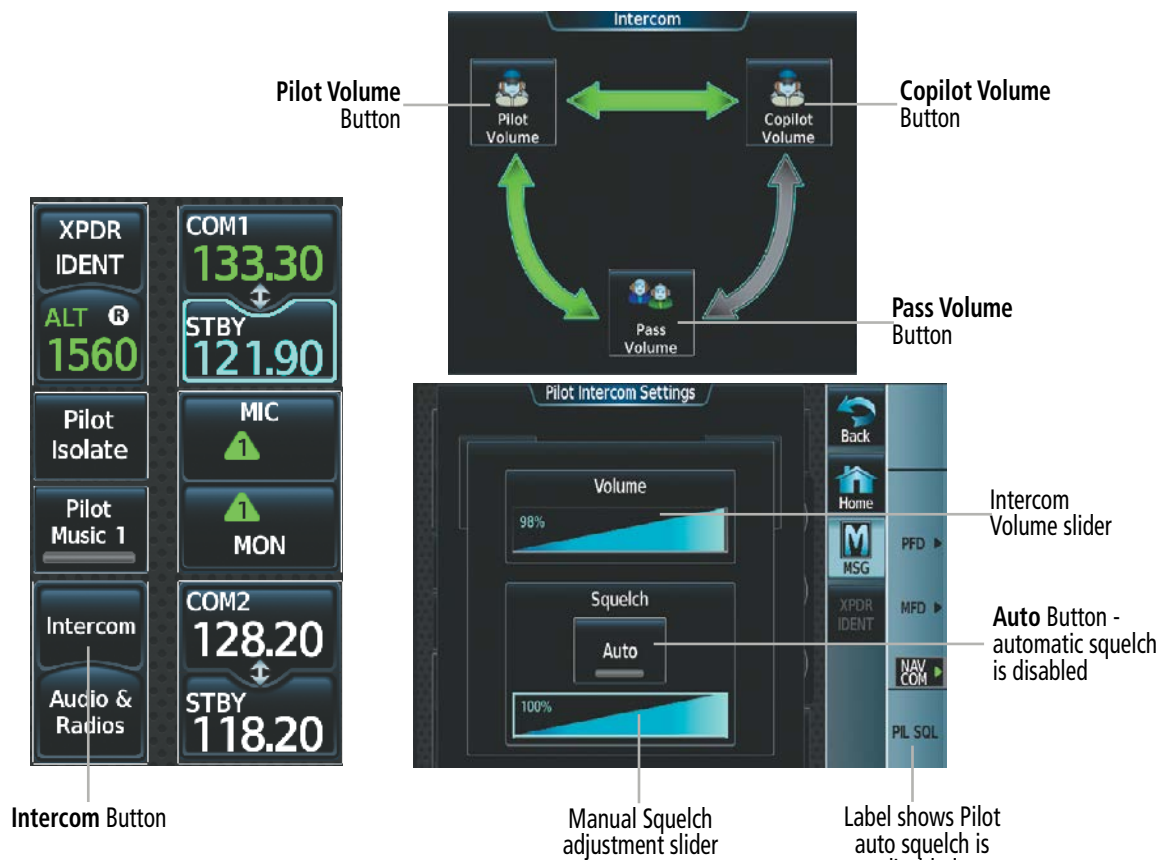


Figure 4-58 Intercom Volume and Squelch Controls

## PASSENGER ADDRESS (PA) SYSTEM



**NOTE:** When selecting the Passenger Address (PA) System, COM monitoring is retained only when the COM is manually monitored.

A passenger address system is available for delivering voice messages over the cabin speaker. When the **PA** Button is selected on the Touchscreen Controller, the MIC Annunciation is replaced with a green PA annunciation, and the active COM frequency changes to white indicating that no COM is selected for transmission. The active COM frequency on the PFD is replaced by a green PA annunciation. A Push-to-Talk (PTT) must be pressed to deliver PA announcements. The PA Annunciation flashes about once per second while the PTT is depressed.



Figure 4-59 PA Button and Annunciations

### Selecting the PA system for transmission:

- 1) From NAV/COM Home, touch the **Audio & Radios** Button to display the 'Audio & Radios' Screen.
- 2) Scroll the list to find the **PA** Button.
- 3) Touch the **PA** Button to enable PA for transmission.

## 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 have 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 **Stop** Button or the **Recorder** (Stop)

Button is displayed while the audio is playing. When the present memory block has finished playing, the **Play** Button and the **Recorder** (Play) Button are displayed again.

Touching the **Stop** Button or 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 press 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 press of the Play Next Button selects the next recorded memory block, if any more exist.

Removing power from the system clears all recorded memory blocks.



Figure 4-60 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.) will be 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 wear 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 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 or Copilot L-R Swap Button.



Figure 4-61 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** and **Copilot** Tabs. 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 4-62 Simultaneous COM Operation

## AUXILIARY AUDIO

Auxiliary audio provides SiriusXM Radio Audio from the Data Link Receiver and stereo auxiliary entertainment inputs. These inputs are compatible with popular portable entertainment devices such as MP3 players, cell phones, and tablets.

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

Auxiliary audio is controlled with the **Pilot Music 1** Button and **Music** Button located on the 'NAV/COM Home' and 'Audio & Radios' Screens.

### Selecting/Deselecting Auxiliary Audio:

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

Or:

- 1) From NAV/COM Home, touch the **Audio & Radios** Button to display the 'Audio & Radios' Screen.
- 2) Touch the **Pilot, Copilot, or Pass** Tab.
- 3) Scroll the list to find the **Music** Button (pilot/copilot) or the **Music 1** Button (passenger).
- 4) Touch the **Music** Button or **Music 1** Button to enable/disable audio input.

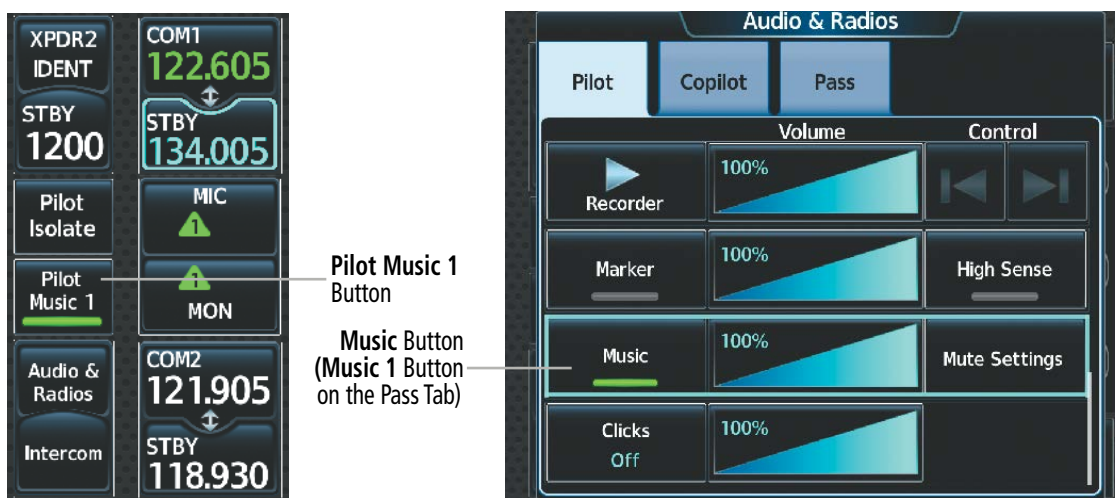


Figure 4-63 Auxiliary Audio Controls

The auxiliary audio (music) 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.



## AUXILIARY AUDIO MUTING

Auxiliary audio muting occurs when the configured activity (intercom, radio inputs, and/or aural alerts) is heard or when there is an alert. 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. Aural alerts (Pilot and Copilot only) cannot be deselected.

### Configuring Auxiliary Audio Mute Settings:

- 1) From NAV/COM Home, touch the **Audio & Radios** Button to display the 'Audio & Radios' Screen.
- 2) Touch the **Pilot** or **Copilot** Tab.
- 3) Scroll the list to find the **Music** Button.
- 4) Touch the **Mute Settings** Button to display the 'Music Mute Settings' Window.
- 5) Touch the **Intercom**, and/or the **Radio Inputs** Button to select which items will mute auxiliary audio. The **Aural Alerts** Button cannot be deselected.

Or:

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

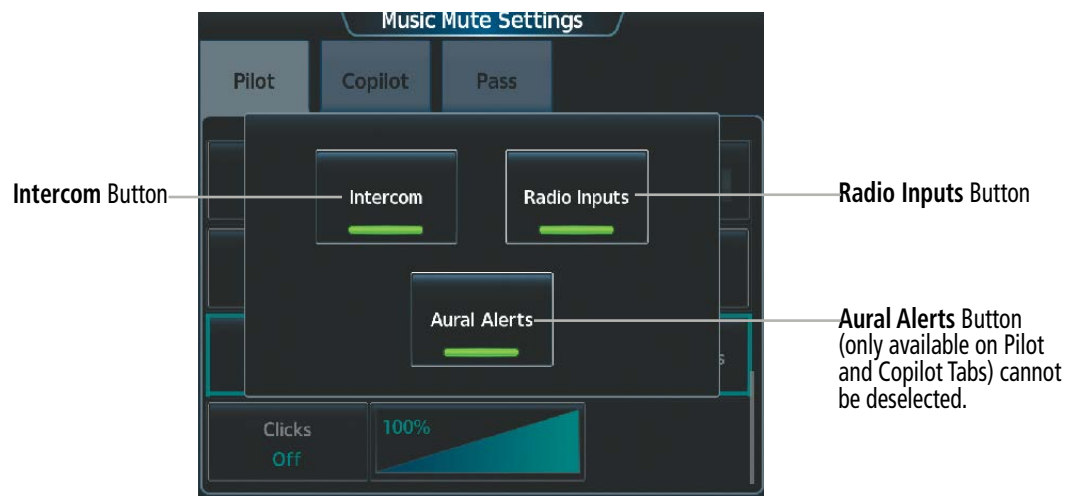


Figure 4-64 Music Mute Controls



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.

Configuring audio feedback:

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

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

Table 4-3 Audio Feedback Settings

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.



Figure 4-65 Audio Feedback (Clicks) Selection

## TELEPHONE (TEL)

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

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



**Figure 4-66 TEL Button Selected**

## 4.5 ABNORMAL OPERATION

Abnormal operation of the G3000 includes equipment failures of the system components and failure of associated equipment, including switches and external devices. A failure of any communication or navigation system on the 'Audio & Radio' Screen will be displayed with a amber X.

### STUCK MICROPHONE

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

The **MIC** Button Annunciator 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.

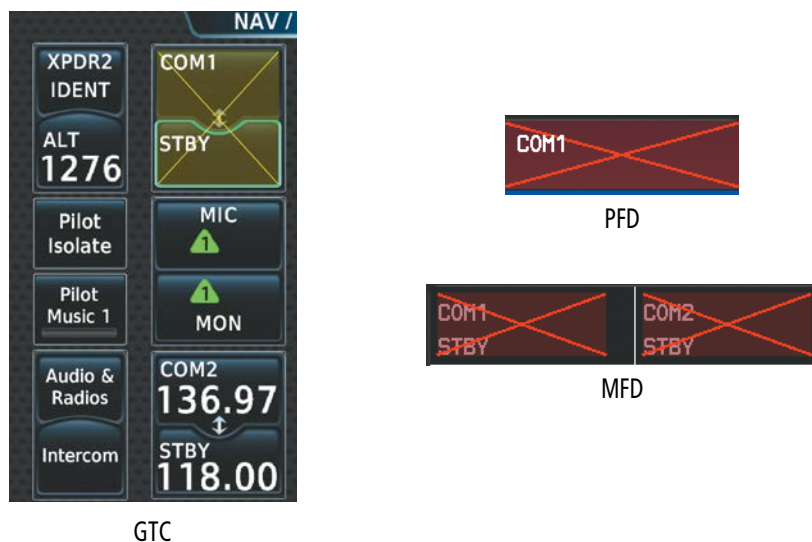


Figure 4-68 COM Failure

## 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.

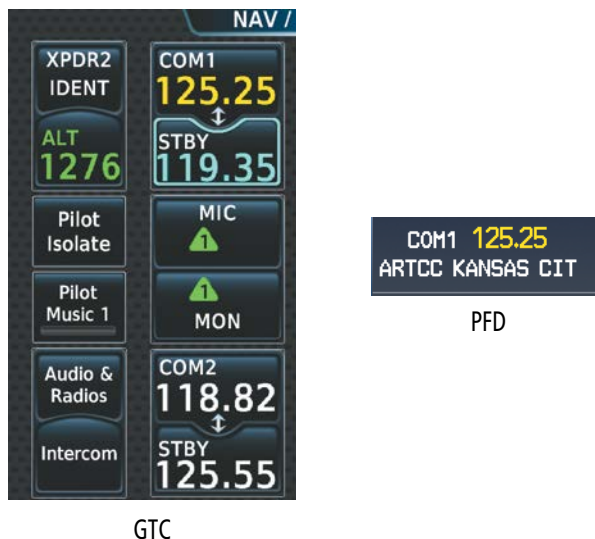


Figure 4-69 COM Tuning Failure

## 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.

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## SECTION 5 FLIGHT MANAGEMENT

### 5.1 INTRODUCTION

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

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

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

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

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

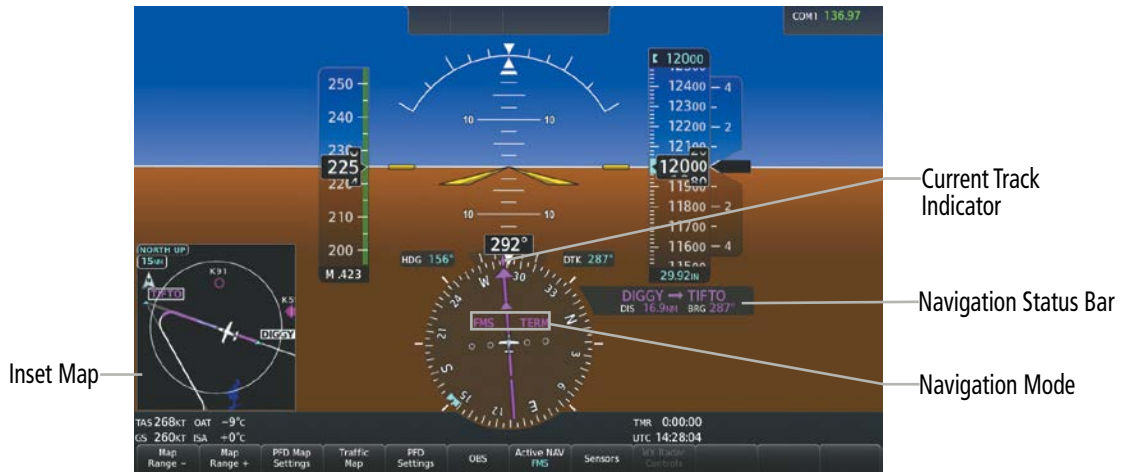


Figure 5-1 GPS Navigation Information on the PFD Inset Map



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



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



## NAVIGATION STATUS BOX / MFD NAVIGATION DATA BAR

The PFD Navigation Status Box located to the right of 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		

**Table 5-1 PFD Navigation Status Box Symbols**

The Navigation Data Bar located at the top of the MFD contains eight data fields. Each displays one of the following items:

- |  |  |
|--|--|
| - <b>BRG</b> (Bearing)                       | - <b>FOB</b> (Fuel on Board)                     |
| - <b>DEST</b> (Destination Airport)          | - <b>FOD</b> (Fuel Over Destination)             |
| - <b>DIS</b> (Distance)                      | - <b>GS</b> (Groundspeed)                        |
| - <b>DTG</b> (Distance to Go to destination) | - <b>ISA</b> (International Standard Atmosphere) |
| - <b>DTK</b> (Desired tack)                  | - <b>LDG</b> (ETA at final destination)          |
| - <b>END</b> (Endurance)                     | - <b>MSA</b> (Minimum Safe Altitude)             |
| - <b>ENR</b> (ETE to final destination)      | - <b>TAS</b> (True Airspeed)                     |
| - <b>ESA</b> (Enroute Safe Altitude)         | - <b>TKE</b> (Track Angle Error)                 |
| - <b>ETA</b> (Estimated Time of Arrival)     | - <b>TRK</b> (Track)                             |
| - <b>ETE</b> (Estimated Time Enroute)        | - <b>VSR</b> (Vertical Speed Required)           |
| - <b>FLT</b> (Flight Timer)                  | - <b>XTK</b> (Cross-track error)                 |



**Figure 5-5 MFD Navigation Data Bar**

The navigation information displayed in the eight data fields can be selected on the Touchscreen Controller. The default selections (in order left to right) are GS, DTK, TRK, ETE, BRG, DIS, MSA, and ETA.

### Changing a field in the MFD Navigation Data Bar:

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

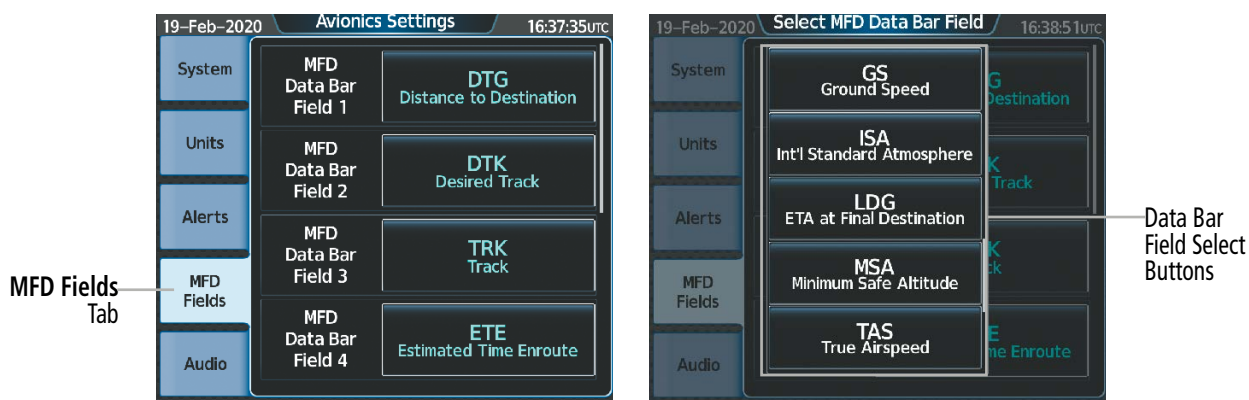


Figure 5-6 MFD Data Bar Field Selection

## 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, airspace, 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

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

### Viewing the map settings:

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

Or:

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

## MAP SETTINGS SYNCHRONIZATION

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

### Enabling/disabling map settings synchronization:

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

Or:

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



Figure 5-7 Map Settings Synchronization

## MAP ORIENTATION

Three different orientation options are available for most system map 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 pane.

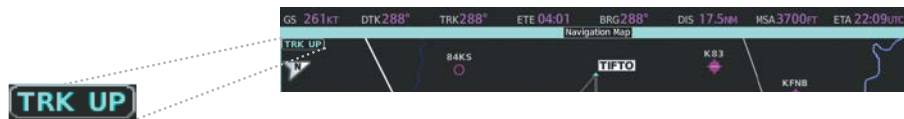
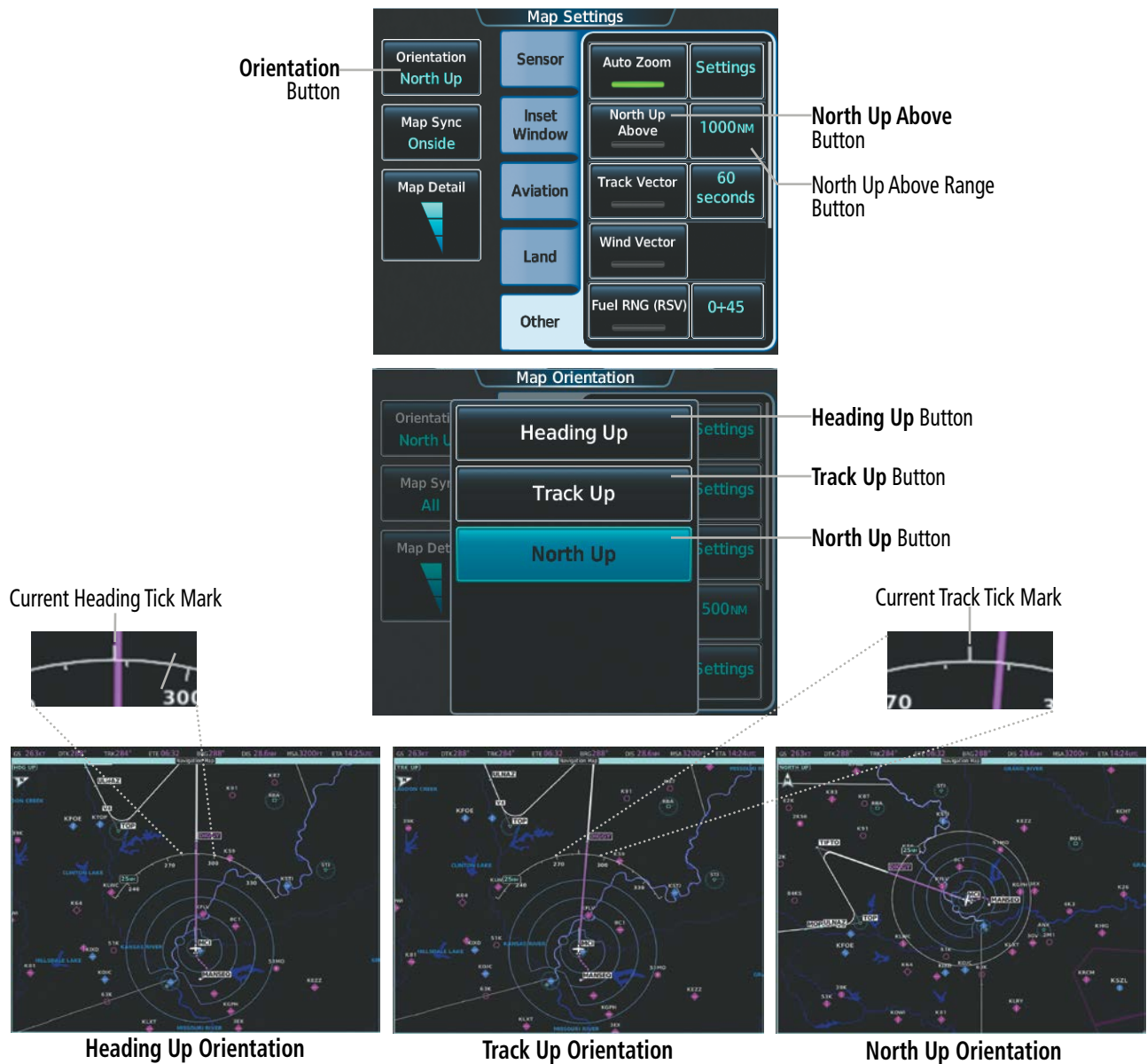


Figure 5-8 Map Orientation

- 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 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 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 Auto North Up 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.

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.

## MAP RANGE

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

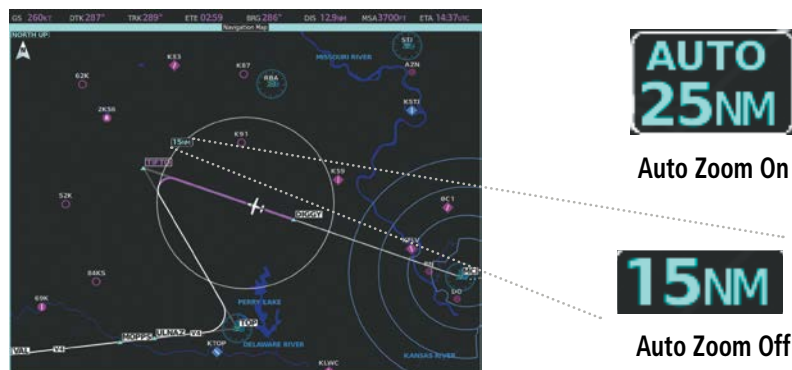


Figure 5-10 Map Range

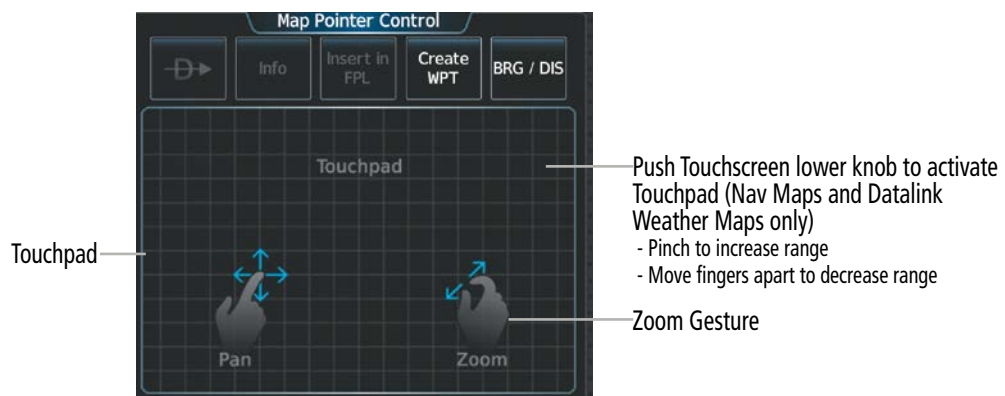


Figure 5-11 Touchpad Map Range Control

## 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. 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 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 5-12 Auto Zoom Setup

## MAP PANNING

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

- View parts of the map outside the displayed range without adjusting the map range by panning the map (the lower knob or **Touchpad**)
- Highlight and select locations on the map (the lower knob or **Touchpad**)
- Graphically initiate a Direct To a selected airport, NAVAID (VOR, Intersection, NDB), VRP, or user waypoint (**→** Button)
- Display an information screen for a selected airport, NAVAID (VOR, Intersection, NDB), VRP, user waypoint, or airspace (**Info** Button)
- Designate locations for use in flight planning (**Insert in FPL** Button)
- 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 pushing the lower knob, the Map Pointer flashes on the map, and the 'Map Pointer Control' Screen is displayed on the Touchscreen Controller. A window also appears at the upper left of the map display showing the latitude/longitude of the pointer, the bearing and distance to the pointer from the aircraft's present position, and the elevation of the land at the position of the pointer.

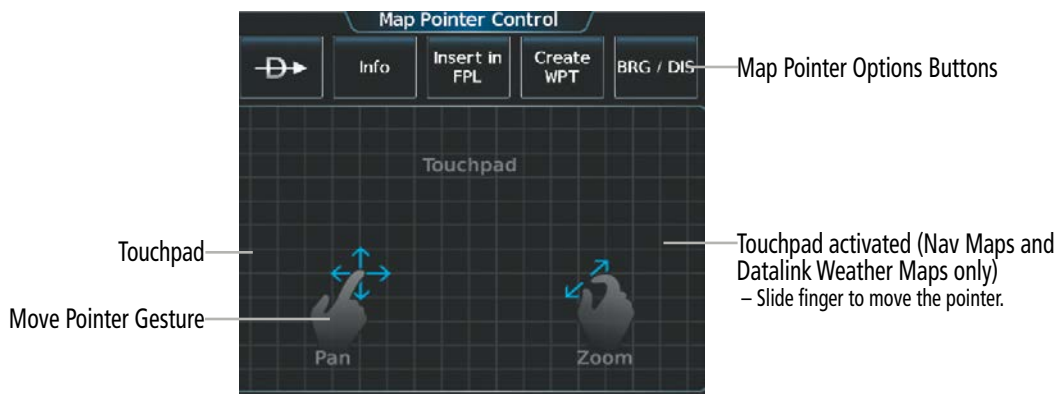


Figure 5-13 Touchpad Map Pointer Control

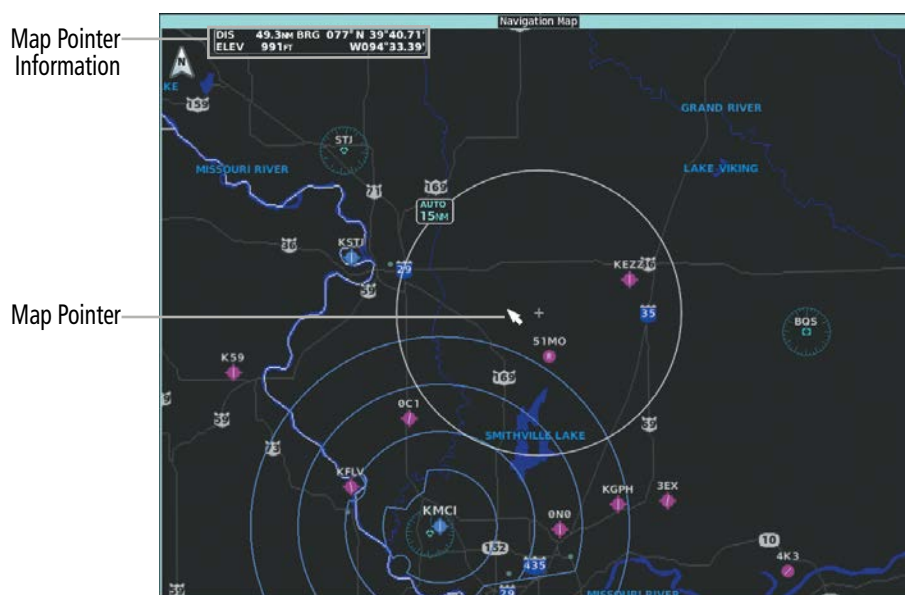


Figure 5-14 Navigation Map – Map Pointer Activated

### Panning the map:

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

### Or:

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

When the Map Pointer is placed on a waypoint (airport, intersection, NAVAID, VRP, or user waypoint), airway, or airspace boundary, the name is highlighted (even if the name was not originally displayed on the map). When placed on an airspace boundary, the name, class, ceiling and floor are shown in feet MSL. When placed on an airway, the name, Minimum Enroute Altitude, and defining waypoints and length for that airway segment are shown. When highlighting waypoints and airspace on the map display, additional pertinent information is available by touching the **Info** Button on the Touchscreen Controller.

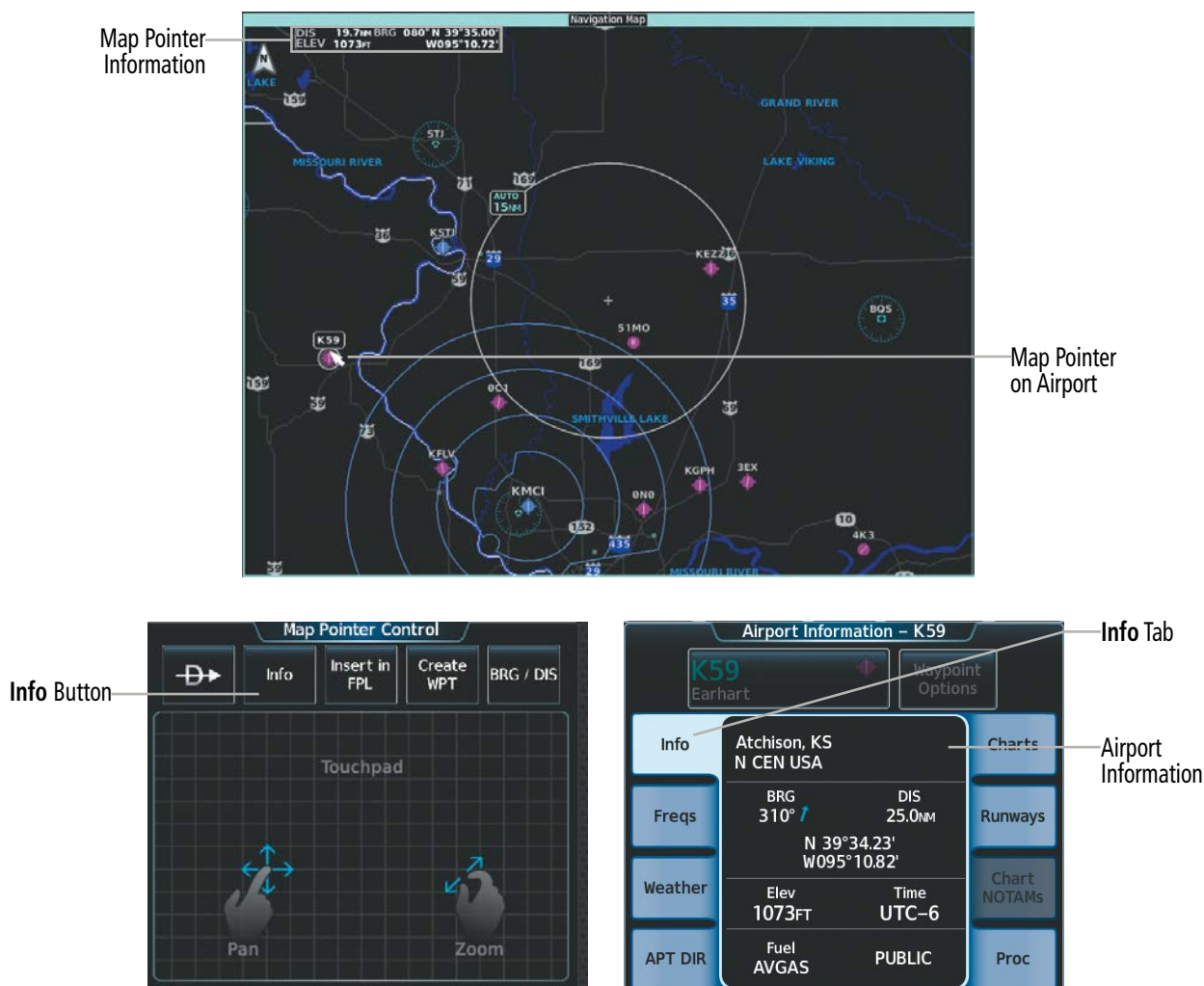


Figure 5-15 Navigation Map – Map Pointer on Waypoint

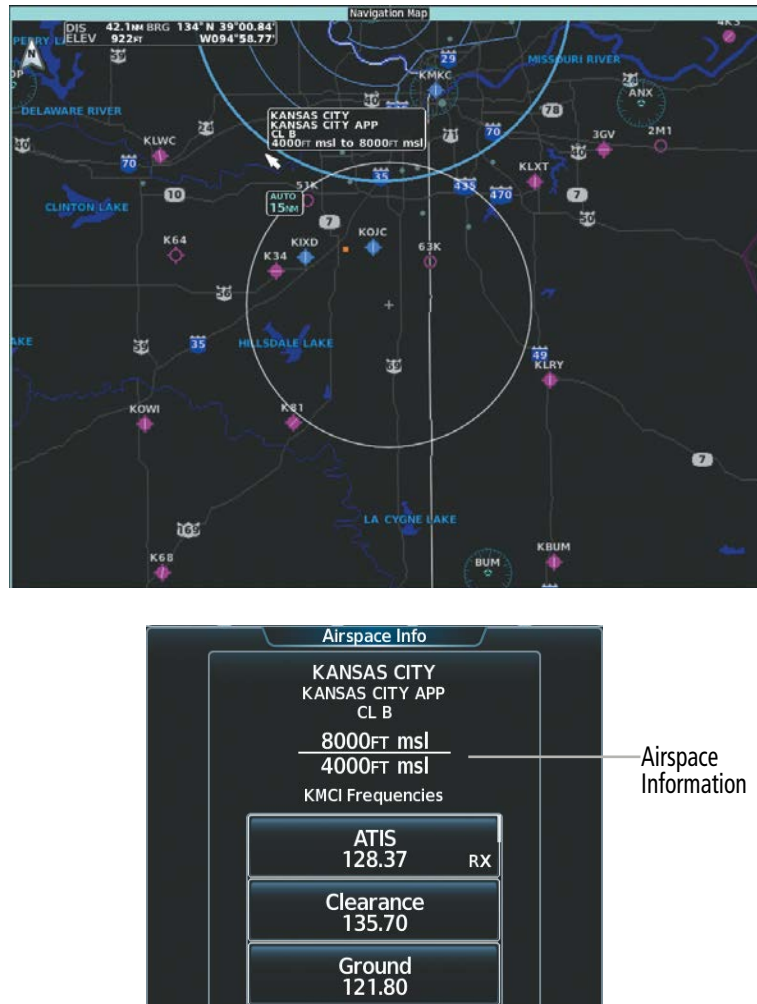


Figure 5-16 Navigation Map – Map Pointer on Airspace

#### Reviewing information for a waypoint or airspace:

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

#### Or:

Push either knob 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 using the lower knob or the **Touchpad**. Measurement can be from the aircraft's present position to any point, or between any two points. The bearing and distance tool displays a dashed Measurement Line and a Measure Pointer to aid in graphically identifying the points to measure. Latitude/Longitude, distance, bearing and elevation data of the Measure Pointer is provided in a window at the top left of the map.

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

- 1) Push the lower knob (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 lower knob, 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, push either knob, or touch the **Back** Button.

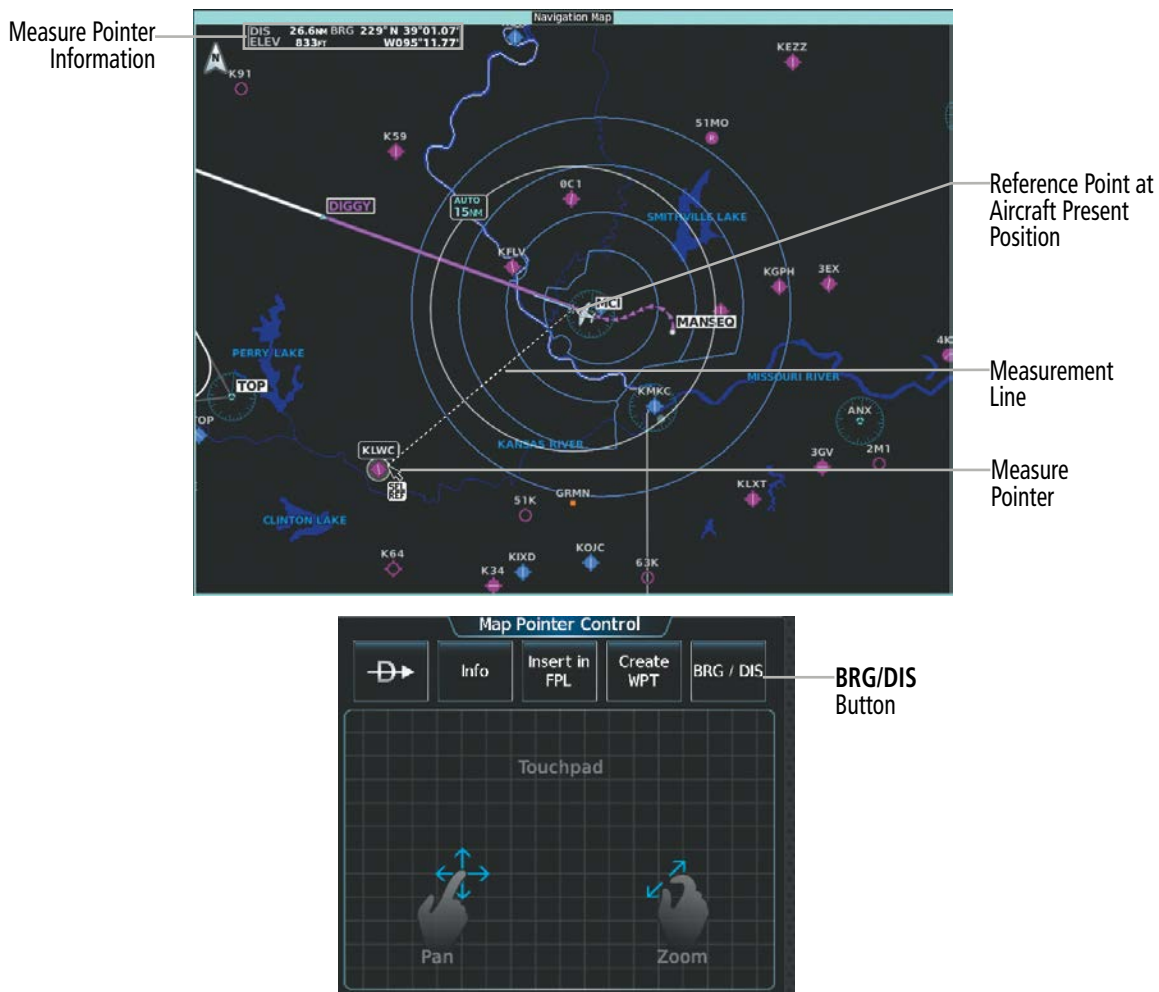


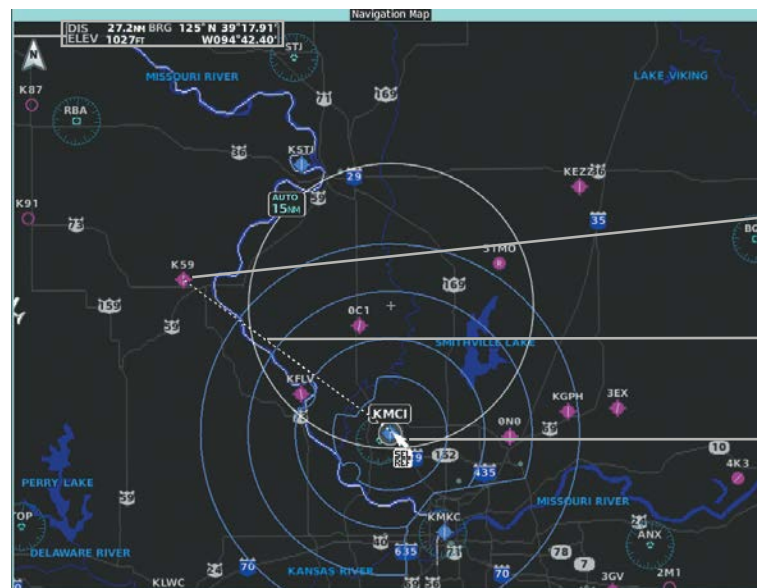
Figure 5-17 Navigation Map – Measuring Bearing/Distance from Aircraft Present Position



## Measuring bearing and distance between any two points:

- 1) Push the lower knob (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 lower knob, 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 lower knob, 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, push either knob, or touch the **Back** Button.

Measure Pointer  
Information



Reference  
Point

Measurement  
Line

Measure Pointer

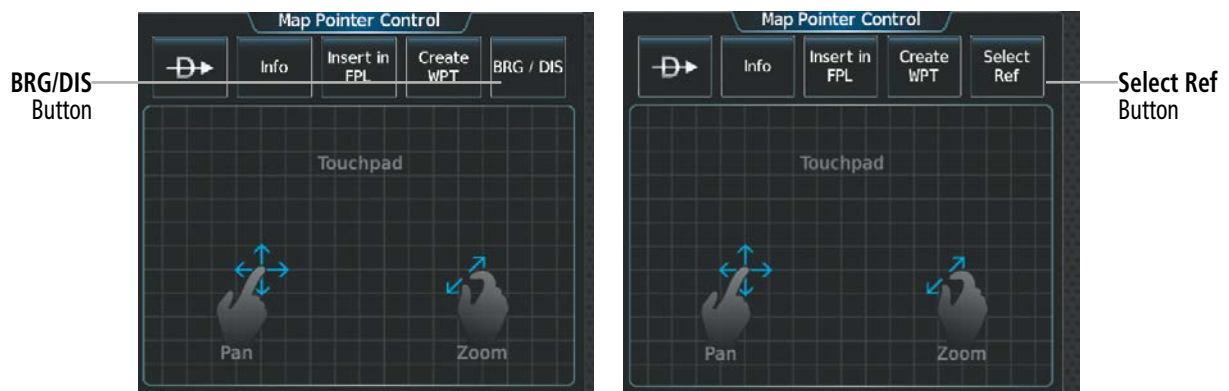


Figure 5-18 Navigation Map – Measuring Bearing/Distance between Two Points

## 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.

Relative terrain is discussed in the Hazard Avoidance Section.

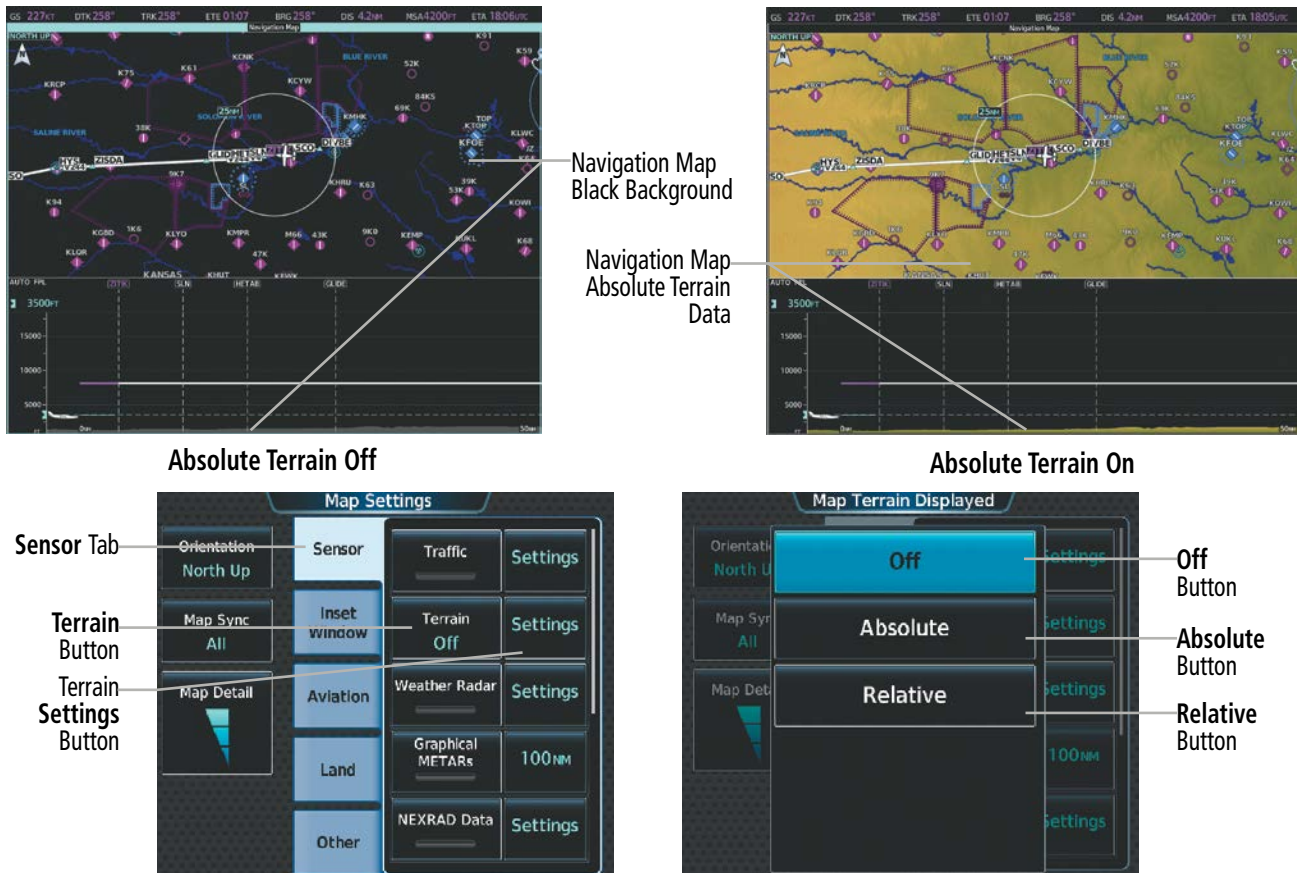


Figure 5-19 Navigation Map - Absolute Terrain Data

Displaying/removing absolute terrain data on navigation maps:

- 1) From MFD Home, touch **Map > 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.



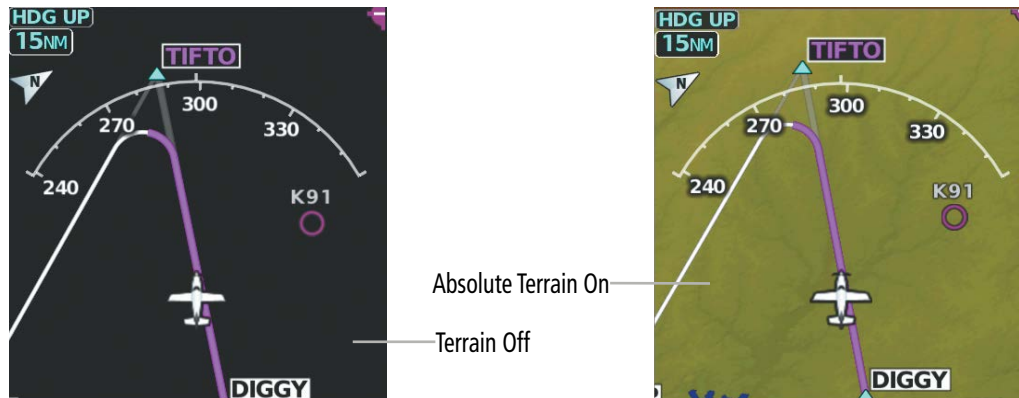


Figure 5-20 Inset Map - Absolute Terrain Data

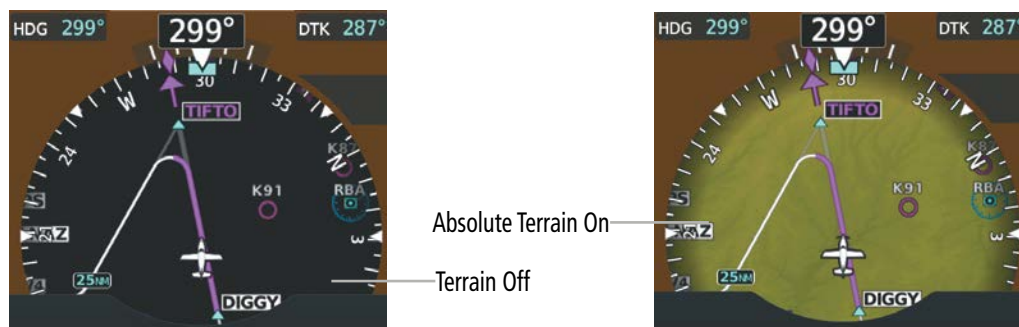


Figure 5-21 HSI Map - Absolute Terrain Data

### Displaying/removing absolute terrain data on the PFD Map:

- 1) From PFD Home, touch **PFD Map Settings**.
- 2) Touch the **Terrain** Button to display the 'Inset Map Terrain Displayed' Screen.
- 3) Display or remove absolute terrain data:  
Touch the **Absolute** Button to display absolute terrain data on the PFD Map.

Or:

Touch the **Off** Button to remove absolute terrain data from the PFD Map.

Or:

- 1) Press the **PFD Map Settings** Softkey on the PFD.
- 2) Display or remove absolute terrain data:  
Press the **Terrain** Softkey until 'Absolute' is shown to display absolute terrain data on the PFD Map.

Or:

Press the **Terrain** Softkey until 'Off' is shown to remove absolute terrain data from the PFD Map.

### Selecting an absolute terrain data range on navigation map displays:

- 1) From MFD Home, touch **Map** > **Map Settings**.
- 2) Touch the **Sensor** Tab, if necessary.
- 3) Touch the **Terrain Settings** Button. A window is displayed providing terrain functions allowed by the system.
- 4) Touch the **Map Settings** Button. A window is displayed providing terrain settings for the navigation map.
- 5) Touch the **Terrain** Button to display the 'Map Terrain Range' Window.
- 6) Scroll the list if necessary to find the desired range, and touch the range button.

In addition, the 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. The minimum and maximum terrain elevations on the Absolute Terrain Scale represent the terrain displayed within the 'Navigation Map' Pane.



Figure 5-22 Navigation Map - Absolute Terrain Data

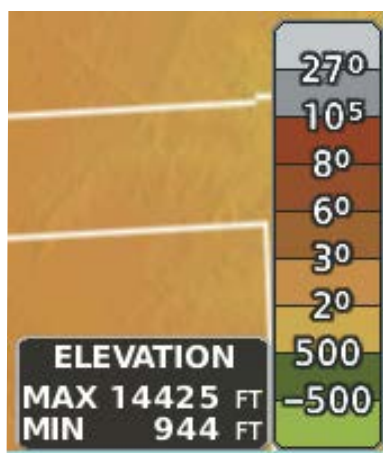


Figure 5-23 Navigation Map – Absolute Terrain Scale

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




- 1) From MFD Home, touch **Map > Map Settings**.
- 2) Touch the **Sensor** Tab, if necessary.
- 3) Touch the Terrain **Settings** Button. A window is displayed providing terrain functions allowed by the system.
- 4) Touch the **Map Settings** Button. A window is displayed providing terrain settings for the navigation map.
- 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	Default Range (nm)	Maximum Range (nm)
Obstacles (Point)	See Hazard Avoidance Section	10	25
Roads		see below	
Interstate Highway (Freeway)		50	400
International Highway (Freeway)		50	400














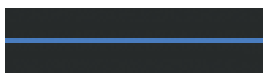
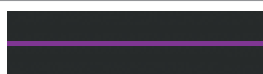






Land Symbols	Symbol	Default Range (nm)	Maximum Range (nm)
US Highway (National Highway)		15	150
State Highway (Local Highway)		2.5	100
Local Road (Local Road)	N/A	4	25
Railroad		7.5	25
Large City (> 200,000)		100	1000
Medium City (> 50,000)		50	400
Small City (> 5,000)		25	100
State/Province		400	1000
Rivers and Lakes (River/Lake)		75	100










Table 5-2 Land Symbol Information

## AVIATION SYMBOLS

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

Aviation Symbols	Symbol	Default Range (nm)	Maximum Range (nm)
Low Altitude Airways (V and T Routes)		50	100
High Altitude Airways (J and Q Routes)		50	100
Class B Airspace Altitude Label (ceiling/floor)		Label placement and ranges are variable, in order to provide the best representation and minimal clutter	
Class C Airspace Altitude Label (ceiling/floor)			
Class D Airspace Altitude Label (ceiling)			
CL B/TMA/AWY	(see below)		
Class B (CL B) and Terminal Manoeuvring Area (TMA)*		50	150
Airway (AWY)*			
CL C/CTA	(see below)		

Aviation Symbols	Symbol	Default Range (nm)	Maximum Range (nm)
Class C Airspace (CL C)		50	150
Control Area (CTA)*			
CL A/D	(see below)		
Terminal Radar Service Area (TRSA), Controlled Traffic Region (CTR)*, and Class A (CL A)*		10	100
Class D			
Aerodrome Traffic Zone (ATZ)*			
Traffic Information Zone (TIZ)*			
Restricted and Prohibited Areas (Restricted)		50	100
Military Operations Areas (MOA (Military))		50	250
Other	(see below)		
ADIZ		50	250
Alert			
Class E*			
Class G*			
Temporary*			
Danger, Warning, Unknown, Special Rules*, and Training*			
Large Airport (Longest Runway ≥ 8100 ft)		100	1000
Medium Airport (8100 ft > Longest Runway ≥ 5000 ft, or Longest Runway < 5000 ft with control tower)		50	400
Small Airport (Longest Runway < 5000 ft without control tower)		25	150

Aviation Symbols	Symbol	Default Range (nm)	Maximum Range (nm)
VOR: (VOR, VOR/DME, DME, VORTAC, TACAN)		50	250
VOR Compass Rose On/Off		N/A	N/A
INT Waypoint		25	40
NDB Waypoint		25	50
VRP Waypoint		25	40
User Waypoint		25	1000
SafeTaxi	See Additional Features	1.5	5
Runway Extension		7.5	150
Missed Approach Preview On/Off		N/A	N/A
Altitude/Speed Constraints		1000	1000

\* Not located in the United States

### Table 5-3 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 Settings**.
- 2) Touch the **Aviation** or **Land**, 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 5-24 Map Settings - Aviation Data Setup**



**Figure 5-25 Map Settings - Land Data Setup**

### Selecting an Aviation or Land item maximum range:

- 1) From MFD Home, touch **Map > Map Settings**.
- 2) Touch the **Aviation** Tab or **Land** Tab, if necessary.
- 3) Scroll the list to find the desired item.
- 4) If necessary, touch the **Settings** Button to display the range buttons.
- 5) Touch the range button to display the range choices.



- 6) Touch a range selection button to select the maximum range.
- 7) Repeat Steps 3 through 6 as necessary.

#### Displaying/removing the VOR compass rose:

- 1) From MFD Home, touch **Map > Map Settings**.
- 2) Touch the **Aviation** Tab, if necessary.
- 3) Scroll the list to find the VOR buttons.
- 4) Touch the VOR **Settings** Button to display the 'VOR Settings' Window.
- 5) Touch the **Compass Rose** Button to display/remove the VOR compass rose.

## MAP DETAIL

The declutter feature allows the pilot to progressively step through four levels of map detail. The navigation map detail level is displayed on the 'Map Settings' Screen on the Touchscreen Controller and on the navigation map. The PFD map detail level is shown on the PFD map and the **Detail** Softkey.

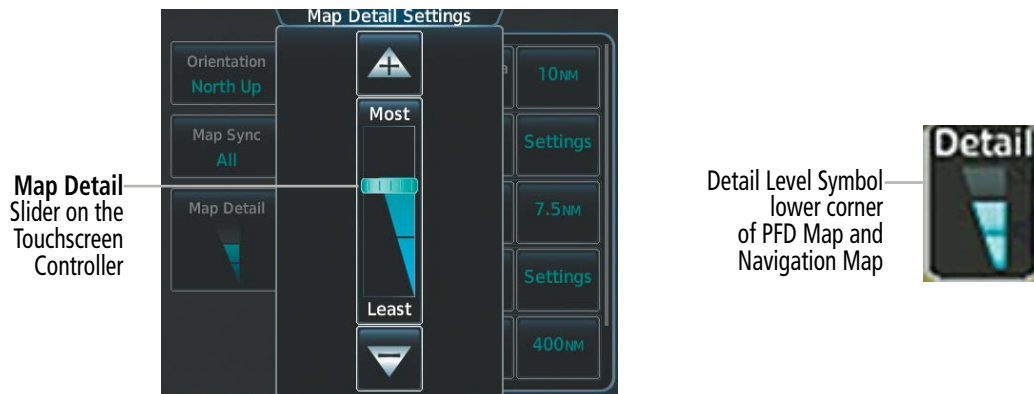


Figure 5-26 Navigation Map – Map Detail

#### Adjusting the navigation map detail:

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

#### Adjusting the PFD 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 Map detail.

Or:

- 1) Press the **PFD Map Settings** Softkey on the PFD.
- 2) Press the **Detail** Softkey, as required, to cycle to the desired PFD Map detail.

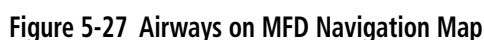
The following table lists the items that are decluttered at each map detail level. The 'X' represents map items decluttered for each level of detail.

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
MOAs (Military)			X
Intersections (does not declutter if used to define airway)		X	X
NAVAIDs (does not declutter if used to define airway)		X	X
User Waypoints		X	X
VRPs		X	X
Latitude/Longitude Grid		X	X
Class B / TMA / AWY airspaces		X	X
Class C / CTA airspaces		X	X
Class A / D airspaces		X	X
Other Airspaces		X	X
Obstacles		X	X
Cities	X	X	X
Roads	X	X	X
Railroads	X	X	X
State/Province Boundaries	X	X	X






**Table 5-4 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 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.



Navigation maps can display some additional items. Some items can be displayed through the use of the nearest frequency, map panning, and map measuring functions. Other items (e.g. track vector, wind vector, fuel range ring, selected altitude range arc, optional SVT field of view, and latitude/longitude lines) can be displayed/removed individually through the 'Map Settings' Screen. Refer to the Hazard Avoidance Section for information on displaying obstacles (Point Obstacle) on the map.

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

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**Displaying/removing Additional Navigation Map Items:**

- 1) From MFD Home, touch **Map > 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.

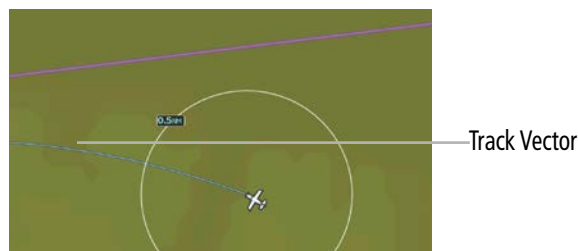


Figure 5-28 Navigation Map - Track Vector

**Selecting track vector look-ahead time:**

- 1) From MFD Home, touch **Map > Map Settings**.
- 2) Touch the **Other** Tab, if necessary.
- 3) Touch the track vector 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 5-29 Navigation Map - Wind Vector



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

## 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.

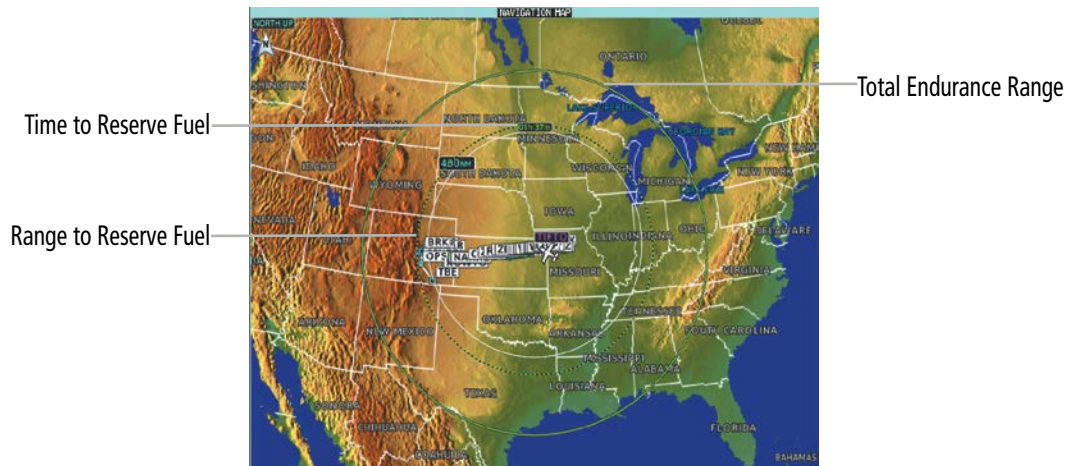


Figure 5-30 Navigation Map - Fuel Range Ring

### Selecting fuel reserve time:

- 1) From MFD Home, touch **Map > 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.

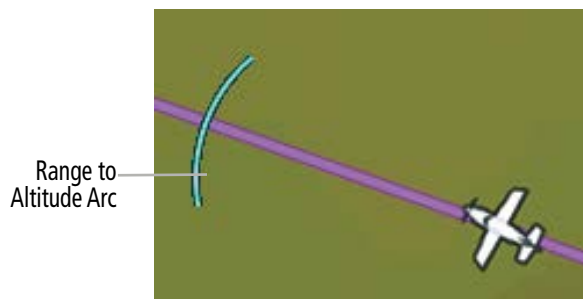
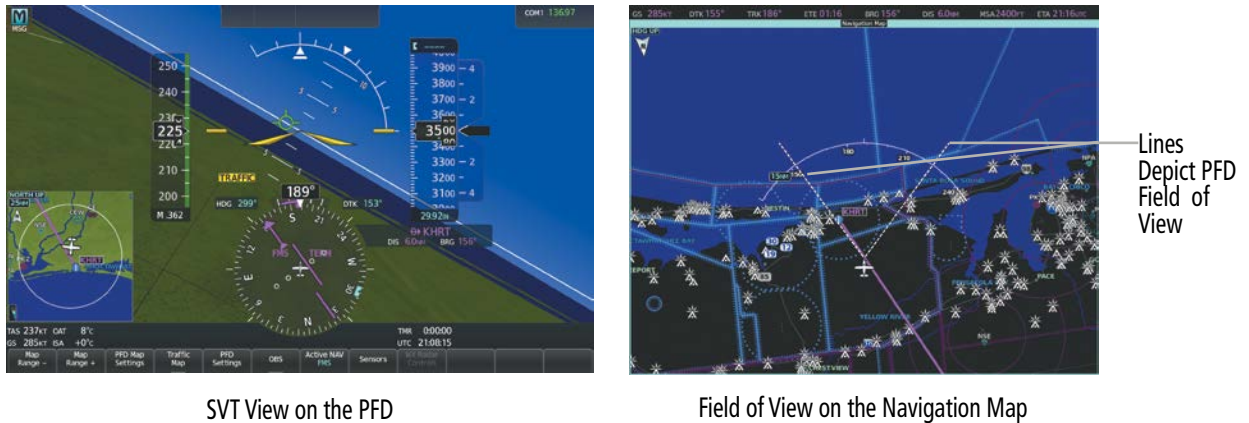


Figure 5-31 Navigation Map - Range to Altitude Arc

## FIELD OF VIEW (SVT)

Garmin SVT™ (Synthetic Vision Technology) depicts a forward-looking attitude display of the absolute terrain immediately in front of the aircraft. The field of view is 35.5 degrees to the left and to the right if the PFD is operating in Full Mode, or 25 degrees to the left and to the right in Split Mode. SVT information is shown on the Primary Flight Display (PFD), or on the Multifunction Display (MFD) in Reversionary Mode.

The PFD field of view is represented on the Navigation Map by two dashed lines forming a V-shape in front of the aircraft symbol on the map. The following figure compares the PFD forward looking depiction with the Navigation Map plan view and Field of View turned on.



**Figure 5-32 PFD and Navigation Map - Field of View Comparison**

## 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. The default setting is 1 nm, while the maximum range is 1000 nm.



**Figure 5-33 Navigation Map – Latitude/Longitude 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 Settings**.
- 2) Touch the **Other** Tab, if necessary.
- 3) Touch the latitude/longitude lines range button to display the range selection buttons.
- 4) Touch a range selection button to select the maximum map display range.

## OBSTACLES

The navigation map can display the location of obstacles (e.g. towers). The obstacles are shown as red, yellow, or white, depending on the height relative to the aircraft AGL altitude. See the Hazard Avoidance section for more details on symbol and color usage.



## 5.3 WAYPOINTS

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

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

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.

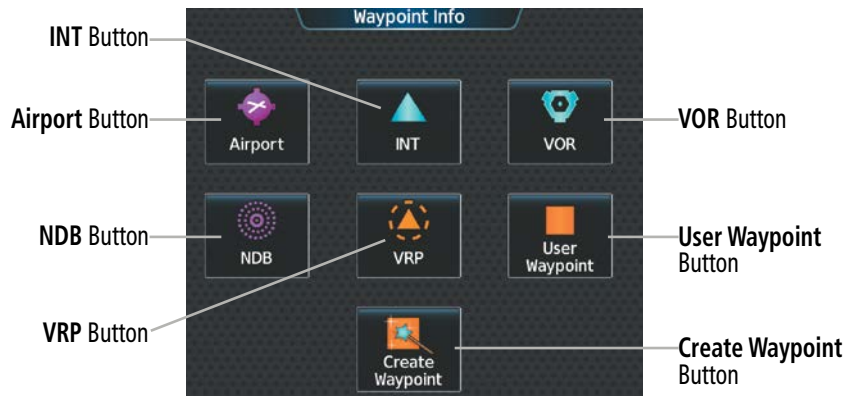


Figure 5-34 'Waypoint Info' Screen

If duplicate entries exist for an identifier, a 'Waypoint Duplicates' Screen is displayed when touching the **Enter** Button or pushing the lower knob.

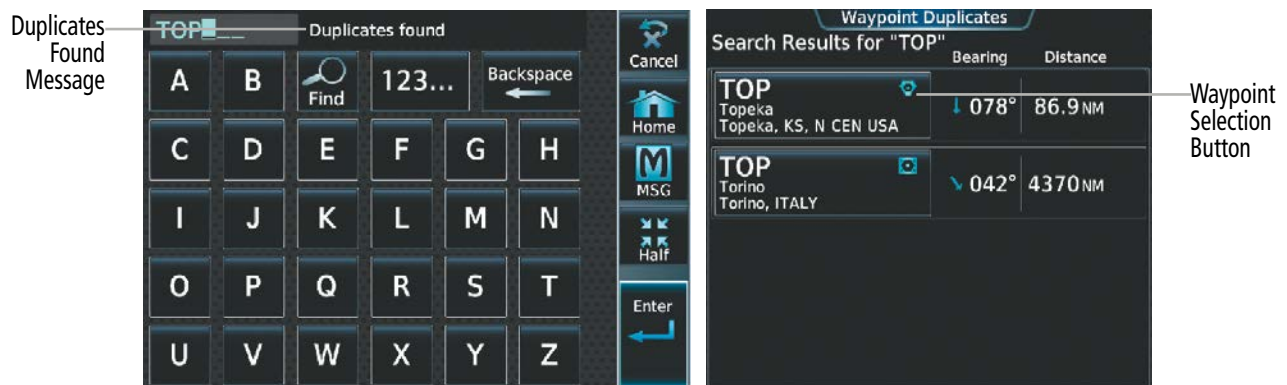


Figure 5-35 Waypoint Duplicates

## AIRPORTS



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

The 'Airport Information' Pane displays a map of the currently selected airport and surrounding area, and the 'Airport Information' Screen on the Touchscreen Controller allows the pilot to view airport information, load frequencies, review runways, and review instrument procedures that may be involved in the flight plan. For airports with multiple runways, information for each runway is available. See the Audio and CNS Section for more information on finding and tuning frequencies. After applying power to the system, and when the aircraft

position is known, the 'Airport Information' Pane defaults to the airport where the aircraft is located. After a flight plan has been loaded, it defaults to the destination airport. On a flight plan with multiple airports, it defaults to the airport which is the current active waypoint.



Figure 5-36 'Airport Information' Pane on MFD



Figure 5-37 'Airport Information' Screen

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

**Usage type:** PUBLIC, MILITARY, PRIVATE, or HELIPORT

**Fuel Available:** AVGAS, JET



Figure 5-38 'Airport Frequencies' Screen

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

**COM Availability:** TX (transmit only), RX (receive only), PT (part time), More Information (additional information available)

**\*COM Frequencies:** Approach, Arrival, ASOS, ATIS, AWOS, Center, Class B, Class C, Clearance, Control, CTA, Departure, Director, Emergency, FSS, Gate, Ground, Helicopter, Military, Multicom, Other, Pre-Taxi, Radar, Radio, Ramp, Terminal, TMA, Tower, TRSA, Unicom

**NAV Frequencies:** ILS, LOC

*\*When 'More Information' is displayed on the button, touching the button will display additional information.*

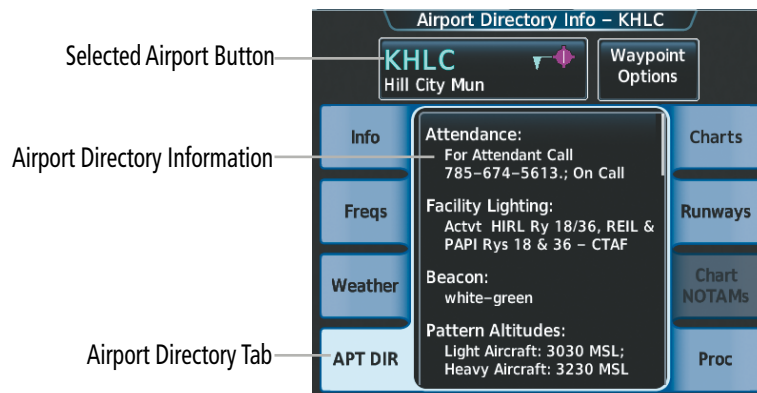


Figure 5-39 'Airport Directory Info' Screen

The Airport Directory Tab provides AC-U-KWIK® airport and FBO directory information for public airfields across the world. Information includes listings of airfield and FBO data, charter companies, fuel suppliers, ground transportation, maintenance, catering services, and much more.

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' Pane, 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' Pane, 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' Pane, 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' Pane shows a map of the nearest airport and surrounding area, and the 'Nearest Airport' Screen on the Touchscreen Controller allows the pilot to view airport information, load frequencies, review runways, and review instrument procedures that may be involved in the flight plan. For airports with multiple runways, information for each runway is available. See the Audio and CNS Section for more information on finding and tuning frequencies.

The 'Nearest Airports' Screen displays a list of up to 25 nearest airports (five entries can be displayed at one time). If there are more than five, they are displayed in a scrollable list. 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

Airport	BRG	DIS	APPR/RWY
<b>KSLN</b> Salina Regl	170°	8.0 NM	ILS 12300 FT
<b>45K</b> Minneapolis City Co	343°	10.6 NM	VFR 3970 FT
<b>K78</b> Abilene Mun	089°	20.4 NM	RNA 4100 FT
<b>9K7</b> Ellsworth Mun	244°	28.2 NM	VFR 3919 FT
<b>KMPR</b> Mc Pherson	177°	34.2 NM	RNA 5502 FT

Nearest Airport Buttons  
(Identifier, Name, Symbol)

Nearest Airport Information  
Bearing  
Distance  
Type of Approach  
Length of Runway

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.

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 AND USER CREATED WAYPOINTS

### WAYPOINT INFORMATION

Non-Airport Waypoints are considered to be Intersections, VRPs, VORs, and NDBs. Non-airport waypoints and User Waypoints have respective Information Panes which show a map of the currently selected waypoint and surrounding area and the Touchscreen Controller shows waypoint information.

The 'VOR Information' Screen can be used to view information about VOR and ILS signals (since ILS signals can be received on a NAV receiver), or to quickly tune a VOR or ILS frequency. If a VOR station is combined with a TACAN station, it is listed as a VOR-TACAN on the 'VOR Information' Screen, and if it includes only DME, it is displayed as VOR-DME.

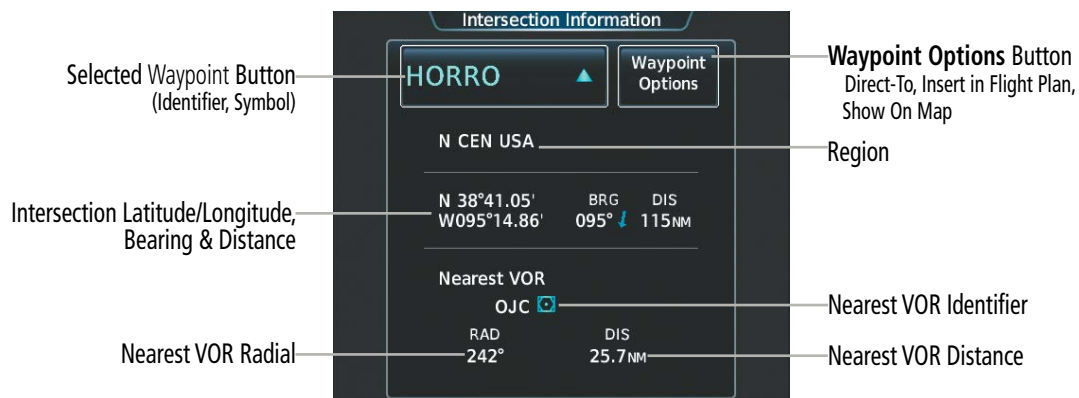


Figure 5-42 'Intersection Information' Screen

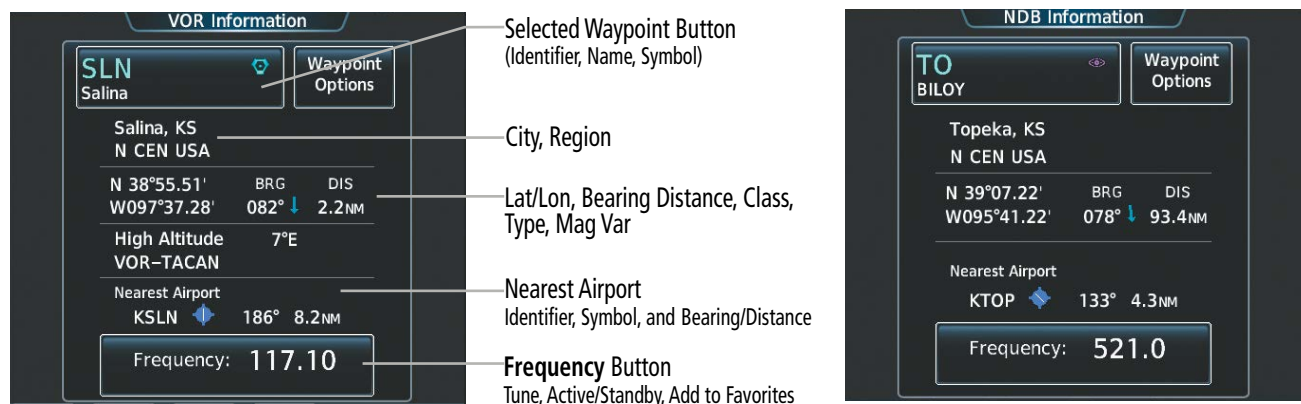


Figure 5-43 VOR and NDB Information Screens



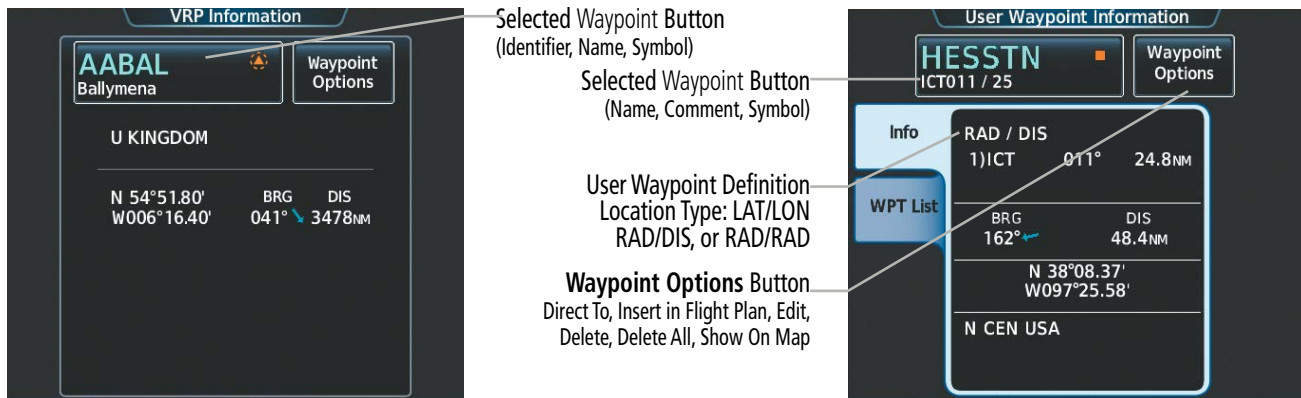


Figure 5-44 VRP and User Waypoint Information Screens



Figure 5-45 'Intersection Information' Pane

### Selecting a non-airport waypoint or User Waypoint:

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

### Finding and selecting a non-airport or User Waypoint by category (Recent, Nearest, Flight Plan, or Favorites):

- 1) From MFD Home, touch **Waypoint Info > INT, VRP, VOR, NDB** or **User Waypoint**.
- 2) Touch the Selected Waypoint Button to display the keypad.
- 3) Touch the **Find** Button to display the 'Find Waypoint' Screen.
- 4) Touch the **Recent, 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, VRP, VOR, NDB, or User WPT Information Pane, if needed.



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

### Finding and selecting a non-airport waypoint for review by facility name or city name:

- 1) From MFD Home, touch **Waypoint Info > INT, VRP, VOR**, or **NDB**.
- 2) Touch the Selected Waypoint Button to display the keypad.
- 3) Touch the **Find** Button to display the 'Find Waypoint' Screen.
- 4) Touch the **Search** Tab to display the **Search By** Button.
- 5) If needed, touch the **Search By** Button to choose Search by City or Search by Facility.
- 6) Touch the **Facility Name** Button or the **City Name** Button to display the keypad.
- 7) Use the keypad to enter the name.
- 8) Touch the **Enter** Button to accept the entry and display the search results.
- 9) Touch a Waypoint Selection Button to display the waypoint information on the Touchscreen Controller.
- 10) Touch the **Waypoint Options** Button, then the **Show on Map** Button to display the Intersection, VRP, VOR, NDB, or User WPT Information Pane, if needed.

## NEAREST WAYPOINTS

The Nearest Intersection/VRP/VOR/NDB/User panes show a map of the nearest waypoint selected and surrounding area, and the Touchscreen Controller shows the selected waypoint information, plus an ability to initiate a direct-to or insert the waypoint into the flight plan.

The Nearest Intersection/VRP/VOR/NDB/User screen shows a list of up to 25 waypoints (five entries can be displayed at one time). If there are more than five, they are displayed in a scrollable list. 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/VRP/VOR/NDB/User) Pane from the aircraft position to the selected nearest waypoint.



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



Figure 5-46 'Nearest VOR' Pane

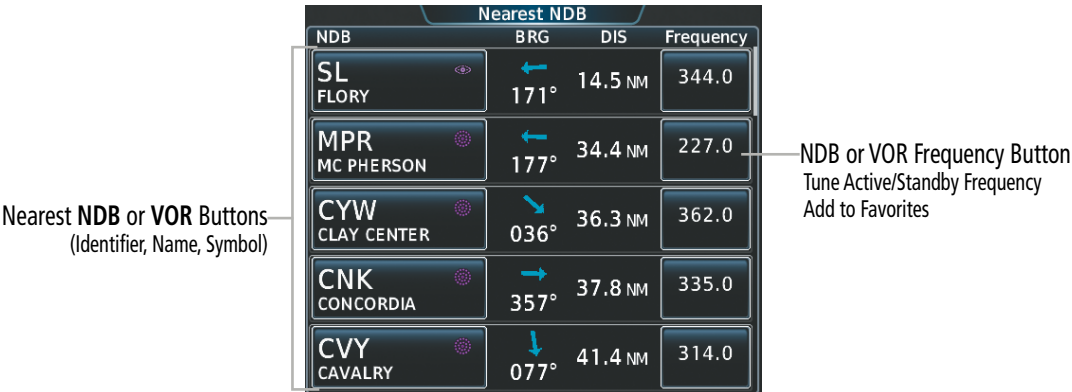


Figure 5-47 Nearest VOR/NDB Screen (Example: NDB)

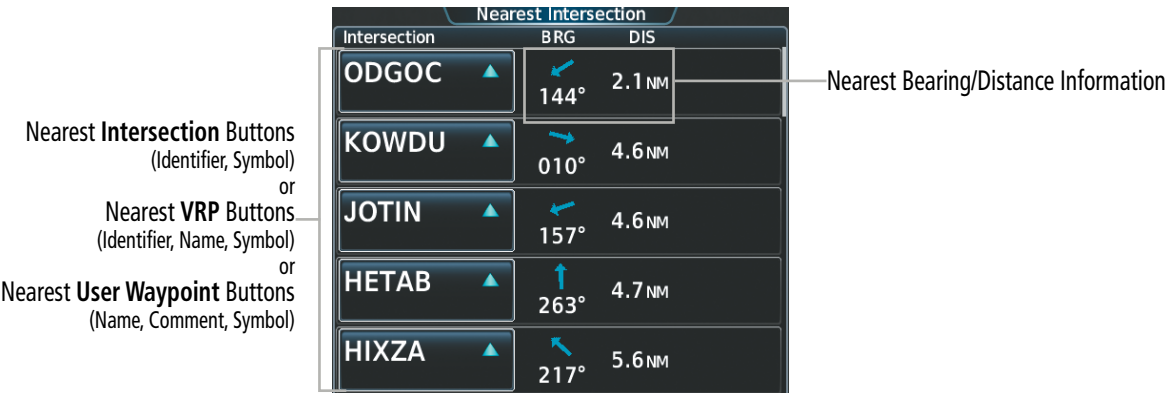


Figure 5-48 Nearest Intersection/VRP/User Screen (Example: Intersection)

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

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

## CREATING USER WAYPOINTS

The system can create and store up to 1,000 user-defined waypoints. 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 navigation map 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.

Any on of the following parameters may be used for defining the location of a user waypoint: Radial/Distance, Radial/Radial, Latitude/Longitude, or Present Position.

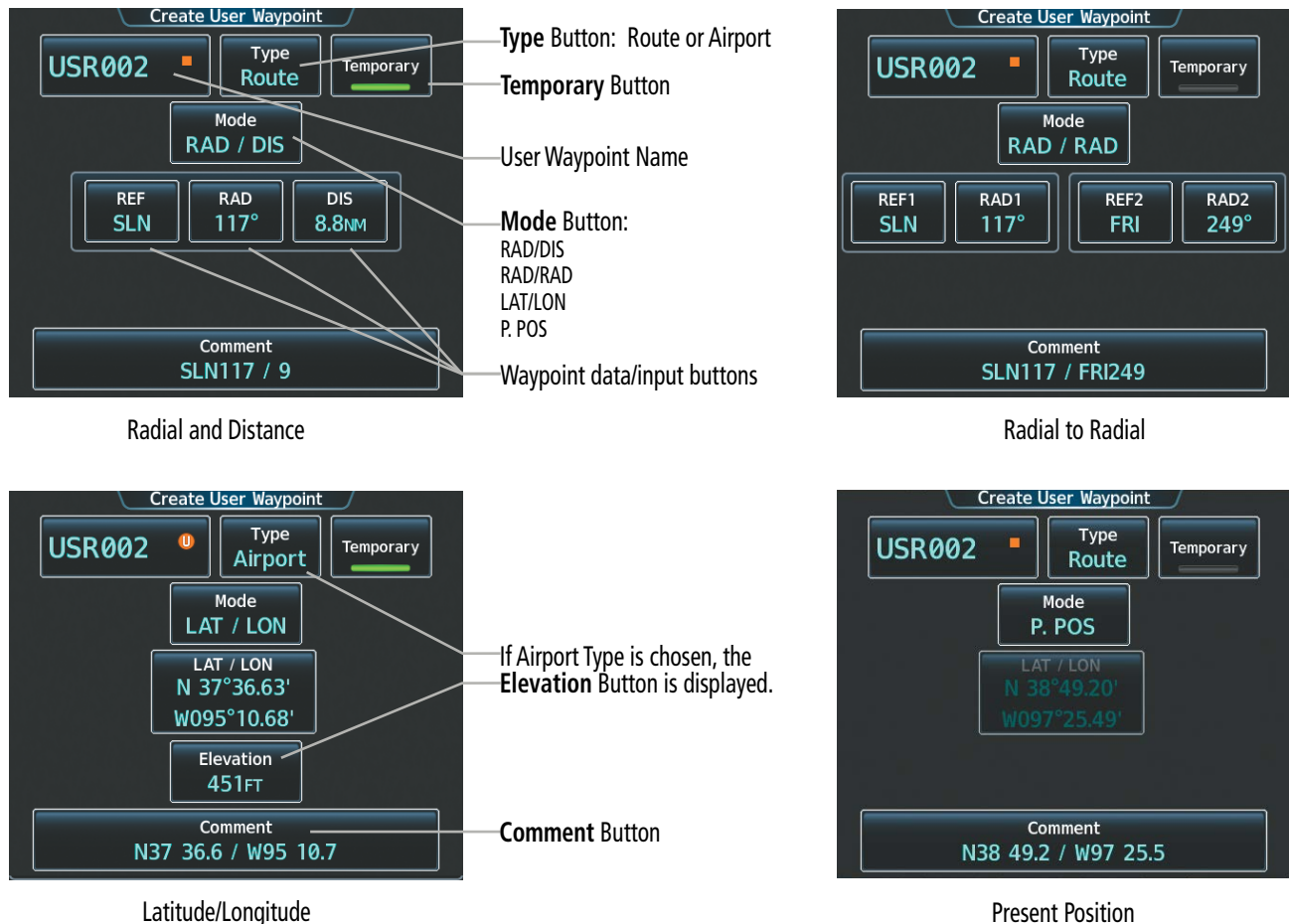


Figure 5-49 'Create User Waypoint' Screens – Type and Mode Options

**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, define the location parameters of the waypoint in one of the following ways:
  - a) Touch the **Type** 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 **Type** 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 through F for the second reference waypoint (**REF2** Button) and radial (**RAD2** Button).

**Or:**

  - a) Touch the **Type** 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 **Type** Button to display the 'Select User Waypoint Mode' Screen.
  - b) Touch the **P. POS** Button to select the present position type as defined by latitude/longitude values.

- 5) 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.
- 6) 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.
- 7) Touch the **Create** Button to accept the new user waypoint. If RAD/RAD was used to define the waypoint, and the radials do not intersect, a message "The radials entered do not intersect" will be displayed. Touch the **OK** Button to return to the 'Create User Waypoint' Screen.

#### Creating user waypoints from map displays:

- 1) Push the lower knob to activate the panning function and display the 'Map Pointer Control' Screen on the Touchscreen Controller.
- 2) Use the lower knob or 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, 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.
- 7) Touch the **Create** Button to create the new waypoint.
- 8) 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 type and location:**

- 1) From MFD Home, touch **Waypoint Info > User Waypoint**.
- 2) If necessary, 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 **Type** Button to display the 'User Waypoint Type' Window.
- 6) Touch the **RAD/DIS** Button, the **RAD/RAD** Button, the **LAT/LON** Button, or the **P. POS** Button to select the waypoint type.
- 7) If necessary, touch the **REF** Button, the **RAD** Button, the **DIS** Button, or the **LAT/LON** Button to bring up the keypad.
- 8) Use the keypad and the **Enter** Button to select the user waypoint location.
- 9) Touch the **Save** Button to accept the new type and location.
- 10) Touch the **OK** Button in response to the question "Are you sure you want to modify this waypoint?".

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

- 1) From MFD Home, touch **Waypoint Info > User Waypoint**.
- 2) If necessary, 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 **Type** Button to display the 'User Waypoint Type' Window.
- 6) Touch the **P. POS** Button to select the aircraft present position as the location.
- 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?".



## 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 many types of airspaces. See the Map Symbols portion of this section for a complete listing of all airspaces, their associated symbols, and default and maximum navigation map ranges. Temporary Flight Restrictions (TFRs) are discussed in the Hazard Avoidance Section.

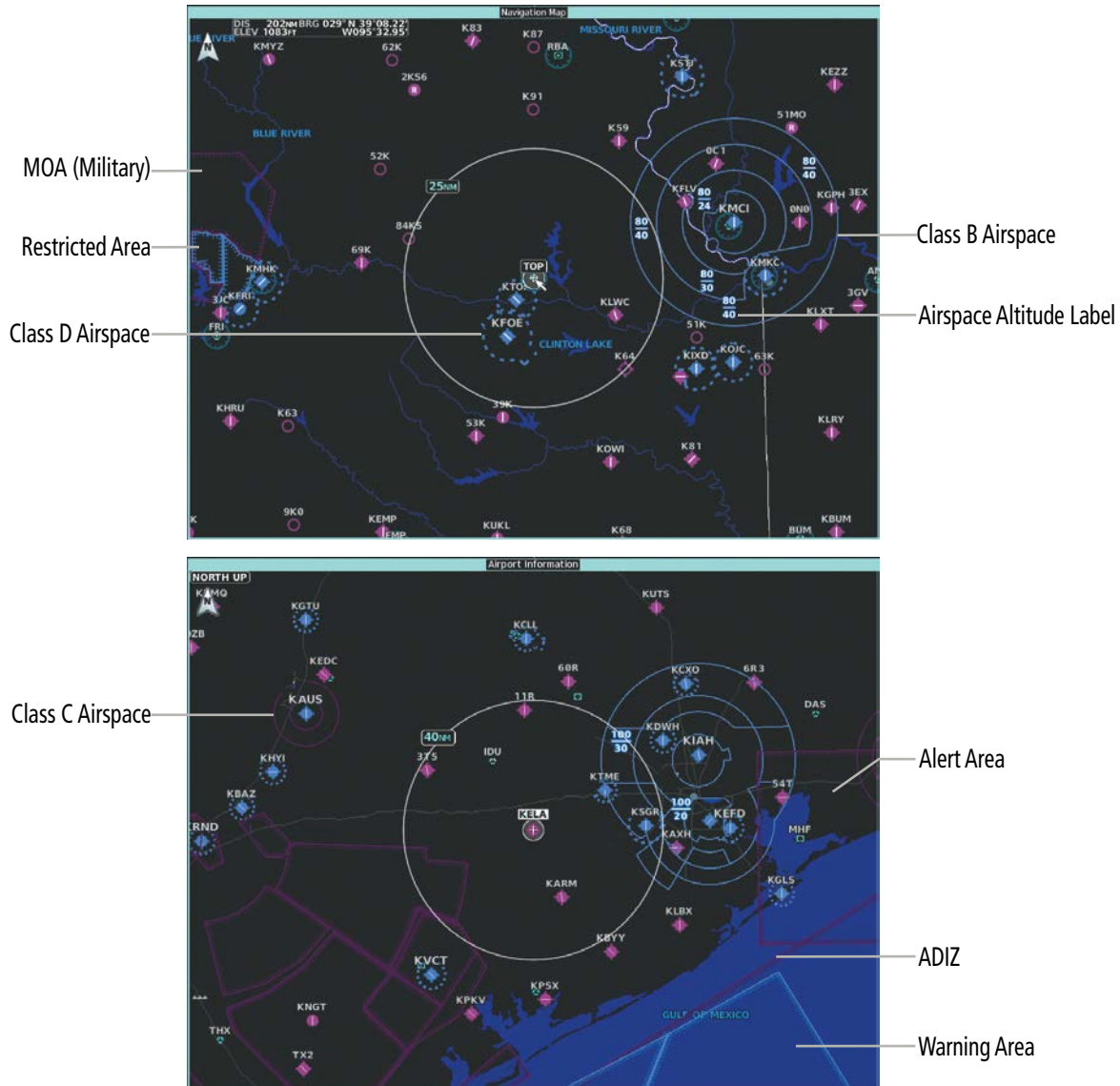


Figure 5-50 Airspaces

**Displaying and removing airspace altitude labels:**

- 1) From MFD Home, touch **Map > 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.

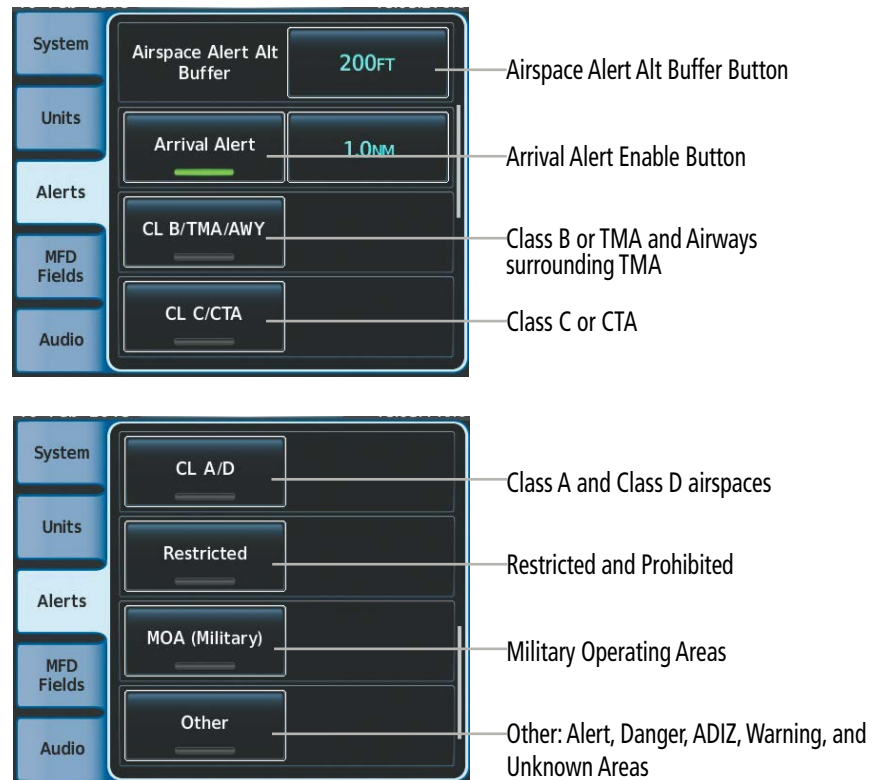


Figure 5-51 Alerts Tab – Airspace/Arrival Alerts

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 value, then touch the **Enter** Button.

### 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.

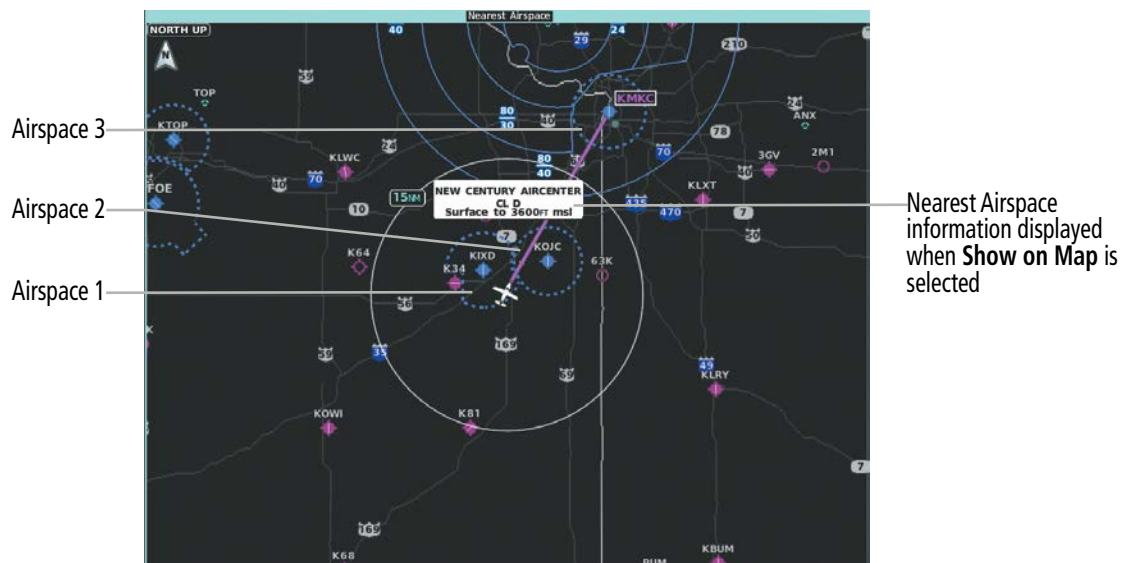


Figure 5-52 'Nearest Airspace' Pane



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.

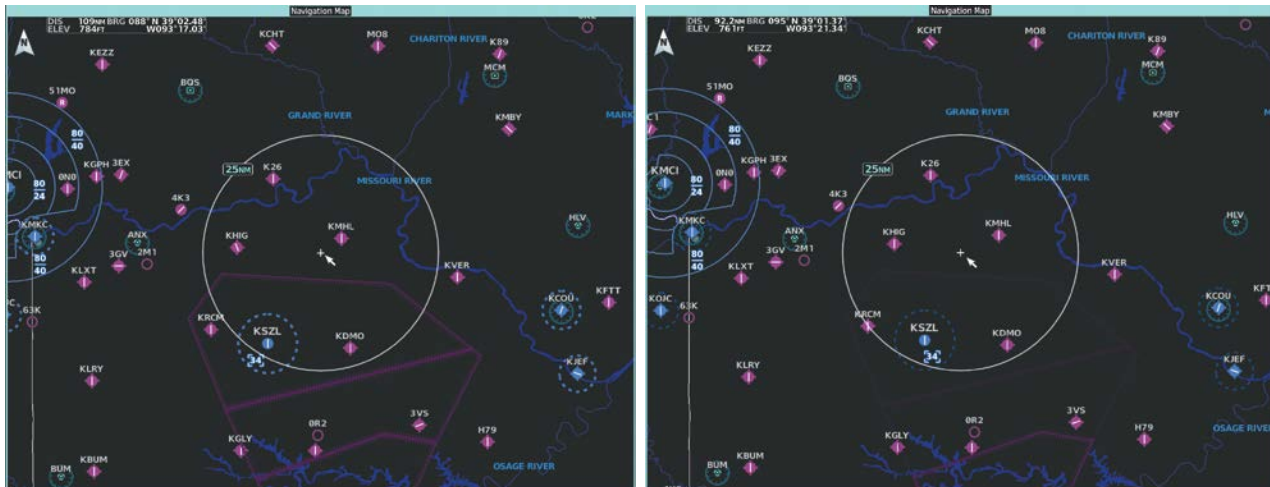
When an airspace alert occurs, the **MSG** Button on the Touchscreen Controller begins flashing. Touch the flashing button to view the list of alerts. The following airspace alerts are displayed in the 'Notifications' Screen:

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

**Table 5-6 Airspace Alert Messages**

## SMART AIRSPACE

The Smart Airspace function de-emphasizes airspaces above or below the current aircraft altitude. The function does not require the aircraft present position or flight path to enter the lateral boundaries of the airspace. If the current aircraft altitude is within 1500 feet of the vertical boundaries of the airspace, the airspace boundary is shown normally. If the current aircraft altitude is not within 1500 feet of the vertical boundaries of the airspace, the airspace boundary is shown subdued.



Smart Airspace Off

Smart Airspace On

Figure 5-54 Smart Airspace

### Enabling/disabling the Smart Airspace function:

- 1) From MFD Home, touch **Map** > **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' Window on the PFD and the 'Direct To' Screen on the Touchscreen Controller allow selection and activation of direct-to navigation. Any waypoint can be entered as a direct-to destination.

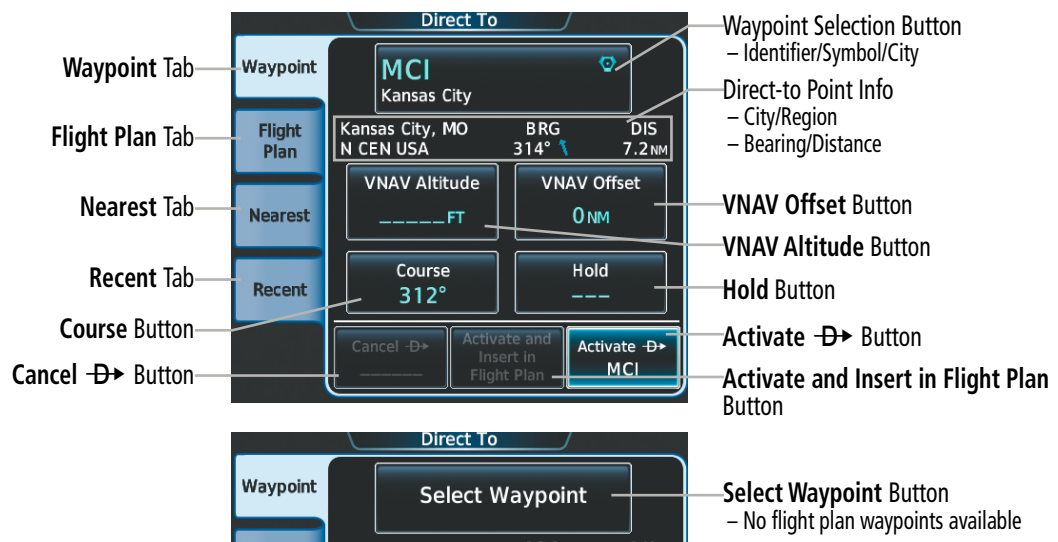


Figure 5-55 'Direct To' Screen

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

- 1) From MFD Home, touch **-D>**.
- 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) 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.
  - 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, push the lower knob to display the pointer.
- 2) Use the lower knob 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 .
- 2) 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 **-D➔**.
- 2) Touch the **Activate -D➔** Button to activate the direct-to using the direct course.

A direct-to with an altitude constraint ('VNAV Altitude') creates a vertical path (and provides guidance to stay on the path) from the aircraft's current altitude to the altitude of the direct-to waypoint. The altitude is reached at the waypoint, or at the specified distance along the flight path if an offset distance ('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.

Symbol Name	Description	Symbol
Course Leg	Course leg currently flown	
	A future course leg in the current phase of flight	
	A course leg in either a previously flown course leg, or a future course leg not in the current phase of flight	
Heading Leg	Heading leg currently flown	
	Future heading leg	
Roll Steering Path*	Turning path currently flown	
	Turning path for the next flight plan leg	
	Turning path beyond the next flight plan leg	
Turn Anticipation Arc	Displayed when sequencing to the next flight plan leg via a fly-by waypoint, a lead turn is created, adjusting for groundspeed	
Fly-Over Waypoint	Displayed as a fly-over waypoint (see the Flight Planning portion in the Flight Management Section)	
Along Track Waypoint	Displayed when an along track waypoint is created (see the Flight Planning portion in the Flight Management Section)	
Flight Path Fix	A fix that terminates: manually, at a specified altitude, or at a specified distance or radial when flying a heading	
Top of Descent (TOD) and Bottom of Descent (BOD)	When vertically navigating, the system will display where the aircraft will begin complete the descent (see the Vertical Navigation portion in the Flight Management Section)	
Parallel Track Waypoint	Displayed when a parallel track is created (see Flight Planning portion in the Flight Management Section)	

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

Table 5-7 Flight Plan Symbols



**NOTE:** See the AFCS Section for information on lateral guidance and course deviation per flight plan leg types.

After applying power to the system, 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 the System Messages portion of the Appendices).

The following could cause the airway update to fail:

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

There are five 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' Inset Window on the 'Navigation Map' Pane (view the active flight plan)
- Vertical Situation Display on the navigation map (view the upcoming vertical profile)

The 'Active Flight Plan' and 'Standby Flight Plan' Screens are shown in the following figures.



Figure 5-57 'Active Flight Plan' Screen

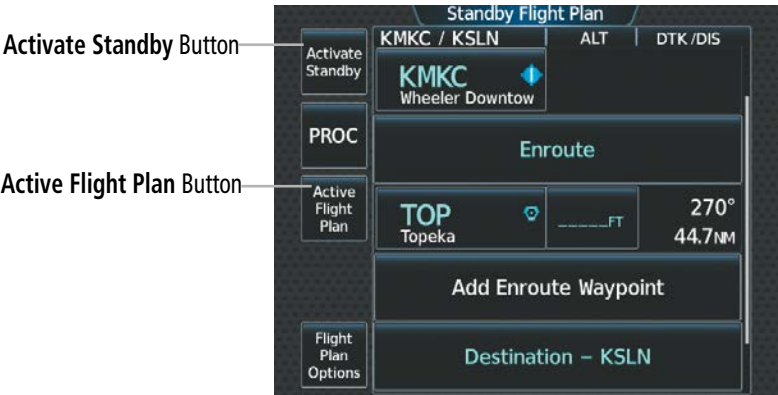


Figure 5-58 'Standby Flight Plan' Screen



Figure 5-59 'Flight Plan Catalog' Screen



The two Flight Plan Data Fields located in the far right column of the flight plan for both the Active and Standby Flight Plan Screens contains two fields, each displaying one of the following items:

- **CUM** (Cumulative Distance)
- **DIS** (Distance)
- **DTK** (Desired track)
- **ESA** (Enroute Safe Altitude)
- **ETA** (Estimated Time of Arrival)
- **ETE** (Estimated Time Enroute)
- **FUEL** (Fuel to Destination)

The navigation information displayed in the two data fields can be changed through the 'Flight Plan Options' Screen.

### Changing a field in the Active or Standby Flight Plan Screen:

- 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**.

- 2) Touch the **Flight Plan Options** Button.
- 3) Touch the **Edit Data Fields** Button.
- 4) Touch the **Data Field 1** or **Data Field 2** Button to edit.
- 5) Scroll as required and touch the desired field type.

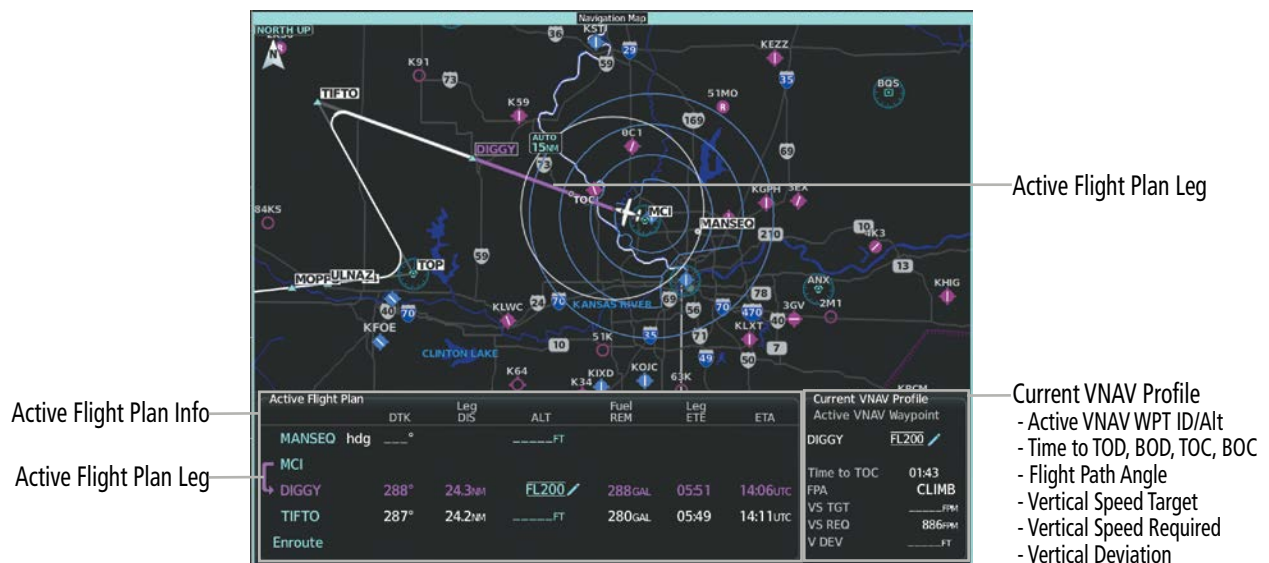


Figure 5-60 Active Flight Plan Inset on Navigation Map



Figure 5-61 Waypoint Options - 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 applying power to the system under the following conditions:

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

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

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

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

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 MFD Home 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 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.

## 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 airways. The following procedures does not include departures, arrivals, approaches, and missed approaches since they 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 waypoint identifier:

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** Tab, **Recent** Tab, **Flight Plan** Tab, 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 Steps 8 through 10 until the flight plan route is complete.
  - 11) 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).
  - 12) If needed, touch the **Origin** Button to display the 'Origin Options' Window to select a new origin airport, departure runway, departure procedure or to remove the origin airport.
  - 13) If needed, touch the **Destination** Button to display the 'Destination Options' Window to select a new destination airport, arrival runway, arrival procedure, approach procedure, or to remove the destination airport.

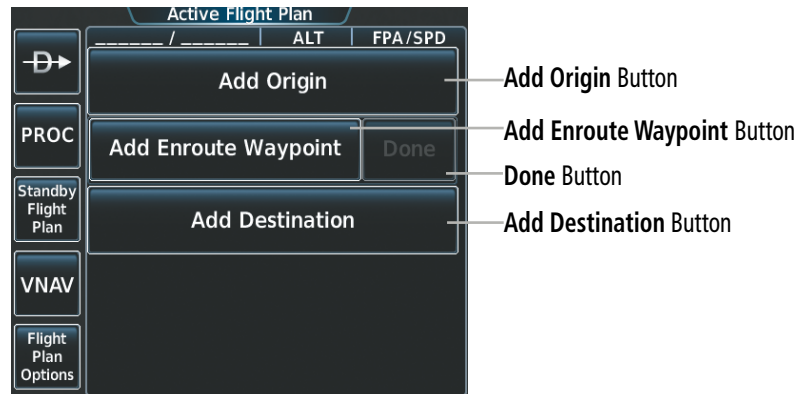


Figure 5-62 Active Flight Plan – Empty

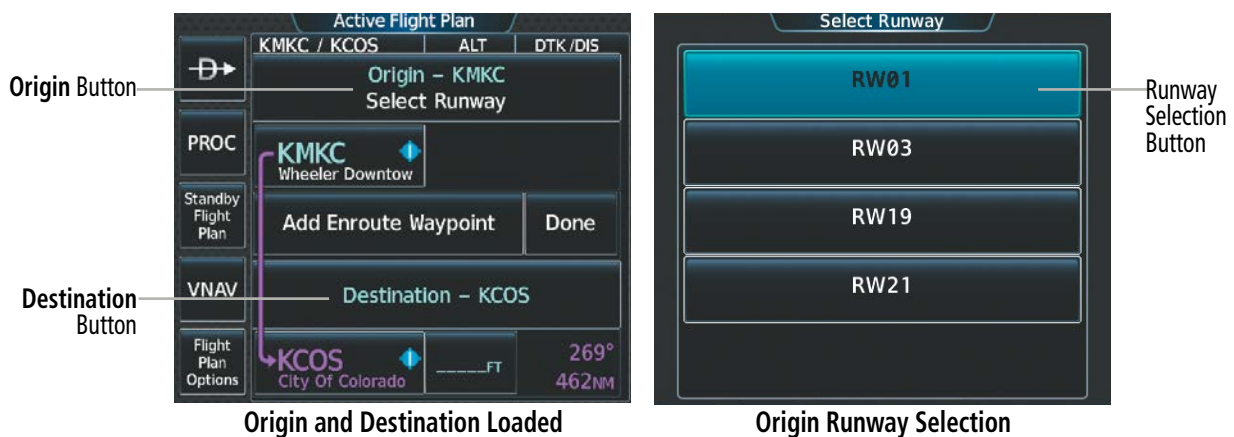


Figure 5-63 Active Flight Plan – Origin and Destination Loading

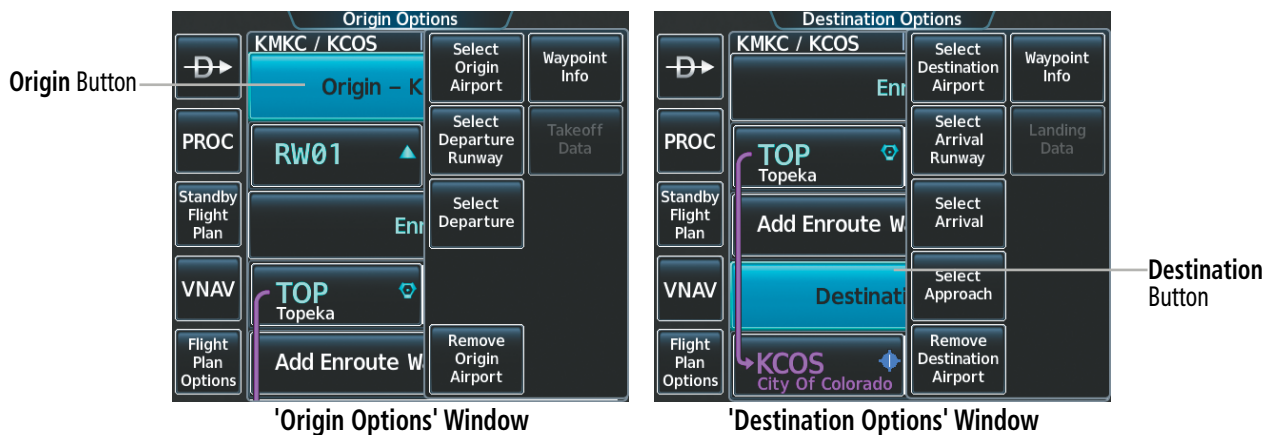


Figure 5-64 Active Flight Plan – Origin and Destination Options

## FLIGHT PLAN WAYPOINT AND AIRWAY MODIFICATIONS

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

## 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.” appears and the new waypoint(s) are not added to the flight plan.

### Adding a waypoint to a 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 adding to a new 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.

For adding to an existing 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 needed and touch a stored flight plan button to display the 'Catalog Options' Window.
- d) Touch the **Edit** 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 an existing 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 waypoint, touch the **Back** Button to return to the previous screen.





Figure 5-65 Active Flight Plan – 'Waypoint Options' Window



Figure 5-66 Active Flight Plan – Adding a Waypoint to the beginning of the Enroute Segment



Figure 5-67 Active Flight Plan – Adding a Waypoint to the end of the Enroute Segment





Figure 5-68 Edit Stored Flight Plan – 'Waypoint Options' Window



Figure 5-69 Edit Stored Flight Plan – Adding a Waypoint to the beginning of the Enroute Segment

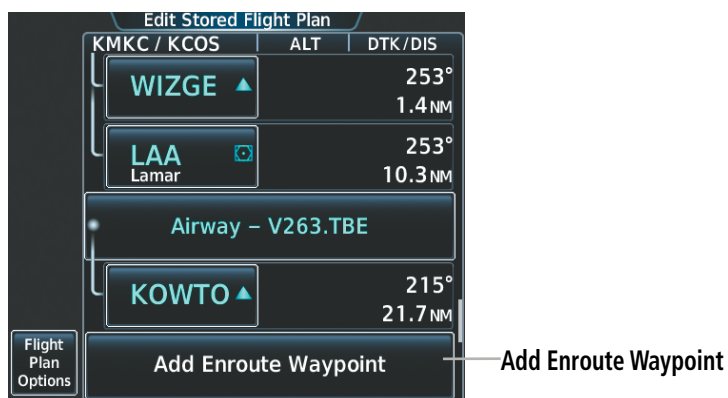


Figure 5-70 Edit Stored Flight Plan – Adding a Waypoint to the end of the Enroute Segment

## 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) Push 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. Push either knob on the Touchscreen Controller to deactivate the map pointer and return to the previous screen.



Figure 5-71 Active Flight Plan – Map Pointer Active



Figure 5-72 Active Flight Plan - Inserting Waypoint

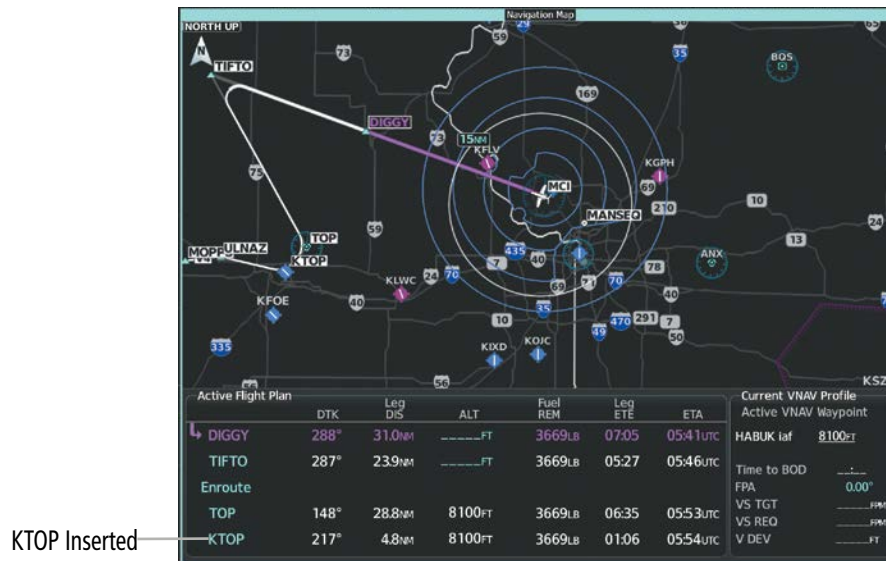


Figure 5-73 KTOP Added to the Active Flight Plan

## 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 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 Waypoint** Button.
  - 3) Touch the **OK** Button in response to 'Remove <waypoint name>?'. The waypoint is removed. To cancel the request, touch the **Cancel** Button.

### FLY OVER WAYPOINTS

Waypoints entered in the enroute segment of the flight plan are considered 'Fly By' waypoints unless specifically designated as 'Fly Over' waypoints. For both types of waypoints, the system will transition using a precisely calculated turn on course to the next waypoint.



Figure 5-74 Waypoint Options – Fly Over Waypoint Disabled (Fly By)

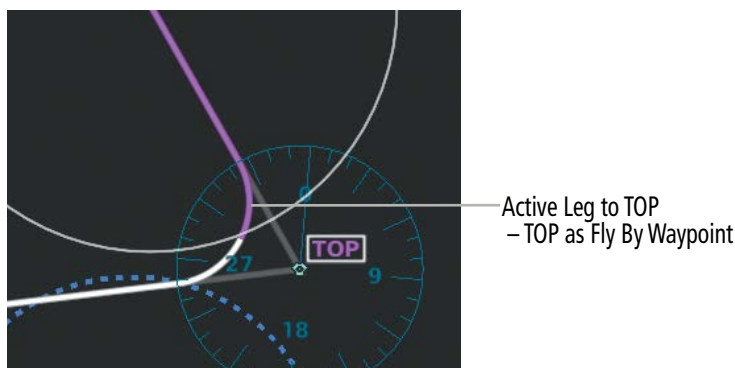


Figure 5-75 Active Flight Plan – Fly By Waypoint



Figure 5-76 Waypoint Options – Fly Over Waypoint Enabled

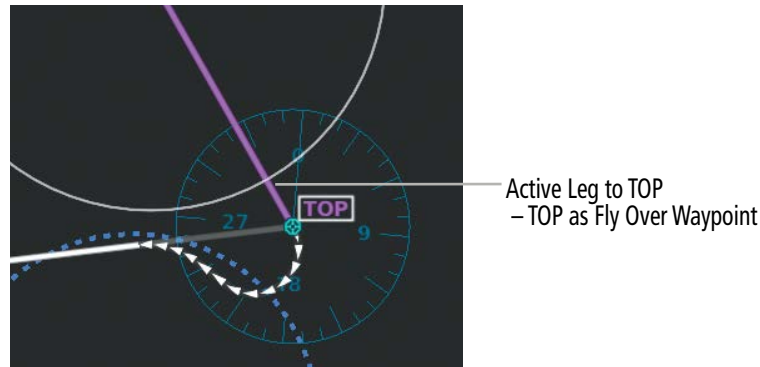


Figure 5-77 Active Flight Plan – Fly Over Waypoint

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

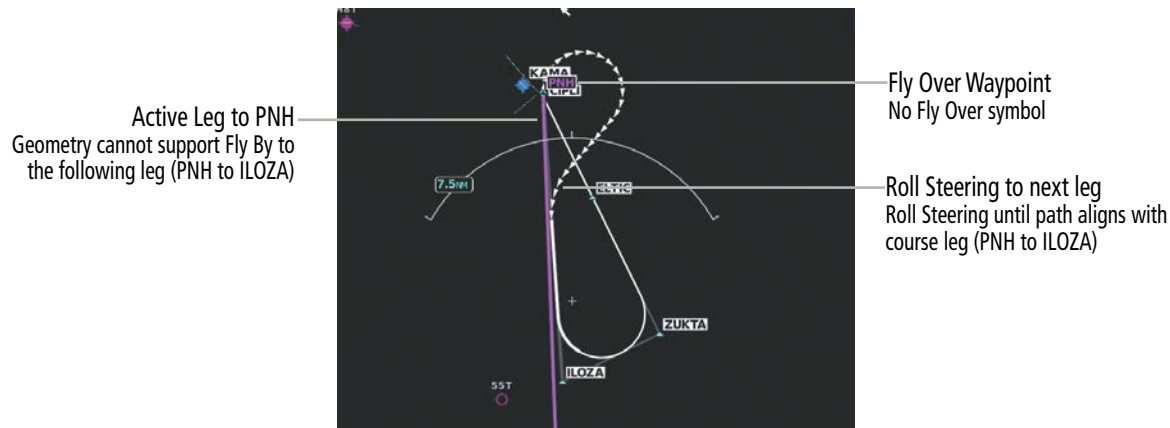


Figure 5-78 PNH Fly-Over Waypoint

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**.

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) 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 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 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 so 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 5-79 Active Flight Plan - Adding an Airway

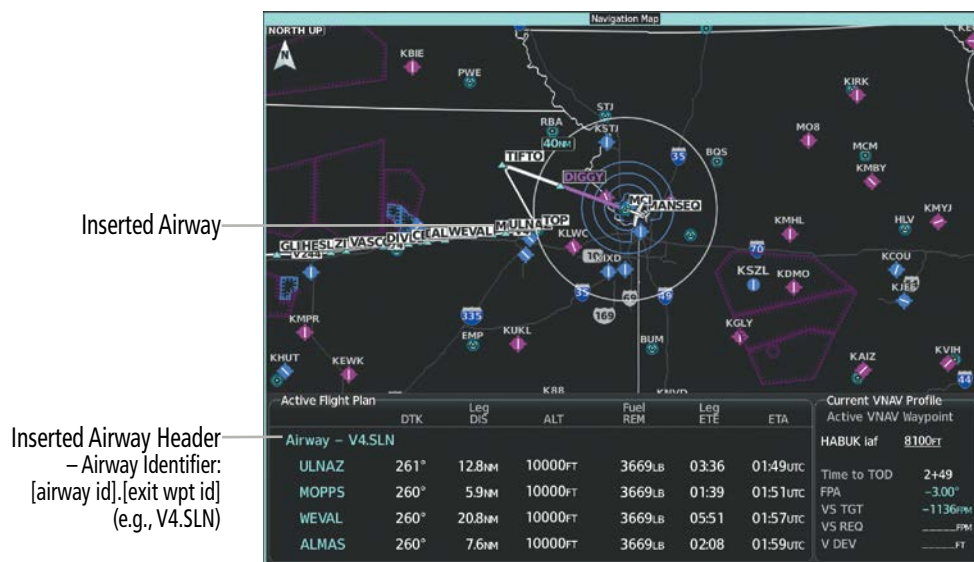


Figure 5-80 'Active Flight Plan' Window – V4 Airway Loaded



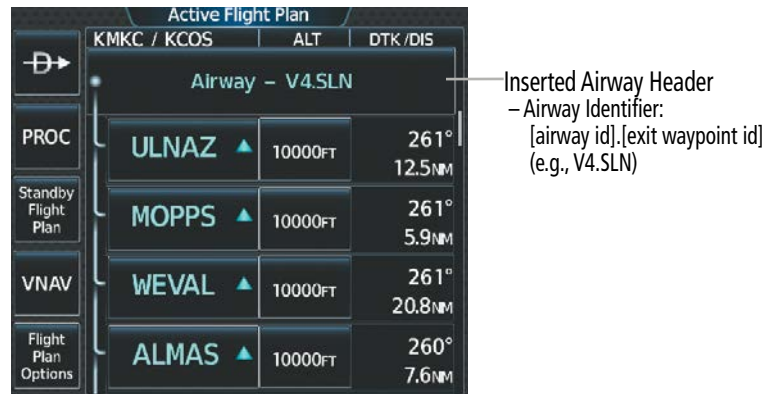


Figure 5-81 'Active Flight Plan' Screen – V4 Airway Loaded

## 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 the 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 5-82 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.

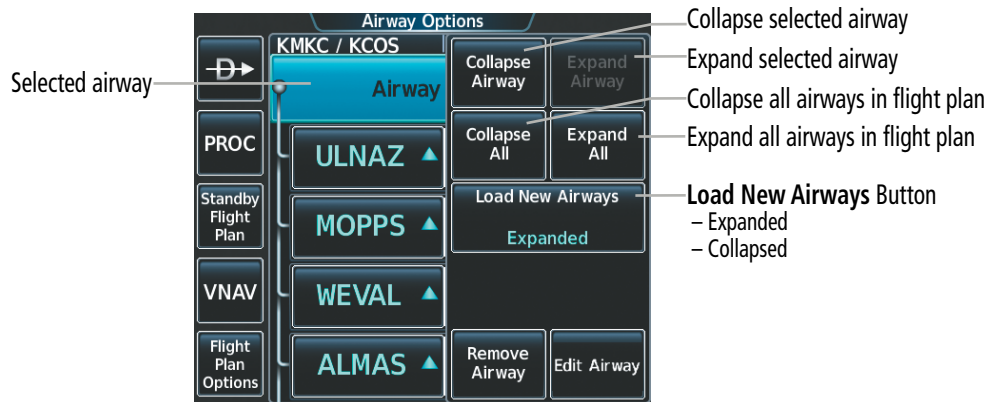


Figure 5-83 'Airway Options' Window

### 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.

## 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. For information on departures, arrivals, and approaches refer to the Procedures Section later in this Flight Management Section.

In-flight, the system automatically sequences through the active flight plan, with the exception of manually terminated legs (such as FM, HM, or VM) that can occur within procedures (refer to the Procedures Section later in this Flight Management 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 5-84 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).

## 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 5-85 Switching between 'Active' and 'Standby Flight Plan' Screens

## Activating the standby flight plan:

- 1) From MFD Home, touch **Flight Plan** > **Standby Flight Plan** > **Flight Plan Options**.
- 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 through 4 for the desired waypoint.





Figure 5-86 Standby Flight Plan – Join From P. POS



Figure 5-87 Standby Flight Plan – Join From P.POS link active (Show on Map Button is active)

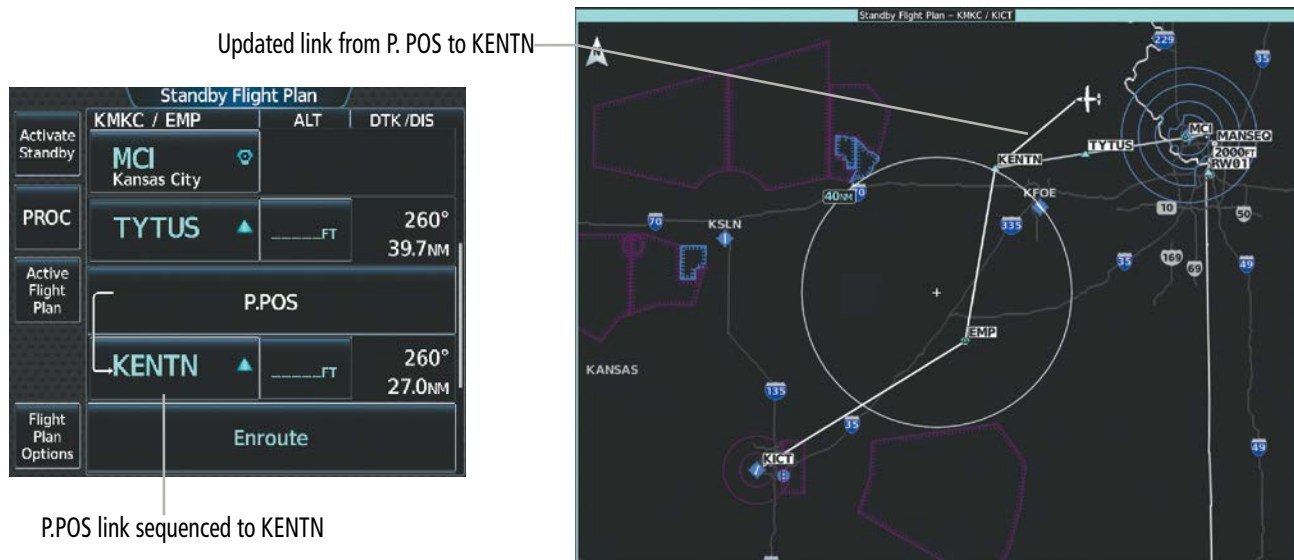


Figure 5-88 P. POS link sequenced to next waypoint in standby flight plan

### 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.

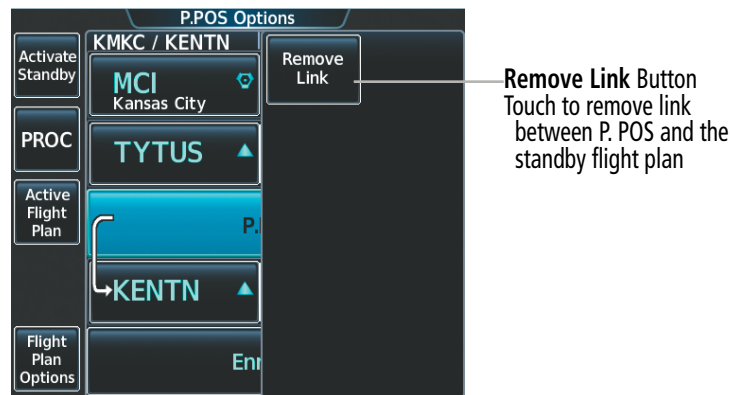


Figure 5-89 Standby Flight Plan – Remove link from P. POS

## ALONG TRACK OFFSETS

A waypoint having an “along track offset” distance from an existing waypoint can be entered into the active flight plan. Along track offset waypoints lie along the path of the existing flight plan, and can be used to make the system reach a specified altitude before or after reaching the specified flight plan waypoint. Offset distances can be entered from 1 to 999 nm in increments of 1 nm. Entering a negative offset distance results in an along track offset waypoint inserted before the selected waypoint, whereas entering a positive offset distance results in an along track offset waypoint inserted after the selected waypoint. Multiple offset waypoints are allowed.



**NOTE:** The along track offset distance is calculated to the waypoint sequence point (e.g. turn anticipation arc bisector), not along the direct course to the waypoint. This can result in the offset waypoint and constraints being placed less than or greater than the specified offset distance along the direct course to the waypoint. To precisely control the offset distance, a user-defined waypoint can be created at the specified distance and bearing from the waypoint. See the Creating User Waypoints procedures.

A waypoint must be adjacent to its parent waypoint in the flight plan, so the system limits the along-track distance to less than the length of the leg before or after the selected waypoint. If the selected waypoint is the active waypoint, the distance is limited to less than the distance to go to the active waypoint. Assigning an along track offset to a leg with indeterminate length is not permitted. An along track offset is not allowed at or after the final approach fix of an approach.

An along track offset distance cannot be modified once entered. If the along track offset distance must be changed, the existing along track offset waypoint must be removed and a new one created with the new offset distance.



An altitude constraint can also be entered for the along track waypoint, and is modifiable. An along track offset waypoint can only be used for vertical navigation, and is not available for creation of a user defined hold, or as a direct to destination.



Figure 5-90 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 selection button to display the 'Waypoint Options' Window.
- 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 (limited by leg distances).
- 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' Window.

- 3) Touch the **Remove Waypoint** Button.
- 4) Touch the **OK** Button to delete the waypoint from the flight plan.



Figure 5-91 Adding an Altitude Constraint

## 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 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.

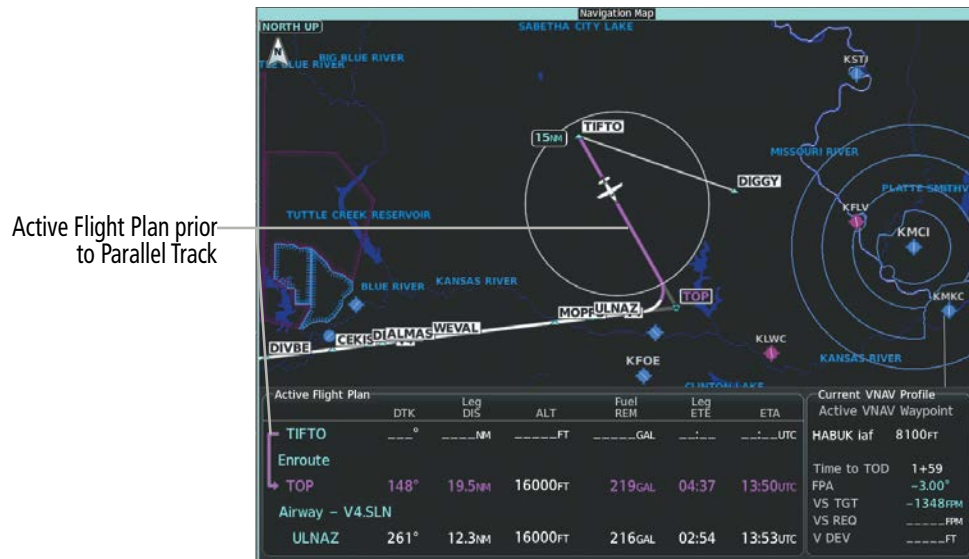


Figure 5-92 Active Flight Plan – Prior to Activating Parallel Track

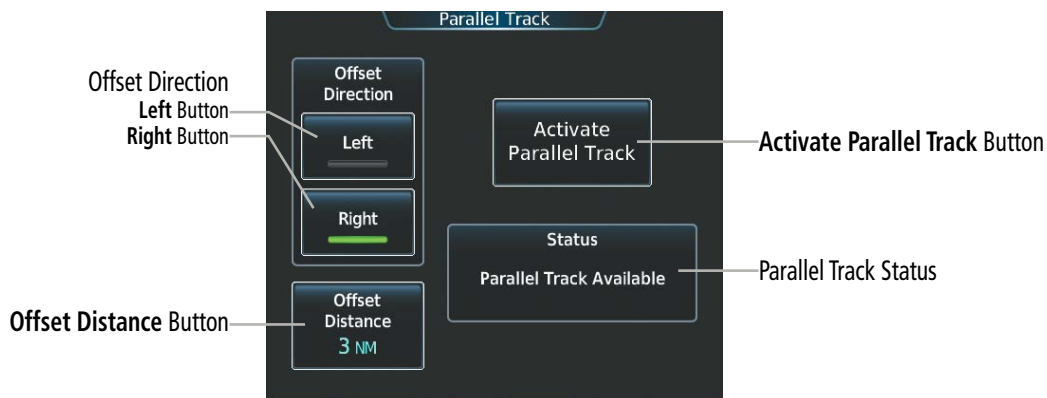


Figure 5-93 'Parallel Track' Screen – Selecting Parallel Track

**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.

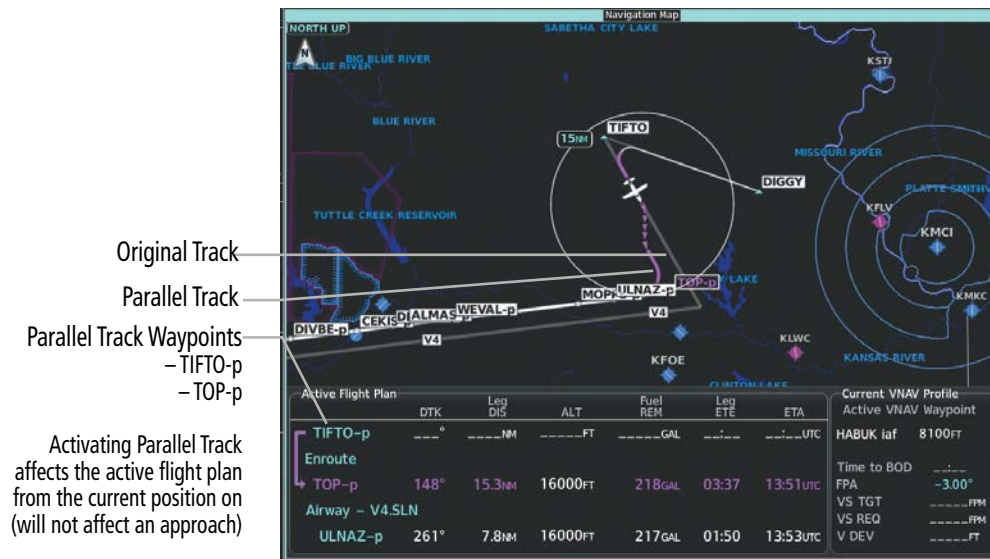


Figure 5-94 Active Flight Plan – Parallel Track Active

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 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 the system is unable to activate the parallel track because of invalid geometry (‘Parallel Track Unavailable Invalid Route Geometry’). If the active leg is not a track between two fixes (TF) or a course to a fix (DF) leg, the status indicates the system is unable to activate the parallel track because parallel track is not available for the active leg type (‘Parallel Track Unavailable Not Allowed for Active Leg’).

#### Cancelling 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 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**.

**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) Touch the **Flight Plan Options** Button to display the 'Flight Plan Options' Window.
  - 3) Touch the **Closest Point of Flight Plan** Button to display the 'Closest Point of Flight Plan' Screen.
  - 4) Touch the **From** Waypoint Button to display the keypad.
  - 5) Use the keypad and the **Enter** Button to select the "From" waypoint.
  - 6) Touch the **Insert Point into Flight Plan** Button to add the calculated waypoint into the flight plan. The name for the new waypoint is derived from the identifier of the From waypoint.

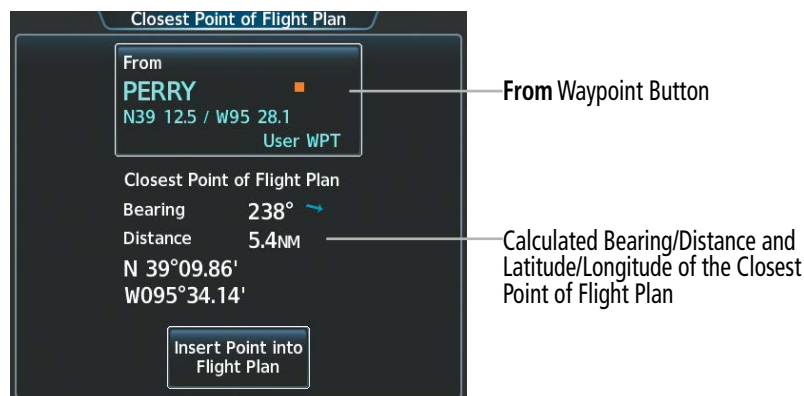


Figure 5-95 Closest Point of Flight Plan

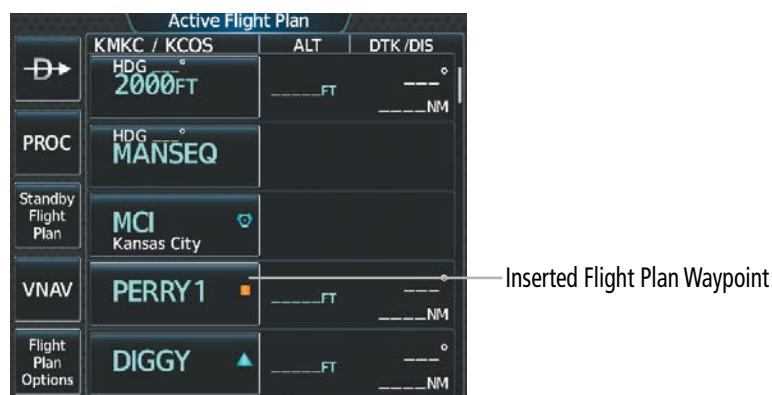


Figure 5-96 Closest Point of Flight Plan inserted in Active Flight Plan

## 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.
- 3) Touch the **Turn** Button, and touch the **Right** Button or the **Left** Button to select the turn direction.
- 4) Touch the Course Direction (Inbound or Outbound) Button, and touch the **Inbound** Button or the **Outbound** Button to select the course direction.
- 5) Touch the **Course** Button to display the keypad. Use the keypad and the **Enter** Button to select the inbound or outbound course.
- 6) Touch the Leg Length Mode Button, and touch the **Distance** Button or the **Time** Button to select the length mode.
- 7) Touch the **Leg Time** Button or the **Leg Distance** Button to display the keypad. Use the keypad and the **Enter** Button to select the length of the leg.
- 8) Touch the **Expect Further Clearance** Button to display the keypad. Use the keypad and the **Enter** Button to select the time for a reminder. A system message (HOLD EXPIRED Holding EFC time expired.) will be triggered at the selected time.
- 9) Touch the **Create** Button to add the hold into the flight plan.



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





Figure 5-97 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 (Inbound or Outbound) Button, and touch the **Inbound** Button or the **Outbound** Button to select the course direction.
- 5) Touch the **Course** Button to display the keypad. Use the keypad and the **Enter** Button to select the course.
- 6) Touch the Leg Length Mode Button, and touch the **Distance** Button or the **Time** Button to select the length mode.
- 7) Touch the **Leg Time** Button or the **Leg Distance** Button to display the keypad. Use the keypad and the **Enter** Button to select the length of the leg.
- 8) Touch the **Expect Further Clearance** Button to display the keypad. Use the keypad and the **Enter** Button to select the time for a reminder. A system message (HOLD EXPIRED Holding EFC time expired.) will be triggered at the selected time.
- 9) Touch the **Create** Button to create 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.

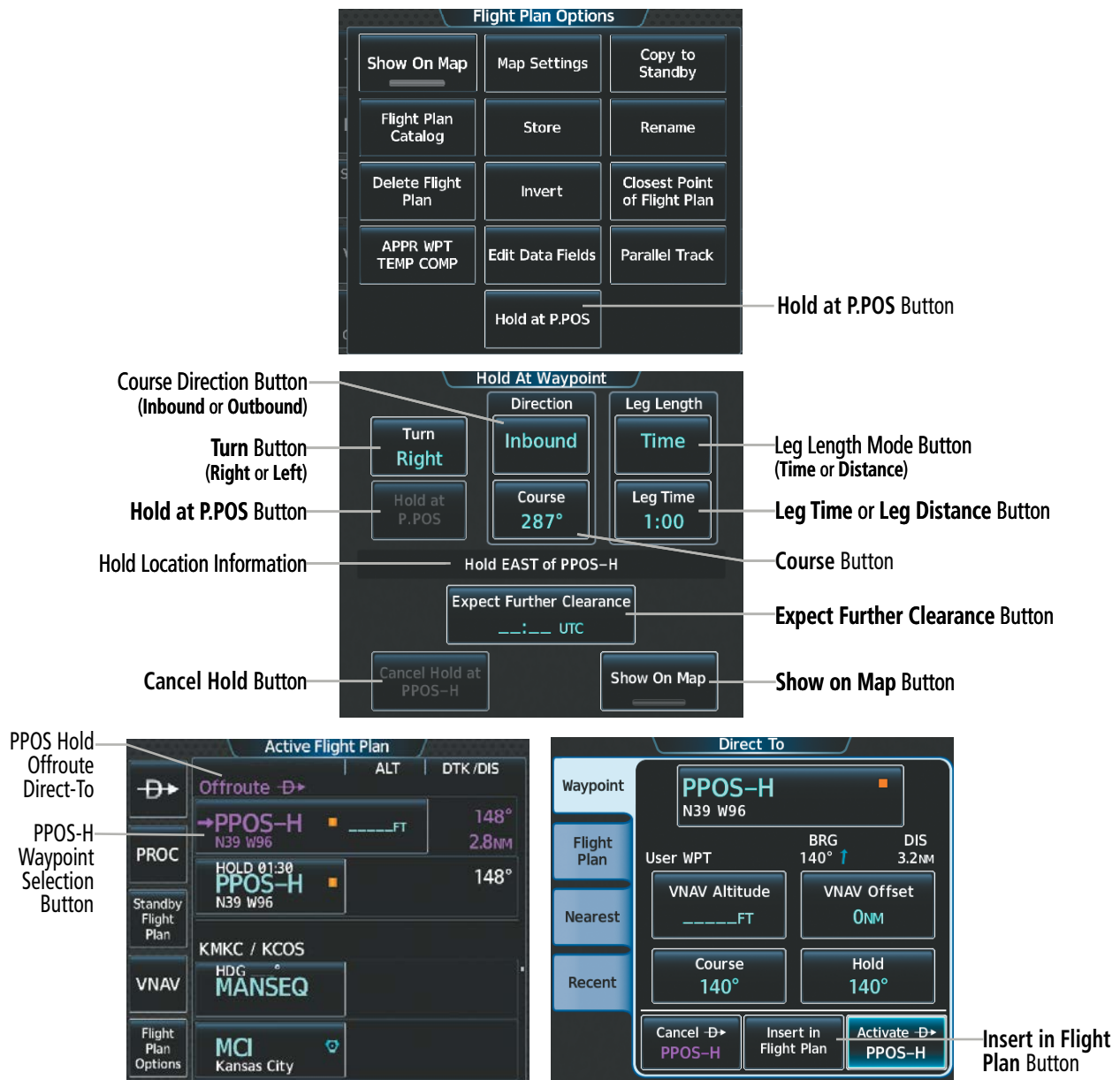


Figure 5-98 Creating a User Defined Holding Pattern at the Aircraft Present Position



**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.



**NOTE:** If a user-defined hold has been created at the aircraft present position and then is edited, the preview shown on the map will reflect the new position of the holding pattern, but the PPOS-H waypoint (orange square) may not be accurately depicted. When the edited holding pattern is created, the PPOS-H waypoint is shown correctly.



**NOTE:** When a user-defined hold is created at the aircraft present position, the hold fix is placed slightly in front of the aircraft to allow the aircraft time to prepare for the upcoming turn.

#### Creating a user-defined hold at a direct-to waypoint:

- 1) From MFD Home, touch **Flight Plan**.
- 2) Touch the **→** Button and set up the Direct To waypoint as desired.
- 3) Touch the **Hold** Button. The 'Direct To Hold' Screen is displayed.
- 4) Touch the **Turn** Button, and touch the **Right** Button or the **Left** Button to select the turn direction.
- 5) Touch the Course Direction (Inbound or Outbound) Button, and touch the **Inbound** Button or the **Outbound** Button to select the course direction.
- 6) Touch the **Course** Button to display the keypad. Use the keypad and the **Enter** Button to select the inbound or outbound course.
- 7) Touch the Leg Length Mode Button, and touch the **Distance** Button or the **Time** Button to select the length mode.
- 8) Touch the **Leg Time** Button or the **Leg Distance** Button to display the keypad. Use the keypad and the **Enter** Button to select the length of the leg.
- 9) Touch the **Expect Further Clearance** Button to display the keypad. Use the keypad and the **Enter** Button to select the time for a reminder. A system message (HOLD EXPIRED Holding EFC time expired.) will be triggered at the selected time.
- 10) Touch the **Enter** Button to return to the 'Direct To' Screen.
- 11) Touch the **Activate →** Button to activate the Direct-To and add the hold into the flight plan.

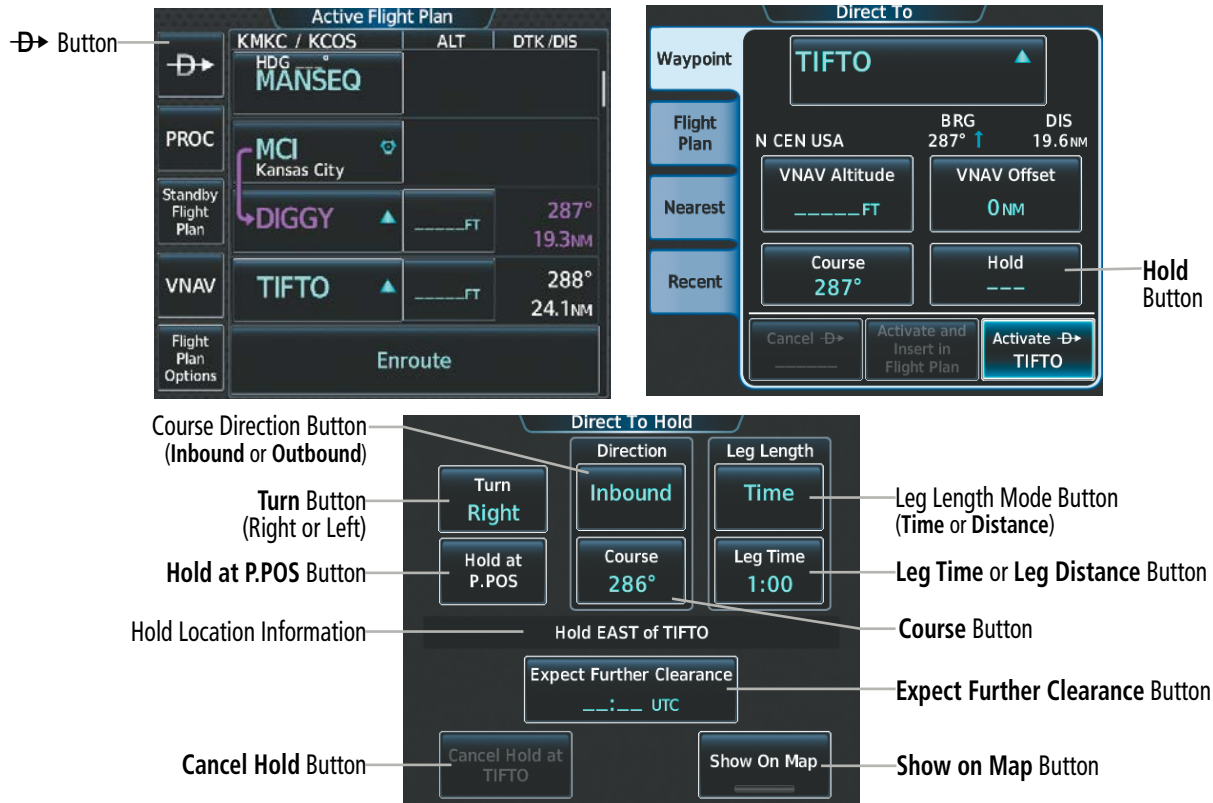


Figure 5-99 Creating a User Defined Holding Pattern at a Direct To Waypoint

### Removing a user-defined hold at an active flight plan waypoint or at a direct-to waypoint:

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

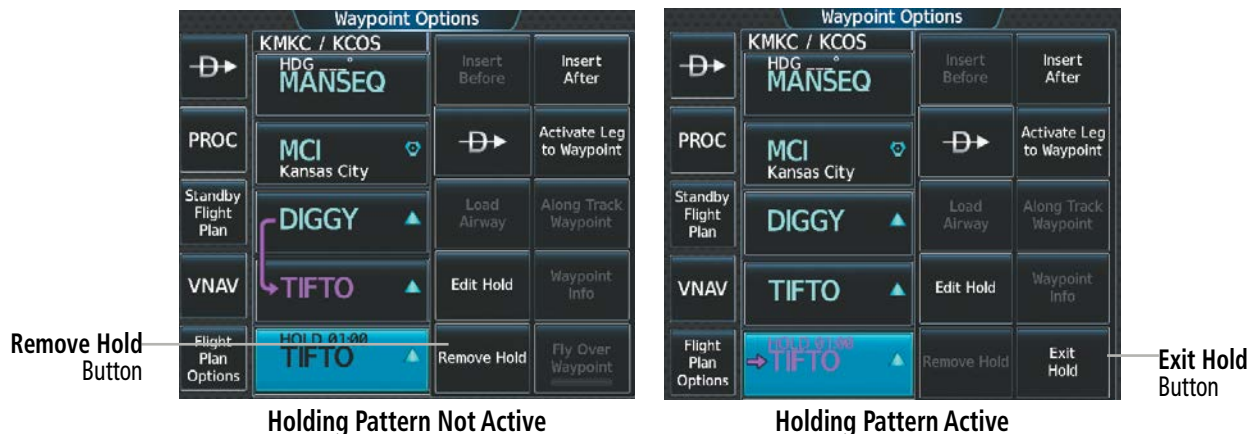


Figure 5-100 Removing a User Defined Holding Pattern at an Active Flight Plan Waypoint

### 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 PFD 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 **→** Button. The 'Direct To' Screen 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.



Cancel → PPOS-H Button

Figure 5-101 Removing a User Defined Holding Pattern at the Aircraft Present Position

## ARRIVAL 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).

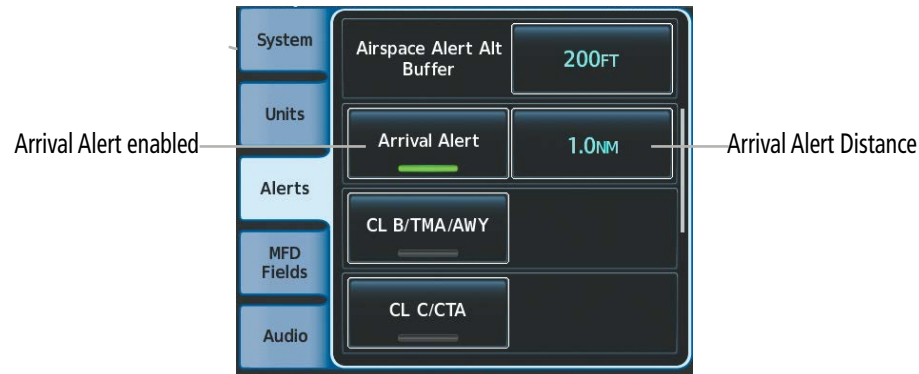


Figure 5-102 'Avionics Settings' Screen – Arrival Alerts enabled

#### Changing the Arrival Alert settings:

- 1) From MFD Home, touch **Utilities > Setup > Avionics Settings**.
- 2) Touch the **Alerts** Tab. Scroll to view the Arrival Alert settings.
- 3) Touch the **Arrival Alert** Button to enable/disable the alert.
- 4) Touch the Arrival Alert Distance Button to display the keypad.
- 5) Enter the arrival alert distance and touch the **Enter** Button.

## MANAGING FLIGHT PLANS

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

### IMPORTING AND EXPORTING FLIGHT PLANS

Flight plans can be transferred to or from a mobile device via the Wireless 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) Touch the **Connex** Button to see the notification of the pending flight plan on the 'Notifications' Screen.
- 3) Touch 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.

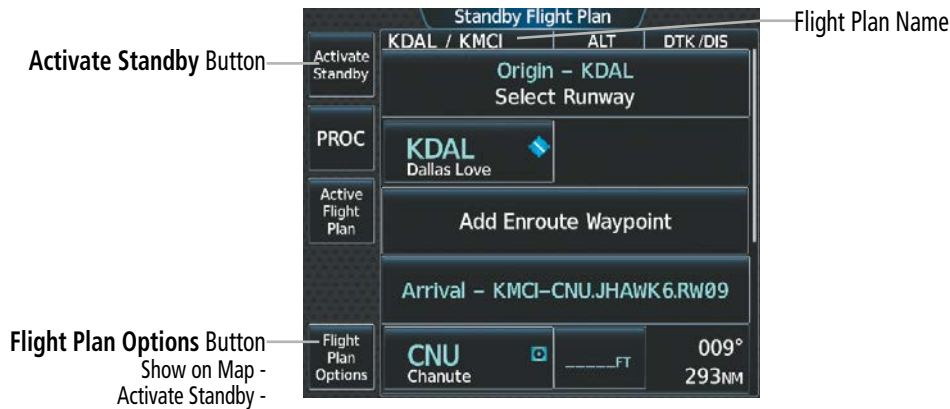


Figure 5-103 Pending Flight Plan added to Standby Flight Plan

### 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 5-104 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 right knobs, if necessary.
- 7) Touch the **Export** Button.
- 8) Touch the **OK** Button in response to the "Flight Plan Successfully Exported." prompt to return to the 'Flight Plan Options' Window.



**NOTE:** The exported flight plan will not contain any procedures or airways. The flight plan origin/destination airport will be exported, but as the first and last waypoint, not the origin and destination.

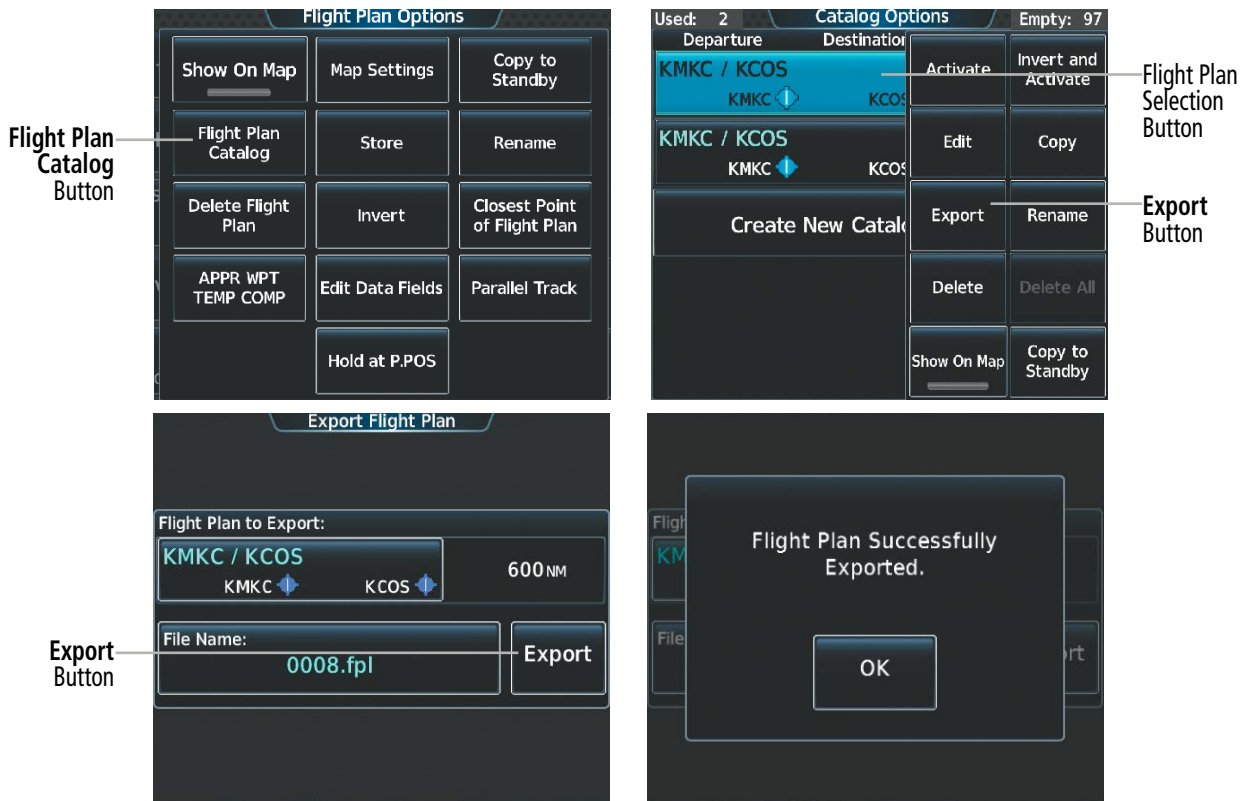


Figure 5-105 Stored Flight Plan Export

In some circumstances, some flight plan import or export messages may appear in conjunction with others.

Flight Plan Import/Export Results	Description
'Flight plan successfully imported.'	A flight plan file stored on the SD card was successfully imported as a stored flight plan.
'File contained user waypoints only. User waypoints imported successfully. No stored flight plan data was modified.'	The file stored on the SD card did not contain a flight plan, only user waypoints. These waypoints have been saved to the system user waypoints. No flight plans stored in the system have been modified.
'No flight plan files found to import.'	The SD card contains no flight plan data.
'Flight plan import failed.'	Flight plan data was not successfully imported from the SD card.
'Flight plan partially imported.'	Some flight plan waypoints were successfully imported from the SD card, however others had errors and were not imported. A partial stored flight plan now exists in the system.
'File contained user waypoints only.'	The file stored on the SD card did not contain a flight plan, only user waypoints. In addition, one or more of these waypoints may not have imported successfully.
'Too many points. Flight plan truncated.'	The flight plan on the SD card contains more waypoints than the system can support. The flight plan was imported with as many waypoints as possible.
'Some waypoints not loaded. Waypoints locked.'	The flight plan on the SD card contains one or more waypoints the system cannot find in the navigation database. The flight plan has been imported, but must be edited within the system before it can be activated for use.

Flight Plan Import/Export Results	Description
'User waypoint database full. Not all loaded.'	The flight plan file on the SD card contains user waypoints. The quantity of stored user waypoints has exceeded system capacity, therefore not all the user waypoints on the SD card have been imported. Any flight plan user waypoints that were not imported are locked in the flight plan. The flight plan must be edited within the system before it can be activated for use.
'One or more user waypoints renamed.'	One or more imported user waypoints were renamed when imported due to naming conflicts with waypoints already existing in the system.
'Flight plan successfully exported.'	The stored flight plan was successfully exported to the SD card.
'Flight plan export failed.'	The stored flight plan was not successfully exported to the SD card. The SD card may not have sufficient available memory or the card may have been removed prematurely.

**Table 5-8 Flight Plan Import/Export Messages**

## DELETING THE ACTIVE OR STANDBY FLIGHT PLAN

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

### 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.

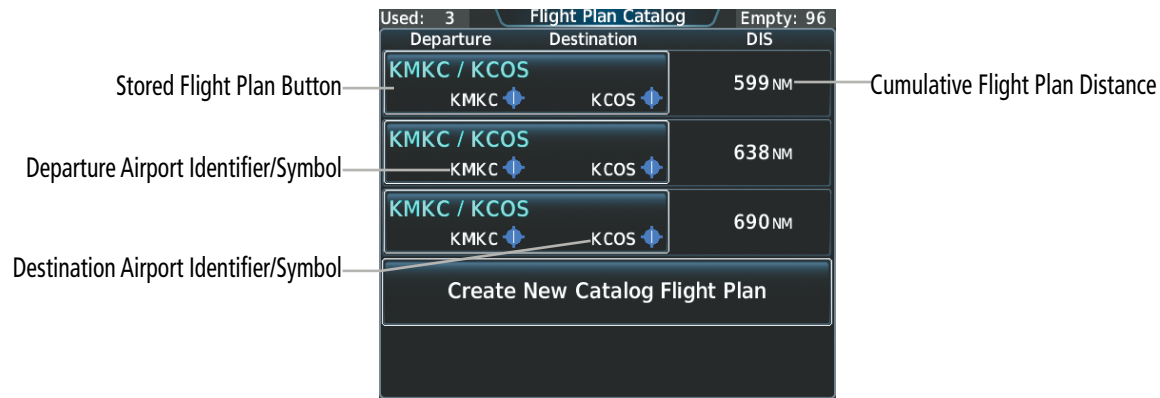


Figure 5-106 'Flight Plan Catalog' Screen

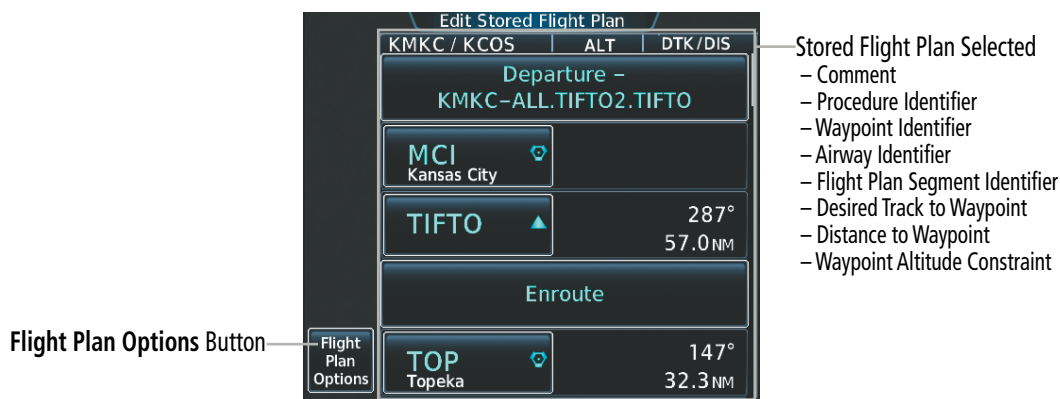


Figure 5-107 'Edit Stored Flight Plan' Screen

## 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 either a standby or active flight plan is created, it can be stored to the Flight Plan Catalog.

### Storing a flight plan from the 'Active Flight Plan' Screen or the '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?".

## ACTIVATE 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. (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 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.

**COPY 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.

## DELETE 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 A FLIGHT PLAN COMMENT (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 guidance for the flight plan during the enroute and terminal phases of flight (does not affect final approach segment VNAV). Guidance based on specified altitude constraints in the active flight plan or for a VNAV direct-to is provided. VNAV guidance is based on barometric altitudes, not on GPS altitude.

Descent VNAV guidance is displayed as a linear deviation from the desired path. The desired path is defined by a line joining two waypoints with designated altitude constraints. Additionally, the desired path may be defined by specifying a Flight Path Angle (FPA) or Vertical Speed (VS) Target from the desired waypoint and designated altitude constraint.

Other displays of VNAV guidance may include the active VNAV waypoint identifier, Target Altitude, VS Required, Top of Descent (TOD), Bottom of Descent (BOD), and descent vertical deviation. The appropriate guidance to be displayed depends upon VNAV profile parameters (such as FPA), and aircraft location relative to the VNAV profile.

VNAV guidance may be viewed on the PFW and Touchscreen Controller. The **VNAV Enabled** Button must be enabled (annunciator bar is green when enabled and grey when inhibited), to allow VNAV guidance to be displayed. VNAV can be enabled or disabled anytime. Disabling VNAV cancels active waypoint vertical guidance, and VNAV guidance is no longer displayed. VNAV remains disabled until manually enabled.

Refer to the Flight Director, AFCS Section for information on the display and use of VNAV guidance using the flight director.



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



**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 5-108 'VNAV Profile' Screen - Enable/Disable VNAV

VNAV Altitude Constraint

Current Vertical Navigation Profile displays dashes when VNAV disabled

Active Flight Plan							Current VNAV Profile	
	DTK	Leg DIS	ALT	Fuel REM	Leg ETE	ETA	Active VNAV Waypoint	
BRK	353°	36.7NM	15000FT	-30GAL	34:56	18:07UTC		
Approach - KCOS-RNAVaps Y 35R LPV								
HABUK iaf	164°	24.5NM	8100FT	-52GAL	23:17	18:31UTC		
FALUR	290°	6.7NM	8100FT	-58GAL	06:22	18:37UTC		
CEGIX faf	352°	6.5NM	8100FT	-64GAL	06:13	18:43UTC		
							Time to BOD	
							FPA	
							VS TGT	
							VS REQ	
							V DEV	

Figure 5-109 'Active Flight Plan' Window - VNAV Disabled

VNAV Altitude Constraint

Current Vertical Navigation Profile VNAV Waypoint ID shown

Active Flight Plan							Current VNAV Profile	
	DTK	Leg DIS	ALT	Fuel REM	Leg ETE	ETA	Active VNAV Waypoint	
BRK	353°	36.7NM	15000FT	-23GAL	34:56	18:01UTC	HABUK iaf	8100FT
Approach - KCOS-RNAVaps Y 35R LPV								
HABUK iaf	164°	24.5NM	8100FT	-45GAL	23:17	18:24UTC		
FALUR	290°	6.7NM	8100FT	-51GAL	06:22	18:30UTC		
CEGIX faf	352°	6.5NM	8100FT	-57GAL	06:13	18:36UTC		
							Time to TOD	1+56
							FPA	-3.00°
							VS TGT	-334FPM
							VS REQ	
							V DEV	

Figure 5-110 'Active Flight Plan' Window - VNAV Enabled

### Enabling/Disabling VNAV guidance:

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

## CONSTRAINTS

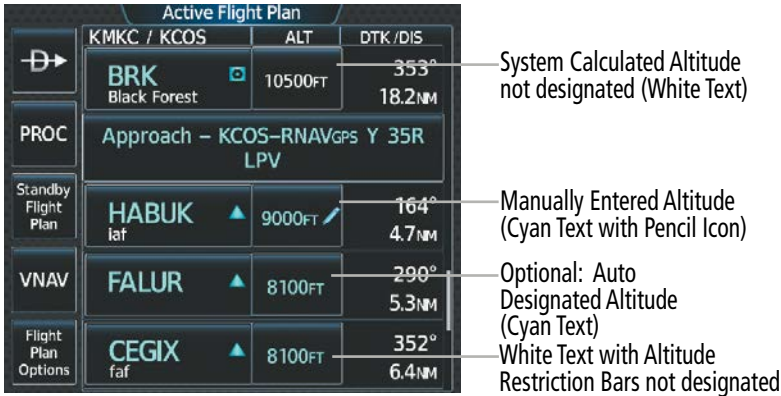


**NOTE:** Manually specifying an FPA to the FAF, or manually creating an altitude constraint at the FAF inhibits the Transition to Approach (TTA) function.

## 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.

Altitude Constraints within a Flight Plan



Altitude Constraint Types

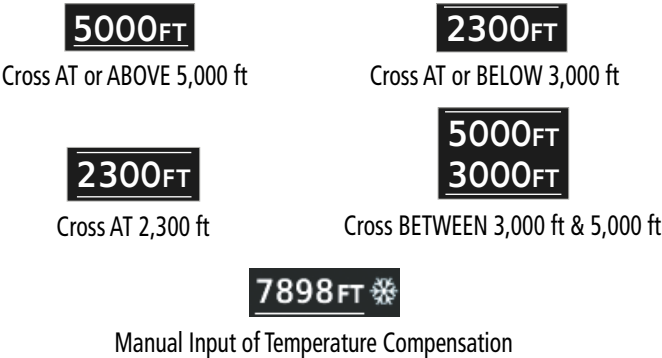


Figure 5-111 Active Flight Plan – Waypoint Altitude Constraints

White Text	Cyan Text
<div>5000FT</div> <p>Advisory altitudes calculated by the system estimating the altitude of the aircraft as it passes over the navigation point.</p> <div>5000FT</div> <p>Altitude retrieved from the navigation database. White line above and/or below indicates the type of constraint, as shown in the preceding figure.</p> <p>These altitudes are provided as a reference, and are not designated for vertical guidance.</p>	<div>5000FT</div> <p>Altitude is designated for use in determining vertical guidance. A pencil icon indicates manual designation or manual data entry.</p> <div><del>5000FT</del></div> <p>The system cannot use this altitude in determining vertical guidance because of an invalid constraint condition.</p>

Table 5-9 Altitude Constraint Color Coding

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

An altitude constraint may be manually designated for procedure waypoints and enroute waypoints by touching the desired VNAV Alt Button and entering the desired altitude. An altitude constraint may be manually designated only if it is selectable and available for vertical guidance. Altitudes that are not available for vertical guidance are shown in white text and are not selectable.



**NOTE:** *If the Final Approach Fix (FAF) is available for vertical guidance, the system will auto-designate the FAF altitude constraint when loading the procedure. If necessary, the FAF altitude constraint may be modified and set above or below the published FAF altitude.*

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” by removing the altitude constraint. The altitude will not be used for vertical guidance and the text displayed will be shown in white. The system will recalculate advisory altitudes (white text) once any altitude constraint is designated, modified, or un-designated.

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



**NOTE:** *After an approach procedure has been loaded into the flight plan, any altitude constraint programmed at the airport reference point (on the flight plan just ahead of the approach procedure) will be removed if the approach procedure is changed or removed.*

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

#### 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 the desired VNAV ALT Button. If the desired altitude is already displayed, skip to Step 5 to designate the altitude constraint for vertical guidance.
- 3) Use the keypad to input the altitude.
- 4) If necessary, touch the **Flight Level** Button or the **MSL** Button to select the altitude mode.
- 5) Touch the **Enter** Button to designate the altitude constraint. The altitude is now shown in cyan, indicating it is usable for vertical guidance.



Figure 5-112 Active Flight Plan – Adding an Altitude Constraint

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

#### Removing/undesignating an altitude constraint:

- 1) For the active flight plan: From 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 the desired VNAV ALT Button.
- 3) Touch the **Remove VNAV ALT** Button. A 'Remove VNAV altitude?' 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 the desired VNAV ALT Button.
- 3) Touch the **Remove VNAV ALT** Button. A 'Remove or Revert to published VNAV altitude of nnnnnFT?' confirmation window is displayed.
- 4) Touch the **Revert** Button. The altitude is now the database altitude and is shown in cyan, indicating it is usable for vertical guidance.

**VERTICAL SPEED TARGET AND FLIGHT PATH ANGLE**

The 'VNAV Profile' Screen provides information on the active VNAV waypoint. The active VNAV waypoint is either the current VNAV waypoint for which VNAV direct-to guidance is being provided, or, when VNAV direct-to is not active, the system determines the next waypoint in the flight plan with a designated altitude constraint to be the active VNAV waypoint.

The vertical speed (VS) target and flight path angle (FPA) for the active VNAV waypoint can be modified by directly entering either a vertical speed target (VS Target) or a flight path angle (FPA) on the 'VNAV Profile' Screen. When VNAV direct-to is not active, these buttons will be subdued until the aircraft is within 10 nm of TOD or if the selected altitude is adjusted below the active VNAV waypoint.

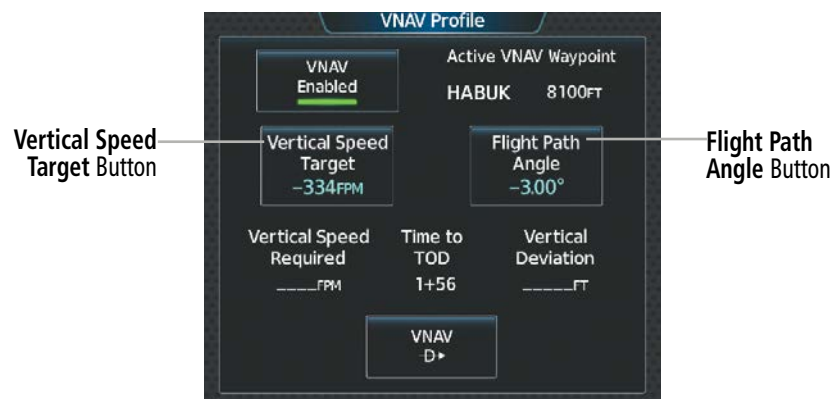


Figure 5-113 VNAV Profile - Vertical Speed Target and Flight Path Angle

**Modifying the Vertical Speed Target and Flight Pat Angle:**

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

**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, 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.

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 VNAV PATH descents because the lateral distance of those legs is unknown. The VSD will not show a VNAV profile for any legs that have no vertical path guidance.

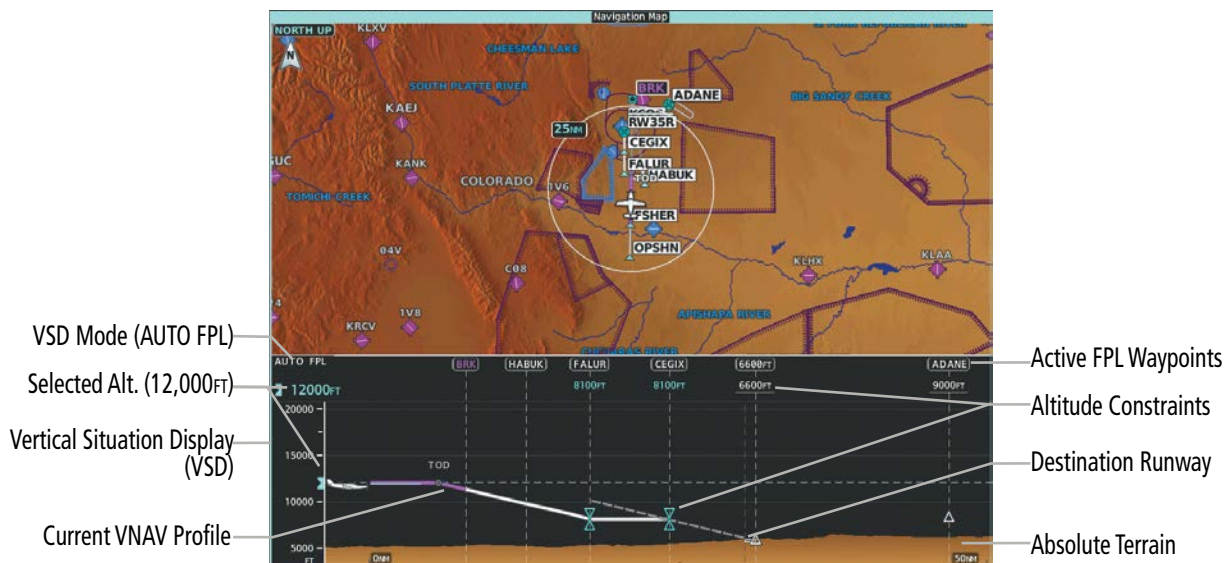


Figure 5-114 Vertical Situation Display (VSD)




Constraint Type	Numeric Representation	Altitude Constraint Icon
AT (Designated Altitude Constraint)	3000FT	
AT or ABOVE (Un-designated Altitude Constraint derived from the database)	3000FT	
AT or BELOW (Un-designated Altitude Constraint derived from the database)	5000FT	

Table 5-10 Altitude Constraint Icons

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.

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

Table 5-11 Swath Width

VSD Mode Button	Displayed Mode	FPL Criteria	Items available on VSD
Auto	AUTO FPL	Available active FPL & aircraft within FPL swath	Terrain/obstacles along the active flight plan route, vertical track vector, selected altitude, and active flight plan information*
	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, and destination runway

Table 5-12 VSD Mode Descriptions

### Enabling/disabling the VSD:

- 1) From MFD Home, touch **Map > 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 Settings**.
- 2) Touch the **Inset Window** Tab.
- 3) Touch the VERT Situation Display **Settings** Button.
- 4) Touch the **Mode** Button to display the 'Mode Selection' Window.
- 5) Touch a Mode Button to select the mode and return to the 'Vertical Situation Display Settings' Window.

## VSD MESSAGES

Under certain conditions, some messages may appear in conjunction with others:

Message	Description
'Loading...'	VSD is loading data due to a range change, full/half switch, or first being selected for display.
'Flight Plan Not Available'	Flight Plan mode is selected and there is not a flight plan loaded with at least one leg.
'Flight Plan mode unavailable because aircraft off course and active leg over 200 NM'	All of the following are true: <ul style="list-style-type: none"> <li>– Flight Plan mode is selected</li> <li>– The active leg is greater than 200 nm</li> <li>– The aircraft is outside the swath</li> </ul>
'VSD Not Available'	At least one of the following is true: <ul style="list-style-type: none"> <li>– Valid terrain database not available</li> <li>– GPS MSL altitude not available</li> <li>– Current barometric altitude not available</li> <li>– Neither current track nor current heading available</li> <li>– GPS position not available</li> <li>– Map range setting is less than 1 nm</li> </ul>
'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 5-13 VSD System Messages

## VERTICAL NAVIGATION DIRECT-TO

The system allows a vertical navigation (VNAV) direct-to for any waypoint in the active flight plan with an altitude descent constraint designated (cyan text) for vertical guidance. Initiating the VNAV direct-to allows the flight plan to be flown, while vertical guidance based on the altitude constraint at the VNAV direct-to waypoint is provided. The altitude change begins on the current leg and is spread along the flight plan from current position to the vertical direct-to waypoint, not just along the leg for the direct-to waypoint. A TOD point is computed based on this altitude change; guidance for descent begins once the TOD is reached. 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.

Once VNAV direct-to is activated, all VNAV altitude constraints prior to the VNAV direct-to waypoint are removed from the active flight plan. All VNAV altitude constraints following the VNAV direct-to waypoint are retained.

A lateral direct-to with an altitude constraint (activated by touching the  $\rightarrow$  Button) also provides vertical guidance, but would bypass flight plan waypoints between the current position in the flight plan and the direct-to waypoint.

Adjusting the active Vertical Speed Target and Flight Path Angle for the active VNAV waypoint is discussed later in this section.



Figure 5-115 VNAV Constraint – Initiating a VNAV Direct-To

Active Flight Plan							Current VNAV Profile	
	DTK	Leg DIS	ALT	Fuel REM	Leg ETE	ETA	Active VNAV Waypoint	
BRK	353°	21.3NM	10000FT	-99GAL	05:01	15:27UTC	BRK	10000FT
Approach – KCOS–RNAVGps Y 35R LPV								
HABUK iaf	164°	7.7NM	9000FT	-101GAL	01:50	15:28UTC	Time to TOD	00:15
FALUR	290°	5.3NM	8100FT	-102GAL	01:15	15:30UTC	FPA	-0.13°
CEGIX faf	352°	6.4NM	8100FT	-103GAL	01:31	15:31UTC	VS TGT	-59fpm
							VS REQ	-59fpm
							V DEV	-10FT

Figure 5-116 Active Flight Plan – VNAV Direct To Active



**NOTE:** Initiating a VNAV Direct-to the FAF, inhibits the Transition to Approach (TTA) function.

### Activating a vertical navigation direct-to:

- 1) From MFD Home, touch **Flight Plan**.
- 2) Scroll the active flight plan and touch the desired VNAV ALT Button.
- 3) Use the keypad to input the altitude. If the desired altitude is already displayed, skip to Step 4 to activate vertical navigation direct-to.
- 4) Touch the **VNAV -D➔ XXXXX** Button to activate the vertical navigation direct-to. Vertical guidance begins to the altitude constraint for the selected waypoint.

Or:

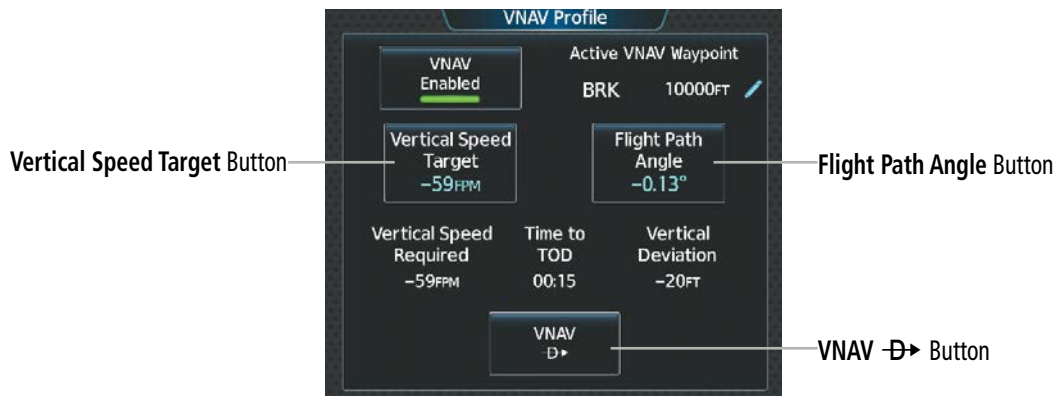


Figure 5-117 VNAV Profile - Vertical Navigation Profile Modification

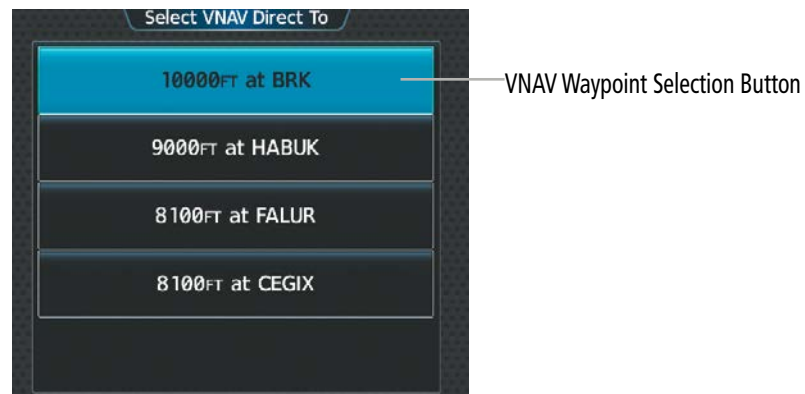


Figure 5-118 Selecting the VNAV Direct To Waypoint

- 1) From MFD Home, touch **Flight Plan > VNAV**.
- 2) Touch the **VNAV -D➔** 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 **OK** Button to activate the vertical navigation direct-to. Vertical guidance begins to the altitude constraint for the selected waypoint.
- 5) Touch the **Back** Button to exit and return to the previous screen.

**Removing an altitude constraint when vertical navigation direct-to is active:**

- 1) From MFD Home, touch **Flight Plan**.
- 2) Scroll the active flight plan list and touch the VNAV ALT Button for the waypoint receiving VNAV direct-to guidance.
- 3) Touch the **Remove VNAV ALT** Button.
- 4) Touch the **OK** Button in response to the question "Remove Altitude Constraint?". Vertical navigation direct-to guidance for the altitude constraint is canceled, and the altitude constraint is removed from the flight plan.



## 5.8 PROCEDURES

The system can access departures, arrivals, and approaches that are stored within the database using the Touchscreen Controller **PROC** Button. Selected procedures can be added to the active, standby, or stored flight plan.

The process of loading procedures into the active flight plan and standby flight plan are similar. Waypoints are not required to be in the flight plan to load procedures. When a selected procedure is added to a flight plan, the airfield identifier for that procedure will fill the origin or destination field. If the origin or destination airport (or runway) is already loaded, the procedure selection screen defaults to the appropriate airport.



**NOTE:** The origin airport/runway remains when removing a departure; the destination airport/runway remains if after deleting the procedure, there is no longer a procedure at the destination airport. A procedure replaces the respective destination/runway waypoint.

The system adds procedures to the flight plan based on the leg types coded within that procedure in the navigation database. Terminal procedures may contain unique characteristics, such as specifically coded leg segments like '2000FT', which indicates a leg that requires manual termination by the pilot when the specified altitude (2000 feet) has been exceeded. A heading leg in the flight plan displays 'hdg' or 'HDG' preceding the DTK (e.g. 'hdg 008°'). A flight plan leg requiring the pilot to manually initiate sequencing to the next leg displays 'MANSEQ' as the identifier.

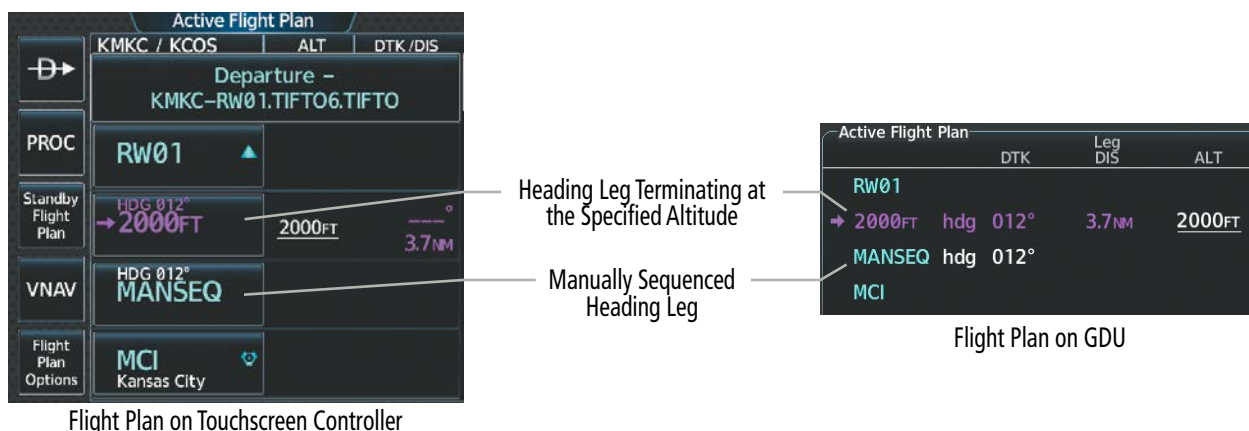


Figure 5-119 Procedure Leg Identifiers

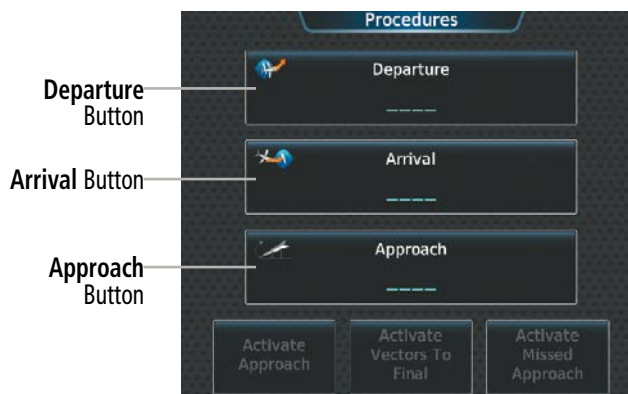


Figure 5-120 Loading Procedures on the Touchscreen Controller

**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 an 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 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 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.

### 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.

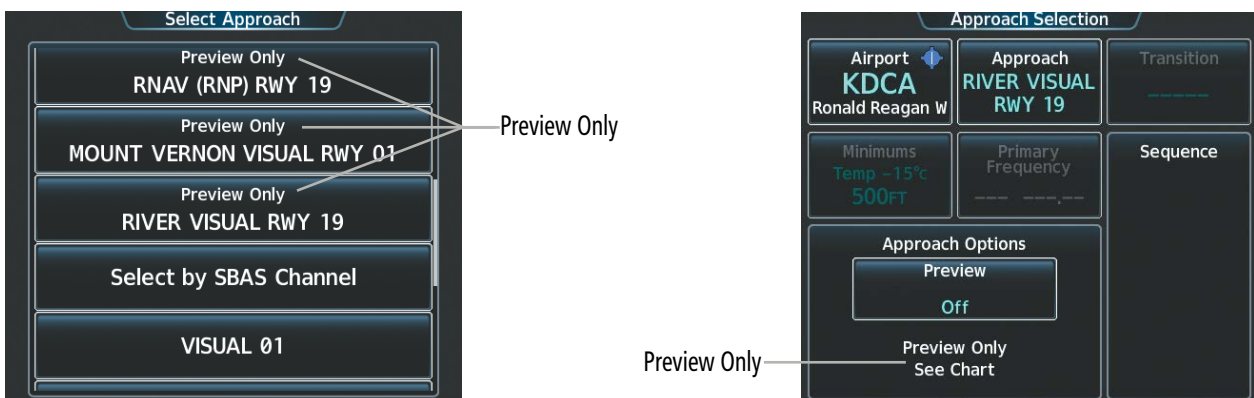


Figure 5-121 Procedure Selection – Preview Only (Approach example)

## DEPARTURES

A Departure can be loaded at any airport that has one available. When loaded, a departure procedure is placed at the origin airport in the flight plan. Only one departure can be loaded at a time in a flight plan. If a departure is loaded when another departure is already in the flight plan, the new departure replaces the previous departure. The departure sequence is defined by selection of a departure, the runway, and transition waypoints.

### Loading a departure into the flight plan using the Touchscreen Controller:

1) For the active flight plan:

- a) From MFD Home, touch **PROC**.
- b) Touch the **Departure** Button to display the 'Departure Selection' Screen.

Or:

For the standby flight plan:

- a) From MFD Home, touch **Flight Plan > Standby Flight Plan > PROC**.
- b) Touch the **Departure** Button to display the 'Departure Selection' Screen.

Or:

For the stored flight plan:

- a) From 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.
  - d) Touch the **Flight Plan Options** Button to display the 'Flight Plan Options' Window.
  - e) Touch the **Load Departure** Button to display the 'Departure Selection' Screen.
- 2) If needed, touch the **Airport** Button to display the keypad and use it to select the origin airport.
  - 3) Touch the **Enter** Button to accept the origin airport.
  - 4) Touch the **Departure** Button to display the 'Select Departure' Screen with a list of available departures.
  - 5) Scroll the list if needed and touch a departure selection button to select a departure. The 'Select Transition' Screen will open.
  - 6) Scroll the list if needed and touch a transition selection button to select the transition. The 'Select Runway' Screen will open.
  - 7) Scroll the list if needed and touch a runway selection button to select the runway and return to the 'Departure Selection' Screen.
  - 8) 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.
  - 9) 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.

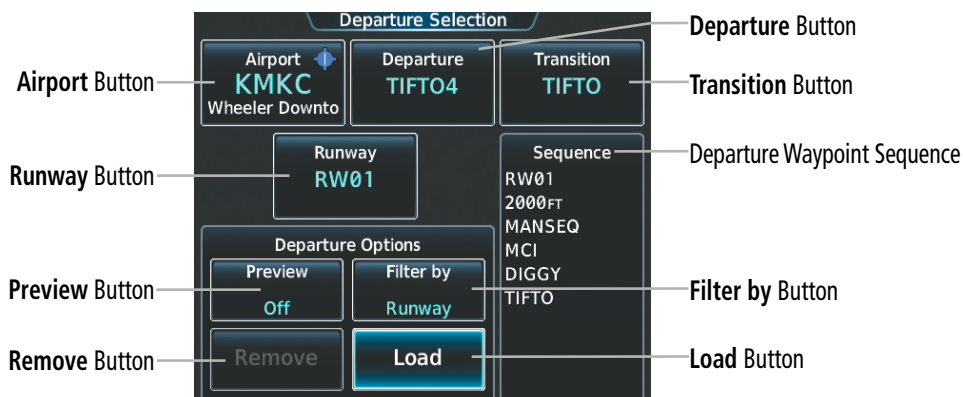


Figure 5-122 Departure Selection

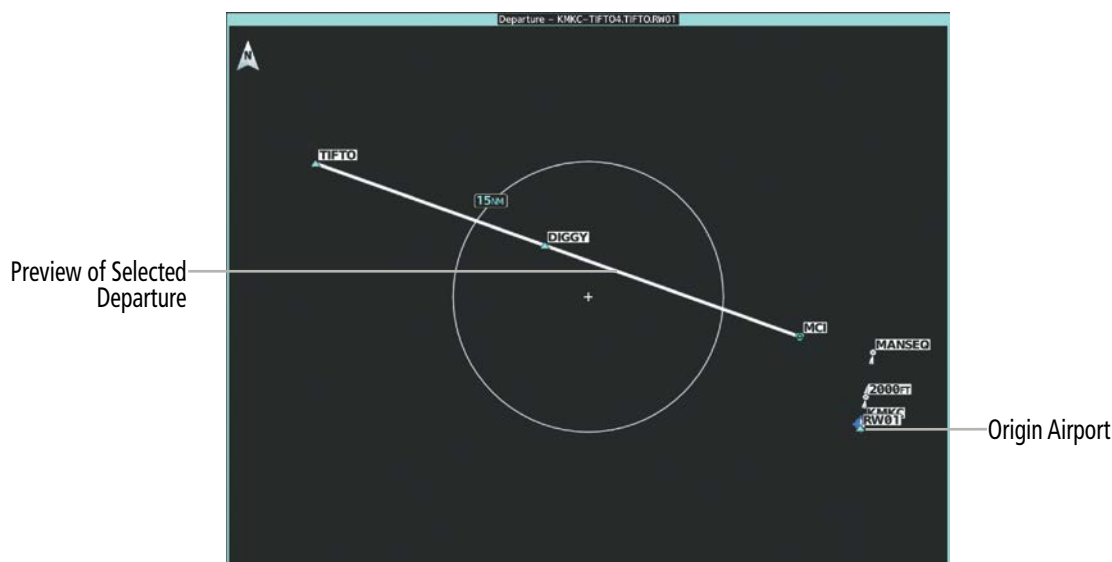


Figure 5-123 Preview of the Selected Departure



Figure 5-124 Loading a Procedure into a Stored Flight Plan

When plans change while flying IFR, departures can be easily removed from the flight plan.

**Removing a departure from a flight plan using the Touchscreen Controller:**

**1) For the active flight plan:**

- a) From MFD Home, touch **PROC**.
- b) Touch the **Departure** Button to display the 'Departure Selection' Screen.
- c) Touch the **Remove** Button. A 'Remove Departure – <departure identifier> from flight plan?' Window is displayed.

**Or:**

- a) From MFD Home, touch **Flight Plan**.
- b) Touch the Departure Header Button to display the 'Departure Options' Window.
- c) Touch the **Remove Departure** Button. A 'Remove Departure – <departure identifier> from flight plan?' Window is displayed.

**Or:**

For the standby flight plan:

- a) From MFD Home, touch **Flight Plan > Standby Flight Plan > PROC**.
- b) Touch the **Departure** Button to display the 'Departure Selection' Screen.
- c) Touch the **Remove** Button. A 'Remove Departure – <departure identifier> from flight plan?' Window is displayed.

**Or:**

- a) From MFD Home, touch **Flight Plan > Standby Flight Plan**.
- b) Touch the Departure Header Button to display the 'Departure Options' Window.
- c) Touch the **Remove Departure** Button. A 'Remove Departure – <departure identifier> from flight plan?' Window is displayed.

**Or:**

For the stored flight plan:

- a) From 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.
- d) Touch the **Flight Plan Options** Button to display the 'Flight Plan Options' Window.
- e) Touch the **Load Departure** Button to display the 'Departure Selection' Screen.
- f) Touch the **Remove** Button. A 'Remove Departure – <departure identifier> from flight plan?' Window is displayed.

**2) Touch the OK Button. The departure is removed from the flight plan.**



## ARRIVALS

A Standard Terminal Arrival can be loaded at any airport that has one available. When loaded, an arrival is placed at the destination airport in the flight plan. Only one arrival can be loaded at a time in a flight plan. If an arrival is loaded when another arrival is already in the flight plan, the new arrival replaces the previous arrival. The arrival sequence is defined by selection of an arrival, the transition waypoints, and a runway.

### Loading an arrival into the flight plan using the Touchscreen Controller:

- 1) For the active flight plan:
  - a) From MFD Home, touch **PROC**.
  - b) Touch the **Arrival** Button to display the 'Arrival Selection' Screen.

**Or:**

For the standby flight plan:

  - a) From MFD Home, touch **Flight Plan > Standby Flight Plan > PROC**.
  - b) Touch the **Arrival** Button to display the 'Arrival Selection' Screen.

**Or:**

For the stored flight plan:

  - a) From 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.
  - d) Touch the **Flight Plan Options** Button to display the 'Flight Plan Options' Window.
  - e) Touch the **Load Arrival** Button to display the 'Arrival Selection' Screen.
- 2) If needed, touch the **Airport** Button to display the keypad and use it to select the destination airport.
- 3) Touch the **Enter** Button to accept the destination airport.
- 4) Touch the **Arrival** Button to display the 'Select Arrival' Screen with a list of available arrivals.
- 5) Scroll the list if needed and touch an arrival selection button to select the arrival. The 'Select Transition' Screen will open.
- 6) Scroll the list if needed and touch a transition selection button to select the transition. The 'Select Runway' Screen will open.
- 7) Scroll the list if needed and touch a runway selection button to select the runway and return to the 'Arrival Selection' Screen.
- 8) 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.
- 9) 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.

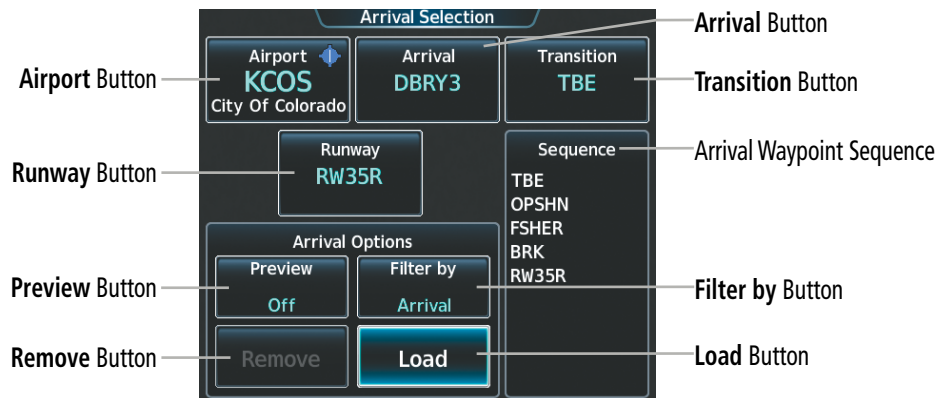


Figure 5-125 Arrival Selection

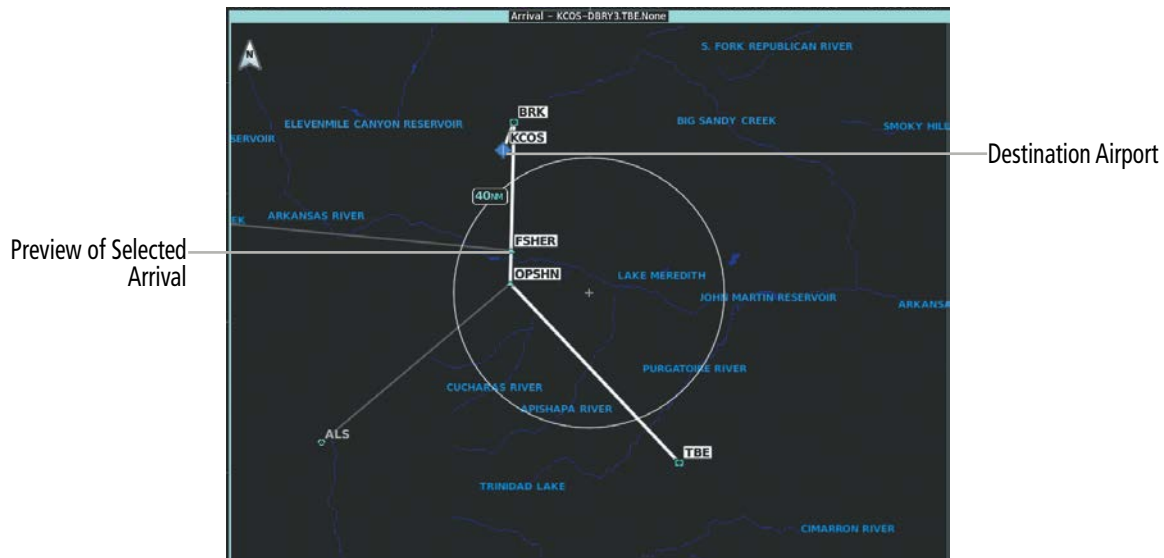


Figure 5-126 Arrival – Preview of the Selected Arrival

When plans change while flying IFR, arrivals can be easily removed from the flight plan.

#### Removing an arrival from a flight plan using the Touchscreen Controller:

- 1) For the active flight plan:
    - a) From MFD Home, touch **PROC**.
    - b) Touch the **Arrival** Button to display the 'Arrival Selection' Screen.
    - c) Touch the **Remove** Button. A 'Remove Arrival – <arrival identifier> from flight plan?' Window is displayed.
- Or:

- a) From MFD Home, touch **Flight Plan**.
- b) Touch the Arrival Header Button to display the 'Arrival Options' Window.
- c) Touch the **Remove Arrival** Button. A 'Remove Arrival – <arrival identifier> from flight plan?' Window is displayed.

**Or:**

For the standby flight plan:

- a) From MFD Home, touch **Flight Plan > Standby Flight Plan > PROC**.
- b) Touch the **Arrival** Button to display the 'Arrival Selection' Screen.
- c) Touch the **Remove** Button. A 'Remove Arrival – <arrival identifier> from flight plan?' Window is displayed.

**Or:**

- a) From MFD Home, touch **Flight Plan > Standby Flight Plan**.
- b) Touch the Arrival Header Button to display the 'Arrival Options' Window.
- c) Touch the **Remove Arrival** Button. A 'Remove Arrival – <arrival identifier> from flight plan?' Window is displayed.

**Or:**

For the stored flight plan:

- a) From 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.
- d) Touch the **Flight Plan Options** Button to display the 'Flight Plan Options' Window.
- e) Touch the **Load Arrival** Button to display the 'Arrival Selection' Screen.
- f) Touch the **Remove** Button. A 'Remove Arrival – <arrival identifier> from flight plan?' Window is displayed.

- 2) Touch the **OK** Button. The arrival is removed from the flight plan.

## APPROACHES

### INSTRUMENT APPROACHES



**NOTE:** *If certain GPS parameters (SBAS, RAIM, etc.) are not available, some published approach procedures for the desired airport may not be displayed in the list of available approaches.*

An Approach Procedure (APPR) can be loaded at any airport that has one available, and provides guidance for non-precision and precision approaches to airports with published instrument approach procedures. If an approach is loaded when another approach is already in the flight plan, the new approach replaces the previous approach, unless the active leg is past the missed approach point. In this case, the second approach is loaded at the end of the previous approach, and the previous approach remains as waypoints (no longer part of an APPR). The approach sequence is defined by selection of an approach and the transition waypoints.

When selecting an approach, a “GPS” designation to the right of the approach type (e.g. RNAV) indicates the procedure can be flown using the GPS receiver. Some procedures do not have this designation, meaning

the GPS receiver can be used for supplemental navigation guidance only. If the GPS receiver cannot be used for primary guidance, the appropriate navigation receiver must be used for the selected approach (e.g., VOR or ILS). The final course segment of ILS approaches, for example, must be flown with the NAV receiver tuned to the proper frequency and selecting that NAV receiver on the CDI.



**NOTE:** Approach downgrade may cause the flight director to revert to Pitch Hold Mode (PIT).

If GPS navigation becomes unavailable on an RNAV GPS approach after the FAF, the approach aborts with an APR ABORT message. When this happens, the CDI is removed, the VDI is flagged 'NO GP', the approach service level (LPV, LP, L/VNAV, etc.) on the HSI is amber, and the GPS LOI and GPS NAV LOST system messages occur. The CDI will not be restored for missed approach guidance until the messages are acknowledged and a position source is available (e.g. restored GPS or Dead Reckoning).

The SBAS GPS allows for flying LNAV, LNAV+V, LNAV/VNAV, LP, LP+V, and LPV approach service levels according to the published chart. The '+V' designation adds advisory vertical guidance for assistance in maintaining a constant vertical glidepath similar to an ILS glideslope on approach. This guidance is displayed on the system PFD in the same location as the ILS glideslope using a magenta diamond. Baro VNAV guidance is displayed on the system PFD in the same location as the ILS glideslope using a magenta pentagon. The active approach service level is annunciated on the HSI as shown in the following table:

Approach Type (as shown on HSI)	Description	LNAV/VNAV or LNAV Minima Available?	When SBAS becomes unavailable prior to one minute to FAF, at one minute to FAF will initiate a switch/downgrade to:
<b>LNAV</b>	GPS approach using published LNAV minima	LNAV	N/A
<b>LNAV+V</b>	GPS approach using published LNAV minima. Advisory vertical guidance is provided	LNAV	LNAV+V (Baro VNAV)
<b>L/VNAV</b>	GPS approach using published LNAV/VNAV minima	LNAV/VNAV	LNAV/VNAV (Baro VNAV)
		LNAV	LNAV
		Neither	Approach Aborted
<b>LP</b> (available only if SBAS available)	GPS approach using published LP minima	LNAV	LNAV
		No LNAV	Approach Aborted
<b>LP+V</b> (available only if SBAS available)	GPS approach using published LP minima. Advisory vertical guidance is provided	LNAV	LNAV
		No LNAV	Approach Aborted
<b>LPV</b> (available only if SBAS available)	GPS approach using published LPV minima	LNAV/VNAV	LNAV/VNAV (Baro VNAV)
		LNAV	LNAV
		Neither	Approach Aborted



**Approach Type**  
– LNAV, LNAV+V, L/VNAV, LP, LP+V, LPV

**Table 5-14 Effects of SBAS Unavailability on Approaches**

## VISUAL APPROACHES

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



**NOTE:** The navigation database may contain Charted Visual Flight Procedures (CVFPs) for certain airports. CVFPs follow a precise prescribed path and are classified as Instrument Approach Procedures (IAPs). See the *Preview Only Procedures* discussion previously provided in this section. See the *Additional Features Section* for more information on Charts.

Each visual approach will have two transitions, the straight in transition (STRAIGHT) and the Vectors-to-Final transition (VECTORS). The visual approach waypoints (fixes) consist of the initial fix (STRGHT), the final approach fix (FINAL), and the missed approach point (RWxx). A 3 degree glide path is calculated from the missed approach point up to each waypoint along the extended straight-in path.

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

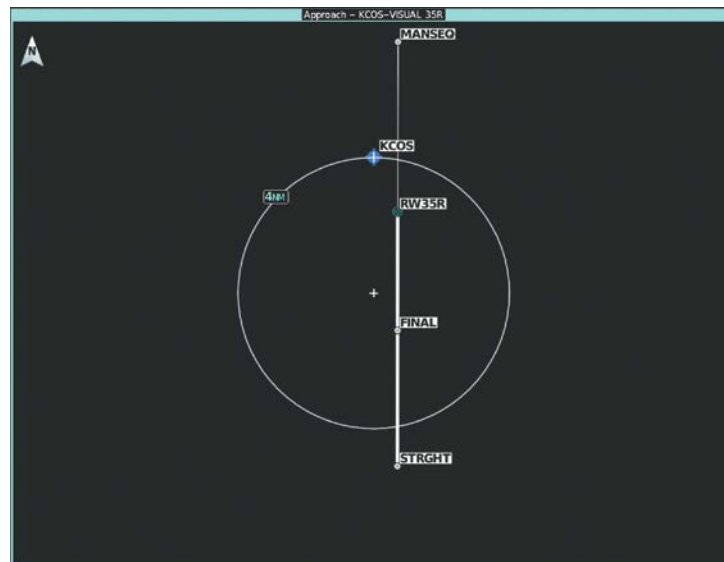


Figure 5-127 Preview of the Selected Visual Approach on Display Pane

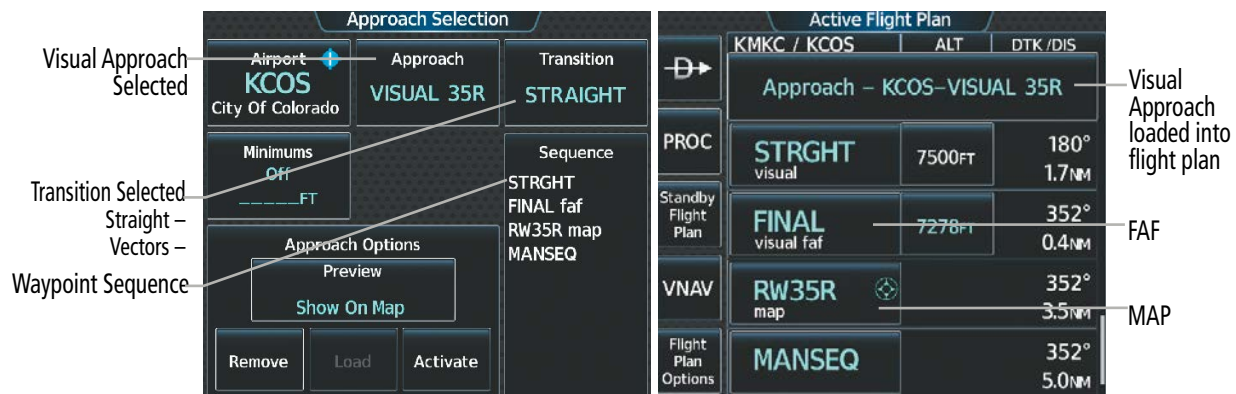


Figure 5-128 Loading a Visual Approach on the Touchscreen Controller

## LOADING AND ACTIVATING AN APPROACH

Whenever an approach is selected, the choice to either “Load” 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.

### Loading an approach into the active/standby flight plan using the Touchscreen Controller:

- 1) For the active flight plan: From MFD Home, touch **PROC**.  
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 or GPS based 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 (SBAS Channel information will be listed on a chart that has LPV or LP minima).
  - 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, use the keypad to select the barometric minimum altitude.
  - b) Touch the **Enter** Button to accept the barometric minimum altitude and return to the 'Approach Selection' Screen.

**Or:**

  - a) If a radio altitude minimum is desired, touch the **Minimums** Button to display the 'Minimums Source' Window.
  - b) Touch the **Radio Alt** Button to select radio 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 radio 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' Window.
  - b) Touch the **Temp Comp** Button to select temperature compensated minimums and display the 'Destination Temp' Screen. Use the numeric keypad to select the destination temperature.
  - c) Touch the **Enter** Button to accept the destination temperature and return to the 'Minimums' Screen.
  - d) Use the keypad to select the minimums altitude.
  - e) 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 a chart selection button to show the procedure chart instead of the navigation map.
- 8) Touch the **Load** Button to insert the approach into the flight plan; or if available, touch the **Load & Activate** Button to begin immediate navigation for the approach.

When GPS is not approved for the selected final approach course, the message ' – NOT APPROVED FOR GPS – GPS guidance is for monitoring only. Load approach?' is displayed. Touch the **OK** Button to continue.

If a visual approach was selected, the message 'Obstacle clearance is not provided for visual approaches' is displayed. Touch the **OK** Button to continue.



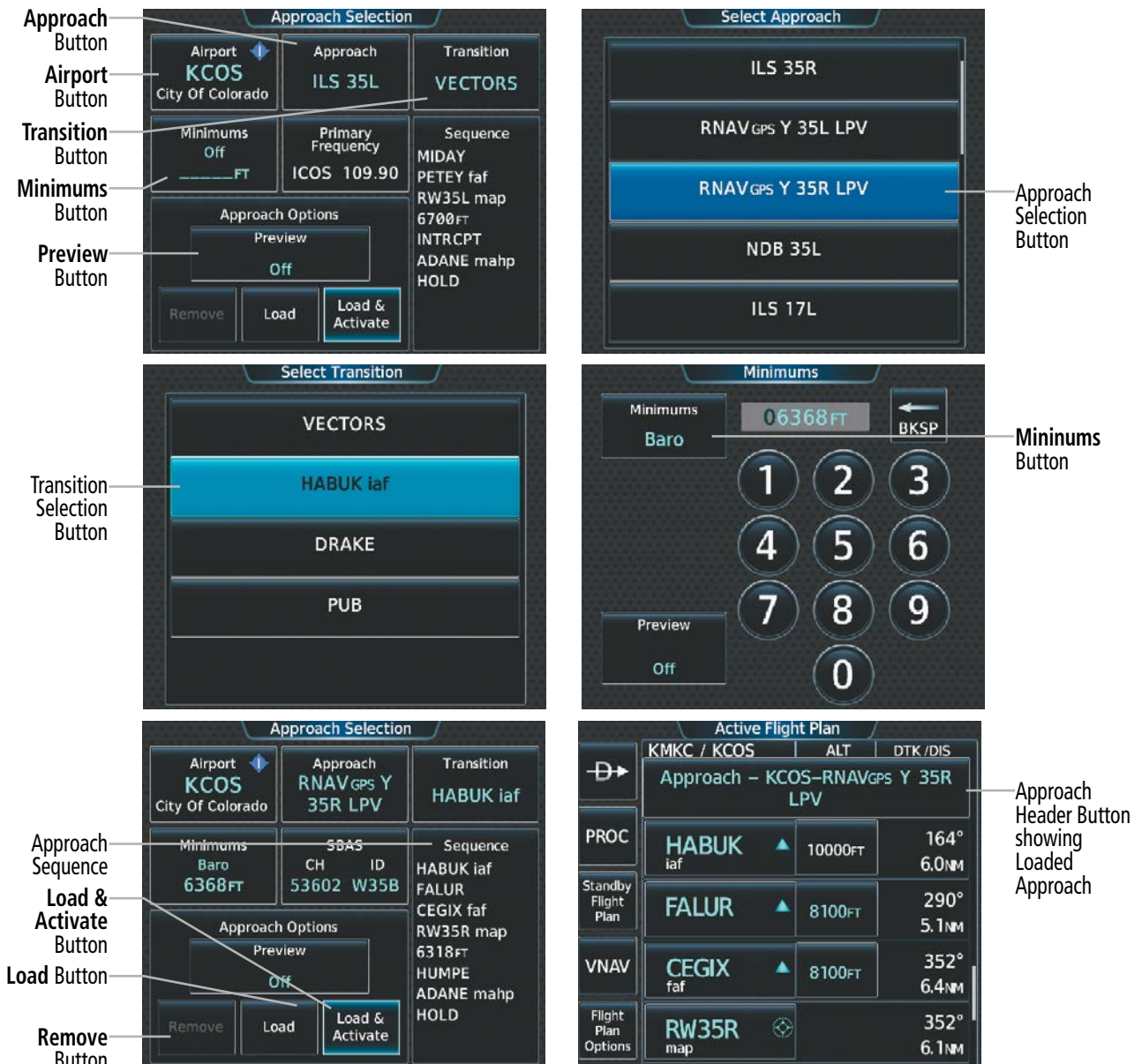
**NOTE:** When GPS is not approved for the selected final approach course, the FMS provides guidance to the approach, but the HSI must be switched to a NAV receiver to fly the final course of the approach, either manually or automatically. Refer to the Flight Instruments section for details on CDI switching.

**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' Window.
- 6) Touch the **Load Approach** Button to display the 'Approach Selection' Screen.
- 7) Select the airport and approach:
  - a) If needed, touch the **Airport** Button to display the keypad and use it to select the approach airport.
  - b) Touch the **Enter** Button to accept the approach airport.
  - c) If needed, touch the **Approach** Button to display the 'Select Approach' Screen with a list of available approaches.
  - d) Scroll the list if needed and touch 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).  
  
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 a chart selection button to show the procedure chart instead of the navigation map.
- 9) Touch the **Load** Button to insert the approach into the stored flight plan.



“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, the 'Active Flight Plan' Screen, or the 'Procedures' Window on the PFD.

### 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.

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.

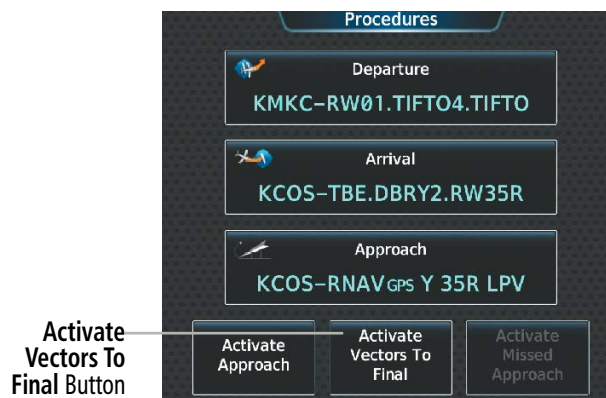


Figure 5-130 Activating Vectors to Final on the Touchscreen Controller

## REMOVING AN APPROACH FROM THE ACTIVE/STANDBY FLIGHT PLAN

When plans change, 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**.  
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**.  
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.

#### Removing an approach 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' Window.
- 3) Touch the **Edit** Button.
- 4) Scroll the list if needed and touch the Approach Header button to display the 'Approach Options' Window.
- 5) Touch the **Remove Approach** Button.
- 6) Touch the **OK** Button in response to "Remove Approach – <procedure name> from flight plan?". The procedure is removed. 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.

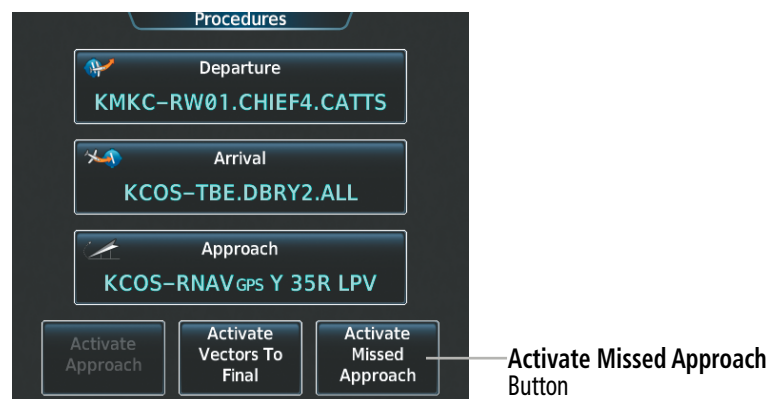


Figure 5-131 Activating a Missed Approach on the Touchscreen Controller

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.

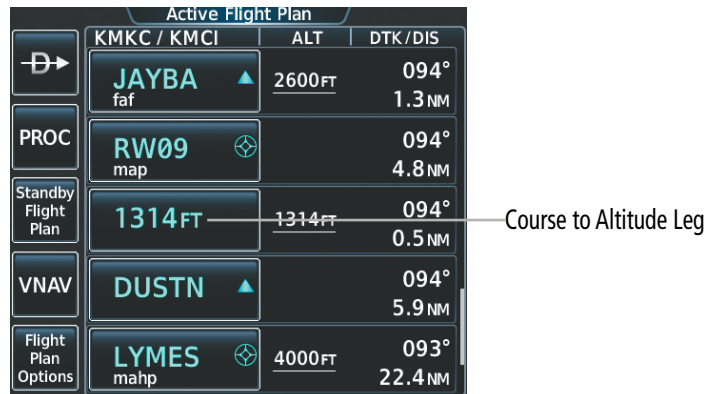


Figure 5-132 Course to Altitude

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 GA Button. The system begins automatic sequencing through the missed approach waypoints to the MAHP. See the AFCS section for more details.

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 Window.
- 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 pilot-supplied temperature at the destination. For example, if the pilot enters a destination temperature of  $-40^{\circ}\text{C}$ , the system increases the approach altitudes accordingly. Temperature compensated altitudes are displayed with a snowflake  icon.

Manually inputting the temperature for compensation is explained in the following procedures. However the system already automatically offsets the lateral position of the baro-VNAV bottom of descent accordingly without manual input. Once calculated (completed by the Transition to Approach VNAV feature), 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 colder than ISA, the baro-VNAV path will typically be below 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 temperature compensation for an approach will disrupt the system from automatically creating a lateral offset of the VNAV function in use.



**NOTE:** Initiating a VNAV direct-to function or 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 baro-VNAV path and may not intersect the approach descent path.

### Manually enabling/disabling temperature compensation for altitudes loaded into approaches:

- 1) For the active flight plan: From MFD Home, touch **Flight Plan > Flight Plan Options**.  
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) Touch the **Temp at Dest** Button to display the numeric keypad. Use the keypad and the **Enter** Button to select the temperature at the <airport>. The compensated altitudes are computed and shown in the flight plan.



**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 minimum alerting altitude



**NOTE:** Enabling/disabling temperature compensation for the loaded approach altitudes does not enable/disable temperature compensated minimums, nor does enabling/disabling temperature compensated minimums enable/disable temperature compensated approach altitudes.

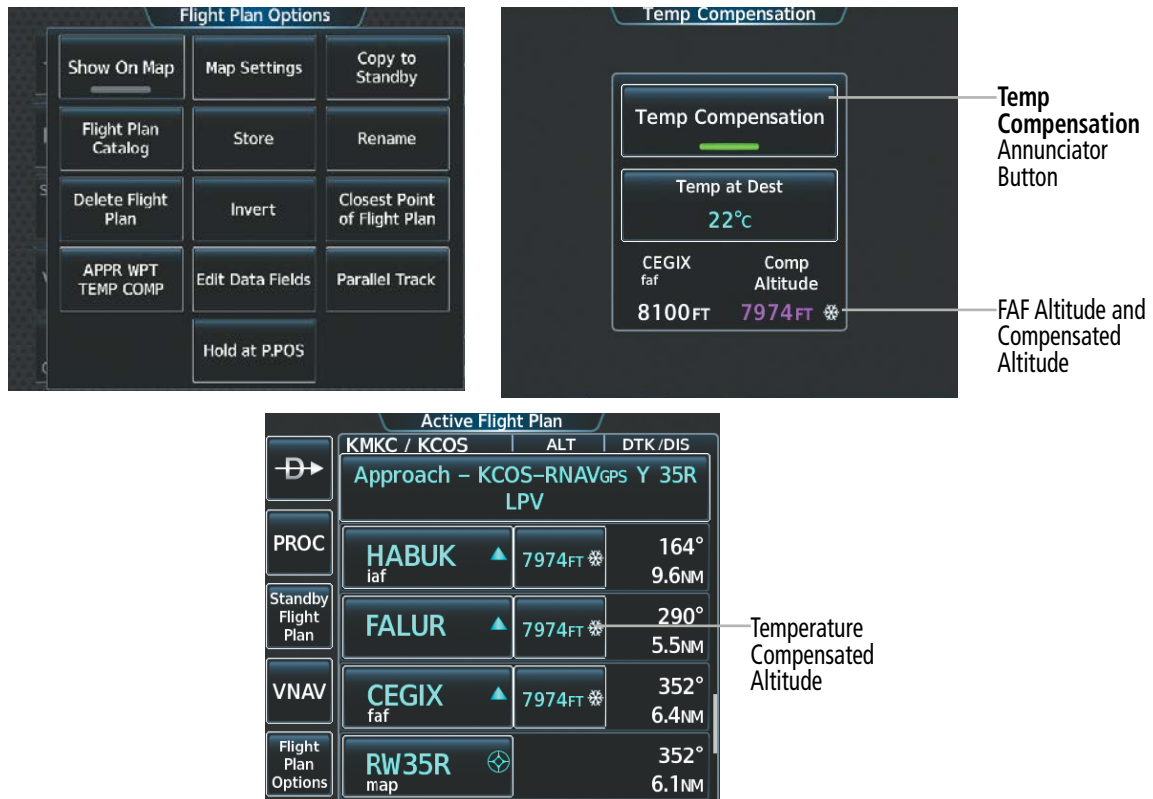


Figure 5-133 Temperature Compensation for Approach Waypoints

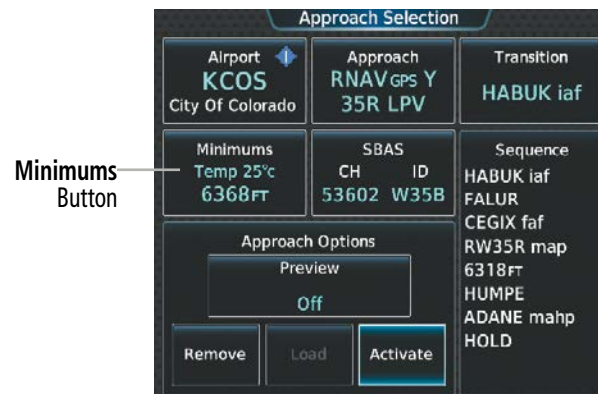
A temperature compensated minimum descent altitude can be entered for the approach. Once this is entered on the touchscreen controller, the altitude is also displayed on the PFD.

#### Entering a temperature compensated minimum descent altitude:

- 1) From MFD Home, touch **PROC**.
- 2) Touch the **Approach** Button to display the 'Approach Selection' Screen.
- 3) Touch the **Minimums** Button to display the 'Minimums' Screen.
- 4) Touch the **Minimums** Button to display the 'Minimums Source' Window.
- 5) Touch the **Temp Comp** Button to select temperature compensated minimums and return to the 'Minimums' Screen.
- 6) Touch the **Temp at Dest** Button to display the numeric keypad.
- 7) Use the keypad to select the temperature.
- 8) Touch the **Enter** Button to accept the destination temperature and return to the 'Minimums' Screen.
- 9) If not already entered, use the keypad to select the minimums altitude.
- 10) Touch the **Enter** Button to return to the 'Approach Selection' Screen.

Or:

- 1) From MFD Home, touch **Flight Plan**.
- 2) Touch the Approach Header Button to display the 'Approach Options' Window.
- 3) Touch the **Edit Approach** Button to display the 'Approach Selection' Screen.
- 4) Touch the **Minimums** Button to display the 'Minimums' Screen.
- 5) Touch the **Minimums** Button to display the 'Minimums Source' Window.
- 6) Touch the **Temp Comp** Button to select temperature compensated minimums and return to the 'Minimums' Screen.
- 7) Touch the **Temp at Dest** Button to display the numeric keypad.
- 8) Use the keypad to select the temperature.
- 9) Touch the **Enter** Button to accept the destination temperature and return to the 'Minimums' Screen.
- 10) If not already entered, use the keypad to select the minimums altitude.
- 11) Touch the **Enter** Button to return to the 'Approach Selection' Screen.



Touchscreen Controller – Approach Selection Screen



PFD – COMP MIN Shown

Figure 5-134 Entering Temp Comp Minimums on the Touchscreen Controller

## 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.



Figure 5-135 'Trip Planning' Screen - Automatic Mode

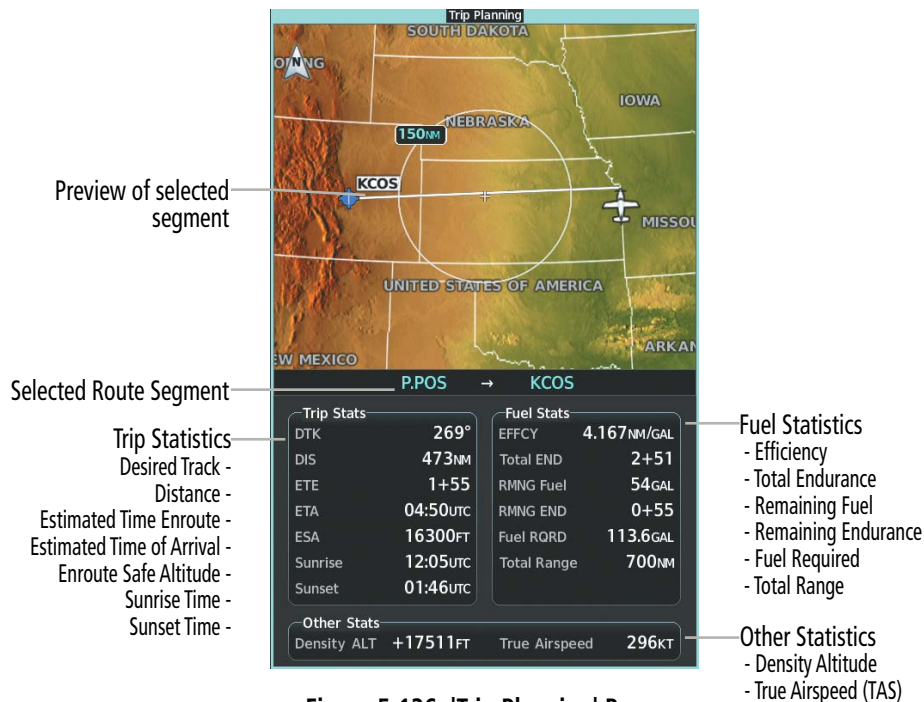


Figure 5-136 'Trip Planning' Pane





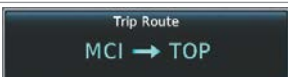
The trip planning inputs are based on sensor inputs (automatic mode) or on pilot inputs (manual entry mode). Some additional explanation of the sources for some of the inputs is as follows:

- 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
<b>Stored Flight Plan - Cumulative Mode</b>		Waypoints are the starting and ending waypoints of the selected flight plan.
<b>Stored Flight Plan - Leg Mode</b>		Waypoints are the endpoints of the selected leg.
<b>Active Flight Plan - Remaining Mode</b>		The 'from' waypoint is the aircraft present position, and the 'to' waypoint is the endpoint of the active flight plan.
<b>Active Flight Plan - Leg Mode</b>		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.
<b>Waypoint Mode</b>		Manually selected waypoints (if there is an active flight plan, these default to the endpoints of the active leg).

**Table 5-15 Trip Route Modes**

Some of the calculated trip statistics shown on the 'Trip Planning' Pane 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

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The fuel statistics are calculated based on the selected starting and ending waypoints and the trip planning inputs. Some of the calculated trip statistics shown on the 'Trip Planning' Pane 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

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These statistics shown on the Trip Planning Display Pane 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.
- 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.
- 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.
- 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.
- 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.
- 4) Scroll the list, if necessary, and touch the active flight plan button.
- 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.
- 4) Scroll the list, if necessary, and touch the active flight plan button.
- 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.
- 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 FUEL PLANNING

The system includes a weight and fuel planning function. The weight and fuel planning function allows the pilot to enter weight and fuel data, which is used with the active flight plan to estimate takeoff and landing weights, landing fuel, and excess fuel.

Weight planning is done on the 'Weight and Fuel' Screen by entering data on each of the tabs. The basic operating weight is shown on the **Operating Weight** Tab and is calculated by adding the basic empty weight to the crew and stores weight.

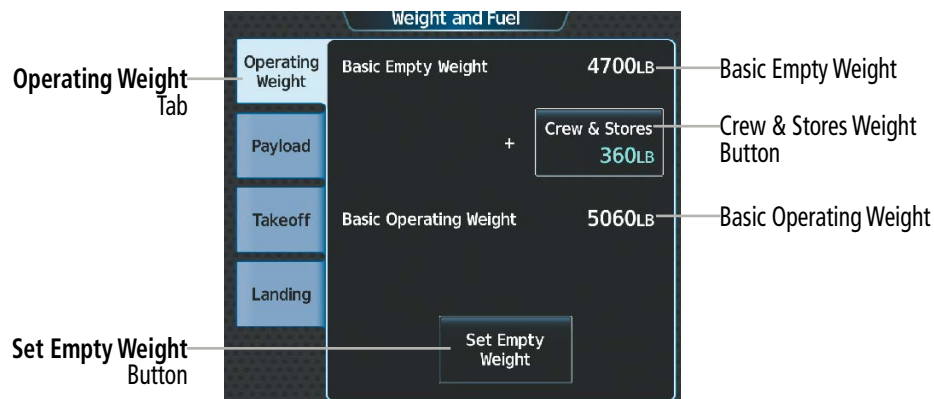


Figure 5-137 'Weight and Fuel' Screen - Operating Weight Tab

### Calculating basic operating weight:

- 1) From MFD Home, touch **Aircraft Systems** > **Weight and Fuel**.

Or:

From MFD Home, touch **PERF** > **Weight and Fuel** (with optional SurfaceWatch).

Or:

From MFD Home, touch **Utilities** > **Weight and Fuel** (without SurfaceWatch).

- 2) Touch the **Set Empty Weight** Button to display the keypad.
- 3) Use the keypad to enter the basic empty weight.
- 4) Touch the **Enter** Button to accept the entry, and return to the 'Weight and Fuel' Screen.
- 5) Touch the **Crew & Stores** Button to display the keypad.
- 6) Use the keypad to enter the crew and stores weight.
- 7) Touch the **Enter** Button to accept the entry, and return to the 'Weight and Fuel' Screen.

Total passenger weight is calculated by multiplying the number of passengers by the average passenger weight. Zero Fuel Weight is calculated by adding the basic operating weight, total passenger weight, and cargo weight.

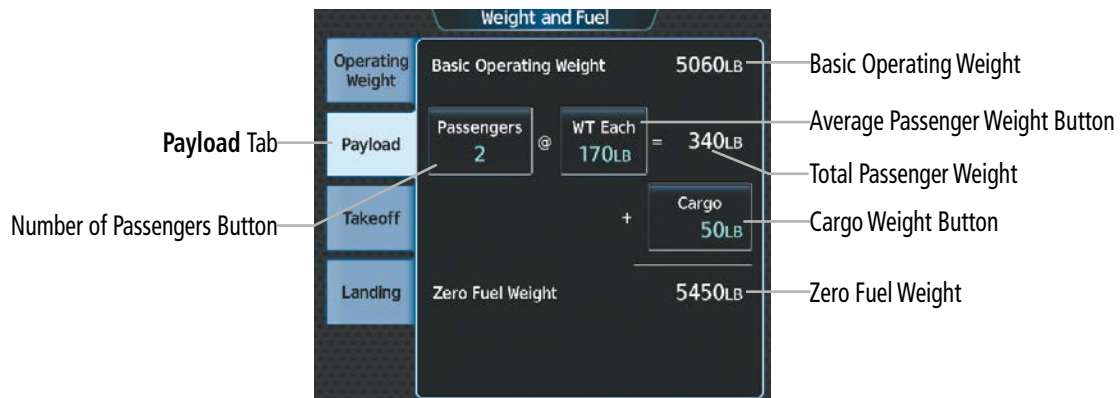


Figure 5-138 Weight and Fuel - Payload Tab

### Calculating zero fuel weight:

- 1) From MFD Home, touch **Aircraft Systems > Weight and Fuel**.

Or:

From MFD Home, touch **PERF > Weight and Fuel** (with optional SurfaceWatch).

Or:

From MFD Home, touch **Utilities > Weight and Fuel** (without SurfaceWatch).

- 2) Touch the **Payload** Tab to display the zero fuel weight calculation.
- 3) Touch the **Passengers** Button to display the keypad.
- 4) Use the keypad to enter the number of passengers.
- 5) Touch the **Enter** Button to accept the entry, and return to the 'Weight and Fuel' Screen.
- 6) Touch the **WT Each** Button to display the keypad.
- 7) Use the keypad to enter the average passenger weight.
- 8) Touch the **Enter** Button to accept the entry, and return to the 'Weight and Fuel' Screen.
- 9) Touch the **Cargo** Button to display the keypad.
- 10) Use the keypad to enter the cargo weight.
- 11) Touch the **Enter** Button to accept the entry, and return to the 'Weight and Fuel' Screen.

Aircraft weight is calculated by adding the zero fuel weight to the fuel on board weight. Both the fuel on board and aircraft weight decrease as fuel is burned, providing the current value for each.



Figure 5-139 Weight and Fuel - Takeoff Tab

**Calculating aircraft weight:**

- 1) From MFD Home, touch **Aircraft Systems > Weight and Fuel**.

**Or:**

From MFD Home, touch **PERF > Weight and Fuel** (with optional SurfaceWatch).

**Or:**

From MFD Home, touch **Utilities > Weight and Fuel** (without SurfaceWatch).

- 2) Touch the **Takeoff** Tab to display the aircraft weight calculation.

- 3) Enter fuel on board:

Touch the **FOB SYNC** Button to insert the fuel amount measured from the fuel sensors.

**Or:**

- a) Touch the **Fuel On Board** Button to display the keypad.
- b) Use the keypad to enter the fuel on board.
- c) Touch the **Enter** Button to accept the entry, and return to the 'Weight and Fuel' Screen.

When the aircraft is in the air and a destination waypoint has been entered, the fuel calculations can be completed.

- Estimated landing weight = zero fuel weight + estimated landing fuel weight
- Estimated landing fuel weight = fuel on board weight - (fuel flow x ETE) - estimated holding fuel weight
- Estimated holding fuel weight = fuel flow x estimated holding time
- Excess fuel weight = estimated landing fuel weight - fuel reserves weight

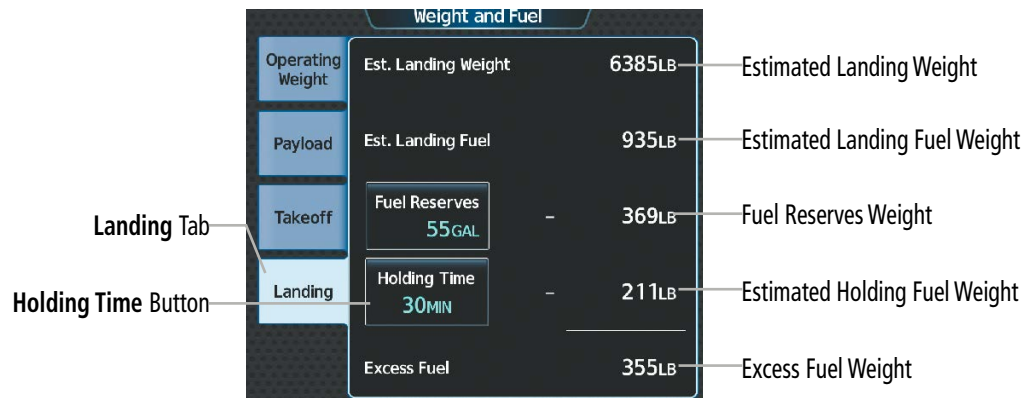


Figure 5-140 Weight and Fuel - Landing Tab

If the aircraft is on the ground or a destination waypoint has not been entered, Est. Landing Weight, Est. Landing Fuel, Holding Fuel Weight, and Excess Fuel display invalid values consisting of five dashes.

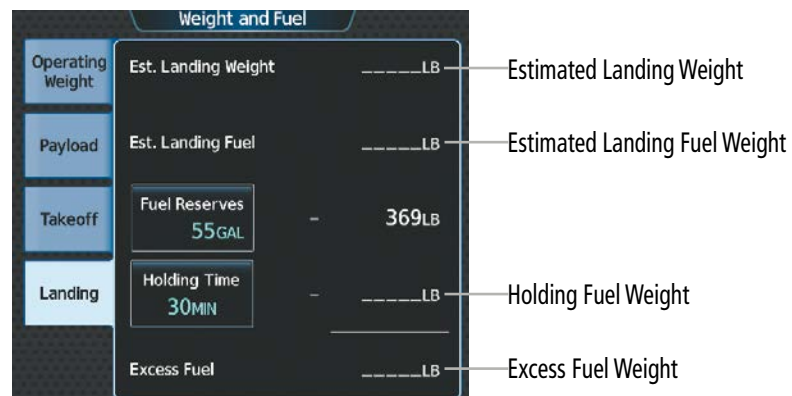


Figure 5-141 Weight and Fuel - Landing Tab with Invalid Fields

### Entering fuel reserve and estimated holding time:

- 1) From MFD Home, touch **Aircraft Systems > Weight and Fuel**.  
**Or:**  
 From MFD Home, touch **PERF > Weight and Fuel** (with optional SurfaceWatch).  
**Or:**  
 From MFD Home, touch **Utilities > Weight and Fuel** (without SurfaceWatch).
- 2) Touch the **Landing** Tab to display the landing weight and fuel calculations.
- 3) Touch the **Fuel Reserves** Button to display the keypad.
- 4) Use the keypad to enter the fuel reserves.
- 5) Touch the **Holding Time** Button to display the keypad.
- 6) Use the keypad to enter the estimated holding time.
- 7) Touch the **Enter** Button to accept the entry, and return to the 'Weight and Fuel' Screen.

## WEIGHT CAUTION AND WARNING CONDITIONS

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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 takeoff weight is greater than the maximum allowable takeoff weight, then the takeoff weight is displayed in amber. A 'Max Takeoff Weight Exceeded' message is also displayed in amber.

If the estimated landing weight is greater than the maximum allowable landing weight, then the estimated landing weight is displayed in amber.

If the estimated landing fuel weight is positive, but less than or equal to the fuel reserves weight plus the holding fuel weight, the following values are displayed in amber:

- Estimated landing fuel weight
- Holding fuel weight
- Excess fuel weight

If the estimated landing fuel weight is zero or negative, then the following values are displayed in red:

- Estimated landing fuel weight
- Holding fuel weight
- Excess fuel weight



## 5.11 ABNORMAL OPERATION

### DEAD RECKONING NAVIGATION

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



**NOTE:** *Dead Reckoning Mode only functions in Enroute (ENR) or Oceanic (OCN) phase of flight. In all other phases, an invalid GPS solution produces a "NO FMS POSITION" annunciation on the map and the system stops using GPS.*

---

The system will revert to Dead Reckoning (DR) Mode if the system is no longer using GPS for position fixing.) In DR mode, the system uses its last-known position combined with continuously updated airspeed and heading data (if available) to calculate and display the aircraft's current estimated position. It is important to note that estimated navigation data supplied by the system in DR mode may become increasingly unreliable and must not be used as a sole means of navigation.

DR mode is inherently less accurate than the 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, and on top of the aircraft symbol on navigation maps. The CDI deviation bar is displayed in amber, but is removed from the display after 20 minutes in DR mode. The autopilot will remain coupled in DR mode as long as the lateral deviation guidance is available (20 min).



**NOTE:** *GPS derived information will remain displayed in magenta (not amber) on the Active Flight Plan Inset if operating in Dead Reckoning mode. However, this information shall still be considered as degraded navigation source information.*

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As a result of operating in DR mode, all data that is dependent upon GPS is displayed as amber text to denote degraded navigation source information. If the VSD Inset is enabled, 'VSD Not Available' will be displayed. Airspace alerts continue to function, but with degraded accuracy. Also, while the system is in DR mode, SVT and terrain alerting functions are disabled.

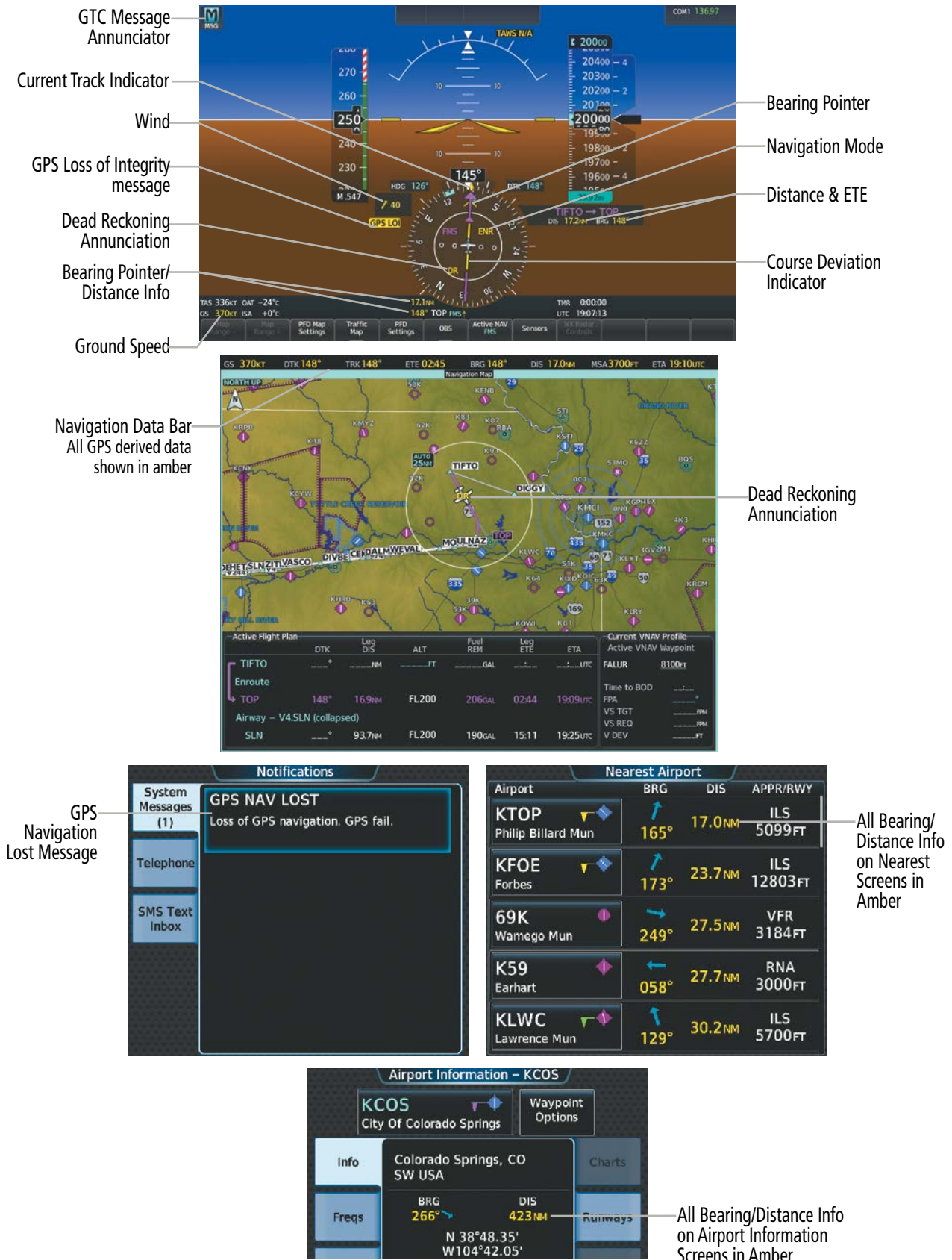


Figure 5-142 Dead Reckoning Mode - GPS Derived Data Shown in Amber

## SECTION 6 HAZARD AVOIDANCE

Hazard Avoidance features available for the Daher TBM 930 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 Weather (Optional).
  - GWX 70 Airborne Color Weather Radar (Optional).
  - L-3 WX-500 Stormscope<sup>®</sup> Lightning Detection System (Optional).
- **Terrain Avoidance**
  - Terrain Proximity (Standard).
  - Terrain SVT (Optional).
  - Terrain Awareness and Warning System Class-B (TAWS-B) (Optional).
- **Traffic**
  - Traffic Information Service (TIS) (Standard).
  - GTS 820 Traffic Advisory System (TAS) (Optional).
  - Automatic Dependent Surveillance-Broadcast (ADS-B) Traffic (Optional).

## 6.1 DATA LINK WEATHER



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



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

The Data Link Weather feature enables the system to receive weather information from a variety of weather sources, depending on the equipment installed in the aircraft. These sources may include SiriusXM Weather, 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](http://flygarmin.com).

## ACTIVATING DATA LINK WEATHER SERVICES

Before SiriusXM Weather and SiriusXM Satellite Radio can be used, the services must be activated by providing SiriusXM's customer service the coded IDs unique to the installed data link receiver. SiriusXM Satellite Radio (audio) and SiriusXM Weather (data) services each have coded IDs, which may be identical. The Data and Audio Radio IDs must be provided to activate the weather and entertainment subscriptions, respectively. These IDs are in the following locations:

- The SiriusXM Info Screen on Touchscreen Controllers.
- The XM Satellite Radio Activation Instructions included with the unit.
- The label on the front of the data link receiver.

SiriusXM uses the coded IDs to send an activation signal to enable the system to receive weather data and/or audio entertainment programming.

### Establishing a SiriusXM Weather Data account:

- 1) From MFD Home, touch **Utilities > Setup > SiriusXM Info**.
- 2) Note the ID shown in the 'Data Radio' Window.
- 3) Contact SiriusXM customer service. Follow the instructions provided by SiriusXM customer service.

### 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 press 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.

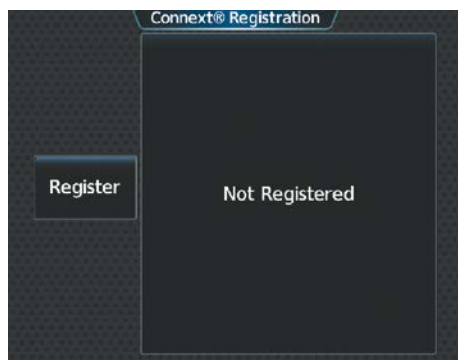


Figure 6-2 Connex Registration Screen Prior to Registration



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 Pane:

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.

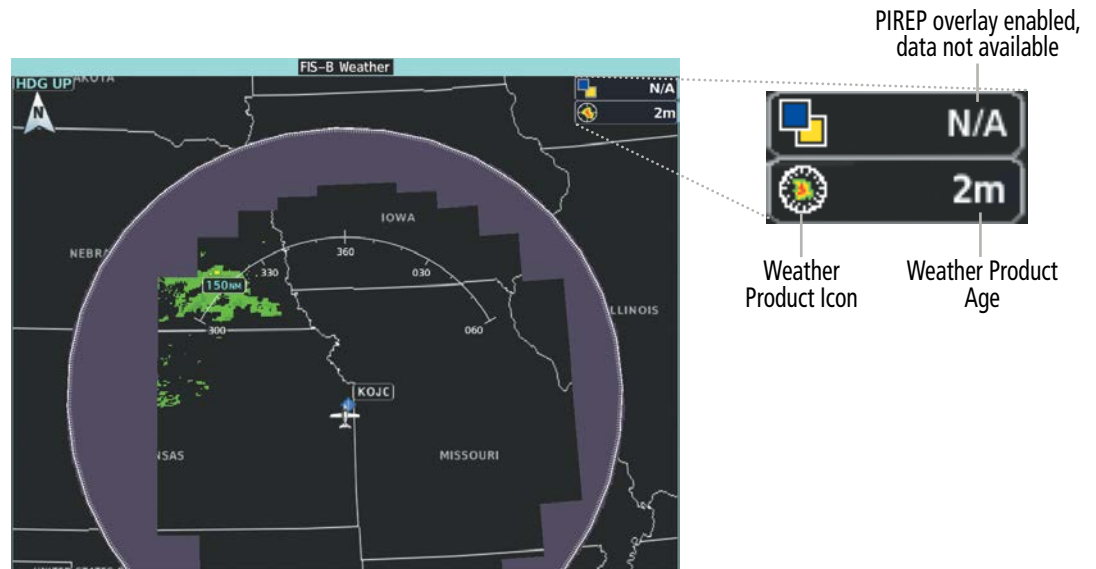


Figure 6-4 'FIS-B Weather' Pane with PIREPs and Regional NEXRAD Enabled

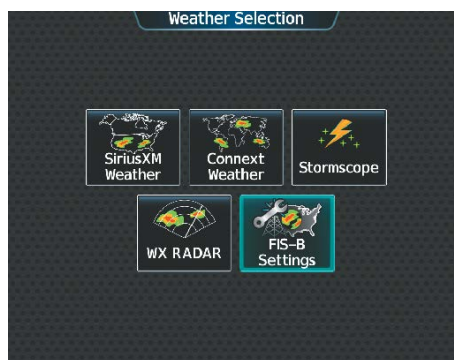


Figure 6-5 'Weather Selection' Screen

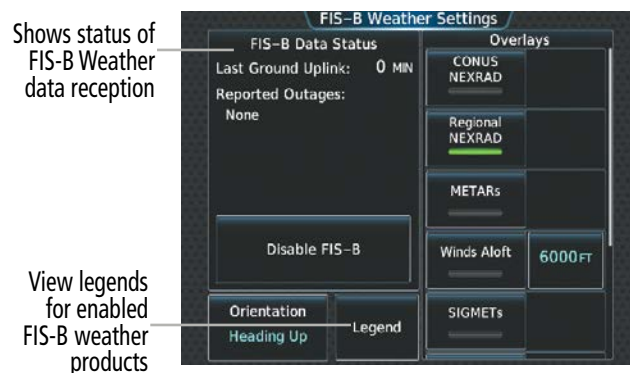


Figure 6-6 'FIS-B Weather Settings' Screen



## WEATHER PRODUCT AGE



**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.

Unlike real-time weather information collected directly from weather sensors on-board an aircraft, such as an airborne weather radar or a lightning detection system, data link weather by contrast relies on service providers to collect, process, and transmit weather information to the aircraft. This information can come from a variety of sources such as government agencies. Due to the time it takes to collect, process, and distribute data link weather information, it is imperative for pilots to understand that data link weather information is not real-time information and may not accurately depict the current conditions.

For each data link weather product which can be displayed as a map overlay, such as METARs, the system can also show a weather product age. This age represents the elapsed time, in minutes, since the weather service provider compiled the weather product and the current time. It does not represent the age of the information contained within the weather product itself. For example, a single mosaic of radar precipitation is comprised data from multiple radar sites providing data at differing scan rates or intervals. The weather service provider periodically compiles this data to create a single composite image, and assigns one time to this image which becomes the basis of the product age. The service provider then makes this weather product available for data link transmission at the next scheduled update time. The actual age of the weather data contained within the mosaic is therefore older than its weather product age and should never be considered current.

SiriusXM weather products are broadcast automatically on a repeating cycle without pilot intervention. For the Garmin Connex service, the pilot schedules a one-time or repeating data request at regular intervals.

Each data link weather product age has an expiration time. The weather product age is shown in white if it is less than half of this expiration time, otherwise it is shown in amber until reaching its expiration time. After a weather product has expired, the system removes the expired weather product from the displays, and shows white dashes instead of the age. If the data link receiver has not yet received a weather product 'N/A' appears instead of the age to show the product is currently not available for display. This may occur, for example, after powering on the system but before the data link receiver has received a complete weather data transmission. It could also indicate a possible outage of a weather product.

The weather product age is shown automatically for weather products displayed on MFD maps. For PFD maps, the pilot can manually enable/disable the age information.

**Enabling/disabling weather product information on the PFD Navigation Maps:**

- 1) From PFD Home, touch **PFD Map Settings**.
- 2) Touch the **Map Layout** Button. If necessary, touch either the **HSI Map** or **Inset Map** Buttons.
- 3) Touch the **Back** Button.
- 3) Touch the **Weather Legend** Button.

**Or:**

- 1) With the PFD Inset Map or HSI Map shown, press the **PFD Map Settings** Softkey.
- 2) Press the **Weather Legend** Softkey.

Tables 6-1 and 6-2 show the weather product symbols, the expiration times and the broadcast rates where applicable, for SiriusXM Weather and FIS-B Weather, respectively. The broadcast rate for FIS-B 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. The service provider and its weather data suppliers define and control the data update intervals, which are subject to change.
























SiriusXM Weather Product	Product Symbol	Expiration Time (Minutes)
Next-generation Radar (NEXRAD)		30
Cloud Tops		60
Echo Tops		30
SiriusXM Lightning		30
Storm Cell Movement		30
SIGMETs	<b>SIGM</b>	60
AIRMETs	<b>AIRM</b>	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)	<b>TFR</b>	60
Terminal Aerodrome Reports (TAFs)	No product symbol	60

Table 6-1 SiriusXM Weather Product Symbols and Expiration Times

FIS-B Weather Product	Product Symbol	Expiration Time (Minutes)
NEXRAD Composite (US)		30
NEXRAD Composite (Regional)		30
METARs		90
Pilot Weather Report (PIREP)		90
Winds Aloft		*
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 Expiration Times**

The following table shows the Garmin Connex Weather product symbols, the expiration times and the refresh rates. The refresh rate represents the interval at which Garmin Connex weather service makes available the most current known weather data. It does not necessarily represent the rate at which the service receives new data from various weather sources. The pilot chooses how often to contact the Garmin Connex weather service in order to retrieve weather data through the Connex Data Request.



**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](http://flygarmin.com).



**NOTE:** When viewing the 'Navigation Map' Pane, displaying a different pane and returning to the "Navigation Map" Pane will ensure the most current weather overlay information is displayed.










Garmin Connex Weather Product	Product Symbol	Expiration Time (Minutes)
Connex Radar		30
IR Satellite		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 symbol	60

Table 6-3 Garmin Connex Weather Product Symbols and Expiration Times

## DISPLAYING DATA LINK WEATHER PRODUCTS

### WEATHER DATA LINK PANE

The Weather Data Link (SiriusXM/Connex/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”).

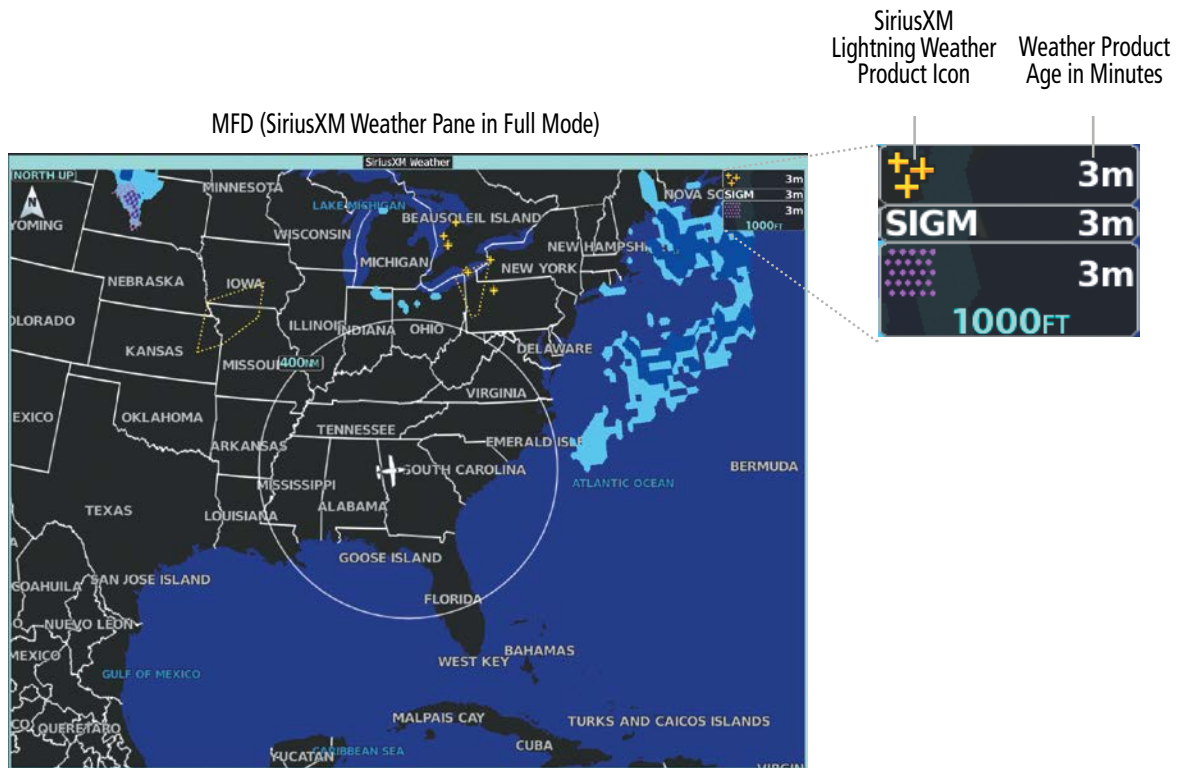


Figure 6-7 'SiriusXM Weather' Pane with Product Icons and Age Information

### 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**, **Connex**, or **FIS-B**, 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:

- 1) From PFD Home, touch the **PFD Map Settings** Button.
- 2) Scroll if necessary to view the **WX Source** Button. Cyan text on the button indicates currently selected weather data link weather source.
- 3) Touch the **WX Source** Button.
- 4) Touch the button for the data link weather source to be used (such as **SiriusXM**, **Connex**, or **FIS-B**, if installed).

#### Or:

- 1) With the Inset Map or HSI Map displayed, press the **PFD Map Settings** Softkey.
- 2) Press the **Data Link Settings** Softkey.
- 3) Press the **Data Link** Softkey. Each press cycles through an available data link weather source, displayed in cyan on the softkey.



## WEATHER PRODUCT MAP OVERLAYS

Other PFD and MFD maps and panes can display a smaller set of data link weather products. The following table shows which data link weather products can be displayed on specific maps, indicated with a '+' symbol.

Data Link Weather Product	PFD 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**

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.

The Touchscreen Controller, when operating in MFD Mode, controls the display of weather information on display panes.

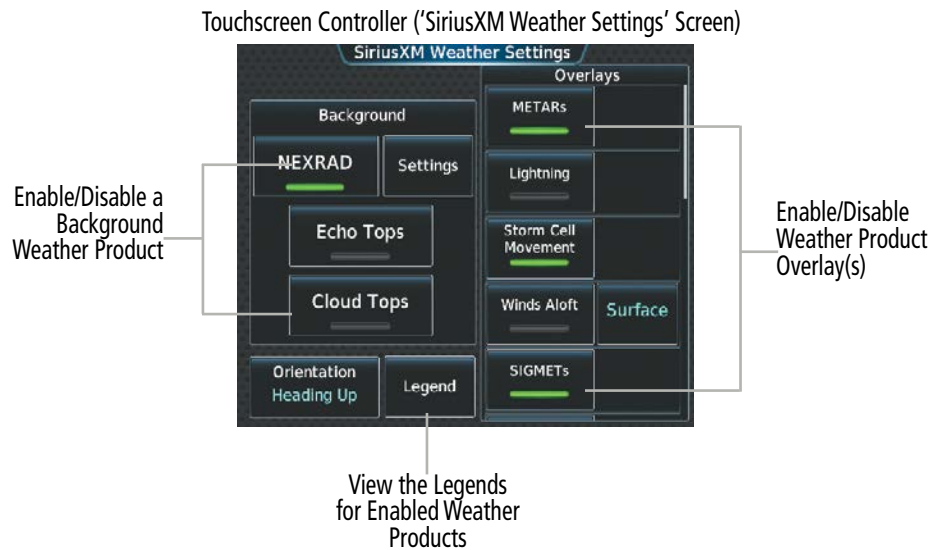


Figure 6-9 'SiriusXM Weather Settings' Screen

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.

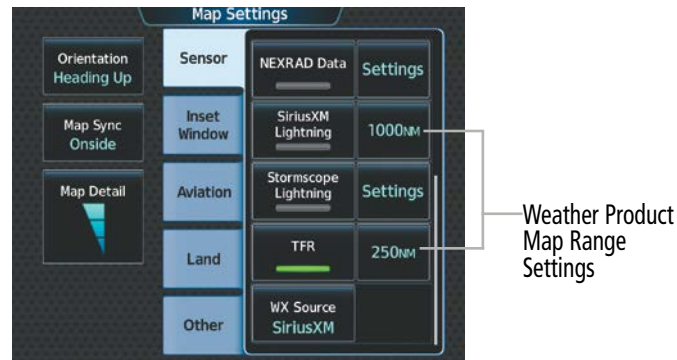


Figure 6-10 'Map Settings' Screen (Sensor Tab Selected)

The 'SiriusXM Weather 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**.

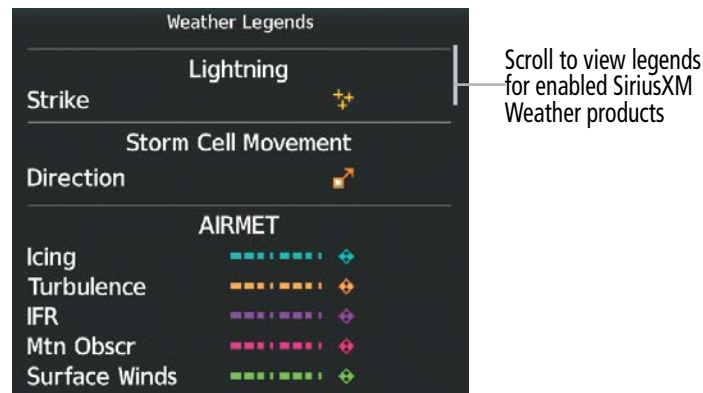


Figure 6-11 'Weather Legends' Window (SiriusXM)

The system displays additional information about the following weather products by panning over the product on the map with the Map Pointer.



**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.

- 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**).

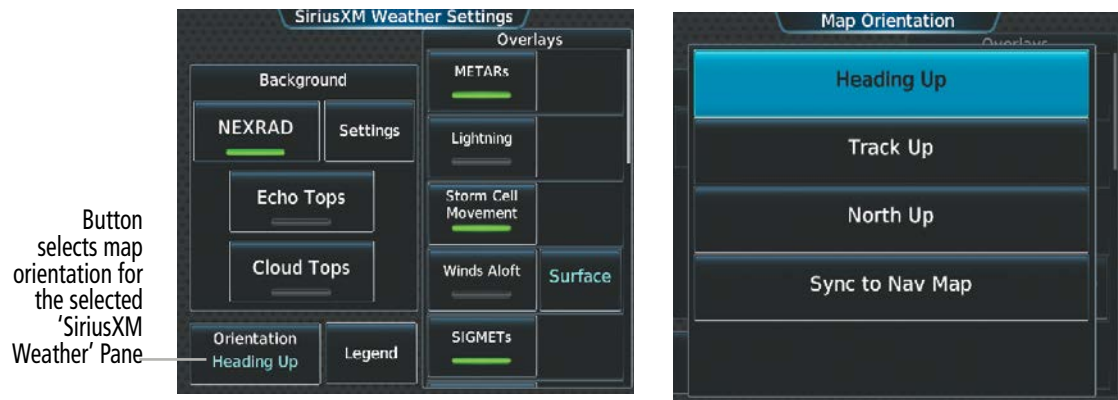


Figure 6-13 Selecting a Map Orientation for the 'SiriusXM Weather' Pane

## 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 press 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'.

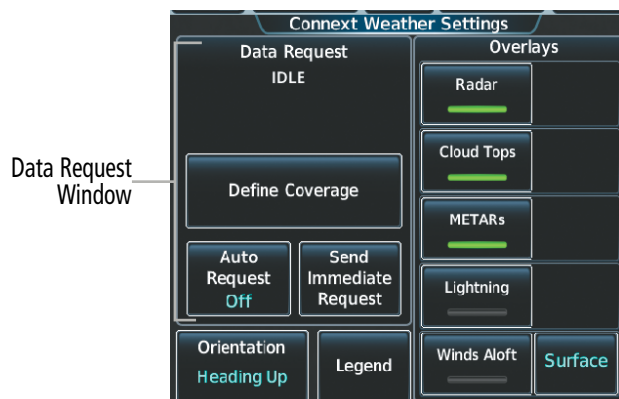


Figure 6-14 'Connex Weather Settings' Screen

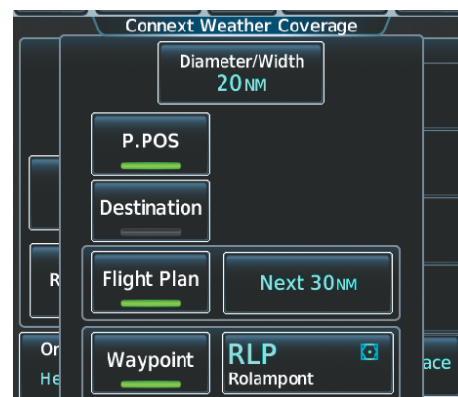
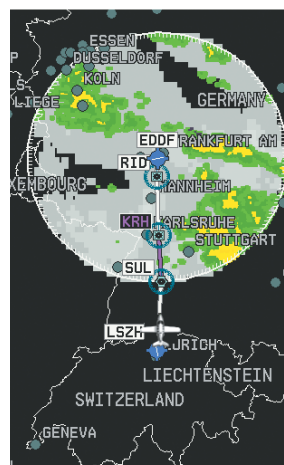
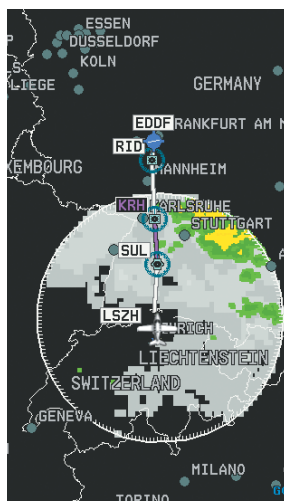


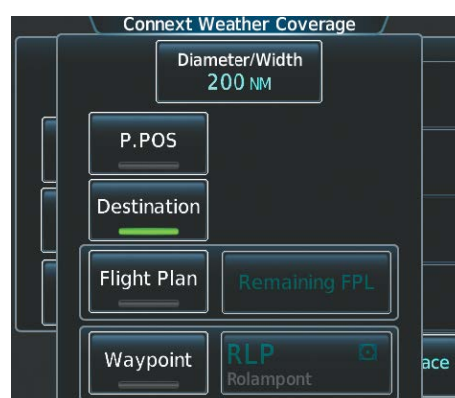
Figure 6-15 Selecting coverage area for Connex Data Request

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.



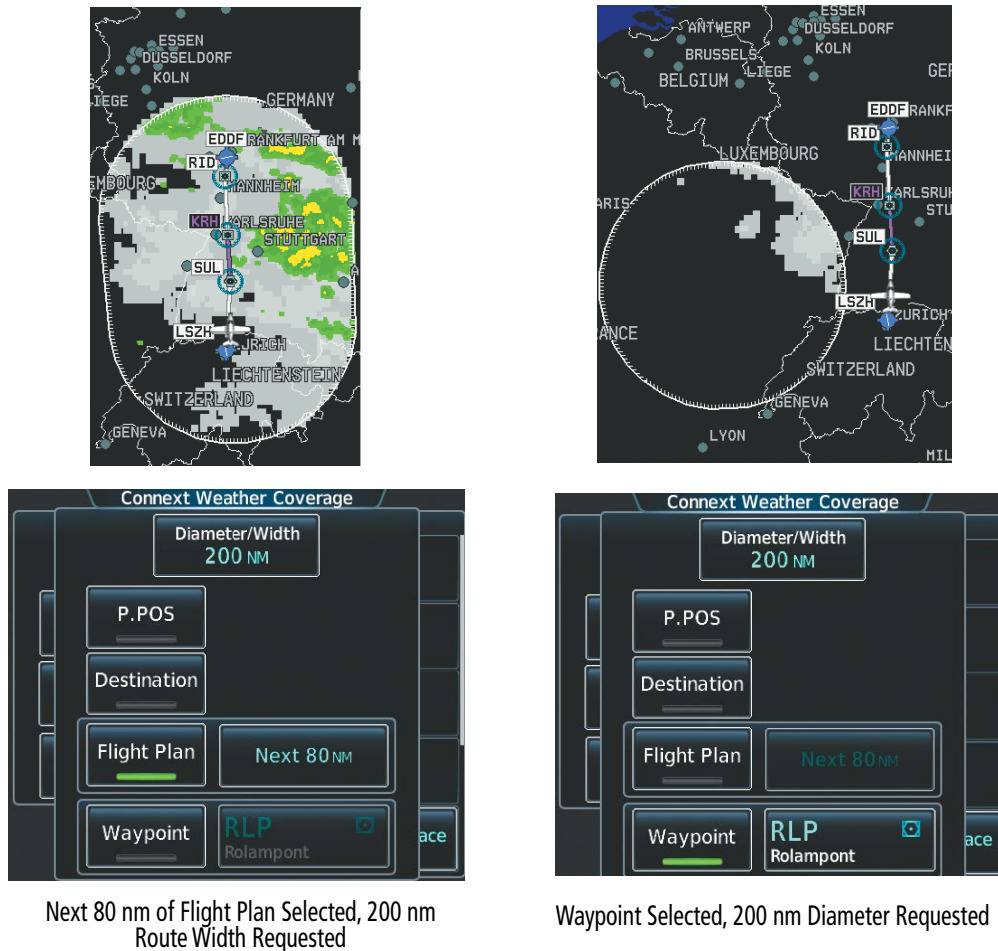
Present Position Selected, 200 nm Diameter Requested



Destination Selected, 200 nm Diameter Requested

Figure 6-16 Connex Weather Coverage Options for Present Position and Destination





**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

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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.*

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**NOTE:** *The NEXRAD weather product cannot be displayed at the same time as terrain, echo tops, turbulence, or icing data.*

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The National Weather Service (NWS) operates the WSR-88D, or NEXRAD (NEXt-generation RADar) system, an extensive network of 160 high-resolution Doppler radar systems. The NEXRAD network provides centralized meteorological information for the continental United States and selected overseas locations. The maximum range of a single NEXRAD site is 250 nm.

Individual NEXRAD sites supply the network with radar images, and the images from each site may arrive at the network at different rates and times. Periodically, the weather data provider compiles the available individual site images from the network to form a composite image, and assigns a single time to indicate when it created the image. This image becomes the NEXRAD weather product. Individual images--gathered from each NEXRAD site--differ in age, and are always older than the displayed NEXRAD weather product age. The data provider then sends the NEXRAD data to the SiriusXM Weather service, whose satellites transmit this information during the next designated broadcast time for the NEXRAD weather product.

Because of the time required to detect, assemble, and distribute the NEXRAD weather product, the displayed weather information contained within the product may be significantly older than the current radar synopsis and may not depict the current weather conditions. The NEXRAD weather product should never be used as a basis for maneuvering in, near, or around areas of hazardous weather regardless of the information it contains.

For radar sites in the United States, the NEXRAD weather product shows a composite reflectivity image. This shows the *highest* radar energy received from multiple antenna tilt angles at various altitudes. For radar sites based in Canada, the NEXRAD weather product shows radar returns from the lowest antenna tilt angle, known as base reflectivity. The display of the information is color-coded to indicate the intensity of the echoes and the type of precipitation, if known.

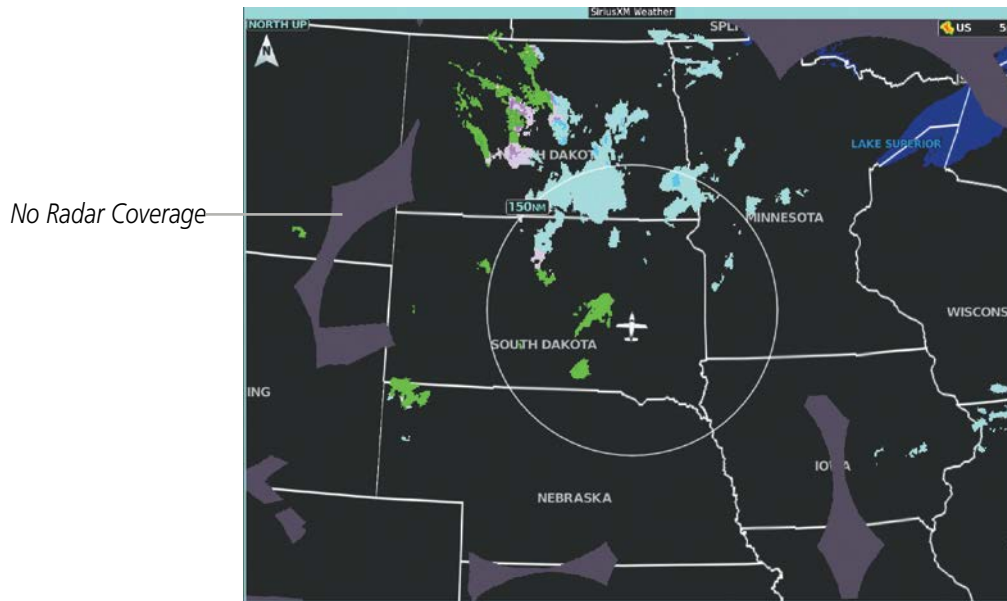


Figure 6-18 NEXRAD Data on the 'SiriusXM Weather' Pane

#### Selecting a Data Link Weather source for the (PFD Navigation Maps):

- 1) Press the **PFD Map Settings** Softkey.
- 2) Press the **Data Link Settings** Softkey.
- 3) Press the **Data Link** Softkey. Each selection of the softkey changes the source, which is displayed in cyan on the softkey.

#### Displaying NEXRAD weather information on the '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 on the '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 **USA** or **Canada** 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 Region** Button (displaying either 'USA' or 'Canada' in cyan).
- 5) Touch the **USA** or **Canada** Button, or touch **Back** or **Home** to exit without changing the coverage area.

**Displaying NEXRAD weather information (PFD Navigation Maps):**

- 1) If necessary, enable the Inset Map or HSI Map.
- 2) From PFD Home, touch **PFD Map Settings**.
- 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 PFD Inset or HSI Map.

**Displaying NEXRAD weather information (PFD Navigation Maps):**

With SiriusXM Data Link Weather as the selected weather source.

- 1) If necessary, enable the Inset Map or HSI Map.
- 2) Press the **PFD Map Settings** Softkey.
- 3) Press the **WX Overlay** Softkey twice to enable/disable the display of SiriusXM NEXRAD Data.

**Changing the NEXRAD coverage area (PFD Navigation Maps):**

- 1) From PFD Home, touch the **PFD Map Settings** Button.
- 2) Scroll as needed and touch the NEXRAD Data **Settings** Button in the Overlays Tab.
- 3) Touch the **NEXRAD Region** Button (displaying either 'USA' or 'Canada' in cyan).
- 4) Touch the **USA** or **Canada** Button, or touch **Back** or **Home** to exit without changing the coverage area.

**Changing the NEXRAD coverage area (PFD Navigation Maps):**

- 1) Press the **PFD Map Settings** Softkey.
- 2) Press the **Data Link Settings** Softkey.
- 3) Press the **Data Link** Softkey as needed to cycle among the options (SiriusXM, Connex, and FIS-B) until 'SiriusXM' appears on the softkey.
- 4) Press the **Source** Softkey. Each selection of the softkey changes the source 'USA' or 'Canada', which is displayed in cyan on the softkey.

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 when NEXRAD is enabled for display on the 'SiriusXM Weather Settings' Screen.

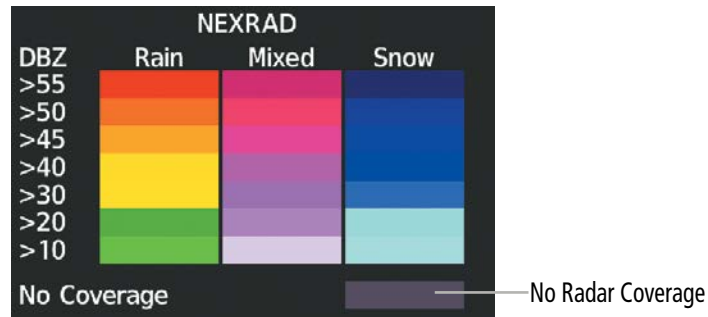


Figure 6-19 NEXRAD Legend

The system can animate a loop of NEXRAD information on the 'SiriusXM Weather' Pane. Animation begins after the system has received at least two NEXRAD images since the system was powered on. 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. Due to the time it takes to accumulate successive frames, allow approximately 30 minute for the maximum number of frames to be available for animation.

#### 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 weather data.
- 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 Navigation Maps):

- 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 selected PFD Navigation 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

The role of radar is essentially to detect moisture in the atmosphere. Simply put, certain types of weather reflect radar better than others. The intensity of a radar reflection is not necessarily an indication of the weather hazard level. For instance, wet hail returns a strong radar reflection, while dry hail does not. Both wet and dry hail can be extremely hazardous.

The different NEXRAD echo intensities are measured in decibels (dB) relative to reflectivity (Z). NEXRAD measures the radar reflectivity ratio, or the energy reflected *back to* the radar receiver (designated by the letter Z). The value of Z increases as the returned signal strength increases.

Reflectivity is the amount of transmitted power returned to the radar receiver. Colors on the NEXRAD display are directly correlative to the level of detected reflectivity. Reflectivity as it relates to hazardous weather can be very complex. Radar reflectivity can be separated into two elements: Base or Composite.

The base reflectivity precipitation weather product shows the radar returns from the perspective of a single antenna tilt angle. The composite reflectivity precipitation weather product shows the *highest* radar energy received from multiple antenna tilt angles. The display of the information is color-coded to indicate the intensity of the echoes and the type of precipitation.

### 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.
  - » Strokes and spurious radar data.
  - » Sun strokes (when the radar antenna points directly at the sun).
  - » Interference from buildings or mountains, which may cause shadows.
  - » Metallic dust (chaff) from military aircraft, which can cause alterations in radar scans.

### NEXRAD LIMITATIONS (CANADA)

- Radar coverage extends to 55°N.
- Any precipitation displayed between 52°N and 55°N is displayed as mixed regardless of actual precipitation type.



## NEXRAD (FIS-B)



**NOTE:** The NEXRAD weather product cannot be displayed at the same time as terrain.



**NOTE:** Pilots are encouraged to check additional Notam sources to supplement FIS-B NOTAMs. NOTAMs older than 30 minutes will not be displayed by FIS-B. For additional information refer to InFO 18008 and AC 00-63.

The National Weather Service (NWS) operates the WSR-88D, or NEXRAD (NEXt-generation RADar) system, an extensive network of 156 high-resolution Doppler radar systems. The NEXRAD network provides centralized meteorological information for the continental United States and selected overseas locations. The maximum range of a single NEXRAD site is 250 nm.

Individual NEXRAD sites supply the network with radar images, and the images from each radar site may arrive at the network at different rates and times. Periodically, the weather data provider to FIS-B compiles the available individual site images from the network to form a composite image, and assigns a single time to indicate when it created the image. This image becomes the NEXRAD weather product. Individual images--gathered from each NEXRAD site--differ in age, and are always older than the displayed NEXRAD weather product age. The data provider then sends the NEXRAD data to the FIS-B GBTs, which transmit this information during the next designated broadcast time for the NEXRAD weather product.

Because of the time required to detect, assemble, and distribute the NEXRAD weather product, the displayed weather information contained within the product may be 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.

**Displaying FIS-B 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. Touch either CONUS, Regional, or Combined to enable/disable the display of the NEXRAD weather product.
- 4) When finished, touch the **Back** Button or the **Home** Button.

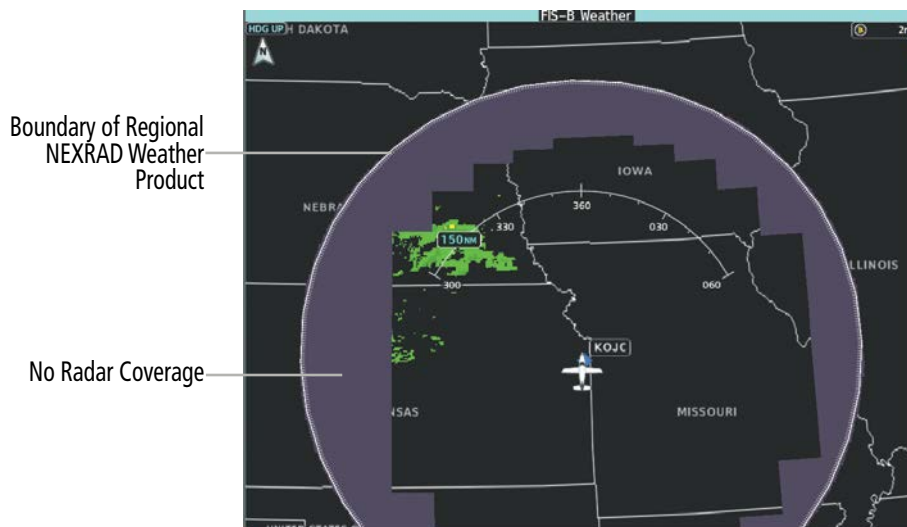


Figure 6-21 Regional NEXRAD Weather Product on the 'FIS-B Weather' Pane

**Selecting a Data Link Weather source for the (PFD Navigation Maps):**

- 1) Press the **PFD Map Settings** Softkey.
- 2) Press the **Data Link Settings** Softkey.
- 3) Press the **Data Link** Softkey. Each selection of the softkey changes the source, which is displayed in cyan on the softkey.

**Displaying NEXRAD weather information (PFD Navigation Maps):**

With FIS-B Data Link Weather as the selected weather source.

- 1) Press the **PFD Map Settings** Softkey.
- 2) Press the **WX Overlay** Softkey as needed to cycle among the options until the desired data link weather source is displayed.

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.

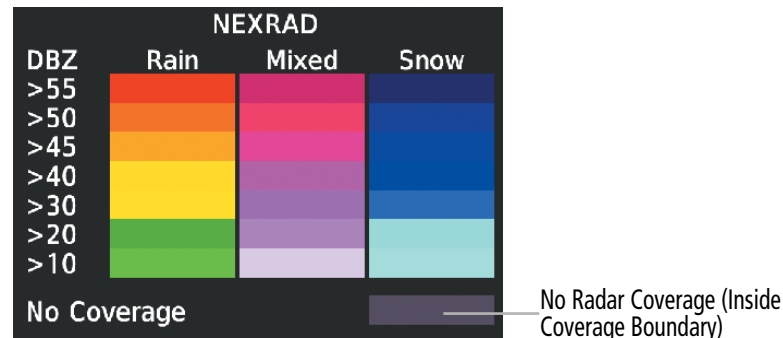


Figure 6-22 NEXRAD Weather Product Legend

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)



**NOTE:** The Garmin Connex weather product cannot be displayed simultaneously on the same map with relative terrain or airborne weather radar information. When one item is enabled the other is disabled.

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.

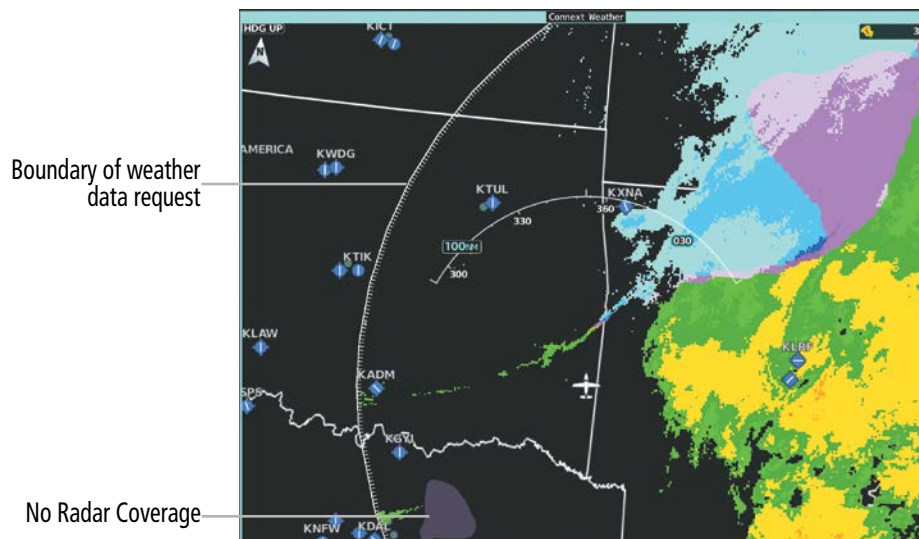


Figure 6-23 'Connex Weather' Pane with Connex Radar Enabled

### Displaying Garmin Connex Radar information on the 'Connex Weather' Pane:

- 1) From MFD Home, touch **Weather** > **Weather Selection** > **Connex Weather** > **Connex Settings**.
- 2) Touch the **Radar** Button in the 'Overlays' Window.

### Displaying Garmin Connex Radar information 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 needed and touch the **Connex Radar** Button.

### Displaying Garmin Connex Radar information (PFD Navigation Maps):

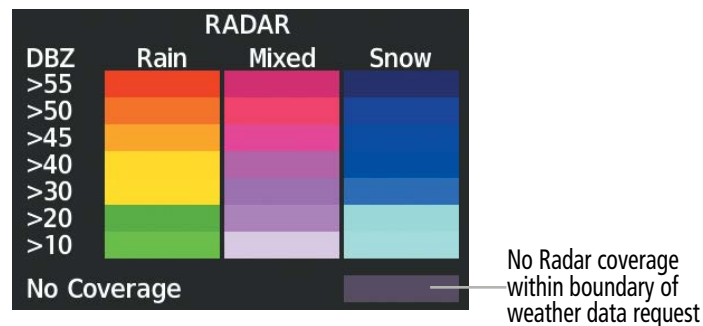
- 1) From PFD Home, touch **PFD Map Settings**.
- 2) Scroll in the Overlays Tab, and touch the **Connex Radar** Button.

### Displaying Garmin Connex Radar information overlay (PFD Navigation Maps):

With Connex Data Link Weather as the selected weather source.

- 1) Press the **PFD Map Settings** Softkey.
- 2) Press the **WX Overlay** Softkey. Each press cycles through an available option, displayed in cyan. When 'Connex' is displayed, Connex Radar is enabled. When 'Off' is displayed, Connex Radar is disabled.

The display of the information is color-coded to indicate the intensity of the echoes and the type of precipitation. All weather product legends can be viewed on the 'Connex Weather' Pane. For the Connex Precipitation legend, touch the **Legend** Button on the 'Connex Weather Settings' Screen when Connex Weather Precipitation is selected 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.

### 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**

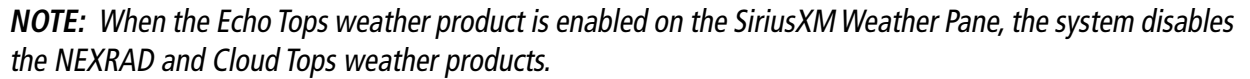
Radar images may have certain limitations:

- 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.
- 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.

## ECHO TOPS (SIRIUSXM)



The image is a SiriusXM Weather map of the Detroit area. A white circle highlights the area around ECHO TOP (20000 FT) and SAGINAW B. A label 'No Radar Coverage' points to the area outside the circle. The map shows various weather stations, including KGOV, KOSC, KBAK, and KFMF, and major roads like I-75 and I-94.

**Figure 6-25 Echo Tops Weather Product**

- 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.



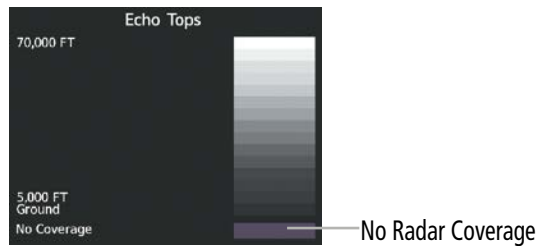


Figure 6-26 Echo Tops Legend

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.

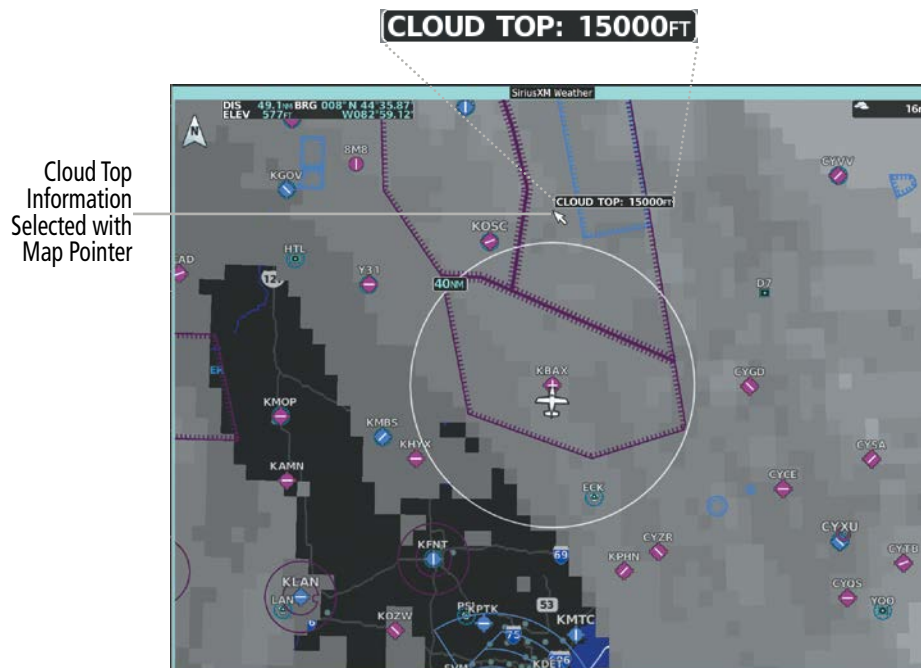


Figure 6-27 Cloud Tops Weather Product

### 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.

## DATA LINK LIGHTNING (SIRIUSXM, GARMIN CONNEXT)

### Enabling/Disabling 'Data Link' Lightning information (SiriusXM or Connext Weather Pane):

- 1) From MFD Home, touch **Weather > Weather Selection > 'Data Link' Weather > 'Data Link' Weather Settings**.
- 2) Touch the **Lightning** Button in the 'Overlays' Window.

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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** 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** Button.

**Or:**

- 1) If necessary, enable the HSI Map or PFD Inset Map to access SiriusXM softkeys.
- 2) Press the **PFD Map Settings** Softkey.
- 3) Press the **SiriusXM Lightning** Softkey.

**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.

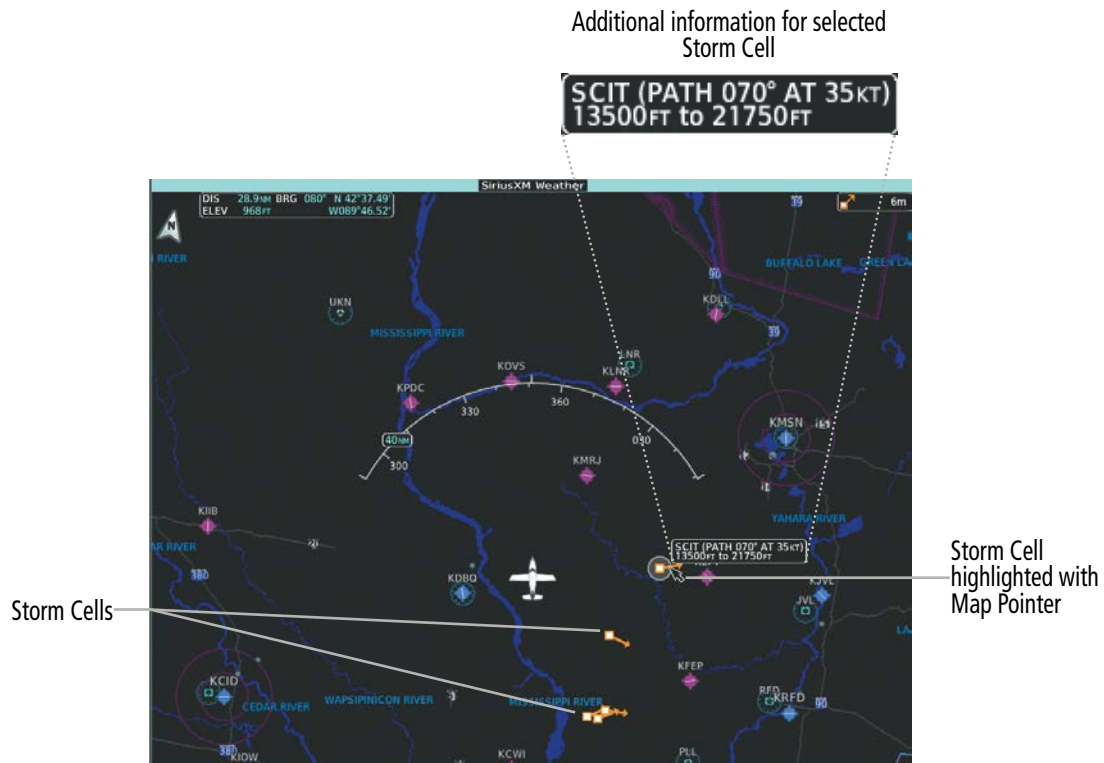


Figure 6-31 Storm Cell Movement Weather Product

#### Enabling/Disabling Storm Cell Movement Information on the '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.

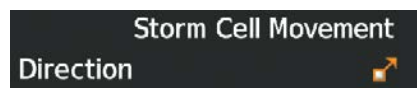


Figure 6-32 Cell Movement Legend

#### Displaying Storm Cell Movement Information on the '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 Navigation Maps):**

- 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**.

**Or:**

- 1) With the Inset Map or HSI Map shown, press the **PFD Map Settings** Softkey.
- 2) Press the **Data Link Settings** Softkey.
- 3) Press the **Storm Cell Movement** Softkey.
- 4) When finished, press the **Back** Softkey.

**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.

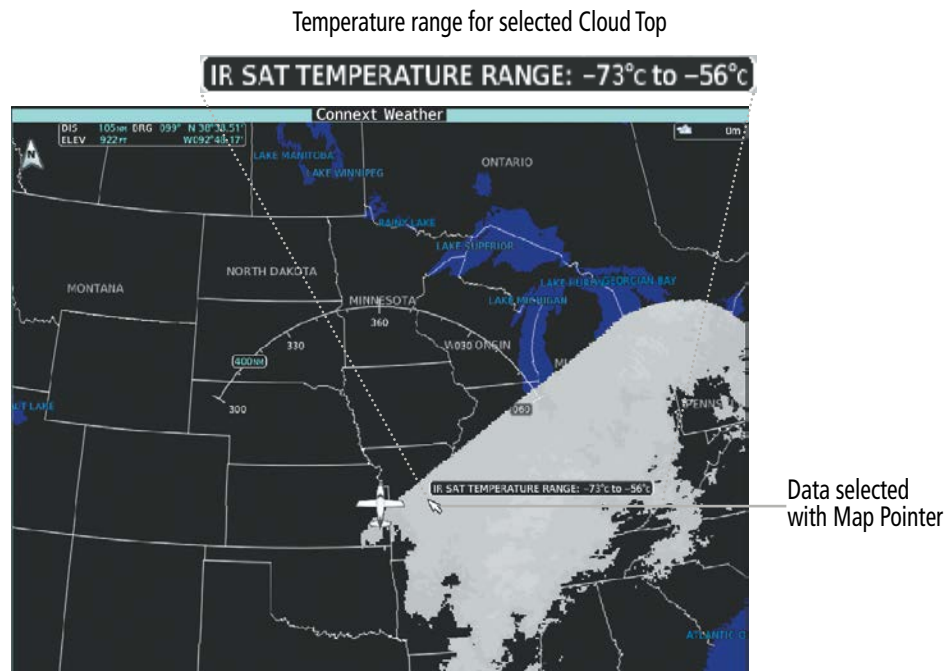


Figure 6-33 Infrared Satellite Weather Product on 'Connex Weather' Pane

### Displaying Cloud Tops information on the '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.

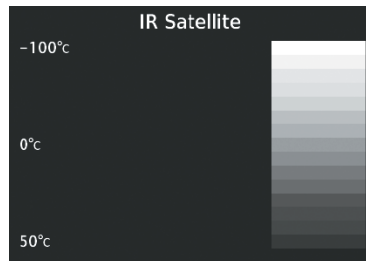


Figure 6-34 Infrared Satellite Legend

## 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.

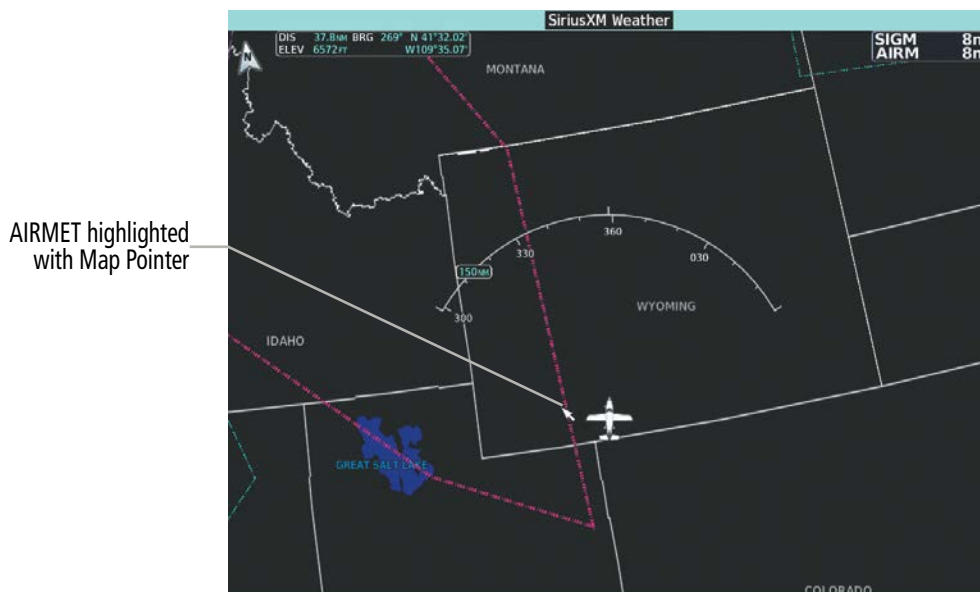


Figure 6-35 AIRMET and SIGMET Weather Products

**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, press 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 '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.

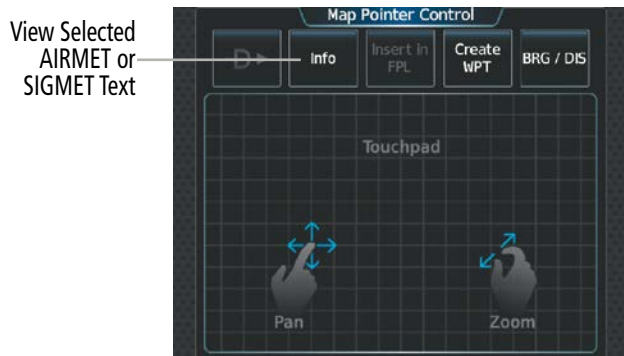


Figure 6-36 Map Pointer Control Screen



Figure 6-37 AIRMET/SIGMET Screen

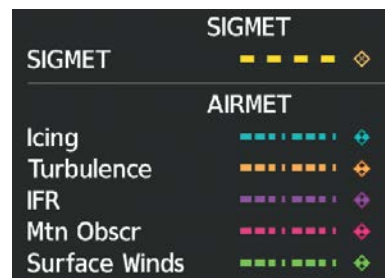


Figure 6-38 SIGMET/AIRMET Legend



## 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.

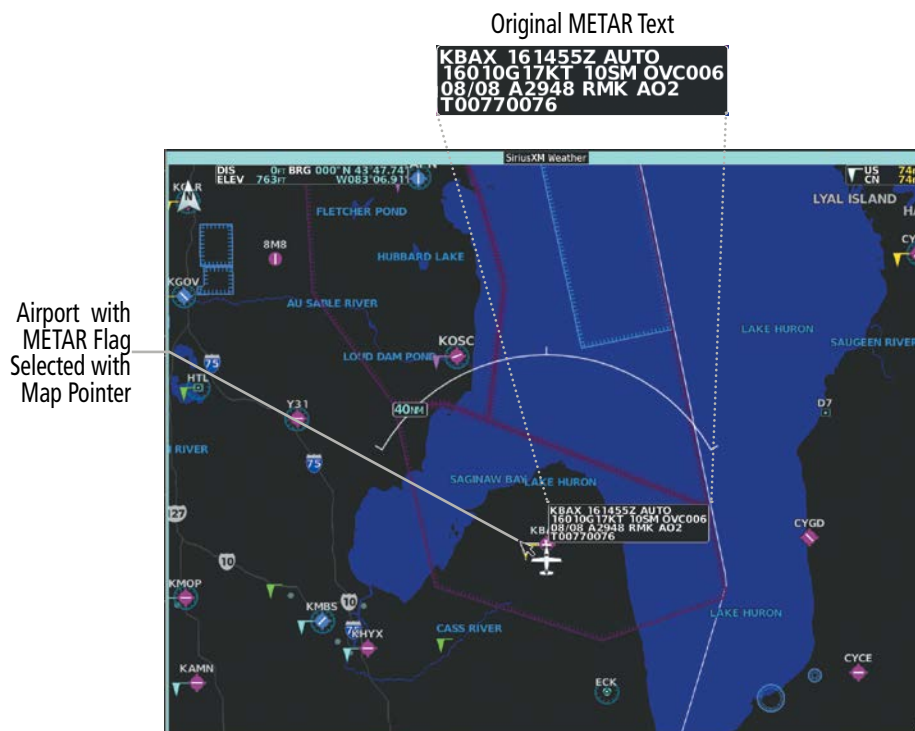


Figure 6-39 Displaying METARS on the 'SiriusXM Weather' Pane

### Showing METAR text on the 'SiriusXM 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, press the lower knob and move the map pointer with the large and small upper knobs or **Touchpad** over a METAR flag. The system displays the original METAR text near the METAR flag. If the display has not yet received the METAR text associated with the selected flag, it displays "Waiting for METAR text." until it receives this information.

The graphical METAR flag color shown on the maps is determined by the information within the METAR. The system displays a gray METAR flag when the system does not have enough information to categorize the METAR.

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.

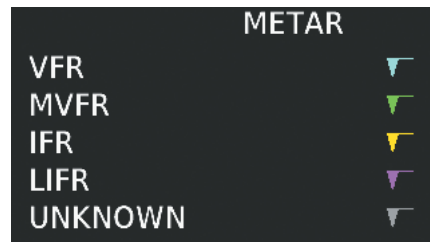


Figure 6-40 METAR Legend

#### Showing METAR information 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 **Graphical METARs** Button. The system displays METAR flags at available reporting stations when METARs are enabled (button annunciator is green).
- 4) To view METAR text, press the lower knob and move the map pointer with the large and small upper knobs or **Touchpad** over a METAR flag. The system displays the original METAR text near the METAR flag. If the display has not yet received the METAR text associated with the selected flag, it displays "Waiting for METAR text." until it receives this information.

Original METAR text can be viewed on the Inset Map by panning the Map Pointer over a graphical METAR flag. The HSI Map also shows the graphical METAR flags, but cannot display the text contained within the METAR.

#### Showing METAR information (PFD Navigation Maps):

- 1) From PFD Home, touch **PFD Map Settings**.
- 2) If necessary, touch the **HSI Map** or **PFD Inset Map** Button to access overlays buttons.
- 3) Scroll and touch the **Graphical METARs** Button. METAR flags appear on the map.
- 4) If the PFD Inset Map is shown, use the upper and lower knobs on the Touchscreen Controller to pan the Map Pointer over the desired METAR flag to view the original METAR text. METAR text is not available on the HSI map.

Textual METAR/TAF information is available on the Airport Information Screen on the Touchscreen Controller for airports with a requested METAR/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.

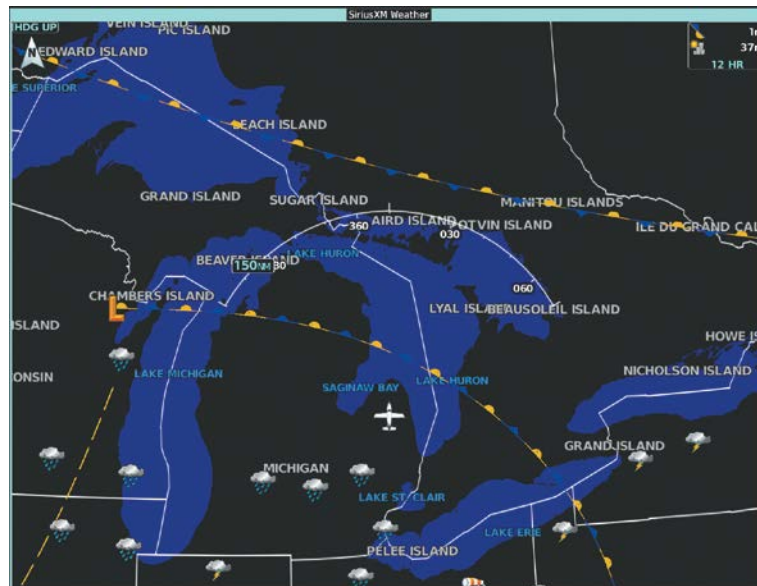


Figure 6-42 Current Surface Analysis Weather Product

### 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 Conditions** Button.
- 3) If needed, touch the Surface Conditions forecast period button (to the right of the **Surface Conditions** 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.

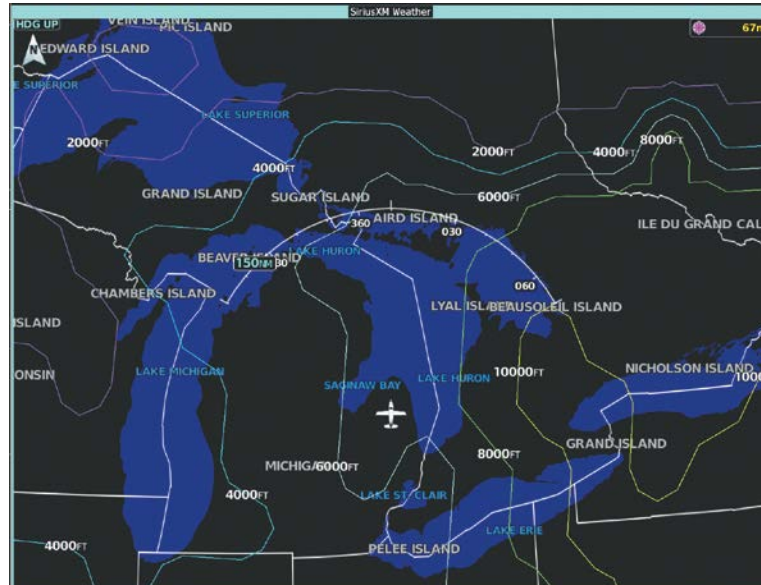


Figure 6-44 Freezing Level Weather Product

### 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

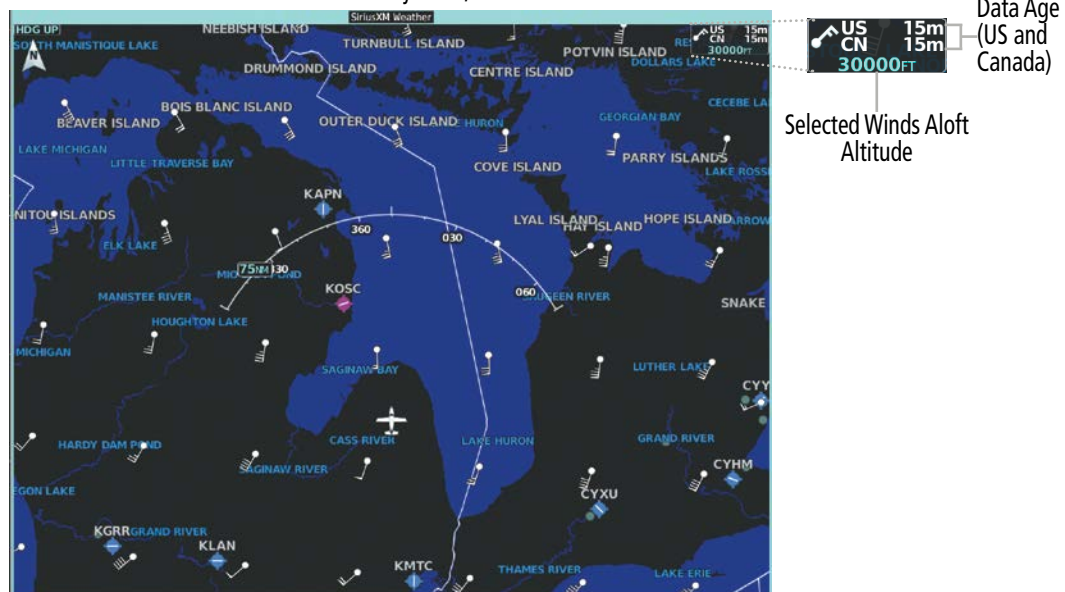
## WINDS ALOFT

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.

Winds Aloft Overlay at 30,000 Feet



Selects Winds Aloft Altitude

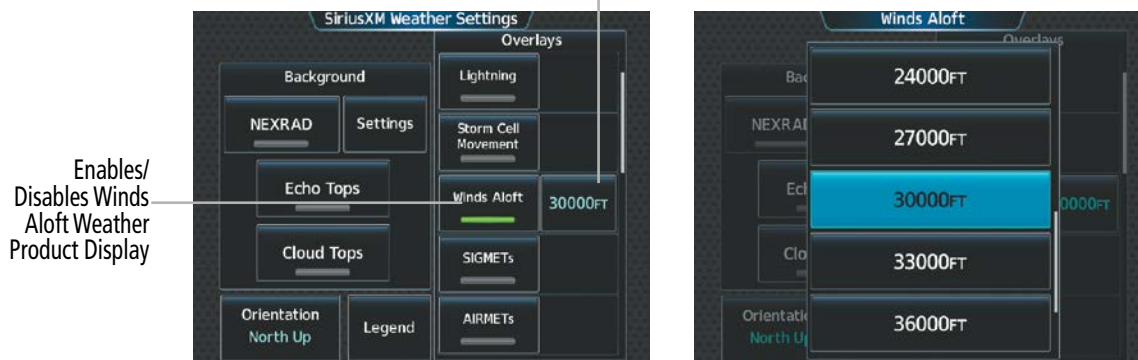


Figure 6-46 Selecting a Winds Aloft Altitude on the 'SiriusXM Weather Settings' Screen



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**.

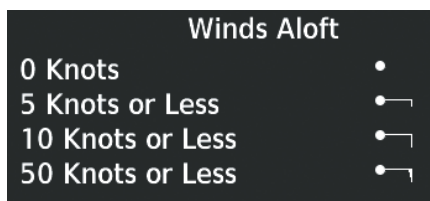


Figure 6-47 Winds Aloft Data Legend

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.

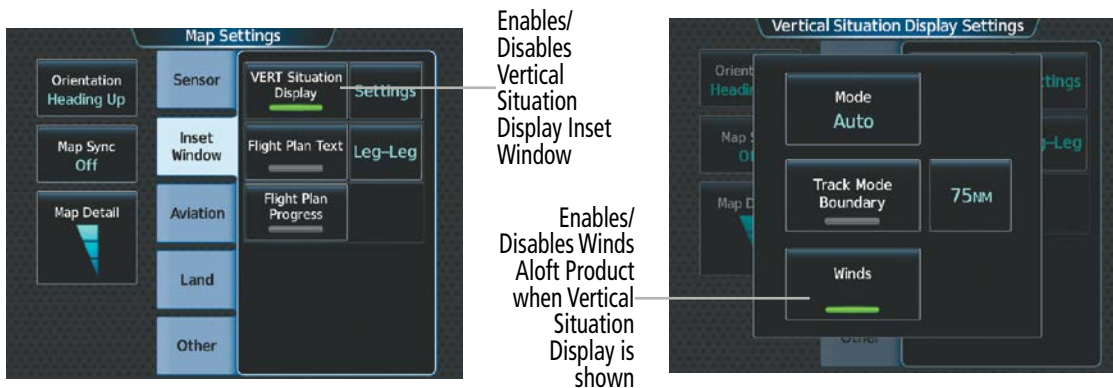


Figure 6-49 Controlling the display of Winds Aloft information for VSD Inset Window

## 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.

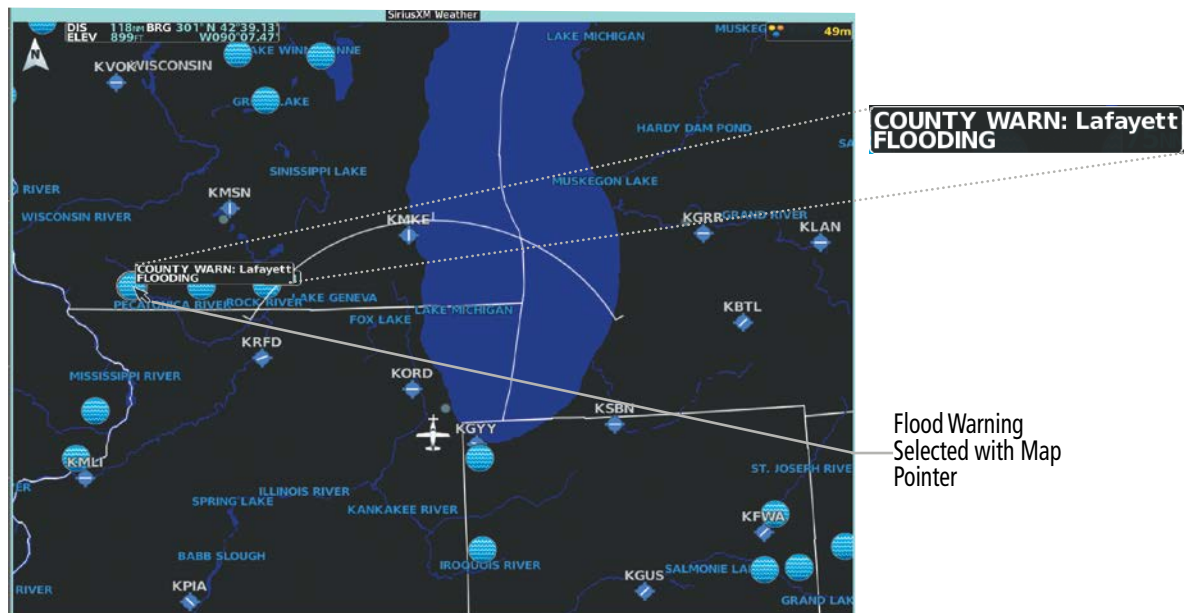


Figure 6-50 County Warnings Weather Product

### 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), press the lower knob to activate the map pointer and turn the large and small upper knobs or use the **Touchpad** to select a County Warning. County Warning information appears in a box near the map pointer.
- 4) When finished, press either knob to deactivate the map pointer.

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**.

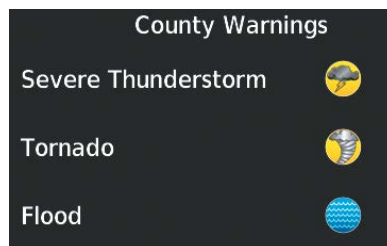


Figure 6-51 County Warnings Legend

## 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.

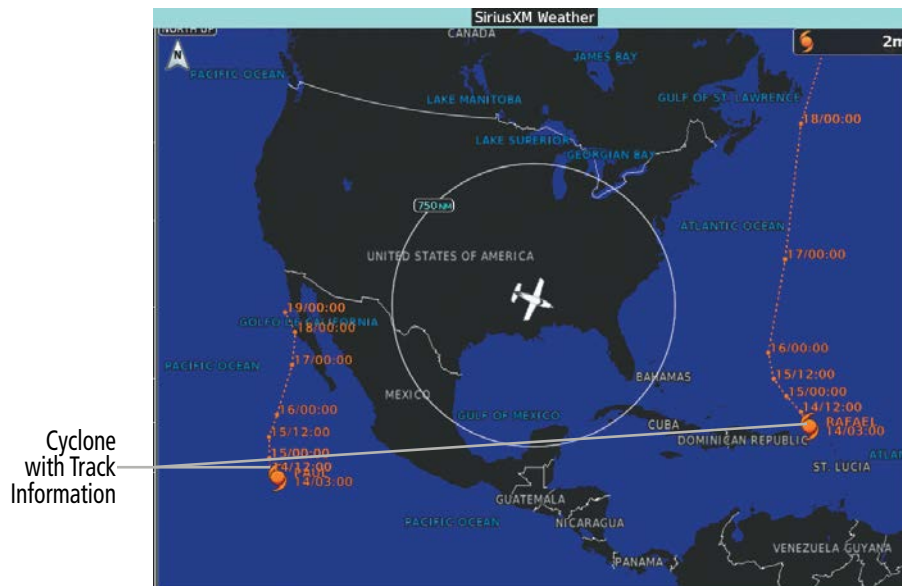


Figure 6-52 Cyclone (Hurricane) Weather Product

### 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.)

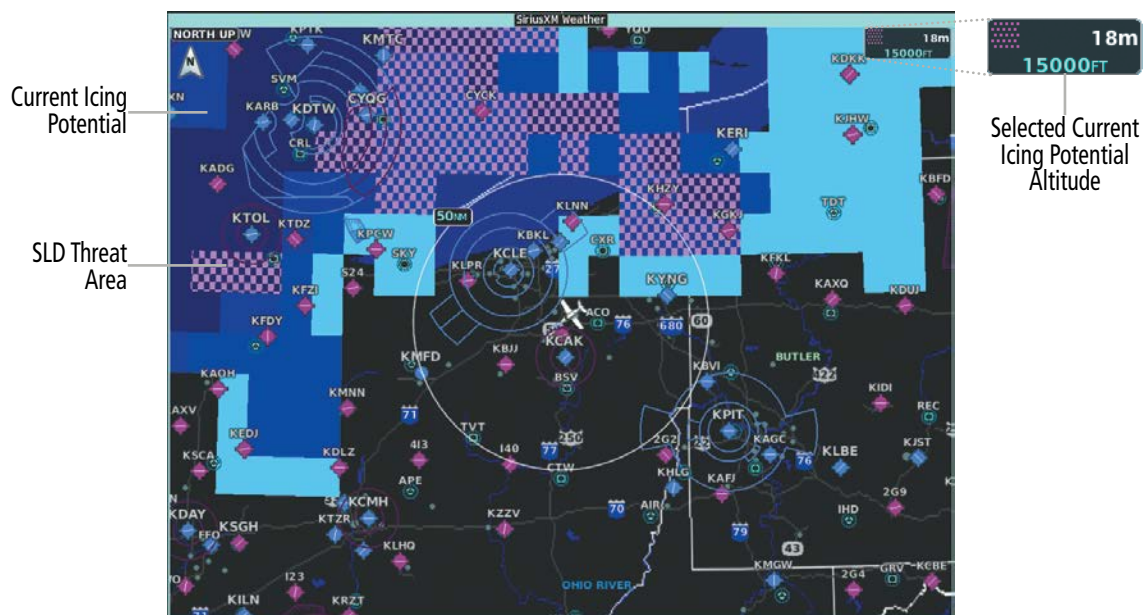


Figure 6-54 Current Icing Potential Overlay at 15,000 Feet

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.

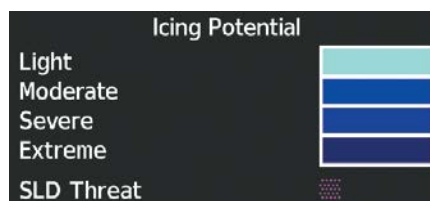


Figure 6-55 Icing Legend

## 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).

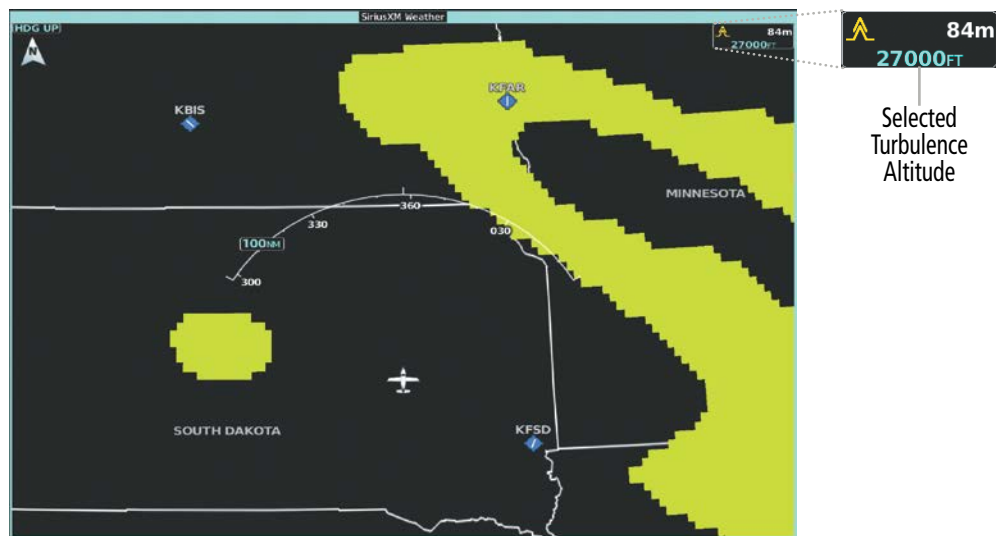


Figure 6-56 Turbulence Weather Product at 27,000 Feet

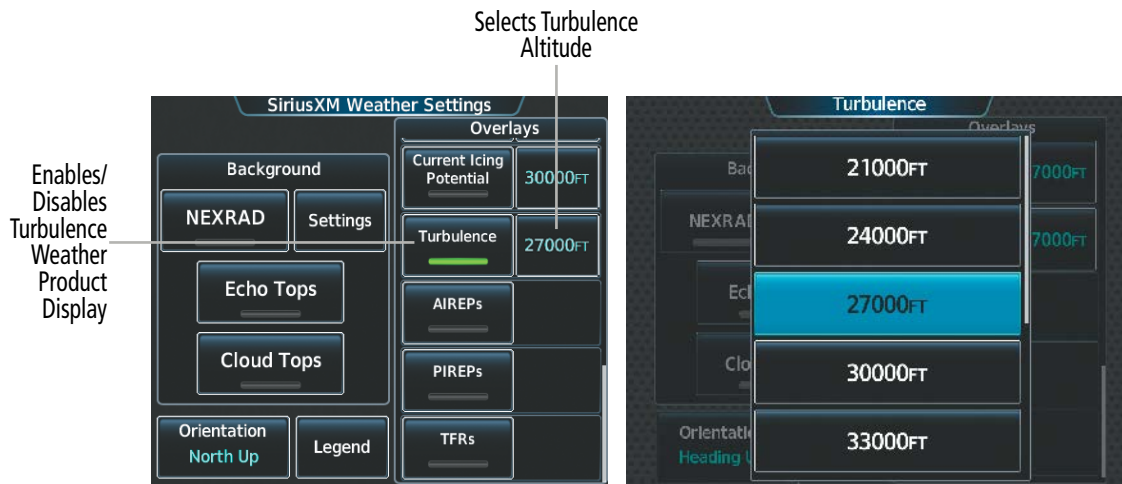


Figure 6-57 Selecting a Turbulence Altitude on the 'SiriusXM Weather Settings' Screen



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**.

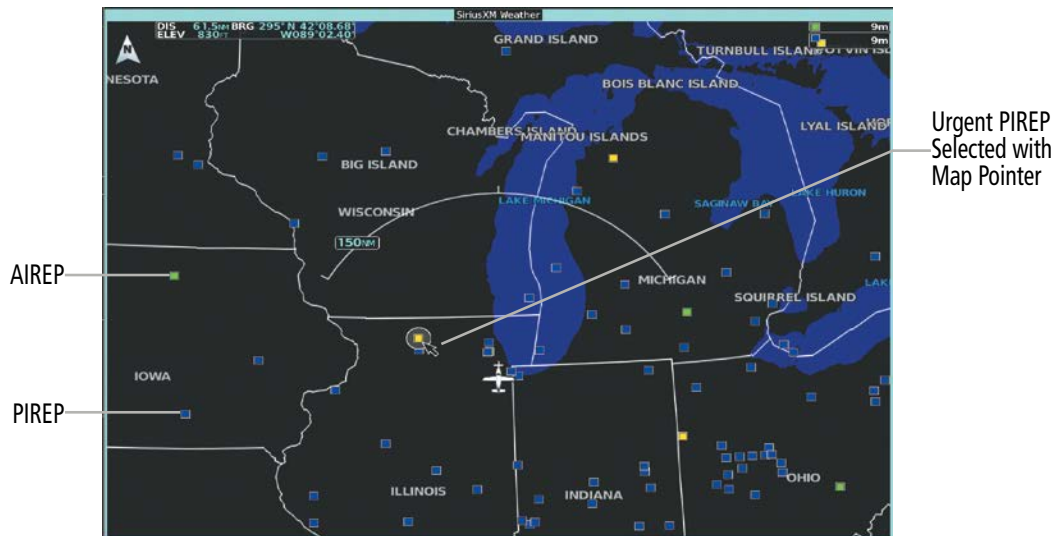


**Figure 6-58 Turbulence Legend**

## 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.

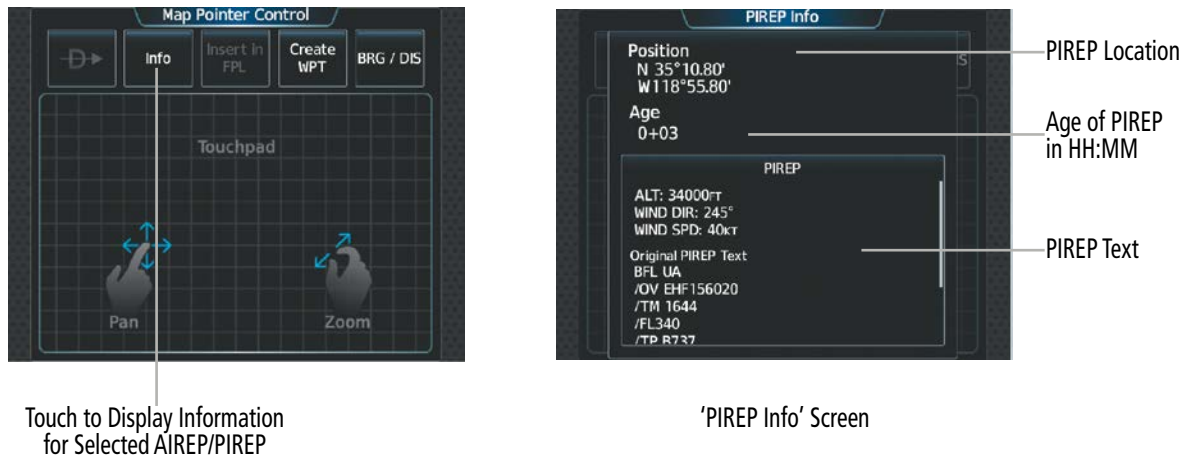


Figure 6-60 Displaying PIREPS/AIREPS on the Touchscreen Controller

Touch the **Legend** Button on the '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**.

The PIREP color is determined by the type (routine or urgent).

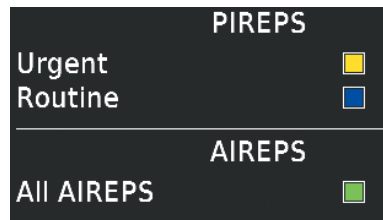


Figure 6-61 AIREPs &amp; PIREPs Legend

## TEMPORARY FLIGHT RESTRICTIONS (TFRS)

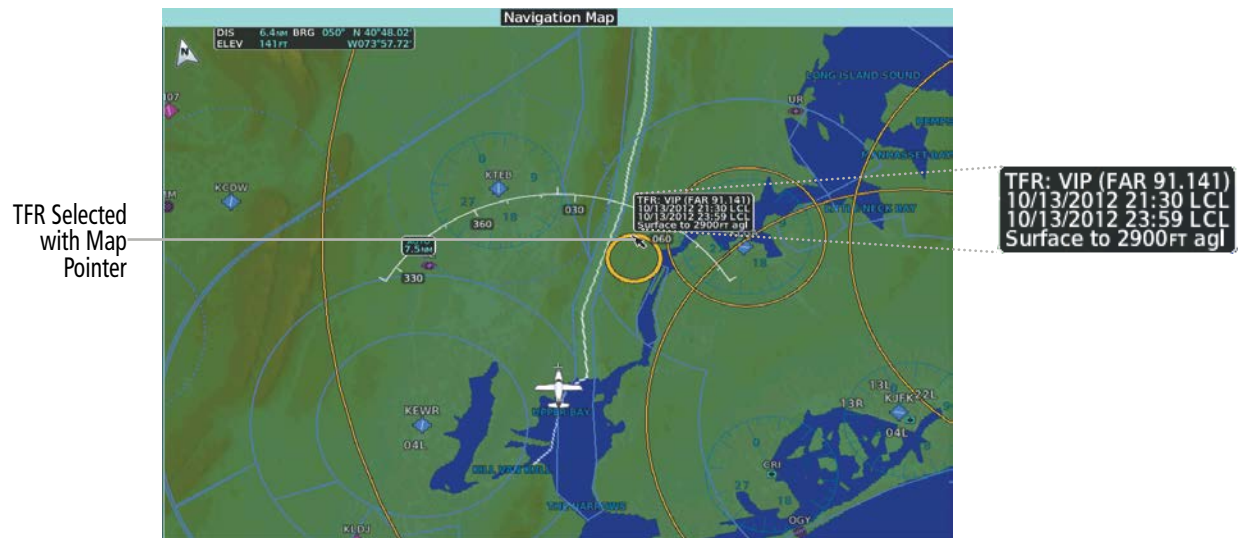


**NOTE:** Do not rely solely upon data link services to provide Temporary Flight Restriction (TFR) information. Always confirm TFR information through official sources such as Flight Service Stations or Air Traffic Control.

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 on the 'SiriusXM 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 on the 'Navigation Map' Pane:

- 1) From MFD Home, touch **Map > Map Selection > Map Settings**.
- 2) If necessary, touch the **Sensor** Tab.
- 3) Scroll and touch the **TFR** Button.

The 'Map Settings' Screen provides controls for enabling/disabling the display of TFR information on navigation maps, in addition to selecting the maximum map range for the system to display TFR information. If the crew selects a map range above this setting, the system declutters TFR information from the selected pane.

Maps other than the 'Navigation Map' Pane use settings based on those selected on the 'Map Settings' Screen.

### Enabling/disabling TFR information (Navigation Maps)

- 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.

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.

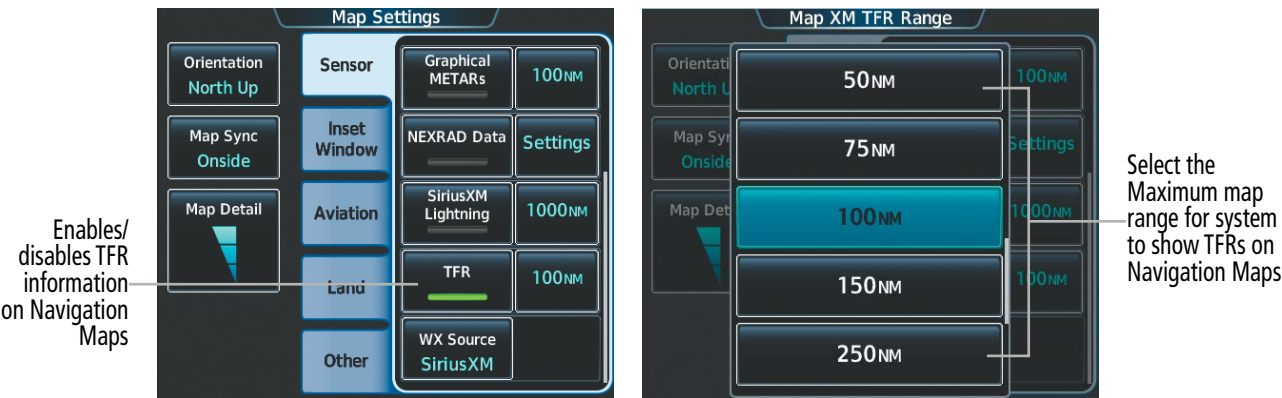


Figure 6-63 Customizing TFR display settings for Navigation Maps

FIS-B WEATHER ABNORMAL OPERATIONS

Additional information about the status of FIS-B Data Status is available on the ‘FIS-B Weather Settings’ Screen of the Touchscreen Controller.

FIS-B Weather Status Banner Annunciation	Description
<b>FIS-B WEATHER UNAVAILABLE</b>	Current aircraft position is outside the FIS-B Coverage area.
<b>NOT RECEIVING WEATHER DATA</b>	GTX 345 is currently offline or not receiving FIS-B Weather data from the antenna.

Table 6-6 FIS-B Weather Status Annunciation

## GARMIN CONNEXT 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 <a href="http://flygarmin.com">flygarmin.com</a> .
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 <a href="http://flygarmin.com">flygarmin.com</a> .
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 6-7 Abnormal Weather Data Request Status Messages**

## 6.2 STORMSCOPE LIGHTNING DETECTION SYSTEM



**WARNING:** Do not rely on information from the lightning detection system display as the sole basis for hazardous weather avoidance. Range limitations and interference may cause the system to display inaccurate or incomplete information. Refer to documentation from the lightning detection system manufacturer for detailed information about the system.



**NOTE:** Stormscope lightning information cannot be displayed simultaneously on the same map as lightning information from data link lightning sources.



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

The system can display the optional L-3 WX-500 Stormscope lightning detection system information on the ‘Stormscope®’ Pane, and as an overlay on navigation maps. The system uses the symbols shown in the following table to depict lightning strikes and cells based on the age of the information.





Lightning Age	Symbol
Strike is less than 6 seconds old	
Strike is between 6 and 60 seconds old	
Strike is between 1 and 2 minutes old	
Strike is between 2 and 3 minutes old	

Table 6-8 Lightning Age and Symbols

The Stormscope operates in either Cell Mode or Strike Mode. When operating in Cell Mode, the system displays clusters or cells of electrical activity. When operating in Strike Mode, the system displays the approximate location of individual lightning strikes.

### USING THE STORMSCOPE PANE

The ‘Stormscope®’ Pane shows lightning information in relation to the aircraft’s current location, with simplified map details to reduce clutter and to allow for easier identification of lightning cells and strikes. It is the principal map pane for viewing Stormscope lightning information. The ‘Stormscope®’ Pane map orientation is heading up, with an arrow pointing North, unless there is no valid heading. The ‘Stormscope’ Pane displays the selected Stormscope operating mode and lightning strike rate in the upper right corner of the pane. The selected map range appears in cyan a box on the range arc. The ‘Stormscope®’ Pane also displays the active flight plan, when one exists.

**Viewing the 'Stormscope®' Pane:**

- 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 'Stormscope®' Pane is shown (such as 'Weather Radar' in the pane title), continue with the procedure to view the 'Stormscope®' Pane.
- 2) Touch the **Weather Selection** Button. The 'Weather Selection' Screen appears.
- 3) Touch the **Stormscope** Button. Button is highlighted and becomes **Stormscope Settings** Button. The system shows the 'Stormscope®' Pane.
- 4) If necessary, touch the **Stormscope Settings** Button to access Stormscope controls.

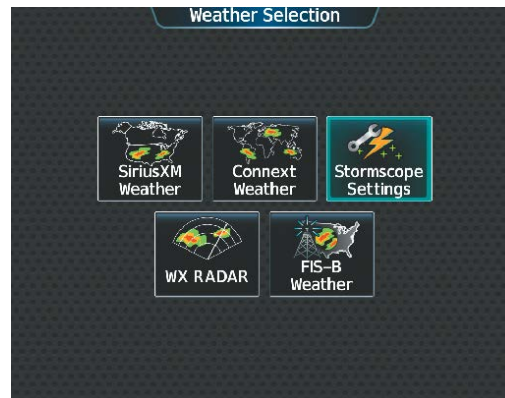
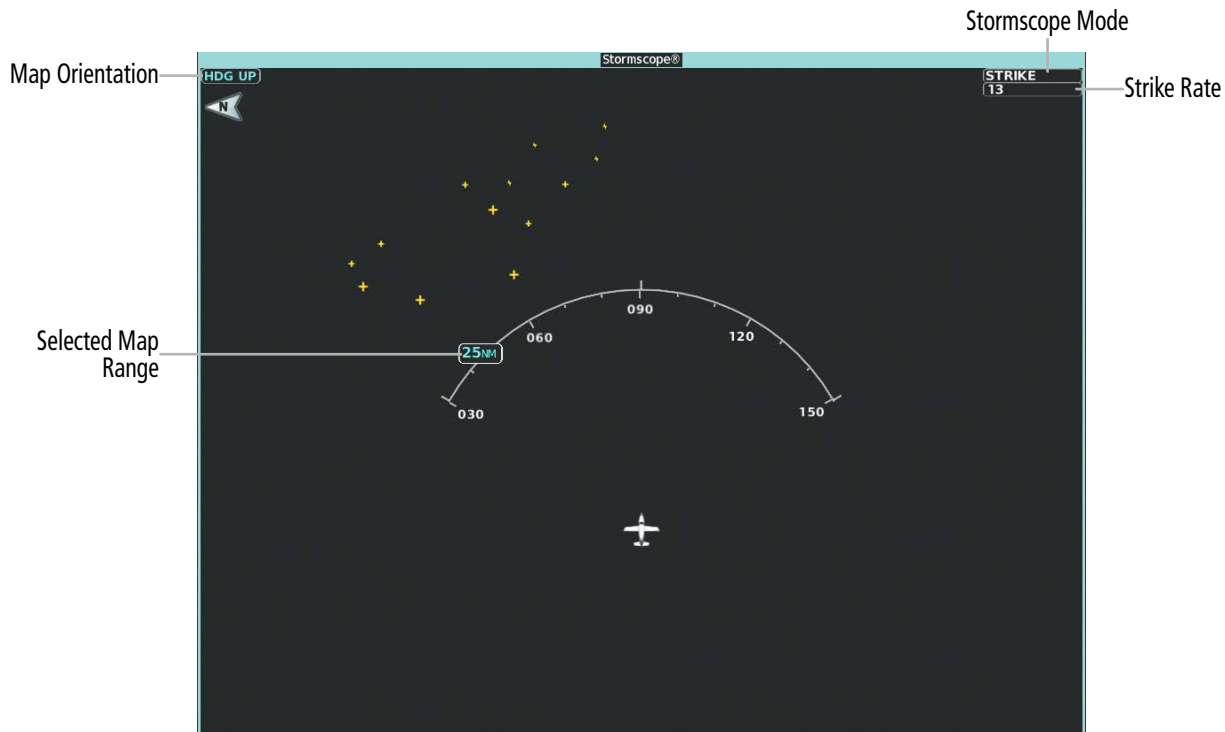


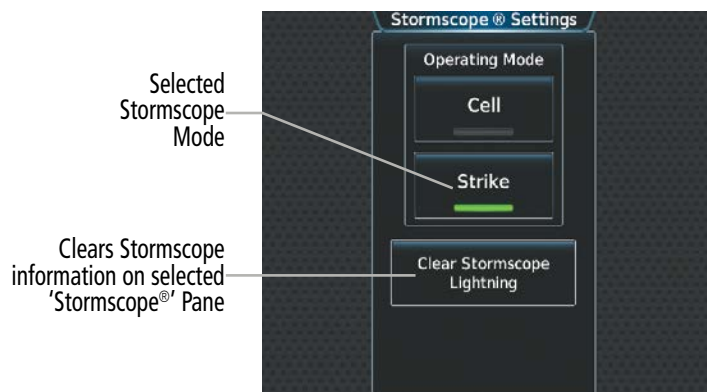
Figure 6-64 'Weather Selection' Screen

**Selecting a Stormscope Operating Mode on the 'Stormscope®' Pane:**

- 1) From MFD Home, touch **Weather > Weather Selection > Stormscope > Stormscope Settings**.
- 2) Touch either the **Cell** Button or the **Strike** Button. Button annunciator is green for currently selected mode.



'Stormscope®' Pane Operating in Strike Mode



Stormscope® Settings Screen

**Figure 6-65** Displaying Stormscope Lighting on the 'Stormscope®' Pane

The **Joystick** on the Touchscreen Controller controls the map range shown on the 'Stormscope®' Pane. Turn the **Joystick** clockwise to increase the map range shown, or counter-clockwise to decrease the map range. Map ranges of 25 NM to 200 NM are available. At a map range of less than 25 nm, Stormscope lightning data is not displayed, but can still be present.

The flight crew can manually clear previous lightning cells or strikes on the 'Stormscope Settings®' Screen on the Touchscreen Controller. Clearing the 'Stormscope®' Pane removes any previously displayed cell or lightning strike information from the 'Stormscope®' Pane. Clearing lightning information affects all maps or display panes showing Stormscope lightning.

### Manually clearing Stormscope information:

- 1) From MFD Home, touch **Weather > Weather Selection > Stormscope > Stormscope Settings**.  
Or:
  - a) From MFD Home, touch **Map > Map Selection > Map Settings**.
  - b) If necessary, touch the **Sensor** Tab.
  - c) Scroll and touch the Stormscope Lightning **Settings** Button.
- 2) Touch the **Clear Stormscope Lightning** Button.
- 3) When finished, touch **Back** or **Home**.

## STORMSCOPE INFORMATION ON NAVIGATION MAPS

Stormscope lightning information is available as an overlay on navigation maps. When the Stormscope overlay is enabled, and the map range is within maximum range setting to display Stormscope lightning, an icon appears in the lower right corner of the map. If the HSI Map is displayed the Stormscope icon will appear in the lower left side of the map.

### Enabling/disabling Stormscope information on '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 **Stormscope Lightning** Button to enable/disable Stormscope lightning on the 'Navigation Map' Pane.

### Selecting a Stormscope mode for the 'Navigation Map' Pane:

- 1) From MFD Home, **Map > Map Selection > Map Settings**.
- 2) If necessary, touch the **Sensor** Tab.
- 3) Scroll as needed and touch the Stormscope Lightning **Settings** Button.
- 4) Touch either the **Cell** Button or the **Strike** Button. Button annunciator is green for currently selected mode.
- 5) When finished, touch **Back** or **Home**.

### Selecting a maximum Stormscope map range on the '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 Stormscope Lightning **Settings** Button.
- 4) Touch the **Stormscope** Button.
- 5) Touch the Stormscope range button (current range setting displayed in cyan).
- 6) Scroll as needed and touch a desired map range setting from the list.
- 7) When finished, touch the **Back** Button or the **Home** Button.



**Enabling/Disabling Stormscope Lightning Information (PFD Navigation maps):**

- 1) From PFD Home, touch **PFD Map Settings**.
- 2) If necessary, touch either the **HSI Map** or **Inset Map** Button to allow for selection of map overlays.
- 3) Scroll if necessary, and touch the **Stormscope Lightning** button to enable/disable Stormscope information.

**Or:**

- 1) With either the Inset Map or HSI Map shown, press the **PFD Map Settings** Softkey.
- 2) Press the **Stormscope** Softkey.

**Selecting a Stormscope operating mode (PFD Navigation maps):**

- 1) From PFD Home, touch **PFD Map Settings**.
- 2) If necessary, touch either the **HSI Map** or **Inset Map** Button to allow for selection of map overlays.
- 3) Touch the Stormscope Lightning **Settings** Button.
- 4) Touch either the **Cell** or **Strike** Buttons.

**Clearing Stormscope Lightning (PFD Navigation maps):**

- 1) From PFD Home, touch the **PFD Map Settings** Button.
- 2) If necessary, touch either the **HSI Map** or **Inset Map** Button to allow for selection of map overlays.
- 3) Touch the Stormscope Lightning **Settings** Button.
- 4) Touch the **Clear Stormscope Lightning** Button.

**Selecting a maximum Stormscope map range (PFD Navigation maps):**

- 1) From PFD Home, touch **PFD Map Settings**.
- 2) If necessary, touch either the **HSI Map** or **Inset Map** Button to allow for selection of map overlays.
- 3) Scroll as needed and touch the Stormscope Lightning **Settings** Button.
- 4) Touch the **Stormscope** Button (current range setting displayed in cyan).
- 5) Scroll as needed and touch a desired map range setting from the list.

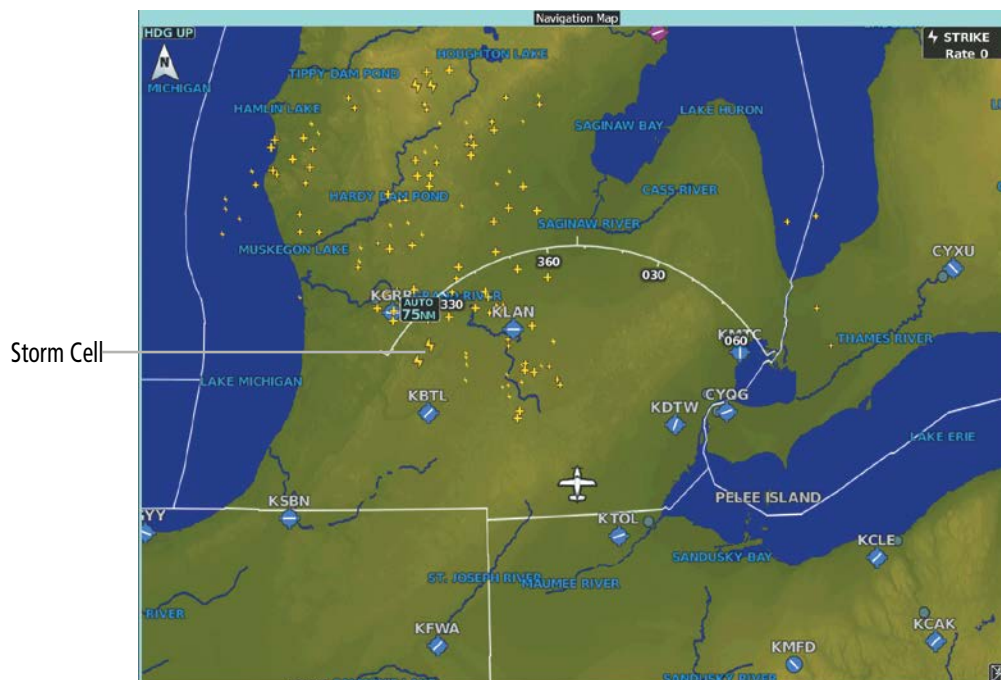
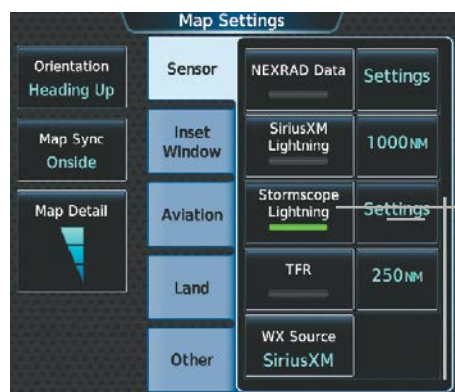


Figure 6-66 Stormscope Information on the 'Navigation Map' Pane (Strike Mode Selected)



Stormscope Lightning Information Enabled for selected 'Navigation Map' Pane

Figure 6-67 Enabling Stormscope Information on the 'Navigation Map' Pane

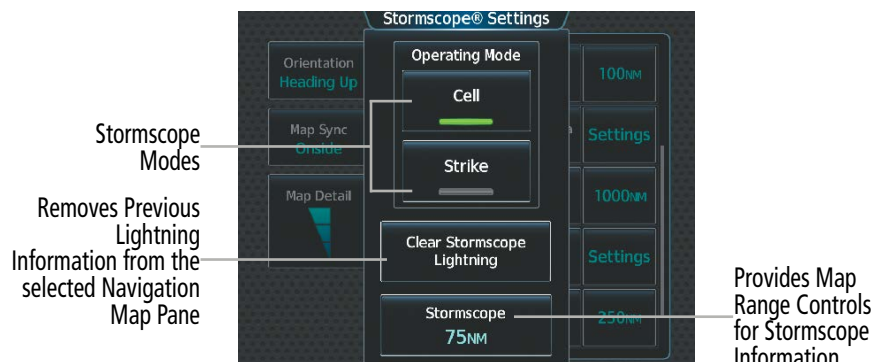


Figure 6-68 Stormscope® Settings for the 'Navigation Map' Pane

## ABNORMAL OPERATIONS

If heading input is lost, strikes and/or cells must be cleared manually after the execution of each turn. This is to ensure the strike and/or cell positions are depicted accurately in relation to the nose of the aircraft. Refer to the previous procedures ‘Manually clearing Stormscope information’ to clear Stormscope information from the selected map.

## SYSTEM STATUS

If the Stormscope system detects a failure, an amber ‘STORMSCOPE FAILED’ banner annunciation appears in the center of the ‘Stormscope®’ Pane. A system message appears on the Touchscreen Controllers; refer to the Appendices for more information about System Messages. If the Stormscope map overlay is enabled on a navigation map, the Stormscope overlay icon displays with a white ‘X’.

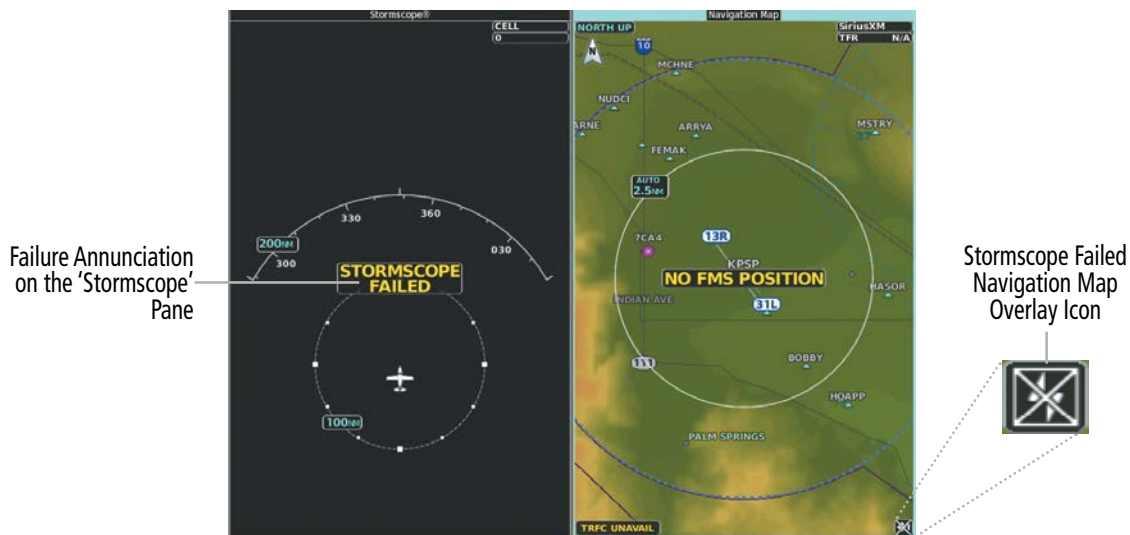


Figure 6-69 Stormscope Failure Indications on Display Panes

## 6.3 AIRBORNE COLOR WEATHER RADAR

### SYSTEM DESCRIPTION

The Garmin GWX 70 Airborne Color Weather Radar is a solid-state pulsed radar with forty watts of output power. The radar combines excellent range and adjustable scanning profiles with a high-definition target display. The GWX 70 has an effective pulse length of 27.31 microseconds ( $\mu$ s), and the system optimizes the pulse length to maximize resolution at each range setting.

The TBM 930 uses a 10-inch antenna that is fully stabilized to accommodate 30° of pitch and roll.

To focus radar scanning on specific areas, Sector Scanning offers crew-adjustable horizontal scan angles of 20°, 40°, 60°, or a full 90° scan. A vertical scanning function helps to analyze storm tops, gradients, and cell buildup activity at various altitudes.

Radar features include:

- Extended Sensitivity Time Constant (STC) logic that automatically correlates distance of the return echo with intensity, so cells do not suddenly appear to get larger as they get closer.
- WATCH™ (Weather ATtenuated Color Highlight) helps identify possible shadowing effects of short-range cell activity, identifying areas where radar return signals are weakened or attenuated by intense precipitation (or large areas of lesser precipitation) and may not fully reflect the weather behind a storm.
- Weather Alert that looks ahead for intense cell activity in the 80-320 nm range, even if these ranges are not being monitored.

If a GWX 70 is installed, the following features may also be available:

- Altitude-Compensated Tilt (ACT) management, which automatically adjusts the antenna tilt angle as the aircraft altitude changes.
- Independent weather radar scans for each PFD HSI Map while the aircraft is in the air.
- Optional Turbulence Detection presents areas of turbulence associated with precipitation using Doppler measurements.
- Optional Ground Clutter Suppression (GCS), to remove ground clutter from the displays.



**NOTE:** *Garmin recommends the user obtain instruction in the proper operation of airborne weather radar.*

### PRINCIPLES OF AIRBORNE WEATHER RADAR

The term RADAR is an acronym for RADio Detecting And Ranging. Pulsed radar locates targets by transmitting a microwave pulse beam that, upon encountering a target, is reflected back to the radar receiver as a return echo. The microwave pulses are focused and radiated by the antenna, with the most intense energy in the center of the beam and decreasing intensity near the edge. The same antenna is used for both transmitting and receiving.

Radar detection is a two-way process that requires 12.36  $\mu$ s for the transmitted microwave pulses to travel out and back for each nautical mile of target range. It takes 123.6  $\mu$ 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), and to determine when

an object, such as the ground, is stationary. The system can use this information to suppress the display of ground clutter.

Airborne weather radar should be used to avoid severe weather. The decision to fly into an area of radar targets depends on target intensity, spacing between the targets, aircraft capabilities, and crew experience. Airborne weather radar is efficient at detecting wet precipitation such as rain, wet snow, and water coated hail, however it will not detect clouds or mist. The display may indicate clear areas between intense returns, but this does not necessarily mean it is safe to fly between them, as these areas may contain severe turbulence or other hazards such as hail. In addition, Doppler radar measurement of precipitation velocity only occurs when rain or hail is moving along the radar beam and either toward or away from the antenna.

The GWX 70, if equipped with the optional Turbulence Detection feature, can detect turbulence associated with precipitation. The GWX 68 cannot detect turbulence. Airborne weather radar systems cannot detect Clear Air Turbulence (CAT) as there are no particulate for the radar to detect.

Airborne weather radar has other capabilities beyond weather detection. It also has the ability to detect and provide distance to cities, mountains, coastlines, rivers, lakes, and oceans.

## NEXRAD AND AIRBORNE WEATHER RADAR

Both Airborne Weather Radar and NEXRAD measure weather reflectivity in decibels (dB). A decibel is a logarithmic expression of the ratio of two quantities. Airborne Weather Radar measures the ratio of power against the gain of the antenna, while NEXRAD measures the energy reflected back to the radar, or the radar reflectivity ratio.

**Although both radar systems use colors to identify the different echo intensities, the thresholds and colors are not interchangeable.** Airborne color radar values from the installed weather radar system must not be confused with NEXRAD radar values. In addition, NEXRAD depicts lower intensity returns than airborne weather radar. Airborne weather radar return images will not appear the same as NEXRAD return images.

Convective weather activity is known to develop rapidly, with cell growth capable of exceeding several thousand feet per minute. Airborne weather radar provides the flight crew with real-time weather avoidance information for precipitation detected within the airborne weather radar's beam. NEXRAD information is **not** real-time. It is intended to assist the flight crew with hazardous weather avoidance planning. NEXRAD images are comprised of individual radar scans arriving at a network at different rates and times, which are periodically compiled into a mosaic (the NEXRAD weather product) and transmitted via data link. Due to inherent delays in this process, it is common for the displayed NEXRAD images to be significantly older than the current weather situation, and may also differ from information the airborne weather radar presents.

Because NEXRAD operates from an extensive network of ground-based radar antennas performing 360° scans, it is capable of providing information on large-scale weather patterns such as precipitation associated with significant frontal activity from multiple radar locations. The airborne weather radar can perform up to 90° scan, but is more affected by distance and precipitation attenuation discussed earlier in this section. Other factors including curvature of the earth (particularly at map ranges greater than 150 miles), antenna tilt setting, and aircraft altitude may also cause the airborne weather radar's antenna beam to miss areas of precipitation which are detected by NEXRAD. In addition, since the airborne weather radar's beam often produces ground returns, it may be difficult to distinguish precipitation from ground returns, especially stratus rain when the aircraft is above the precipitation.

Both airborne weather radar and the NEXRAD system can detect a radar top of a storm cell. Airborne weather radar can display this information in vertical scan mode, while NEXRAD radar top information appears in the Echo Tops SiriusXM Weather Product (Refer to Section 6.1 for more information about SiriusXM Weather). Because airborne weather radar and NEXRAD use different detection thresholds, a radar top from airborne weather radar may appear 5,000 feet or more below the NEXRAD-derived Echo Top. Furthermore, radar top information provided from either source is not the actual or true top of the storm, which is only observable with the eyes in clear air and may be much higher than the radar top detected by either system.

Because airborne weather radar and NEXRAD present information using similar (but not interchangeable colors), only one radar source may be shown on a map Display 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, in that they will illuminate targets within the beam. Just as with a flashlight, the further the beam travels, the wider it becomes and the less effective it is at illuminating targets. The certified beam width contains 90% of the energy of the radar signal, with the strongest part of the beam in the center. Pointing the center of the beam at targets to investigate provides the best returns for a particular target.

The remaining 10% of beam energy (outside the certified beam) has sufficient strength and the antenna has the sensitivity to display highly reflective targets, including additional weather and ground returns. Weather returns from this portion of the beam energy will most likely be under representative of the true intensity of the hazards, because they are so far from the center of the beam (and outside of the certified beam width). The strong reflective nature of terrain features will cause the display of ground clutter well short of where the certified beam width intersects the ground. For the 10-inch antenna this additional beam energy represents approximately four additional degrees at the top and bottom of the certified beam width of 10 degrees.

The following figure depicts the radar beam as seen from the side, with both the certified beam width and the additional beam energy illustrated. With the aircraft at 30,000 ft. AGL and a radar tilt angle of zero degrees, ground clutter may be observed starting at approximately 30 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.



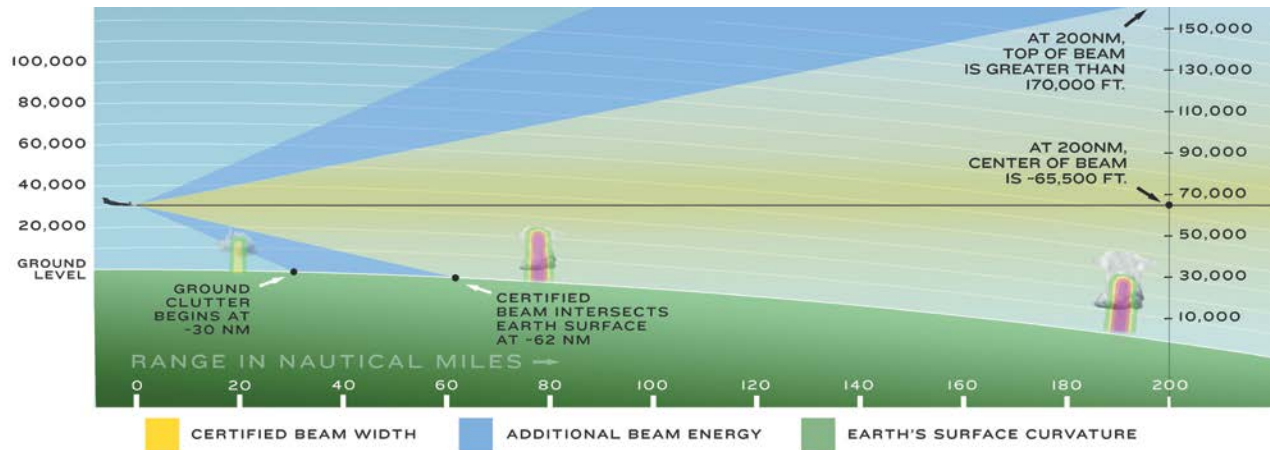


Figure 6-70 Radar Beam in Relation to the Curvature of the Earth from a 10 inch Antenna

## 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<sup>®</sup> feature of the installed weather radar system can help to identify these shadowed areas. Areas in question appear as shadowed or gray on the radar display. Proper use of the antenna tilt control can also help detect radar shadows.

Attenuation can also be due to poor maintenance or degradation of the radome. Even the smallest amount of wear and scratching, pitting, and pinholes on the radome surface can cause damage and system inefficiency.



## RADAR SIGNAL REFLECTIVITY

### PRECIPITATION

Precipitation or objects more dense than water, such as the surface of the earth or solid structures, are detected by the weather radar. The weather radar does not detect clouds, thunderstorms, or turbulence directly. It detects precipitation associated with clouds, thunderstorms, and turbulence. The best radar signal reflectors are raindrops, wet snow, or wet hail. The larger the raindrop, the better the reflectivity. The size of the precipitation droplet is the most important factor in radar reflectivity. Because large drops in a small concentrated area are characteristic of a severe thunderstorm, the radar displays the storm as a strong return. Ice crystals, dry snow, and dry hail have low levels of reflectivity as shown in the illustration, and often are not displayed by the radar. Additionally, a cloud that contains only small raindrops, such as fog or drizzle, does not reflect enough radar energy to produce a measurable target return.

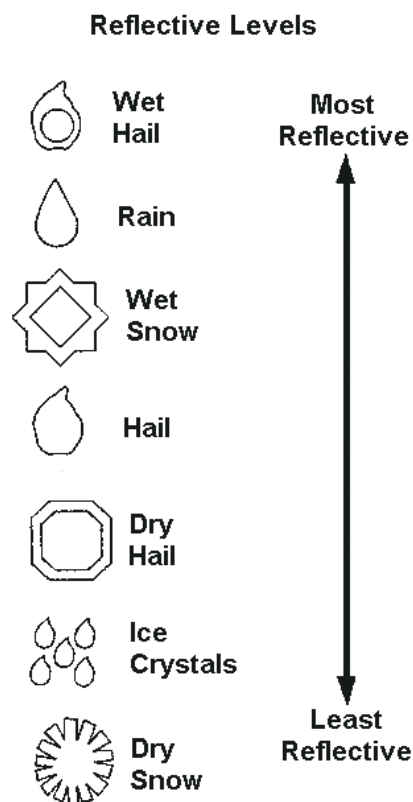
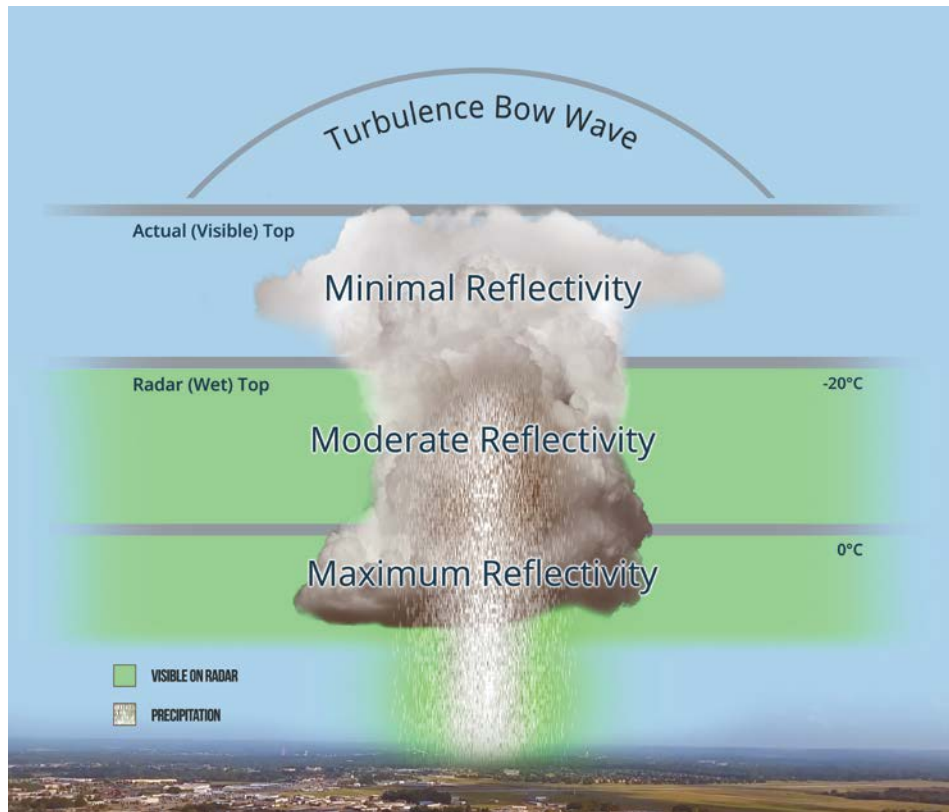


Figure 6-71 Precipitation Type and Reflectivity



**Figure 6-72 Precipitation Reflectivity by Altitude**

When using the airborne weather radar to explore a more intense thunderstorm cell, it is critical to understand where radar returns can be expected to be intense, and where they can be expected to decrease to a point where no returns will be displayed. Since wet precipitation reflects radar energy far better than dry precipitation, strong radar returns can be expected at lower altitudes, with the strongest radar returns found near the melting level. At higher altitudes, precipitation becomes frozen, and reflectivity is significantly reduced. At a certain altitude within a thunderstorm cell, returns will begin to diminish. This is the “echo top” of a cell, where radar can no longer detect the frozen precipitation, but this is not the actual top of the cell, which could extend significantly further into the atmosphere. Since it is difficult to detect the actual tops of a thunderstorm cell with radar, and invisible bow waves may extend beyond visible tops, overflight of thunderstorms should never be attempted.

## GROUND RETURNS

The intensity of ground target returns depends upon the angle at which the radar beam strikes the ground target (Angle of Incidence) and the reflective properties of that target. The gain can be adjusted so shorelines, rivers, lakes, and cities are well defined. Increasing the gain too much causes the display to fill in between targets, thus obscuring some landmarks.

Cities normally provide a strong return signal. While large buildings and structures provide good returns, small buildings can be shadowed from the radar beam by the taller buildings. As the aircraft approaches and shorter ranges are selected, details become more noticeable as the highly reflective regular lines and edges of the city become more defined.

Bodies of water such as lakes, rivers, and oceans are not good reflectors and normally do not provide good returns. The energy is reflected in a forward scatter angle with inadequate energy being returned. They can appear as dark areas on the display. However, rough or choppy water is a better reflector and provides stronger returns from the downwind sides of the waves.

Mountains also provide strong return signals to the antenna, but also block the areas behind. However, over mountainous terrain, the radar beam can be reflected back and forth in the mountain passes or off canyon walls, using up all or most of the radar energy. In this case, no return signal is received from this area, causing the display to show a dark spot which could indicate a pass where no pass exists.

### GROUND CLUTTER SUPPRESSION (OPTIONAL)

Ground Clutter Suppression (GCS) enhances the flight crews ability to differentiate precipitation returns from ground clutter, by suppressing most, but not all, returns from ground objects. The optional feature is most effectively used by first obtaining the desired tilt and range settings, and then activating GCS. For normal surveillance of an air mass, tilt angle and range should be adjusted to obtain minimal ground clutter prior to activation of the GCS feature. This ensures the radar beam is functioning and tilt is set to observe the air above the ground clutter before that clutter is suppressed. The same holds true for investigating suspected precipitation returns. Tilt angle and range should be set to maximize the precipitation return image prior to activation of GCS to suppress clutter.

### ANGLE OF INCIDENCE

The angle at which the radar beam strikes the target is called the Angle of Incidence. The figure illustrates the incident angle ('A'). This directly affects the detectable range, the area of illumination, and the intensity of the displayed target returns. A large incident angle gives the radar system a smaller detectable range and lower display intensity due to minimized reflection of the radar energy.

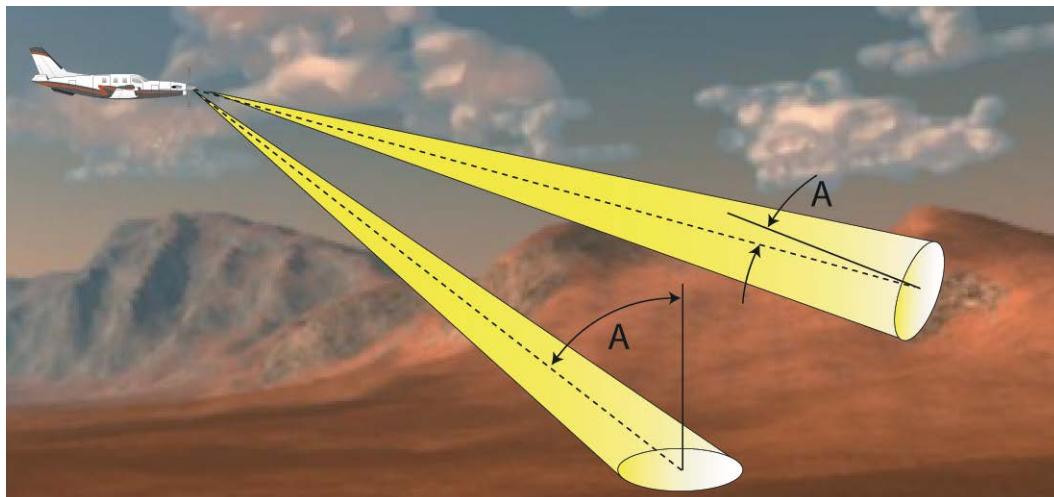


Figure 6-73 Angle of Incidence

A smaller incident angle gives the radar a larger detectable range of operation and the target display shows a higher intensity. Since more radar energy is reflected back to the antenna with a low incident angle, the resulting detectable range is increased for mountainous terrain.

## SAFE OPERATING DISTANCE

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/cm<sup>2</sup>. See Advisory Circular 20-68B for more information on safe distance determination.

### MAXIMUM PERMISSIBLE EXPOSURE LEVEL (MPEL)



**WARNING:** Do not operate the weather radar in a transmitting mode when personnel or objects are within the MPEL boundary.

The recommended minimum safe distance between personnel and an operating weather radar antenna is 12 feet from the 10-inch antenna. All personnel must remain outside of this zone. With a scanning or rotating beam, the averaged power density at the MPEL boundary is significantly reduced. This recommendation slightly exceeds the calculation methods defined in Advisory Circular 20-68B.

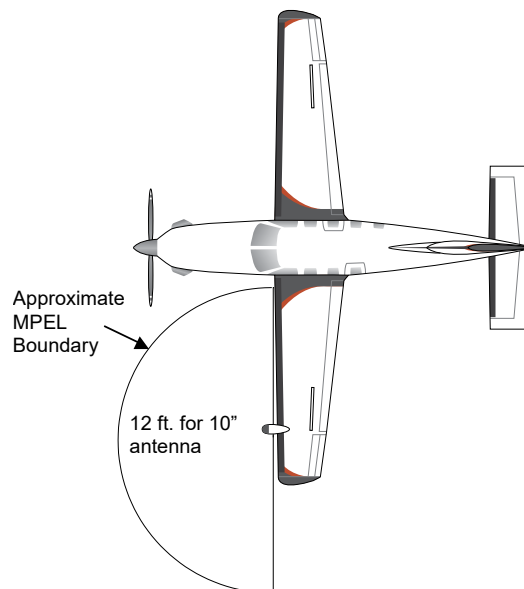


Figure 6-74 Approximate MPEL Boundary



**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.

## BASIC ANTENNA TILT AND RANGE SETUP

Proper antenna tilt management techniques are a major factor for the successful use of any airborne weather system. If the antenna tilt angle is set too low, the radar display will show excessive ground returns, making it difficult for the pilot to distinguish adverse weather phenomena from ground clutter. If the antenna tilt angle is set too high, the radar beam will overscan the top of the adverse weather. In either of these examples, the flight crew would be unable to adequately recognize critical weather information.

The following discussion is a simple method for setting up the weather radar antenna tilt for most situations. It is not to be considered an all encompassing setup that works in all situations, but this method does provide good overall parameters for the monitoring of intense weather threats. Correct application of tilt angle is directly dependent on the storms height and intensity and its relative distance from own ship. Adjusting the airborne weather radar tilt angle setting until minimal ground clutter is displayed is the simplest setup method for general surveillance of precipitation returns. For ranges of up to 80 NM this ground clutter should appear on the outer portion of the radar display. At ranges greater than 80 NM, the displayed ground clutter will move lower on the radar display due to the curvature of the earth. By displaying a minimal amount of ground clutter on the installed weather radar system the flight crew can ensure the system is operating and the air mass above the ground clutter is being scanned.

When a strong a weather return is detected within the ground clutter it must be further investigated to determine the source of this return. Further tilt angle adjustment of the airborne radar may be required to explore this return. Adjusting the radar tilt angle upwards can reveal the radar tops of this return, while adjusting the tilt angle downwards may be necessary to investigate the strongest intensity of a particular return.

Effective airborne weather radar range management during all phases of flight should be based on the volume of air to be scanned for returns ahead of own aircraft, to allow sufficient time needed to investigate, analyze, decide, and tactically maneuver around these hazardous weather returns. Longer ranges may be used to tactically identify intense weather returns that may warrant further investigation, and closer ranges may be used during the investigation process.

There is no one tilt or range setting that works for all situations. It is best to remember that active tilt and range management is necessary to identify and then investigate returns.



**NOTE:** When a strong weather return is displayed on the weather radar, the tilt angle may be adjusted to explore return intensities at various altitudes to aid in determination of radar tops.



**NOTE:** It is the sole responsibility of the flight crew to avoid areas of hazardous weather by adequate margins.



**WARNING:** Overflight of thunderstorms should not be considered safe, as extreme turbulence may exist significantly above observed returns.

## MANAGING TILT ANGLE AND RANGE

There are many factors to be considered in order to become proficient at using airborne weather radar in all situations. The following setup provides a good starting point for the practical application of radar tilt management.

Radar tilt management can easily be remembered by use of the 1-10-1000 rule. The summary of this rule is the fact that when the flight crew changes the radar tilt angle by 1 degree the resulting change will displace the center of the beam 1000 feet vertically at a range of 10 nautical miles. Applying the 1-10-1000 rule to various distances provides the flight crew with the ability to determine how much a 1-degree change in tilt will move the beam vertically. The radar tilt angle is capable of being adjusted in one-quarter degree increments, allowing for greater accuracy in the placement of the beam center at desired altitudes.

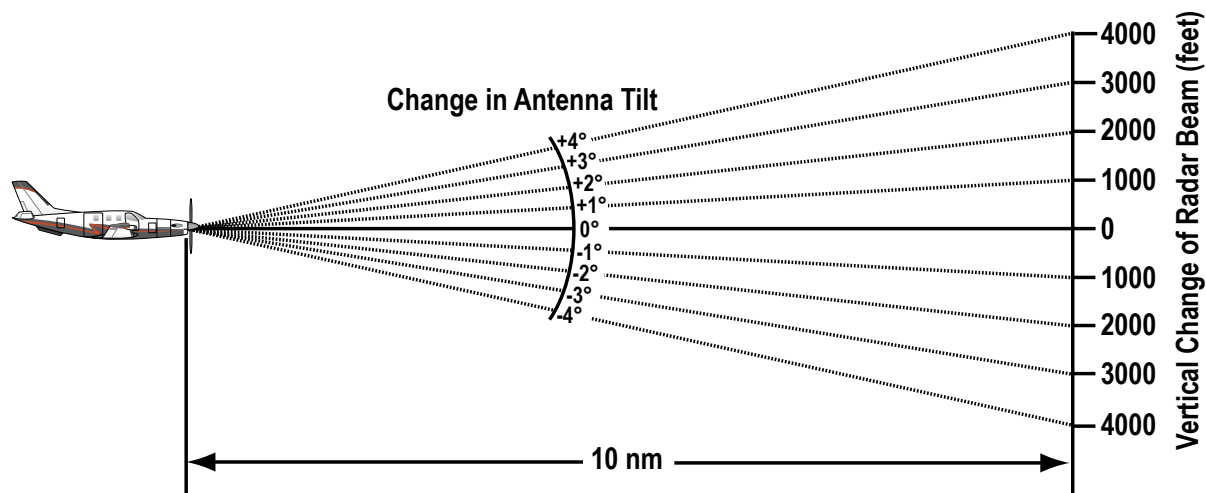


Figure 6-75 Vertical Change in Radar Beam per Nautical Mile

The 10-inch phased array antenna has a certified beam width of 10 degrees, which means the beam is 10,000 feet in height (and width) at 10 NM and 100,000 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
<b>Taxi</b>	Up 7.50° to 10.00°	20 NM	Activate weather mode when clear of ramp area.
<b>Takeoff / Initial Climb</b>	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.
<b>10,000 Ft. AGL</b>	Up 5.00° Altitude Compensated Tilt On	60 - 80 NM	Range setting is dependent upon ground speed and time available for deviations.
<b>Cruise</b>	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.
<b>Descent To 10,000 FT</b>	Tilt to Minimize Clutter Altitude Compensated Tilt On	60 - 120 NM	Range setting is dependent upon ground speed and time available for deviation.
<b>Descent Below 10,000 FT</b>	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.
<b>Approach</b>	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 6-9 Typical Tilt Settings by Phase of Flight**



## ALTITUDE COMPENSATED TILT

The Altitude Compensated Tilt feature enables the equipped weather radar system to automatically adjust the antenna beam tilt angle setting based on changes of the aircraft's altitude. For example, if the ACT feature is enabled and the aircraft climbs, the system compensates by adjusting the tilt downward. As the aircraft descends with ACT enabled, the system adjusts the antenna tilt upward. The system uses the ground as a reference for adjusting the antenna tilt angle setting with ACT enabled.

## WEATHER DISPLAY AND INTERPRETATION

When evaluating various radar returns on the weather radar displays, the colors denote precipitation intensity and rates shown in the table.

Weather Mode Color	Intensity (in dBZ)
Black	< 23 dBZ
Green	23 dBZ to < 33 dBZ
Yellow	33 dBZ to < 41 dBZ
Red	41 dBZ and greater
Magenta	TURB- (Optional) Turbulence Detection uses the color magenta to show areas of rain or hail that may also contain turbulence.

Table 6-10 Precipitation Intensity Levels

## THUNDERSTORMS

Updrafts and downdrafts in thunderstorms carry water through the cloud. The more severe the drafts, the greater the number and size of the precipitation droplets. With this in mind, the following interpretations can be made from what is displayed on the weather radar. Avoid these areas by an extra wide margin.

- Areas that show steep color gradients (intense color changes) over thin bands or short distances suggest irregular rainfall rate, hail, and severe turbulence. Vertical scanning and antenna tilt management may be necessary in order to assist in identifying areas of maximum intensity.
- In areas where the displayed weather return intensity is strong (indicating high precipitation rates), the associated turbulence should be considered severe.
- Areas of radar shadowing which can result from an attenuated (weakened) signal from a nearby storm, hiding a larger and more dangerous storm which may exist in the apparently benign area directly behind the nearby return.

Along squall lines (multiple cells or clusters of cells in a line) individual cells may be in different stages of development. Areas between closely spaced, intense echoes may contain developing clouds not having enough moisture to produce a return. However, these areas could have strong updrafts or downdrafts. Echoes showing wide areas of green are generally associated with precipitation without severe turbulence.

Irregularities in the target return may also indicate turbulence, appearing as hooks, fingers, or scalloped edges. These irregularities may be present in green areas in the absence of a steep color gradient return and should be treated as highly dangerous areas. These areas of irregularity should be avoided.

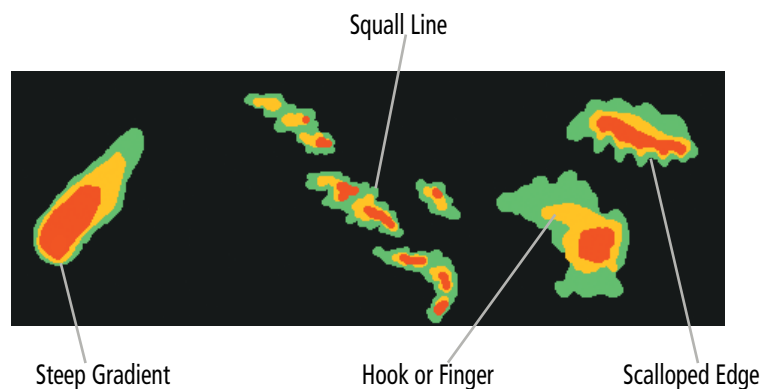


Figure 6-76 Cell Irregularities

Thunderstorm development is rapid. A course may become blocked within a short time. When displaying shorter ranges, periodically select a longer range to see if problems are developing further out. That can help prevent getting trapped in a blind alley or an area that is closed at one end by convective weather.

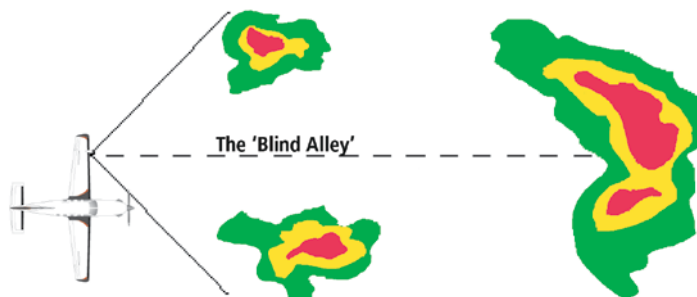
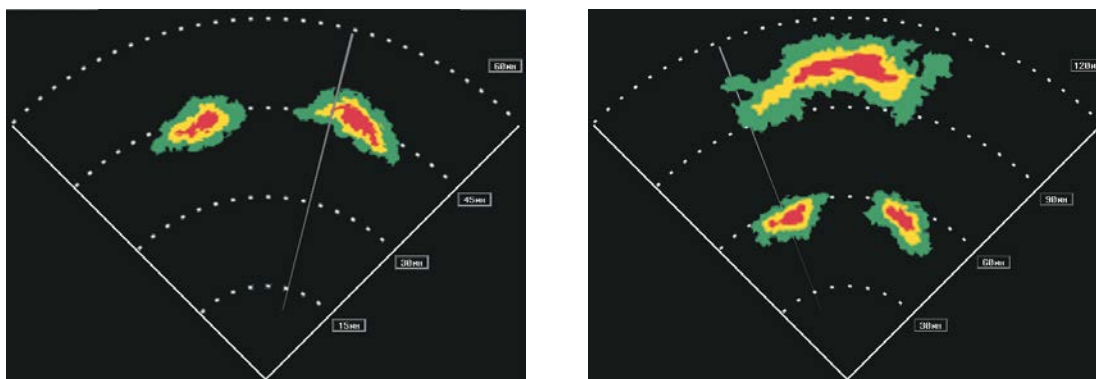


Figure 6-77 The Blind Alley - Horizontal Scan

In areas of multiple heavy cells, use the Vertical Scan feature along with antenna tilt management to examine the areas. Remember to avoid shadowed areas behind cells.



The Blind Alley at Close Range

The Large Storm Behind

Figure 6-78 The Blind Alley

## TORNADOES

There are no conclusive radar return characteristics which identify a tornado. However, tornadoes may be present if the following characteristics are observed:

- » A narrow, finger-like portion extends and in a short time curls into a hook and closes on itself.
- » A hook, which may be in the general shape of the numeral 6 (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

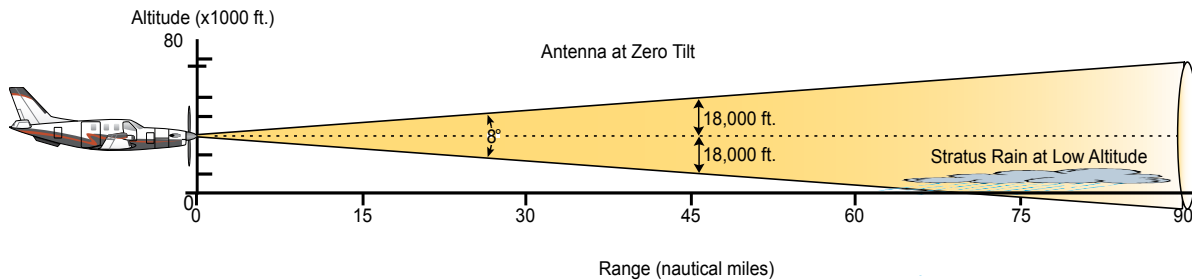
Hail results from updrafts carrying water high enough to freeze. Therefore, the higher the top of a thunderstorm, the greater the probability it contains hail. Frozen hail is a very poor reflector of radar energy, which makes it difficult to detect. When investigating a thunderstorm for return tops, pilots must understand that hail and extreme turbulence are likely to exist above the return tops.

Hail can fall below the minimum reflectivity threshold for radar detection. At lower altitudes, hail may have a film of water on its surface, making its reflective characteristics similar to a very large water droplet. Because of this film of water, and because hail stones usually are larger than water droplets, thunderstorms with large amounts of wet hail return stronger signals than those with rain. Some hail shafts are extremely narrow (100 yards or less) and make poor radar targets. In the upper regions of a cell where ice particles are dry (no liquid coating), target returns are less intense.

Hail shafts are associated with the same radar target return characteristics as tornados. U-shaped cloud edges three to seven miles across can also indicate hail. These target returns appear quite suddenly along any edge of the cell outline. They also change in intensity and shape in a matter of seconds, making vigilant monitoring essential.

## STRATUS PRECIPITATION

Detecting areas of low altitude, stratus precipitation while the aircraft altitude is significantly above the precipitation is difficult to accomplish with airborne weather radar. This is because as the radar beam detects the low altitude precipitation, it also receives significant ground returns which are displayed with the precipitation. Raising the antenna tilt angle may reduce the ground returns, however the radar beam is likely to overshoot the low-altitude precipitation when the aircraft is at a high altitude above the precipitation.



**Figure 6-79 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.

## 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 pages displaying weather radar are set to Standby Mode, and are displaying 'STANDBY' in the center of each weather radar display.



**CAUTION:** When the weather radar is 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.



**NOTE:** Garmin recommends the user obtain instruction in the proper 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 many 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. The remaining discussions regarding the GWX 70 Airborne Weather Radar System apply to each of the possible radar displays.

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.

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 Off Mode if the unit detects a fault.

When the weather radar system is in the Weather or Ground Map mode, the system automatically places the radar in Standby Mode on landing.

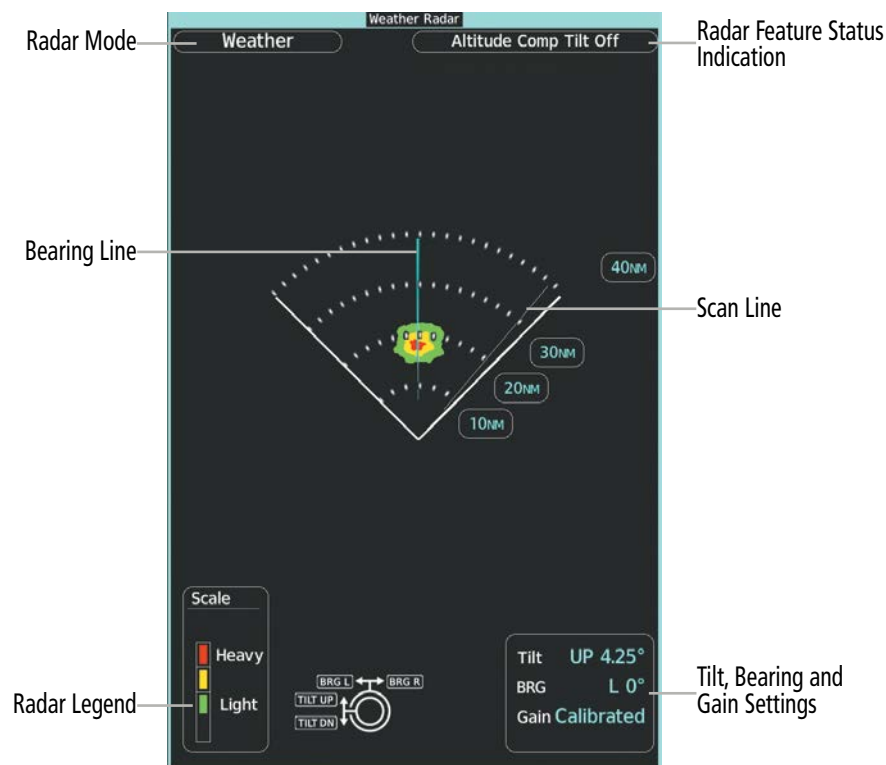


Figure 6-80 'Weather Radar' Pane with a Horizontal Scan

### 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 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 6-81 Confirming Activating Radar**

### 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) Press 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 Mode** 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 Mode** Button.
  - b) Touch the **Horizontal** Button.
  - c) Return to Step 2 of this procedure.



**NOTE:** Vertical scanning of a storm cell should be done with the aircraft wings level to avoid constant adjustment of the Bearing Line.

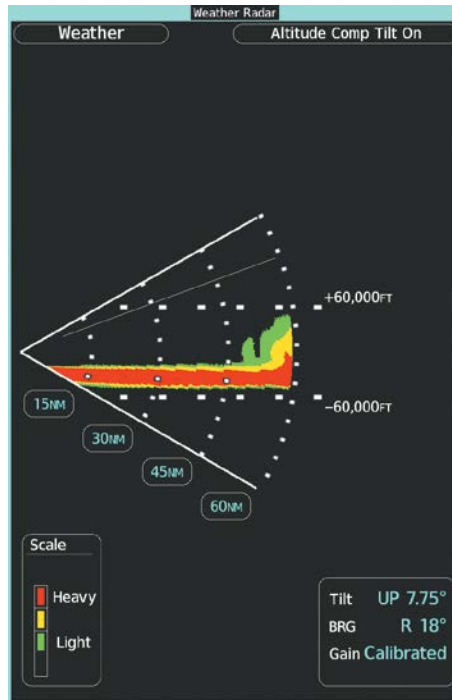


Figure 6-82 Weather Radar Display with Vertical Scan Mode Selected

## 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'.

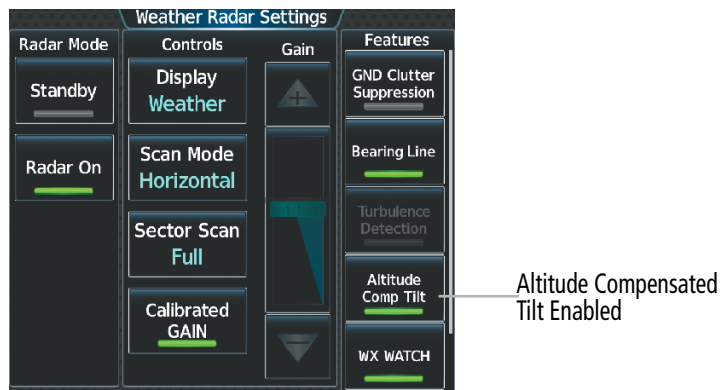


Figure 6-83 Enabling Altitude Compensated Tilt

## 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.

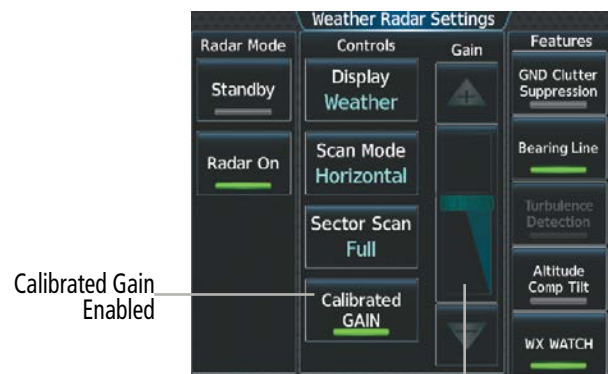
Or:

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.

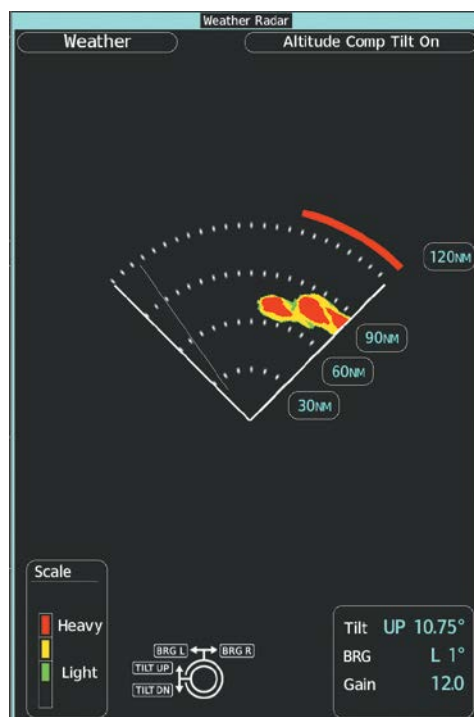


'Weather Radar' Pane with Calibrated Gain Setting



Manual Gain Adjustment subdued when Calibrated Gain is enabled

Figure 6-84 Calibrated Gain



'Weather Radar' Pane set Above Calibrated Gain Setting

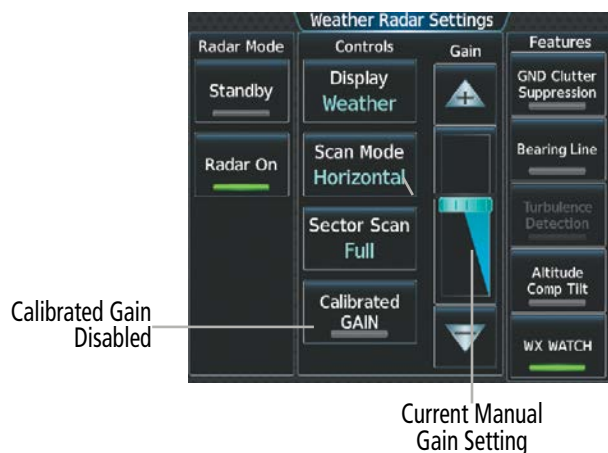


Figure 6-85 Manual Gain

## 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) Press 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°, or touch the **FULL** Button to resume a 90° scan.
- 7) If desired, readjust the Bearing Line as discussed previously to change the center of the Sector Scan.
- 8) Press the upper knob again to remove the bearing selection function.

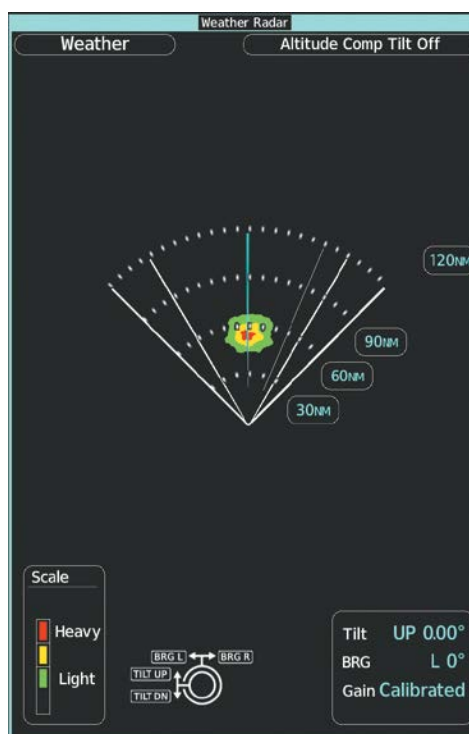


Figure 6-86 'Weather Radar' Pane on a 60 Degree Sector Scan

## TURBULENCE DETECTION



**WARNING:** *Do not rely on the Turbulence Detection function for hazardous weather avoidance, or to maneuver in, near, or around areas of hazardous weather.*

The optional Turbulence Detection feature, available with the GWX 70, identifies areas of turbulence associated with precipitation during a horizontal scan. Using Doppler radar measurements, areas of turbulence displayed by the GWX 70 represent precipitation moving at a high rate of speed either toward or away from the radar antenna. 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 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 'Weather Radar' Pane and the **Turbulence Detection** Button is subdued on the Touchscreen Controller. If the system is missing information needed to detect turbulence, a 'TURB Detection Unavailable' annunciation appears on the 'Weather Radar' Pane.

### 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<sup>®</sup>)

WATCH<sup>®</sup> 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.

### 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.

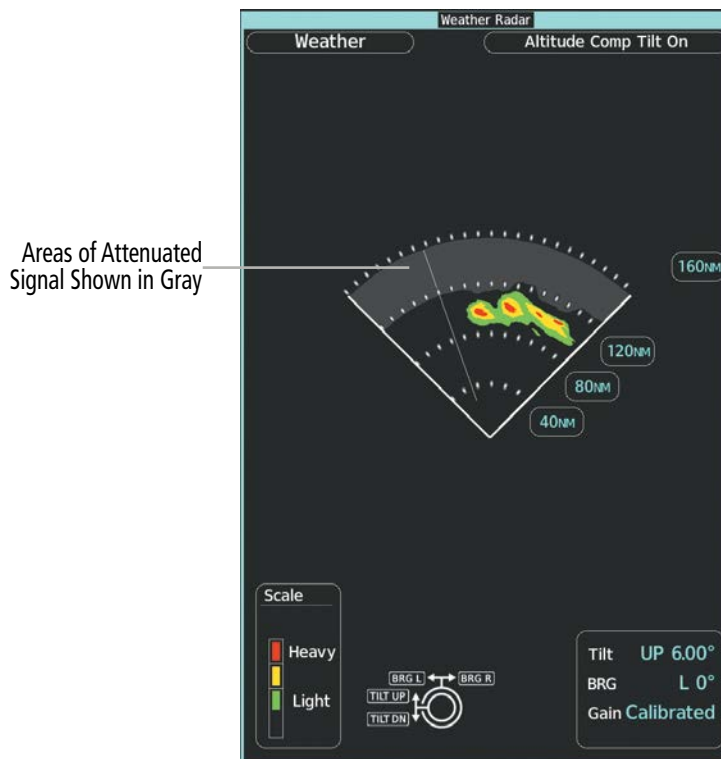


Figure 6-87 Horizontal Scan with WATCH® Enabled

## 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.)

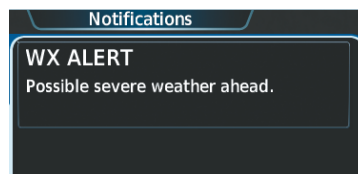


Figure 6-88 WX Alert System Message on the Notifications Screen

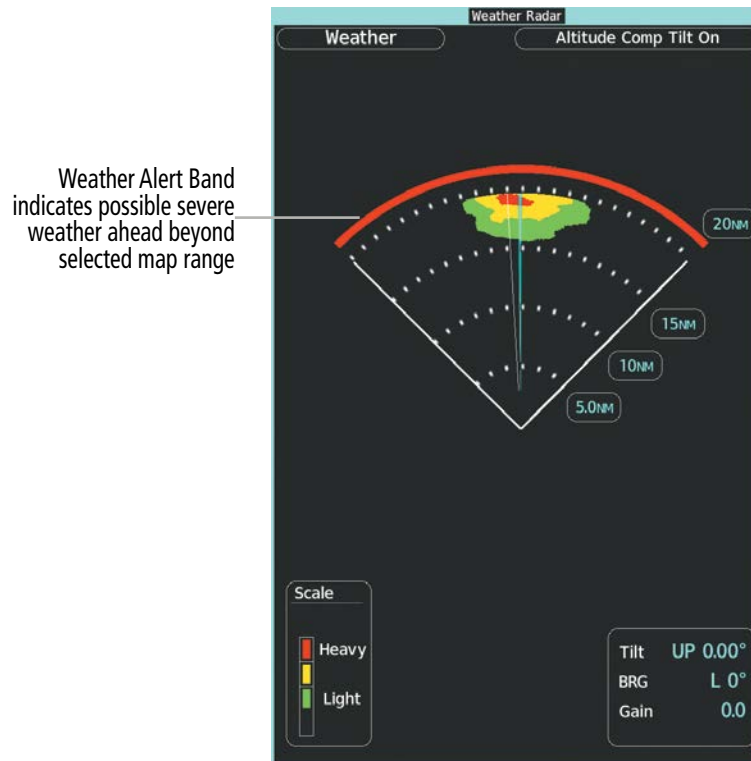


Figure 6-89 Horizontal Scan with WX Alert Enabled

#### Enabling/disabling WX Alert Indication and System Message:

- 1) From MFD 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 ground clutter suppression feature is optional.



**NOTE:** The GCS feature of the GWX 70 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 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 dB
Cyan	3 dB to < 13 dB
Yellow	13 dB to < 21 dB
Magenta	21 dB to < 29 dB
Blue	29 dB and greater

**Table 6-11 Ground Radar Return Intensity Levels**



Figure 6-90 'Weather Radar' Pane with Ground Map Mode Enabled

### 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 **Ground** Button to place the radar in Ground Map mode.
- 4) Press 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, press the upper knob to disable the tilt adjustment function.

## ADDITIONAL RADAR DISPLAYS



**NOTE:** The NEXRAD weather product cannot be displayed simultaneously on the 'Map - Navigation Map' Pane with weather radar information.

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, navaids, 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.

#### **Enabling/disabling the display of Weather Radar information on Navigation Map Panes:**

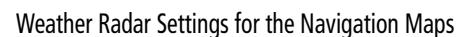
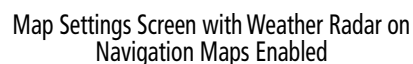
- 1) From MFD Home, touch **Map > Map Selection > Map Settings**.
- 2) If necessary, touch the **Sensor** Tab.
- 3) Touch the **Weather Radar** Button to enable or disable the display of weather radar information on the selected navigation map pane.
- 4) To access controls for weather radar information on the 'Navigation Map' Pane, touch the Weather Radar **Settings** Button.

The control of weather radar settings on navigation maps is similar to the controls on the 'Weather Radar' Pane discussed previously. However, the Horizontal Scan mode is the only scan mode available on navigation maps.

Bearing and antenna tilt angle are adjustable on the 'Navigation Map' Pane when viewing its associated 'Weather Radar Settings' Screen.

#### **Adjusting bearing or antenna tilt angle on Navigation Map Panes:**

- 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.



### Figure 6-91 Displaying Weather Radar Information on the 'Navigation Map' Pane

If the aircraft is in the air, PFD softkeys control the airborne weather radar overlay for the HSI Map. These softkeys are subdued if the aircraft is on the ground. The pilot and copilot can select a weather radar mode for each PFD (Standby, Weather, Ground), make adjustments to antenna gain, antenna tilt angle, Turbulence Detection, WATCH or Altitude Compensated Tilt features. Weather radar settings on the HSI Map are independent for each PFD. For example, the pilot's PFD may have Weather Mode selected while the copilot's PFD may have Ground Mode selected. The installed weather radar performs multiple scans as necessary to accommodate displays of weather radar data among the PFDs and MFD.



Figure 6-92 HSI Map with Airborne Weather Radar Overlay and Softkeys (Full Mode PFD)



**NOTE:** The aircraft must be in the air in order for HSI Map airborne weather radar softkeys to become available.

#### Enabling/disabling the Airborne Weather Radar Overlay on the HSI Map:

- 1) With the HSI Map enabled, press the **PFD Map Settings** Softkey.
- 2) Press the **WX Overlay** Softkey as needed to cycle among the options until 'WX Radar' appears on the softkey.

#### Selecting Airborne Weather Standby or On Mode on the HSI Map:

- 1) With the weather radar in the 'On' Mode on the HSI Map, press the **WX Radar Controls** Softkey.
- 2) To select between 'Standby' or 'On' Modes, press the **Mode** Softkey.

#### Selecting Airborne Weather or Ground Mode on the HSI Map:

- 1) With the weather radar in the 'On' Mode on the HSI Map, press the **WX Radar Controls** Softkey.
- 2) To select between 'Weather' and 'Ground' Modes, press the **Display** Softkey.

#### Adjusting antenna tilt angle on the HSI Map:

- 1) With the weather radar in the 'On' Mode on the HSI Map, press the **WX Radar Controls** Softkey.
- 2) Press either the **Tilt Up** or **Tilt Down** Softkey to adjust the antenna tilt angle in the respective direction. The current antenna tilt angle setting appears on the HSI Map.

#### Adjusting Airborne Weather gain on the HSI Map:

- 1) With the weather radar in the 'On' Mode on the HSI Map, press the **WX Radar Controls** Softkey.
- 2) Press the **Gain +** or **Gain -** Softkeys to adjust the gain setting. Each softkey press adjusts the gain in 0.5 increments.

**Enabling/disabling Turbulence Detection or Ground Clutter Suppression on the HSI Map:**

- 1) With the weather radar in the 'On' Mode on the HSI Map, press the **WX Radar Controls** Softkey.
- 2) Press the **GND Clutter Suppression** Softkey to enable/disable Ground Clutter Suppression.
- 3) To enable the 'Turbulence Detection' feature, press the **Features** Softkey.
- 4) Press the **Turbulence Detection** Softkey to enable/disable **Turbulence Detection** feature.

**Enabling/Disabling WATCH display feature on the HSI Map:**

- 1) With the weather radar in the 'On' Mode on the HSI Map, press the **WX Radar Controls** Softkey.
- 2) To enable the 'WATCH' feature, press the **Features** Softkey.
- 3) Press the **WX WATCH** Softkey to enable/disable the **WATCH** feature.

**Enabling/disabling Altitude Compensated Tilt on the HSI Map:**

- 1) With the weather radar in the 'On' Mode on the HSI Map, press the **WX Radar Controls** Softkey.
- 2) Press the **Features** Softkey.
- 3) Press the **Altitude COMP Tilt** Softkey to enable/disable the **Altitude Compensated Tilt** feature.

**Enabling/disabling the Airborne Weather Radar Overlay on the HSI Map (PFD in Split Mode):**

- 1) If necessary, enable the HSI Map on the PFD.
- 2) Press the **PFD Map Settings** Softkey.
- 3) Press the **Map Overlays** Softkey.
- 4) Press the **WX Overlay** Softkey to cycle through an overlay setting with each softkey press until 'WX Radar' is displayed in cyan on the softkey.

**Selecting Airborne Weather Standby or On Mode on the HSI Map (PFD in Split Mode):**

- 1) If necessary, enable the HSI Map on the PFD.
- 2) Press the **PFD Map Settings** Softkey.
- 3) Press the **WX Radar Controls** Softkey.
- 4) To change between Standby Mode or On Mode, press the **Mode** Softkey. The selected mode appears in cyan text on the softkey.
- 5) With the weather radar in On Mode, press the **Display** Softkey to change between Weather Mode and Ground Mode. The selected mode appears in cyan text on the softkey.

**Adjusting antenna tilt angle on the HSI Map (PFD in Split Mode):**

- 1) If necessary, enable the HSI Map on the PFD.
- 2) Press the **PFD Map Settings** Softkey.
- 3) Press the **WX Radar Controls** Softkey.
- 4) Press either the **Tilt Up** or **Tilt Down** Softkey as needed to increase/decrease the antenna tilt angle in 0.25° increments. Press and hold the softkey to continue adjustment while the softkey is held.

**Adjusting Airborne Weather gain on the HSI Map (PFD in Split Mode):**

- 1) If necessary, enable the HSI Map on the PFD.
- 2) Press the **PFD Map Settings** Softkey.
- 3) Press the **WX Radar Controls** Softkey.
- 4) Press the **Gain/More** Softkey.
- 5) Press either the **Gain -** or **Gain +** Softkey once to decrease/increase the gain in increments of 0.5, or press and hold the softkey to continue adjustment while the softkey is held. A manual setting of '0.0' is equivalent to the calibrated gain setting.

**Enabling/disabling Altitude Compensated Tilt or Turbulence Detection on the HSI Map (PFD in Split Mode):**

- 1) If necessary, enable the HSI Map on the PFD.
- 2) Press the **PFD Map Settings** Softkey.
- 3) Press the **WX Radar Controls** Softkey.
- 4) Press the **Gain/More** Softkey.
- 5) To enable/disable turbulence detection, press the **Turbulence Detection** Softkey.
- 6) To enable/disable Altitude Compensated Tilt, press the **Features** Softkey.
- 7) Press the **Altitude COMP Tilt** Softkey.

**Enabling/disabling Ground Clutter Suppression on the HSI Map (PFD in Split Mode):**

- 1) If necessary, enable the HSI Map on the PFD.
- 2) Press the **PFD Map Settings** Softkey.
- 3) Press the **WX Radar Controls** Softkey.
- 4) Press the **Gain/More** Softkey.
- 5) To enable/disable Ground Clutter Suppression, press the **GND Clutter Suppression** Softkey.

**Enabling/disabling WATCH Feature on the HSI Map (PFD in Split Mode):**

- 1) If necessary, enable the HSI Map on the PFD.
- 2) Press the **PFD Map Settings** Softkey.
- 3) Press the **WX Radar Controls** Softkey.
- 4) Press the **Gain/More** Softkey.
- 5) To enable/disable Altitude Compensated Tilt, press the **Features** Softkey.
- 6) Press the **WX WATCH** Softkey.



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.

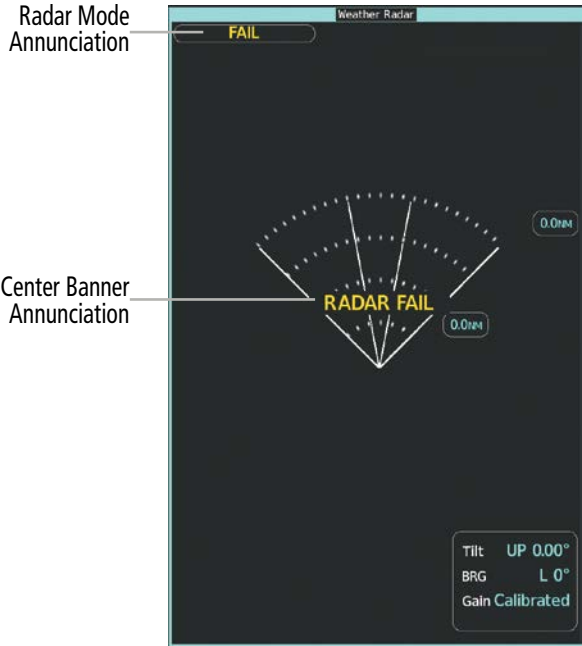


Figure 6-93 Radar System Status Indications on ‘Weather Radar’ Pane

Radar Mode	Radar Mode Annunciation Box	Center Banner Annunciation
Standby	STANDBY	STANDBY
Weather	WEATHER	None
Ground Mapping	GROUND	None
Radar Failed*	FAIL	RADAR FAIL

\* See Table 6-14 for additional failure annunciations

Table 6-12 Radar Mode Annunciations 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
<b>STAB INOP</b>	The radar is not receiving pitch and roll information. The antenna stabilization feature is inoperative.
<b>ALTITUDE COMP TILT ON</b>	The altitude-compensated tilt feature is selected on.
<b>ALTITUDE COMP TILT OFF</b>	The altitude-compensated tilt feature is selected off.
<b>GND CLTR SUPPRESS ON</b>	The ground clutter suppression feature is selected on.
<b>GND CLTR SUPPRESS OFF</b>	The ground clutter suppression feature is selected off.
<b>GND CLTR SUPPRESS INACTIVE</b>	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).
<b>GND CLTR SUPPRESS UNAVAILABLE</b>	The radar is missing data needed to suppress ground clutter.
<b>TURB DETECTION ON</b>	The turbulence detection feature is selected on.
<b>TURB DETECTION OFF</b>	The turbulence detection feature is selected off.
<b>TURB DETECTION INACTIVE</b>	Turbulence detection is inactive when map range is greater than 160 nm, or radar is in a mode which cannot support turbulence detection.
<b>TURB DETECTION UNAVAILABLE</b>	The radar is missing data needed to detect turbulence.

**Table 6-13 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
<b>BAD CONFIG</b>	The radar configuration is invalid. The radar should be serviced.
<b>RDR FAULT</b>	The radar unit is reporting a fault. The radar should be serviced.
<b>RADAR FAIL</b>	The system is not receiving valid data from the radar unit. The system should be serviced.

**Table 6-14 Abnormal Radar Status Annunciations on the 'Weather Radar' Pane**

## 6.4 VERTICAL SITUATION DISPLAY TERRAIN

The system offers a Vertical Situation Display (VSD), which includes a profile of terrain and obstacles in an inset window on the bottom of the 'Navigation Map' Pane. Although the VSD does not display TAWS alerts and potential impact areas, the VSD does use many of the same colors and symbols as TAWS to depict relative terrain and obstacles within the VSD. Refer to the TAWS discussion for more information about relative terrain and obstacle color correlation and symbols.



**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.

### 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 6-94 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 6-95 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 6-96 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

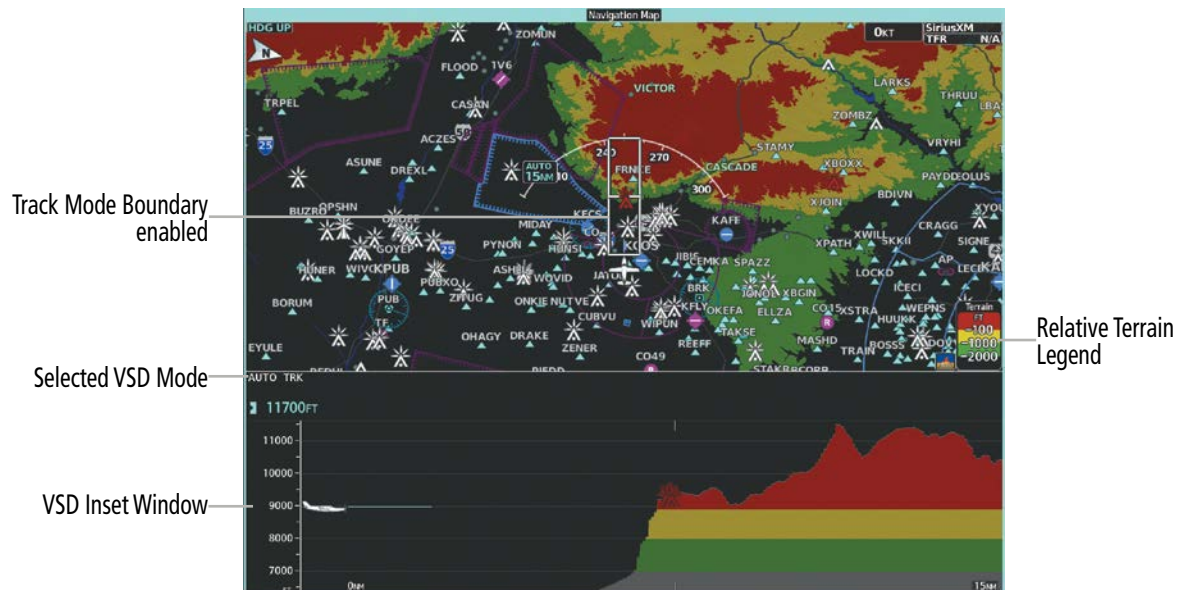
## Changing the Vertical Situation Display Mode:

- 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.

## VSD INSET WINDOW

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.

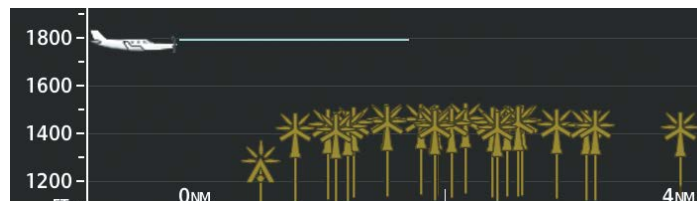
The VSD horizontal distance is the same as the Navigation Map Pane Range distance displayed on the map range arc or circle, down to one nautical mile. At Navigation Map Pane ranges below this distance, the VSD horizontal distance remains at one nautical mile. Adjusting the Navigation Map Pane range also 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 6-97 '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.

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 6-98 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 6-99 Customizing the Track Mode Boundary Navigation Maximum Map Range

#### Enabling/disabling the Track Mode Boundary:

- 1) From Home, touch **Map > Map Selection > Map Settings**.
- 2) If necessary, 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.



## 6.5 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. PS 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

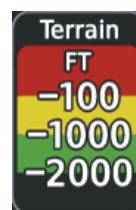


Figure 6-100 Terrain SVT Relative Terrain Legends

The following figure shows relative terrain coloring for the Terrain-SVT and TAWS-B systems.

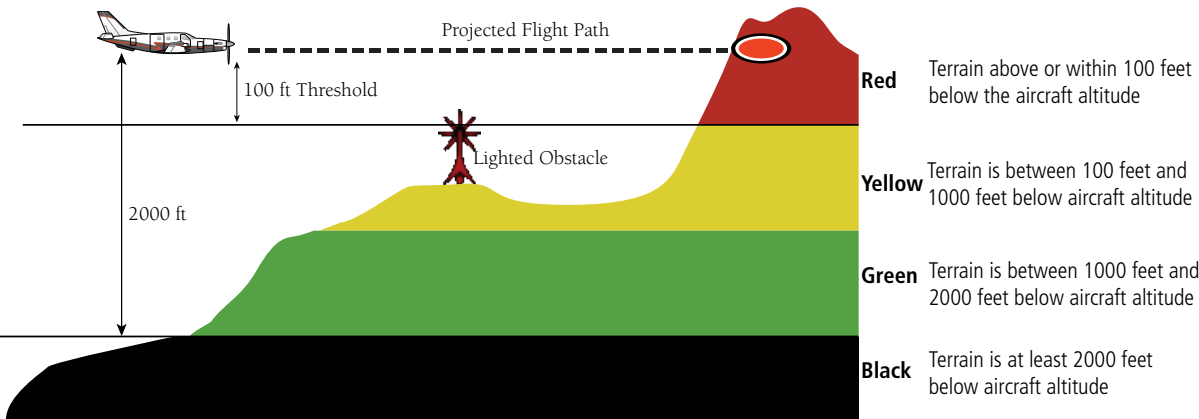


Figure 6-101 In-Air Terrain Altitude/Color Correlation for Terrain-SVT or TAWS-B

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 6-15 Terrain SVT Relative Point Obstacle Symbols and Colors

Unlighted Wind Turbine Obstacle	Lighted Wind Turbine Obstacle	Wind Turbine Obstacle Location
		Red obstacle is above or within 100 ft below the aircraft altitude.
		Yellow obstacle is between 100 ft and 1000 ft below the aircraft altitude.
		White obstacle is more than 1000 ft below aircraft altitude.

Table 6-16 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
 or 	Warning	TAWS-B Warning <b>PULL UP</b> Terrain-SVT Warning <b>TERRAIN</b>
 or 	Caution	<b>TERRAIN</b>

Table 6-17 Terrain-SVT and TAWS-B Potential Impact Area with Annunciations

## DISPLAYING RELATIVE TERRAIN INFORMATION

The Terrain Pane is the principal map pane for viewing relative terrain information. Relative Terrain information is also available for display on navigation maps.

### 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, 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.

#### Showing the Terrain 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) Touch Terrain Setting Button. [Terrain Settings Button] can be **Terrain-SVT Settings** Button or **TAWS Settings** Button.
- 3) Touch the **Show Aviation Data** Button to enable/disable aviation information (airports, VORs, NDBs, Intersections) for the terrain pane.

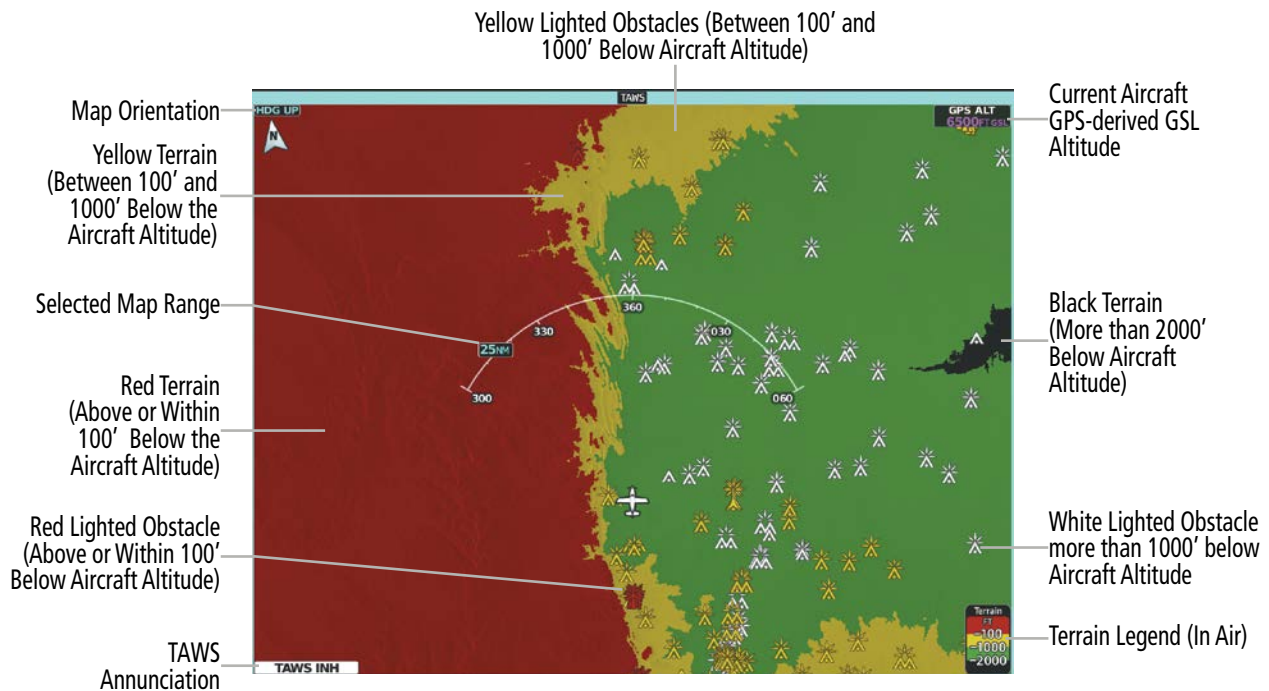


Figure 6-102 'TAWS' Pane with Aircraft in the Air

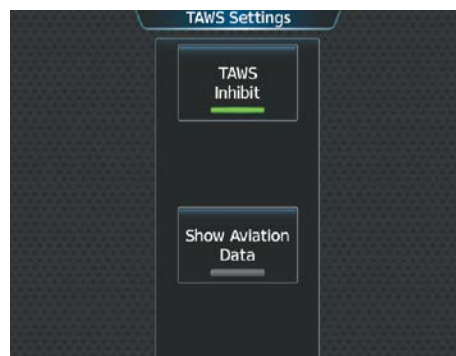


Figure 6-103 'TAWS Settings' Screen

## RELATIVE TERRAIN ON THE NAVIGATION MAPS

The optional terrain system provides relative terrain information for the Navigation Maps. This includes the display of relative terrain, obstacles, and potential impact areas. When relative terrain information is enabled on a navigation map, the system displays a Terrain-SVT/TAWS icon and legend. If the terrain system is not available or has failed, a white 'X' appears over the Terrain-SVT/TAWS icon. If the system calculates a potential impact area, it appears on any navigation map, regardless of whether relative terrain information is enabled/disabled.

### Controlling Relative Terrain Information Navigation Map Panes:

- 1) From 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 Obstacle Information on Navigation Maps:

- 1) From MFD Home, touch **Map > Map Selection > Map Settings**.
- 2) If necessary, touch the **Land** Tab.
- 3) Touch the **Obstacle Data** Button to enable/disable the display of relative obstacle information.
- 4) To change the maximum map range to display obstacle information, touch the Obstacle Data Range Button, then scroll and select a maximum map range from the list.
- 5) If necessary, touch the **Map Sync** Button to enable map synchronization. This is used to synchronize map settings (including obstacle settings) with other Navigation Maps.
- 6) Touch the **Onside** Button to synchronize the selected Navigation Map settings to onside Navigation Maps, then touch either the **PFD 1** or **MFD Left** Buttons to select which Navigation Map settings should be initially be applied to onside Navigation Maps.

**Or:**

Touch the **All** Button to synchronize all navigation maps, then touch a button to select which Navigation Map settings should initially be applied to all Navigation Maps (**MFD Left, MFD Right, PFD1, PFD2**).

### 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 His 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). 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 information; however, obstacles for which Terrain-SVT or TAWS-B warnings and cautions are issued are shown when terrain is selected for display and the map range is within the setting limit.

Maps besides the terrain pane use settings based on those selected for the Navigation Map Pane. The maximum display ranges for obstacles on each map are dependent on the range setting made for the 'Navigation Map' Pane.

**Customizing terrain and obstacle display on the 'Navigation Map' Pane:**

- 1) From 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 three times to return to the 'Map Settings' Screen.
- 8) Touch the **Land** Tab.
- 9) Touch the **Point Obstacle** Button to enable/disable the display of point obstacles on navigation maps.
- 10) 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) 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.



## TERRAIN-SVT AND TAWS-B TERRAIN AND OBSTACLE ALERTS

The system issues alerts when flight conditions meet parameters that are set within Terrain-SVT or TAWS-B software algorithms. The system issues terrain/obstacle alerts as a caution or warning severity level. Alerts include visual annunciations and voice alerts.

When the system issues an alert, annunciations appear on the 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.

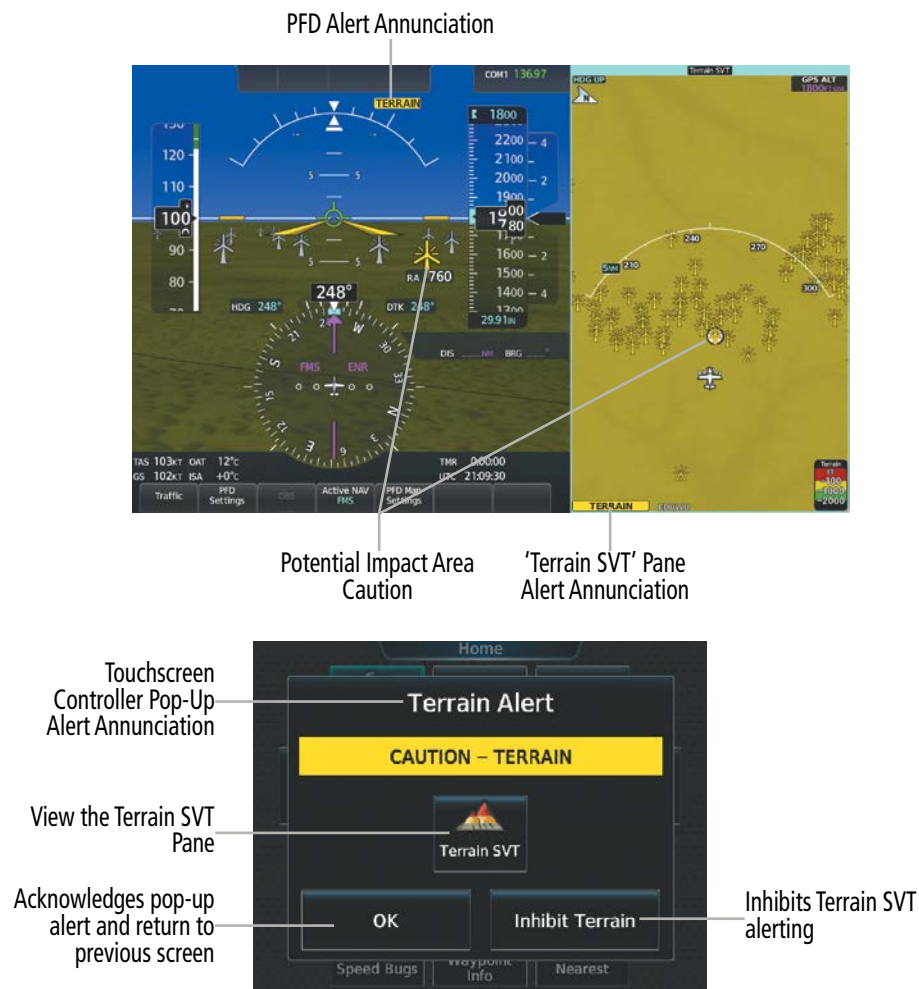


Figure 6-104 Terrain SVT Alert Annunciations

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)	<b>TERRAIN</b>	<b>WARNING – TERRAIN</b>	"Warning; Terrain, Terrain"
Imminent Terrain Impact Warning (ITI)	<b>TERRAIN</b>	<b>WARNING – TERRAIN</b>	"Warning; Terrain, Terrain"
Reduced Required Obstacle Clearance Warning (ROC)	<b>TERRAIN</b>	<b>WARNING – OBSTACLE</b>	"Warning; Obstacle, Obstacle"
Imminent Obstacle Impact Warning (IOI)	<b>TERRAIN</b>	<b>WARNING – OBSTACLE</b>	"Warning; Obstacle, Obstacle"
Reduced Required Terrain Clearance Caution (RTC)	<b>TERRAIN</b>	<b>CAUTION – TERRAIN</b>	"Caution; Terrain, Terrain"
Imminent Terrain Impact Caution (ITI)	<b>TERRAIN</b>	<b>CAUTION – TERRAIN</b>	"Caution; Terrain, Terrain"
Reduced Required Obstacle Clearance Caution (ROC)	<b>TERRAIN</b>	<b>CAUTION – TERRAIN</b>	"Caution; Obstacle, Obstacle"
Imminent Obstacle Impact Caution (IOI)	<b>TERRAIN</b>	<b>CAUTION – TERRAIN</b>	"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)	<b>PULL UP</b>	<b>PULL-UP</b>	"Pull Up"
Reduced Required Terrain Clearance Warning (RTC)	<b>PULL UP</b>	<b>TERRAIN – PULL-UP</b> or <b>TERRAIN AHEAD – PULL-UP</b> *	"Terrain, Terrain; Pull Up, Pull Up" * or "Terrain Ahead, Pull Up; Terrain Ahead, Pull Up"
Imminent Terrain Impact Warning (ITI)	<b>PULL UP</b>	<b>TERRAIN – PULL-UP</b> * or <b>TERRAIN AHEAD – PULL-UP</b>	"Terrain, Terrain; Pull Up, Pull Up" or "Terrain Ahead, Pull Up; Terrain Ahead, Pull Up" *
Reduced Required Obstacle Clearance Warning (ROC)	<b>PULL UP</b>	<b>OBSTACLE – PULL-UP</b> or <b>OBSTACLE AHEAD – PULL-UP</b> *	"Obstacle, Obstacle; Pull Up, Pull Up" * or "Obstacle Ahead, Pull Up; Obstacle Ahead, Pull Up"
Imminent Obstacle Impact Warning (IOI)	<b>PULL UP</b>	<b>OBSTACLE – PULL-UP</b> * or <b>OBSTACLE AHEAD – PULL-UP</b>	"Obstacle, Obstacle; Pull Up, Pull Up" or "Obstacle Ahead, Pull Up; Obstacle Ahead, Pull Up" *

Alert Type	PFD/ TAWS Pane Annunciation	Touchscreen Controller Pop- Up Alert	Voice Alerts
Reduced Required Terrain Clearance Caution (RTC)	<b>TERRAIN</b>	<b>CAUTION – TERRAIN</b> or <b>TERRAIN AHEAD</b> *	"Caution, Terrain; Caution, Terrain" * or "Terrain Ahead; Terrain Ahead"
Imminent Terrain Impact Caution (ITI)	<b>TERRAIN</b>	<b>CAUTION – TERRAIN</b> * or <b>TERRAIN AHEAD</b>	"Caution, Terrain; Caution, Terrain" or "Terrain Ahead; Terrain Ahead" *
Reduced Required Obstacle Clearance Caution (ROC)	<b>TERRAIN</b>	<b>CAUTION – OBSTACLE</b> or <b>OBSTACLE AHEAD</b> *	"Caution, Obstacle; Caution, Obstacle" * or "Obstacle Ahead; Obstacle Ahead"
Imminent Obstacle Impact Caution (IOI)	<b>TERRAIN</b>	<b>CAUTION – OBSTACLE</b> * or <b>OBSTACLE AHEAD</b>	"Caution, Obstacle; Caution, Obstacle" or "Obstacle Ahead; Obstacle Ahead" *
Premature Descent Alert Caution (PDA)	<b>TERRAIN</b>	<b>TOO LOW – TERRAIN</b>	"Too Low, Terrain"
Altitude Callout "500"	None	None	"Five-Hundred"
Excessive Descent Rate Caution (EDR)	<b>TERRAIN</b>	<b>SINK RATE</b>	"Sink Rate"
Negative Climb Rate Caution (NCR)	<b>TERRAIN</b>	<b>DONT SINK</b> * or <b>TOO LOW – TERRAIN</b>	"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. When an RTC alert is issued, the system displays a potential impact area on navigation maps and the Terrain 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 Pane. The alert occurs when the projected vertical flight path is calculated to come within minimum clearance altitudes.



Figure 6-105 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.

## 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.

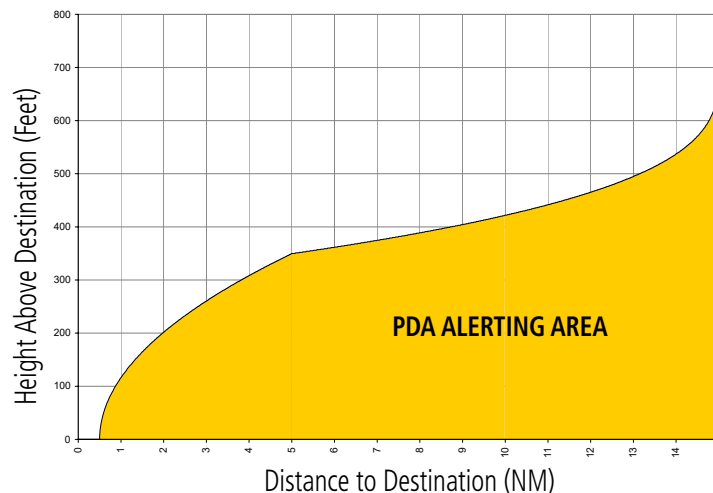


Figure 6-106 PDA Alerting Threshold

## INHIBITING FLTA AND PDA ALERTS

The flight crew can manually inhibit FLTA and PDA visual annunciations and voice alerts. Discretion should be used when inhibiting alerts and the system should be enabled when appropriate. When PDA and FLTA alerts are inhibited, the system status annunciation 'TER INH' or 'TAWS INH' depending on installed terrain system, will appear on the Terrain Pane in addition to the PFD.



**NOTE:** Inhibiting TAWS alerts inhibits FLTA and PDA alerts only. EDR and VCO alerts remain enabled even when TAWS is inhibited.



Figure 6-107 Alerting is Inhibited when Annunciation is displayed

### Inhibiting Terrain-SVT or TAWS-B FLTA and PDA Alerting:

- 1) From MFD Home, touch the [Terrain] Button. [Terrain] can be **Terrain-SVT**, or **TAWS**.
- 2) Touch Terrain Setting Button. [Terrain Settings Button] can be **Terrain-SVT Settings** Button or **TAWS Settings** Button.
- 3) Touch the either the **Terrain Inhibit** or **TAWS Inhibit** Button. When the annunciator on the button is green, Terrain-SVT or TAWS-B alerting is inhibited. When the button annunciator is gray, Terrain-SVT or 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 either the **Terrain Inhibit** or **TAWS Inhibit** Button. When the annunciator on the button is green, Terrain SVT or TAWS-B alerting is inhibited. When the annunciator is gray, Terrain SVT or TAWS-B alerting is enabled.

Or:

- 1) From PFD Home, touch **PFD Map Settings**.
- 2) Touch the Terrain **Settings** Button in the 'Overlays' Window.
- 3) Touch the either the **Terrain Inhibit** or **TAWS Inhibit** Button.

### Inhibiting Terrain-SVT or TAWS-B alerting while an alert is occurring:

- 1) Touch the **Inhibit Terrain** or **Inhibit TAWS** Button on the Terrain Alert pop-up window on the Touchscreen Controller.
- 2) Touch the **OK** Button to confirm and inhibit of either Terrain-SVT or TAWS-B 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 terrain system is not available or has failed), the system may display a 'LOW ALT' annunciation on the PFDs 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 **Excessive Descent Rate (EDR)** alert occurs when the system determines the aircraft is closing (descending) upon terrain at an excessive speed. The following figure shows the parameters for the alert as defined by TSO-C151b.

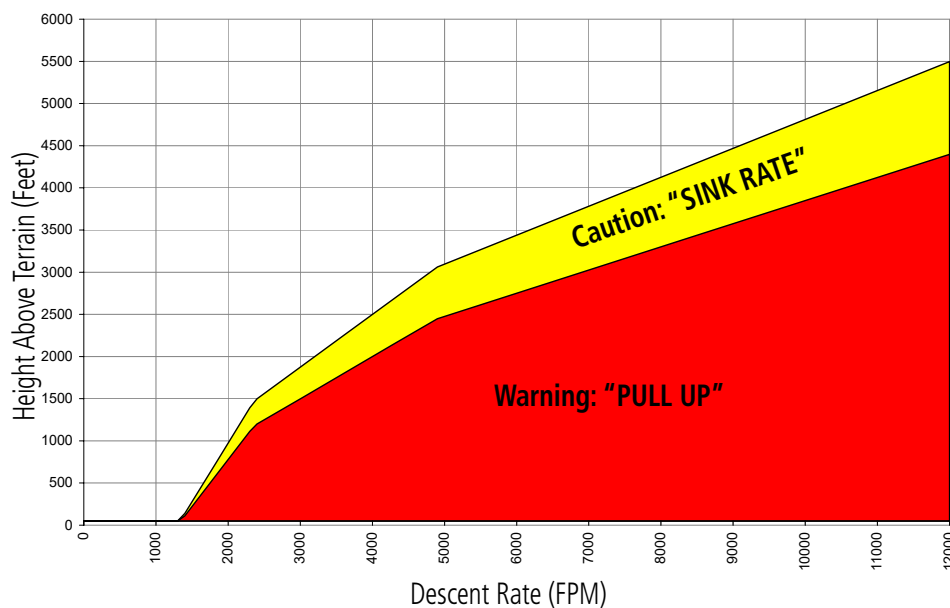
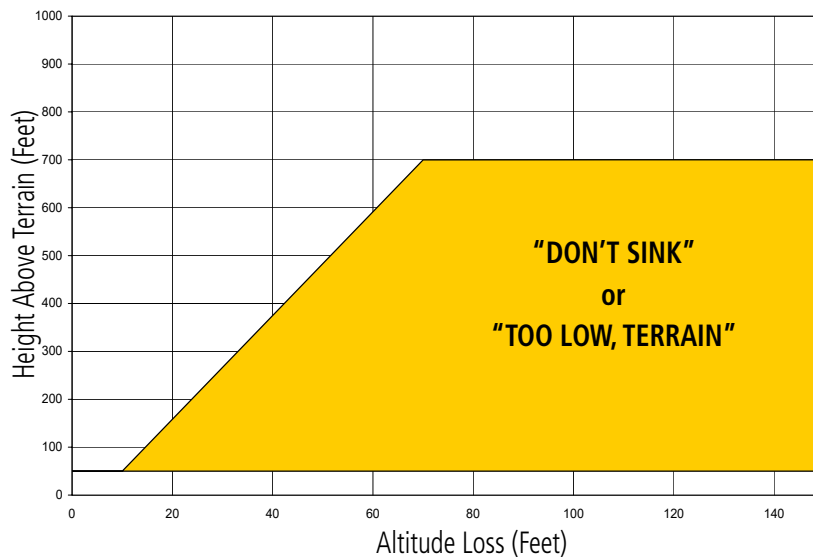


Figure 6-108 Excessive Descent Rate Alert Criteria

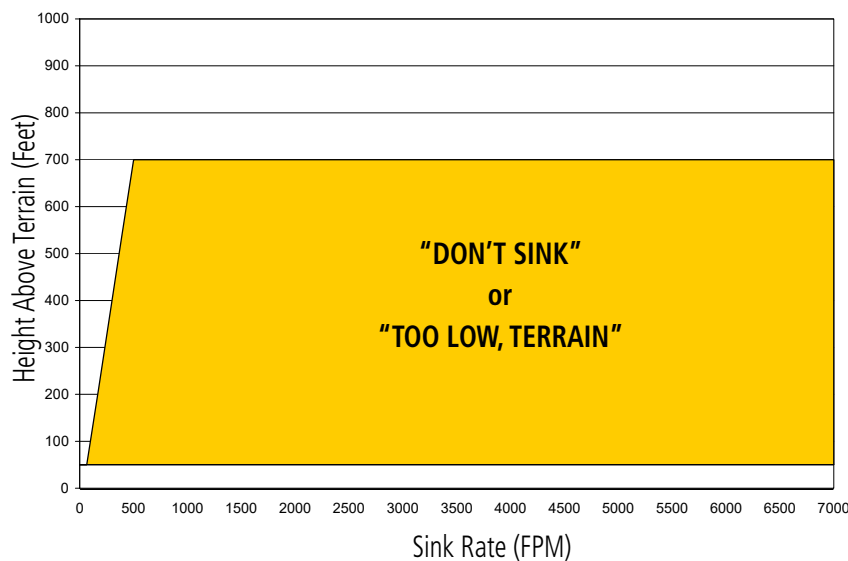
## NEGATIVE CLIMB RATE AFTER TAKEOFF ALERT (NCR)

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 6-109 Negative Climb Rate (NCR) Altitude Loss**



**Figure 6-110 Negative Climb Rate (NCR) Sink Rate**



## ALTITUDE VOICE CALLOUT (VCO)

The purpose of the TAWS-B “Five-hundred” voice alert is to provide an advisory alert of when the aircraft descends to within 500 feet above the terrain or runway threshold. When the aircraft is within 5 nm of an airport, the “Five Hundred” voice alert is based on the nearest runway threshold elevation. When the aircraft is more than 5 nm of the nearest airport, the “Five Hundred” voice alert is based on the height above terrain (as determined by the GPS altitude and Terrain Database).

There are no display annunciations or pop-up alerts that accompany the VCO alert. This voice alert cannot be inhibited.

## SYSTEM STATUS

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### 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 FMS 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.

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	<b>TAWS FAIL</b>	<b>TAWS FAIL</b>	"TAWS System Failure"
TAWS Not Available	<b>TAWS N/A</b>	<b>NO FMS POSITION</b> (if FMS position lost)	"TAWS Not Available"
TAWS Available	None	None	"TAWS Available"
System Test in progress	<b>TAWS TEST</b>	<b>TAWS TEST</b>	None
TAWS System Test pass	None	None	"TAWS System Test OK"
TAWS PDA/FLTA Alerting Inhibited	<b>TAWS INH</b>	None	None

Table 6-21 TAWS-B System 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.	<b>TAWS FAIL</b> and <b>TAWS FAIL</b>	FLTA, PDA
MFD Terrain or Obstacle database unavailable or invalid. TAWS operating with PFD Terrain or Obstacle databases.	<b>TERRAIN DATABASE FAILURE</b>	
No GPS position.	<b>TAWS N/A</b> and <b>NO FMS POSITION</b>	FLTA, PDA, VCO
Excessively degraded GPS signal, or out of database coverage area.	<b>TAWS N/A</b>	FLTA, PDA

Table 6-22 TAWS-B Abnormal Status Annunciations

## 6.6 TRAFFIC INFORMATION SERVICE (TIS)



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






**NOTE:** Mode-S TIS is available only when the aircraft is within the service volume of a TIS-capable terminal radar site. Aircraft without an operating transponder are invisible to Traffic Advisory Systems (TAS), Traffic Alert and Collision Avoidance Systems (TCAS), and to TIS. Aircraft without altitude reporting capability are shown without altitude separation data or climb descent indication.



**NOTE:** Mode-S TIS is disabled if another traffic system is installed such as TAS or ADS-B.

Traffic Information Service (TIS) is designed to help in detection and avoidance of other aircraft. TIS uses the Mode S transponder for the traffic data link. TIS receives traffic information from ground stations, and is updated every five seconds. The system displays up to eight traffic targets within a 7.5-nm radius, from 3000 feet below to 3500 feet above the requesting aircraft. Traffic is displayed using the symbols shown in the following table.

TIS Symbol	Description
	Other Traffic
	Traffic Advisory (TA)
	Traffic Advisory Off Scale

**Table 6-23 TIS Traffic Symbols**

Traffic Advisories (TA) alert the crew to intruding aircraft. When traffic meets the advisory criteria for the TA, the system displays a solid amber circle and issues a voice alert. A TA which is detected but is outside the range of the map on which traffic is displayed are indicated with a message in the lower left corner of the map.

TIS also provides a vector line showing the direction in which the traffic is moving, to the nearest 45°. Traffic information for which TIS is unable to determine the bearing (non-bearing traffic) is displayed in the center of the Traffic Map Pane, the Traffic Inset Map/HSI Traffic Map and in a banner at the lower left corner of navigation maps with the traffic overlay enabled.

The altitude difference between the requesting aircraft and other intruder aircraft is displayed above/below the traffic symbol in hundreds of feet. If the other aircraft is above the requesting aircraft, the altitude separation appears above the traffic symbol; if below, the altitude separation appears below. Altitude trend is displayed as an up/down arrow (for speeds greater than 500 fpm in either direction) to the right of the target symbol. Traffic symbols for aircraft without altitude reporting capability appear without altitude separation or climb/descent information.

## TRAFFIC MAP PANE

The 'Traffic Map' Pane is specialized to show surrounding TIS traffic data in relation to the aircraft's current position and altitude, without clutter from the basemap. Aircraft orientation on this map is always heading up unless there is no valid heading, in which case it is track up. Map range is adjustable with the lower knob from 2 to 12 nm, as indicated by the map range rings.

The traffic mode is annunciated in the upper right corner of the Traffic Map Pane. When the aircraft is on the ground, TIS automatically enters Standby Mode. Once the aircraft is airborne, TIS switches from Standby to Operating Mode, and the system displays traffic information. Refer to the System Status discussion for more information.

### Viewing the Traffic Map Pane:

From MFD Home, touch the **Traffic** Button.

Or:

If the PFD is in Split Mode, from PFD Home, touch the **Traffic Map** Button.

Or:

If the PFD is in Split Mode, press the **Traffic** Softkey.

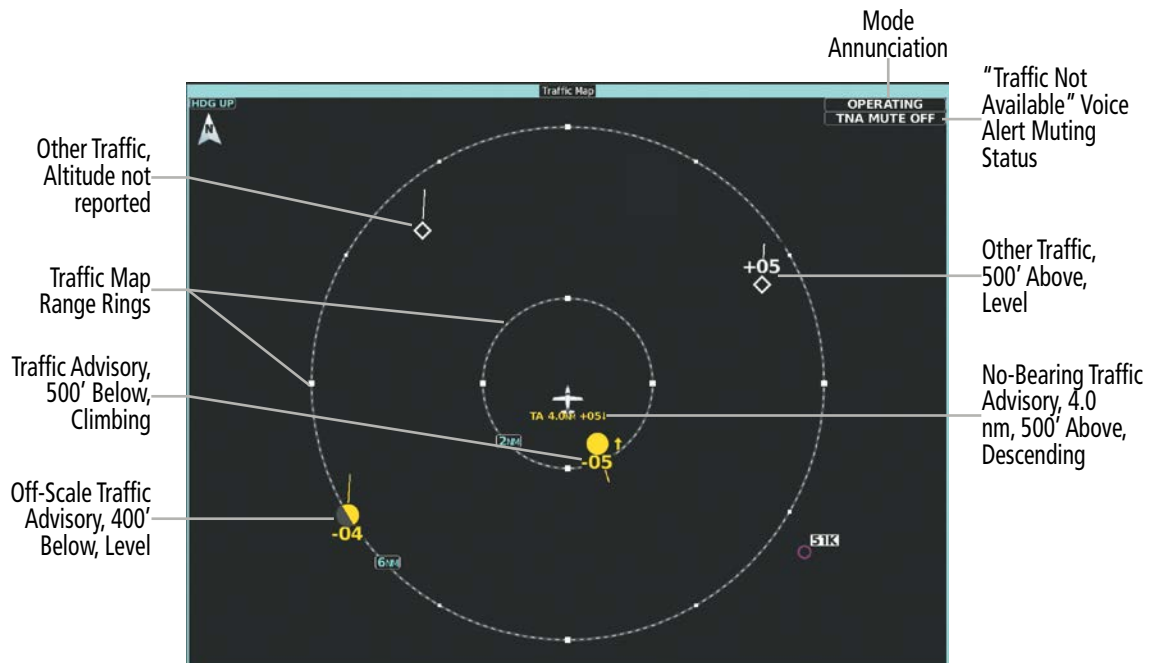


Figure 6-111 'Traffic Map' Pane with TIS Traffic (MFD in Full Mode)

If the traffic overlay is enabled for display on a navigation map while Standby Mode is selected, the traffic display enabled icon is crossed out (also the case whenever TIS has failed). Once the aircraft is in the air, TIS automatically selects Operating Mode and traffic information is displayed. The flight crew can also manually select the mode using the Touchscreen Controller.

**Selecting a TIS mode:**

- 1) From MFD Home, touch **Traffic > Traffic Settings**.

Or:

- a) From MFD Home, touch **Map > Map Settings**.
- b) If necessary, touch the **Sensor** Tab.
- c) Touch the Traffic **Settings** Button.

Or:

- a) From **PFD Home**, touch **PFD Map Settings**.
- b) Touch the Traffic **Settings** Button.

- 2) Touch the **Operate** Button or the **Standby** Button.



Figure 6-112 Traffic Setting Screen for the Traffic Map Pane

## DISPLAYING TRAFFIC DATA ON NAVIGATION MAPS

The 'Traffic Map' Pane is the principal map for viewing traffic information. Additional displays of traffic information are available as navigation map overlays while TIS is operating, and serve as additional reference to the 'Traffic Map' Pane.

Traffic information is also displayed on the PFD when the optional Garmin Synthetic Vision Technology (SVT) system is installed and enabled. See the Flight Instruments Section for more information about Garmin SVT.

**Enabling/disabling the display traffic information the 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 to enable/disable the display of traffic.

When traffic is selected on maps other than the 'Traffic Map' Pane, a status icon is shown to indicate the feature is enabled for display.





Figure 6-113 TIS Traffic on 'Navigation Map' Pane

When the PFD is in Full Mode, a PFD Inset Map and HSI Map are available for selection. Either map may be displayed with traffic information.

#### Displaying traffic information on the PFD Inset Map and HSI Map:

- 1) Press the **Traffic Map** Softkey to display traffic data on the PFD Inset navigation map.

Or:

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

#### Displaying/removing the Traffic Inset Map on the PFD:

Press the **Traffic Inset** Softkey.

Or:

- 1) From PFD Home, touch **PFD Map Settings**.
- 2) Touch the **Traffic Inset** Button.

The flight crew can control the map range settings above which traffic data (symbols and labels) are decluttered from the navigation maps. If a map range larger than the map range setting is selected, the data is removed from the map.

**Customizing traffic display 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 traffic labels on navigation maps.
- 6) To change the map maximum navigation map range to show traffic symbols, touch the **Symbols** Button, then scroll as needed and touch a button for the desired range.
- 7) To change the map maximum navigation map range to show traffic labels, touch the **Labels** Button, then scroll as needed and touch a button for the desired range.

**Or:**

- 1) From PFD Home, touch **Inset Map Settings**.
- 2) In the Overlays Tab, touch the Traffic **Settings** Button.
- 3) Touch the **Map Settings** Button.
- 4) Touch the **Labels** button to enable/disable the display of traffic labels on navigation maps.
- 5) To change the map maximum navigation map range to show traffic symbols, touch the **Symbols** Button, then scroll as needed and touch a button for the desired range.
- 6) To change the map maximum navigation map range to show traffic labels, touch the **Labels** Button, then scroll as needed and touch a button for the desired range.

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**TIS ALERTS**

When the number of TAs increases from one scan to the next, the following occur:

- The system issues a single “Traffic” voice alert.
- A ‘TRAFFIC’ Annunciation appears to the right of the Airspeed Indicator on the PFD, flashes for five seconds, and remains displayed until no TAs are detected in the area.
- If the PFD is in Full Mode, and an Inset Navigation Map or HSI Map was already displayed, the traffic appears on the map with its overlay setting enabled. If the PFD is in Full Mode, and an Inset Map or HSI map was not already displayed, the Traffic Inset Map appears. If the PFD is in Half Mode, no map automatically appears.

To reduce the number of nuisance alerts due to proximate aircraft, the “Traffic” voice alert is generated only when the number of TAs increases. For example, when the first TA is displayed, a visual annunciation appears with a voice alert. As long as a single TA remains on the display, no additional voice alerts are generated. If a second TA appears on the display or if the number of TAs initially decreases and then subsequently increases, another voice alert is generated.



**Figure 6-114 Traffic Annunciation (PFD)**

A “Traffic Not Available” (TNA) voice alert is generated when the TIS service becomes unavailable or is out of range. TIS may be unavailable in the radar coverage area due to the following:

- Radar site TIS Mode S sensor is not operational or is out of service.
- Traffic or requesting aircraft is beyond the maximum range of the TIS-capable Mode S radar site.
- Traffic or requesting aircraft is above the radar site in the cone of silence and out of range of an adjacent site.
- Traffic or requesting aircraft is below radar coverage. In flat terrain, the coverage extends from about 3000 feet upward at 55 miles. Terrain and obstacles around the radar site can further decrease radar coverage in all directions.
- Traffic does not have an operating transponder.

The “Traffic Not Available” (TNA) voice alert can be manually muted to reduce nuisance alerting. TNA muting status is shown in the upper right corner of the traffic map.

#### **Muting the “Traffic Not Available” voice alert:**

- 1) From MFD Home, touch **Traffic > Traffic Settings**.
- 2) Touch the **Mute “Traffic Not Available”** Button. ‘TNA MUTE ON’ appears in the upper right corner of the Traffic Map.

**Or:**

- 1) From MFD **Home**, touch **Map > Map Settings**.
- 2) If necessary, touch the **Sensor** Tab.
- 3) Touch the **Traffic Settings** Button.
- 4) Touch the **Mute “Traffic Not Available”** Button. ‘TNA MUTE ON’ appears in the upper right corner of the Traffic Map.

**Or:**

- 1) From PFD Home, touch **Inset Map Settings**.
- 2) Scroll in the Overlays Tab and touch the **Traffic Settings** Button.
- 3) Touch the **Mute “Traffic Not Available”** Button. ‘TNA MUTE ON’ appears in the upper right corner of the Traffic Map.

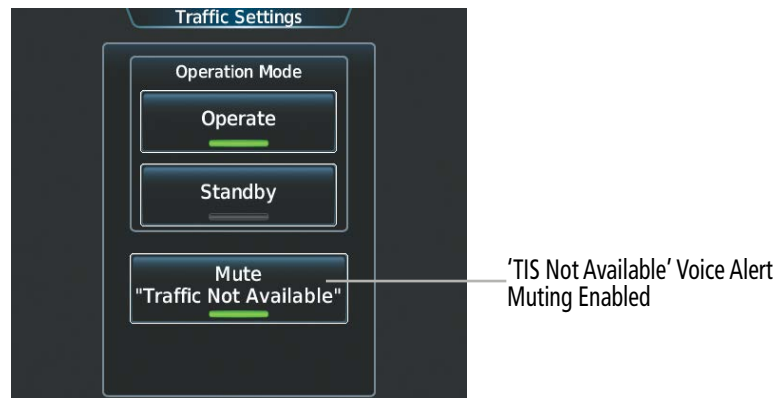


Figure 6-115 'Traffic Settings' Screen for TIS

## ADDITIONAL TRAFFIC DISPLAYS

When the PFD is operating in Full Mode, a Traffic Inset Map is available for display on the PFD.

### Enabling/disabling the Traffic Inset Map on the PFD:

With the PFD in Full Mode, press the **Traffic Inset** Softkey.

**Or:**

- 1) From PFD Home, touch **PFD Map Settings**.
- 2) Touch the **Traffic Inset** Button.

The HSI can also present a version of the Traffic Map. Traffic operating mode information is not present on this map. Refer to the Flight Instruments section for more information about displaying maps on the HSI.

### Showing the HSI Traffic Map:

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

**Or:**

- 1) On the PFD, press the **PFD Map Settings** Softkey.
- 2) Press the **Map Layout** Softkey.
- 3) Press the **HSI Traffic** Softkey.

## SYSTEM STATUS

The system performs an automatic test of TIS during when system power is applied. If TIS passes the test, TIS enters Standby Mode (on the ground) or Operating Mode (in the air). The following annunciations indicate the traffic system status.

Traffic Map Mode Annunciation	Traffic Map Center Banner Annunciation	Traffic Overlay Status Icon (Navigation Maps)	Description
<b>DATA FAILED</b>	<b>TRFC FAIL</b>		Data is being received from the transponder, but a failure is detected in the data stream.*
<b>NO DATA</b>	<b>TRFC FAIL</b>		Data is not being received from the transponder.*
<b>OPERATING</b>	None		TIS is operating and is receiving traffic data from a data link..
<b>OPERATING</b>	<b>UNAVAILABLE</b>		TIS is operating, but the traffic service is currently unavailable or is out of reception range.
<b>STANDBY</b>	<b>STANDBY</b>		TIS is in Standby Mode.
<b>UNIT FAILED</b>	<b>TRFC FAIL</b>		The transponder has failed.*

\* Contact a service center or Garmin dealer for corrective action.

Table 6-24 TIS Modes and Status Annunciations

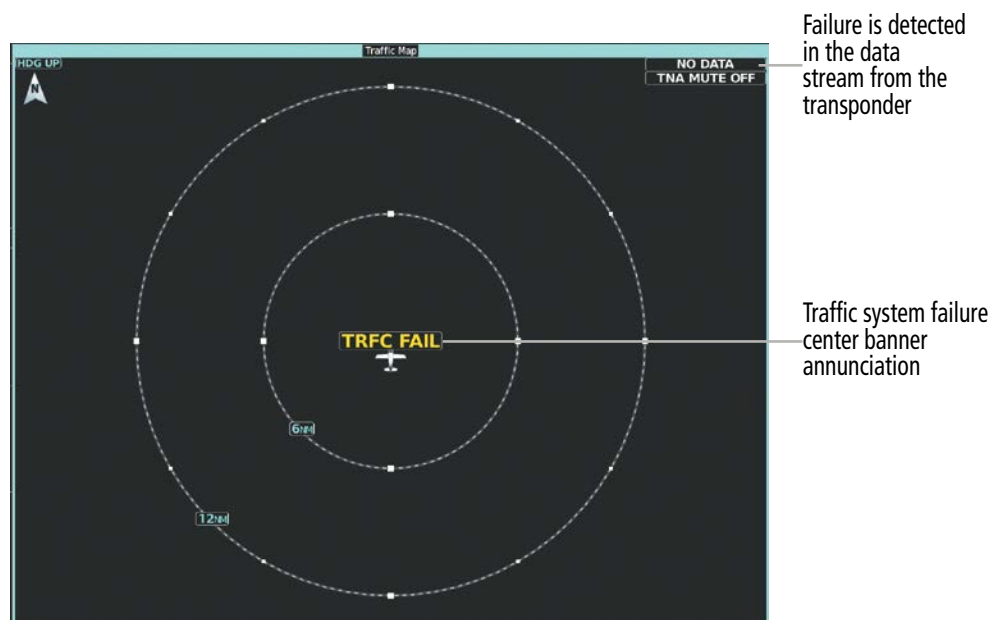


Figure 6-116 TIS Failure Annunciations on the 'Traffic Map' Pane

The annunciations to indicate the status of traffic information appear in a banner at the lower left corner on navigation maps.

Traffic Status Banner Annunciation	Description
<b>TA OFF SCALE *</b>	A Traffic Advisory is outside the selected display range. Annunciation is removed when traffic comes within the selected display range.
<b>TA X.X ± XX ↓</b>	System cannot determine bearing of Traffic Advisory. Annunciation indicates distance in nm, altitude separation in hundreds of feet, and altitude trend, if available ('<UP>' indicates climbing, '<DN>' indicates descending).
<b>AGE MM:SS†</b>	Appears if traffic data is not refreshed within 6 seconds. If after another 6 seconds data is not received, traffic is removed from the display. The quality of displayed traffic information is reduced as the age increases.
<b>TRFC COAST†</b>	The displayed data is not current (6 to 12 seconds since last message).† The quality of displayed traffic information is reduced when this message is displayed.
<b>TRFC RMVD†</b>	Traffic is removed because it is too old for coasting (12 to 60 seconds since last message). Traffic may exist within the selected display range, but it is not displayed.
<b>TRFC FAIL**</b>	Traffic data has failed.
<b>NO TRFC DATA</b>	Traffic has not been detected.
<b>TRFC UNAVAIL</b>	The traffic service is unavailable or is out of reception range.

\*Shown as symbol on traffic maps.

\*\*Also shown in center of traffic maps.

†Also shown in lower left corner of traffic maps.

Table 6-25 TIS Traffic Status Annunciations

## 6.7 TRAFFIC ADVISORY SYSTEM (TAS)



**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 820 is a Traffic Advisory System (TAS). 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 TAS system is capable of tracking up to 45 intruding aircraft equipped with Mode A or C transponders, and up to 30 intruding aircraft equipped with Mode S transponders. 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.

### 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

The GTS 820 TAS surveillance system actively scans the airspace within  $\pm 10,000$  feet of its altitude. Under ideal conditions, the TAS system scans transponder traffic up to 40 NM in the forward direction. The range is somewhat reduced to the sides and aft of own aircraft due to the directional interrogation signal patterns. In areas of greater transponder traffic density, the on-board traffic system automatically reduces its interrogation transmitter power (and therefore range) in order to limit potential interference from other signals.



When the traffic system is paired with the optional GTX 33D ES (Extended Squitter) 1090 MHz transponder, the traffic system uses Automatic Dependent Surveillance - Broadcast (ADS-B) position reports from participating aircraft to enhance the positional accuracy of traffic displayed within the TAS surveillance range.

















TAS Symbol	Description
	Non-Threat Traffic
	Proximity Advisory (PA)
	Traffic Advisory (TA)
	Traffic Advisory Off Scale

Table 6-26 TAS Symbology (GTX 33D ES Transponder)



**NOTE:** Do not confuse this functionality with full ADS-B capability, which can provide traffic information from ADS-B Ground-Based Transceivers (GBTs) and ADS-B traffic outside of the TAS surveillance volume.

When the traffic system is paired with the optional GTX 345R transponder, the traffic system also uses Automatic Dependent Surveillance - Broadcast (ADS-B) position reports from participating aircraft to enhance the positional accuracy of traffic displayed within the TAS surveillance range, in addition to broadcasts from traffic outside of the TAS surveillance range. It also receives information from ADS-B Ground Based Transceivers (GBTs). This includes the Traffic Information Service-Broadcast (TIS-B) service and Automatic Dependent Surveillance-Rebroadcast (ADS-R) service; refer to the ADS-B Traffic section for more information about these features.

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 6-27 TAS Traffic with ADS-B Symbology (GTX 345R Transponder)**

A Traffic Advisory (TA), displayed as an amber circle, or an amber circle with a directional arrow inside of it, alerts the crew to a potentially hazardous intruding aircraft, if the closing rate, distance, and vertical separation meet TA criteria. A Traffic Advisory 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.

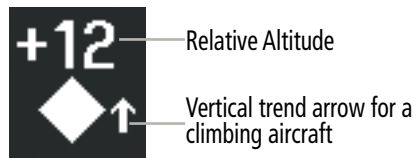
A Proximity Advisory (PA), displayed as a solid white diamond or white arrow, indicates the intruding aircraft is within  $\pm 1200$  feet and is within a six nautical mile range, but is still not considered a TA threat.

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. See ADS-B Traffic section for more information on enabling Motion Vectors.



**Figure 6-117 Intruder Altitude and Vertical Trend Arrow**



**Figure 6-118 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.

## 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 the aircraft's landing gear is extended, or when the radar altimeter (if equipped) indicates own aircraft altitude is below 2000' AGL. In all other conditions, Level B (greater) TA sensitivity is used to assess TA threats.

Sensitivity Level	Intruder Altitude Available	TA Alerting Conditions
A	Yes	Intruder closing rate provides less than 20 seconds of vertical and horizontal separation. Or: Intruder closing rate provides less than 20 seconds of horizontal separation and vertical separation is within 600 feet. Or: Intruder range is within 0.2 nm and vertical separation is within 600 feet.
A	No	Intruder closing rate provides less than 15 seconds of separation or intruder range is within 0.2 NM.
B	Yes	Intruder closing rate provides less than 30 seconds of vertical and horizontal separation. Or: Intruder closing rate provides less than 30 seconds of horizontal separation and vertical separation is within 800 feet. Or: Intruder range is within 0.55 nm and vertical separation is within 800 feet.
B	No	Intruder closing rate provides less than 15 seconds of separation or intruder range is less than 0.55 NM.

**Table 6-28 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 6-29 TA Descriptive Voice Alert**



**NOTE:** If a GTX 345 transponder is installed, and TA occurs within 0.25 nautical miles from own aircraft, or multiple TAs occur simultaneously, then relative altitude is omitted from the voice alert(s).



**NOTE:** If a GTX 345R transponder is installed, the system mutes TAS-derived voice alerts below 400' AGL, and mutes ADS-B-derived voice alerts below 500' AGL or when landing gear is extended. If a TAS is installed without a GTX 345R transponder, the system mutes TA voice alerts below 400' AGL or when landing gear is extended.

- 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 6-119 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.

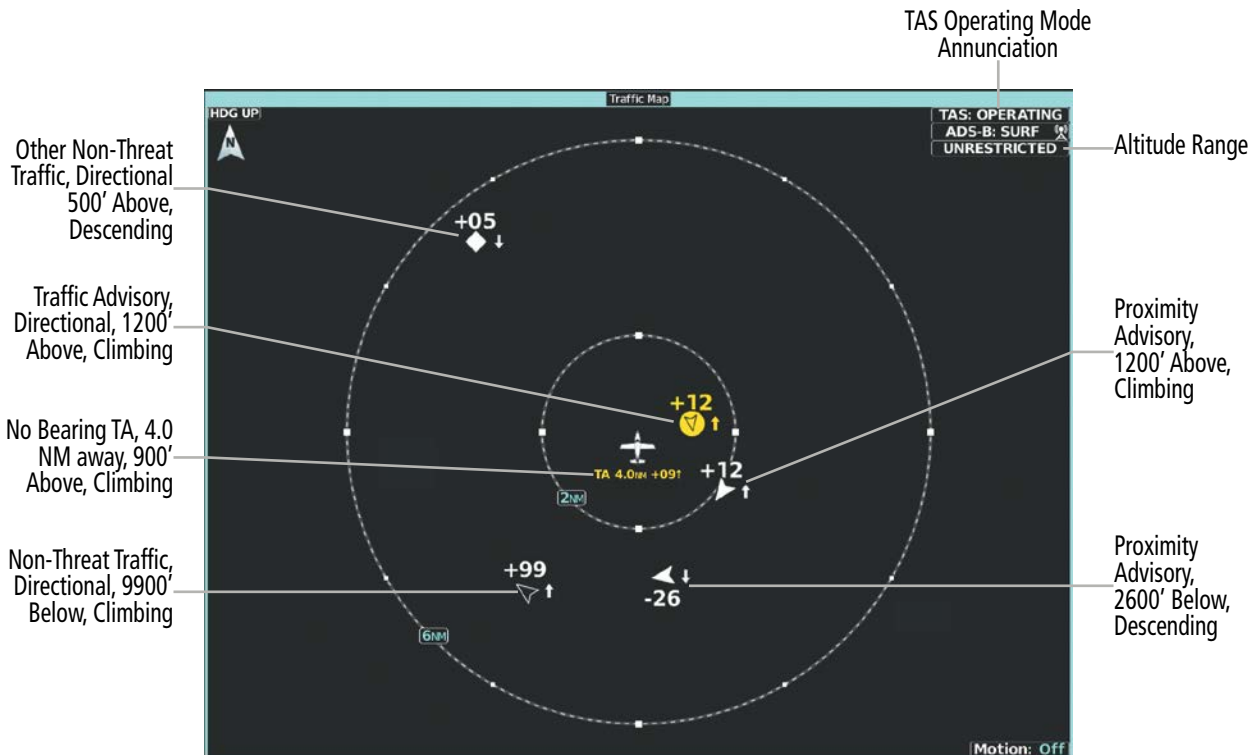


Figure 6-120 'Traffic Map' Pane with TAS and ADS-B Traffic Display Enabled

## 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, press the **Traffic** Softkey or touch the **Traffic Map** Button from **PFD Home** on the touchscreen controller.

## ALTITUDE RANGE

The flight crew can select the volume of airspace in which other Non-Threat and Proximity Advisory 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:**

- 1) From MFD Home, touch **Map > Map Selection > Map Settings > Traffic Settings** Button.
- 2) Touch the **Altitude Range** Button:
- 3) Touch one of the following buttons from the list:
  - **Unrestricted:** All traffic is displayed from 9900 feet above and 9900 feet below the aircraft.
  - **Above:** Displays non-threat and proximity traffic from 9900 feet above the aircraft to 2700 feet below the aircraft. Typically used during climb phase of flight.
  - **Normal:** Displays non-threat and proximity traffic from 2700 feet above the aircraft to 2700 feet below the aircraft. Typically used during enroute phase of flight.
  - **Below:** Displays non-threat and proximity traffic from 2700 feet above the aircraft to 9900 feet below the aircraft. Typically used during descent phase of flight.



Figure 6-121 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.



## TRAFFIC MAP PANE DISPLAY RANGE

The display range on the 'Traffic Map' Pane can be changed at any time. Map range is adjustable with the **Joystick**, and rings on the map denote the ranges.

### Changing the display range on the Traffic Map Pane:

- 1) Turn the **Joystick**.
- 2) The following range options are available:
  - 750 ft (with optional ADS-B).
  - 750 ft and 1500 ft (with optional ADS-B).
  - 1500 ft and 0.5 nm (with optional ADS-B).
  - 0.5 nm and 1 nm (with optional ADS-B).
  - 1 nm and 2 nm (with optional ADS-B).
  - 2 and 6 nm.
  - 6 and 12 nm.
  - 12 and 24 nm.
  - 24 and 40 nm.

## ADDITIONAL TRAFFIC DISPLAYS

The 'Traffic Map' Pane is the principal map for viewing traffic information. Additional displays of traffic information are available as navigation map overlays while the traffic system is operating, and serve as additional reference to the 'Traffic Map' Pane.

Traffic information is also displayed on the PFD when the optional Garmin Synthetic Vision Technology (SVT) system is installed and enabled. See the Flight Instruments Section for more information about Garmin SVT.

### Enabling/disabling display of traffic information 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 **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.

**Or:**

- 1) If necessary, enable the Inset Map or HSI Map.
- 2) Press the **PFD Map Settings** Softkey.
- 3) Press the **Traffic** Softkey.

When the display of traffic is enabled on navigation maps as an overlay, the system shows a traffic status icon and altitude mode in the lower right corner of the map to indicate the feature has been enabled.

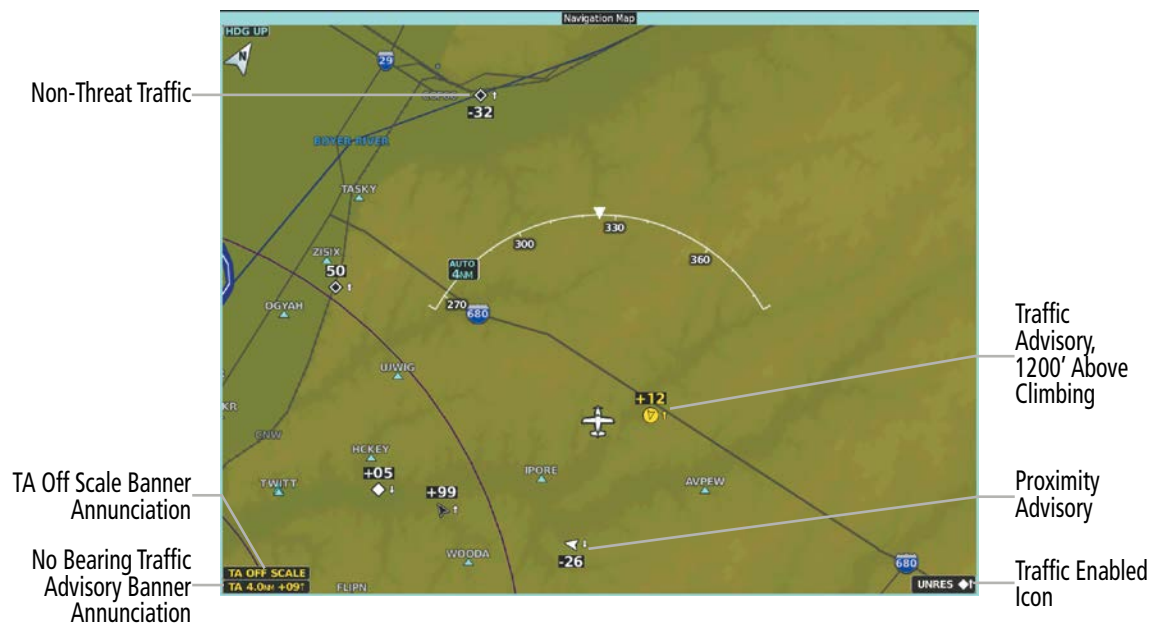


Figure 6-122 Traffic on 'Navigation Map' Pane

The system provides controls to customize the display of traffic information on navigation maps. Traffic symbols and labels (such as up or down arrows and relative altitudes) can be decluttered from the display when the map range exceeds a specified distance. In addition, traffic labels may also be enabled or disabled, regardless of map range.

#### Customizing 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:**

With the PFD in Full Mode, press the **Traffic Map** Softkey.

**Or:**

- 1) On the PFD, press the **PFD Map Settings** Softkey.
- 2) Press the **Map Layout** Softkey.
- 3) Press the **Inset Traffic** Softkey.

**Or:**

- 1) From PFD Home, touch **PFD Map Settings**.
- 2) Touch the **Traffic Inset** Button.

The HSI can also present a version of the Traffic Map. Traffic operating mode information is not present on this map. Refer to the Flight Instruments section for more information about displaying maps on the HSI.

**Enabling the HSI Traffic Map on the PFD:**




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

**Or:**

- 1) On the PFD, press the **PFD Map Settings** Softkey.
- 2) Press the **Map Layout** Softkey.
- 3) Press the **HSI Traffic** Softkey.

## 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	<b>OPERATING</b>	
Standby	<b>STANDBY</b> (also shown in white in center of Traffic Map Pane)	
Failed*	<b>UNIT FAILED</b>	

\* See Table 6-31 for additional failure annunciations.

**Table 6-30 TAS Mode Annunciations**

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
<b>NO DATA</b>	System is not receiving any data from the traffic unit.
<b>DATA FAILED</b>	System is receiving data from the traffic unit, but the unit is reporting a failure.
<b>FAILED</b>	The traffic unit is sending invalid data to the system.

**Table 6-31 TAS Failure Annunciations**

Traffic Status annunciations appear in banners at the lower left corner of navigation map panes.

Traffic Status Banner Annunciation	Description
<b>TA OFF SCALE</b>	A Traffic Advisory is outside the selected display range.* Annunciation is removed when traffic comes within the selected display range.
<b>TA X.X ± XX ↓</b>	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.
<b>TRFC FAIL</b>	The traffic unit has failed (unit is self-reporting a failure or sending incorrectly formatted data).
<b>NO TRFC DATA</b>	Data is not being received from the traffic unit.

\*Shown as symbol on 'Traffic Map' Pane.

\*\*Shown in center of 'Traffic Map' Pane.

**Table 6-32 TAS Traffic Status Annunciations**

## 6.8 ADS-B TRAFFIC



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



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

### 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.

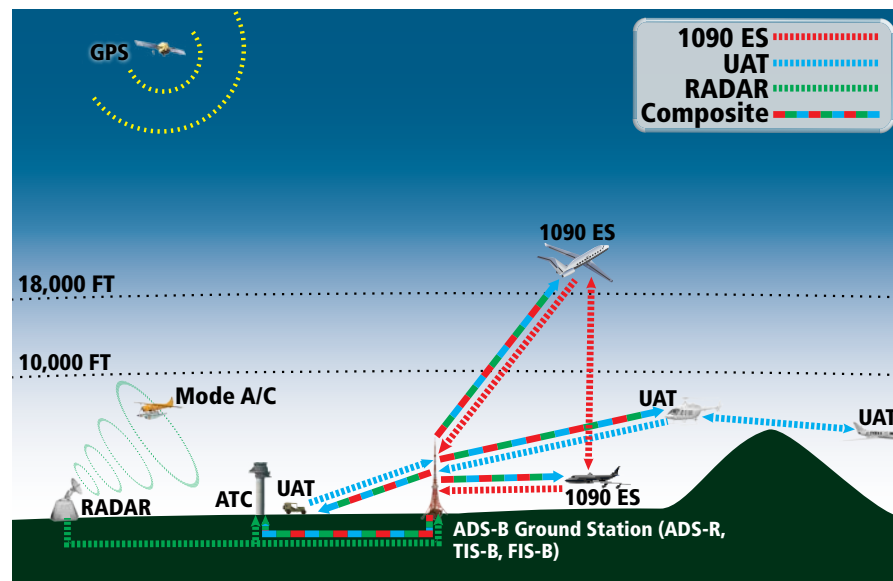


Figure 6-123 ADS-B System

For the purpose of distinguishing between levels of ADS-B service, there are three classifications of aircraft or system capability: ADS-B In, ADS-B Out, and ADS-B participating. ADS-B In refers to the capability to receive ADS-B information. ADS-B Out refers to the capability to transmit ADS-B information. ADS-B participating refers to the capability to both send and receive ADS-B information. Aircraft lacking either ADS-In, ADS-B Out, or both ADS-B capabilities may also be referred to as ADS-B nonparticipating aircraft.

The ADS-B system operates on two frequencies: 1090 MHz and 978 MHz. Both frequencies provide the same traffic information. An aircraft may be ADS-B In, Out, or participating on one or both frequencies, depending on the installed equipment. The 1090 MHz frequency portion of ADS-B is known as 1090 Extended Squitter (1090 ES). The 978 MHz portion of ADS-B is known as Universal Access Transceiver (UAT).

The optional Garmin GTX 33 ES transponder provides ADS-B Out functionality using the 1090 ES data link, however no ADS-B In traffic display are provided by these transponders.

The optional Garmin GTX 345R transponder provides ADS-B Out functions using the 1090 ES data link. It also performs ADS-B In functions using the UAT data link. For the GTX 345, this includes the reception of Flight Information Services-Broadcast (FIS-B) data link weather service, which is 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 provides 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 6-33 Aircraft Available for Viewing by an ADS-B Equipped Own Aircraft**

## ADS-B WITH TAS

When an optional active traffic system, such as a Traffic Advisory System (TAS) is installed and operating with an optional GTX 345R transponder, the transponder receives traffic from the active traffic system and attempts to match (or “correlate”) this traffic with ADS-B traffic the transponder is tracking. When a correlation is made, the only the traffic with the most accurate information is displayed to the flight crew. Any traffic that is not correlated (i.e., only detected by one system but not the other) is also displayed for the flight crew. This correlation of traffic by the transponder improves the accuracy of the traffic displayed, while reducing the occurrence of the same aircraft being displayed twice.



**NOTE:** In certain situations, a single aircraft may be depicted as two aircraft on the display if the system is unable to correlate the traffic. This may occur, for example, when operating on the edges of ATC radar coverage, or the traffic system is receiving intermittent data. This may also occur if TIS-B traffic data does not closely match the traffic data from other sources, especially while the traffic tracked by ATC radar is turning.



**NOTE:** The optional TAS system issues alerts for traffic it is tracking using TAS alerting criteria. The ADS-B system issues alerts for traffic it is tracking using the ADS-B Traffic Advisory System (ATAS) criteria.



## ADS-B TRAFFIC ADVISORY SYSTEM (ATAS)

ADS-B Traffic Advisory System (ATAS) is an alerting algorithm which provides ADS-B traffic alerts to the flight crew which are similar in nature to the TAS Traffic system discussed previously.

When a TA occurs, the system displays an amber 'TRAFFIC' annunciation and provides a voice alert is "Traffic", followed by additional voice information about the bearing, relative altitude, and approximate distance from the intruder that caused the TA. The own aircraft altitude above terrain determines the sensitivity of the ATAS algorithm to minimize nuisance alerts to the flight crew.



**NOTE:** The system mutes TA voice alerts from ADS-B sources when own aircraft is below 400 feet AGL.

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 6-34 ATAS Alerting Thresholds for ADS-B Traffic**

## AIRBORNE AND SURFACE APPLICATIONS

The optional GTX 345R can help the pilot visually acquire traffic both in the air and on-the-ground. There are two ADS-B applications or modes: Airborne Situational Awareness (AIRB) and Surface Situational Awareness (SURF). The system automatically selects the appropriate application based on conditions.

The AIRB application is on when the aircraft is more than five NM and 1,500 feet above the nearest airport. When the AIRB application is active, the system only displays traffic which is airborne.

The SURF application is on when the aircraft is within five NM and less than 1,500 feet above field elevation. When the SURF application is on, the system displays airborne and on the ground traffic. At a Traffic Map Pane range of one NM or less, the airport environment (including taxiways and runways) appears in addition to traffic. The airport displays are derived from the SafeTaxi database. Refer to the Additional Features section for more information about SafeTaxi displays.



**NOTE:** Do not rely on the solely on the traffic display to determine the runway alignment of traffic, especially when runways are in close proximity to each other.

Due to the varying precision of the data received via ADS-B, ADS-R, and TIS-B services, not all traffic symbols may not be depicted on the traffic display. Because higher data precision is required for traffic to be displayed in the SURF environment, some traffic eligible for AIRB will not be displayed while SURF is on. Availability for AIRB and SURF is depicted on the ADS-B Status Screen, discussed later in this section.

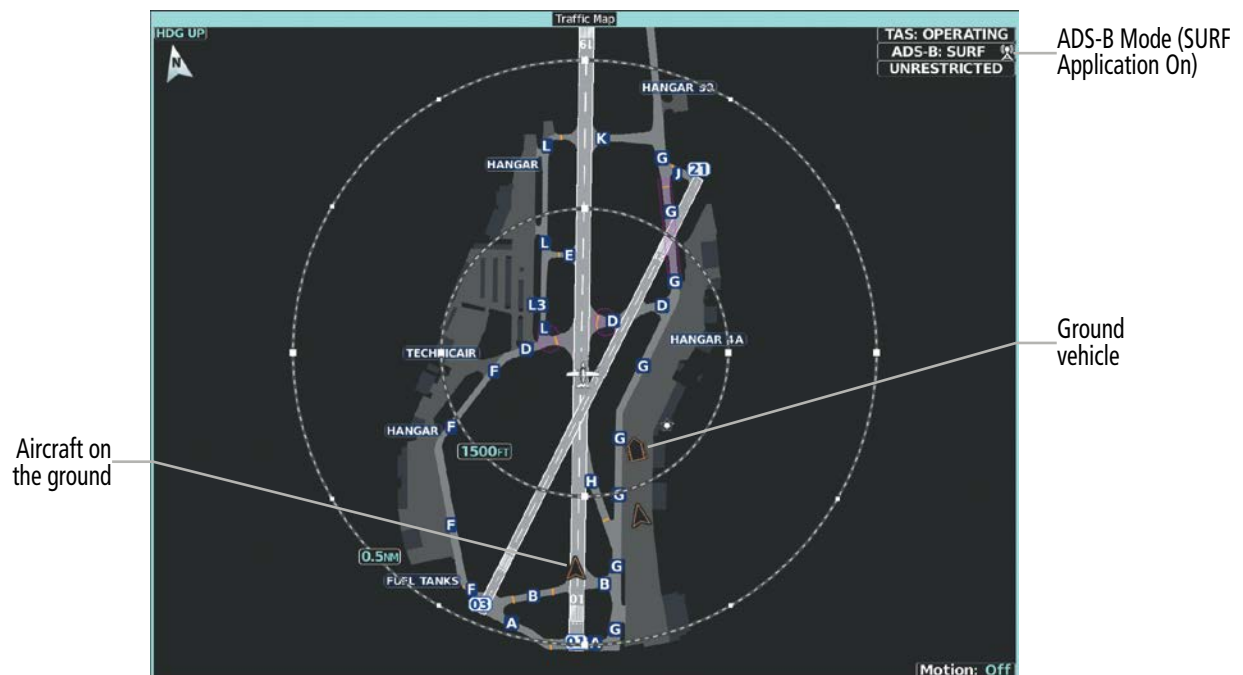


Figure 6-124 'Traffic Map' Pane with SURF Mode On



**NOTE:** Refer to the previous traffic sections in this Pilot's Guide for a table of traffic symbols the system can display.

## OPERATION

## TRAFFIC MAP PANE

The 'Traffic Map' Pane shows surrounding traffic data in relation to the aircraft's current position and altitude, without basemap clutter. Aircraft orientation is always heading up unless there is no valid heading. Map range is adjustable with the lower knob. Rings denote the map range.

The traffic mode and altitude mode are annunciated in the upper right corner of the pane.



Figure 6-125 '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.

## ALTITUDE RANGE

The flight crew can select the volume of airspace in which other Non-Threat and Proximity Advisory 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:

1) From MFD Home, touch **Map > Map Selection > Map Settings > Traffic Settings** Button.

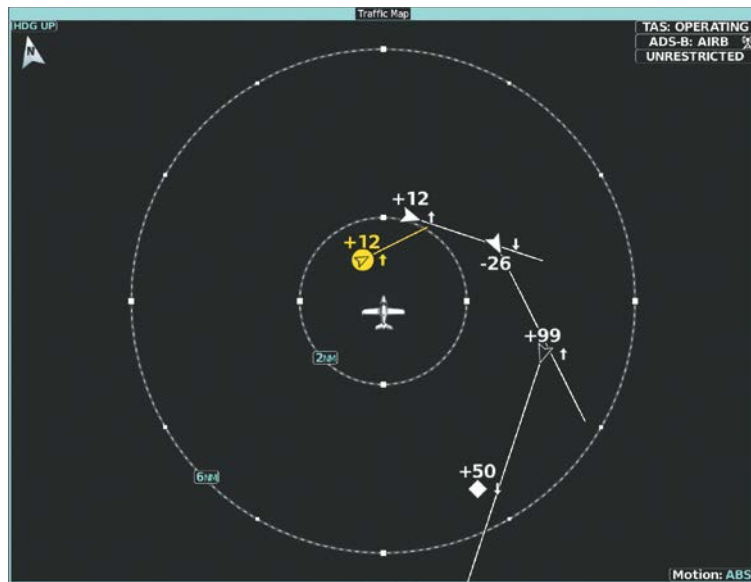
2) Touch the **Altitude Range** Button:

3) Touch one of the following buttons from the list:

- **Unrestricted:** All traffic is displayed from 9900 feet above and 9900 feet below the aircraft.
- **Above:** Displays non-threat and proximity traffic from 9900 feet above the aircraft to 2700 feet below the aircraft. Typically used during climb phase of flight.
- **Normal:** Displays non-threat and proximity traffic from 2700 feet above the aircraft to 2700 feet below the aircraft. Typically used during enroute phase of flight.
- **Below:** Displays non-threat and proximity traffic from 2700 feet above the aircraft to 9900 feet below the aircraft. Typically used during descent phase of flight.

## 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 Selected

Figure 6-126 'Traffic Map' Pane with Absolute Motion Vectors Enabled



Relative Motion  
Vector Selected

Figure 6-127 '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**.

## TRAFFIC MAP DISPLAY RANGE

The display range on the 'Traffic Map' Pane can be changed at any time. Map range is adjustable with the **Joystick**, and rings on the map denote the ranges.

### Changing the display range on the Traffic Map Pane:

- 1) Turn the **Joystick**.
- 2) The following range options are available:
  - 750 ft.
  - 750 ft and 1500 ft.
  - 1500 ft and 0.5 nm.
  - 0.5 nm and 1 nm.
  - 1 nm and 2 nm.
  - 2 and 6 nm.
  - 6 and 12 nm.
  - 12 and 24 nm.
  - 24 and 40 nm.



**NOTE:** ADS-B traffic can be displayed as an overlay to navigation maps. Refer to the previous TAS discussion for information about these additional traffic displays.

## ADDITIONAL TRAFFIC DISPLAYS

The 'Traffic Map' Pane can display additional information for a selected aircraft symbol. This may include the aircraft tail number/Flight ID, type of aircraft (e.g., glider, small/medium/large aircraft, service vehicle, unmanned airborne vehicle (UAV), course, track, groundspeed, and other information.

Traffic information is also displayed on the PFD when the optional Garmin Synthetic Vision Technology (SVT) system is installed and enabled. See the Flight Instruments Section for more information about Garmin SVT.






### Showing additional traffic information:

- 1) From 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.



## 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	<b>ADS-B: AIRB</b>	None	
ADS-B Operating in Surface Mode	<b>ADS-B: SURF</b>	None	
ADS-B Traffic Off	<b>ADS-B: OFF</b>	<b>ADS-B TRFC OFF</b>	
ADS-B Traffic Not Available	<b>ADS-B: N/A</b>	<b>ADS-B TRFC N/A</b>	
ADS-B Failed*	<b>ADS-B: FAIL</b>	<b>ADS-B TRFC FAIL</b>	

\* See Table 6-38 for additional failure annunciations.

Table 6-35 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. A white-X over this icon indicates reception of ADS-B services is unavailable.



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 6-36 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
<b>NO DATA</b>	Data is not being received from the traffic unit.
<b>DATA FAILED</b>	Data is being received from the traffic unit, but the unit is self-reporting a failure.
<b>FAILED</b>	Incorrect data format received from the traffic unit.

Table 6-37 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
<b>TA OFF SCALE</b>	A Traffic Advisory is outside the selected display range.* Annunciation is removed when traffic comes within the selected display range.
<b>TA X.X ± XX ↑</b>	System cannot determine bearing of Traffic Advisory.** Annunciation indicates distance in nm, altitude separation in hundreds of feet, and altitude trend arrow (climbing/descending).
<b>TRFC FAIL</b>	Traffic unit has failed (unit is self-reporting a failure or sending incorrectly formatted data).
<b>NO TRFC DATA</b>	Data is not being received from the traffic unit.

\*Shown as symbol on 'Traffic Map' Pane.

\*\*Shown in center of 'Traffic Map' Pane.

**Table 6-38 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 6-128 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 6-39 ADS-B Status Screen Messages for ADS-B Traffic**

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## 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:** A failure of the primary (#1) GIA 63W Integrated Avionics Unit (IAU) results in loss of the flight director. Any IAU failure results in loss of the autopilot.

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 1200W Flight Display (3)
- GIA 63W Integrated Avionics Unit (2)
- GMC 710 AFCS Controller (1)
- GSM 86 Servo Gearbox (4)
- GSA 81 Servo Actuator (4) (Pitch, Roll, Yaw, Pitch-Trim)
- GTA 82 Trim Adapter (1) (Yaw-Trim)

The AFCS can be divided into these main operating functions:

- **Flight Director (FD)** — This aircraft is equipped with dual flight directors (i.e., FD 1 and FD 2). Each flight director can be selected to operate on its respective PFD. The Garmin AFCS flight director function can be coupled to either the pilot-side or copilot-side PFD data. The **XFR** Key selects the PFD source for the flight director. Commands for the selected flight director source are displayed on both PFDs and 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, roll, and pitch-trim servos, and within the yaw-trim adapter. It provides automatic flight control in response to flight director steering commands, Attitude and Heading Reference System (AHRS) attitude and rate information, and airspeed.
- **Yaw Damper (YD)** — The yaw servo provides Dutch roll damping and turn coordination in response to yaw rate, roll angle, lateral acceleration, and airspeed.
- **Manual Electric Pitch Trim (MEPT)** — The pitch trim system provides manual electric pitch trim capability.
- **Manual Electric Yaw Trim (MEYT)** — The yaw trim adapter provides manual electric yaw trim capability when the autopilot is not engaged.

## BASIC AUTOPILOT OPERATION

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This section provides an overview for autopilot engagement and disengagement. A more detailed description follows in Section 7.5.

- **Autopilot Engagement** — The autopilot may be engaged by pushing the **AP** Key on the AFCS Controller. Annunciations regarding the engagement are indicated on the PFDs. Engaging the autopilot also engages the yaw damper.
- **Autopilot Engagement with Flight Director Off** — Upon engagement, the autopilot will be set to hold the current attitude of the airplane, if the flight director was not previously on. In this case, 'PIT' and 'ROL' will be annunciated.
- **Autopilot Engagement with Flight Director On** — If the flight director is on, the autopilot will smoothly pitch and roll the airplane to capture the FD command bars. The prior flight director modes remain unchanged.
- **Autopilot Disengagement** — The most common way to disconnect the autopilot is to press and release the **AP DISC** Switch, which is located on the control wheel. When disengaged an autopilot disconnect tone will be heard and annunciated on the PFDs until the disconnect is acknowledged via a second press of the **AP DISC** Switch. Other ways to disconnect the autopilot include:
  - » Pressing the **AP** Key on the AFCS Controller
  - » Pressing the **GA** Switch (located on the throttle lever)
  - » Operating the **MEPT** Switch (located on the control wheel)
  - » Pulling the autopilot circuit breaker

In the event of unexpected autopilot behavior, pressing and holding the **AP DISC** Switch will disconnect the autopilot and remove all power to the servos.

## AFCS PREFLIGHT TEST (PFT)

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The AFCS Preflight Test is initiated upon system startup. Evidence of this test is indicated by a white 'PFT' annunciation.



**NOTE:** During system PFT an "autopilot" aural alert may be observed with the autopilot servos circuit breaker pulled.

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## 7.2 AFCS CONTROLS

### AFCS CONTROLLER

The AFCS Controller has the following controls:

- ① **HDG** Key Selects/deselects Heading Select Mode
- ② **APR** Key Selects/deselects Approach Mode
- ③ **NAV** Key Selects/deselects Navigation Mode
- ④ **FD** Key Activates/deactivates the flight director only
  - Pressing once turns on the selected flight director in the default vertical and lateral modes
  - Pressing again deactivates the flight director and removes the command bars; If the autopilot is engaged, the key is disabled
- ⑤ **XFR** Key Transfers between the active flight director and standby flight director
- ⑥ **ALT** Key Selects/deselects Altitude Hold Mode
- ⑦ **VS** Key Selects/deselects Vertical Speed Mode
- ⑧ **FLC** Key Selects/deselects Flight Level Change Mode
- ⑨ ⑬ **CRS** Knobs Adjusts the Selected Course in 1° increments on the Horizontal Situation Indicator (HSI) of the corresponding PFD
  - Press to re-center the Course Deviation Indicator (CDI) and return course pointer directly TO the bearing of the active waypoint/station
- ⑩ **SPD** Key Toggles the Airspeed Reference units between IAS and Mach
- ⑪ **UP/DN** Wheel Adjusts the reference in Pitch Hold, Vertical Speed, and Flight Level Change modes
- ⑫ **VNV** Key Selects/deselects VNAV Path Descent Mode for Vertical Navigation flight control
- ⑬ **ALT SEL** Knob Controls the Selected Altitude in 100-ft increments (a finer resolution of one foot is available under approach conditions)
- ⑭ **YD** Key Engages/disengages the yaw damper
- ⑮ **AP** Key Engages/disengages the autopilot
- ⑯ **BANK** Key Manually selects/deselects Low Bank Mode
- ⑰ **BC** Key Selects/deselects Backcourse Mode
- ⑱ **HDG** Knob Adjusts the Selected Heading and bug in 1° increments on the HSI (both PFDs)
  - Press to synchronize the Selected Heading to the current heading

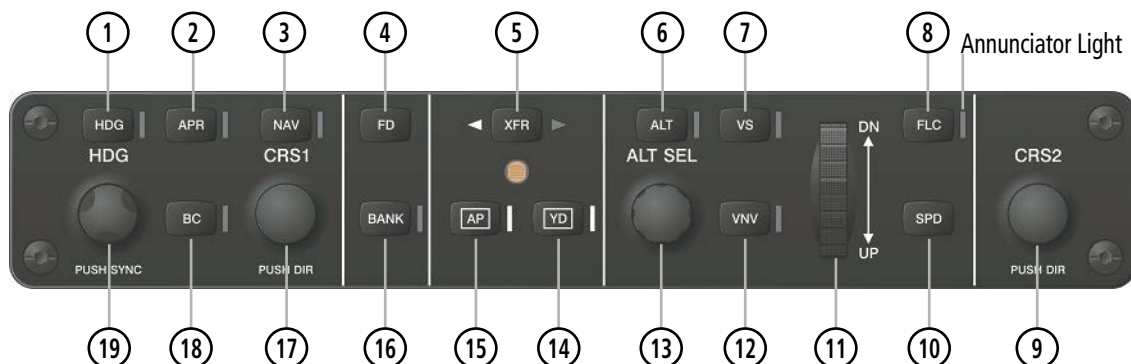


Figure 7-1 GMC 710 AFCS Controller



## ADDITIONAL AFCS CONTROLS

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The following AFCS controls are located separately from the AFCS Controller:

<b>AP DISC</b> Switch (Autopilot Disconnect)	Disengages the autopilot, yaw damper, and flight director and interrupts pitch trim operation <ul style="list-style-type: none"><li>- An <b>AP/TRIM DISC</b> Switch is located on each control wheel.</li><li>- This switch may be used to acknowledge an autopilot disconnect alert and mute the associated aural alert.</li></ul>
<b>CWS</b> Button (Control Wheel Steering)	While pressed, allows manual control of the aircraft while the autopilot is engaged and synchronizes the flight director's command bars with the current aircraft pitch (if not in a Vertical Navigation Mode (e.g., Glideslope Mode or Glidepath Mode) and roll (if in Roll Hold Mode) <ul style="list-style-type: none"><li>- A <b>CWS</b> Button is located on each control wheel.</li><li>- Upon release of the <b>CWS</b> Button, the flight director may establish new pitch and roll references, depending on the current vertical and lateral modes. CWS operation details are discussed in the respective mode sections of this manual.</li></ul>
<b>GA</b> Switch (Go Around)	Selects flight director Takeoff Mode (on ground) or Go Around Mode (in air) <ul style="list-style-type: none"><li>- If an approach procedure is loaded, this switch also activates the missed approach when the selected navigation source is FMS or when the navigation source is VOR/LOC and a valid frequency has been tuned.</li><li>- The <b>GA</b> Switch is located on the throttle.</li></ul>
<b>MEPT/MEYT</b> Switch	This aircraft uses a four direction switch to command manual electric pitch trim and yaw trim. A <b>MEPT/MEYT</b> Switch is located on each control wheel. The two components of this switch are discussed below.
<b>MEPT</b> Switch (Manual Electric Pitch Trim)	Pushing down on the <b>MEPT</b> Switch and operating the switch forward and backward adjusts pitch trim down (forward) and up (rearward) respectively. <ul style="list-style-type: none"><li>- Pushing the switch in either direction disengages the autopilot, if currently engaged, but does not affect yaw damper operation.</li></ul>
<b>MEYT</b> Switch (Manual Electric Yaw Trim)	Operating the switch left and right adjusts yaw trim left or right.
<b>LVL</b> Switch	Engages the autopilot (if the autopilot is disengaged and the aircraft is within the autopilot engagement limitations) in level vertical and lateral modes <ul style="list-style-type: none"><li>- The LVL Button is located above the AFCS Controller</li></ul>

## 7.3 FLIGHT DIRECTOR OPERATION

The flight director function provides pitch and roll commands to the AFCS and displays them on the PFDs. With the flight director active, the aircraft can be hand-flown to follow the path shown by the command bars. Maximum commanded pitch (-15°, +25°) and roll (25°) angles, vertical acceleration, and roll rate are limited to values established during AFCS certification. The flight director also provides commands to the autopilot.

### ACTIVATING THE FLIGHT DIRECTOR

An initial press of a key listed in the following table (when the flight director is not active) activates the flight director in the listed modes. The flight director may be turned off and the command bars removed from the display by pressing the **FD** Key again. The **FD** Key is disabled when the autopilot is engaged.

Control Pressed	Modes Selected			
	Lateral		Vertical	
<b>FD</b> Key	Roll Hold (default)	ROL	Pitch Hold (default)	PIT
<b>AP</b> Key	Roll Hold (default)	ROL	Pitch Hold (default)	PIT
<b>CWS</b> Button	Roll Hold (default)	ROL	Pitch Hold (default)	PIT
<b>GA</b> Switch	Roll Hold (default)	TO	Takeoff (on ground)	TO
	Roll Hold (default)	GA	Go Around (in air)	GA
<b>ALT</b> Key	Roll Hold (default)	ROL	Altitude Hold	ALT
<b>VS</b> Key	Roll Hold (default)	ROL	Vertical Speed	VS
<b>VNV</b> Key	Roll Hold (default)	ROL	VNAV Path Tracking*	V PATH
<b>NAV</b> Key	Navigation**	FMS VOR LOC	Pitch Hold (default)	PIT
<b>BC</b> Key	Backcourse***	BC	Pitch Hold (default)	PIT
<b>APR</b> Key	Approach**	FMS VAPP LOC	Pitch Hold (default)	PIT
<b>HDG</b> Key	Heading Select	HDG	Pitch Hold (default)	PIT
<b>LVL</b> Key	Level Mode	LVL	Level Mode	PIT

\* Valid VNAV flight plan must be entered before **VNV** Key press activates flight director. When the **VNV** Key is pressed in conjunction with another mode selection, a 'V' is displayed with the selected mode annunciation.

\*\* The selected navigation receiver must have a valid VOR or LOC signal or active FMS course before **NAV** or **APR** Key press activates flight director.

\*\*\* The selected navigation receiver must have a valid LOC signal before **BC** Key press activates flight director.

**Table 7-1 Flight Director Activation**

## AFCS STATUS BOX

Flight director mode annunciations are displayed on the PFDs when the flight director is active. Flight director selection and autopilot and yaw damper 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.

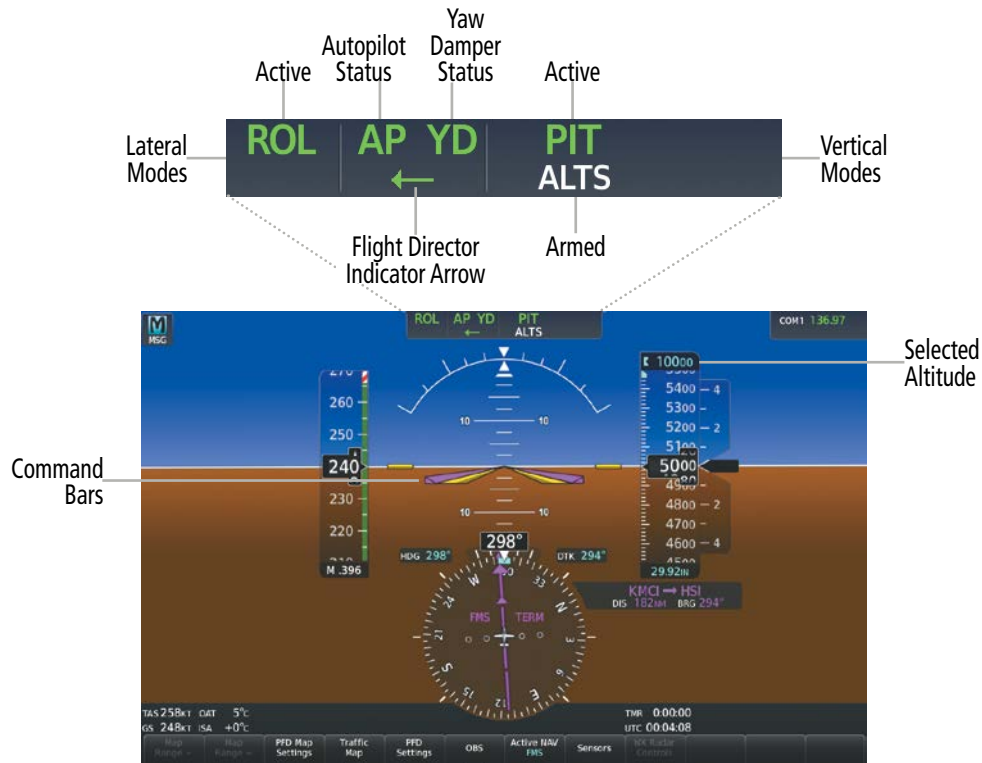


Figure 7-2 PFD AFCS Display

## 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). Mode keys on the AFCS controller are accompanied by annunciator lights which are illuminated when their respective modes are armed or active.

Armed modes are annunciated in white and active in green in the AFCS Status Box. Under normal operation when the flight director is activated by pressing the **FD** Button, the flight director activates the default mode(s) for the axis(es). Automatic transition from armed to active mode is indicated by the white armed mode annunciation moving to the green active mode field and flashing for 10 seconds.

If the information required to compute a flight director mode becomes invalid or unavailable, the flight director automatically reverts to the default mode for that axis. A flashing amber mode annunciation indicates loss of sensor (ADC) or navigation data (VOR, LOC, FMS) required to compute commands. When such a loss occurs, the command bars give guidance to roll the wings level, and then depending on the affected axis, either enters Roll Hold Mode or maintains the pitch angle (enters Pitch Hold Mode). The flashing annunciation stops when the affected mode key is pressed or another mode for the axis is selected. If after 10 seconds no action is taken, the flashing annunciation stops.



Figure 7-3 Loss of VOR Signal

The flight director is automatically disabled if the attitude information required to compute the default flight director modes becomes invalid or unavailable.

## FLIGHT DIRECTOR SELECTION

The AFCS has two flight directors, each operating within an IAU. Only one flight director is active (selected) at a time. Flight directors may be switched by pressing the **XFR** Key. Both PFDs display the selected flight director, indicated by an arrow pointing toward either the pilot or copilot side, in the center of the AFCS Status Box. The annunciator light arrow for the selected flight director is also illuminated beside the **XFR** Key. When the flight directors are switched, the vertical and lateral modes revert to default.



Figure 7-4 Flight Director Selection Indications

## COMMAND BARS

### SINGLE-CUE

Upon activation of the flight director, command bars are displayed in magenta on the PFDs as single cue or dual cue. The aircraft symbol 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.

If the attitude information being sent to the flight director becomes invalid or unavailable, the command bars are removed from the display. The flight director command bars also disappear if the pitch exceeds +30°/-20° or bank exceeds 65°.

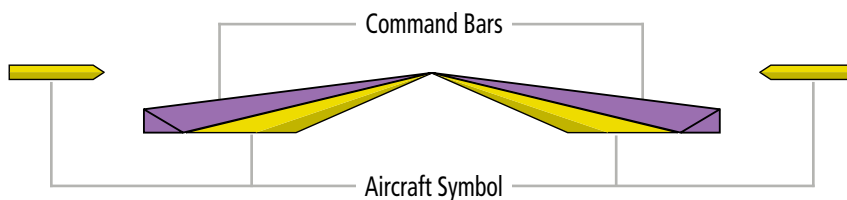
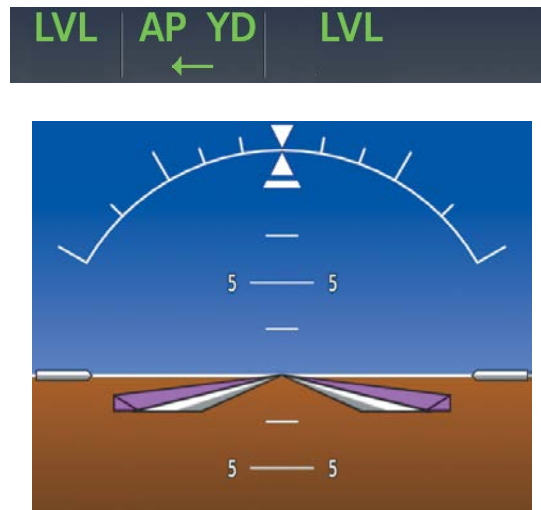


Figure 7-5 Single Cue Command Bars

## LEVEL MODE

Level Mode is a coupled pitch and roll mode and is annunciated as both the vertical and lateral modes when active. Pressing the **LVL** Key engages the autopilot and yaw damper (if the autopilot is disengaged and the aircraft is within the autopilot engagement limitations) 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.

Level mode also becomes active as a function of Electronic Stability and Protection (ESP). Refer to the Additional Features section for a detailed discussion of the ESP feature.



Command Bars Indicate  
Level With Horizon

Figure 7-6 Level Mode Annunciation

## 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 FMS 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, or Flight Level Change Mode. Increments of change and acceptable ranges of values for each of these references using the **UP/DN** Wheel are also listed in the table where applicable. Pressing the **SPD** Key toggles the Airspeed Reference units between IAS and Mach.

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		-15° to +25°	0.5°
Selected Altitude Capture	Captures the Selected Altitude	*	ALTS			
Altitude Hold	Holds current Altitude Reference	<b>ALT</b> Key	ALT	XX,XXX FT		
Vertical Speed	Holds aircraft vertical speed; may be used to climb/descend to the Selected Altitude	<b>VS</b> Key	VS	XXX FPM	-4,000 to +3,000 fpm	100 fpm
Flight Level Change (IAS)	Holds aircraft airspeed (in IAS or Mach) while aircraft is climbing/ descending to the Selected Altitude	<b>FLC</b> Key	FLC	XXX KT	80 to 265 kts	1 kt
Flight Level Change (Mach)				M .xxx	M 0.20 to 0.69	M 0.01

\* *ALTS is armed automatically when the Selected Altitude is to be captured instead of the VNAV Target Altitude.*

**Table 7-2 Flight Director Vertical Modes**

### PITCH HOLD MODE (PIT)

When the flight director is activated (i.e., the **FD** Key is pressed) or switched (the **XFR** Key is pressed), Pitch Hold Mode is selected by default. Pitch Hold Mode is indicated as the active vertical mode by the 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.
- Pressing the **CWS** Button, hand-flying the aircraft to establish a new pitch reference, then releasing the **CWS** Button.

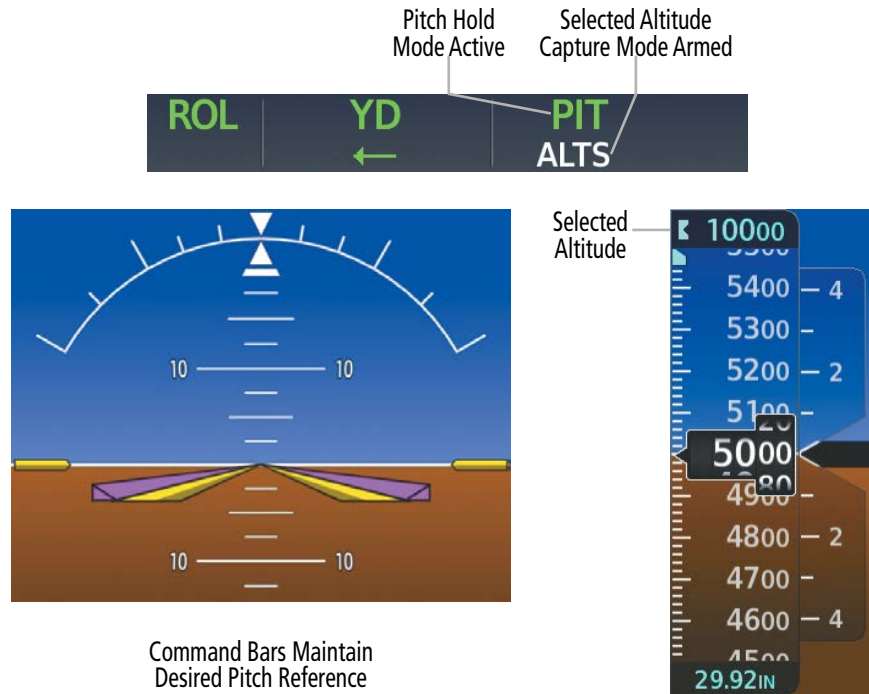


Figure 7-7 Pitch Hold Mode

## SELECTED ALTITUDE CAPTURE MODE (ALTS)

Selected Altitude Capture Mode is automatically armed with activation of the following modes:

- » Pitch Hold
- » Vertical Speed
- » Flight Level Change
- » Takeoff/ Go Around
- » Vertical Path Tracking (if the Selected Altitude is to be captured instead of the VNAV Target Altitude)

The white 'ALTS' annunciation indicates Selected Altitude Capture Mode is armed (see previous figure). The **ALT SEL** Knob is used to set the Selected Altitude (shown above the Altimeter) until Selected Altitude Capture Mode becomes active.

As the aircraft nears the Selected Altitude, the flight director automatically transitions to Selected Altitude Capture Mode with Altitude Hold Mode armed (see following figure). This automatic transition is indicated by the green 'ALTS' annunciation flashing for up to 10 seconds and the appearance of the white 'ALT' annunciation. The Selected Altitude is shown as the Altitude Reference beside the 'ALTS' annunciation.

At 50 feet from the Selected Altitude, the flight director automatically transitions from Selected Altitude Capture to Altitude Hold Mode and holds the Selected Altitude. As Altitude Hold Mode becomes active, the white 'ALT' annunciation moves to the active vertical mode field and flashes green for 10 seconds to indicate the automatic transition.



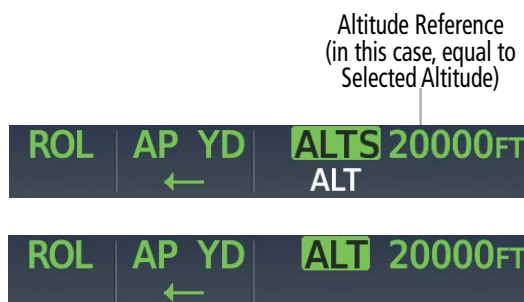


Figure 7-8 Automatic Mode Transitions During Altitude Capture

## CHANGING THE SELECTED ALTITUDE



**NOTE:** Pressing the **CWS** Button while in Selected Altitude Capture Mode does not cancel the mode.



**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)

If Altitude Hold Mode is activated by pressing the **ALT** Key, the flight director maintains the current aircraft altitude (to the nearest ten feet) as the Altitude Reference. The flight director's Altitude Reference, shown in the AFCS Status Box, is independent of the Selected Altitude, displayed above the Altimeter. Altitude Hold Mode active is indicated by a green 'ALT' annunciation in the AFCS Status Box.

Altitude Hold Mode is automatically armed when the flight director is in Selected Altitude Capture Mode (see previous figure). Selected Altitude Capture Mode automatically transitions to Altitude Hold Mode when the altitude error is less than 50 feet. In this case, the Selected Altitude becomes the flight director's Altitude Reference.

## CHANGING THE ALTITUDE REFERENCE



**NOTE:** Turning the **ALT SEL** Knob while in Altitude Hold Mode changes the Selected Altitude, but not the flight director's Altitude Reference, and does not cancel the mode.

With the **CWS** Button pressed, the aircraft can be hand-flown to a new Altitude Reference. When the **CWS** Button is released at the desired altitude, the new altitude is established as the Altitude Reference.

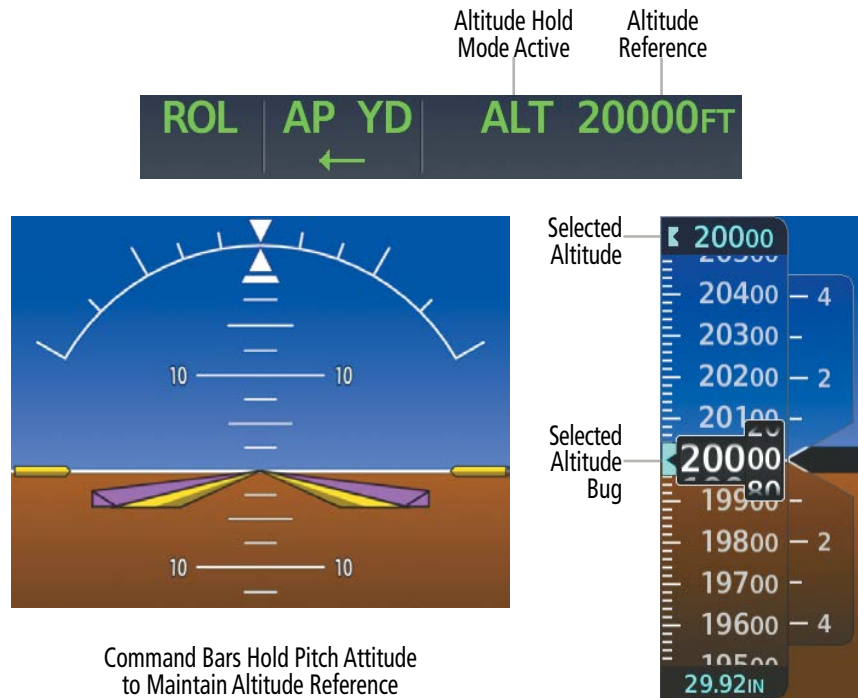


Figure 7-9 Altitude Hold Mode

## VERTICAL SPEED MODE (VS)

In Vertical Speed Mode, the flight director acquires and maintains a Vertical Speed Reference (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 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.
- Pressing the **CWS** Button, hand-flying the aircraft to attain a new Vertical Speed Reference, then releasing the **CWS** Button.

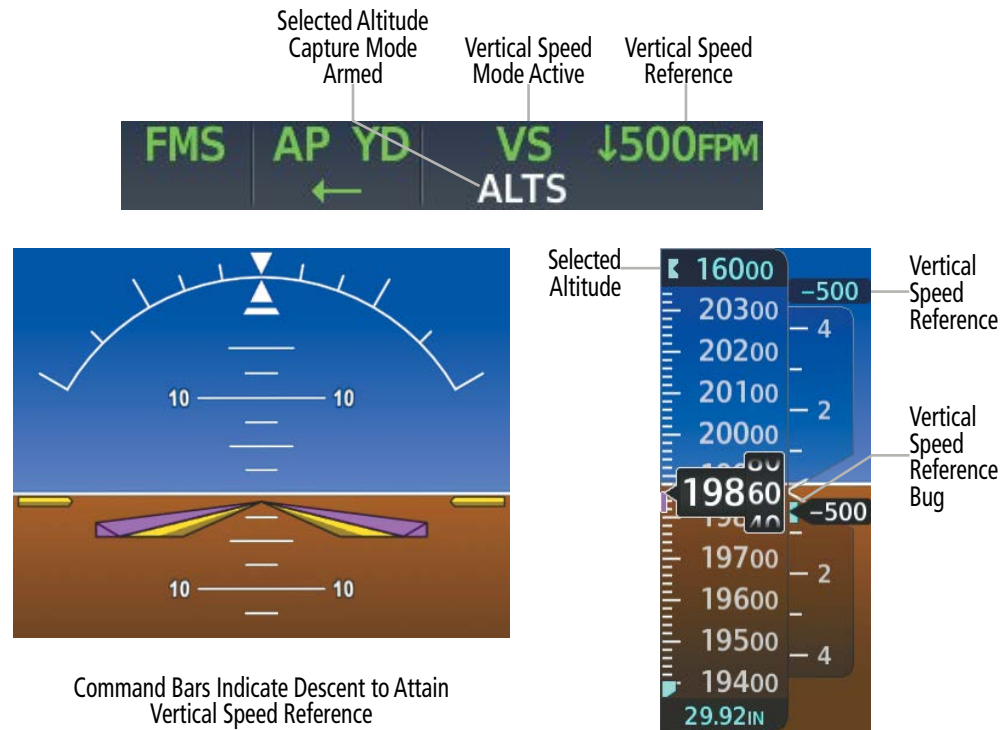


Figure 7-10 Vertical Speed Mode

## 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 current altitude.

The Airspeed Reference is set to the current airspeed upon mode activation. Flight Level Change Mode is indicated by a green 'FLC' annunciation in the AFCS Status Box. 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.

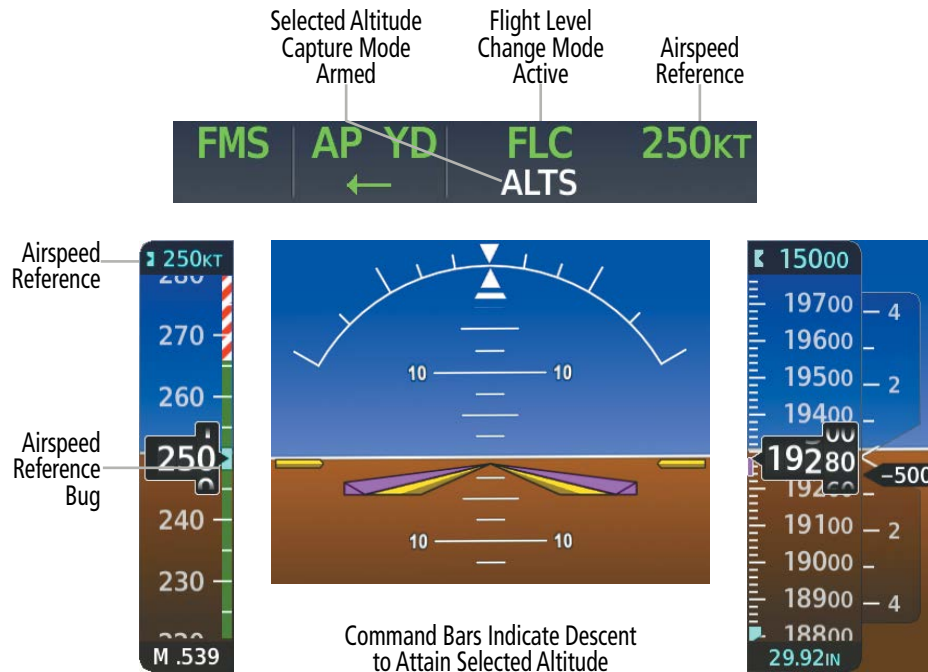


Figure 7-11 Flight Level Change Mode

### CHANGING THE AIRSPEED REFERENCE (FLC MODE)

The Airspeed Reference (shown in both the AFCS Status Box and above the Airspeed Indicator) may be adjusted by:

- Using the NOSE UP/DN Wheel
- Pressing the CWS Button, hand-flying the aircraft to attain a new Airspeed Reference, then releasing the CWS Button



**NOTE:** If the Selected Altitude is reached during CWS maneuvering, the Altitude Reference is not changed. To adjust the Altitude Reference in this case, the CWS Button must be pressed again after the Selected Altitude is reached.

Airspeed Reference units can be manually toggled between IAS and Mach units by pressing the **SPD** Button. 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.

## LATERAL MODES

The following table relates each AFCS lateral mode to its respective control and annunciation.



**NOTE:** The AFCS may generate a lower bank angle than the maximum roll command limit in degrees indicated in the following table by the amount needed to produce a turn rate equal to or less than standard rate.

Lateral Mode	Description	Control	Annunciation	Maximum Roll Command Limit
Roll Hold	Holds the current aircraft roll attitude or rolls the wings level, depending on the commanded bank angle	(default)	ROL	25°
Low Bank	Limits the maximum commanded roll angle	<b>BANK</b> Key	*	15°
Heading Select **	Captures and tracks the Selected Heading	<b>HDG</b> Key	HDG	25°
Navigation Mode				
FMS**	Captures and tracks the selected navigation source (FMS, VOR, LOC)	<b>NAV</b> Key	FMS	25°
VOR Enroute/Capture/Track**			VOR	25° Capture 10° Track
LOC Capture/Track (No Glideslope)			LOC	25° 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.

\* 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.

\*\* The Heading, Navigation FMS and Navigation VOR mode maximum roll command limit will be limited to the Low Bank mode value if it is engaged.

**Table 7-3 Flight Director Lateral Modes**

The **CWS** Button does not change lateral references for Heading Select, Navigation, Backcourse, or Approach Modes. The autopilot guides the aircraft back to the Selected Heading/Course upon release of the **CWS** Button.

## ROLL HOLD MODE (ROL)



**NOTE:** If Roll Hold Mode is activated as a result of a mode reversion, the flight director rolls the wings level.

When the flight director is activated, 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 7-12 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

### CHANGING THE ROLL REFERENCE

The roll reference can be changed by pressing the **CWS** Button, establishing the desired bank angle, then releasing the **CWS** Button.

### LOW BANK MODE

When in Low Bank Mode, the flight director limits the maximum commanded roll angle to 15°. Low bank arc limits are displayed in green along the Roll Scale as shown in the following figure.

Low Bank Mode can be manually selected/deselected by pressing the **BANK** Key while in Heading Select or Navigation Modes (FMS and VOR). Low Bank Mode is activated automatically climbing above 25,000 ft and deactivated when descending below 25,000 ft. The annunciator light next to the **BANK** Key illuminates while Low Bank Mode is selected.

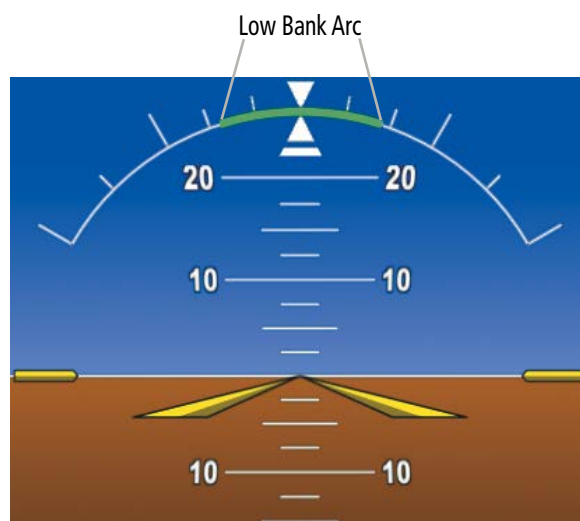


Figure 7-13 Low Bank Mode Limits

## HEADING SELECT MODE (HDG)

Heading Select Mode is activated by pressing the **HDG** Key. Heading Select Mode acquires and maintains the Selected Heading. The Selected Heading is shown by a cyan bug on the HSI and in the box to the upper left of the HSI.

### CHANGING THE SELECTED HEADING

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.

Pressing the **CWS** Button and hand-flying the aircraft does not change the Selected Heading. The flight director/autopilot guides the aircraft back to the Selected Heading upon release of the **CWS** Button.

Turns are commanded in the same direction as Selected Heading Bug movement, even if the bug is turned more than 180° from the present heading (e.g., a 270° turn to the right). However, Selected Heading changes of more than 330° at a time result in turn reversals.

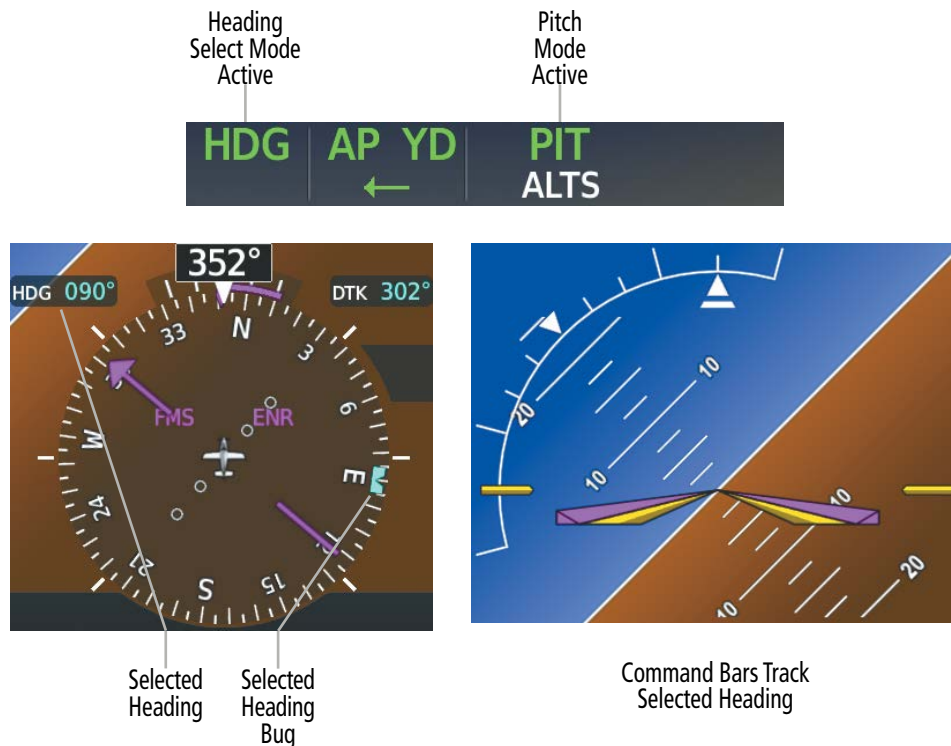


Figure 7-14 Heading Select Mode



## NAVIGATION MODE



**NOTE:** The selected navigation receiver must have a valid VOR or LOC signal or active FMS course for the flight director to enter Navigation Mode.

Pressing the **NAV** Key selects Navigation Mode. Navigation Mode acquires and tracks the selected navigation source (FMS, VOR, LOC). The flight director follows FMS roll steering commands when FMS is the selected navigation source. When the navigation source is VOR or LOC, the flight director creates roll steering guidance from the Selected Course and deviation. Navigation Mode can also be used to fly non-precision FMS and LOC approaches where glideslope capture is not required.

If the Course Deviation Indicator (CDI) shows greater than one dot when the **NAV** Key is pressed, the selected mode is armed. If the CDI is less than one 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 7-15 FMS Navigation Mode Armed**

When the CDI has automatically switched from FMS to LOC during a LOC/ILS approach, FMS Navigation Mode remains active and provides FMS steering guidance until the localizer signal is captured. LOC Navigation Mode is armed automatically when the navigation source switch takes place if the APR Key is not pressed prior to the automatic source switch.

If the following occurs, the flight director reverts to Roll Hold Mode (wings rolled level):

- » Different VOR tuned while in VOR Navigation Mode (VOR Navigation Mode reverts to armed)
- » Navigation source manually switched (with the CDI Softkey)
- » During a LOC/ILS approach, FMS Navigation Mode is active and the FAF is crossed after the automatic navigation source transition from FMS to LOC

### CHANGING THE SELECTED COURSE

If the navigation source is VOR or LOC, or OBS Mode has been enabled when using FMS, the Selected Course is controlled using the **CRS** Knob corresponding to the selected flight director (**CRS1** for the pilot side, **CRS2** for the copilot side).

Pressing the **CWS** Button and hand-flying the aircraft does not change the Selected Course while in Navigation Mode. The autopilot guides the aircraft back to the Selected Course (or FMS flight plan) when the **CWS** Button is released.

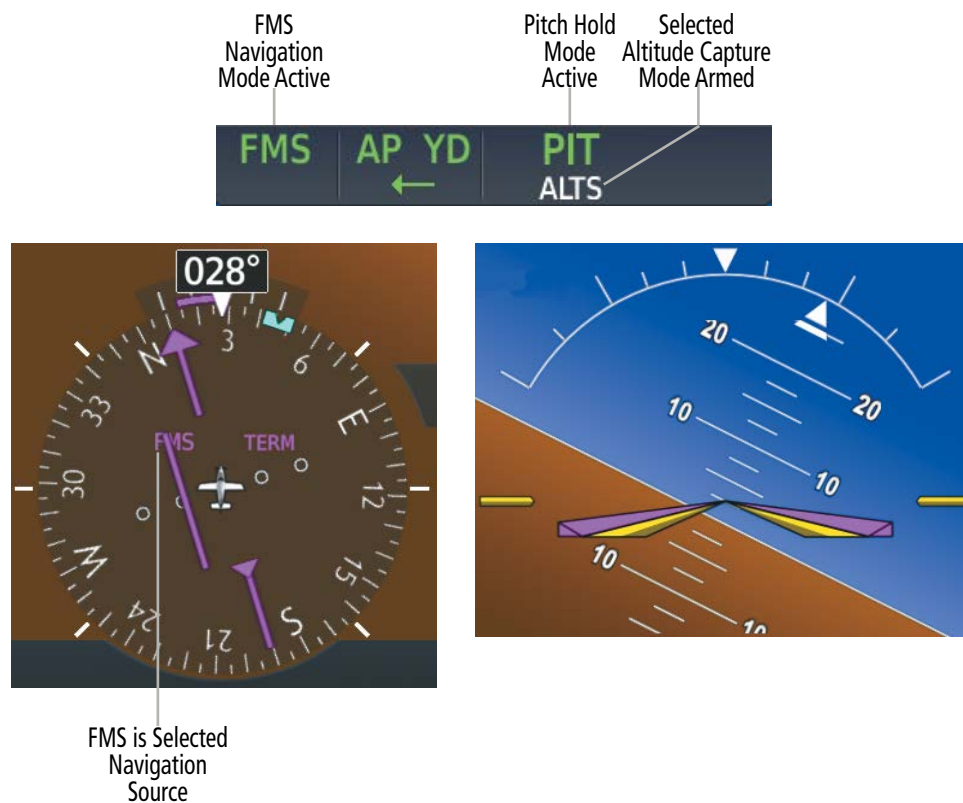


Figure 7-16 Navigation Mode

## 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					
Vertical Path Tracking	Captures and tracks descent legs of an active vertical profile	VNV Key	V PATH		
VNAV Target Altitude Capture	Captures the Vertical Navigation (VNAV) Target Altitude	*	ALTV		
VOR Approach Mode					
VOR Arm/Capture/Track	Captures and tracks VOR navigation source	APR Key	VAPP	25° Capture 10° Track	
FMS Approach Mode					
FMS Arm/Capture/Track	Captures and tracks FMS navigation source	APR Key	FMS	25°	
Glidepath Mode	Captures and tracks the SBAS glidepath on approach		GP		
LOC Approach Mode					
LOC Arm/Capture/Track	Captures and tracks the LOC navigation source	APR Key	LOC	25° Capture 10° Track	
Glideslope	Captures and tracks the ILS glideslope on approach		GS		
Backcourse Arm/Capture/Track	Captures and tracks the LOC source for backcourse approaches	BC Key	BC	25° Capture 10° Track	
Additional Modes					
Takeoff	Commands a constant pitch angle on the ground in preparation for takeoff	GA Switch	TO	0°	
Go Around	Disengages the autopilot and commands a constant pitch angle and wings level in the air		GA	0°	

\* ALTV is armed automatically under V PATH when VNAV Target Altitude is to be captured instead of Selected Altitude.

**Table 7-5 Flight Director Combination Modes**

## VERTICAL NAVIGATION MODES (V)



**NOTE:** VNAV is disabled when parallel track or dead reckoning mode is active.



**NOTE:** The Selected Altitude takes precedence over any other vertical constraints.

Vertical Navigation (VNV) flight control is available for terminal and descent operations when VNV flight planning is available. Conditions for availability include, but are not limited to:

- » The selected navigation source is FMS
- » A 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 or track angle error is within certain limits.

The flight director may be armed for vertical navigation at any time, but no target altitudes are captured during a climb or cruise. The appropriate VNV flight control modes are sequenced by the flight director to follow the path defined by the vertical profile. Upon reaching the last waypoint in the VNV flight plan, the flight director transitions to Altitude Hold Mode and cancels any armed VNV modes.



Figure 7-17 VNAV Annunciations

## VERTICAL PATH TRACKING MODE (V PATH)



**NOTE:** If another vertical mode key is pressed while Vertical Path Tracking Mode is selected, Vertical Path Tracking Mode reverts to armed.



**NOTE:** Pressing the **CWS** Button while Vertical Path Tracking Mode is active does not cancel the mode. The autopilot guides the aircraft back to the descent path upon release of the **CWS** Button.

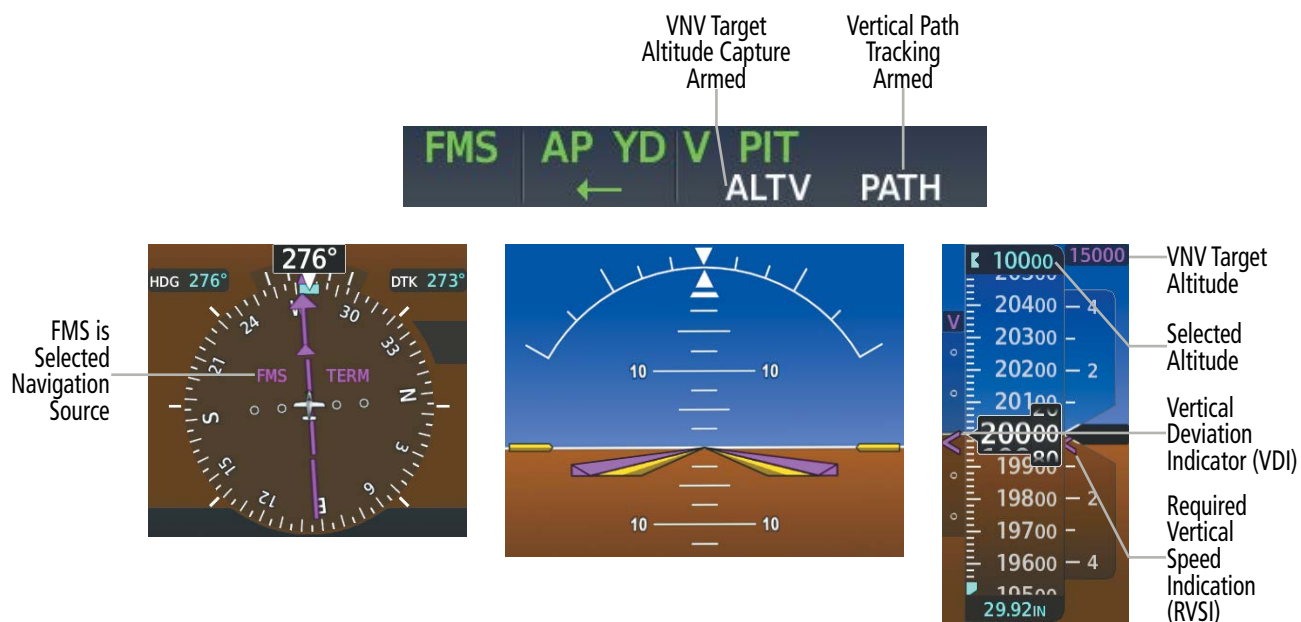
When a vertical profile (VNV flight plan) is active and the **VNV** Key is pressed, Vertical Path Tracking Mode is armed in preparation for descent path capture. 'V PATH' (or 'V' when Glidepath or Glideslope Mode is concurrently armed) is annunciated in white in addition to previously armed modes. If applicable, the appropriate altitude capture mode is armed for capture of the next VNV Target Altitude (ALTV) or the Selected Altitude (ALTS), whichever is greater.

Prior to descent path interception, the Selected Altitude must be set below the current aircraft altitude by at least 75 feet. For the flight director to transition from Altitude Hold to Vertical Path Tracking Mode, acknowledgment is required within five minutes of descent path interception by:

- Pressing the **VNV** Key
- Adjusting the Selected Altitude

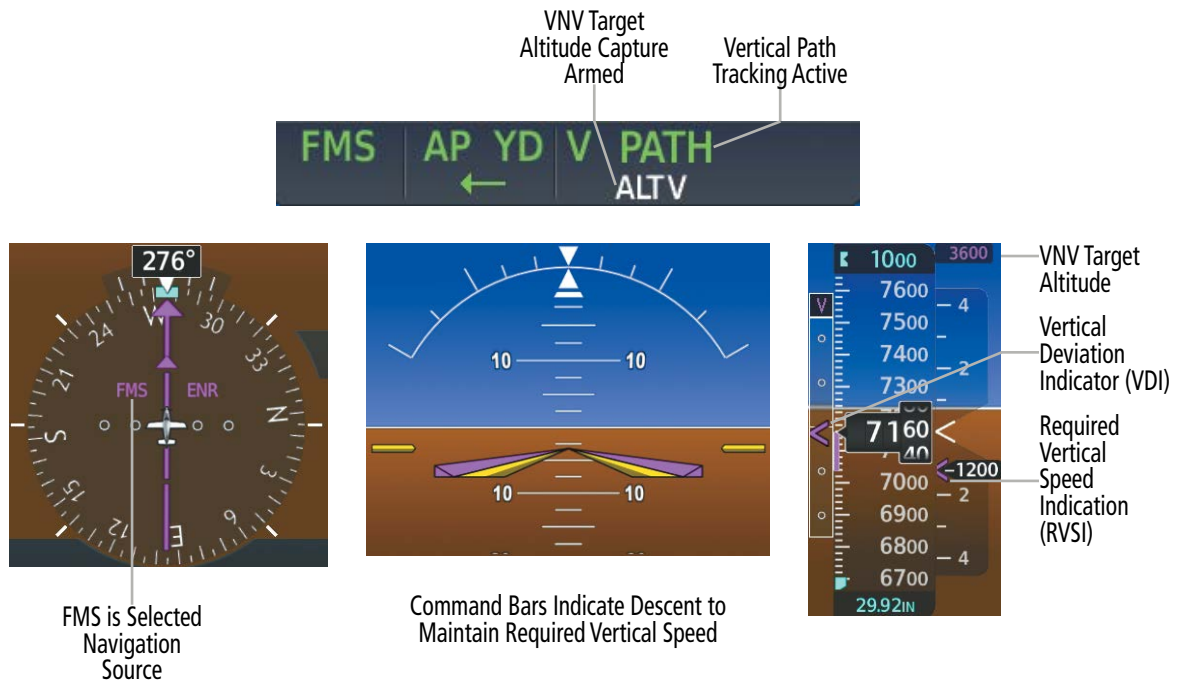
If acknowledgment is not received within 1 minute of descent path interception, the white 'V PATH' annunciation starts to flash. Flashing continues until acknowledged or the descent path is intercepted. If the descent is not confirmed by the time of interception, Vertical Path Tracking Mode remains armed and the descent is not captured.

In conjunction with the "TOD [top of descent] within 1 minute" annunciation in the PFD Navigation Status Box and the "Vertical track" voice message, VNV indications (VNV Target Altitude, vertical deviation, and vertical speed required) appear on the PFDs in magenta (see following figure).



**Figure 7-18 Vertical Path Tracking Mode**

When a descent leg is captured (i.e., vertical deviation becomes valid), Vertical Path Tracking becomes active and tracks the descent profile (see following figure). An altitude capture mode ('ALTS' or 'ALTV') is armed as appropriate.



**Figure 7-19 Vertical Path Tracking Mode**

If the barometric setting is adjusted while Vertical Path Tracking is active, the flight director increases/decreases the descent rate by up to 500 fpm to re-establish the aircraft on the descent path (without commanding a climb). Adjusting the altimeter barometric setting creates discontinuities in VNV vertical deviation, moving the descent path. For large adjustments, it may take several minutes for the aircraft to re-establish on the descent path. If the change is made while nearing a waypoint with a VNV Target Altitude, the aircraft may not re-establish on the descent path in time to meet the vertical constraint.

### Automatic Reversion to Pitch Hold Mode

Several situations can occur while Vertical Path Tracking Mode is active which cause the flight director to revert to Pitch Hold Mode:

- ➔ Vertical deviation exceeds 200 feet during an overspeed condition.
- ➔ Vertical deviation experiences a discontinuity that both exceeds 200 feet in magnitude and results in the vertical deviation exceeding 200 feet in magnitude. Such discontinuities are usually caused by flight plan changes that affect the vertical profile.
- ➔ Vertical deviation becomes invalid (the Vertical Deviation Indicator is removed from the PFD).
- ➔ A display enters Reversionary Mode (this does not apply to an active vertical direct-to).

Unless VNV is disabled, Vertical Path Tracking Mode and the appropriate altitude capture mode become armed following the reversion to Pitch Hold Mode to allow for possible profile recapture.

### Non-Path Descents

Pitch Hold, Vertical Speed, and Flight Level Change modes can also be used to fly non-path descents while VNV flight control is selected. If the **VS** or **FLC** Key is pressed while Vertical Path Tracking Mode is selected, Vertical Path Tracking Mode reverts to armed along with the appropriate altitude capture mode to allow profile re-capture.



Figure 7-20 Vertical Path Tracking Mode

To prevent immediate profile re-capture, the following must be satisfied:

- ➔ At least 10 seconds have passed since the non-path transition was initiated
- ➔ Vertical deviation from the profile has exceeded 250 feet, but is now less than 200 feet

Pressing the **VNV** Key twice re-arms Vertical Path Tracking for immediate profile re-capture.

### 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. The annunciation 'ALTV' indicates 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 Flight Management Section for details). At the same time as "TOD within 1 minute" is annunciated in the Navigation Status Box, the active VNV Target Altitude is displayed above the Vertical Speed Indicator.

As the aircraft nears the VNV Target Altitude, the flight director automatically transitions to VNV Target Altitude Capture Mode with Altitude Hold Mode armed. This automatic transition is indicated by the green 'ALTV' annunciation flashing for up to 10 seconds and the appearance of the white 'ALT' annunciation. The VNV Target Altitude is shown as the Altitude Reference beside the 'ALTV' annunciation and remains displayed above the Vertical Speed Indicator. The Required Vertical Speed Indication (RVSI) is removed once VNV Target Altitude Capture Mode becomes active.

At 50 feet from the VNV Target Altitude, the flight director automatically transitions from VNV Target Altitude Capture to Altitude Hold Mode and tracks the level leg. As Altitude Hold Mode becomes active, the white 'ALT' annunciation moves to the active vertical mode field and flashes green for 10 seconds to indicate the automatic transition. The flight director automatically arms Vertical Path Tracking, allowing upcoming descent legs to be captured and subsequently tracked.

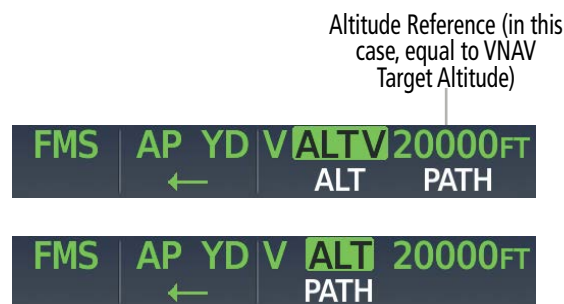


Figure 7-21 Automatic Mode Transitions During Altitude Capture



## Changing the VNAV Target Altitude



**NOTE:** Pressing the **CWS** Button while in VNAV Target Altitude Capture Mode does not cancel the mode.

Changing the current VNV Target Altitude while VNV Target Altitude Capture Mode is active causes the flight director to revert to Pitch Hold Mode. Vertical Path Tracking and the appropriate altitude capture mode are armed in preparation to capture the new VNV Target Altitude or the Selected Altitude, depending on which altitude is to be intercepted first.

VNV target altitudes can be changed while editing the active flight plan (see the Flight Management Section for details).

## APPROACH MODE



**NOTE:** The selected navigation receiver must have a valid VOR or LOC signal or active FMS course for the flight director to enter Approach Mode.

Approach Mode is activated when the **APR** Key is pressed. Approach Mode acquires and tracks the selected navigation source (FMS, 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 below the active lateral mode). If the CDI is less than one dot, the LOC, FMS, or VAPP 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, FMS Navigation Mode is active and the FAF is crossed after the automatic navigation source switch from FMS to LOC

### VOR APPROACH MODE (VAPP)

VOR Approach Mode (VAPP) provides greater sensitivity for signal tracking than VOR Navigation Mode.

#### Selecting VOR Approach Mode:

- 1) Ensure a valid VOR frequency is tuned.
- 2) Ensure that VOR is the selected navigation source.
- 3) Press the **APR** Key.



Figure 7-22 Navigation/Approach Mode Armed

## FMS APPROACH MODE

When FMS Approach Mode is armed, Glidepath Mode is also armed. FMS Approach Mode can be utilized to fly non-precision and precision approaches (Glidepath Mode).

### Selecting FMS Approach Mode without a glidepath:

- 1) Ensure an RNAV Approach is loaded into the active flight plan. The active waypoint must be part of the flight plan (cannot be a direct-to a waypoint not in the flight plan).
- 2) Ensure that FMS is the selected navigation source (use the **Active NAV** Softkey to cycle through navigation sources if necessary).
- 3) Press the **NAV** Key.

### Glidepath Mode (GP)



**NOTE:** Pressing the **CWS** Button while Glidepath Mode is active does not cancel the mode. The autopilot guides the aircraft back to the glidepath upon release of the **CWS** Button.

Glidepath Mode is used to track the glidepath when executing an approach procedure in FMS Approach Mode. When Glidepath Mode is armed, 'GP' is annunciated in white in the AFCS Status Box.

### Selecting FMS Approach Mode with a glidepath:

- 1) Ensure an RNAV approach with vertical guidance (LPV, LNAV/VNAV, LP+V, LNAV+V) is loaded into the active flight plan. The active waypoint must be part of the flight plan (cannot be a direct-to a waypoint not in the flight plan).
- 2) Ensure that FMS is the selected navigation source (use the **Active NAV** Softkey to 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 Nonprecision 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:

- ➔ An RNAV 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)

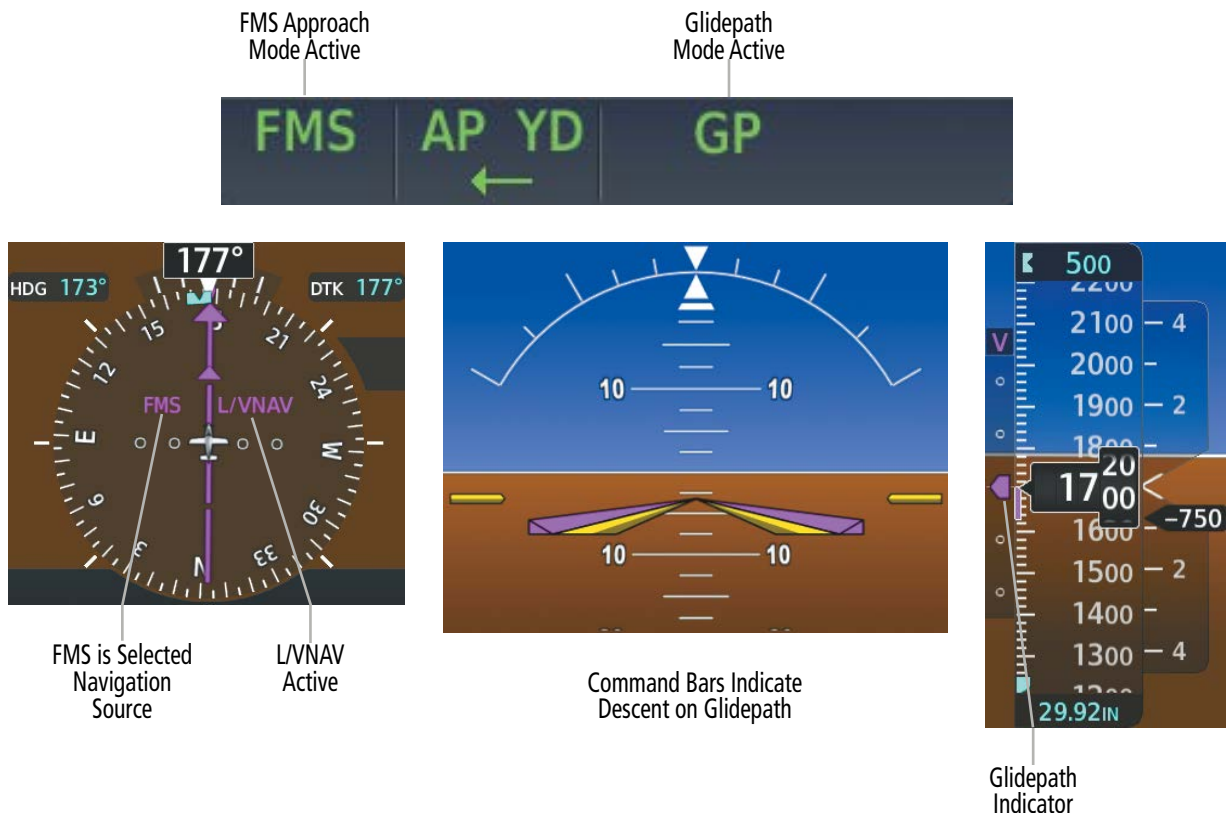


Figure 7-24 Glidepath Mode

## 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 (use the **Active NAV** Softkey to 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°.



**NOTE:** Pressing the **CWS** Button while Glideslope Mode is active does not cancel the mode. The autopilot guides the aircraft back to the glideslope upon release of the **CWS** Button.

### Selecting Glideslope Mode:

- 1) Ensure a valid localizer frequency is tuned.
- 2) Ensure that LOC is the selected navigation source (use the **Active NAV** Softkey to cycle through navigation sources if necessary).
- 3) Press the **APR** Key.

Or:

- 1) Ensure that FMS is the selected navigation source (use the **Active NAV** Softkey to 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.

If the navigation source is VOR or localizer or OBS Mode has been enabled when using the FMS, the Selected Course is controlled using the **CRS** Knob corresponding to the selected flight director (**CRS1** for the pilot side, **CRS2** for the copilot side).

Pressing the **CWS** Button and hand-flying the aircraft does not change the Selected Course while in Approach Mode. The autopilot guides the aircraft back to the Selected Course (or GPS flight plan) when the **CWS** Button is released.

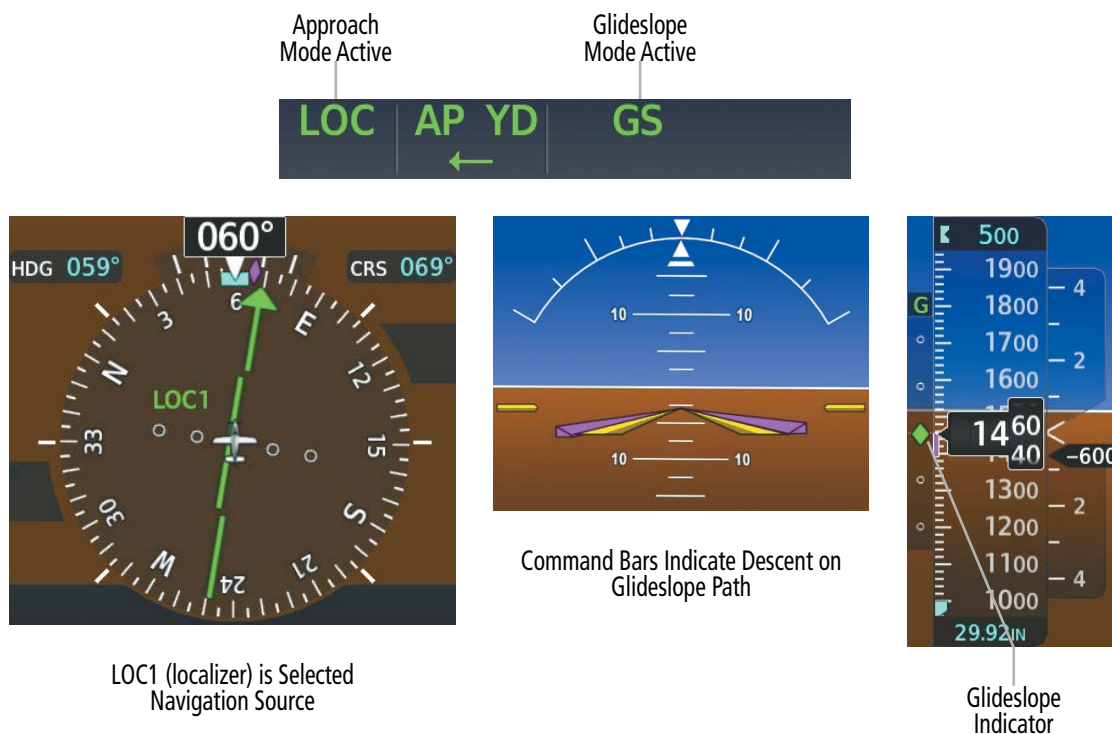


Figure 7-26 Glideslope Mode

### Backcourse Mode (BC)



**NOTE:** In order to Arm a LOC Backcourse, the aircraft heading must be within 75 degrees of the LOC Backcourse.



**NOTE:** When making a backcourse approach, verify the Selected Course is the localizer front course.

Backcourse Mode captures and tracks a localizer signal in the backcourse direction. The mode may be selected by pressing the **BC** Key. Backcourse Mode is armed if the CDI is greater than one dot when the mode is selected. If the CDI is less than one dot, Backcourse Mode is automatically captured when the **BC** Key is pressed. The flight director creates roll steering commands from the Selected Course and deviation when in Backcourse Mode.



Figure 7-27 Backcourse Navigation Mode

## INTERCEPTING AND FLYING A DME ARC

The AFCS will intercept and track a DME arc that is part of the active flight plan provided that FMS Navigation Mode is engaged, FMS is the active navigation source on the CDI, and the DME arc segment is the active flight plan leg. It is important to note that automatic navigation of DME arcs is based on FMS. Thus, even if the **APR** Key is pressed and LOC or VOR Approach Mode is armed prior to reaching the Initial Approach Fix (IAF), Approach Mode will not activate until the arc segment is completed.

If the pilot decides to intercept the arc at a location other than the published IAF (i.e., ATC provides vectors to intercept the arc) and subsequently selects Heading Mode or Roll Mode, the AFCS will not automatically intercept or track the arc unless the pilot activates the arc leg of the flight plan and arms FMS Navigation Mode. The AFCS will not intercept and fly a DME arc before reaching an IAF that defines the beginning of the arc segment. Likewise, if at any point while established on the DME arc the pilot deselects FMS Navigation Mode, the AFCS will no longer track the arc.

## TAKEOFF AND GO AROUND MODES

In Takeoff and Go Around modes, the flight director commands a constant set pitch attitude. The **GA** Switch is used to select both modes. The mode entered by the flight director depends on whether the aircraft is on the ground or airborne.

### TAKEOFF MODE (TO)

Takeoff Mode provides an attitude reference during rotation and takeoff. This mode can be selected only while on the ground by pressing the **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.

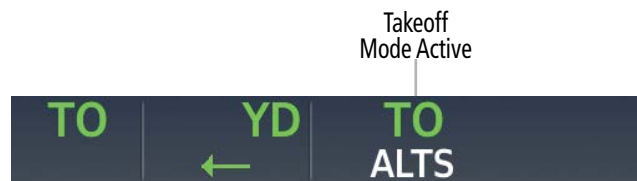


Figure 7-28 Takeoff Mode

### GO AROUND MODE (GA)

Pressing the **GA** Switch while the aircraft is in the air activates the flight director command bars to assume a wings-level, pitch-up attitude, allowing the execution of a missed approach or a go around. If there is a valid flight plan loaded with FMS lateral guidance, FMS 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.

Selecting Go Around Mode disengages the autopilot; however, subsequent autopilot engagement is allowed. Attempts to modify the aircraft attitude (i.e., with the **CWS** Button) result in reversion to Pitch Hold Mode.



Figure 7-29 Go Around 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 Daher TBM 930 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 and yaw autotrim provide trim commands to the pitch trim servo and yaw trim adapter to relieve any sustained effort required by the pitch and yaw servos, respectively. Autopilot operation is independent of the yaw damper for the Daher TBM 930.

The yaw damper reduces Dutch roll tendencies and coordinates turns. It can operate independently of the autopilot and may be used during normal hand-flight maneuvers. Yaw rate commands are limited to 6 deg/sec by the yaw damper.

### FLIGHT CONTROL

Pitch and roll commands are provided to the servos based on the active flight director modes. Yaw damping is provided by the yaw servo. Servo motor control limits the maximum servo speed and torque. The servo gearboxes are equipped with slip-clutches set to certain values. This allows the servos to be overridden in case of an emergency.

#### PITCH AXIS AND TRIM

The autopilot pitch axis uses pitch rate to stabilize the aircraft pitch attitude during flight director maneuvers. Flight director pitch commands are rate- and attitude-limited, combined with pitch damper control, and sent to the pitch servo motor. The pitch servo measures the output effort (torque) and provides this signal to the pitch trim servo. The pitch trim servo commands the motor to reduce the average pitch servo effort.

When the autopilot is not engaged, the pitch trim servo may be used to provide manual electric pitch trim (MEPT). This allows the aircraft to be trimmed using a control wheel switch rather than the trim wheel. Manual trim commands are generated only when both halves of the **MEPT** Switch are operated simultaneously. Trim speeds are scheduled with airspeed to provide more consistent response.

#### ROLL AXIS

The autopilot roll axis uses roll rate to stabilize aircraft roll attitude during flight director maneuvers. The flight director roll commands are rate- and attitude-limited, combined with roll damper control, and sent to the roll servo motor.

#### YAW AXIS AND TRIM

The yaw damper uses yaw rate and roll attitude to dampen the aircraft's natural Dutch roll response. It also uses lateral acceleration to coordinate turns. Yaw damper operation is independent of autopilot engagement.

When the yaw damper is not engaged, the yaw trim adapter may be used to provide manual electric yaw trim (MEYT). This allows the aircraft to be trimmed using a control wheel switch. Trim speeds are scheduled with airspeed to provide more consistent response.



## ENGAGING THE AUTOPILOT AND YAW DAMPER



**NOTE:** Autopilot engagement/disengagement is not equivalent to servo engagement/disengagement. Use the **CWS** Button to disengage the pitch and roll servos while the autopilot remains active.

When the **AP** Key is pressed, the autopilot, yaw damper, and flight director (if not already active) are activated and the annunciator lights on the AFCS controller for the autopilot and yaw damper are illuminated. The flight director engages in Pitch and Roll Hold Modes when initially activated.



Figure 7-30 Autopilot and Yaw Damper Engaged

When the **YD** Key is pressed, the system engages the yaw damper independently of the autopilot and the yaw damper annunciator light is illuminated.

Autopilot and yaw damper status are displayed in the center of the AFCS Status Box. Engagement is indicated by green 'AP' and 'YD' annunciators, respectively.

## CONTROL WHEEL STEERING (CWS)

During autopilot operation, the aircraft may be hand-flown without disengaging the autopilot. Pressing and holding the **CWS** Button disengages the pitch and roll servos from the flight control surfaces and allows the aircraft to be hand-flown. At the same time, the flight director is synchronized to the aircraft attitude during the maneuver. CWS activity has no effect on yaw damper engagement.

The 'AP' annunciation is temporarily replaced by 'CWS' in white for the duration of CWS maneuvers.

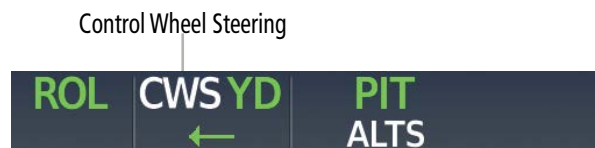


Figure 7-31 CWS Annunciation

In most scenarios, releasing the **CWS** Button reengages the autopilot with a new reference. Refer to flight director mode descriptions for specific CWS behavior in each mode.

## DISENGAGING THE AUTOPILOT AND YAW DAMPER

### MANUAL DISENGAGEMENT



**NOTE:** Pressing the **AP** Key does not disengage the yaw damper.

The autopilot is manually disengaged by pressing the **AP** Key on the AFCS Controller, the **GA** Switch, the **MEPT** Switches, or the **AP DISC** Switch. Pressing the **AP** Key while airborne does not disengage the yaw damper. Manual autopilot disengagement is indicated by a flashing amber and black 'AP' annunciation and an autopilot disconnect aural alert, "autopilot."



Figure 7-32 Manual AP Disengagement

The **YD** Key, the **MEYT** Switch, and **AP DISC** Switch disengage the yaw damper (the autopilot, if engaged, also disengages when the **AP DISC** Switch is pressed). Upon disengagement, the 'YD' annunciation flashes amber for five seconds and is then removed.



Figure 7-33 Manual Yaw Damper Disengagement

## AUTOMATIC DISENGAGEMENT

Automatic autopilot disengagement is indicated by a flashing red and white 'AP' annunciation and the autopilot disconnect aural alert, which continue until acknowledged by pressing the **AP DISC** Switch or **MEPT** Switch. Automatic autopilot disengagement occurs due to:

- » System failure
- » Invalid sensor data
- » Roll trim input
- » Stall warning
- » Inability to compute default flight director modes (FD also disengages automatically)

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 7-34 Automatic Disengagement

## 7.6 AFCS ANNUNCIATIONS AND ALERTS

### AFCS STATUS ALERTS

The annunciations in the following table (listed in order of increasing priority) can appear on the PFDs above the Airspeed and Attitude indicators. Only one annunciation may occur at a time, and messages are prioritized by criticality.



Figure 7-35 AFCS Status Annunciation

Alert Condition	Annunciation	Description
Rudder Mistrim Right	<b>RUD→</b>	Yaw servo providing sustained force in the indicated direction.
Rudder Mistrim Left	<b>←RUD</b>	
Aileron Mistrim Right	<b>AIL→</b>	Roll servo providing sustained force in the indicated direction
Aileron Mistrim Left	<b>←AIL</b>	
Elevator Mistrim Down	<b>↓ELE</b>	Pitch servo providing sustained force in the indicated direction.
Elevator Mistrim Up	<b>↑ELE</b>	
Pitch Trim Failure (or stuck <b>MEPT</b> Switch)	<b>PTRM</b>	If AP engaged, take control of the aircraft and disengage AP. If AP disengaged, move <b>MEPT</b> switches separately to unstick
Yaw Trim Failure (or stuck <b>MEYT</b> Switch)	<b>YTRM</b>	If AP engaged, take control of the aircraft and disengage AP. If AP disengaged, move the <b>MEYT</b> switch to check if a stuck switch is causing the annunciation
Yaw Damper Failure	<b>YAW</b>	YD control failure
Roll Failure	<b>ROLL</b>	Roll axis control failure; AP inoperative
Pitch Failure	<b>PTCH</b>	Pitch axis control failure; AP inoperative
System Failure	<b>AFCS</b>	AP and MEPT are unavailable; FD may still be available
Preflight Test	<b>PFT</b>	Performing preflight system test; aural alert sounds at completion. Do not press the <b>AP DISC</b> Switch during servo initialization and preflight system tests as this may cause the preflight system test to fail or never to start (if servos fail their initialization tests). Power must be cycled to the servos to remedy the situation.
	<b>PFT</b>	Preflight system test failed; aural alert sounds at failure

Table 7-6 AFCS Status Alerts

## 7.7 ABNORMAL OPERATION

### SUSPECTED AUTOPILOT MALFUNCTION

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**NOTE:** Consult the aircraft documentation for the location of circuit breakers as well as specifics that may supplement or amplify this procedure.

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#### Mitigating suspected autopilot failure or trim failure:

- 1) Firmly grasp the control wheel.
- 2) Press and hold the **AP DISC** Switch. The autopilot will disconnect and power is removed from the trim motor. Power is also removed from all primary servo motors and engaged solenoids. Note the visual and aural alerting indicating autopilot disconnect.
- 3) Retrim the aircraft as needed. Substantial trim adjustment may be needed.
- 4) Pull the appropriate circuit breaker(s) to electrically isolate the servo and solenoid components.
- 5) Release the **AP DISC** Switch.

### OVERPOWERING AUTOPILOT SERVOS

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In the context of this discussion, “overpowering” refers to any pressure or force applied to the pitch controls when the autopilot is engaged. A small amount of pressure or force on the pitch controls can cause the autopilot automatic trim to run to an out-of-trim condition. Therefore, any application of pressure or force to the controls should be avoided when the autopilot is engaged.

Overpowering the autopilot during flight will cause the autopilot’s automatic trim to run, resulting in an out-of-trim condition or cause the trim to hit the stop if the action is prolonged. In this case, larger than anticipated control forces are required after the autopilot is disengaged.

#### Checking autopilot servos during the preflight check:

- 1) Check for proper autopilot operation and ensure the autopilot can be overpowered.
- 2) Note the forces required to overpower the autopilot servo clutches.

### OVERSPEED PROTECTION

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While Pitch Hold, Vertical Speed, Indicated Airspeed, Vertical Path Tracking, or an altitude capture mode is active, airspeed is monitored by the flight director. Pitch commands are not changed until overspeed protection becomes active. Overspeed protection is provided in situations where the flight director cannot acquire and maintain the mode reference for the selected vertical mode without exceeding the certified maximum autopilot airspeed.

When an autopilot overspeed condition occurs, the Airspeed Reference appears in a box above the Airspeed Indicator, flashing a yellow ‘MAXSPD’ annunciation. The autopilot, if engaged, will follow the pitch up command from the flight director. 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 7-36 Overspeed Annunciation

## UNDERSPEED PROTECTION



**NOTE:** While underspeed protection is active, the aircraft will deviate from the selected reference.

Underspeed Protection is designed to discourage aircraft operation below minimum established airspeeds and is available when the autopilot is on.

When the airspeed trend vector reaches a predetermined airspeed, a single aural “AIRSPEED” will sound and an amber ‘MINSPD’ annunciation will appear above the airspeed indicator, alerting the pilot to the impending underspeed condition.

Flaps	MINSPD Annunciation and Airspeed Alert
0%	88 kts
Takeoff	84 kts
100%	74 kts

Table 7-7 MINSPD Annunciation and Airspeed Alert



Figure 7-37 Underspeed 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, ALTV, ALTS, GS, GP, TO, GA, FLC)

If the aircraft decelerates to stall warning for at least one second, the lateral and vertical flight director modes will change from active to armed (Figure 7-48). 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.



Figure 7-38 Lateral and Vertical Flight Director Modes Armed

An aural “AIRSPEED” alert will sound every five seconds and a red “UNDERSPEED PROTECT ACTIVE” annunciation will appear in the CAS Window on the MFD.

When airspeed increases (as a result of adding power/thrust) to above the IAS at which stall warning turns off, plus two knots, the autopilot will cause the aircraft to pitch up until recapturing the vertical reference. The vertical and lateral flight director modes will change from armed to active.

### NON-ALTITUDE CRITICAL MODES (VS, VNAV, PIT, LVL)

If the aircraft decelerates to an IAS below the minimum commandable autopilot airspeed, a red “UNDERSPEED PROTECT ACTIVE” annunciation will appear in the CAS Window. The vertical flight director mode will change from active to armed (Figure 7-48), and the autopilot will cause the aircraft to pitch down until reaching a pitch attitude at which IAS equals the minimum commandable autopilot airspeed.



Figure 7-39 Vertical Flight Director Mode Armed

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.

## EMERGENCY DESCENT MODE

### ACTIVATION

The Daher TBM 930 is equipped with an Emergency Descent Mode (EDM). EDM is automatically activated when the autopilot is engaged and:

- » Pressure Altitude is greater than 15,000 feet MSL,
- AND

- » Cabin Altitude is too high.

Power lever should be reduced to idle to achieve a maximum rate of decent. EDM is annunciated on the PFD and the following AFCS modes are engaged: FLC Mode with a target speed of 255 KIAS or Mach equivalent, Heading Mode with a course 90° left of current heading, and a target altitude of 15,000 feet MSL.



**NOTE:** Refer to the current version of the pertinent flight manual for specific instructions regarding emergency procedures.

### EDM OVERRIDE

To exit the EDM Mode press the **AP** Key on the AFCS Controller. If the **AP** Key is pressed again an EDM Override caution will appear. EDM Mode cannot be reentered until the EDM Override is cleared. To clear the EDM Override the cabin altitude will need to descend to below 14,900 ft and the **AP** Key needs to be cycled off and back on again.



## SECTION 8 ADDITIONAL FEATURES

### 8.1 OVERVIEW



**NOTE:** *Regardless of the availability of SafeTaxi<sup>®</sup> 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<sup>®</sup> Diagrams (Optional)
- SurfaceWatch<sup>™</sup> (Optional)
- Electronic Charts
  - ChartView (Optional)
  - FliteCharts
- Satellite Telephone & Datalink Services (Optional)
- Connex<sup>®</sup> Setup (Optional)
- SiriusXM<sup>®</sup> Satellite Radio (Optional)
- Data Logging
- Electronic Checklists (Optional)
- Electronic Documents (Optional)
- Electronic Stability & Protection (Optional)
- Database Cycle Number and Revisions

Optional SafeTaxi diagrams provide detailed taxiway, runway, and ramp information at more than 1,400 airports in North America, South America, and Europe. By decreasing range on an airport that has a SafeTaxi diagram available, a close up view of the airport layout can be seen.

The optional SurfaceWatch feature provides voice and visual annunciations to aid in maintaining situational awareness and avoid potential runway incursions during ground and air operations in the airport environment.

ChartView (optional) provides on-board electronic terminal procedures charts. FliteCharts provide on-board electronic terminal procedures charts. Electronic charts offer the convenience of rapid access to essential information.

The optional Iridium Transceiver provides an airborne low speed datalink, Iridium Satellite Telephone service, and Short Message Service (SMS).

The optional Connex feature allows for setting up the installed optional Flight Stream device for a Bluetooth connection between the system and a mobile device running the Garmin Pilot<sup>™</sup> application.

The optional SiriusXM Satellite Radio entertainment audio feature of the SiriusXM Datalink Receiver handles more than 170 channels of music, news, and sports. SiriusXM Satellite Radio offers more entertainment choices and longer range coverage than commercial broadcast stations.

The Flight Data Logging feature automatically stores critical flight and engine data on an SD data card. Approximately 1,000 flight hours can be recorded for each 1GB of available space on the card. CMC Data Logging automatically stores avionics data, events/faults, exceedances, and aircraft logs on a SD Card.

The optional Enhanced Electronic Checklists feature allows the pilot to view and interact with aircraft checklists. This feature supports font and color control, hyperlink-based navigation, branched questioning, and checklist images.

The optional Electronic Documents feature allows viewing of electronic documents on selected GDU displays.

The optional Electronic Stability and Protection (ESP<sup>™</sup>) feature discourages aircraft operation outside the normal flight envelope.

The database management feature provides a comprehensive means to view and manage all databases installed on the system.

## 8.2 SAFETAXI (OPTIONAL)



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

SafeTaxi is an enhanced feature that gives greater map detail when viewing airports at close range on the 'Navigation Map' Page or the Inset Map on the 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 on the 'Map Settings' Page through the **Aviation** Tab on the Touchscreen Controller.



**NOTE:** When obstacles are displayed on the 'Navigation Map' Page in the vicinity of an airport being viewed with SafeTaxi, the obstacle symbols may be obscured by SafeTaxi feature labels.

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' Page
- 'Weather Datalink' Pane
- Inset Map (PFD)
- '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 runway 28L approaching a designated Airport Hot Spot boundary on KSFO airport. Airport Hot Spots are outlined in magenta. When panning over the airport, features such as runway holding lines and taxiways are shown at the cursor.

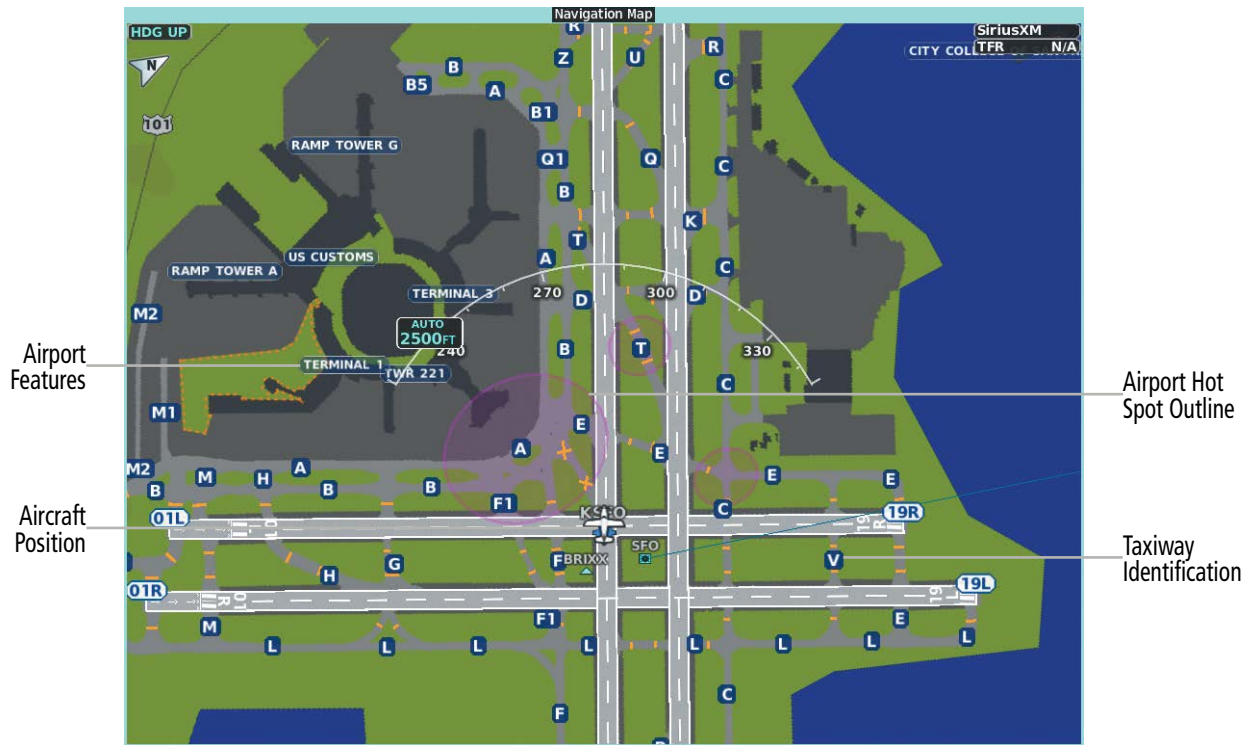


Figure 8-1 SafeTaxi Depiction on the Navigation Map Display

#### Enabling/disabling SafeTaxi:

- 1) From MFD Home, touch **Map > Map Settings**.
- 2) If not already selected, touch the **Aviation** Tab.
- 3) If necessary, scroll to display the **SafeTaxi** Annunciator Button.
- 4) Touch the **SafeTaxi** Button to enable or disable 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 Settings**.
- 2) If not already selected, touch the **Aviation** Tab.
- 3) If necessary, scroll to display the **SafeTaxi** Range Button.
- 4) Touch the **SafeTaxi** Range Button. A selection of ranges are displayed.
- 5) Touch the desired range. In the following figure, 1.5 NM has been selected. With this setting, SafeTaxi will be displayed on the 'Navigation Map' Page for range settings up to and including 1.5 NM.

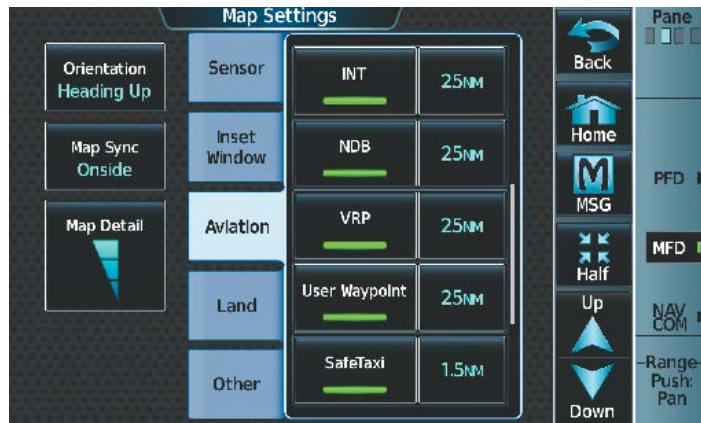


Figure 8-2 SafeTaxi Map Settings

## 8.3 SURFACWATCH (OPTIONAL)



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

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 not available in Reversionary Mode. 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



Figure 8-3 SurfaceWatch Information on the PFD

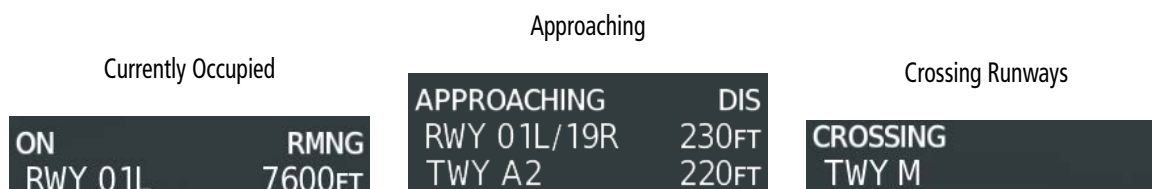
### Enabling/disabling SurfaceWatch:

- 1) From MFD Home, touch **Utilities > Setup > Avionics Settings**.
- 2) If not already selected, touch the **Alerts** Tab and scroll to view the **SurfaceWatch Inhibit** Button.
- 3) Touch the **SurfaceWatch Inhibit** Button to enable or disable SurfaceWatch. A green annunciator indicates SurfaceWatch is inhibited, or disabled. The 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



**NOTE:** When approaching a runway, the distance displayed does not take into account the position of Hold Line for the runway. Do not cross the Hold Line until authorized.

This component indicates the aircraft is 'APPROACHING' the indicated apron, taxiway, or runway. 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 TOLD function.
CHECK RUNWAY	"Check runway"	Issued when the aircraft is taking off from or landing on a runway different than that entered in TOLD.
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 and the remaining runway length is less than the required takeoff distance calculated by TOLD.



**NOTE:** While the Runway Too Short alert may be issued for any runway from which the aircraft is taking off, the system will always calculate the runway length for the specific runway entered in TOLD.

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 TOLD or the active flight plan when TOLD is not used. 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 TOLD function or the active flight plan.

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.

### 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 TOLD function. The system determines this when the On-Final phase-of-flight is valid and the aircraft is aligned with a runway the system TOLD function has calculated to be too short.



**NOTE:** While the Runway Too Short alert may be issued for any runway with which the aircraft is aligned, the system will always calculate the runway length for the specific runway entered in TOLD.

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 TOLD function. The system determines this when the On-Final phase-of-flight is valid and the aircraft is not aligned with a runway.

Additionally, the Information Box will display the destination airport identifier, the runway with which the aircraft is aligned, and the distance to the runway.

## DISTANCE REMAINING CALLOUTS



**NOTE:** SurfaceWatch aural/visual indications may not be aligned with physical runway distance remaining markers.

With rejected takeoff or during landing rollout, distance remaining voice callouts are issued for the remaining runway distances of 5,000', 4,000', 3,000', 2,000', 1,000', 500', and 100'.

## SURFACEWATCH SETUP

Origin/destination airport, runway, and distance data entered integrates with SurfaceWatch technology to alert the flight crew to a runway too short for takeoff/landing, or to advise of a potential taxiway takeoff/landing. The runway selected in SurfaceWatch Setup appears on the airport diagram in cyan and appears outlined in cyan on the synthetic vision representation of the runway on the PFD.

**Entering origin/destination airport when no flight plan has been entered:**

- 1) From MFD Home, touch **Flight Plan > Add Origin** or **Add Destination** as appropriate.
- 2) Use the keypad to enter the Airport Identifier and touch **Enter**.

**Selecting origin runway:**

- 1) From MFD Home, touch **Flight Plan > Origin**.
- 2) On the 'Select Runway' Screen, scroll down as required and select the appropriate runway.

**Selecting destination runway:**

- 1) From MFD Home, touch **Flight Plan > Destination > Select Arrival Runway**.
- 2) On the 'Select Runway' Screen, scroll down as required and select the appropriate runway.

## 8.4 ELECTRONIC CHARTS



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



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



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



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



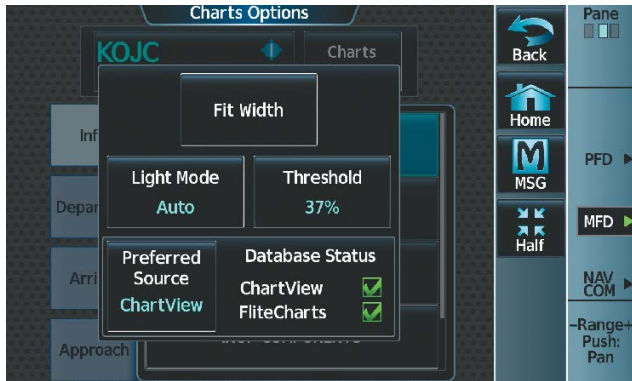
**NOTE:** Do not rely solely upon datalink services to provide Temporary Flight Restriction (TFR) information. Always confirm TFR information through official sources such as Flight Service Stations or Air Traffic Control.

Electronic charts that resemble the paper versions of AeroNav Services terminal procedures charts (FliteCharts) and Jeppesen terminal procedures charts (ChartView) can be displayed on the MFD or PFD.

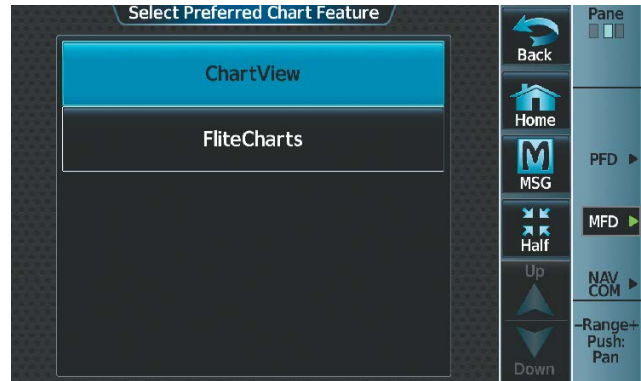
When the databases for both chart types are purchased and loaded in the system, the desired charts brand, or source, can be selected for viewing. The active chart source for a particular procedure is shown on the 'Charts Options' Screen under Preferred Source.

### Selecting Preferred Charts Source:

- 1) From MFD Home, touch **Charts > Chart Selection > Chart Options > Preferred Source**.
- 2) Touch either **ChartView** or **FliteCharts** to set as the preferred chart source



**Figure 8-5 Chart Options Preferred Source Button**



**Figure 8-6 'Select Preferred Chart Feature' Screen**

## CHARTVIEW (OPTIONAL)

ChartView Electronic Charts resemble the paper version of Jeppesen Terminal Procedures Charts and can be viewed on the MFD or PFD. The charts are displayed in full color with high-resolution. The display pane depiction shows the aircraft position on the moving map in the plan view of approach charts and on airport diagrams.

The geo-referenced aircraft position is indicated by an aircraft symbol displayed on the chart when the current position is within the boundaries of the chart. Inset boxes are not considered within the chart boundaries. Therefore, when the aircraft symbol reaches a chart boundary line, or inset box, the aircraft symbol is removed from the display.

The following figure shows examples of off-scale areas, indicated by the 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.

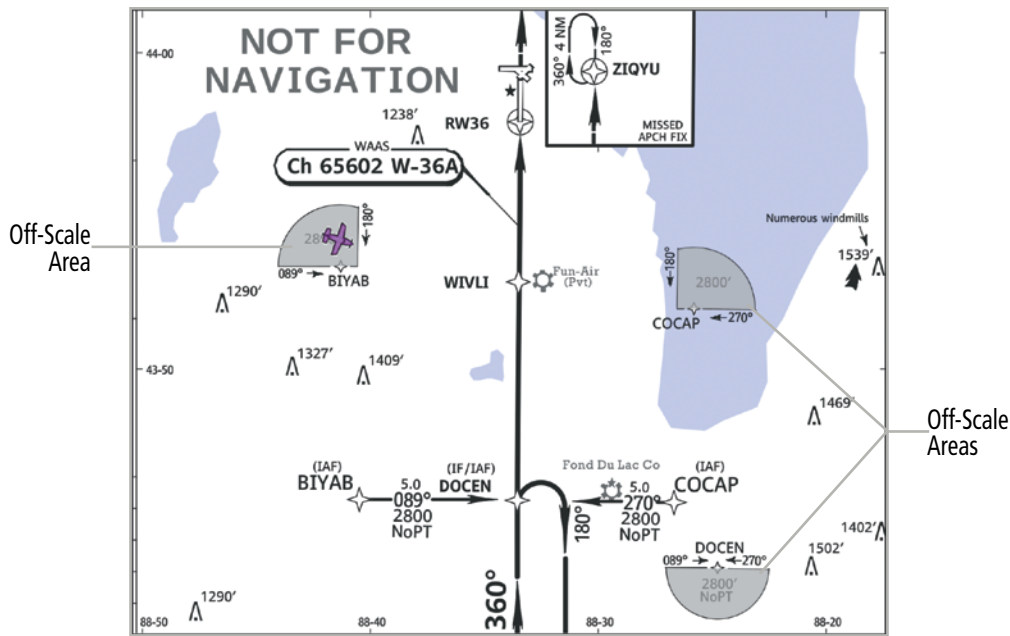


Figure 8-7 Sample Chart Indicating Off-Scale Areas



**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

## 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. If the charts pane is displayed when landing, the chart will automatically change to the airport diagram upon landing.

### 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).
  - a) Touch the **Departure** Tab to display a list of possible departures for the selected airport.
  - b) Touch the **Arrival** Tab to display a list of possible arrivals for the selected airport.
  - c) Touch the **Approach** Tab to display a list of possible approaches for the selected airport.

- 4) Touch the desired information button in any of these lists to display the applicable chart on the selected display pane.



Figure 8-8 Airport Info Selection

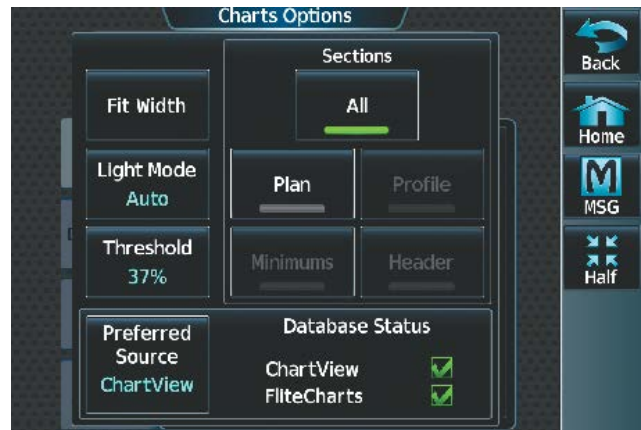


Figure 8-9 'Chart Options' Screen

- 5) Touch the **Charts Options** Button to select the desired display option for the selected chart (see previous figure).
- 6) Touch **All** to display the complete Airport Diagram. **Fit Width** displays the full width of the Airport Diagram. **Plan** displays only the diagram portion of the chart. **Minimums** displays only the approach minimums on an approach chart. **Profile** displays only the descent profile on the approach chart. **Header** displays the chart header. Only appropriate views are available for the selected chart.
- 7) Touch the **Back** Button to return to the 'Charts' Screen.

#### Zooming-in, zooming-out, rotating, and panning the displayed chart:

- 1) From 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.

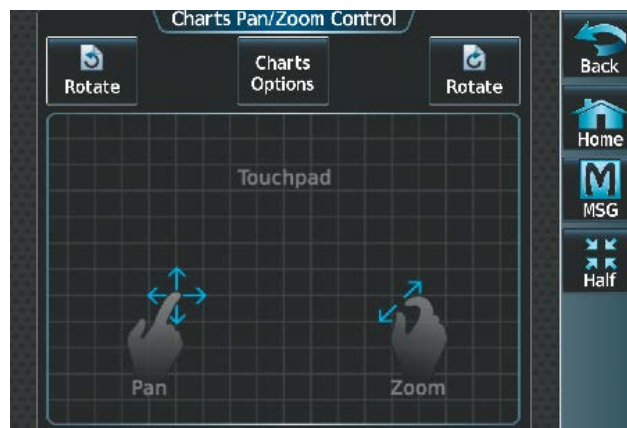


Figure 8-10 'Charts Pan/Zoom Control' Screen





The aircraft symbol is shown on the chart only if the chart is to scale and the aircraft position is within the boundaries of the chart. The aircraft symbol is not displayed when the Aircraft Not Shown Icon appears. If the Chart Scale Box displays a banner 'NOT TO SCALE', the aircraft symbol is not shown. The Aircraft Not Shown Icon may appear at certain times, even if the chart is displayed to scale.

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 (e.g., 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.
- 3) Touch the **Day**, **Night**, or **Auto** Button. When **Auto** is selected, the display will change to the appropriate day or night setting, dependent on ambient lighting.

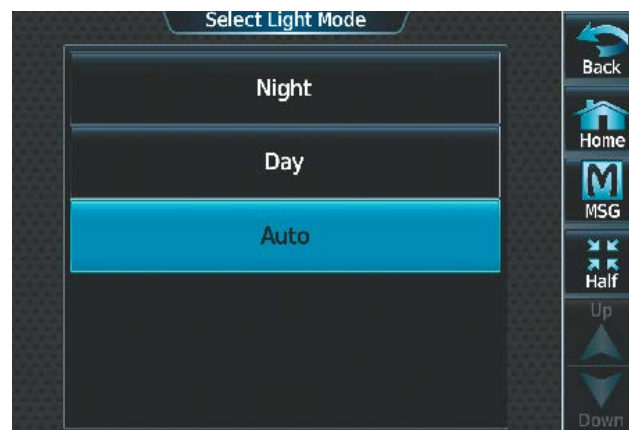
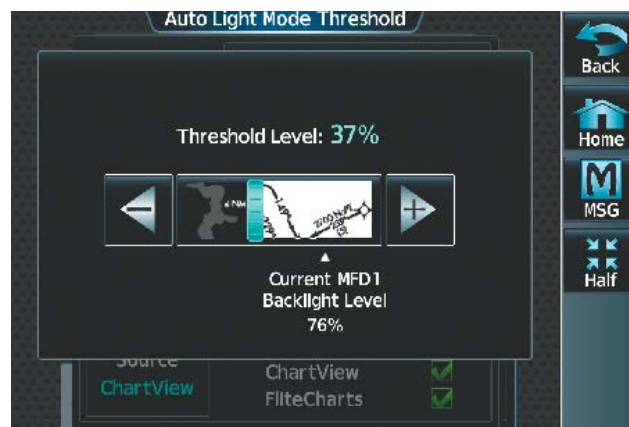


Figure 8-15 Selecting Day, Night, or Auto View

- 4) With 'Auto' selected, touch the **Threshold** Button. The 'Auto Light Mode Threshold' Window is displayed.



Select Chart Options



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.

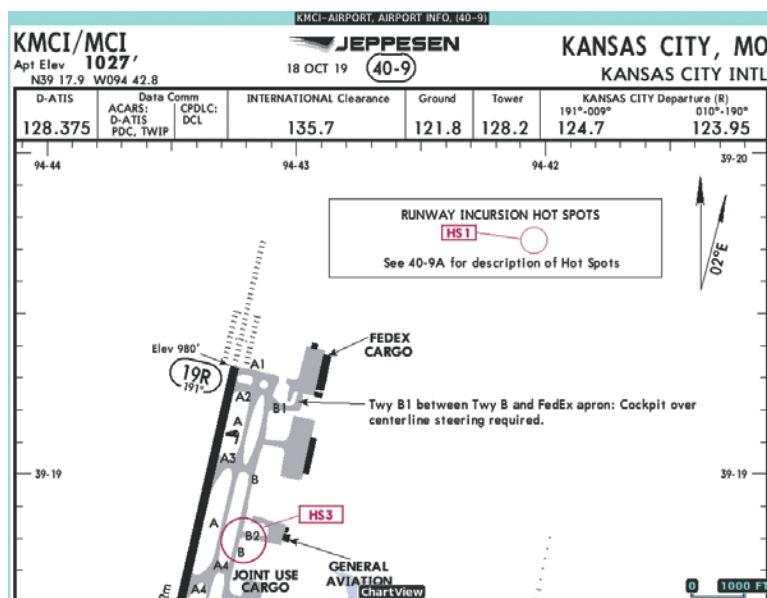
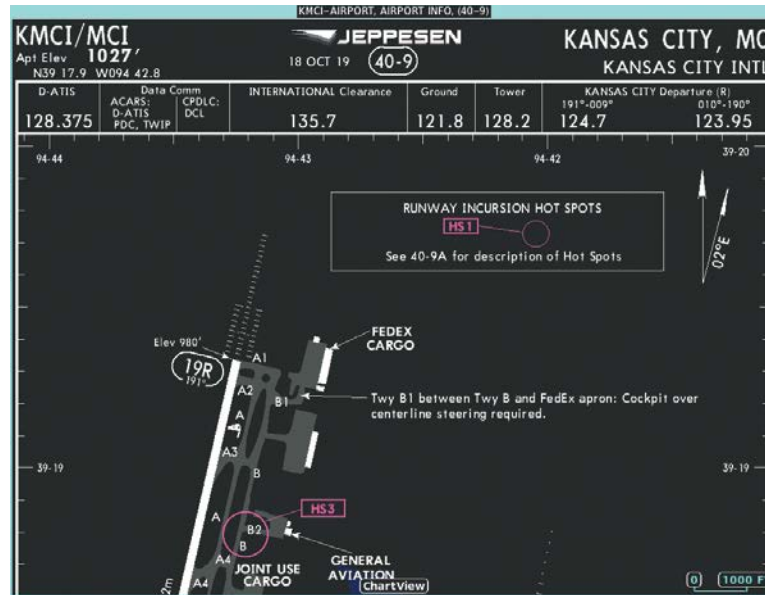


Figure 8-17 Airport Diagram, Day View



**Figure 8-18 Airport Diagram, Night View**

## FLITECHARTS

FliteCharts are electronic charts that resemble the paper version of AeroNav Services Terminal Procedures Charts. The charts are displayed with high-resolution and in color for applicable charts. The display pane depiction shows the aircraft position on the moving map and on airport diagrams.

The geo-referenced aircraft position is indicated by an aircraft symbol displayed on the chart when the current position is within the boundaries of the chart. Inset boxes are not considered within the chart boundaries. Therefore, when the aircraft symbol reaches a chart boundary line, or inset box, the aircraft symbol is removed from the display.

The following figure shows examples of off-scale areas, indicated by the grey shading. Note, the grey shading is for illustrative purposes only and will not appear on the published chart or display pane. These off-scale areas appear on the chart to convey supplemental information. However, the depicted geographical position of this information, as it relates to the chart plan view, is not the actual geographic position. Therefore, when the aircraft symbol appears within one of these areas, the aircraft position indicated is relative to the chart plan view, not to the off-scale area.



**NOTE:** Do not maneuver the aircraft based solely upon the geo-referenced aircraft symbol.

The FliteCharts database subscription is available from Garmin. Available data includes:

- Arrivals (STAR)
- Departure Procedures (DP)
- Approaches
- Airport Diagrams

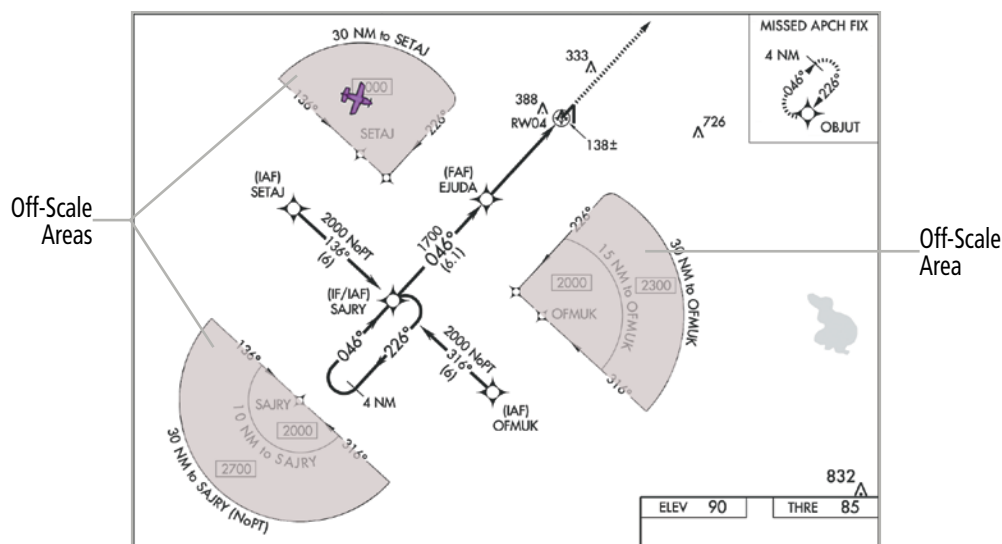


Figure 8-19 Sample Chart Indicating Off-Scale Areas

## 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. If the charts pane is displayed when landing, the chart will automatically change to the airport diagram upon landing.

### 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).
  - a) Touch the **Departure** Tab to display a list of possible departures for the selected airport.
  - b) Touch the **Arrival** Tab to display a list of possible arrivals for the selected airport.
  - c) Touch the **Approach** Tab to display a list of possible approaches for the selected airport.
- 4) Touch the desired information button in any of these lists to display the applicable chart on the selected display pane.



Figure 8-20 Airport Diagram Selection



Figure 8-21 Airport Diagram View Options

- 5) Touch the **Charts Options** Button to select the desired display option for the selected chart (see previous figure).
- 6) Touch **Fit Width** to display the full width of the chart.
- 7) Touch the **Back** Button to return to the 'Charts' Screen.

#### Zooming-in, zooming-out, rotating, and panning the displayed chart:

- 1) From 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.

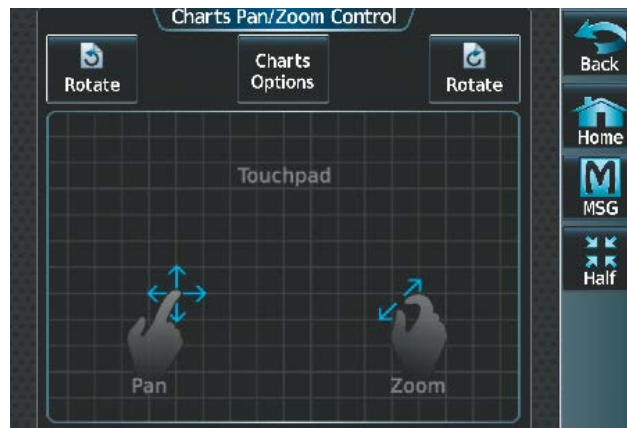


Figure 8-22 'Charts Pan/Zoom Control' Screen

- 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.

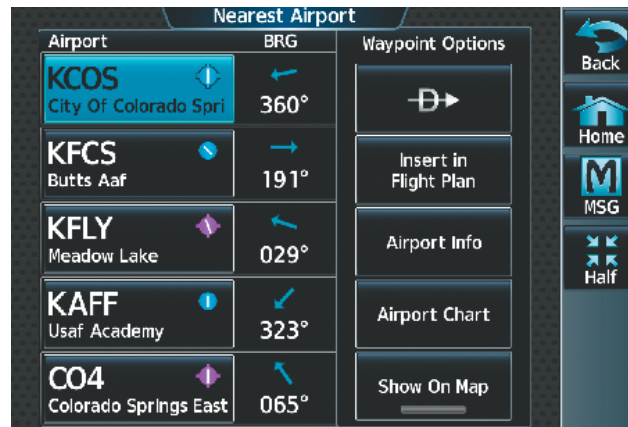


Figure 8-23 Airport Diagram Selection

- 3) Touch the **Airport Chart** Button. The **Info** Tab selections are displayed on the Touchscreen Controller and the Airport Diagram is displayed on the selected display pane.

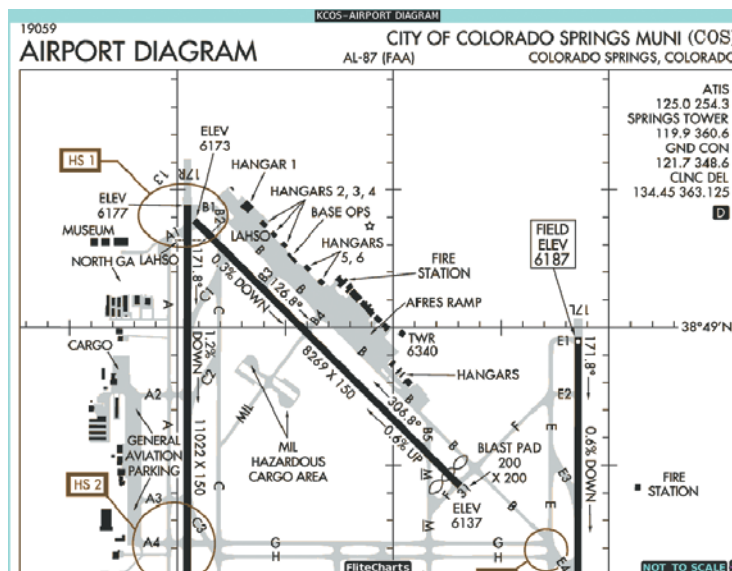


Figure 8-24 Airport Chart for Selected Airport

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 8-25 No Available Charts Banner

If there is a problem in rendering the data (e.g., a data error or a failure of an individual chart), the banner 'Unable To Display Chart' is then displayed.

### Unable To Display Chart

Figure 8-26 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. When **Auto** is selected, the display will change to the appropriate day or night setting, dependent on ambient lighting.

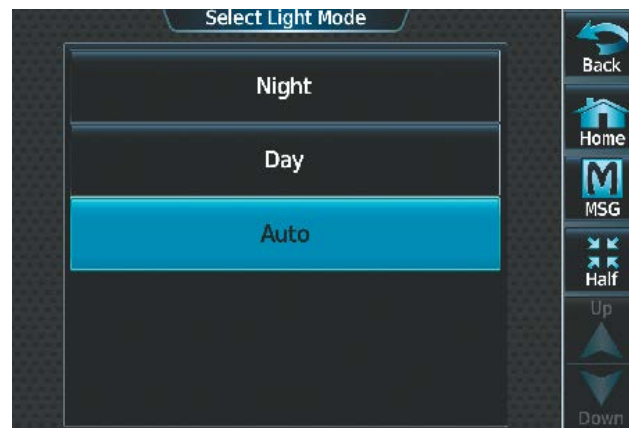


Figure 8-27 Selecting Day, Night, or Auto View

- 4) With 'Auto' selected, touch the **Threshold** Button. The 'Auto Light Mode Threshold' Window is displayed.





Select Chart Options



Adjust Threshold Setting

Figure 8-28 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.

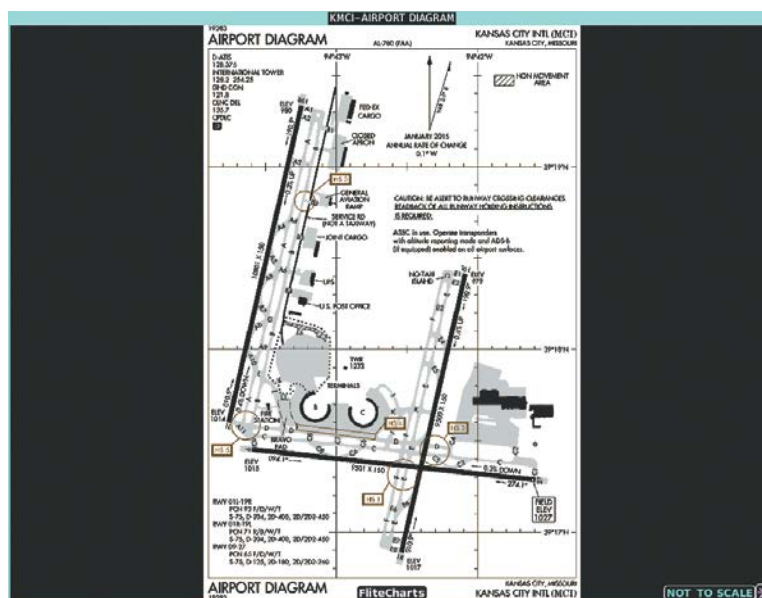


Figure 8-29 Airport Diagram, Day View



## 8.5 SATELLITE TELEPHONE AND DATALINK SERVICES (OPTIONAL)



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



**NOTE:** Separate accounts must be established to access the Iridium Satellite Network for voice and Garmin Connex for data transmission of maintenance reports.

### REGISTERING THE SYSTEM WITH GARMIN CONNEXT

A subscriber account must be established prior to 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 as seen in the following figure. This number will be needed when contacting Garmin Connex to establish the account.

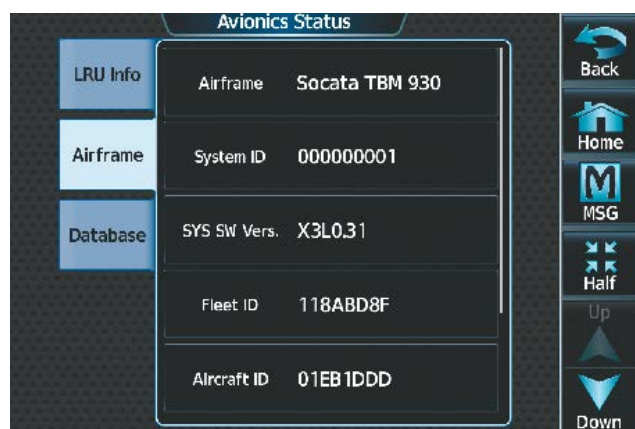


Figure 8-31 System ID Number

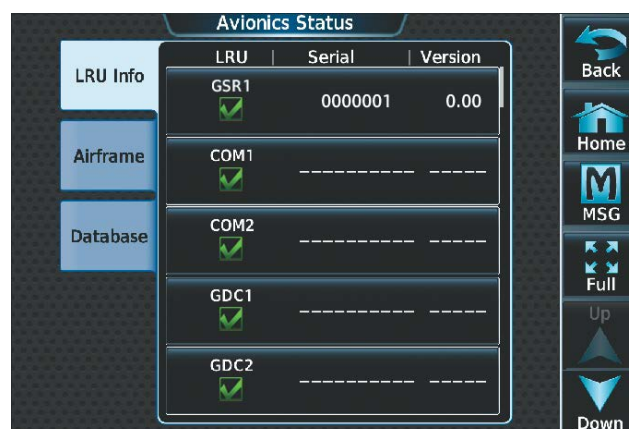


Figure 8-32 Iridium Transceiver Serial Number (GSR1)

- 3) Touch the **LRU Info** Tab. Scroll to view 'GSR1.' Note the serial number of each (see previous figure) 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 8-33 'Connex Registration' Display



Figure 8-34 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.

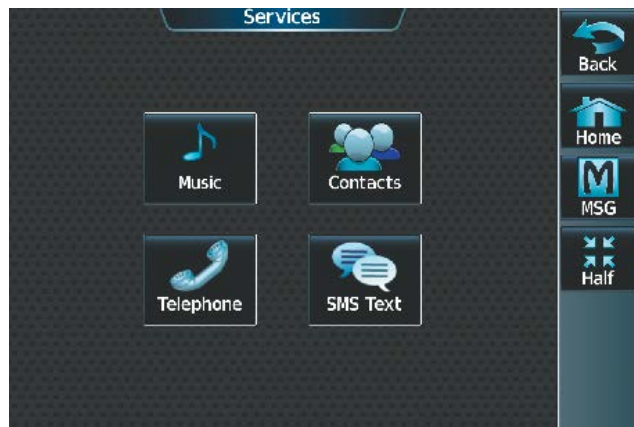


Figure 8-35 'Services' Page



Figure 8-36 Contact List

- 3) Touch the **Create New** Button.
- 4) Touch the **Name** Button, shown in the following figure. The 'Contact Name' Entry Screen is displayed.



Figure 8-37 Enter New Contact Information



Figure 8-38 Enter Name

- 5) Enter the name of the new contact as the example shows in the previous figure.
- 6) Touch the **Enter** Button.
- 7) If desired, touch the **Favorite** Button to designate the new contact as a favorite. A green annunciator indicates the contact is now designated as a favorite.
- 8) Touch the **Telephone Number** Button. The Telephone Number entry screen is displayed.



Figure 8-39 Select Telephone Number

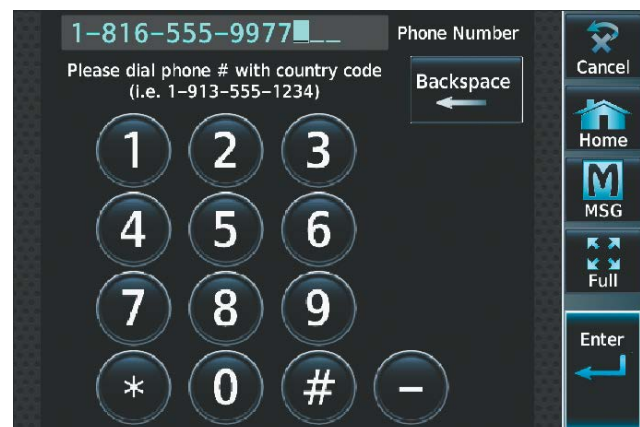


Figure 8-40 Enter Telephone Number

- 9) Enter the telephone number of the new contact as the example shows in the previous figure.
- 10) Touch the **Enter** Button.
- 11) Touch the **Email Address** Button (scroll down as required). The 'Email Address' Entry Screen is displayed.





Figure 8-41 Select Email Address



Figure 8-42 Enter Email Address

- 12) Enter the email address of the new contact as the example shows in the previous figure.
- 13) Touch the **Enter** Button.
- 14) Touch the **Create** Button. The new contact is created and appears in the list of contacts. If the contact was selected as a 'Favorite,' a star symbol will display on the right side of the contact button to indicate this selection.



Figure 8-43 New Contact Info Complete



Figure 8-44 Enter Email Address

#### Editing a contact:

- 1) From MFD Home, touch **Services > Contacts**.
- 2) Touch the contact you desire to edit.
- 3) Touch the information field that you would like to edit.
- 4) When changes are complete, touch the **Save** Button.

### Deleting a contact:

- 1) From MFD Home, touch **Services** > **Contacts**.
- 2) Touch the contact you desire to delete.
- 3) Touch **Delete**.
- 4) Touch **OK**.

### Deleting all contacts:

- 1) From MFD Home, touch **Services** > **Contacts**.
- 2) Touch **Options**.
- 3) Touch **Delete All Contacts**.
- 4) Touch **OK**.

## TELEPHONE COMMUNICATION (OPTIONAL)



**NOTE:** Iridium transceiver setup may differ based on aircraft configuration.

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. Reference the Audio & CNS Section for information regarding enabling and disabling telephone audio.

### Viewing the 'Telephone' Screen:

- 1) From MFD Home, touch **Services** > **Telephone**.
- 2) The 'Telephone' Screen is displayed.

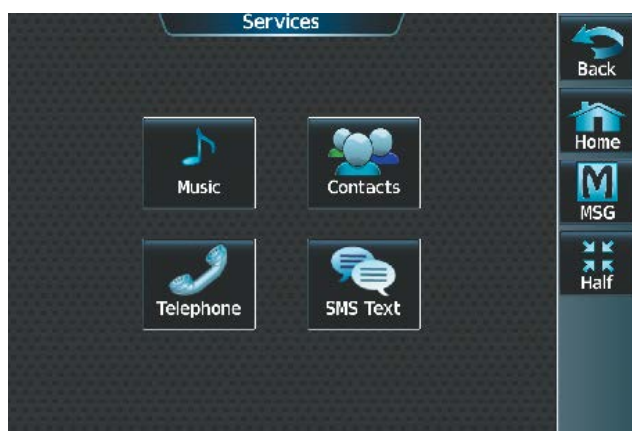





















Figure 8-45 'Services' Page



Figure 8-46 'Telephone' Screen

The 'Telephone' Screen gives a graphical representation of the current disposition of voice transmissions.



Internal Phone	External Phone	Description
 Idle	 Idle	Phone is Idle
 Ringing	 Ringing	Phone is ringing
 Connected	 Connected	Phone has a dial tone (off hook) or connected to another phone
		Phone dialed is busy
 Dialing	 Dialing	Phone is dialing another phone
		Phone has failed
		Phone status not known
	 Disabled	Phone is disabled
	 DATA TX	Phone is reserved for data transmission
		Calling other phone or incoming call from other phone
		Other phone is on hold
		Phones are connected

**Table 8-2 Telephone Symbols**

## ENABLING/DISABLING THE IRIDIUM TELEPHONE SYSTEM

The Iridium Satellite Telephone System may be disabled by the flight crew. When disabled, incoming calls will not be received and outgoing calls will not be possible from the cockpit 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.
- 3) Touch the **Disable Iridium Transmission** Button to disable the transceiver. A green annunciator indicates Iridium transmission is disabled. Touch the button again to enable the transceiver. A gray annunciator indicates Iridium transmission is enabled.



Figure 8-47 Iridium Transceiver Enabled



Figure 8-48 Iridium Transceiver Disabled

## INCOMING CALLS

Incoming voice calls from an external telephone through the Iridium Satellite Network are annunciated by a ring tone and flashing **TEL** Button on the Touchscreen Controller Button Bar, 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.
- 2) Touch the **Answer** Button. The call is now connected as indicated. Touching the **Ignore** Button extinguishes the new call annunciation and the call remains disconnected.



Figure 8-49 Incoming Call Notification



Figure 8-50 Telephone Notification Selected

- 3) When the call is finished, touch the **End Call** Button to disconnect the call.



**NOTE:** When calling the Iridium Telephone, if the initiator of the call hangs up, the annunciation does not disappear for approximately 1 minute.

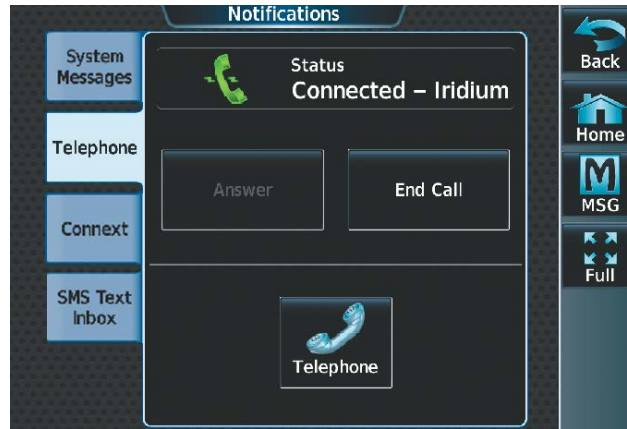


Figure 8-51 Call Answered

## OUTGOING CALLS

Voice calls can be made from the cockpit to an external telephone through the Iridium Satellite Network.

### Making an external call using a telephone number:

- 1) From MFD Home, touch **Services > Telephone**.
- 2) Touch the **Cockpit** Phone Button. The 'Cockpit Phone' Screen is displayed.
- 3) Touch the **Dial** Button. The phone number entry screen is displayed.



Figure 8-52 Cockpit Telephone Status



Figure 8-53 Telephone Number Entry

- 4) Using the number keys, enter the phone number. Touch the **Find** Button to select a phone number from the Contact 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 8-3 International Calling Codes

- 5) Touch the **Enter** Button. The system now begins establishing a connection. The system indicates a completed connection when the telephone is answered.



Figure 8-54 Establishing a Connection

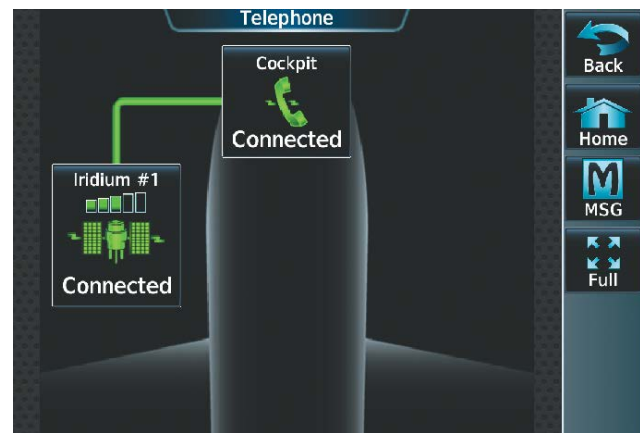


Figure 8-55 Telephone Connected

#### Making an external 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 8-56 Contact List



Figure 8-57 Contact Chosen

- 3) Touch the **Call or Send Text** Button. A selection screen, as shown in the following figure, is displayed.

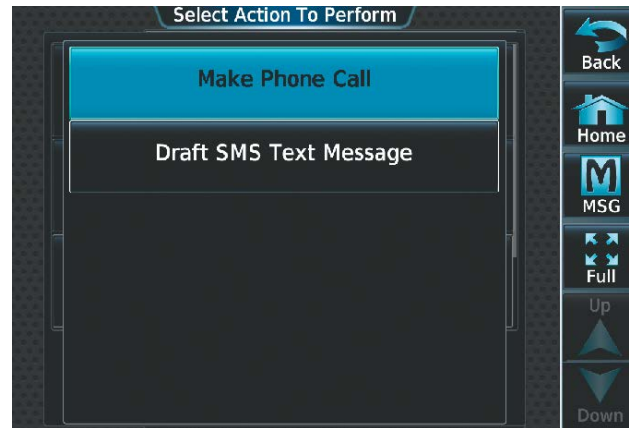


Figure 8-58 Select Action To Perform

- 4) Touch the **Make Phone Call** Button. The system initiates the call. The system indicates a completed connection when the telephone is answered.

**Ending a call:**

- 1) From MFD Home, touch **Services > Telephone**.
- 2) Touch the **Cockpit** Phone Button. The 'Cockpit Phone' Screen is displayed.
- 3) Touch the **End Call** Button.



Figure 8-59 Ending the Call



Figure 8-60 System is Idle After Ending Call

**Using the keypad during a call:**

- 1) From MFD Home, touch **Services > Telephone**.
- 2) Touch the **Cockpit** Phone Button. The 'Cockpit Phone' Screen is displayed.
- 3) Touch the **Open Keypad** Button if you need to enter numbers during a call (e.g., to enter a PIN).
- 4) Touch the Back Button when finished to return to the 'Cockpit Phone' Screen.



Figure 8-61 Keypad During Call

## MANAGING TELEPHONE AUDIO



**NOTE:** The **Push-to-Talk Switch** is not utilized for telephone communication. The microphone is active whenever a call is connected and telephone audio is enabled.



**NOTE:** A call must be connected in order to view the cockpit phone options.

When an incoming call is received or an outgoing call is made, telephone audio (which includes headset and microphone) is automatically enabled for either the pilot or copilot, depending on which Touchscreen Controller was used to make or answer the call. If the pilot or copilot wishes to join an existing call, the telephone audio must be enabled manually on the appropriate Touchscreen Controller. When the call is ended, telephone audio is automatically disabled. The green **Pilot Audio** Annunciator Button indicates the enabled pilot audio on the pilot-side Touchscreen Controller. The copilot-side controller will, likewise, indicate a green **Copilot Audio** Annunciator Button. Pilot and copilot telephone audio can be enabled and disabled manually by performing the following steps.

Additionally, the pilot or copilot may choose to silence their radios during a call. After silencing the radios, the pilot or copilot radio audio is muted for the duration of the call and the annunciation “Pilot Radios Muted - Pilot radios are muted” or “Copilot Radios Muted - Copilot radios are muted” is provided on the Touchscreen Controller as a system message. Once the call is complete, radio audio will automatically unmute.

### Enabling/disabling telephone audio and adjusting volume:

- 1) After a call is connected, from MFD Home, touch **Services > Telephone**.
- 2) Touch the **Cockpit Phone** Button. The ‘Cockpit Phone’ Screen is displayed.





Figure 8-62 Pilot Audio Annunciator is Gray

- 3) Touch the **Pilot Audio** or **Copilot Audio** Annunciator Button to disable telephone audio, including microphone (gray annunciator).
- 4) Touch the Annunciator Button again to enable telephone audio, including microphone (green annunciator).
- 5) Touch and move the **Volume** Slider on the appropriate Touchscreen Controller to adjust the telephone volume.

## TEXT MESSAGING (SMS)

The pilot or copilot can send and receive short message service (SMS) text messages on the Iridium Satellite Network. Messages may be sent to an email address or text message capable cellular telephone. Message length is limited to 160 characters, including the email address.

Incoming SMS messages are annunciated by a flashing **SMS** Button on the Touchscreen Controller Button Bar, as well as a flashing 'SMS' annunciation in the upper left corner of the PFD display.

### Viewing the 'SMS Text Messaging' Screen:

From MFD Home, touch **Services** > **SMS Text**.

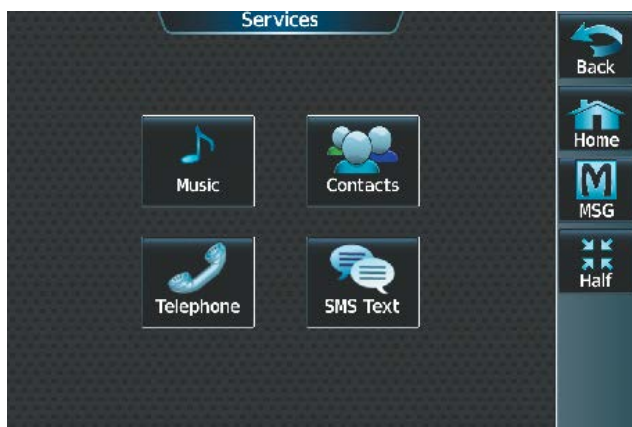


Figure 8-63 'Services' Page

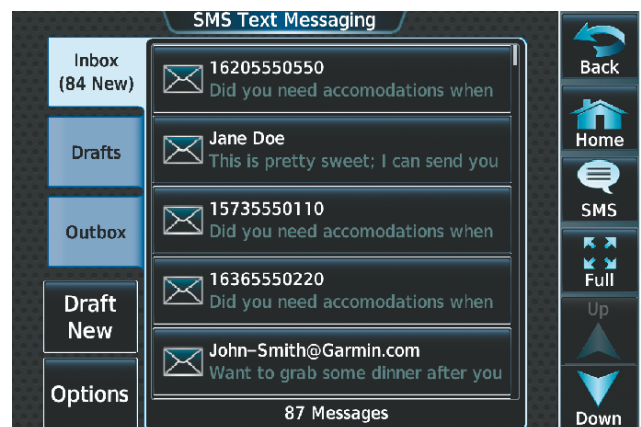


Figure 8-64 'SMS Text Messaging' Page



### Sending a text message:

- 1) From MFD Home, touch **Services** > **SMS Text**.
- 2) Touch the **Draft New** Button. The 'SMS Text Message Draft' Screen is displayed. The **Draft New Message** Button is also available from within the **Drafts** and **Outbox** Tabs.

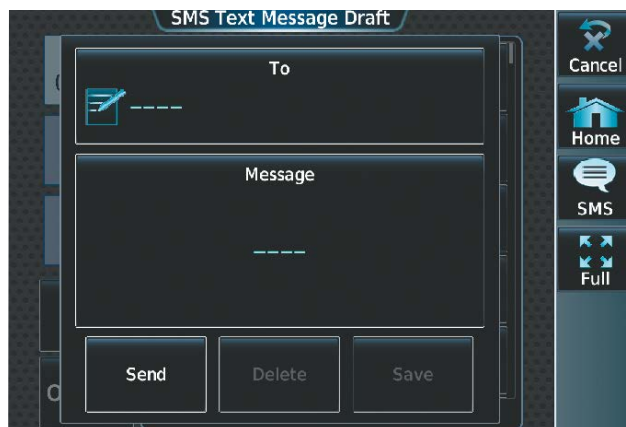


Figure 8-65 Touch 'To' Window

- 3) Touch the **To** Window. A selection screen is displayed. If the text message is to be sent to an SMS compatible telephone, touch the **Phone** Button. If the message is to be sent to an email address, touch the **Email** Button.

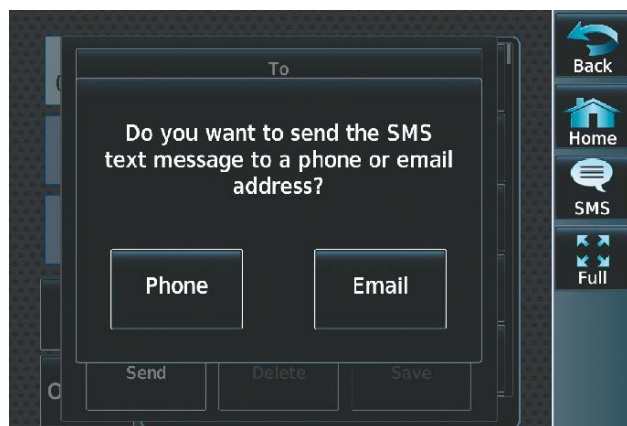


Figure 8-66 Select Message Destination

Alpha Buttons are displayed when the **Email** Button is touched



Numeric Buttons are displayed when the **Phone** Button is touched

Figure 8-67 Enter Number or Address

- 4) Enter the telephone number or email address. The number or address may be obtained from stored Contacts by touching the **Find** Button.
- 5) If a phone number or address was entered manually, touch the **Enter** Button. The number or address is now displayed.
- 6) Touch the **Message** Window. The alphanumeric buttons are displayed.

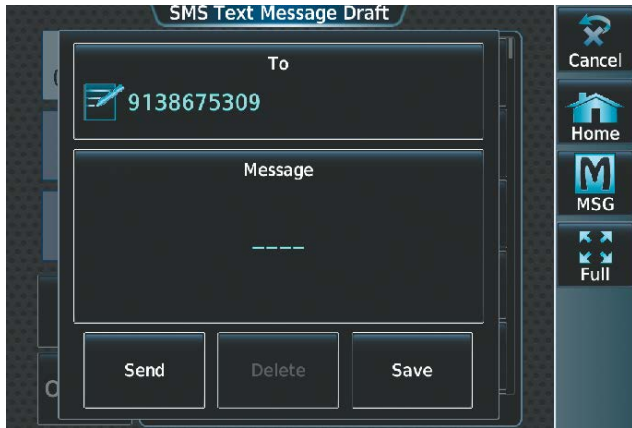


Figure 8-68 Touch Message Window

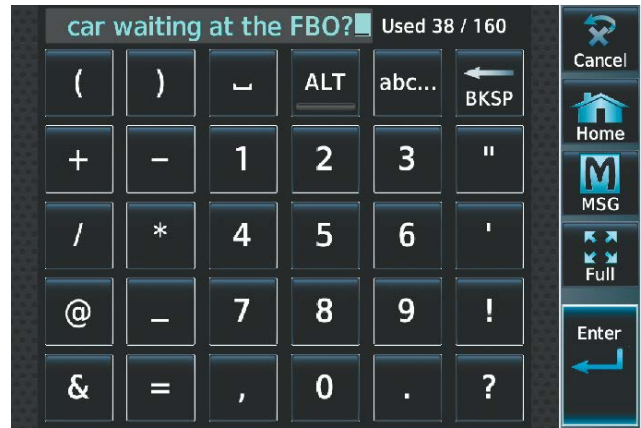


Figure 8-69 Reply Message

- 7) Enter the message text. The large upper knob on the Touchscreen Controller may be used to move the cursor within the message text in order to select the location for adding new text, or delete existing text.
- 8) Touch the **Enter** Button. The message text is displayed in the **Message** Window.

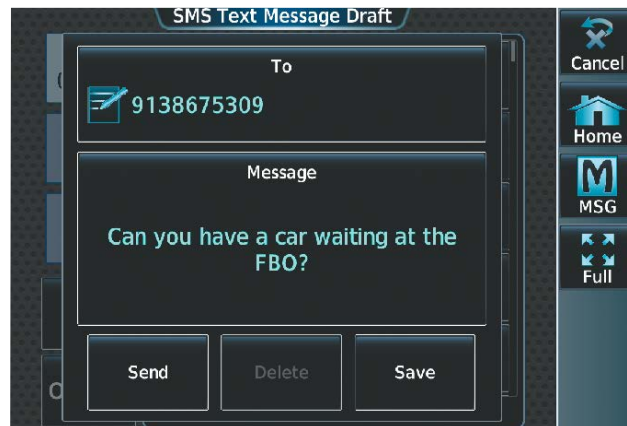


Figure 8-70 Message Ready to Send

- 9) Touch the **Send** Button.

#### **Sending a new text message to a saved contact:**

- 1) From MFD Home, touch **Services > Contacts**.
- 2) Scroll down as required to find a contact. Touch the contact's name on the Touchscreen Controller.
- 3) Touch the **Call or Send Text** Button.

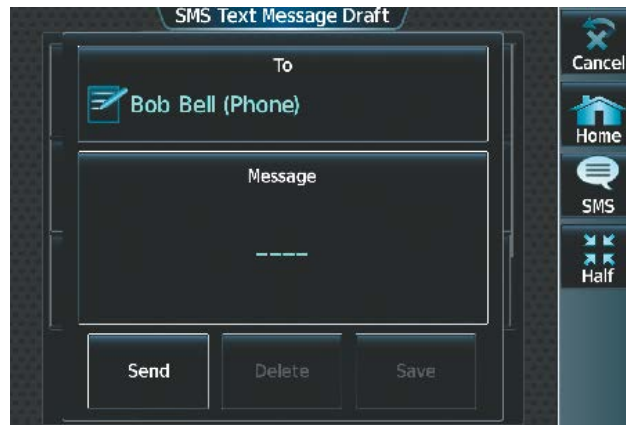


Figure 8-71 Touch the Call or Send Text Button

- 4) Touch the **Draft SMS Text Message** Button. The 'SMS Text Message Draft' Screen is displayed.
- 5) Follow the steps in the previous procedure to fill out and send the text message.

**Viewing a text message when received:**

- 1) Touch the flashing **SMS** Button on the Touchscreen Controller. The **SMS Text Inbox** Tab is automatically selected and the newly received text message is shown at the top of the list.



Figure 8-72 New SMS Text Message Annunciation

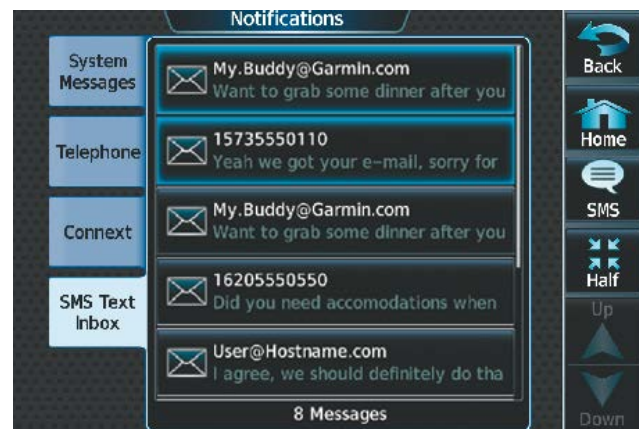


Figure 8-73 New SMS Text Message at Top of List

- 2) Touch the desired message to display its contents.



Figure 8-74 New Text Message Contents

- 3) If desired, touch the **Reply** Button to create a reply to the message.
- 4) Touch the **Delete** Button to delete the message from the list.
- 5) Touching the **Save Contact** Button saves the contact information in the system contact list.

#### Replying to a text message:

While viewing the text message content, touch the **Reply** Button.

Or:

- 1) From MFD Home, touch **Services > SMS Text**.



Figure 8-75 SMS Text Services Selection



Figure 8-76 Touch Desired Message

- 2) If necessary, scroll to the desired message. Touch the desired text message in the Inbox list. The text message is displayed.
- 3) Touch the **Reply** Button. The opened 'SMS Text Message' Screen is displayed.



Figure 8-77 Message Content



Figure 8-78 New Reply Message Screen

- 4) Touch the **Message** Window to display the alphanumeric buttons.

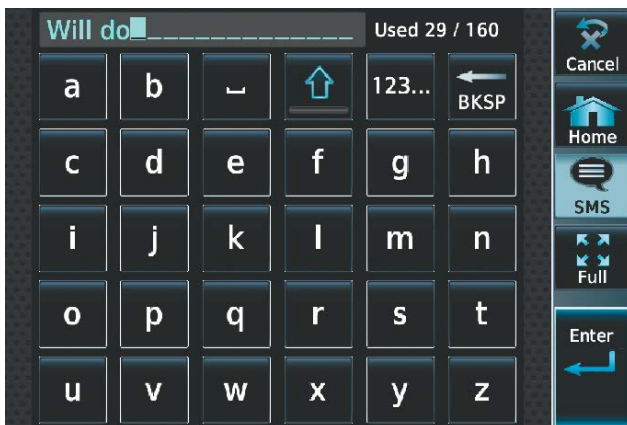


Figure 8-79 Message Content

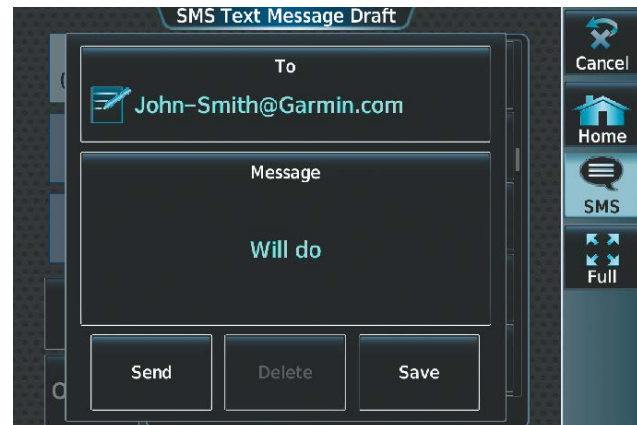


Figure 8-80 Reply Message

- 5) Enter the reply text as seen in the previous figure. The large upper knob on the Touchscreen Controller may be used to move the cursor within the message text in order to select the location for adding new text, or delete existing text.
- 6) Touch the **Enter** Button. The reply message is displayed.
- 7) Touch the **Send** Button. The 'SMS Message Replied To' Screen is displayed.





Figure 8-81 Reply Message Sent

- 8) If desired, touch the **Reply Again** Button to resend the reply.
- 9) Touch the **Delete** Button to delete the message from the list.
- 10) Touching the **Save Contact** Button saves the contact information in the system contact list.

## TEXT MESSAGE BOXES

Received text messages reside in the Inbox as 'Read' or 'Unread' messages. The Outbox contains 'Sent' and 'Unsent' text messages. Saved messages that are meant to be sent later are stored as Drafts.

### Viewing Inbox messages:

- 1) From MFD Home, touch **Services > SMS Text**.
- 2) Touch the **Inbox** Tab. A list of received messages is displayed. The **Inbox** Tab is selected by default when accessing the 'SMS Text Messaging' Screen.



Figure 8-82 SMS Text Inbox

### Viewing Draft messages:

- 1) From MFD Home, touch **Services > SMS Text**.
- 2) Touch the **Drafts** Tab. A list of draft messages is displayed; provided messages have been previously saved.
- 3) Touch a message to access the **Send** or **Delete** Buttons.



Figure 8-83 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.
- 3) Touch a message to access the **Send Again**, **Delete**, and **Save Contact** Buttons.

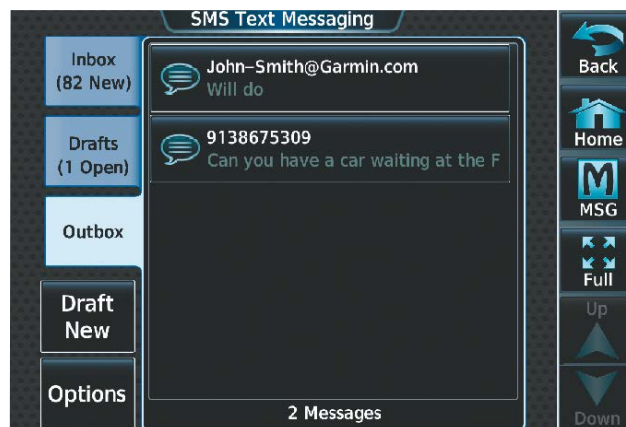





Figure 8-84 SMS Text Outbox

## 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



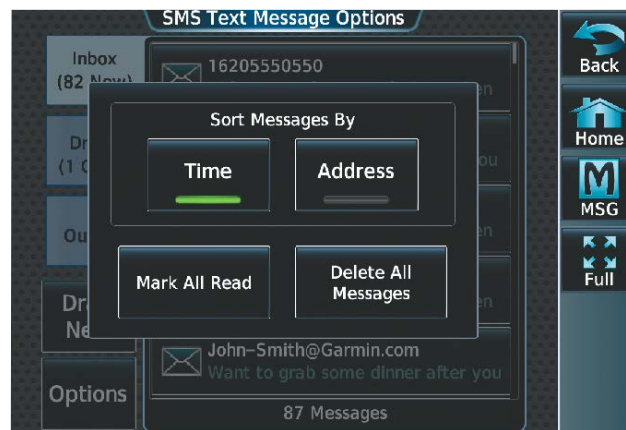
Message Symbol	Description
	System is sending text message
	Text message has been sent
	System failed to send text message

**Table 8-4 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.



**Figure 8-85 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.
- 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.
- 3) Touch the **Mark All Read** Button. All messages in the Inbox now indicate they have been opened.
- 4) Touch the **Back** Button to return to the Inbox.

## Deleting all messages:

- 1) From MFD Home, touch **Services** > **SMS Text**.
- 2) Touch the **Options** Button. The selection buttons are displayed.
- 3) Touch the **Delete All Messages** Button. A confirmation screen is displayed.
- 4) Touch the **Back** Button to return to the Inbox.

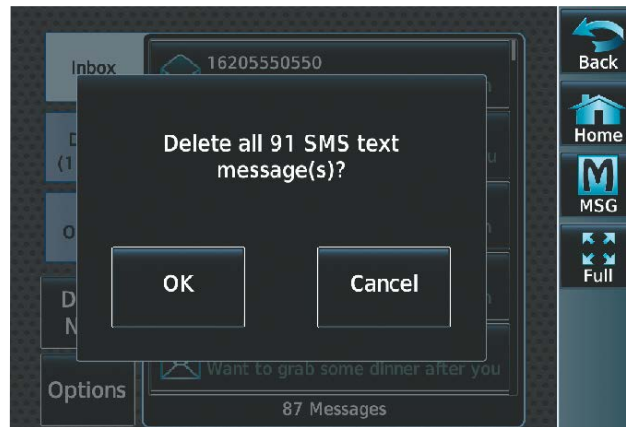


Figure 8-86 Confirm Deletion of Messages

- 4) Touch the **OK** Button.

## 8.6 CONNEXT SETUP (OPTIONAL)

Connex seamlessly brings together people, flight information, and hardware to create a connected environment. This section will discuss how to setup the optional wireless transceiver (Flight Stream 510) with a mobile device running the Garmin Pilot™ application. Data shared is dependent upon the hardware installed on your aircraft and whether you are operating Garmin Pilot™ on an iOS System or an Android System.

Please see the applicable section in this Pilot's Guide for discussion on the feature from the flight deck point of view. See the Garmin Pilot™ for iOS Manual or the Garmin Pilot™ for Android Manual for discussion in detail on how to use the below features from the Garmin Pilot application point of view.

Upon successful connection, the Garmin Pilot application and the wireless transceiver enable an array of features:

- **Database Concierge:** enables wireless transfer of databases to select avionics
- **Flight Plan Transfer:** supports two-way flight plan transmission
- **Garmin Pilot Interface:**
  - **Iridium Communications:** provides satellite voice and SMS message capability
  - **SiriusXM Music:** delivers audio remote control of SiriusXM audio entertainment
    - » Requires GDL 69/69A satellite datalink receiver and a SiriusXM subscription
- **Flight Deck Data Streaming to Mobile Device:**
  - **Attitude & Heading Reference System (AHRS):** displays attitude information including roll, pitch, and yaw
  - **ADS-B Traffic:** displays Automatic Dependent Surveillance - Broadcast (ADS-B) traffic targets
  - **GPS Information:** shares position, velocity, and time with Garmin Pilot
  - **SiriusXM Weather:** displays SiriusXM aviation weather for the U.S. and Canada
    - » Requires GDL 69/69A satellite datalink receiver and a SiriusXM subscription
  - **Flight Data Logging:** streamed in real time to Garmin Pilot and saved as a log for each flight in Garmin Pilot on your portable electronic device

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' Screen:

- 1) From MFD Home, touch **Utilities > Setup**.
- 2) Touch **Connex Setup**.

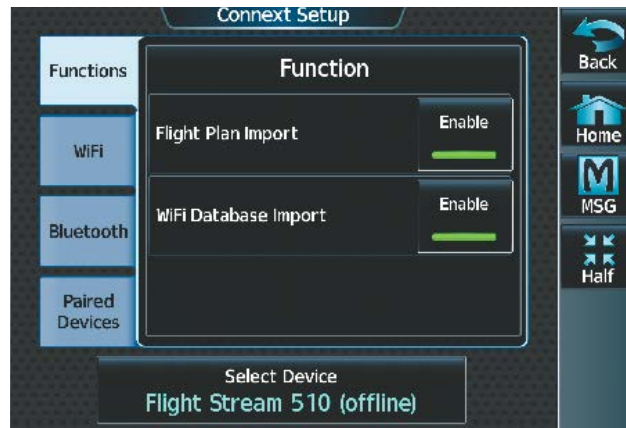


Figure 8-87 'Connex Setup' Screen

### Changing the Bluetooth Name:

- 1) From MFD Home, touch **Utilities > Setup > Connex Setup**.
- 2) From the 'Connex Setup' Screen, touch the **Bluetooth** Tab.
- 3) Touch the **Bluetooth Device Name** Window to display the alphanumeric buttons.
- 4) Enter the desired name using the alphanumeric buttons (see following figure).
- 5) Press the **Enter** Button upon completion.

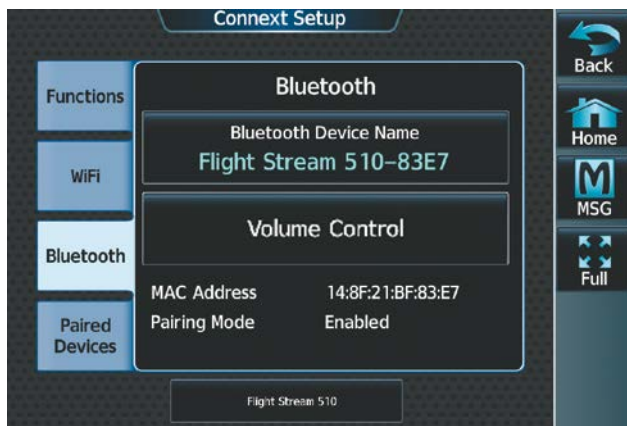


Figure 8-88 Connex Setup Bluetooth Device Info

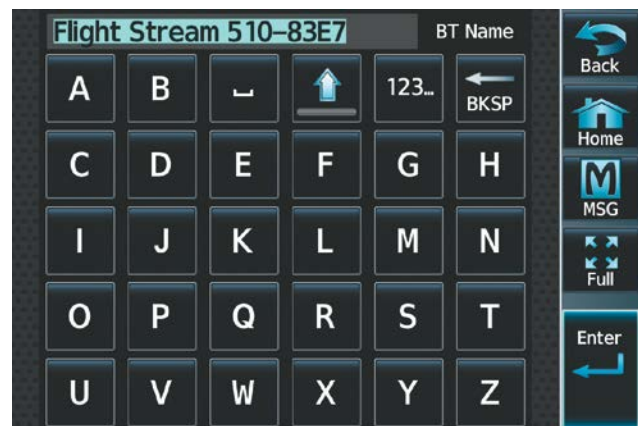


Figure 8-89 Edit Bluetooth Device Name



**NOTE:** When selecting crew position for the first time or after clearing user data, volume control defaults to having no crew position selected (i.e., no green annunciator). After the initial selection, the last selected crew position (indicated by a green annunciator) will become the default position.

### Selecting crew position for Garmin Pilot control of Connex Bluetooth volume:

- 1) From MFD Home, touch **Utilities > Setup > Connex Setup**.
- 2) From the 'Connex Setup' Screen, touch the **Bluetooth** Tab.

- 3) In the center of the GTC Touchscreen, touch the **Volume Control** Button.
- 4) Touch **Pilot**, **Copilot**, or **Pass** (indicated by a green annunciator) to enable SiriusXM remote volume control on a mobile device running Garmin Pilot.

In the following figure, the **PASS** (Passenger) Button has been selected. A mobile device running Garmin Pilot can now control the passenger's SiriusXM volume.

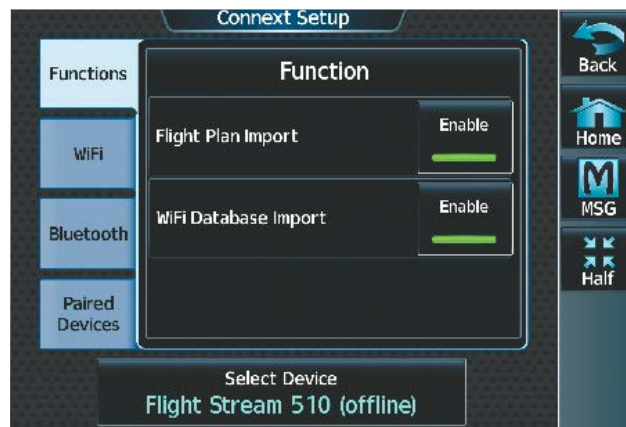


**Figure 8-90 Bluetooth Volume Control**

- 5) Once a selection has been made, press the **Back** Button to return to the previous screen.

#### **Enabling/Disabling Flight Plan Importing from Garmin Pilot:**

- 1) From MFD Home, touch **Utilities > Setup > Connex Setup**.
- 2) While viewing the 'Connex Setup' Screen, touch **Functions** Tab.
- 3) Touch the **Enable** Button to enable (green annunciator) Flight Plan Import from Garmin Pilot (see following figure).



**Figure 8-91 'Connex Setup' Screen**

### Enabling/Disabling WiFi Database Importing from Garmin Pilot:

- 1) From MFD Home, touch **Utilities > Setup > Connex Setup**.
- 2) While viewing the 'Connex Setup' Screen, touch **Functions** Tab.
- 3) Touch the **Enable** Button to enable (green annunciator) WiFi Database Import from Garmin Pilot (see previous figure).

### Enabling/disabling automatic reconnection of a specific paired device:

- 1) From MFD Home, touch **Utilities > Setup > Connex Setup**.
- 2) While viewing the 'Connex Setup' Screen, touch the **Paired Devices** Tab.
- 3) Touch the **Enable** Button to enable (green annunciator) auto reconnect to the desired paired device (see following figure).



Figure 8-92 Bluetooth Device Info.



Figure 8-93 Editing the Bluetooth Name.

### Removing a specific paired device from the list of paired devices:

- 1) From MFD Home, touch **Utilities > Setup > Connex Setup**.
- 2) While viewing the 'Connex Setup' Screen, touch **Paired Devices** Tab.
- 3) Touch the Bluetooth device name to be removed.
- 4) A confirmation screen is displayed asking to remove the paired Bluetooth device.
- 5) Touch **OK** to remove the device from the list of paired devices (see previous figure).



## 8.7 SIRIUSXM SATELLITE RADIO (OPTIONAL)



**NOTE:** Refer to the Hazard Avoidance Section for information and activation of SiriusXM Weather Products.

The SiriusXM Satellite Radio entertainment feature of the SiriusXM Datalink Receiver provides audio entertainment for passengers and crew. The SiriusXM Datalink Receiver can receive SiriusXM Satellite Radio entertainment services at any altitude throughout the Continental United States.

SiriusXM Satellite Radio offers a variety of radio programming over long distances without having to constantly search for new stations. Based on signals from satellites, coverage far exceeds land-based transmissions. SiriusXM Satellite Radio services are subscription-based. For more information on specific service packages, visit [www.siriusxm.com](http://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 and/or Data Radio ID must be provided to SiriusXM Satellite Radio to activate the entertainment subscription.

SiriusXM Satellite Radio uses the coded radio ID to send an activation signal that, when received by the SiriusXM Datalink Receiver, allows it to play entertainment programming.

These radio IDs are located:

- On the label on the back of the Datalink Receiver.
- On the 'SiriusXM Info' Screen on the Touchscreen Controller (see following figure).

Contact the installer if the radio ID cannot be located.

#### Establishing a SiriusXM Satellite Radio account:

- 1) From MFD Home, touch **Utilities > Setup > SiriusXM Info**.
- 2) Note the Audio Radio ID and/or Data Radio ID as seen in the following figure.
- 3) Contact SiriusXM Satellite Radio. Follow the instructions provided by SiriusXM Satellite Radio services.



Figure 8-94 XM Information Display





**NOTE:** The **LOCK** Button on the 'SiriusXM Info' Screen is used to save GDL 69A SXM activation data when the SiriusXM services are initially set up. It is not used during normal SiriusXM Radio operation, but there should be no adverse effects if inadvertently selected during flight.

### Activating SiriusXM Satellite Services on the system:

- 1) After contacting SiriusXM in the above procedure, from MFD Home, touch **Utilities > Setup > SiriusXM Info**.
- 2) Verify the Data Radio and/or Audio Radio show a signal strength, indicating the system is communicating with the satellite.
- 3) Touch the **Start Activation** Button in the 'Activation' Field.
- 4) Touch the **LOCK** Button in the 'Activation' Field as seen in the following figure. The system is now activated and ready for use.

## USING SIRIUSXM RADIO

The 'Music' Screen provides information and control of the audio entertainment features of the SiriusXM Satellite Radio.



Figure 8-95 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 (e.g., 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.

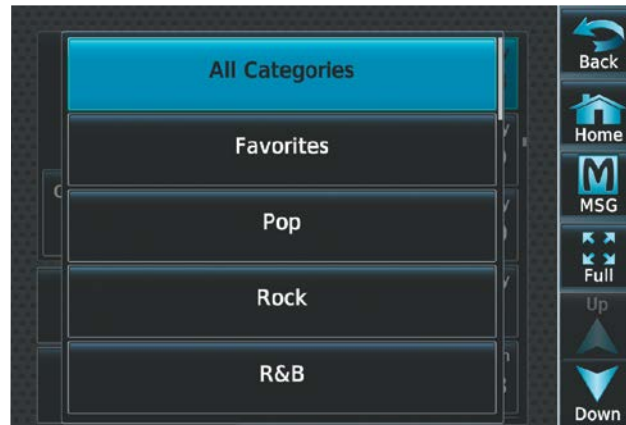


Figure 8-96 Channel Categories

- 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 'Favorites' Channel List.
- 5) Touch the desired channel in the list. The channel is now displayed in the 'Now Playing' Field.

## ADJUSTING VOLUME

Pilot SiriusXM audio volume is shown in the 'Music Volume' Field (see following figure) as a percentage of full volume. Volume can be muted manually, or muting may be initiated automatically when other audio, such as radio, intercom, or aural alerts, is present. Entertainment audio adjustment may also be accessed by touching the **Audio & Radios** Button on the Touchscreen Controller, then scrolling to display the **SAT Music** Button.

### Adjusting SiriusXM pilot 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. Dragging to the right increases volume. Dragging to the left to decrease the volume.

Or:

Turn the **Volume** Knob on the Touchscreen Controller.

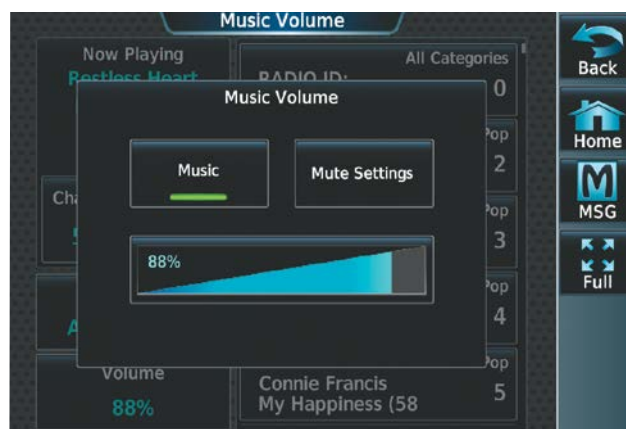


Figure 8-97 Adjusting Volume

### Muting or unmuting the 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 'Music 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 2,000 feet AGL
- » Aircraft decelerates to less than 150 KIAS
- » Aircraft enters an unusual pitch or roll attitude sufficient to cause PFD display decluttering
- » A flight display enters reversionary mode (PFD split mode does not cause muting)

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 (see following figure) to select/deselect automatic soft muting of entertainment audio when intercom audio is present. This function is active when the annunciator is green.

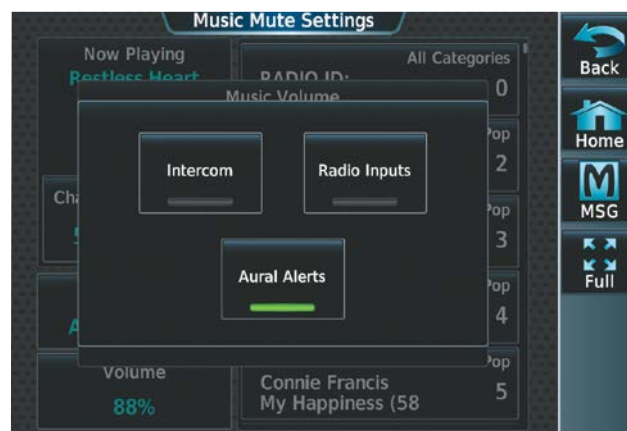


Figure 8-98 Mute Settings

- 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.

## 8.8 DATA LOGGING

### FLIGHT DATA LOGGING



**NOTE:** Some aircraft installations may not provide all aircraft/engine data capable of being logged by the system.



**NOTE:** When a wireless transceiver (FS 510) is installed, Flight Data Logging parameters can be streamed to a mobile device running the Garmin Pilot application and the log file is available in Garmin Pilot.

The Flight Data Logging feature will automatically store critical flight and engine data on a SD data card (up to 16GB) inserted into the top card slot of the MFD. Approximately 600 flight hours can be recorded for each 1GB of available space on the card. The data recorded by the Flight Data Logging feature is separate from data recorded by the Central Maintenance Computer (CMC).

Data is written to the SD card once each second while the MFD is powered on. All flight data logged on a specific date is stored in a file named in a format which includes the date, time, and nearest airport identifier. The file is created automatically each time the system is powered on, provided an SD card has been inserted. The .csv file may be viewed with Microsoft Excel® or other spreadsheet applications.

When a wireless transceiver (FS 510) is installed, logged data from the current flight plan and from past flights can be streamed via a Bluetooth connection. This requires a Flight Stream 510 to be inserted in the bottom slot of the GDU, and a the Garmin Pilot application running on a mobile device.

Once the data has been transferred to Garmin Pilot, the app can transfer the flight log to the pilot's flygarmin.com account for archiving and analysis once the mobile device connects to the internet.

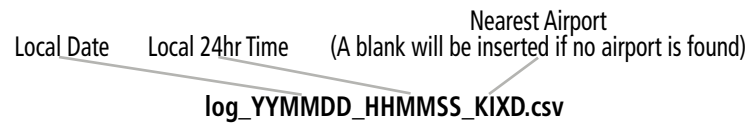


**NOTE:** Past flights cannot be viewed directly on Garmin Pilot and need to be pushed to flygarmin.com to access them.

The following is a list of data parameters the system is capable of logging.

- |                                    |  |  |
|------------------------------------|--|--|
| • Date                             | • Latitude (degrees; geodetic; +North) | • AFCS roll/pitch modes                |
| • Time                             | • Longitude (degrees; geodetic; +East) | • AFCS roll/pitch commands             |
| • GPS altitude (MSL)               | • Magnetic Heading (degrees)           | • GPS fix                              |
| • GPS altitude (WGS84 datum)       | • HSI source                           | • GPS horizontal alert limit           |
| • Baro-Corrected altitude (feet)   | • Selected course                      | • GPS vertical alert limit             |
| • Baro Correction (in/Hg)          | • Com1/Com2 frequency                  | • SBAS GPS horizontal protection level |
| • Indicated airspeed (kts)         | • Nav1/Nav2 frequency                  | • SBAS GPS vertical protection level   |
| • Vertical speed (fpm)             | • CDI deflection                       | • Fuel Qty (lbs)                       |
| • GPS vertical speed (fpm)         | • VDI/GP/GS deflection                 | • Fuel Flow (pph)                      |
| • OAT (degrees C)                  | • Wind Direction (degrees)             | • Fuel Temperature (deg. C)            |
| • True airspeed (knots)            | • Wind Speed (knots)                   | • Oil Pressure (psi)                   |
| • Pitch Attitude Angle (degrees)   | • Active Waypoint Identifier           | • Oil Temperature (deg. C)             |
| • Roll Attitude Angle (degrees)    | • Distance to next waypoint (nm)       | • N1, N2 (percent)                     |
| • Lateral and Vertical G Force (g) | • Bearing to next waypoint (degrees)   | • ITT (deg. C)                         |
| • Ground Speed (kts)               | • Magnetic variation (degrees)         |  |
| • Ground Track (degrees magnetic)  | • Autopilot On/Off                     |  |

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.



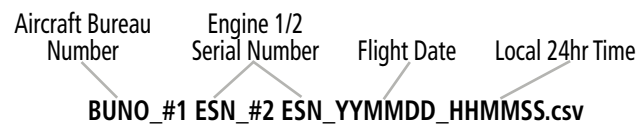
**Figure 8-99 Flight Data Log File Format**

## CMC DATA LOGGING (OPTIONAL)

Central Maintenance Computer (CMC) Data Logging automatically stores avionics data, events/faults, exceedances, and aircraft logs on a SD Card inserted into the top card slot of the MFD. This feature is useful for system integration, maintenance diagnostics, maintenance scheduling, return to service, and in-flight reporting of failure status.

Continuous data recording is written to the SD card once every ten seconds. All CMC data logged on a specific date is stored in a file named in a format which includes the aircraft bureau number, engine serial numbers, flight date, and time. 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 file containing CMC recorded data will appear in the format shown in the following figure. This file can be imported into most computer spreadsheet applications.



**Figure 8-100 CMC Data Log File Format**

The following image is an example of how the file could be named.

**761551\_228039\_226729\_200329\_151208.csv**

**Figure 8-101 CMC Data Log File Name Example**

## 8.9 ELECTRONIC CHECKLISTS (OPTIONAL)



**NOTE:** The checklists shown in the following figures are examples only.

The Electronic Checklists (ECL) function allows the pilot to view and interact with aircraft checklists. Checklist contents are displayed on the PFD and the MFD. Checklist controls are provided on the GTC. The user can load a checklist file to the system by placing it on an SD card hosted in the top or bottom slot of the MFD. Once the checklist file is synced across the system, the SD card with the checklist file is no longer required.

### CHECKLIST FEATURES

#### CHECKSET TOOL

A checklist file can be created or edited by the pilot without involvement from Garmin. Garmin provides a CheckSet Tool which is used to generate and edit electronic checklist files. These files are saved in the .gcl format. Previous files in the .ace format should be converted to .gcl using the CheckSet Tool. Visit [flygarmin.com](http://flygarmin.com) to download the CheckSet Tool.



**NOTE:** Garmin does not provide a checklist file required for flight operation. The file is expected to be authored and certified by the customer.

#### FONTS AND COLORS

Electronic Checklists allow the pilot to configure checklist information in various font sizes and colors. Additional checklists support all characters available on a standard keyboard, however titles and text may limit character use. Challenge items notes, subtitles, etc., have a new palette of colors available based on the design selection from the author of the checklist.

The following table displays the recommended color scheme for various elements. It is possible to define a custom scheme for these items.

Item	Color
'Checked' Checklist Item	Green
'Unchecked' Checklist Item	White
Plain Text	Silver
Notes	Silver
Cursor Box on Selected Item	Cyan
Warning Statements	Amber
Hyperlinks	Cyan
Subtitle	White
Caution Statements	White

Table 8-5 Suggested Color Scheme

#### HYPERLINK-BASED NAVIGATION

Checklist files support navigation using hyperlinks. The author can develop checklists with embedded hyperlinks and the pilot can select the link to navigate to the associated checklist. A checklist can contain one or more links to allow rapid navigation to the associated checklists.





**NOTE:** The pilot must add return links for navigating back to the initial checklist if applicable.

## BRANCHED QUESTIONING

Many checklists involve a decision-making process that depends on operational conditions. Branched questioning allows the checklist to provide two or more options. Each option can have a sub checklist associated with it. The pilot can pick the appropriate option and complete the associated checklist. Only one of the sub checklists needs to be filled out in order to satisfy the “Checklist Complete” criteria.

When the pilot is complete with all items on a branched checklist, the bottom of the page will display “Back to Previous?” which will return the pilot back to the main checklist.

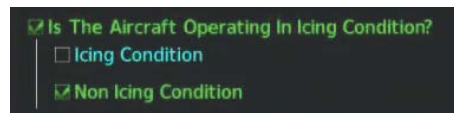


Figure 8-102 Branched Questioning

## CHECKLIST IMAGES

The Checklist feature can display an image as a part of the checklist. The image can be setup as a challenge item with an associated check box or as a reference item without a check box. The images are included in the checklist file uploaded to the system.

## OPERATION

The following discussion on Dual Pilot Control operation is based on the assumption that PFDs are operating in 60/40 viewing mode. This scheme has four panes available for electronic checklist display.

Press the small right knob on the Touchscreen Controller to check/uncheck a checklist item. Press and hold the small right knob to open and close a checklist.

## DUAL PILOT CONTROL

In dual pilot control, the pilot controls checklists on the pilot-side PFD and on the left half of the MFD. The copilot controls checklists on the right half of the MFD and on the copilot-side PFD.

### Accessing and navigating checklists:

- 1) From MFD Home, touch **Checklist**. The checklist structure is displayed as shown in the following figure.

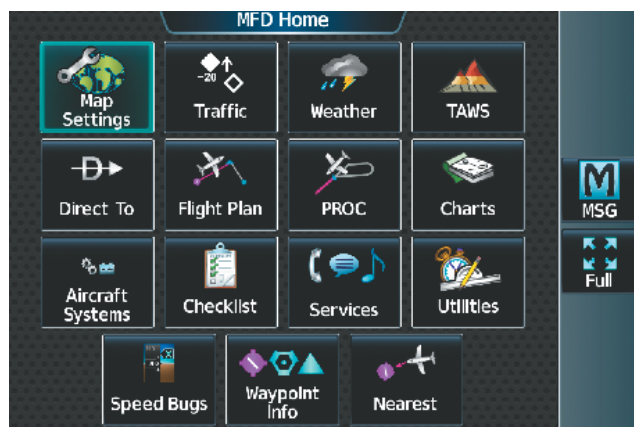


Figure 8-103 'Home' Screen



Figure 8-104 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 Start** is selected and the checklist is displayed in the previously selected GDU display pane as in the following figure. The first checklist item is selected as indicated by the white text surrounded by a cyan box.

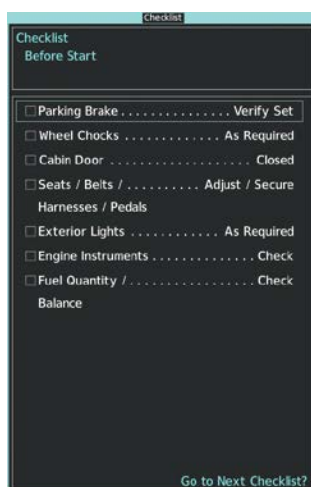


Figure 8-105 First Checklist Item Selected

- 3) Press the lower knob on the Touchscreen Controller 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.

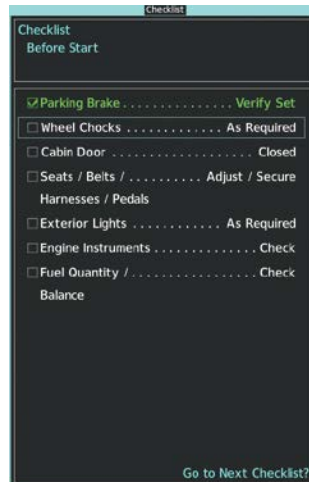


Figure 8-106 First Checklist Item Completed and Checked

Turn the lower knob on the Touchscreen Controller to scroll through the checklist and select the desired checklist item.

Selecting a checked item and pushing the lower knob on the Touchscreen Controller will return the item to the unchecked state.

- 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 prior to checking all the checklist items, '\*Checklist Not Finished\*' will be displayed in amber text.



Figure 8-107 Checklist Complete

- 5) While the 'Go To Next Checklist?' text is highlighted, push the small right knob on the Touchscreen Controller 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. **Before Start** is selected in the following figure.
- 3) Touch the **Checklist Options** Button.
- 4) Touch the **Reset Checklist** Button as seen in the following figure.



Figure 8-108 'Checklist' Screen



Figure 8-109 Checklist Options

### Resetting all checklists:

- 1) From MFD Home, touch **Checklist**.
- 2) Touch the **Checklist Options** Button shown in the previous figure.
- 3) Touch **Reset All Checklists** as seen in the previous figure.

## 8.10 ELECTRONIC DOCUMENTS (OPTIONAL)

The Electronic Document function allows viewing of electronic documents on the selected display pane. The system allows the display of electronic documents from two sources. These sources are Installed Documents and User Documents.

### INSTALLED DOCUMENTS

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Installed Documents are stored on 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

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User Documents are those loaded by the crew. User Documents must be in .pdf format and reside on an SD Card no larger than 16GB. The Maximum document file size is 1.5GB. The maximum number of pages per document is limited to 9,999. Pages that contain large and/or numerous images may exceed RAM memory limits and therefore may not be displayed correctly or may not be displayed at all.

An SD card must be inserted into the top card slot of each display on which it is desired to view the user documents. Each display can only access electronic documents on the SD Cards that are inserted in that display.

User Documents are unique to the display on which they are viewed.

### SUPPORTED PDF FEATURES

User Documents must be in .pdf format. The following .pdf features are not supported. If a file contains any of these features, the system will ignore the feature and display the document.

- » Embedded files (attachments)
- » Alternate images (using a different image for display and printing)
- » Page labels (alternate page numbers; e.g., i, ii, iii, iv for Table of Contents)
- » Additional annotations, including file attachment annotation, sound annotation, movie annotation, widget annotation, and trap network annotation
- » Digital signatures
- » JavaScript
- » Logical structure (structuring documents into chapters, paragraphs, headings, footnotes)
- » Web capture information (annotations for search engines)
- » Prepress support (annotations for newspapers, etc.)

### SD CARD FILE STRUCTURE FOR USER DOCUMENTS

User document files must reside on the SD card in a directory named “Documents.” The list of available User Documents is limited to 100 documents and are shown in alphabetical order based on filename.

### VIEWING ELECTRONIC DOCUMENTS

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#### Selecting a document:

- 1) From MFD Home, touch **Utilities > Documents**. The ‘Document Viewer’ Screen is now displayed as in the following figure.



Figure 8-110 Electronic Document Viewer

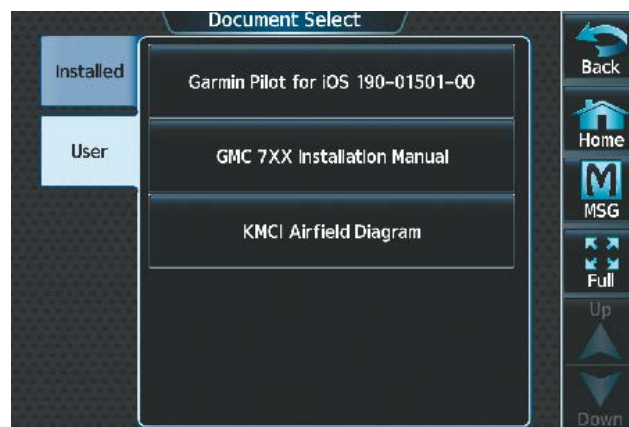


Figure 8-111 Document Selection

- 2) Touch the **Selected Document** Button.
- 3) Touch the **Installed** or **User** Tab to select the desired document source as seen in the previous figure. In the above example, the **User** Tab is selected.
- 4) Touch the desired document button. The selected document name is displayed in the **Selected Document** Button as seen in the following image. The document is displayed in the selected pane.



Figure 8-112 Selected Document Indicated



Figure 8-113 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 the document name, the file size, and the creation date.





Figure 8-114 Document Viewer Options

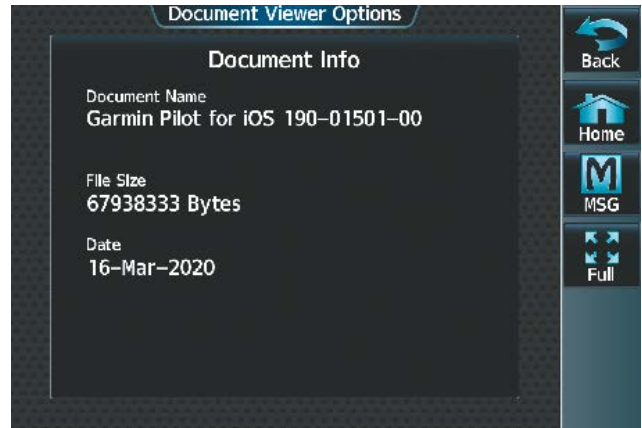


Figure 8-115 Document Information

- 3) After touching the **Back** Button, touch the **Fit Page** Button to view the complete page in the selected pane.
- 4) Touch the **Fit Width** Button to enlarge the displayed page to fill the width of the selected pane.
- 5) Touching the **Rotate Page** buttons will rotate the displayed page 90 degrees to the right or left within the selected pane. Each subsequent touch will rotate the page another 90 degrees.
- 6) Touch the **Brightness** Slider to adjust the brightness of the displayed page.

Or:

Touch the **+** Button to increase brightness, or the **-** Button to decrease brightness. Each touch increases or decreases the brightness by approximately five percent.

### Browsing the document:

- 1) After selecting the desired document, touch the **Next Page** and **Prev Page** buttons to increment and decrement one page with each touch.
- 2) The page select button (see following figure) shows the number of pages contained in the document and the page currently being displayed.



Figure 8-116 Document Browsing Options



- 3) 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 8-117 Enter Document Page Number

- 4) From the 'Document Viewer' Screen, touch the **Find** Button to display the 'Document Viewer Find' Screen as shown in the following figure.

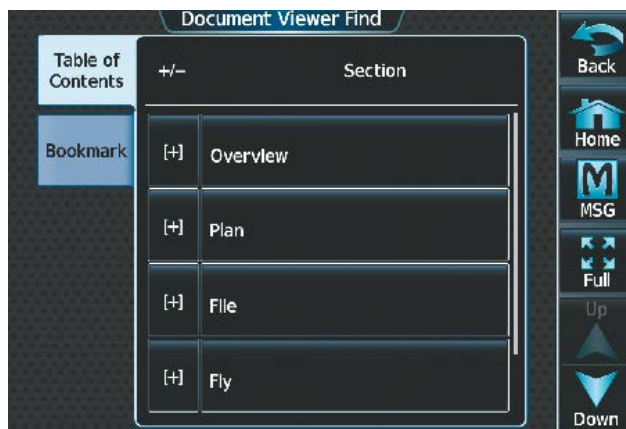


Figure 8-118 Table of Contents

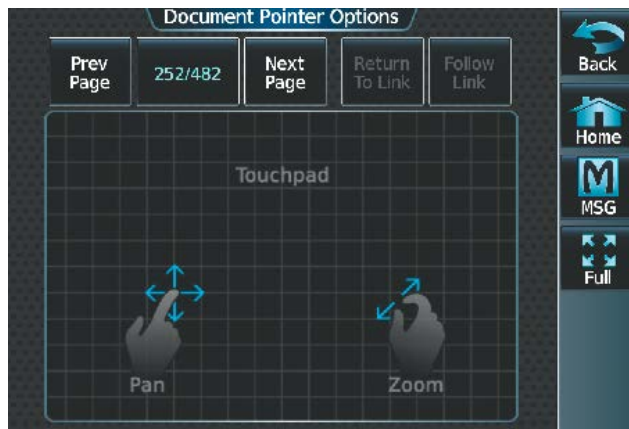


Figure 8-119 Flight Plan Section Displayed

- 5) If necessary, touch the **Table of Contents** Tab to display the document's Table of Contents (see previous figure).
- 6) Touch the **[+]** Button to expand a topic. Touch the **[-]** Button to return to the collapsed view of the topic.
- 7) Touch the desired topic to jump to that portion of the document. In this example, the Flight Plan Section is selected (see previous figure).

### Zooming in and out on a document page:

- 1) With the document displayed, 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.
- 2) Turn the lower knob, or use the pinch-and-zoom feature on the Touchpad to zoom in or zoom out on the document page display.
- 3) Turn the upper knobs, or move a finger across the Touchpad to move the pointer within the document. When the pointer reaches the edge of the display, the display will scroll to show more of the document page.



**Figure 8-120 Touchpad**



**Figure 8-121 Zoom Enabled**

### 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.
- 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.

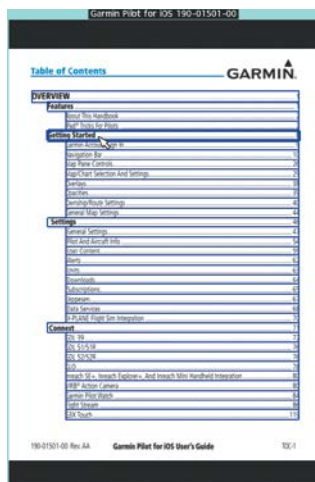


Figure 8-122 Link Selected

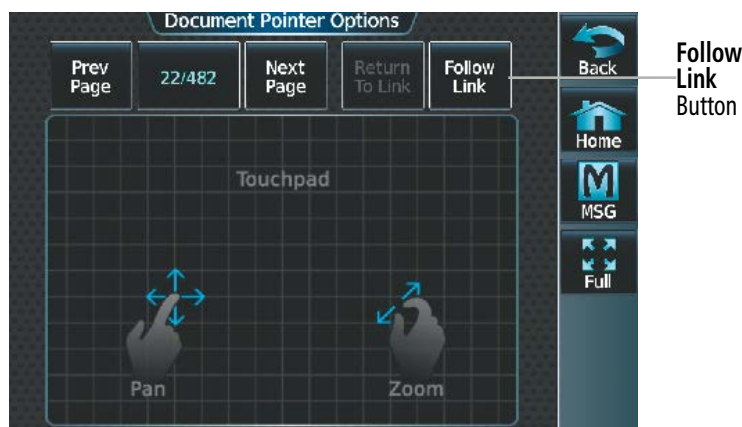


Figure 8-123 Follow Link

- 3) With the link highlighted, touch the **Follow Link** Button shown in the previous figure. The selected link destination is now displayed in the selected pane as indicated in the following figure.



Figure 8-124 Link Selected is Displayed

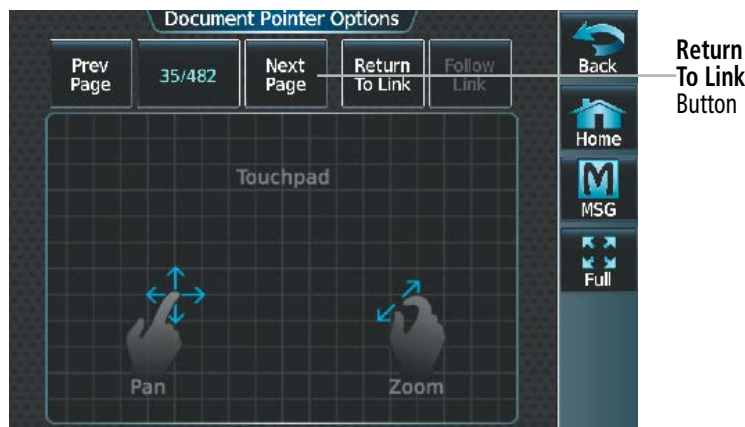


Figure 8-125 Return to Link

- 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 link origin.

### Creating bookmarks in the document:

- 1) While viewing the page to bookmark, touch the **Find** Button on the 'Document Viewer' Screen.
- 2) Touch the **Bookmark** Tab to display the 'Bookmark' Window as in the following figure.

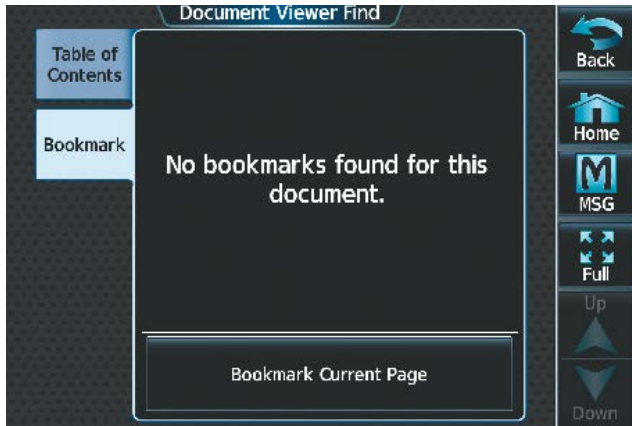


Figure 8-126 Select Bookmark Tab



Figure 8-127 Enter Bookmark Name

- 3) Touch the **Bookmark Current Page** Button. The 'Enter Bookmark Name' Screen is displayed as shown in the previous figure.
- 4) After naming the bookmark, touch the **Enter** Button. A confirmation screen is displayed as seen in the following figure.

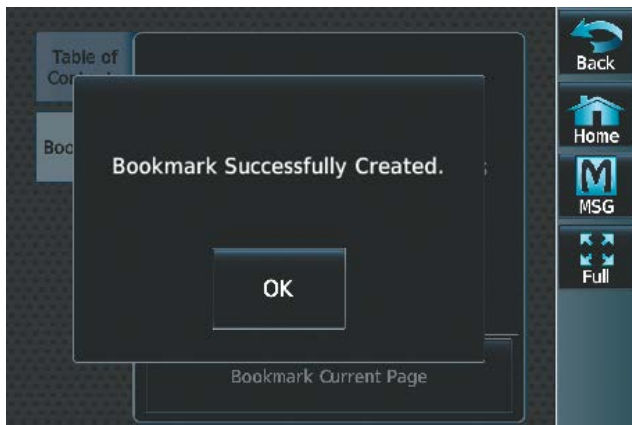


Figure 8-128 Create Bookmark

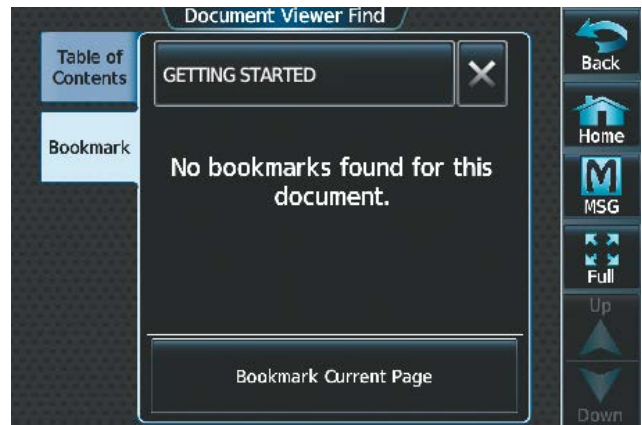
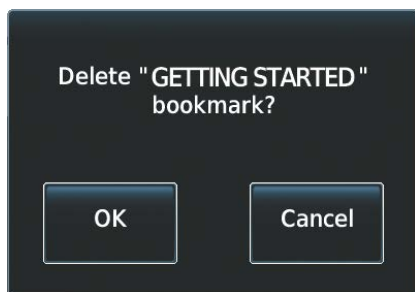


Figure 8-129 Bookmark Created

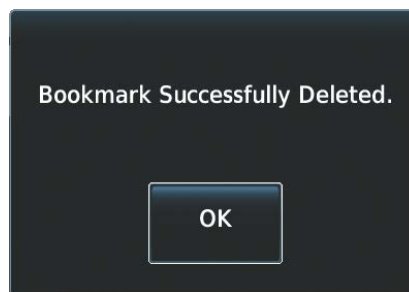
- 5) Touch the **OK** Button. The newly created bookmark is displayed as in the previous figure.

#### Deleting document bookmarks:

- 1) With the desired document displayed, touch the **Find** Button to display the 'Document Viewer Find' Screen.
- 2) Touch the **Bookmark** Tab to display the 'Bookmark' Window.
- 3) Touch the **X** Button next to the bookmark to be deleted (see previous figure).



**Figure 8-130 Delete Bookmark**



**Figure 8-131 Bookmark Deleted**

- 4) Touch the **OK** Button on the confirmation screen.
- 5) To acknowledge deletion of the bookmark, touch the **OK** Button.

## 8.11 ELECTRONIC STABILITY & PROTECTION (ESP) (OPTIONAL)

Electronic Stability and Protection (ESP™) is intended to discourage the exceedance of attitude, established airspeed, and angle of attack parameters. This feature will only function when the aircraft is above 200 feet AGL and the autopilot is not engaged.

ESP engages when the aircraft exceeds one or more conditions (pitch, roll, V<sub>MO</sub>, M<sub>MO</sub>, 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, 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 and AOA beyond threshold, 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 or AOA HIGH condition.

When ESP has been engaged for more than ten seconds (cumulative; not necessarily consecutive seconds) of a 20-second interval, the autopilot is automatically engaged with the flight director in Level Mode, bringing the aircraft into level flight. An aural “Engaging Autopilot” alert is played and the flight director mode annunciation will indicate ‘LVL’ for vertical and lateral modes.

The pilot can interrupt ESP by pressing and holding either the Control Wheel Steering (**CWS**) or Autopilot Disconnect (**AP/YD DISC TRIM INTRPT**) switch. Upon releasing the **CWS** or **AP/YD DISC TRIM INTRPT** switch, ESP force will again be applied, provided aircraft attitude, angle of attack and/or airspeed are within their respective engagement limits. ESP can also be overridden by overpowering the servo’s mechanical torque limit.

ESP can be enabled or disabled on the System Tab of the Avionics Settings Screen on the MFD Touchscreen Controller.

### Enabling/disabling ESP:

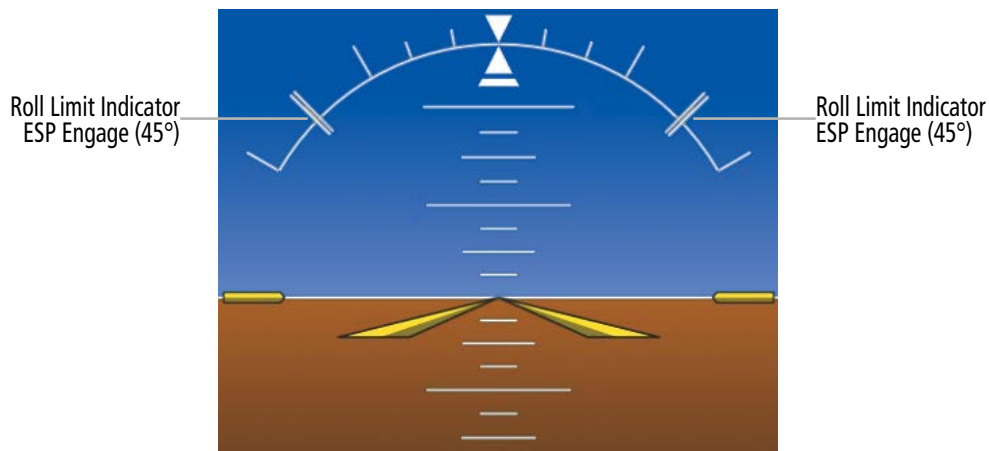
- 1) From MFD Home, touch **Utilities > Setup > Avionics Settings**.
- 2) If necessary, scroll to display the **Stability & Protection** Button.
- 3) Touch the **Stability & Protection** Button to enable or disable ESP. A green annunciator on the button indicates ESP is enabled.

ESP is automatically enabled when power is applied to the system.

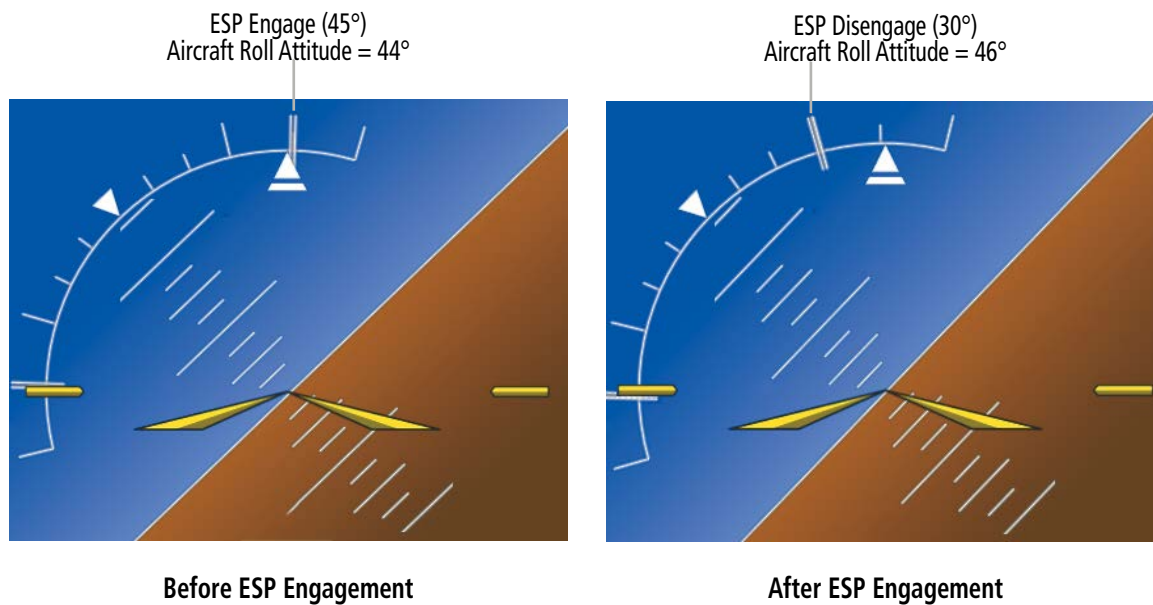
## ROLL ENGAGEMENT

Roll Limit Indicators are displayed on the roll scale at 45° right and left, indicating where ESP will engage (see following figure). As roll attitude exceeds 45°, ESP will engage and the on-side Roll Limit Indicator will move to 30°, as shown in the following figure. The Roll Limit Indicator is now showing where ESP will disengage as roll attitude decreases.





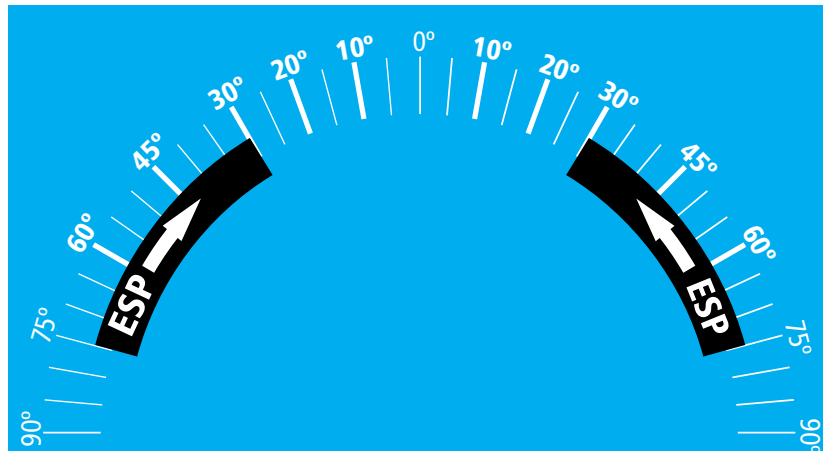
**Figure 8-132 ESP Roll Engagement Indication (ESP Not Engaged)**



**Figure 8-133 Roll Increasing to ESP Engagement**

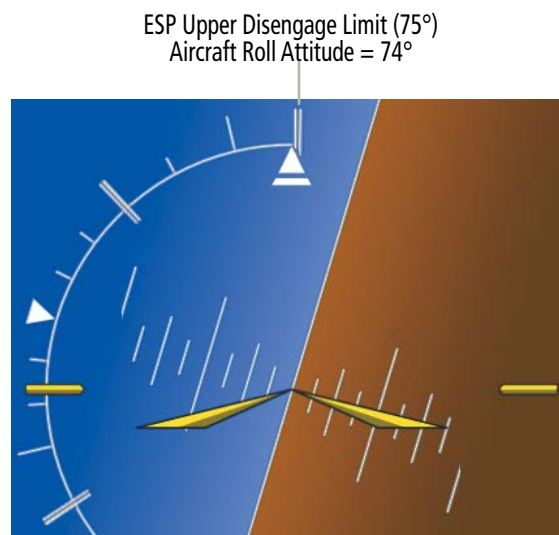
Once engaged, ESP force will be applied between 30° and 75°, as illustrated in the following figure. The force increases as roll attitude increases and decreases as roll attitude decreases. The applied force is intended to encourage pilot input that returns the airplane to a more normal roll attitude. As roll attitude decreases, ESP will disengage at 30°.





**Figure 8-134 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).



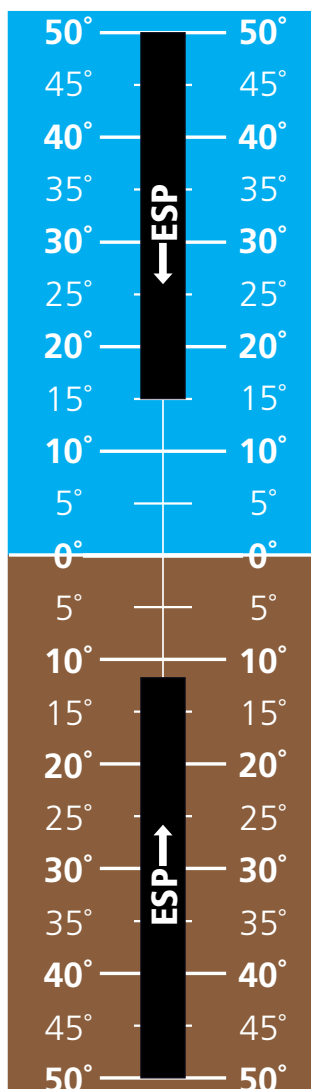
**Figure 8-135 Roll Attitude Autopilot Engagement Limit (ESP Engaged)**

## PITCH ENGAGEMENT

ESP engages at 20° nose-up and 22° nose-down. Once ESP is engaged, it will apply opposing force between 15° and 50° nose-up and between 12° and 50° nose-down, as indicated in the following figure. Maximum opposing force is applied between 25° and 50° nose-up and between 27° and 50° nose-down.

The opposing force increases or decreases depending on the pitch angle and the direction of pitch travel. This force is intended to encourage movement in the pitch axis in the direction of the normal pitch attitude range for the aircraft.

There are no indications marking the pitch ESP engage and disengage limits in these nose-up/nose-down conditions.



**Figure 8-136 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 may be applied if the lift computer determines a stall warning condition is imminent. In this condition, the Pitch Limit Indicator will be initially displayed 4° below this computed pitch attitude. When pitch attitude equals that indicated by the Pitch Limit Indicator, ESP will engage, applying a force in the direction necessary to lower the nose of the aircraft.

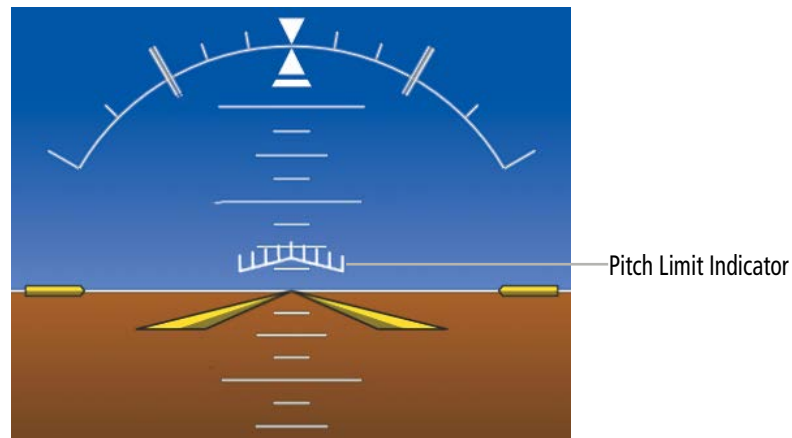


Figure 8-137 Pitch Limit Indicator

## HIGH AIRSPEED PROTECTION

Exceeding 268 kts. IAS will result in ESP applying force to raise the nose of the aircraft. When the indicated airspeed decreases to below 256 kts., ESP force is no longer applied.

## 8.12 DATABASE CYCLE NUMBER AND REVISIONS



**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:** *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](http://flygarmin.com) and select 'Aviation Data Error Report.'*



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



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










### CYCLE NUMBER AND REVISION

Databases that may be available include Terrain, Obstacle, Navigation, Basemap, SafeTaxi, Airport Directory, and FliteCharts. 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 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	<b>MFD Databases</b> 	Not Applicable	<b>MFD1 Databases</b> 
Database is current	<b>MFD Databases</b> 	<b>MFD Databases</b> 	<b>MFD1 Databases</b> 
Database has expired	<b>MFD Databases</b> 	<b>MFD Databases</b> 	<b>MFD1 Databases</b> 
Database is disabled	Not Applicable	<b>MFD Databases</b> 	Not Applicable




Database Condition	SafeTaxi	ChartView	Airport Directory
Database is not installed			

Table 8-6 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**, **PFD2**, **GTC1**, or **GTC2**) for which the database information will be viewed.
- 4) Scroll to display the appropriate database information.

Refer to the Database Management Section in Appendix 'B' for instructions on revising databases. 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 (e.g., 20 represents 2020)
- » T – Indicates the database type (e.g., 'S' is for SafeTaxi, 'D' is for Airport Directory, etc., as seen in the following table)
- » I – Indicates the numerical issue of the database for the year (e.g., 05 is the fifth issue of the year)

### YYII

- » YY – Indicates the last two digits of the year (e.g., 20 represents 2020)
- » II – Indicates the numerical issue of the database for the year (e.g., 05 is the fifth issue of the year)

Refer to Updating Garmin Databases in the Appendices 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 8-7 Database Cycle Number Format and Revision Cycle

## 8.13 ABNORMAL OPERATION

### DATALINK TROUBLESHOOTING

For troubleshooting purposes, check the LRU Information Box on the 'Avionics Status' Page for Iridium Receiver (GSR 56) or the XM Datalink Receiver (GDL 69) status, serial number, and software version number. If a failure has been detected in the GDL 69 the status is marked with a red X.

#### Viewing the 'Avionics Status' Screen:

- 1) From MFD Home, touch **Utilities > Setup > Avionics Status**.
- 2) Touch the **LRU Info** Tab.
- 3) Scroll to display the appropriate database information.
- 4) Touch an LRU to view further information.

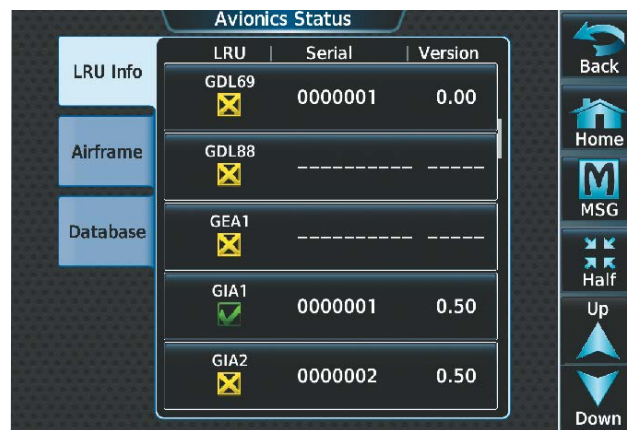


Figure 8-138 'Avionics Status' Screen

### QUICK TROUBLESHOOTING

Some quick troubleshooting steps listed below can be performed to find the possible cause of a failure.

- » Ensure the installed hardware has an active subscription or account (e.g., Iridium subscription, XM subscription)
- » Perform a quick check of the circuit breakers to ensure that power is applied to the applicable hardware
- » If a failure still exists, the following messages may provide insight as to the possible problem:



Message	Message Location	Description
<b>CHECK ANTENNA</b>	'XM Information' Screen (Touchscreen Controller)	Datalink Receiver antenna error; service required
<b>UPDATING</b>	'XM Information' Screen (Touchscreen Controller)	Datalink Receiver updating encryption code
<b>NO SIGNAL</b>	'XM Information' Screen (Touchscreen Controller) Weather Datalink Display (selected display pane)	Loss of signal; signal strength too low for receiver
<b>LOADING</b>	'Music' Screen (Touchscreen Controller)	Acquiring channel audio or information
<b>OFF AIR</b>	'Music' Screen (Touchscreen Controller)	Channel not in service
<b>---</b>	'Music' Screen (Touchscreen Controller)	Missing channel information
<b>WEATHER DATA LINK FAILED</b>	Weather Datalink Display (selected display pane)	No communication from Datalink Receiver within last 5 minutes
<b>ACTIVATION REQUIRED</b>	'XM Information' Screen (Touchscreen Controller) Weather Datalink Display (selected display pane)	SiriusXM subscription is not activated

**Table 8-8 SiriusXM Datalink Receiver Messages**

## ANNUNCIATIONS AND ALERTS

### CAS (CREW ALERTING SYSTEM) MESSAGES



**NOTE:** Refer to the current version of the pertinent flight manual for corrective pilot actions.



**NOTE:** Refer to the Engine Indication and Crew Alerting System (EICAS) section for more information on the Crew Alerting System.

### WARNING MESSAGES

Message	Description
<b>ABORT APR</b>	Loss of GPS navigation. Abort approach
<b>AURAL WRN FAIL</b>	Aural warning system failure due to non-communicating LRUs
<b>AURAL WARN 1 CHNL</b>	Aural warning failure of one LRU
<b>CABIN ALTITUDE</b>	Cabin altitude over 10,000 ft
<b>CABIN DIFF PRESS</b>	Cabin pressure differential over 6.4 psi
<b>DOOR</b>	Pilot or cabin door open
<b>ELEC FEATH FAULT</b>	Feathering system failure
<b>EDM</b>	Autopilot has activated emergency descent mode
<b>FIRE</b>	Engine compartment fire (temperature over 200°C; if installed)
<b>FLAPS ASYM</b>	Dissymmetry between left- and right-hand flaps
<b>FUEL OFF</b>	Fuel tank selectors set to "Off"
<b>FUEL PRESS</b>	Fuel pressure below 10 psi
<b>GEAR UNSAFE</b>	Gears are in an unsafe configuration
<b>ITT</b>	Engine start: ITT over 1000°C, 870°C (5 s), or 840°C (20 s) Engine running : ITT over 840°C
<b>OIL PRESS</b>	Oil pressure below 60 psi
<b>O2 CYL CLOSED</b>	Oxygen cylinder closed
<b>PARK BRAKE</b>	Parking brake applied
<b>PRESSU OFF</b>	No bleed air provided to cabin
<b>USP ACTIVE</b>	Underspeed protection is active

### CAUTION MESSAGES

Message	Description
<b>AP ON YD OFF</b>	The autopilot is ON while the Yaw Damper is OFF
<b>APR DWNGRADE</b>	Approach downgraded , vertical guidance generated by SBAS is unavailable,. Use LNAV only minimums
<b>AUTO SEL</b>	Fuel timer off or out of service
<b>AUX BOOST PMP ON</b>	Electric fuel pump running (manual or automatic mode)
<b>BAT AMP</b>	Battery current over 50 A while on ground
<b>BAT OFF</b>	Battery off
<b>CARGO DOOR</b>	Forward cargo door open
<b>CHIP</b>	Oil chip detector on (if installed)

Message	Description
ESP DEGRADED - AOA	Electronic Stability and Protection (ESP™) angle of attack (AOA) mode is inoperative. The system should be serviced
ESP DEGRADED - IAS	Electronic Stability and Protection (ESP™) indicated air speed (IAS) mode is inoperative. The system should be serviced
ESP FAIL	The ESP function has failed and is inoperative. The system should be serviced
FUEL IMBALANCE	Fuel tanks imbalanced by more than 15 USGAL for >30 seconds
FUEL LOW L-R*	Fuel quantity less than or equal to 9.1 USGAL in specified tank
GAS DEGRADED	Global Air System failure. The system should be serviced.
GAS EVENT	Global Air System needs servicing
GPU DOOR	GPU receptacle door not closed
GWX FAIL	The GDU is not receiving status packet from the GWX 70 is reporting a fault. The GWX 70 radar system should be serviced
IGNITION	Ignition exciter running
INERT SEP FAIL	Inertial separator failure
LOW LVL FAIL L-R*	Low fuel level sensor failure for specified tank
LOW VOLTAGE	Battery voltage below 26 V
MAIN GEN	Starter generator unconnected
NG HI	Generator speed is more than 103%
OIL PRESS	Oil pressure between 60 and 100 psi
OIL TEMP	Oil temperature below 0°C or above 104°C
PITOT HT ON L-R*	Specified pitot heat (left or right) on while engine off
PITOT NO HT L-R*	Specified pitot heat (left or right) off
PRESSU BACKUP	GASC cannot compute optimal cabin altitude (cabin altitude default value is set at 9800 feet)
PROP DEICE FAIL	Prop deice selected and not on
PROP DEICE ON	Prop deice on while engine off
STALL HEAT ON	Stall heat on
STALL NO HEAT	Stall heat off
TCAS FAIL	TCAS has failed and is inoperative. The system should be serviced
TRAFFIC FAIL	Traffic has failed and is inoperative. The system should be serviced
VACUUM LOW	Vacuum pressure less than 3.75 in Hg
USE OXYGEN MASK	Cabin altitude high
XPDR1 ADS-B FAIL	ADS-B of XPDR1 is inoperative. The transponder may not be receiving a valid GPS position. Other transponder functions may be available. Service when possible.
XPDR1 FAIL	XPDR1 has failed and is inoperative. The system should be serviced
XPDR2 ADS-B FAIL	ADS-B of XPDR2 is inoperative. The transponder may not be receiving a valid GPS position. Other transponder functions may be available. Service when possible.
XPDR2 FAIL	XPDR2 has failed and is inoperative. The system should be serviced

\* Only affected side (L, R, or L-R) displayed in CAS message; applicable messages listed here display L-R for example

## ADVISORY MESSAGES

Message	Description
EDM OVERRIDE	Emergency Descent Mode has been overridden by the crew
ESP OFF	Electronic Stability and Protection has been disabled on the Avionics Settings Screen
INERT SEP ON	Inertial separator extended
MAX DIFF MODE	Cabin pressurization system in MAX DIFF MODE.
STARTER	Starter generator running

## VOICE ALERTS

VOICE ALERT	DESCRIPTION
"Minimums, minimums"	The aircraft has descended below the preset barometric minimum descent altitude.
"Vertical track"	The aircraft is one minute from Top of Descent. Issued only when vertical navigation is enabled.
"Airspeed"	Played when the indicated airspeed is below a given threshold for a given aircraft configuration. Note this alert may be heard under normal conditions during the landing flare.
"Engaging Autopilot"	The autopilot is being engaged automatically by the system. Only available when ESP™ is installed.
"Incoming Call"	Satellite telephone is receiving a call.
"ATC Message"	New Data Link message received from ATC.
"Traffic"	Played when a Traffic Advisory (TA) is issued with the TIS system.
"Traffic Not Available"	The aircraft is outside the Traffic Information Service (TIS) coverage area.
"Traffic, Traffic"	Played when a Traffic Advisory (TA) is issued with a TAS system.
"TAS System Test OK"	Played when the TAS system passes a pilot-initiated self test.
"TAS System Test Failed"	Played when the TAS system fails a pilot-initiated self test.
"One o'clock" through "Twelve o'clock" or "No Bearing"	Played to indicate bearing of traffic from own aircraft.
"High", "Low", "Same Altitude" (if within 200 feet of own altitude), or "Altitude not available"	Played to indicate altitude of traffic relative to own aircraft.
"Less than one mile", "One Mile" through "Ten Miles", or "More than ten miles"	Played to indicate distance of traffic from own aircraft.
"Stall"	Imminent stall is sensed.
"Landing Gear"	Indicates to the pilot the landing gear should be down.
"Overspeed"	Indicates the aircraft is exceeding 265 knots.
"Use Oxygen Mask"	Indicates that there is a cabin depressurization and the pilots should use oxygen mask.

## SYSTEM MESSAGE ANNUNCIATIONS

When the system issues a message, the MSG annunciator flashes on the PFDs 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 either Touchscreen Controller. Active messages are displayed 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 'X' (depending on the LRU) 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 applying power to the system, certain windows remain invalid as the equipment begins to initialize. All windows should be operational within one minute of applying power to the system. If any window continues to remain flagged, the system should be serviced by a Garmin-authorized repair facility.

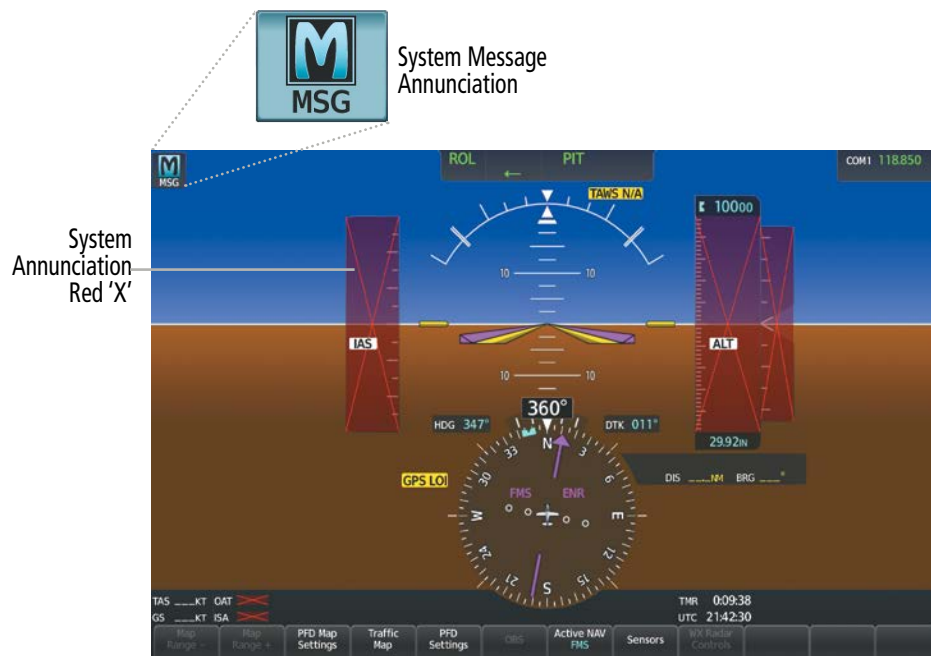


Figure A-1 System Annunciations (PFD)



Figure A-2 System Messages Annunciation (Touchscreen Controller)

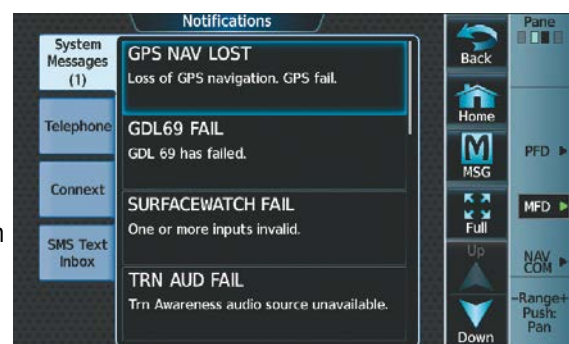


Figure A-3 'Notifications' Screen After MSG Button Touched (Touchscreen Controller)

## SYSTEM MESSAGES

This section describes various system messages. Certain messages are issued due to an LRU or an LRU function failure. Such messages are normally accompanied by a corresponding red 'X' annunciation as shown previously in the System Annunciation section.



**NOTE:** This section provides information regarding System 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.

System Message	Comments
<b>ADC1 SERVICE</b> – GDC1 needs service. Return unit for repair.	A failure has been detected in the GDC1. The system should be serviced.
<b>ADC2 SERVICE</b> – GDC2 needs service. Return unit for repair.	A failure has been detected in the GDC2. The system should be serviced.
<b>AHRS MAG DB</b> – AHRS magnetic model database version mismatch.	AHRS1 and AHRS2 magnetic model database versions do not match.
<b>AHRS1 CAL</b> – AHRS1 calibration version error. Svc req'd.	AHRS1 calibration version error. The system should be serviced.
<b>AHRS1 CONFIG</b> – AHRS1 config error. Config service req'd.	AHRS configuration settings do not match those of backup configuration memory. The system should be serviced.
<b>AHRS1 GPS</b> – AHRS1 not receiving any GPS information.	AHRS1 is not receiving any or any useful GPS information. Check current version of the pertinent flight manual limitations. The system should be serviced.
<b>AHRS1 GPS</b> – AHRS1 not receiving backup GPS information.	AHRS1 is not receiving backup GPS information. The system should be serviced.
<b>AHRS1 GPS</b> – AHRS1 operating exclusively in no-GPS mode.	AHRS1 is operating exclusively in no-GPS mode. The system should be serviced.
<b>AHRS1 GPS</b> – AHRS1 using backup GPS source.	AHRS1 is using the backup GPS path. Primary GPS path has failed. The system should be serviced when practical.
<b>AHRS1 SERVICE</b> – AHRS1 needs service. Return unit for repair.	A failure has been detected in the #1 AHRS. The system should be serviced.
<b>AHRS1 SRVC</b> – AHRS1 Magnetic-field model needs update.	AHRS1 earth magnetic field model is out of date. Update magnetic field model when practical.
<b>AHRS1 TAS</b> – AHRS1 not receiving valid airspeed.	AHRS1 is not receiving true airspeed from the air data computer. The AHRS relies on GPS information to augment the lack of airspeed. The system should be serviced.
<b>AHRS2 CAL</b> – AHRS2 calibration version error. Svc req'd.	AHRS2 calibration version error. The system should be serviced.
<b>AHRS2 CONFIG</b> – AHRS2 config error. Config service req'd.	AHRS configuration settings do not match those of backup configuration memory. The system should be serviced.
<b>AHRS2 GPS</b> – AHRS2 not receiving any GPS information.	AHRS2 is not receiving any or any useful GPS information. Check current version of the pertinent flight manual limitations. The system should be serviced.
<b>AHRS2 GPS</b> – AHRS2 not receiving backup GPS information.	AHRS2 is not receiving backup GPS information. The system should be serviced.

System Message	Comments
<b>AHRS2 GPS</b> – AHRS2 operating exclusively in no-GPS mode.	AHRS2 is operating exclusively in no-GPS mode. The system should be serviced.
<b>AHRS2 GPS</b> – AHRS2 using backup GPS source.	AHRS2 is using the backup GPS path. Primary GPS path has failed. The system should be serviced when practical.
<b>AHRS2 SERVICE</b> – AHRS2 needs service. Return unit for repair.	A failure has been detected in the AHRS2. The system should be serviced.
<b>AHRS2 SRVC</b> – AHRS2 Magnetic-field model needs update.	AHRS2 earth magnetic field model is out of date. Update magnetic field model when practical.
<b>AHRS2 TAS</b> – AHRS2 not receiving valid airspeed.	AHRS2 is not receiving true airspeed from the air data computer. The AHRS relies on GPS information to augment the lack of airspeed. The system should be serviced.
<b>APR INACTV</b> – Approach is not active.	The system notifies the pilot the loaded approach is not active. Activate approach when required.
<b>ARSPC AHEAD</b> – Airspace ahead - less than 10 minutes.	Special use airspace is ahead of aircraft. The aircraft will penetrate the airspace within 10 minutes.
<b>ARSPC NEAR</b> – Airspace near – less than 2 nm.	Special use airspace is within 2 nm of the aircraft position.
<b>ARSPC NEAR</b> – Airspace near and ahead.	Special use airspace is near and ahead of the aircraft position.
<b>AUDIO MANIFEST</b> – Audio software mismatch, communication halted.	The GIA has incorrect software installed. The system should be serviced.
<b>CHECK CRS</b> – Database course for LOC1 / [LOC ID] is [CRS]°.	Selected course for LOC1 differs from published localizer course by more than 10 degrees.
<b>CHECK CRS</b> – Database course for LOC2 / [LOC ID] is [CRS]°.	Selected course for LOC2 differs from published localizer course by more than 10 degrees.
<b>CNFG MODULE</b> – PFD1 configuration module is inoperative.	The specified GDU's configuration module backup memory has failed. The system should be serviced.
<b>COM1 CONFIG</b> – COM1 config error. Config service req'd.	The COM1 configuration settings do not match backup configuration memory. The system should be serviced.
<b>COM1 MANIFEST</b> – COM1 software mismatch, communication halted.	The COM 1 has incorrect software installed. The system should be serviced.
<b>COM1 PTT</b> – 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.
<b>COM1 SERVICE</b> – COM1 needs service. Return unit for repair.	The system has detected a failure in COM1. COM1 may still be usable. The system should be serviced when practical.
<b>COM1 TEMP</b> – COM1 over temp. Reducing transmitter power.	The system has detected an over temperature condition in COM1. The transmitter operates at reduced power. If the problem persists, the system should be serviced.
<b>COM2 CONFIG</b> – COM2 config error. Config service req'd.	The COM2 configuration settings do not match backup configuration memory. The system should be serviced.
<b>COM2 MANIFEST</b> – COM2 software mismatch, communication halted.	The COM 2 has incorrect software installed. The system should be serviced.



System Message	Comments
<b>COM2 PTT</b> – 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.
<b>COM2 SERVICE</b> – COM2 needs service. Return unit for repair.	The system has detected a failure in COM2. COM2 may still be usable. The system should be serviced when practical.
<b>COM2 TEMP</b> – COM2 over temp. Reducing transmitter power.	The system has detected an over temperature condition in COM2. The transmitter operates at reduced power. If the problem persists, the system should be serviced.
<b>COPILOT PRIM PTT KEYSTK</b> – Copilot 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.
<b>COPILOT SEC PTT KEYSTK</b> – Copilot 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.
<b>CRUISE I</b> – Cruise I conditions met.	Cruise I engine trend data log has been captured.
<b>CRUISE II</b> – Cruise II conditions met.	Cruise II engine trend data log has been captured.
<b>DATA LOST</b> – 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.
<b>DATABASE CHANGE</b> – 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.
<b>DATABASE CHANGE</b> – 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.
<b>DB MISMATCH</b> – 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.
<b>DB MISMATCH</b> – 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.
<b>DB MISMATCH</b> – Standby Navigation database mismatch.	The GDUs have different standby navigation 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.
<b>DB MISMATCH</b> – 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.
<b>DIG GMA1 MANIFEST</b> – DIG GMA 1 software mismatch, communication halted.	The digital audio controller has incorrect software installed. The system should be serviced.
<b>EXCEEDANCE</b> – Exceedance data is being logged.	An exceedance log has been captured.

System Message	Comments
<b>FAILED PATH</b> – A data path has failed.	A data path between two or more LRUs has failed. The system should be serviced when practical.
<b>FPL TRUNC</b> – 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.
<b>FPL WPT LOCK</b> – Flight plan waypoint is locked.	Upon applying power to the system, 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.
<b>FPL WPT MOVE</b> – Flight plan waypoint moved.	The system has detected that a waypoint coordinate has changed due to a new navigation database update. Verify that stored flight plans contain correct waypoint locations.
<b>FS510 CARD ERROR</b> – FS510 not detected in MFD Bottom Slot.	The wireless transceiver (FS 510) multimedia card for the wireless transceiver (FS 510) was removed from the bottom card slot of the MFD. The multimedia card needs to be reinserted.
<b>G/S1 FAIL</b> – G/S1 is inoperative.	A failure has been detected in glideslope receiver 1. The system should be serviced.
<b>G/S1 SERVICE</b> – G/S1 needs service. Return unit for repair.	A failure has been detected in glideslope receiver 1. The receiver may still be available. The system should be serviced when practical.
<b>G/S2 FAIL</b> – G/S2 is inoperative.	A failure has been detected in glideslope receiver 2. The system should be serviced.
<b>G/S2 SERVICE</b> – G/S2 needs service. Return unit for repair.	A failure has been detected in glideslope receiver 2. The receiver may still be available. The system should be serviced when practical.
<b>GDC1 MANIFEST</b> – GDC1 software mismatch, communication halted.	The GDC1 has incorrect software installed. The system should be serviced.
<b>GDC2 MANIFEST</b> – GDC2 software mismatch, communication halted.	The GDC2 has incorrect software installed. The system should be serviced.
<b>GDL69 CONFIG</b> – GDL 69 config error. Config service req'd.	GDL 69A SXM configuration settings do not match those of backup configuration memory. The system should be serviced.
<b>GDL69 FAIL</b> – GDL 69 has failed.	A failure has been detected in the GDL 69A SXM. The receiver is unavailable. The system should be serviced.
<b>GDL69 MANIFEST</b> – GDL69 software mismatch, communication halted.	The GDL 69A SXM has incorrect software installed. The system should be serviced.
<b>GEA1 CONFIG</b> – GEA1 config error. Config service req'd.	The GEA1 configuration settings do not match those of backup configuration memory. The system should be serviced.
<b>GEA1 MANIFEST</b> – GEA1 software mismatch, communication halted.	The GEA1 has incorrect software installed. The system should be serviced.
<b>GEO LIMITS</b> – AHRS1 too far north/south, no magnetic compass.	The aircraft is outside geographical limits for approved AHRS operation. Heading is annunciated as invalid.
<b>GEO LIMITS</b> – AHRS2 too far North/South, no magnetic compass.	The aircraft is outside geographical limits for approved AHRS operation. Heading is flagged as invalid.

System Message	Comments
<b>GFC MANIFEST</b> – GFC software mismatch, communication halted.	Incorrect servo software is installed, or gain settings are incorrect.
<b>GIA1 CONFIG</b> – GIA1 audio config error. Config service req'd.	The GIA1 have an error in the audio configuration. The system should be serviced.
<b>GIA1 CONFIG</b> – GIA1 config error. Config service req'd.	The GIA1 configuration settings do not match backup configuration memory. The system should be serviced.
<b>GIA1 COOLING</b> – GIA1 over temperature.	The GIA1 temperature is too high. If problem persists, the system should be serviced.
<b>GIA1 COOLING</b> – GIA1 temperature too low.	The GIA1 temperature is too low to operate correctly. Allow units to warm up to operating temperature.
<b>GIA1 MANIFEST</b> – GIA1 software mismatch, communication halted.	The GIA1 has incorrect software installed. The system should be serviced.
<b>GIA1 SERVICE</b> – GIA1 needs service. Return the unit for repair.	The GIA1 self-test has detected a problem in the unit. The system should be serviced.
<b>GIA2 CONFIG</b> – GIA2 audio config error. Config service req'd.	The GIA2 have an error in the audio configuration. The system should be serviced.
<b>GIA2 CONFIG</b> – GIA2 config error. Config service req'd.	The GIA2 configuration settings do not match backup configuration memory. The system should be serviced.
<b>GIA2 COOLING</b> – GIA2 over temperature.	The GIA2 temperature is too high. If problem persists, the system should be serviced.
<b>GIA2 COOLING</b> – GIA2 temperature too low.	The GIA2 temperature is too low to operate correctly. Allow units to warm up to operating temperature.
<b>GIA2 MANIFEST</b> – GIA2 software mismatch, communication halted.	The GIA2 has incorrect software installed. The system should be serviced.
<b>GIA2 SERVICE</b> – GIA2 needs service. Return the unit for repair.	The GIA2 self-test has detected a problem in the unit. The system should be serviced.
<b>GMA1 AUX MANIFEST</b> – GMA 1 AUX software mismatch, communication halted.	The digital audio controller has incorrect software installed. The system should be serviced.
<b>GMA1 CONFIG</b> – GMA1 config error. Config service req'd.	The audio controller configuration settings do not match backup configuration memory. The system should be serviced.
<b>GMA1 FAIL</b> – GMA1 is inoperative.	The audio controller has detected a failure. The audio controller is unavailable. The system should be serviced.
<b>GMA1 MANIFEST</b> – DIG GMA 1 software mismatch, communication halted.	The audio controller has incorrect software installed. The system should be serviced.
<b>GMA1 SERVICE</b> – 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.
<b>GMC1 CONFIG</b> – GMC Config error. Config service req'd.	Error in the configuration of GMC1.
<b>GMC1 FAIL</b> – GMC is inoperative.	A failure has been detected in GMC1. GMC1 is unavailable.
<b>GMC1 KEYSTK</b> – 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.

System Message	Comments
<b>GMC1 MANIFEST</b> – GMC software mismatch. Communication halted.	GMC1 has incorrect software installed. The system should be serviced.
<b>GMU1 MANIFEST</b> – GMU1 software mismatch, communication halted.	GMU1 has incorrect software installed. The system should be serviced.
<b>GPS NAV LOST</b> – Loss of GPS navigation. Enable GPS sensors.	Loss of GPS navigation due to GPS being disabled
<b>GPS NAV LOST</b> – Loss of GPS navigation. GPS fail.	Loss of GPS navigation due to GPS failure.
<b>GPS NAV LOST</b> – Loss of GPS navigation. Position error.	Loss of GPS navigation due to position error.
<b>GPS1 CHECK POSITION</b> – Position difference. Check position sensors.	A difference has been detected in the current position. Check position sensors.
<b>GPS1 FAIL</b> – GPS1 is inoperative.	A failure has been detected in GPS1 receiver. The system should be serviced.
<b>GPS1 SERVICE</b> – GPS1 needs service. Return unit for repair.	A fault has been detected in the GPS1 receiver. The receiver may still be available. If the message persists through a normal power cycle, the system should be serviced when practical.
<b>GPS2 CHECK POSITION</b> – Position difference. Check position sensors.	A difference has been detected in the current position. Check position sensors.
<b>GPS2 FAIL</b> – GPS2 is inoperative.	A failure has been detected in GPS2 receiver. The system should be serviced.
<b>GPS2 SERVICE</b> – GPS2 needs service. Return unit for repair.	A fault has been detected in the GPS2 receiver. The receiver may still be available. If the message persists through a normal power cycle, the system should be serviced when practical.
<b>GRA1 CAL</b> – GRA1 calibration error. Service req'd.	A calibration error has been detected in the GRA. The system should be serviced.
<b>GRA1 CONFIG</b> – GRA1 config error. Config service req'd.	The GRA configuration settings do not match those of backup configuration memory. The system should be serviced.
<b>GRA1 MANIFEST</b> – GRA1 software mismatch, communication halted.	The GRA has incorrect software installed. The system should be serviced.
<b>GRA1 SERVICE</b> – GRA1 needs service. Return unit for repair.	A failure has been detected in the GRA. The system should be serviced.
<b>GRA1 TEMP</b> – GRA1 over temperature.	The GRA temperature is too high. If the problem persists, the system should be serviced.
<b>GRS1 CONFIG</b> – GRS1 config error. Config service req'd.	GRS configuration settings do not match those of backup configuration memory. The system should be serviced.
<b>GRS1 MANIFEST</b> – GRS1 software mismatch, communication halted.	The AHRS1 has incorrect software installed. The system should be serviced.
<b>GRS1 SERVICE</b> – GRS1 needs service. Return unit for repair.	The AHRS1 should be serviced when practical.
<b>GSR1 FAIL</b> – GSR1 has failed.	A failure has been detected in GSR1. The system should be serviced.
<b>GTC1 CARD1 ERR</b> – GTC1 card 1 is invalid.	The internal SD card in the Touchscreen Controller contains invalid data. The system should be serviced.

System Message	Comments
<b>GTC1 CARD1 REM</b> – GTC1 card 1 was removed. Reinsert card.	The internal SD card in the Touchscreen Controller was removed. The system should be serviced.
<b>GTC1 CONFIG</b> – GTC1 config error. Config service req'd.	Touchscreen Controller configuration settings do not match those of backup configuration memory. The system should be serviced.
<b>GTC1 COOLING</b> – GTC1 has poor cooling. Reducing power usage.	The Touchscreen Controller has insufficient cooling. If the problem persists, the system should be serviced.
<b>GTC1 DB ERR</b> – GTC1 database error exists.	The Touchscreen Controller detected a failure in one or more databases. Reload databases with new data card. If problem persists, delete databases and reload with a new card.
<b>GTC1 FAN FAIL</b> – GTC1 internal fan failure. Unit needs service.	The internal fan in the Touchscreen Controller has failed. The system should be serviced.
<b>GTC1 KEYSTK</b> – GTC1 [key name] key is stuck.	A knob or key is stuck on the GTC bezel. Attempt to free the stuck control by pushing or turning it several times. The system should be serviced if the problem persists.
<b>GTC1 MANIFEST</b> – GTC1 software mismatch, communication halted.	The Touchscreen Controller has incorrect software installed. The system should be serviced.
<b>GTC1 SERVICE</b> – GTC1 needs service. Return unit for repair.	The Touchscreen Controller should be serviced..
<b>GTC2 CARD1 ERR</b> – GTC2 card 1 is invalid.	The internal SD card in the Touchscreen Controller contains invalid data. The system should be serviced.
<b>GTC2 CARD1 REM</b> – GTC2 card 1 was removed. Reinsert card.	The internal SD card in the Touchscreen Controller was removed. The system should be serviced.
<b>GTC2 CONFIG</b> – GTC2 config error. Config service req'd.	Touchscreen Controller configuration settings do not match those of backup configuration memory. The system should be serviced.
<b>GTC2 COOLING</b> – GTC2 has poor cooling. Reducing power usage.	The Touchscreen Controller has insufficient cooling. If the problem persists, the system should be serviced.
<b>GTC2 DB ERR</b> – GTC2 database error exists.	The Touchscreen Controller detected a failure in one or more databases. Reload databases with new data card. If problem persists, delete databases and reload with a new card.
<b>GTC2 FAN FAIL</b> – GTC2 internal fan failure. Unit needs service.	The internal fan in the Touchscreen Controller has failed. The system should be serviced.
<b>GTC2 KEYSTK</b> – GTC2 [key name] key is stuck.	A knob or key is stuck on the GTC bezel. Attempt to free the stuck control by pushing or turning it several times. The system should be serviced if the problem persists.
<b>GTC2 MANIFEST</b> – GTC 2 software mismatch, communication halted.	The Touchscreen Controller has incorrect software installed. The system should be serviced.
<b>GTC2 SERVICE</b> – GTC2 needs service. Return unit for repair.	The Touchscreen Controller should be serviced..
<b>GTS CONFIG</b> – 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.
<b>GTS MANIFEST</b> – GTS software mismatch, communication halted.	The GTS has incorrect software installed. The system should be serviced.
<b>GTX1 MANIFEST</b> – GTX1 software mismatch, communication halted.	The transponder has incorrect software installed. The system should be serviced.

System Message	Comments
<b>GTX2 MANIFEST</b> – GTX2 software mismatch, communication halted.	The transponder has incorrect software installed. The system should be serviced.
<b>GWX CONFIG</b> – GWX config error. Config service req'd.	GWX configuration settings do not match those of the GDU configuration. The system should be serviced.
<b>GWX MANIFEST</b> – GWX software mismatch, communication halted.	The GWX has incorrect software installed. The system should be serviced.
<b>GWX SERVICE</b> – GWX needs service. Return unit for repair.	A failure has been detected in the GWX. The GWX may still be usable.
<b>HDG FAULT</b> – AHRS1 magnetometer fault has occurred.	A fault has occurred in AHRS1. Heading is flagged as invalid. The AHRS uses GPS for backup mode operation. The system should be serviced.
<b>HDG FAULT</b> – AHRS2 magnetometer fault has occurred.	A fault has occurred in the AHRS2. Heading is flagged as invalid. The AHRS uses GPS for backup mode operation. The system should be serviced.
<b>HF1 FAIL</b> – HF1 antenna coupler failure.	HF1 antenna coupler has failed. The system should be serviced.
<b>HF1 FAIL</b> – HF1 antenna coupler pressure fail -TX 50W.	HF1 antenna coupler pressure fail.
<b>HF1 FAIL</b> – HF1 antenna coupler pressure warning.	HF1 antenna coupler pressure is too high.
<b>HF1 FAIL</b> – HF1 power amplifier failure.	HF1 power amplifier has failed. The system should be serviced.
<b>HF1 FAIL</b> – HF1 receiver exciter failure.	HF1 receiver exciter has failed. The system should be serviced.
<b>HOLD EXPIRED</b> – Holding EFC time expired.	Expect Further Clearance (EFC) time has expired for the User Defined Hold.
<b>HW MISMATCH</b> – GIA hardware mismatch, GIA2 communication halted.	A GIA mismatch has been detected, where only one is SBAS capable.
<b>HW MISMATCH</b> – GIA1 hardware mismatch, GIA1 communication halted.	A GIA mismatch has been detected, where only one is SBAS capable.
<b>INSIDE ARSPC</b> – Inside airspace.	The aircraft is inside the airspace.
<b>LOI</b> – GPS integrity lost. Crosscheck with other NAVS.	GPS integrity is insufficient for the current phase of flight.
<b>LOCKED FPL</b> – Cannot navigate locked flight plan.	This occurs when the pilot attempts to activate a stored flight plan that contains locked waypoint. Remove locked waypoint from flight plan. Update flight plan with current waypoint.
<b>LOSS OF GPS NAVIGATION</b> – Poor Satellite Coverage.	Loss of GPS navigation due to insufficient/poor satellite coverage.
<b>LOW BANK ACTIVE</b> – Disengage for approach.	Low Bank mode is active. Disengage to continue approach.
<b>LOW BANK ACTIVE</b> – Disengage for RNP less than 1.0.	Low Bank mode is active. Disengage to continue RNP 1.0.

System Message	Comments
<b>LRG MAG VAR</b> – 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°.
<b>MFD1 BACKLIGHT CALIBRATION</b> – MFD1 calibration lost. Return for repair.	The specified GDU's backlight calibration cannot be found or is invalid. The system should be serviced.
<b>PFD1 CARD 1 ERR</b> – Card 1 is invalid.	The SD card in the top card slot of the specified PFD contains invalid data.
<b>PFD1 CARD 1 REM</b> – Card 1 was removed. Reinsert card.	The SD card was removed from the top card slot of the specified PFD. The SD card needs to be reinserted.
<b>PFD1 CARD 2 ERR</b> – Card 2 is invalid.	The SD card in the bottom card slot of the specified PFD contains invalid data.
<b>PFD1 CARD 2 REM</b> – Card 2 was removed. Reinsert card.	The SD card was removed from the bottom card slot of the specified PFD. The SD card needs to be reinserted.
<b>MFD1 DB ERR</b> – MFD1 multiple database errors exists.	The MFD detected a failure in more than one database. Reload databases with new data card. If problem persists, delete databases and reload with a new card.
<b>MFD1 DB ERR</b> – MFD1 obstacle database error exists.	The MFD detected a failure in the obstacle database. Reload databases with new data card. If problem persists, delete databases and reload with a new card.
<b>MFD1 DB ERR</b> – MFD1 obstacle database missing.	The obstacle database is present on another LRU, but is missing on the specified LRU.
<b>MFD1 DB ERR</b> – MFD1 terrain database error exists.	The MFD detected a failure in the terrain database. Reload databases with new data card. If problem persists, delete databases and reload with a new card.
<b>MFD1 DB ERR</b> – MFD1 terrain database missing.	The terrain database is present on another LRU, but is missing on the specified LRU.
<b>MFD1 CONFIG</b> – MFD1 config error. Config service req'd.	The MFD configuration settings do not match backup configuration memory. The system should be serviced.
<b>MFD1 COOLING</b> – 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.
<b>MFD1 DB ERR</b> – MFD1 multiple database errors exists.	The MFD detected a failure in more than one database. Reload databases with new data card. If problem persists, delete databases and reload with a new card.
<b>MFD1 DB ERR</b> – MFD1 obstacle database error exists.	The MFD detected a failure in the obstacle database. Reload databases with new data card. If problem persists, delete databases and reload with a new card.
<b>MFD1 DB ERR</b> – MFD1 obstacle database missing.	The obstacle database is present on another LRU, but is missing on the specified LRU.
<b>MFD1 DB ERR</b> – MFD1 terrain database error exists.	The MFD detected a failure in the terrain database. Reload databases with new data card. If problem persists, delete databases and reload with a new card.
<b>MFD1 DB ERR</b> – MFD1 terrain database missing.	The terrain database is present on another LRU, but is missing on the specified LRU.
<b>MFD1 FAN FAIL</b> – MFD1 internal fan failure. Return for repair.	The specified GDU's internal cooling fan has failed. The system should be serviced.
<b>MFD1 KEYSTK</b> – 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.



System Message	Comments
<b>MFD1 MANIFEST</b> – MFD 1 software mismatch, communication halted.	The MFD has incorrect software installed. The system should be serviced.
<b>MFD1 SERVICE</b> – MFD1 needs service. Return unit for repair.	The MFD self-test has detected a problem. The system should be serviced.
<b>MFD1 SOFTWARE</b> – MFD1 mismatch, communication halted.	The MFD has different software versions installed. The system should be serviced.
<b>MFD1 TERRAIN DSP</b> – MFD1 Terrain awareness display unavailable.	One of the terrain or obstacle databases required for TAWS in the MFD is missing or invalid.
<b>MFD1 VOLTAGE</b> – MFD1 has low voltage. Reducing power usage	The MFD voltage is low. The system should be serviced.
<b>NAV DB UPDATED</b> – Active navigation database updated.	System has updated the active navigation database from the standby navigation database.
<b>NAV1 MANIFEST</b> – NAV1 software mismatch, communication halted.	The NAV 1 has incorrect software installed. The system should be serviced.
<b>NAV1 RMT XFR</b> – 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.
<b>NAV1 SERVICE</b> – NAV1 needs service. Return unit for repair.	A failure has been detected in the NAV1 receiver. The receiver may still be available. The system should be serviced.
<b>NAV2 MANIFEST</b> – NAV2 software mismatch, communication halted.	The NAV 2 has incorrect software installed. The system should be serviced.
<b>NAV2 RMT XFR</b> – 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.
<b>NAV2 SERVICE</b> – NAV2 needs service. Return unit for repair.	A failure has been detected in the NAV2 receiver. The receiver may still be available. The system should be serviced.
<b>NON-MAG UNITS</b> – Non-magnetic NAV ANGLE display units are active.	Navigation angle is not set to MAGNETIC after applying power to the system.
<b>NON WGS84 WPT</b> – 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.
<b>NO RUNWAY POSITION DATA</b> – Inhibit SurfaceWatch. No runway position data.	Inhibit SurfaceWatch.
<b>PFD POSITIONS DIFFERENT</b> – PFD position mismatch. Check position sensors.	A difference has been detected in the displayed position on the PFDs. Check position sensors.

System Message	Comments
<b>PFD1 BACKLIGHT CALIBRATION</b> – PFD1 calibration lost. Return for repair.	The PFD1 backlight calibration cannot be found or is invalid. The system should be serviced.
<b>PFD1 CARD 1 ERR</b> – Card 1 is invalid.	The SD card in the top card slot of the specified PFD contains invalid data.
<b>PFD1 CARD 1 REM</b> – Card 1 was removed. Reinsert card.	The SD card was removed from the top card slot of the specified PFD. The SD card needs to be reinserted.
<b>PFD1 CARD 2 ERR</b> – Card 2 is invalid.	The SD card in the bottom card slot of the specified PFD contains invalid data.
<b>PFD1 CARD 2 REM</b> – Card 2 was removed. Reinsert card.	The SD card was removed from the bottom card slot of the specified PFD. The SD card needs to be reinserted.
<b>PFD1 CONFIG</b> – PFD1 config error. Config service req'd.	The PFD1 configuration settings do not match backup configuration memory. The system should be serviced.
<b>PFD1 COOLING</b> – PFD1 has poor cooling. Reducing power usage.	PFD1 is overheating and is reducing power consumption by dimming the display. If problem persists, the system should be serviced.
<b>PFD1 DB ERR</b> – PFD1 multiple database errors exists.	The PFD detected a failure in more than one database. Reload databases with new data card. If problem persists, delete databases and reload with a new card.
<b>PFD1 DB ERR</b> – PFD1 obstacle database error exists.	The PFD detected a failure in the obstacle database. Reload databases with new data card. If problem persists, delete databases and reload with a new card.
<b>PFD1 DB ERR</b> – PFD1 obstacle database missing.	The obstacle database is present on another LRU, but is missing on the specified LRU.
<b>PFD1 DB ERR</b> – PFD1 terrain database error exists.	The PFD detected a failure in the terrain database. Reload databases with new data card. If problem persists, delete databases and reload with a new card.
<b>PFD1 DB ERR</b> – PFD1 terrain database missing.	The terrain database is present on another LRU, but is missing on the specified LRU .
<b>PFD1 FAN FAIL</b> – PFD1 internal fan failure. Unit needs service.	The PFD1 internal cooling fan has failed. The system should be serviced.
<b>PFD1 KEYSTK</b> – PFD1 [key name] is stuck.	A key is stuck on the PFD1 bezel. Attempt to free the stuck key by pressing it several times. The system should be serviced if the problem persists.
<b>PFD1 MANIFEST</b> – PFD1 software mismatch, communication halted.	PFD1 has incorrect software installed. The system should be serviced.
<b>PFD1 SERVICE</b> – PFD1 needs service. Return unit for repair.	The PDF1 self-test has detected a problem. The system should be serviced.
<b>PFD1 SOFTWARE</b> – PFD1 mismatch, communication halted.	PFD1 has different software versions installed. The system should be serviced.
<b>PFD1 TERRAIN DSP</b> – PFD1 Terrain awareness display unavailable.	One of the terrain or obstacle databases required for TAWS in PFD1 is missing or invalid.
<b>PFD1 VOLTAGE</b> – PFD1 has low voltage. Reducing power usage	The PFD1 voltage is low. The system should be serviced.
<b>PFD2 BACKLIGHT CALIBRATION</b> – PFD2 calibration lost. Return for repair.	The PFD2 backlight calibration cannot be found or is invalid. The system should be serviced.

System Message	Comments
<b>PFD2 CARD 1 ERR</b> – Card 1 is invalid.	The SD card in the top card slot of the specified PFD contains invalid data.
<b>PFD2 CARD 1 REM</b> – Card 1 was removed. Reinsert card.	The SD card was removed from the top card slot of the specified PFD. The SD card needs to be reinserted.
<b>PFD2 CARD 2 ERR</b> – Card 2 is invalid.	The SD card in the bottom card slot of the specified PFD contains invalid data.
<b>PFD2 CARD 2 REM</b> – Card 2 was removed. Reinsert card.	The SD card was removed from the bottom card slot of the specified PFD. The SD card needs to be reinserted.
<b>PFD2 CONFIG</b> – PFD2 config error. Config service req'd.	The PFD2 configuration settings do not match backup configuration memory. The system should be serviced.
<b>PFD2 COOLING</b> – PFD2 has poor cooling. Reducing power usage.	PFD2 is overheating and is reducing power consumption by dimming the display. If problem persists, the system should be serviced.
<b>PFD2 DB ERR</b> – PFD2 multiple database errors exists.	The PFD detected a failure in more than one database. Reload databases with new data card. If problem persists, delete databases and reload with a new card.
<b>PFD2 DB ERR</b> – PFD2 obstacle database error exists.	The PFD detected a failure in the obstacle database. Reload databases with new data card. If problem persists, delete databases and reload with a new card.
<b>PFD1 DB ERR</b> – PFD2 obstacle database missing.	The obstacle database is present on another LRU, but is missing on the specified LRU.
<b>PFD2 DB ERR</b> – PFD2 terrain database error exists.	The PFD detected a failure in the terrain database. Reload databases with new data card. If problem persists, delete databases and reload with a new card.
<b>PFD2 DB ERR</b> – PFD2 terrain database missing.	The terrain database is present on another LRU, but is missing on the specified LRU.
<b>PFD2 FAN FAIL</b> – PFD2 internal fan failure. Unit needs service.	The PFD2 internal cooling fan has failed. The system should be serviced.
<b>PFD2 KEYSTK</b> – PFD2 [key name] is stuck.	A key is stuck on the PFD2 bezel. Attempt to free the stuck key by pressing it several times. The system should be serviced if the problem persists.
<b>PFD2 MANIFEST</b> – PFD 1 software mismatch, communication halted.	PFD2 has incorrect software installed. The system should be serviced.
<b>PFD2 SERVICE</b> – PFD2 needs service. Return unit for repair.	The PFD1 self-test has detected a problem. The system should be serviced.
<b>PFD2 SOFTWARE</b> – PFD2 mismatch, communication halted.	PFD2 has different software versions installed. The system should be serviced.
<b>PFD2 TERRAIN DSP</b> – PFD2 Terrain awareness display unavailable.	One of the terrain or obstacle databases required for TAWS in PFD2 is missing or invalid.
<b>PFD2 VOLTAGE</b> – PFD2 has low voltage. Reducing power usage	The PFD2 voltage is low. The system should be serviced.
<b>PILOT PRIM PTT KEYSTK</b> – 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.
<b>PILOT SEC PTT KEYSTK</b> – 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.

System Message	Comments
<b>PTK FAIL</b> – Parallel track unavailable: bad geometry.	Bad parallel track geometry.
<b>PTK FAIL</b> – Parallel track unavailable: invalid leg type.	Invalid leg type for parallel offset.
<b>PTK FAIL</b> – Parallel track unavailable: past IAF.	IAF waypoint for parallel offset has been passed.
<b>RAIM UNAVAIL</b> – RAIM not available from FAF to MAP waypoints.	GPS satellite coverage is insufficient to perform Receiver Autonomous Integrity Monitoring (RAIM) from the FAF to the MAP waypoints.
<b>RECORDER SERVICE REQUIRED</b> – The CVDR needs service.	The CVDR should be serviced.
<b>REGISTER CONNEXT</b> – Data services inop, register w/Connext.	The system is not registered with Garmin Connext, or its current registration data has failed authentication.
<b>SCHEDULER [#]</b> – <message>.	Message criteria entered by the user.
<b>SLCT FREQ</b> – 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.
<b>SLCT MAG</b> – Select MAGNETIC NAV ANGLE display units.	The system notifies the pilot to set the Nav Angle units on the 'Avioncs Settings' Screen to Magnetic.
<b>SLCT NAV</b> – 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.
<b>SLCT NON-MAG</b> – Select alternate NAV ANGLE display units.	The system notifies the pilot to set the Nav Angle units on the 'Avioncs Settings' Screen to True.
<b>STEEP TURN</b> – Steep turn ahead.	The computed bank angle needed to execute the turn ahead may exceed the current bank angle limit.
<b>STRMSCP FAIL</b> – Stormscope has failed.	Stormscope has failed. The system should be serviced.
<b>SURFACEWATCH DISABLED</b> – Too far north/south.	The SurfaceWatch system has been disabled.
<b>SURFACEWATCH FAIL</b> – Invalid audio configuration.	The SurfaceWatch system has failed due to an invalid audio configuration.
<b>SURFACEWATCH FAIL</b> – Invalid configurable alerts.	The SurfaceWatch system has failed due to invalid configurable alerts.
<b>SURFACEWATCH FAIL</b> – One or more inputs invalid.	The SurfaceWatch system has failed due to one or more invalid inputs.
<b>SURFACEWATCH INHIBITED</b> – Surfacewatch inhibited.	The SurfaceWatch system has been inhibited.
<b>SVT DISABLED</b> – Out of available terrain region.	Synthetic Vision is disabled because the aircraft is not within the boundaries of the installed terrain database.
<b>SVT DISABLED</b> – 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.
<b>TERRAIN AUD CFG</b> – Trn Awareness audio config error. Service req'd.	TAWS is disabled because the audio configuration is invalid. The system should be serviced.

System Message	Comments
<b>TERRAIN DISABLED</b> – 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.
<b>TIMER EXPIRD</b> – Timer has expired.	The system notifies the pilot the timer has expired.
<b>TRN AUD FAIL</b> – Trn Awareness audio source unavailable.	TAWS is disabled because an aural alert audio source is unavailable.
<b>UNABLE V WPT</b> – 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.
<b>UNABLE VNAV</b> – Excessive cross-track error.	The current cross-track exceeds the limit, causing vertical deviation to go invalid.
<b>UNABLE VNAV</b> – Excessive track angle error.	The current track angle error exceeds the limit, causing the vertical deviation to go invalid.
<b>UNABLE VNAV</b> – Reverted to PIT.	The current VNAV is not supported, the Flight Director has reverted to PIT mode.
<b>UNABLE VNAV</b> – Parallel course selected.	A parallel course has been selected, causing the vertical deviation to go invalid.
<b>UNABLE VNAV</b> – 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.
<b>UNABLE VNAV ALTITUDE</b> – Cannot meet VNAV altitude constraint.	The current vertical speed is insufficient to make the active flight plan altitude constraint prior to crossing the waypoint.
<b>VNAV CONFIG</b> – VNAV config error Config service req'd.	VNAV configuration error. The system should be serviced.
<b>WPT ARRIVAL</b> – Arriving at waypoint - [xxxx]	Arriving at waypoint [xxxx], where [xxxx] is the waypoint name.
<b>WX ALERT</b> – Possible severe weather ahead.	The GWX indicates severe weather within $\pm 10$ degrees of the aircraft heading at a range of 80 to 320 nm.
<b>XPDR1 ADS-B 1090</b> – Datalink: ADS-B 1090 receiver has failed.	A failure has been detected in the 1090 receiver.
<b>XPDR1 ADS-B NO POS</b> – Transponder: ADS-B is not transmitting position.	The transponder is not able to receive position information.
<b>XPDR1 ADS-B TRFC</b> – Transponder: ADS-B traffic has failed	The Transponder is incapable of processing traffic information.
<b>XPDR1 ADS-B NO TX</b> – Transponder: ADS-B out has failed.	ADS-B is inoperative. The transponder may not be receiving a valid GPS position. Other transponder functions may be available. Service when possible.
<b>XPDR1 ADS-B UAT</b> – Datalink: ADS-B in UAT receiver has failed.	A failure has been detected in the UAT receiver.
<b>XPDR1 CONFIG</b> – XPDR1 config error. Config service req'd.	The transponder configuration settings do not match those of backup configuration memory. The system should be serviced.
<b>XPDR1 CSA FAIL</b> – Traffic: ADS-B In traffic alerting has failed.	ADS-B Conflict Situational Awareness (CSA) is unavailable.
<b>XPDR1 FAULT</b> – Datalink: ADS-B in has failed.	The transponder is unable to receive ADS-B information.

System Message	Comments
<b>XPDR1 FIS-B WX</b> – Datalink: FIS-B Weather has failed.	The transponder is unable to receive FIS-B weather information.
<b>XPDR1 OVER TEMP</b> – 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.
<b>XPDR1 PRES ALT</b> –Transponder: ADS-B no pressure altitude.	Unable to provide pressure altitude information.
<b>XPDR1 SERVICE</b> – XPDR1 needs service. Return unit for repair.	The #1 transponder should be serviced when possible.
<b>XPDR1 UNDER TEMP</b> – 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.
<b>XPDR2 ADS-B 1090</b> – Datalink: ADS-B 1090 receiver has failed.	A failure has been detected in the 1090 receiver.
<b>XPDR2 FIS-B WX</b> – Datalink: FIS-B Weather has failed.	The transponder is unable to receive FIS-B weather information.
<b>XPDR2 ADS-B NO POS</b> – Transponder: ADS-B is not transmitting position.	The transponder is not able to receive position information.
<b>XPDR2 ADS-B TRFC</b> – Transponder: ADS-B traffic has failed	The Transponder is incapable of processing traffic information.
<b>XPDR2 ADS-B UAT</b> – Datalink: ADS-B in UAT receiver has failed.	A failure has been detected in the UAT receiver.
<b>XPDR2 CONFIG</b> – XPDR2 config error. Config service req'd.	The transponder configuration settings do not match those of backup configuration memory. The system should be serviced.
<b>XPDR2 CSA FAIL</b> – Traffic: ADS-B In traffic alerting has failed.	ADS-B Conflict Situational Awareness (CSA) is unavailable.
<b>XPDR2 FAULT</b> – Datalink: ADS-B in has failed.	The transponder is unable to receive ADS-B information.
<b>XPDR2 OVER TEMP</b> – 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.
<b>XPDR2 PRES ALT</b> –Transponder: ADS-B no pressure altitude.	Unable to provide pressure altitude information.
<b>XPDR2 SERVICE</b> – XPDR2 needs service. Return unit for repair.	The #2 transponder should be serviced when possible.
<b>XPDR2 UNDER TEMP</b> – 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.
<b>XTALK ERROR</b> – Flight display crosstalk error has occurred.	The GDUs and/or GTCs are not communicating with each other. The system should be serviced.

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## DATABASE MANAGEMENT

Database information is obtained from third party sources. Inaccuracies in the data may be discovered from time to time. Garmin communicates this information by issuing a Database Alert. These notifications are available on [flygarmin.com](http://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](http://flygarmin.com) and select Aviation Data Error Report.

The system uses Secure Digital (SD) cards to load various types of data. For basic flight operations, SD cards are required for database updates. Use only 32 GB cards that are Garmin, OEM, or dealer provided.



**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](http://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 current version of pertinent flight manual and regulatory guidance or limitations as applicable to the pilot, the aircraft, and installed equipment.*



**NOTE:** *The pilot/operator must review and be familiar with Garmin's database exclusion list as discussed in SAIB CE-14-04 to determine what data may be incomplete. The database exclusion list can be viewed at [flygarmin.com](http://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](http://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](http://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.

When utilizing the Wireless Transceiver, multiple regional databases (e.g. North America and Europe) may be available to be loaded to the system depending on the database type. Some databases offer only one region. Only one database region may be active on the system at any time for each database. If desired, a database compatible with the aircraft's current region of operation may be loaded as the active database through the preferred mobile device, replacing the existing region specific database. The regions loaded become the Preferred Region for each database.

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](http://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 for the United States only. This database is updated on a 28-day cycle. If not updated within 180 days of the expiration date, FliteCharts will no longer function. The FliteCharts database is available for multiple regions. Refer to flygarmin.com for a list of FliteCharts databases available.

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.

## DATABASE UPDATES USING A SUPPLEMENTAL DATA CARD

All databases are updated through an SD card in the bottom slot of each unit, or on a single card on the bottom slot of the MFD. Updating three SD cards, each loaded with new databases, will reduce the time needed for synchronization. After update, the databases are stored on the SD card in the bottom slot so the card must remain in the bottom slot of the GDU. For updating using a single SD card, see 'Automatic Database Synchronization Feature' below. When in standby, databases are not immediately available for use, but stored to be activated at a later time.

Database updates can be obtained by following the instructions detailed in the 'Aviation Databases' section of the Garmin website (flygarmin.com). Once the updated files have been downloaded from the website, a PC equipped with an appropriate SD card reader is used to unpack and program the new databases onto an existing Supplemental Data Card. When database files are loaded to the SD card, any previously loaded database files of the same type residing on the SD card will be overwritten. This includes loading a database of a different coverage area or data cycle than that currently residing on the SD card. Equipment required to perform the update is as follows:

- Windows-compatible PC computer
- SD Card Reader: SanDisk SDDR-93, SanDisk SDDR-99, Verbatim #96504, or equivalent
- Updated database obtained from the Garmin website
- Supplemental SD Cards



**NOTE:** If the FS510 is used as the Supplemental Data Card, the card reader supplied with the FS510 must be used to load the databases onto the FS510.

## AUTOMATIC DATABASE SYNCHRONIZATION FEATURE

When updating the active navigation database, the automatic database synchronization feature automatically transfers the navigation database from a single SD Card to the internal memory of the Touchscreen Controllers. Supplemental database SD cards are required to be kept in all GDUs for database storage.

In addition to the navigation database, the system can automatically synchronizes the following databases: Basemap, Safetaxi, Obstacle, and Airport Directory. The ChartView and terrain databases are too large for the automatic database synchronization feature. These databases must be copied directly to each Supplemental Database Card to be installed in the bottom card slot of each GDU.

After applying power, the system compares all copies of each applicable database. If similar databases do not match, the most recent valid database is automatically copied to each card in the system that does not already contain that database.

The synchronization progress may be monitored on the 'Database Status' Screen on the Touchscreen Controller. This screen shows the synchronization status of each applicable database as follows:

While database synchronization is occurring, 'Sync in Progress' is displayed along with percent complete and estimated time remaining. When the synchronization is complete for the selected GTC 'Database Status' Screen, the status is listed as 'Sync Complete'. The synchronization status is only present when a synchronization is occurring or has occurred during the current power cycle.

### Updating Databases using an SD Card:



**NOTE:** When using the automatic synchronization feature, it is only necessary to use a single card on the MFD. The Chartview and terrain databases are too large to synchronize using this method.

- 1) Download and install the databases on three SD cards.
- 2) Put an SD Card in the bottom SD card slot of the each display.
- 3) Turn the system ON.
- 4) Press the right-most softkey to acknowledge the startup screen.
- 5) Touch **Database Status** on the 'Initialization' Screen on either Touchscreen Controller.

**Or:**

From Home, touch **Utilities > Setup > Database Status**.

- 6) 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.
- 7) 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.

Database Status		
Databases Ready		
Activate databases with on ground restart.		
Database	Standby (effective)	Active (expires)
Navigation	2002 30-JAN-2020	2001 30-JAN-2020
Basemap		19M1 N/A
Terrain		16T1 N/A
Obstacle	20B1 30-JAN-2020	19B7 30-JAN-2020

Figure B-1 'Database Status' Screen before Activation of Standby Databases

- 8) The status window will display the message 'Activate databases with on ground restart.'
- 9) Remove and reapply power to the system.
- 10) Touch **Database Status** on the 'Initialization' Screen on the either Touchscreen Controller.

Or:

From Home, touch **Utilities > Setup > Database Status**.

- 11) Verify the standby databases transferred and are now in the Active database column.

Database Status		
Databases Ready		
Database	Standby (effective)	Active (expires)
Navigation	2001 02-JAN-2020	2002 27-FEB-2020
Basemap	None	19M1 N/A
Terrain	None	16T1 N/A
Obstacle	19B7 05-DEC-2019	20B1 26-MAR-2020

Figure B-2 'Database Status' Screen after Activation of Standby Databases

- 12) To manually activate any databases that did not transfer to the active column:
  - a) Touch **Database Status** on the 'Initialization' Screen on either Touchscreen Controller.

Or:

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.
  - d) Remove and reapply power to the system.
  - e) Press the right-most softkey on MFD display to acknowledge the startup screen.
  - f) Touch **Database Status** on the 'Initialization' Screen of either Touchscreen Controller.  
 Or:  
 From Home, touch **Utilities** > **Setup** > **Database Status**.
  - g) Verify the standby databases transferred and are now in the Active database column.
- 13) To view database status:
- a) Touch **Database Status** on the 'Initialization' Screen on either Touchscreen Controller.  
 Or:  
 From Home, touch **Utilities** > **Setup** > **Database Status**.
  - b) To view database status for an individual display, touch **Database Options** > **LRU Database Info**.  
 Or:  
 To view database status from "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.

## DATABASE UPDATES USING THE 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 Multimedia card inserted in the bottom SD slot of the MFD. A mobile device with Garmin Pilot™ must be paired with the Wireless Transceiver over Bluetooth. The system's preferred mobile device 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 mobile device is made, Garmin Pilot™ makes available databases that can be transferred via 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 the Touchscreen Controller.



**NOTE:** The system will only provide a WIFI connection if new databases have been detected for download on Garmin Pilot™ via a valid Bluetooth connection. If there are no database updates required, the system will not provide a WIFI signal.



**NOTE:** If the mobile device has previously connected to the Wireless Transceiver, and is not connected to another Bluetooth device, the mobile device should connect automatically to the Wireless Transceiver. If the mobile device is connected to another Bluetooth device, then the Wireless Transceiver will not automatically connect.

### Updating Databases using the Wireless Transceiver:

- 1) With the system OFF, insert the Flight Stream Multimedia Card in the bottom slot of the MFD if not already inserted.
- 2) Turn the system on.



**NOTE:** The Flight Stream Multimedia Card should not be removed while the system is powered on. If the Multimedia 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 MFD display to acknowledge the startup screen.
- 4) From Home, touch **Utilities > Setup > Wireless Setup > Connex**.
- 5) Touch the **Functions** Tab and ensure the WiFi Database Import **Enable** Button is selected.



Figure B-3 Wifi Enabled

- 6) Touch the **Bluetooth** Tab to ensure Bluetooth is enabled.



Figure B-4 Bluetooth Setup

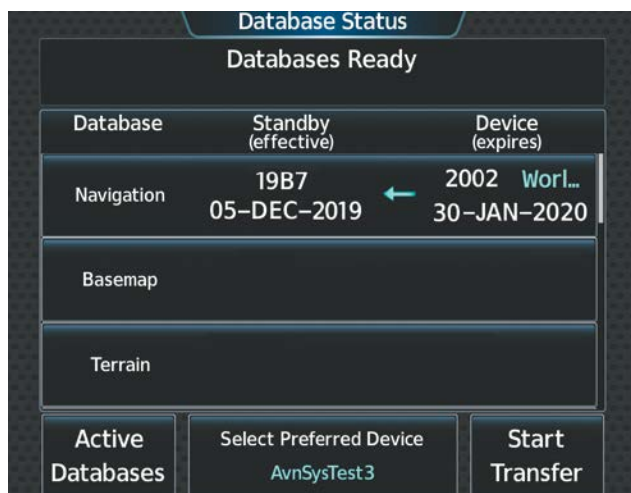


- 7) On the mobile device, connect via Bluetooth to the Wireless Transceiver.
- 8) Touch the **Database Status > Device Databases** on the 'Initialization' Screen on either Touchscreen Controller.

**Or:**

From Home, touch **Utilities > Setup > Database Status > Device Databases**.

- 9) The 'Database Status' Screen will show the databases connected to the mobile device in place of the active databases on the system. Databases selected to load will be indicated by a cyan arrow.



**Figure B-5 Database Start Transfer**

- 10) If required, select the Preferred Device.
  - a) Touch the **Select Preferred Device** Button.
  - b) Touch the button for the desired mobile device from the list.
- 11) 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.

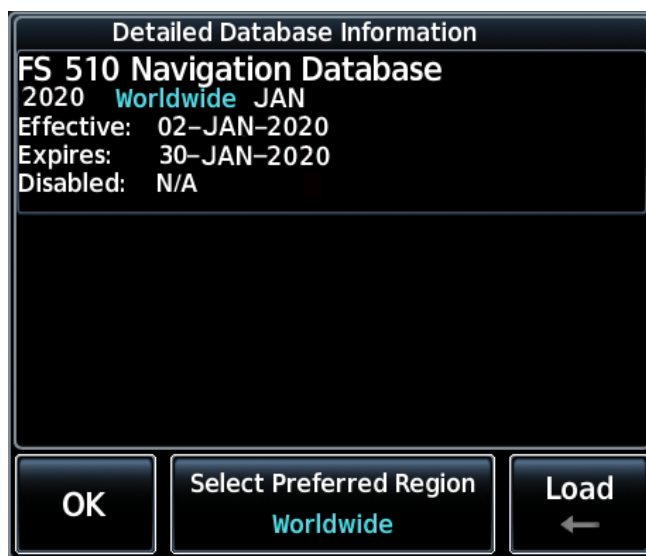


Figure B-6 Selecting Preferred Region

- 12) Touch the **Start Transfer** Button on the 'Database Status' Screen.
- 13) On the mobile device, connect to the indicated SSID Wi-Fi network shown on the **WiFi** Tab of the 'Connex Setup' Screen.



Figure B-7 WiFi Setup

- 14) On the mobile device, start Garmin Pilot™ and touch **Home > Connex > Database Concierge**.
- 15) Monitor the Sync Status on the 'Database Status' Screen. Wait for all databases to complete syncing, indicated by 'Sync Complete' being displayed.
- 16) 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.
- 17) 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	Standby (effective)	Active (expires)
Navigation	2002 30-JAN-2020	2001 30-JAN-2020
Basemap		19M1 N/A
Terrain		16T1 N/A

Device Databases    Select Preferred Device: Greg's iPad    Start Transfer

**Figure B-8 'Database Status' Screen before Activation of Standby Databases**

- 18) The system will display the message 'Activate databases with on ground restart.'
- 19) Remove and reapply power to the system.
- 20) Touch **Database Status** on the 'Initialization' Screen on either Touchscreen Controller.

Or:

From Home, touch **Utilities > Setup > Database Status**.

Database	Standby (effective)	Active (expires)
Navigation	2001 02-JAN-2020	2002 27-FEB-2020
Basemap	None	19M1 N/A
Terrain	None	16T1 N/A

Device Databases    Select Preferred Device: Greg's iPad    Start Transfer

**Figure B-9 'Database Status' Screen after Activation of Standby Databases**

- 21) Verify the standby databases transferred and are now in the Active database column.
- 22) To manually activate any databases that did not transfer to the Active column:
  - a) Touch the **Database Status** Button on the 'Initialization' Screen of either touchscreen controller.

Or:

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.
  - d) Touch **Database Options > Restart Displays**.

- e) Press the right-most softkey on MFD display to acknowledge the startup screen.
  - f) Touch **Database Status** on the 'Initialization' Screen of either touchscreen controller.  
**Or:**  
From Home, touch **Utilities > Setup > Database Status**.
  - g) Verify the standby databases transferred and are now in the Active database column.
- 23) To view database status:
- a) Touch **Database Status** on the 'Initialization' Screen on the MFD touchscreen controller.  
**Or:**  
From Home, touch **Utilities > Setup > Database Status**.
  - b) To view database status for an individual display, touch **Database Options > LRU Database Info**.  
**Or:**  
To view database status from "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.

## DATABASE SYNCHRONIZATION FEATURE

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When a PFD or MFD has failed, any database updates will not be automatically synchronized to the other displays. When this occurs, the database synchronization feature allows synchronizing to be completed on the remaining powered displays.

### Synchronizing databases:

- 1) Follow the procedures for loading databases in this section. The databases will not sync to any of the displays when a display is not powered.
- 2) Touch the **Database Status** Button on the 'Initialization' Screen on either Touchscreen Controller.  
**Or:**  
From Home, touch **Utilities > Setup > Database Status**.
- 3) Scroll down and touch **Database Options > Sync Databases**.

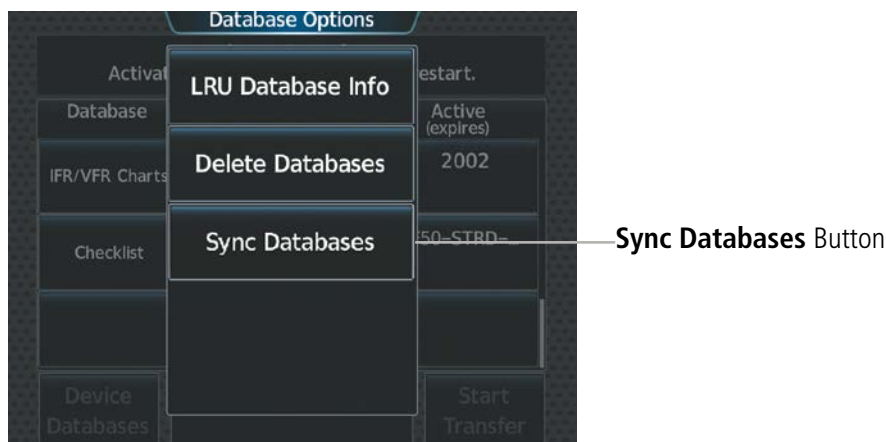


Figure B-10 Sync Databases

- 4) From the 'Sync From Display' Screen, touch the button for the display the databases will be synced from (this will be the display containing the SD Card or multimedia card with the proper databases).
- 5) The database sync process will begin. Follow the procedures for loading databases in this section to complete the database updates.

## DATABASE DELETION FEATURE

If databases are not properly loading or functioning, and an attempt has been made to load the databases using a new SD card or multimedia card, it may be necessary to delete the databases from the system.

### Deleting the databases:

- 1) Touch the **Database Status** Button on the 'Initialization' Screen on either Touchscreen Controller.

Or:

From Home, touch **Utilities > Setup > Database Status**.

- 2) Scroll down and touch **Database Options > Delete Databases**.

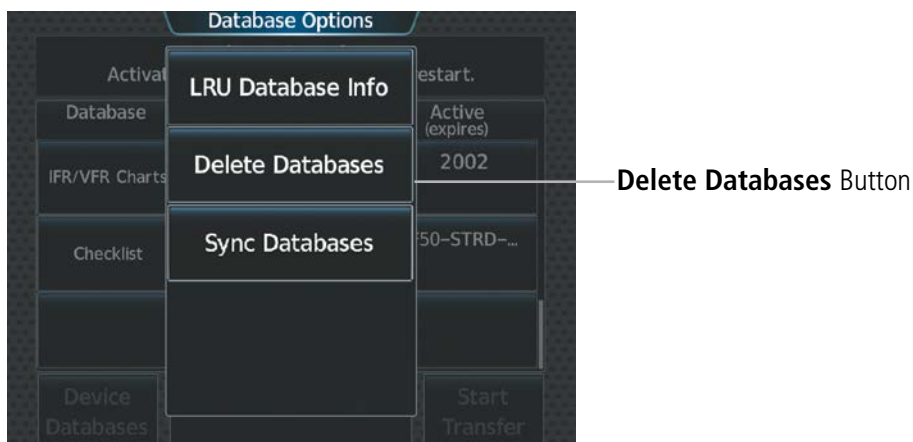


Figure B-11 Delete Databases

- 3) A prompt will appear to confirm deletion of all internal databases. Touch the **OK** Button.

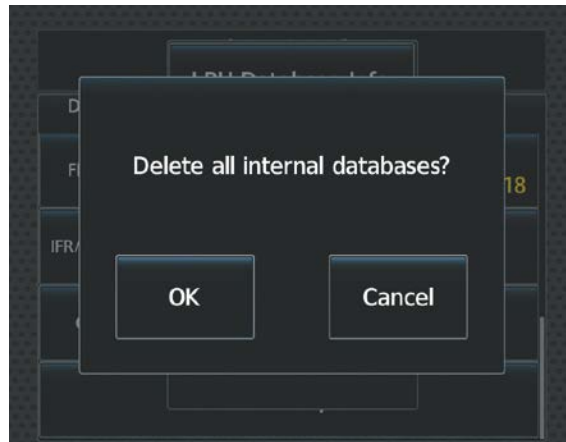


Figure B-12 Confirm Deletion

- 4) Another confirmation prompt will appear. Touch the **OK** Button.

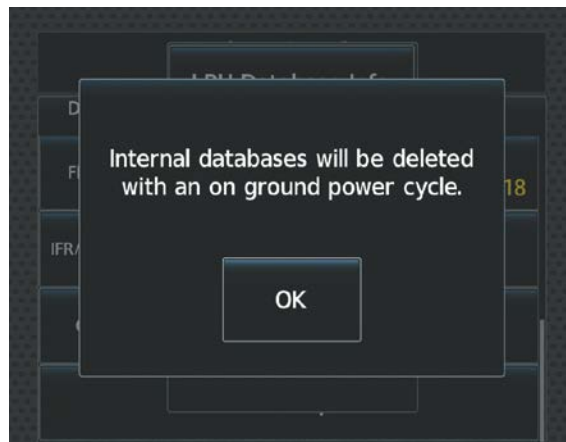


Figure B-13 Ground Power Cycle

- 5) Touch the **Database Status** Button on the 'Initialization' Screen on either Touchscreen Controller.

Or:

From Home, touch **Utilities > Setup > Database Status**.

- 6) Confirm that all databases have been deleted from the system.

## MAGNETIC FIELD VARIATION DATABASE UPDATE

The Magnetic Field Variation Database is loaded as part of the navigation database, but is copied to, and resides within each AHRS (GRS1 and GRS2). At startup, 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 determine 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-16. 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, touch the **OK** Button. A progress monitor is displayed.

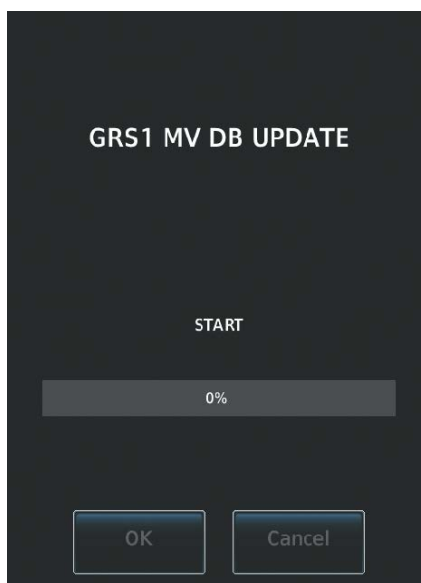


Figure B-15 Uploading Database to GRS1

- 2) When the upload is complete, the prompt for the next GRS upload is displayed. A database mismatch message indicates the second GRS has not yet been updated.





Figure B-16 GRS2 Magnetic Field Variation Database Update Prompt

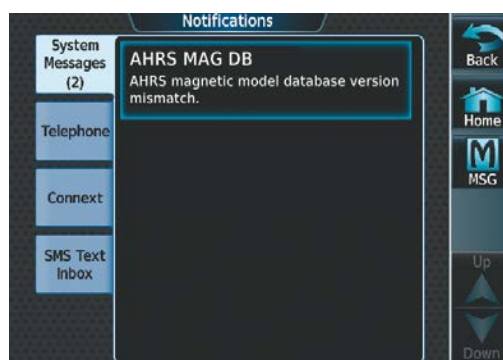


Figure B-17 Database Mismatch Message is Annunciated Before Second GRS is Updated

- 3) Touch the **OK** Button. A progress monitor for the next GRS is displayed as in step 1. When the upload is complete, the system is ready for use.

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## AVIATION TERMS AND ACRONYMS

<b>A</b>	Amps	<b>AM</b>	Amplitude Modulation
<b>AC</b>	Advisory Circular, Alternating Current	<b>AMPS</b>	Amperes
<b>ACARS</b>	Aircraft Communications Addressing and Reporting System	<b>ANNUNC/ANN</b>	Annunciation/Annunciator
<b>ACC</b>	Accuracy	<b>ANSP</b>	Air Navigation Service Provider
<b>ACK</b>	Acknowledge	<b>ANT</b>	Antenna
<b>ACT, ACTV</b>	Active, Activate, Altitude Compensated Tilt	<b>AOA</b>	Angle of Attack, ACARS Over AVL
<b>ADAHRS</b>	Air Data, Attitude and Heading Reference System	<b>AOC</b>	Aeronautical Operational Control
<b>ADC</b>	Air Data Computer	<b>AOG</b>	Aircraft On Ground
<b>ADF</b>	Automatic Direction Finder	<b>AOPA</b>	Aircraft Owners and Pilots Association
<b>ADI</b>	Attitude Direction Indicator	<b>AP</b>	Autopilot
<b>ADIZ</b>	Air Defense Identification Zone	<b>AP DISC</b>	Autopilot Disconnect
<b>ADM</b>	Administrative Domain	<b>APPR, APR</b>	Approach
<b>ADS-B</b>	Automatic Dependent Surveillance-Broadcast	<b>APT</b>	Airport, Aerodrome, Automatic Pitch Trim
<b>ADS-R</b>	Automatic Dependent Surveillance-Rebroadcast	<b>APTSIGNS</b>	Airport Signs
<b>AEA</b>	Aircraft Electronic Association	<b>APU</b>	Auxiliary Power Unit
<b>AF</b>	Arc to Fix Leg	<b>APV</b>	Approaches with Vertical Guidance
<b>AFCS</b>	Automatic Flight Control System	<b>ARINC</b>	Aeronautical Radio Incorporated
<b>AFM</b>	Airplane Flight Manual	<b>ARSPC</b>	Airspace
<b>AFMS</b>	Airplane Flight Manual Supplement	<b>ARTCC</b>	Air Route Traffic Control Center
<b>AFN</b>	ATS Facilities Notification	<b>ARV</b>	Arrival
<b>AFRM</b>	Airframe	<b>AS</b>	Airspeed
<b>AFTN</b>	Aeronautical Fixed Telecommunication Network	<b>ASB</b>	Aviation Support Branch
<b>AGL</b>	Above Ground Level	<b>ASOS</b>	Automated Surface Observing System
<b>AHRS</b>	Attitude and Heading Reference System	<b>AT</b>	Auto Throttle
<b>AIM</b>	Aeronautical Information Manual	<b>ATAS</b>	ADS-B Traffic Advisory System
<b>AIRB</b>	Airborne	<b>ATC</b>	Air Traffic Control
<b>AIRMET</b>	Airman's Meteorological Information	<b>ATCRBS</b>	ATC Radar Beacon System
<b>AIRREP</b>	Air Reports	<b>ATIS</b>	Automatic Terminal Information Service
<b>ALRT</b>	Alert	<b>ATK</b>	Along Track
<b>ALT</b>	Altitude	<b>ATN</b>	Aeronautical Telecommunications Network
<b>ALT, ALTN</b>	Alternator, Alternate	<b>ATS</b>	Air Traffic Services
<b>ALTS</b>	Altitude Select, Selected Altitude Capture Mode	<b>ATT</b>	Attitude
<b>ALTV</b>	VNAV Altitude Capture Mode	<b>AUD</b>	Audio
		<b>AUTO</b>	Automatic
		<b>AUTOSEQ</b>	Automatic Sequence
		<b>AUX</b>	Auxiliary
		<b>AVAIL</b>	Available

<b>AVG</b>	Average	<b>CL</b>	Class
<b>AVLC</b>	Aviation VHF Link Control	<b>CLB</b>	Climb
<b>AWOS</b>	Automated Weather Observing System	<b>CLD</b>	Cloud
<b>B</b>	Both Runways	<b>CLR</b>	Clear
<b>B ALT</b>	Barometric Altitude	<b>CLTR</b>	Clutter
<b>B/C, BC</b>	Back Course	<b>CM</b>	Centimeter
<b>BARO</b>	Barometer, Barometric	<b>CMC</b>	Central Maintenance Computer
<b>BATT</b>	Battery	<b>CN</b>	Canada
<b>Bearing</b>	The compass direction from the present position to a destination waypoint.	<b>CNS</b>	Communication, Navigation, & Surveillance
<b>BFO</b>	Beat Frequency Oscillator	<b>CO</b>	Carbon Monoxide
<b>BKLT</b>	Backlight	<b>COM</b>	Communication Radio
<b>BKSP</b>	Backspace	<b>COMP</b>	Compensated, Compensation
<b>Bluetooth</b>	Wireless standard for data exchange over short distances	<b>CONFIG</b>	Configuration
<b>BOC</b>	Bottom of Climb	<b>CONUS</b>	Continental United States
<b>BOD</b>	Bottom of Descent	<b>COOL</b>	Coolant
<b>BRG</b>	see also Bearing	<b>COPLT</b>	Copilot
<b>BTM</b>	Bottom	<b>Course</b>	The line between two points to be followed by the aircraft.
<b>°C</b>	Degrees Celsius	<b>Course to Steer</b>	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.
<b>C</b>	Center Runway	<b>CPDLC</b>	Controller Pilot Datalink Communications
<b>CA</b>	Course to Altitude Leg	<b>CPL</b>	Couple
<b>CAL</b>	Calibrated	<b>CR</b>	Course to Radial Leg
<b>CALC</b>	Calculator	<b>CRG</b>	Cockpit Reference Guide
<b>Calibrated Airspeed</b>	Indicated airspeed corrected for installation and instrument errors.	<b>CRNT</b>	Current
<b>CAS</b>	Crew Alerting System	<b>Crosstrack Error</b>	The distance the aircraft is off a desired course in either direction, left or right.
<b>CCG</b>	Current Climb Gradient	<b>CRS</b>	see also Course, Course to Steer
<b>CD</b>	Course to DME Distance Leg	<b>CRSR</b>	Cursor
<b>CDA</b>	Current Data Authority	<b>CRU, CRZ</b>	Cruise
<b>CDI</b>	Course Deviation Indicator	<b>CSA</b>	Conflict Situational Awareness
<b>CDU</b>	Control Display Unit	<b>CSC</b>	Current Speed Control
<b>CF</b>	Course to Fix Leg	<b>CTA</b>	Control Area
<b>CFG</b>	Configuration	<b>CTAF</b>	Common Traffic Advisory Frequency
<b>CFIT</b>	Controlled Flight into Terrain	<b>CTR</b>	Center
<b>CG</b>	Center of Gravity	<b>CTRL</b>	Control
<b>CH, CHNL</b>	Channel	<b>Cumulative, CUM</b>	The total of all legs in a flight plan.
<b>CHKLIST</b>	Checklist	<b>CVDR</b>	Cockpit Voice Data Recorder
<b>CHT</b>	Cylinder Head Temperature		
<b>CI</b>	Course to Intercept Leg		
<b>CIP</b>	Current Icing Potential		

<b>CVFP</b>	Charted Visual Flight Procedure	<b>DOP</b>	see also Dilution of Precision
<b>CVR</b>	Cockpit Voice Recorder	<b>DP</b>	Departure Procedure
<b>CVRG</b>	Coverage	<b>DPRT</b>	Departure
<b>CWS</b>	Control Wheel Steering	<b>DQR</b>	Data Quality Requirements
<b>CYC CTR</b>	Cyclic Centering	<b>DR</b>	Dead Reckoning
<b>CYL</b>	Cylinder	<b>DSBL</b>	Disabled
<b>D ALT</b>	Density Altitude	<b>DSP</b>	Display, Datalink Service Provider, Digital Signal Processor
<b>D-ATIS</b>	Digital Automatic Terminal Info Service	<b>DTG</b>	Distance To Go, Remaining distance to last active FPL waypoint
<b>DB, DBASE</b>	Database	<b>DTK</b>	see also Desired Track
<b>dBZ</b>	Decibels 'Z' (Radar Return)	<b>DWNGRADE</b>	Downgrade
<b>DCL</b>	Departure Clearance	<b>E</b>	Empty, East
<b>DCLTR, DECLTR</b>	Declutter	<b>EAS</b>	Engine and Airframe Systems
<b>DEC FUEL</b>	Decrease Fuel	<b>EC</b>	Error Correction
<b>DEG</b>	Degree	<b>ECC</b>	Error Correcting Code
<b>DEIC, DEICE</b>	De-icing	<b>ECR</b>	Excessive Closure Rate
<b>DEP</b>	Departure	<b>ECS</b>	Environmental Control System
<b>DESC</b>	Descent	<b>ECU</b>	Engine Control Unit
<b>Desired Track</b>	The desired course between the active "from" and "to" waypoints.	<b>EDM</b>	Emergency Descent Mode
<b>DEST, DES</b>	Destination, Destination Airport Identifier	<b>EDR</b>	Excessive Descent Rate
<b>DEV</b>	Deviation	<b>EFC</b>	Expected Further Clearance
<b>DF</b>	Direct to Fix Leg	<b>Efficiency</b>	A measure of fuel consumption, expressed in distance per unit of fuel.
<b>DFLT</b>	Default	<b>EGNOS</b>	European Geostationary Navigation Overlay Service
<b>DG</b>	Directional Gyro	<b>EGT</b>	Exhaust Gas Temperature
<b>DGRD</b>	Degrade	<b>EICAS</b>	Engine Indication and Crew Alerting System
<b>DH</b>	Decision Height	<b>EIS</b>	Engine Indication System
<b>DIFF</b>	Differential	<b>ELEC</b>	Electrical
<b>Dilution of Precision</b>	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).	<b>ELEV</b>	Elevation, Elevator
<b>DIR</b>	Direction	<b>ELT</b>	Emergency Locator Transmitter
<b>DIS</b>	Distance	<b>EMER, EMERG, EMERGCY</b>	Emergency
<b>Distance</b>	The 'great circle' distance from the present position to a destination waypoint.	<b>EMI</b>	Electromagnetic Interference
<b>DL LTNG</b>	Datalink Lightning	<b>END, ENDUR</b>	Endurance
<b>DLS</b>	Data Link System	<b>Endurance</b>	Flight endurance, or total possible flight time based on available fuel on board.
<b>DME</b>	Distance Measuring Equipment	<b>ENG</b>	Engine
<b>DN</b>	Down	<b>ENGD</b>	Engaged
<b>DNALT</b>	Density Altitude	<b>ENR</b>	Enroute; ETE to Final Destination
<b>DOD</b>	Department of Defense		

<b>Enroute Safe Altitude (ESA)</b>	Uses Grid MORAs to determine a safe altitude within ten miles left or right of the desired course on an active flight plan or direct-to.	<b>FIS-B</b>	Flight Information Services-Broadcast
<b>ENT</b>	Enter	<b>FISDL</b>	Flight Information Service Data Link
<b>EPE</b>	see also Estimated Position Error	<b>FIT</b>	Flight Into Terrain
<b>EPU</b>	Estimated Position Uncertainty	<b>FL</b>	Flight Level
<b>ERR</b>	Error	<b>FLC</b>	Flight Level Change
<b>ES</b>	Extended Squitter	<b>FLT</b>	Flight, Flight Timer
<b>ESA</b>	see also Enroute Safe Altitude	<b>FLTA</b>	Forward Looking Terrain Avoidance
<b>ESP</b>	Electronic Stability and Protection	<b>FM</b>	Course From Fix to Manual Termination Leg
<b>Estimated Position Error (EPE)</b>	A measure of horizontal GPS position error derived by satellite geometry conditions and other factors.	<b>FMS</b>	Flight Management System
<b>Estimated Time Enroute (ETE)</b>	The estimated time it takes to reach the destination waypoint from the present position, based upon current groundspeed.	<b>FOB</b>	see also Fuel On Board
<b>Estimated Time of Arrival (ETA)</b>	The estimated time at which the aircraft should reach the destination waypoint, based upon current speed and track.	<b>FOD</b>	see also Fuel Over Destination
<b>ETA</b>	see also Estimated Time of Arrival	<b>FPA</b>	Flight Path Angle
<b>ETE</b>	see also Estimated Time Enroute	<b>FPL</b>	Flight Plan
<b>EVS</b>	Enhanced Vision System	<b>FPM</b>	Feet Per Minute, Flight Path Marker
<b>EXPIRD</b>	Expired	<b>FREQ</b>	Frequency
<b>EXT</b>	External	<b>FRMT</b>	Format
<b>°F</b>	Degrees Fahrenheit	<b>FRZ</b>	Freezing
<b>FA</b>	Course From Fix to Altitude Leg	<b>FSM</b>	Flight System Messages
<b>FAA</b>	Federal Aviation Administration	<b>FSS</b>	Flight Service Station
<b>FADEC</b>	Full Authority Digital Engine Control	<b>FT</b>	Foot/Feet
<b>FAF</b>	Final Approach Fix	<b>Fuel Flow</b>	The fuel flow rate, expressed in units of fuel per hour.
<b>FAIL</b>	Failure	<b>Fuel On Board</b>	The total amount of usable fuel on board the aircraft.
<b>FANS</b>	Future Air Navigation System	<b>Fuel Over Destination</b>	The estimated fuel remaining when the aircraft reaches the destination waypoint, based upon current fuel flow.
<b>FAR</b>	Federal Aviation Regulations	<b>FWD</b>	Forward
<b>FBO</b>	Fixed Base Operator	<b>G/S</b>	Glideslope
<b>FC</b>	Course From Fix to Distance Leg	<b>GA</b>	Go-Around
<b>FCC</b>	Federal Communication Commission	<b>GAGAN</b>	GPS Aided GEO Augmented Navigation
<b>FCST</b>	Forecast	<b>GAGL</b>	GPS AGL Altitude
<b>FD</b>	Flight Director, Course From Fix to DME Distance Leg	<b>GAL, GL</b>	Gallon(s)
<b>FDE</b>	Fault Detection and Exclusion	<b>GBAS</b>	Ground Based Augmentation System
<b>FDR</b>	Flight Data Recorder	<b>GBOX</b>	Gearbox
<b>FF, FFLOW</b>	see also Fuel Flow	<b>GBT</b>	Ground Based Transceiver
		<b>GCS</b>	Ground Clutter Suppression
		<b>GCSS</b>	Garmin Connex Satellite Services
		<b>GCU</b>	Garmin Control Unit
		<b>GDC</b>	Garmin Air Data Computer

<b>GDL</b>	Garmin Satellite Data Link	<b>GTX</b>	Garmin Transponder
<b>GDR</b>	Garmin Data Radio	<b>GW</b>	Gross Weight
<b>GDU</b>	Garmin Display Unit	<b>GWX</b>	Garmin Weather Radar
<b>GEA</b>	Garmin Engine/Airframe Unit	<b>HA</b>	Hold Terminating at Altitude Leg
<b>GEN</b>	Generator	<b>HDG</b>	see also Heading
<b>GEO</b>	Geographic	<b>HDOP</b>	Horizontal Dilution of Precision
<b>GFC</b>	Garmin Flight Control	<b>Heading</b>	The direction an aircraft is pointed, based upon indications from a magnetic compass or a properly set directional gyro.
<b>GHz</b>	Gigahertz	<b>HF</b>	High Frequency, Hold Terminating at Fix Leg
<b>GIA</b>	Garmin Integrated Avionics Unit	<b>HFOM</b>	see also Horizontal Figure of Merit
<b>GLONASS</b>	Global Orbiting Navigation Satellite Landing System	<b>Hg</b>	Mercury
<b>GLS</b>	Global Navigation Satellite Landing System	<b>HI</b>	High
<b>GMA</b>	Garmin Audio Panel System	<b>HI SENS</b>	High Sensitivity
<b>GMC</b>	Garmin Mode Controller	<b>HM</b>	Hold with Manual Termination Leg
<b>GMT</b>	Greenwich Mean Time	<b>HNS</b>	Hybrid Navigation Sensor
<b>GMU</b>	Garmin Magnetometer Unit	<b>Horizontal Figure of Merit</b>	A measure of the uncertainty in the aircraft's horizontal position.
<b>GND</b>	Ground	<b>HOV</b>	Hover
<b>GOLD</b>	Global Operational Data Link	<b>HOV-P</b>	Hover Prediction
<b>GP</b>	Glidepath	<b>hPa</b>	Hectopascal
<b>GPH</b>	Gallons per Hour	<b>HPI</b>	Hover Power Indicator
<b>GPN</b>	Garmin Part Number	<b>HPL</b>	Horizontal Protection Level
<b>GPS</b>	Global Positioning System	<b>HR</b>	Hour
<b>GPWS</b>	Ground Proximity Warning System	<b>HRZN HDG</b>	Horizon Heading
<b>Grid MORA (Minimum Off-Route Altitude)</b>	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	<b>HSDB</b>	High-Speed Data Bus
<b>Ground Track</b>	See Track	<b>HSI</b>	Horizontal Situation Indicator
<b>Groundspeed</b>	The velocity the aircraft is travelling relative to a ground position.	<b>HT</b>	Heat
<b>GRS</b>	Garmin Reference System	<b>HTR</b>	Heater
<b>GS</b>	Ground Speed, Glideslope	<b>HUL</b>	Horizontal Uncertainty Level
<b>GSA</b>	Garmin Servo Adapter	<b>HYD</b>	Hydraulic
<b>GSD</b>	Glideslope/Glidepath Deviation, Garmin Data Concentrator	<b>Hz</b>	Hertz (cycles per second)
<b>GSL</b>	Geodetic Sea Level	<b>I</b>	Inner Marker
<b>GSR</b>	Garmin Satellite Radio	<b>IAF</b>	Initial Approach Fix
<b>GSU</b>	Garmin Sensor Unit	<b>IAP</b>	Instrument Approach Procedure
<b>GTC</b>	Garmin Touchscreen Controller	<b>IAS</b>	Indicated Air Speed
<b>GTS</b>	Garmin Traffic System	<b>IAT</b>	Indicated Air Temperature
		<b>IATA</b>	International Air Transport Association
		<b>IAU</b>	Integrated Avionics Unit
		<b>IBD, INBD</b>	Inboard



<b>ICAO</b>	International Civil Aviation Organization	<b>KM</b>	Kilometer
<b>ICS</b>	Intercom System	<b>KT</b>	Knot
<b>ID</b>	Identification/Morse Code Identifier	<b>L</b>	Left, Left Runway
<b>IDENT, IDNT</b>	Identification	<b>LAT</b>	Latitude, Lateral
<b>IEEE</b>	Institute of Electrical & Electronics Engineers	<b>LB</b>	Pound
<b>IF</b>	Initial Fix	<b>LBL</b>	Label
<b>IFR</b>	Instrument Flight Rules	<b>LCD</b>	Liquid Crystal Display
<b>IG</b>	Imperial Gallon	<b>LCL</b>	Local
<b>IGE</b>	In Ground Effect	<b>LDA</b>	Landing Distance Available
<b>ILI</b>	Imminent Line Impact	<b>LDG</b>	ETA at Final Destination
<b>ILS</b>	Instrument Landing System	<b>LED</b>	Light Emitting Diode
<b>IMC</b>	Instrument Meteorological Conditions	<b>Left Over Fuel On Board</b>	The amount of fuel remaining on board after the completion of one or more legs of a flight plan or direct-to.
<b>IN</b>	Inch	<b>Left Over Fuel Reserve</b>	The amount of flight time remaining, based on the amount of fuel on board after the completion of one or more legs of a flight plan or direct-to, and a known consumption rate.
<b>IN Hg</b>	Inches of Mercury	<b>Leg</b>	The portion of a flight plan between two waypoints.
<b>INACTV</b>	Inactive	<b>LGND</b>	Legend
<b>INC FUEL</b>	Increase Fuel	<b>LIFR</b>	Low Instrument Flight Rules
<b>IND</b>	Indicator, Indicated	<b>LI-ION</b>	Lithium Ion
<b>Indicated</b>	Information provided by properly calibrated and set instrumentation on the aircraft panel.	<b>LIM</b>	Limit
<b>INFO</b>	Information	<b>LMM</b>	Location Middle Marker
<b>INH</b>	Inhibit	<b>LNAV</b>	Lateral Navigation
<b>INOP</b>	Inoperative	<b>LO</b>	Low
<b>INS</b>	Inertial Navigation System	<b>LOA</b>	Letter of Authorization
<b>INT</b>	Intersection(s)	<b>LOC</b>	Localizer
<b>INTEG</b>	Integrity (RAIM unavailable)	<b>LOI</b>	Loss of Integrity (GPS)
<b>INTERN, INTRL</b>	Internal	<b>LOM</b>	Location Outer Marker
<b>INV</b>	Invalid	<b>LON</b>	Longitude, Longitudinal
<b>IOI</b>	Imminent Obstacle Impact	<b>LP</b>	Localizer Performance
<b>IR</b>	Infrared	<b>LPV</b>	Localizer Performance with Vertical Guidance
<b>IrDA, IRDA</b>	Infrared Data Association	<b>LRU</b>	Line Replaceable Unit
<b>ISA</b>	International Standard Atmosphere; ISA Relative Temperature	<b>LSB V</b>	Lower Sideband Voice
<b>ISO</b>	International Standards Organization	<b>LT</b>	Left
<b>ITI</b>	Imminent Terrain Impact	<b>LTNG</b>	Lightning
<b>ITT</b>	Inter-Turbine Temperature, Interstage Turbine Temperature	<b>LVL</b>	Level
<b>KEYSTK</b>	Key Stuck	<b>M</b>	Meter, Middle Marker, Mach
<b>KG</b>	Kilogram		
<b>KHz</b>	Kilohertz		

<b>Mach Number</b>	Mach number is the ratio of the true airspeed to the speed of sound.	<b>MSAS</b>	Multi-functional Satellite Augmentation System
<b>MAG</b>	Magnetic	<b>MSG</b>	Message
<b>MAG VAR</b>	Magnetic Variation	<b>MSL</b>	Mean Sea Level
<b>MAHP</b>	Missed Approach Hold Point	<b>MT, M</b>	Meter
<b>MAN</b>	Manual	<b>MTN</b>	Mountain
<b>MAN IN</b>	Manifold Pressure (inches Hg)	<b>mV</b>	Millivolt(s)
<b>MAN SQ</b>	Manual Squelch	<b>MVFR</b>	Marginal Visual Flight Rules
<b>MANSEQ</b>	Manual Sequence	<b>N</b>	North
<b>MAP</b>	Missed Approach Point	<b>NATS</b>	North Atlantic Tracks System
<b>MASQ</b>	Master Avionics Squelch	<b>NAV</b>	Navigation
<b>MAX</b>	Maximum	<b>NAVAID</b>	Navigation Aid
<b>MAXSPD</b>	Maximum Speed (overspeed)	<b>NCR</b>	Negative Climb Rate
<b>MB</b>	Marker Beacon	<b>NDA</b>	Next Data Authority
<b>MCP</b>	Maximum Continuous Power	<b>NDB</b>	Non-Directional Beacon
<b>MDA</b>	Barometric Minimum Descent Altitude	<b>NEXRAD</b>	Next Generation Radar
<b>MEM</b>	Memory	<b>NG</b>	Gas Producer Rotation Speed
<b>MEPT</b>	Manual Electric Pitch Trim	<b>NM</b>	Nautical Mile(s)
<b>MET</b>	Manual Electric Trim	<b>NoPT</b>	No Procedure Turn Required (procedure shall not be executed without ATC clearance)
<b>METAR</b>	Aviation Routine Weather Report	<b>NOTAM</b>	Notice To Airman
<b>METRO</b>	Metropolitan	<b>NP</b>	Power Turbine Speed
<b>MFD</b>	Multi Function Display	<b>NR</b>	Rotor Speed
<b>MGRS</b>	Military Grid Reference System	<b>NRST</b>	Nearest
<b>MGT</b>	Measured Gas Temperature	<b>NWS</b>	National Weather Service
<b>MHz</b>	Megahertz	<b>O</b>	Outer Marker
<b>MIC</b>	Microphone	<b>OAT</b>	Outside Air Temperature
<b>MID</b>	Middle	<b>OBD, OUTBD</b>	Outboard
<b>MIN</b>	Minimum	<b>OBS</b>	Omni Bearing Selector
<b>Minimum Safe Altitude (MSA)</b>	Uses Grid MORAs to determine a safe altitude within ten miles of the aircraft present position.	<b>OBSCR</b>	Obscuration
<b>MKR</b>	Marker Beacon	<b>OCL</b>	Oceanic Clearance
<b>MMO (VMO)</b>	Maximum Speed	<b>OEM</b>	Original Equipment Manufacturer
<b>MOA</b>	Military Operations Area	<b>OFST</b>	Offset
<b>MON</b>	Monitor	<b>OGE</b>	Out of Ground Effect
<b>MORA</b>	Minimum Off-Route Altitude	<b>OOOI</b>	Out of the gate, Off the ground, On the ground, and In the gate
<b>MOV</b>	Movement	<b>OVR</b>	Override
<b>MPEL</b>	Maximum Permissible Exposure Level	<b>OXY</b>	Oxygen
<b>MPM</b>	Meters per Minute	<b>P ALT</b>	Pressure Altitude
<b>MSA</b>	see also Minimum Safe Altitude		

<b>P. POS</b>	Present Position	<b>RAD</b>	Radial
<b>PA</b>	Passenger Address, Proximity Advisory	<b>RAD ALT</b>	Radio Altimeter, Radar Altimeter
<b>PASS</b>	Passenger(s)	<b>RAIM</b>	Receiver Autonomous Integrity Monitoring
<b>PC</b>	Personal Computer	<b>RAM</b>	Random Access Memory
<b>PDA</b>	Premature Descent Alerting	<b>RAT</b>	Ram Air Temperature
<b>PDC</b>	Pre-Departure Clearance	<b>RCVR</b>	Receiver
<b>PED</b>	Personal Electronic Device	<b>RDR</b>	Radar
<b>PERF</b>	Performance	<b>RECIRC</b>	Recirculate/Recirculating
<b>PFD</b>	Primary Flight Display	<b>REF</b>	Reference
<b>PG</b>	Pilot's Guide	<b>REM</b>	Remaining (fuel remaining), Reminder, Removed
<b>PI</b>	Procedure Turn to Course Intercept Leg	<b>REQ</b>	Required
<b>PIREP</b>	Pilot Report	<b>RES</b>	Reserve (fuel reserve entered by pilot)
<b>PIT, PTCH</b>	Pitch	<b>REV</b>	Reverse, Revision, Revise
<b>POA</b>	Plain Old ACARS	<b>RF</b>	Radio Frequency, Constant Radius Turn to Fix Leg
<b>POF</b>	Phase of Flight	<b>RFM</b>	Rotorcraft Flight Manual
<b>POH</b>	Pilot's Operating Handbook	<b>RLC</b>	Required Line Clearance
<b>POHS</b>	Pilot's Operating Handbook Supplement	<b>RMI</b>	Radio Magnetic Indicator
<b>POS, POSN</b>	Position	<b>RMT</b>	Remote
<b>PPH</b>	Pounds per Hour	<b>RNAV</b>	Area Navigation
<b>PPM</b>	Parts per Million	<b>RNG</b>	Range
<b>PRES, PRESS</b>	Pressure	<b>RNP</b>	Required Navigation Performance
<b>PREV</b>	Previous	<b>RNWX, RWY</b>	Runway
<b>PRN</b>	Pseudo Random Noise	<b>ROASS</b>	Runway Overrun Awareness and Alerting System
<b>PROC</b>	Procedure(s), Procedure Turn	<b>ROC</b>	Required Obstacle Clearance
<b>PROP</b>	Propeller	<b>ROL</b>	Roll
<b>PROX</b>	Proximity	<b>ROM</b>	Read Only Memory
<b>PSI</b>	Pounds per Square Inch, Power Situation Indicator	<b>RPM</b>	Revolutions Per Minute
<b>PT</b>	Procedure Turn	<b>RQRD</b>	Required
<b>PTK</b>	Parallel Track	<b>RST FUEL</b>	Reset Fuel
<b>PTT</b>	Push-to-Talk	<b>RSV</b>	Reserve (fuel reserve entered by pilot)
<b>PWR</b>	Power	<b>RT</b>	Right
<b>Q</b>	Engine Torque	<b>RTC</b>	Required Terrain Clearance
<b>QFE</b>	Field Elevation Pressure	<b>RTR</b>	Router
<b>QNH</b>	Sea Level Pressure	<b>RUDICS</b>	Router-Based Unrestricted Digital Interworking Connectivity Solution
<b>QTY</b>	Quantity	<b>RVRSNRY</b>	Reversionary
<b>R</b>	Right, Right Runway	<b>RVSI</b>	Required Vertical Speed Indicator
<b>RA</b>	Resolution Advisory, Radio Altimeter, Radar Altimeter		

<b>RVSM</b>	Reduced Vertical Separation Minimums	<b>STAR</b>	Standard Terminal Arrival Route
<b>RX</b>	Receive	<b>STATS</b>	Statistics
<b>S</b>	South	<b>STBY</b>	Standby
<b>SA</b>	Selective Availability	<b>STC</b>	Sensitivity Time Constant, Supplemental Type Certificate
<b>SAIB</b>	Special Airworthiness Information Bulletin	<b>STD</b>	Standard
<b>SAR</b>	Search and Rescue	<b>STR</b>	Strip
<b>SAT</b>	Static Air Temperature	<b>STRMSCP</b>	Stormscope
<b>SATCOM</b>	Satellite Communication	<b>SUA</b>	Special Use Airspace
<b>SBAS</b>	Satellite-Based Augmentation System	<b>SUPPRESS</b>	Suppression
<b>SCIT</b>	Storm Cell Identification and Tracking	<b>SURF</b>	Surface
<b>SD</b>	Secure Digital	<b>SUSP</b>	Suspend
<b>SEC</b>	Second(s)	<b>SVT</b>	Synthetic Vision Technology
<b>SEL, SLCT</b>	Select	<b>SW</b>	Software
<b>SELCAL</b>	Selective Calling	<b>SYN TERR</b>	Synthetic Terrain
<b>SENS</b>	Sense	<b>SYN VIS</b>	Synthetic Vision
<b>SFC</b>	Surface	<b>SYNC</b>	Synchronize
<b>SIAP</b>	Standard Instrument Approach Procedures	<b>SYNTH</b>	Synthesizer
<b>SID</b>	Standard Instrument Departure	<b>SYS</b>	System
<b>SIG/AIR</b>	SIGMET/AIRMET	<b>T</b>	True
<b>SIGM</b>	SIGMET	<b>T HDG</b>	True Heading
<b>SIGMET</b>	Significant Meteorological Information	<b>T/R</b>	Thrust Reverser
<b>SIM</b>	Simulator	<b>TA</b>	Traffic Advisory
<b>SITA</b>	Societe Internationale de Telecommunications	<b>TACAN, TCN</b>	Tactical Air Navigation System
<b>SLD</b>	Supercooled Large Droplet	<b>TAF</b>	Terminal Aerodrome Forecast
<b>SLP/SKD</b>	Slip/Skid	<b>TAS</b>	True Airspeed, Traffic Advisory System
<b>SMBL</b>	Symbol	<b>TAT</b>	Total Air Temperature
<b>SMS</b>	Short Message System	<b>TAWS</b>	Terrain Awareness and Warning System
<b>SNGL</b>	Single	<b>TCA</b>	Terminal Control Area
<b>SPC</b>	Space	<b>TCAS</b>	Traffic Alert Collision Avoidance System
<b>SPD</b>	Speed	<b>TEL</b>	Telephone
<b>SPI</b>	Special Position Identification	<b>TEMP</b>	Temperature
<b>SPKR</b>	Speaker	<b>TERM</b>	Terminal
<b>SQ, SQL</b>	Squelch	<b>TF</b>	Track Between Two Fixes Leg
<b>SRVC, SVC</b>	Service	<b>TFR</b>	Temporary Flight Restriction
<b>SSEC</b>	Static Source Error Correction	<b>TGT</b>	Target
<b>SSID</b>	Wireless Service Set Identifier	<b>THR</b>	Thrust
<b>STAB</b>	Stabilization	<b>TIS</b>	Traffic Information Service
<b>STAL</b>	Stall	<b>TIS-B</b>	Traffic Information Service-Broadcast

<b>TIT</b>	Turbine Inlet Temperature	<b>UTM/UPS</b>	Universal Transverse Mercator/ Universal Polar Stereographic Grid
<b>TKE</b>	see also Track Angle Error	<b>UUA</b>	Urgent PIREP
<b>TLA</b>	Throttle Lever Angle, Thrust Lever Angle	<b>V</b>	Volts, Vertical
<b>TMA</b>	Terminal Maneuvering Area	<b>V DEV</b>	Vertical Deviation
<b>TMR/REF</b>	Timer/Reference	<b>V, Vspeed</b>	Velocity (airspeed)
<b>TO</b>	Takeoff	<b>V<sub>1</sub></b>	Takeoff Decision Speed
<b>TOC</b>	Top of Climb	<b>V<sub>2</sub></b>	Takeoff Safety Speed
<b>TOD</b>	Top of Descent, Time to TOD	<b>V<sub>A</sub></b>	Maneuvering Speed
<b>TOGA, TO/GA</b>	Take-Off, Go-Around	<b>VA</b>	Heading Vector to Altitude Leg
<b>TOLD</b>	Takeoff and Landing Data	<b>VAC</b>	Volts Alternating Current
<b>TOPO</b>	Topographic	<b>VAPP</b>	VOR Approach Mode
<b>TORA</b>	Takeoff Run Available	<b>V<sub>APP</sub>, V<sub>AC</sub></b>	Approach Climb Speed
<b>TOT</b>	Total	<b>VAR</b>	Variation
<b>TPA</b>	Traffic Pattern Altitude	<b>VCO</b>	Voice Call Out
<b>Track</b>	Direction of aircraft movement relative to a ground position; also 'Ground Track'.	<b>VD</b>	Heading Vector to DME Distance Leg
<b>Track Angle Error</b>	The angle difference between the desired track and the current track.	<b>VDC</b>	Volts Direct Current
<b>TRFC</b>	Traffic	<b>VDI</b>	Vertical Deviation Indicator
<b>TRK</b>	see also Track	<b>VDL</b>	VHF Datalink
<b>TRN</b>	Terrain	<b>VECT</b>	Vector
<b>TRSA</b>	Terminal Radar Service Area	<b>VERT</b>	Vertical
<b>TRUNC</b>	Truncated	<b>Vertical Figure of Merit</b>	A measure of the uncertainty in the aircraft's vertical position.
<b>TSO</b>	Technical Standard Order	<b>Vertical Speed Required</b>	The vertical speed necessary to descend/ climb from a current position and altitude to a defined target position and altitude, based upon current groundspeed.
<b>TTL</b>	Total	<b>V<sub>FE</sub></b>	Maximum Flap Extended Speed
<b>TTS</b>	Text to Speech	<b>VFOM</b>	see also Vertical Figure of Merit
<b>TURB</b>	Turbulence	<b>VFR</b>	Visual Flight Rules
<b>TURN</b>	Procedure Turn	<b>VHF</b>	Very High Frequency
<b>TWIP</b>	Terminal Weather Information for Pilots	<b>VI</b>	Heading Vector to Intercept Leg
<b>TX</b>	Transmit	<b>V<sub>LE</sub></b>	Maximum Landing Gear Extended Speed
<b>UA</b>	Routine PIREP	<b>V<sub>LNDx</sub></b>	Approach Speed (Flaps at x°)
<b>UAT</b>	Universal Access Transceiver	<b>V<sub>LO</sub></b>	Maximum Landing Gear Operating Speed
<b>UHF</b>	Ultra-High Frequency	<b>VLOC</b>	VOR/Localizer Receiver
<b>UNAVAIL</b>	Unavailable	<b>VM</b>	Heading Vector to Manual Termination Leg
<b>US</b>	United States	<b>V<sub>MC</sub></b>	Minimum Control Speed
<b>USB V</b>	Upper Sideband Voice	<b>VMC</b>	Visual Meteorological Conditions
<b>USR</b>	User		
<b>UTC</b>	Coordinated Universal Time		

<b>V<sub>MO</sub> (M<sub>MO</sub>)</b>	Maximum Operating Speed	<b>WT</b>	Weight
<b>VNAV, VNV</b>	Vertical Navigation	<b>WW</b>	World Wide
<b>V<sub>NE</sub></b>	Never-Exceed Speed	<b>WX</b>	Weather
<b>VOL</b>	Volume	<b>XFER, XFR</b>	Transfer
<b>VOR</b>	VHF Omnidirectional Range	<b>XFLOW</b>	Crossflow
<b>VORTAC</b>	VHF Omnidirectional Range Station and Tactical Air Navigation	<b>XM LTNG</b>	SiriusXM Lightning
<b>VPATH, VPTH</b>	Vertical Path	<b>XMIT</b>	Transmit
<b>VPL</b>	Vertical Protection Level	<b>XMSN</b>	Transmission
<b>VPROF</b>	VNAV Profile, Vertical Profile	<b>XPDR</b>	Transponder
<b>V<sub>R</sub></b>	Takeoff Rotate Speed	<b>XTALK</b>	Cross-Talk
<b>VR</b>	Heading Vector to Radial Leg	<b>XTK</b>	Cross-Track, Crosstrack Error
<b>V<sub>REF</sub></b>	Landing Approach Speed, Reference Landing Speed	<b>YD</b>	Yaw Damper
<b>VRP</b>	Visual Reporting Point	<b>Z</b>	Reflectivity Factor
<b>VS</b>	Vertical Speed		
<b>V<sub>SB</sub></b>	Maximum Speedbrake Speed		
<b>VSD</b>	Vertical Situation Display		
<b>VSI</b>	Vertical Speed Indicator		
<b>V<sub>SR</sub></b>	Stall Speed		
<b>VSR, VS REQ</b>	see also Vertical Speed Required		
<b>V<sub>T</sub></b>	Takeoff Flap Retraction Speed		
<b>VTF</b>	Vector to Final		
<b>V<sub>TIRE</sub></b>	Maximum Tire Speed		
<b>V<sub>X</sub></b>	Best Angle of Climb Speed		
<b>V<sub>Y</sub></b>	Best Rate of Climb Speed		
<b>V<sub>YSE</sub></b>	Best Single-Engine Rate of Climb Speed		
<b>W</b>	Watt(s), West		
<b>WAAS</b>	Wide Area Augmentation System		
<b>WARN</b>	Warning		
<b>WATCH</b>	Weather Attenuated Color Highlight		
<b>WGS-84</b>	World Geodetic System - 1984		
<b>WI-FI, WIFI</b>	Wireless Local Area Network based on IEEE 802.11		
<b>WILCO</b>	Will Comply		
<b>WNSHR</b>	Windshear		
<b>WOG</b>	Weight on Gear		
<b>WOW</b>	Weight on Wheels		
<b>WPT</b>	Waypoint(s)		

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## FREQUENTLY ASKED QUESTIONS

If a particular aspect of the G3000 operational capability is not addressed by these commonly asked questions or in the index, contact Garmin (see the copyright page or back cover for contact information) or a Garmin-authorized dealer. Garmin is dedicated to supporting its products and customers.

### WHAT IS SBAS?

The Satellite Based Augmentation System (SBAS) uses a system of ground stations to correct any GPS signal errors. These ground stations correct for errors caused by ionospheric disturbances, timing, and satellite orbit errors. It also provides vital integrity information regarding the health of each GPS satellite. The signal correction is then broadcast through geostationary satellites. This correction information can then be received by any SBAS-enabled GPS receiver.

SBAS is designed to provide the additional accuracy, availability, and integrity necessary to enable users to rely on GPS for all phases of flight.

There are several SBAS systems serving different parts of the world. The Wide Area Augmentation System (WAAS) is currently available in the United States, including Alaska and Hawaii. The European Geostationary Navigation Overlay Service (EGNOS) offers coverage of Europe, parts of the middle east and northern Africa. The Multi-functional Satellite Augmentation System (MSAS) covers mainly Japan and parts of northern Australia.

### HOW DOES SBAS AFFECT APPROACH OPERATIONS?

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 G3000?

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.

## WHAT DOES THE OBS SOFTKEY DO?

The **OBS** Softkey sets the current course to the active waypoint as the OBS course and suspends automatic 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.

If OBS Mode is disabled prior to reaching the defined waypoint, the system resumes automatic sequencing of waypoints, and follows the course set in OBS Mode to the defined waypoint. The flight path on the moving map retains the modified course line. Sequencing will occur based upon the automatic sequencing criteria.

If OBS mode is disabled after reaching the defined waypoint, the system will activate suspend mode. The **SUSP** Softkey on the PFD must be pressed to exit suspend mode and resume automatic waypoint sequencing. 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, the system may sequence sooner than expected, or to a different waypoint than expected.

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 G3000 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 G3000 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 active waypoint, 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 active waypoint. 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 active waypoint.

### WHAT IS THE CORRECT MISSED APPROACH PROCEDURE? HOW IS THE MISSED APPROACH HOLDING POINT SELECTED?

To comply with TSO specifications, the G3000 does not automatically sequence past the MAP. The first waypoint in the missed approach procedure becomes the active waypoint when the **SUSP** Softkey 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 G3000 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 right knobs. Touch the **Enter** Button or push the **Right Knob** to accept the selected airport, then follow the steps in the preceding paragraph to select an approach for the new airport.

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