SPECIFICATION CONTROL DRAWING

REVISIONS

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A	5/21/19	Production Release for GDU 21.25	----------------

NOTES:
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Document fonts	Folder containing fonts
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TBM 940 Front Matter.indd	Adobe InDesign CS6 document
01 TBM 940 System Overview.indd	Adobe InDesign CS6 document
02 TBM 940 Flight Instruments.indd	Adobe InDesign CS6 document
03 TBM 940 EAS.indd	Adobe InDesign CS6 document
04 TBM 940 Audio & CNS.indd	Adobe InDesign CS6 document
05 TBM 940 Flight Management.indd	Adobe InDesign CS6 document
06 TBM 940 Hazard Avoidance.indd	Adobe InDesign CS6 document
07 TBM 940 AFCS.indd	Adobe InDesign CS6 document
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1200 E. 151st Street
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GARMIN

G3000®

Integrated Avionics System
Pilot's Guide

Daher TBM 940

System Software Version 3518.00 or later

GARMIN

This manual reflects the operation of System Software version 3518.00 or later for the Daher TBM 940. Some differences in operation may be observed when comparing the information in this manual to earlier or later software versions.

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

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

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

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

Contact Garmin Product Support or view warranty information at www.fly.garmin.com.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

WARNING: *Do not operate the weather radar in a transmitting mode when personnel or objects are within the MPEL boundary.*

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

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

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

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

***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.*

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

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

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

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

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

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

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

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

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

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

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

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

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

- *It is the pilot's responsibility to remain familiar with all FAA regulatory and advisory guidance and information related to the use of databases in the National Airspace System.*
- *Garmin equipment will only recognize and use databases that are obtained from Garmin or Jeppesen. Databases obtained from Garmin or Jeppesen 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 http://fly.garmin.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 AFM(S) and regulatory guidance or limitations as applicable to the pilot, the aircraft, and installed equipment.*

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

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

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

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

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

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

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

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

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

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

SOFTWARE LICENSE AGREEMENT

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Record of Revisions				
Part Number	Revision	Date	Page Range	Description
190-02577-00	A	5/21/2019	All	Production Release for GDU 21.25

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SECTION 2 FLIGHT INSTRUMENTS

SECTION 3 ENGINE AND AIRFRAME SYSTEMS

SECTION 4 AUDIO AND CNS

SECTION 7 AUTOMATIC FLIGHT CONTROL SYSTEM

SECTION 8 ADDITIONAL FEATURES

APPENDICES

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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 940 aircraft. The G3000 is an integrated flight control system that presents flight instrumentation, position, navigation, communication, and identification information to the flight crew using flat-panel color displays and Touchscreen Controllers.

GARMIN LINE REPLACEABLE UNITS (LRUs)

- **GDU 1250W** (3) – Each GDU (display unit) is configured as one of two Primary Flight Displays (PFDs) or one Multi-function Display (MFD). The GDU 1250W features a 12-inch light emitting diode (LED) backlit widescreen display. The unit installed on the left/pilot side is designated as PFD1, and the one installed on the right/copilot side is designated as PFD2. The unit installed in the center is designated as the MFD. The displays communicate with each other, the Touchscreen Controllers, and the on-side GIA 64W.
- **GTC 585** (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 and the MFD. GTC1 communicates with the GMA 36B.
- **GIA 64W** (2) – The Integrated Avionics Units (IAU) function as the main communications hub, linking several LRUs with each on-side GDU 1250W. 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.
- **GMA 36B** (1) – The Remote Audio Unit integrates navigation/communication radio (NAV/COM) digital audio, intercom, and marker beacon audio. The GMA 36B is connected to GTC1 and each IAU.
- **GDC 72B** (2) – Processes data from the pitot/static system as well as the OAT probe. This unit provides pressure altitude, airspeed, vertical speed and OAT information to the system, and it communicates with the on-side GIA 64W, on-side GDU 1250W and on-side GRS 79 (it also interfaces directly with the OAT). The GDC 72B is designed to operate in Reduced Vertical Separation Minimum (RVSM) airspace.
- **GEA 71B** (2) – The Engine Airframe Unit receives and processes signals from the engine and airframe sensors. This unit communicate with both IAUs.
- **GTX 345R / GTX 33D with ES** (1-2) – One or two transponders are installed with four different model variations (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 33D with ES features extended squitter capabilities as well as diversity. The transponder(s) communicate with the onside IAU.
- **GRS 79** (2) – The Attitude and Heading Reference System (AHRS) provides aircraft attitude and heading information to the on-side and cross-side IAU, and to the on-side GDU 1250W. A 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 44B** (2) **–** The Magnetometer measures local magnetic field and sends data to the AHRS for processing to determine aircraft magnetic heading. The magnetometer receives power directly from and communicates with the AHRS.
- **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. A subscription to SiriusXM Weather and/or SiriusXM Satellite Radio service is required to enable GDL 69A capability.
- **GMC 711** (1) **–** The AFCS Mode Controller connects to PFD1 and PFD2.
- **GRA 55** (1) **–** The GRA 55 provides altitude above the ground information, called radar or radio altitude.
- **GTA 82** (1) **–** The Trim Adapter is a remote-mounted device that is used to allow the AFCS to drive the yaw trim actuator.
- **GTS 820** (1 optional) **–** The GTS 820 Traffic Advisory System (TAS) uses active interrogations of Mode S and Mode C transponders to provide Traffic Advisories to the crew independent of the air traffic control system.
- **GSA 81** (4) **–** The autopilot servos are used for the automatic control of roll, yaw, pitch, and pitch trim. These units interface with each IAU.
- **GSA 87** (1) **–** The autothrottle servo is used to automatically control the throttle. This unit interfaces with each IAU.
- **GWX 70** (1) **–** The GWX 70 provides airborne real-time weather and ground-mapped radar data to the displays. The unit is connected to the MFD.
- **GSR 56** (1 optional) **–** The GSR 56 is an Iridium Transceiver which provides connection to the Garmin Connext/Iridium satellite network. Operation for voice communication is by means of pilot and copilot headsets in the cockpit. The system is also capable of SMS text messaging.
- **Flight Stream 510** (1 optional) **–** The Flight Stream 510 SD Card Wireless Transceiver provides wireless connectivity between a compatible tablet/mobile device and the avionics system. GPS, AHRS, ADC, ADS-B, traffic, SiriusXM audio controls, and weather data can then be shared with the mobile device, and flight plans can be transferred to or from the mobile device. Database updates may also be performed using the Flight Stream 510. The Flight Stream 510 is inserted in the bottom SD card slot of the MFD.

The Daher TBM 940 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 system.

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

Figure 1-1 shows interconnection of the LRUs.

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

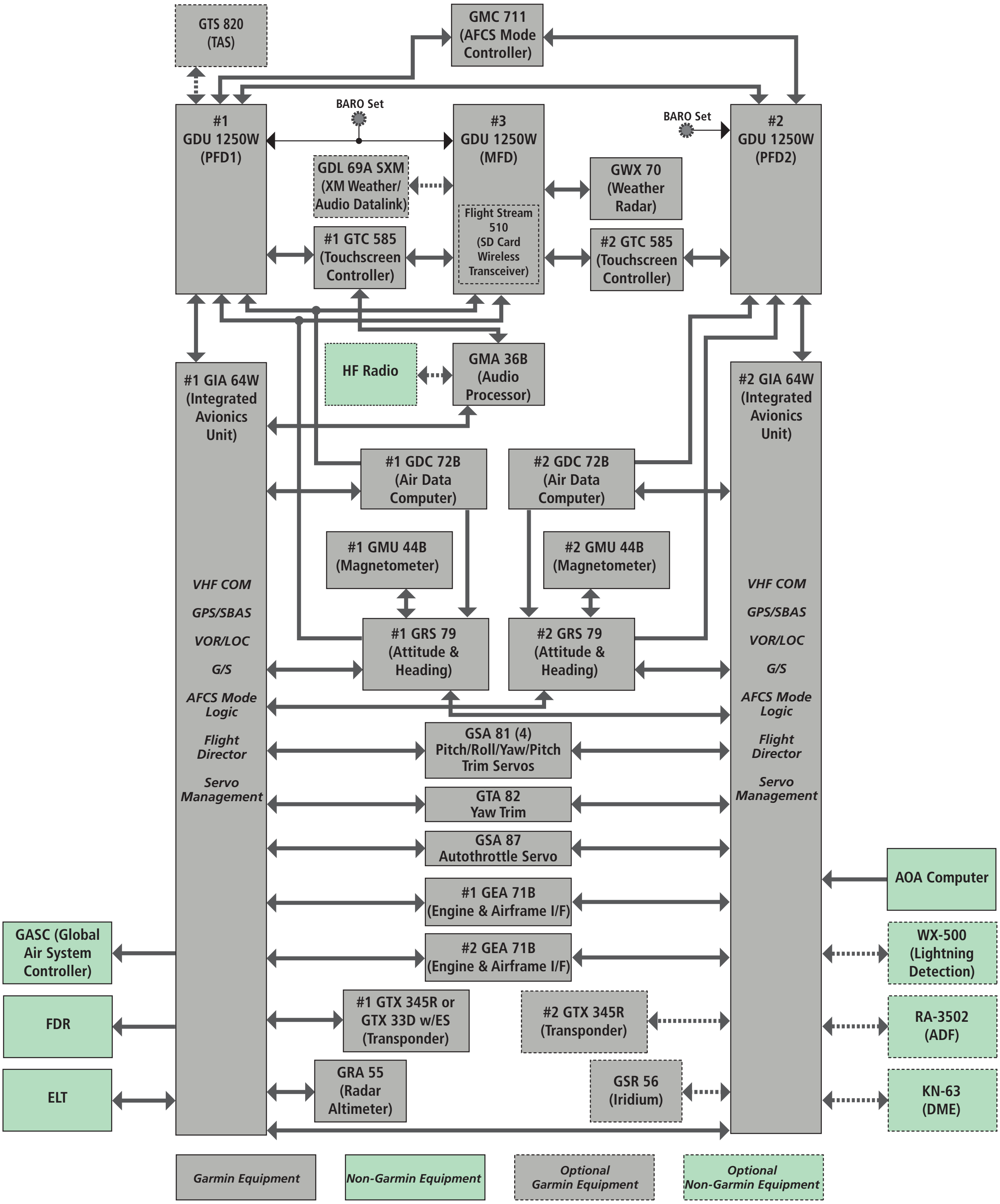


Figure 1-1 Basic System Block Diagram

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

Split Mode

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
		Inset Traffic		Overlays a dedicated traffic display on the Inset Map.
		HSI Traffic		Overlays a dedicated traffic display on the HSI.
	Detail			Selects desired amount of map detail; cycles through declutter levels: **All** (No Declutter): All map features visible **DCLTR 1**: Declutters land data **DCLTR 2**: Declutters land and SUA data **Least**: Removes everything except for the active flight plan
	Weather Legend			Displays/removes the name of the selected data link weather provider (SiriusXM, Connext, FIS-B) and the weather product icon and age box (for enabled weather products).
	Traffic			Adds or removes the display of traffic on the PFD Map. The softkey annunciator is green when the traffic function is on. When the traffic function is off, the annunciator is gray.
	Storm-scope			Adds or removes the display of Stormscope information on the PFD Map. The softkey annunciator is green when the function is on. When the function is off, the annunciator is gray.
	Terrain			**Off**: Removes terrain information from the PFD Map. **Absolute**: Displays Absolute terrain information on the PFD Map. **Relative**: Displays relative terrain information on the PFD Map.
	Data Link Settings			Displays Data Link settings softkeys.
		Data Link		Selects the data link source for the PFD Map: **Connext**: Selects Garmin Connext (optional) as the weather source for the display of weather data on the PFD Map. **SiriusXM**: Selects SiriusXM (optional) as the weather source for the display of weather data on the PFD Map. **FIS-B**: Selects FIS-B (optional) as the weather source for the display of weather data on the PFD Map.
		NEXRAD		Selects type of NEXRAD coverage: **CONUS**: Selects NEXRAD coverage for continental U.S. **Regional**: Selects NEXRAD coverage for a region which provides a higher resolution. **Combined**: Combines CONUS and Regional coverages.
		Source		Selects **USA** or **Canada** as the source when SiriusXM is enabled as the datalink setting.
		Storm Cell Movement		Adds or removes the display of storm cell movement. Available when SiriusXM is selected as the weather source.
		NEXRAD Animation		Animates NEXRAD Data. Available when SiriusXM is selected as the weather source.

Level 1	Level 2	Level 3	Level 4	Description
	WX Overlay			Selects the display of weather information on the PFD Map: **SiriusXM**: Selects SiriusXM as the weather source for the display of weather data when SiriusXM is selected as the weather source using the Data Link softkey. **Connext**: Selects Connext as the weather source for the display of weather data when Connext is selected as the weather source using the Data Link softkey. **WX Radar**: Displays airborne weather radar map overlay on the Inset or HSI Map. **FIS-B**: Selects FIS-B as the weather source for the display of weather data when FIS-B is selected as the weather source using the Data Link softkey. **Off**: Removes weather data from HSI Map.
	SiriusXM Lightning Or Connext Lightning			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. Softkey is available when Connext is selected as the weather source Data Link Settings. Adds/removes the display of Connext information on the PFD Map. The softkey annunciator is green when the lightning function is on. When the lightning function is off, the annunciator is gray.
	METAR			Adds or removes the display of SiriusXM, Connext, or FIS-B sourced METAR data on the PFD Map. The softkey annunciator is green when the METAR data is enabled. When the METAR data is off, the annunciator is gray.
Traffic Map				Replaces the PFD Map with a dedicated traffic display. The softkey annunciator is green when the dedicated traffic display 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.

Level 1	Level 2	Level 3	Level 4	Description
		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.
	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. **FULL**: Display Pane is disabled. The PFD display occupies the full screen. **Split**: Display Pane is enabled. The PFD screen is split between the PFD display and the Display Pane.
	Bearing 1			Cycles the Bearing 1 Information Window through NAV1, NAV2, GPS/waypoint identifier and GPS-derived distance information, ADF1/frequency, and Off.
	Bearing 2			Cycles the Bearing 2 Information Window through NAV1, NAV2, GPS/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 **On**: Displays AOA indicator on the PFD **Off**: Removes AOA indicator from the PFD
		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 GPS (only available with active leg). When OBS is on, the softkey annunciator is green.
Active NAV				Cycles through GPS, NAV1, and NAV2 navigation modes on the CDI.
Sensors				Displays the sensor selection softkeys.

Level 1	Level 2	Level 3	Level 4	Description
	ADC Settings			Displays the ADC selection softkeys.
		ADC 1		Selects the number 1 ADC. The softkey annunciator is green when selected.
		ADC 2		Selects the number 2 ADC. The softkey annunciator is green when selected.
	AHRS Settings			Displays the AHRS selection softkeys.
		AHRS 1		Selects the number 1 AHRS. The softkey annunciator is green when selected.
		AHRS 2		Selects the number 2 AHRS. The softkey annunciator is green when selected.
WX Radar Controls				Displays the WX Radar softkeys.
	Mode			Selects the display mode for the display of weather radar on the HSI map: **Standby**: Sets the weather radar displayed on the HSI map to Standby when airborne. **On**: Enables display of weather radar on the HSI Map.
	Display			If enabled (Mode Softkey **On**), selects the mode of weather radar displayed. If not enabled, this softkey is subdued. **Ground:** Allows ground mapping returns to be displayed on the HSI map. **Weather:** Allows weather returns to be displayed on the HSI map.
	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
	Features			Displays weather radar feature softkeys
		Altitude COMP Tilt		Enables automatic management of the antenna tilt angle as the aircraft altitude changes. The softkey annunciator is green when selected.

Level 1	Level 2	Level 3	Level 4	Description
		Stabilizer		Enables the radar antenna to stay level with the horizon as the aircraft maneuvers. The softkey annunciator is green when selected.

TOUCHSCREEN CONTROLLER

The two Touchscreen Controllers, designated from left to right as GTC1 and GTC2, are pedestal-mounted user interfaces allowing for ease of data entry as well as operation of the PFD, MFD, and NAV/COM system. Many procedures in this Pilot's Guide are performed using the Touchscreen Controllers.

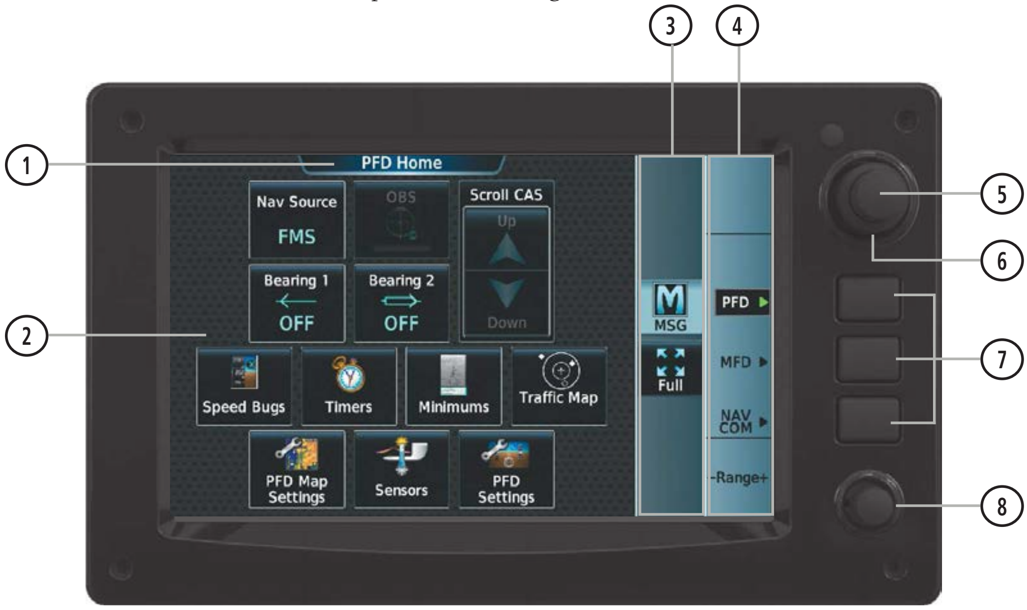


Figure 1-5 GTC 585 Touchscreen Controller

(1) **Screen Title**	Displays the title of the current screen
(2) **Screen**	Displays set of context sensitive controls and data
(3) **Button Bar**	Displays System level buttons (e.g. **Home**, **MSG**, **Full**/**Half**/**Split**, Scroll **Up**/**Down**, **Back**, **Enter**, **Cancel**)
(4) **Label Bar**	Displays labels to show status and current functions of knobs and softkeys, when functions are available.
(5) **Small Upper Knob**	Provides functions as labeled on the Label Bar (e.g. Display Pane selection, COM Freq/switching/Hold, Data Entry/map panning)
(6) **Large Upper Knob**	Provides functions as labeled on the Label Bar (e.g. Display Pane selection, COM Freq/switching, 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 crew selects a control mode for a given controller (e.g. 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 crew or system input. At the top level of each mode is a corresponding home screen containing mode-specific controls. 'PFD Home' is the Home Screen for PFD control mode. 'MFD Home' is the Home Screen for MFD (i.e. Display Pane) control mode. 'NAV/COM Home' is the Home Screen for NAV/COM control mode.

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

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

If the system issues a message, the **MSG** Button is shown. Touching this button will display the 'Notifications' Screen. The Button Bar also contains buttons for controlling the size of MFD Display Panes (Full or Half Mode), and 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.

Button	Function	Button	Function
	Returns to the Home Screen		Selects split display mode on the PFD.
	Returns to the previous screen		Selects half-display mode on the MFD.
	Displays the 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 the Home Screen 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 Connext Notifications Window on the Touchscreen Controller. Flashes when a new Connext message is received.

Table 1-1 Button Bar Buttons with Functions

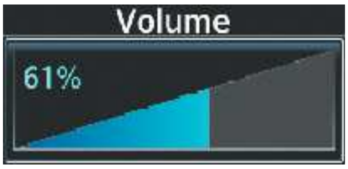
The Label Bar, on the right side of the Touchscreen Controller, displays the current function of each control as a reference. These functions include Map Range adjustment, Display Pane selection, radio volume/squelch adjustment, COM radio tuning, and alphanumeric data entry, which are controlled using 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 cyan 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 shown in the figure below. In addition, a slider adjustment may also be accomplished using knobs on the Touchscreen Controller if the Label Bar indicates the selected slider supports this additional control.



Volume Adjustment Slider

Map Detail Adjustment Slider

Figure 1-6 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 touching the **Up** or **Down** scroll buttons, each touch of the scroll button will display one 'page' of information. Touch 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 (dimmed) to indicate their functions are currently not available. Generally, crew-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.

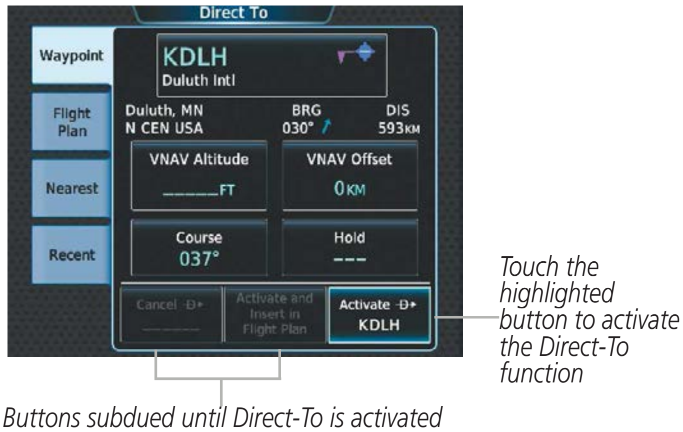


Figure 1-8 Subdued Buttons on Touchscreen Controller

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.

On or Enabled *Off or Disabled*

Figure 1-9 Touchscreen Controller Annunciator Buttons

Datafield Buttons can be modified based on information the crew 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.

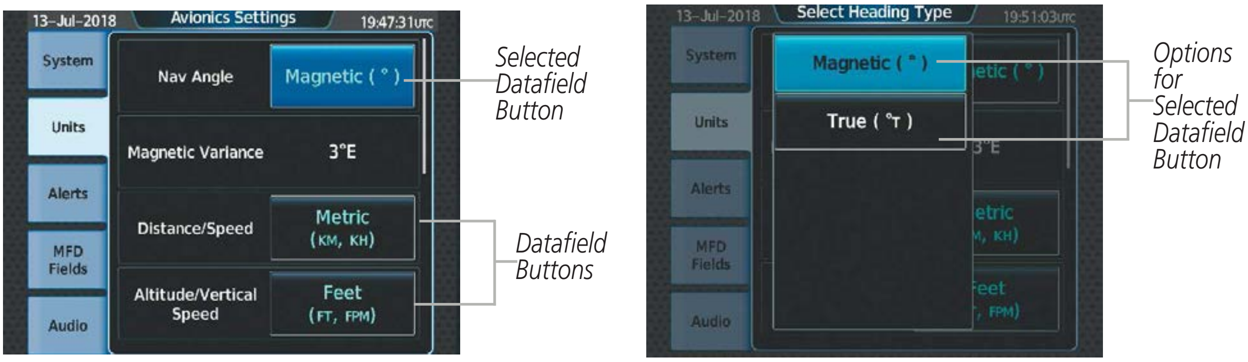


Figure 1-10 Touchscreen Controller Datafield Buttons

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.

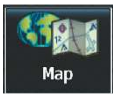
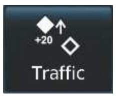
SCREEN OVERVIEW

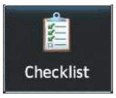
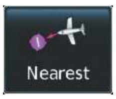
The following is a brief overview of the major screens used to access Touchscreen Controller functions. Additional specific screens used to perform functions are shown and discussed in detail throughout this Pilot’s Guide.

NOTE: *Screen appearance varies based on the installed options.*

MFD Touchscreen Controller Screens

'MFD Home' Screen

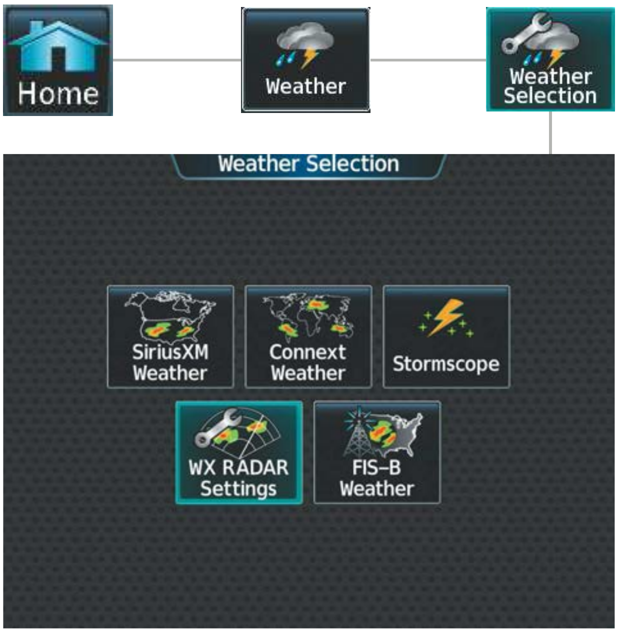
 or 	The **Map** Button shows a 'Navigation Map' Pane in the selected Display Pane. This button will change to a **VFR**, **IFR Low**, or **IFR High** Button if an IFR or VFR chart was last selected within the 'Map Selection' Screen (see later in this section). When a 'Navigation Map', 'VFR', 'IFR Low', or 'IFR High' Pane is displayed, the button becomes the **Map Selection** Button. Touch the **Map Selection** Button again to access the 'Map Selection' Screen on the Touchscreen Controller.
 or 	Shows a 'Traffic Map' Pane in the selected Display Pane. When the 'Traffic Map' Pane is displayed, the button becomes the **Traffic Settings** Button. Touch the **Traffic Settings** Button to access the 'Traffic Settings' Screen on the Touchscreen Controller.
 or 	Shows a 'Weather' (SiriusXM, Connext, FIS-B, Stormscope or Radar) Pane in the selected Display Pane. When the weather pane is displayed, the button becomes the **Weather Selection** Button. Touch the **Weather Selection** Button to access the 'Weather Selection' Screen on Touchscreen Controller.

 or 	Shows the 'TAWS' Pane in the selected Display Pane. When the 'TAWS' Pane is displayed, the button becomes the **TAWS Settings** Button. Touch the **TAWS Settings** Button to access the 'TAWS Settings' Screen on Touchscreen Controller.
	Accesses '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.
 or 	Accesses the 'Chart Selection' Screen on the Touchscreen Controller. Accesses the 'Charts' Screen and the **Charts Options** Button.
	Accesses 'Systems' Screen on Touchscreen Controller. Systems data can be selected for display on the Touchscreen Controller, and displayed on a Display Pane. Also provides access to systems controls, systems tests, and optional video controls.
	Accesses the Checklists for display in the selected Display Pane (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, VRPs, NDBs, User Waypoints, Airspace, ARTCC facilities, Flight Service Stations, and Weather reporting stations.

'Map Selection' Screen

 **or** 	Shows a 'Navigation Map' Pane in the selected Display Pane. When the 'Navigation Map' Pane is displayed, the button becomes the **Map Settings** Button. Touch the **Map Settings** Button again to access the 'Map Settings' Screen on the Touchscreen Controller.
	Shows a 'VFR' Pane in the selected Display Pane which represents a VFR chart.
 **or** 	Shows an 'IFR Low' Pane in the selected Display Pane which represents an IFR Low chart. When the 'IFR Low' Pane is displayed, the button becomes the **IFR Low Settings** Button. Touch the **IFR Low Settings** Button again to access the 'IFR/VFR Charts Settings' Screen on the Touchscreen Controller.
 **or** 	Shows an 'IFR High' Pane in the selected Display Pane which represents an IFR High chart. When the 'IFR High' Pane is displayed, the button becomes the **IFR High Settings** Button. Touch the **IFR High Settings** Button again to access the 'IFR/VFR Charts Settings' Screen on the Touchscreen Controller.

'Weather Selection' Screen



	Shows optional SiriusXM Weather data in the selected Display Pane. When the 'SiriusXM Weather' Pane is displayed, the button becomes the **SiriusXM Settings** Button. Touch the button again to access the 'SiriusXM Weather Settings' Screen on the Touchscreen Controller.
	Shows optional Connext Weather data in the selected Display Pane. When the 'Connext Weather' Pane is displayed, the button becomes the **Connext Settings** Button. Touch the button again to access the 'Connext 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 **Stormscope Settings** 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 **Weather Radar Settings** 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 **FIS-B Settings** Button. Touch the button again to access the 'FIS-B Weather Settings' Screen on the Touchscreen Controller.

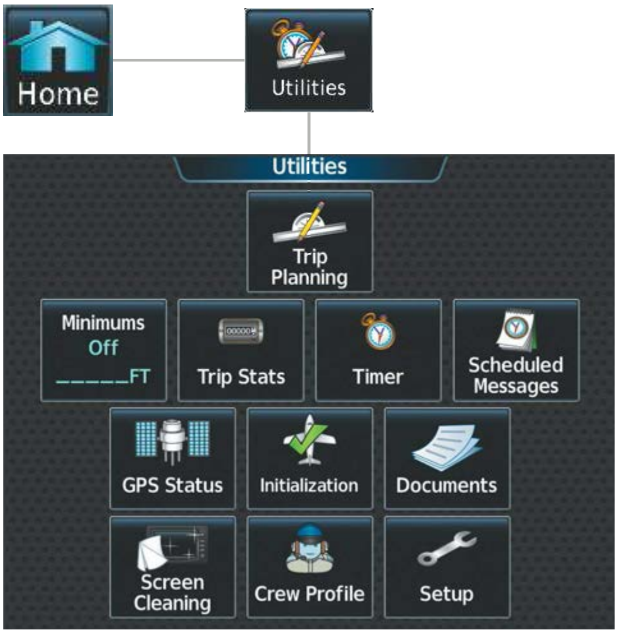
‘Aircraft Systems’ Screen

	Shows the status of the fuel tanks and feed system. Fuel quantity is depicted graphically.
	Shows the ‘Electrical’ Pane, with information about the batteries, generators, and electrical busses.
	Shows open doors in red (CAS messages also generated). Statuses of stall sensor, propeller, pitot probes, and windshield heat
	Shows the ‘Landing Field Elevation’ Screen. Provides controls for entering the landing field elevation, selecting the source of landing field elevation data, and pressurization MAXDIFF mode selection.
	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.

'Services' Screen

	'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.
	'Telephone' Screen (available with the Iridium voice telephone option) shows the status of the Iridium satellite telephone connection and provides telephone controls.
	'SMS Text Messaging' Screen (available with the Iridium voice telephone option) provides management of incoming and outgoing SMS (short message service) text messages.

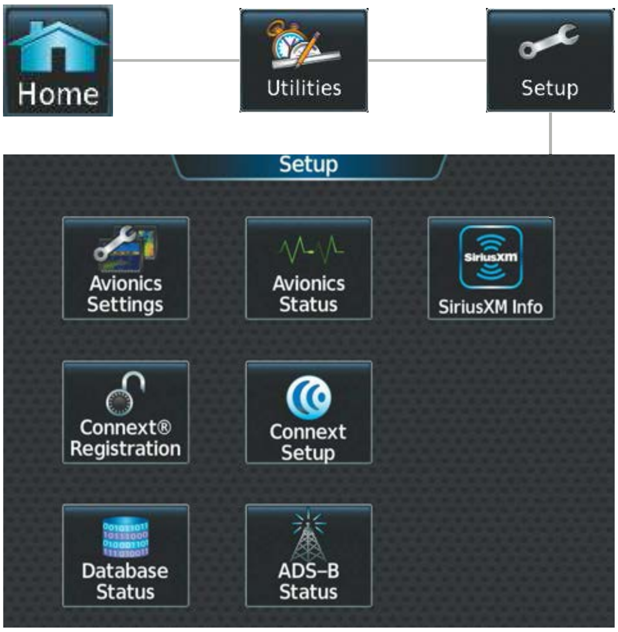
'Utilities' Screen



Trip Planning	Shows the 'Trip Planning' Pane in the selected Display Pane and accesses the 'Trip Planning' Screen on the Touchscreen Controller.
Minimums Off _____FT	Accesses the 'Minimums' Screen on the Touchscreen Controller. Provides controls for the Minimum Altitude Alerting function. Button displays the current minimums altitude and source if provided.
Trip Stats	Accesses the 'Trip Statistics' Screen on the Touchscreen Controller. Shows information regarding Flight Time, Departure/Arrival Time, Odometer, Trip Odometer, Trip Air Odometer, Fuel Used, Average Ground Speed, Maximum Ground Speed, Average Wind Speed, and Average Wind Direction. Also provides settings for resetting trip statistics.
Timer	Accesses the 'Timer' Screen on the Touchscreen Controller. Controls the timer on the PFD.
Scheduled Messages	Used to create custom messages to be displayed one-time or periodically. The Touchscreen Controller displays these System Messages on the 'Notifications' Screen.
GPS Status	Accesses the 'GPS Status' Screen for control of GPS sensors. Shows the 'GPS Status' Pane in the Selected Display Pane.
Initialization	Displays the 'Initialization' Screen on the Touchscreen Controller. Provides controls for selecting the Crew Profile, checking System Tests, Weight and Fuel, and Flight Plan.
Documents	Shows optional controls for viewing electronic documents on the Touchscreen Controller, and displays documents in the selected Display Pane.
Screen Cleaning	Feature temporarily disables touchscreen glass input to allow for manual cleaning. Turn or push any knob or softkey on the Touchscreen Controller to exit Screen Cleaning Mode.

Crew Profile	Displays 'Crew Profile' Screen, which provides controls for activating and managing crew profiles.
Setup	Displays the 'Setup' Screen, which provides controls for avionics settings and status, data link settings, and for displaying the status of avionics databases.

'Setup' Screen

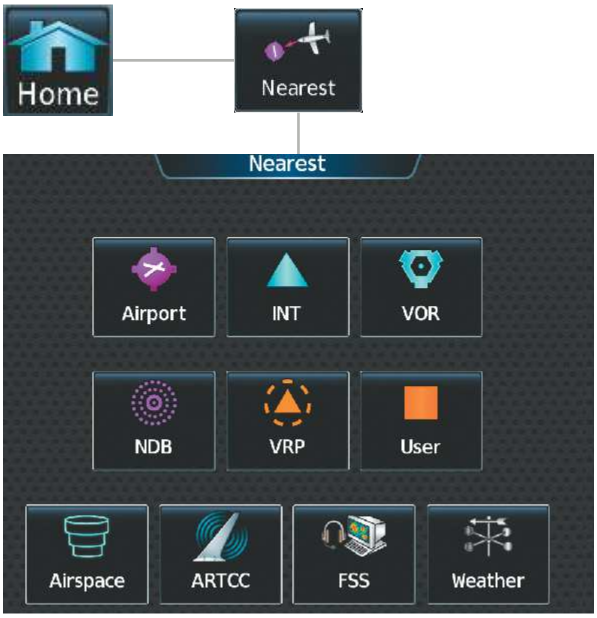


Avionics Settings	Provides controls for changing system avionics settings such as time format, units of measure, airspace alert settings, and MFD Data Bar Fields.
Avionics Status	Displays information on the Touchscreen Controller for installed LRUs, system software, and databases.
SiriusXM Info	Shows 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.
Connext Registration	Used to register with the optional Garmin Connext. Also provides information on current Connext registration.
Connext Setup	Provides controls for Connext® settings and for selecting available wireless networks, and for storing favorite wireless hotspots. Also provides controls used to access Connext functionality when configured with the optional Flight Stream 510.
Database Status	Provides access to the 'Database Status' Screen for checking database cycle information.
ADS-B Status	Provides access to the 'ADS-B Status' Screen for information on the reception of ADS-B services.

'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



 Airport	Displays a list of the nearest airports, with runway, bearing, and distance information.
 INT	Displays a list of the nearest intersections with bearing and distance information.
 VOR	Displays a list of the nearest VORs with bearing, distance, and frequency information.
 NDB	Displays a list of the nearest NDBs with bearing, distance, and frequency information.
 VRP	Displays a list of the nearest Visual Reporting Points with bearing and distance information.
 User	Displays a list of the nearest User Waypoints with bearing and distance information.
 Airspace	Displays information about the nearest airspace and status.
 ARTCC	Displays information about the nearest ARTCC facilities including bearing, distance, and frequencies.
 FSS	Displays the nearest Flight Service Stations with bearing, distance, and frequency information.
 Weather	Displays the nearest weather reporting sources, bearings, distances, and frequencies.

PFD Touchscreen Controller Screens

'PFD Home' Screen

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

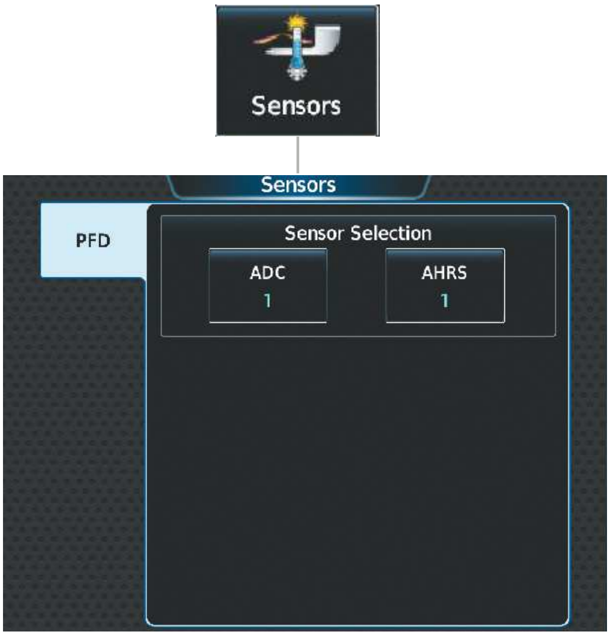
	Accesses the 'Speed Bugs' Screen on Touchscreen Controller, where the speed bugs can be configured.
	Accesses the 'Timer' Screen on the Touchscreen Controller. Controls timer on PFD.
	Accesses the 'Minimums' Screen on the Touchscreen Controller. Set Minimum Altitude Alerting.
	Shows the Traffic Map on 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.
	Accesses the 'PFD Map Settings' Screen on the Touchscreen Controller. The Inset Map or HSI Map is not available when in split mode.
	Accesses the 'Sensors' Screen. Allows for selection of ADC and AHRS sensors.
	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.

'PFD Settings' Screen

Screen Cleaning	Deactivates touch input on the Touchscreen Controller to facilitate cleaning. Push or turn a knob on the controller to resume touch input.
PFD Tab	
Flight Director — Single Cue	Shows the active format of the Flight Director.
Horizon Heading	Enables/disables display of compass heading along the Zero-Pitch line when SVT is enabled. When Enabled, the annunciator is green.
Wind — Option 1	**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.
FPA Reference Manual — -3.0	**Off:** Flight Path Angle Reference disabled. **Manual:** Permits crew to manually select a Flight Path Angle reference. **Auto:** System generates and displays a Flight Path Angle reference based on the active VNAV profile.
Meters Overlay	Enables/disables the display of the meter overlay on the Altimeter.

BARO Select Units — IN	Selects the barometric pressure units: **Inches (IN):** Displays the BARO setting as inches of mercury. **Hectopascals (HPA):** Displays the BARO setting as hectopascals.
SVT Tab	
SVT	Enables/disables synthetic terrain depiction. When enabled, the annunciator is green.
SVT Airport Signs	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. When synthetic terrain is disabled, button is subdued.
SVT Pathways	Enables/disables synthetic terrain pathways depiction. When enabled, the annunciator is green. When synthetic terrain is disabled, button is subdued.
General Tab	
Time Format — UTC	Selects the Time Format: Local 12hr, Local 24hr, or UTC
Time Offset — --:--	Displays the Local and UTC time offset.
COM Channel Spacing — 25.0 kHz	Selects the COM Channel Spacing: 25 kHz or 8.33 kHz

'PFD Sensors' Screen



	Accesses the 'ADC Sensors' Page where the Air Data Computer (ADC) used by the on-side PFD can be manually selected.
	Accesses the 'AHRS Sensors' Screen where the Attitude and Heading Reference System sensors used can be manually selected.

CONTROLLING DISPLAY PANES

Either GTC may be used to select and control Display Panes in MFD control mode; however, both GTC controllers may not select, display or control MFD function at the same time. When selecting the MFD mode from one GTC 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 (see figure below). 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 GTC control of display panes.

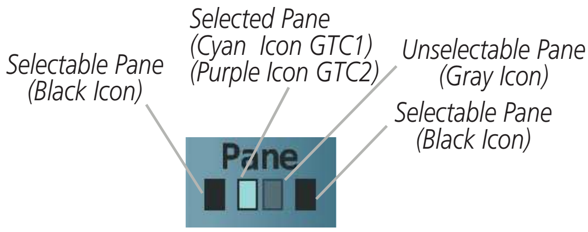


Figure 1-11 GTC Display Pane Control Icons

The MFD shows the EIS 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 GTC 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.

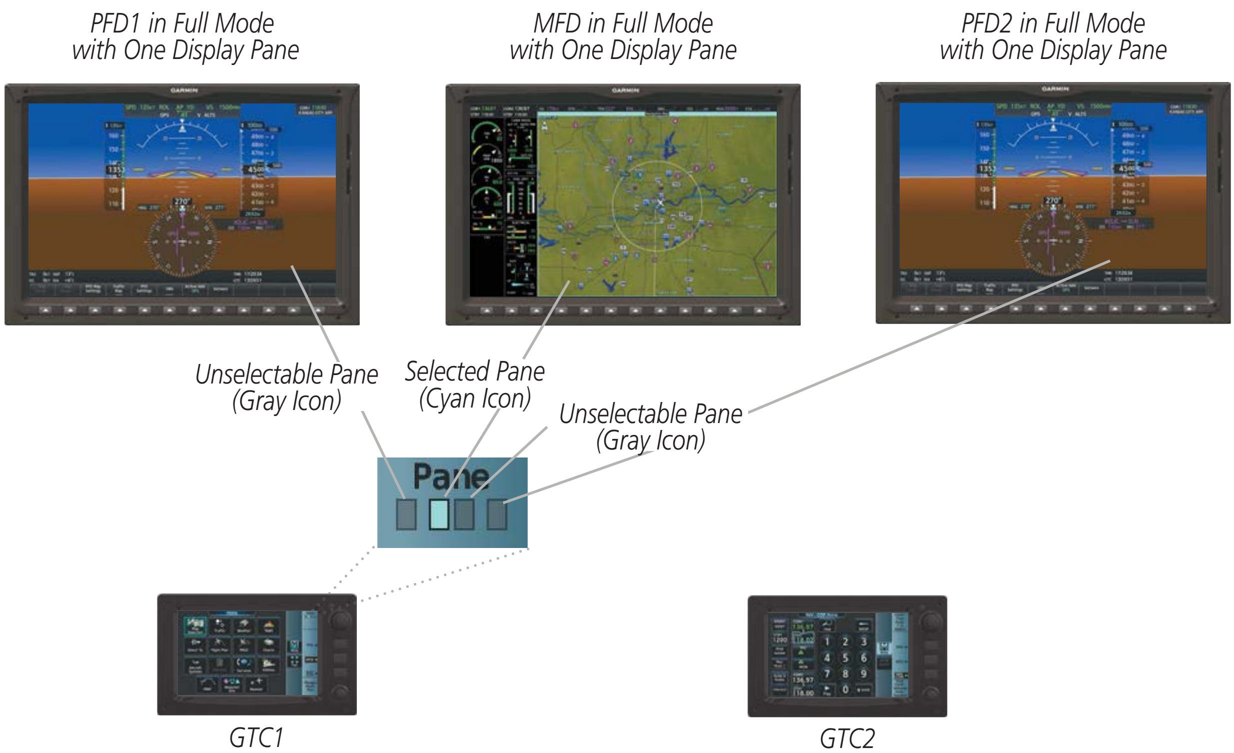


Figure 1-12 GTC1 Control with PFD 1 in Full Mode, MFD in Full Mode and PFD2 in Full Mode

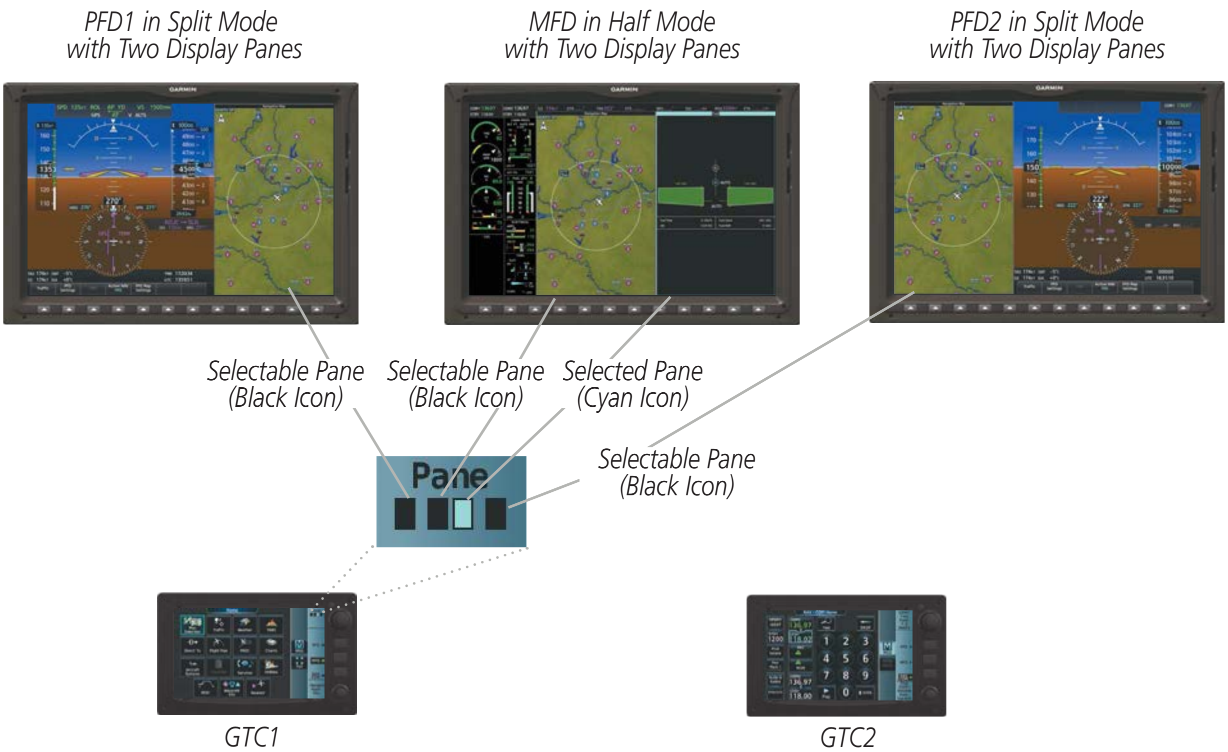


Figure 1-13 GTC1 Control with PFD1 in Split Mode, MFD in Half Mode and PFD2 in Split Mode

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, after acknowledging the information on the MFD Start-up Screen, 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 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 crew 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 (e.g. waypoint, radio frequency, etc.). A keypad will appear, and the Datafield Button will be highlighted in cyan.
2) Touch the desired letters or numbers, one at a time.
3) If an alphabetic keypad is displayed and numbers are desired, touch the **123...** Button.
4) If the numeric keypad is displayed and letters are desired, touch the **ABC...** Button.
5) To accept the entry, touch the **Enter** Button. Otherwise, touch the **Back, Cancel,** or **Home** Button (on the Button Bar) to exit the datafield without saving the entry.

Figure 1-14 Entering Text on the Keypad

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

1) Select a datafield button on the Touchscreen Controller for which data entry is required (e.g. 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, Cancel** or **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 that 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.

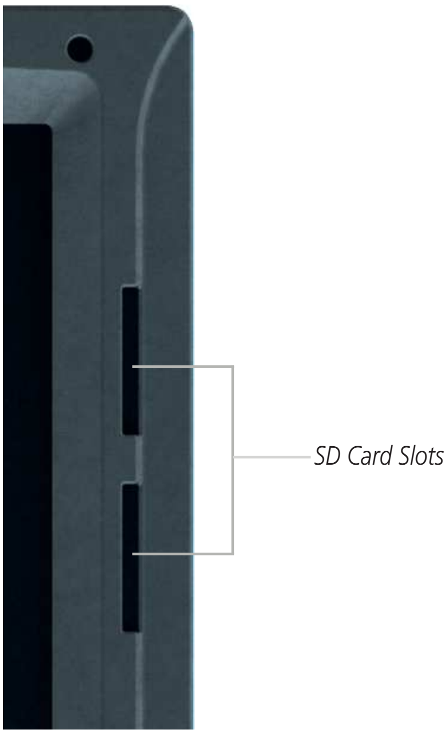


Figure 1-15 Display Bezel SD Card Slots

1.3 SYSTEM OPERATION

SYSTEM POWER-UP

***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-up, annunciator lights on the AFCS Controller illuminate momentarily.

On the PFD (Figure 1-16), 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-up.

When the MFD powers up, the start-up screen (Figure 1-17) displays the following information:

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

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.

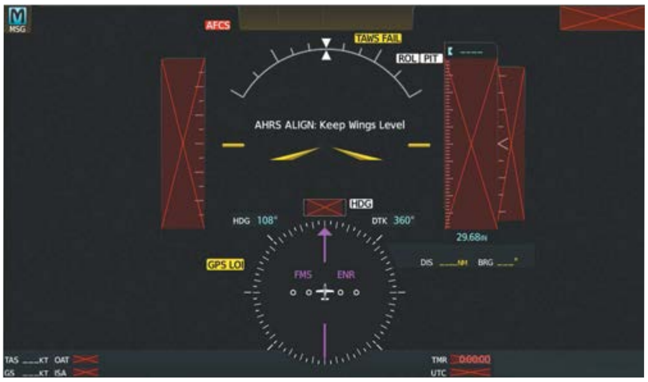


Figure 1-16 PFD Power-Up

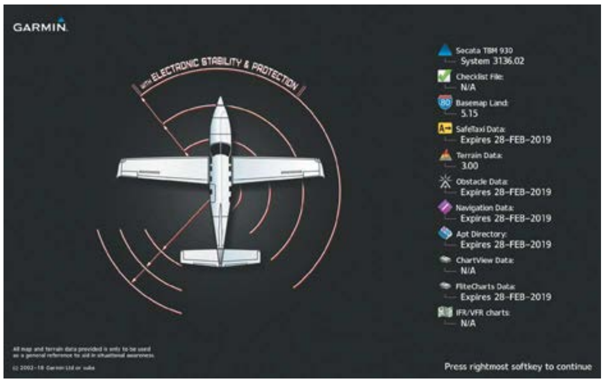
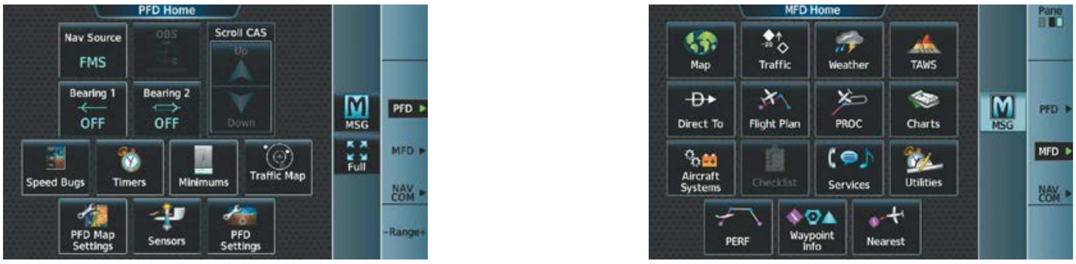


Figure 1-17 MFD Power-Up



GTC1 PFD Home Screen *GTC2 Screen*

Figure 1-18 Touchscreen Controller Power-Up

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

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.

PFD1 in Full Mode with One Display Pane *MFD Operating in Half Mode with Two Display Panes* *PFD2 Operating in Split Mode with Two Display Panes*

GTC1 *GTC2*

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 GTC 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 GTC 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.*

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

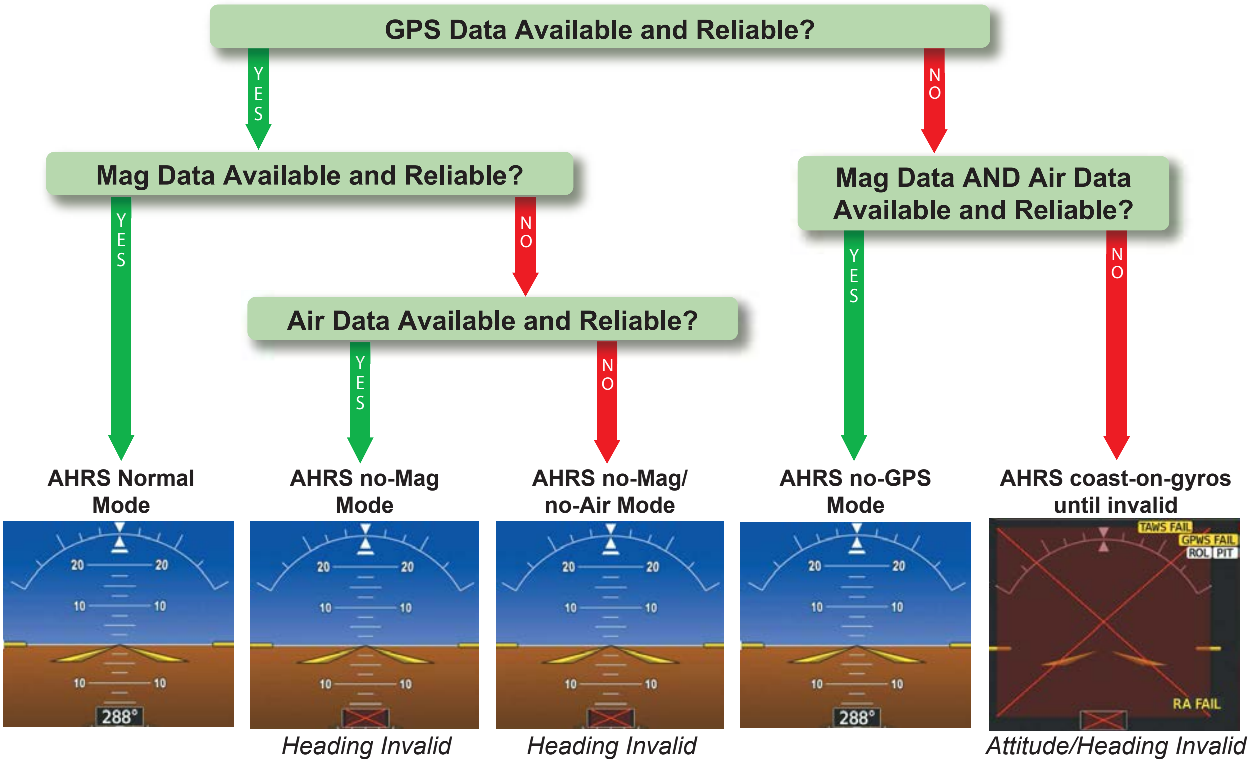


Figure 1-23 AHRS Operation

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 PFDs as long as magnetometer and airspeed data are available and valid.

MAGNETOMETER FAILURE

If the magnetometer input fails, the AHRS transitions to one of the reversionary 'heading invalid' modes and continues to output valid attitude information. However, if the aircraft is airborne, the heading output on the PFD does become invalid (as indicated by a red "X").

AIR DATA INPUT FAILURE

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

MAGNETIC FIELD VARIATION DATABASE

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

GPS RECEIVER OPERATION

Each GIA 64W IAU contains a GPS receiver. Information collected by the specified receiver (GPS1 for the left/pilot side or GPS2 for the right/copilot side) may be viewed on the 'GPS1 Status' or 'GPS2 Status' Pane and the 'GPS Status' Screen on the Touchscreen Controller (refer to the following figure).

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

If the sensor annunciation persists, check for a system failure message by touching the **MSG** Button on Touchscreen Controller. If no failure message exists, check the 'GPS Status' Pane and compare the information for GPS1 and GPS2. 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 satellite identification number. Satellites whose signals are currently being used are represented by solid ovals.

SATELLITE SIGNAL STATUS

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

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

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

GPS RECEIVER STATUS

The GPS solution type (ACQUIRING, 2D NAV, 2D DIFF NAV, 3D NAV, 3D DIFF NAV) for the active GPS receiver (GPS1 or GPS2) is shown in the lower right of the 'GPS (1 and 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 indicates 'INACTIVE'. When acquisition is complete, the solution status indicates '3D DIFF NAV' and SBAS indicates 'ACTIVE'. If SBAS providers are disabled, SBAS status will read 'DISABLED'.

SATELLITE SIGNAL STRENGTHS

The 'GPS (1 and 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 identification number 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).

SATELLITE-BASED AUGMENTATION SYSTEM (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**, or **WAAS** (any combination) Annunciator Button(s) to enable or disable. A green annunciation indicates an enabled SBAS selection, disabled selections are gray.

RECEIVER AUTONOMOUS INTEGRITY MONITORING (RAIM) PREDICTION

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

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

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

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

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

Predicting RAIM availability:

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

12) Touch the button for the desired day. If necessary, touch and drag in the window, or use the **Up** and **Down** buttons to display the desired day. The selected date is now displayed on the **Arrival Date** Button.

13) Touch the **Compute RAIM** Button. One of the following will be displayed in the RAIM Status Field.

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

ANNUNCIATIONS

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.

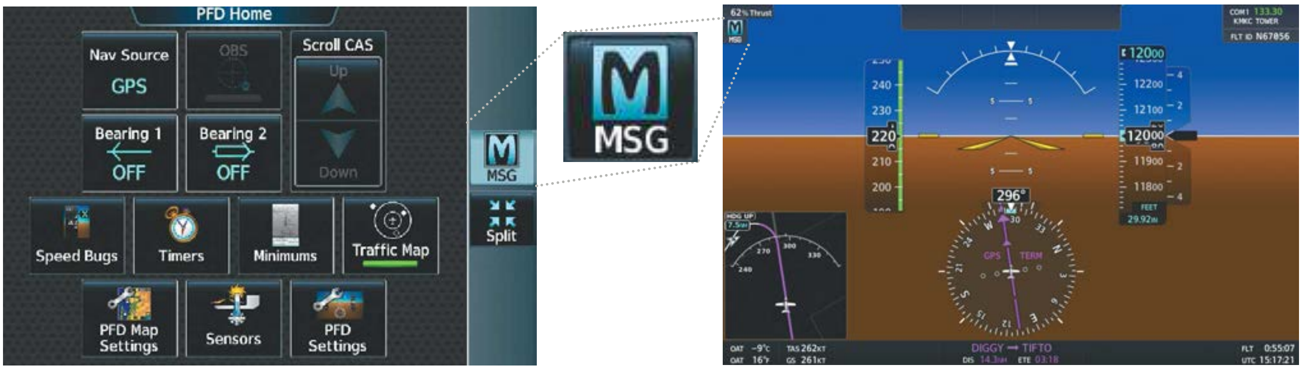
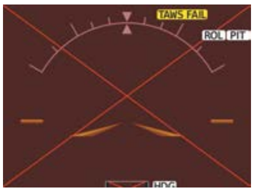
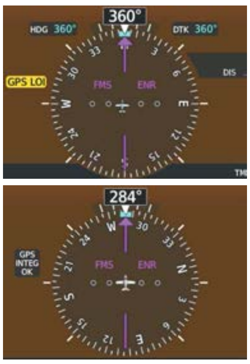


Figure 1-25 Message Annunciation on Touchscreen Controller and PFD

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

System Annunciation	Comment
	AHRS is aligning.
	Display system is not receiving attitude information from the AHRS.
	AHRS calibration incomplete or configuration module failure.
	This annunciation is seen only when the Autopilot is engaged. The annunciation indicates an AFCS monitor has detected an abnormal flight parameter, possibly caused by strong turbulence. In this case, the situation should correct itself within a few seconds. If there is an actual failure, a red "X" soon appears over the Attitude Indicator.
	'LOI' Indicates Loss of Integrity of GPS information. GPS information is either not present or is invalid for navigation use. Note that AHRS uses GPS inputs during normal operation. AHRS operation may be degraded if GPS signals are not present (see the current version of the pertinent flight manual). If GPS integrity is subsequently restored, system displays 'GPS INTEG OK' annunciation.

System Annunciation	Comment
	Display system is not receiving valid temperature information from air data computer.
	Display system is not receiving airspeed input from air data computer.
	Display system is not receiving vertical speed input from the air data computer.
	Display system is not receiving altitude input from the air data computer.
	CDI is not receiving valid data from the corresponding IAU. Does not apply when the CDI is set to GPS.
	Display system is not receiving heading input.
	Display system is not receiving valid transponder information.
Other Various Red or Amber X Indications	A red or amber 'X' through any other display field indicates the field is not receiving valid data.

Table 1-2 System Annunciations

1.4 INITIALIZATION

Initialization is a process that prompts the flight crew to perform system checks and enter flight parameters, and is completed prior to each flight using the Touchscreen Controllers. After powering up the system on the ground, the 'Initialization' Screen appears on GTC1 or GTC2 when MFD Home has been selected. On this screen, the crew 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. 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 the Home Screen. Touching the **Accept Initialization** Button prior to the completion of all Initialization Tasks will cause a pop-up screen to appear as shown below in the following figure. Touching the **OK** Button on the pop-up screen acknowledges the incomplete initialization and opens the 'MFD Home' Screen; touching the **Cancel** Button removes the pop-up.

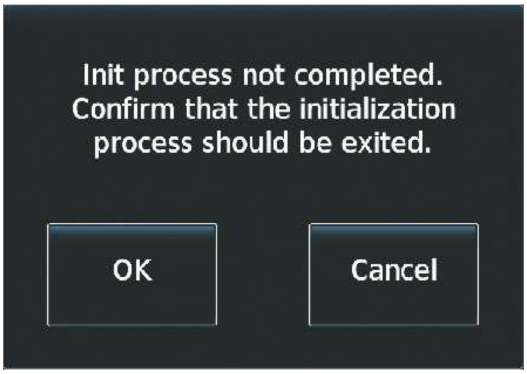


Figure 1-27 System Initialization Exit Confirmation

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 the Home Screen. The 'Initialization' Screen may also be accessed at any time via MFD 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 this section for more information on creating, importing, and exporting Crew Profiles)
2) Touch **Flight Plan** Button to proceed to the 'Active Flight Plan' Screen to **Add Origin**, **Add Enroute Waypoints** and **Add Destination**. (See the Flight Management section for details).
3) Touch the **Next** Button to proceed to the 'Weight and Fuel' Screen to input values for Empty Weight, Aircraft Loading, and Fuel Information. (See the Flight Management section, Trip Planning - Weight and Fuel Planning for details).
4) Touch **Next** Button to proceed to the 'Database Status' Screen to update missing or outdated database information.
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 System Initialization Completed Tasks

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

1.5 SYSTEM MANAGEMENT

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

AVIONICS SETTINGS

Avionics Settings are categorized into five tabs (**System**, **Units**, **Alerts**, **MFD Fields**, and **Audio**). Settings 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

- Time display format (local 12 hour, local 24 hour, or UTC)
- Time offset
- Keyboard Format (Alphabetical or QWERTY)
- Flight Director Active Format: Single Cue
- GPS CDI range
- COM transceiver channel spacing
- Stability & Protection
- Nearest Airport Runway Surface
- Nearest Airport Minimum Rwy Length
- Show Airport Chart on Landing
- Sync CDI
- Sync Altimeter Baro Pressure

***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 the MFD Home Screen, 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**).

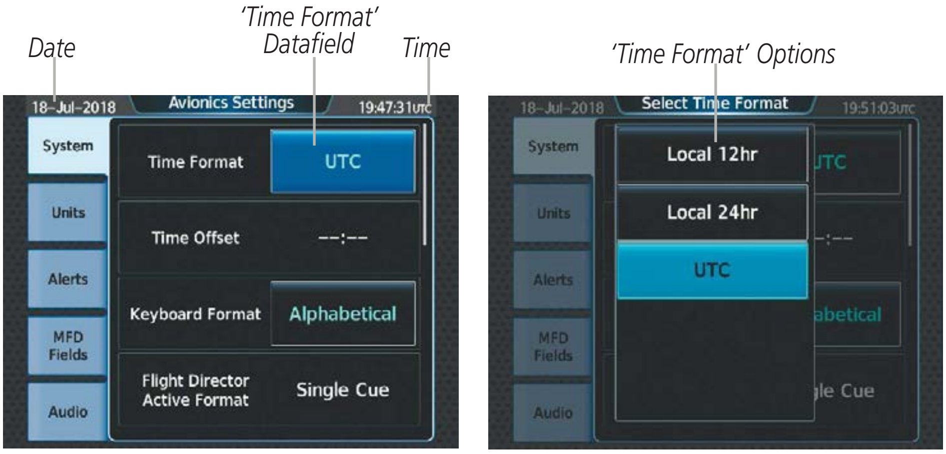


Figure 1-29 Time Format Settings

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

1) From the MFD Home Screen, touch **Utilities** > **Setup** > **Avionics Settings**.
2) If necessary, from the **System** Tab.
3) Touch the Time Offset Button (currently selected time offset shown in cyan).
4) Input the desired value using the numeric keypad or the large and small upper 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 the MFD Home Screen, touch **Utilities** > **Setup** > **Avionics Settings**.
2) If necessary, touch the **System** Tab.
3) Touch the Keyboard Format datafield button.
4) Touch either the **Alphabetical** or **QWERTY** Button to select the desired keypad format.

GPS CDI

The GPS CDI setting controls range scale of the CDI when GPS is the active navigation 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.

COM Channel Spacing

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

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 crew can enable/disable ESP on the 'Avionics Settings' Screen. Disabling ESP also disables Autothrottle ESP and Engine Protections. Refer to the Additional Features section for more details.

Nearest Airport Runways

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

Showing Airport Charts on Landing

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

Enabling/disabling the display of airport charts on landing:

1) From the MFD Home Screen, 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 same navigation source on both PFDs. See the Flight Instruments section for details.

Synchronize Altimeter Setting

When enabled, setting the altimeter setting on either PFD will also enter the setting on the other PFD. Refer to the Flight Instruments section for more details.

UNITS SETTINGS

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

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)
- External Temperature (Celsius or Fahrenheit)
- Cockpit/Cabin Temperature (Celsius or 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 the MFD Home Screen, 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.

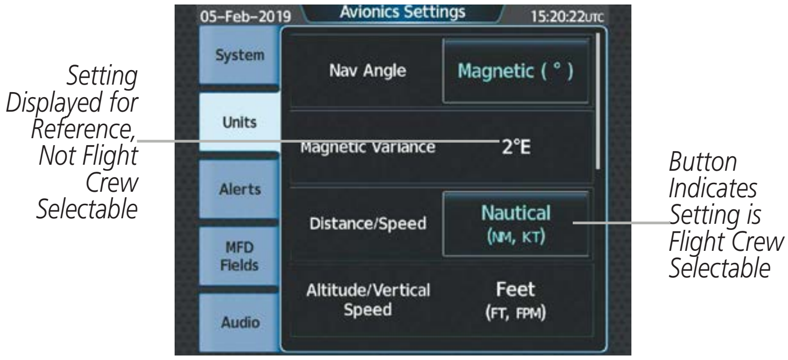


Figure 1-31 Viewing Unit Data on the 'Avionics Settings' Screen

ALERTS SETTINGS

- Baro transition ALT climb
- Baro transition LVL descent
- SurfaceWatch Inhibit
- Airspace alert alt buffer
- Arrival Alert
- Class B/TMA/AWY airspace alert
- Class C/CTA airspace alert
- Class A/D airspace alert
- Restricted airspace alert
- MOA (Military) airspace alert
- Other airspace alert (*as designated by the database*)

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 Alerts flash the barometric pressure setting. The Baro Transition Alerts serve as a reminder to the crew to change the barometric pressure setting to standard when climbing through the barometric transition altitude, or to change the barometric pressure setting from standard to the local altimeter setting when descending through the barometric transition altitude. Refer to the Flight Instruments section for more information about the Baro Transition Alert.

SurfaceWatch Inhibit

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

Arrival and Airspace Alert settings

An arrival alert can be set to notify the pilot with a message upon reaching a user-specified distance from the final destination (the direct-to waypoint or the last waypoint in a flight plan). The system is also capable of providing alerts as the aircraft approaches special-use airspace. For Airspace Alert Altitude Buffer settings, Arrival Alerts, and Airspace specific alerts, see the Flight Management Section.

MFD FIELDS SETTINGS

- 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 though 8 as displayed from left-to-right in the MFD Navigation Status Bar. Refer to the Flight Management section for details.

AUDIO SETTINGS

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

Audio

From the **Audio** Tab the audio alert voice gender can be set to male or female. A tone may be enabled or disabled which alerts the flight crew that a COM frequency has been changed. 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 the MFD Home Screen, 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**).

To enable/disable the COM Frequency Changed Tone:

1) From the MFD Home Screen, touch **Utilities** > **Setup** > **Avionics Settings.**

2) If necessary, touch the **Audio** Tab.

3) Touch the **COM Frequency Changed Tone** Button. A green annunciator indicates the feature is enabled.

Enable/disable the Pilot 3D Audio:

1) From the MFD Home Screen, 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 the MFD Home Screen, 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 the MFD Home Screen, 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 the MFD Home Screen, 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 the MFD Home Screen, 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 **Home**.

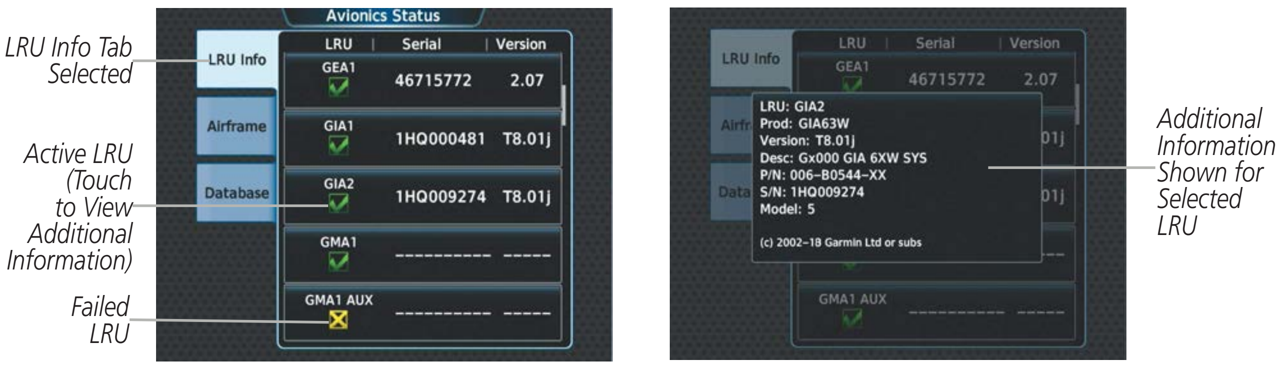


Figure 1-32 Viewing LRU Info Information on the Touchscreen Controller

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 the MFD Home Screen, 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 the MFD Home Screen, 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 **Home.**

ADDITIONAL SYSTEM SETUP OPTIONS

SIRIUSXM AND GARMIN CONNEXT

***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 the MFD Home Screen, touch **Utilities > Setup > SiriusXM Info**

Viewing Connext® Registration Information:

From MFD Home, touch **Utilities > Setup > Connext® Registration**

SiriusXM and Garmin Connext Satellite services are subscription-based. The services must be activated before their functionality is available to the system and crew.

For more information on how to register SiriusXM and Garmin Connext, see the Hazard Avoidance and Additional Features Sections.

WIRELESS SETUP

If the Flight Stream 510 is installed, the system is capable of pairing to a mobile device wirelessly.

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

1.6 UTILITIES

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

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.

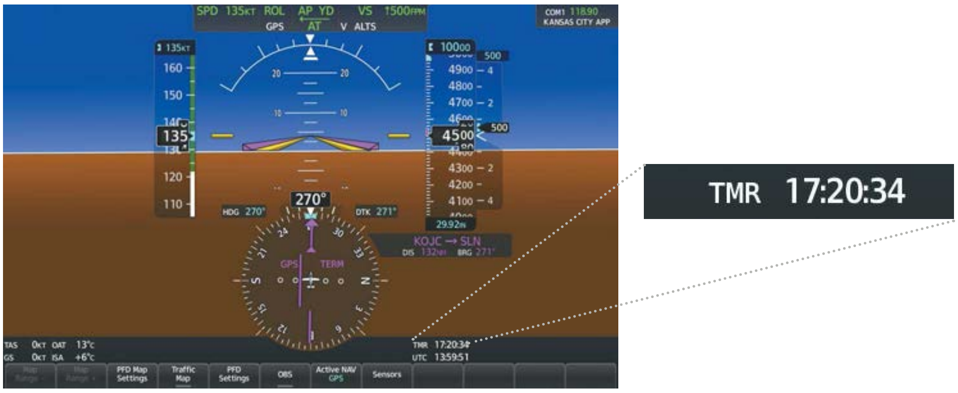


Figure 1-33 Generic Timer on the PFD

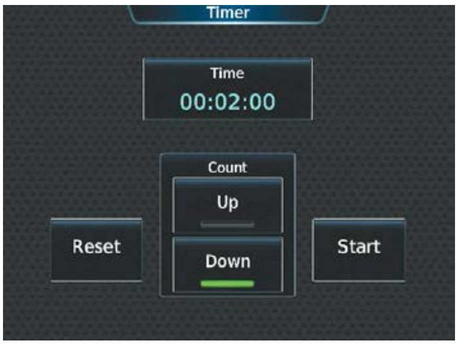


Figure 1-34 Timer (Touchscreen Controller)

Setting the generic timer:

1) From the MFD Home Screen, touch **Utilities > Timer**.

   Or:

   From PFD Home, touch the **Timers** Button.

2) Touch the **Time** Button.

3) Input the desired time using the numeric keypad or the large and small upper knobs, then touch the **Enter** Button or push the upper knob.
4) Touch the **Start** Button. The button changes to 'Stop'.
5) To stop the timer, touch the **Stop** Button.
6) To reset the timer, touch the **Reset** Button.

TRIP STATISTICS

FLIGHT TIME

The flight timer can be set to count up from zero starting at system power-up 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 (see figure below).
3) Touch either the **Power-On** or **In-Air** Button.

Resetting the flight timer:

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

Figure 1-35 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 Screen, 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 the MFD Home Screen, 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 the MFD Home Screen, touch **Utilities** > **Trip Stats**.
2) Touch the Odometer **Reset** Button (see previous figure).
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 the MFD Home Screen, 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 the MFD Home Screen, touch **Utilities** > **Trip Stats.**
2) Touch the Trip Odometer **Reset** Button (see previous figure).
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 Trip Odometer:

1) From the MFD Home Screen, 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 the MFD Home Screen, 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. Note manual reset is always available regardless of the option selected for automatic reset.

Manually resetting the average ground speed:

1) From the MFD Home Screen, 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 the MFD Home Screen, 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. Note manual reset is always available regardless of the option selected for automatic reset.

Manually resetting the Maximum Ground Speed:

1) From the MFD Home Screen, 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 the MFD Home Screen, 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 the MFD Home Screen, 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 the MFD Home Screen, 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 the MFD Home Screen, 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 the MFD Home Screen, 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 the MFD Home Screen, 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 LCL) as local time. If the **One Time** or **Periodic** Buttons were selected in step 7, the time is entered in a HH:MM:SS format.
10) Touch the **Enter** Button. The time is displayed on the **Time** Button.
11) If the **Event** Button was selected in step 7, touch the **Date** Button. The **Date** Button is subdued and disabled if the **One Time** or **Periodic** Buttons were selected in step 7.
12) Touch the desired year, then the month, followed by the day.

Editing a scheduled message:

1) From 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.

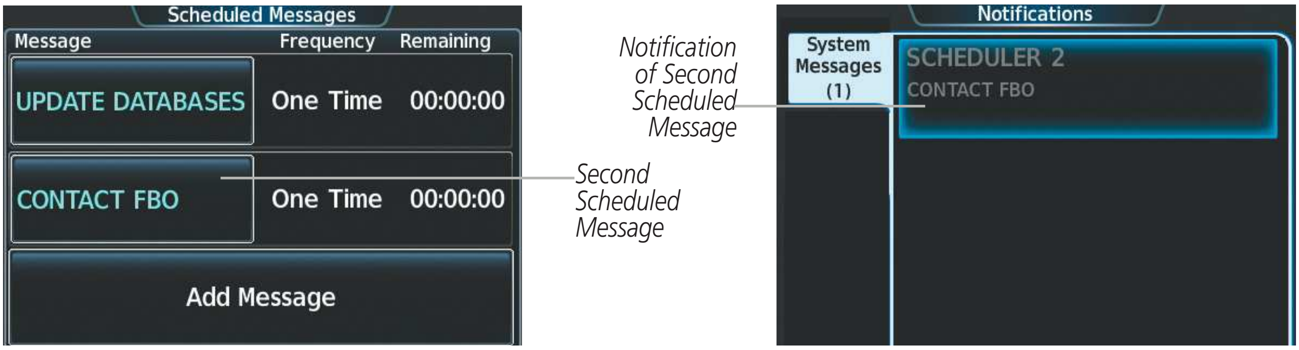


Figure 1-36 Scheduled Message Example

SCREEN CLEANING

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

Cleaning the Touchscreen Controller screen:

1) From the MFD Home Screen, 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) Push or turn any knob or softkey to return to the 'Utilities' Screen.

CREW PROFILES

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

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

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

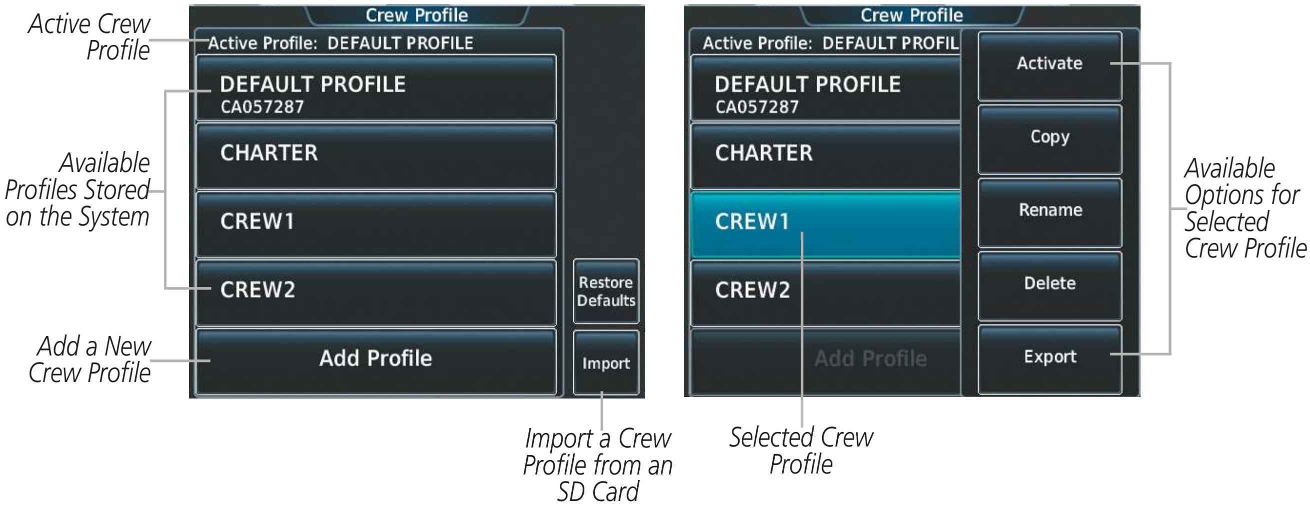


Figure 1-37 Managing Crew Profiles on the Crew Profile Screen

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 push the upper knob. Crew Profiles may be up to 16 characters long, and cannot share the exact name of an existing crew profile. The 'Crew Profile' Screen displays the name of the renamed crew profile in the list.

Deleting a crew profile:

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

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

Importing a crew profile from an SD card:

1) If necessary, insert an SD card containing a crew profile into the top card slot on the MFD.
2) From MFD Home, touch **Utilities** > **Crew Profile**.
3) Touch the **Import** Button.
4) Scroll if necessary, and touch the button for the crew profile to be imported.

Exporting a crew profile to an SD card:

1) If necessary, insert an SD card to store a crew profile into the top card slot on the MFD.
2) From MFD Home, touch **Utilities** > **Crew Profile**.
3) Scroll if necessary, and touch the button for the crew profile to be exported from the list.
4) Touch the **Export** Button.

CREW PROFILE IMPORT/EXPORT MESSAGES

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

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

Table 1-3 Crew Profile Import/Export Messages

1.7 DISPLAY BACKLIGHTING

The PFD and MFD backlighting, GTC backlighting, PFD and MFD bezel keys, GTC bezel controls, and AFCS Controller 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.

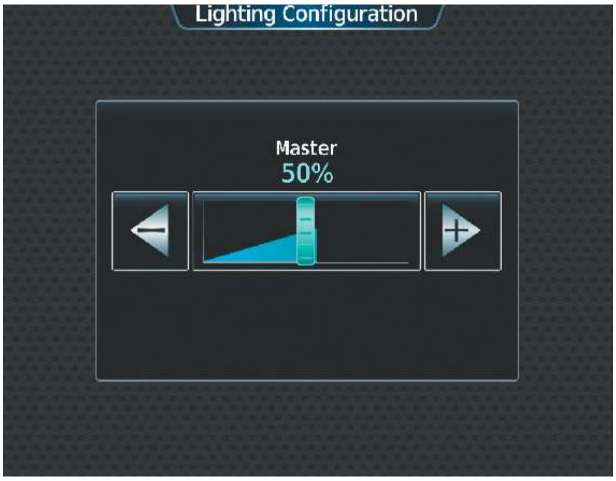


Figure 1-38 'Lighting Configuration' Screen

SECTION 2 FLIGHT INSTRUMENTS

***NOTE:** The Automatic Flight Control System (AFCS) provides additional indications 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.

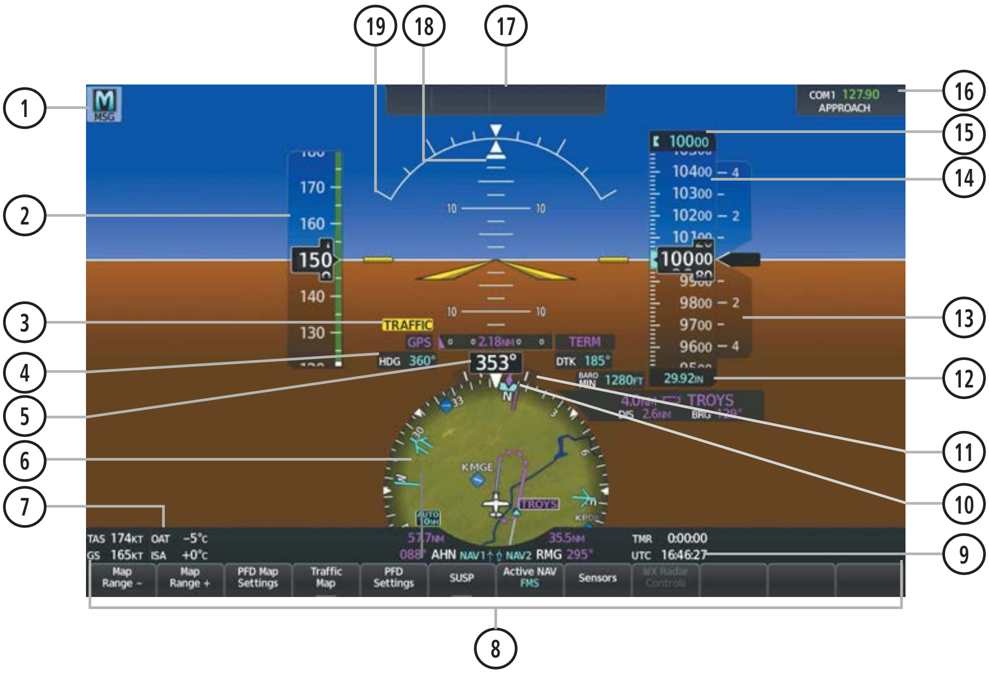


Figure 2-1 Primary Flight Display (Default)

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

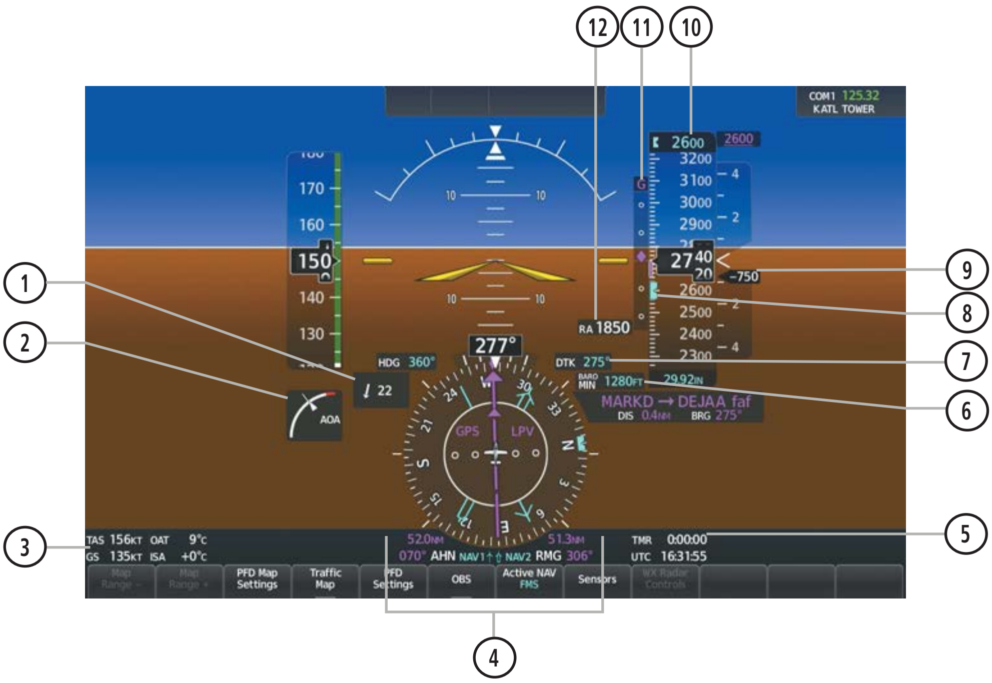


Figure 2-2 Primary Flight Display (Additional Information)

1. *Wind Data*
2. *Angle of Attack Indicator*
3. *True Air Speed, Ground Speed*
4. *Bearing Information Windows*
5. *Timer*
6. *Minimum Altitude Alert Setting*
7. *Selected Course*
8. *Selected Altitude Bug*
9. *Current Vertical Speed*
10. *Selected Altitude*
11. *Glidepath Indicator*
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 Indictor at or above Mach 0.3. The Mach number appears white within a red background when the airspeed enters $M_{MO.}$

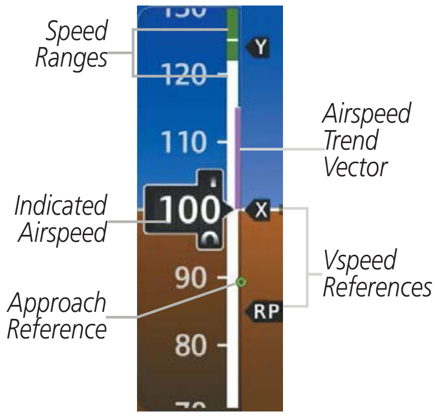


Figure 2-3 Airspeed Indicator

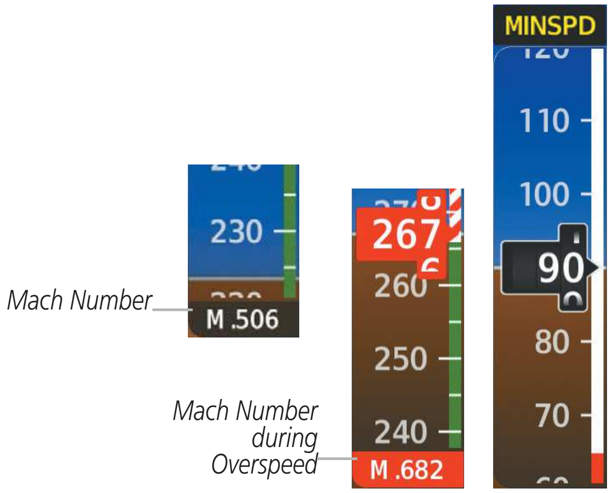


Figure 2-4 Overspeed/Minimum Speed Indications

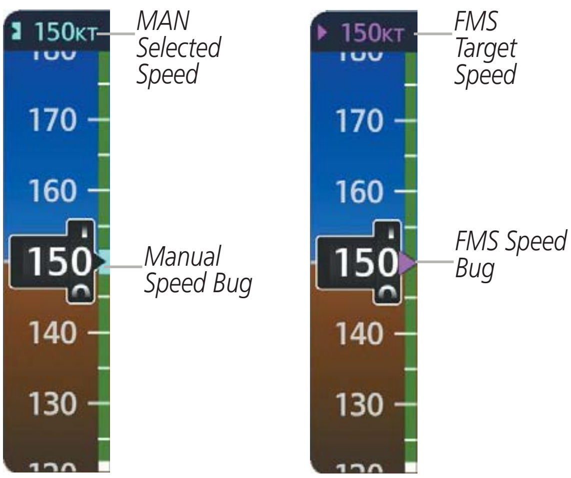


Figure 2-5 Airspeed Indicator with Target Speed Bugs

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 (Vmo). 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 Vref. It is not actually Vref, but will indicate approximately what Vref 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 Target is displayed above the Airspeed Indicator in cyan (MAN speed mode) or magenta (FMS speed mode). A bug corresponding to this speed is shown on the tape.

While in MAN speed mode, if the Airspeed Target or Mach Target exceeds the range shown on the tape, the cyan selection bug appears at the corresponding edge of the tape. See the AFCS Section for more information about the Airspeed Reference.

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 Vspeeds 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 during power up.

Manually changing Vspeeds 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 diminished, 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 that the Vspeed is a pilot-entered value.

Figure 2-6 Speed Bugs

Figure 2-7 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.

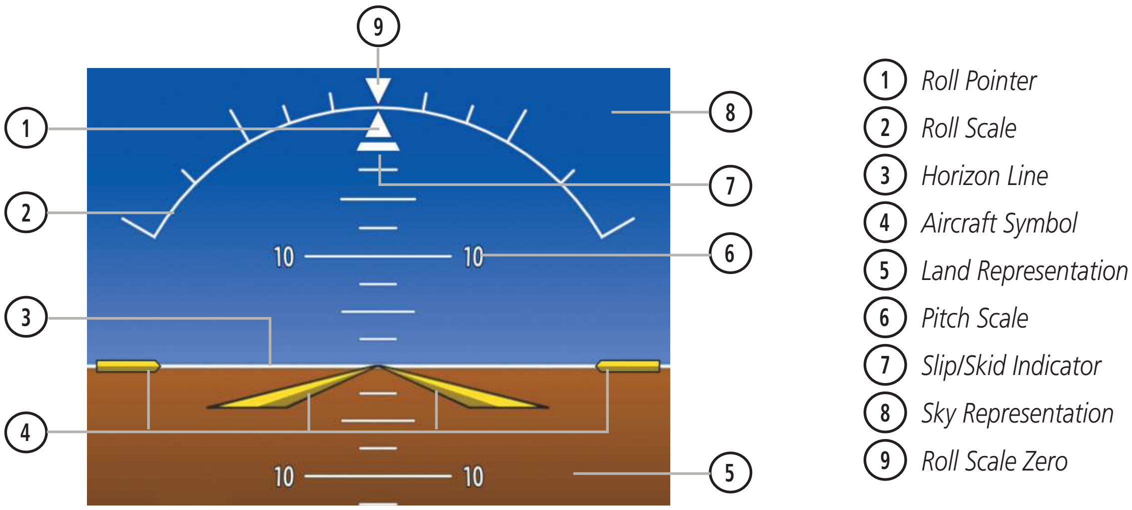


Figure 2-8 Attitude Indicator

The horizon line is part of the pitch scale. Above and below the horizon line, major pitch marks and numeric labels are shown for every 10°, up to 80°. Minor pitch marks are shown for intervening 5° increments, up to 25° below and 45° above the horizon line. Between 20° below to 20° above the horizon line, minor pitch marks occur every 2.5°. 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 2-9 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.

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. See the AFCS Section for more information about 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.

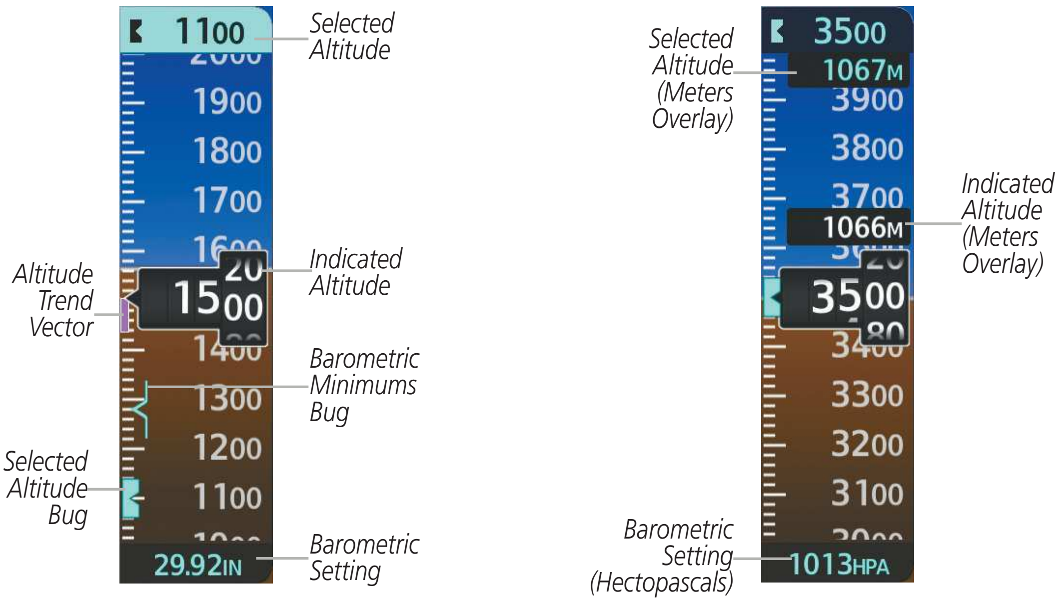


Figure 2-10 Altimeter (Standard and Metric)

Altitudes can also be displayed in meters as an overlay. Note that 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) Select 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.

ALTIMETER SETTING

***NOTE:** Adjusting the altimeter barometric setting creates discontinuities in VNAV vertical deviation, moving the descent path. For large adjustments, it may take several minutes for the aircraft to re-establish on the descent path. If the change is made while nearing a waypoint with a VNAV Target Altitude, the aircraft may not re-establish on the descent path in time to meet the vertical constraint.*

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

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

Figure 2-1 Altimeter Setting Preview

Selecting the altimeter barometric pressure setting:

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

Selecting standard barometric pressure:

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

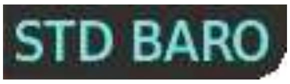


Figure 2-11 Standard Barometric Altimeter Setting

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 2-12 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 2-13 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 GPS is the selected navigation source. Full-scale deflection (two dots), is angular with upper and lower limits. The upper limit is ±492 feet (150 meters) and the lower limits depends on the approach service level.

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

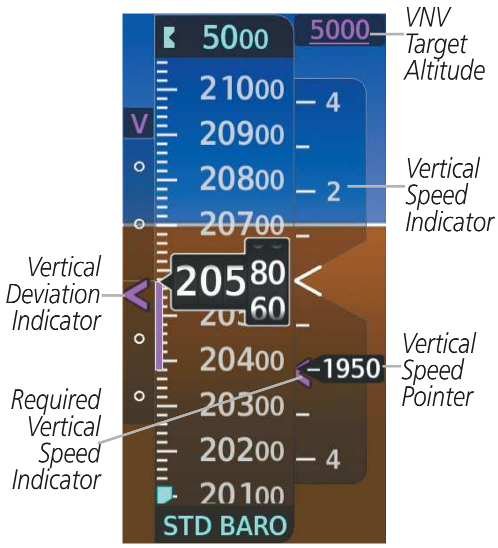


Figure 2-14 Vertical Speed and Deviation Indicators (VSI and VDI)

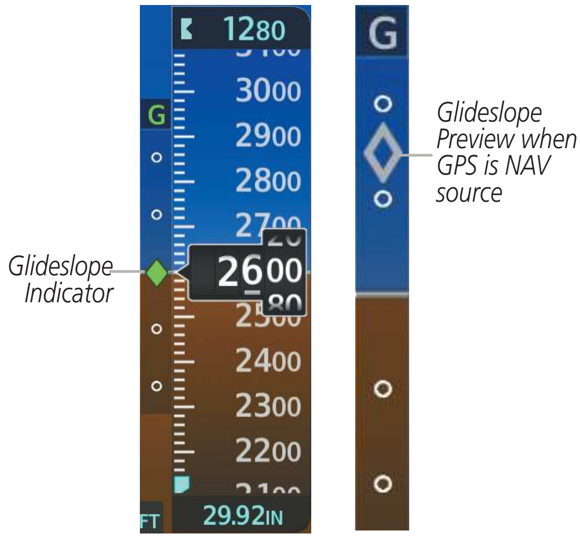


Figure 2-15 Glideslope Indicator

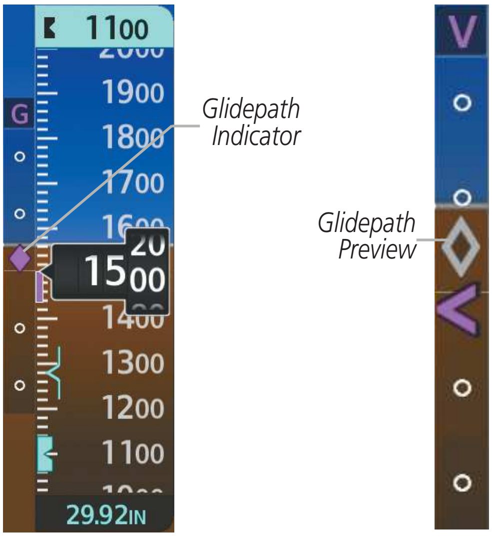


Figure 2-16 Glidepath Indicator

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

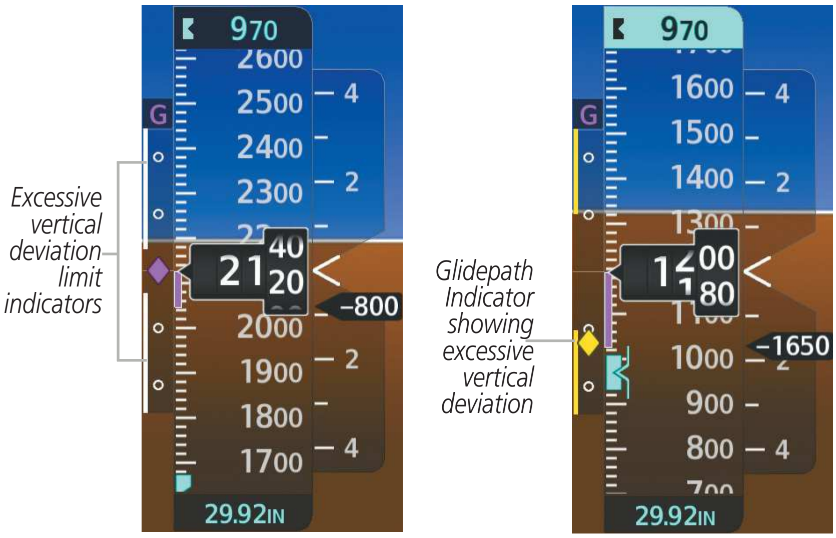


Figure 2-17 Glidepath Indicator (LNAV/VNAV) and Vertical Deviation Limit Indicators

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 (sideways "doghouse"). 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.

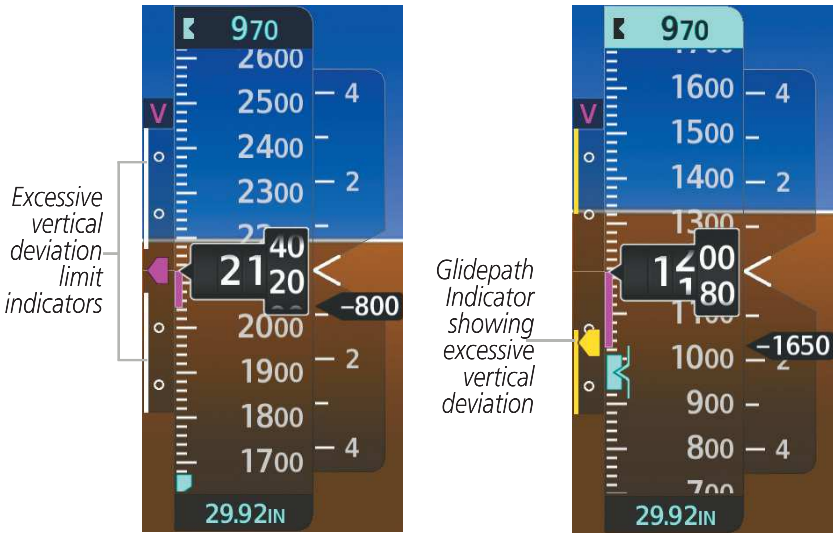
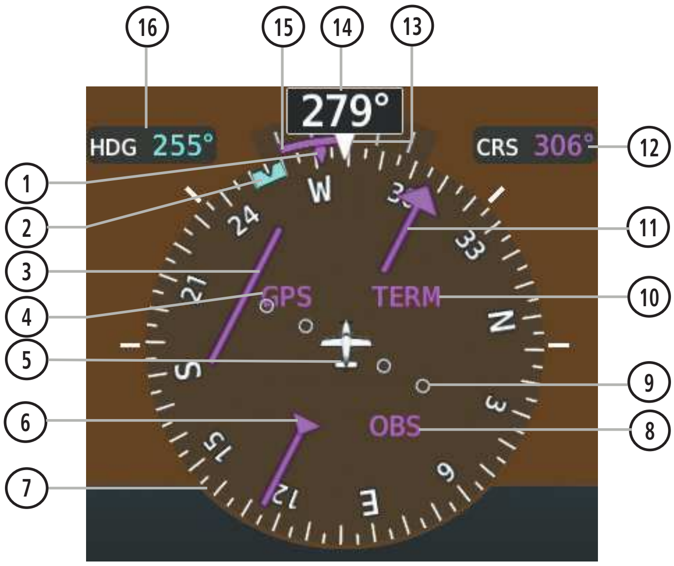


Figure 2-18 Glidepath Indicator (Baro VNAV) and Vertical Deviation Limit Indicators

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 (GPS, VOR1, and LOC1) or a double line arrow (VOR2 and LOC2) which points in the direction of the set course. The To/From arrow rotates with the course pointer and is displayed when the active NAVAID is received.



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

Figure 2-19 Horizontal Situation Indicator

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

Figure 2-20 HSI Map

A digital reading of the current heading appears above the rotating compass card. To the upper left of the HSI, the Selected Heading is shown in cyan, which corresponds to the cyan heading bug on the compass rose. While the HSI is displayed in HSI Map format, if the Selected Heading Bug is beyond the shown portion of the compass rose, the Selected Heading Bug will appear at the edge of the HSI Map. The Desired Track (DTK) is shown in cyan to the upper right of the HSI when the selected navigation source is GPS and OBS Mode is not active. The Selected Course (CRS) is shown to the upper right of the HSI in cyan when the selected navigation source is VOR or LOC and when the selected navigation source is GPS with OBS Mode active. Upon station passage, the To/From Indicator flips and points to the tail of the aircraft, just like a conventional To/From flag. Depending on the navigation source, the CDI on the can appear in two different ways: an arrowhead (GPS, VOR, OBS) or a diamond (LOC).

When the pilot enables the HSI Map, the HSI is formatted to show a navigation map on the rotating compass card. The following information appears above the Current Heading when the HSI Map is enabled:

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

Changing the HSI display format:

1) From PFD Home, 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.

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 2-21 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 2-22 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 2-23 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 2-24 Turn Rate Indicator and Trend Vector

BEARING POINTERS AND INFORMATION WINDOWS

Two bearing pointers and associated information can be displayed on the HSI for NAV, GPS, 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.

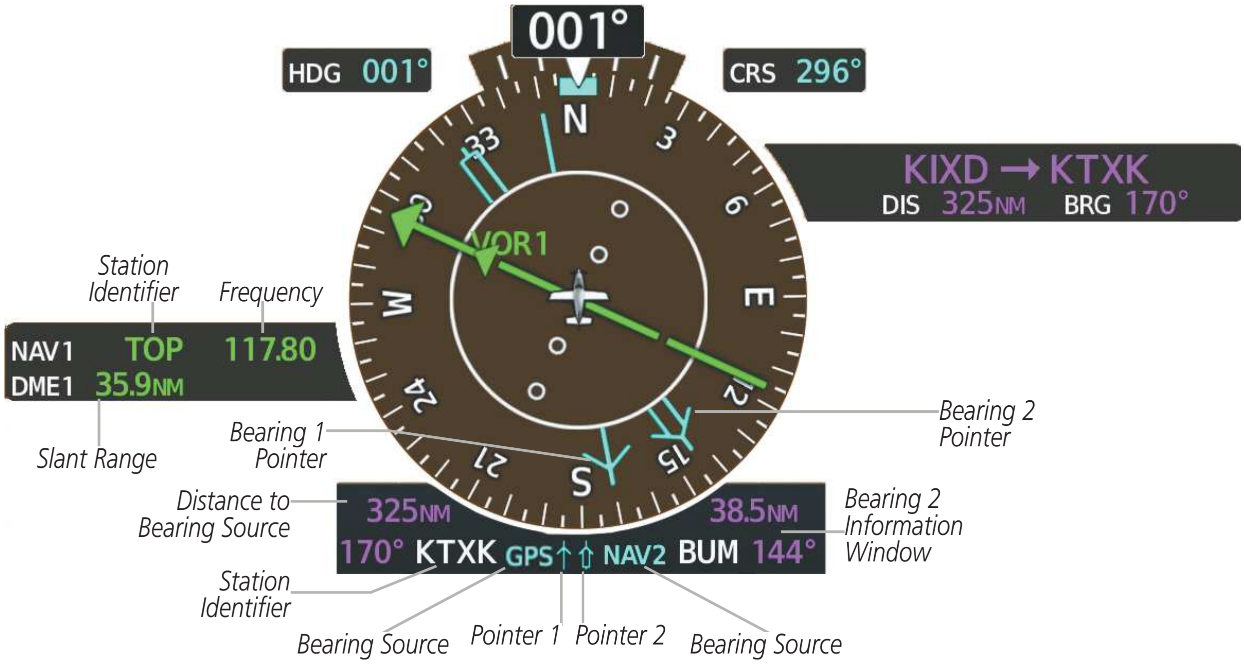


Figure 2-25 HSI with Bearing and Distance Information

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

When the NAV radio is tuned to an ILS frequency, the bearing source and bearing pointer are removed from the HSI. When NAV1 or NAV2 is the selected bearing source, the frequency is replaced by the station identifier when the station is within range. If GPS is the bearing source, the active waypoint identifier is displayed in lieu of a frequency.

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

Selecting bearing display and changing sources:

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

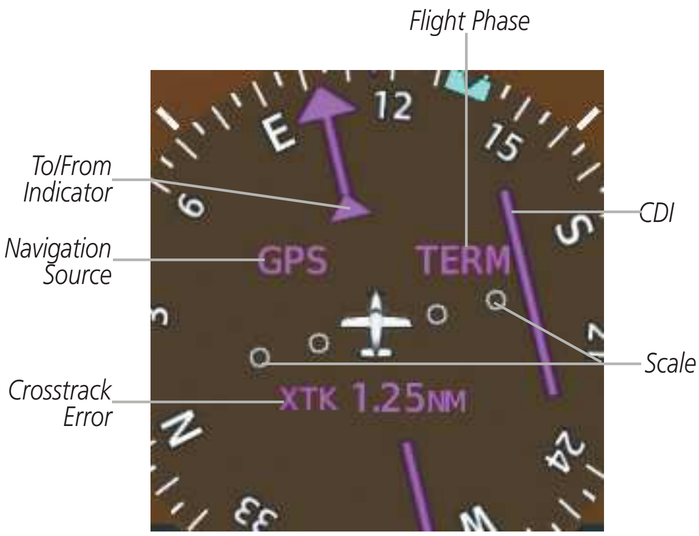


Figure 2-26 Course Deviation Indicator

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

Figure 2-27 Navigation Sources

Changing navigation sources:

1) From PFD Home, touch the **Nav Source** Button to change from GPS to VOR1.

2) Touch the **Nav Source** Button again to change from VOR1 to VOR2.

3) Touch the **Nav Source** Button a third time to return to GPS.

Or:

1) Press the **Active NAV** Softkey to change from GPS to VOR1/LOC1.

2) Press the **Active NAV** Softkey again to change from VOR1/LOC1 to VOR2/LOC2.

3) Press the **Active NAV** Softkey a third time to return to GPS.

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

Turn CDI synchronization on/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 the button for the desired synchronization setting (**On** or **Off**).

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

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

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

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

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

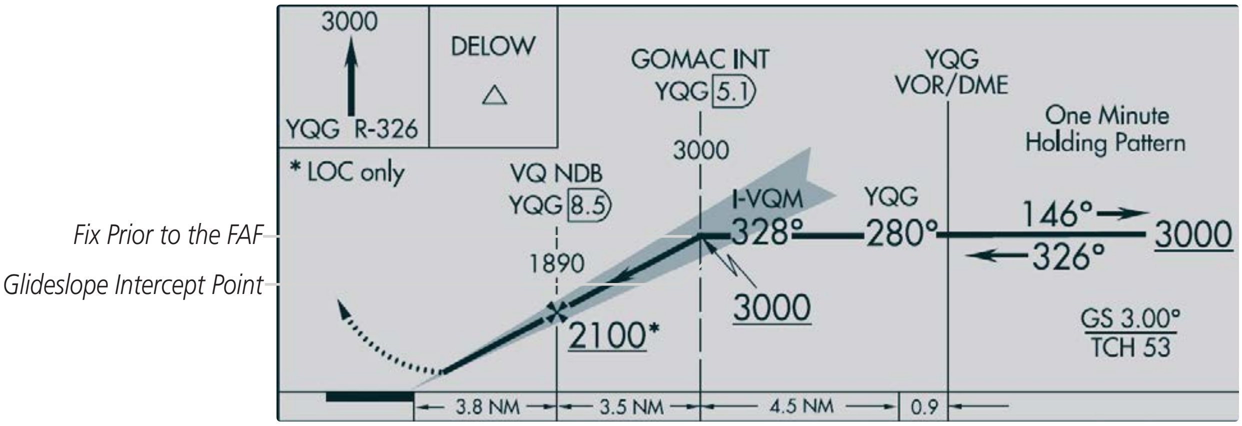


Figure 2-28 ILS Approach with Glideslope Intercept Point at Fix Prior to the FAF

GPS CDI SCALING

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

The current GPS CDI scale setting is displayed on the 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 GPS CDI setting:

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

Figure 2-29 GPS CDI Settings

When set to 'Auto' (default), the GPS CDI scale automatically adjusts to the appropriate limits based upon the current phase of flight (Table 2-1).

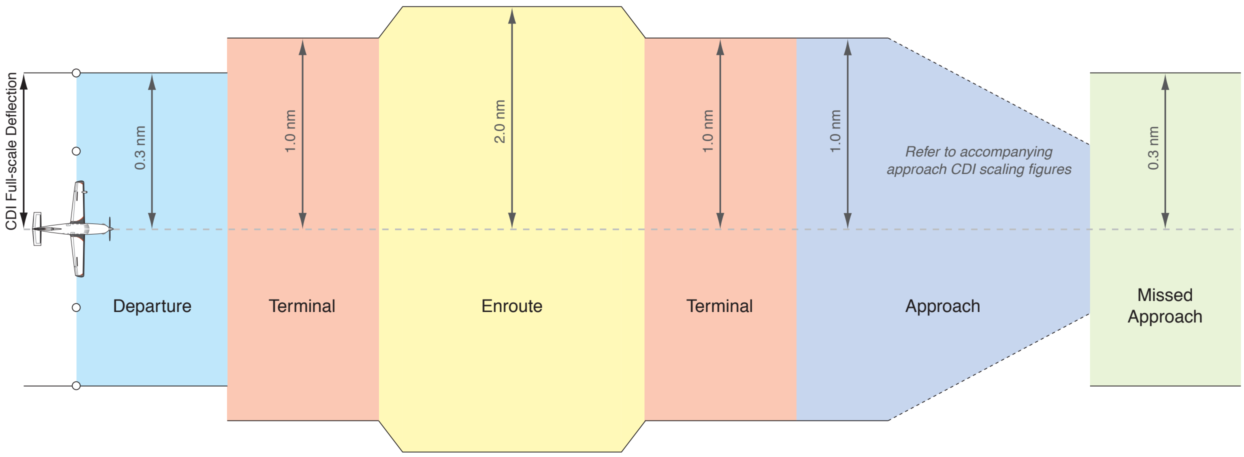


Figure 2-30 Automatic CDI Scaling

- 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 (see Figure 2-31 and Figure 2-32). This transition normally occurs within 2.0 nm of the final approach fix (FAF). The CDI switches to approach scaling automatically once the approach procedure is activated or if 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.

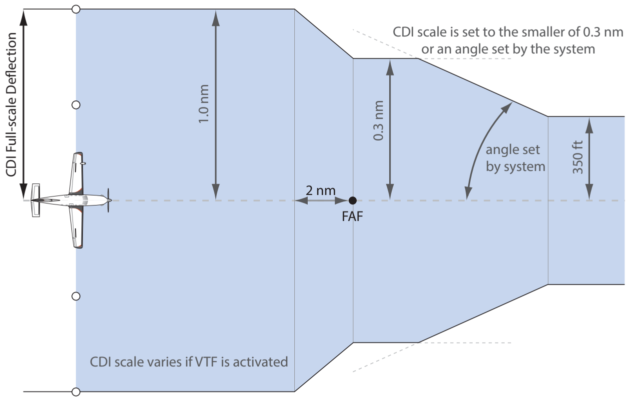


Figure 2-31 Typical LNAV, LNAV+V, and Visual Approach Service Level CDI Scaling

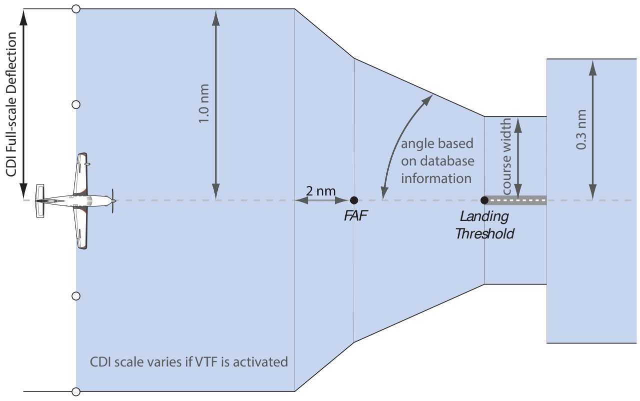


Figure 2-32 Typical LNAV/VNAV, LP, LP+V, and LPV Approach Service Level CDI Scaling

• 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

<table>
<tr><th>Flight Phase</th><th>Annunciation*</th><th>Automatic CDI Full-scale Deflection</th></tr>
<tr><td>Departure</td><td>DPRT</td><td>0.3 nm</td></tr>
<tr><td>Terminal</td><td>TERM</td><td>1.0 nm</td></tr>
<tr><td>Enroute</td><td>ENR</td><td>2.0 nm</td></tr>
<tr><td>Oceanic</td><td>OCN</td><td>4.0 nm</td></tr>
<tr><td>Approach (Non-precision)</td><td>LNAV</td><td rowspan="3">1.0 nm decreasing to 350 feet depending on variables (Figure 2-31)</td></tr>
<tr><td rowspan="2">Approach (Non-precision with Advisory Vertical Guidance)</td><td>LNAV+V</td></tr>
<tr><td>VISUAL</td></tr>
<tr><td>Approach (LNAV/VNAV)</td><td>L/VNAV</td><td rowspan="4">1.0 nm decreasing to a specified course width, then 0.3 nm, depending on variables (Figure 2-32)</td></tr>
<tr><td>Approach (LPV)</td><td>LPV</td></tr>
<tr><td>Approach (Non-precision with Advisory Vertical Guidance)</td><td>LP+V</td></tr>
<tr><td>Approach (LP)</td><td>LP</td></tr>
<tr><td>Missed Approach</td><td>MAPR</td><td>0.3 nm</td></tr>
</table>

** 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 GPS flight plan (GPS must be the selected navigation source), but retains the current "active-to" waypoint as the navigation reference even after passing the waypoint. OBS is annunciated to the lower right of the aircraft symbol when OBS Mode is selected.

While OBS Mode is enabled, a course line is drawn through the Active-to waypoint on the moving map. If desired, the course to/from the waypoint can now be adjusted. When OBS Mode is disabled, the 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.

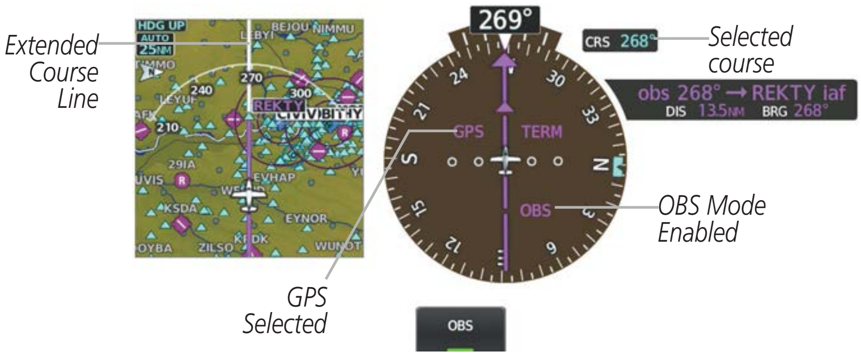


Figure 2-33 Omni-bearing Selector (OBS) Mode Enabled

Figure 2-34 Omni-bearing Selector (OBS) Mode Disabled

Enabling/disabling OBS Mode while navigating a GPS 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. Selecting the **SUSP** Button or Softkey deactivates the suspension and resumes automatic sequencing of approach waypoints.

Figure 2-35 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 2-36 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 that the terrain elevation contours are stored in squares measuring 4.9 arc-seconds on each side, is required for the operation of SVT. Loss of any of the required data, including temporary loss of the GPS signal, will cause SVT to be disabled (although the softkeys will still appear functional) until the required data is restored.

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

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

SVT can be displayed on the Multifunction Display (MFD) in Reversionary Mode. If SVT is enabled when switching to Reversionary Mode, it 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 **Synthetic Terrain**, **Horizon Heading**, **Airport Signs**, and **FPA Ref Settings**. 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 **Horizon Heading**, **Airport Signs**, and **FPA Ref Settings** 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.
- **FPA Ref** enables the Flight Path Reference Angle overlay on the PFD.

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 > SVT**.

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** > **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** > **SVT Airport Signs**.

Enabling/disabling Flight Path Angle Reference Settings:

1) Press the **PFD Settings** Softkey.
2) Press the **Attitude Overlays** Softkey.
3) Press the **FPA Ref Settings** Softkey.
4) Press the desired climb/descent angle softkey.
5) Press the **FPA** Softkey to display the Flight Path Angle Reference**.** The Flight Path Angle Reference display will cycle through OFF, MANUAL, and AUTO with each press of the **FPA** Softkey.

   Or:

   From PFD Home, touch **PFD Settings** > **FPA Reference**.

SVT FEATURES

Figure 2-37 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 2-38 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.

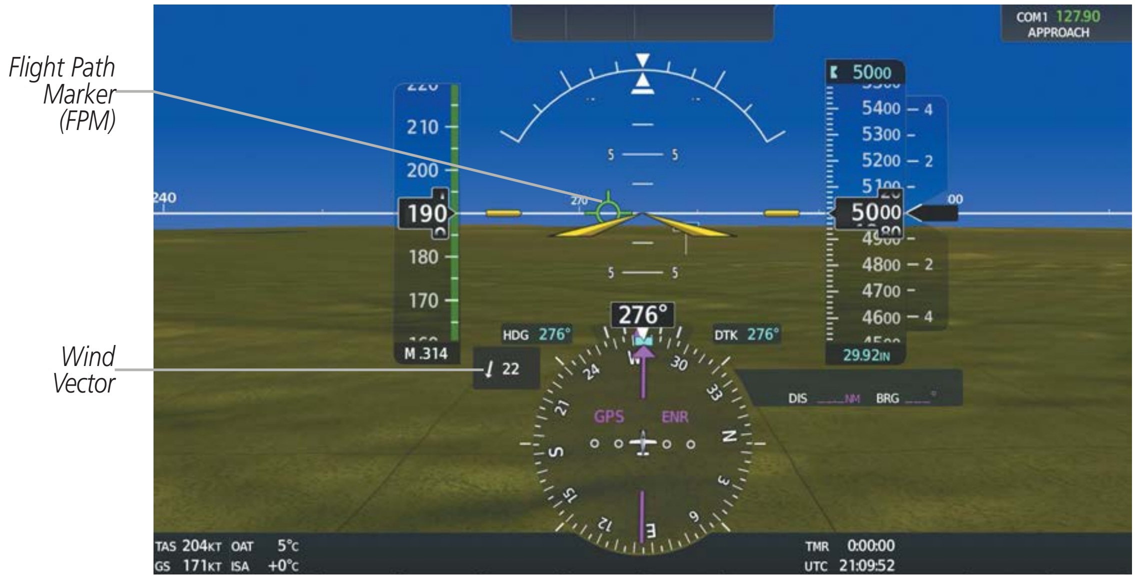


Figure 2-39 Flight Path Marker Position is Affected by Wind

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.

FLIGHT PATH ANGLE REFERENCE

The Flight Path Angle (FPA) Reference provides a visual indication of the desired climb/descent angle on the SVT pitch ladder. When activated, the FPA Reference will serve as a guide for the flight path marker to aid the crew in achieving the proper vertical flight profile. The FPA Reference can be set manually between -9.9 and +9.9 degrees of pitch. When set to AUTO, the system will generate the appropriate FPA reference when VNV is enabled.

Figure 2-40 Flight Path Angle Reference

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 GPS or GPS overlay flight plan leg is represented by magenta boxes that correspond to the magenta CDI. A localizer course is represented by green boxes that correspond to a green CDI. An inactive leg of an active flight plan is represented by gray boxes corresponding to a white line drawn on the Inset map or MFD map indicating an inactive leg.

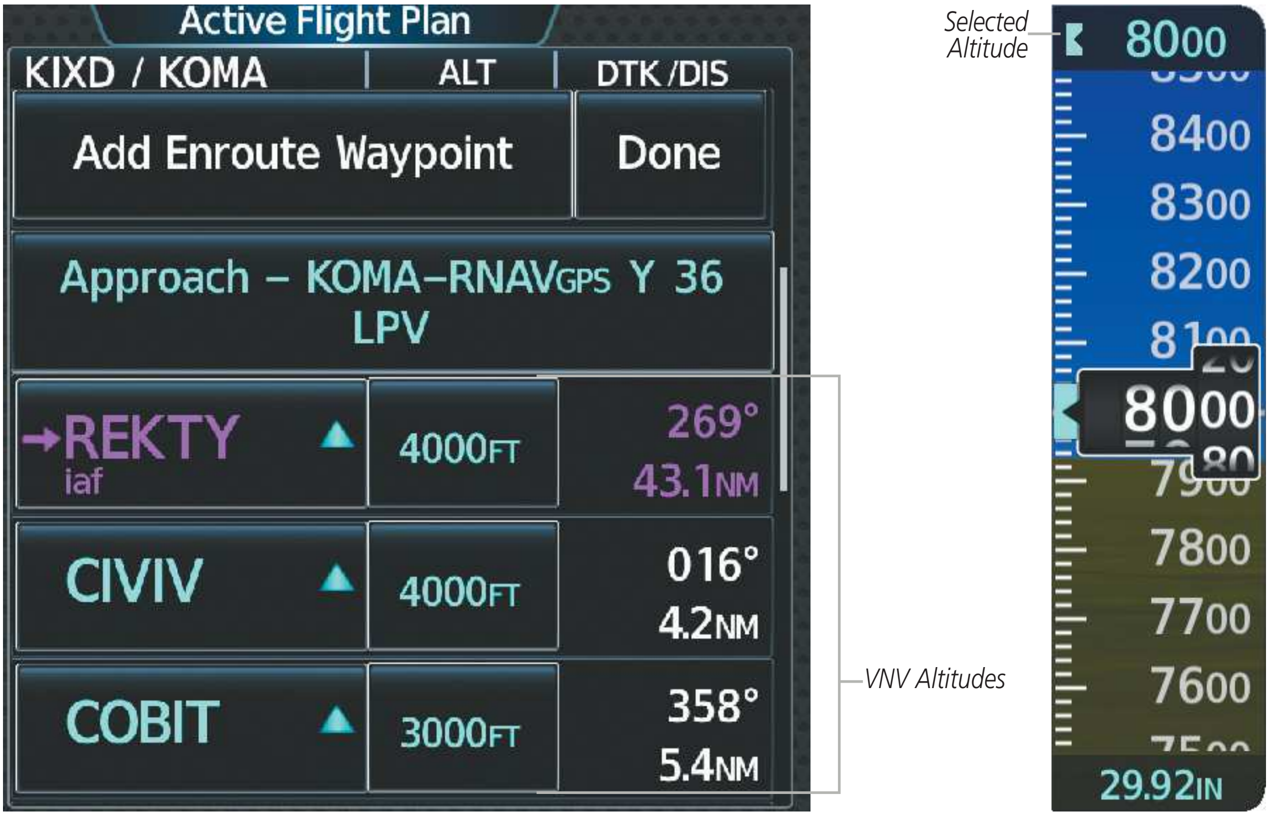


Figure 2-41 VNV and Selected Altitude

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 GPS leg or active leg with a GPS overlay. If this leg of the flight plan route is outside the SVT field of view, pathways will not be visible until the aircraft has turned toward this leg. While approaching the center of the active leg and prescribed altitude, the number of pathway boxes decreases to a minimum of four.

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

Descent and Approach

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

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

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

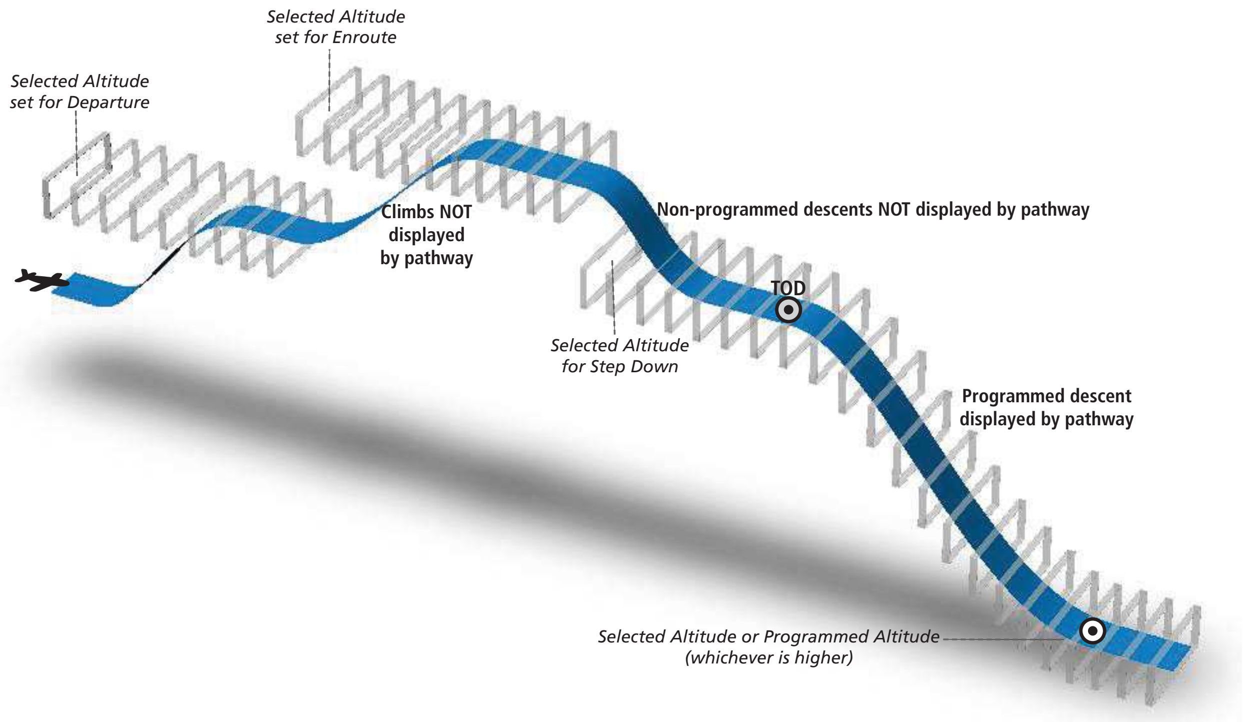


Figure 2-42 SVT Pathways, Enroute and Descent

Missed Approach

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

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

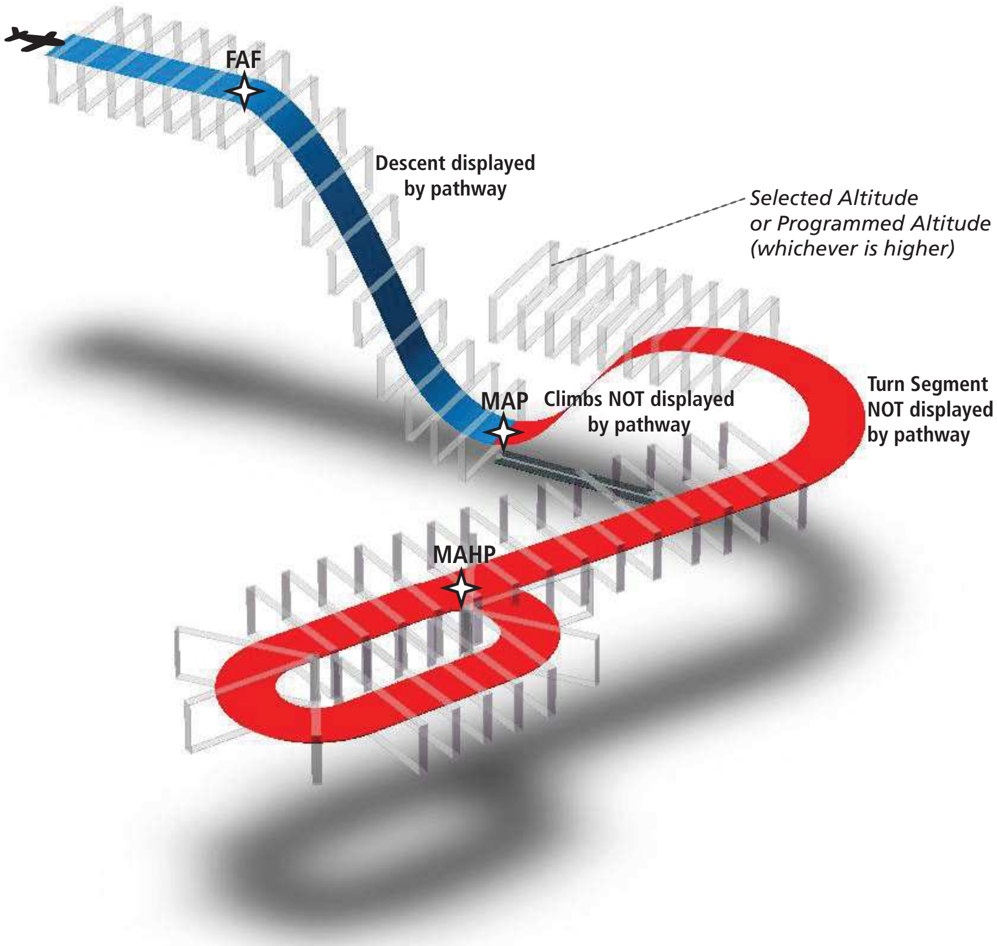


Figure 2-43 SVT Pathways, Approach, Missed Approach, and Holding

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 2-44 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 page, and MFD Terrain Page. 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 2-45 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).

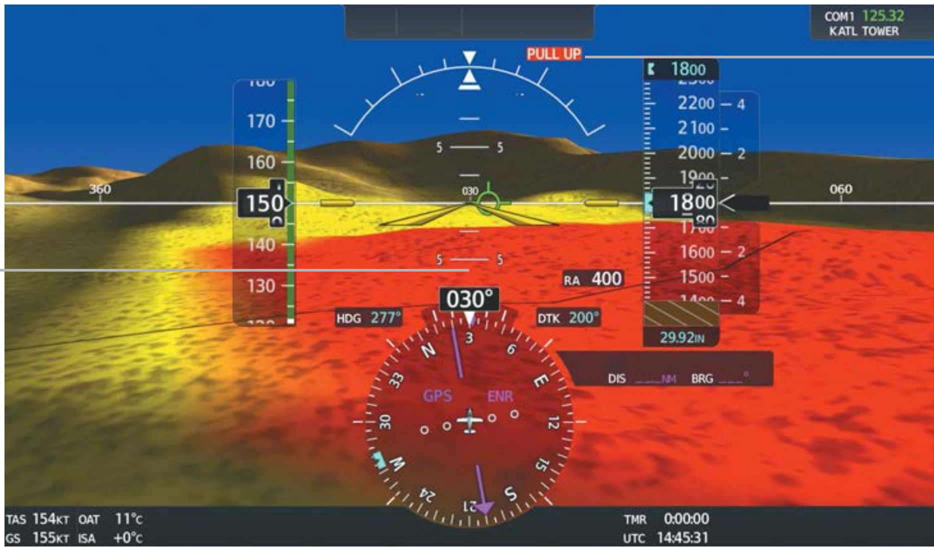


Figure 2-46 Terrain Warning

FIELD OF VIEW

The PFD field of view can be represented on the MFD Navigation Map Page. Two dashed lines forming a V-shape in front of the aircraft symbol on the map, represent the forward viewing area shown on the PFD.

Enabling or Disabling the field of view indication:

1) From MFD Home, touch **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*

Figure 2-47 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 2-48 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.

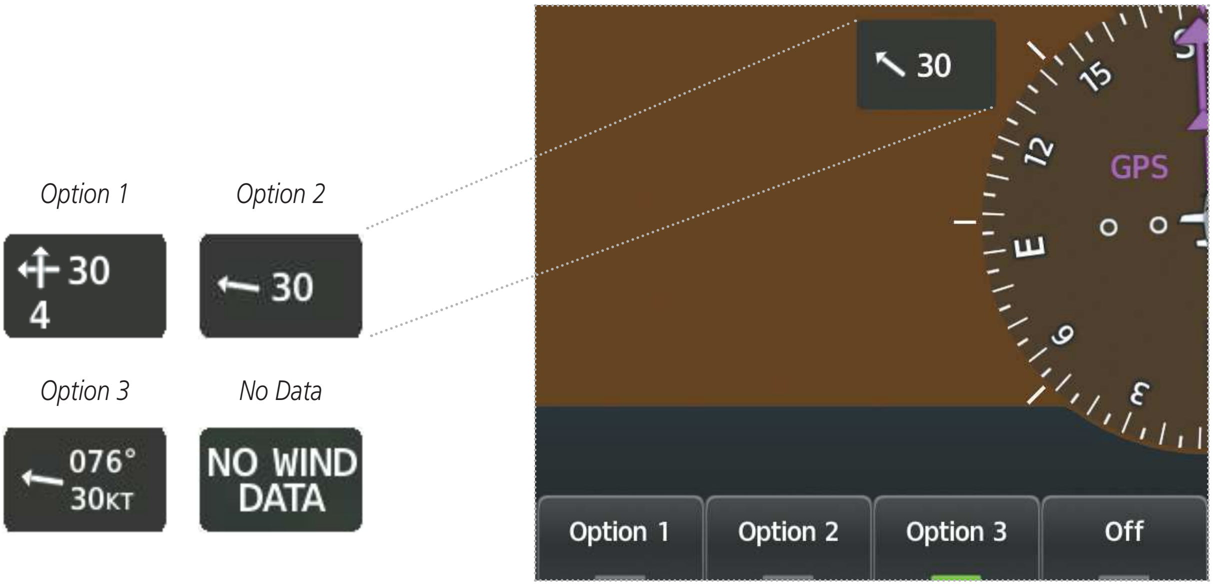


Figure 2-49 Wind Data

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**.
2) Touch the Wind datafield and touch **Option 1**, **Option 2**, or **Option 3**.
3) Touch **Wind** to toggle the window.

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 AOA Indicator can be set to display (on) or be hidden (off).

Figure 2-50 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 2-51 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.

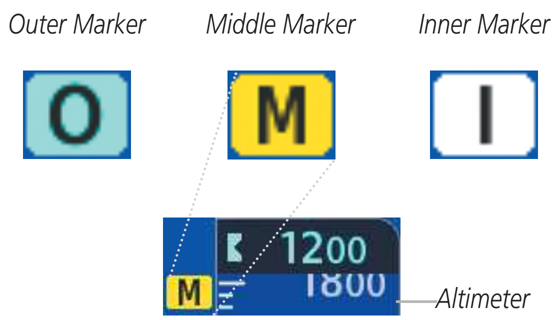


Figure 2-52 Marker Beacon Annunciations

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 (±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 2-53 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.

Figure 2-54 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 2-55 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 2-56 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 2-57 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.

Figure 2-58 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 2-59 Altimeter Displaying the Ground Line (Radio Alt)

Figure 2-60 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

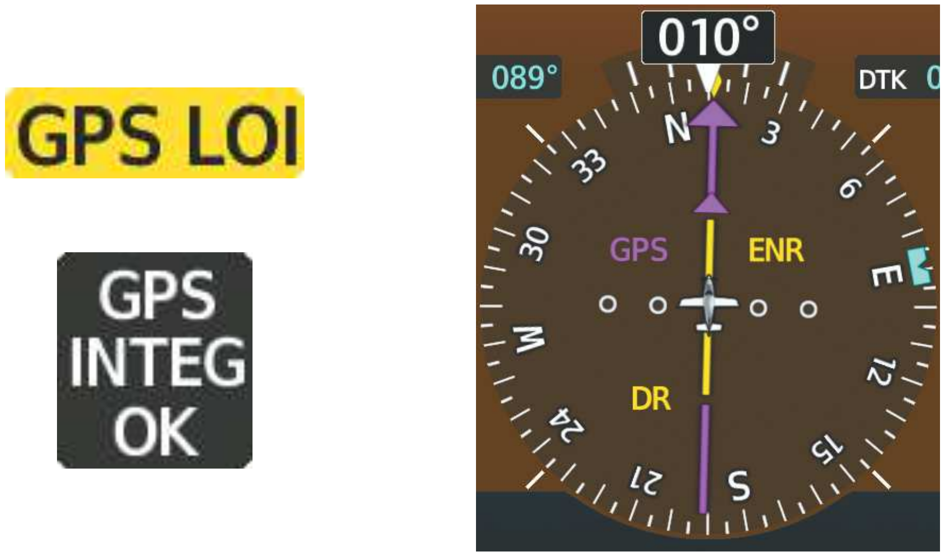


Figure 2-61 Example of HSI Annunciations

Dead Reckoning (DR) Mode causes the following items on the PFD to be shown in amber when GPS 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 2-62 Sensor Comparator Annunciations on the PFD

Annunciation	Condition
ALT	Difference in altitude sensors is ≥ 200 ft.
IAS	If either airspeed sensor detects ≥ 35 knots, and the difference in sensors is > 10 knots.
	If either airspeed sensor detects ≥ 80 knots, and the difference in sensors is > 7 knots.
HDG	Difference in heading sensors is > 6 degrees.
PIT	Difference in pitch sensors is > 5 degrees.
ROL	Difference in roll sensors is > 6 degrees.
VDI	Difference in temperature compensated altitudes is > 50 ft.
ALT	No data from one or both altitude sensors.
IAS	No data from one or both airspeed sensors.
HDG	No data from one or both heading sensors.
PIT	No data from one or both pitch sensors.
ROL	No data from one or both roll sensors.
VDI	No temperature compensated altitude data available 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 2-63 Reversionary Sensor Annunciations

Reversionary Sensor Window Text	Condition
BOTH ON ADC1	Both PFDs are displaying data from ADC1.
BOTH ON ADC2	Both PFDs are displaying data from ADC2
BOTH ON AHRS1	Both PFDs are displaying data from AHRS1.
BOTH ON AHRS2	Both PFDs are displaying data from AHRS2.
BOTH ON GPS1	Both PFDs are displaying data from GPS1.
BOTH ON GPS2	Both PFDs are displaying data from GPS2.
USING ADC1	PFD2 is displaying data from ADC1. Shown while PFD1 is displaying data from ADC2.
USING ADC2	PFD1 is displaying data from ADC2. Shown while PFD2 is displaying data from ADC1.
USING AHRS1	PFD2 is displaying data from AHRS1. Shown while PFD1 is displaying data from AHRS2.
USING AHRS2	PFD1 is displaying data from AHRS2. Shown while PFD2 is displaying data from AHRS1.
USING GPS1	PFD2 is displaying data from the #1 GPS.
USING GPS2	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
- 4.9 arc-second terrain data
- Obstacle data
- TAWS function is not available, in test mode, or failed

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.

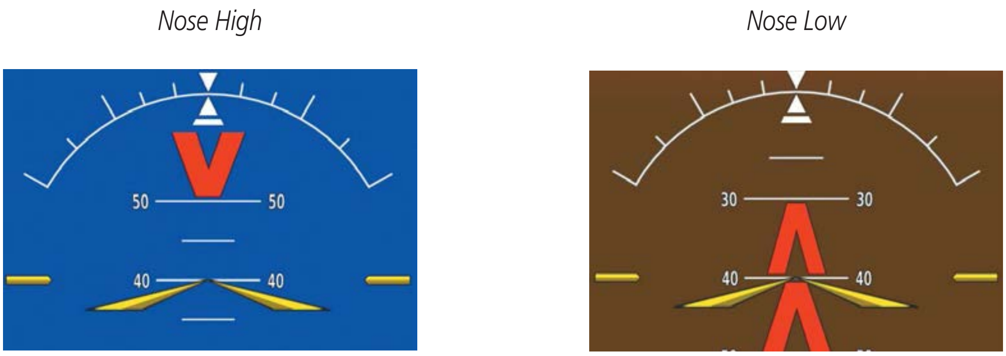


Figure 2-64 Pitch Attitude Warnings

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

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

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 2-65 Blue Sky Bar with Full Display Terrain

SECTION 3 ENGINE AND AIRFRAME SYSTEMS

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

The G3000 offers improved flight operations and reduces crew workload by automatically monitoring critical system parameters and providing system alerts during all phases of flight using the following:

- The **Engine Indication System** (EIS) displays electrical, fuel, engine, pressurization, and flight control information on the left side of the Multi Function Display (MFD).
- **Synoptics pages** are provided for monitoring the status of the doors, de-icing systems, electrical, and fuel.
- 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 on the left side of the MFD.

In combination with these, aural alerts, additional avionics messages, and master indicators are used to inform the crew of aberrant flight conditions.

Refer to the Appendices section for information on CAS messages and functionality.

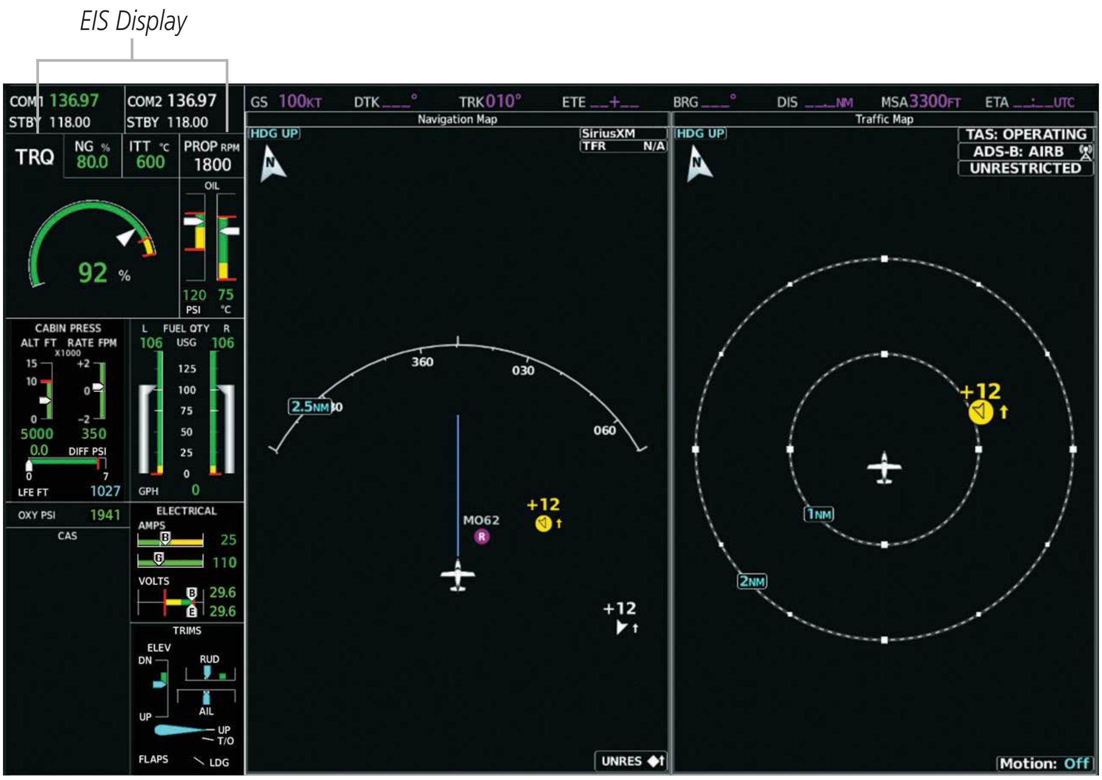


Figure 3-1 Multi Function Display

3.1 ENGINE INDICATION SYSTEM (EIS)

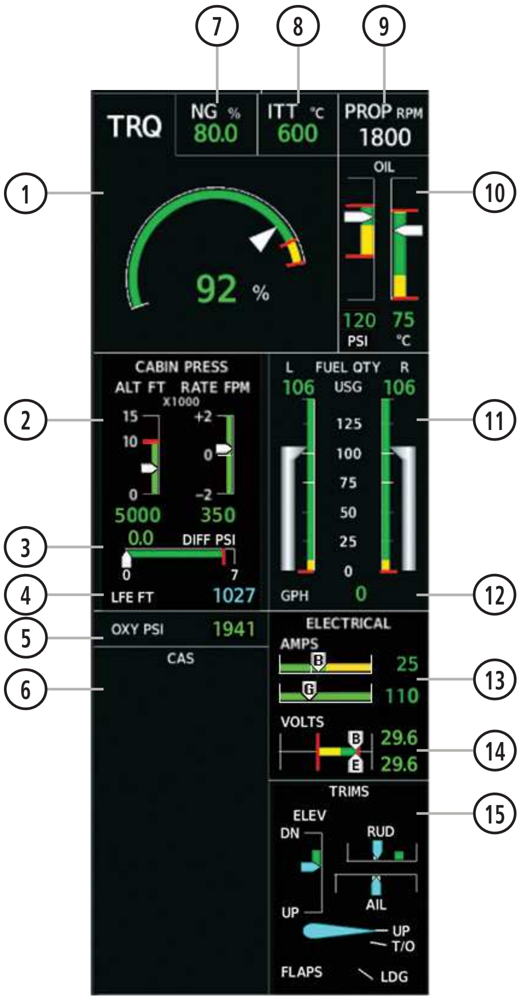


Figure 3-2 EIS Display (Normal Mode)

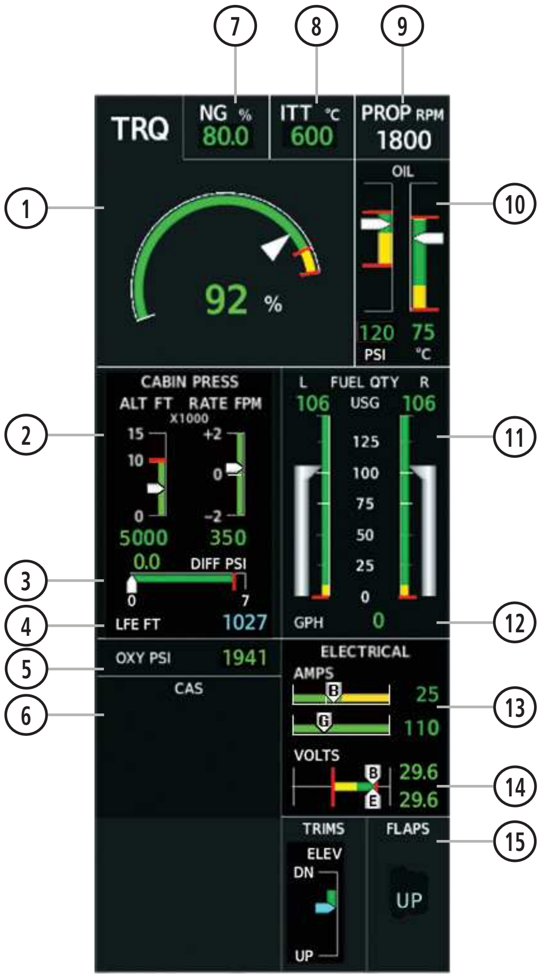


Figure 3-3 EIS Display (Reversionary Mode)

1. *Torque*
2. *Cabin Pressure Altitude and Change Rate*
3. *Differential Pressure*
4. *Landing Field Elevation (LFE)*
5. *Oxygen Pressure*
6. *CAS Display (Refer to Appendices Section)*
7. *Generator Speed*
8. *Interturbine Temperature*
9. *Propeller Speed*
10. *Oil Group: Pressure and Temperature*
11. *Fuel Quantity*
12. *Fuel Flow*
13. *Battery and Generator Currents*
14. *Battery and Essential Bus Voltages*
15. *Trim Group: Aileron, Rudder, Elevator, and Flap Position. (Aileron and Rudder Trims not displayed in Reversionary Mode).*

EIS information is presented 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.

ENGINE PARAMETERS

The EIS displays torque, generator speed, and interturbine temperature using arc gauges. The propeller speed uses digital display.

TORQUE GAUGE

The Torque Gauge displays values from 0 to 110% of maximum safe torque. If the torque exceeds 100%, an amber caution indication is displayed. If the torque exceeds 110%, a red warning indication is displayed. 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. The long range cruise is displayed as a white 'T'. When bleed pressure reaches its upper limit, 'BLEED HI' is annunciated in the upper right corner of the Torque Gauge.

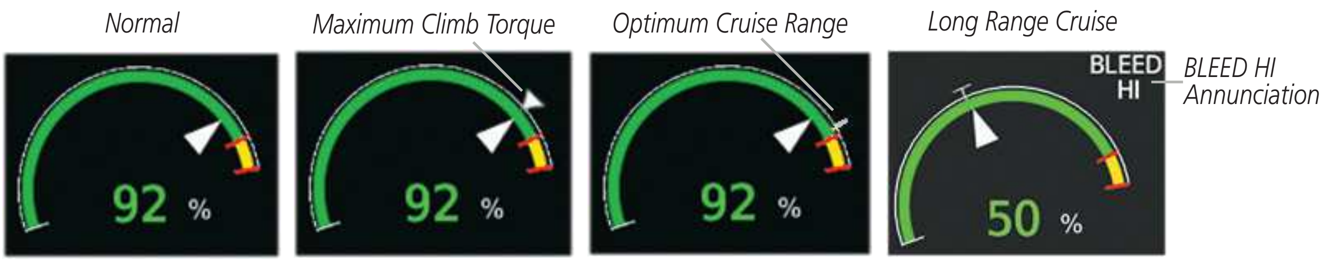


Figure 3-4 Torque Gauge

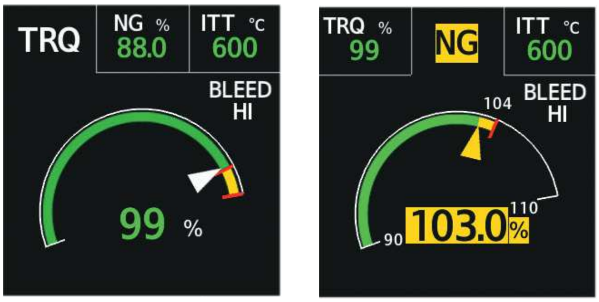
PROPELLER RPM GAUGE

Propeller speed is shown in revolutions per minute (rpm) from zero to 2200. A propeller overspeed warning is indicated if propeller speed exceeds the maximum safe operating speed.

Figure 3-5 Propeller RPM Gauge

GENERATOR SPEED GAUGE

Generator speed is indicated as a percentage of maximum safe operating speed (rpm), from 0 to 110%. If generator speed exceeds 103% an amber caution condition occurs. If generator speed exceeds 104% a red warning condition occurs. When the engine is running normally, only the digital value is displayed and no annunciations are shown.

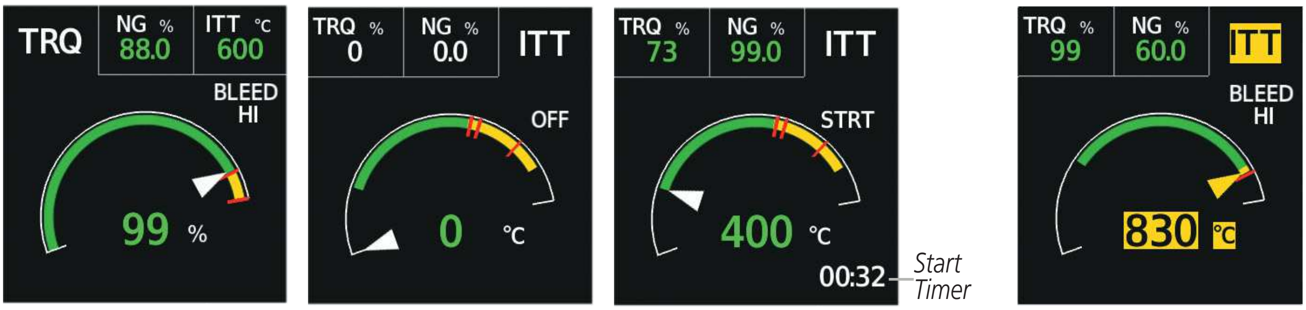


Normal Indication Cautionary Indication

Figure 3-6 Generator Speed Gauge

ITT GAUGE

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 with engine running. When the engine is not running, 'OFF' is annunciated above and to the right of the ITT display; this changes to 'STRT' upon engine start and also displays the start timer. When the engine is running normally, only the digital temperature is displayed and no annunciations are shown. Temperatures above which warnings occur are indicated by red tick marks along the ITT Gauge.



Engine Running (ITT Normal) Engine Off Engine Start ITT Cautionary

Figure 3-7 Interturbine Temperature Gauge Status Annunciations

OIL PRESSURE AND TEMPERATURE GAUGES

Engine oil pressure and temperature are shown along vertical bar indicators. Oil pressure is shown in pounds per square inch (psi) and temperature in degrees Celsius (°C).

Figure 3-8 Oil Pressure and Temperature Gauges

CABIN PRESSURIZATION

Cabin pressurization information (cabin altitude, rate of change, and differential cabin pressure) is shown at the center of the left EICAS column.

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.

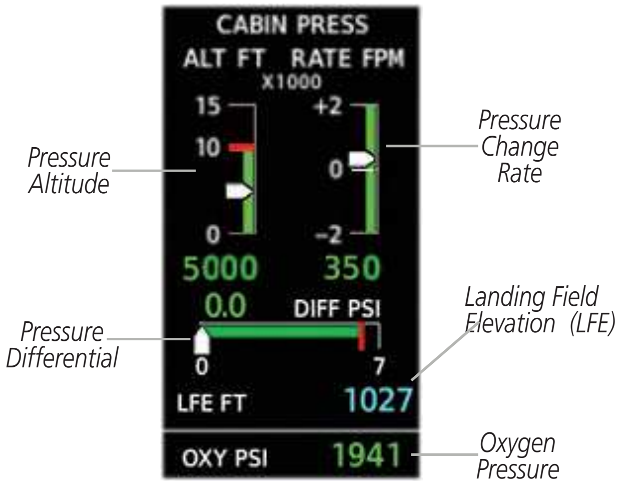


Figure 3-9 Cabin Pressure Display

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

LANDING FIELD ELEVATION (LFE)

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

Figure 3-10 FMS LFE on the Cabin Pressure Display

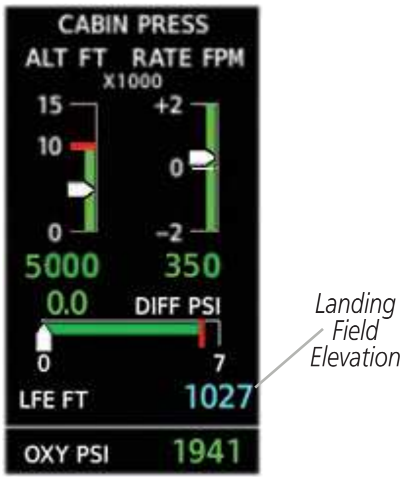


Figure 3-11 Manual LFE on the Cabin Pressure Display

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, and touch **Enter** Button or touch **Use FMS Destination** Button.

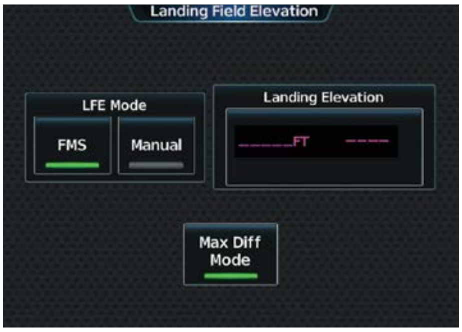


Figure 3-12 Landing Field Elevation - FMS Mode

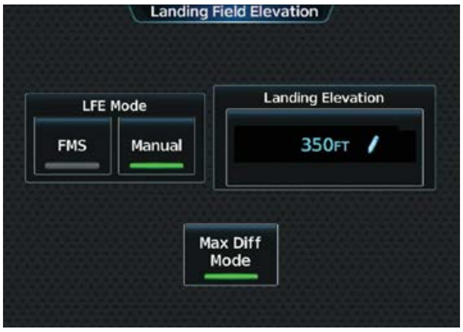


Figure 3-13 Landing Field Elevation - Manual Mode

Figure 3-14 Landing Elevation - Manual Input

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

FUEL INFORMATION

The fuel display is located beneath the Oil group display and shows the fuel quantity in each tank (in United States Gallons, USG), and fuel flow (in Gallons Per Hour, GPH). Fuel quantity for each tank is shown along a vertical slider scale.

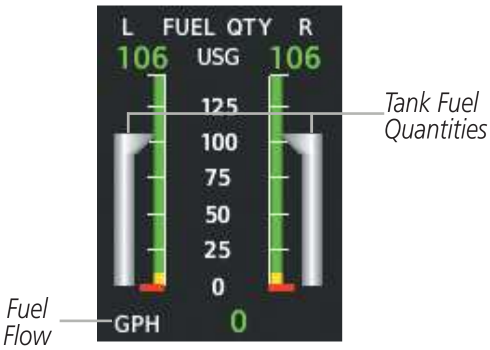


Figure 3-15 Fuel Display

ELECTRICAL INFORMATION

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.

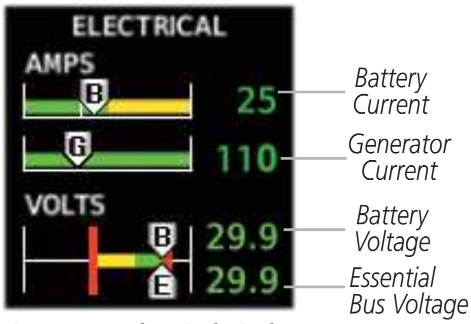
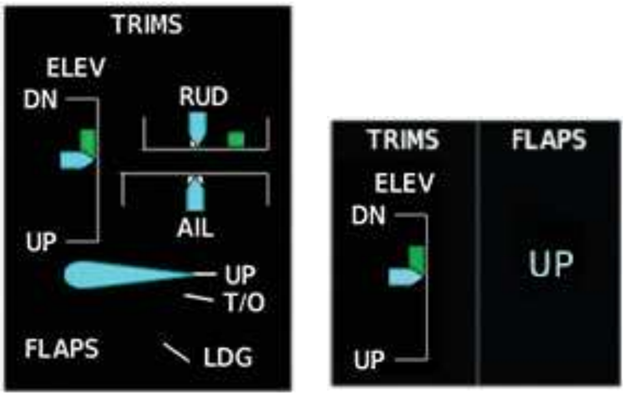


Figure 3-16 Electrical Display

TRIM AND FLAP INDICATORS

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 and Aileron trims are 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.



Normal Mode Reversionary Mode

Figure 3-17 Trim and Flap Indications

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 3-18 Systems Overview

Refer to the Flight Planning for information on how to use the **Weight and Fuel** Button functions.

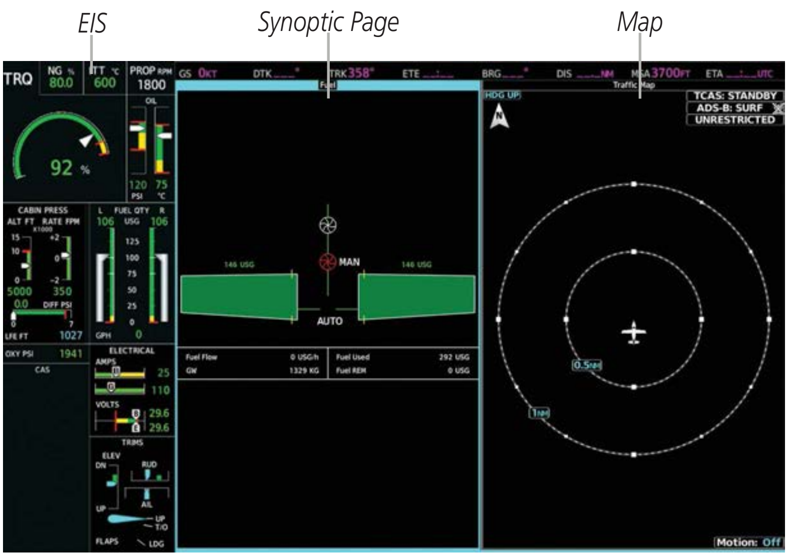


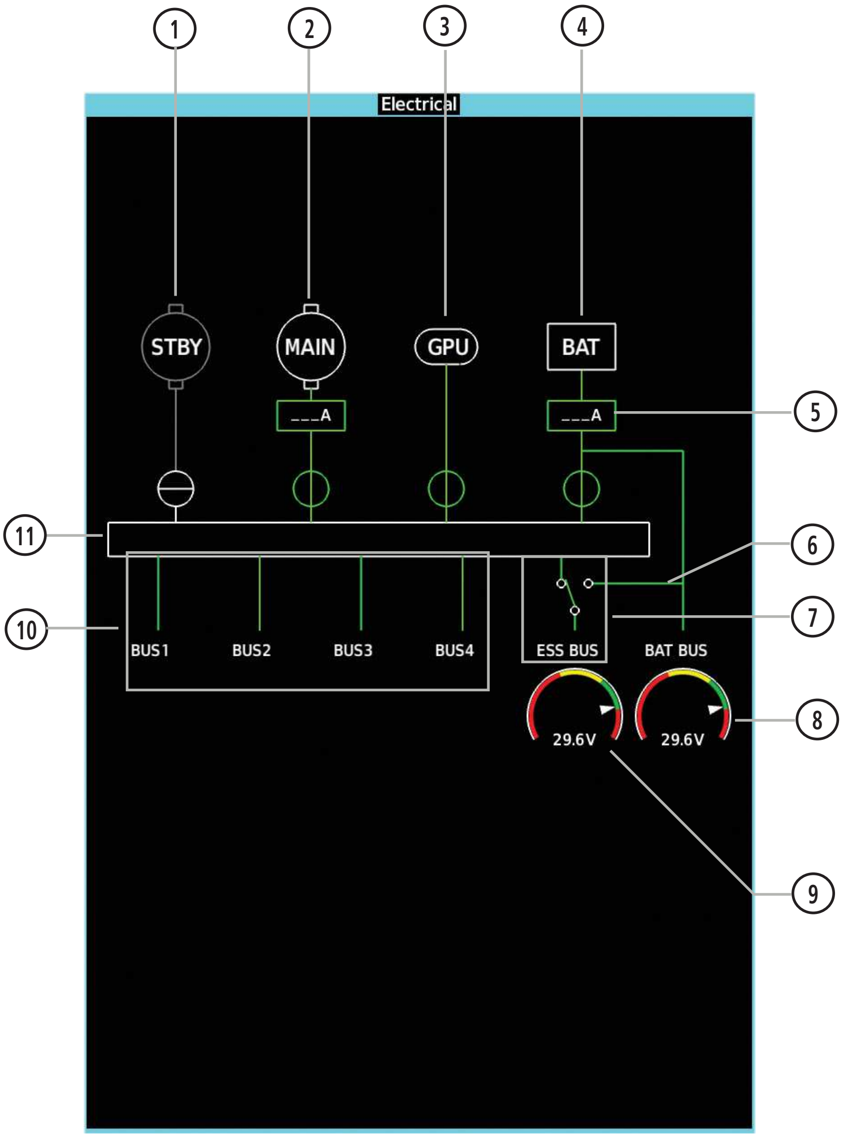
Figure 3-19 MFD Layout

ELECTRICAL SYSTEM

The Electrical Synoptics Page 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*
2. *Main Generator*
3. *Ground Power Unit Door*
4. *Battery*
5. *Amperage*
6. *Battery Bus*
7. *Essential Bus*
8. *Battery Bus Voltage*
9. *Essential Bus Voltage*
10. *DC Buses 1 through 4*
11. *Main Bus*

Figure 3-20 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.

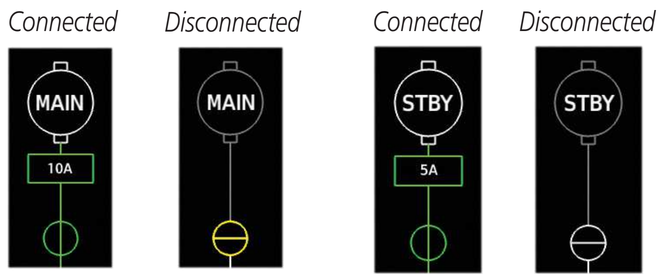


Figure 3-21 Generator Status

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.

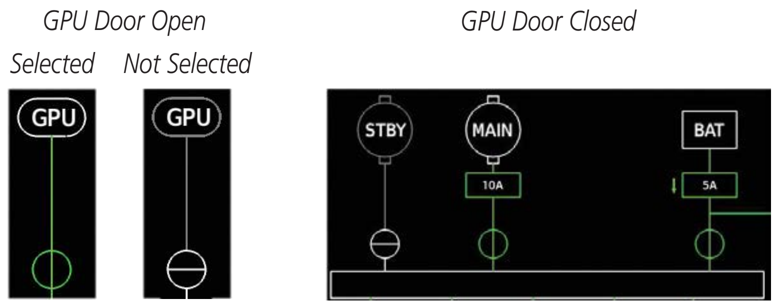


Figure 3-22 GPU Door Status

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.

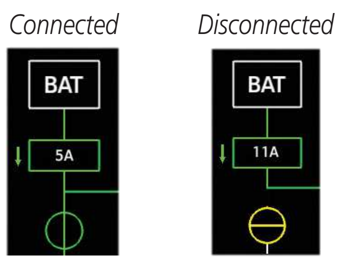


Figure 3-23 Battery Status

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 3-24 Essential Bus and Battery Over Voltage

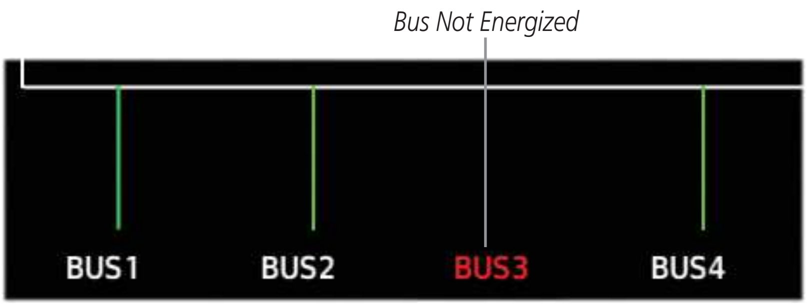


Figure 3-25 DC Bus Status

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.

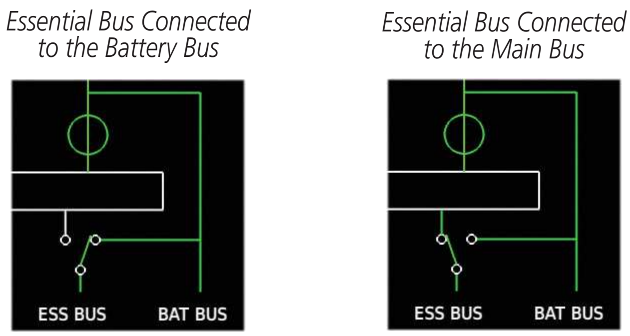


Figure 3-26 Essential Bus Connections

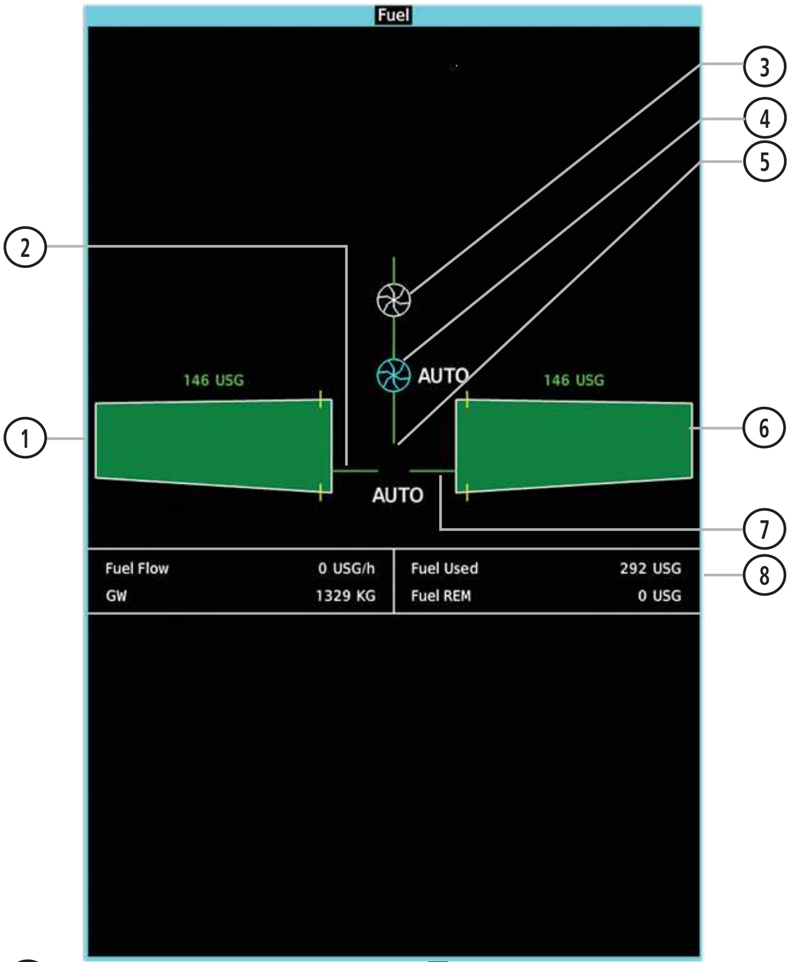
A red “X” over a component indicates invalid data or a failed unit.

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**.



1 *Left Fuel Tank*
2 *Left Fuel Line*
3 *Engine Driven Boost Pump*
4 *Auxiliary Boost Pump*
5 *Fuel Selector*
6 *Right Fuel Tank*
7 *Right Fuel Line*
8 *Fuel Flow Data*

Figure 3-27 Fuel Synoptics Page

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).

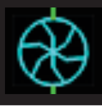
Fuel Boost Pump On	Fuel Boost Pump Off (Auto)	Fuel Boost Pump Off (Manual)
		

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).

Figure 3-28 Fuel Flow Data

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

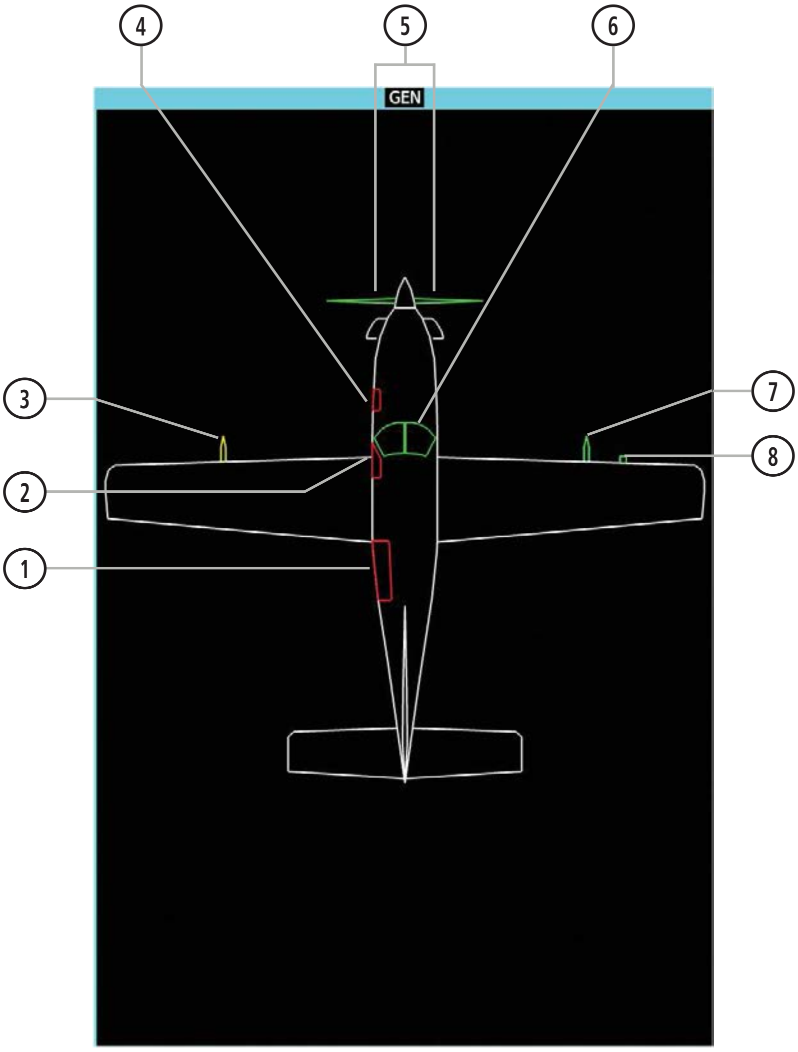
GENERAL SYSTEMS

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)
- 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**.



1 *Cabin Door Open*
2 *Pilot Door Open*
3 *Pitot Probe 1*
4 *Forward Cargo Door Open*
5 *Propeller Heaters*
6 *Right Windshield Heat On*
7 *Pitot Probe 2*
8 *Stall Warning Sensor*

Figure 3-29 General Synoptics Page

Figure 3-30 Windshield Heat Status

3.3 LIGHTING CONFIGURATION

The Interior Lights Screen on the Touchscreen Controller provides control of the following interior lights:

Adjusting the Interior Lights Configuration Settings:

1) From **MFD Home**, touch **Aircraft Systems > Lighting Config.**

2) Touch '**+**' or '**-**', or touch and slide right or left on the slider bar to increase or decrease the light intensity.

Figure 3-31 Interior Lights Screen

3.4 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 3-32 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 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
- Cockpit Speaker
- Bluetooth
- 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 Home'** Screen 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 **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. Also enables Bluetooth audio control when devices are paired with the Flight Stream 510 or GMA 36B.

14 **Intercom** Button – Displays the 'Intercom' Screen used to connect or isolate pilot, copilot, and passengers and to control volume and squelch settings.

15 **MON** Button – Controls which COM receiver is being monitored.

16 **Pilot Music 1** Button – Enables/Disables the 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 – Indicates the current Code and Mode of the transponder and displays the 'Transponder' Screen. The Transponder Screen is used to select the transponder mode by selecting a mode button. It is also used to select the code by using the keypad or by selecting the **VFR** Button. While the transponder is replying to an interrogation, an R is displayed on the button.

20 **XPDR 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).
3. **Flight ID Box –** Displays the optional Flight ID\Tail number.

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.

4.2 COM OPERATION

COM TRANSCEIVER SELECTION AND ACTIVATION

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

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

The COM1 and COM2 Frequencies are shown on the 'NAV/COM Home' Screen and also on the 'Audio & Radios' Screen. The COM transceiver can be selected for transmitting using the Touchscreen Controller.

The active COM frequency is displayed in green. The standby frequency of the COM selected for tuning is cyan. When the standby frequency of the COM selected for tuning is being tuned with the upper knobs, the entire standby frequency button is highlighted in cyan The other standby frequency is white.

Selecting a COM Radio for transmission:

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

Or:

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

Or:

1) From the 'NAV/COM Home' Screen, 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
1	COM1 selected for transmission/monitoring
2	COM2 selected for transmission/monitoring
MULTI	An additional audio source is manually selected for monitoring
HF	HF COM selected for transmission/monitoring

Table 4-1 CNS Bar MIC/MON Button Symbols

TRANSMIT/RECEIVE INDICATIONS

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

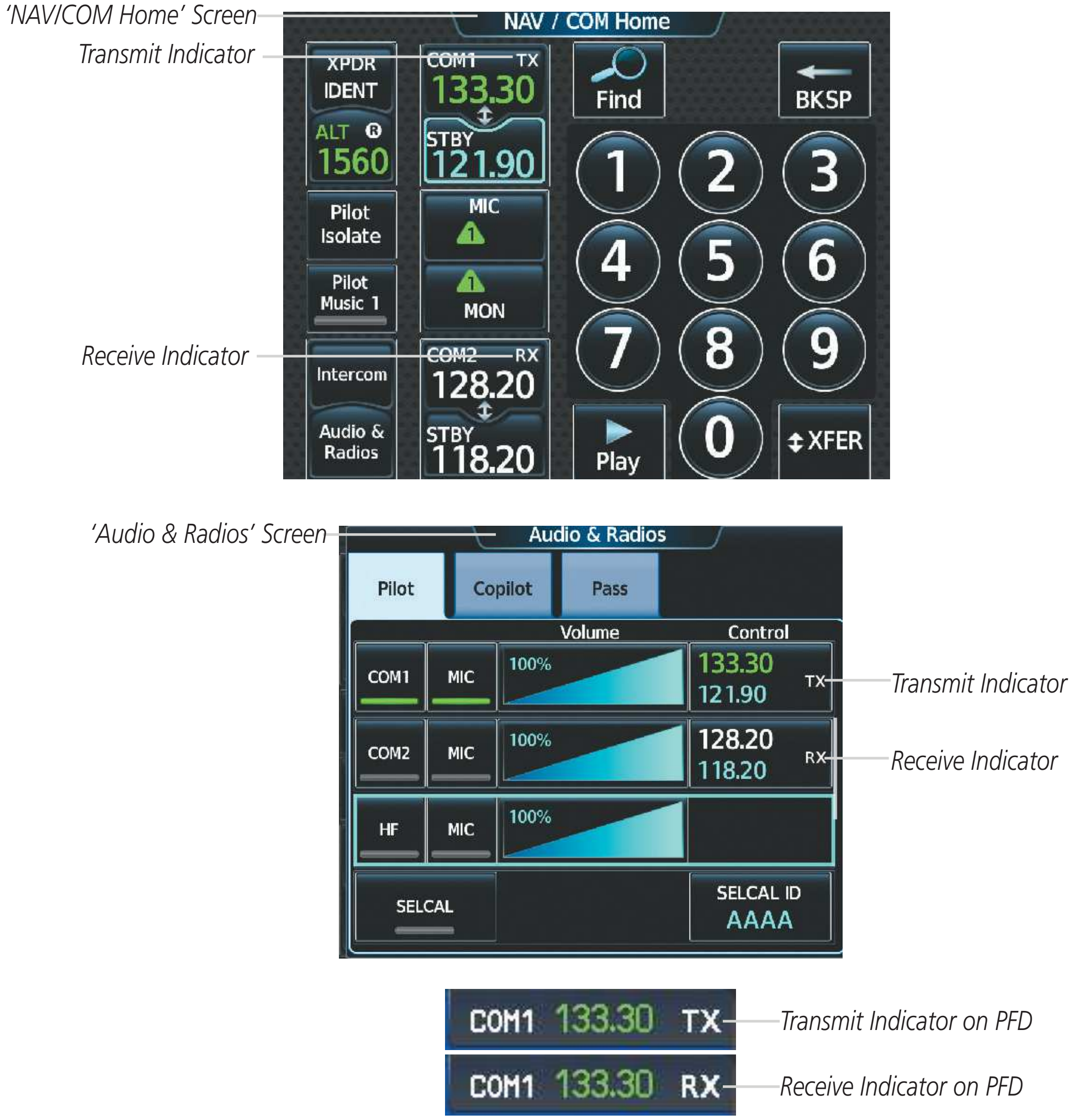


Figure 4-5 COM Radio Transmit and Receive Indications

COM FREQUENCY TUNING

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

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

Or:

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

2) Use the keypad to select the frequency.

Or:

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

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

Or:

Push the small upper knob.

Or:

Touch the COM1 or COM2 standby frequency button.

Or:

Accept the new frequency as the COM1 or COM2 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

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

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

2) Touch the COM1 or COM2 frequency button to display the keypad.

3) Select the desired frequency:

Use the keypad.

Or:

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

4) Accept the new frequency as the COM1 or COM2 standby frequency:

Touch the **Enter** Button.

Or:

Push the small upper knob.

Or:

Accept the new frequency as the COM1 or COM2 active frequency:

Touch the **XFER** Button.

Or:

Push and hold the small upper knob.

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

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

2) Touch the COM1 or COM2 volume slider button to select COM1 or COM2 for tuning.

Or:

Push the small upper knob to select COM1 or COM2 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 COM1 or COM2 active frequency and transfer the previously active frequency to the standby frequency.

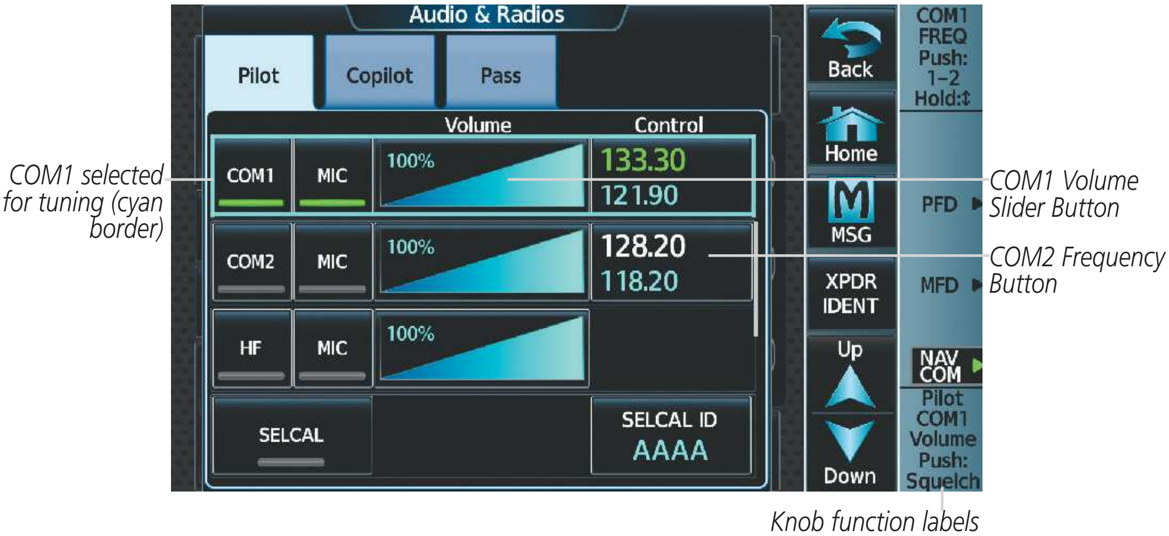


Figure 4-7 'Audio & Radios' Screen - COM Frequency Tuning

Transferring the active and standby COM frequencies:

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

Or:

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

Or:

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

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

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

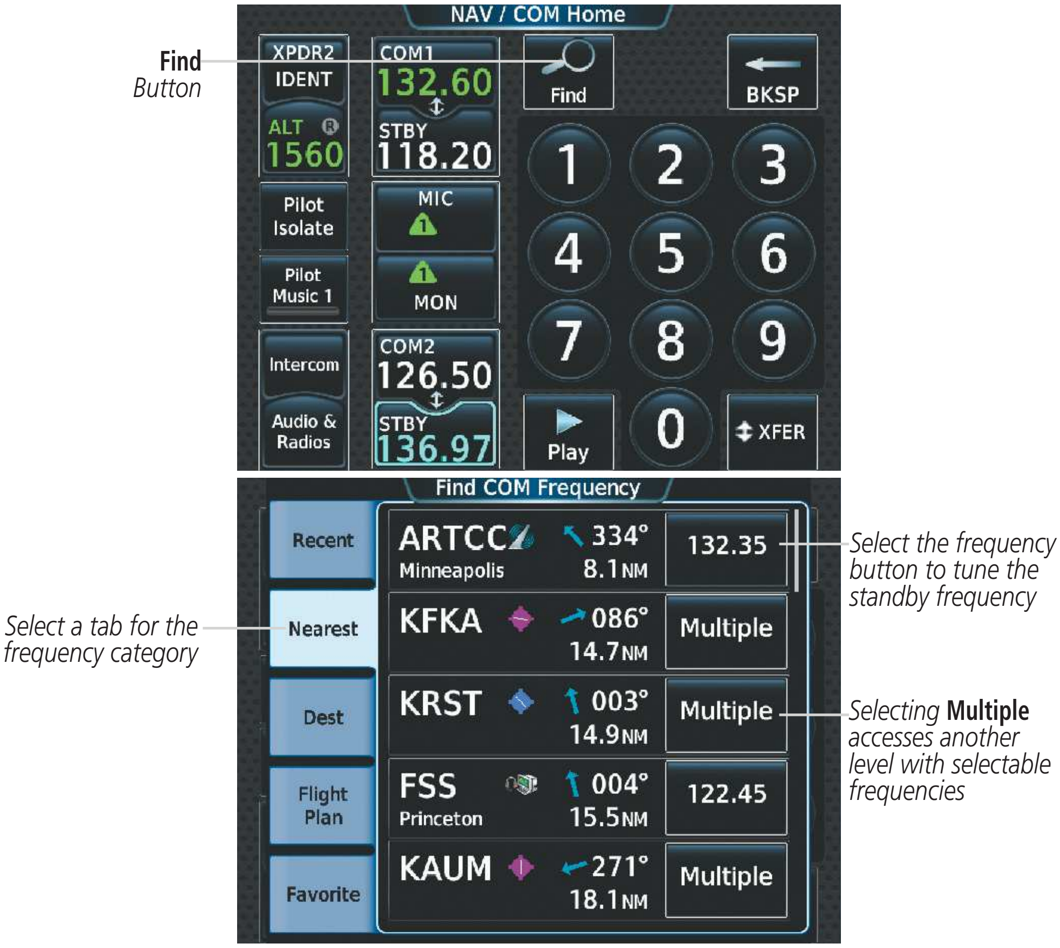


Figure 4-8 ‘Find COM Frequency’ Screen

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

1) From the ‘MFD Home’ Screen, 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 the desired airport.

4) Touch the **Freqs** Tab to display the ‘Airport Frequencies’ Screen.

5) Scroll the list to find the desired frequency.

6) Touch the **Frequency** Button to display the ‘Load Frequency’ Screen.

7) Touch the location button to load the frequency into COM1 or COM2 Active, Standby, or Favorites.

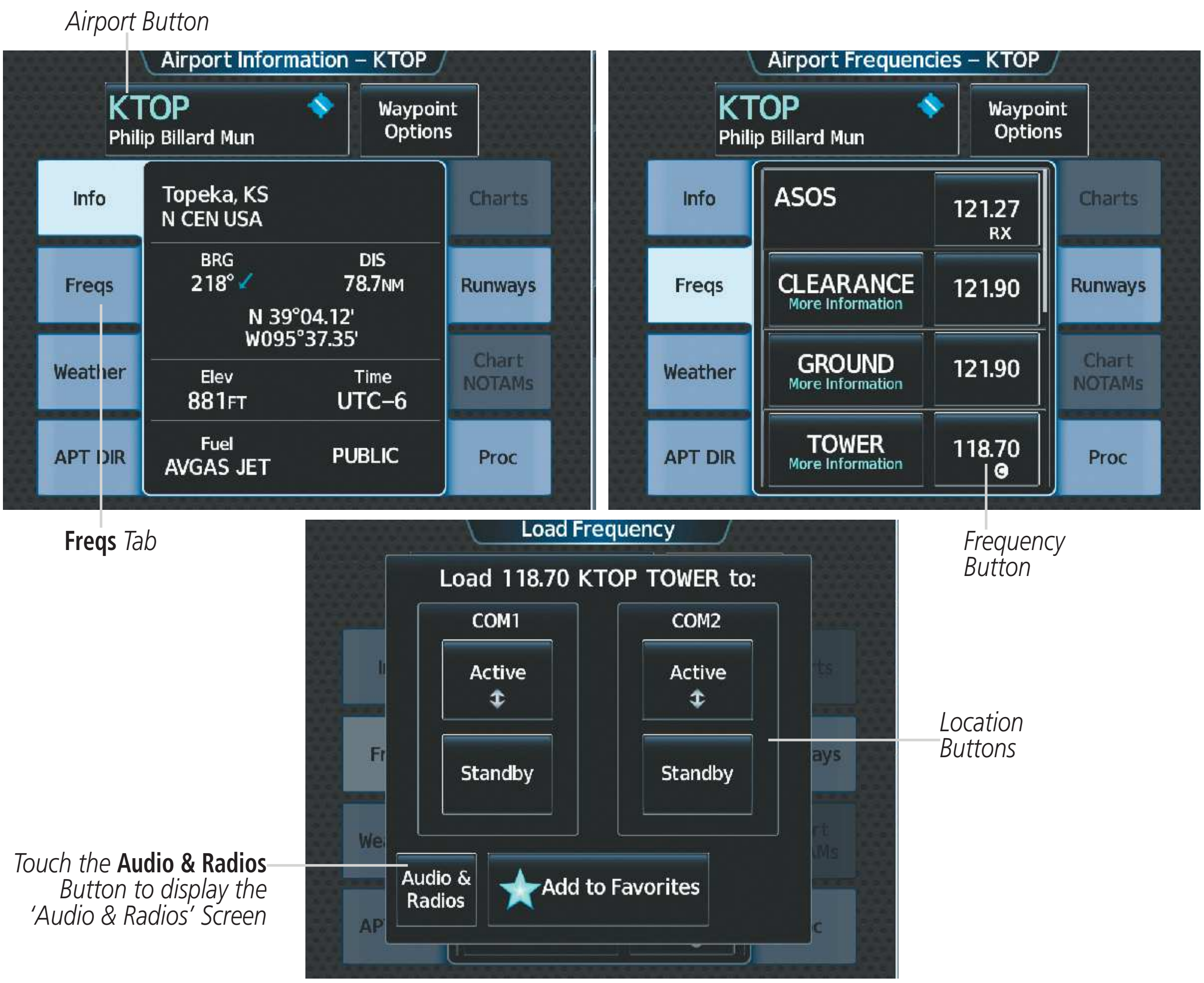


Figure 4-9 'Airport Information' Screen COM Tuning

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 the desired frequency.
8) Touch the frequency button to display the 'Load Frequency' Screen.
9) Touch the location button to load the frequency into COM1 or COM2 Active, Standby, or Favorites.

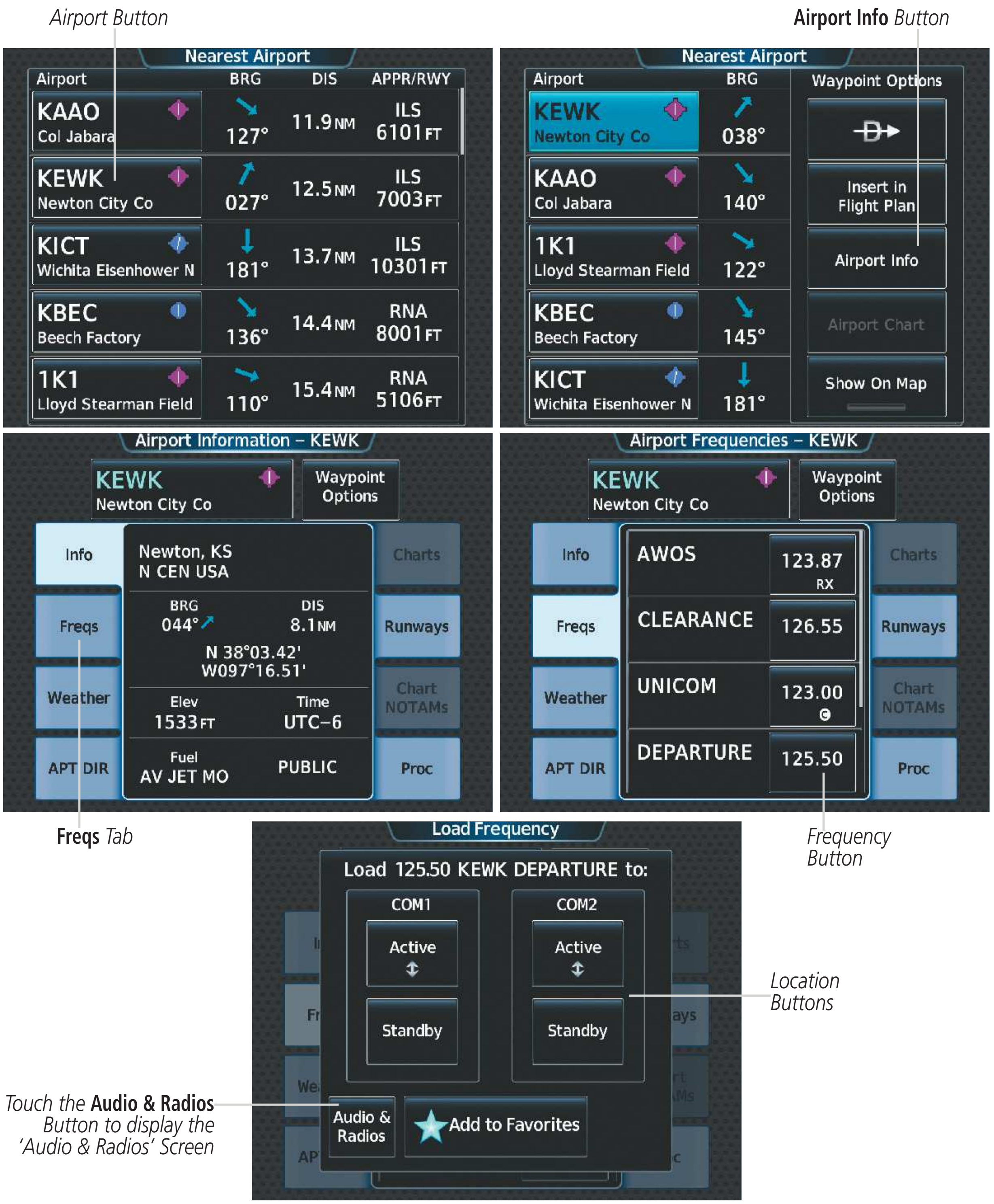


Figure 4-10 'Nearest Airport' COM Tuning

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

1) From the 'MFD Home' Screen, touch the **Nearest** Button to display the 'Nearest' Screen.
2) Select **Airspace**, **ARTCC, FSS,** or **Weather** Button.
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 into COM1/COM2 Active, Standby, or Favorites.

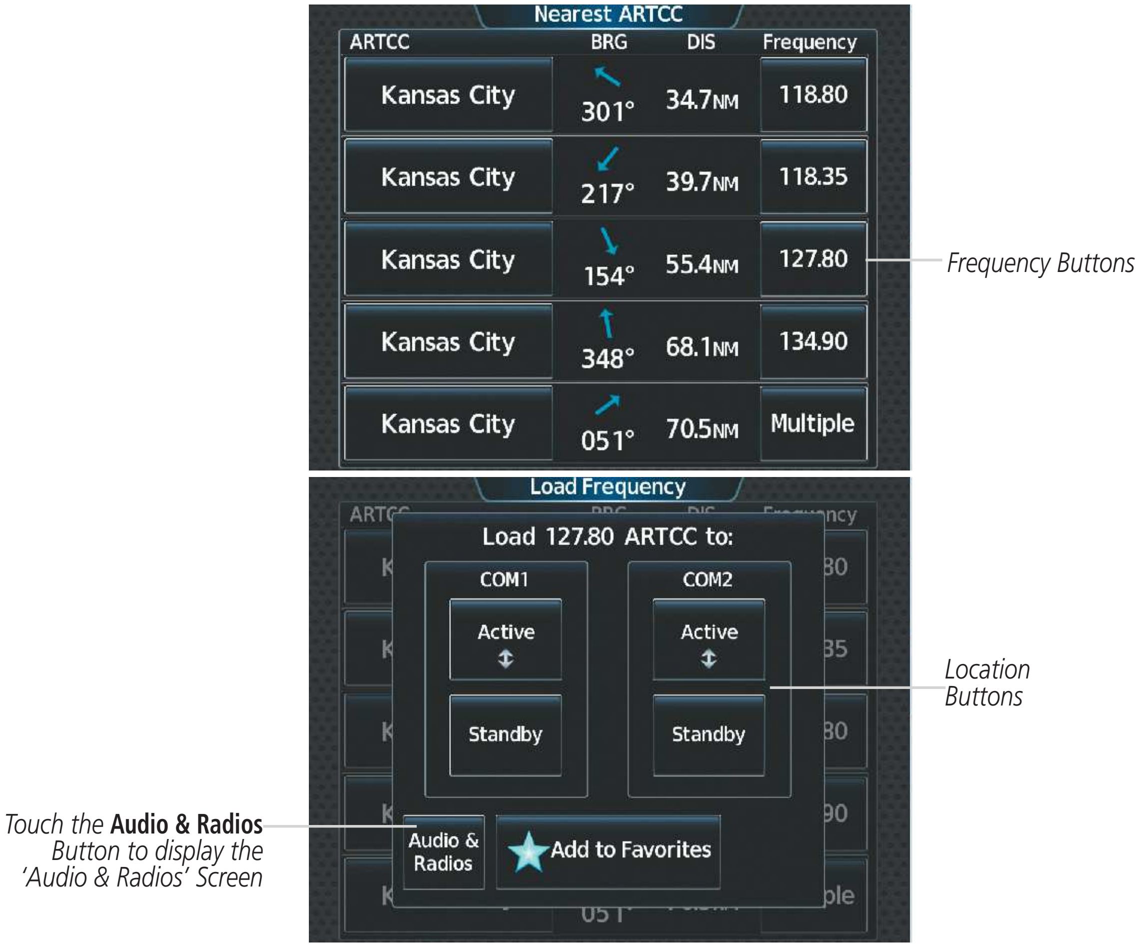


Figure 4-11 'Nearest ARTCC' Screen COM Tuning

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.

8.33-kHz Channel Spacing *25-kHz Channel Spacing*

Figure 4-12 COM Channel Spacing

Changing COM frequency channel spacing:

1) From the 'MFD Home' Screen touch the **Utilities** Button.
2) Touch the **Setup** Button.
3) Touch the **Avionics Settings** Button.
4) Scroll the list to find the **COM Channel Spacing** Button.
5) Touch the **COM Channel Spacing** Button to select desired spacing (8.33 kHz or 25.0 kHz).

Figure 4-13 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 4-14 COM Radio Automatic Squelch Disable/Enable

VOLUME

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

The pilot and copilot COM volume can be controlled independently. Select the Pilot or Copilot Tab to control the volume for that respective position. The Function Label for the lower knob will indicate which position is currently being controlled by the lower knob.

Figure 4-15 COM Volume Level

HF COM TRANSCEIVER

The optional High Frequency (HF) COM transceiver can be selected for monitoring and transmitting using the Touchscreen Controller.

Selecting the HF COM Radio for monitoring and transmitting:

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

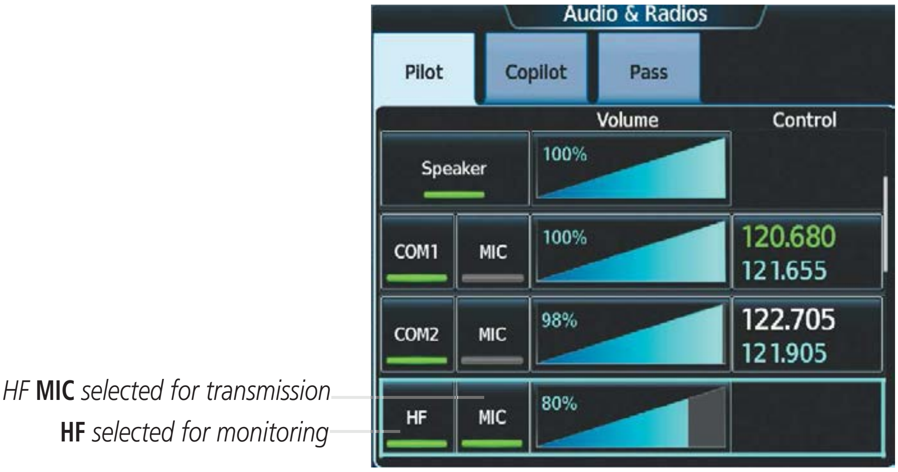


Figure 4-16 Selecting the HF COM Radio

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.

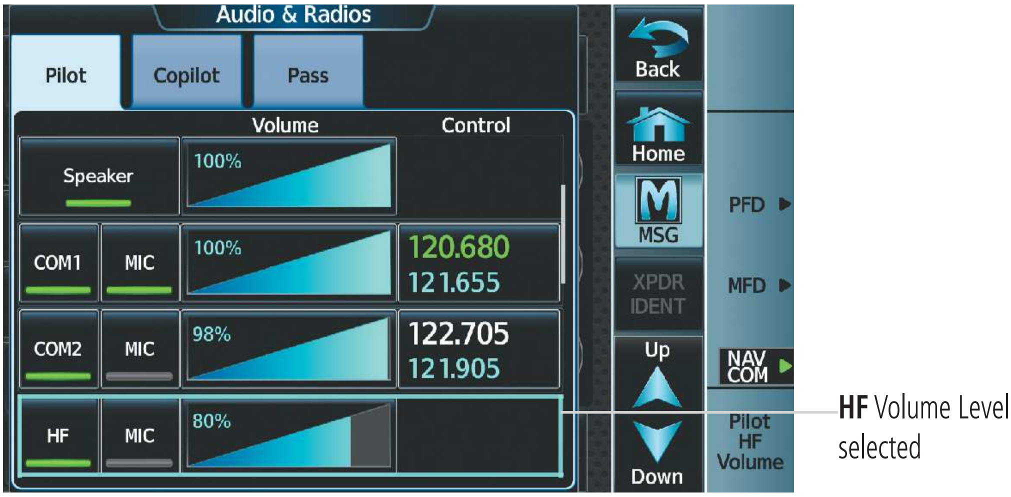


Figure 4-17 HF COM Volume Level

4.3 NAV OPERATION

NAV RADIO SELECTION AND ACTIVATION

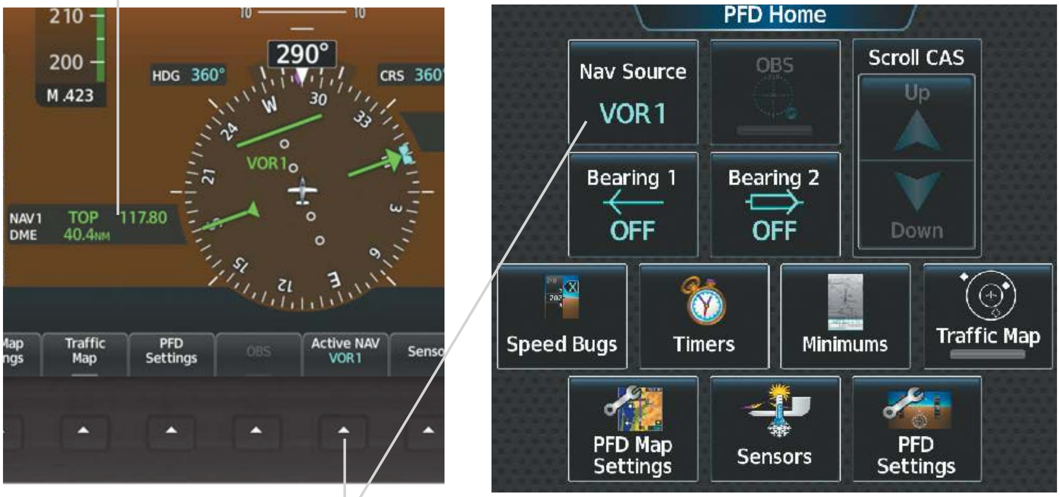
The active NAV frequency selected for navigation is shown on the PFD. Active and Standby NAV frequencies are shown on the NAV/COM Touchscreen Controller.

A NAV radio is selected for navigation by touching the **Nav Source** Button located on the 'PFD Home' Screen 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 GPS 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.
- GPS – If GPS Mode is selected, a magenta single line arrow (not shown) appears on the HSI. Both active NAV frequencies are displayed in white on the Touchscreen Controller.

NAV1 Active Frequency and ID - displayed on the PFD



*The NAV Radio is selected by touching the **NAV Source** Button displayed on the GTC 'PFD Home' Screen or by pressing the **Active NAV** Softkey on the PFD.*

Figure 4-18 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 4-19 Selecting a NAV Radio for Monitoring

Selecting/deselecting a navigation radio for monitoring:

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

NAV RECEIVER TUNING

The NAV frequencies are tuned from the Touchscreen Controller.

Figure 4-20 'Audio & Radios' Screen - NAV1/NAV2 Frequency Tuning

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

1) From, 'NAV/COM Home' Screen, touch the **Audio & Radios** Button to display the 'Audio & Radios' Screen.
2) Touch the NAV1/NAV2 frequency button to display the 'NAV1/NAV2 Standby' Screen.
3) 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) Accept the new frequency as the NAV1/NAV2 standby frequency.

      Touch the **Enter** Button.

      Or:

      Push the small upper knob.

   Or:

   Accept the new frequency as the NAV1/NAV2 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 4-21 NAV Frequency Tuning Window

Or:

1) From 'NAV/COM Home' Screen, touch the **Audio & Radios** Button to display the 'Audio & Radios' Screen.
2) Touch the NAV1/NAV2 volume slider to select NAV1/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/NAV2 active frequency and transfer the previously active frequency to the standby frequency.

Transferring the active and standby NAV frequencies:

1) From 'NAV/COM Home' Screen, touch the **Audio & Radios** Button to display the 'Audio & Radios' Screen.
2) Scroll the list to find **NAV1** or **NAV2**.
3) Touch the NAV1/NAV2 frequency button to display the 'NAV1/NAV2 Standby' Screen.
4) Touch the **XFER** Button to transfer the frequencies.

Or:

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

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

1) From 'MFD Home' Screen, 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 NAV1/2 Active/Standby or Favorites.
8) Touch the **Done** Button or the **Back** Button to return to the 'Airport Frequencies' Screen.

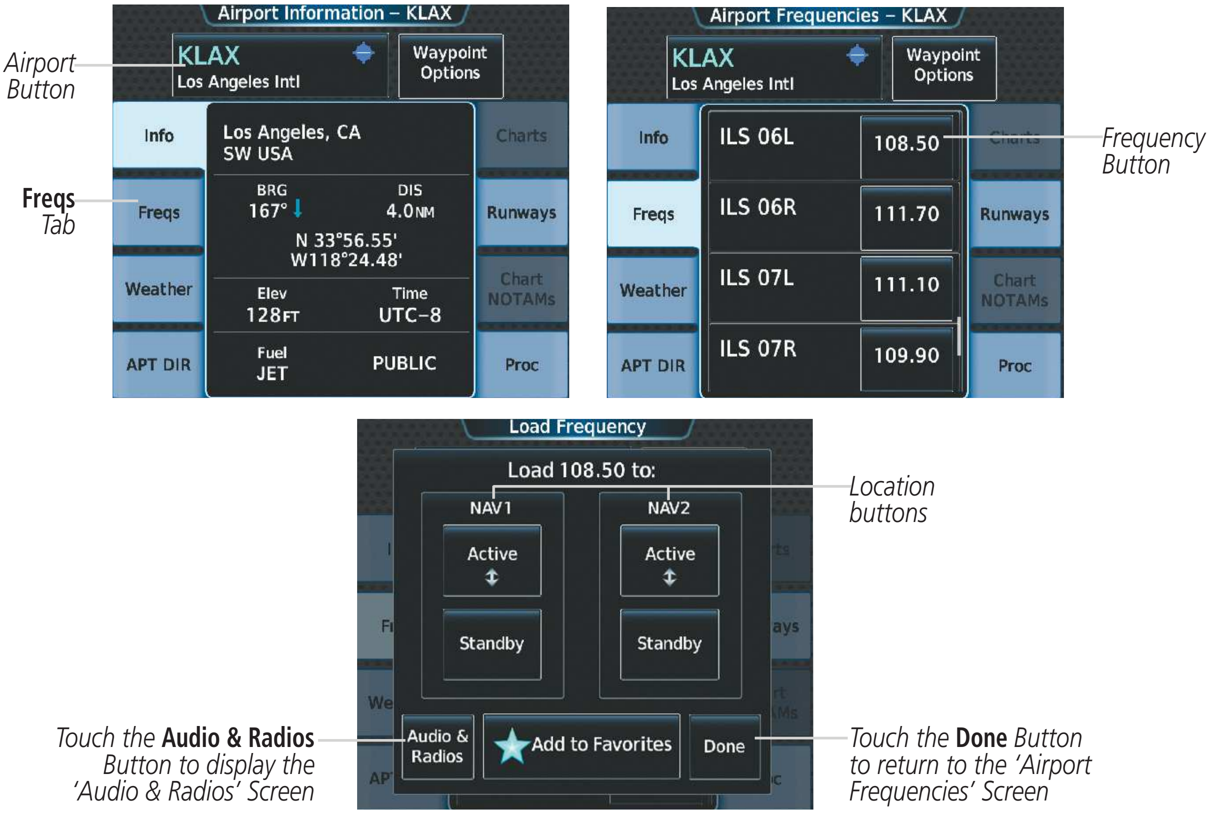


Figure 4-22 Airport Information Tuning

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

1) From 'MFD Home' Screen, touch the **Waypoint Info** Button
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 NAV1/2 Active/Standby or Favorites.
6) Touch the **Done** Button or the **Back** Button to return to the 'Airport Frequencies' Screen.

Figure 4-23 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 NAV1/2 Active/Standby or Favorites.
10) Touch the **Done** Button or the **Back** Button to return to the 'Airport Frequencies' Screen.

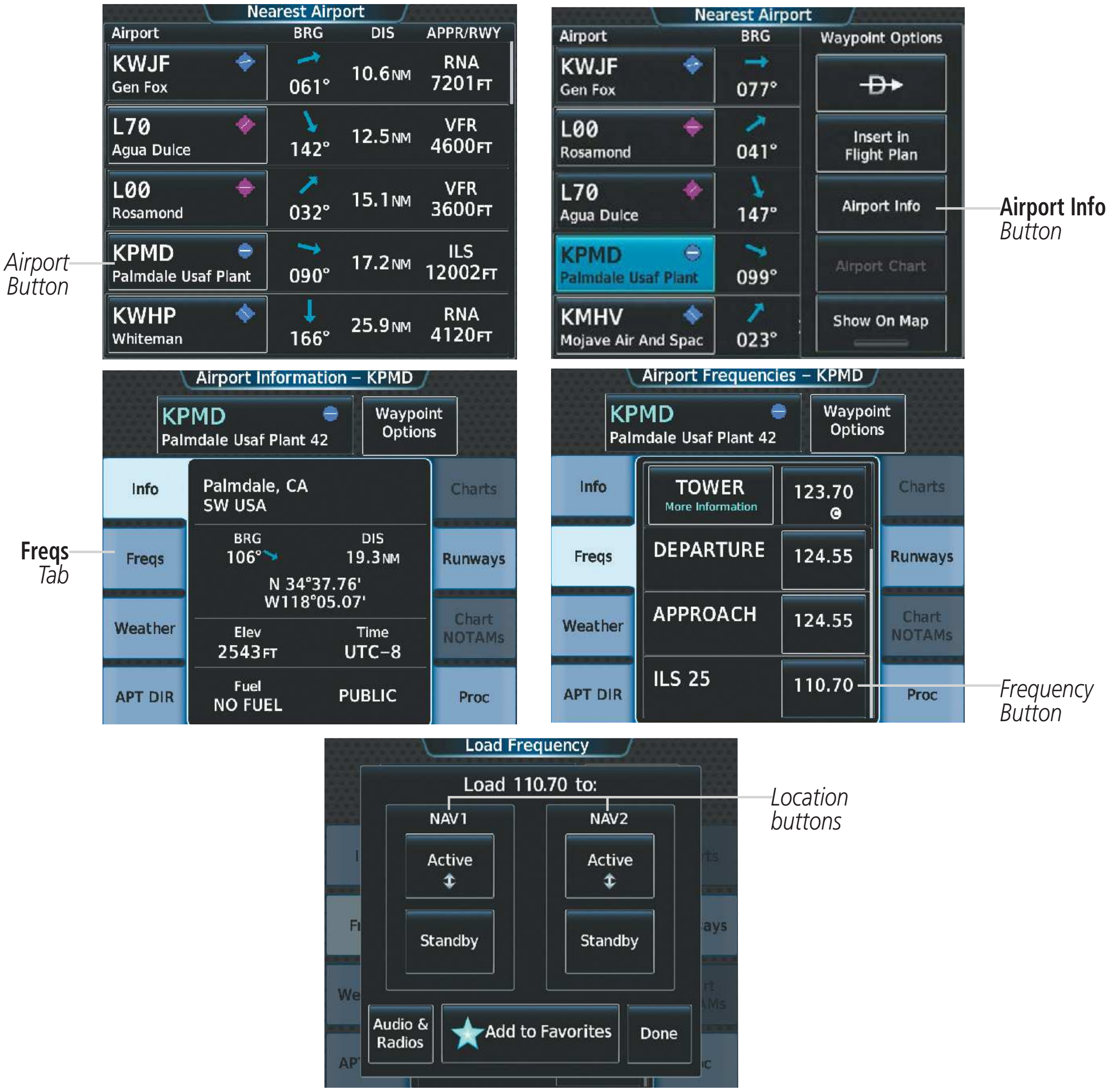


Figure 4-24 Nearest Airport Tuning

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

1) From 'MFD Home' Screen, 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 NAV1/2 Active/Standby or Favorites.
6) Touch the **Done** Button or the **Back** Button to return to the 'Nearest VOR' Screen.

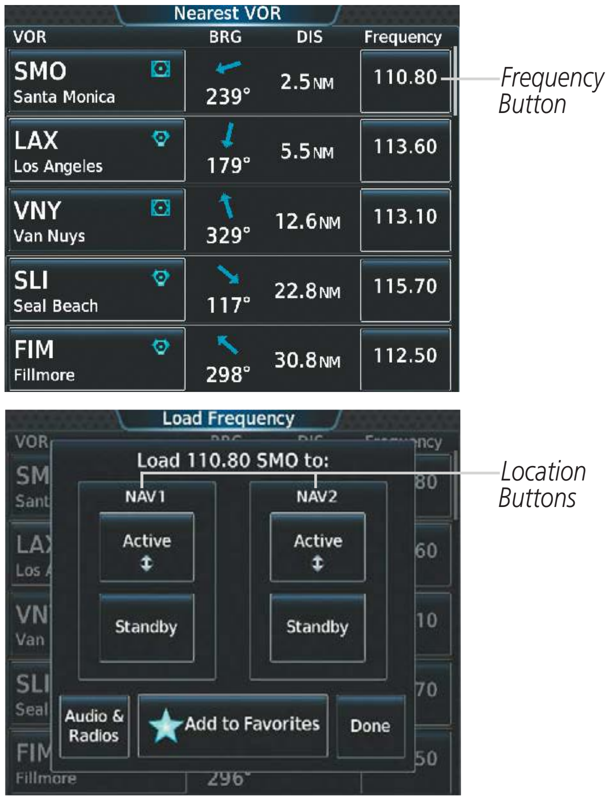


Figure 4-25 Nearest VOR Tuning

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

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

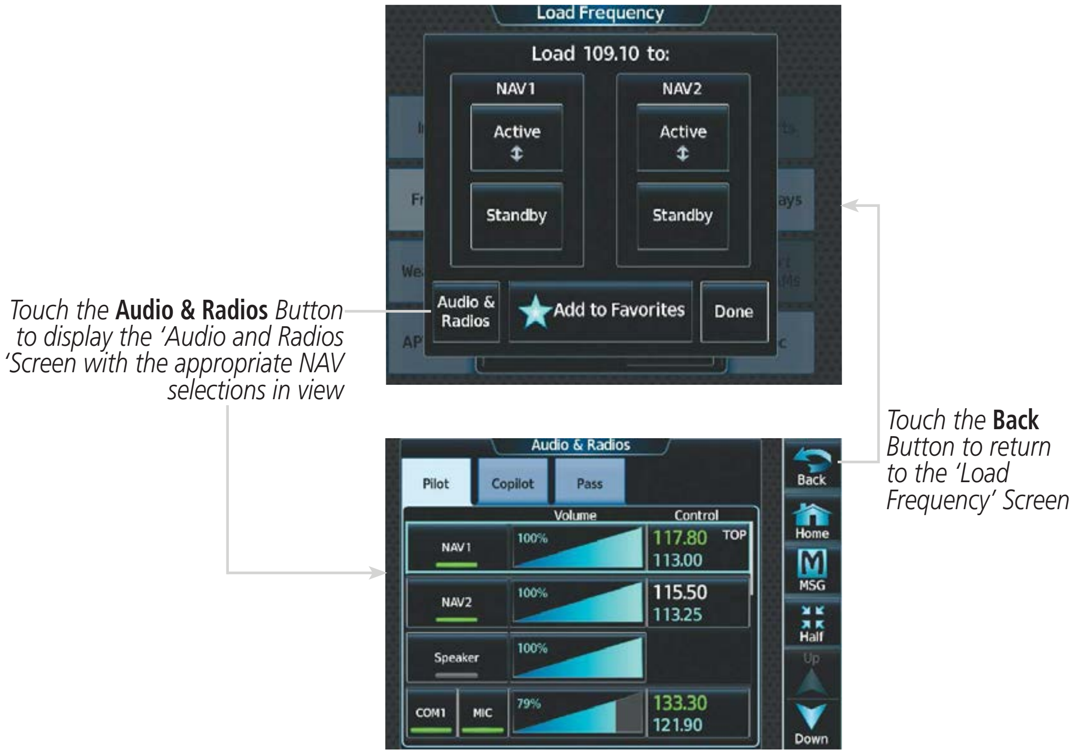


Figure 4-26 Tuning from a NAV 'Load Frequency' Screen

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 4-27 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 Lable - Indicates when Pilot/Copilot and NAV1/NAV2 volume is being controlled.

Lower Knob - Turn to adjust COM volume

Figure 4-28 NAV Volume Level

AUTO-TUNING OF NAV FREQUENCIES

NOTE: *The primary NAV frequency is auto-tuned upon loading a VOR or ILS/Localizer approach.*

NOTE: *When an ILS/LOC approach has been activated in GPS Mode, the system switches to NAV Mode as the final approach course is intercepted (within 15 nm of the FAF). See the Flight Management Section for details.*

NAV frequencies are automatically loaded into the NAV Frequency Box on approach activation.

When loading or activating a VOR or ILS/LOC approach, the approach frequency is automatically transferred to a NAV frequency field as follows:

- If the current CDI navigation source is GPS, the approach frequency is transferred to the NAV1 and NAV2 active frequency field. The frequency that was previously in the NAV1 and NAV2 active frequency fields are transferred to standby.
- If the current CDI navigation source is GPS, and if the approach frequency is already loaded into the NAV1 standby frequency field, the standby frequency is transferred to active.
- If the current CDI navigation source is NAV1 or NAV2 and the approach is activated, the approach frequency is transferred to the active frequency fields of the selected CDI NAV radio.

- If the current CDI navigation source for either PFD is NAV1 or NAV2 and the approach is loaded, the approach frequency is transferred to the standby frequency fields of the selected CDI NAV radio.

<table>
<tr><th></th><th>If the Current CDI NAV Source is NAV1 or NAV2</th><th>If the Current CDI NAV Source is GPS</th></tr>
<tr><td>Approach LOADED</td><td>Approach Frequency is transferred to the standby frequency field of the selected CDI NAV radio.</td><td rowspan="2">Current NAV1 and NAV2 frequencies will be transferred to the standby field. The approach frequency will be transferred to the ACTIVE NAV1 and NAV2 frequency fields.
If the approach frequency was already loaded into the NAV1 standby frequency field, it will be transferred to the ACTIVE frequency field.</td></tr>
<tr><td>Approach ACTIVATED</td><td>Approach Frequency is transferred to the active frequency field on both NAV1 and NAV2, and the previously active frequencies will be transferred to standby.</td></tr>
</table>

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 annunciator 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 (annunciator illuminated) is used to provide an earlier indication when nearing a marker during an approach. The Low Sense function (annunciator extinguished) results in a narrower marker dwell while over a station.

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

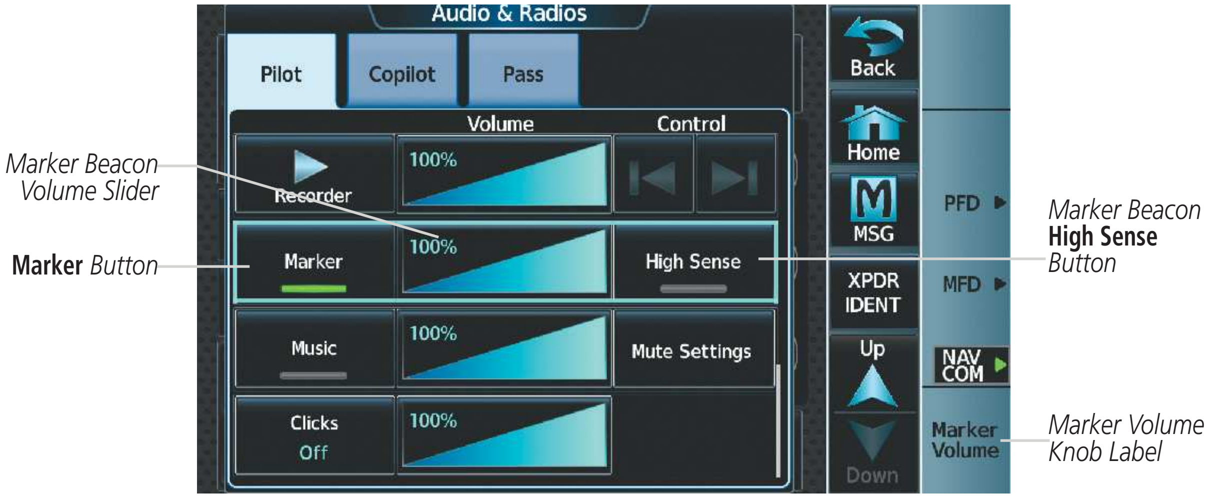


Figure 4-29 Marker Beacon Controls

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. 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 4-30 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

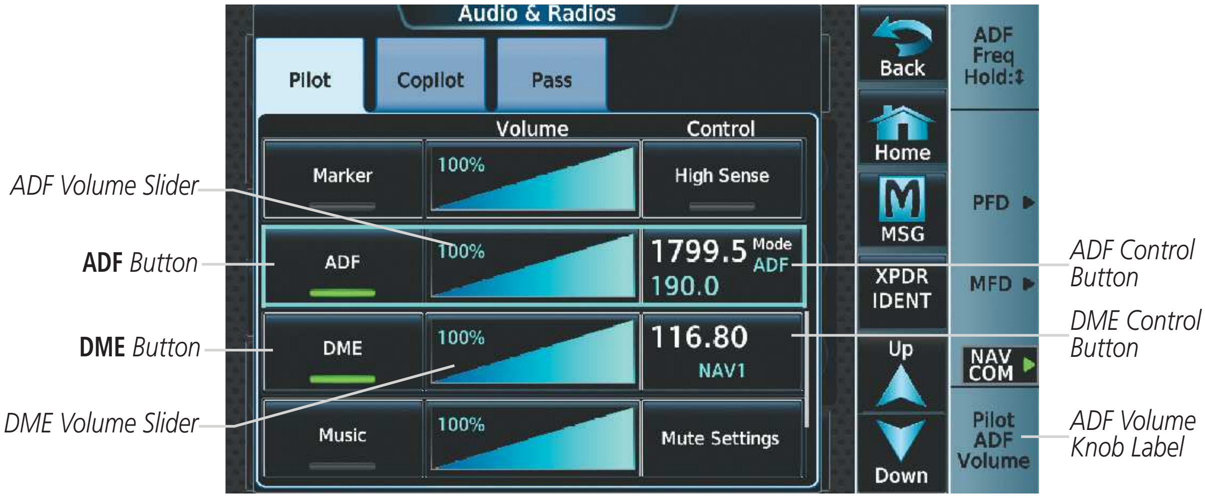


Figure 4-31 ADF/DME Tuning

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 the 'NAV/COM Home' Screen, 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' Screen.
4) Use the keypad to select the desired frequency.
5) Touch the **Enter** Button to enter the new frequency as the ADF standby frequency; or touch the **XFER** Button to enter the new frequency as the ADF standby frequency and transfer it to the active frequency.

Figure 4-32 ADF Mode/Tuning Window

Or:

1) From the 'NAV/COM Home' Screen, 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' Screen.
4) Turn the large and small upper knobs to tune the frequency (Large knob increases/decreases kHz; Small knob selects .5 kHz).
5) Push the small upper knob to enter the new frequency as the ADF standby frequency; or push and hold the small upper knob to transfer the new standby frequency to the active frequency.

Finding and selecting an ADF frequency:

1) From the 'NAV/COM Home' Screen, 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' 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 enter the new frequency as the ADF standby frequency.

Figure 4-33 ADF Mode/Tuning Window

Transferring the active and standby ADF frequencies:

1) From the 'NAV/COM Home' Screen, 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 the 'NAV/COM Home' Screen, 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 Mode/Tuning Screen.
4) Touch the **ANT**, **ADF**, **ADF/BFO**, or **ANT/BFO** Button to select the ADF mode.

Figure 4-34 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.

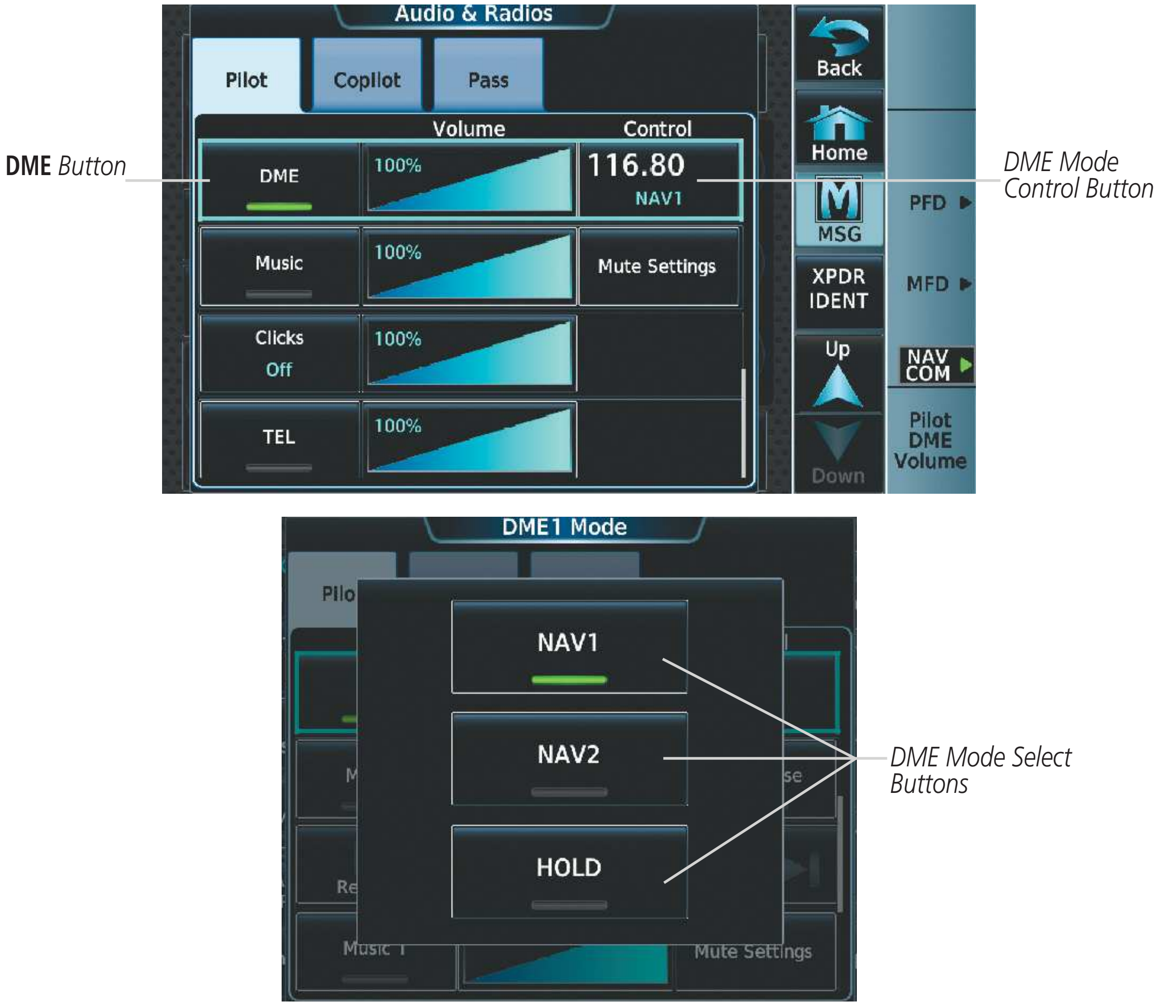


Figure 4-35 DME Mode Selection

Selecting a DME mode:

1) From the 'NAV/COM Home' Screen, touch the **Audio & Radios** Button to display the 'Audio & Radios' Screen.
2) Scroll the list to find the DME.
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 4-36 DME Hold Mode on PFD

4.4 TRANSPONDER(S)

The system is equipped with one or two Mode S transponders. One of the Mode S 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 4-37 Transponder Display and Controls

TRANSPONDER/MODE SELECTION

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

Selecting a transponder mode:

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

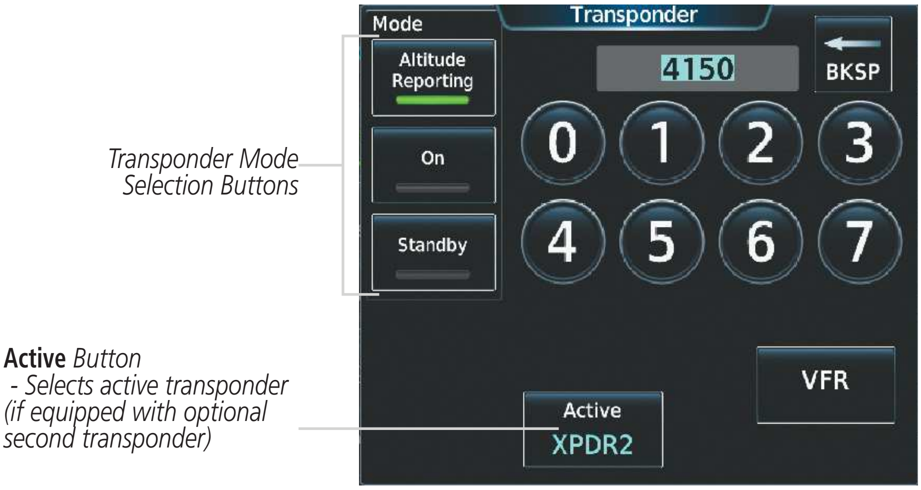


Figure 4-38 Active Transponder and Transponder Mode Selection

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 4-39 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 Mode Button on the ground. A green ON indication appears in the Transponder Mode Button when the aircraft is airborne.

Figure 4-40 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 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 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 4-41 Altitude Reporting Mode

REPLY STATUS

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

Figure 4-42 Transponder Reply Indication

ENTERING A TRANSPONDER CODE

Entering a transponder code with the keypad:

1) From the 'NAV/COM Home' Screen, 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 4-43 Transponder Code Entry

Entering a transponder code with the knobs:

1) From the 'NAV/COM Home' Screen, 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 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 4-44 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 4-45 Transponder IDENT Controls

4.5 ADDITIONAL AUDIO FUNCTIONS

MONO/STEREO HEADSETS

Stereo headsets are recommended for use in this aircraft.

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

3D AUDIO

Because this feature uses different signals for left and right channels, it requires wiring for stereo intercom and stereo headsets. If 3D audio is activated when mono headsets are in use, the listener will still hear all audio sources; however, there is no benefit from location separation.

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. All other intercom positions are processed to sound like their relative seat location. By default, the audio panel assumes the pilot sits in the left seat. A Garmin authorized service center can make changes to the default configuration.

COCKPIT SPEAKER

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

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 4-46 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 bring up the 'Intercom' Screen. The intercom links between the Pilot, Copilot, and Passengers are enabled/disabled by touching the connecting arrows on the 'Intercom' Screen.

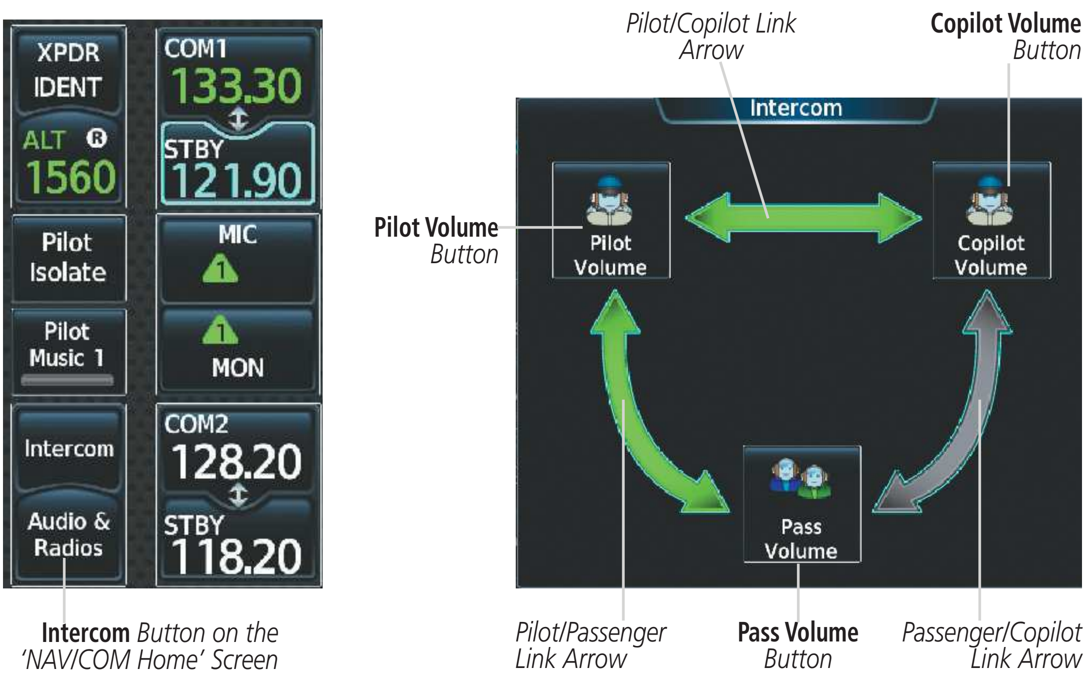


Figure 4-47 Intercom Controls

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

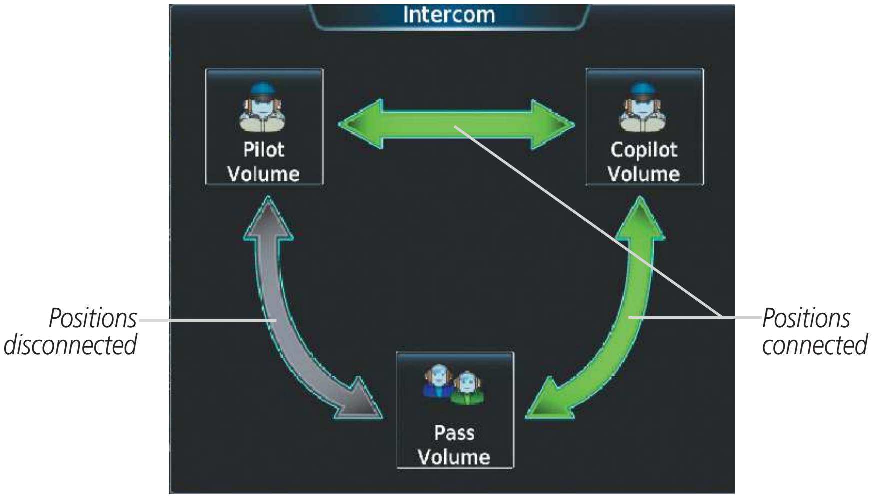


Figure 4-48 Intercom Screen

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.

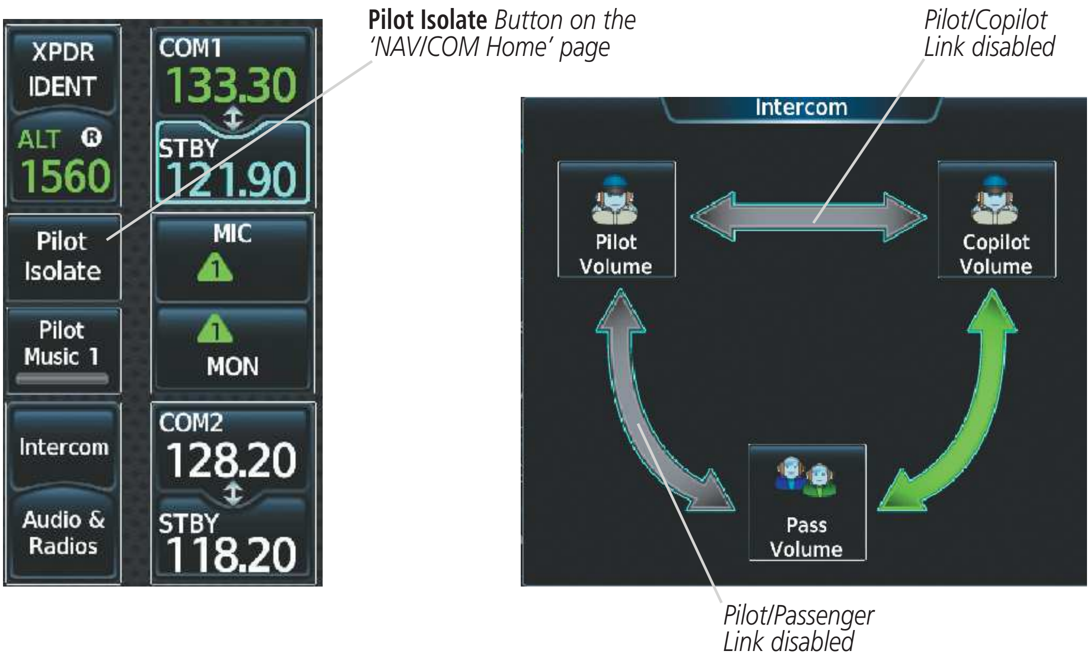


Figure 4-49 Pilot Isolation Controls

INTERCOM VOLUME AND SQUELCH

The Touchscreen Controller controls the volume and squelch for the pilot, copilot, and passengers independently.

The selected intercom volume or squelch level can be adjusted from 0 to 100% on the touchscreen controller by turning the lower knob or by sliding your finger right or left on the slider. Turning the knob clockwise increases volume, turning the knob counterclockwise decreases volume. Sliding to the right increases volume, sliding to the left decreases volume.

By default, the automatic squelch is always enabled. Touch the **Pilot Volume**, **Copilot Volume**, or **Pass Volume** Button on the 'Intercom' Screen to control individual volume levels and disable the automatic squelch and adjust manual squelch.

Adjusting the intercom volume:

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

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

Adjusting the squelch:

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

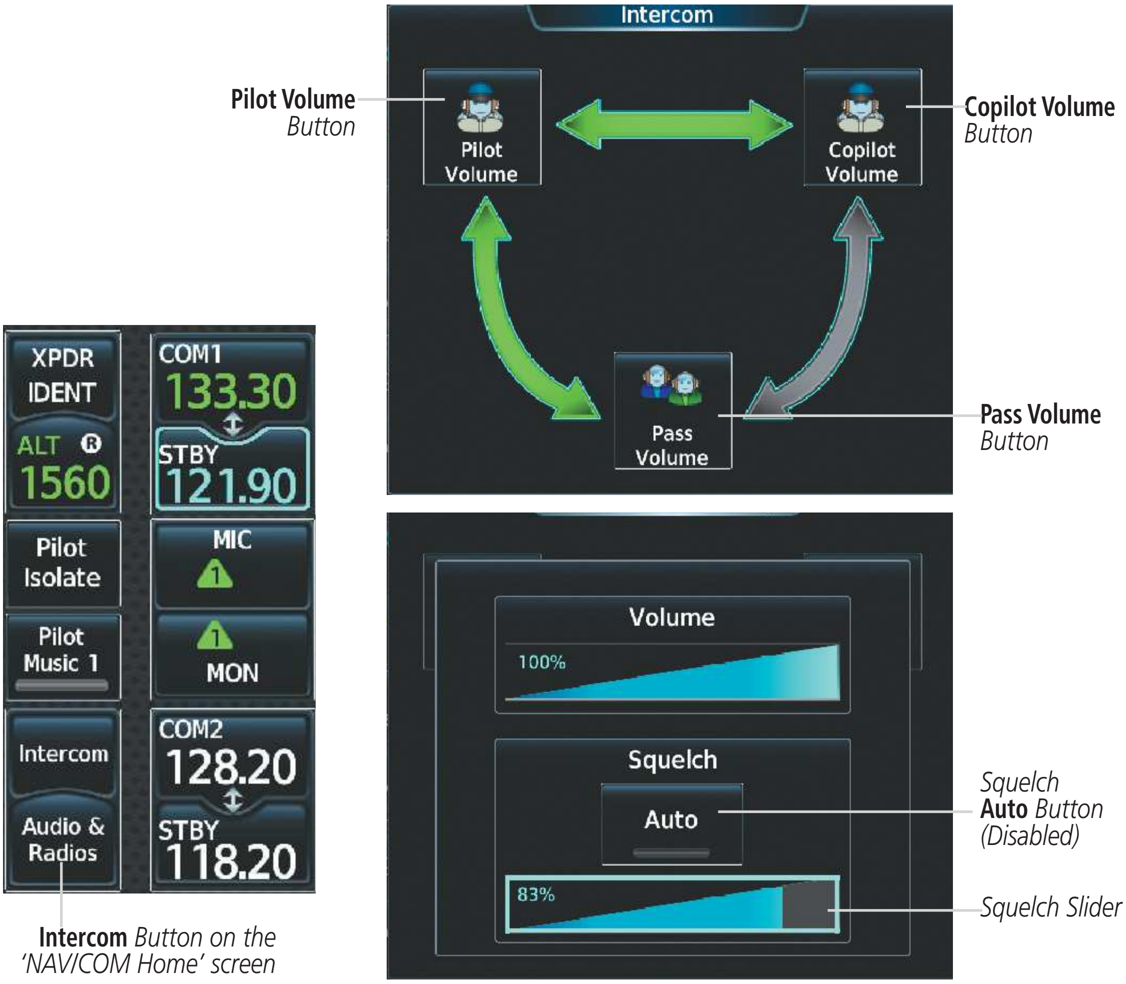


Figure 4-50 Intercom Volume/Squelch Controls

CLEARANCE RECORDER AND PLAYER

The Audio Controller contains a digital clearance recorder that records up to 2.5 minutes of the selected COM radio signal. Recorded COM audio is stored in separate memory blocks. Once 2.5 minutes of recording time 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 menu, 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.

Powering down the system automatically clears all recorded blocks.

NAV/COM Home Screen Recorder Controls

Audio & Radios Menu Recorder Controls

Figure 4-51 Recorder Controls

SIMULTANEOUS COM OPERATION

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

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

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

'NAV/COM Home' Screen

Figure 4-52 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.

The auxiliary audio is controlled with the **Pilot Music 1** Button on the 'NAV/COM Home' Screen or **Music** Button on the 'Audio & Radios' Screen.

Selecting/Deselecting Auxiliary Audio:

Touch the **Pilot Music 1** Button on the 'NAV/COM Home' Screen to select/deselect the SiriusXM Radio input for the pilot position.

Or:

1) Touch the **Audio & Radios** Button to display the 'Audio & Radios' Screen.
2) If selecting for the Copilot, touch the **Copilot** Tab.
3) Scroll the list to find the **Music** Button.
4) Touch the **Music** Button to select/deselect the audio input for the selected position (pilot or copilot).
5) If selecting for the Passengers, touch the **Pass** Tab.
6) Scroll the list to find the **Music 1** Button.
7) Touch the **Music 1** Button to select/deselect the audio input for the passenger position.

Figure 4-53 Auxilary 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.

AUXILARY 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) Touch the **Audio & Radios** Button to display the 'Audio & Radios' Screen.
2) If selecting for the Copilot or Passengers, touch the **Copilot** Tab or the **Pass** Tab.

3) Scroll the list to find **Music** for the Pilot or Copilot and **Music 1** for the Passengers.

4) Touch the **Mute Settings** Button to display the 'Music Mute Settings' Window.

5) Select the **Intercom,** and/or the **Radio Inputs** Buttons to select which items will mute auxiliary audio.

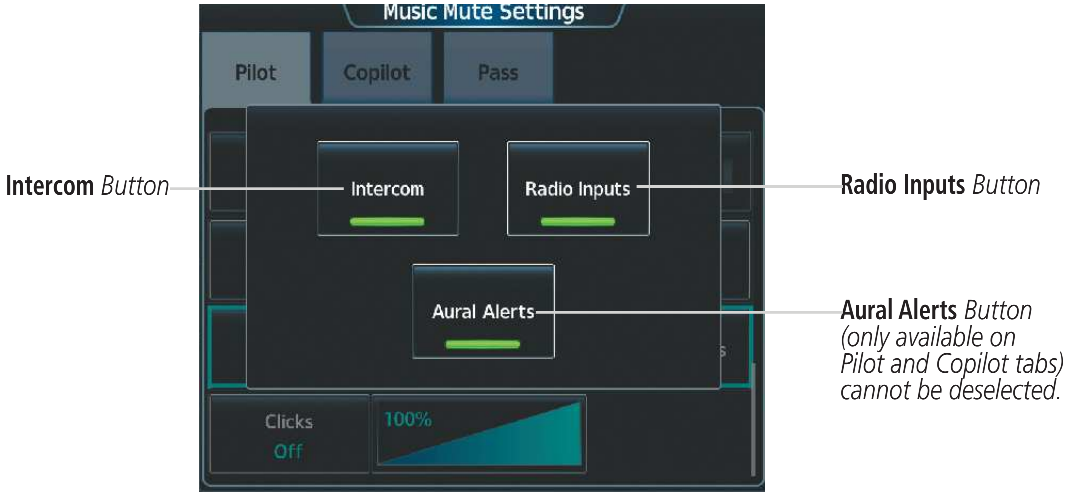


Figure 4-54 Music Mute Controls

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) Touch the **Audio & Radios** Button to display the 'Audio & Radios' Screen.

2) If selecting for the Copilot, touch the **Copilot** Tab.

3) Scroll the list to find **Clicks**.

4) Touch the **Clicks** Button to display the 'Audio Feedback Settings' 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.

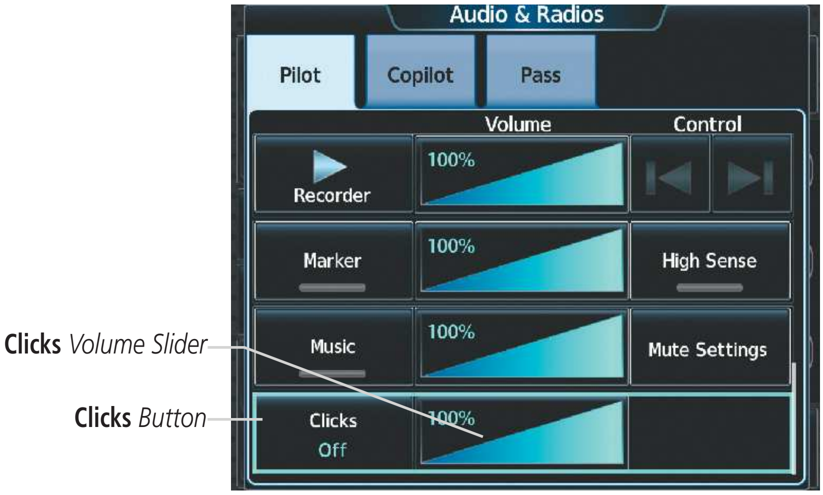


Figure 4-55 Audio Feedback (Clicks) Selection

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.

SELCAL (SELECTIVE CALLING)

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. This feature is generally used on oceanic or lengthy flights.

The SELCAL code is a 4 character code within the range of A through S. The characters 'I', 'N', and 'O' are excluded and no letters may be repeated. A specific code will be assigned to any aircraft participating in the SELCAL system. If an invalid SECAL code is entered, a pop up window will notify the flight crew of the error and the code will be rejected. SELCAL detection is used only for the HF radio.

Entering the SELCAL Code

1) Touch the **Audio & Radios** Button to display the Audio & Radios Screen.

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. The 'Update SELCAL Code?' confirmation window appears.

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

Figure 4-56 SELCAL Code Screen

Selecting/deselecting SELCAL

1) Touch the **Audio & Radios** Button to display the 'Audio & Radios' Screen.

2) Touch the **Pilot** Tab or **Copilot** Tab.

3) Scroll the list to find **SELCAL**.

4) Touch the **SELCAL** Button.

Figure 4-57 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 4-58 SELCAL Button on the 'NAV/COM Home' Screen

Pressing the **SELCAL** Button on the NAV/COM Home Screen 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 Touchscreen Controller screen is open a **SELCAL ACK** Annunciation/Button will display over the Control field of the HF radio.

Figure 4-59 SELCAL Acknowledge Annunciation

BLUETOOTH AUDIO CONTROLS

The 'Connext Setup' Screen allows for establishing Bluetooth connections between the Flight Stream 510 and a mobile device running the Garmin Pilot™ application or between a mobile device and the GMA. See Additional Features section for how to establish Bluetooth connections.

Selecting a paired device as an audio source:

1) From the 'NAV/COM Home' Screen, touch the **Audio & Radios** Button.

2) Touch the desired user tab (Pilot, Copilot, Passenger).

3) Touch the **iPhone** Button to enable/disable connected device audio.

4) Touch the **Music** Button to enable/disable SiriusXM or other music source audio.

4) Adjust volume using the slider bar.

5) Adjust mute settings touching the **Mute Settings** Button

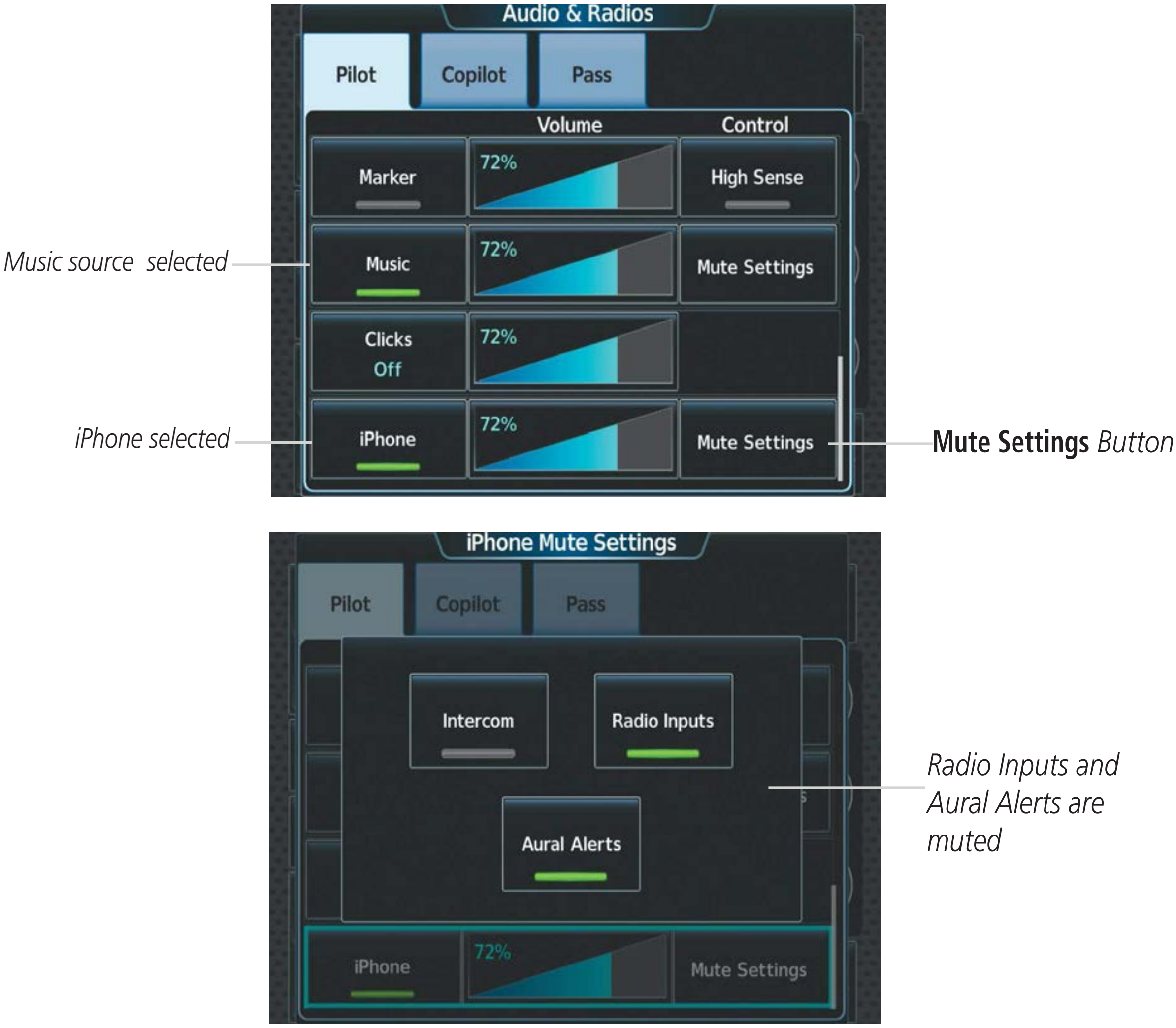


Figure 4-60 Bluetooth Audio Controls

4.6 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.

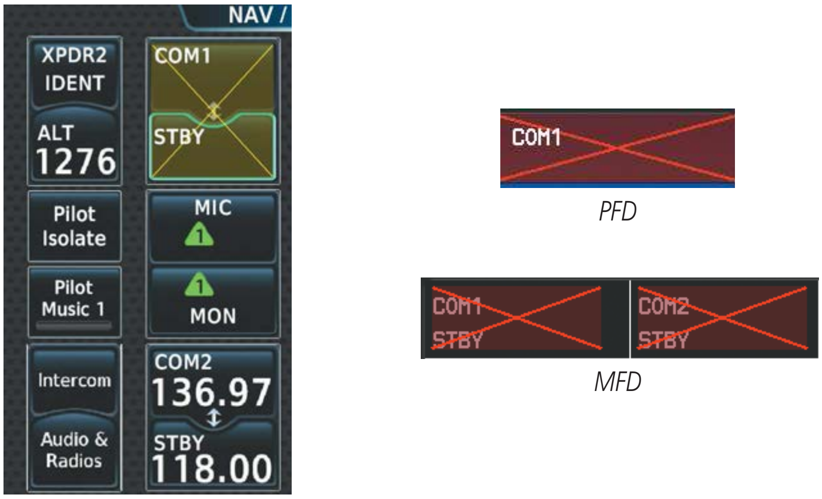
STUCK MICROPHONE

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.



GTC *PFD* *MFD*

Figure 4-61 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.

GTC

PFD

Figure 4-62 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.

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 GPS navigation.

The most prominent parts of the system are the Primary Flight Displays (PFDs), the Multi Function Display (MFD), and the Touchscreen Controllers. The information to successfully navigate the aircraft using the GPS sensors is displayed on these units.

A brief description of the GPS navigation data on the PFDs and the MFD follows. Navigation mode indicates which sensor is providing the course data (e.g., FMS, VOR) and the active approach service level (LNAV, LNAV+V, L/VNAV, LP, LP+V, or LPV).

The Inset Map is a small version of the Navigation Map and can be displayed in the lower left corner of the PFD. The Inset Map is displayed by pressing the **PFD Map Settings** Softkey on the PFD Home Screen, pressing the **Map Layout** Softkey, then pressing the **Inset Map** softkey. Pressing the **Map Off** Softkey removes the Inset Map. The Inset Map can also be displayed by touching the **PFD Map Settings** Button on the 'PFD Home' Screen, then touching the **Inset Map** Button. Touching the **Off** Button removes the Inset Map.

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

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

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

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

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

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

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

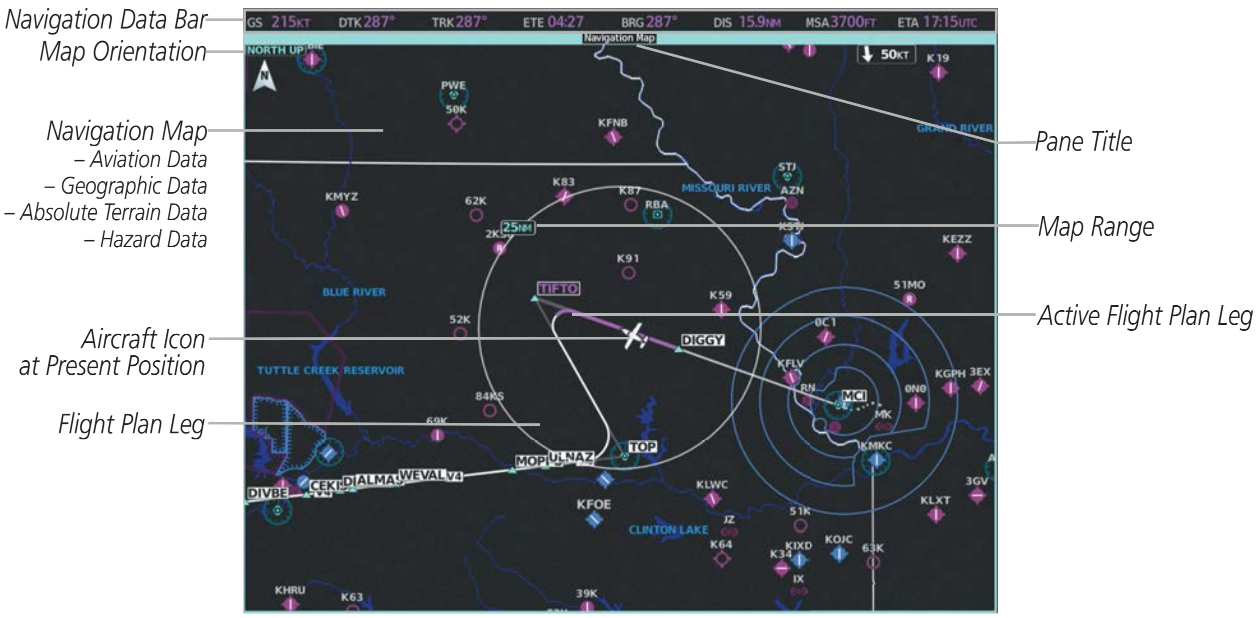


Figure 5-3 GPS Navigation Information on the 'Navigation Map' Pane

NAVIGATION STATUS BOX AND DATA BAR

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

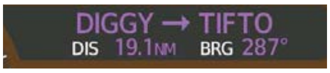


Figure 5-4 PFD Navigation Status Bar

- 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 bar 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		

The Data Bar on the 'Navigation Map' Pane contains eight data fields, each displaying one of the following items:

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

Figure 5-5 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 Navigation Data Bar:

1) From MFD Home, touch **Utilities** > **Setup** > **Avionics Settings** to display the 'Avionics Settings' Screen.

2) Touch the **MFD Fields** Tab to display the MFD data bar field selection list.

3) If necessary, scroll through the data field list to find the desired field.

4) Touch the MFD Data Bar Field Button to display the data options list.

5) If necessary, scroll through the data options list to find the desired option.

6) Touch the desired data option button.

7) Repeat steps 3 through 6 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, airspaces, airways, land data (highways, cities, lakes, rivers, borders, etc.) with names
- Map range
- Wind direction and speed
- Map orientation
- Icons for enabled map features
- Aircraft icon (representing present position)
- Obstacle data
- Map Pointer information (distance and bearing to pointer, location of pointer, name, and other pertinent information)
- Fuel range ring
- Flight plan legs
- User waypoints
- Track vector
- Terrain

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

MAP SETTINGS SYNCHRONIZATION

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

Enabling/disabling map settings synchronization:

1) From MFD Home, touch **Map** > **Map Selection > Map Settings** > **Map Sync**.
2) Touch the **Onside** Button or the **All** Button.
3) Touch the **PFD1**, **MFD**, or **PFD2** Button to initially synchronize the onside map settings or all map settings with the selected display.

   Or:

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

Figure 5-7 Map Settings Synchronization

MAP ORIENTATION

Maps are shown in one of three different orientation options, allowing flexibility in determining aircraft position relative to other items on the map (north up) or for determining where map items are relative to where the aircraft is going (track up or heading up). The map orientation is shown in the upper left corner of the map.

Figure 5-8 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).

Figure 5-9 Map Orientation Selection

Changing the Navigation Map orientation:

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

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

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

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

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 MFD map: (1) turn the lower knob on the Touchscreen Controller counter-clockwise to decrease the range, or clockwise to increase the range; or (2) touch two fingers on the **Touchpad** and move them apart to decrease range, or pinch using two fingers to increase range.

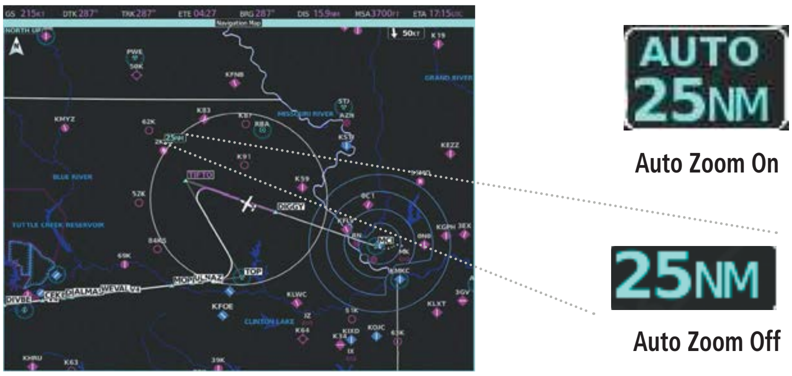


Figure 5-10 Map Range

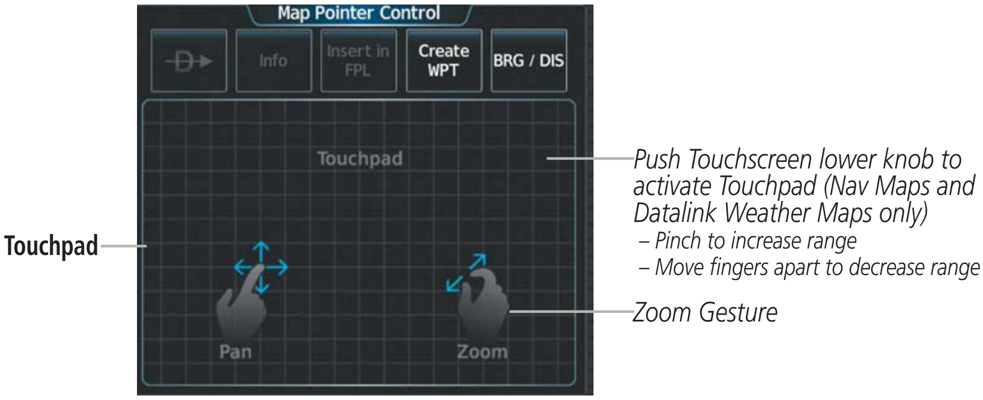


Figure 5-11 Touchpad Map Range Control

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 with the lower knob or the **Touchpad**, 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 (configurable on the Touchscreen Controller 'Map Settings' Screen) determines how long auto zoom is overridden by a manual adjustment of the range knob. At the expiration

of this time, the auto zoom range is restored. Setting the 'Auto Zoom Time Out' value to zero causes the manual override to never time out.

- When the maximum 'look forward' time is set to zero, the upper limit becomes the maximum range available (1000 nm).
- When the minimum 'look forward' time is set to zero, the lower limit becomes 0.75 nm.

Configuring automatic zoom:

1) From MFD Home, touch **Map** > **Map Selection > Map Settings**.
2) If necessary, touch the **Other** Tab to display the options list.
3) Touch the **Auto Zoom** Button to enable/disable auto zoom.
4) Touch the Auto Zoom **Settings** Button to display the 'Auto Zoom Settings' Window.
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 the 'Auto Zoom Min Look Fwd' (zero to 99 minutes) and the 'Auto Zoom Time Out' (zero to 99 minutes) functions using the corresponding button names.

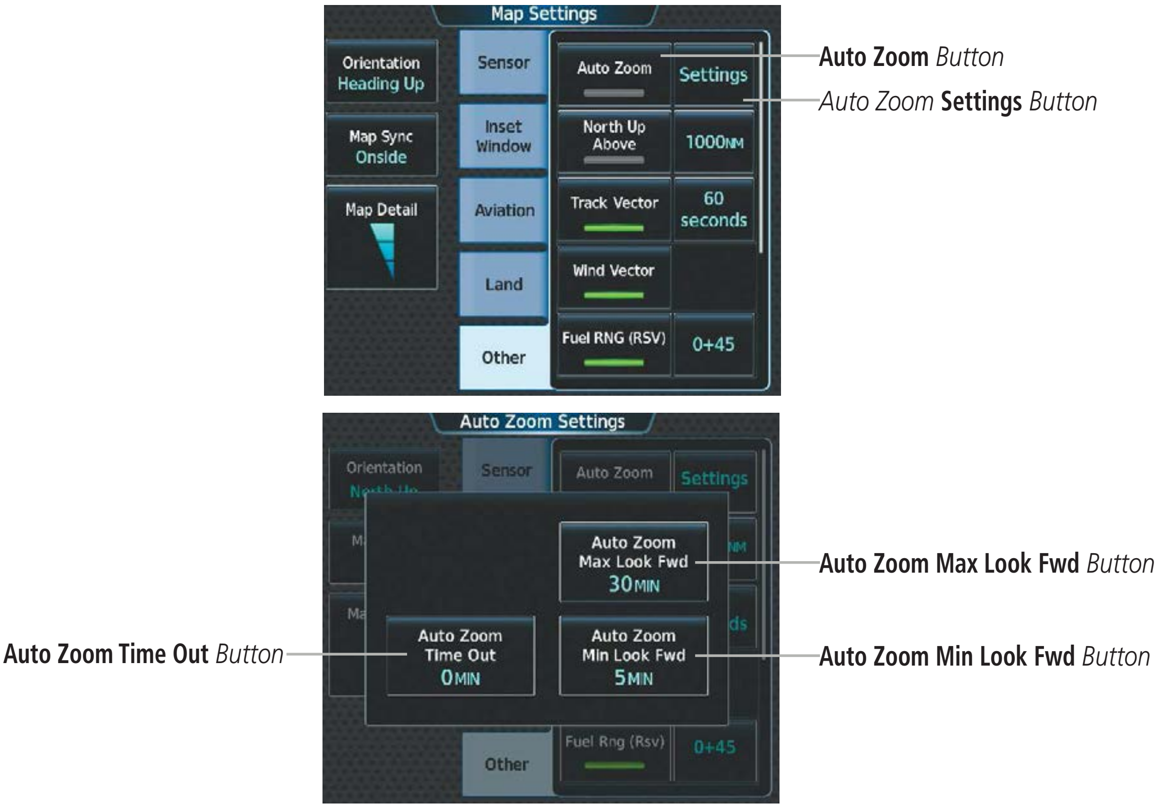


Figure 5-12 Auto Zoom Setup

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

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

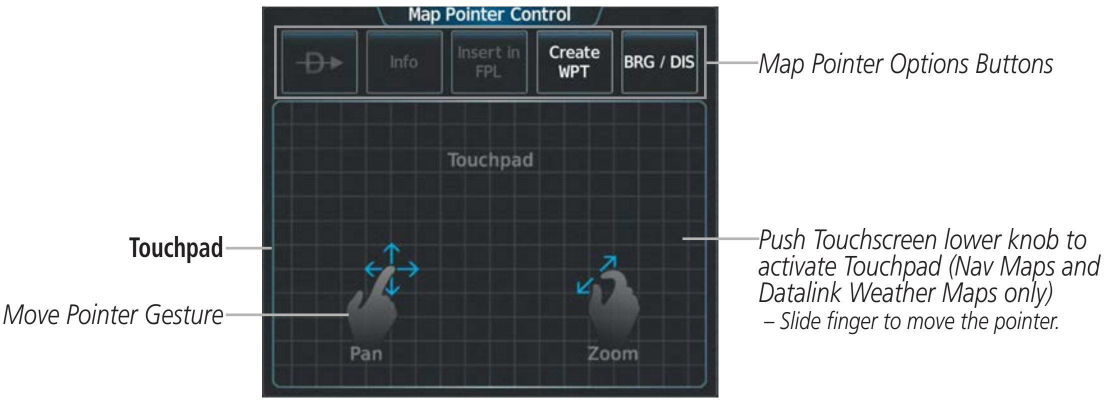


Figure 5-13 Touchpad Map Pointer Control

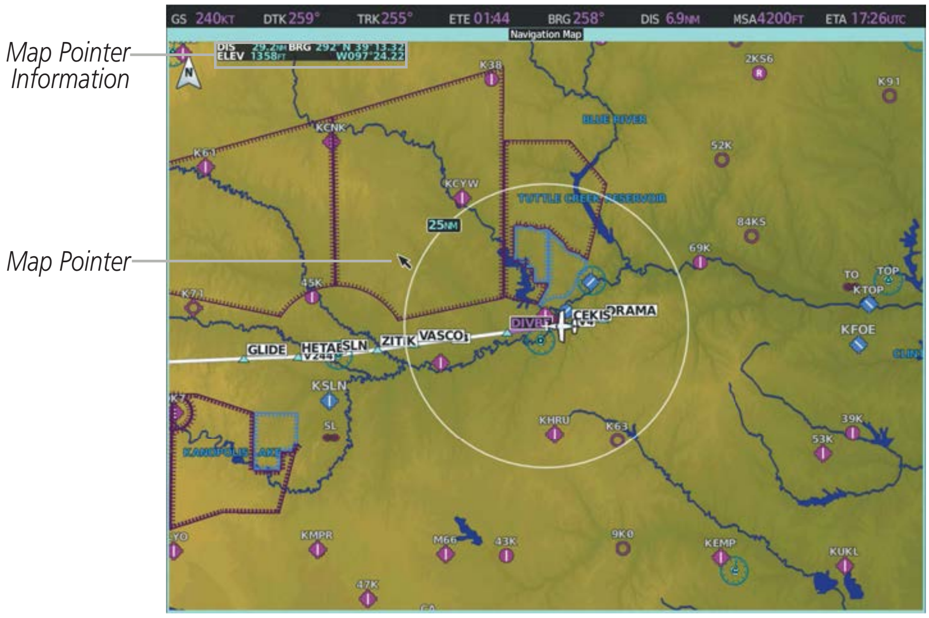


Figure 5-14 Navigation Map – Map Pointer Activated

Panning the map:

1) Press the lower knob on the Touchscreen Controller to display the Map Pointer.

2) Turn the upper knobs on the Touchscreen Controller**,** or slide your finger on the **Touchpad**, to move the Map Pointer on the map. The map will pan when the pointer approaches the edge of the map.

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

When the Map Pointer is placed on an airport, the name of the airport is highlighted (even if the name was not originally displayed on the map). When an airport is highlighted on the map display, pertinent information is available by pressing the **Info** Button on the Touchscreen Controller.

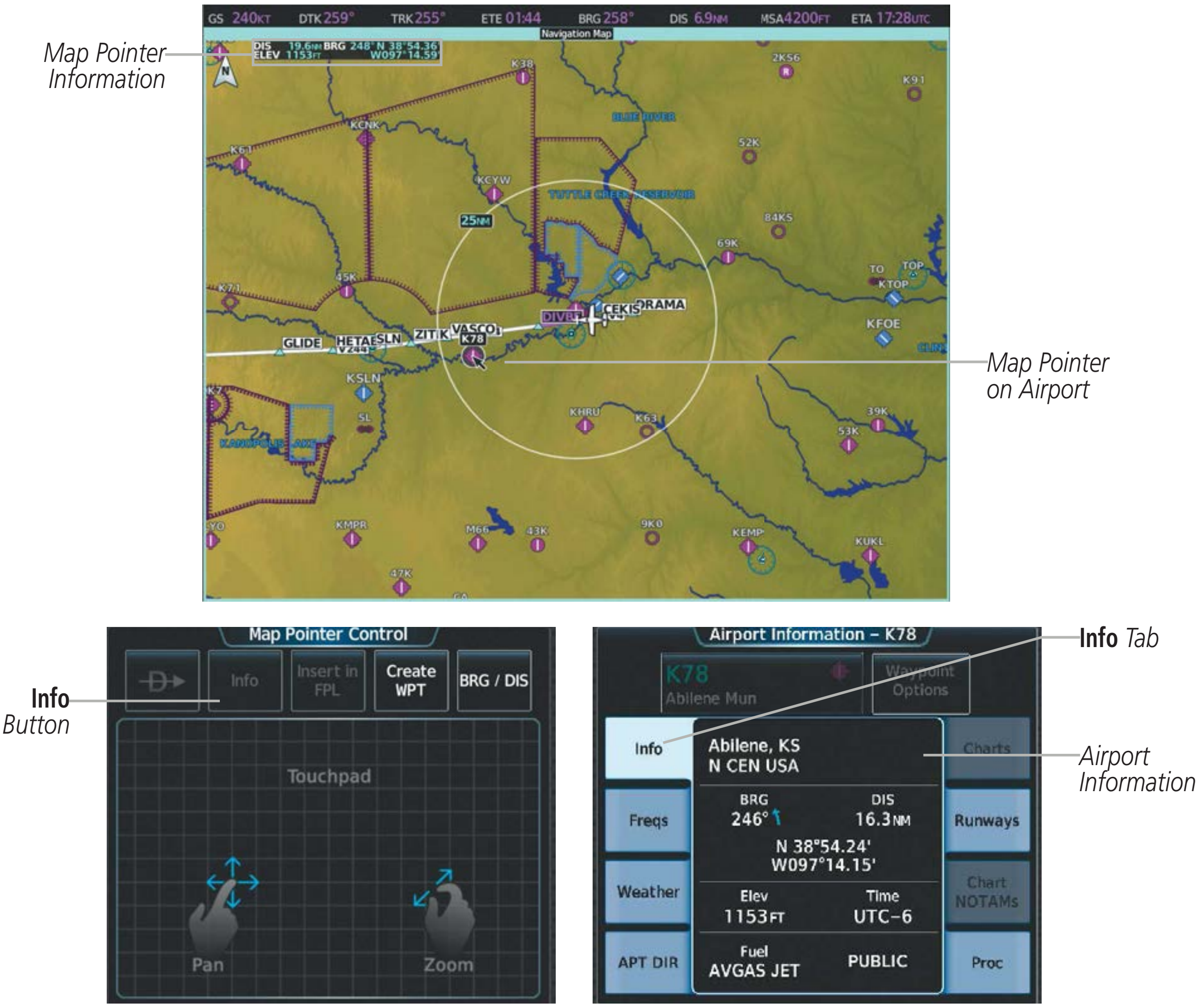


Figure 5-15 Navigation Map – Map Pointer on Airport

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

1) Place the Map Pointer on an airport, NAVAID, or user waypoint.

2) Touch the **Info** Button to display the waypoint information screen.

3) Touch the **Back** Button on the Touchscreen Controller to return to the 'Map Pointer Control' Screen without removing the Map Pointer from the Navigation Map.

Or:

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

When the Map Pointer is placed on a NAVAID, the name of the NAVAID is highlighted (even if the name was not originally displayed on the map). When a NAVAID is highlighted on the map display, pertinent information is available by pressing the **Info** Button on the Touchscreen Controller.

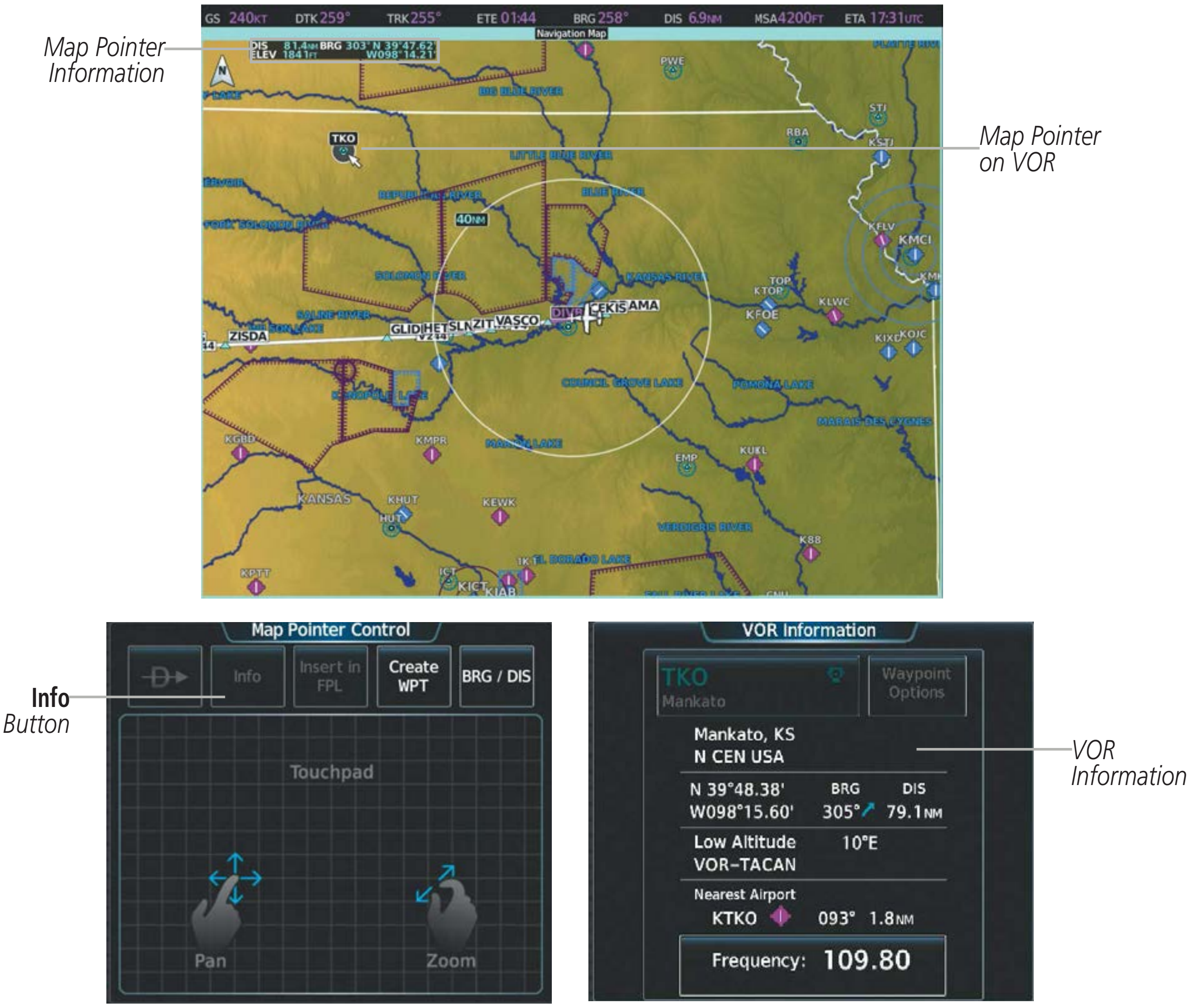


Figure 5-16 Navigation Map – Map Pointer on VOR

When the Map Pointer is placed on a User Waypoint, the name of the User Waypoint is highlighted (even if the name was not originally displayed on the map). When a User Waypoint is highlighted on the map display, pertinent information is available by pressing the **Info** Button on the Touchscreen Controller.

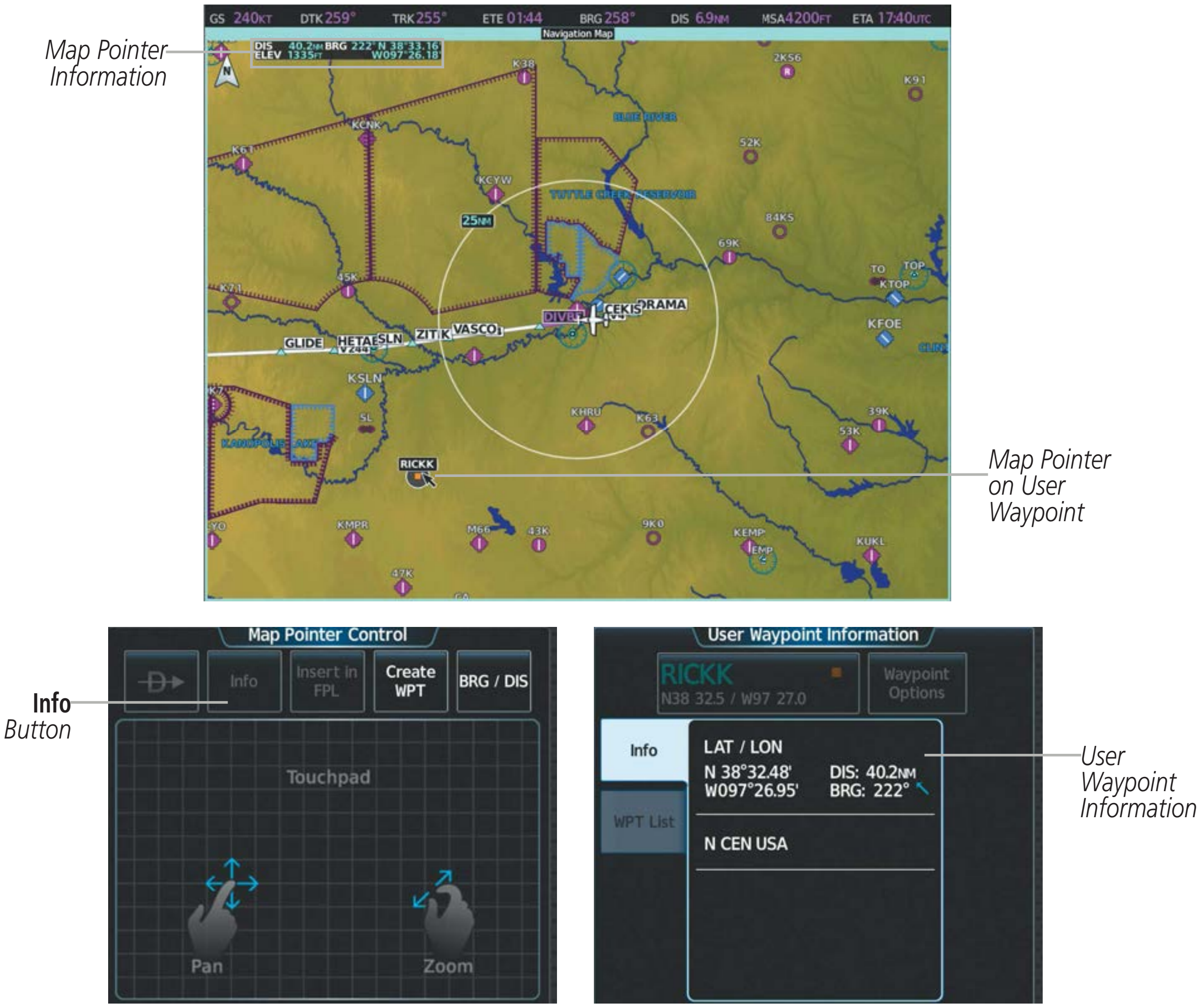


Figure 5-17 Navigation Map – Map Pointer on User Waypoint

When the Map Pointer is on an airspace boundary, the boundary is highlighted and airspace information is shown in a box above and to the right of the Map Pointer. The information includes the name and class of airspace, the ceiling in feet above Mean Sea Level (MSL), and the floor in feet MSL. When an airspace is selected on the map display, additional frequency information is also available by pressing the **Info** Button on the Touchscreen Controller.

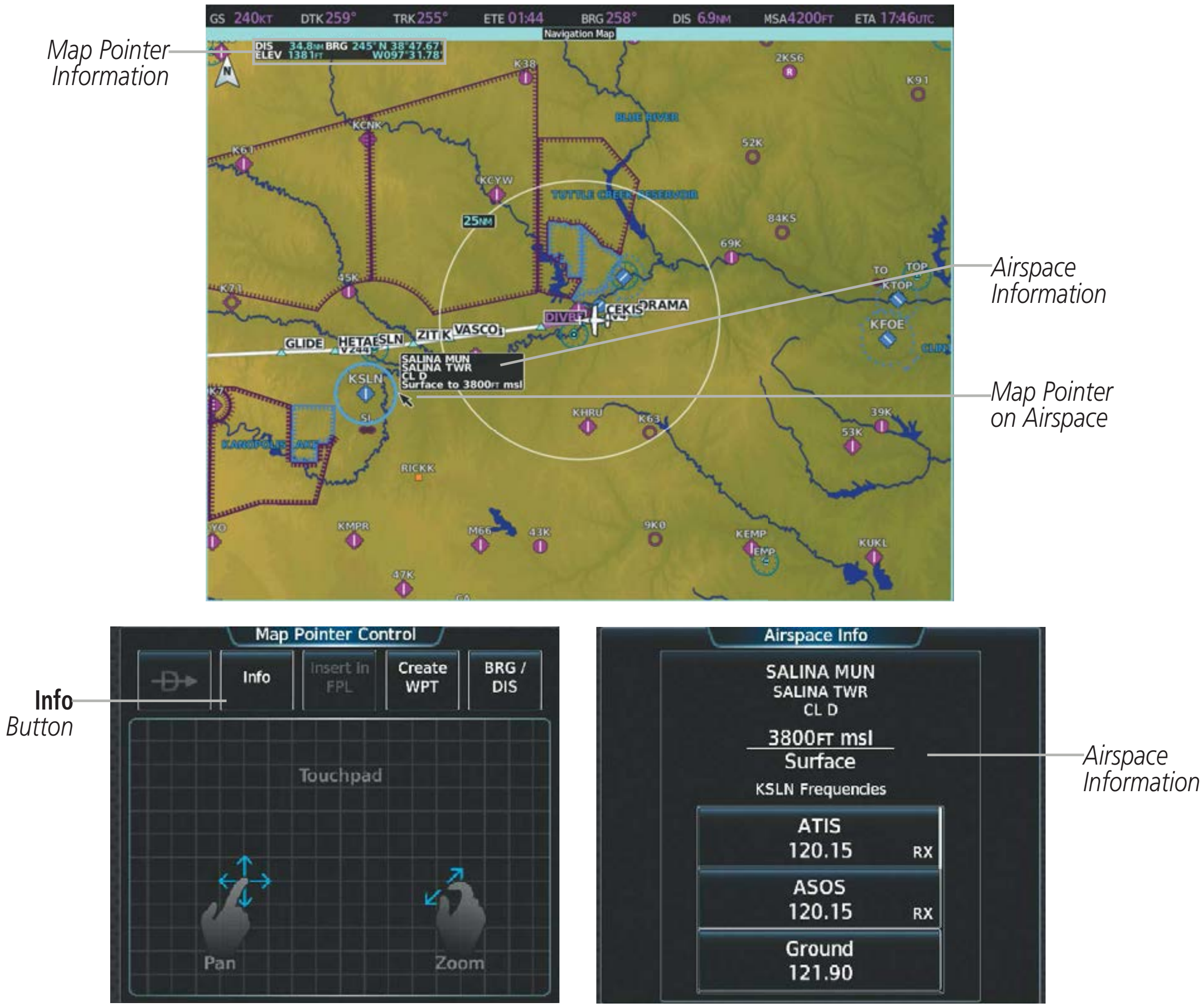


Figure 5-18 Navigation Map – Map Pointer on Airspace

Reviewing information for a special use or controlled airspace:

1) Place the Map Pointer on an airspace boundary

2) Touch the **Info** Button to display the 'Airspace Info' Screen.

3) Touch the **Back** Button on the Touchscreen Controller to return to the 'Map Pointer Control' Screen without removing the Map Pointer from the Navigation Map.

Or:

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

MEASURING BEARING AND DISTANCE

Distance and bearing can be measured on a navigation map or on a data link weather map may be calculated using the knobs on the Touchscreen Controller or the **Touchpad**. Measurement can be from the aircraft's present position to any point, or between any two points. The bearing and distance tool displays a dashed Measurement Line and a Measure Pointer to aid in graphically identifying the points to measure. Latitude/Longitude, distance, bearing and elevation data of the Measure Pointer is provided in a window at the top left of the map.

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

1) Press the lower knob on the Touchscreen Controller (with a navigation map or data link weather map displayed).
2) Touch the **BRG/DIS** Button. A Measure Pointer is displayed on the map at the aircraft's present position.
3) Move the pointer using the upper knob on the Touchscreen Controller or the **Touchpad** to the desired location. A dashed Measurement Line is drawn from the aircraft present position to the location of the Measure Pointer. The latitude/longitude, distance, bearing and elevation data of the Measure Pointer are displayed at the top left of the map. Move the pointer again to measure to any other point.
4) To exit the Measure Bearing/Distance function, press the either knob on the Touchscreen Controller or touch the **Back** Button.

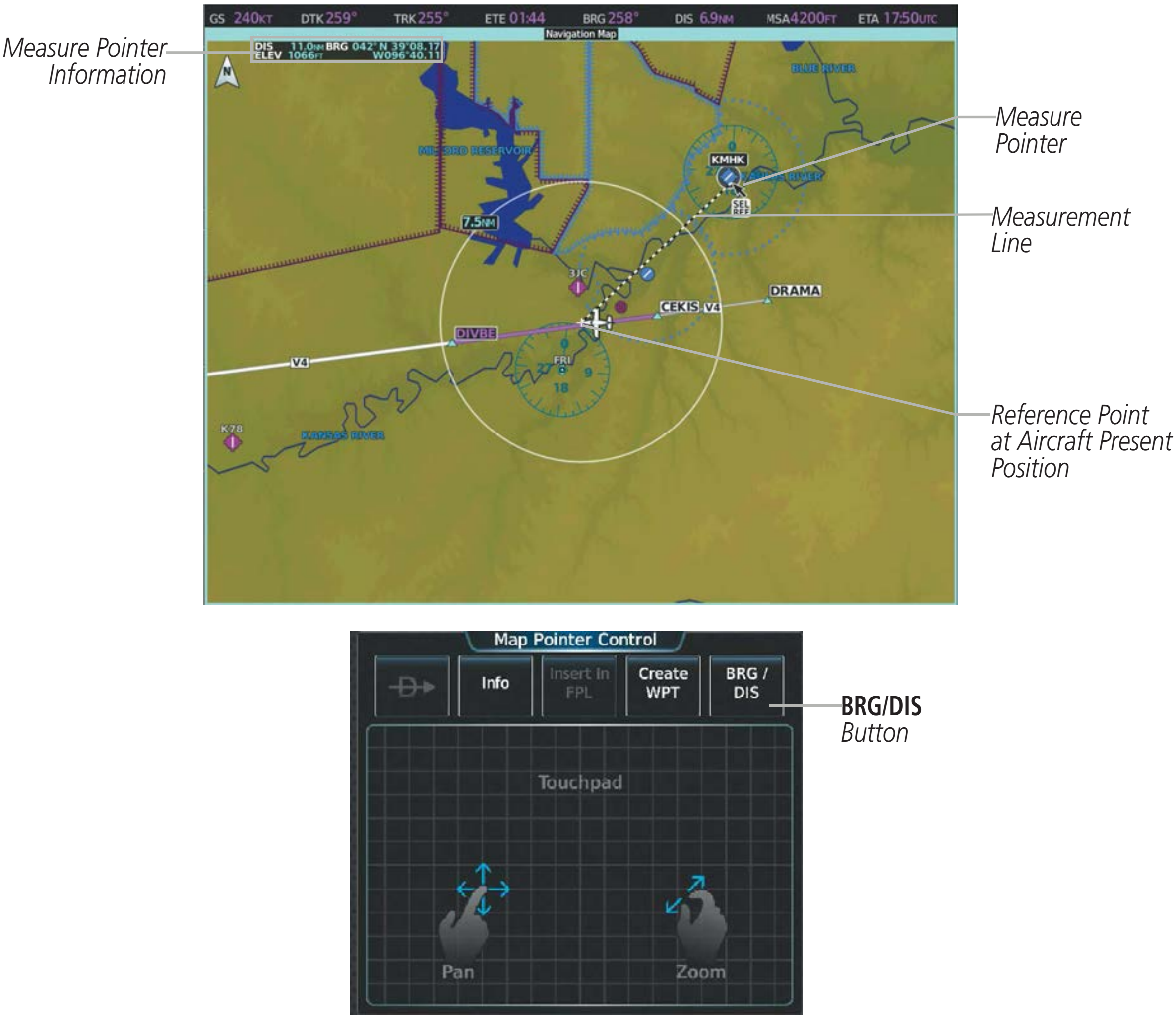


Figure 5-19 Navigation Map – Measuring Bearing/Distance from Aircraft Present Position

Measuring bearing and distance between any two points:

1) Press the lower knob on the Touchscreen Controller (with a navigation map or data link weather map displayed).
2) Touch the **BRG/DIS** Button. A Measure Pointer is displayed on the map at the aircraft's present position.
3) Move the pointer using the upper knob on the Touchscreen Controller or the **Touchpad** to the desired reference location. A dashed Measurement Line is drawn from the aircraft present position to the location of the Measure Pointer. The latitude/longitude, distance, bearing and elevation data of the Measure Pointer are displayed at the top left of the map.
4) Touch the **Select Ref** Button to set the Measure Pointer location as the new reference point for measurement. The dashed Measurement Line is erased.
5) Move the pointer using the upper knob on the Touchscreen Controller or the **Touchpad** to the desired location. A dashed Measurement Line is drawn from the reference point to the location of the Measure Pointer. The latitude/longitude, distance, bearing and elevation data of the Measure Pointer are displayed at the top left of the map.
6) Repeat steps 3 through 5 to measure between other points.
7) To exit the Measure Bearing/Distance function, press either knob on the Touchscreen Controller or touch the **Back** Button.

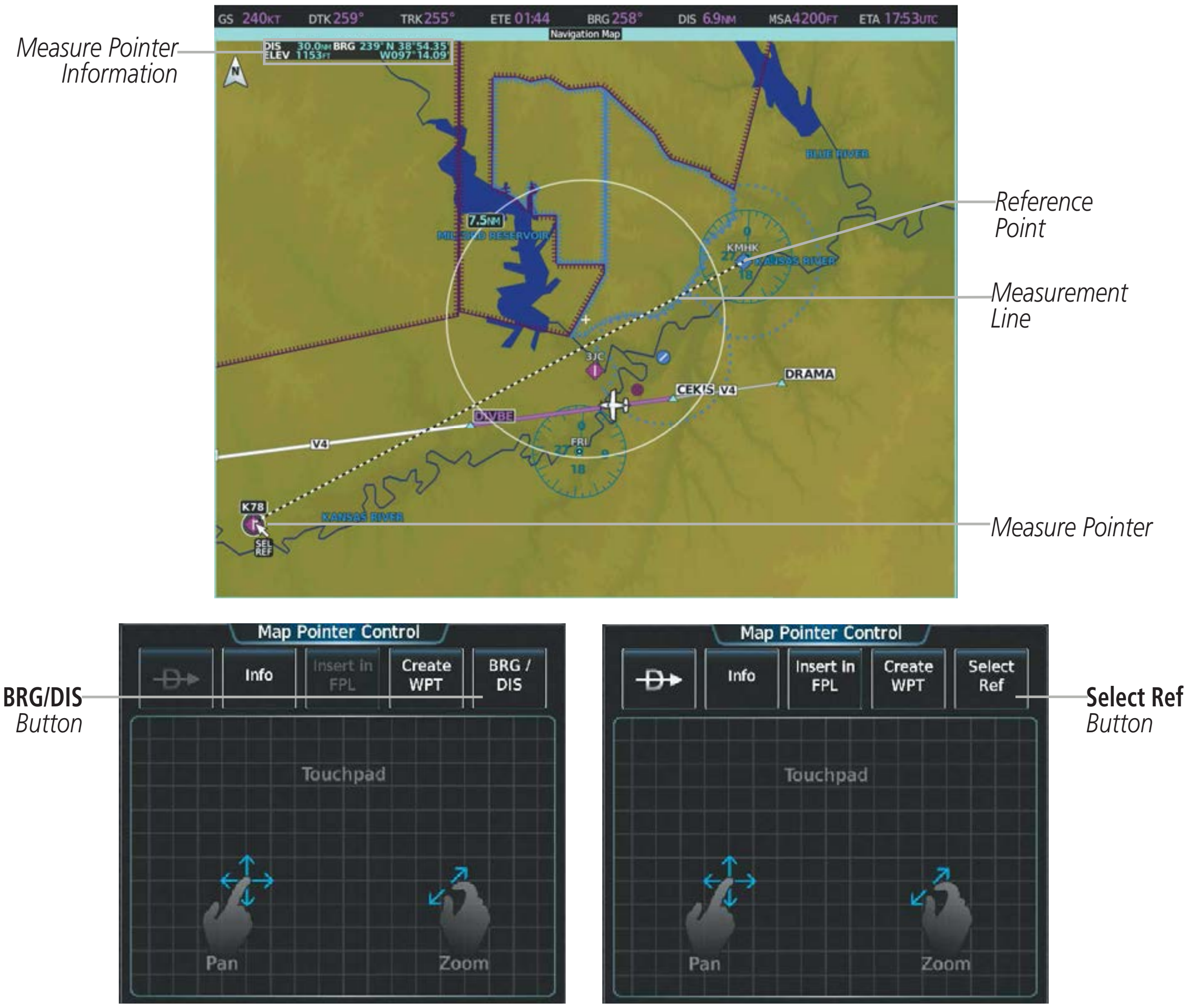


Figure 5-20 Navigation Map – Measuring Bearing/Distance between Two Points

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.

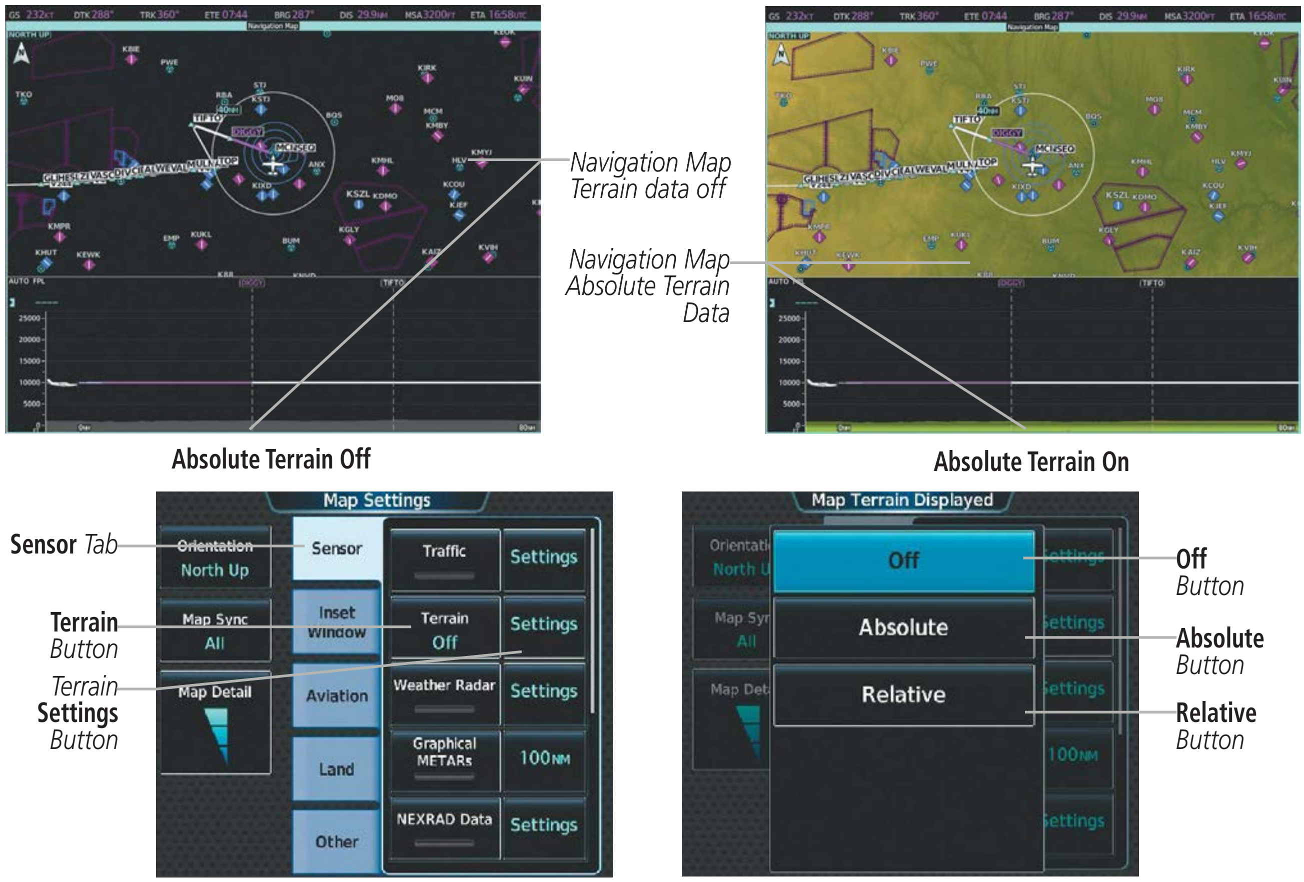


Figure 5-21 Navigation Map – Absolute Terrain Data

Displaying/removing absolute terrain data on navigation maps:

1) From MFD Home, touch **Map > Map Selection > Map Settings.**
2) Touch the **Sensor** Tab, if necessary.
3) Touch the **Terrain** Button to display the 'Map Terrain Displayed' Window.
4) Touch the **Absolute** Button to display absolute terrain data on the navigation map.

   Or:

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

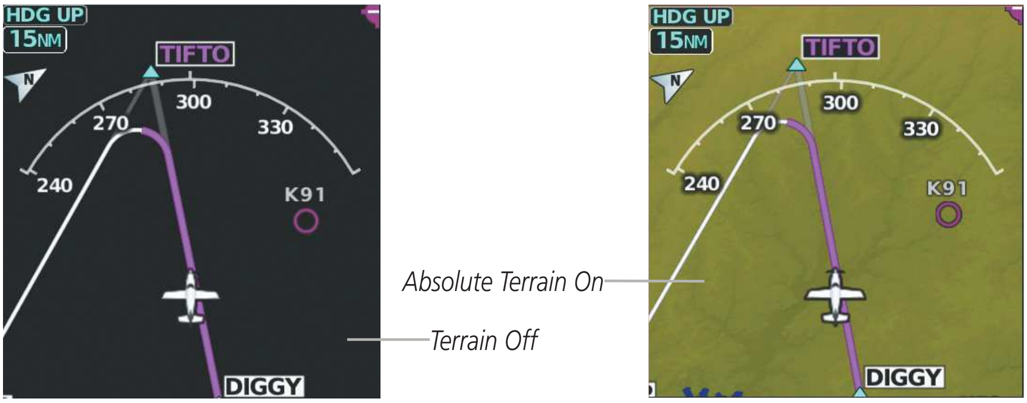


Figure 5-22 PFD Inset Map – Absolute Terrain Data

Figure 5-23 HSI Map – Absolute Terrain Data

Displaying/removing absolute terrain data from the PFD Inset Map or the HSI Map:

1) From PFD Home, touch **PFD Map Settings.**

2) Touch the **Terrain** Button to display the 'Inset Map Terrain Displayed' Window.

3) 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.

4) Press the **Back** Softkey to return to 'PFD Map Settings' Screen.

Or:

1) Press the **PFD Map Settings** Softkey on the PFD.

2) 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.

3) Press the **Back** Softkey to return to the top level PFD softkeys.

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

Figure 5-24 Navigation Map – Absolute Terrain Data

Selecting an absolute terrain data range on navigation map displays:

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

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 decluttering of the symbols from the PFD Map using the **DCLTR** Softkey and the decluttering of the symbols from the MFD navigation map using the Map Detail Slider are also discussed.

LAND SYMBOLS

The following items are configured on the **Land** Tab on the 'Map Settings' Screen:

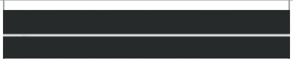
Land Symbols	Symbol	Default Range (nm)	Maximum Range (nm)
Point Obstacle	See Hazard Avoidance Section	10	25
Roads			
Interstate Highway (Freeway)		50	400
International Highway (Freeway)		50	400
US Highway (National Highway)		15	150
State Highway (Local Highway)		2.5	100
Local Road (Local Road)	N/A	4	25
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 5-1 Land Symbol Information

AVIATION SYMBOLS

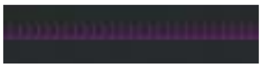
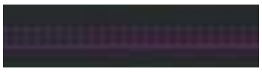
The following items are configured on the aviation menu:

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

Table 5-2 Aviation Symbol Information

AIRSPACE SYMBOLS

The following items are configured on the airspace menu:

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

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

Table 5-3 Airspace Symbol Information

SYMBOL SETUP

All navigation maps can display aviation and land symbols. Aviation and land symbol types (e.g. runway extensions, railroads) can be removed individually. Runway Extensions, when enabled, will be depicted under the following conditions:

- The enroute waypoint after the active leg is an airport.
- The off-route -D▸ waypoint is an airport.
- The destination airport has a loaded arrival or loaded/activated approach.

If a loaded arrival or loaded/activated approach is subsequently removed from the active flight plan, the system removes the runway extensions from the map.

Displaying/removing a navigation or land symbol type:

1) From MFD Home, touch **Map** > **Map Selection** > **Map Settings**.
2) Touch the **Aviation** Tab 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.

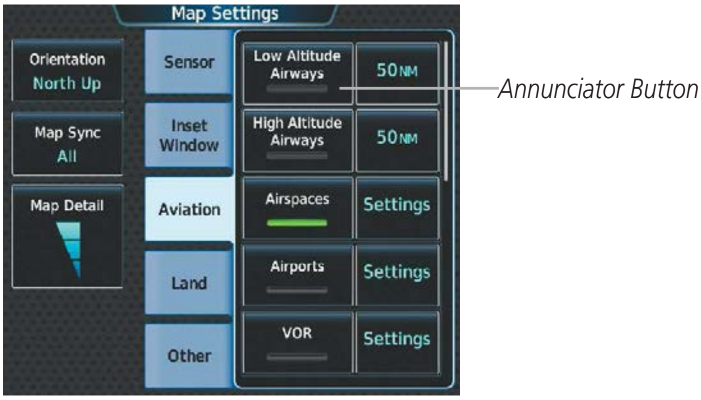


Figure 5-26 'Map Settings' Screen – Individual Items On/Off

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

Selecting an Aviation or Land item maximum range:

1) From MFD Home, touch **Map > Map Selection > Map Settings.**
2) Touch the **Aviation** Tab or **Land** Tab, if necessary.
3) Scroll the list to find the desired item.
4) If necessary, touch the **Settings** Button to display the range buttons.
5) Touch the range button to display the range choices.
6) Touch a range selection button to select the maximum range.
7) Repeat steps 3 through 6 as necessary.

Figure 5-27 Map Settings Screen – Aviation Data Setup

Figure 5-28 Map Settings Screen – Land Data Setup

Displaying/removing the VOR compass rose:

1) From MFD Home, touch **Map** > **Map Selection** > **Map Settings.**
2) Touch the **Aviation** Tab, if necessary.
3) Scroll the list to find the VOR buttons.
4) Touch the VOR **Settings** Button to display the 'VOR Settings' 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 Inset Map, the HSI Map, and the **Detail** Softkey.

Figure 5-29 Navigation Map – Map Detail

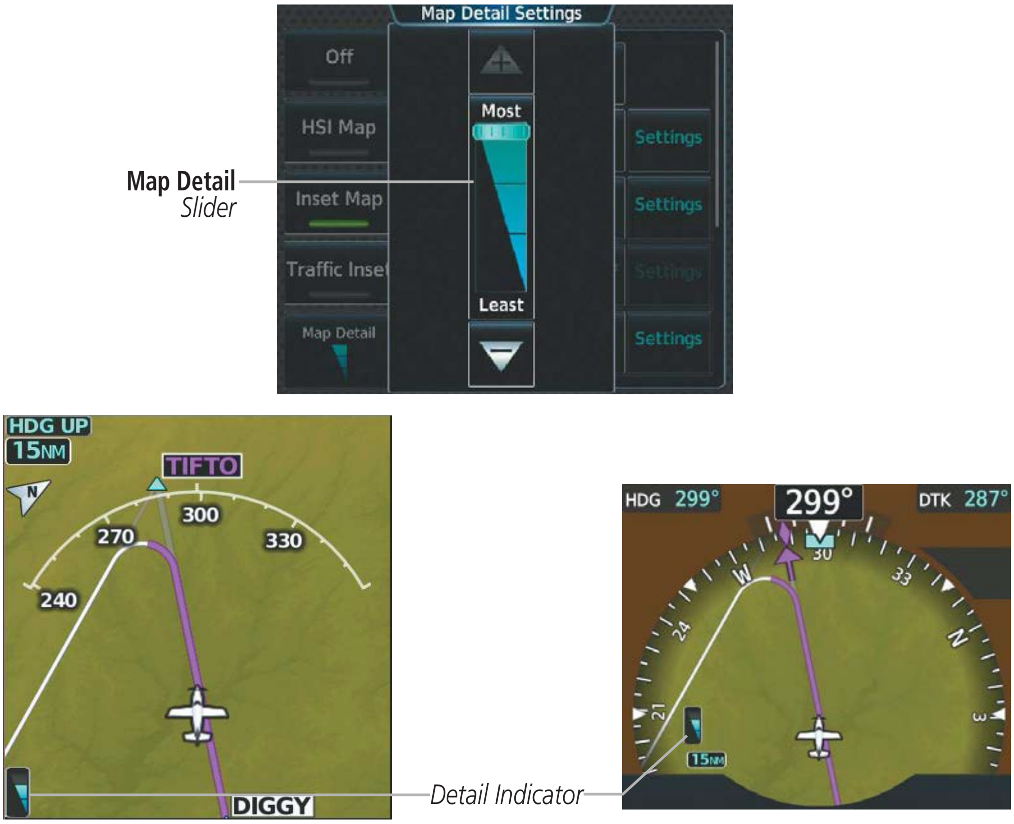


Figure 5-30 PFD Inset Map/HSI Map – Map Detail

Adjusting the navigation map detail:

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

Adjusting the PFD Map detail:

1) From PFD Home, touch **PFD Map Settings** > **Map Detail**.
2) Slide up or down on the **Map Detail** Slider to adjust the PFD Inset Map or HSI Map detail.

Or:

1) Press the **PFD Map Settings** Softkey.
2) Press the **Detail** Softkey to adjust the PFD Inset Map or HSI Map detail.

Table 5-3 lists the items that are decluttered at each map detail level. The 'X' represents map items decluttered for each level of detail.

Item	DCLTR 1	DCLTR 2	Least
Data Link Radar Precipitation			X
Data Link Lightning			X
Graphical METARs			X
Airports			X
Safe Taxi			X
Runway Labels			X
TFRs			X
Restricted			X
MOA (Military)			X
VRPs		X	X
User Waypoints		X	X
Latitude/Longitude Grid		X	X
NAVAIDs (does not declutter if used to define airway)		X	X
Intersections (does not declutter if used to define airway)		X	X
Class B Airspaces/TMA		X	X
Class C Airspaces/TCA		X	X
Class D Airspaces		X	X
Other Airspaces/ADIZ		X	X
Obstacles		X	X
Cities	X	X	X
Roads	X	X	X
Railroads	X	X	X
State/Province Boundaries	X	X	X

Table 5-4 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 (Victor Airways or T-Routes) start 1,200 feet above ground level (AGL) and extend up to 18,000 feet mean sea level (MSL). Low Altitude Airways are designated with a "V" or a "T" before the airway number.

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

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

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

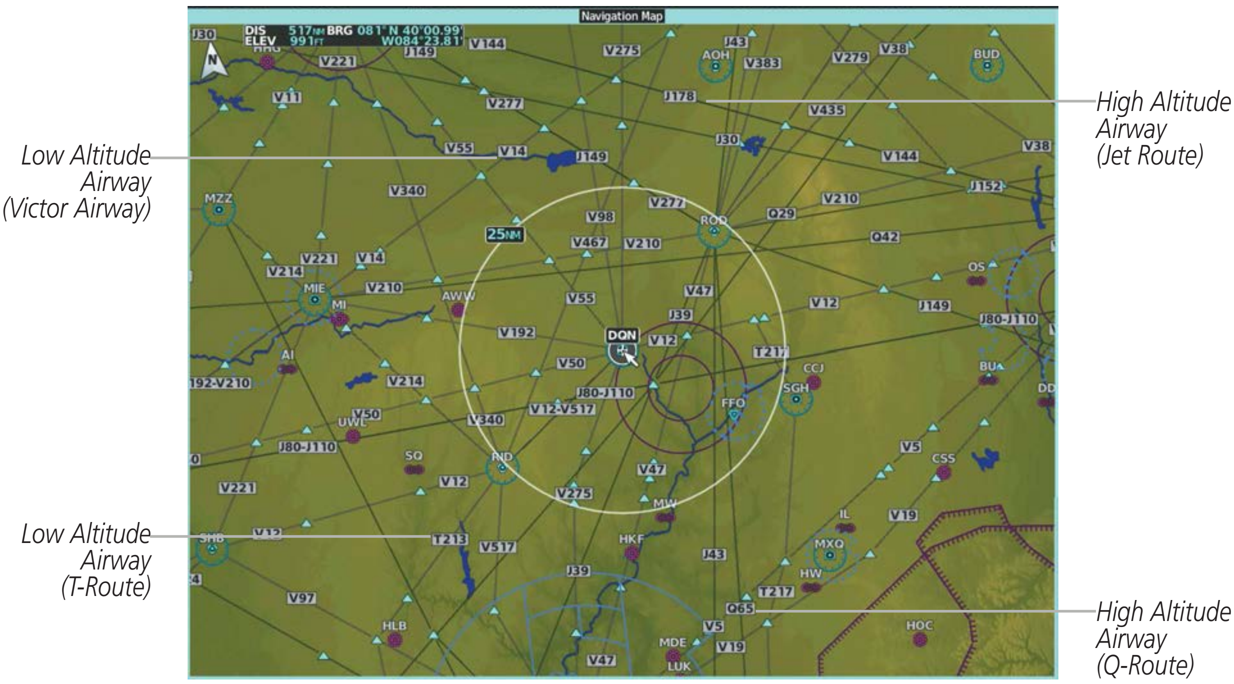


Figure 5-31 Airways on MFD Navigation Map

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

Displaying/removing airways:

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

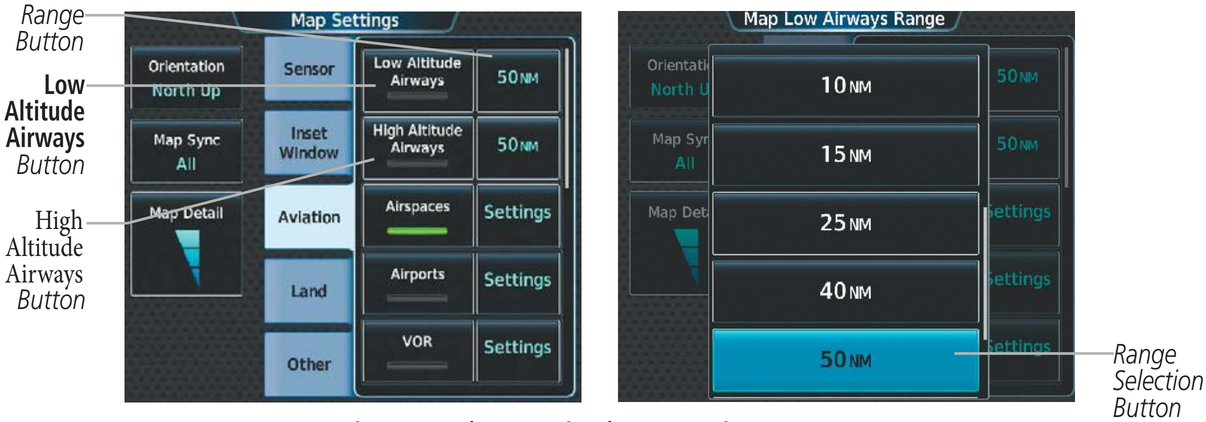


Figure 5-32 'Map Settings' Screen – Airways Setup

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

Selecting an airway range:

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

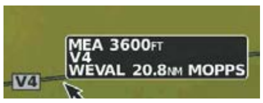
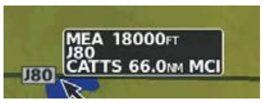
Airway Type	Airway Symbol/Line	Highlighted Airway Information Box	Default Range (nm)	Maximum Range (nm)
Low Altitude Airways (V Routes and T Routes)			50	100
High Altitude Airways (J Routes and Q Routes)			50	100

Table 5-5 Airway Range Information

ADDITIONAL NAVIGATION MAP ITEMS

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

Displaying/removing Additional Navigation Map Items:

1) From MFD Home, touch **Map** > **Map Selection** > **Map Settings**.
2) Touch the **Other** Tab, if needed.
3) Scroll as required and touch the desired button to display/remove map items.

TRACK VECTOR

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

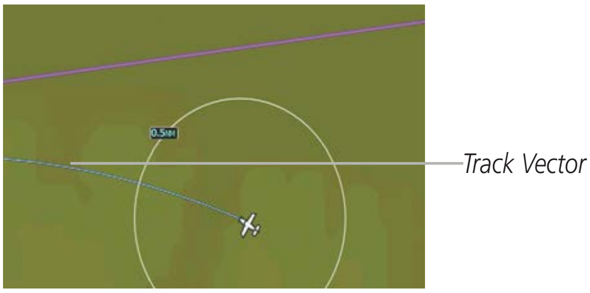


Figure 5-33 Navigation Map – Track Vector

Figure 5-34 Map Options Screen – Track Vector Setup

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 5-35 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 5-36 Navigation Map – Fuel Range Ring

Selecting fuel reserve time:

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

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.

Field of View on the Navigation Map

Figure 5-37 PFD and Navigation Map Field of View Comparison

SELECTED ALTITUDE RANGE ARC

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

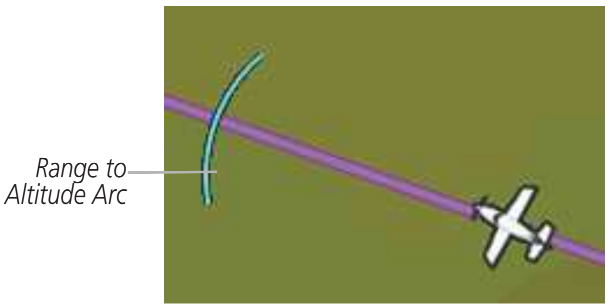


Figure 5-38 Navigation Map – Selected Altitude Range Arc

LATITUDE/LONGITUDE LINES

The navigation map can display the latitude and longitude lines. They are shown as cyan dashed lines.

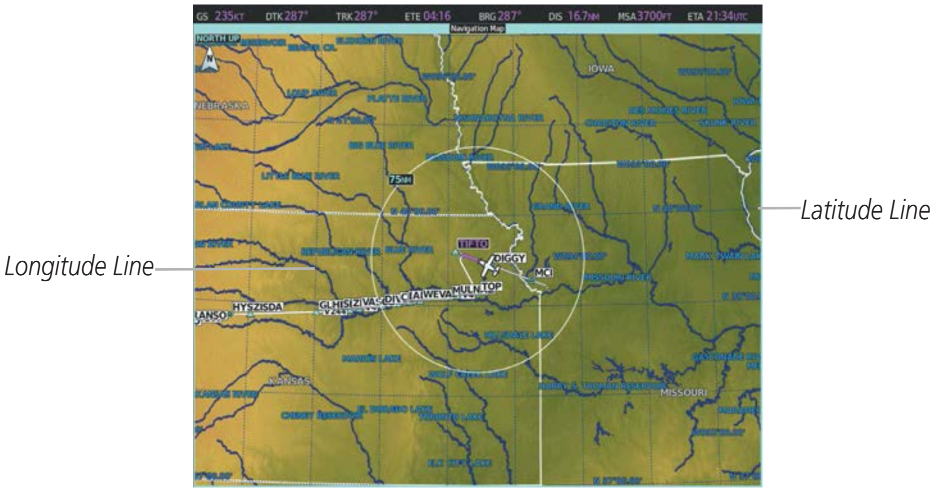


Figure 5-39 Navigation Map – Latitude/Longitude Lines

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 Selection > Map Settings.**
2) Touch the **Other** Tab, if necessary.
3) Touch the Lat/Lon lines range button to display the range selection buttons.
4) Touch a range selection button to select the maximum map display range.

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.

Figure 5-40 Navigation Map – Obstacles

Displaying/removing obstacles:

1) From MFD Home, touch **Map** > **Map Selection** > **Map Settings.**
2) Touch the **Land** Tab, if necessary.
3) Touch the **Point Obstacle** Button to display/remove the obstacles.

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

Selecting the obstacle data range:

1) From MFD Home, touch **Map** > **Map Selection** > **Map Settings.**
2) Touch the **Land** Tab, if necessary.
3) Touch the point obstacle range button to display the range selection buttons.
4) Touch a range selection button to select the maximum map display range.

5.3 WAYPOINTS

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

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

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

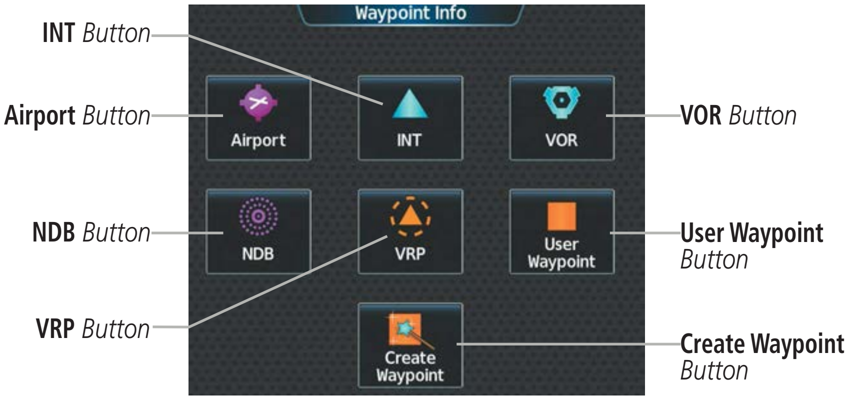


Figure 5-41 Waypoint Info Screen

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

Figure 5-42 'Waypoint Duplicates' Screen

AIRPORTS

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

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 avionics power-up 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 5-43 'Airport Information' Pane on MFD

Figure 5-44 '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	

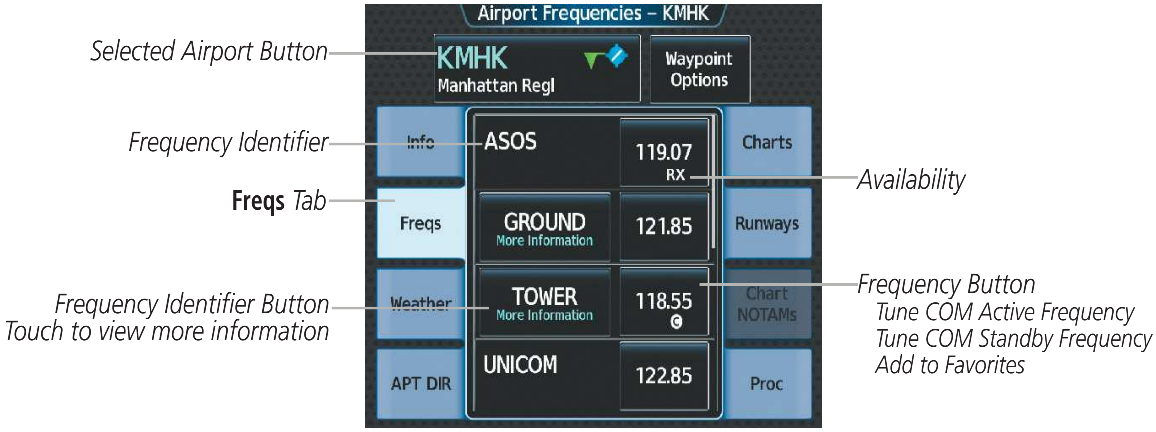


Figure 5-45 'Airport Frequencies' Screen

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

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

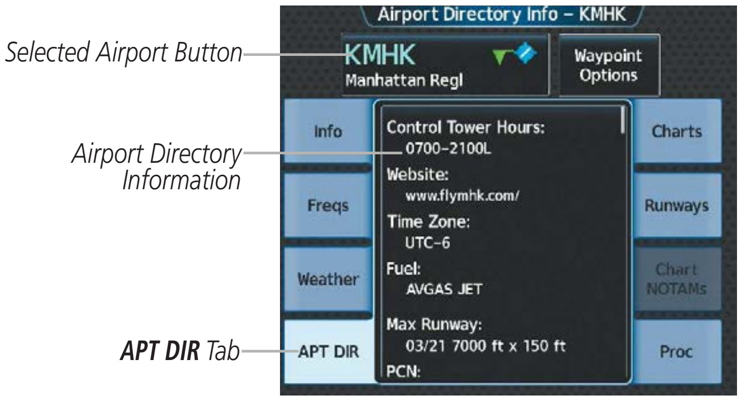


Figure 5-46 'Airport Directory Info' Screen

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

Airport: Identifier, Type, Name, City, State, Map	**Control Tower:** Full/Part-time Hours, Days Open	**Attendance**: Annual, weekly, daily, hours
Facility Lighting and Beacon: Hours operating, Type and Location, CTAF, beacon colors	**Noise Abatement**: Flying Procedures	**Pattern Altitudes:** Aircraft Class/ Altitude
Runways: Headings, Length, Width, Facility Obstructions, Surface, Condition, Clearance Slope	**FBO:** Name/Type, Frequencies, Services, Fees, Fuel, Credit Cards, Phone/Fax, Hours Internet, Courtesy Car	**Aircraft Businesses/Clubs:** Name, Type (sales, training, servicing), Frequencies/Phone/Fax, Credit Cards, Internet, Services
Frequencies: Type/Frequency	**Weather Contacts:** Service Type and Frequencies/Phone (AWOS/ ASOS)	**Obstructions:** General Airport Obstructions
Flight Service Station (FSS): FSS Name, Phone Numbers	**Approaches:** Types	**General Information and/or Notes:** Fees, Airport Notes, local area information
Special Operations at Airport: Helicopters, etc.	**Restaurants:** On the Field and Nearby	**Transportation:** Taxi Services, Car Rentals, Type and Availability (public, shuttle, limo, etc.)
Attractions: Hotels, Museums, Raceways, Golfing, etc.	**NAVAIDS:** Type, Identifier, Frequency, Radial, Distance	**Charts:** VFR Sectional
Elevation: Airfield Elev (ft)	**Mag Var:** Airfield Mag Var (degrees)	**Airport Manager:** Phone

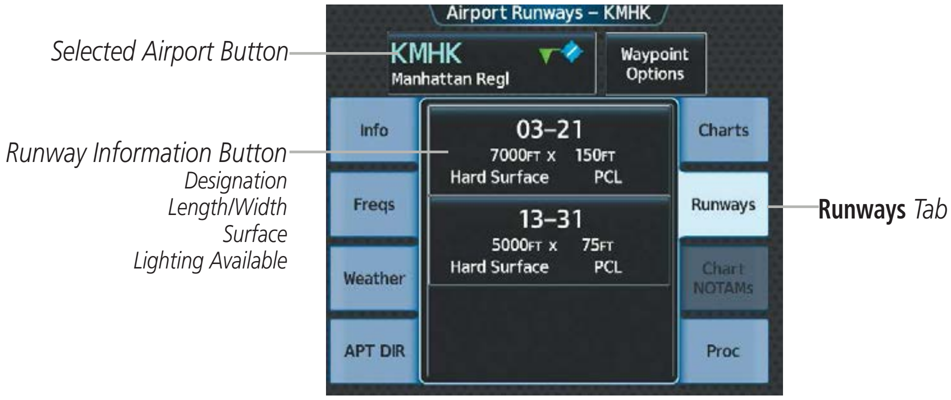


Figure 5-47 'Airport Runways' Screen

The **Runways** Tab brings up the 'Airport Runways' Screen with a Runway Information button for each runway at the selected airport. The Runway Information button contains information about each runway, and selects the runway, which scales the 'Airport Information' Pane to focus on the selected runway.

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

Runway surface type: Hard, Turf, Sealed, Gravel, Dirt, Soft, Unknown, 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 identifier 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 identifier 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.

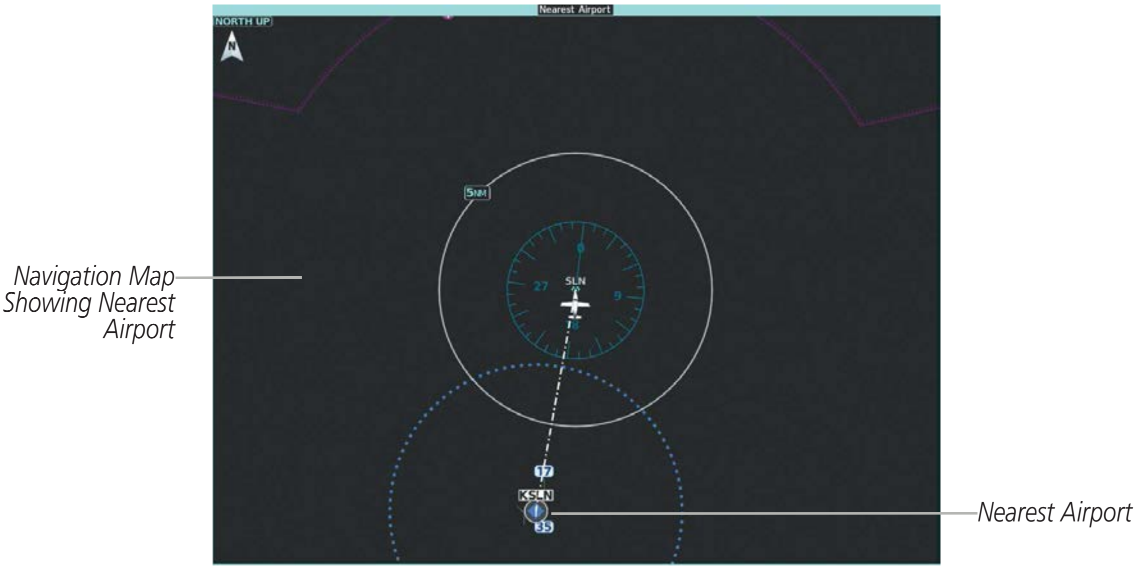


Figure 5-48 'Nearest Airport' Pane

Figure 5-49 'Nearest Airport' Screen

Viewing information for a nearest airport:

1) From MFD Home, touch **Nearest** > **Airport**.
2) Touch a nearest airport button to display the 'Waypoint Options' Window. If necessary, touch the **Show On Map** Button to highlight the airport on the 'Nearest Airport' Pane.
3) Touch the **Airport Info** Button to display the 'Airport Information' Screen.
4) Touch a Tab to display the desired information on the Touchscreen Controller.

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

The minimum runway length and surface type used when determining the 25 nearest airports to display on the 'Nearest Airports' Screen are set on the 'Avionics Settings' Screen under the **System** Tab. A minimum runway length and/or surface type can be entered to prevent airports with small runways or runways that are not appropriately surfaced from being displayed. Default settings are 3000 feet (or meters) for runway length and "Hard Only" for runway surface type.

Selecting nearest airport surface matching criteria:

1) From MFD Home, touch **Utilities** > **Setup** > **Avionics Settings**.
2) Touch the **System** Tab, if necessary.
3) Scroll the list to display the Nearest Airport Runway Surface button.
4) Touch the Nearest Airport Runway Surface button to display the surface choices.
5) Touch a surface selection button to set the surface criteria.

Selecting nearest airport minimum runway length matching criteria:

1) From MFD Home, touch **Utilities** > **Setup** > **Avionics Settings**.
2) Touch the **System** Tab, if necessary.
3) Scroll the list to display the Nearest Airport Min Rwy Length button.
4) Touch the Nearest Airport Min Rwy Length button to display the keypad.
5) Use the keypad to enter the minimum length.
6) Touch the **Enter** Button to accept the length criteria.

NON-AIRPORT AND USER CREATED WAYPOINTS

WAYPOINT INFORMATION

All other waypoints include Intersections, VORs, NDBs, VRPs, and User Waypoints. For each of these waypoints, their respective information pane will 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.

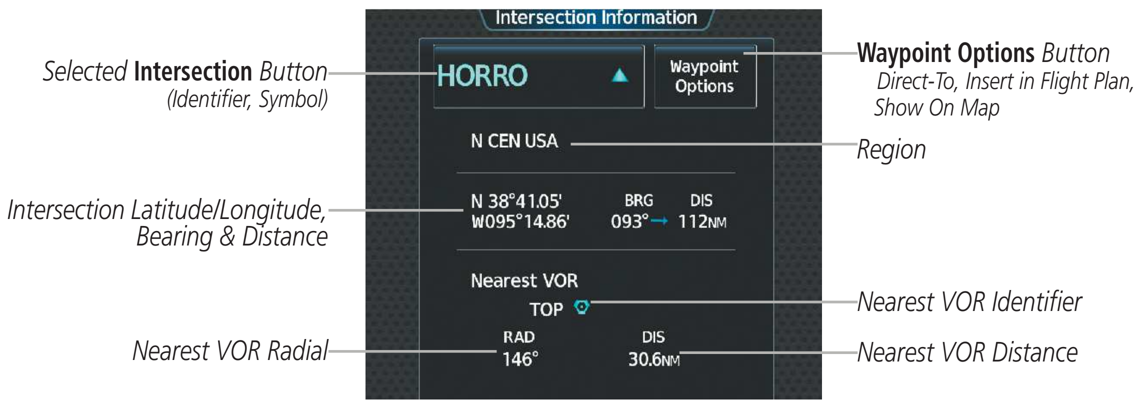


Figure 5-50 Intersection Information Screen

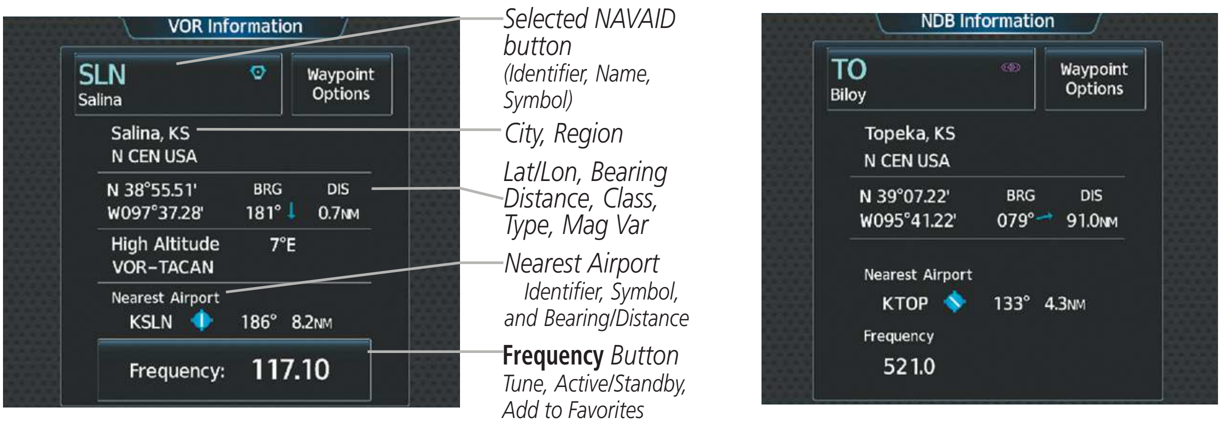


Figure 5-51 VOR and NDB Information Screens

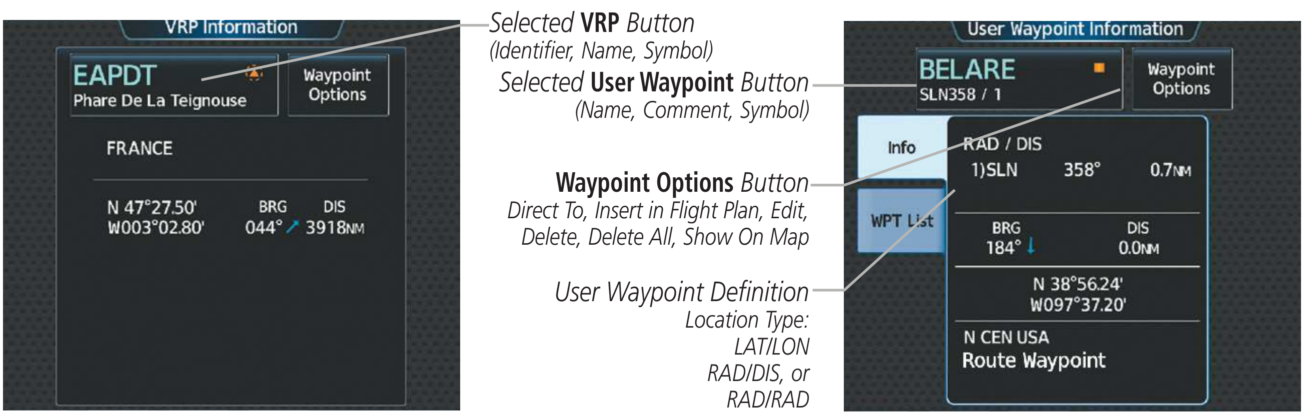


Figure 5-52 VRP and User Waypoint Information Screens

Figure 5-53 Non-Airport Waypoint Display (shown via "Show on Map")

Selecting an Intersection, VOR, NDB, or VRP:

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

Selecting a User Waypoint:

1) From MFD Home, touch **Waypoint Info > User Waypoint**
2) Choose the desired User Waypoint.
    a) Touch the available user waypoint button to display the keypad.
    b) Use the keypad to enter the waypoint identifier or name.
    c) Touch the **Enter** Button to accept the identifier and display the waypoint's information on the Touchscreen Controller.

    Or:

    a) Touch the **WPT List** Tab
    b) Touch the desired waypoint button.
3) Touch the Waypoint Options button, then the **Show on Map** Button to display the 'User WPT Information' Pane, if needed.

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

1) From MFD Home, touch **Waypoint Info** and select the desired Non-Airport Waypoint Button**.**
2) Touch the selected waypoint button to display the keypad.
3) Touch the **Find** Button to display the 'Find Waypoint' Screen.
4) Touch the **Recent**, **Nearest**, **Active Flight Plan**, or **Favorites** Tab to display a list of waypoints in the selected category.
5) Touch a waypoint selection button to display that waypoint's information on the Touchscreen Controller.
6) Touch the **Waypoint Options** Button, then the **Show on Map** Button to display the '(Intersection, VOR, NDB, VRP, or User WPT) Information' Pane, if needed.

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

Finding and selecting a VOR, NDB, or VRP for review by facility name or city name:

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

NEAREST NON-AIRPORT WAYPOINTS

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

The 'Nearest (Intersection/VOR/NDB/VRP/User)' Screen shows a list of up to 25 waypoints (five entries can be displayed at one time). If there are more than five, they are displayed in a scrollable list. If there are no existing waypoints or nearest waypoints available, "No Results Found" is displayed. When shown on a map, a dashed white line is drawn on the 'Nearest (Intersection/VOR/NDB/VRP/User)' Pane from the aircraft position to the selected nearest waypoint.

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

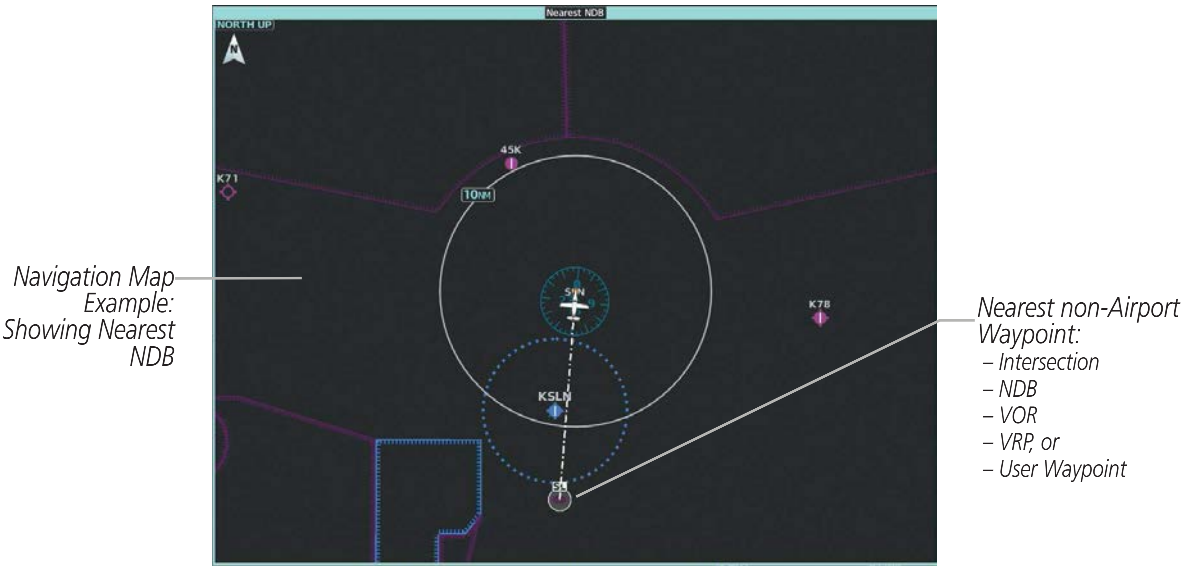


Figure 5-54 Nearest non-Airport Waypoint Display (Example: NDB)

Figure 5-55 Nearest VOR/NDB Screen Layouts (Example: NDB)

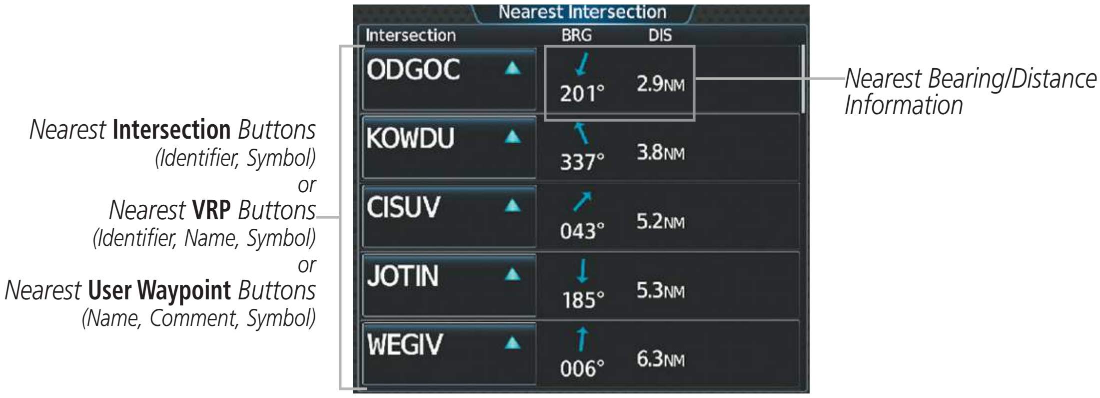


Figure 5-56 Nearest Intersection/VRP/User Screen Layouts (Example: Intersection)

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

1) From MFD Home, touch **Nearest** and select the desired Non-Airport Waypoint Button

2) Touch a nearest waypoint button to display the 'Waypoint Options' Window.

3) Touch the **Show on Map** Button to display the 'Nearest (Intersection/NDB/VOR/VRP/User)' Pane, if needed.

4) Touch the (**Intersection, VOR, NDB, VRP,** or **User Waypoint**) **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. Waypoints can be created as a Route or Airport waypoints using the **Type** Button. User waypoints can be created in three different ways. The first can be done through the 'Waypoint Info' Screen, and the second can be done by selecting a position on a map page using the **Joystick** or the **Touchpad**. The third can be done by creating and inserting into the flight plan via route entry (discussed later in this section). Once a waypoint has been created, it can be renamed, deleted, or moved. Temporary user waypoints are erased upon system power down.

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

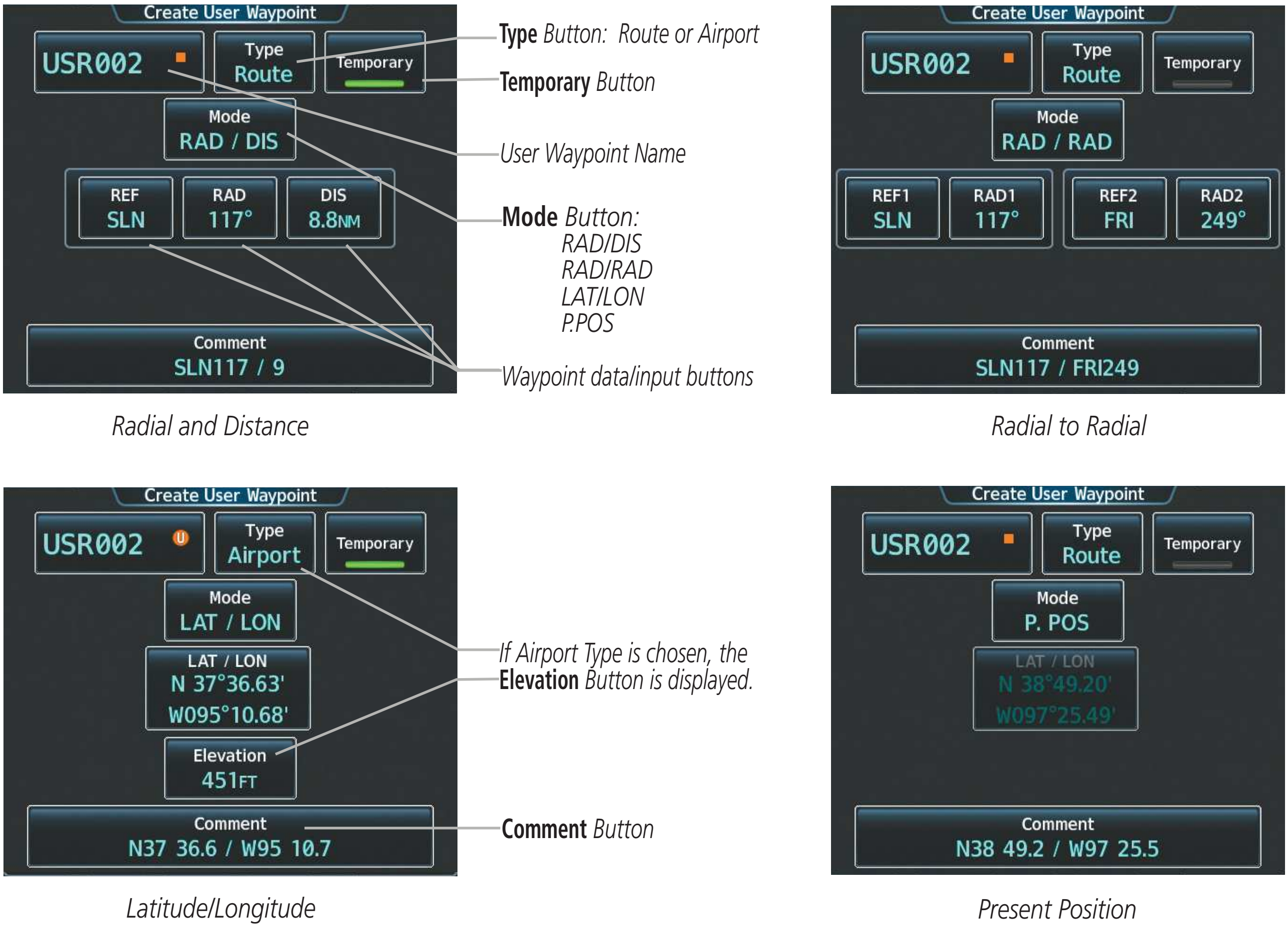


Figure 5-57 'Create User Waypoint' Screen - Mode Options

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

1) From MFD Home, touch **Waypoint Info** > **Create Waypoint**. The current aircraft position is the default location of the new waypoint.
2) Touch the user waypoint name button to display the keypad.
3) Use the keypad and the **Enter** Button to select a user waypoint name (up to six characters).
4) If desired, touch the **Type** Button to open the 'Select User Waypoint Type' Screen and change the default setting from Route to Airport.
   a) Touch the **Airport** Button.
   b) Touch the **Elevation** Button.
   c) Use the keypad and the **Enter** Button to select the airport elevation.
5) If desired, define the type and location of the waypoint in one of the following ways:
   a) Touch the **Mode** Button to display the 'Select User Waypoint Type' Screen.
   b) Touch the **RAD/DIS** Button to select the bearing/distance from a waypoint type.
   c) Touch the **REF** Button to display the keypad.
   d) Use the keypad and the **Enter** Button, or the Find function, to select the reference waypoint.
   e) Touch the **RAD** Button to display the keypad.
   f) Use the keypad and the **Enter** Button to select the radial.
   g) Touch the **DIS** Button to display the keypad.
   h) Use the keypad and the **Enter** Button to select the distance.

   Or:

   a) Touch the **Mode** Button to display the 'Select User Waypoint Mode' Screen.
   b) Touch the **RAD/RAD** Button to select the bearings from two waypoints type.
   c) Touch the **REF1** Button to display the keypad.
   d) Use the keypad and the **Enter** Button, or the Find function, to select the waypoint.
   e) Touch the **RAD1** Button to display the keypad.
   f) Use the keypad and the **Enter** Button to select the radial.
   g) Repeat Steps 5c through 5f for the second reference waypoint (**REF2** Button) and radial (**RAD2** Button).

   Or:

   a) Touch the **Mode** Button to display the 'Select User Waypoint Mode' Screen.
   b) Touch the **LAT/LON** Button to select the latitude/longitude type.
   c) Touch the **LAT/LON** Button to display the keypad.
   d) Use the keypad and the **Enter** Button to select the latitude and longitude.

   Or:

a) Touch the **Mode** Button to display the 'Select User Waypoint Mode' Screen.

b) Touch the **P.POS** Button to select the present position type.

6) If desired, change the waypoint comment.

a) Touch the **Comment** Button to display the keypad.

b) Use the keypad and the **Enter** Button to select the comment.

7) If desired, touch the **Temporary** Button to change the waypoint storage method. When the annunciator bar is green, the waypoint is only stored until the next power cycle. When the annunciator bar is grey, the waypoint is stored until manually erased.

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

Creating user waypoints from map displays:

1) Push the **Joystick** to activate the panning function and display the 'Map Pointer Control' Screen on the Touchscreen Controller.

2) Use the **Joystick** 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, Touch the **Type** Button to open the 'Select User Waypoint Type' Screen and change the default setting from Route to Airport.

a) Touch the **Airport** Button

b) Touch the **Elevation** Button

c) Use the keypad and the **Enter** Button to select the airport elevation.

7) If desired, change the waypoint comment. The comment defaults to the abbreviated latitude/longitude of the user waypoint.

a) Touch the **Comment** Button to display the keypad.

b) Use the keypad and the **Enter** Button to select the comment.

8) Press the **Create** Button to create the new waypoint.

9) Touch the **Back** Button or press the **Joystick** to deactivate the panning function and return to the previous display on the Touchscreen Controller.

EDITING USER WAYPOINTS

Editing a user waypoint comment:

1) From MFD Home, touch **Waypoint Info** > **User Waypoint**.
2) If needed, touch the **WPT List** Tab to display the list of user waypoints, and touch the desired user waypoint selection button.
3) Touch the **Waypoint Options** Button to display the 'Waypoint Options' Window.
4) Touch the **Edit** Button to display the 'Edit User Waypoint' Screen.
5) Touch the **Comment** Button to display the keypad.
6) Use the keypad and the **Enter** Button to select a user waypoint comment (up to 25 characters).
7) Touch the **Save** Button to accept the new comment.
8) Touch the **OK** Button in response to the question "Are you sure you want to modify this waypoint?".

Editing a user waypoint name:

1) From MFD Home, touch **Waypoint Info** > **User Waypoint**.
2) If needed, touch the **WPT List** Tab to display the list of user waypoints, and touch the desired user waypoint selection button.
3) Touch the **Waypoint Options** Button to display the 'Waypoint Options' Window.
4) Touch the **Edit** Button to display the 'Edit User Waypoint' Screen.
5) Touch the user waypoint name button to display the keypad.
6) Use the keypad and the **Enter** Button to select a user waypoint name (up to six characters).
7) Touch the **Save** Button to accept the new name.
8) Touch the **OK** Button in response to the question "Are you sure you want to modify this waypoint?".

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

1) From MFD Home, touch **Waypoint Info** > **User Waypoint**.
2) If needed, touch the **WPT List** Tab to display the list of user waypoints, and touch the desired user waypoint selection button.
3) Touch the **Waypoint Options** Button to display the 'Waypoint Options' Window.
4) Touch the **Edit** Button to display the 'Edit User Waypoint' Screen.
5) If desired, Touch the **Type** Button to open the 'Select User Waypoint Type' Screen and change the waypoint Type and/or airport elevation:
6) Touch the **Route** Button.

   Or:

a) Touch the **Airport** Button.

b) Touch the **Elevation** Button.

c) Use the keypad and the **Enter** Button to select the airport elevation.

6) If desired, touch the **Mode** Button to display the 'Select User Waypoint Mode' Screen to change the waypoint Mode and/or location.

Touch the **P. POS** Button to select the aircraft present position as the location.

Or:

a) Touch the **RAD/DIS**, **RAD/RAD**, or **LAT/LON** Button.

b) Touch the **REF** Button, the **RAD** Button, the **DIS** Button, or the **LAT/LON** Button, as required, to bring up the keypad.

c) Use the keypad and the **Enter** Button to change the user waypoint location.

7) Touch the **Save** Button to accept the new type and location.

8) Touch the **OK** Button in response to the question "Are you sure you want to modify this waypoint?".

DELETING USER WAYPOINTS

Deleting a single user waypoint:

1) From MFD Home, touch **Waypoint Info** > **User Waypoint**.

2) If needed, touch the **WPT List** Tab to display the list of user waypoints, and touch the desired user waypoint selection button.

3) Touch the **Waypoint Options** Button to display the 'Waypoint Options' Window.

4) Touch the **Delete** Button.

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

Deleting all user waypoints:

1) From MFD Home, touch **Waypoint Info** > **User Waypoint**.

2) If needed, touch the **WPT List** Tab to display the list of user waypoints, and touch the desired user waypoint selection button.

3) Touch the **Waypoint Options** Button to display the 'Waypoint Options' Window.

4) Touch the **Delete All** Button.

5) Touch the OK Button in response to the question "Would you like to delete all user waypoints?".

5.4 AIRSPACES

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

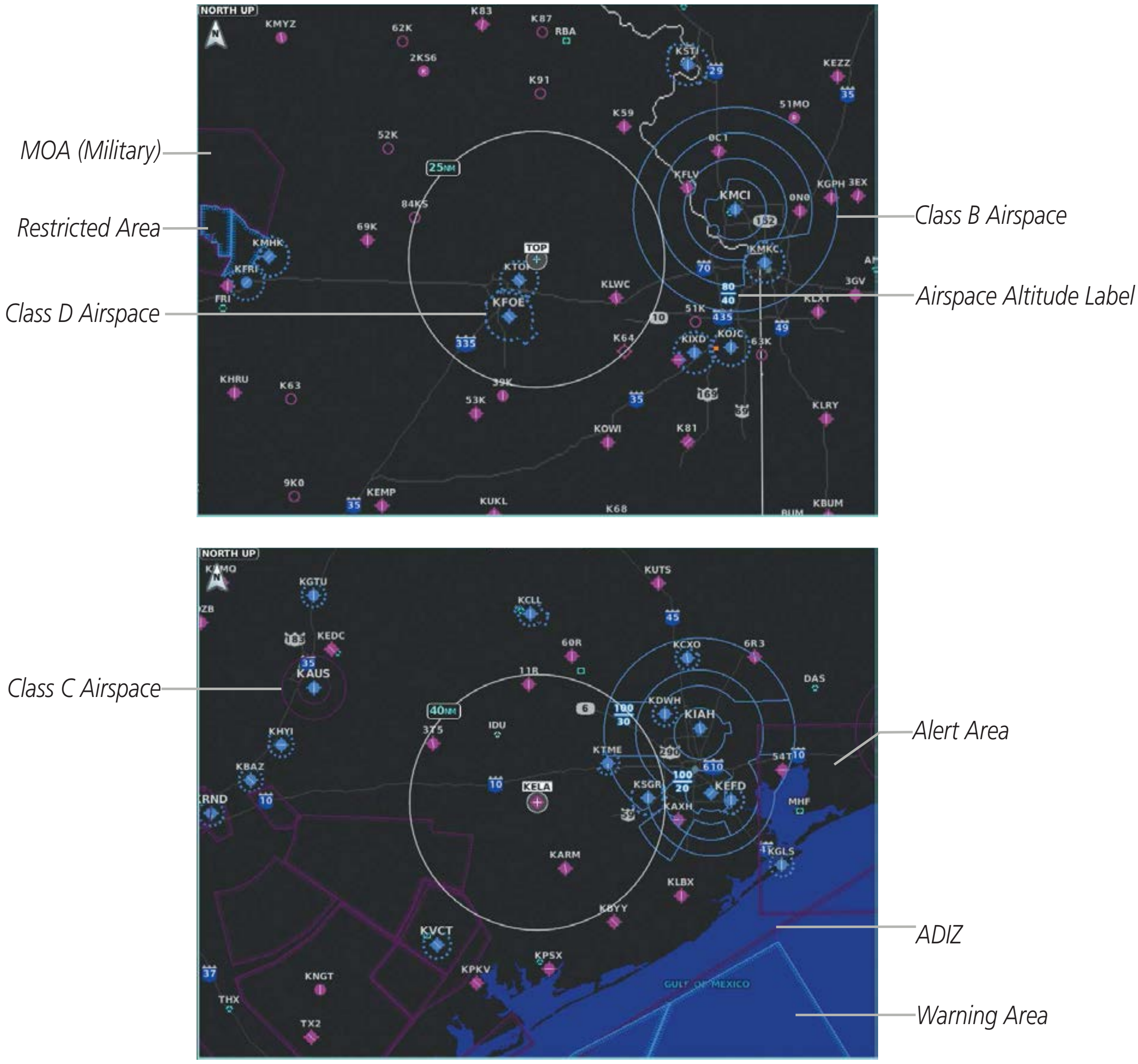


Figure 5-58 Airspaces

Displaying and removing airspace altitude labels:

1) From MFD Home, touch **Map** > **Map Selection** > **Map Settings**.

2) Touch the **Aviation** Tab.

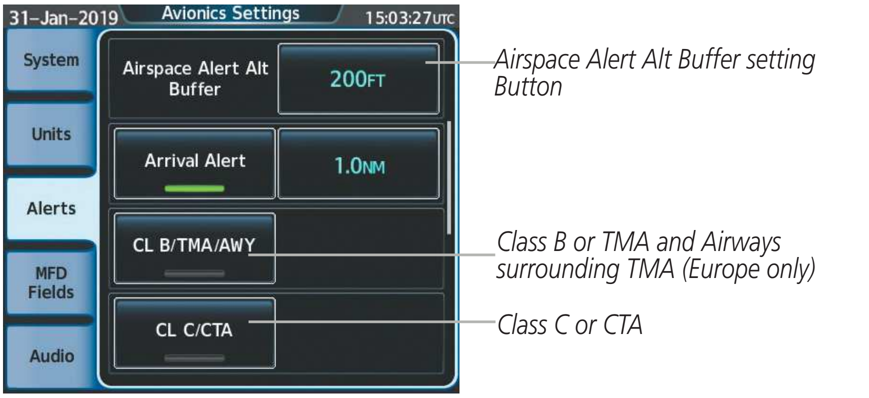
3) Touch the Airspaces **Settings** Button to display the 'Airspace Settings' Screen.

4) Touch the **Airspace Altitude Labels** Button to display/remove the labels from the navigation map.

NEAREST AIRSPACE

SETTING AIRSPACE ALERTS

The **Alerts** Tab on the 'Avionics Settings' Screen allows the pilot to turn the controlled/special-use airspace alerts on or off. This does not affect the airspaces listed on the 'Nearest Airspace' Screen or the airspace boundaries depicted on the 'Navigation Map' Pane. It simply turns on/off the alert provided when the aircraft is approaching or near an airspace. Alerts for the following airspaces can be enabled/disabled.



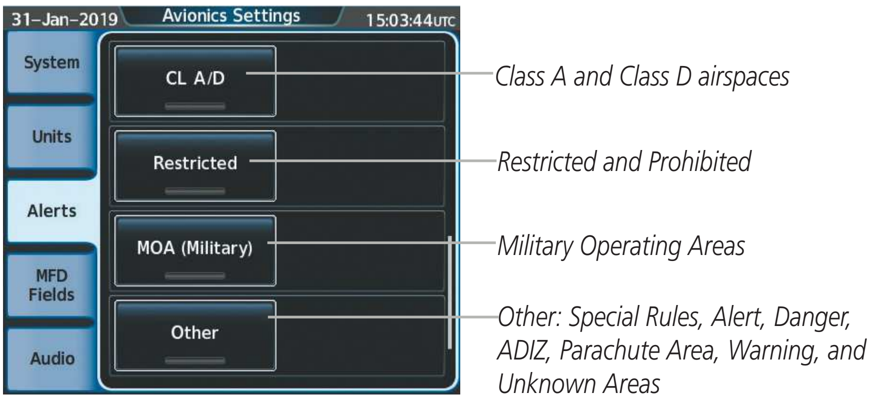


Figure 5-59 Alerts Tab – Airspace Alerts

An altitude buffer is also provided which “expands” the vertical range above or below an airspace. For example, if the buffer is set at 500 feet, and the aircraft is more than 500 feet above/below an airspace, an alert message is not generated, but if the aircraft is less than 500 feet above/below an airspace and projected to enter it, the pilot is notified with an alert message. The default setting for the altitude buffer is 200 feet.

Setting the altitude buffer distance:

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

Enabling/disabling an airspace alert:

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

VIEWING NEAREST AIRSPACE INFORMATION

The 'Nearest Airspace' Screen and the 'Nearest Airspace' Pane can be used to quickly find airspaces close to the flight path. 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.

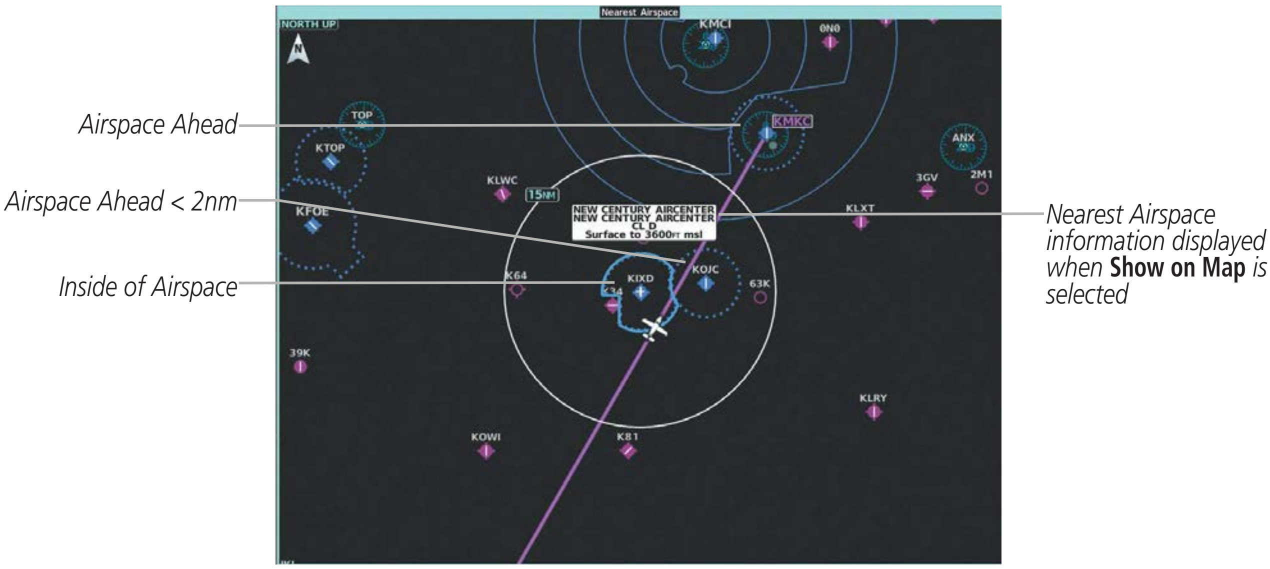


Figure 5-60 'Nearest Airspace' Pane

Figure 5-61 'Nearest Airspace' Screen

***Proximity**: Ahead, Inside, Ahead<2nm, Within 2nm	
****Time till Intercept**: Only if Ahead or Ahead < 2nm	

Viewing information for the Nearest Airspace:

1) From MFD Home, touch **Nearest** > **Airspace**.
2) Touch a Nearest Airspace button to display the 'Airspace Options' Window. If no airspace is projected, the 'Nearest Airspace' Screen will read "No Results Found".
3) Touch the **Show on Map** Button to display the selected airspace, if needed.
4) Touch the **Details** Button to display the selected 'Nearest Airspace' Screen information.

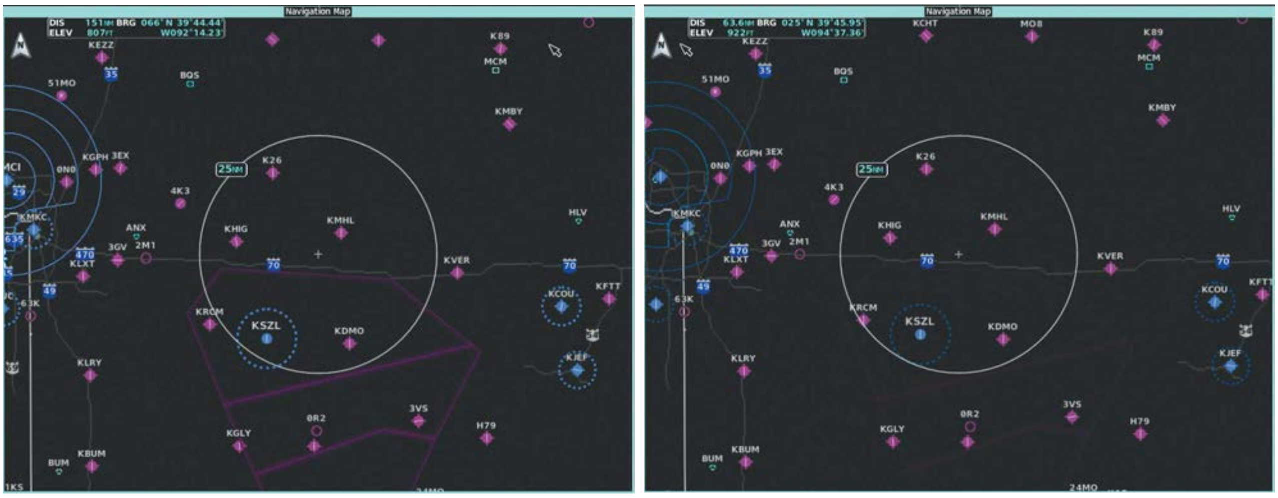
When an airspace alert occurs, the **MSG** Button on the Touchscreen Controller begins flashing. Touch the flashing button to view the list of alerts. The following airspace alerts are displayed in the 'Notifications' Screen:

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

Table 5-6 Table 5-5 Airspace Alert Messages

SMART AIRSPACE

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



Smart Airspace Off

Smart Airspace On

Figure 5-62 Smart Airspace

Enabling/disabling the Smart Airspace function:

1) From MFD Home, touch **Map** > **Map Selection** > **Map Settings**.

2) Touch the **Aviation** Tab, if necessary.

3) Scroll the list to find the Airspaces buttons.

4) Touch the Airspaces **Settings** Button to display the 'Airspace Settings' Screen.

5) Touch the **Smart Airspace** Button to enable/disable the Smart Airspace function.

5.5 DIRECT-TO NAVIGATION

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

Once a direct-to is activated, the system establishes a course from the present position to the selected direct-to destination, with initial turn as needed. Course guidance is provided until the direct-to is cancelled, replaced with a new direct-to, or a new flight plan leg or sequence is activated.

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

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

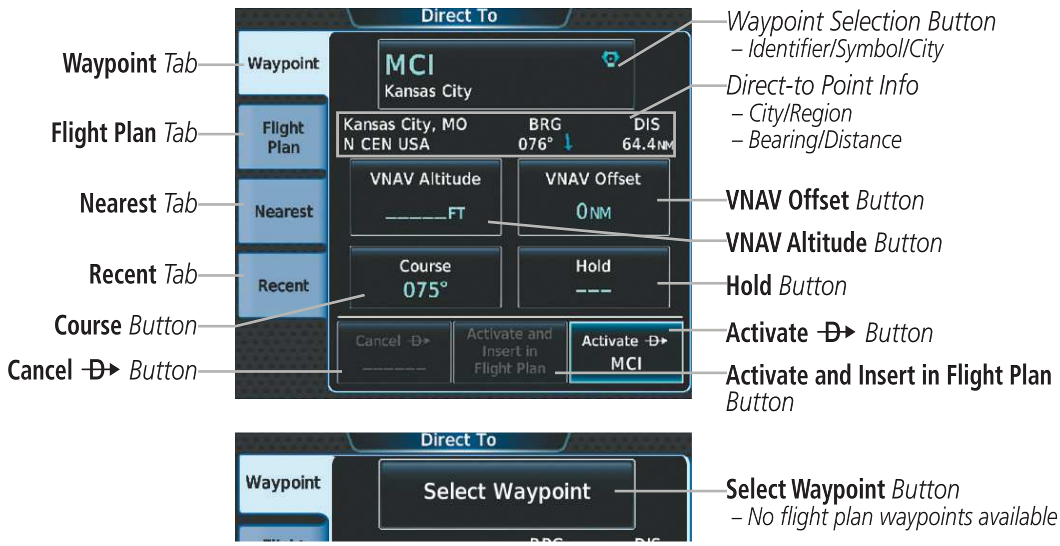


Figure 5-63 'Direct To' Screen

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

1) From MFD Home, touch **Direct To**.
2) Touch the waypoint selection button to display the keypad (available waypoints in flight plan).

   Or:

   Touch the **Select Waypoint** Button to display the keypad.
3) Select a waypoint as a direct-to destination.

   Input the waypoint identifier using the keypad and touch the **Enter** Button to accept the identifier, and return to the 'Direct To' Screen.

   Or:

a) Touch the **Find** Button to display the 'Find Waypoint' Screen.

b) Touch the **Search** Tab to display the **Search By** Button.

c) If needed, touch the **Search By** Button to choose Search by City or Search by Facility.

d) Touch the **Facility Name** Button or the **City Name** Button to display the keypad.

e) Use the keypad to select the name.

f) Touch the **Enter** Button to accept the entry and display the search results.

g) Touch a waypoint selection button to choose the waypoint as the direct-to destination, and return to the 'Direct To' Screen.

4) Touch the **Activate -D->** 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 -D-> <waypoint> Before?' Window.

b) Touch the waypoint selection button to select the flight plan location to insert the direct to waypoint, and to activate the direct-to.

Selecting a waypoint as the direct-to destination by 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 -D->** 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 -D-> <waypoint> Before?' Window.

b) Touch the waypoint selection button to select the flight plan location to insert the direct to waypoint, and to activate the direct-to.

Selecting a waypoint from the active flight plan 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 -D-> Button to choose the waypoint as the direct-to destination and display the 'Direct To' Screen.

4) Touch the **Activate -D->** 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** D→ Button to activate the direct-to.

Or:

1) From MFD Home, touch the D→ Button to display the 'Direct To' Screen with the active flight plan waypoint selected as the direct-to destination.
2) Touch the **Activate** D→ Button to activate the direct-to.

Or:

1) From MFD Home, touch **Flight Plan.**
2) Touch the D→ Button to display the 'Direct To' Screen with the active flight plan waypoint selected the direct-to destination.
3) Touch the **Activate** D→ 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 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 displayed). Direct-to requests on waypoint information screens or nearest waypoint screens default to the displayed waypoint.

Selecting any waypoint as a direct-to destination:

1) Select the screen containing the desired waypoint type and select the desired waypoint.
2) If necessary, touch the **Waypoint Options** Button to display 'Waypoint Options' Window.
3) Touch the D→ Button to choose the waypoint as the direct-to destination, and display the 'Direct To' Screen.
4) Touch the **Activate** D→ 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 D→ <waypoint> Before?' Window.
   b) Touch the waypoint selection button to select the flight plan location to insert the direct to waypoint, and to activate the direct-to.

Selecting a nearby airport as a direct-to destination:

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

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

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

1) From the navigation map display, press the lower knob to display the pointer.
2) Use the upper 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 -D→** 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 -D→ <waypoint> Before?' Window.
   b) Touch the waypoint selection button to select the flight plan location to insert the direct to waypoint, and to activate the direct-to.

Cancelling a Direct To:

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

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

Selecting a manual direct-to course:

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

Figure 5-64 Direct To – Selecting a Manual Course

Reselecting the direct course from the current position:

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

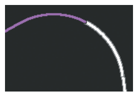
A direct-to with an altitude constraint ('VNAV Altitude') creates a descent path (and provides guidance to stay on the path) from the aircraft's current altitude to the altitude of the direct-to waypoint. The altitude is reached at the waypoint, or at the specified distancce along the flight path if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

5.6 FLIGHT PLANNING

INTRODUCTION

Flight planning consists of building a flight plan by entering waypoints one at a time, adding waypoints along airways, and inserting departures, airways, arrivals, or approaches as needed. The system allows flight planning information to be entered using the Touchscreen Controller. The flight plan is displayed on maps using different line widths, colors, and types, based on the type of leg and the segment (departure, enroute, arrival, approach, or missed approach) of the flight plan currently being flown.

The system displays a calculated turn anticipation arc, and provides guidance to follow the arc. When the aircraft reaches the beginning of the arc, the guidance will prompt a turn, and the course pointer and desired track will indicate the course for the next flight plan leg. The CDI will indicate the cross track error relative to the arc for the duration of the turn. The flight plan leg will sequence to the next leg at the apex of the arc, indicated by the To/From Indicator momentarily switching to From, and the displayed FMS information updating to the new active leg.

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

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

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

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

Table 5-7 Flight Plan Leg Symbols

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

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 storing flight plans with an approach, departure, or arrival, the system uses the waypoint information from the current database to define the waypoints. If the database is changed or updated, the system automatically updates the stored procedure information as long as the stored procedure has not been modified by the flight crew. If an approach, departure, or arrival procedure is no longer available, the procedure is deleted from the affected stored flight plan(s), and an alert is displayed (see Miscellaneous Messages in Appendix A) advising that one or more stored flight plans need to be edited.

When the database is updated, stored flight plan airways may need to be reloaded also. Each airway segment is reloaded from the database given the entry waypoint, the airway identifier and the exit waypoint. This reloads the sequence of waypoints between the entry and exit waypoints (the sequence may change when the database is updated). The update of a flight plan airway can fail during this process. If that happens, the airway waypoints are changed to regular (non-airway) flight plan waypoints, and an alert is displayed (see Miscellaneous Messages in Appendix A).

The following could cause the airway update to fail:

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

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

- 'Active Flight Plan' Inset on the 'Navigation Map' Pane (view the active 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)

Figure 5-65 Active Flight Plan Screen

Figure 5-66 Standby Flight Plan Screen

Figure 5-67 Flight Plan Catalog Screen

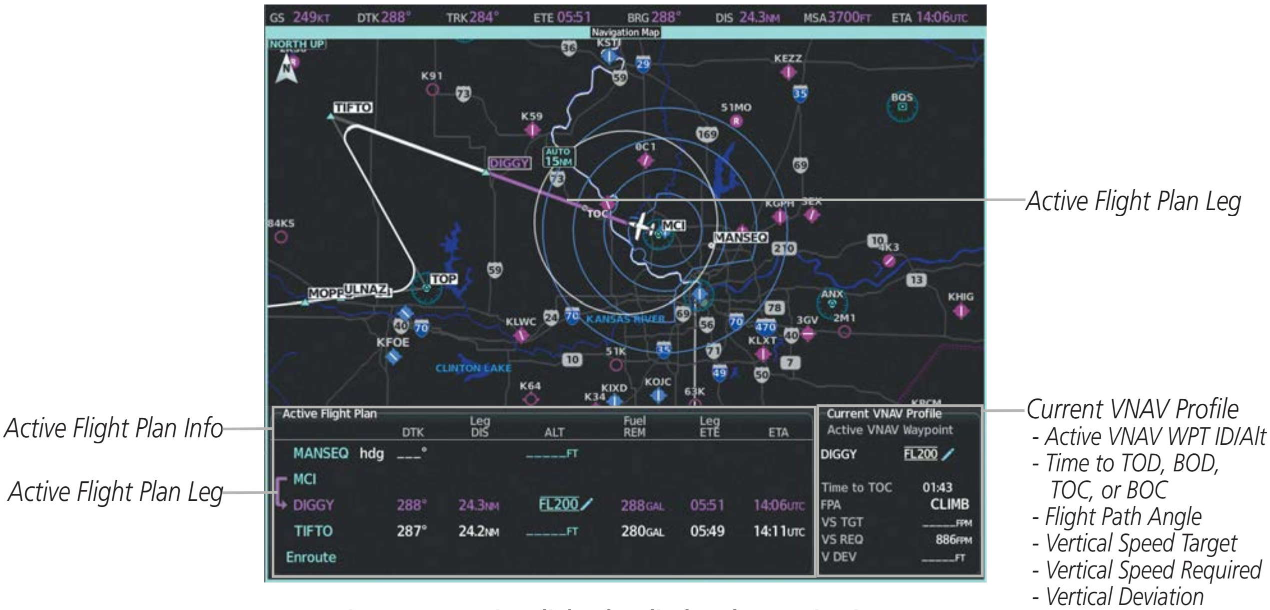


Figure 5-68 Active Flight Plan displayed on Navigation Map

***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).*

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

3) To view a flight plan segment:

a) Press the **Back** Button.

b) Scroll as needed, and press the selection button corresponding to the desired segment of the flight plan.

c) Press the **Back** Button to return to the flight plan preview.

4) Press the **Show on Map** Button again or return to the 'Home' Screen to turn off the Show on Map Button and remove the preview from the display.

Displaying/removing 'Active Flight Plan' Inset 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' Inset on the 'Navigation Map' Pane.
4) Waypoint distances shown on the 'Active Flight Plan' Inset may be set as leg to leg distances or cumulative distance by selecting the **CUM** Button or **Leg-Leg** Button.

Displaying/removing the active flight plan progress on the navigation map:

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

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 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 standby flight plan and each stored flight plan is available for activation (becomes the active flight plan).

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

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

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

If the pilot manually enters the origin, or any other leg of the flight plan before auto-designation occurs, the system will not attempt to auto-designate. 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.

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

Creating an active, standby or stored flight plan:

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

Or:

For a standby flight plan: From MFD Home, touch **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:

To manually select the Origin, touch the **Origin** Button; or if displayed, touch the **Add Origin** Button.

3) Use the right knobs or the keypad to enter the origin waypoint.

Or:

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

Or:

a) Touch the **Find** Button to display the 'Find Waypoint' Screen. Then, touch the **Search** Tab to display the **Search By** Button.

b) If necessary, touch the **Search By** Button to choose Search by City or Search by Facility.

c) Touch the **Facility Name** Button or the **City Name** Button to display the keypad.

d) Use the keypad to select the name, and the **Enter** Button to accept the entry and display the search results.

e) Touch a waypoint selection button to choose the waypoint.

4) If needed, touch the **Origin** Button to display the 'Select Runway' Screen. Touch a runway selection button to select the departure runway and return to the flight plan.

5) Touch the **Add Destination** Button to display the keypad.

6) Select the identifier of the destination waypoint using one of the step 3 procedures.

7) If needed, touch the **Destination** Button to display the 'Destination Options' Window. Touch the **Select Arrival Runway** Button to display the 'Select Runway' Screen. Touch a runway selection button to select the destination runway and return to the flight plan.

8) Touch the **Add Enroute Waypoint** Button to display the keypad.

9) Select enroute waypoints using one of the methods from step 3 of this procedure.

10) Repeat step numbers 8 through 10 until the flight plan 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.

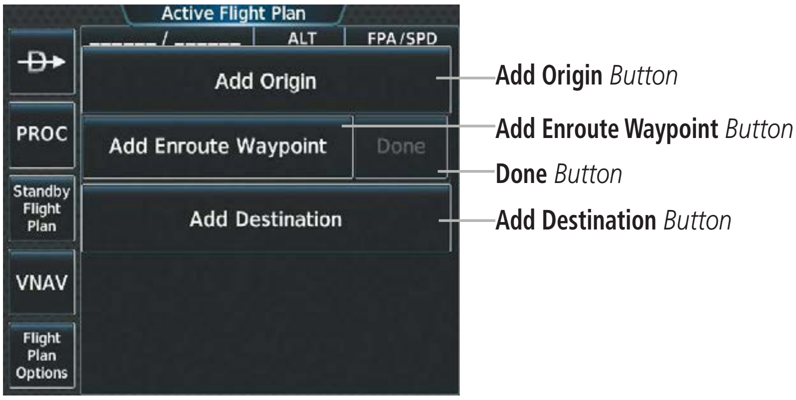
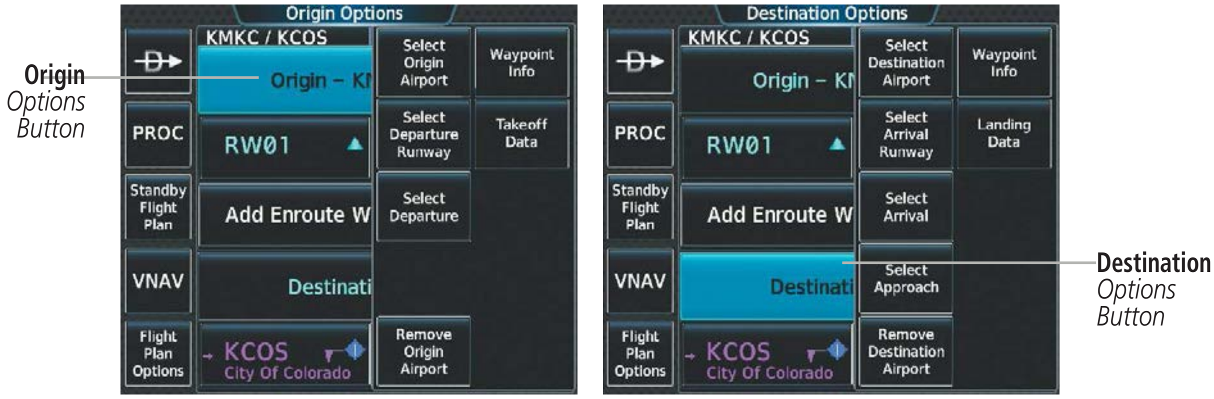


Figure 5-69 Active Flight Plan Screen - Empty

Origin and Destination Loaded **Origin Runway Selection**

Figure 5-70 Active Flight Plan Screen - Origin and Destination Loaded



Origin Options Screen **Destination Options Screen**

Figure 5-71 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. A waypoint or a series of waypoints can be added to the active flight plan, the standby flight plan, and the stored flight plan using the following procedures.

Adding a waypoint to any flight plan:

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

Or:

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

Or:

For a stored flight plan:

a) From MFD Home, touch **Flight Plan > Flight Plan Options**.

b) Touch the **Flight Plan Catalog** Button to display the 'Flight Plan Catalog' Screen.

c) Touch the **Create New Catalog Flight Plan** Button to display the 'Edit Stored Flight Plan' Screen.

2) Insert waypoint:

If adding a waypoint to the end of the enroute segment of the flight plan, touch the **Add Enroute Waypoint** Button to display the keypad.

Or:

a) If adding a waypoint before or after an existing waypoint in the enroute segment of the flight plan, touch a waypoint selection button to display the 'Waypoint Options' Window.

b) Touch the **Insert Before** Button or the **Insert After** Button to select where the new waypoint will be placed in relation to the selected waypoint. The keypad is displayed.

Or:

a) If adding a waypoint to the beginning of the enroute segment of the flight plan, touch the **Enroute** Button to display the 'Enroute Options' Window.

b) Touch the **Insert Waypoint** Button to display the keypad.

3) Use the keypad, right knobs, or the Find function to select the new waypoint.

4) Touch the **Enter** Button to accept the waypoint and place it in the flight plan.

5) If you are finished adding enroute waypoints, touch the **Done** Button to remove the **Add Enroute Waypoint** Button and the **Done** Button (This step is only necessary if creating a flight plan on the 'Active Flight Plan' Screen).

Figure 5-72 Active Flight Plan Screen - Waypoint Options Window

Figure 5-73 A'ctive Flight Plan' Screen - Adding a Waypoint to the beginning of the Enroute segment of the Flight Plan

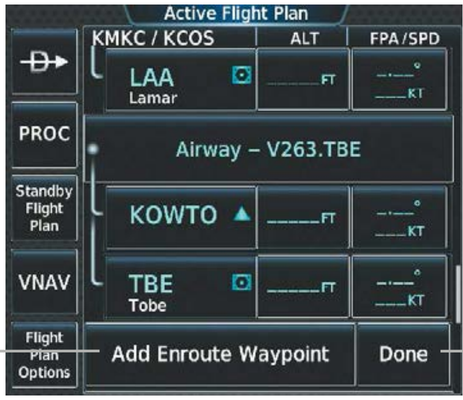


Figure 5-74 Active Flight Plan Screen - Adding a Waypoint to the end of the Enroute segment of the Flight Plan

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

1) Push the **Joystick** to the display 'Map Pointer Control' Screen on the Touchscreen Controller and to activate the map pointer on the 'Navigation Map' Pane. Use the **Joystick** 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 active flight plan, the **Insert in FPL** Button is activated.

2) Touch the **Insert In FPL** Button. The 'Insert Before Waypoint' Window is displayed.

3) Touch the waypoint selection button to select where to insert the new waypoint. The waypoint is inserted into the active flight plan before the selected waypoint, and the Touchscreen Controller returns to the 'Map Pointer Control' Screen. Push the **Joystick** to deactivate the map pointer and return to the previous screen.

Figure 5-75 Active Flight Plan Display - Map Pointer Active

Figure 5-76 Inserting Waypoint in Active Flight Plan

Figure 5-77 KTOP in Flight Plan

Fly-Over Waypoint Designation

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

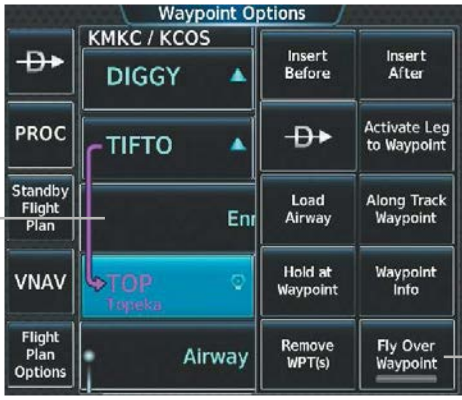


Figure 5-78 'Waypoint Options' Window - Fly Over Waypoint Disabled (Fly By)

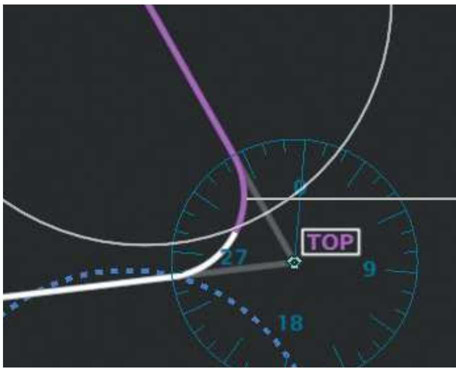


Figure 5-79 Active Flight Plan Display - Fly By Waypoint

Figure 5-80 'Waypoint Options' Window - Fly Over Waypoint Enabled

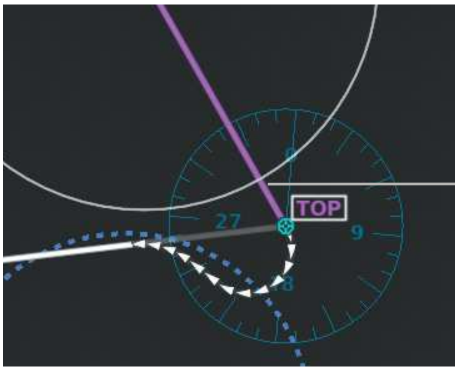


Figure 5-81 Active Flight Plan Display - Fly Over Waypoint

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

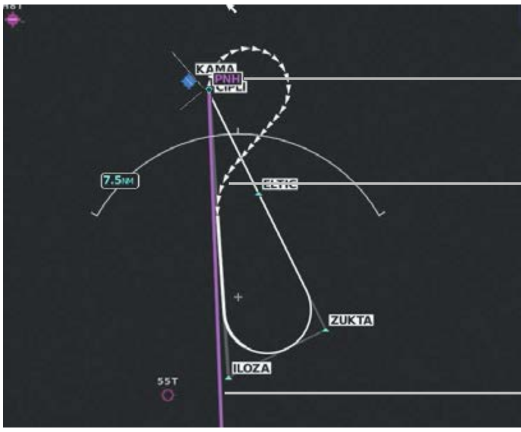


Figure 5-82 PNH Fly-Over Waypoint

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

Designating a fly-over waypoint:

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

Or:

For a standby flight plan: From MFD Home, touch **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) Touch the desired enroute waypoint selection button. The 'Waypoint Options' Window is displayed.

3) Touch the **Fly Over Waypoint** Button. The annunciator bar on the button will be green when enabled. Touching the **Fly Over Waypoint** Button again (accessed via steps 1-2) will turn off the green annunciator bar and the waypoint will revert back to a fly-by waypoint.

Removing Flight Plan Waypoints

Waypoints, airways, and entire procedures can be deleted from a flight plan. Some waypoints in the final approach segment (such as the FAF or MAP) can not be deleted individually. Attempting to delete a waypoint that is not allowed results in a window displaying 'Invalid flight plan modification.'

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

Removing an individual waypoint or multiple waypoints from a flight plan:

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

Or:

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

Or:

For the stored flight plan:

a) From MFD Home, touch **Flight Plan > Flight Plan Options > Flight Plan Catalog** to display the 'Flight Plan Catalog' Screen.

b) Scroll the list if needed and touch a stored flight plan button to display the 'Catalog Options' Window.

c) Touch the **Edit** Button.

2) Scroll the list if necessary and touch a waypoint options button to display the 'Waypoint Options' Window. Then, touch the **Remove WPT(s)** Button.

3) To remove an individual waypoint, touch the **OK** Button in response to 'Remove <waypoint name>?'. The waypoint is removed. To cancel the request, touch the **Cancel** Button.

Or:

To remove a series of multiple waypoints:

a) Touch the **Remove Multiple** Button to display the 'Remove From <waypoint> Through' Window.

b) Touch a waypoint button that is sequenced before or after the previously selected waypoint. The confirmation window 'Remove <waypoint> Through <waypoint>?'.

c) Touch the **OK** Button to confirm the removal of the two selected waypoints and all waypoints sequenced between them, the **Edit** Button to return to the previous step, or the **Cancel** Button.

AIRWAY MODIFICATIONS

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

Adding Airways

Airways can be added to the active, standby, or stored flight plan. An airway can only be added if there is a waypoint in the flight plan that is part of the desired airway and is not part of an arrival or approach procedure. The system also anticipates the desired airway based on the selected waypoint and the flight plan.

Some airways have directional restrictions on all or part of the route. Airway "A2" in Europe has a directional restriction over the whole route such that it can be flown only in the direction MTD-ABB-BNE-DEVAL.

Airway "UR975" in North Africa has more complicated directional restrictions within the list of airway waypoints AMANO, VAKOR, LIBRO, NELDA, DIRKA, GZO, KOSET, and SARKI:

- Starting from AMANO, the airway can be flown only to LIBRO.
- Starting from SARKI, the airway can be flown only to LIBRO.
- Between NELDA and GZO, the airway can be flown in either direction.

In the US, airways that are "one-way" for specified hours of operation are not uncommon. These airways are always bidirectional in the system database.

The system only allows correct airway sequences to be inserted. If the pilot subsequently inverts the flight plan, the system inverts the airway waypoint sequence and removes the airway header.

Figure 5-83 Adding an Airway to the Active Flight Plan

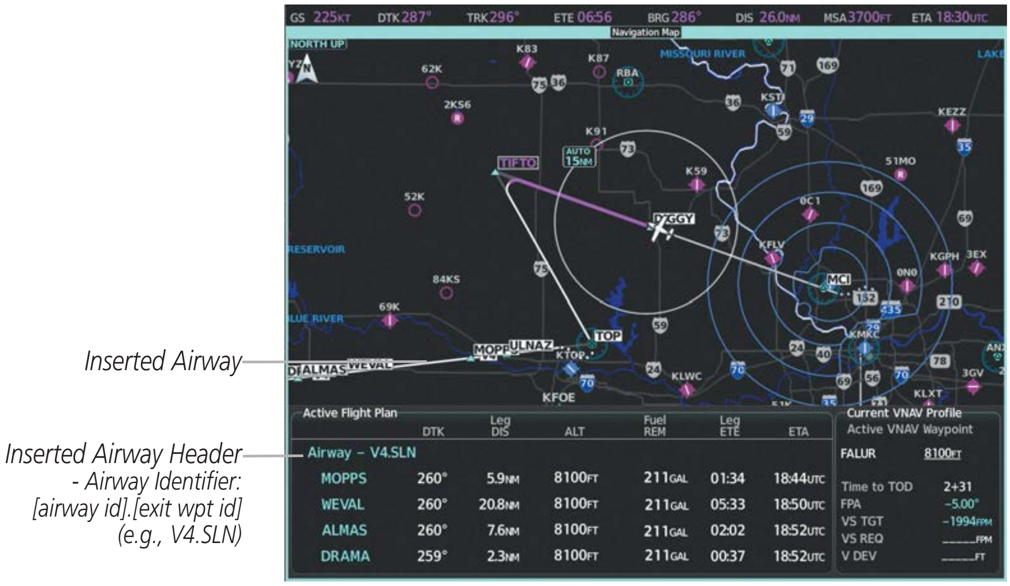


Figure 5-84 Active Flight Plan Display - V4 Airway Loaded

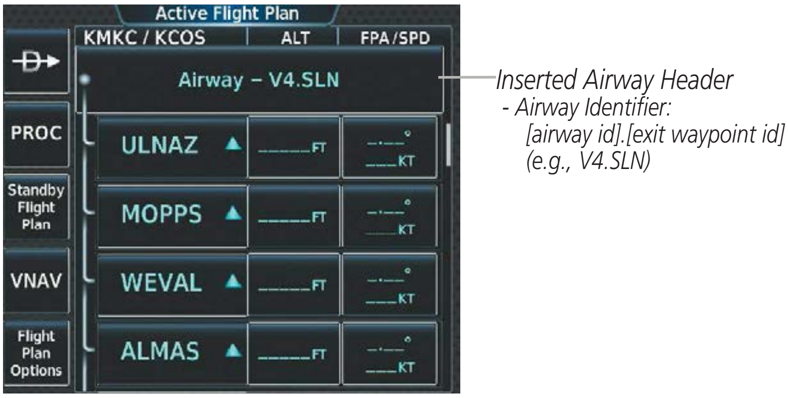


Figure 5-85 Active Flight Plan Screen - V4 Airway Loaded

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' Window.
7) Touch the **Load Airway** Button to insert the airway into the flight plan.

Removing Airways

Removing an entire airway 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**.

   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.

***NOTE:** The **Remove Multiple** Button will have no affect on airways within a flight plan. Only one airway may be removed at a time.*

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 expand all airways as they are loaded into the flight plan. If instead, it is preferred to have airways collapsed within the flight plan as they are loaded, this setting may be changed.

Figure 5-86 Expanded/Collapsed Airways

Collapsing/expanding the airways in 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**.

   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 all airways, or collapse/expand an individual airway. Individual airways may only be expanded/collapsed on the active and standby flight plan.

4) Touch the **Back** Button to return to the flight plan.

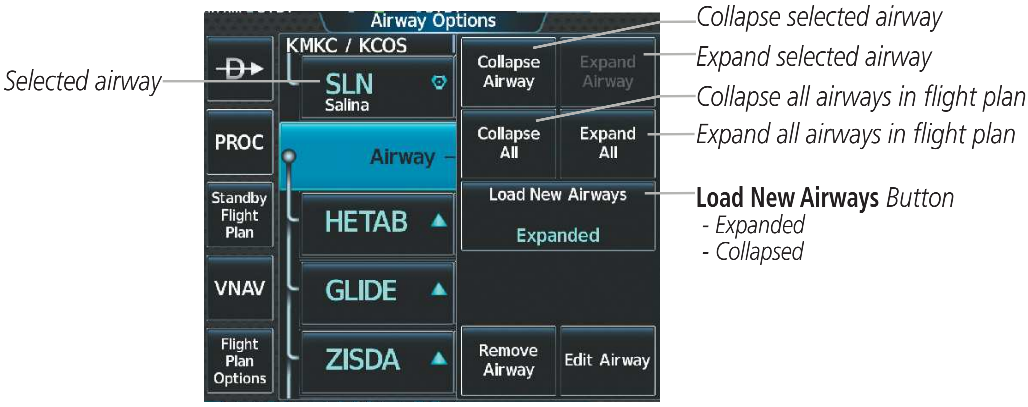


Figure 5-87 'Airway Options' Window

Changing Collapsed/Expanded settings for newly loaded airways:

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**.

   (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.

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 the Flight Management Section.

In-flight, the system automatically sequences through the active flight plan, with the exception of manually terminated legs (such as FM, HM, or VM).

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

The **OBS** mode 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 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.

While OBS Mode is enabled, a course line is drawn through the “active-to” waypoint on the moving map. If desired, the course to/from the waypoint can now be adjusted. When OBS Mode is disabled, the system resumes automatic sequencing of waypoints, and follows the course set in OBS Mode. The flight path on the moving map retains the modified course line. Sequencing will occur based upon the automatic waypoint sequencing criteria. Depending on aircraft position, crosstrack error, and turn anticipation arc, the system may sequence sooner than expected, or to a different waypoint than expected.

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

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 5-88 Active Flight Plan Screen - 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 5-89 Switching between Active and Standby Flight Plan Screen

Activating the standby flight plan:

1) From MFD Home, touch **Flight Plan > Standby Flight Plan**.
2) Touch the **Activate Standby** Button.

   Or:

   a) Touch the **Flight Plan Options** Button.
   b) 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 5-90 'Standby Flight Plan' Screen - Join From P. POS

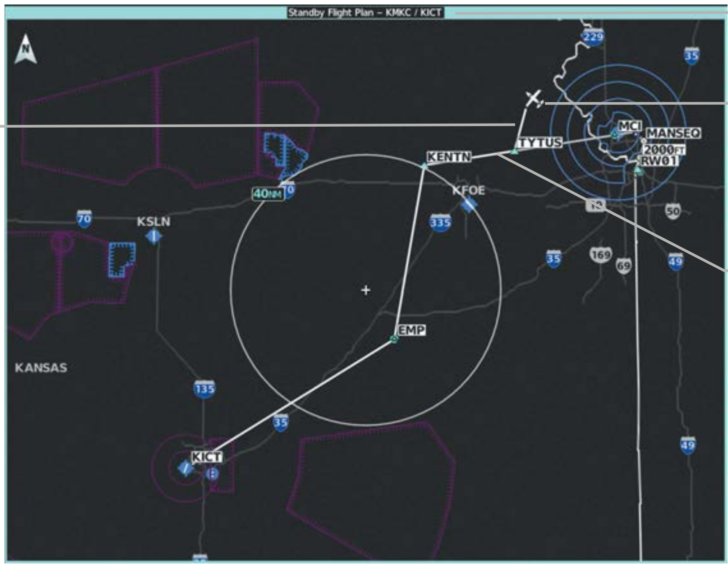


Figure 5-91 'Standby Flight Plan' Pane - Join From P.POS link active

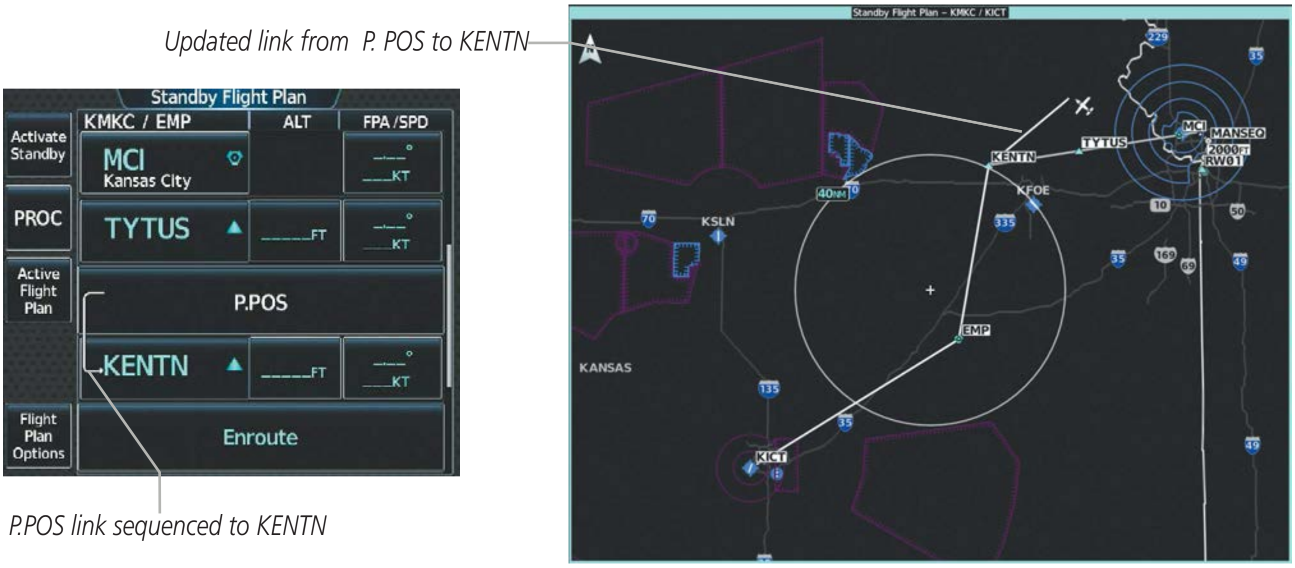


Figure 5-92 P. POS link sequenced to next waypoint in standby flight plan

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.

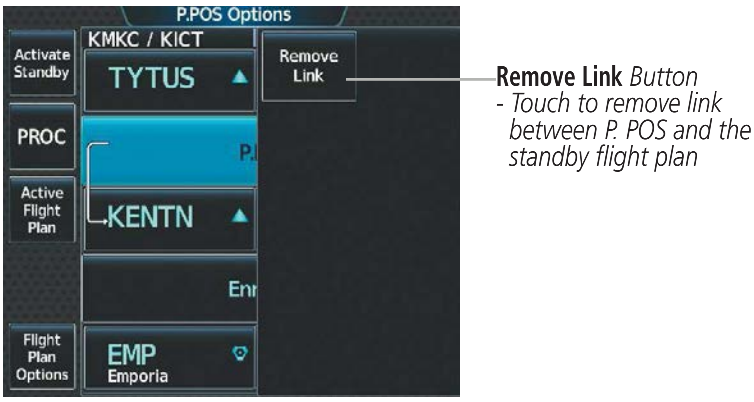


Figure 5-93 Standby Flight Plan - Remove link from P. POS

ALONG TRACK OFFSETS

A waypoint having an "along track offset" distance from an existing waypoint can be entered into a flight plan. Along track offset waypoints lie along the path of the existing flight plan, and can be used to make the system reach a specified altitude before or after reaching the specified flight plan waypoint. Offset distances can be entered from 1 to 999 nm in increments of 1 nm.

Offset distance is calculated as a radial distance from the reference waypoint rather than a direct distance. The system will place the offset waypoint in the flight plan leg for which the radial distance intersects, regardless of distance between preceding flight plan legs. If the system is unable to determine a point for which the radial offset distance intersects the flight path, the message 'Unable to place <offset waypoint and distance> on the existing Flight Plan' will be displayed.

Entering a negative offset distance results in an along track offset waypoint inserted before the selected waypoint, whereas entering a positive offset distance results in an along track offset waypoint inserted after the selected waypoint. Offset waypoints can span multiple flight plan legs, and multiple offset waypoints are allowed on each leg.

NOTE: *Initiating a Direct-to may remove the along track waypoint from the navigation map if the along track waypoint is prior to the end of the direct-to segment. However, the along track waypoint will still remain in the flight plan. If it's desired to have the along track waypoint re-displayed on the navigation map, recreate the along track waypoint.*

The system limits the along track offset distance such that the along-track offset falls between the first and last waypoints in the flight plan. Assigning an along track offset to a leg with indeterminate length is not permitted. An along track offset is not allowed between the final approach fix and missed approach point of an approach.

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

Figure 5-94 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' Window.

4) Use the keypad to select the distance in the range of 1 to 999 nm (offset must fall between the first and last waypoint within the flight plan).

5) Touch the **(Before) -** Button or the **(After) -** Button to select the offset waypoint direction.

6) Touch the **Enter** Button to insert the offset waypoint into the flight plan.

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

1) From **MFD Home**, touch **Direct To.**
2) Touch the **VNAV Altitude** Button to display the keypad.
3) Use the keypad to select the altitude.
4) Touch the **Enter** Button to accept the altitude, and and return to the 'Direct To' Screen.
5) Touch the **VNAV Offset** Button to display the keypad.
6) Touch the **(Before) -** Button or the **(After) +** Button, if necessary.
7) Use the keypad to select the offset distance.
8) Touch the **Enter** Button to accept the offset distance, and and return to the 'Direct To' Screen.
9) Touch the **Activate** -D-> Button to activate the direct-to using the VNAV constraints.

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 selection button to display the 'Waypoint Options' Window.
3) Touch the **Remove WPT(s)** Button.
4) Touch the **OK** Button to delete the waypoint from the flight plan.

Altitude constraints can also be entered for the along track waypoint, and are 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. See the Vertical Navigation section for more information on altitude constraints and for information on the vertical navigation direct-to (VNAV -D->) function.

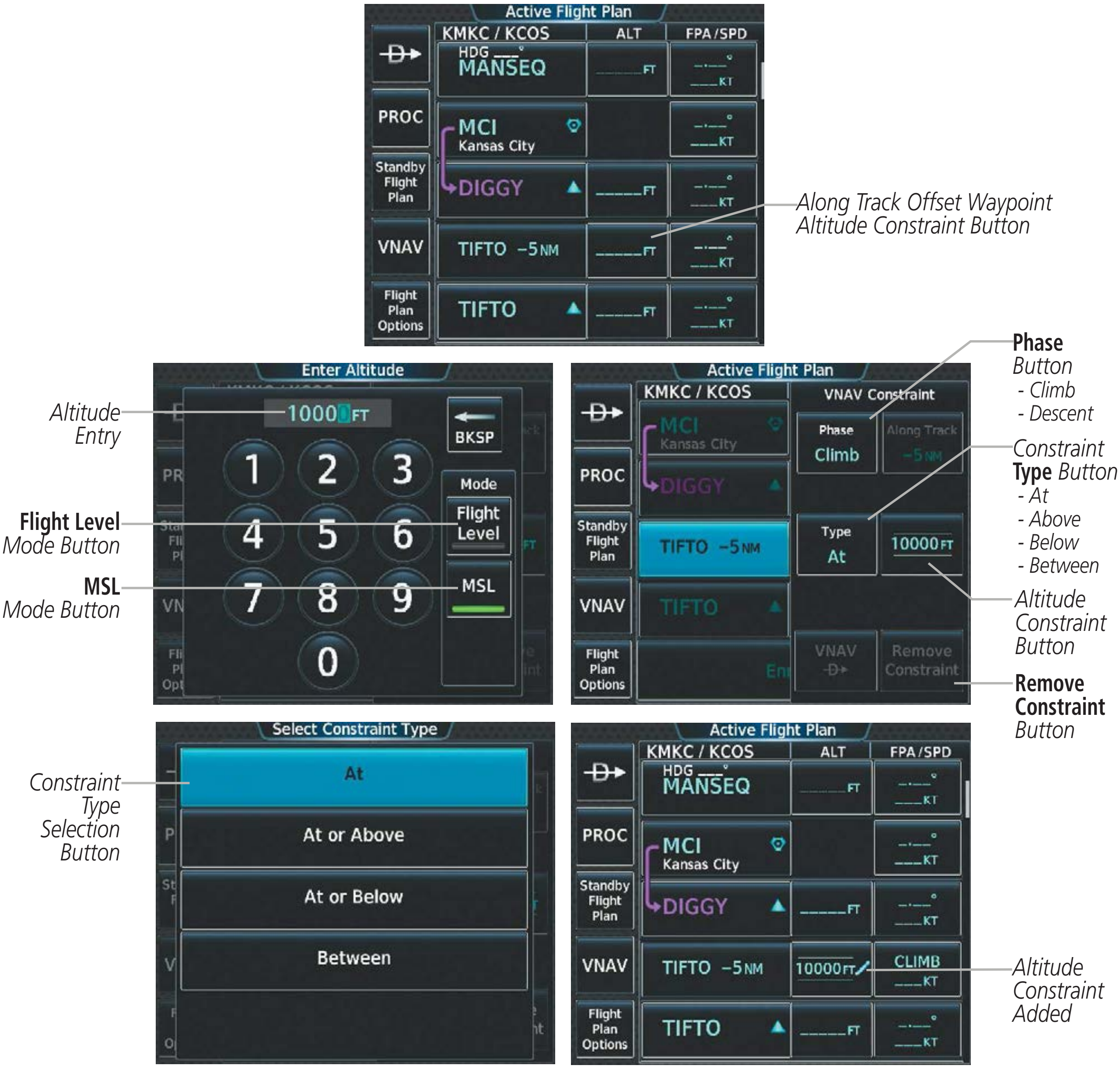


Figure 5-95 Adding an Altitude Constraint

Adding an altitude constraint at an along track offset waypoint:

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

   Or:

   For the standby flight plan: From MFD Home, touch **Flight Plan > Standby Flight Plan**.
2) Touch an Along Track Offset Waypoint Altitude Constraint Button to display the 'VNAV Altitude' Window.
3) Use the keypad to select the altitude.
4) Touch the **Flight Level** Button or the **MSL** Button to select the altitude mode.
5) Touch the **Enter** Button to add the altitude constraint to the flight plan.

Removing an altitude constraint from an along track offset waypoint:

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

   Or:

   For the standby flight plan: From MFD Home, touch **Flight Plan > Standby Flight Plan**.
2) Touch the Along Track Offset Waypoint Altitude Constraint Button to display the 'VNAV Altitude' Window.
3) Touch the **Remove VNAV ALT** Button. A 'Remove VNAV altitude?' window is displayed.
4) Touch the **OK** Button to remove the altitude constraint. To cancel the request, touch the **Cancel** Button.

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.

Figure 5-96 Active Flight Plan Display - Prior to Activating Parallel Track

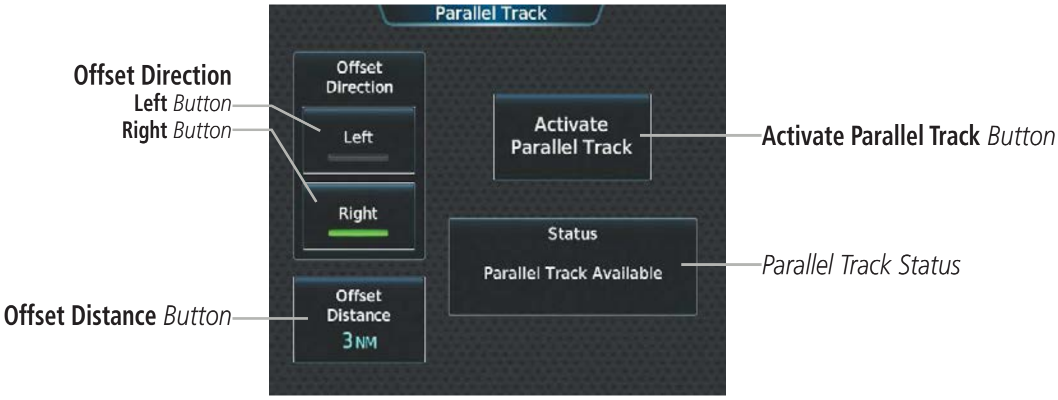


Figure 5-97 Parallel Track Screen - Selecting Parallel Track

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.

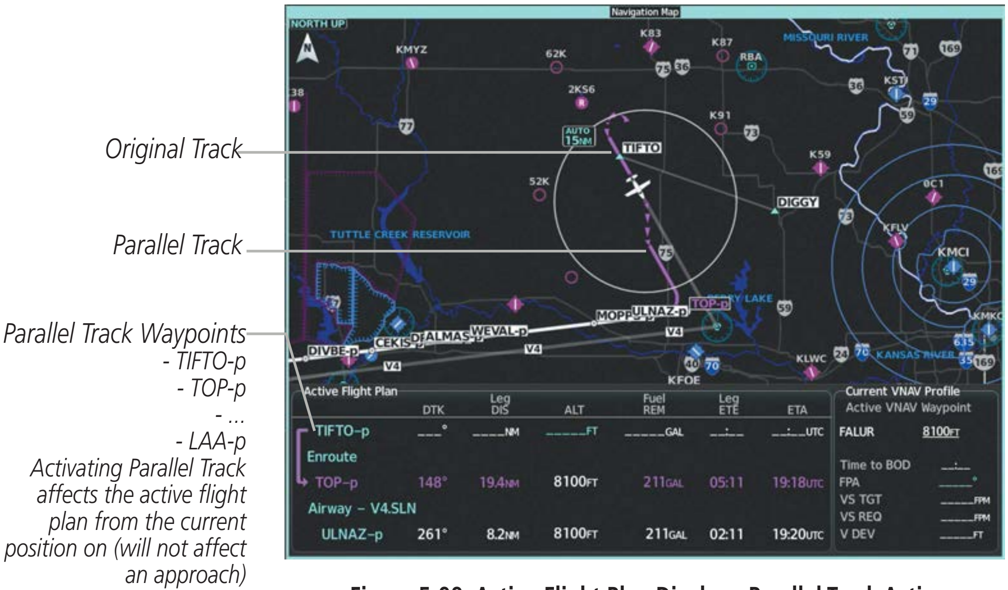


Figure 5-98 Active Flight Plan Display - Parallel Track Active

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

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 active or standby flight plan to a selected waypoint:

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

   Or:

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

   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.

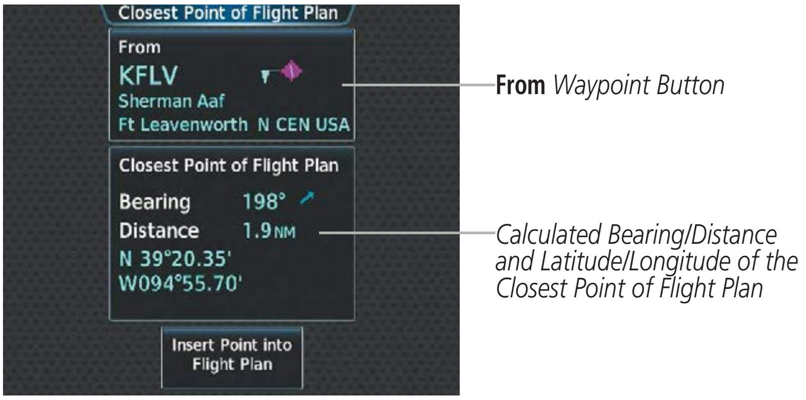


Figure 5-99 Closest Point of Flight Plan

Figure 5-100 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.

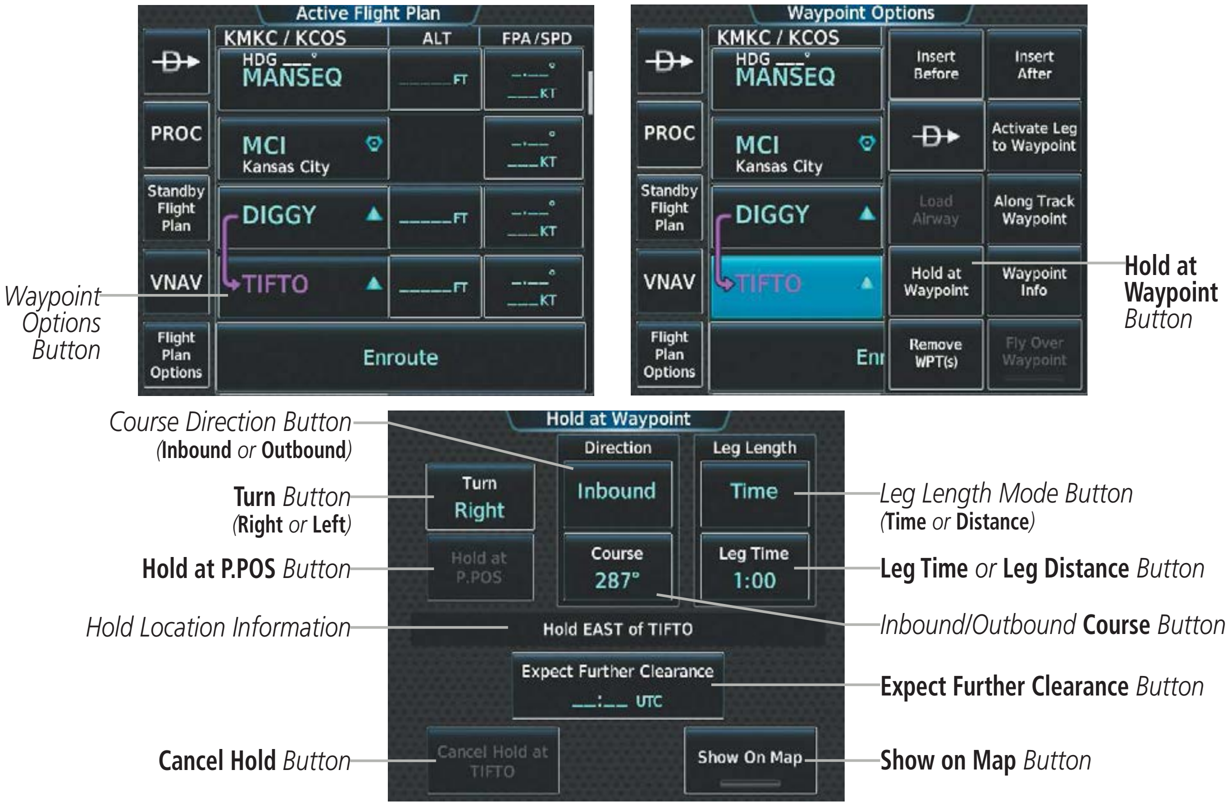


Figure 5-101 Creating a User Defined Holding Pattern at an Active Flight Plan Waypoint

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.*

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 D→ PPOS-H Before?' Screen is displayed.

12) Touch the desired waypoint selection button, and the hold is inserted in the flight plan before the selected waypoint.

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

> ***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 (shown as "Offroute ⊕▸", "→PPOS-H", at the top of the 'Active Flight Plan' Screen), and then is edited, the preview shown on the map will reflect the new position of the holding pattern, but the PPOS-H waypoint (orange square) may not be accurately depicted. When the edited holding pattern is created, the PPOS-H waypoint is shown correctly.*

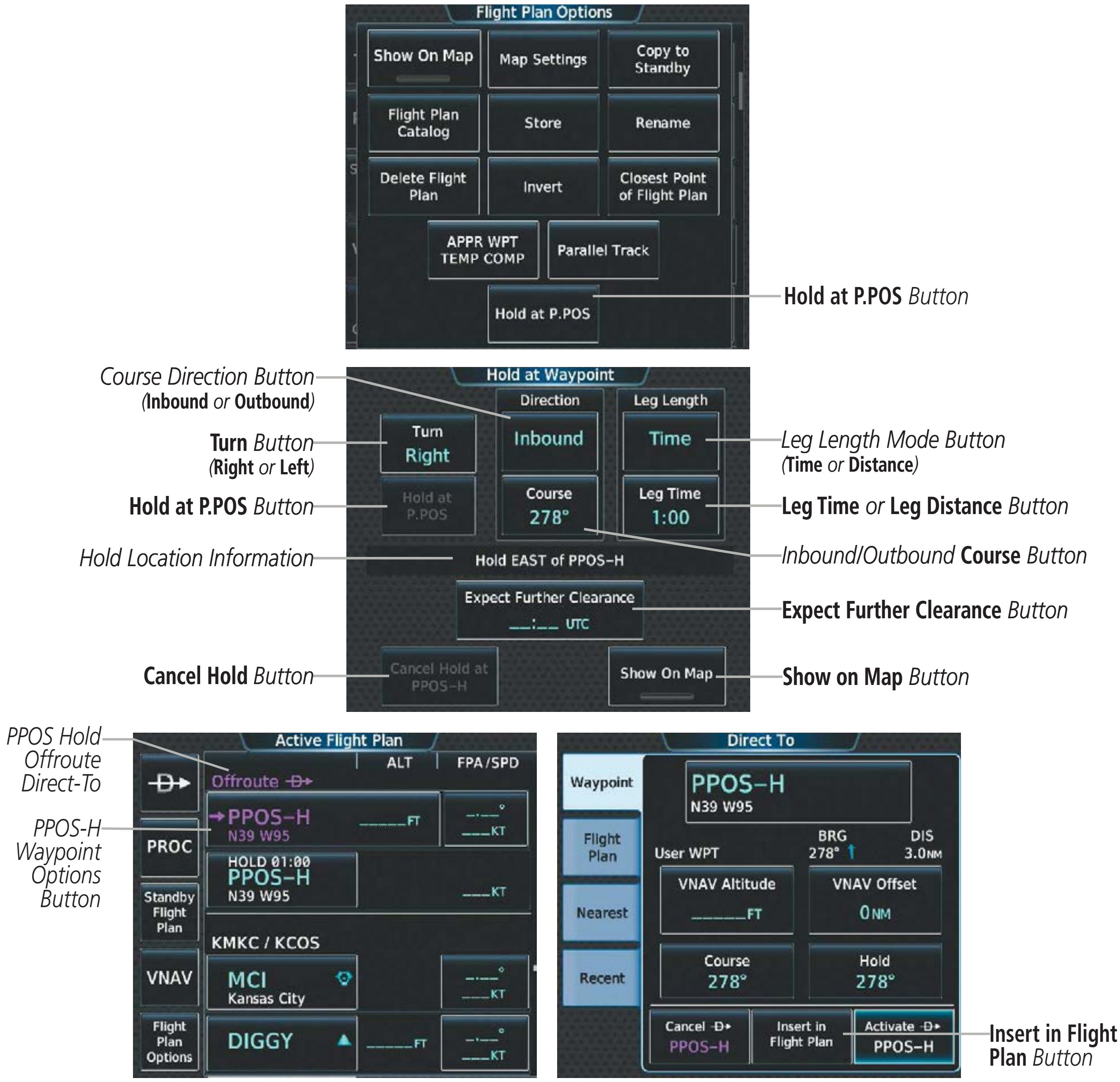


Figure 5-102 Creating a User Defined Holding Pattern at the Aircraft Present Position

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

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

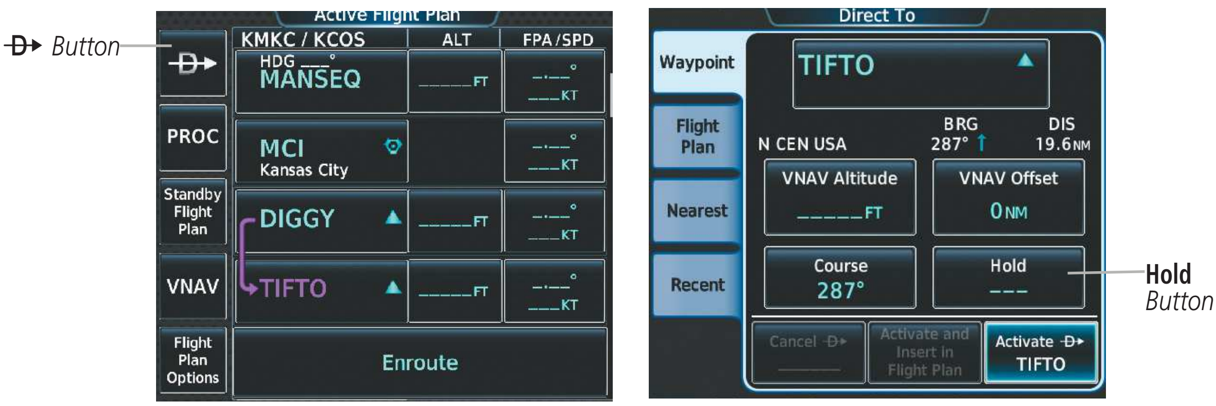


Figure 5-103 Creating a User Defined Holding Pattern at a Direct To Waypoint

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

1) From MFD Home, touch **Flight Plan**.

2) Scroll the list, if necessary, and touch the Hold waypoint selection button. The 'Waypoint Options' Window is displayed.

3) Touch the **Remove Hold** Button.

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

Figure 5-104 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 Softkey on the PFD 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 D→ 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.

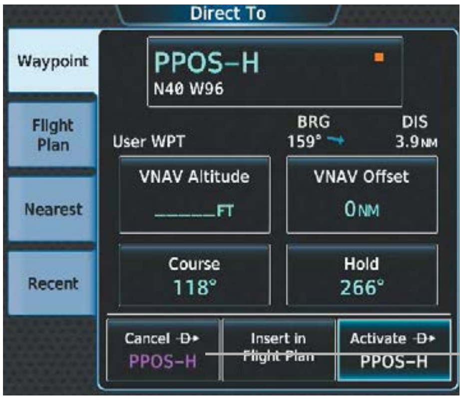


Figure 5-105 Removing a User Defined Holding Pattern at the Aircraft Present Position

MANAGING FLIGHT PLANS

The pilot can manage flight plans by importing/exporting, storing, copying, and deleting.

IMPORTING AND EXPORTING FLIGHT PLANS

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.*

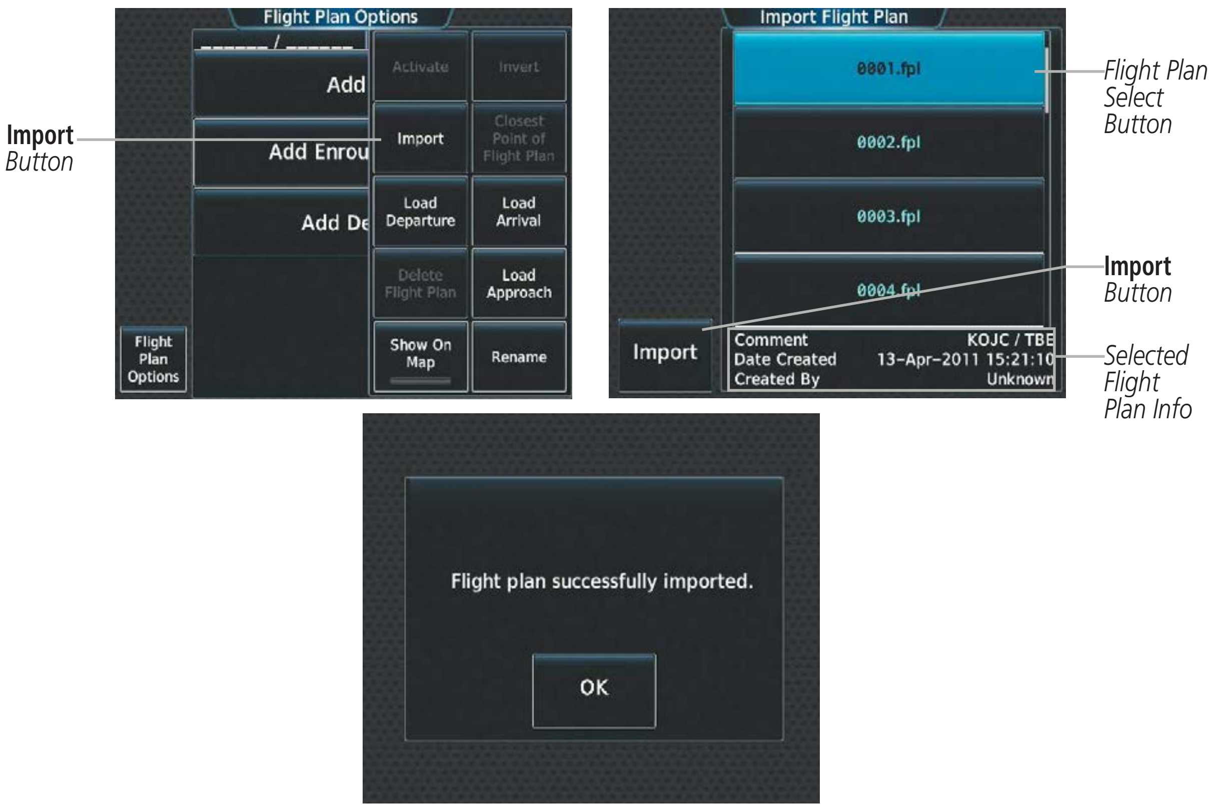


Figure 5-106 Flight Plan Import

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 5-107 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.
'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

INVERTING A FLIGHT PLAN

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

Inverting 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**.

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.

d) 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 **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.

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 5-108 'Flight Plan Catalog' Screen

Figure 5-109 '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 a standby flight plan is created, it can be stored to the Flight Plan Catalog.

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

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

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

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

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

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

NOTE: *Adjusting the altimeter barometric setting creates discontinuities in VNAV vertical deviation, moving the path. For large adjustments, it may take several minutes for the aircraft to re-establish on the descent path. If the change is made while nearing a waypoint with a VNAV Target Altitude, the aircraft may not re-establish on the path in time to meet the vertical constraint.*

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

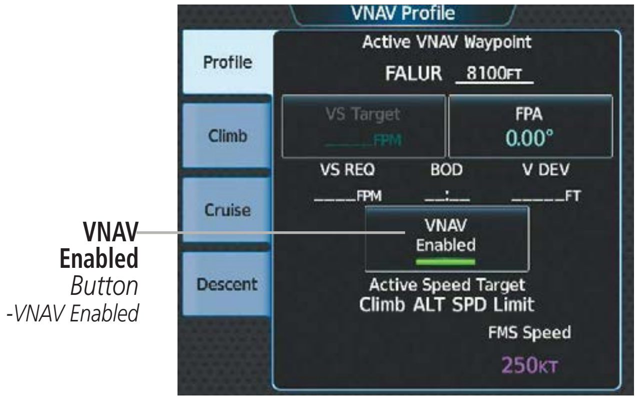


Figure 5-110 VNAV Profile - Enable/Disable VNAV

Figure 5-111 Flight Plan Text on Navigation Map - VNAV Enabled

Figure 5-112 Flight Plan Text on Navigation Map - VNAV Disabled

Enabling/Disabling VNAV guidance:

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

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

Modifying the Vertical Speed Target and Flight Path Angle:

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

CLIMB/ CRUISE/ DESCENT PHASES

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

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

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

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

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

CLIMB

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

Figure 5-113 VNAV Climb - Climb Schedule Modification

Selecting a pre-defined Climb Schedule:

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

Modifying the Climb Schedule:

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

Modifying the Climb Transition Altitude:

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

Reverting the Transition Altitude to the published value:

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

Modifying the Climb Speed Limits:

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

CRUISE

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

Figure 5-114 'VNAV Cruise' Screen

Selecting a pre-defined Cruise Schedule:

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

Modifying the Cruise Schedule:

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

DESCENT

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

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

Figure 5-115 'VNAV Descent ' Screen

Selecting a pre-defined Descent Schedule:

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

Modifying the Descent Schedule:

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

Modifying the Descent Transition Level:

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

Reverting the Descent Transition Level to the published value:

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

Modifying the Descent Speed Limits:

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

CONSTRAINTS

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

ALTITUDE CONSTRAINTS

The system can use MSL or AGL altitude constraints associated with lateral waypoints to give guidance for vertical navigation. These altitudes are, depending on the specific instance, manually entered or retrieved from the published altitudes in the navigation database.

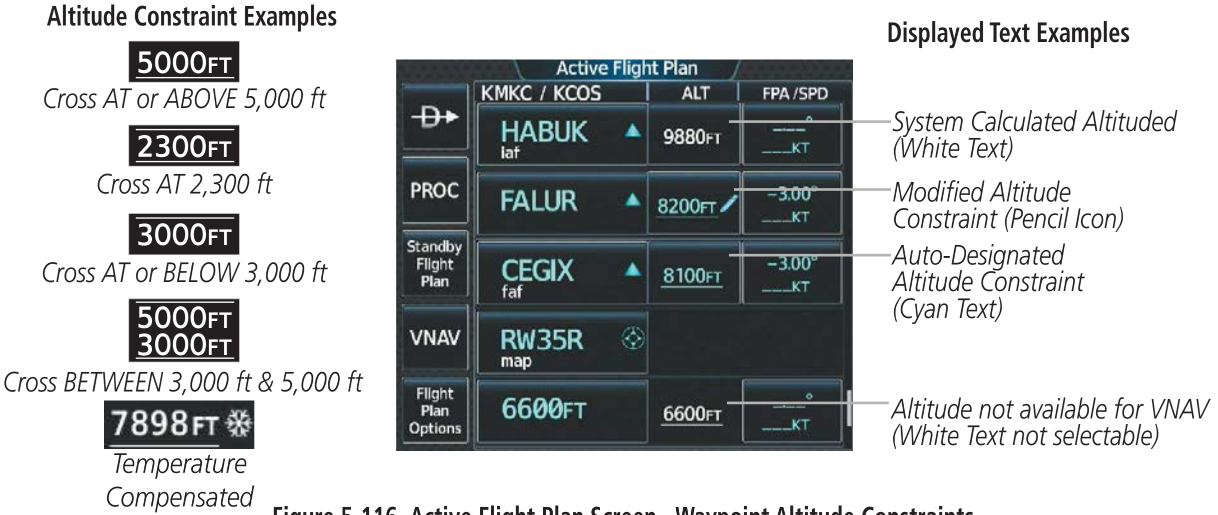


Figure 5-116 Active Flight Plan Screen - Waypoint Altitude Constraints

White Text	Cyan Text
5000FT Advisory altitudes calculated by the system estimating the altitude of the aircraft as it passes over the navigation point. 5000FT Altitude retrieved from the navigation database. White line above or below indicates the type of constraint, as shown in the preceding figure. These altitudes are provided as a reference, and are not designated for vertical guidance.	5000FT Altitude is designated for use in determining vertical guidance. A pencil icon indicates manual designation or manual data entry. At or above/below bars displayed. ~~5000FT~~ The system cannot use this altitude in determining vertical guidance because of an invalid constraint condition. At or above/below bars displayed.

Table 5-9 Altitude Constraint Color Coding

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

An altitude constraint may be manually designated for procedure waypoints and enroute waypoints by pressing the desired VNAV Alt button and the **Create** Button. An altitude constraint may be manually designated only if it is available for vertical guidance. Altitudes that are not available for vertical guidance are shown in white text with associated altitude restriction bar(s) and are not selectable.

***NOTE:** If the Final Approach Fix (FAF) is available for vertical guidance, the system will auto-designate the FAF altitude constraint when loading the procedure. If necessary, the FAF altitude constraint may be modified and set above or below the published FAF altitude.*

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

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

An altitude constraint may be entered as a flight level (FL), height above mean sea level (MSL), or height above ground level (AGL). AGL format is only available for airport waypoints If an altitude constraint is created as an “AT or ABOVE” or “AT or BELOW”   restriction, the "AT" portion of the restriction will be designated for vertical guidance.

***NOTE:** After an approach procedure has been loaded into the flight plan, any altitude or speed 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.*

A designated altitude constraint may be rendered invalid if any of the following are true:

- The climb constraints are not sequentially ascending, or the descent constraints are not sequentially descending.

Figure 5-117 Active Flight Plan - Waypoint Altitude Designation

Entering or modifying an altitude constraint:

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

Or:

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

2) Scroll the list, if necessary, and touch a VNAV ALT button to display the 'VNAV Constraint' Window. Review the constraint information. If it is correct, skip to step 9 to designate the altitude constraint for vertical guidance.

3) Touch the Altitude Constraint Button to display the 'Enter Altitude' window.

4) If necessary, use the keypad to select the altitude.

5) If necessary, touch the **Flight Level** Button or the **MSL** Button to select the altitude mode.

6) Touch the **Enter** Button to accept the altitude entry and return to the 'VNAV Constraint' window.

7) If necessary, touch the **Phase** Button, then touch the **Climb** Button or the **Descent** Button.

8) If necessary, touch the **Type** Button, then touch the **At**, **At or Above**, **At or Below** or **Between** Button. If Between is selected, use the keypad to enter the second altitude.

9) Touch the **Create** Button to designate the new altitude constraint. The altitude is now shown in cyan, indicating it is usable for vertical guidance.

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

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

Removing/undesignating an altitude constraint:

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

   Or:

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

2) Scroll the list, if necessary, and touch a VNAV ALT button to display the 'VNAV Constraint' Window.

3) Touch the **Remove Constraint** Button. A 'Remove Altitude Constraint?' window is displayed.

4) Touch the **OK** Button. The altitude is now shown in white (or possibly as white dashes if there are no other constraints in the flight plan), indicating it is not usable for vertical guidance. To cancel the request, touch the **Cancel** Button.

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

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

   Or:

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

2) Scroll the list, if necessary, and touch a VNAV ALT button to display the 'VNAV Constraint' Window.

3) Touch the **Remove Constraint** Button. A 'Remove or Revert to published VNAV altitude of nnnnnFT?' confirmation window is displayed.

4) Touch the **Revert** Button. The altitude is now the database altitude and is shown in cyan, indicating it is usable for vertical guidance.

FMS SPEED, VERTICAL SPEED, AND FLIGHT PATH ANGLE CONSTRAINTS

FMS Speed Constraints

The FMS Speed is located either on the 'Active Performance' Screen, **Targets** Tab (when Performance is installed) or the 'VNAV Profile' Screen, **Profile** Tab (without Performance). It is normally determined based on the overall mode (climb, cruise or descent), the speed schedule selected for that mode, and any speed limits that may be active (including speed constraints programmed at flight plan waypoints).

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

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

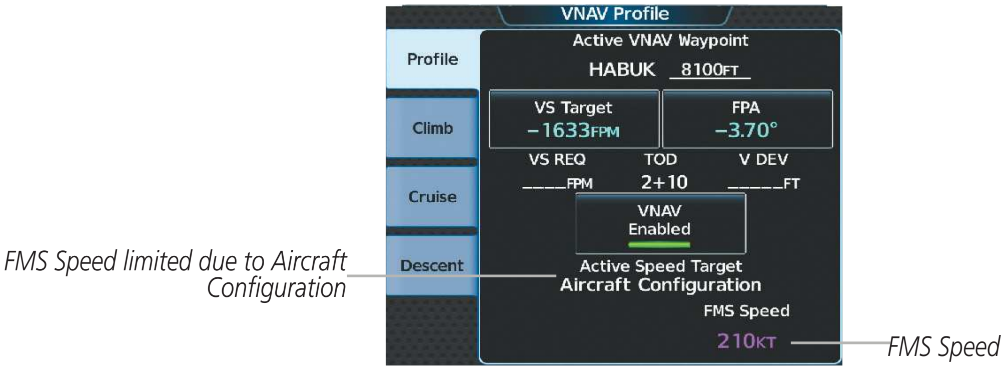


Figure 5-118 VNAV Profile - FMS Speed

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

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

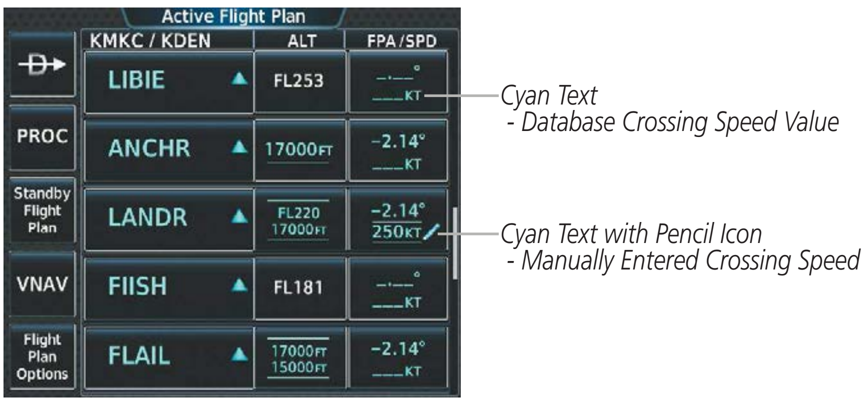


Figure 5-119 Active Flight Plan Screen - Waypoint Speed Constraints

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

Table 5-10 Speed Constraint Color Coding

Constraint Type	Departure or Missed Approach	Arrival or Approach
250KT AT or BELOW	Do not exceed PRIOR	Do not exceed AT and AFTER
210KT AT	Do not exceed PRIOR, do not go below AFTER, cross AT	Do not go below PRIOR, do not exceed AFTER, cross AT
175KT AT or ABOVE	Do not go below AT and AFTER	Do not go below PRIOR to and AT

Table 5-11 Speed Constraint Application

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

A speed constraint is invalid if:

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

Entering or modifying a flight plan waypoint speed constraint:

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

Or:

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

2) Scroll the list, if needed, and touch an FPA/SPD Button to display the **Speed Constraint** Button.

3) Touch the **Speed Constraint** Button to display the 'Enter Speed' Screen.

4) Use the keypad to select the speed.

5) If needed, touch the **IAS** Button or the **Mach** Button to select the speed units.

6) If needed, touch the **At**, **Above**, or **Below** Button to select the constraint type.

7) Touch the **Enter** Button to accept the new speed constraint.

Figure 5-120 Active Flight Plan - Adding a Speed Constraint

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

Removing a flight plan waypoint speed constraint:

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

Or:

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

2) Scroll the list, if needed, and touch a FPA/SPD Button to display the **Speed Constraint** Button.

3) Touch the **Speed Constraint** Button. The 'Enter Speed' Window is displayed.

4) Touch the **Remove Speed** Button. A 'Remove Speed Constraint?' confirmation window is displayed.

5) Touch the **OK** Button. The speed constraint is removed. To cancel the request, touch the **Cancel** Button.

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

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

Or:

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

2) Scroll the list, if needed, and touch a FPA/SPD Button to display the **Speed Constraint** Button.

3) Touch the **Speed Constraint** Button. The 'Enter Speed' Window is displayed.

4) Touch the **Remove Speed** Button. A 'Remove or Revert to published speed of nnnKT?' confirmation window is displayed.

5) Touch the **Revert** Button.

Flight Path Angle Constraints

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

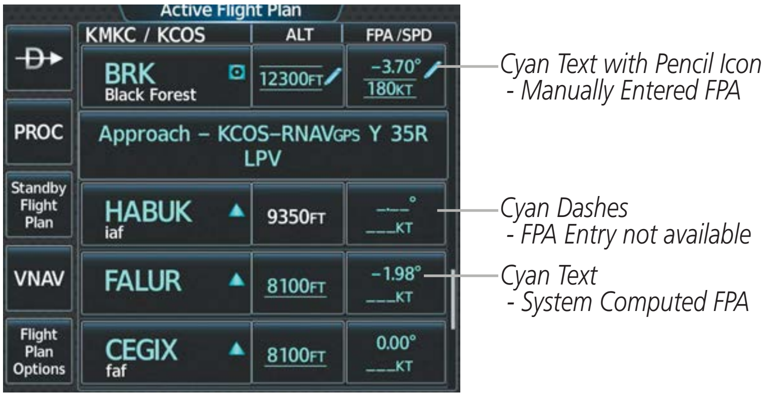


Figure 5-121 Active Flight Plan - Waypoint Flight Path Angle Constraints

Entering or modifying a flight path angle constraint:

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

   Or:

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

2) Scroll the list, if necessary, and touch a FPA/SPD button to display the Flight Path Angle/Speed Constraint window.

3) Touch the **Flight Path Angle** Button to display the 'VNAV Flight Path Angle' Window.

4) Use the keypad to select the angle.

5) Touch the **Enter** Button to accept the new FPA constraint.

Manually entered FPA constraints can be modified or deleted after having been added to the flight plan. These modifications will redefine the calculated vertical path and may result in movement of the Top of Descent (TOD).

Removing a flight path angle constraint:

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

   Or:

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

2) Scroll the list, if necessary, and touch a FPA/SPD button to display the Flight Path Angle/Speed Constraint Window.

3) Touch the **Flight Path Angle** Button. The 'VNAV Flight Path Angle' Window is displayed.

4) Touch the **Remove FPA** Button.

5) Touch the **OK** Button. The FPA reverts to the FMS computed value, or to dashes. To cancel the request, touch the **Cancel** Button.

VERTICAL SITUATION DISPLAY

A Vertical Situation Display (VSD) can be shown on the bottom of the 'Navigation Map' Pane. The terrain, obstacles, vertical track vector, selected altitude, and active flight plan information (active flight plan information consists of waypoints, associated altitude constraints, current VNAV profile, BOC/TOC, TOD/BOD, and destination runway) can be displayed on the VSD, depending on the selected mode. See the Hazard Avoidance section for information about winds aloft, obstacles, and relative terrain on the VSD.

The VSD horizontal range is equal to the navigation map indicated range when the VSD is in Track mode. When the VSD is in Flight Plan mode, the horizontal range is the lower of twice the navigation map indicated range or the lowest range the displays all of the remaining active flight plan. The VSD altitude range automatically changes when the navigation map range is changed to keep a constant ratio of altitude range to horizontal range, until both minimum and maximum display limits have been met. At ranges above the maximum, the altitude range remains constant at the maximum.

The aircraft symbol is displayed on the left side of the VSD window. The position of the aircraft symbol on the vertical scale is close to the top for a descent phase, at the bottom for on-ground or a climb phase, and in the middle for a cruise phase or if the phase is unknown.

If two waypoints are close together, and their labels or constraint values overlap enough to obscure any text, one waypoint label/constraint value is removed and the vertical dashed line for that waypoint is displayed as darker gray. The priority for which waypoint remains displayed is: (1) the current TO waypoint, (2) waypoint with an altitude constraint, and (3) waypoint closer to the aircraft.

Terrain/obstacles are available on the VSD, and will be shown if the aircraft altitude is low enough for the terrain/obstacles to be in view (terrain will be subdued if the terrain is selected Off on the Navigation Map). Obstacles will be shown if the navigation map zoom is within the Map Obstacle Range settings. The depicted terrain profile represents an approximate forward-looking contour of the terrain based upon the highest reported terrain elevations, measured at intervals defined by the terrain database resolution, within a predefined width along the active flight plan between the aircraft present position and the end of the map range or active flight plan. The predefined width is determined by the flight phase.

The numeric constraint values are displayed below the waypoint label, using the same color and format as on the 'Active Flight Plan' Screen. Advisory altitude values are not shown. The graphical symbols are shown on the descending dashed line at the constraint value altitude(s). The following table shows the numeric representation and the graphical representation of the constraints. The tip of each constraint symbol triangle is placed at the corresponding constraint barometric altitude.

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

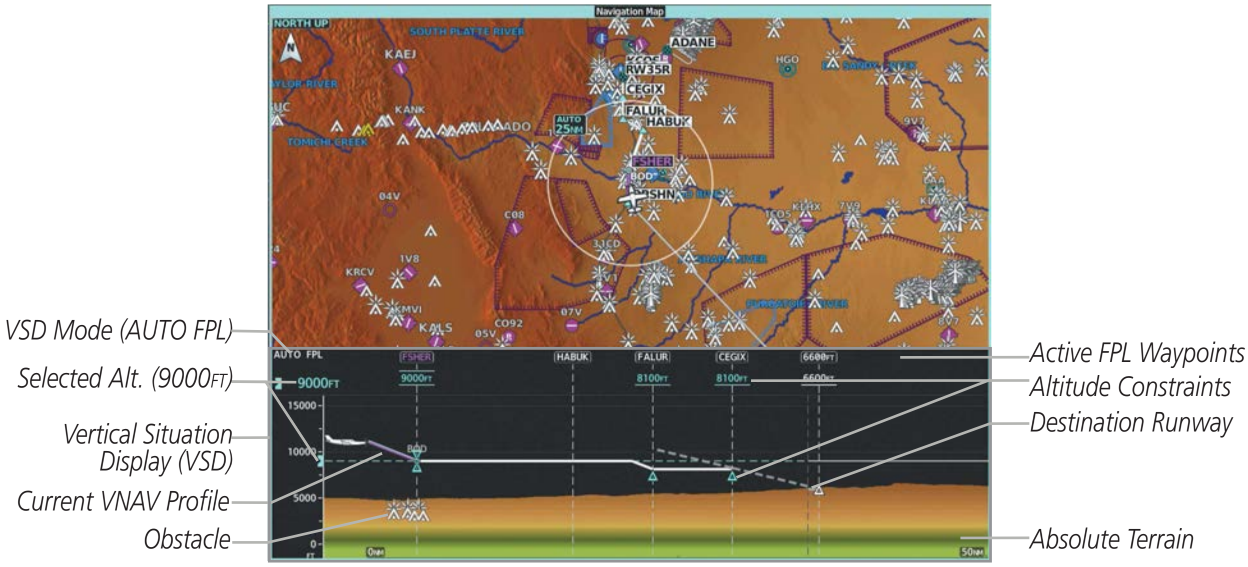


Figure 5-122 Vertical Situation Display (VSD)

Constraint Type	Numeric Representation	Altitude Constraint Icon
AT (Designated Altitude Constraint)	3000FT	
AT or ABOVE (Designated Altitude Constraint)	5000FT	
AT or BELOW (Designated Altitude Constraint)	3000FT	
BETWEEN (Designated Altitude Constraint)	5000FT 3000FT	
AT or ABOVE (Un-designated Altitude Constraint derived from the database)	5000FT	
AT or BELOW (Un-designated Altitude Constraint derived from the database)	3000FT	

Table 5-12 VSD Altitude Constraint Icons

Climb and descend icons are shown on the VSD when the aircraft altitude meets a condition shown in the following table.

Condition	Climb/Descend Icon
If the active leg's flight plan line is above the highest altitude shown on the VSD, a magenta climb icon will be displayed to the right of the ownship symbol	
If a future leg's flight plan line is above the highest altitude shown on the VSD during the climb phase of flight, a white climb icon will be displayed to the right of the last leg visible on the VSD	
If the active leg's flight plan line is below the lowest altitude shown on the VSD, a magenta descend icon will be displayed to the right of the ownship symbol	

Table 5-13 VSD Climb/Descent Icons

VSD Mode Button	Displayed Mode	FPL Criteria	Items available on VSD
Auto	AUTO FPL	Available active FPL & aircraft within FPL swath	Terrain/obstacles along the active flight plan route, vertical track vector, selected altitude, and active flight plan information*
	AUTO TRK	(1) Active FPL available & aircraft not within FPL swath, or (2) Active FPL not available	Terrain/obstacles along the current track, vertical track vector, and selected altitude
Flight Plan	FPL	Active FPL available	Terrain/obstacles along the active flight plan route, vertical track vector, selected altitude, and active flight plan information
		Active FPL not available	Only shows message 'Flight Plan Not Available'
Track	TRK	NA	Terrain/obstacles along the current track, vertical track vector, and selected altitude
Active flight plan information consists of waypoints, associated altitude constraints, current VNV profile, TOD/BOD, and destination runway			

Table 5-14 VSD Mode Descriptions

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

Table 5-15 Swath Width

VSD MESSAGES

Under certain conditions, some messages may appear in conjunction with others:

Message	Description
'Loading...'	VSD is loading data due to a range change, full/half switch, or first being selected for display.
'Flight Plan Not Available'	Flight Plan mode is selected and there is not a flight plan loaded with at least one leg.
'Flight Plan mode unavailable because aircraft off course and active leg over 200 NM'	All of the following are true: - Flight Plan mode is selected - The active leg is greater than 200 nm - The aircraft is outside the swath
'Aircraft Beyond Active Leg'	Flight Plan mode is selected and the aircraft's position, as projected on the flight plan, is past the end of the active leg.
'VSD Not Available'	At least one of the following is true: - Valid terrain database not available - GPS MSL altitude not available - Current barometric altitude not available - Neither current track nor current heading available - GPS position not available - Map range setting is less than 1 nm
'VSD Data is old, disable and enable VSD'	The system has encountered a delay and VSD data has failed to update for 2 seconds or more. This message may be momentarily displayed and then removed as the delay is overcome.

Table 5-16 VSD System Messages

Enabling/disabling the VSD:

1) From MFD Home, touch **Map** > **Map Selection** > **Map Settings**.
2) Touch the **Inset Window** Tab
3) Touch the **VERT Situation Display** Button to enable/disable display of the VSD.

Changing the VSD Mode:

1) From MFD Home, touch **Map** > **Map Selection** > **Map Settings**.
2) Touch the **Inset Window** Tab
3) Touch the VERT Situation Display **Settings** Button.
4) Touch the **Mode** Button to display the 'Mode Selection' Screen.
5) Touch a Mode button to select the mode and return to the 'Vertical Situation Display Settings' Screen.

VERTICAL NAVIGATION DIRECT TO

The system allows a vertical navigation direct-to to any waypoint in the active flight plan with an altitude descent constraint “designated” for vertical guidance. Initiating the vertical navigation direct-to allows the flight plan to be flown, while vertical guidance based on the altitude constraint at the VNAV direct-to waypoint is provided. The altitude change begins on the current leg and is spread along the flight plan from current position to the vertical direct-to waypoint, not just along the leg for the direct-to waypoint. A TOD point is computed based on this altitude change; guidance for descent begins once the TOD is reached. All VNAV altitudes prior to the direct-to destination are removed from the active flight plan upon successful activation of the direct-to. All VNAV altitudes following the direct-to waypoint are retained. As with the previously discussed vertical navigation, the direct to vertical navigation profile can be modified by directly entering either a vertical speed target (VS Target) or a flight path angle (FPA) constraint, on the 'VNAV Profile' Screen.

A lateral direct-to with an altitude constraint (activated by touching the D→ Key) also provides vertical guidance, but would bypass flight plan waypoints between the current position in the flight plan and the direct-to waypoint.

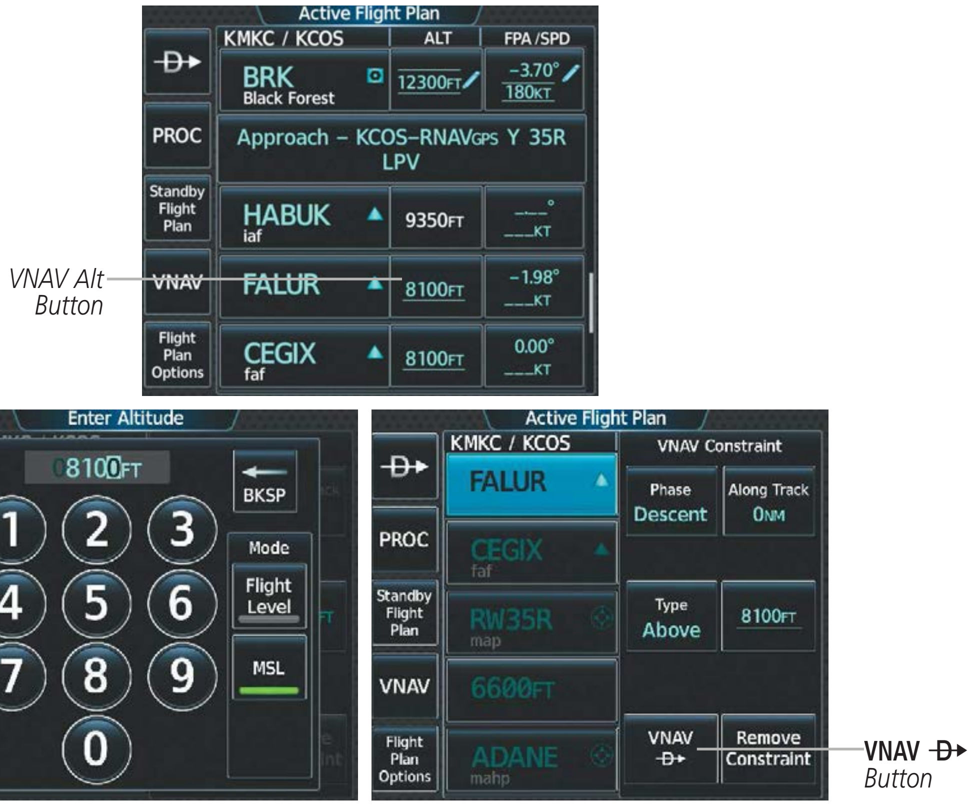


Figure 5-123 VNAV Altitude - VNAV Direct To

Activating a vertical navigation direct to:

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 **Activate** Button in response to "Activate Vertical D→: NNNNNFT at XXXXXX" to initiate the vertical navigation direct to. Vertical guidance begins to the altitude constraint for the selected waypoint. To cancel the request, touch the **Cancel** Button.

Or:

1) From MFD Home, touch **Flight Plan**

2) Scroll the list, if necessary, and touch the VNAV ALT button for the desired waypoint to display the 'VNAV Altitude' Window. Review the altitude constraint information. If it is correct, skip to step 5 to initiate the vertical navigation direct to.

3) If necessary, touch the **Flight Level** Button or the **MSL** Button to select the altitude mode.

4) Use the keypad to select the altitude.

5) Touch the VNAV D→ XXXXX Button to activate the vertical navigation direct to. Vertical guidance begins to the altitude constraint for the selected waypoint.

Figure 5-124 Active Flight Plan - VNAV Direct To Not Active

Figure 5-125 Active Flight Plan - VNAV Direct To Active

Removing a Direct To VNAV constraint:

1) From MFD Home, touch **Direct To**.
2) Touch the **VNAV Altitude** Button to display the keypad.
3) Touch the **Remove VNAV ALT** Button.
4) Touch the **OK** Button in response to the question "Remove VNAV altitude?".
5) Touch the **Activate** -D→ Button to activate the direct to without the VNAV constraints.

Or:

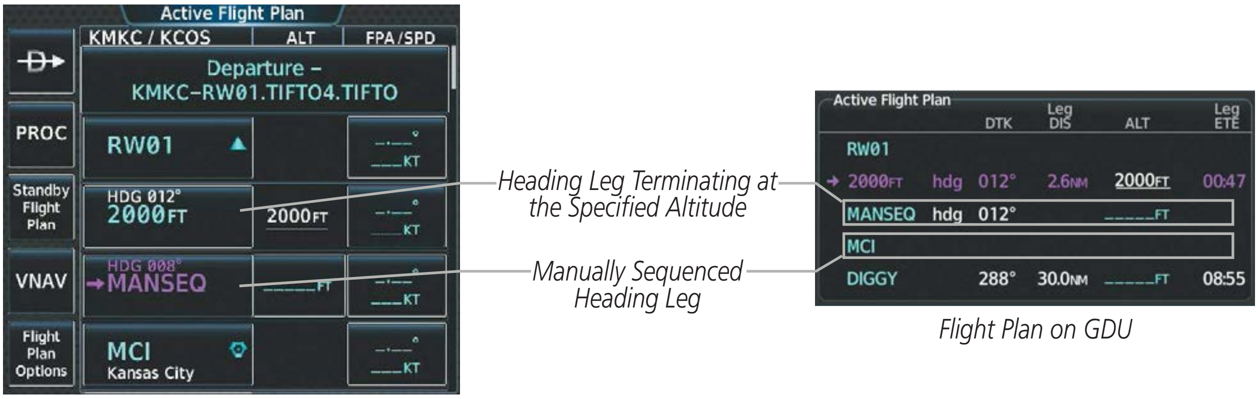
1) From MFD Home, touch **Flight Plan**.
2) Scroll the active flight plan to display the direct-to waypoint.
3) Touch the VNAV Altitude Button for the direct-to waypoint to display the 'VNAV Altitude' Window.
4) Touch the **Remove VNAV ALT** Button.
5) Touch the **OK** Button in response to the question "Remove VNAV Altitude?".

5.8 PROCEDURES

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

No waypoints are required to be in the flight plan to load procedures; however, if the origin and destination airport (or runway) are already loaded, the procedure selection screen defaults to the appropriate airport, saving some time selecting the correct airport.

The system adds terminal procedures to the flight plan based on leg types coded within that procedure in the navigation database. If the terminal procedure in the flight plan contains an identifier like '2000FT', that indicates a leg that requires manual termination by the pilot when the specified altitude (2000 feet) has been exceeded. A heading leg in the flight plan displays 'hdg' or 'HDG' preceding the DTK (e.g. 'hdg 008°'). A flight plan leg requiring the pilot to manually initiate sequencing to the next leg displays 'MANSEQ' as the identifier.



Flight Plan on Touchscreen Controller

Flight Plan on GDU

Figure 5-126 Procedure Leg Identifiers

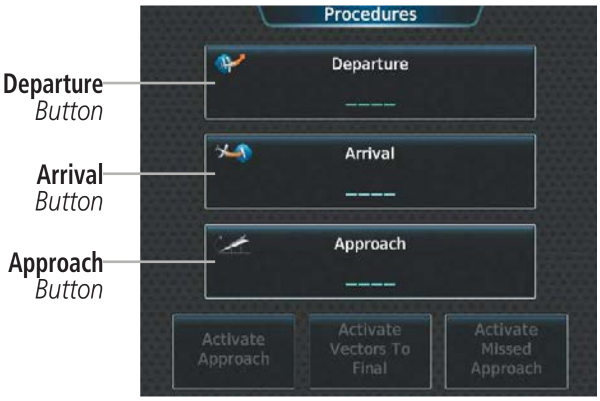


Figure 5-127 Loading Procedures on the Touchscreen Controller

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 a chart selection button to show the procedure 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 a chart selection 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 a chart selection 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.*

PREVIEW ONLY PROCEDURES

The charts database may contain other published instrument procedures which are available for preview, but are not available for navigation guidance. Such procedures will be listed on the 'Select (Departure, Arrival, or Approach)' Screen and are selectable for chart viewing purposes only. See the Additional Features Section for more information on charts.

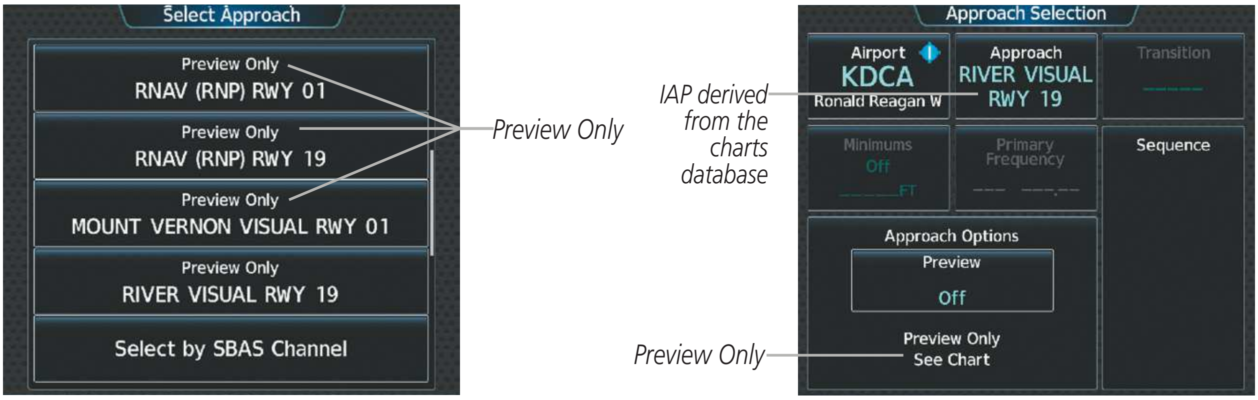


Figure 5-128 Procedure Selection – Preview Only (Approach example)

DEPARTURES

A Departure Procedure (DP) is loaded at the origin airport in the flight plan. Only one departure can be loaded at a time in a flight plan. If a departure is loaded when another departure is already in the flight plan, the new departure replaces the previous departure. The departure sequence is defined by selection of a departure, the transition waypoints, and a runway.

Loading a departure into the standby/active flight plan using the Touchscreen Controller:

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

Or:

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

2) Touch the **Departure** Button to display the 'Departure Selection' Screen.

3) If needed, touch the **Airport** Button to display the keypad and use it to select the origin airport.

4) Touch the **Enter** Button to accept the origin airport.

5) Touch the **Departure** Button to display the 'Select Departure' Screen with a list of available departures.

6) Scroll the list if needed and touch a departure selection button to select a departure. The 'Select Transition' Screen will open.

7) Scroll the list if needed and touch a transition selection button to select the transition. The 'Select Runway' Screen will open.

8) Scroll the list if needed and touch a runway selection button to select the runway and return to the 'Departure Selection' Screen.

9) Touch the **Preview** Button, then the **Show on Map** Button to show the preview of the departure on the navigation map or touch a chart selection button to show the procedure chart instead of the navigation map.

10) Touch the **Load** Button to insert the departure into the active flight plan.

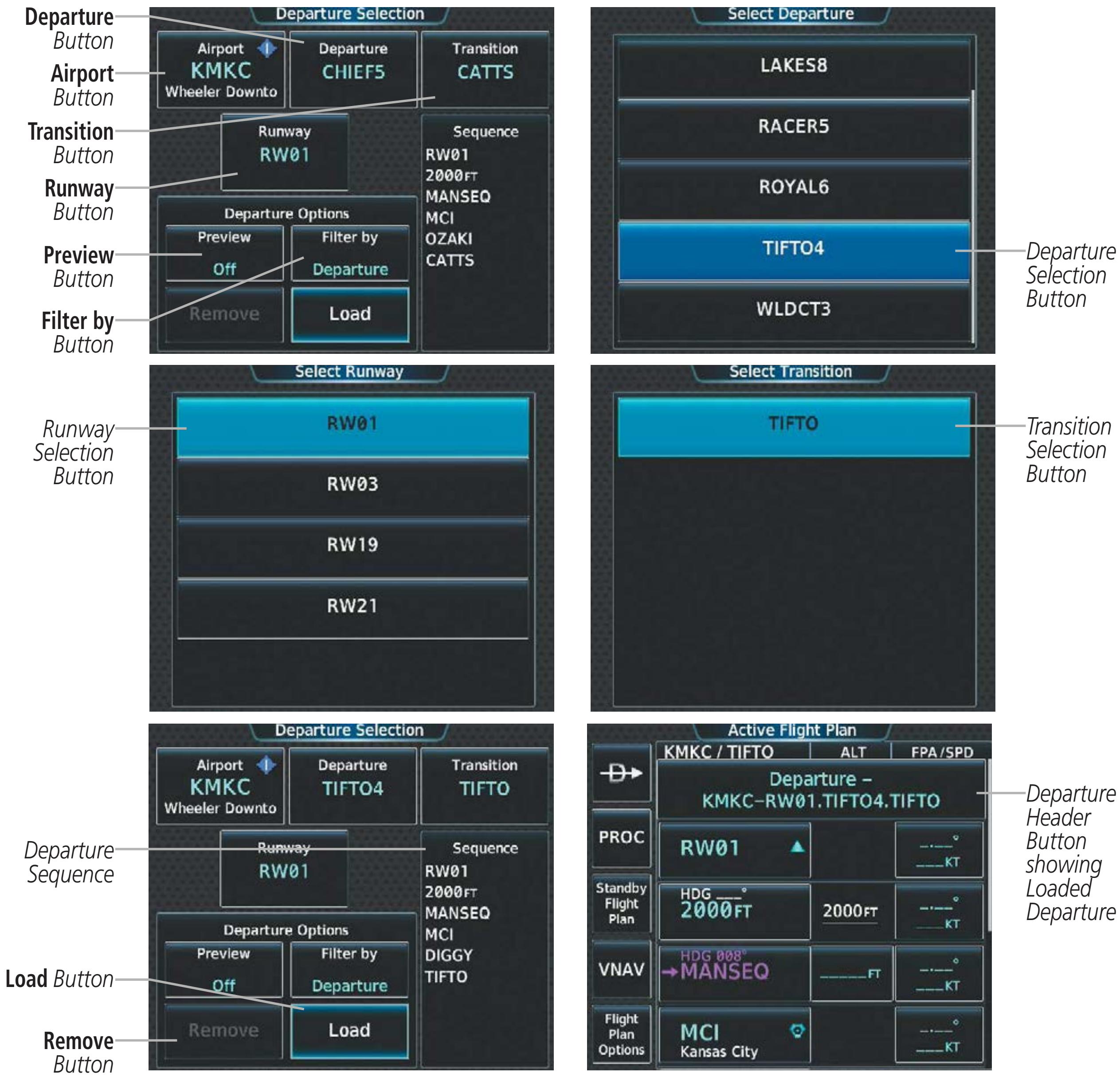


Figure 5-129 Loading a Departure into the Active Flight Plan

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 desired order.

Loading a departure procedure into a stored flight plan:

1) From MFD Home, touch **Flight Plan > Flight Plan Options > Flight Plan Catalog** to display the 'Flight Plan Catalog' Screen.
2) Touch a flight plan selection button to display the 'Catalog Options' Screen.
3) Touch the **Edit** Button to display the 'Edit Stored Flight Plan' Screen.
4) Touch the **Flight Plan Options** Button to display the 'Flight Plan Options' Window.
5) Touch the **Load Departure** Button to display the 'Departure Selection' Screen.
6) Touch the **Departure** Button to display the 'Select Departure' Screen with a list of available departures.
7) Scroll the list as needed and touch a departure selection button. The 'Select Transition' Screen is opened.
8) Scroll the list as needed and touch a transition selection button to select the transition. The 'Select Runway' Screen is opened.
9) Scroll the list if needed and touch a runway selection button to select the runway and return to the 'Departure Selection' Screen.
10) Touch the **Preview** Button, then the **Show on Map** Button to show the preview of the arrival on the navigation map or touch a chart selection button to show the procedure chart instead of the navigation map.
11) Touch the **Load** Button to insert the arrival into the stored flight plan.

Removing a departure from the active/standby flight plan using the Touchscreen Controller:

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

   Or:

   For the standby flight plan: From MFD Home, touch **Flight Plan > Standby Flight Plan > PROC**.
2) Touch the **Departure** Button to display the 'Departure Selection' Screen.
3) Touch the **Remove** Button. A 'Remove Departure – <departure identifier> from flight plan?' Window is displayed.
4) Touch the **OK** Button. The departure is removed from the flight plan. To cancel the request, touch the **Cancel** Button.

   Or:

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

   Or:

   For the standby flight plan: From MFD Home, touch **Flight Plan > Standby Flight Plan**.
2) Touch the Departure Header button to display the 'Departure Options' Window.
3) Touch the **Remove Departure** Button. A 'Remove Departure – <departure identifier> from flight plan?' Window is displayed.
4) Touch the **OK** Button. The departure is removed from the flight plan. To cancel the request, touch the **Cancel** Button.

Removing a departure 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 Departure Header button to display the 'Departure Options' Window.
5) Touch the **Remove Departure** Button.
6) Touch the **OK** Button in response to "Remove Departure – <procedure name> from flight plan?". The procedure is removed. To cancel the request, touch the **Cancel** Button.

ARRIVALS

A Standard Terminal Arrival (STAR) can be loaded at any airport that has one available. Only one arrival can be loaded at a time in a flight plan. If an arrival is loaded when another arrival is already in the flight plan, the new arrival replaces the previous arrival. The arrival sequence is defined by selection of an arrival, the transition waypoints, and a runway.

Loading an arrival into the active/standby flight plan using the Touchscreen Controller:

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

   Or:

   For the standby flight plan: From MFD Home, touch **Flight Plan > Standby Flight Plan > PROC**.
2) Touch the **Arrival** Button to display the 'Arrival Selection' Screen.
3) If needed, touch the **Airport** Button to display the keypad and use it to select the destination airport.
4) Touch the **Enter** Button to accept the destination airport.
5) Touch the **Arrival** Button to display the 'Select Arrival' Screen with a list of available arrivals.
6) Scroll the list if needed and touch an arrival selection button to select the arrival. The 'Select Transition' Screen will open.
7) Scroll the list if needed and touch a transition selection button to select the transition. The 'Select Runway' Screen will open.
8) Scroll the list if needed and touch a runway selection button to select the runway and return to the 'Arrival Selection' Screen.
9) Touch the **Preview** Button, then the **Show on Map** Button to show the preview of the arrival on the navigation map or touch a chart selection button to show the procedure chart instead of the navigation map.
10) Touch the **Load** Button to insert the arrival into the flight plan.

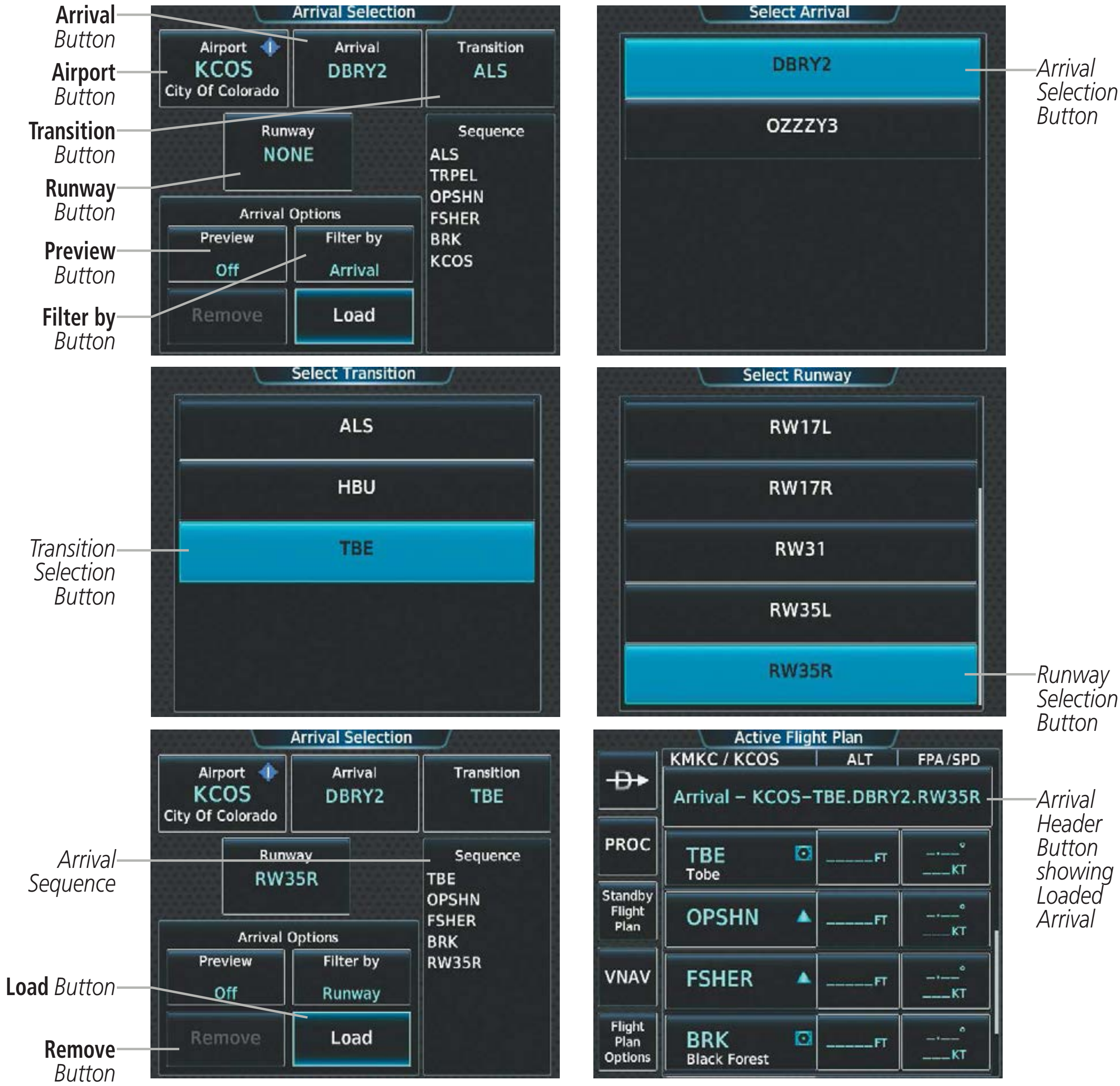


Figure 5-130 Loading an Arrival into the Active Flight Plan

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 desired order.

Loading an arrival procedure into a stored flight plan:

1) From MFD Home, touch **Flight Plan > Flight Plan Options > Flight Plan Catalog** to display the 'Flight Plan Catalog' Screen.
2) Touch a flight plan selection button to display the 'Catalog Options' Screen.
3) Touch the **Edit** Button to display the 'Edit Stored Flight Plan' Screen.
4) Touch the **Flight Plan Options** Button to display the 'Flight Plan Options' Window.

5) Touch the **Load Arrival** Button to display the 'Arrival Selection' Screen.

6) Touch the **Arrival** Button to display the 'Select Arrival' Screen with a list of available arrivals.

7) Scroll the list as needed and touch an arrival selection button. The 'Select Transition' Screen is opened.

8) Scroll the list as needed and touch a transition selection button to select the transition. The 'Select Runway' Screen is opened.

9) Scroll the list if needed and touch a runway selection button to select the runway and return to the 'Arrival Selection' Screen.

10) Touch the **Preview** Button, then the **Show on Map** Button to show the preview of the arrival on the navigation map or touch a chart selection button to show the procedure chart instead of the navigation map.

11) Touch the **Load** Button to insert the arrival into the stored flight plan.

Removing an arrival from the active/standby flight plan using the Touchscreen Controller:

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

   Or:

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

2) Touch the **Arrival** Button to display the 'Arrival Selection' Screen.

3) Touch the **Remove** Button. A 'Remove Arrival – <arrival> from flight plan?' Window is displayed.

4) Touch the **OK** Button. The arrival is removed from the flight plan. To cancel the request, touch the **Cancel** Button.

   Or:

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

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

2) Touch the Arrival Header Button to display the 'Arrival Options' Screen.

3) Touch the **Remove Arrival** Button. A 'Remove Arrival – <arrival> from flight plan?' Window is displayed.

4) Touch the **OK** Button. The arrival is removed from the flight plan. To cancel the request, touch the **Cancel** Button.

Removing an arrival 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 Arrival Header button to display the 'Arrival Options' Window.

5) Touch the **Remove Arrival** Button.

6) Touch the **OK** Button in response to "Remove Arrival – <procedure name> from flight plan?". The procedure is removed. To cancel the request, touch the **Cancel** Button.

APPROACHES

INSTRUMENT APPROACH

NOTE: *If certain GPS parameters (SBAS, RAIM, etc.) are not available, some published approach procedures for the desired airport may not be displayed in the list of available approaches.*

An Approach Procedure can be loaded at any airport that has one available, and provides guidance for non-precision and precision approaches to airports with published instrument approach procedures. Only one approach can be loaded at a time in a flight plan. If an approach is loaded when another approach is already in the active flight plan, the new approach replaces the previous approach. The route is defined by selection of an approach and the transition waypoints.

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

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

When selecting an approach, a "GPS" designation to the right of the procedure name indicates the procedure can be flown using the GPS receiver. Some procedures do not have this designation, meaning the GPS receiver can be used for supplemental navigation guidance only. If the GPS receiver cannot be used for primary guidance, the appropriate navigation receiver must be used for the selected approach. The final course segment of ILS approaches, for example, must be flown by tuning the NAV receiver to the proper frequency and selecting that NAV receiver on the CDI. For information on changing the navigation source of the CDI, and for information on the display of vertical deviation on the PFD, see the Flight Instruments Section. See the Audio Panel & CNS Section for information on selecting and tuning a NAV receiver.

Approaches using GPS

When 'gps' is indicated in the charted approach title, the approach is approved for GPS navigation.

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

<table>
<tr><th>HSI Annunciation</th><th>Description</th><th>Example on HSI</th></tr>
<tr><td>LNAV</td><td rowspan="2">Approach to the published MDA</td><td rowspan="6">
</td></tr>
<tr><td>LP</td></tr>
<tr><td>LNAV+V</td><td rowspan="2">Approach with advisory vertical guidance to the published MDA</td></tr>
<tr><td>LP+V</td></tr>
<tr><td>L/VNAV</td><td rowspan="2">Approach with approved vertical guidance to the published DA</td></tr>
<tr><td>LPV</td></tr>
</table>

Table 5-17 Approach Service Levels

***NOTE:** The system requires 30 seconds of valid SBAS integrity monitoring prior to selecting an approach that requires SBAS vertical guidance.*

The system GPS receivers will use Satellite Based Augmentation (SBAS) when available. Some approaches require the use of SBAS for lateral and/or vertical GPS navigation. However, the system will provide Barometric Vertical Navigation (Baro VNAV) if SBAS is not available. For information on how lateral and vertical guidance is depicted on the PFD, see the Flight Instruments Section.

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

**SBAS required*
***See Approach Downgrade Behavior Table*

Table 5-18 Source of Lateral and Vertical Navigation per Approach Service Level

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

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

Approach with SBAS	SBAS Becomes Unavailable	Description	System Message Generated	Action Required	Approach Downgrade
LNAV	Approach phase not specified	SBAS not required. The approach is continued.	None	None*	N/A
LNAV+V					
LNAV/VNAV	Prior to the FAF	HSI displays 'L/VNAV' in amber VDI displays 'NO GP'	APR ADVISORY - SBAS VNAV not available. Using Baro VNAV.	Acknowledge message to display Baro VNAV Glidepath	N/A
	At/after the FAF	HSI displays 'LNAV' in magenta VDI displays 'No GP'	None	None	LNAV**
LP	More than 1 min. prior to the FAF	HSI displays 'LP' in amber	None	None	N/A
	Within 1 min. prior to the FAF	HSI displays 'LNAV' in magenta CDI is removed	APR DWNGRADE - Approach downgraded. Use LNAV minimums.	Acknowledge message to redisplay CDI with LNAV	LNAV**
	At/after the FAF	CDI is removed	ABORT APR - Loss of GPS navigation. Abort approach.	Abort	N/A
LP+V	More than 1 min. prior to the FAF	HSI displays 'LP+V' in amber VDI displays 'No GP'	None	None	N/A
	Within 1 min. prior to the FAF	HSI displays 'LNAV' in magenta CDI is removed VDI displays 'No GP'	APR DWNGRADE - Approach downgraded. Use LNAV minimums.	Acknowledge message to redisplay CDI with LNAV	LNAV**
	At/after the FAF	CDI is removed VDI displays 'No GP'	ABORT APR - Loss of GPS navigation. Abort approach.	Abort	N/A
LPV	More than 1 min. prior to the FAF	HSI displays 'LPV' in amber	None	None	N/A
	Within 1 min. prior to the FAF	HSI displays 'L/VNAV' in magenta VDI displays 'NO GP'	APR DWNGRADE - Use LNAV/VNAV minimums.	Acknowledge message to display Baro VNAV Glidepath	LNAV/VNAV
	At/after the FAF	HSI displays 'LNAV' in magenta VDI displays 'NO GP'	None	None	LNAV**

**If total loss of GPS occurs, abort.*

***If there is no LNAV minimums available for the approach, abort.*

Table 5-19 Approach Downgrade Behavior

VISUAL APPROACHES

***NOTE:** When flying Direct-to the visual Final Approach Fix (FINAL), the system will suspend (SUSP) leg sequencing if the approach intercept angle exceeds 45 degrees. For visual approaches only, if leg sequencing is subsequently unsuspended, turn anticipation from the FAF will be provided.*

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 some airports. a Charted Visual Flight Procedure (CVFP) may be defined in the chart database. CVFPs do follow a precise prescribed path and are classified as Instrument Approach Procedures. CVFPs may be selected for PReview Only and are not available for navigation guidance.

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.

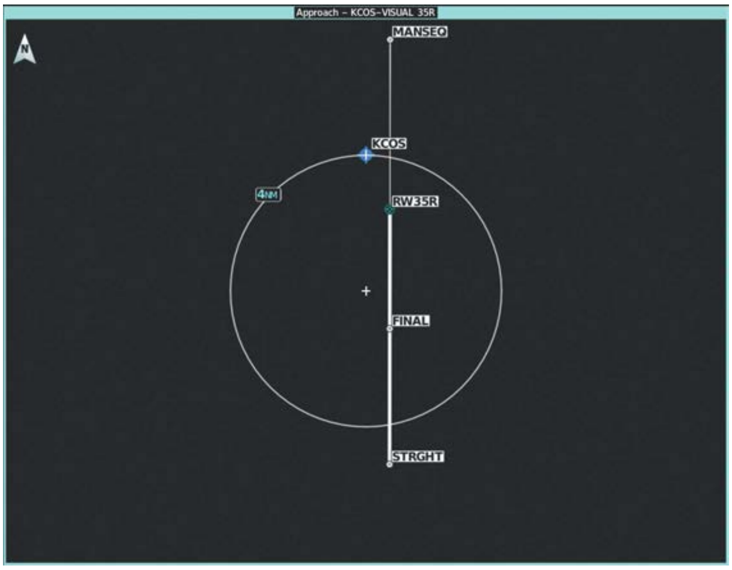


Figure 5-131 Preview of the Selected Visual Approach on Display Pane

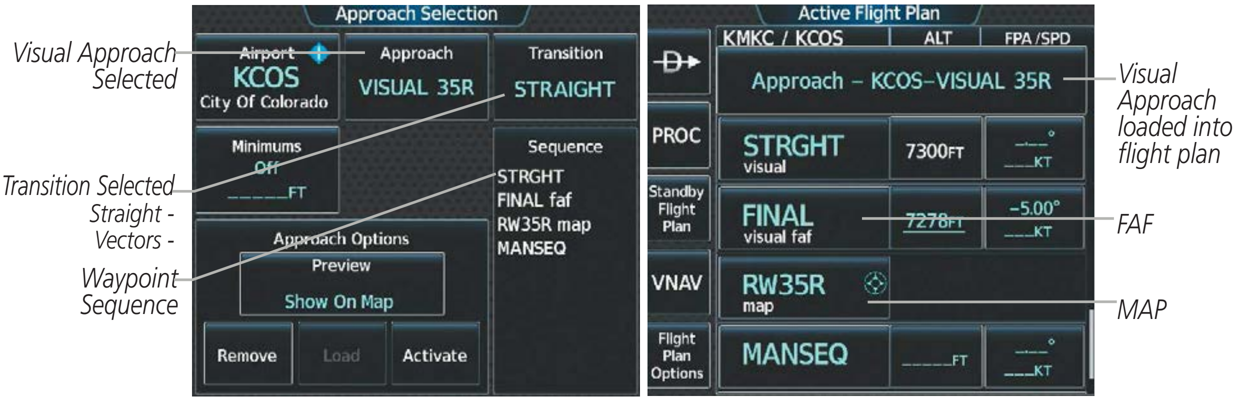


Figure 5-132 Loading a Visual Approach on the Touchscreen Controller

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.

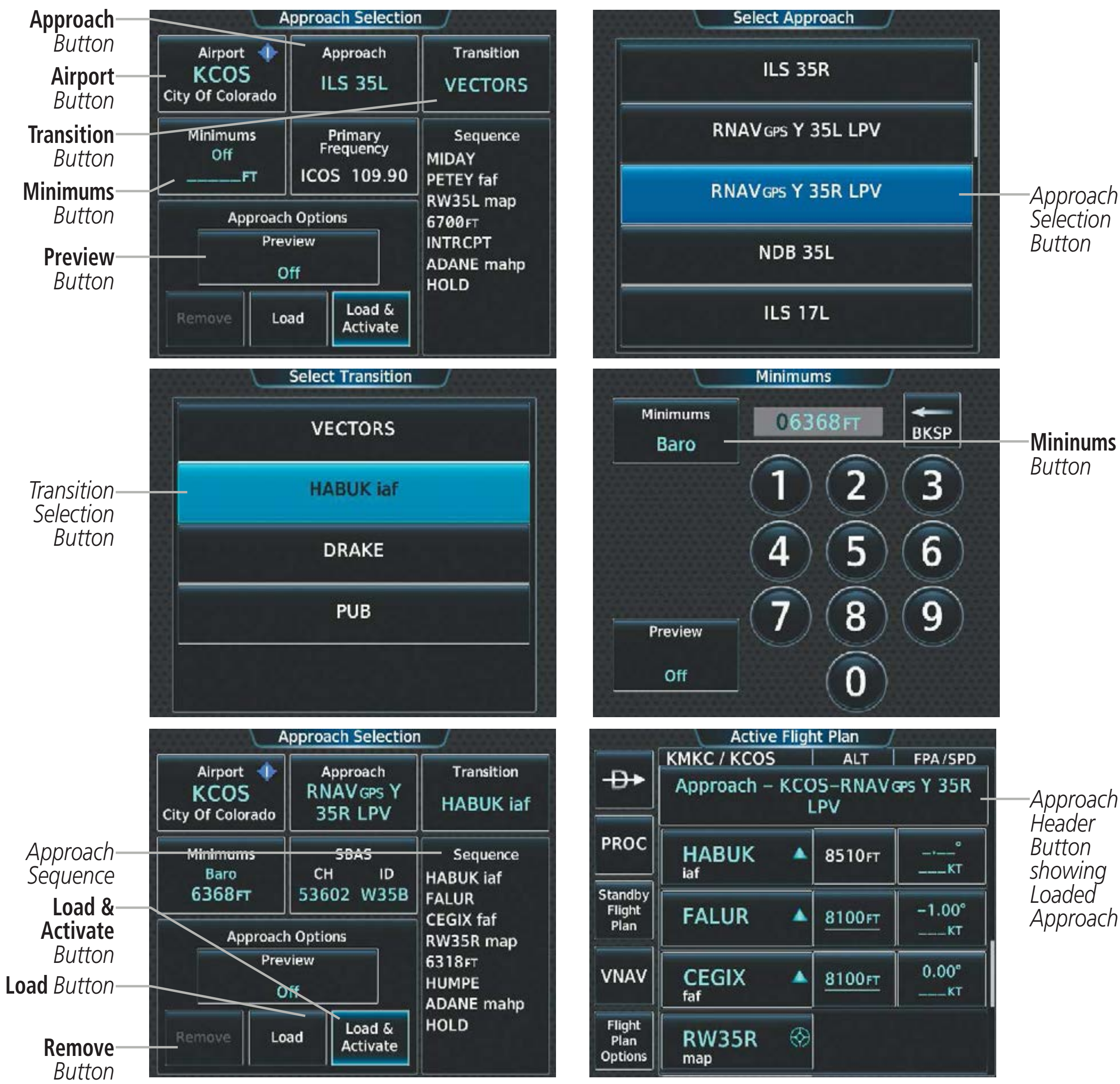


Figure 5-133 Loading an Approach into the Active Flight Plan

Loading an approach into the active flight plan using the PROC Key:

1) Press the **PROC** Key. The 'Procedures' Window is displayed.

2) Highlight 'Select Approach', and press the **ENT** Key. The 'PROC – Approach Loading' Page is displayed.

3) Select the airport and approach:

- **a)** To enter or change the destination airport, use the **FMS** Knob to select an airport and press the **ENT** Key.
- **b)** Select an approach from the list and press the **ENT** Key.

  Or:
- **a)** If necessary, push the **FMS** Knob to exit the approach list, and use the large **FMS** Knob to move the cursor to the 'Channel' Field.
- **b)** Use the **FMS** Knob to enter the approach channel number, and press the **ENT** Key to accept the approach channel number. The airport and approach are selected.

4) Select a transition (if required) and press the **ENT** Key.

5) Minimums

   a) To set approach minimums, turn the small **FMS** Knob to select 'BARO', 'TEMP COMP', or 'RAD ALT' and press the **ENT** Key. Turn the small **FMS** Knob to select the altitude, and press the **ENT** Key.

   b) If 'TEMP COMP' was selected, the cursor moves to the temperature field. Turn the small **FMS** Knob to select the temperature, and press the **ENT** Key.

   Or:

   To skip setting minimums, select 'OFF' and press the **ENT** Key.

6) Press the **ENT** Key with 'Load?' highlighted to load the approach procedure; or turn the large **FMS** Knob to highlight 'Activate' and press the **ENT** Key to load and activate the approach procedure.

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

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

1) Select the 'NRST – Nearest Airports' Page.

2) Push the **FMS** Knob, then turn the large **FMS** Knob to highlight the desired nearest airport. The airport is previewed on the map.

3) Press the **APR** Softkey; or press the **MENU** Key, highlight 'Select Approach Window', and press the **ENT** Key.

4) Turn the **FMS** Knob to highlight the desired approach.

5) Press the **LD APR** Softkey; or press the **MENU** Key, highlight 'Load Approach', and press the **ENT** Key. The 'PROC – Approach Loading' Page is displayed with the 'Transition' Field highlighted.

6) Turn the **FMS** Knob to highlight the desired transition, and press the **ENT** Key.

7) Minimums

   a) To set 'Minimums', turn the small **FMS** Knob to select 'BARO', 'TEMP COMP', or 'RAD ALT' and press the **ENT** Key. Turn the small **FMS** Knob to select the altitude, and press the **ENT** Key.

   b) If 'TEMP COMP' was selected, the cursor moves to the temperature field. Turn the small **FMS** Knob to select the temperature, and press the **ENT** Key.

   Or:

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

8) Press the **ENT** Key with 'Load?' highlighted to load the approach procedure; or turn the large **FMS** Knob to highlight 'Activate?' and press the **ENT** Key to load and activate the approach procedure.

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

Loading an approach procedure into a standby flight plan or a stored flight plan:

1) For the standby flight plan, press the **FPL** Key for the MFD. Turn the small **FMS** Knob to select the 'FPL – Standby Flight Plan' Page.

   Or:

   For a stored flight plan:

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

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

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

2) Press the **LD APR** Softkey; or press the **MENU** Key, select "Load Approach", and press the **ENT** Key. The 'PROC – Approach Loading' Page is displayed.

3) Select the airport and approach:

   a) Use the **FMS** Knob to select an airport and press the **ENT** Key.

   b) Select an approach from the list and press the **ENT** Key.

   Or:

   a) If necessary, push the **FMS** Knob to exit the approach list, and use the large **FMS** Knob to move the cursor to the Approach 'Channel' Field.

   b) Use the **FMS** Knob to enter the approach channel number, and press the **ENT** Key to accept the approach channel number. The airport and approach are selected.

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

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

Activating a previously loaded approach:

1) Press the **PROC** Key. The 'Procedures' Window is displayed with 'Activate Approach' highlighted.

2) Press the **ENT** Key to activate the approach.

Activating a previously loaded approach with vectors to final:

1) Press the **PROC** Key to display the 'Procedures' Window.

2) Highlight 'Activate Vector-to-Final' and press the **ENT** Key.

Loading and activating an approach using the MENU Key:

1) Press the **PROC** Key.

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

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

4) Press the **ENT** Key.

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

Removing an approach from the active, standby, or stored flight plan:

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

Or:

For the standby flight plan, press the **FPL** Key for the MFD. Turn the small **FMS** Knob to select the 'FPL – Standby Flight Plan' Page.

Or:

For a stored flight plan:

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

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

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

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

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

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

Or:

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

Or:

For the standby flight plan, press the **FPL** Key for the MFD. Turn the small **FMS** Knob to select the 'FPL – Standby Flight Plan' Page and push the **FMS** Knob to activate the cursor.

Or:

For a stored flight plan:

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

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

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

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

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

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

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

MISSED APPROACH

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

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

Figure 5-134 Course to Altitude

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.

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° 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 VNV 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.*

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.*

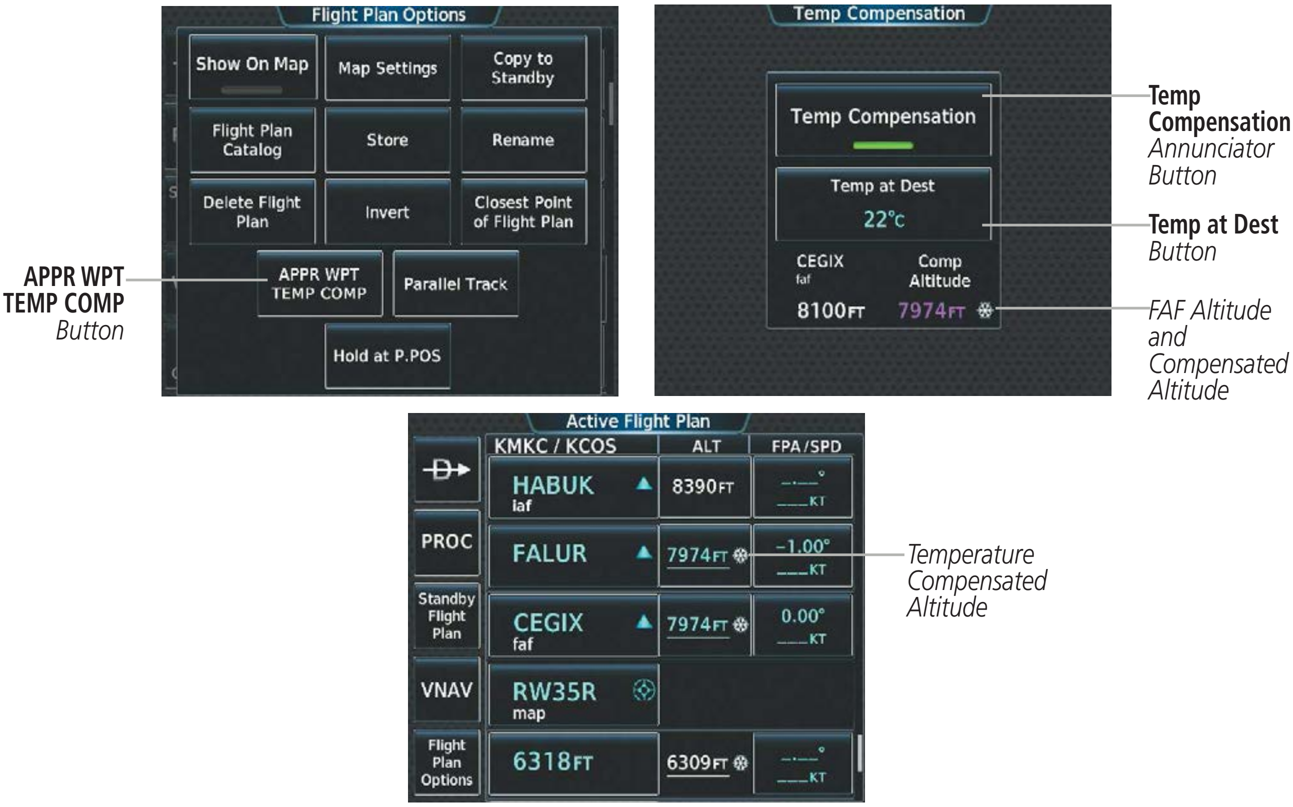


Figure 5-135 Temperature Compensation for Approach Waypoints

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 5-136 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 5-137 Trip Planning Screen – Automatic Mode

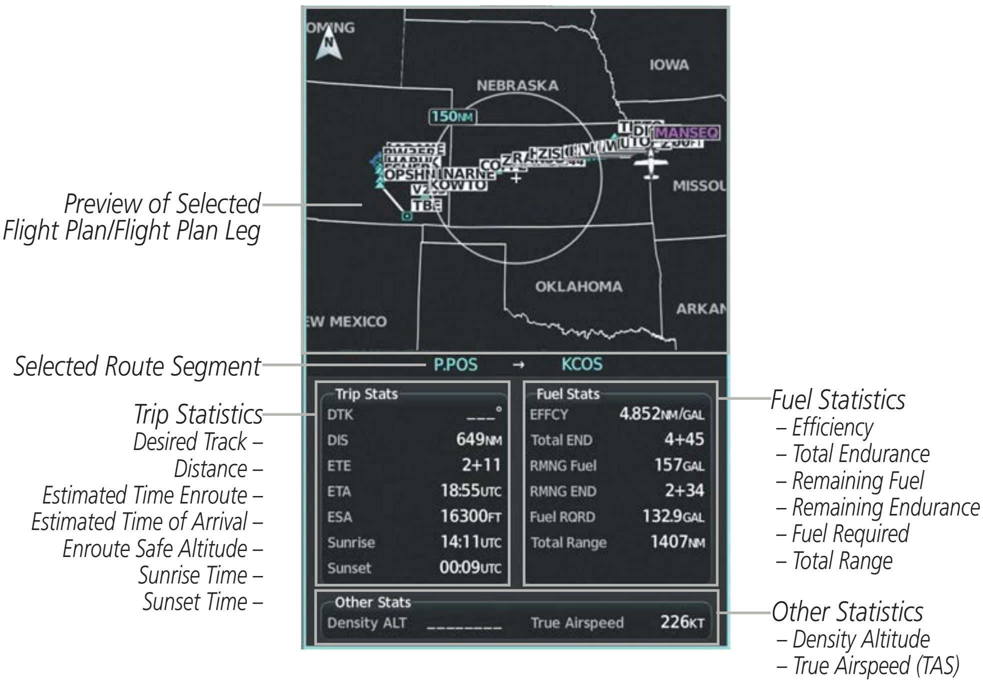


Figure 5-138 Trip Planning Display Pane

The trip planning inputs are based on sensor inputs (automatic mode) or on pilot inputs (manual entry mode). Some additional explanation of the sources for some of the inputs is as follows:

- Departure time (Depart Time) – This defaults to the current time in automatic page mode. The computations are from the aircraft present position, so the aircraft is always just departing. If the time is denoted as LCL, then the time is shown based on the time zone of the aircraft present position

- Calibrated airspeed (Cal Airspeed) – The primary source is from the air data system, and the secondary source of information is GPS ground speed.
- Indicated altitude (Indicated Alt) – The primary source is the barometric altitude, and the secondary source of information is GPS altitude.

TRIP STATISTICS

The trip statistics are calculated based on the trip route selected and the trip planning inputs.

Trip Route Mode	Trip Route Button	Description
Stored Flight Plan – Cumulative Mode		Waypoints are the starting and ending waypoints of the selected flight plan.
Stored Flight Plan – Leg Mode		Waypoints are the endpoints of the selected leg.
Active Flight Plan – Remaining Mode		The 'from' waypoint is the aircraft present position, and the 'to' waypoint is the endpoint of the active flight plan.
Active Flight Plan – Leg Mode		The 'from' waypoint is the aircraft present position or a selected waypoint, and the 'to' waypoint is the endpoint of the selected leg. In automatic mode, the 'from' waypoint is always present position.
Waypoint Mode		Manually selected waypoints (if there is an active flight plan, these default to the endpoints of the active leg).

Some of the calculated trip statistics shown on the Trip Planning Display 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

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 Display 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

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 to display the 'Input Selection' Window.
3) Touch the **Select from Flight Plan** Button to display the 'Select Flight Plan' Window.
4) Scroll the list, if necessary, and touch a stored flight plan button to display the 'Select Flight Plan Leg' Window.
5) Touch the **Cumulative Flight Plan** Button to select the mode and return to the 'Trip Planning' Screen.

Selecting the Stored Flight Plan – Leg trip route mode:

1) From MFD Home, touch **Utilities** > **Trip Planning**.
2) Touch the **Trip Route** Button to display the 'Input Selection' Window.
3) Touch the **Select from Flight Plan** Button to display the 'Select Flight Plan' Window.
4) Scroll the list, if necessary, and touch a stored flight plan button to display the 'Select Flight Plan Leg' Window.
5) Scroll the list, if necessary, and touch a flight plan leg selection button to select the mode and return to the 'Trip Planning' Screen.

Selecting the Active Flight Plan – Remaining trip route mode:

1) From MFD Home, touch **Utilities** > **Trip Planning**.
2) Touch the **Trip Route** Button to display the 'Input Selection' Window.
3) Touch the **Select from Flight Plan** Button to display the 'Select Flight Plan' Window.
4) Scroll the list, if necessary, and touch the active flight plan button to display the 'Select Flight Plan Leg' Window.
5) Touch the **Remaining Flight Plan** Button to select the mode and return to the 'Trip Planning' Screen.

Selecting the Active Flight Plan – Leg trip route mode:

1) From MFD Home, touch **Utilities** > **Trip Planning**.
2) Touch the **Trip Route** Button to display the 'Input Selection' Window.
3) Touch the **Select from Flight Plan** Button to display the 'Select Flight Plan' Window.
4) Scroll the list, if necessary, and touch the active flight plan button to display the 'Select Flight Plan Leg' Window.
5) Scroll the list, if necessary, and touch a flight plan leg selection button (P.POS → Waypoint or Waypoint → Waypoint) to select the mode and return to the 'Trip Planning' Screen.

Selecting the waypoints trip route mode:

1) From MFD Home, touch **Utilities** > **Trip Planning**.
2) Touch the **Trip Route** Button to display the 'Input Selection' Window.
3) Touch the **Select Starting and Ending Waypoints** Button to display the 'Waypoint Selection' Window.
4) Touch the starting waypoint button to display the 'Origin Waypoint Selection' Window.
5) Select the starting waypoint:

   Touch the **Present Position** Button to use the present position of the aircraft and return to the 'Waypoint Selection' Window.

   Or:

   Touch the **Waypoint** Button to select a waypoint using the keypad and touch the **Enter** Button to return to the 'Waypoint Selection' Window.
6) Touch the ending waypoint button to select a waypoint using the keypad and return to the 'Waypoint Selection' 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.

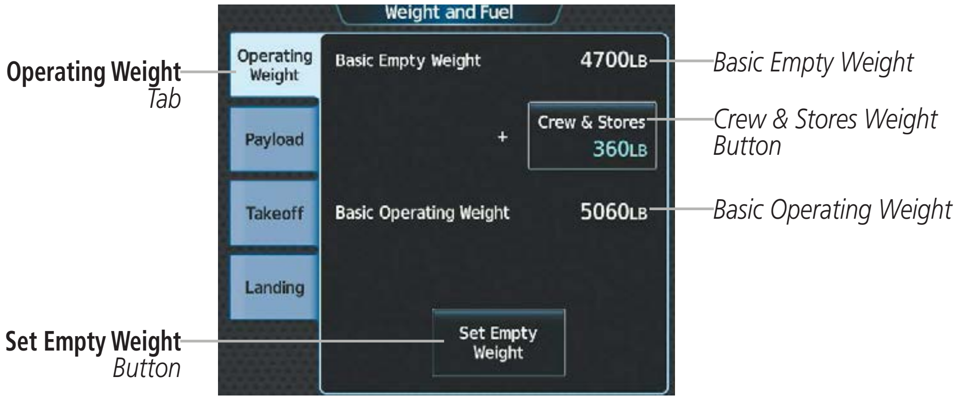


Figure 5-139 Weight and Fuel Screen - Operating Weight Tab

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).
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 5-140 Weight and Fuel Screen - 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).
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 5-141 Weight and Fuel Screen - 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).
2) Touch the **Takeoff** Tab to display the aircraft weight calculation.
3) Touch the **Fuel On Board** Button to display the keypad.
4) Use the keypad to enter the fuel on board.
5) Touch the **Enter** Button to accept the entry, and return to the Weight and Fuel Screen.

   Or:

1) From MFD Home, touch **Aircraft Systems** > **Weight and Fuel**.

   Or:

   From MFD Home, touch **PERF** > **Weight and Fuel** (with optional SurfaceWatch).
2) Touch the **Takeoff** Tab to display the aircraft weight calculation.
3) Touch the **FOB SYNC** Button to insert the fuel amount measured from the fuel sensors.

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 5-142 Weight and Fuel Screen - 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.

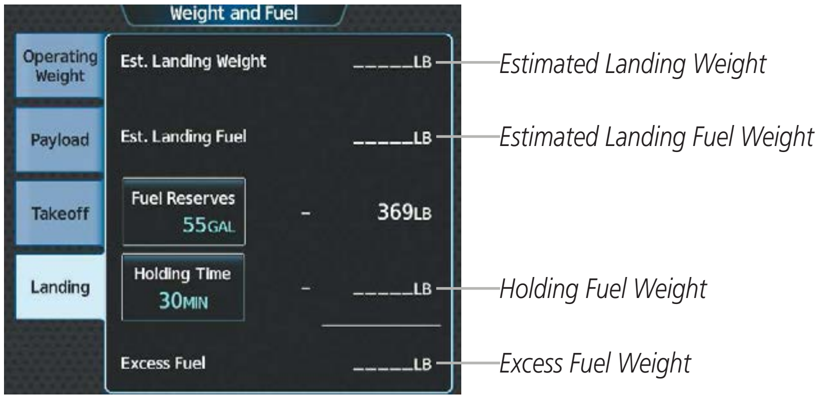


Figure 5-143 Weight and Fuel Screen - Landing Tab with Invalid Fields

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).
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

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 TAKEOFF AND LANDING DATA

The SurfaceWatch function allows the pilot to manually enter the airport, runway, and required takeoff/landing distances in order to increase situational awareness and avoid potential runway incursions and excursions.

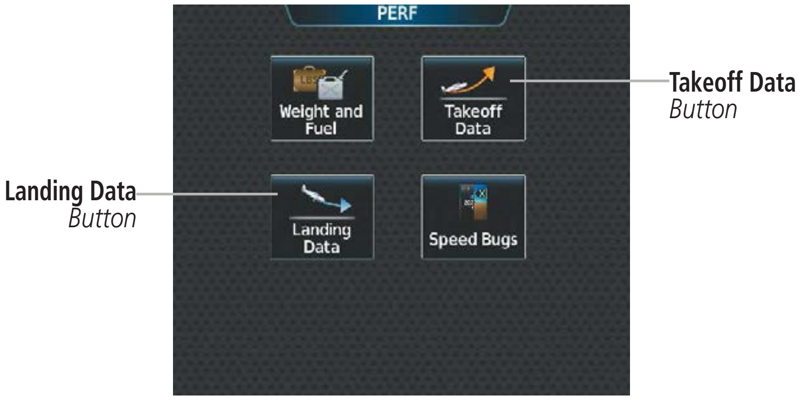


Figure 5-144 'PERF' Screen (only available if SurfaceWatch is installed)

TAKEOFF DATA

The 'Takeoff Data' Screen allows entry of the origin airport, origin runway, required takeoff distance, and takeoff run available. The origin airport and runway default to the active flight plan selections, if available.

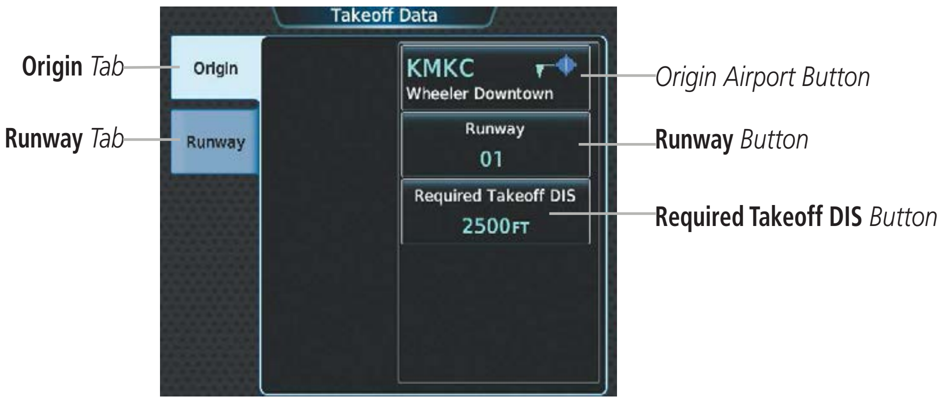


Figure 5-145 Takeoff Data - Origin Tab

Selecting an origin airport, runway, and required takeoff distance on the 'Takeoff Data' Screen:

1) From MFD Home, touch **PERF** > **Takeoff Data**.
2) Touch the **Origin** Tab, if necessary, to display the origin airport and runway data.
3) If adding or changing the origin airport is necessary, touch the origin airport button to display the keypad.
4) Use the keypad to enter the origin airport.
5) Touch the **Enter** Button to accept the entry, and return to the 'Takeoff Data' Screen.
6) Touch the **Runway** Button to display the 'Select Runway' Window.

7) Touch the desired runway selection button, and return to the 'Takeoff Data' Screen.

8) Touch the **Required Takeoff DIS** Button to display the keypad.

9) Use the keypad to enter the required takeoff distance.

10) Touch the **Enter** Button to accept the entry, and return to the 'Takeoff Data' Screen.

Origin runway information can be viewed on the **Runway** Tab.

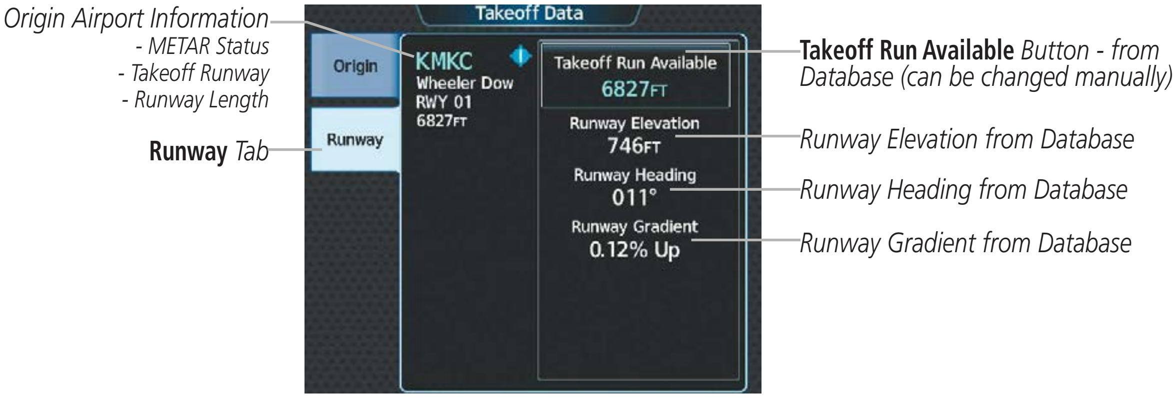


Figure 5-146 Takeoff Data - Runway Tab

The takeoff run available can be manually entered, or the database takeoff run available distance can be manually reduced specifically at the approach and/or departure end.

Figure 5-147 Takeoff Run Available - No Origin Selected

Figure 5-148 Takeoff Run Available - Normal

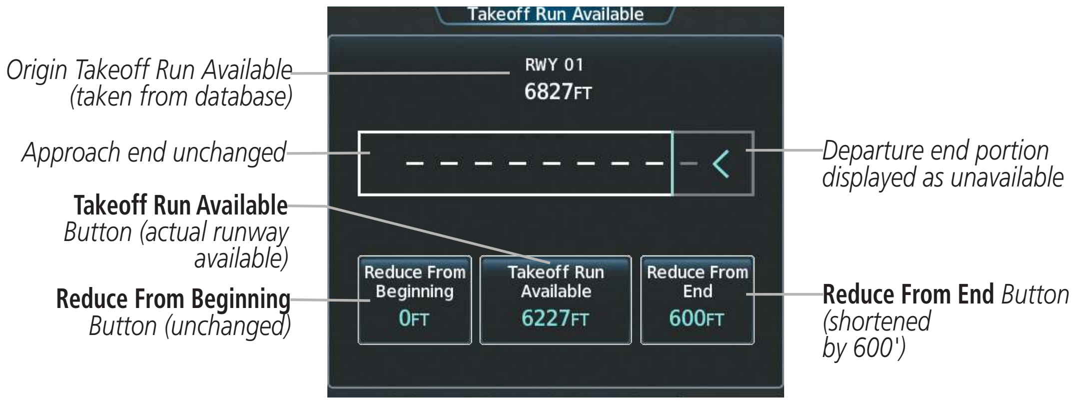


Figure 5-149 Takeoff Run Available - Corrected

Entering takeoff run available:

1) From MFD Home, touch **PERF** > **Takeoff Data**.

2) Touch the **Runway** Tab.

3) Touch the **Takeoff Run Available** Button to display the 'Takeoff Run Available' Screen.

4) Enter or change the takeoff run available distance.

   a) Touch the **Takeoff Run Available** Button to display the keypad.

   b) Use the keypad to enter the takeoff run available distance.

   c) If an Origin runway had been selected, touch the Reduce From **BEGIN** or **END** Button to place the reduction distance at the approach or departure end.

   Or:

   a) Touch the **Reduce From Beginning** Button to display the keypad.

   b) Use the keypad to enter the reduction distance.

   Or:

   a) Touch the **Reduce From End** Button to display the keypad.

   b) Use the keypad to enter the reduction distance.

5) Repeat Step 4 until the takeoff run data is displayed correctly.

6) Touch the Save Button to make the changes and return to the 'Takeoff Data' Screen.

LANDING DATA

The 'Landing Data' Screen allows entry of the destination airport, destination runway, required landing distance, and landing distance available. The destination airport and runway default to the active flight plan selections, if available.

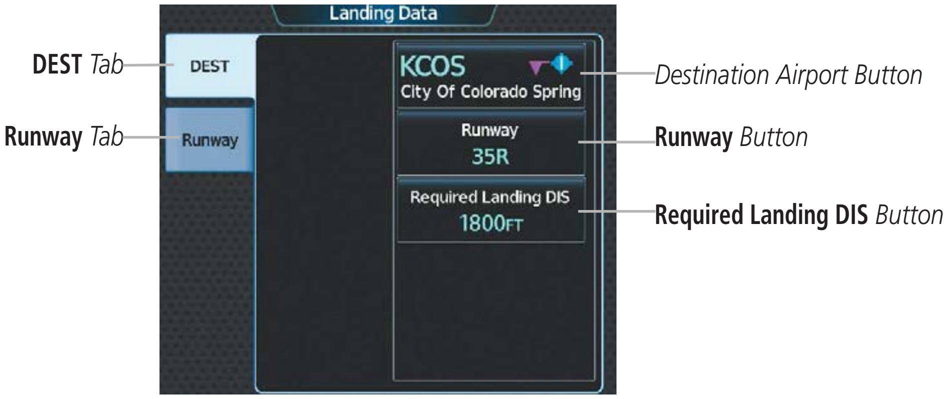


Figure 5-150 Landing Data - DEST Tab

Selecting a destination airport, runway, and required landing distance on the 'Landing Data' Screen:

1) From MFD Home, touch **PERF** > **Landing Data**.

2) Touch the **DEST** Tab, if necessary, to display the destination airport and runway data.

3) Touch the destination airport button to display the keypad.

4) Use the keypad to enter the origin airport.

5) Touch the **Enter** Button to accept the entry, and return to the 'Landing Data' Screen.

6) Touch the **Runway** Button to display the 'Select Runway' Window.

7) Touch the desired runway selection button, and return to the 'Landing Data' Screen.

8) Touch the **Required Landing DIS** Button to display the keypad.

9) Use the keypad to enter the required landing distance.

10) Touch the **Enter** Button to accept the entry, and return to the 'Landing Data' Screen.

Destination runway information can be viewed on the **Runway** Tab.

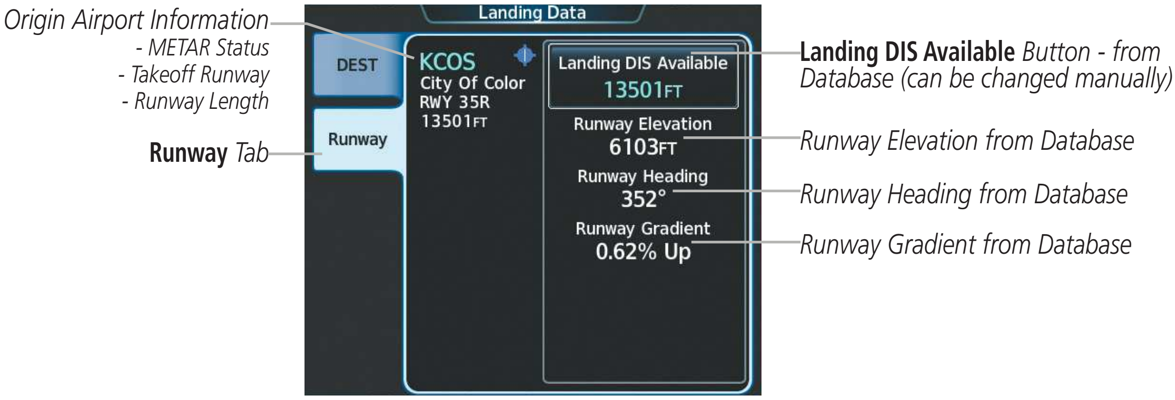


Figure 5-151 Landing Data - Runway Tab

The landing distance available can be manually entered, or the database landing distance available can be manually reduced specifically at the approach and/or departure end.

Figure 5-152 Landing Distance Available - No Destination Selected

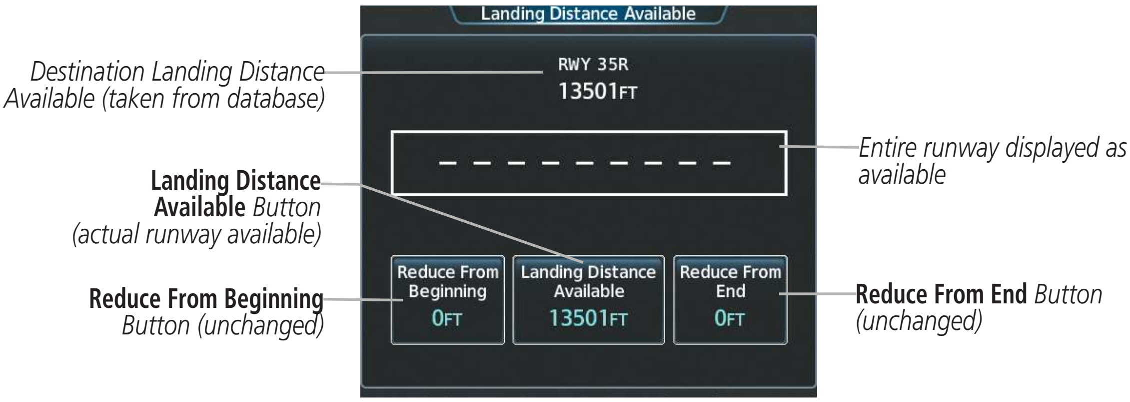


Figure 5-153 Landing Distance Available - Normal

Figure 5-154 Landing Distance Available - Corrected

Entering landing distance available:

1) From MFD Home, touch **PERF** > **Landing Data**.

2) Touch the **Runway** Tab.

3) Touch the **Landing DIS Available** Button to display the 'Landing Distance Available' Screen.

4) Enter or change the landing distance available.

- **a)** Touch the **Landing Distance Available** Button to display the keypad.
- **b)** Use the keypad to enter the landing distance available.
- **c)** If a Destination runway had been selected, touch the Reduce From **BEGIN** or **END** Button to place the reduction distance at the approach or departure end.

  Or:

- **a)** Touch the **Reduce From Beginning** Button to display the keypad.
- **b)** Use the keypad to enter the reduction distance.

  Or:

- **a)** Touch the **Reduce From End** Button to display the keypad.
- **b)** Use the keypad to enter the reduction distance.

5) Repeat Step 4 until the landing distance data is displayed correctly.

6) Touch the Save Button to make the changes and return to the 'Landing Data' Screen.

5.12 ABNORMAL OPERATION

FMS DEGRADATION

Loss of GPS position is indicated on the system by the message 'GPS LOI' displayed in amber to the left of the HSI. Also, a 'GPS NAV LOST' alert message appears on the Touchscreen Controller. Normal navigation using GPS/SBAS source data resumes automatically once a valid GPS solution is restored.

DEAD RECKONING NAVIGATION

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.*

In DR mode, the system uses its last-known position combined with continuously updated airspeed and heading data (when available) to calculate and display the aircraft's current estimated position.

It is important to note that estimated navigation data supplied by the system in DR mode may become increasingly unreliable and must not be used as a sole means of navigation. If while in DR mode airspeed and/or heading data is also lost or not available, the DR function may not be capable of accurately tracking estimated position and, consequently, the system may display a path that is different than the actual movement of the aircraft. Estimated position information displayed by the system through DR while there is no heading and/or airspeed data available should not be used for navigation.

DR mode is inherently less accurate than the other modes due to the lack of satellite measurements or DME inputs needed to determine a position. Changes in wind speed and/or wind direction compound the relative inaccuracy of DR mode. Because of this degraded accuracy, other navigation equipment must be relied upon for position awareness until other position data is restored.

DR mode is indicated on the system by the appearance of the letters 'DR' displayed in amber on the HSI below and to the left of the aircraft symbol on the CDI, and on top of the aircraft symbol on navigation maps. The message 'GPS LOI' is displayed in amber to the left of the HSI. The CDI deviation bar remains, but is removed from the display after 20 minutes in DR mode. The autopilot will remain coupled in DR mode as long as the deviation is available (20 min).

NOTE: *GPS derived information will remain displayed in magenta (not amber) on the Flight Plan Text inset when operating in Dead Reckoning mode. However, this information shall still be considered as degraded navigation source information.*

As a result of operating in DR mode, all GPS-derived data on the PFD and MFD is computed based upon an estimated position, and is displayed as amber text to denote degraded navigation source information. The accuracy of all bearing and distance information on nearest screens (airports, airspaces, and waypoints), and on waypoint information screens is questionable, and is displayed in amber. Airspace alerts continue to function, but with degraded accuracy. Also, while the system is in DR mode, TAWS is disabled.

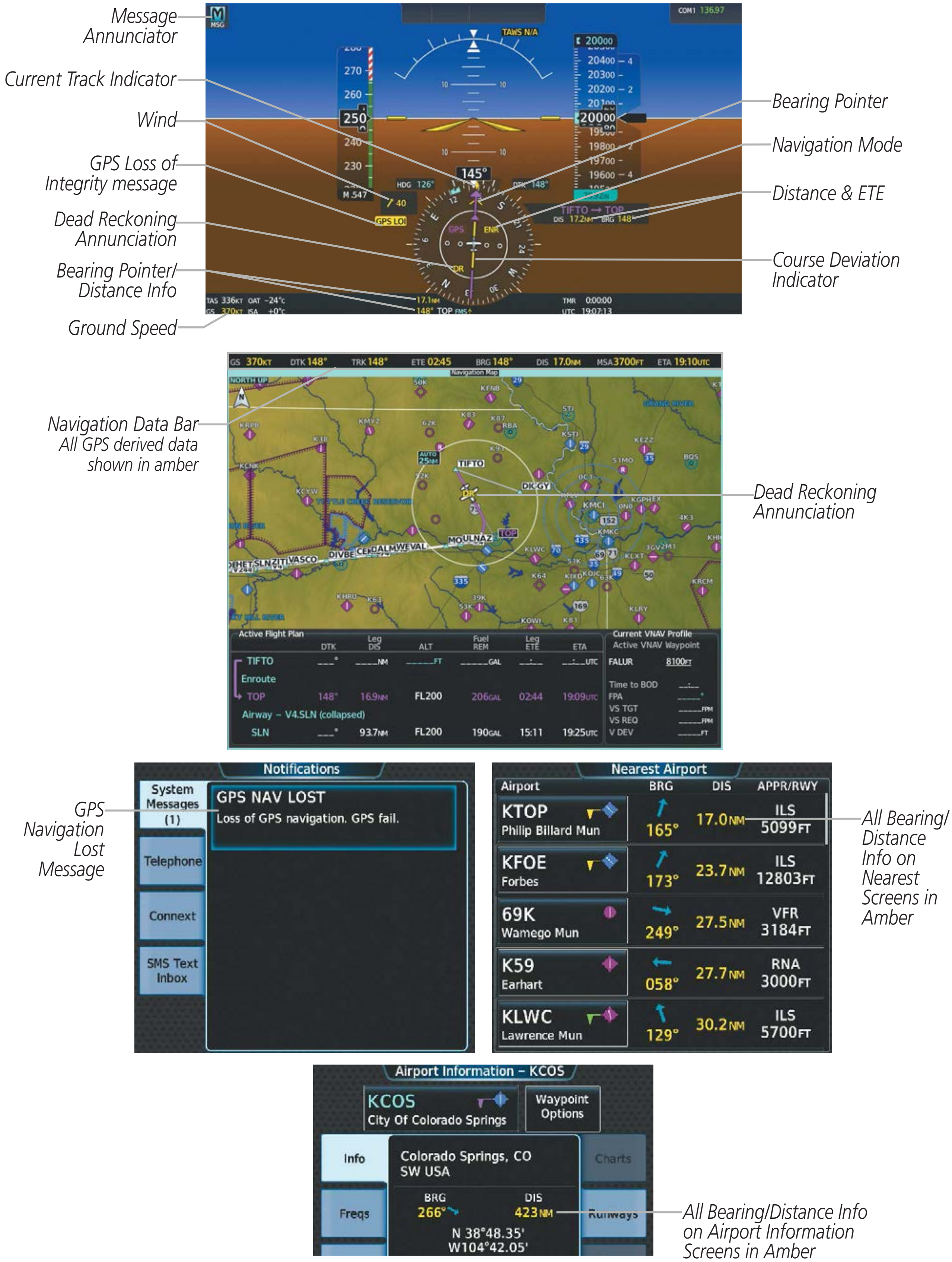


Figure 5-155 Dead Reckoning Mode – GPS Derived Data Shown in Amber

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SECTION 6 HAZARD AVOIDANCE

Hazard avoidance features available for the Daher TBM 940 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 Connext Weather (Optional)
- GWX 70 Airborne Color Weather Radar (Optional)
- L-3 WX-500 Stormscope® Lightning Detection System (Optional)
- Flight Information Services-Broadcast (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 Connext Weather, and Flight Information Services-Broadcast (FIS-B) Weather. For each source, a ground-based system processes the weather information collected from a network of sensors and weather data providers.

The SiriusXM Weather service, available with the optional Garmin GDL 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 Connext Weather service, available when equipped with the optional Garmin GSR 56 Iridium Transceiver and an active service subscription, provides data link weather information to the aircraft after the pilot defines a geographic area and subsequently selects a manual or automatically recurring Connext Data Request. The transceiver then contacts the Garmin Connext Weather service using the Iridium Satellite telephone system and retrieves the weather data for the specified area. The Garmin Connext Weather service offers worldwide weather coverage, but the availability of individual weather products, such as radar precipitation, varies by region.

***NOTE:** To check the availability of Garmin Connext weather products offered in a particular region, visit http://www.flygarmin.com.*

ACTIVATING DATA LINK WEATHER SERVICES

Before SiriusXM Weather and SiriusXM Satellite Radio can be used, the services must be activated by providing SiriusXM's customer service the coded IDs unique to the installed data link receiver. SiriusXM Satellite Radio (audio) and SiriusXM Weather (data) services each have coded IDs, which may be identical. The Data and Audio Radio IDs must be provided to activate the weather and entertainment subscriptions, respectively. These IDs are in the following locations:

- The SiriusXM Info Screen on Touchscreen Controllers (Figure 6-1)
- The XM Satellite Radio Activation Instructions included with the unit
- The label on the front of the data link receiver

SiriusXM uses the coded IDs to send an activation signal to enable the system to receive weather data and/or audio entertainment programming.

Establishing a SiriusXM Weather Data account:

1) From MFD Home, touch **Utilities > Setup** > **SiriusXM Info**.
2) Note the ID shown in the Data Radio Window as seen in Figure 6-1.
3) Contact SiriusXM customer service. Follow the instructions provided by SiriusXM customer service.

Verifying SiriusXM Weather services:

1) Ensure the aircraft is outside, and the SiriusXM antenna away from obstructions such as buildings.
2) From MFD Home, touch **Utilities > Setup > SiriusXM Info**.
3) View the Service Class window and verify the displayed Service Class corresponds to the chosen SiriusXM subscription type.
4) View the Weather Products window, scrolling as needed to see all supported products. Available weather product names appear in white text; unavailable weather products appear with subdued text. When all weather products in the selected Service Class are available, activation is successful.

Figure 6-1 SiriusXM Info Screen After Activation

NOTE: *Not all weather products offered by SiriusXM are supported for display on this system. This pilot's guide only discusses supported weather products.*

After SiriusXM has been contacted, it may take approximately 15 minutes until the activation occurs.

REGISTERING THE SYSTEM FOR GARMIN CONNEXT SERVICES

When an account is established, Garmin Aviation Product Support provides an Access Code which must be entered and transmitted to Garmin in order to receive Garmin Connext weather data.

Registering the system to receive Garmin Connext Weather:

1) Ensure the aircraft is outside and has a clear view of the sky (if connecting via the Iridium network).
2) From MFD Home, touch **Utilities > Setup > Connext 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 Connext customer service.
5) Touch the **Enter** Button or press the upper knob. The system contacts the Garmin Connext Weather service. Registration is complete when the Registration Information Window displays the name of the airframe, tail number, and the serial numbers for the airframe and Iridium unit.

Figure 6-2 Connext Registration Screen 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.

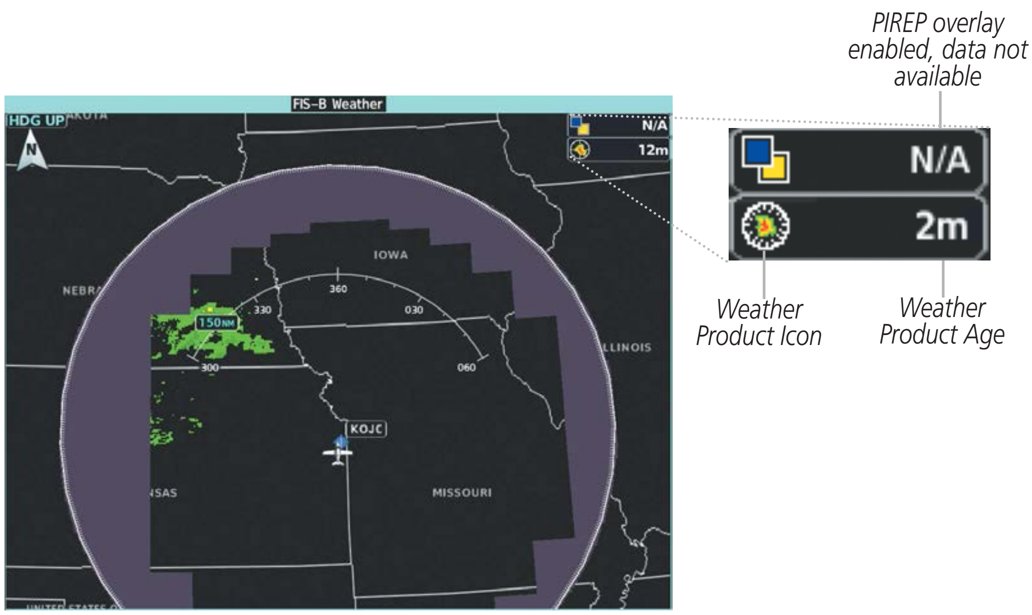


Figure 6-4 FIS-B Weather Pane with PIREPs and Regional NEXRAD Enabled

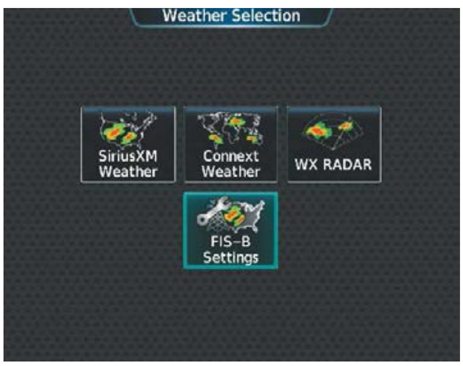


Figure 6-5 Weather Selection Screen

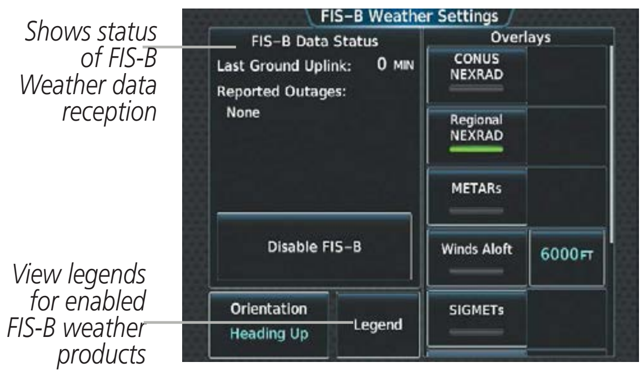


Figure 6-6 FIS-B Weather Settings Screen

WEATHER PRODUCT AGE

Unlike real-time weather information collected directly from weather sensors on-board an aircraft, such as an airborne lightning detection system, data link weather by contrast relies on service providers to collect, process, and transmit weather information to the aircraft. This information can come from a variety of sources such as government agencies. Due to the time it takes to collect, process, and distribute data link weather information, it is imperative for pilots to understand that data link weather information is not real-time information and may not accurately depict the current conditions.

For each data link weather product which can be displayed as a map overlay, such METARs, the system can also show a weather product age. This age represents the elapsed time, in minutes, since the weather service provider compiled the weather product and the current time. It does not represent the age of the information contained within the weather product itself. For example, a single mosaic of radar precipitation is comprised data from multiple radar sites providing data at differing scan rates or intervals. The weather service provider periodically compiles this data to create a single composite image, and assigns one time to this image which becomes the basis of the product age. The service provider then makes this weather product available for data link transmission at the next scheduled update time. The actual age of the weather data contained within the mosaic is therefore older than its weather product age and should never be considered current. The pilot can optionally enable or disable this information on the Inset Map or HSI Map.

SiriusXM and FIS-B weather products are broadcast automatically on a repeating cycle without pilot intervention. The Garmin Connext weather service requires the pilot to select a manual or automatic (recurring) weather data request in order to receive weather data updates.

Each data link weather product age has an expiration time. The weather product age is shown in white if it is less than half of this expiration time, otherwise it is shown in amber until reaching its expiration time. After a weather product has expired, the system removes the expired weather product from the displays, and shows white dashes instead of the age. If the data link receiver has not yet received a weather product 'N/A' appears instead of the age to show the product is currently not available for display. This may occur, for example, after powering on the system but before the data link receiver has received a complete weather data transmission. It could also indicate a possible outage of a weather product.

The weather product age is shown automatically for weather products displayed on MFD maps. For PFD maps, the pilot can manually enable/disable the age information.

Enabling/disabling weather product information on the Inset Navigation Map and HSI Map:

1) From 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.

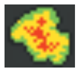
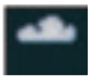
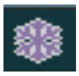
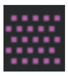
SiriusXM Weather Product	Product Symbol	Expiration Time (Minutes)
Next-generation Radar (NEXRAD)		30
Cloud Tops		60
Echo Tops		30
SiriusXM Lightning		30
Storm Cell Movement		30
SIGMETs	SIGM	60
AIRMETs	AIRM	60
METARs		90
City Forecast		90
Surface Analysis		60
Freezing Levels		120
Winds Aloft		90
County Warnings		60
Cyclone (Hurricane) Warnings		60
Icing Potential (CIP and SLD)		90
Pilot Weather Report (PIREPs)		90
Air Report (AIREPs)		90
Turbulence		180
No Radar Coverage	no product symbol	30
Temporary Flight Restrictions (TFRs)	TFR	60
Terminal Aerodrome Reports (TAFs)	no product symbol	60

Table 6-1 SiriusXM Weather Product Symbols and Data Timing

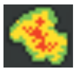
WARNING: *Do not use the indicated data link weather product age to determine the age of the weather information shown by the data link weather product. Due to time delays inherent in gathering and processing weather data for data link transmission, the weather information shown by the data link weather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

FIS-B Weather Product	Symbol	Expiration Time (Minutes)
CONUS NEXRAD (US)		30
Regional NEXRAD		30
Meteorological Aerodrome Report (METARs)		90
Pilot Weather Report (PIREPs)		90
Winds Aloft (WIND)		90
SIGMETs/AIRMETs (SIG/AIR)	AIRM SIGM	60
No Radar Coverage	no product image	30
Terminal Aerodrome Forecast	no product image	60
Temporary Flight Restriction (TFR)	TFR	60

Table 6-2 Weather Product Symbols and Data Timing

The following table shows the Garmin Connext Weather product symbols, the expiration times and the refresh rates. The refresh rate represents the interval at which Garmin Connext weather service makes available the most current known weather data. It does not necessarily represent the rate at which the service receives new data from various weather sources. The pilot chooses how often to contact the Garmin Connext weather service in order to retrieve weather data through the Connext Data Request.

NOTE: *The availability of specific Garmin Connext Weather products varies by region and by subscription type. For Garmin Connext weather product coverage information, refer to www.flygarmin.com.*

Garmin Connext Weather Product	Symbol	Expiration Time (Minutes)
Connext Radar		30
Cloud Tops		60
Connext Lightning		30
SIGMETs/AIRMETs	SIGM AIRM	60
Meteorological Aerodrome Report (METARs)		90
Winds Aloft		90
Pilot Weather Reports (PIREPs)		90
Temporary Flight Restrictions (TFRs)	TFR	60
Terminal Aerodrome Reports (TAFs)	no product image	60

** The composite precipitation image is updated every 3 minutes, but individual radar sites may take between 3 and 10 minutes to provide new data.*
† Canadian radar precipitation data provided by Environment Canada.
ˆ Australian radar precipitation data provided by the Australia Bureau of Meteorology

Table 6-3 Garmin Connext Weather Product Symbols and Data Timing

DISPLAYING DATA LINK WEATHER PRODUCTS

WEATHER DATA LINK PANE

The Weather Data Link (SiriusXM/Connext/FIS-B) Pane is the principal map pane for viewing data link weather information.

This pane provides the capability for displaying the most data link weather products of any map on the system. The Weather Data Link Pane also provides system-wide controls for selecting the data link weather source, if more than one source has been installed. The pane title indicates the selected data link weather source (e.g., “SiriusXM”, “Connext” or “FIS-B”).

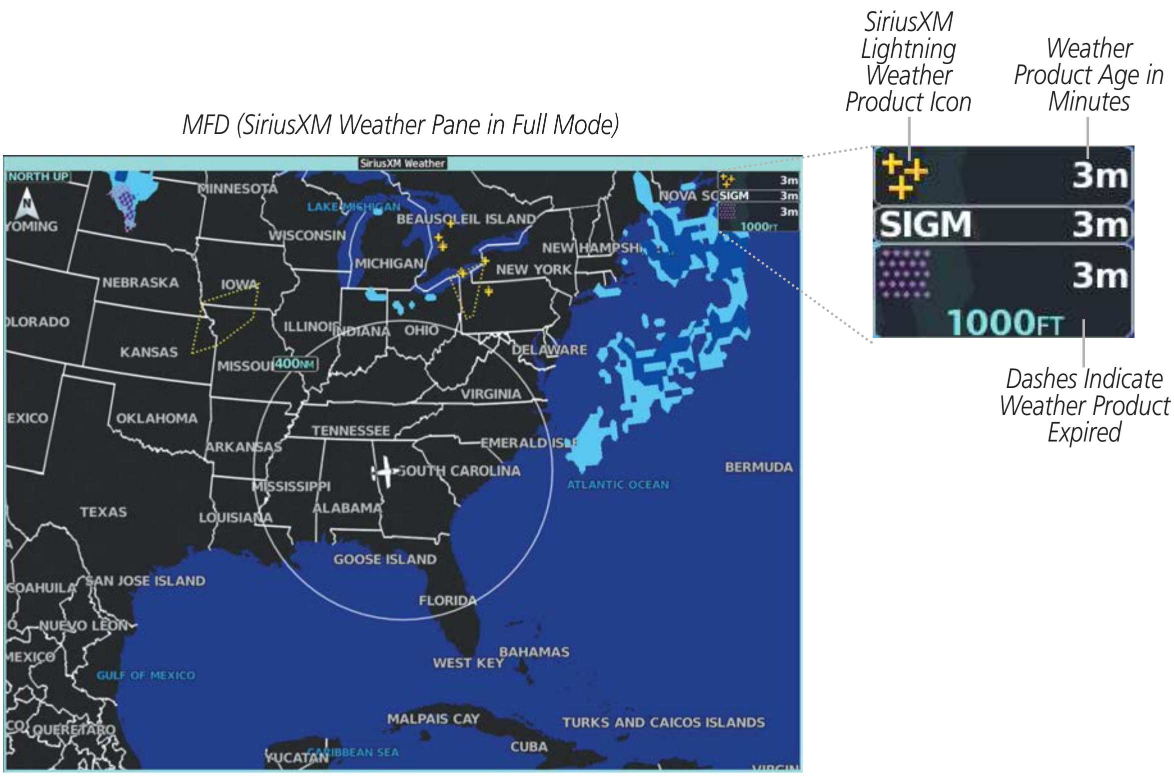


Figure 6-7 SiriusXM Weather Pane with Product Icons and Age Information

Viewing the Weather Data Link Pane and changing the data link weather source, if applicable:

1) From 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 Connext)

2) Touch the **Weather Selection** Button. The Weather Selection Screen appears.

3) Touch either **SiriusXM Weather, Connext Weather or FIS-B Weather** Button. Touched button is highlighted and becomes the settings Button. For example, if the **SiriusXM Weather** Button is touched it becomes the S**iriusXM Settings** Button.

4) If necessary, touch either the **SiriusXM, Connext, or FIS-B Settings** Button to access controls for the selected weather pane.

Figure 6-8 Weather Selection Screen

If more than one weather data link weather source has been installed (such as Garmin Connext Weather or FIS-B), the system provides the option to select a source of weather information for each Navigation Map Pane.

Selecting a Data Link Weather Source for Navigation Map Panes:

1) From MFD Home, touch **Map** > **Map Selection** > **Map Settings**.
2) If necessary, touch the **Sensor** Tab.
3) Scroll if necessary to view the **WX Source** Button. Cyan text on the button indicates currently selected weather data link weather source.
4) Touch the **WX Source** Button.
5) Touch the button for the data link weather source to be used (such as **SiriusXM, FIS-B,** or **Connext**, if installed).

Navigation Maps displaying data link weather products show the name of the selected source ('Connext WX', 'FIS-B', or 'SiriusXM') in a window on the map while data link weather products are enabled for display.

Selecting a Data Link Weather Source for PFD Maps (Inset Map, HSI Map):

1) From PFD Home, touch the **PFD Map Settings** Button.
2) Touch the **WX Overlay** Button. The button will change to reflect desired source (**SiriusXM**, **FIS-B,** or **Connext**).

Table 6-4 shows which Datalink Weather products can be displayed (indicated with a '+' symbol) on specific maps.

Data Link Weather Product	PFD Inset or HSI Map	Navigation Map Pane	Weather Data Link Pane	VSD Inset Window
NEXRAD/Radar Precipitation	+	+	+	
Cloud Tops			+	
Echo Tops			+	
Infrared Satellite			+	
Data Link Lightning	+	+	+	
Cell Movement	+	+	+	
SIGMETs/AIRMETs			+	
METARs	+	+	+	
City Forecast			+	
Surface Analysis			+	
Freezing Levels			+	
Winds Aloft		+*	+	+
County Warnings			+	
Cyclone Warnings			+	
Icing Potential			+	
PIREPs			+	
AIREPs			+	
Turbulence			+	
No Radar Coverage	+	+	+	
TFRs	+	+	+	
TAFs			+	

* *Winds Aloft data is available inside the VSD when VSD is enabled on the Navigation Map Pane.*

Table 6-4 Weather Product Display Maps

***NOTE:** In configurations with multiple datalink weather sources, it is possible that the HSI map not display weather data, or may display weather data from the incorrect source. This can occur either immediately following power-up or activation of a crew profile. When this occurs, it can be remedied by deselecting then reselecting the source on the GTC HSI Map Settings page.*

For each enabled 'Data Link' Weather product shown on a map, the system displays a weather product icon or name and the product age. The product age is the elapsed time (in minutes) since the weather data provider compiled the weather product. The product age display does not indicate the age of the information contained within the weather product, which can be significantly older than the displayed weather product age. This information appears automatically when a weather product is enabled on the 'Data Link' Weather Pane or Navigation Map Pane. The pilot can optionally enable or disable this information on the Inset Map or HSI Map.

The Touchscreen Controller, when operating in MFD Mode, controls the display of weather information on display panes.

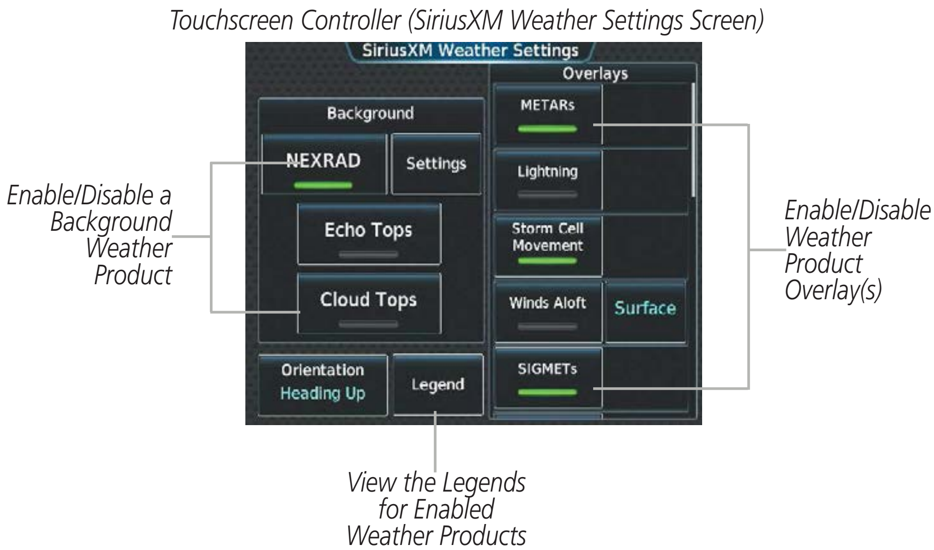


Figure 6-9 SiriusXM Weather Settings Screen

The 'Data Link' Weather Settings Screen controls the enabling/disabling of weather products on the 'Data Link' Weather Pane. The Map Settings Screen controls the enabling/disabling of weather products on navigation maps.

The Map Settings Screen on the Touchscreen Controller controls the maximum map range at which the system displays a weather product on a map; selecting a map range higher than this range will declutter (remove) the weather product from the map.

Setting up and customizing 'Data Link' Weather Products on navigation maps:

1) From MFD Home, touch **Map > Map Selection > Map Settings.**
2) If necessary, touch the **Sensor** Tab.
3) Scroll through the list to view the available weather products.
4) Touch a weather product annunciator button to enable/disable the selected weather product. Button annunciator is green when a weather product is enabled, or gray when disabled.
5) If necessary, touch a range button next to the corresponding weather product, then touch to select the maximum map range at which the system will display the selected weather product.

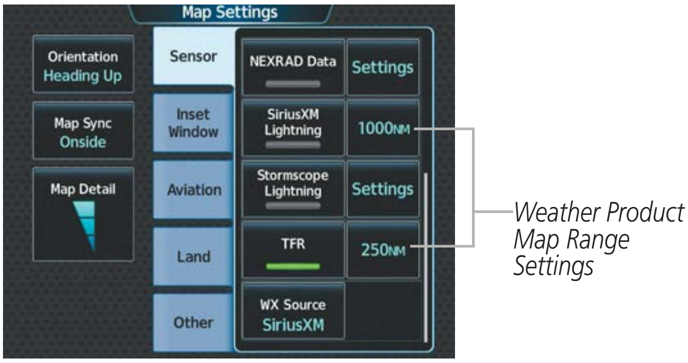


Figure 6-10 Map Settings Screen (Sensor Tab Selected)

The SiriusXM Settings Screen can display a legend for each weather product currently enabled on the SiriusXM Weather Pane.

Viewing legends for weather products enabled on the 'Data Link' (SiriusXM, Connext, or FIS-B) Weather Pane:

1) From MFD Home, touch **Weather > Weather Selection > 'Data Link' Weather > 'Data Link' Weather Settings**
2) Touch the **Legend** Button. The Weather Legends Window appears on the Touchscreen Controller.
3) Scroll as needed to view the weather legends in the Weather Legends window.
4) To remove the Weather Legends Window, touch **Back** or **Home.**

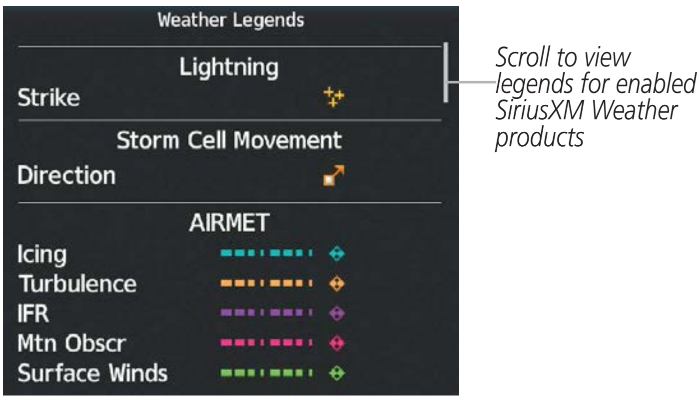


Figure 6-11 Weather Legends Window (SiriusXM)

The system displays additional information about the following weather products by panning over the product on the map with the Map Pointer.

- Echo Tops (SiriusXM)
- Storm Cell Movement (SiriusXM)
- SIGMETs
- AIRMETs
- METARs
- County Warnings (SiriusXM)
- TFRs
- PIREPSs
- AIREPs
- Infrared (IR) Satellite (Connext)

The lower knob adjusts the map range. Pushing the lower knob enables map panning. Once panning is enabled, pushing either the upper knobs or lower knob disables map panning. To move the Map Pointer while panning is enabled, turn the large and small upper knobs or use the **Touchpad**. If the map range is adjusted while panning is enabled, the map is re-positioned on the Map Pointer.

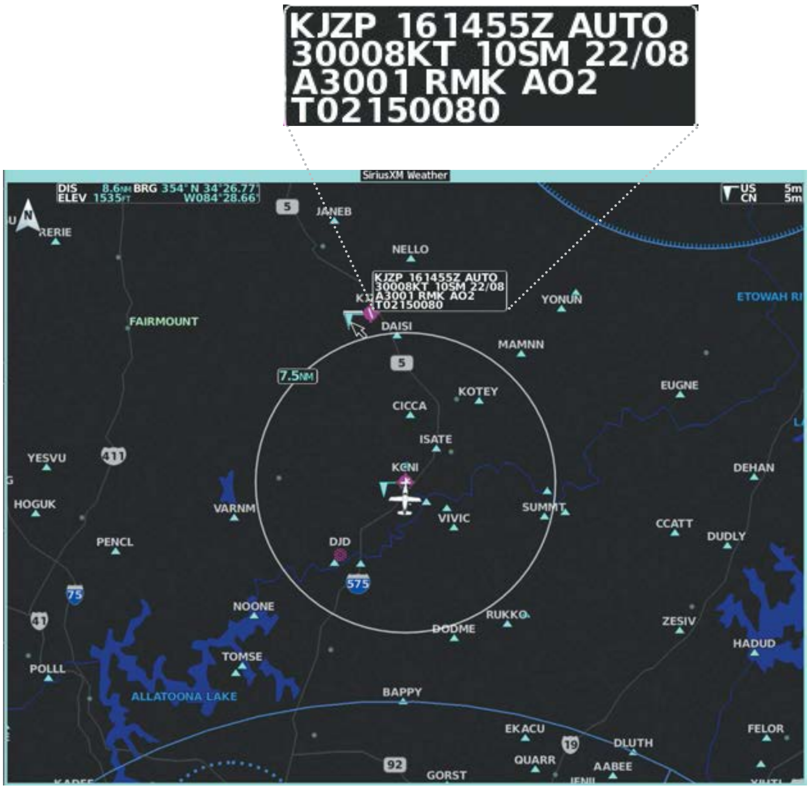


Figure 6-12 Panning on the SiriusXM Weather Pane

The system provides the ability to select a map orientation for the 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, Connext, 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 Connext Weather Settings Screen provides the flight crew with the options to define weather data request coverage areas, select automatic weather data request intervals, and provides the ability to send an manual data request immediately. The Data Request Window also displays the status of the Connext Data Request process.

Before the system can retrieve weather information, a valid coverage area must be defined from which all available Garmin Connext Weather products will be retrieved (regardless of which weather products are currently enabled for display). The flight crew may define the coverage area by enabling/disabling one or more of the following buttons at any time:

- **P.POS** (Present Position)
- **Destination** (as part of the active flight plan)
- **Flight Plan** (active)
- **Waypoint**

It is not necessary to provide the system with the destination, flight plan, or waypoint prior to enabling these buttons. However, if none of this information is supplied, the present position must be included in the Connext Data Request. Otherwise, the Data Request Window indicates 'INVALID COVERAGE AREA' when performing a data request, because the system has insufficient information to define the coverage area.

Defining Weather Data Request Coverage Area:

1) From MFD Home, touch **Weather > Weather Selection > Connext Weather > Connext Settings**.
2) Touch the **Define Coverage** Button.
3) To change the diameter and route width of the weather data request coverage area, touch the **Diameter/ Width** Button. Scroll as needed and touch the desired distance button in the selection window.
4) To include/remove the present position in the weather data request, touch the **P.POS** Button.

5) To include/remove the destination of the active flight plan in the weather data request, touch the **Destination** Button.

6) To include/remove any portion of the active flight plan route in the weather data request, touch the **Flight Plan** Button.

7) To change distance of the flight plan to be used in the data request, touch the Flight Plan Distance Button. Scroll as needed and touch the desired distance of the flight plan to be used ('Remaining FPL' uses the remainder of the flight plan, or select a specified look-ahead distance from the list.)

8) To include/remove a specific waypoint to be used in the weather data request, touch the **Waypoint** Button.

   a) Touch the waypoint entry Button (to the right of the **Waypoint** Button.)

   b) Use Touchscreen Controller keypad or large and small upper knobs to enter a waypoint to include in the weather data request, then touch the **Enter** Button or press the small upper knob.

9) When finished, touch the **Back** Button to return to the Connext Weather Settings Screen, or touch the **Home** Button.

Sending/Cancelling an Immediate Weather Data Request:.

1) From MFD Home, touch **Weather > Weather Selection > Connext Weather > Connext Settings**.

2) Touch the **Send Immediate Request** Button. The system contacts Garmin Connext services and displays the status in the Data Request Window. System displays 'Completed' when finished.

3) If desired, touch the **Cancel Immediate Reques**t Button while a request is occurring. Data Request Window displays 'Cancelled'.

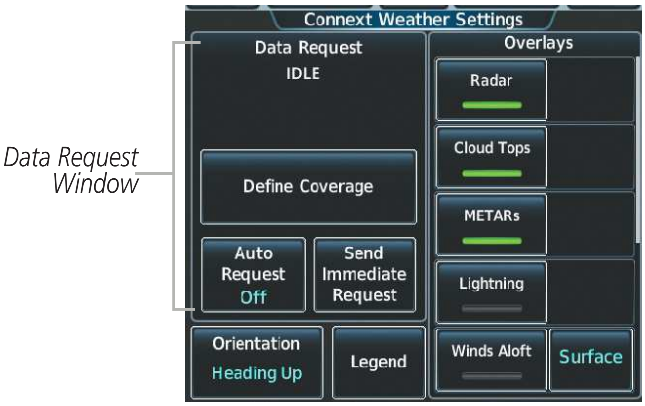
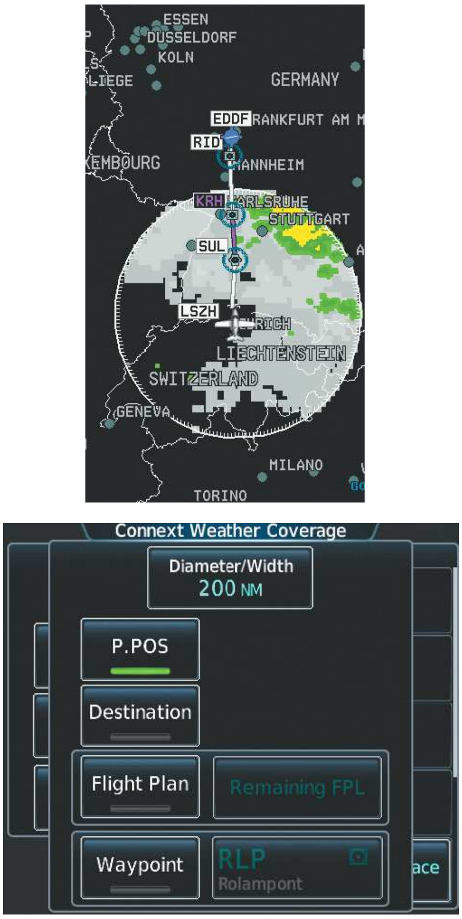


Figure 6-14 Connext Weather Settings Screen

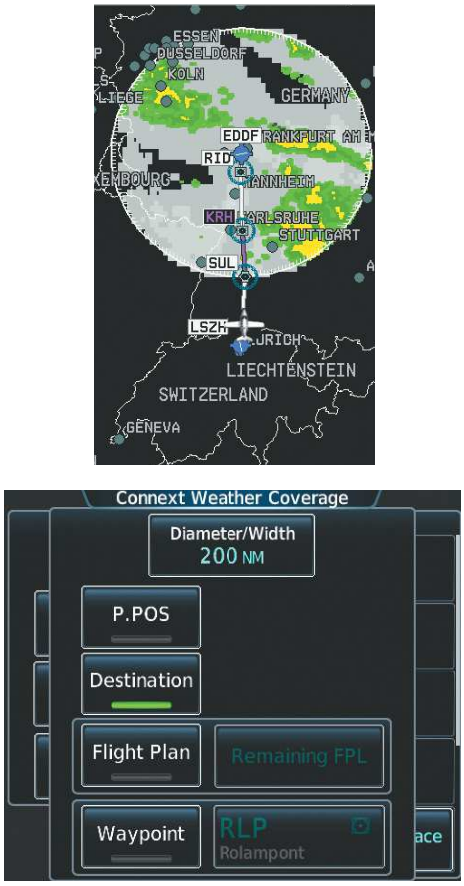
Figure 6-15 Selecting coverage area for Connext Data Request

During a weather data request, the Data Request Window initially displays "Contacting Connext...". Once a connection is established, the Data Request Window displays "Receiving Wx Data... Time Remaining:" with an estimated data transfer time (either minutes or seconds). Connext Data Requests typically take between one to four minutes to complete depending on the size of the selected weather coverage area and the data link signal strength. If the system cannot complete the data request, the Data Request Window displays an error; see the Abnormal Operations discussion later in this section for more information.

The system retrieves all available Connext Weather products within the selected coverage area during an initial weather data request, regardless of which products (if any) are currently enabled for display. On subsequent weather data requests, previously retrieved textual products (such as METARs and TAFS) are retained if not expired, while new textual weather data matching the current coverage area and all graphical weather data is downloaded during every data request.

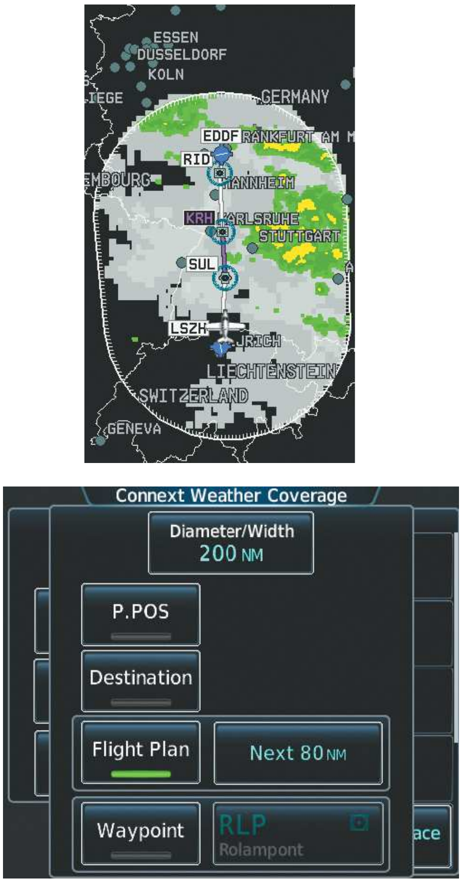


Present Position Selected, 200 nm Diameter Requested

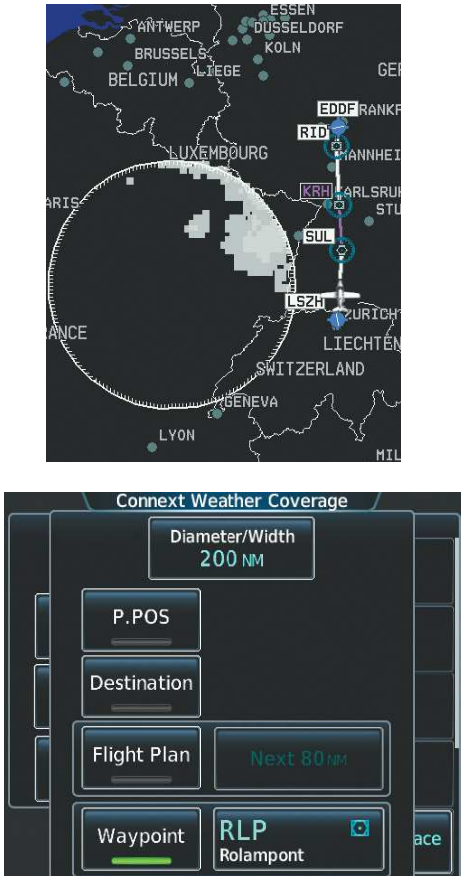


Destination Selected, 200 nm Diameter Requested

Figure 6-15 Connext Weather Coverage Options for Present Position and Destination



Next 80 nm of Flight Plan Selected, 200 nm Route Width Requested



Waypoint Selected, 200 nm Diameter Requested

Figure 6-16 Connext Weather Coverage Options based on Flight Plan and Waypoint Selections

The flight crew can schedule Connext Data Requests to recur automatically. Automatic requests remain enabled until the flight crew disables them, or the system power is cycled. The Data Request Window will indicate a countdown timer until the next automatic Connext Data Request occurs. Performing an immediate data request resets the timer until the next Automatic data request occurs.

Enabling/disabling automatic Connext Data Requests:

1) From MFD Home, touch **Weather** > **Weather Selection** > **Connext Weather** > **Connext Settings**.
2) Touch the **Auto Request** Button.
3) From the selection window, touch an Auto Update Request Rate Button to select the desired weather request update interval in minutes or touch the **Off** Button to disable automatic Connext Data Requests.

WEATHER PRODUCT OVERVIEW

The following is an overview of data link weather products the system can display.

NEXRAD (SIRIUSXM)

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

NOTE: *The NEXRAD weather product cannot be displayed at the same time as terrain, echo tops, turbulence, or icing data.*

The National Weather Service (NWS) operates the WSR-88D, or NEXRAD (NEXt-generation RADar) system, an extensive network of 160 high-resolution Doppler radar systems. The NEXRAD network provides centralized meteorological information for the continental United States and selected overseas locations. The maximum range of a single NEXRAD site is 250 nm.

Individual NEXRAD sites supply the network with radar images, and the images from each site may arrive at the network at different rates and times. Periodically, the weather data provider compiles the available individual site images from the network to form a composite image, and assigns a single time to indicate when it created the image. This image becomes the NEXRAD weather product. Individual images--gathered from each NEXRAD site--differ in age, and are always older than the displayed NEXRAD weather product age. The data provider then sends the NEXRAD data to the SiriusXM Weather service, whose satellites transmit this information during the next designated broadcast time for the NEXRAD weather product.

Because of the time required to detect, assemble, and distribute the NEXRAD weather product, the displayed weather information contained within the product may be significantly older than the current radar synopsis and may not depict the current weather conditions. The NEXRAD weather product should never be used as a basis for maneuvering in, near, or around areas of hazardous weather regardless of the information it contains.

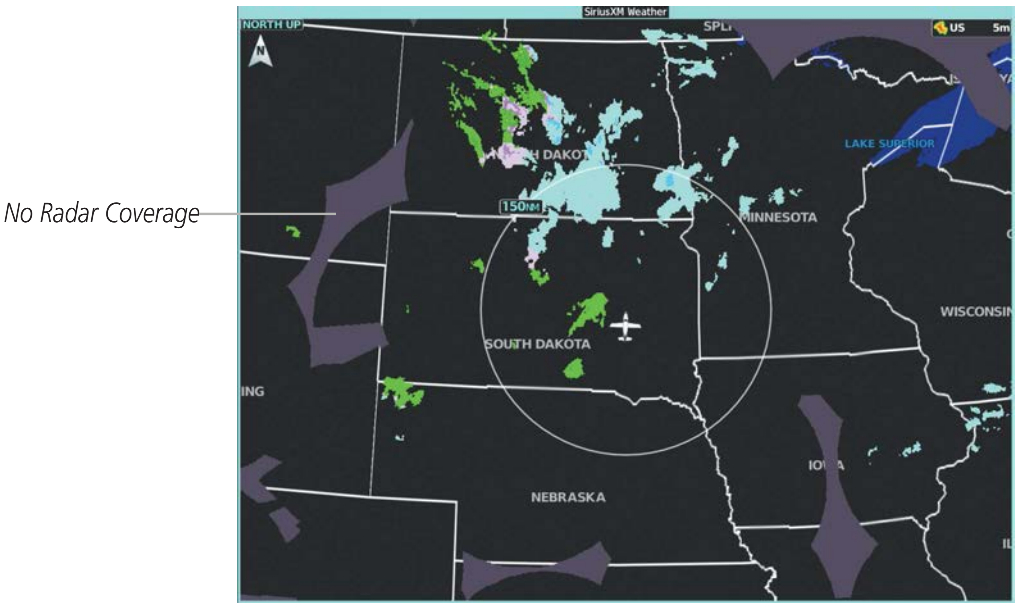


Figure 6-18 NEXRAD Data on the SiriusXM Weather Pane

Displaying NEXRAD weather information (SiriusXM Weather Pane):

1) From MFD Home, touch **Weather > Weather Selection > SiriusXM Weather > SiriusXM Settings.**
2) Touch the **NEXRAD** Button in the Background Window to enable/disable the display of NEXRAD information.

Changing the NEXRAD coverage area (SiriusXM Weather Pane):

1) From MFD Home, touch **Weather > Weather Selection > SiriusXM Weather > SiriusXM Settings.**
2) Touch the NEXRAD **Settings** Button. The NEXRAD Options window appears.
3) Touch the **NEXRAD** Button.
4) Touch the **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 Data** coverage 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 Inset Map or HSI Map):

1) If necessary, enable the Inset Map or HSI Map.
2) From PFD Home, touch **PFD Map Settings.**
3) Scroll and touch the **WX Overlay** Button and select a source that provides NEXRAD.

Changing the NEXRAD coverage area (PFD Inset Map or HSI Map):

1) From PFD Home, touch the **PFD Map Settings** Button.
2) Scroll in the Overlays Tab, and touch the **Data Link Settings** Button.
3) Touch the **NEXRAD Data** Button.
4) Touch the **USA** or **Canada** Button.

The display shows composite data from all available NEXRAD radar sites in the selected coverage area (either United States or Canada.) This data is composed of the maximum reflectivity from the individual radar sweeps. The display of the information is color-coded to indicate the strength of the radar returns. All weather product legends can be viewed on the Touchscreen Controllers. For the NEXRAD legend, touch the **Legend** Button on the SiriusXM Weather Settings Screen when NEXRAD is enabled for display.

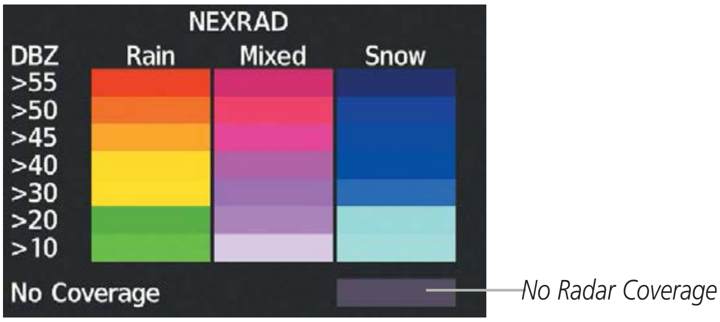


Figure 6-19 NEXRAD Legend

The system can animate a loop of NEXRAD information on the SiriusXM Weather Pane, navigation maps, and Inset Map. Animation begins after the system has received at least two NEXRAD images. When animation is enabled, a timeline appears to the left of the NEXRAD weather product age display. The large square on the timeline indicates the relative position of the displayed frame of animation, from oldest to newest.

The NEXRAD weather product age corresponds to the displayed frame. The system can show up to six frames of NEXRAD animation when the USA coverage option is selected, and up to three frames of animation when Canada is selected.

Displaying Time-Lapse NEXRAD Animation on the SiriusXM Weather Pane:

1) From MFD Home, touch **Weather > Weather Selection > SiriusXM Weather > SiriusXM Settings**.
2) If necessary, touch the **NEXRAD** Button in the Background Window to enable the display of NEXRAD.
3) Touch the NEXRAD **Settings** Button.
4) Touch the **Animation** Button to enable/disable the animation.
5) When finished, touch **Back** or **Home**.

Displaying Time-Lapse NEXRAD Animation on the Navigation Map Pane:

1) From MFD Home, touch **Map > Map Selection > Map Settings**.
2) If necessary, touch the **Sensor** Tab.
3) Scroll if necessary and touch the NEXRAD Data **Settings** Button.
4) Touch the **NEXRAD Animation** Button to enable/disable the animated NEXRAD information.
5) When finished, touch **Back** or **Home**.

Displaying Time-Lapse NEXRAD Animation on the PFD Inset Map:

1) If necessary, enable the Inset Map.
2) From PFD Home, touch the **PFD Map Settings** Button.
3) Scroll and touch the NEXRAD Data **Settings** Button.
4) Touch the **NEXRAD Animation** Button to enable/disable the animated NEXRAD information on the Inset Map

The display of No Radar Coverage is always active when either the NEXRAD or Echo Tops weather products are enabled for display. Areas where NEXRAD radar coverage and Echo Tops information is not currently available, or outside of the selected coverage area, or is not being collected are indicated in a gray shade of purple.

Reflectivity

Reflectivity is the amount of transmitted power returned to the radar receiver. Colors on the NEXRAD display are directly correlative to the level of detected reflectivity. Reflectivity as it relates to hazardous weather can be very complex.

The role of radar is essentially to detect moisture in the atmosphere. Simply put, certain types of weather reflect radar better than others. The intensity of a radar reflection is not necessarily an indication of the weather hazard level. For instance, wet hail returns a strong radar reflection, while dry hail does not. Both wet and dry hail can be extremely hazardous.

The different NEXRAD echo intensities are measured in decibels (dB) relative to reflectivity (Z). NEXRAD measures the radar reflectivity ratio, or the energy reflected *back to* the radar receiver (designated by the letter Z). The value of Z increases as the returned signal strength increases.

NEXRAD Limitations

NEXRAD radar images may have certain limitations:

- NEXRAD base reflectivity does not provide sufficient information to determine cloud layers or precipitation characteristics (wet hail vs. rain). For example, it is not possible to distinguish between wet snow, wet hail, and rain.
- NEXRAD base reflectivity is sampled at the minimum antenna elevation angle. An individual NEXRAD site cannot depict high altitude storms at close ranges. It has no information about storms directly over the site.
- When zoomed in to a range of 30 nm, each square block on the display represents an area of four square kilometers. The intensity level reflected by each square represents the *highest* level of NEXRAD data sampled within the area.
- Colors displayed from NEXRAD and airborne weather radar systems are not interchangeable. Refer to the applicable legends based on the weather source.

The following may cause abnormalities in displayed NEXRAD radar images:

- Ground clutter
- Spurious radar data
- Sun strobes (when the radar antenna points directly at the sun)
- Interference from buildings or mountains, which may cause shadows
- Metallic dust (chaff) from military aircraft, which can cause alterations in radar scans

NEXRAD Limitations (Canada)

- Radar coverage extends to 55°N.
- Any precipitation displayed between 52°N and 55°N is displayed as mixed regardless of actual precipitation type.

NEXRAD (FIS-B)

NOTE: *The NEXRAD weather product cannot be displayed at the same time as terrain.*

The National Weather Service (NWS) operates the WSR-88D, or NEXRAD (NEXt-generation RADar) system, an extensive network of 156 high-resolution Doppler radar systems. The NEXRAD network provides centralized meteorological information for the continental United States and selected overseas locations. The maximum range of a single NEXRAD site is 250 nm.

Individual NEXRAD sites supply the network with radar images, and the images from each radar site may arrive at the network at different rates and times. Periodically, the weather data provider to FIS-B compiles the available individual site images from the network to form a composite image, and assigns a single time to indicate when it created the image. This image becomes the NEXRAD weather product. Individual images--gathered from each NEXRAD site--differ in age, and are always older than the displayed NEXRAD weather product age. The data provider then sends the NEXRAD data to the FIS-B GBTs, which transmit this information during the next designated broadcast time for the NEXRAD weather product.

Because of the time required to detect, assemble, and distribute the NEXRAD weather product, the displayed weather information contained within the product may be significantly older than the current radar synopsis and may not depict the current weather conditions. NEXRAD information should never be used as a basis for maneuvering in, near, or around areas of hazardous weather regardless of the information it contains.

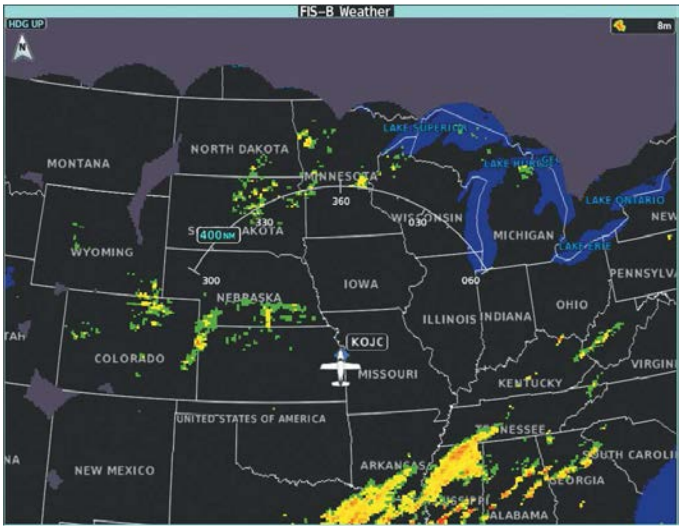


Figure 6-20 CONUS NEXRAD Weather Product on the FIS-B Weather Pane

The Regional NEXRAD weather product may be displayed for a region around the GBT (higher resolution, updated more frequently) or for across the continental United States (lower resolution, updated less frequently). The pilot can choose which type of NEXRAD weather product is displayed.

Displaying the NEXRAD weather product on the FIS-B Weather Pane (CONUS or Regional):

1) From MFD Home, touch **Weather > Weather Selection > FIS-B Weather > FIS-B Settings.**
2) Touch the **CONUS NEXRAD** or **Regional NEXRAD** Buttons in the Overlays Window.

The Regional NEXRAD weather product coverage area varies, as it is determined by the data received from ground-based sources. When the Regional NEXRAD weather product is enabled, a white hatched boundary encloses this area to indicate the geographic limits of the Regional NEXRAD coverage being displayed. The system shows composite radar data from all available NEXRAD sites inside of this boundary area.

Both types of NEXRAD may be enabled on the map simultaneously. When this occurs, the Regional NEXRAD display takes precedence when the CONUS and Regional NEXRAD coverage overlaps.

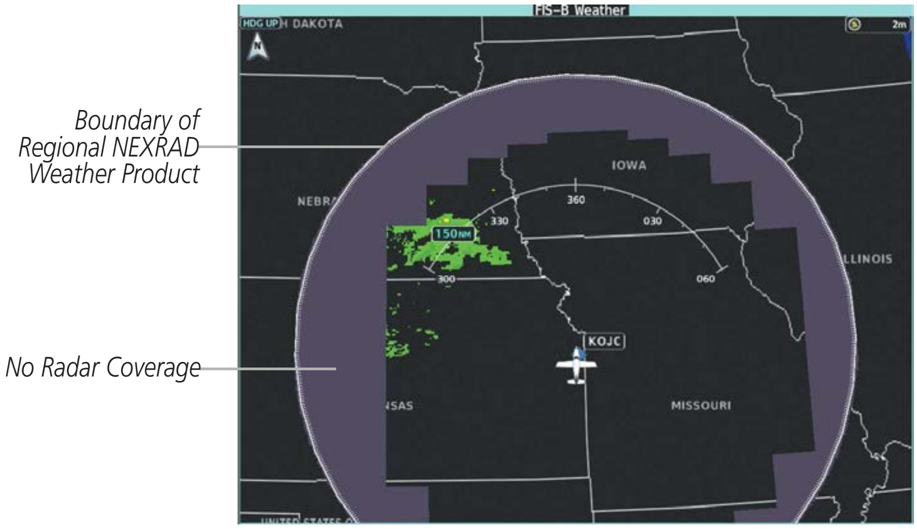


Figure 6-21 Regional NEXRAD Weather Product on the FIS-B Weather Pane

This data is composed of the maximum reflectivity from the individual radar sweeps. The display of the information is color-coded to indicate the weather severity level.

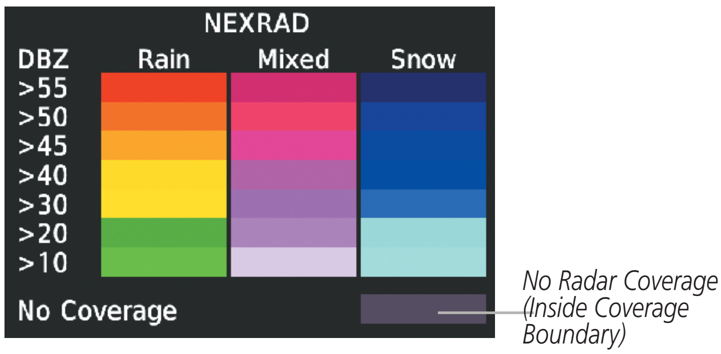


Figure 6-22 NEXRAD Weather Product Legend

When NEXRAD is enabled, areas where radar data is not currently available, has not yet been received, or is not being collected are indicated in gray shade of purple.

***NOTE:** If the system has not received all available NEXRAD weather data (such as during initial FIS-B signal acquisition or in areas of marginal or poor signal reception), the system may display areas of no radar coverage which are subsequently removed as radar data is received. It may take up to approximately ten minutes to receive all FIS-B data, when adequate reception is available.*

Reflectivity

Reflectivity is the amount of transmitted power returned to the radar receiver. Colors on the NEXRAD display are directly correlative to the level of detected reflectivity. Reflectivity as it relates to hazardous weather can be very complex.

The role of radar is essentially to detect moisture in the atmosphere. Simply put, certain types of weather reflect radar better than others. The intensity of a radar reflection is not necessarily an indication of the weather hazard level. For instance, wet hail returns a strong radar reflection, while dry hail does not. Both wet and dry hail can be extremely hazardous.

The different NEXRAD echo intensities are measured in decibels (dB) relative to reflectivity (Z). NEXRAD measures the radar reflectivity ratio, or the energy reflected *back to* the radar receiver (designated by the letter Z). The value of Z increases as the returned signal strength increases.

NEXRAD Limitations

NEXRAD radar images may have certain limitations:

- At a map range of 30 nm or less, individual blocks of NEXRAD weather data are viewable. For the regional version of the NEXRAD weather product, each block is 1.5 nm wide by 1 nm tall. For the continental United States version of the NEXRAD weather product, each block is 7.5 nm wide by 5 nm wide.
- The continental US version of the NEXRAD weather product is not available above 60° of latitude.

The following may cause abnormalities in displayed NEXRAD radar images:

- Ground clutter
- Spurious radar data
- Sun strobes (when the radar antenna points directly at the sun)
- Interference from buildings or mountains, which may cause shadows
- Metallic dust (chaff) from military aircraft, which can cause alterations in radar scans

PRECIPITATION (GARMIN CONNEXT)

The Garmin Connext Radar weather product, where available, shows a mosaic of weather radar images compiled from individual radar sites. Images may arrive at ground-based collection systems at different rates and times.

Periodically, the Garmin Connext Weather service collects these images, and assigns a single time to indicate when it created the image. This composite image becomes the Garmin Connext Radar product. Images from individual radar sites differ in age, and are always older than the displayed Precipitation weather product age.

Because of the time required to detect, assemble, and distribute this weather product, the displayed weather information contained within the product may be significantly older than the current radar synopsis and may not depict the current weather conditions. Information from the Garmin Connext Radar weather product should never be used as a basis for maneuvering in, near, or around areas of hazardous weather regardless of the information it contains.

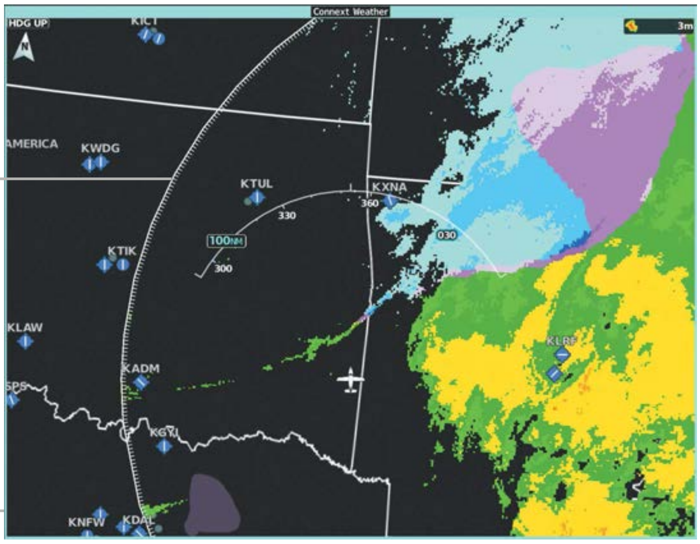


Figure 6-23 Connext Weather Pane with Connext Radar Enabled

Displaying Garmin Connext Radar information (Connext Weather Pane)

1) From MFD Home, touch **Weather > Weather Selection > Connext Weather > Connext Settings.**
2) Touch the **Radar** Button in the Overlays Window.

Connext Weather Radar data shown represents lowest level, base reflectivity, of radar returns. The display of the information is color-coded to indicate the weather severity level. All weather product legends can be viewed on the Connext Weather Pane. For the Connext Radar legend, touch the **Legend** Button on the Connext Weather Settings Screen when Connext Weather is enabled for display.

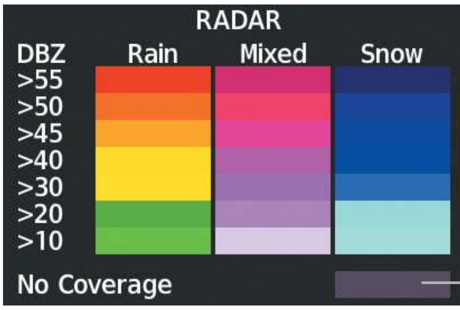


Figure 6-24 Connext Weather Radar Legend

The display of no radar coverage is enabled when Garmin Connext Radar is enabled for display. Areas where radar coverage is not currently available or is not being collected are indicated in a gray shade of purple. A white boundary line with white tick marks depicts the selected coverage area of the Connext Data Request (as defined in the Data Request Window). This boundary encloses the precipitation data when this weather product is displayed. This boundary assists the flight crew in differentiating an area without precipitation from an area outside of the Connext Data Request coverage area.

Displaying Garmin Connext Radar information (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 **Connext Radar** Button

Displaying Garmin Connext Radar information (PFD Inset Map or HSI Map):

1) From PFD Home, touch **PFD Map Settings**.
2) Scroll in the Overlays Tab, and touch the **Connext Radar** Button.

   Or:

1) Press the **PFD Map Settings** Softkey.
2) Press the **WX Overlay** Softkey. Each press cycles through an available option, displayed in cyan. When 'Connext' is displayed, Connext Radar is enabled. When 'Off' is displayed, Connext Radar is disabled.

Reflectivity

Reflectivity is the amount of transmitted power returned to the radar receiver. Colors on the Precipitation display directly correlate to the level of detected reflectivity. Reflectivity as it relates to hazardous weather can be very complex.

The role of radar is essentially to detect moisture in the atmosphere. Simply put, certain types of weather reflect radar better than others. The intensity of a radar reflection is not necessarily an indication of the weather hazard level. For instance, wet hail returns a strong radar reflection, while dry hail does not. Both wet and dry hail can be extremely hazardous.

The different radar echo intensities are measured in decibels (dB) relative to reflectivity (Z). Weather radars measure the reflectivity ratio, or the energy reflected *back to* the radar receiver (designated by the letter Z). The value of Z increases as the returned signal strength increases.

Radar Limitations

Radar images may have certain limitations:

- Radar base reflectivity does not provide sufficient information to determine cloud layers or precipitation characteristics (wet hail vs. rain). For example, it is not possible to distinguish between wet snow, wet hail, and rain.
- Radar base reflectivity is sampled at the minimum antenna elevation angle. An individual radar site cannot depict high altitude storms at close ranges. It has no information about storms directly over the site.
- When zoomed in to a range of 30 nm, each square block on the display represents an area of four square kilometers.
- Colors displayed from NEXRAD and airborne weather radar systems are not interchangeable. Refer to the applicable legends based on the weather source.

The following may cause abnormalities in displayed radar images:

- Ground clutter
- Spurious radar data
- Sun strobes (when the radar antenna points directly at the sun)
- Interference from buildings or mountains, which may cause shadows
- Metallic dust (chaff) from military aircraft, which can cause alterations in radar scans

ECHO TOPS (SIRIUSXM)

***NOTE:** When the Echo Tops weather product is enabled on the SiriusXM Weather Pane, the system disables the NEXRAD and Cloud Tops weather products.*

The Echo Tops weather product shows the location and elevation of the highest radar echo. The highest radar echo does not indicate the actual top of a storm or clouds. It indicates the highest altitude at a which NEXRAD radar was able to detect precipitation. Note this Echo Tops altitude may be significantly higher than the highest altitude airborne weather radar was able to detect precipitation, particularly at longer ranges from the airborne weather radar antenna. See the Airborne Color Weather Radar discussion later in this section for more information on airborne weather radar. The Echo Tops weather product, like all data link weather products, does not provide real-time weather information.

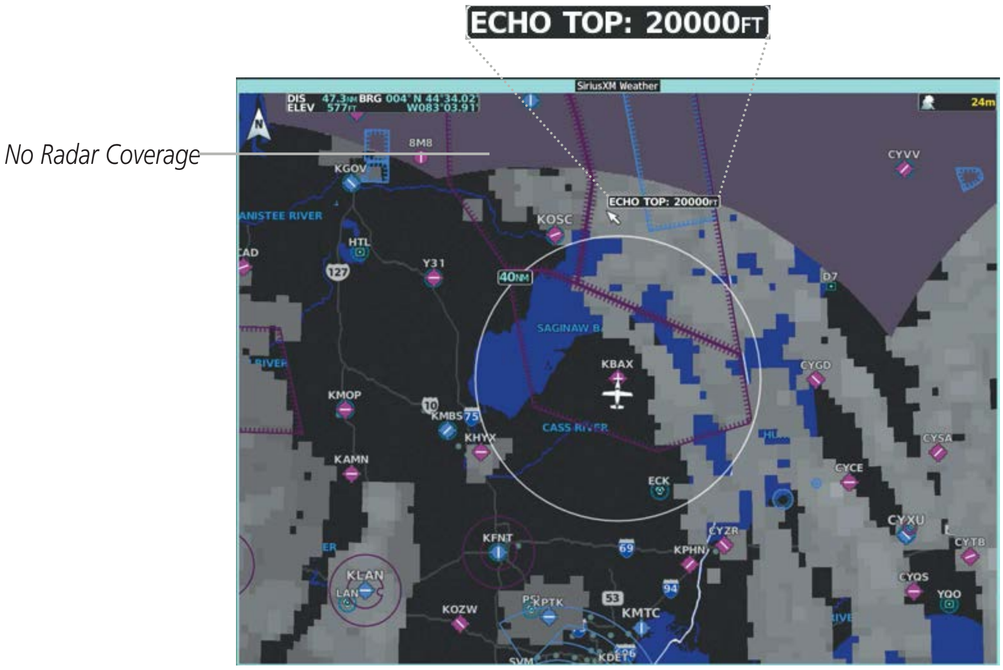


Figure 6-25 Echo Tops Weather Product

Enabling/Disabling Echo Tops information:

1) From MFD Home, touch **Weather > Weather Selection > SiriusXM Weather > SiriusXM Settings**.
2) Touch the **Echo Tops** Button in the Background window.

Touch the **Legend** Button on the SiriusXM Weather Settings Screen to display the Echo Tops legend when Echo Tops is enabled. Since Echo Tops and Cloud Tops use the same color scaling to represent altitude, only one of these products may be displayed at a time. When Echo Tops is enabled, the system disables NEXRAD and Cloud Tops information.

Figure 6-26 Echo Tops Legend

The display of No Radar Coverage is always active when either Echo Tops or NEXRAD is enabled. Areas where NEXRAD radar coverage and Echo Tops information is not available, or is not being collected are indicated in gray shade of purple.

CLOUD TOPS (SIRIUSXM)

***NOTE:** When the Cloud Tops weather product is enabled on the SiriusXM Weather Pane, the system disables the Echo Tops weather product.*

The Cloud Tops weather product depicts cloud top altitudes as determined from satellite imagery. When the Cloud Tops weather product is enabled, the system removes the Echo Tops weather product. When the Map Pointer is activated, the system displays the altitude of the selected Cloud Tops.

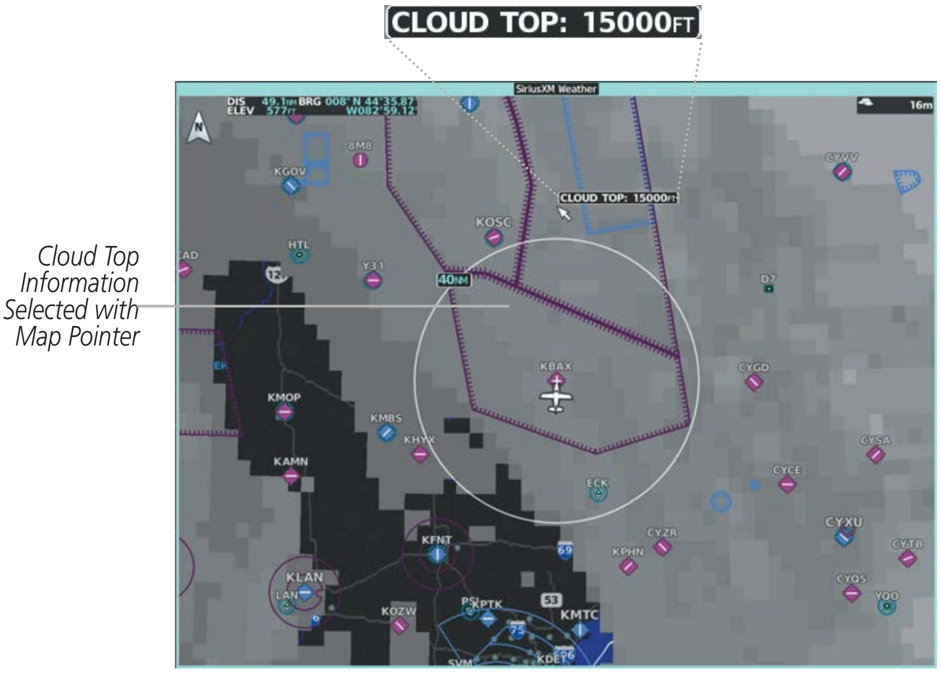


Figure 6-27 Cloud Tops Weather Product

Enabling/Disabling Cloud Tops information:

1) From MFD Home, touch **Weather > Weather Selection > SiriusXM Weather > SiriusXM Settings**.
2) Touch the **Cloud Tops** Button in the Background Window.

Touch the **Legend** Button on the SiriusXM Weather Settings Screen to display weather legend(s) for enabled weather product(s). Scroll as necessary to view the information, then touch **Back** or **Home**.

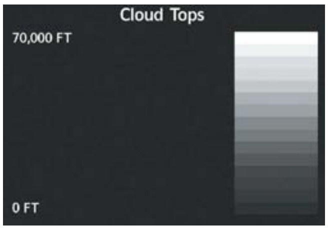


Figure 6-28 Cloud Tops Legend

DATA LINK LIGHTNING (SIRIUSXM, GARMIN CONNEXT)

The Lightning weather product shows the approximate location of cloud-to-ground lightning strikes. A strike icon represents a strike has occurred within a two-kilometer region. The exact location of the lightning strike is not displayed.

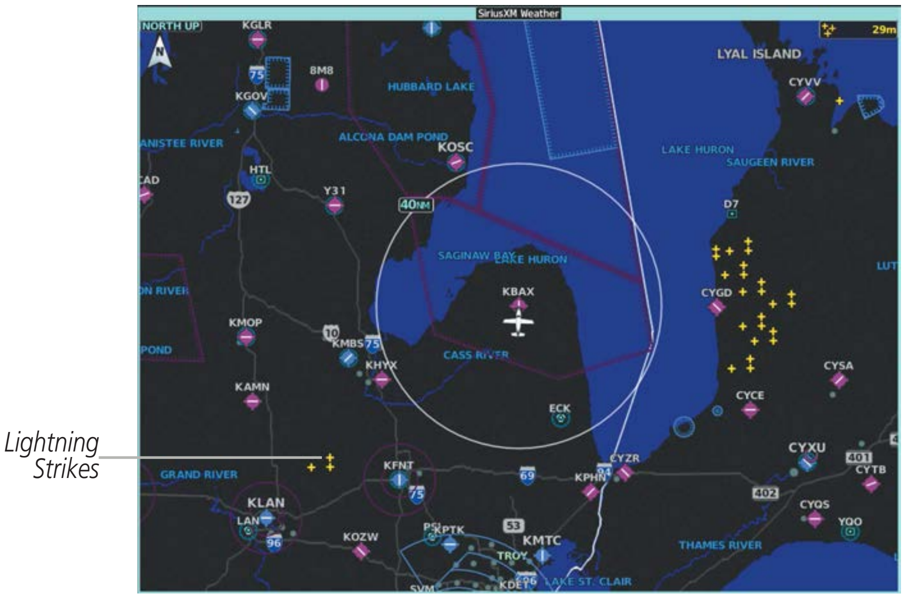


Figure 6-29 SiriusXM Lightning Weather Product

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.

Touch the **Legend** Button on the SiriusXM Weather Settings Screen to display weather legend(s) for enabled weather product(s). Scroll as necessary to view the information, then touch **Back** or **Home**.

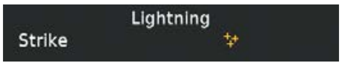


Figure 6-30 SiriusXM Lightning Legend

Displaying 'Data Link' Lightning information on the Navigation Map Page:

1) From MFD Home, touch **Map** > **Map Selection > Map Settings**.
2) If necessary, touch the **Sensor** Tab.
3) Scroll as needed and touch the **SiriusXM Lightning** 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 Idenification and Tracking), shows the location and movement of storm cells as identified by the ground-based system. Orange squares represent cells, with arrows indicating the direction of cell movement. When the Map Pointer is panned over a Storm Cell, the system displays the path, speed, and altitude range of the Storm Cell, as determined by the NEXRAD system.

***NOTE:** The Storm Cell base height is not available if a GDL 69A SiriusXM Datalink Receiver is installed. In this case, the Storm Cell base height is displayed as 0 feet when the map pointer selects a storm cell.*

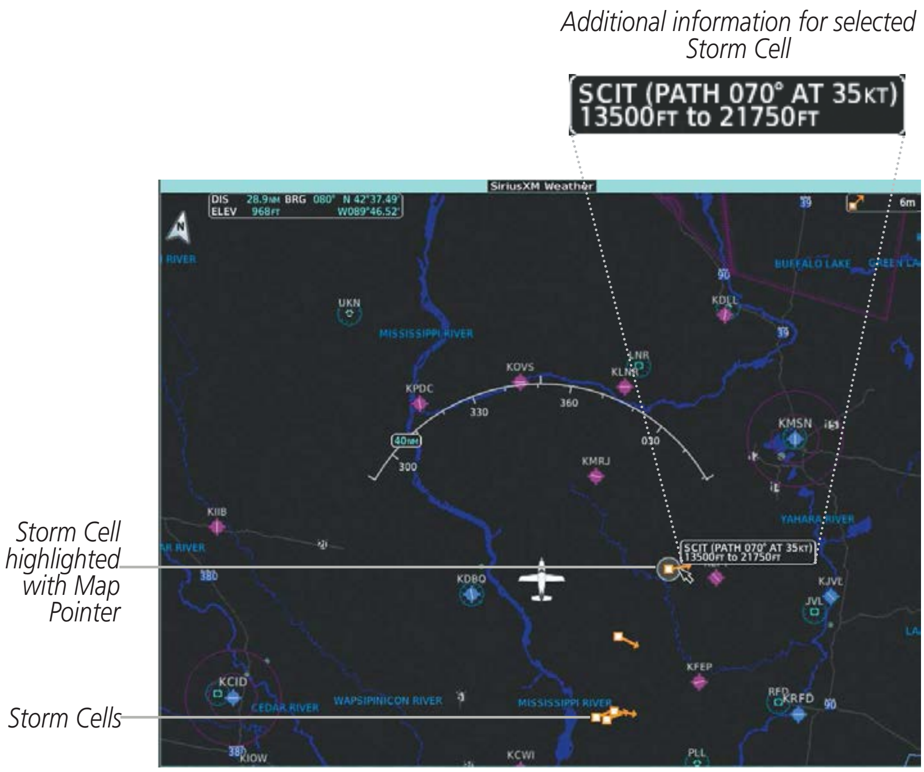


Figure 6-31 Storm Cell Movement Weather Product

Enabling/Disabling Storm Cell Movement Information (SiriusXM Weather Pane)

1) From MFD Home, touch **Weather > Weather Selection > SiriusXM Weather > SiriusXM Settings**.
2) Touch the **Storm Cell Movement** Button in the Overlays Window.

Touch the **Legend** Button on the SiriusXM Weather Settings Screen to display weather legend(s) for enabled weather product(s). Scroll as necessary to view the information, then touch the **Back** Button or the **Home** Button.

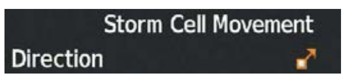


Figure 6-32 Cell Movement Legend

Displaying Storm Cell Movement Information (Navigation Map Panes)

1) From MFD Home, touch **Map** > **Map Selection > Map Settings.**
2) If necessary, touch the **Sensor** Tab.
3) Scroll as needed and touch the NEXRAD Data **Settings** Button.
4) Touch the **Storm Cell Movement** Button. When button annunciator is green, the system shows Storm Cell Movement with the NEXRAD weather product on navigation map panes. When button annunciator is gray, system will not show the Storm Cell Movement weather product on navigation map panes.

Displaying Storm Cell Movement with NEXRAD information (PFD Inset and HSI Map):

1) From PFD Home, touch **PFD Map Settings.**

2) If necessary, touch either the **HSI Map** or **Inset Map** Button to access overlays buttons.

3) Touch the NEXRAD Data **Settings** Button.

4) Touch the **Storm Cell Movement** Button.

5) When finished, touch **Back** or **Home**.

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.

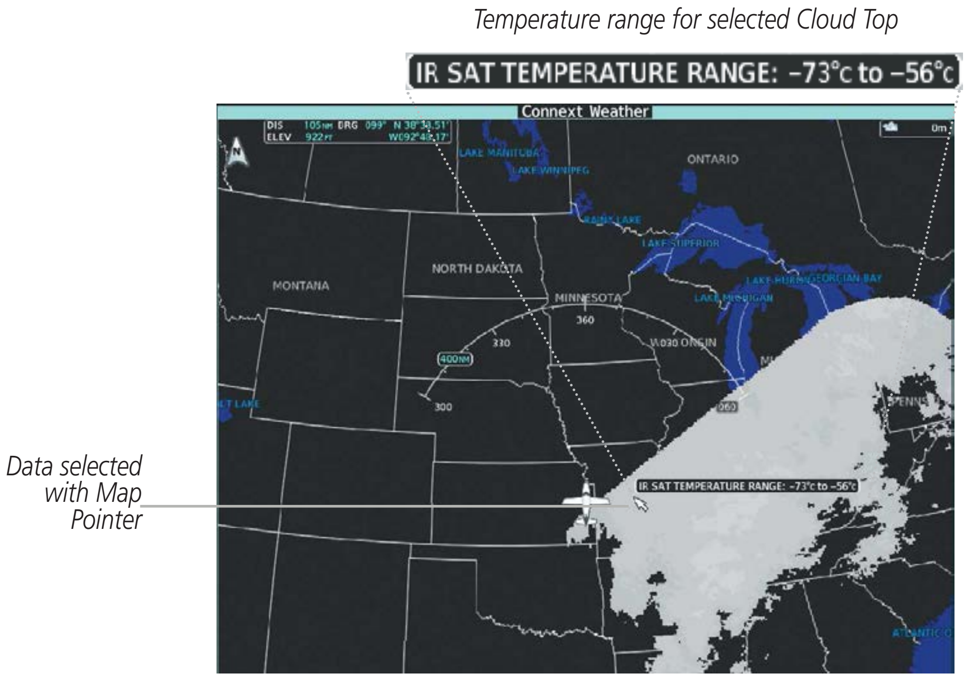


Figure 6-33 Infrared Satellite Weather Product on Connext Weather Pane

Displaying Cloud Tops information (Connext Weather Pane):

1) From MFD Home, touch **Weather > Weather Selection > Connext Weather > Connext Settings**.
2) Touch the **IR Satellite** Button in the Overlays Window.

To display the Cloud Tops legend, touch the **Legend** Button on the Connext Weather Settings Settings Screen when the Infrared Satellite weather product is enabled for display.

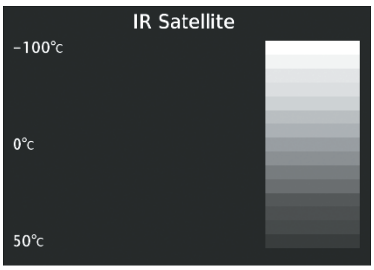


Figure 6-34 Infrared Satellite Legend

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.

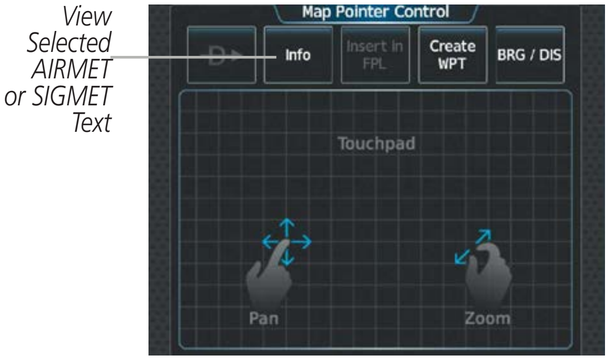


Figure 6-36 Map Pointer Control Screen

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.

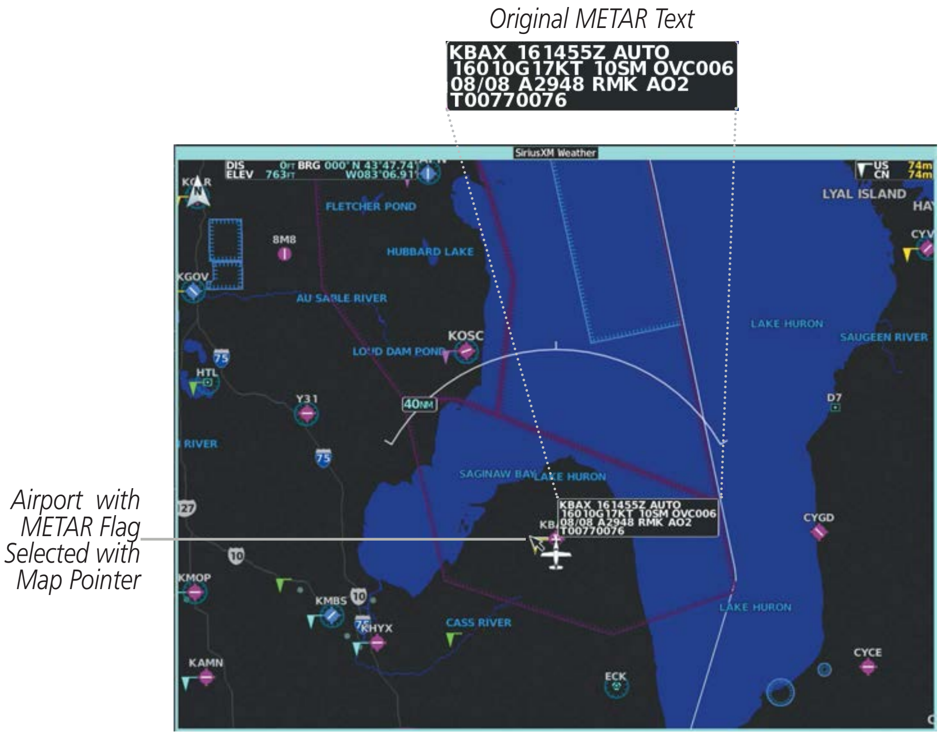


Figure 6-39 Displaying METARS on the SiriusXM Weather Pane

Showing METAR text (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.

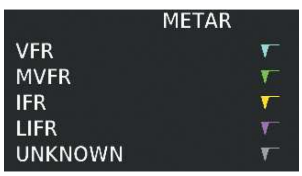


Figure 6-40 METAR Legend

Showing METAR information (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 Inset Map or HSI Map):

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 Connext), if more than one source is installed. In this case, the system automatically displays the newest available METAR. If the METAR age is identical from all available data link sources, the system selects one METAR to display in the following order of source priority: SiriusXM, FIS-B, Garmin Connext.

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.

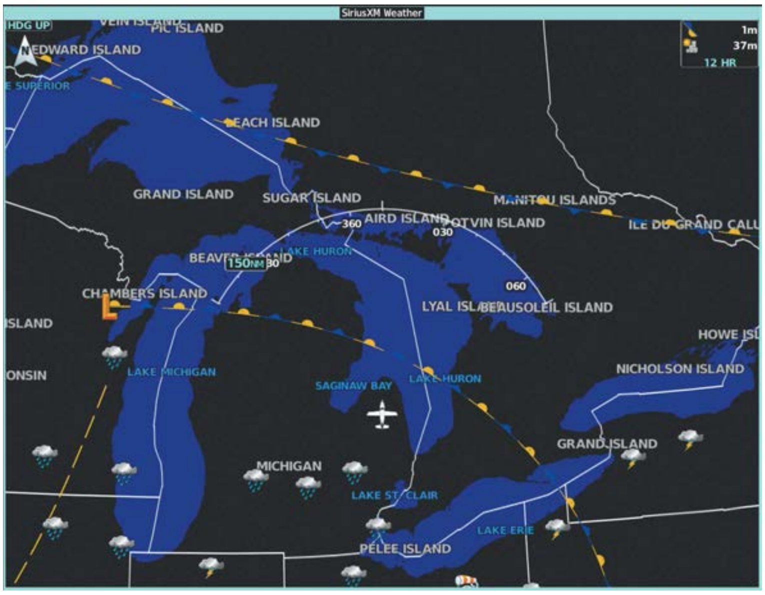


Figure 6-42 Current Surface Analysis Weather Product

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.

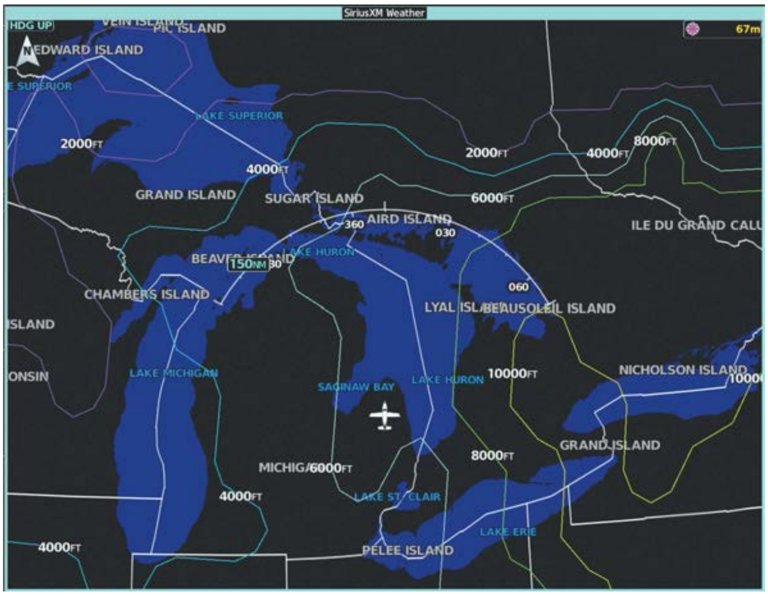


Figure 6-44 Freezing Level Weather Product

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**.

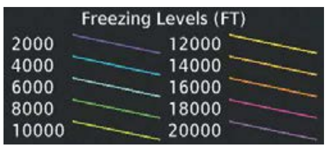


Figure 6-45 Freezing Level Legend

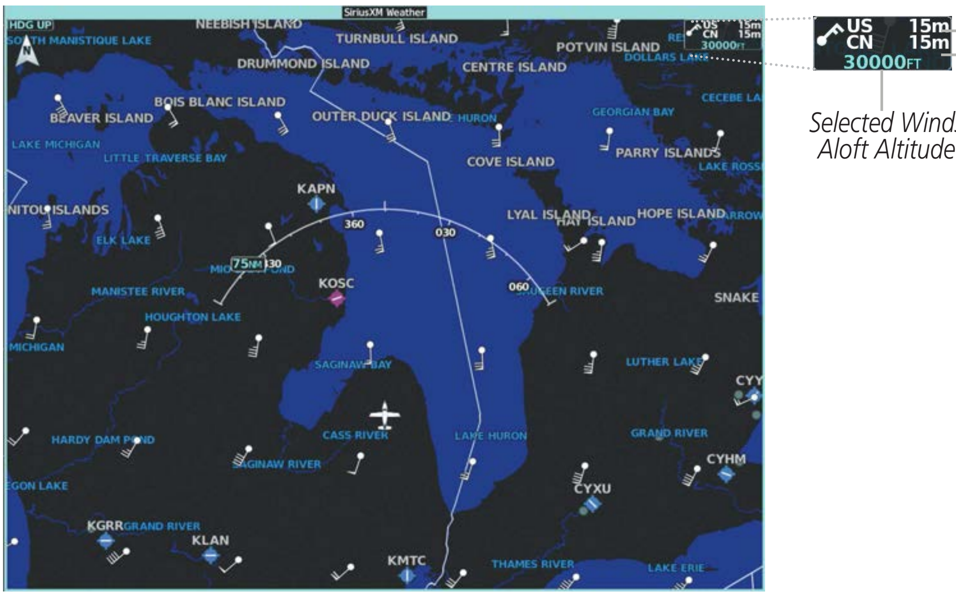
WINDS ALOFT

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**.

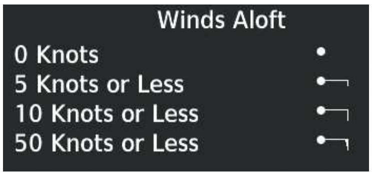


Figure 6-47 Winds Aloft Data Legend

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.

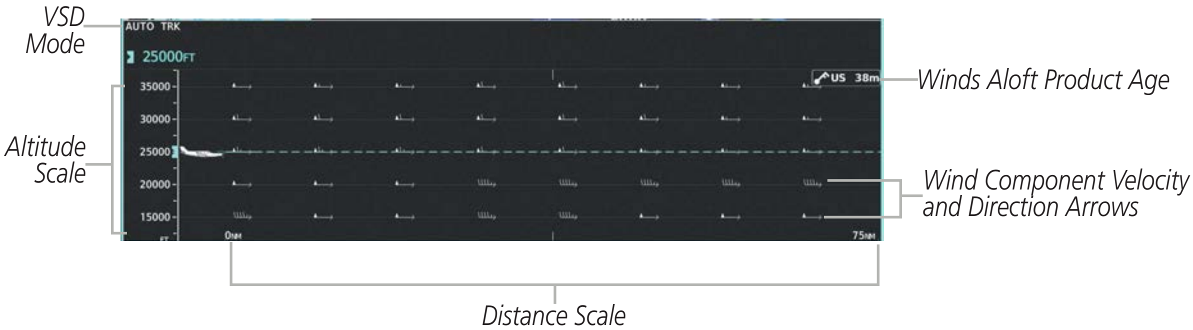


Figure 6-48 VSD Inset Window with Winds Aloft Information

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.

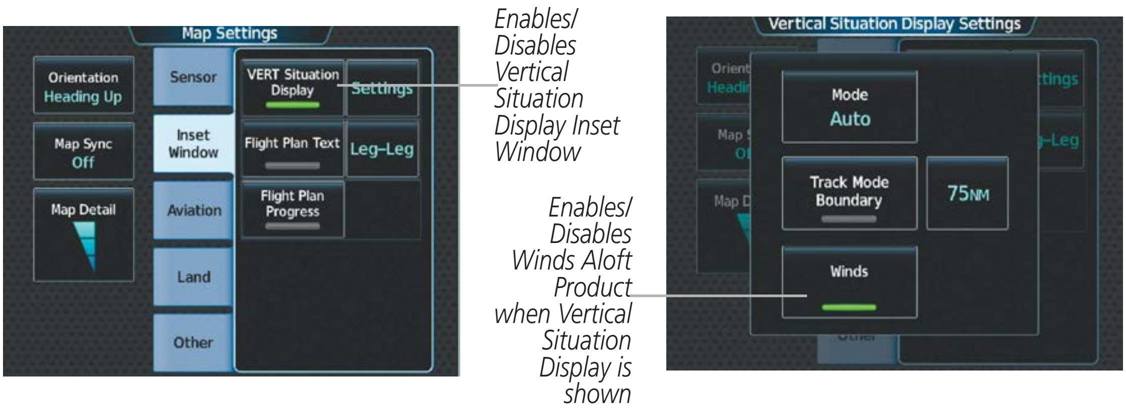


Figure 6-49 Controlling the display of Winds Aloft information for VSD Inset Window

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.

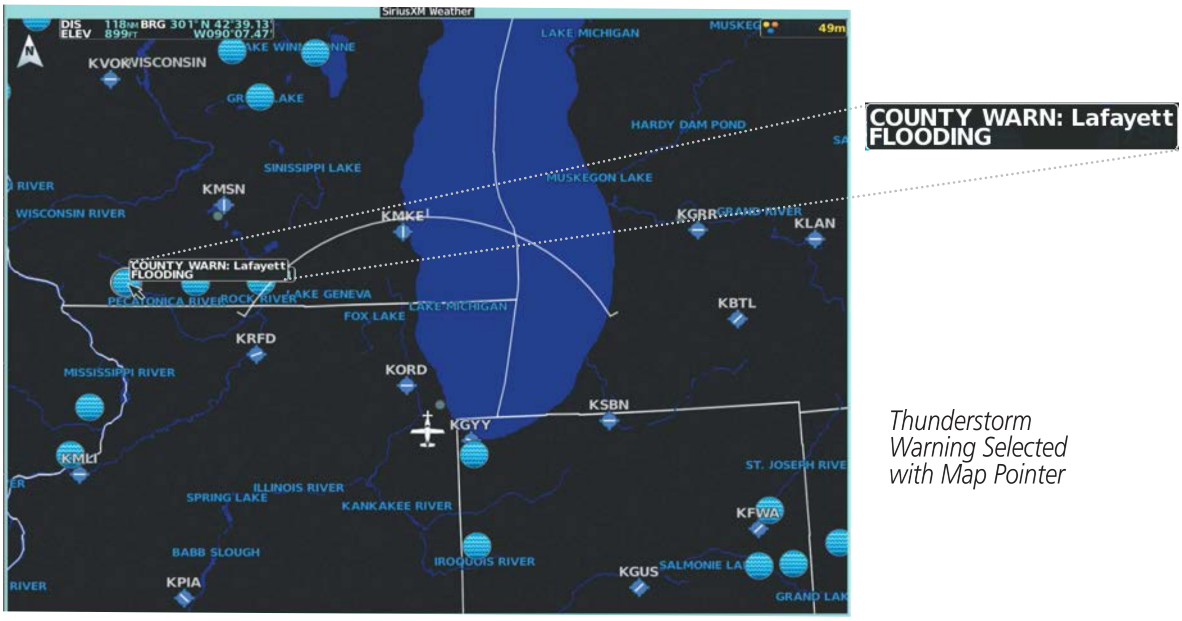


Figure 6-50 County Warnings Weather Product

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**.

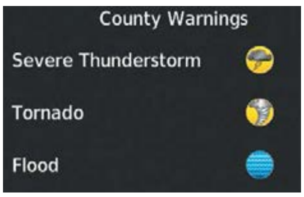


Figure 6-51 County Warnings Legend

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.

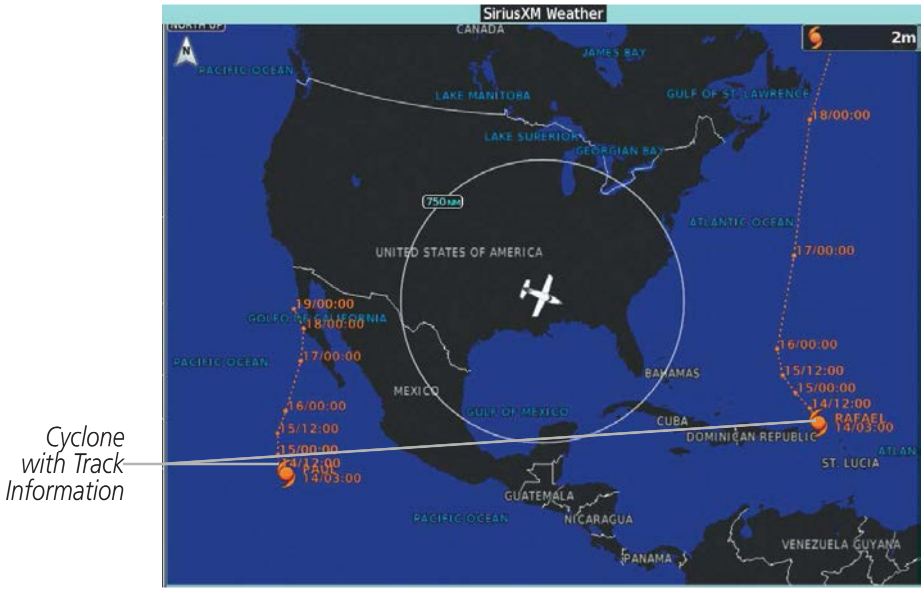


Figure 6-52 Cyclone (Hurricane) Weather Product

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**.

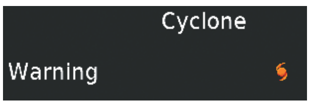


Figure 6-53 Cyclone Legend

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.)

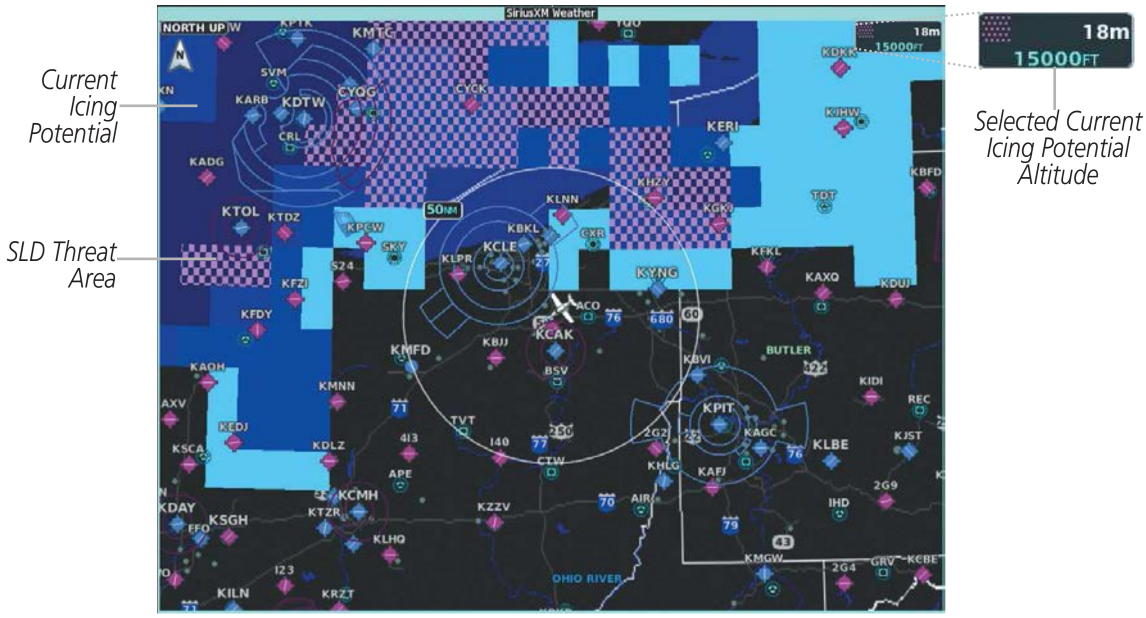


Figure 6-54 Current Icing Potential Overlay at 15,000 Feet

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 33,000 Feet

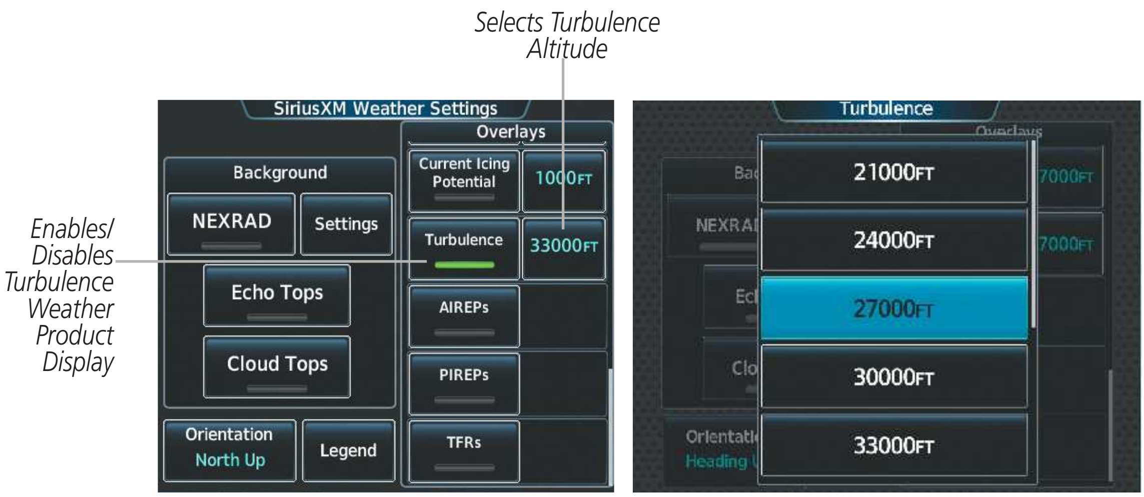


Figure 6-57 Selecting a Turbulence Altitude on the SiriusXM Weather Settings Screen

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, wind shear, and turbulence. PIREPs are issued as either Routine (UA) or Urgent (UUA).

Another type of PIREP is an Air Report (AIREP). Commercial airlines typically generate AIREPs.

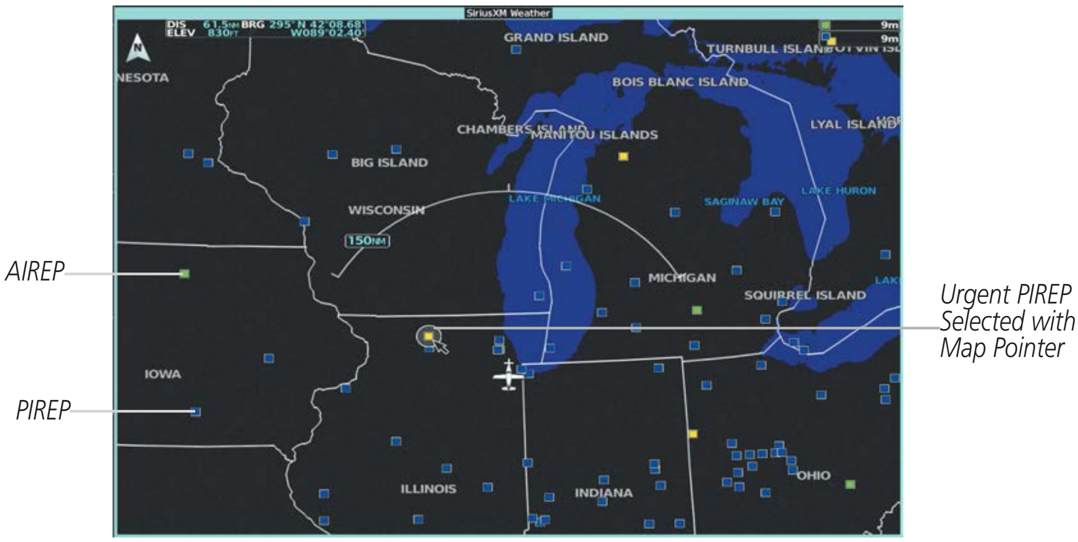


Figure 6-59 AIREPs and PIREPs on the SiriusXM Weather Pane

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.

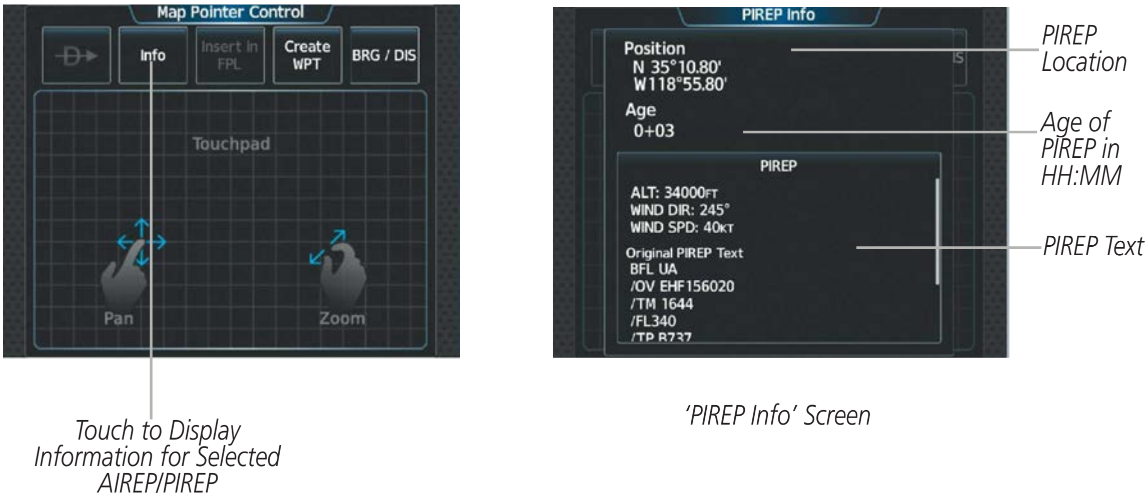


Figure 6-60 Displaying PIREPS/AIREPS on the Touchscreen Controller

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 & 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 (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 (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

ABNORMAL OPERATIONS

If the system cannot complete a weather data request, one or more messages will appear in the Data Request Window.

Weather Request Status Message	Description
Auto requests inhibited Send manual request to reset.	The system has disabled automatic weather data requests due to excessive errors. Automatic weather data requests have stopped. Send a manual weather data request to resume automatic updates.
Auto update retry: ## Seconds	The system will attempt another automatic weather data request after an error occurred during the previous request. Timer counts down until the next automatic request occurs.
Connext Comm Error [2]	A communications error has occurred with the GIA. The system should be serviced.
Connext Comm Error [4]	This occurs if multiple automatic weather data requests have recently failed, or the GIA is off-line.
Connext Comm Error [5]	The Iridium or Garmin Connext services are not accessible. Check Iridium signal strength. If this error persists, the system should be serviced.
Connext Comm Error [6]	A communications error has occurred. If this error persists, the system should be serviced.
Connext Comm Error [7]	A weather data transfer has timed out. Check Iridium signal strength and re-send the Connext Data Request.
Connext Comm Error [8]	A server error has occurred or invalid data received.
Connext Login Invalid	There is a problem with the Garmin Connext registration. Contact Garmin Aviation Product Support using the information at www.flygarmin.com.
Connext Server Temporarily Inop	The Garmin Connext weather data server is temporarily out of service, but is expected to return to service in less than 30 minutes.
Connext Server Inop	The Garmin Connext weather data server will be out of service for at least 30 minutes.
Invalid Coverage Area	The Connext Data Request does not sufficiently define a coverage area on which to retrieve weather data. Verify the selections in the Connext Weather Coverage Window, then issue another Connext Data Request.
No Connext Subscription	The system is not currently subscribed to the Garmin Connext Weather service, or the access code is incorrect. Verify the access code. Contact Garmin Aviation Product Support using the information at www.flygarmin.com.
Reduce Request Area	The weather data request area exceeds size limits. Reduce weather coverage area and re-send data request.
Request Cancelled	The user has cancelled a weather data request.
Request Failed - Try Again	The weather data request timed-out. Re-send data request.
Transfer Preempted	The data link is busy. Retry request later.

Table 6-6 Abnormal Weather Data Request Status Messages

6.2 STORMSCOPE LIGHTNING

***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:** The Stormscope lightning map overlay cannot be displayed simultaneously with data link lightning overlays on the same map.*

The system can display the optional L-3 WX-500 Stormscope lightning detection system displays lightning cell and strike information on the Stormscope Pane and navigation maps using the symbology shown in the table below.

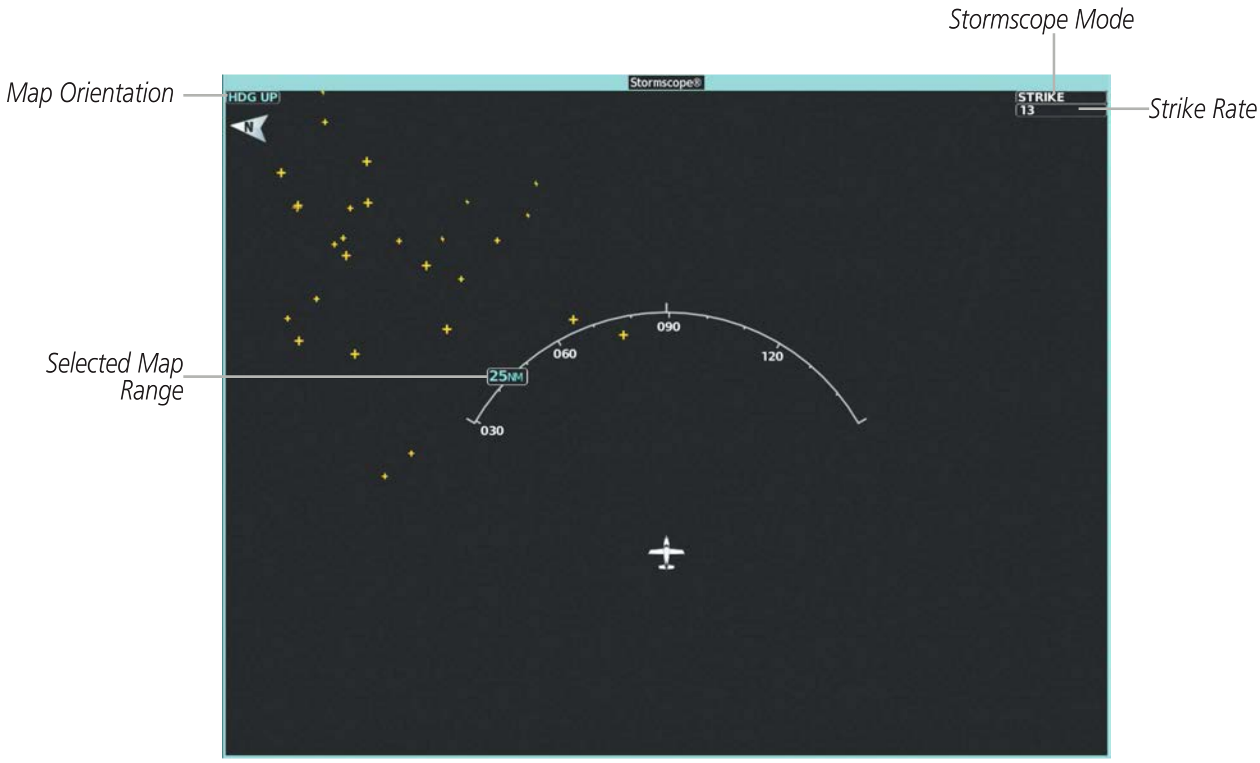
Lightning Age	Symbol
Strike is less than 6 seconds old	
Strike is between 6 and 60 seconds old	
Strike is between 1 and 2 minutes old	
Strike is between 2 and 3 minutes old	

Table 6-7 Lightning Age and Symbols

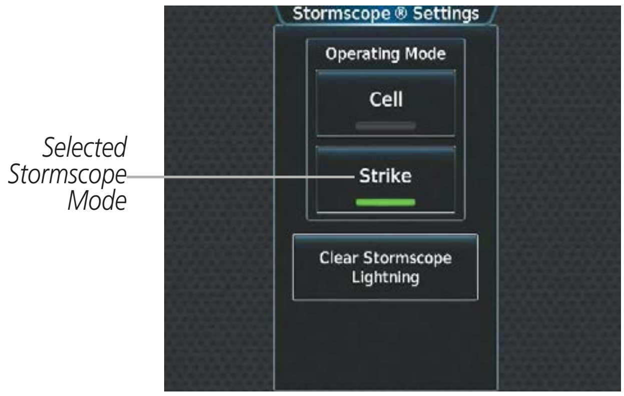
The Stormscope operates in either Cell Mode or Strike Mode. When operating in Cell Mode, the system displays clusters or cells of electrical activity. When operating in Strike Mode, the system displays the approximate location of individual lightning strikes.

USING THE STORMSCOPE PANE

The Stormscope Pane shows lightning information in relation to the aircraft's current location, with simplified map details to reduce clutter and to allow for easier identification of lightning cells and strikes. It is the principal map pane for viewing Stormscope lightning information. The Stormscope Pane map orientation is heading up, with an arrow pointing North, unless there is no valid heading. The Stormscope Pane displays the selected Stormscope operating mode and lightning strike rate in the upper right corner of the pane. The selected map range appears in cyan a box on the range arc. The Stormscope Pane also displays the active flight plan, when one exists.



Stormscope Pane Operating in Strike Mode



Stormscope Settings Screen

Figure 6-64 Displaying Stormscope Lighting on the Stormscope Pane

Displaying the Stormscope Pane:

From MFD Home, touch **Weather** > **Weather Selection** > **Stormscope**.

The knob on the lower right of the Touchscreen Controller controls the map range shown on the Stormscope Pane. Turn the knob clockwise to increase the map range shown, or counter-clockwise to decrease the map range. Map ranges of 25 nm to 200 nm are available.

Selecting a Stormscope Operating Mode on the Stormscope Pane:

1) From 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.

Clearing the Stormscope pane removes any previously displayed cell or lightning strike information from the Stormscope pane.

Clearing Stormscope Information on the Stormscope Pane:

1) From MFD Home, touch **Weather** > **Weather Selection** > **Stormscope** > **Stormscope Settings**.

2) Touch the **Clear Stormscope Lightning** Button.

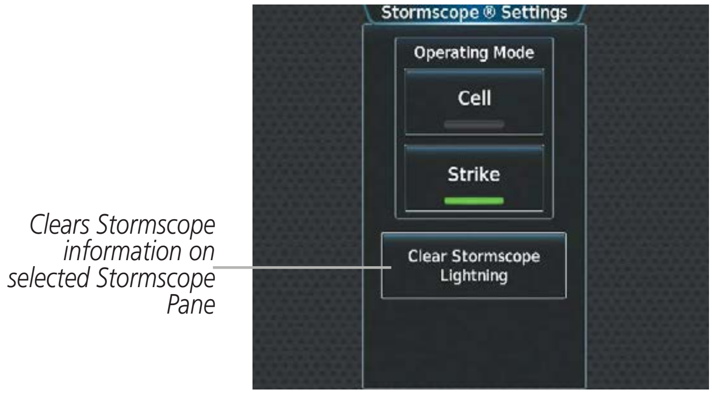


Figure 6-65 Clearing Stormscope Lightning for the Stormscope Pane

STORMSCOPE INFORMATION ON NAVIGATION MAPS

Stormscope lightning information is available as an overlay on navigation maps.

Enabling/Disabling Stormscope Lightning Information on the PFD maps:

1) From 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 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 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 for the PFD 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 **Map Settings** Button.
5) Touch the **Stormscope** Button (current range setting displayed in light blue).
6) Scroll as needed and touch a desired map range setting from the list.

Enabling/disabling Stormscope information on Navigation Map Panes:

1) From MFD Home, touch **Map** > **Map Settings**.
2) If necessary, touch the **Sensor** Tab.
3) Scroll as needed and touch the **Stormscope Lightning** Button.

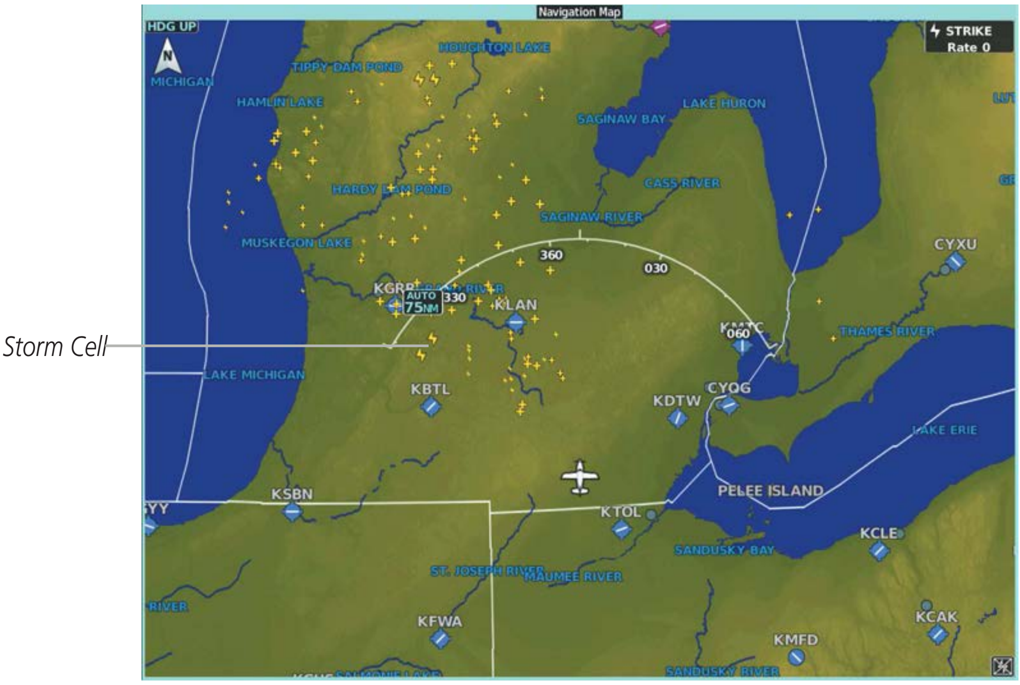


Figure 6-66 Stormscope Information on the Navigation Map Pane (Cell Mode Selected)

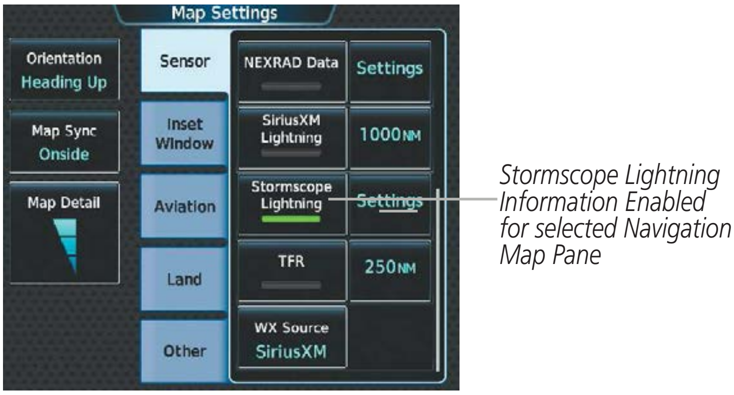


Figure 6-67 Enabling Stormscope Information for the Navigation Map Pane

Selecting a Stormscope mode for the Navigation Map Pane:

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

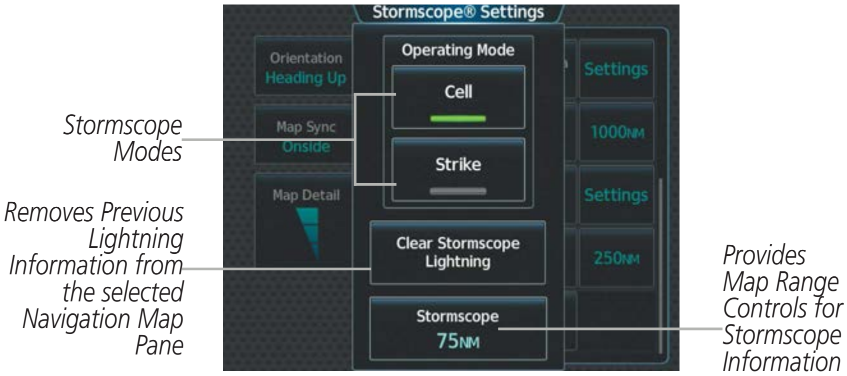


Figure 6-68 Stormscope Settings for the Navigation Map Pane

Clearing the Stormscope Pane removes any previously displayed cell or lightning strike information from the navigation maps.

Clearing Stormscope information on the Navigation Map Pane:

1) From MFD Home, touch **Map** > **Map Settings**.
2) If necessary, touch the **Sensor** Tab.
3) Scroll as needed and touch the Stormscope Lightning **Settings** Button.
4) Touch the **Clear Stormscope Lightning** Button.
5) When finished, touch **Back** or **Home**.

Selecting a maximum Stormscope map range on the Navigation Map Pane:

1) From MFD Home, touch **Map** > **Map Settings**.
2) If necessary, touch the **Sensor** Tab.
3) Scroll as needed and touch the Stormscope Lightning **Settings** Button.
4) Touch the **Map Settings** Button.
5) Touch the **Stormscope** Button (current range setting displayed in light blue).
6) Scroll as needed and touch a desired map range setting from the list.

Figure 6-69 Selecting maximum Navigation Map Pane range to display Stormscope Lightning information

ABNORMAL OPERATIONS

If heading input is lost, strikes and/or cells must be cleared manually after the execution of each turn. This is to ensure that the strike and/or cell positions are depicted accurately in relation to the nose of the aircraft. Refer to the previous procedures ‘Clearing Stormscope information on the Navigation Map Pane’ or ‘Clearing Stormscope Information on the Stormscope Pane’ to clear Stormscope information from the selected map.

6.3 AIRBORNE COLOR WEATHER RADAR

SYSTEM DESCRIPTION

The Garmin GWX 70 Airborne Color Weather Radar is a solid-state pulsed radar. It combines excellent range, sensitivity, and adjustable scanning profiles with high-definition, real-time precipitation information. The system optimizes the pulse length to maximize resolution at each range setting. This reduces the weather cells smearing together on the maps for better definition at close range.

The TBM 940 uses a 10-inch phased array antenna that is fully stabilized to accommodate 30º of pitch and roll.

To focus radar scanning on specific areas, Sector Scanning offers crew-adjustable horizontal scan angles of 20º, 40º, 60º, or 90º. A vertical scanning function helps to analyze storm tops, gradients, and cell buildup activity at various altitudes.

Radar features include:

- Independent weather radar settings for each map.
- WATCH® (Weather ATtenuated Color Highlight) helps to 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 indicate the weather behind a storm.
- Weather Alert that looks ahead for intense cell activity in the 80-320 nm range, even if these ranges beyond the currently selected map range.
- Extended Sensitivity Time Constant (STC) logic automatically correlates distance of the return echo with intensity, so cells do not suddenly appear to get larger as they get closer.
- Altitude-Compensated Tilt (ACT) management, which automatically adjusts the antenna tilt angle during climbs and descents.
- Optional Turbulence Detection presents areas of turbulence associated with precipitation using Doppler measurements up to a 40 nm range.
- Optional Ground Clutter Suppression (GCS), to remove ground clutter from the displays.

***NOTE:** Garmin recommends the user obtain instruction in the proper operation of airborne weather radar.*

PRINCIPLES OF AIRBORNE WEATHER RADAR

The term RADAR is an acronym for RAdio Detecting And Ranging. Pulsed radar locates targets by transmitting a microwave pulse beam that, upon encountering a target, is reflected back to the radar receiver as a return echo. The microwave pulses are focused and radiated by the antenna, with the most intense energy in the center of the beam and decreasing intensity near the edge. The same antenna is used for both transmitting and receiving.

Radar detection is a two-way process that requires 12.36 μs for the transmitted microwave pulses to travel out and back for each nautical mile of target range. It takes 123.6 μs for a transmitted pulse to make the round trip if a target is ten nautical miles away.

The airborne weather radar has the capability to detect the velocity of precipitation moving toward or away from the radar antenna. As the radar pulse beam strikes a moving object, the frequency of the returned echo shifts in relation to the speed at which the object is moving. This effect is analogous to the audible pitch change observed when an emergency vehicle's siren gets closer or moves away. Doppler radar employs this effect to detect areas of precipitation moving at a high rate of speed (indicative of turbulence), and to determine when an object, such as the ground, is stationary. The system can use this information to suppress the display of ground clutter.

Airborne weather radar should be used to avoid severe weather. The decision to fly into an area of radar targets depends on target intensity, spacing between the targets, aircraft capabilities, and crew experience. Airborne weather radar is efficient at detecting wet precipitation such as rain, wet snow, and water coated hail, however it will not detect clouds or mist. The display may indicate clear areas between intense returns, but this does not necessarily mean it is safe to fly between them, as these areas may contain severe turbulence or other hazards such as hail. In addition, Doppler radar measurement of precipitation velocity only occurs when rain or hail is moving along the radar beam and either toward or away from the antenna. Airborne weather radar systems cannot detect Clear Air Turbulence (CAT) as there are no particulate for the radar to detect.

Airborne weather radar has other capabilities beyond weather detection. It also has the ability to detect and provide distance to cities, mountains, coastlines, rivers, lakes, and oceans.

NEXRAD AND AIRBORNE WEATHER RADAR

Both Airborne Weather Radar and NEXRAD measure weather reflectivity in decibels (dB). A decibel is a logarithmic expression of the ratio of two quantities. Airborne Weather Radar measures the ratio of power against the gain of the antenna, while NEXRAD measures the energy reflected back to the radar, or the radar reflectivity ratio.

Although both radar systems use colors to identify the different echo intensities, the thresholds and colors are not interchangeable. Airborne color radar values from the installed weather radar system must not be confused with NEXRAD radar values. In addition, NEXRAD depicts lower intensity returns than airborne weather radar. Airborne weather radar return images will not appear the same as NEXRAD return images.

Convective weather activity is known to develop rapidly, with cell growth capable of exceeding several thousand feet per minute. Airborne weather radar provides the flight crew with real-time weather avoidance information for precipitation detected within the airborne weather radar's beam. NEXRAD information is **not** real-time. It is intended to assist the flight crew with hazardous weather avoidance planning. NEXRAD images are comprised of individual radar scans arriving at a network at different rates and times, which are periodically compiled into a mosaic (the NEXRAD weather product) and transmitted via data link. Due to inherent delays in this process, it is common for the displayed NEXRAD images to be significantly older than the current weather situation, and may also differ from information the airborne weather radar presents.

Because NEXRAD operates from an extensive network of ground-based radar antennas performing 360° scans, it is capable of providing information on large-scale weather patterns such as precipitation associated with significant frontal activity from multiple radar locations. Airborne weather radar can perform up to 120° 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 8 degrees.

The following figure depicts the radar beam as seen from the side, with both the certified beam width and the additional beam energy illustrated. With the aircraft at 30,000 ft. AGL and a radar tilt angle of zero degrees, ground clutter may be observed starting at approximately 36 NM. The cell located 20 NM from own ship would be over-scanned by the beam, and as a result would not be represented on the radar display. The cell located 80 NM from own ship displays radar tops of 22,000 ft. AGL which is relatively close to the beam center, so this cell would be represented on the display. However, utilizing a lower radar tilt angle would better depict the precipitation intensities of this cell. The cell located at approximately 190 NM displays radar tops of 28,000 ft. AGL, while the center of the beam is at about 65,500 ft. AGL (due to the Earth's curvature at that distance). While this particular cell may appear on the display due to being within the certified beam width, it would most likely be under-represented due to being so distant from the beam center. The radar tilt angle would need to be adjusted downwards to properly explore this cell's precipitation intensity.

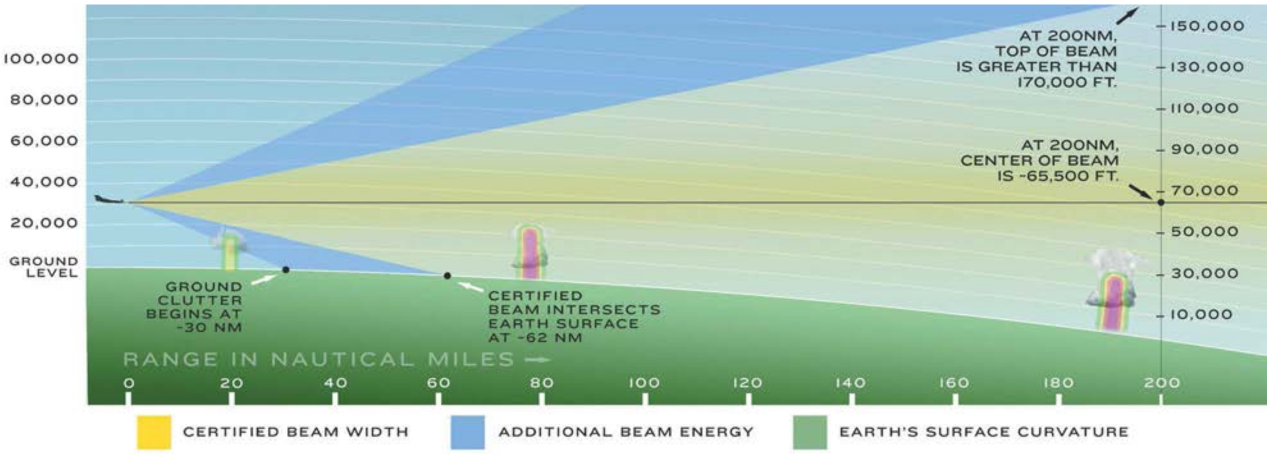


Figure 6-70 Radar Beam in Relation to the Curvature of the Earth from a 10 inch Antenna

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 that the radar energy leaving the antenna is inversely proportional to the square of the distance. The reflected radar energy from a target 40 miles away that fills the radar beam is one fourth the energy reflected from an equivalent target 20 miles away. This would appear to the operator that the storm is gaining intensity as the aircraft gets closer. Internal signal processing within the equipped weather radar system compensates for much of this distance attenuation.

Attenuation due to precipitation is not as predictable as distance attenuation. It is also more intense. As the radar signal passes through moisture, a portion of the radar energy is reflected back to the antenna. However, much of the energy is absorbed. If precipitation is very heavy, or covers a large area, the signal may not reach completely through the area of precipitation. The weather radar system cannot distinguish between an attenuated signal and an area of no precipitation. If the signal has been fully attenuated, the radar displays a radar shadow. This appears as an end to the precipitation when, in fact, the heavy rain may extend much further. A cell containing heavy precipitation may block another cell located behind the first, preventing it from being displayed on the radar. Never fly into these shadowed areas and never assume that all of the heavy precipitation is being displayed unless another cell or a ground target can be seen beyond the heavy cell. The WATCH® feature of the installed weather radar system can help to identify these shadowed areas. Areas in question appear as shadowed or gray on the radar display. Proper use of the antenna tilt control can also help detect radar shadows.

Attenuation can also be due to poor maintenance or degradation of the radome. Even the smallest amount of wear and scratching, pitting, and pinholes on the radome surface can cause damage and system inefficiency.

RADAR SIGNAL REFLECTIVITY

Precipitation

Precipitation or objects more dense than water, such as the surface of the earth or solid structures, are detected by the weather radar. The weather radar does not detect clouds, thunderstorms, or turbulence directly. It detects precipitation associated with clouds, thunderstorms, and turbulence. The best radar signal reflectors are raindrops, wet snow, or wet hail. The larger the raindrop, the better the reflectivity. The size of the precipitation droplet is the most important factor in radar reflectivity. Because large drops in a small concentrated area are characteristic of a severe thunderstorm, the radar displays the storm as a strong return. Ice crystals, dry snow, and dry hail have low levels of reflectivity as shown in the illustration, and often are not displayed by the radar. Additionally, a cloud that contains only small raindrops, such as fog or drizzle, does not reflect enough radar energy to produce a measurable target return.

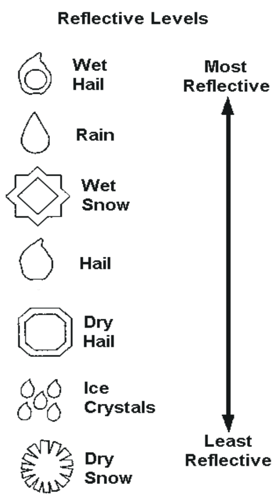


Figure 6-71 Precipitation Type and Reflectivity

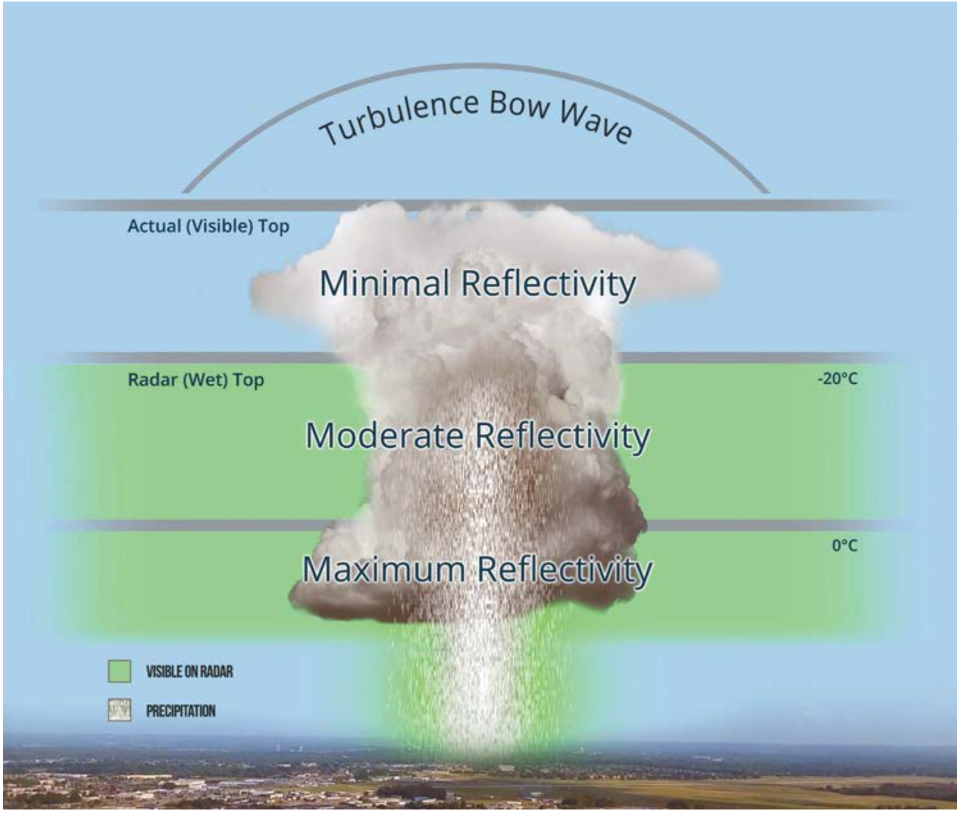


Figure 6-72 Precipitation Reflectivity by Altitude

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 in a thunderstorm cell, returns will begin to diminish. This is the “echo top” of a cell, where radar can no longer detect the frozen precipitation, but this is not the actual top of the cell, which could extend significantly further into the atmosphere. Since it is difficult to detect the actual tops of a thunderstorm cell with radar, and invisible bow waves may extend beyond visible tops, overflight of thunderstorms should never be attempted.

Ground Returns

The intensity of ground target returns depends upon the angle at which the radar beam strikes the ground target (Angle of Incidence) and the reflective properties of that target. The gain can be adjusted so shorelines, rivers, lakes, and cities are well defined. Increasing the gain too much causes the display to fill in between targets, thus obscuring some landmarks.

Cities normally provide a strong return signal. While large buildings and structures provide good returns, small buildings can be shadowed from the radar beam by the taller buildings. As the aircraft approaches and shorter ranges are selected, details become more noticeable as the highly reflective regular lines and edges of the city become more defined.

Bodies of water such as lakes, rivers, and oceans are not good reflectors and normally do not provide good returns. The energy is reflected in a forward scatter angle with inadequate energy being returned. They can appear as dark areas on the display. However, rough or choppy water is a better reflector and provides stronger returns from the downwind sides of the waves.

Mountains also provide strong return signals to the antenna, but also block the areas behind. However, over mountainous terrain, the radar beam can be reflected back and forth in the mountain passes or off canyon walls, using up all or most of the radar energy. In this case, no return signal is received from this area, causing the display to show a dark spot which could indicate a pass where no pass exists.

Ground Clutter Suppression (Optional)

Ground Clutter Suppression (GCS) enhances the flight crews ability to differentiate precipitation returns from ground clutter, by suppressing most, but not all, returns from ground objects. The optional feature is most effectively used by first obtaining the desired tilt and range settings, and then activating GCS. For normal surveillance of an air mass, tilt angle and range should be adjusted to obtain minimal ground clutter prior to activation of the GCS feature. This ensures that the radar beam is functioning and tilt is set to observe the air above the ground clutter before that clutter is suppressed. The same holds true for investigating suspected precipitation returns. Tilt angle and range should be set to maximize the precipitation return image prior to activation of GCS to suppress clutter.

Angle of Incidence

The angle at which the radar beam strikes the target is called the Angle of Incidence. The figure illustrates the incident angle ('A'). This directly affects the detectable range, the area of illumination, and the intensity of the displayed target returns. A large incident angle gives the radar system a smaller detectable range and lower display intensity due to minimized reflection of the radar energy.

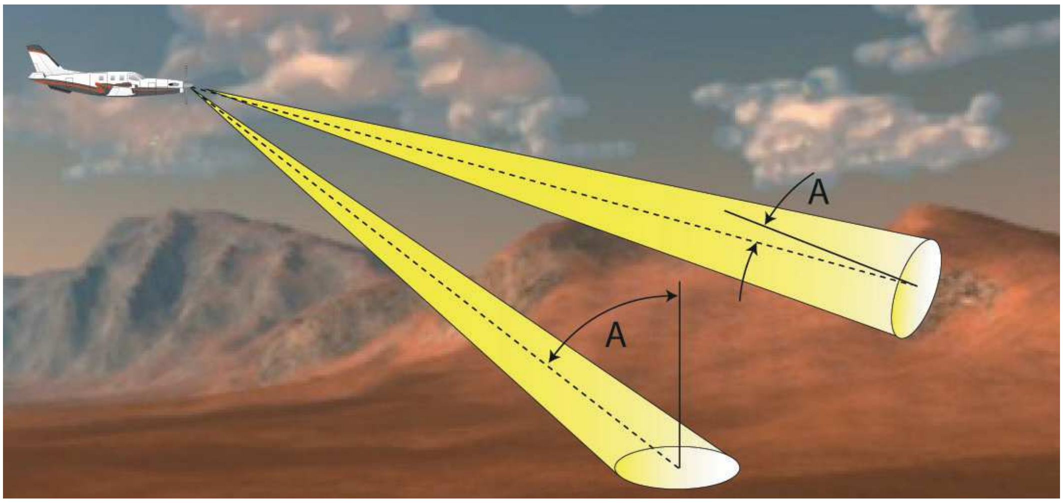


Figure 6-73 Angle of Incidence

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/cm2. See Advisory Circular 20-68B for more information on safe distance determination.

***WARNING:** Do not operate the weather radar in transmitting mode when personnel or objects are within the MPEL boundary.*

MAXIMUM PERMISSIBLE EXPOSURE LEVEL (MPEL)

The recommended minimum safe distance between personnel and an operating weather radar antenna is 12 feet from the 12-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.

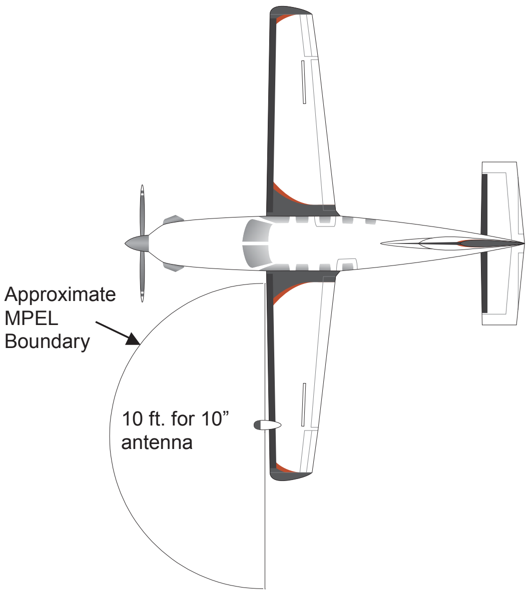


Figure 6-74 Approximate MPEL Boundary

BASIC ANTENNA TILT AND RANGE SETUP

Proper antenna tilt management techniques are a major factor for the successful use of any airborne weather system. If the antenna tilt angle is set too low, the radar display will show excessive ground returns, making it difficult for the pilot to distinguish adverse weather phenomena from ground clutter. If the antenna tilt angle is set too high, the radar beam will overscan the top of the adverse weather. In either of these examples, the flight crew would be unable to adequately recognize critical weather information.

The following discussion is a simple method for setting up the weather radar antenna tilt for most situations. It is not to be considered an all encompassing setup that works in all situations, but this method does provide good overall parameters for the monitoring of intense weather threats. Correct application of tilt angle is directly dependent on the storms height and intensity and its relative distance from own ship. Adjusting the airborne weather radar tilt angle setting until minimal ground clutter is displayed is the simplest setup method for general surveillance of precipitation returns. For ranges of up to 80 NM this ground clutter should appear on the outer portion of the radar display. At ranges greater than 80 NM, the displayed ground clutter will move lower on the radar display due to the curvature of the earth. By displaying a minimal amount of ground clutter on the installed weather radar system the flight crew can ensure the system is operating and that the air mass above the ground clutter is being scanned.

When a strong a weather return is detected within the ground clutter it must be further investigated to determine the source of this return. Further tilt angle adjustment of the airborne radar may be required to explore this return. Adjusting the radar tilt angle upwards can reveal the radar tops of this return, while adjusting the tilt angle downwards may be necessary to investigate the strongest intensity of a particular return.

Effective airborne weather radar range management during all phases of flight should be based on the volume of air to be scanned for returns ahead of own aircraft, to allow sufficient time needed to investigate, analyze, decide, and tactically maneuver around these hazardous weather returns. Longer ranges may be used to tactically identify intense weather returns that may warrant further investigation, and closer ranges may be used during the investigation process.

There is no one tilt or range setting that works for all situations. It is best to remember that active tilt and range management is necessary to identify and then investigate returns.

NOTE: *When a strong weather return is displayed on the weather radar, the tilt angle may be adjusted to explore return intensities at various altitudes to aid in determination of radar tops.*

WARNING: *Overflight of thunderstorms should not be considered safe, as extreme turbulence may exist significantly above observed returns.*

NOTE: *It is the sole responsibility of the flight crew to avoid areas of hazardous weather by adequate margins.*

MANAGING TILT ANGLE AND RANGE

There are many factors to be considered in order to become proficient at using airborne weather radar in all situations. The following setup provides a good starting point for the practical application of radar tilt management.

Radar tilt management can easily be remembered by use of the 1-10-1000 rule. The summary of this rule is the fact that when the flight crew changes the radar tilt angle by 1 degree the resulting change will displace the center of the beam 1000 feet vertically at a range of 10 nautical miles. Applying the 1-10-1000 rule to various distances provides the flight crew with the ability to 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.

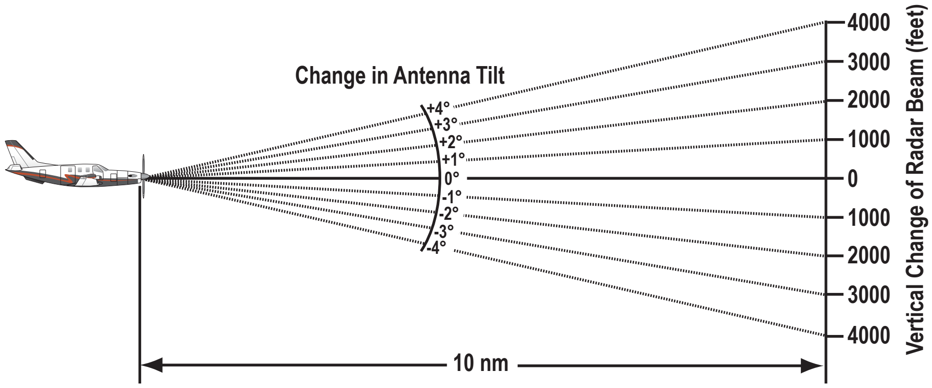


Figure 6-75 Vertical Change in Radar Beam per Nautical Mile

The 10-inch phased array antenna has a certified beam width of 8 degrees, which means that 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
Taxi	Up 7.50° to 10.00°	20 NM	Activate weather mode when clear of ramp area.
Takeoff / Initial Climb	Up 7.50° to 10.00° Altitude Compensated Tilt On	60 NM	If precipitation is observed in the departure path, gain can be reduced to aid in identification of intense returns.
10,000 Ft. AGL	Up 5.00° Altitude Compensated Tilt On	60 - 80 NM	Range setting is dependent upon ground speed and time available for deviations.
Cruise	Tilt to Minimize Clutter Altitude Compensated Tilt On	60 - 120 NM	Range setting is dependent upon ground speed and time available for deviations. Tilt angle set to show minimal ground clutter.
Descent To 10,000 FT	Tilt to Minimize Clutter Altitude Compensated Tilt On	60 - 120 NM	Range setting is dependent upon ground speed and time available for deviation.
Descent Below 10,000 FT	Up 7.50° to 10.00° Altitude Compensated Tilt On	40 - 60 NM	Range setting is dependent upon ground speed and time available for deviation. Tilt angle set to show ground clutter in outer 1/3 of radar display.
Approach	Up 7.50° to 10.00° Altitude Compensated Tilt On	20 NM	These settings allow for observation of the approach area and the missed approach holding area.

Table 6-8 Typical Tilt Settings by Phase of Flight

NOTE: *Garmin recommends the user obtain instruction in the proper operation of airborne weather radar.*

ALTITUDE COMPENSATED TILT

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)	Approximate Precipitation Rate (in/hr.)
Black	< 23 dBZ	< .01
Green	23 dBZ to < 33 dBZ	.01 - 0.1
Yellow	33 dBZ to < 41 dBZ	0.1 - 0.5
Red	41 dBZ and greater	greater than 0.5
Magenta	TURB- (Optional) Turbulence Detection uses the color magenta to show areas of rain or hail that may also contain turbulence	

Table 6-9 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 red are associated with hail or turbulence, as well as heavy precipitation. Vertical scanning and antenna tilt management may be necessary to identify areas of maximum intensity. The turbulence associated with these returns should be considered severe.

• Areas that show steep color gradients (intense color changes) over thin bands or short distances suggest irregular rainfall rate and strong turbulence.

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 precipitation without severe turbulence.

Irregularities in the radar return may also indicate turbulence, appearing as hooks, fingers, or scalloped edges. These irregularities may be present in green areas with no yellow or red areas and should be treated as highly dangerous areas. Avoid these areas as if they are red.

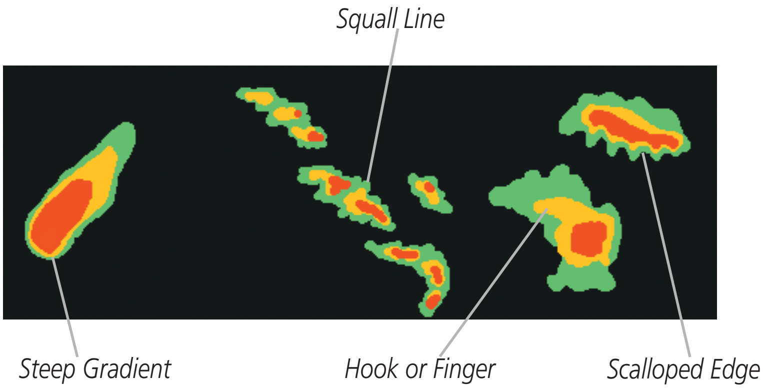


Figure 6-76 Cell Irregularities

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.

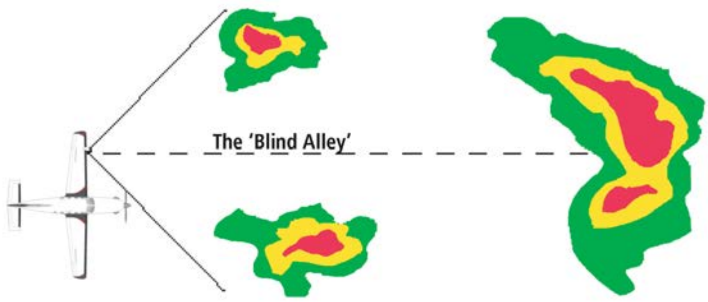
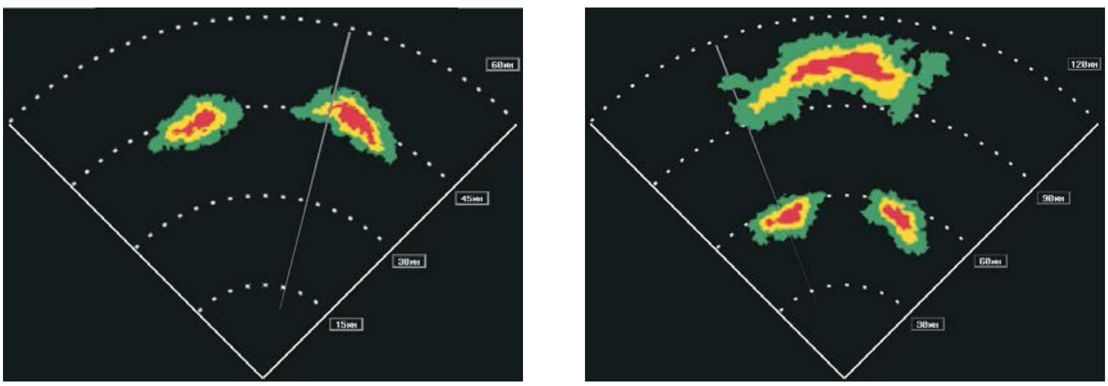


Figure 6-77 The Blind Alley - Horizontal Scan

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 that 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.

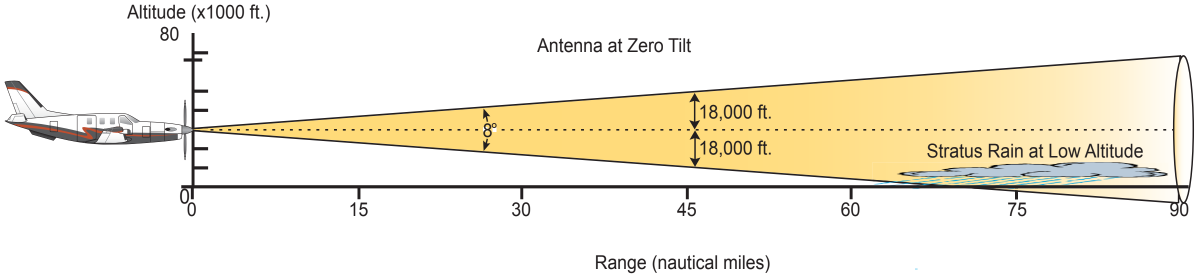


Figure 6-79 Stratus Rain Combines with Ground Returns when Aircraft is at Higher Altitudes

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: *Begin transmitting only when it is safe to do so. When transmitting while the aircraft is on the ground, no personnel or objects should be within 12 feet of the antenna.*

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 display weather radar information on multiple map displays, and to customize each radar display independently. For example, if three radar map displays are shown (including map overlays or Weather Radar Panes), the flight crew can select different map ranges and modes (e.g. Horizontal or Vertical Scan) on each map. The weather radar updates each map display as it performs a scan with the given parameters for that map display. If more than one map display has identical scan parameters, the system uses information from the same antenna sweep to update the applicable maps 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 map until the next available scan refreshes that map.

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. 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.

When the pilot enables (green annunciator) the **Radar On** Button, each weather radar display pane or weather radar map overlay shows a radar scan. When the **Standby** Button is selected, all display panes or map overlays showing weather radar information are placed in Standby Mode.

The system automatically places the radar in Standby mode on landing.

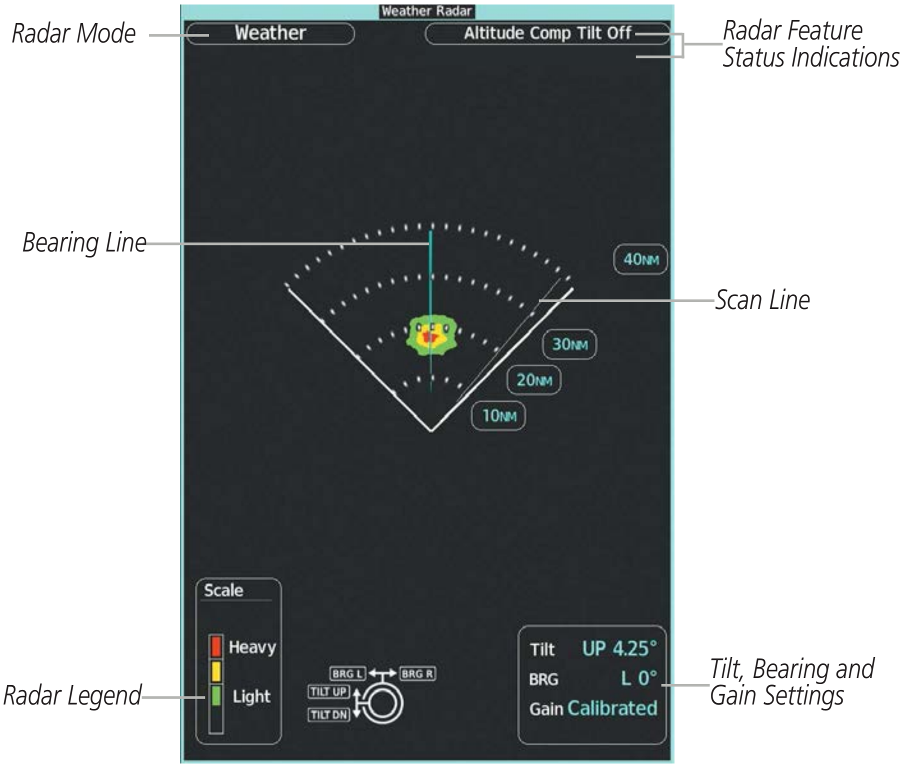


Figure 6-80 Weather Radar Pane with a Horizontal Scan

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 Mode** Button.

4) Touch the **Weather** Button. If the aircraft is airborne, the radar begins transmitting, and the Radar Mode indicates 'WEATHER'.

5) If the aircraft is on the ground, the Touchscreen Controller displays a prompt shown in the figure below 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:

NOTE: *Vertical scanning of a storm cell should be done with the aircraft wings level to avoid constant adjustment of the Bearing Line.*

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** Button.
6) Touch the **Vertical** Button. The Weather Radar Pane shows a vertical scan.
7) Turn the large upper knob to move the bearing line a few degrees left or right. When finished, push the knob to disable bearing line adjustment.
8) Turn the lower knob to adjust the map range as needed.
9) To select a new area to be vertically scanned, return to the Horizontal scan mode.
    a) Touch the **Scan** Button.
    b) Touch the **Horizontal** Button.
    c) Return to Step 2 of this procedure.

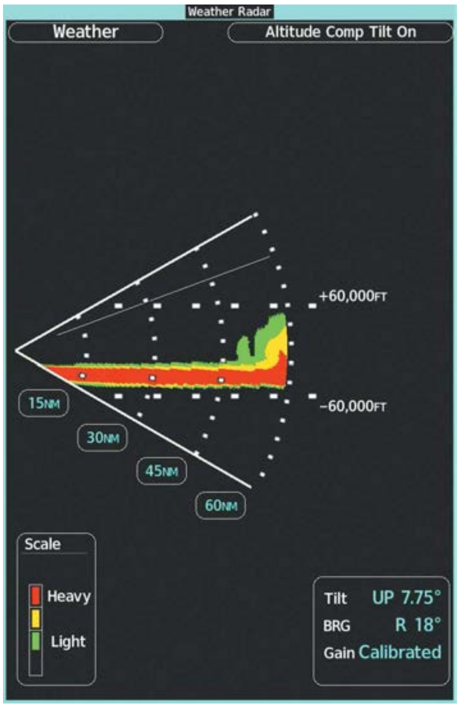


Figure 6-82 Weather Radar Display with Vertical Scan Mode Selected

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'.

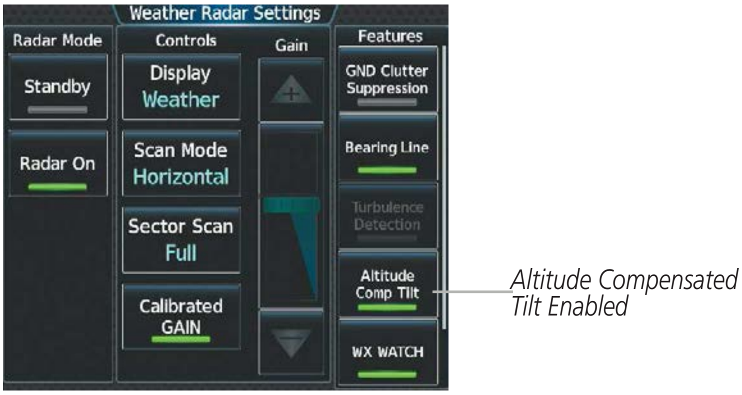


Figure 6-83 Enabling Altitude Compensated Tilt

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.

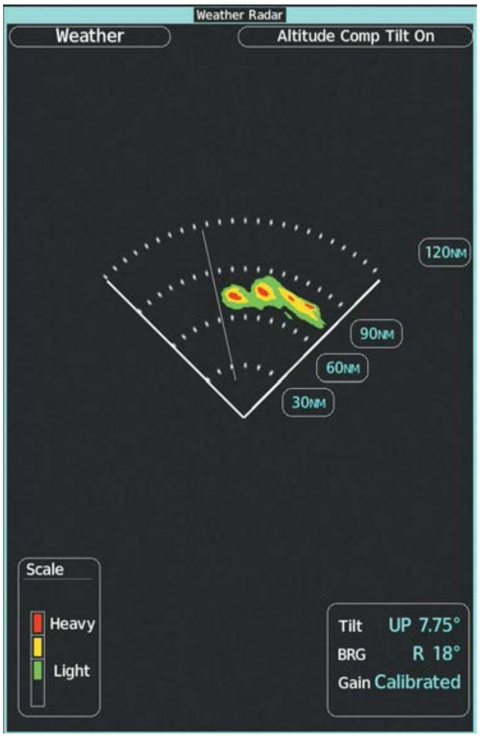
The Weather Radar Gain is set to calibrated gain setting when the Weather Radar is powered on.

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

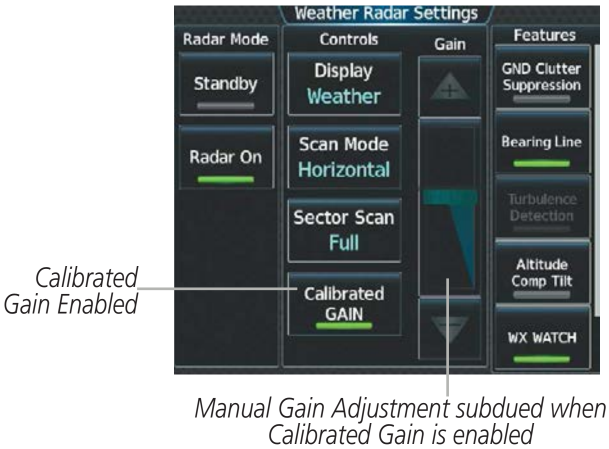
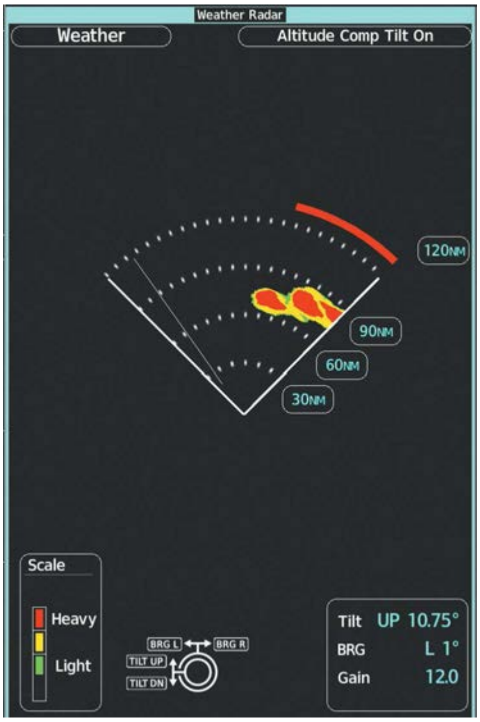


Figure 6-84 Calibrated Gain



Weather Radar Pane set Above Calibrated Gain Setting

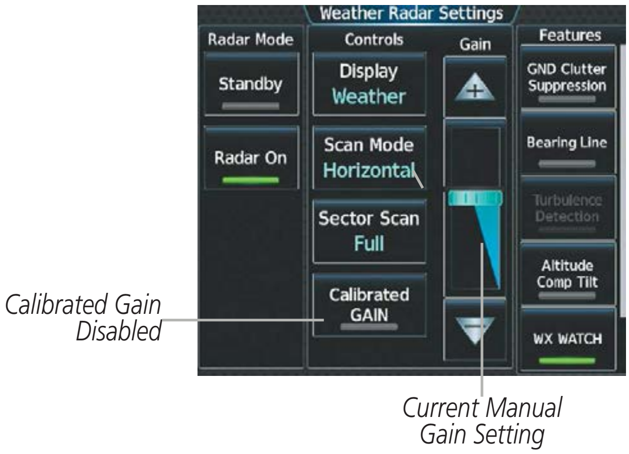


Figure 6-85 Manual Gain

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°, 90° scan, or touch the **FULL** Button to resume a 120° degree scan.
7) If desired, readjust the Bearing Line as discussed previously to change the center of the Sector Scan.
8) Press the upper knob again to remove the bearing selection function.

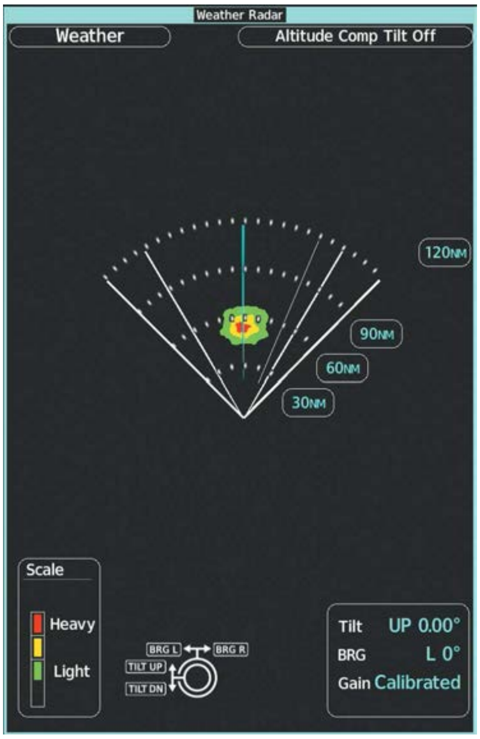


Figure 6-86 Weather Radar Pane on a 60 Degree Sector Scan

TURBULENCE DETECTION

***WARNING:** Do not rely only on the Turbulence Detection function for hazardous weather avoidance, or to maneuver in, near, or around areas of hazardous weather.*

The Turbulence Detection feature identifies areas of turbulence associated with precipitation using the color magenta during a horizontal scan. These magenta areas represent precipitation moving at a high rate of speed either toward or away from the radar antenna, using Doppler radar measurements. This feature cannot detect areas of Clear Air Turbulence.

The Turbulence Detection feature is only available in Weather Mode while a horizontal scan is selected. The system can detect turbulence up to 40 nm in front of the aircraft. At radar ranges of less than 200 nm, the system displays turbulence information when the feature is enabled. While Turbulence Detection is enabled, 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®)

WATCH® identifies deceptively strong or unknown intensity parts of a storm. While in horizontal scan mode, this feature can be used as a tool to determine areas of possible inaccuracies in displayed intensity due to weakening of the radar energy. This weakening is known as attenuation. The radar energy weakens as it passes through areas of intense precipitation, large areas of lesser precipitation, and distance. Issues with the radome attenuates the radar energy. All these factors have an effect on the return intensity. The more energy that dissipates, the lesser the displayed intensity of the return. Accuracy of the displayed intensity of returns located in the shaded areas are suspect. Make maneuvering decisions with this information in mind. Proper antenna tilt management should still be employed to determine the extent of attenuation in a shaded area.

***NOTE:** The WATCH feature is unavailable on the Navigation Map Pane.*

Enabling/Disabling WATCH display feature:

1) From MFD Home, touch **Weather > Weather Selection > WX RADAR > WX RADAR Settings**.
2) To activate or deactivate the WATCH feature, touch the **WX Watch** Button.

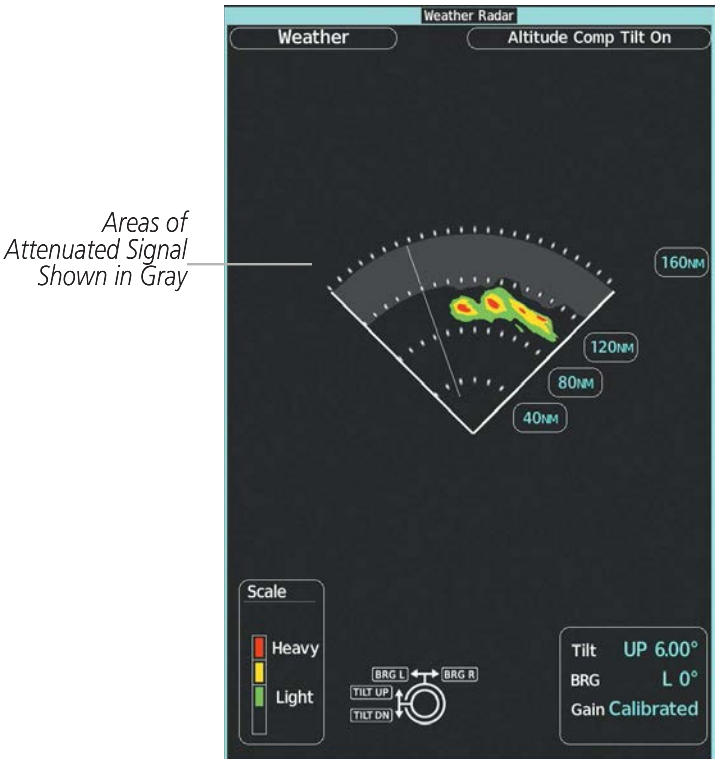


Figure 6-87 Horizontal Scan with WATCH® Enabled

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 ±10° 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.)

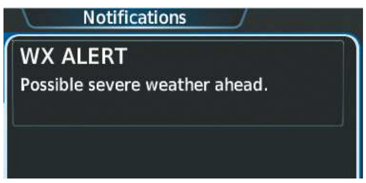


Figure 6-88 WX Alert System Message on the Notifications Screen

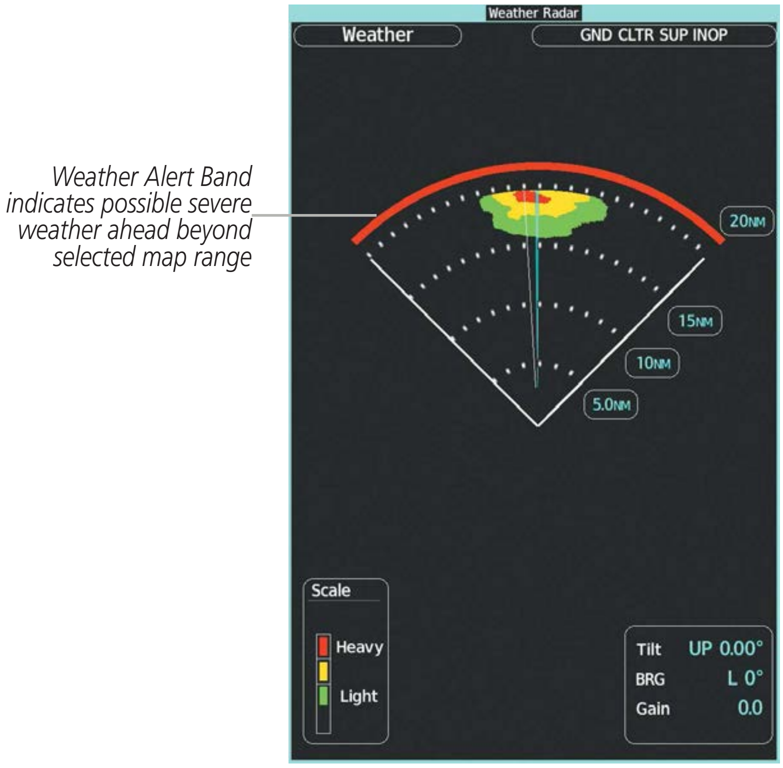


Figure 6-89 Horizontal Scan with WX Alert Enabled

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	> 0 dB to < 13 dB
Yellow	at least 13 dB to less than 21 dB
Magenta	at least 21 dB to less than 29 dB
Blue	29 dB and greater

Table 6-10 Ground Radar Return Intensity Levels

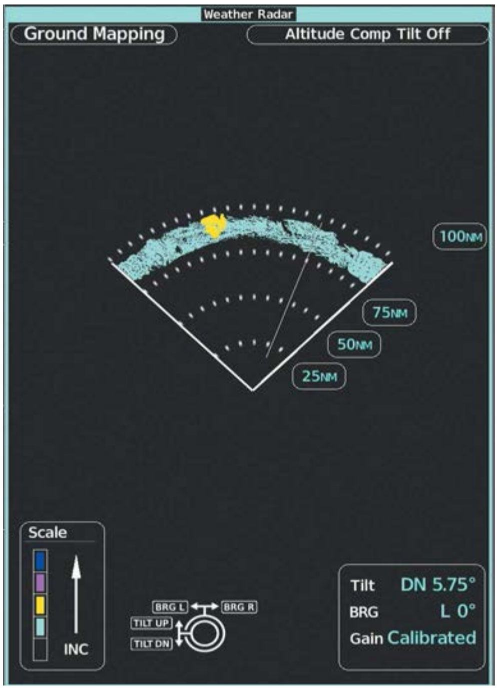


Figure 6-90 Weather Radar Pane with Ground Map Mode Enabled

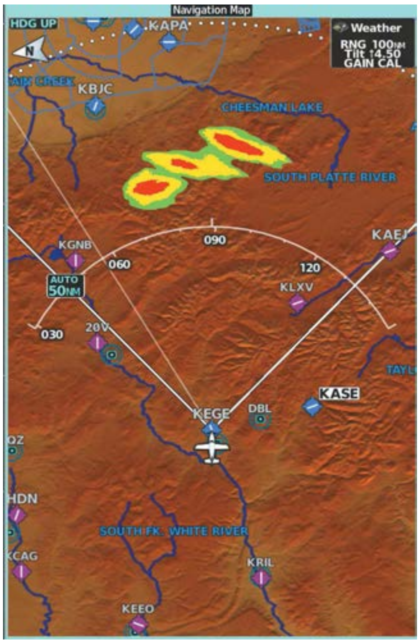
Operation in Ground Map Mode

1) From MFD Home, touch **Weather > Weather Selection > WX RADAR > WX RADAR Settings**.
2) Touch the **Display Mode** 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.

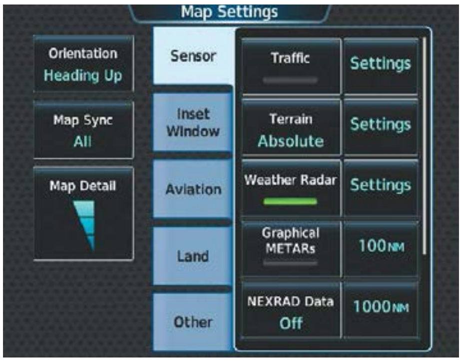
ADDITIONAL RADAR DISPLAYS

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.



Weather Radar information shown on the Navigation Map Pane



Map Settings Screen with Weather Radar on Navigation Maps Enabled

Weather Radar Settings for the Navigation Maps

Figure 6-91 Displaying Weather Radar Information on the Navigation Map Pane

Controlling the display of Weather Radar information on Navigation Map Panes:

1) From MFD Home, touch **Map** > **Map Selection** > **Map Settings**.

2) If necessary, touch the **Sensor** Tab.

3) Touch the **Weather Radar** Button to enable or disable the display of weather radar information on the selected navigation map pane.

4) To access controls for weather radar information on the Navigation Map Pane, touch the Weather Radar **Settings** Button.

Adjusting antenna tilt angle or radar bearing on the Navigation Map Pane:

1) With the airborne weather overlay enabled on the Navigation Map Pane, push the upper knob. The tilt and bearing legend appears in the lower-left corner of the maps. The Touchscreen Controller displays the Weather Radar Settings Screen.
2) To adjust radar bearing, turn the large upper knob. A dashed white bearing line appears during adjustment and momentarily after adjustment.
3) To increase antenna tilt angle, turn the small upper knob clockwise. To decrease antenna tilt angle, turn the small upper knob counter-clockwise.
4) When finished with these adjustments, push the upper knob. The Touchscreen Controller returns to the Map Settings Screen.

Enabling/disabling the weather radar map overlay on the HSI Map:

1) With the HSI Map enabled, press the **PFD Map Settings** Softkey.
2) Press the **Map Overlays** Softkey.
3) Press the **WX Overlay** Softkey as needed to cycle among the options (Off, SiriusXM) until 'WX Radar' appears on the softkey.

Selecting weather radar Standby or On Mode on the HSI Map:

1) With the weather radar overlay enabled on the HSI Map, press the **PFD Map Settings** Softkey.
2) Press the **WX Radar Controls** Softkey.
3) To select between 'Standby' or 'On' Modes, press the **Mode** Softkey.

Selecting weather radar Weather or Ground Mode on the HSI Map:

1) With the weather radar in the 'On' Mode on the HSI Map, press the **PFD Map Settings** Softkey.
2) Press the **WX Radar Controls** Softkey.
3) To select between 'Weather' and 'Ground' Modes, press the **Display** Softkey.

Adjusting the antenna tilt angle on the HSI Map:

1) With the weather radar in the 'On' Mode on the HSI Map, press the **PFD Map Settings** Softkey.
2) Press the **WX Radar Controls** Softkey.
3) 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 weather radar gain on the HSI Map:

1) With the weather radar in the 'On' Mode on the HSI Map, press the **PFD Map Settings** Softkey.
2) Press the **WX Radar Controls** Softkey.
3) Press the **Gain / More** Softkey.
4) Press the **Gain +** or **Gain -** Softkeys to adjust the gain setting. Each softkey press adjusts the gain in 0.5 increments.

Enabling/disabling Altitude Compensated Tilt or Antenna Stabilization on the HSI Map:

1) With the weather radar in the 'On' Mode on the HSI Map, press the **PFD Map Settings** Softkey.
2) Press the **WX Radar Controls** Softkey.
3) Press the **Gain / More** Softkey.
4) Press the **Features** Softkey.
5) Press the **Altitude COMP Tilt** Softkey to enable/disable the **Altitude Compensated Tilt** feature.
6) Press the **Stabilizer** Softkey to enable/disable the antenna tilt stabilization feature.

The weather radar mode, range, antenna tilt angle setting, and gain setting appear for 3 seconds on the HSI map during radar adjustments performed with the knobs on the Touchscreen Controller. If preferred, the pilot can also show this information on the HSI Map whenever the Weather Legend Button is enabled and the weather radar information is within maximum display range setting limits.

Displaying the weather radar status window on the HSI Map:

1) From PFD Home, touch **PFD Map Settings**.
2) Touch the **Weather Legend** Button.

SYSTEM STATUS

The system displays the radar mode annunciation in the upper left corner of the Weather Radar Pane. Additional information may be displayed in the center of the Weather Radar Pane as a center banner annunciation. Refer to the following tables for a list of annunciations and their locations for airborne weather radar.

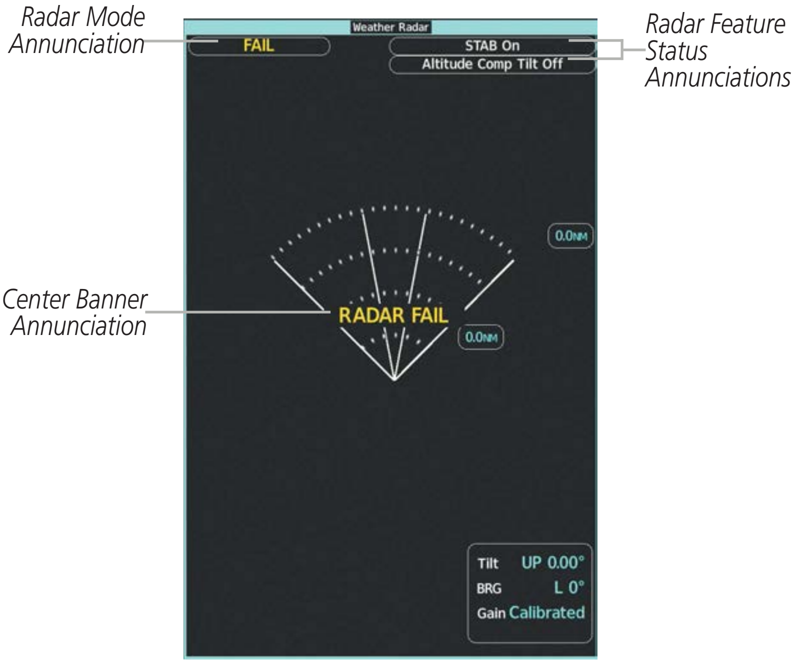


Figure 6-92 Radar System Status Indications on Weather Radar Pane

Radar Mode	Radar Mode Annunciation Box	Center Banner Annunciation
Standby	STANDBY	STANDBY
Weather	WEATHER	None
Ground Mapping	GROUND	None
Off	OFF	OFF
Radar Failed*	FAIL	RADAR FAIL
** See Table 6-13 for additional failure annunciations*		

Table 6-11 Radar Modes on the Weather Radar Pane

The system displays the status of the weather radar features in the upper-right corner of the Weather Radar Pane.

Radar Feature Status	Description
STAB INOP	The radar is not receiving pitch and roll information. The antenna stabilization feature is inoperative.
ALTITUDE COMP TILT ON	The altitude-compensated tilt feature is selected on.
ALTITUDE COMP TILT OFF	The altitude-compensated tilt feature is selected off.
GND CLTR SUPPRESS ON	The ground clutter suppression feature is selected on.
GND CLTR SUPPRESS OFF	The ground clutter suppression feature is selected off.
GND CLTR SUPPRESS INACTIVE	The ground clutter suppression feature is enabled, but the radar is in a mode which cannot support ground clutter suppression (e.g. vertical scan or sector scan).
GND CLTR SUPPRESS UNAVAILABLE	The radar is missing data needed to suppress ground clutter.
TURB DETECTION ON	The turbulence detection feature is selected on.
TURB DETECTION OFF	The turbulence detection feature is selected off.
TURB DETECTION INACTIVE	Turbulence detection is inactive when map range is greater than 160 nm, or radar is in a mode which cannot support turbulence detection.
TURB DETECTION UNAVAILABLE	The radar is missing data needed to detect turbulence.

Table 6-12 Radar Feature Status Annunciations on the Weather Radar Pane

If the radar unit fails, an annunciation as to the cause of the failure is shown as a banner in the center of the Weather Radar Pane.

Weather Radar Pane Center Banner Annunciation	Description
BAD CONFIG	The radar configuration is invalid. The radar should be serviced.
RDR FAULT	The radar unit is reporting a fault. The radar should be serviced.
RADAR FAIL	The system is not receiving valid data from the radar unit. The system should be serviced.

Table 6-13 Abnormal Radar Status Annunciations on the Weather Radar Pane

6.4 VERTICAL SITUATION DISPLAY TERRAIN

The system offers a Vertical Situation Display (VSD), which includes a profile of terrain and obstacles in an inset window. Although the VSD does not display Terrain SVT or TAWS alerts and potential impact areas, the VSD does use many of the same colors and symbols as TAWS to depict relative terrain and obstacles within the VSD. Refer to the Terrain SVT or TAWS discussions for more information about relative terrain and obstacle color correlation and symbols.

VSD INSET WINDOW

NOTE: *Wire obstacles are not available for display inside the VSD Inset Window.*

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.

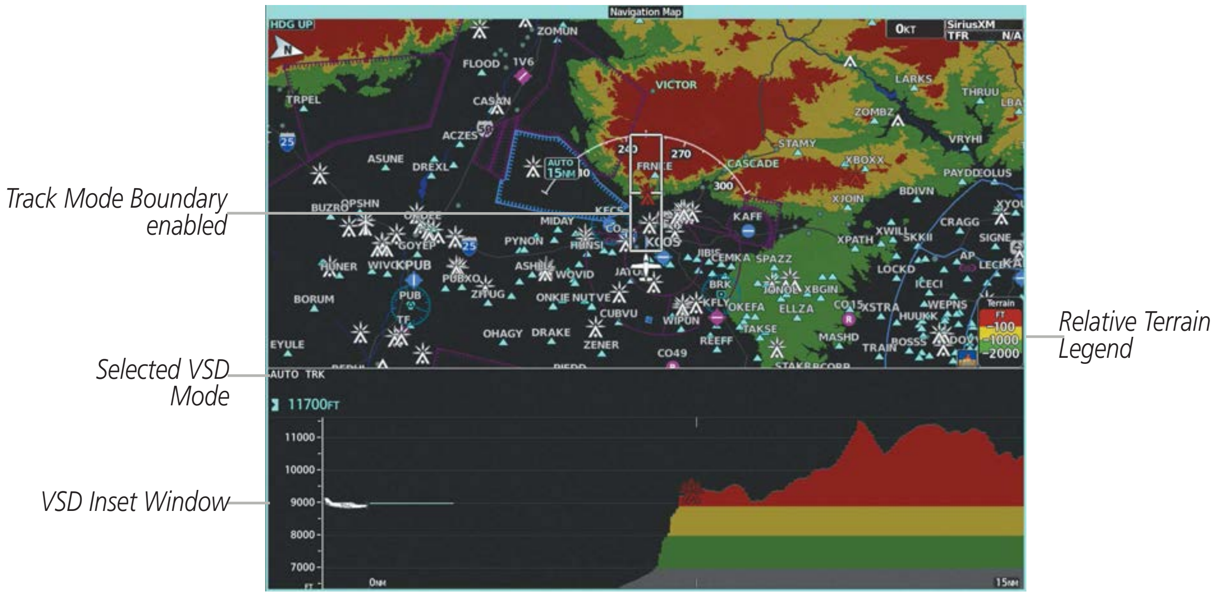


Figure 6-93 Navigation Map Pane with VSD Inset Window and Relative Terrain Enabled

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.

***NOTE:** Only one inset window may be shown per display pane. If another inset window is selected, it replaces the previously selected inset window.*

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.

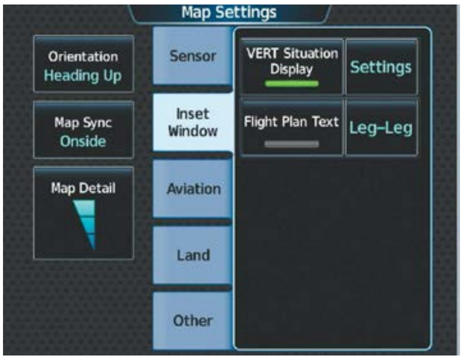


Figure 6-94 Enabling Vertical Situation Display Inset Window on the Map Settings Screen

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.

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.

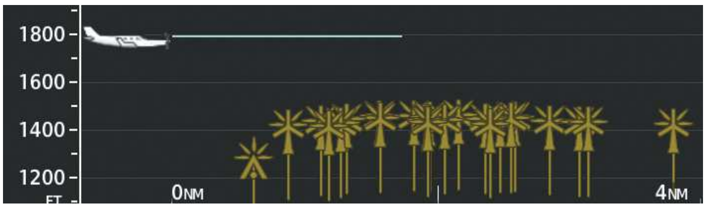


Figure 6-97 Lines raise obstacle symbols to their heights AGL along the altitude scale, if necessary

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 89º North latitude and south of 89º South latitude. This is due to limitations present within the Terrain database and the system's ability to process the data representing the affected areas.*

***NOTE:** Terrain and obstacle alerting requires the Terrain-SVT or TAWS-B option.*

The terrain system increases situational awareness and aids in reducing controlled flight into terrain (CFIT) and obstacles.

One of the following terrain systems is installed on this aircraft:

- Terrain-SVT (included with the Garmin SVT option when the Terrain Awareness and Warning System Class-B (TAWS-B) is not installed; refer to the Flight Instruments section for more information about Garmin SVT.)
- TAWS-B (optional)

The installed terrain system provides color indications on map displays when terrain or obstacles, including certain power lines, are within a certain altitude threshold from the aircraft. Terrain-SVT and TAWS-B furthermore provide advisory visual annunciations and voice alerts to indicate the presence of threatening terrain or obstacles relevant to the projected flight path. Compared to Terrain-SVT alerting, TAWS-B uses more sophisticated algorithms to assess aircraft distance from terrain and obstacles. The TAWS-B system includes more alerting capabilities than the Terrain-SVT system.

The terrain system requires the following for proper operation:

- Valid 3-D GPS position
- Valid terrain and obstacle databases

The terrain system uses terrain and obstacle information supplied by government and other sources. Terrain information is based on terrain elevation information in a database that may contain inaccuracies. Individual obstructions, such as towers or power lines, may be shown if available in the database. Garmin verifies the data to confirm accuracy of the content. However, the displayed information should never be understood as being all-inclusive and data may still contain inaccuracies.

The terrain system uses information provided from the GPS receiver to provide a horizontal position and altitude. GPS altitude is derived from satellite measurements. GPS altitude is then converted to the height above geodetic sea level (GSL), which is the height above mean sea level (MSL) calculated geometrically. The system uses GSL altitude to 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

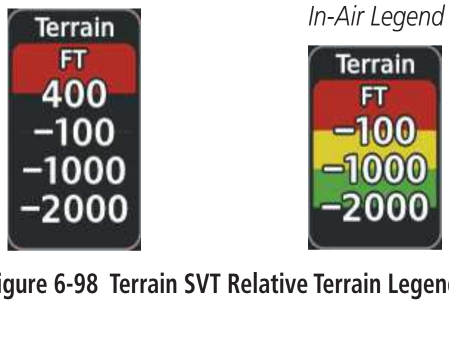


Figure 6-98 Terrain SVT Relative Terrain Legends

The following figure shows relative terrain coloring for the Terrain-SVT and TAWS-B systems.

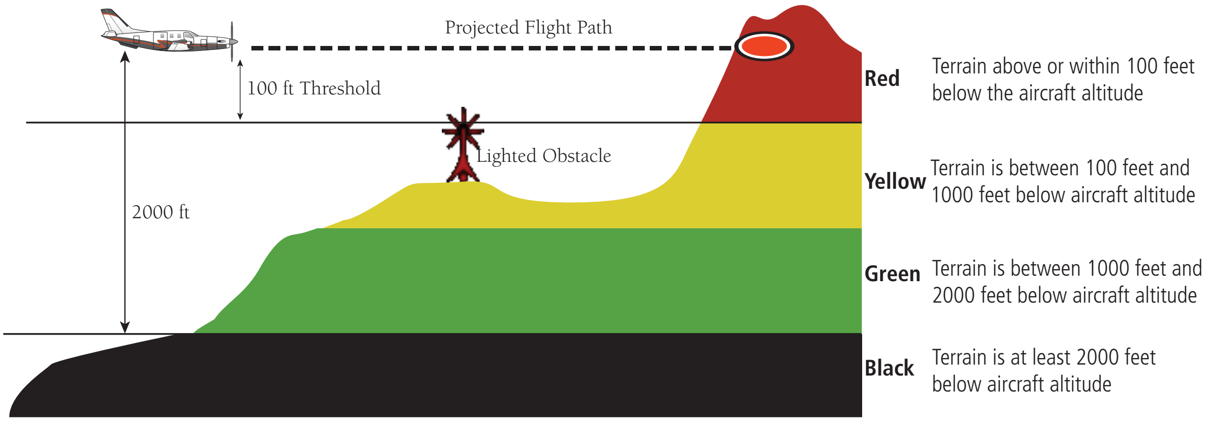


Figure 6-99 In-Air Terrain Altitude/Color Correlation for Terrain-SVT or TAWS-B

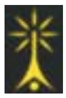
Unlighted Obstacle		Lighted Obstacle		Obstacle Location
< 1000' AGL	> 1000' AGL	< 1000' AGL	> 1000' AGL	
				Red obstacle is above or within 100 ft below the aircraft altitude
				Yellow obstacle is between 100 ft and 1000 ft below the aircraft altitude
				White obstacle is more than 1000 ft below aircraft altitude

Table 6-14 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 6-15 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 PULL UP Terrain-SVT Warning TERRAIN
 or 	Caution	TERRAIN

Table 6-16 Terrain-SVT and TAWS-B Potential Impact Area with Annunciations

TERRAIN PANE

The Terrain-SVT/TAWS Pane is specialized to show terrain, and obstacle in relation to the aircraft's current altitude, without clutter from the basemap. This pane is the principal page for viewing terrain information. Aviation data (airports, VORs, and other NAVAIDs) can be enabled for reference.

For Terrain-SVT and TAWS-B systems only, this pane also shows potential impact areas. If terrain or obstacles (including wire obstacles) and the projected flight path of the aircraft intersect, the display automatically adjusts to a map range if necessary to emphasize the display of the potential impact area.

Aircraft orientation on this map is always heading up unless there is no valid heading, in which case the orientation is track up. Map range is adjustable with the **Joystick** from 250 feet to 1000 nm, which is indicated on the map range arc.

The Terrain SVT Pane also displays annunciations in the lower-left corner of the pane, in addition to banner annunciations in the center of the pane.

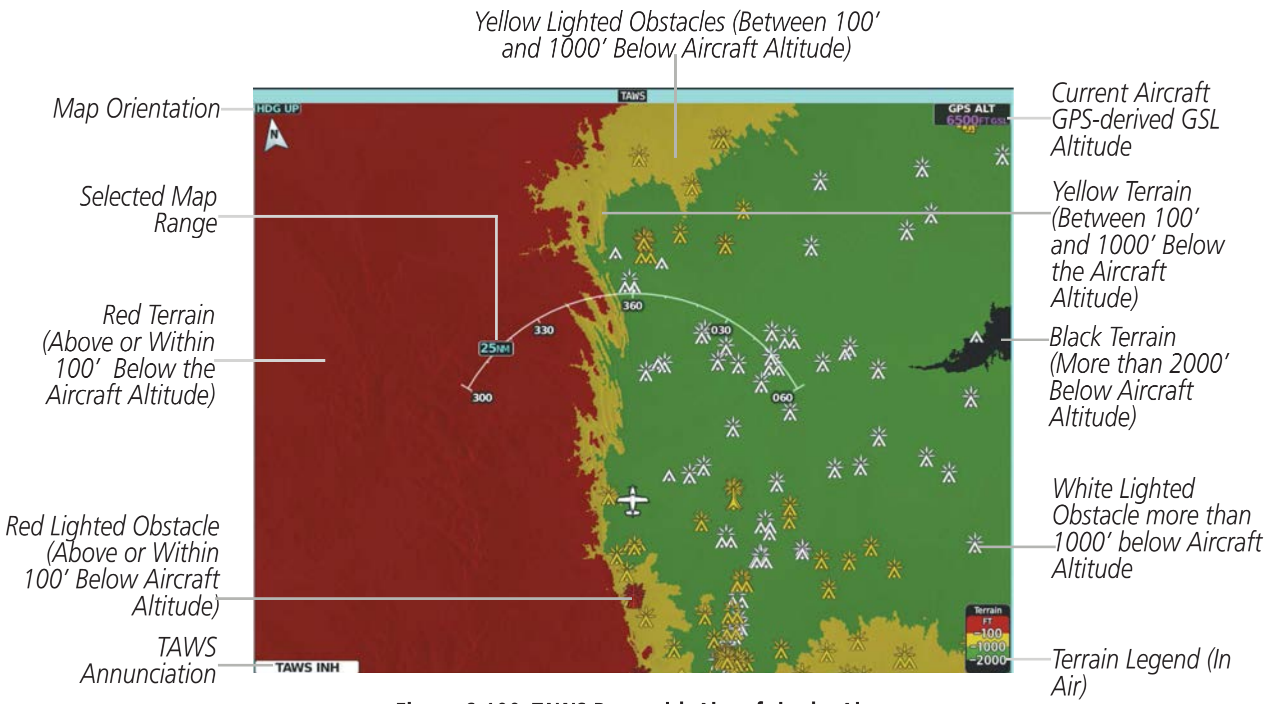


Figure 6-100 TAWS Pane with Aircraft in the Air

Figure 6-101 TAWS Settings Screen

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 the **Show Aviation Data** Button to enable/disable aviation information (airports, VORs, NDBs, Intersections) for the terrain pane.

RELATIVE TERRAIN MAP OVERLAYS

The Terrain Proximity/Terrain-SVT/TAWS Pane is the principal map page for viewing terrain information. Relative terrain information is also available for display on navigation maps.

Controlling Relative Terrain Information (Navigation Map Panes):

1) From MFD Home, touch **Map** > **Map Selection** > **Map Settings**.
2) If necessary, touch the **Sensor** Tab.
3) Touch the **Terrain** Button.
4) Touch the **Relative** Button to enable Relative Terrain, or **Off** to remove terrain information.

Controlling Relative Terrain Information (Inset and HSI Map):

1) From PFD Home, touch **PFD Map Settings**.
2) If the Inset Map or HSI Map is not presently shown on the PFD, do the following:
   a) Touch the **Layout** Button.
   b) Touch the **Inset Map** Button to display the Inset Map, or touch the **HSI Map** Button to display the HSI Map.
3) Touch the **Terrain** Button.
4) Touch the **Relative** Button to enable Relative Terrain, or **Off** to remove terrain information.

When relative terrain information is enabled on the 'Navigation Map' Pane or dedicated terrain pane, a relative terrain legend appears. A relative terrain overlay enabled icon also appears on navigation maps with the exception of the HSI Map.

The 'Map Settings' Screen provides a means for enabling/disabling the display of relative terrain, point obstacles (such as towers), and wire obstacles (such as power lines). The 'Map Settings' Screen also controls the map range settings above which terrain and obstacle data are decluttered from the display. If a map range larger than the map range setting is selected, the data is removed from the map.

The pilot can display relative terrain information independently of point or wire obstacle information; however, obstacles for which Terrain-SVT or TAWS-B warnings and cautions are issued are shown when terrain is selected for display and the map range is within the setting limit.

Maps besides the terrain pane use settings based on those selected for the Navigation Map Page. The maximum display ranges for obstacles on each map are dependent on the range setting made for the 'Navigation Map' Pane.

Customizing terrain and obstacle display on the 'Navigation Map' Pane:

1) From MFD Home, touch **Map** > **Map Selection** > **Map Settings**.
2) If necessary, touch the **Sensor** Tab.
3) Touch the **Terrain Settings** Button.
4) Touch the **Map Settings** Button.

5) The **Terrain** Button displays the maximum navigation map range to show relative terrain information in cyan. To change this value, touch the **Terrain** Button.

6) Scroll as needed, and touch a maximum navigation map range to display relative terrain information.

7) Touch the **Back** Button twice to return to the 'Map Settings' Screen.

8) Touch the **Land** Tab.

9) Touch the **Point Obstacle** Button to enable/disable the display of point obstacles on navigation maps.

10) The Point Obstacle Range Button displays the maximum map range to show point obstacles in cyan. Touch this button to change the value.

11) Scroll as needed, and touch a maximum navigation map range to display point obstacle information.

12) 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 ALERTING DISPLAYS

The system issues alerts when flight conditions meet parameters that are set within Terrain-SVT or TAWS-B software algorithms. The system issues terrain/obstacle alerts as a caution or warning severity level. Alerts include visual annunciations and voice alerts .

When the system issues an alert, annunciations appear on the PFDs, the 'Terrain-SVT' Pane or 'TAWS' Pane, and on the Touchscreen Controllers. The PFD shows the annunciation to the left of the altitude tape. The Terrain-SVT or TAWS Pane shows the annunciation in the lower-left corner of the pane. In addition, a pop-up alert appears on each Touchscreen Controller. To respond to the pop-up alert, do one of the following on either Touchscreen Controller:

- Touch the **Terrain-SVT** or **TAWS** Button to the terrain pane and terrain settings screen.
- Touch the **OK** Button to remove the pop-up alert.
- Touch the **Inhibit Terrain** or **Inhibit TAWS** Button to inhibit the terrain system from issuing alerts.

Figure 6-102 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)	TERRAIN	WARNING - TERRAIN	"Warning; Terrain, Terrain"
Imminent Terrain Impact Warning (ITI)	TERRAIN	WARNING - TERRAIN	"Warning; Terrain, Terrain"
Reduced Required Obstacle Clearance Warning (ROC)	TERRAIN	WARNING - OBSTACLE	"Warning; Obstacle, Obstacle"
Imminent Obstacle Impact Warning (IOI)	TERRAIN	WARNING - OBSTACLE	"Warning; Obstacle, Obstacle"
Reduced Required Terrain Clearance Caution (RTC)	TERRAIN	CAUTION - TERRAIN	"Caution; Terrain, Terrain"
Imminent Terrain Impact Caution (ITI)	TERRAIN	CAUTION - TERRAIN	"Caution; Terrain, Terrain"
Reduced Required Obstacle Clearance Caution (ROC)	TERRAIN	CAUTION - OBSTACLE	"Caution; Obstacle, Obstacle"
Imminent Obstacle Impact Caution (IOI)	TERRAIN	CAUTION - OBSTACLE	"Caution; Obstacle, Obstacle"

Table 6-17 Terrain SVT Alerts Summary

The following table lists the TAWS-B alerts.

Alert Type	PFD/ TAWS Pane Annunciation	Touchscreen Controller Pop-Up Alert	Voice Alerts
Excessive Descent Rate Warning (EDR)	PULL UP	PULL-UP	"Pull Up"
Reduced Required Terrain Clearance Warning (RTC)	PULL UP	TERRAIN - PULL-UP * or TERRAIN AHEAD - PULL-UP	"Terrain, Terrain; Pull Up, Pull Up" * or "Terrain Ahead, Pull Up; Terrain Ahead, Pull Up"
Imminent Terrain Impact Warning (ITI)	PULL UP	TERRAIN - PULL-UP or TERRAIN AHEAD - PULL-UP *	"Terrain, Terrain; Pull Up, Pull Up" or "Terrain Ahead, Pull Up; Terrain Ahead, Pull Up" *
Reduced Required Obstacle Clearance Warning (ROC)	PULL UP	OBSTACLE - PULL-UP * or OBSTACLE AHEAD - PULL-UP	"Obstacle, Obstacle; Pull Up, Pull Up" * or "Obstacle Ahead, Pull Up; Obstacle Ahead, Pull Up"
Imminent Obstacle Impact Warning (IOI)	PULL UP	OBSTACLE - PULL-UP or OBSTACLE AHEAD - PULL-UP *	"Obstacle, Obstacle; Pull Up, Pull Up" or "Obstacle Ahead, Pull Up; Obstacle Ahead, Pull Up" *
Reduced Required Terrain Clearance Caution (RTC)	TERRAIN	CAUTION - TERRAIN or TERRAIN AHEAD	"Caution, Terrain; Caution, Terrain" * or "Terrain Ahead; Terrain Ahead"

Alert Type	PFD/ TAWS Pane Annunciation	Touchscreen Controller Pop-Up Alert	Voice Alerts
Imminent Terrain Impact Caution (ITI)	TERRAIN	CAUTION - TERRAIN or TERRAIN AHEAD *	"Caution, Terrain; Caution, Terrain" or "Terrain Ahead; Terrain Ahead" *
Reduced Required Obstacle Clearance Caution (ROC)	TERRAIN	CAUTION - OBSTACLE * or OBSTACLE AHEAD	"Caution, Obstacle; Caution, Obstacle" * or "Obstacle Ahead; Obstacle Ahead"
Imminent Obstacle Impact Caution (IOI)	TERRAIN	CAUTION - OBSTACLE or OBSTACLE AHEAD *	"Caution, Obstacle; Caution, Obstacle" or "Obstacle Ahead; Obstacle Ahead" *
Premature Descent Alert Caution (PDA)	TERRAIN	TOO LOW - TERRAIN	"Too Low, Terrain"
Altitude Callout "500"	None	None	"Five-Hundred"
Excessive Descent Rate Caution (EDR)	TERRAIN	SINK RATE	"Sink Rate"
Negative Climb Rate Caution (NCR)	TERRAIN	DONT SINK * or TOO LOW - TERRAIN	"Don't Sink" * or "Too Low, Terrain"

* *Alerts with multiple messages are configurable at installation and are installation-dependent. Alerts for the default configuration when more than one option is available are indicated with asterisks.*

Table 6-18 TAWS-B Alerts Summary

FORWARD LOOKING TERRAIN AVOIDANCE

The Forward Looking Terrain Avoidance (FLTA) feature of Terrain-SVT or TAWS-B compares the projected flight path as derived from GPS data with terrain features and obstacles from the terrain and obstacle databases. The system issues FLTA alerts when the projected flight path conflicts with terrain or obstacles.

The projected flight path is a calculated area ahead of, to the sides, and below the aircraft. The size of the projected flight path varies based on factors including ground speed (the path ahead is larger when the ground speed is higher), whether the aircraft is level, turning, or descending, and the proximity to the nearest usable runway along the current track. As the aircraft approaches the runway, the projected flight path becomes narrower until the system automatically disables FLTA alerts or the flight crew manually inhibits them.

There are two types of FLTA alerts, Reduced Required Terrain/Obstacle Clearance (RTC or ROC respectively) and Imminent Terrain/Obstacle Impact (ITI or IOI respectively).

The system issues Reduced Required Terrain Clearance (RTC) and Reduced Required Obstacle Clearance (ROC) alerts when the aircraft flight path is above terrain, yet is projected to come within the minimum clearance values in the following figure. When an RTC alert is issued, the system displays a potential impact area on navigation maps and the Terrain SVT Pane.

Imminent Terrain Impact (ITI) and Imminent Obstacle Impact (IOI) alerts occur when the aircraft is below the elevation of a terrain or obstacle in the aircraft's projected path. ITI and IOI alerts are accompanied by a potential impact area on navigation maps and the Terrain SVT Pane. The alert occurs when the projected vertical flight path is calculated to come within minimum clearance altitudes in the following figure.

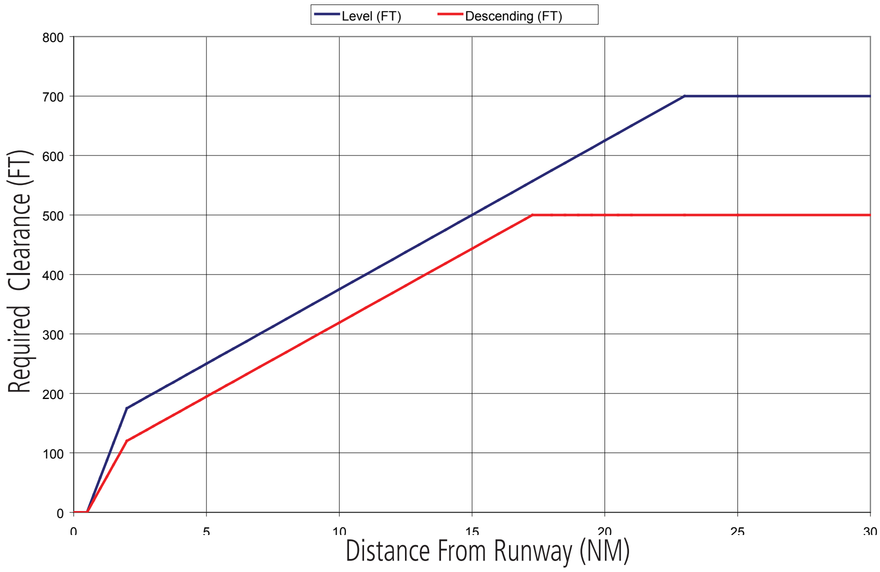


Figure 6-103 FLTA Alert Minimum Terrain and Obstacle Clearance Values

The system automatically inhibits FLTA alerts when the aircraft is less than 200 feet above the destination runway elevation while within 0.5 nm of the approach runway or the aircraft is between runway ends.

INHIBITING FLTA AND PDA ALERTS

The flight crew can manually inhibit FLTA and PDA visual annunciations and voice alerts. Discretion should be used when inhibiting alerts and the system should be enabled when appropriate. When PDA and FLTA alerts are inhibited, the system status annunciation 'TAWS INH' appears on the TAWS Pane and on the PFD.

***NOTE:** Inhibiting TAWS alerts inhibits FLTA and PDA alerts only. EDR and VCO alerts remain enabled even when TAWS is inhibited.*

Figure 6-104 Alerting is Inhibited when Annunciation is displayed

Inhibiting/enabling Terrain SVT alerting:

1) From MFD **Home**, touch **Terrain SVT** > **Terrain SVT Settings**.

   Or:

   a) From MFD Home, touch **Map > Map Selection > Map Settings**.

   b) If necessary, touch the **Sensor** Tab.

   c) Touch the Terrain **Settings** Button.

   Or:

   a) From PFD Home, touch **Inset Map Settings**.

   b) If necessary, touch the **HSI Map** or **Inset Map** button to enable the Overlays buttons.

   c) Touch the Terrain **Settings** Button.

2) Touch the **Terrain Inhibit** Button. When the annunciator on the button is green, Terrain SVT alerting is inhibited. When the annunciator is gray, Terrain SVT alerting is enabled.

Inhibiting Terrain SVT alerting while an alert is occurring:

Touch the **Inhibit Terrain** Button on the Terrain SVT pop-up window.

Inhibiting/enabling TAWS-B FLTA and PDA alerting:

1) From MFD Home, touch **TAWS > TAWS Settings**.

2) Touch the **TAWS Inhibit** Button. When the annunciator on the button is green, TAWS-B alerting is inhibited. When the button annunciator is gray, TAWS-B alerting is enabled.

   Or:

1) From MFD Home, touch **Map > Map Selection > Map Settings**.

2) If necessary, touch the **Sensor** Tab.

3) Touch the Terrain **Settings** Button.

4) Touch the **TAWS Inhibit** Button. TAWS-B alerting is inhibited when the button annunciator is green, enabled when gray.

   Or:

1) From PFD Home, touch **PFD Map Settings**.

2) Touch the Terrain **Settings** Button in the Overlays Window.

3) Touch the **TAWS Inhibit** Button.

Inhibiting TAWS-B alerting while an alert is occurring:

1) Touch the **Inhibit TAWS** Button on the Terrain Alert pop-up window on the Touchscreen Controller.

2) Touch the **OK** Button to confirm and inhibit TAWS or touch the **Cancel** Button to return to the previous screen or Terrain Alert pop-up window.

While Terrain alerting is manually inhibited (or the TAWS system is not available or has failed), the system may display a 'LOW ALT' annunciation on the PFD next to the altitude tape if the following conditions are met:

- The aircraft is on an SBAS approach.
- The Final Approach Fix is the active waypoint.
- The aircraft is at least 164 feet below the prescribed altitude at the Final Approach Fix.

See the Flight Instruments Section for more details about the 'LOW ALT' annunciation.

ADDITIONAL TAWS-B ALERTING

In addition to the FLTA alerting discussed previously, TAWS-B provides the following additional types of alerts.

EXCESSIVE DESCENT RATE ALERT

The purpose of the **Excessive Descent Rate (EDR)** alert is to provide notification when the aircraft is determined to be closing (descending) upon terrain a rate that is calculated to be excessive relative to height above terrain.

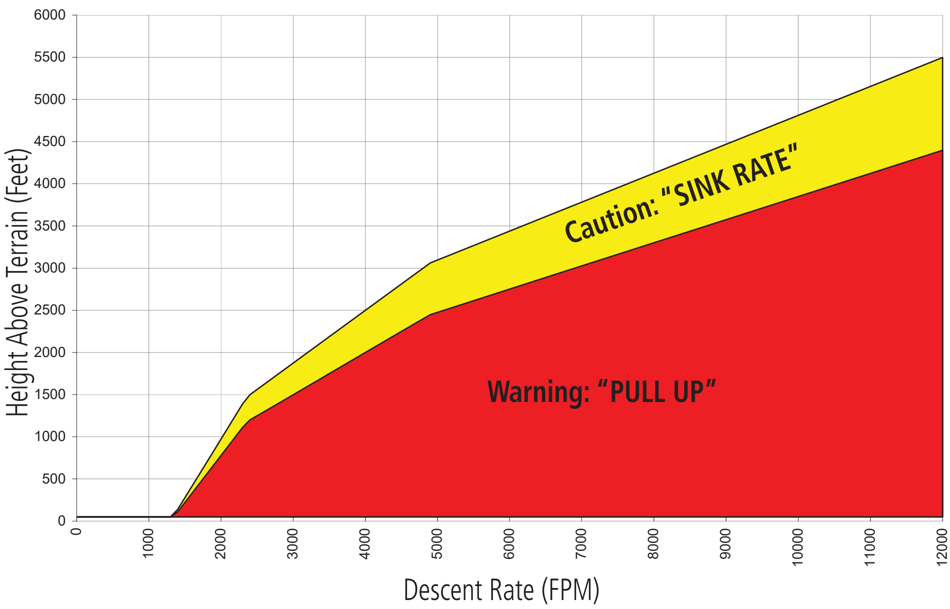


Figure 6-105 Excessive Descent Rate Alert Criteria

PREMATURE DESCENT ALERTING

A **Premature Descent Alert (PDA)** is issued when the system detects that the aircraft is significantly below the normal approach path to a runway.

PDA alerting begins when the aircraft is below 700 feet AGL within 15 nm of the destination airport and ends when the aircraft is 0.5 nm from the runway threshold.

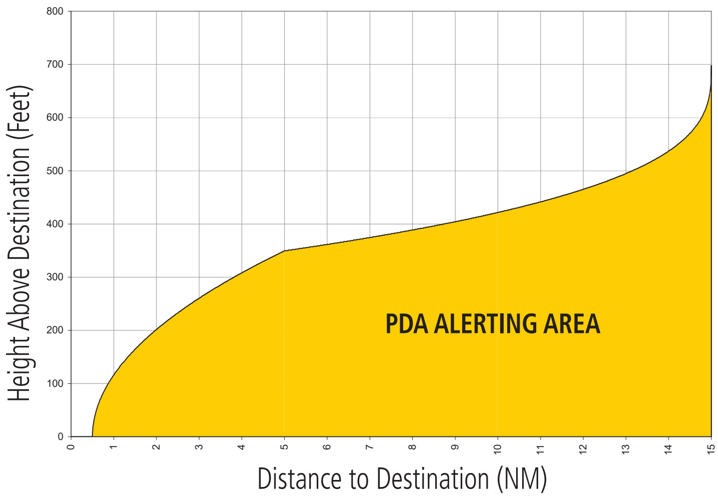


Figure 6-106 PDA Alerting Threshold

NEGATIVE CLIMB RATE AFTER TAKEOFF ALERT (NCR)

The **Negative Climb Rate (NCR) After Takeoff** alert (also referred to as "Altitude Loss After Takeoff") provides alerts when the system determines the aircraft is losing altitude (closing upon terrain) after takeoff. The voice alert ***"Don't Sink"*** is given for NCR alerts, accompanied by visual annunciations. NCR alerting is only active when departing from an airport and when the following conditions are met:

- Height above the terrain is less than 700 feet
- Distance from the departure airport is 5 nm or less
- Heading change from the departure heading is less than 110 degrees
- NCR alerts can be triggered by either altitude loss or sink rate.

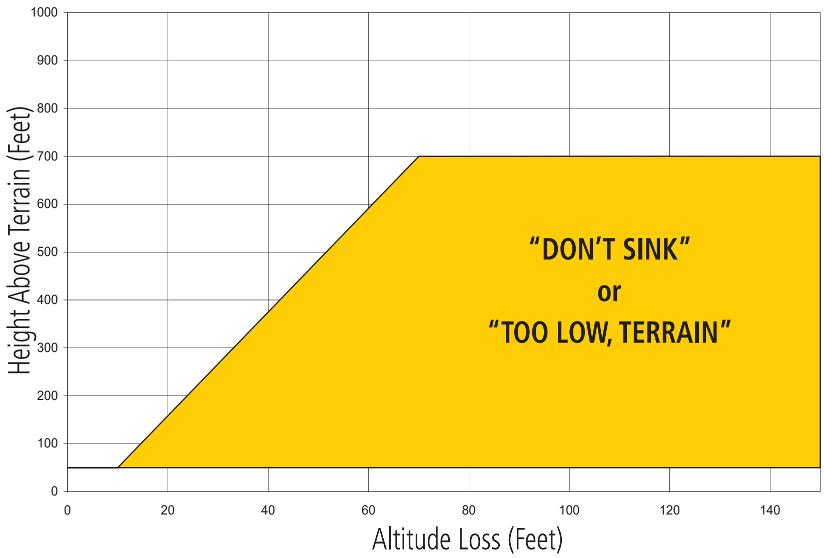


Figure 6-107 Negative Climb Rate (NCR) Altitude Loss

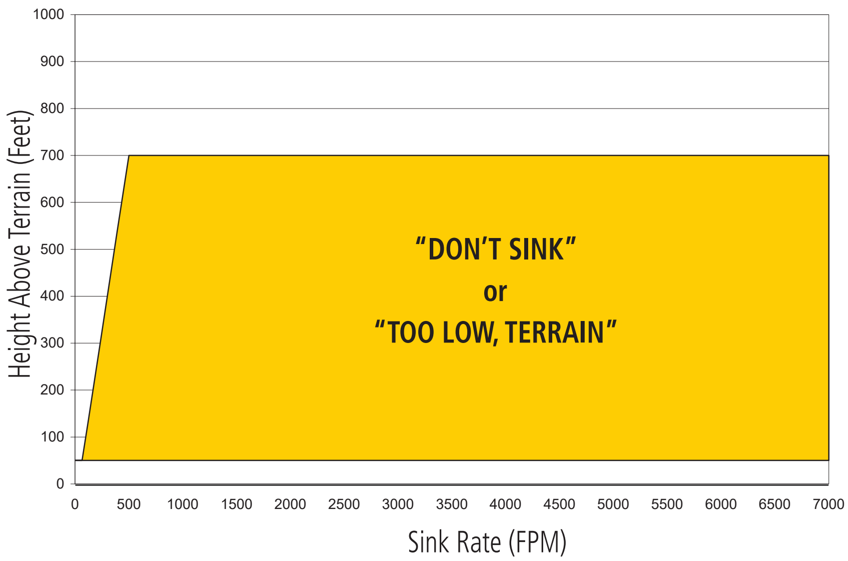


Figure 6-108 Negative Climb Rate (NCR) Sink Rate

FIVE-HUNDRED VOICE ALERT

The purpose of the TAWS-B ***"Five-hundred"*** voice alert is to provide an advisory alert of when the aircraft descends to within 500 feet above the terrain or runway threshold. When the aircraft is within 5 nm of an airport, the ***"Five Hundred"*** voice alert is based on the nearest runway threshold elevation. When the aircraft is more than 5 nm of the nearest airport, the ***"Five Hundred"*** voice alert is based on the height above terrain (as determined by the GPS altitude and Terrain Database).

There are no display annunciations or pop-up alerts that accompany the VCO alert. This voice alert cannot be inhibited.

SYSTEM STATUS

TERRAIN-SVT

At the beginning of an avionics power cycle, Terrain-SVT conducts a self-test of its visual annunciations and voice alerts. A voice alert is issued at test completion.

Terrain-SVT continually monitors several system-critical items such as database validity, hardware status, and FMS (GPS) status. If the terrain/obstacle database is not available, the system issues the voice alert ***"Terrain System Failure"*** along with the 'TER FAIL' alert annunciation.

Terrain-SVT requires a 3-D FMS navigation solution along with specific vertical accuracy minimums. Should the navigation solution become degraded or if the aircraft is out of the database coverage area, the annunciation 'TER N/A' appears on the PFDs and on the 'Terrain-SVT' Pane. The voice alert ***"Terrain System Not Available"*** is generated. When sufficient GPS signal is returns and the aircraft is within the database coverage area, the voice alert "***Terrain System Available***" is generated.

Alert Type	PFD/Terrain SVT Display Annunciation	Terrain SVT Display Center Banner Annunciation	Voice Alert
System Test in Progress	TER TEST	TERRAIN TEST	None
System Test Pass	None	None	"Terrain System Test OK"
Terrain Alerting Inhibited	TER INH	None	None
No FMS position	TER N/A	NO GPS POSITION	"Terrain System Not Available"*
Excessively degraded GPS signal; or Out of database coverage area	TER N/A	None	"Terrain System Not Available"*
Terrain System Test Fail; Terrain or Obstacle database unavailable or invalid; Invalid software configuration; or System audio fault	TER FAIL	TERRAIN FAIL	"Terrain System Failure"
MFD Terrain or Obstacle database unavailable or invalid, and Terrain SVT operating with PFD Terrain or Obstacle databases	None	TERRAIN DATABASE FAILURE	None

** "Terrain System Available" will be heard when sufficient GPS signal is received, or terrain database coverage area re-entered.*

Table 6-19 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	TAWS FAIL	TAWS FAIL	"TAWS System Failure"
TAWS Not Available	TAWS N/A	NO GPS POSITION (if GPS position lost)	"TAWS Not Available"
TAWS Available	None	None	"TAWS Available"
System Test in progress	TAWS TEST	TAWS TEST	None
TAWS System Test pass	None	None	"TAWS System Test OK"
TAWS PDA/FLTA Alerting Inhibited	TAWS INH	None	None

Table 6-20 TAWS-B System Test Status Annunciations

TAWS-B ABNORMAL OPERATIONS

TAWS-B continually monitors several system-critical items such as database validity and GPS status.

If no PFD or MFD contains Terrain, Airport Terrain, and Obstacle databases (or the databases are invalid), the voice alert ***"TAWS System Failure"*** is generated along with the 'TAWS FAIL' alert annunciation.

TAWS-B requires a 3-D GPS navigation solution along with specific vertical accuracy minimums. Should the navigation solution become degraded or if the aircraft is out of the database coverage area, the annunciation 'TAWS N/A' appears on the TAWS Pane and the PFD. The voice alert ***"TAWS Not Available"*** is also generated if airborne. When the GPS signal is re-established and the aircraft is within the database coverage area, the system issues a "TAWS Available" voice alert.

Alert Cause	TAWS Pane Annunciation(s)	TAWS Alert Types Not Available
TAWS System Test Fail; Terrain, Airport Terrain or Obstacle database unavailable or invalid on all displays; software mismatch among displays; TAWS audio fault	TAWS FAIL and TAWS FAIL	FLTA, PDA
MFD Terrain or Obstacle database unavailable or invalid. TAWS operating with PFD Terrain or Obstacle databases	TERRAIN DATABASE FAILURE	
No GPS position	TAWS N/A and NO FMS POSITION	FLTA, PDA, VCO
Excessively degraded GPS signal, or out of database coverage area	TAWS N/A	FLTA, PDA

Table 6-21 TAWS-B Abnormal Status Alerts

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 6-22 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.

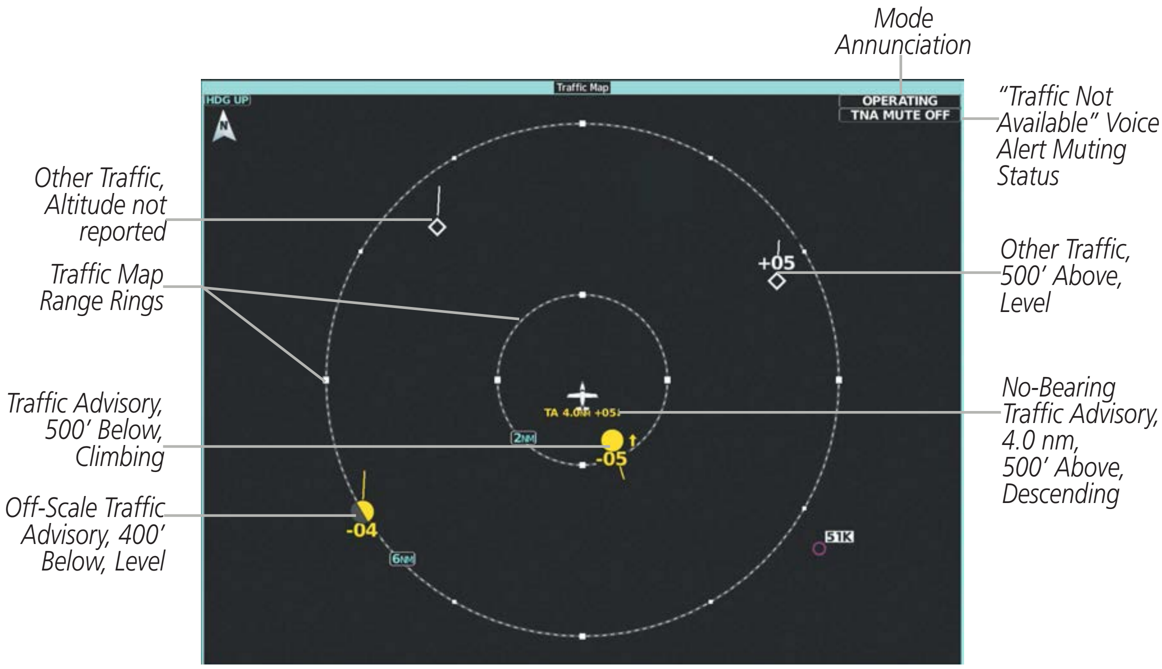


Figure 6-109 Traffic Map Pane with TIS Traffic (MFD in Full Mode)

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.

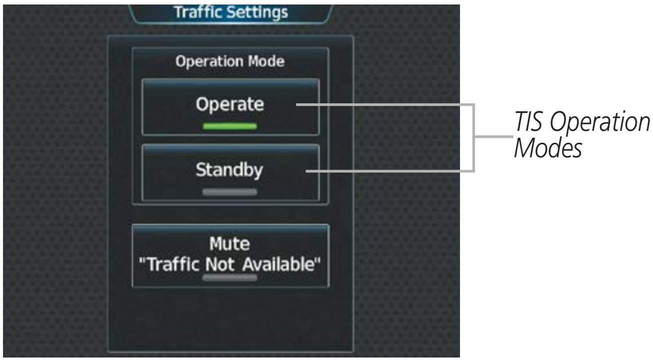


Figure 6-110 Traffic Setting Screen for the Traffic Map Pane

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.

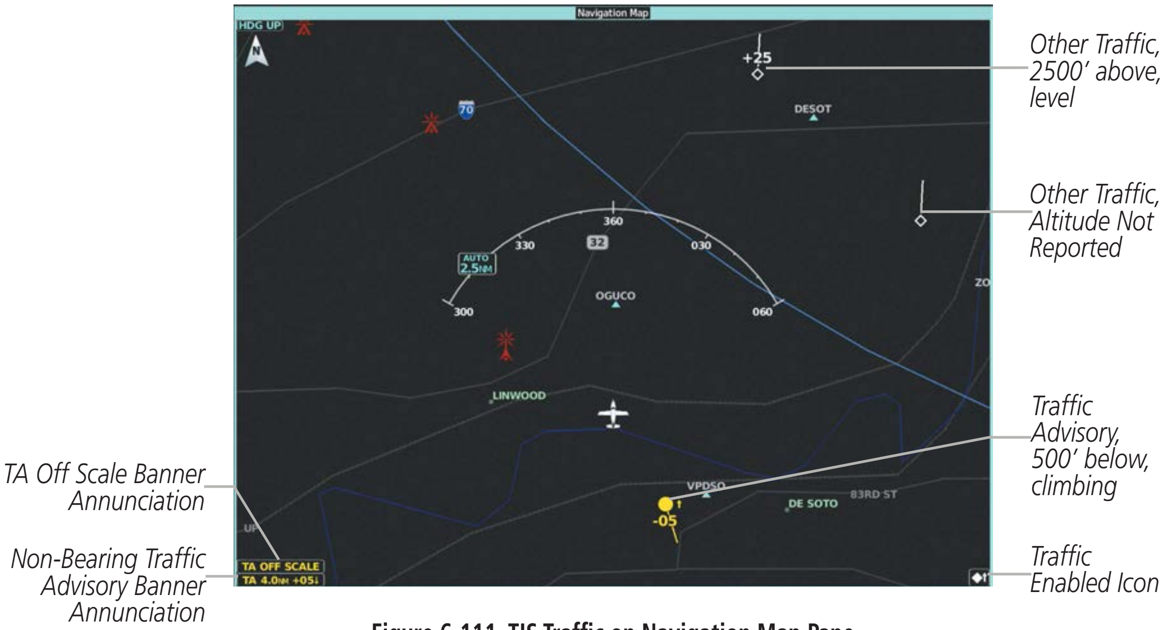


Figure 6-111 TIS Traffic on Navigation Map Pane

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.

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.

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 6-112 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.

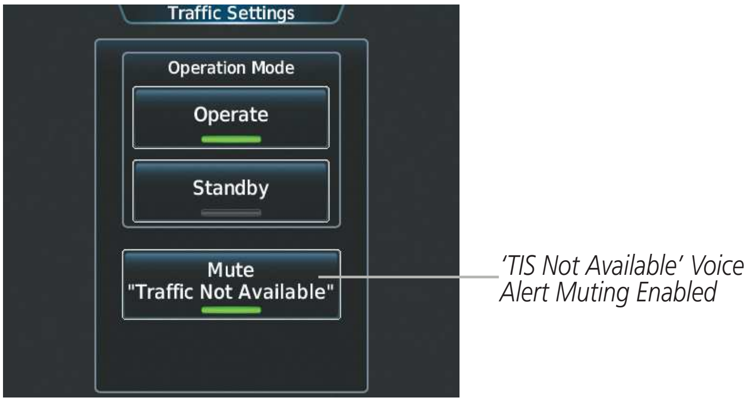


Figure 6-113 Traffic Settings Screen for TIS

SYSTEM STATUS

The system performs an automatic test of TIS during power-up. If TIS passes the test, TIS enters Standby Mode (on the ground) or Operating Mode (in the air). The following annunciations indicate the traffic system status.

Traffic Map Mode Annunciation	Traffic Map Center Banner Annunciation	Traffic Overlay Status Icon (Navigation Maps)	Description
DATA FAILED	TRFC FAIL		Data is being received from the transponder, but a failure is detected in the data stream*
NO DATA	TRFC FAIL		Data is not being received from the transponder*
OPERATING	None		TIS is operating and is receiving traffic data from a data link.
OPERATING	UNAVAILABLE		TIS is operating, but the traffic service is currently unavailable or is out of reception range.
STANDBY	STANDBY		TIS is in Standby Mode.
UNIT FAILED	TRFC FAIL		The transponder has failed*

** Contact a service center or Garmin dealer for corrective action*

Table 6-23 TIS Modes and Status Annunciations

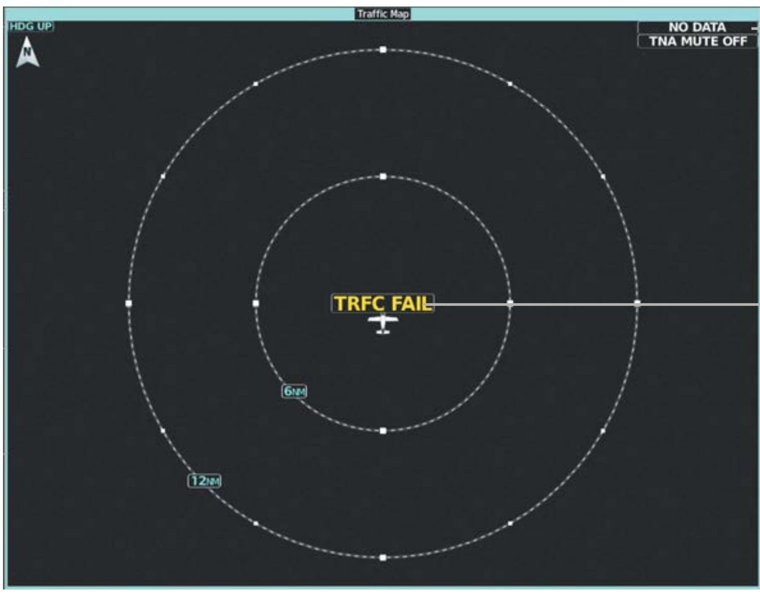


Figure 6-114 TIS Failure Annunciations on the Traffic Map Pane

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
TA OFF SCALE*	A Traffic Advisory is outside the selected display range Annunciation is removed when traffic comes within the selected display range
TA X.X ± XX ↕**	System cannot determine bearing of Traffic Advisory Annunciation indicates distance in nm, altitude separation in hundreds of feet, and altitude trend, if available (‘<UP>’ indicates climbing, ‘<DN>’ indicates descending).
AGE MM:SS†	Appears if traffic data is not refreshed within 6 seconds If after another 6 seconds data is not received, traffic is removed from the display The quality of displayed traffic information is reduced as the age increases
TRFC COAST†	The displayed data is not current (6 to 12 seconds since last message)† The quality of displayed traffic information is reduced when this message is displayed
TRFC RMVD†	Traffic is removed because it is too old for coasting (12 to 60 seconds since last message) Traffic may exist within the selected display range, but it is not displayed
TRFC FAIL**	Traffic data has failed
NO TRFC DATA	Traffic has not been detected
TRFC UNAVAIL	The traffic service is unavailable or 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 6-24 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 AND SYMBOLOGY

The TAS system monitors the airspace within ±10,000 feet of own altitude, and up to 40 nm in the forward direction. Traffic system range is somewhat reduced to the sides and aft of own aircraft due to the directional interrogation signal patterns. The symbols in the following table depict TAS traffic, and include Automatic Dependent Surveillance-Broadcast (ADS-B) traffic symbols. Refer to the ADS-B Traffic discussion later in this section for more information about ADS-B.

Symbol	Description
	Traffic Advisory with ADS-B directional information. Arrow points in the direction of the intruder aircraft track.
	Traffic Advisory without directional information.
	Traffic Advisory with ADS-B directional information is beyond the selected display range. Displayed at outer range ring at proper bearing. Arrow points in the direction of the intruder aircraft track.
	Traffic Advisory out of the selected display range without directional information. Displayed at outer range ring at proper bearing.
	Proximity Advisory with ADS-B directional information. Arrow points in the direction of the aircraft track.
	Proximity Advisory without directional information.
	Other Non-Threat traffic with ADS-B directional information. Arrow points in the direction of the intruder aircraft track.
	Other Non-Threat traffic without directional information.
	Traffic located on the ground with ADS-B directional information. Arrow points in the direction of the aircraft track. Ground traffic is only displayed when ADS-B is in Surface (SURF) Mode or own aircraft is on the ground.
	Ground traffic without ADS-B directional information. Ground traffic is only displayed when ADS-B is in Surface (SURF) Mode or own aircraft is on the ground.
	Non-aircraft ground traffic with ADS-B directional information. Pointed end indicates direction of travel. Ground traffic is only displayed when ADS-B is in Surface (SURF) Mode or own aircraft is on the ground.
	Non-aircraft ground traffic without ADS-B directional information. Ground traffic is only displayed when ADS-B is in Surface (SURF) Mode or own aircraft is on the ground.

Table 6-25 Traffic Symbols with TAS and ADS-B

A Traffic Advisory (TA), displayed as an amber circle, or an amber circle with a directional arrow inside of it, alerts the 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 ±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.

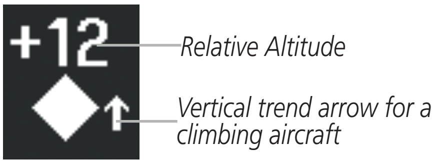


Figure 6-115 Intruder Altitude and Vertical Trend Arrow

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.

TAS 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 6-26 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 6-27 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 6-116 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 Half 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 6-117 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 non-threat and proximity traffic is displayed. Note the system will still show TAs occurring outside of these limits regardless of the altitude mode chosen.

Changing the altitude range:

1) From MFD Home, touch **Traffic** > **Traffic Settings**.

Or:

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 6-118 Selecting an Altitude Mode on the Traffic Settings Screen

NOTE: *Refer to the ADS-B Traffic Section for more information for controlling the display of ADS-B traffic information.*

ADDITIONAL TRAFFIC DISPLAYS

The system can overlay traffic information on the Navigation Map Pane. Traffic information is also available on the PFD when the Synthetic Vision Technology (SVT) terrain display is enabled. See the Flight Instruments section for details about SVT traffic.

Enabling/disabling display of traffic information (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, the system shows a traffic status icon and altitude mode in the lower right corner of the map.

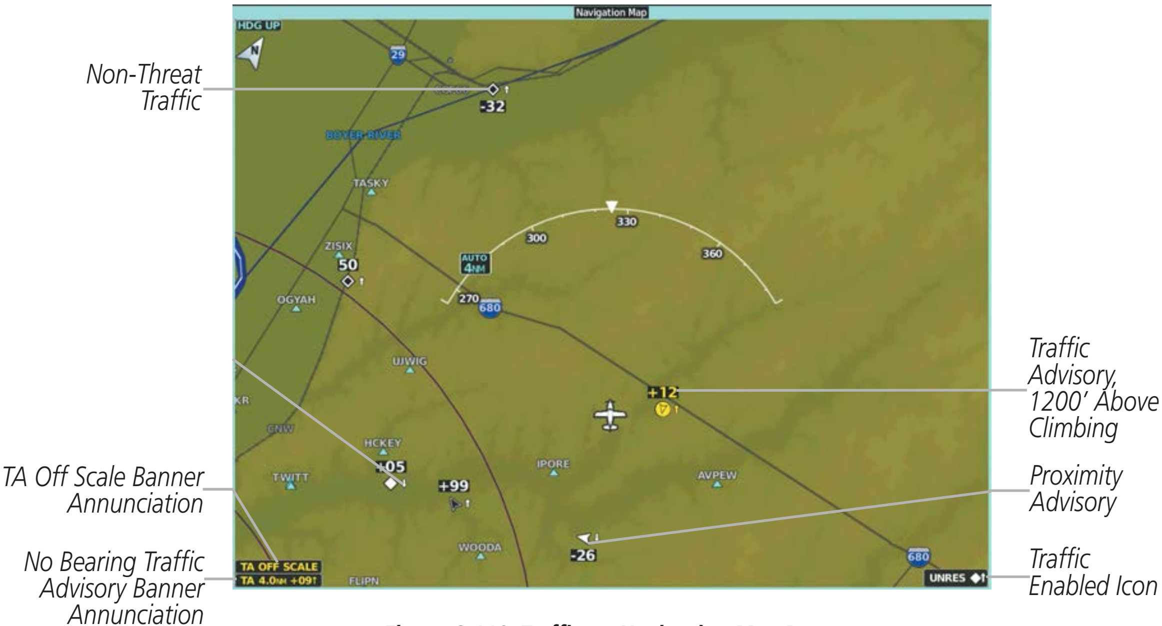


Figure 6-119 Traffic on Navigation Map Pane

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 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 traffic system mode appears in the upper right corner of the Traffic Map Pane.

Traffic System Mode	Traffic Map Mode Annunciation	Traffic Overlay Status Icon
Operating	OPERATING	
Standby	STANDBY (also shown in white in center of Traffic Map Pane)	
Failed*	UNIT FAILED	

** See Table 6-30 for additional failure annunciations.*

Table 6-28 TAS Modes

If the traffic unit fails, the system shows an annunciation as to the cause of the failure in the center of the Traffic Map Pane. During a failure condition, the Operating Mode is not available.

Traffic Map Pane Center Annunciation	Description
NO DATA	System is not receiving any data from the traffic unit.
DATA FAILED	System is receiving data from the traffic unit, but the unit is reporting a failure.
FAILED	The traffic unit is sending invalid data to the system.

Table 6-29 TAS Failure Annunciations

Traffic Status annunciations appear in banners at the lower left corner of navigation map panes.

Traffic Status Banner Annunciation	Description
TA OFF SCALE	A Traffic Advisory is outside the selected display range*. Annunciation is removed when traffic comes within the selected display range.
TA X.X ± XX ↕	System cannot determine bearing of Traffic Advisory**. Annunciation indicates distance in nm, altitude separation in hundreds of feet, and an altitude trend ('<UP>' indicates climbing, '<DN>' indicates descending), if a trend of at least 500 fpm is detected.
TRFC FAIL	The traffic unit has failed (unit is self-reporting a failure or sending incorrectly formatted data)
NO TRFC DATA	Data is not being received from the traffic unit

**Shown as symbol on Traffic Map Pane*
***Shown in center of Traffic Map Pane*

Table 6-30 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.

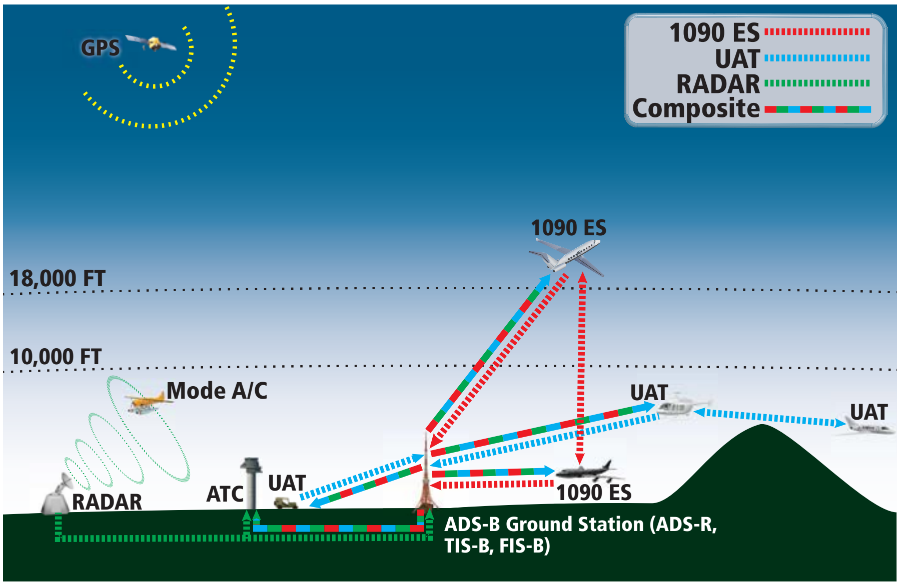


Figure 6-120 ADS-B System

For the purpose of distinguishing between levels of ADS-B service, there are three classifications of aircraft or system capability: ADS-B In, ADS-B Out, and ADS-B participating. ADS-B In refers to the capability to receive ADS-B information. ADS-B Out refers to the capability to transmit ADS-B information. ADS-B participating refers to the capability to both send and receive ADS-B information. Aircraft lacking either ADS-In, ADS-B Out, or both ADS-B capabilities may also be referred to as ADS-B nonparticipating aircraft.

The ADS-B system operates on two frequencies: 1090 MHz and 978 MHz. Both frequencies provide the same traffic information. An aircraft may be ADS-B In, Out, or participating on one or both frequencies, depending on the installed equipment. The 1090 MHz frequency portion of ADS-B is known as 1090 Extended Squitter (1090 ES). The 978 MHz portion of ADS-B is known as Universal Access Transceiver (UAT).

The optional Garmin GTX 33D transponder provides ADS-B Out functions using the 1090 ES data link. When the GTS 855 TCAS I is installed with a GTX 33D, the GTS 855 receives ADS-B In traffic data from the 1090 ES data link.

The Garmin GTX 345R transponder provides ADS-B Out functions using the 1090 ES data link. It also performs ADS-B In functions using the UAT data link. For the GTX 345, this includes the reception of Flight Information Services-Broadcast (FIS-B) data link weather service, provided when the aircraft is receiving data from a participating ground station; refer to the Data Link Weather section for more information about FIS-B Weather.

AUTOMATIC DEPENDENT SURVEILLANCE-REBROADCAST (ADS-R)

Because it is not required that ADS-B In capable aircraft be able to receive ADS-B data on both the 1090 MHz and 978 MHz data links, a method exists to get data from one data link to the other. ADS-R is the rebroadcast of ADS-B data by FAA ground stations, which provide this service by taking traffic data from one link and rebroadcasting it on the other. For example, if two aircraft are in the service volume for a ground station, and one is transmitting on 1090 MHz and the other is transmitting on 978 MHz, the ground station retransmits the data from each aircraft on the other link to ensure the two aircraft can “see” each other as traffic.

For example, if another aircraft can only receive 978 MHz UAT information, it cannot directly ‘see’ another aircraft sending only 1090 ES information aircraft unless an ADS-R ground station in the vicinity rebroadcasts the 1090 ES data over the 978 MHz UAT frequency. This is also true for an aircraft when can only receive 1090 ES data; it would need an ADS-R ground station to ‘see’ another aircraft operating on the UAT frequency.

TRAFFIC INFORMATION SERVICE-BROADCAST (TIS-B)

TIS-B provides a link between the secondary surveillance radar (SSR)-based system ATC uses and the ADS-B-based system. When an ADS-B In or Out capable aircraft is within the service volume of an FAA ADS-B ground station, the ground station broadcasts a portion of the ATC radar data to the aircraft. This aircraft is then included in the list of aircraft being provided TIS-B service and is then considered a “TIS-B participant.”

TIS-B coverage is available when the aircraft is within ground station and SSR coverage, and the other aircraft is also in SSR coverage, and is transmitting its altitude.

The ground station provides ATC radar information for other aircraft within ±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 6-31 Aircraft Available for Viewing by an ADS-B Equipped Own Aircraft

ADS-B WITH TCAS I

When the display of ADS-B traffic is enabled, and the TCAS I system is in an operating mode (i.e. actively interrogating the transponders of other aircraft, the system attempts to match (or "correlate") data the two traffic sources. When a correlation is made, the system displays the traffic information for the tracked aircraft determined to be the most accurate. Any traffic that is not correlated (i.e., only detected by one system but not the other) is also displayed for the flight crew. This may occur, for example, if another aircraft is beyond the active surveillance range of the TCAS I system, but own aircraft is receiving information via an ADS-B In signal for the other aircraft. The traffic correlation feature improves the accuracy of the traffic displayed, while reducing the occurrence of displaying the same traffic for a given aircraft twice.

***NOTE:** In certain situations, a single aircraft may be depicted as two aircraft on the display if the system is unable to correlate the traffic. This may occur, for example, when operating on the edges of ATC radar coverage, or the traffic system is receiving intermittent data. This may also occur if TIS-B traffic data does not closely match the traffic data from other sources, especially while the traffic tracked by ATC radar is turning.*

***NOTE:** The TCAS I system issues alerts for traffic it is tracking using TCAS I alerting criteria. The ADS-B system issues alerts for traffic it is tracking using the Conflict Situational Awareness & Alerting (CSA) criteria.*

CONFLICT SITUATIONAL AWARENESS & ALERTING

Conflict Situational Awareness (CSA) is an alerting algorithm which provides ADS-B traffic alerting similar to the TCAS I system discussed previously in the form of TAs.

When a TA based on CSA parameters occurs, the system displays an amber 'TRAFFIC' annunciation on the PFD and issues a voice alert. The TA voice alerts are discussed in the TCAS I traffic section of this pilot's guide.

***NOTE:** The system mutes TA voice alerts when own aircraft is below 400' AGL.*

The own aircraft altitude above terrain determines the sensitivity of the CSA algorithm to minimize nuisance alerts. Height Above Terrain, and Geodetic Sea Level (GSL) altitude are used to adjust the sensitivity of the CSA algorithm in accordance with the following table:

Sensitivity Level	Height Above Terrain (HAT)	GPS Phase of Flight	Own Altitude (Feet)	Look-ahead time (sec)	Vertical Threshold for Alert (feet)	Protected Volume (NM)
4	Any	Any	Any	20	850	0.20
4	Unavailable	Approach	Any	20	850	0.20
5	Any	Any	Any	25	850	0.20
5	>1000 <=2350	Any	Any	25	850	0.20
5	Unavailable	Terminal	Any	25	850	0.20
6	Unavailable or >2350	Not approach and not Terminal (including unavailable)	<=5000	30	850	0.35
7	Unavailable or >2350	Not approach and not Terminal (including unavailable)	>5000 <=10,000	40	850	0.55
8	Unavailable or >2350	Not approach and not Terminal (including unavailable)	>10,000 <=20,000	45	850	0.80
9	Unavailable or >2350	Not approach and not Terminal (including unavailable)	>20,000 <=42,000	48	850	1.10
10	Unavailable or >2350	Not approach and not Terminal (including unavailable)	> 42,000	48	1200	1.10

Table 6-32 CSA Alerting Thresholds for ADS-B Traffic

AIRBORNE AND SURFACE APPLICATIONS

ADS-B traffic can help the pilot visually acquire traffic both in the air and on-the-ground. There are two ADS-B applications or modes: Airborne Situational Awareness (AIRB) and Surface Situational Awareness (SURF). The system automatically selects the appropriate application based on conditions.

The AIRB application is on when the aircraft is more than five nautical miles and 1,500 feet above the nearest airport. When the AIRB application is active, the system only displays traffic which is airborne.

The SURF application is on when the aircraft is within five nautical miles and less than 1,500 feet above field elevation. When the SURF applications is on, the system displays airborne and on the ground traffic. At a Traffic Map Pane range of one nautical mile or less, the airport environment (including taxiways and runways) appears in addition to traffic. The airport displays are derived from the SafeTaxi database. Refer to the Additional Features section for more information about SafeTaxi displays.

NOTE: *Do not rely on the solely on the traffic display to determine the runway alignment of traffic, especially when runways are in close proximity to each other.*

Due to the varying precision of the data received via ADS-B, ADS-R, and TIS-B services, not all traffic symbols may not be depicted on the traffic display. Because higher data precision is required for traffic to be displayed in the SURF environment, some traffic eligible for AIRB will not be displayed while SURF is on. Availability for AIRB and SURF is depicted on the ADS-B Status Screen, discussed later in this section.

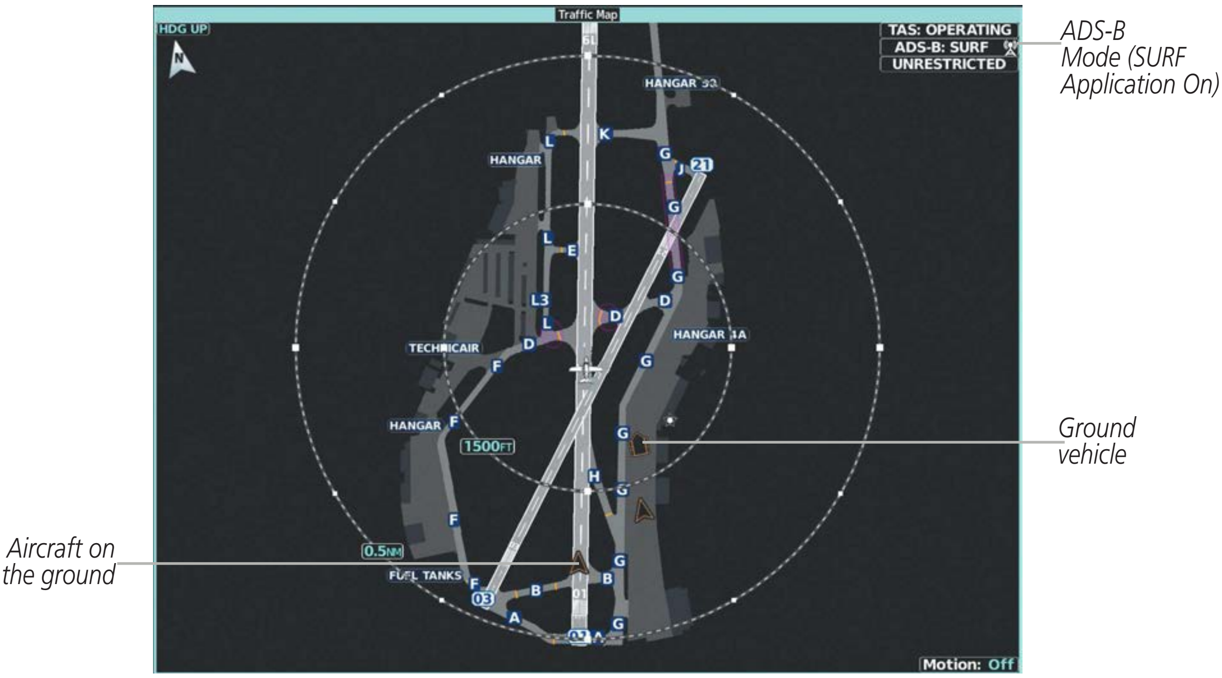


Figure 6-121 Traffic Map Pane with SURF Mode On

NOTE: *Refer to the TCAS I Traffic section for a table of ADS-B and TCAS I traffic symbols the system can display.*

OPERATION

NOTE: *Refer to the TCAS I Traffic Section for information about testing the traffic system(s).*

TRAFFIC MAP PANE

The Traffic Map Pane shows surrounding traffic data in relation to the aircraft's current position and altitude, without basemap clutter. Aircraft orientation is always heading up unless there is no valid heading. Map range is adjustable with the lower knob. Rings denote the map range.

The traffic mode and altitude mode are annunciated in the upper right corner of the pane.

Figure 6-122 Traffic Map Pane with ADS-B Traffic Enabled

Enabling/disabling the display of ADS-B traffic:

1) From MFD Home, touch **Traffic** > **Traffic Settings**.

   Or:

   a) From MFD Home, touch **Map** > **Map Selection** > **Map Settings**.

   b) Touch the **Traffic Settings** Button on the Sensor Tab.

   Or:

   a) From PFD Home, touch **PFD Map Settings**.

   b) Touch the Traffic **Settings** Button.

2) Touch the **ADS-B Display** Button.

NOTE: *If a TCAS I system is installed, and the TCAS I mode changes from Standby to Operating, the display of ADS-B traffic is automatically enabled, unless the pilot has manually disabled the* ***ADS-B Display*** *Button while the TCAS I was in Standby Mode.*

DISPLAYING MOTION VECTORS

When Absolute Motion Vectors are selected, the vectors extending from the traffic symbols depict the traffic's reported track and speed over the ground. When Relative Motion Vectors are selected, the vectors extending from the traffic symbols display how the traffic is moving relative to own aircraft. These vectors are calculated using the traffic's track and ground speed and own aircraft's track and ground speed. These two values are combined to depict where the traffic is moving purely with respect to own aircraft, and provide a forecast of where the traffic will be, relative to own aircraft, in the near future. If the system does not have sufficient information to calculate motion vectors, they are not shown.

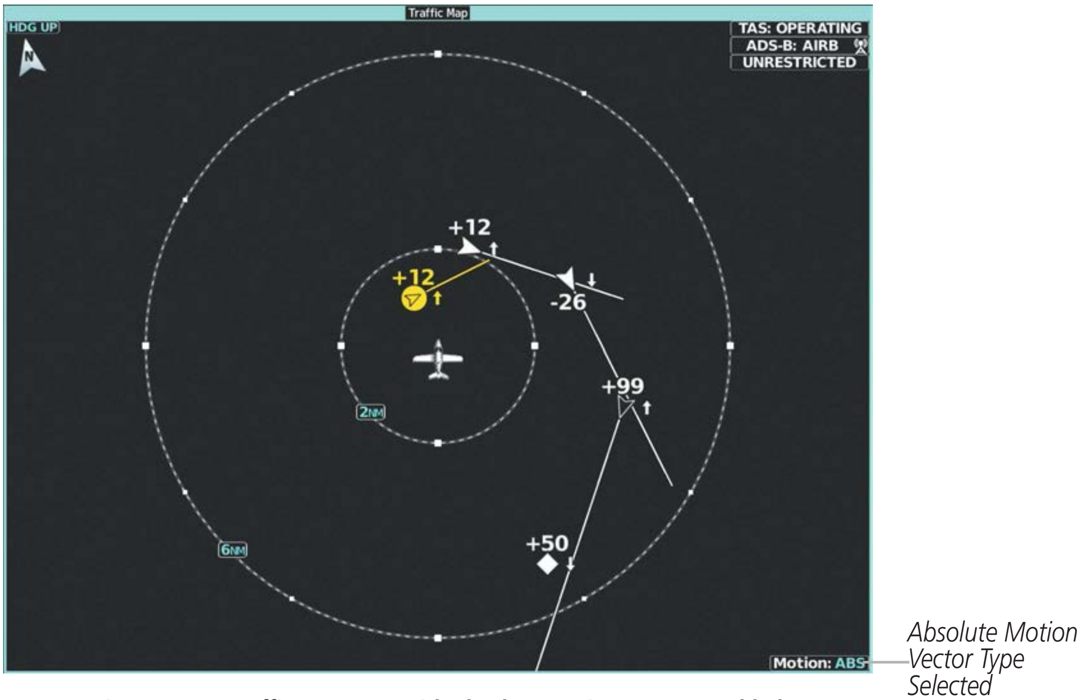


Figure 6-123 Traffic Map Pane with Absolute Motion Vectors Enabled

Figure 6-124 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 **VECT Duration** Button.
5) Touch a button for the desired duration: **30SEC**, **1MIN**, **2MIN**, or **5MIN**.

Displaying Additional Traffic Information

The Traffic Map Pane can display additional information for a selected aircraft symbol. This may include the aircraft tail number/Flight ID, type of aircraft (e.g., glider, small/medium/large aircraft, service vehicle, unmanned airborne vehicle (UAV), course, track, groundspeed, and other information.

Showing additional traffic information on the Traffic Map Pane:

1) From MFD Home, touch **Traffic** > **Traffic Settings**.
2) Touch the ADS-B **Target Selection** Button.
3) Turn the upper knob. A cyan border appears on the first selected traffic symbol. Additional information appears in a window in the lower-left corner of the Traffic Map Pane.
4) To select a different aircraft symbol, turn the upper knob.
5) When finished, touch the **Target Selection** Button again to disable the button.

Traffic Map Pane Display Range

The pilot can adjust the range of traffic displayed on the Traffic Map Pane. Range indications appear on rings shown on the page. The minimum map range is 750 feet. A maximum map range of 40 nautical miles is available.

Selecting the Traffic Map Pane display range:

1) From MFD Home, touch the **Traffic** > **Traffic Settings** Button.
2) Turn the lower knob clockwise to increase map range, or counter-clockwise to decrease map range.

NOTE: *ADS-B traffic can be displayed as an overlay to navigation maps. Refer to the previous TCAS I discussion for information about these additional traffic displays.*

ADS-B SYSTEM STATUS

The traffic mode is annunciated in the upper right corner of the Traffic Map Pane.

ADS-B Mode	Traffic Mode Annunciation (Traffic Map Pane)	Traffic Map Pane Center Banner Annunciation	Traffic Display Status Icon (Other Maps)
ADS-B Operating in Airborne Mode	ADS-B: AIRB	None	
ADS-B Operating in Surface Mode	ADS-B: SURF	None	
ABS-B Traffic Off	ADS-B: OFF	ADS-B TRFC OFF	
ADS-B Traffic Not Available	ADS-B: N/A	NO TRK/HDG	
ADS-B Failed*	ADS-B: FAIL	ADS-B TRFC FAIL	

** See Table 6-36 for additional failure annunciations*

Table 6-33 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 6-34 ADS-B Modes

If the traffic unit fails, an annunciation as to the cause of the failure is shown in the center of the Traffic Map Pane. During a failure condition, the Operating Mode cannot be selected.

Traffic Map Pane Center Annunciation	Description
NO DATA	Data is not being received from the traffic unit
DATA FAILED	Data is being received from the traffic unit, but the unit is self-reporting a failure
FAILED	Incorrect data format received from the traffic unit

Table 6-35 Traffic Failure Annunciations

The annunciations to indicate the status of traffic information appear in a banner at the lower left corner of maps on which traffic can be displayed.

Traffic Status Banner Annunciation	Description
TA OFF SCALE	A Traffic Advisory is outside the selected display range*. Annunciation is removed when traffic comes within the selected display range.
TA X.X ± XX ↕	System cannot determine bearing of Traffic Advisory**. Annunciation indicates distance in nm, altitude separation in hundreds of feet, and altitude trend arrow (climbing/descending).
TRFC FAIL	Traffic unit has failed (unit is self-reporting a failure or sending incorrectly formatted data)
NO TRFC DATA	Data is not being received from the traffic unit
**Shown as symbol on Traffic Map Pane* ***Shown in center of Traffic Map Pane*	

Table 6-36 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.

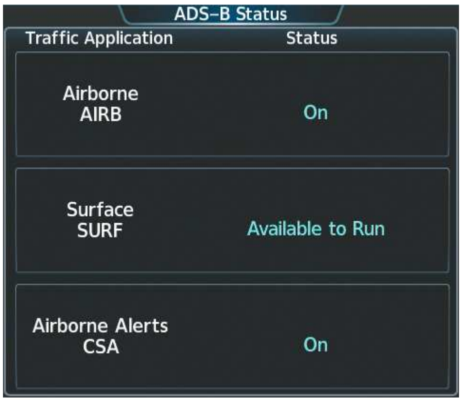


Figure 6-125 Viewing ADS-B Traffic Status on the ADS-B Status Screen

ADS-B Status Screen Item	Status Message	Description
Airborne (AIRB), Surface (SURF), Airborne Alerts (CSA)	On	Traffic application is currently on. Required input data is available, and it meets performance requirements.
	Available to Run	Traffic application is not currently active, but application is ready to run when condition(s) determine the application should be active. Required input data is available, and it meets performance requirements.
	Not Available	Traffic application is not available. Required input data is available, but it does not meet performance requirements.
	Fault	Traffic application is not available. Required input data is not available or the application has failed.
	Not Configured	Traffic application is not available, because it has not been configured. If this annunciation persists, the system should be serviced.
	----------------	Traffic application status is invalid or unknown.

Table 6-37 ADS-B Status Screen Messages for ADS-B Traffic

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SECTION 7 AUTOMATIC FLIGHT CONTROL SYSTEM

***NOTE:** The approved current pertinent flight manual always supersedes this Pilot's Guide.*

The digital Garmin Automatic Flight Control System (AFCS) is fully integrated within the G3000 System avionics architecture. The System Overview section provides a block diagram to support this system description. AFCS functionality in the Daher TBM 940 is distributed across the following Line Replaceable Units (LRUs):

- GDU 1250W Primary Flight Displays (PFDs) (2)
- GMC 711 AFCS Controller
- GIA 64W Integrated Avionics Units (IAUs) (2)
- GSA 81 AFCS Servos (4)
- GTA 82 Trim Adapter (1)
- GSM 86 servo Gearboxes (4)
- GSA 87 Autothrottle Servo (1)

The Garmin AFCS can be divided into these main operating functions:

- **Flight Director (FD)** — The Daher TBM 940 has two flight directors, each operating within an IAU and referred to as pilot-side and copilot-side. Commands for the selected flight director are displayed on both PFDs. The flight directors provide:
  - Command Bars showing pitch/roll guidance
  - Vertical/lateral mode selection and processing
  - Autopilot communication
- **Autopilot (AP)** — Autopilot operation occurs within the pitch, roll, and pitch trim servos and yaw trim adapter. It also provides servo monitoring and automatic flight control in response to flight director steering commands, Attitude and Heading Reference System (AHRS) attitude and rate information, and airspeed.
- **Yaw Damper (YD)** — The yaw servo is self-monitoring and provides Dutch roll damping and turn coordination in response to yaw rate, roll angle, lateral acceleration, and airspeed.
- **Manual Electric Pitch Trim (MEPT)** — The pitch trim servo provides manual electric pitch trim capability when the autopilot is not engaged.
- **Manual Electric Yaw Trim (MEYT)** — The yaw trim adapter provides manual electric yaw trim capability when the autopilot is not engaged.
- **Autothrottle (AT)—** The Autothrottle sets the throttles based on phase of flight and Flight Director modes and assists in preventing the aircraft from entering an underspeed or overspeed condition as well as assisting in preventing the exceedence of engine parameters.

7.1 AFCS CONTROLS

The AFCS Controller is positioned above the MFD, and has the following controls:

1	**HDG Key**	Selects/deselects Heading Select Mode
2	**APR Key**	Selects/deselects Approach Mode
3	**NAV Key**	Selects/deselects Navigation Mode
4	**FD Key**	Activates/deactivates the Flight Director only Pressing once turns on the selected Flight Director in the default vertical and lateral modes. Pressing again deactivates the Flight Director and removes the Command Bars. If the Autopilot is engaged, the key is disabled.
5	**AT Key**	Engages/disengages the Autothrottle
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 18	**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 Knob**	Adjusts the speed reference for autothrottle speed mode and autopilot FLC mode. Toggles the Airspeed Reference units between IAS and Mach for FLC mode when pushed.
11	**SPD Source Switch**	Activates FMS or MAN speed reference.
12	**UP/DN Wheel**	Adjusts the reference in Pitch Hold and Vertical Speed modes.
13	**VNV Key**	Selects/deselects VNAV Path Descent Mode for Vertical Navigation flight control
14	**ALT Knob**	Controls the Selected Altitude in 100-ft increments (a finer resolution of one foot is available under approach conditions)
15	**YD Key**	Engages/disengages the Yaw Damper
16	**XFR Key**	Transfers between the active Flight Director/Autothrottle and standby Flight Director/Autothrottle
17	**AP Key**	Engages/disengages the Autopilot
19	**BANK Key**	Manually selects/deselects Low Bank Mode
20	**BC Key**	Selects/deselects Backcourse Mode
21	**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

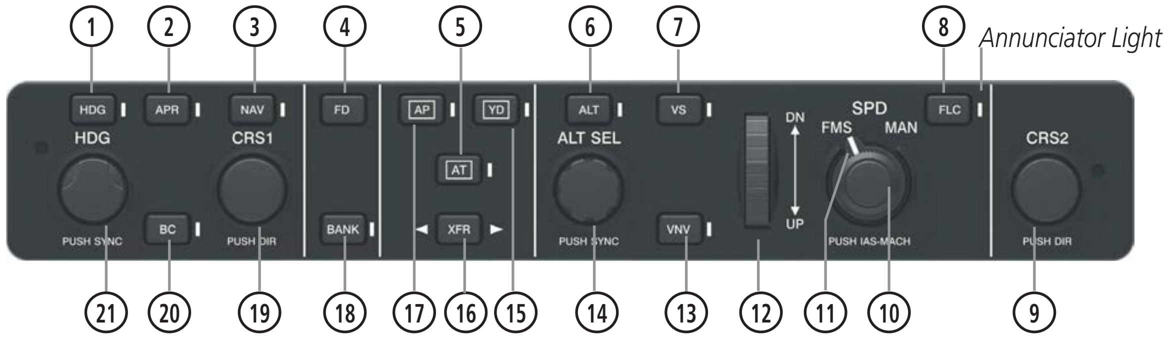


Figure 7-1 GMC 711 AFCS Controller

The following AFCS controls are located separately from the AFCS Controller:

AP DISC Switch (Autopilot Disconnect)	Disengages the autopilot, autothrottle, yaw damper, and flight director and interrupts pitch trim operation An **AP DISC** Switch is located on each control wheel. This switch may be used to acknowledge an autopilot/autothrottle disconnect alert and mute the associated aural tone.
CWS Button (Control Wheel Steering)	While pressed, allows manual control of the aircraft while the autopilot is engaged and synchronizes the flight director's Command Bars with the current aircraft pitch (if not in a Vertical Navigation, Glideslope, or Glidepath Mode) and roll (if in Roll Hold Mode) A **CWS** Button is located on each control wheel. Upon release of the **CWS** Button, the flight director may establish new pitch and roll references, depending on the current vertical and lateral modes. CWS operation details are discussed in the respective mode sections of this manual.
GA Switch (Go Around)	Selects flight director Takeoff (on ground) or Go Around (in air) Mode. If an approach procedure is loaded this switch also activates the missed approach when the selected navigation source is GPS or when the navigation source is VOR/LOC and a valid frequency has been tuned. The **GA** Switch is located on the throttle.
MEPT Switch (Manual Electric Pitch Trim)	The TBM 940 uses a four direction switch. to command manual electric pitch & yaw trim. An **MEPT/MEYT** Switch is located on each control wheel. Pushing down on the switch and operating the switch forward and backward adjusts pitch trim down (forward) and up (rearward). Pushing the switch in either direction disengages the autopilot, if currently engaged, but does not affect yaw damper operation.
MEYT Switch (Manual Electric Yaw Trim)	Operating the switch left and right adjusts yaw trim left or right.
LVL Button	Engages the autopilot and autothrottle (if the autopilot and autothrottle are disengaged and the aircraft is within the autopilot engagement limitations) in level vertical and lateral modes and autothrottle's speed mode. The **LVL** Button is located above the AFCS Controller
AT DISC Switch (Autothrottle Disconnect)	The **AT DISC** switch is located on the throttle knob and is used to disengage the autothrottle. This switch may also be used to acknowledge an autothrottle disconnect alert and mute the associated aural tone

BASIC AUTOPILOT OPERATION

This section provides an overview for autopilot engagement and disengagement. A more detailed description follows in Section 7.4.

- **Autopilot Engagement —** The autopilot may be engaged by pushing the **AP** Key on the AFCS Controller. Annunciations regarding the engagement are indicated on the PFD.
- **Autopilot Engagement with Flight Director Off —** Upon engagement, the autopilot will be set to hold the current attitude of the airplane, if the flight director was not previously on. In this case, 'PIT' and 'ROL' will be annunciated.
- **Autopilot Engagement with Flight Director On —** If the flight director is on, the autopilot will smoothly pitch and roll the airplane to capture the FD command bars. The prior flight director modes remain unchanged.
- **Autopilot Disengagement —** The most common way to disconnect the autopilot is to press and release the **AP DISC** Switch, which is located on each control wheel. An autopilot disconnect tone will be heard and annunciated on the PFD. Other ways to disconnect the autopilot include:
  - Pressing the **AP** Key on the AFCS Controller
  - Operating the **MEPT** Switch (located on the each 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 for as long as the **AP DISC** Switch is held.

7.2 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 Table 7-1 (when the flight director is not active) activates the pilot-side flight director in the listed modes. The flight director may be turned off and the Command Bars removed from the displays by pressing the **FD** Key again. The **FD** Key is disabled when the autopilot is engaged.

Control Pressed	Modes Selected			
	Lateral		Vertical	
FD Key	Roll Hold (default)	ROL	Pitch Hold (default)	PIT
AP Key	Roll Hold (default)	ROL	Pitch Hold (default)	PIT
CWS Button	Roll Hold (default)	ROL	Pitch Hold (default)	PIT
GA Switch	Takeoff (on ground) Go Around (in air)	TO GA	Takeoff (on ground) Go Around (in air)	TO GA
ALT Key	Roll Hold (default)	ROL	Altitude Hold	ALT
VS Key	Roll Hold (default)	ROL	Vertical Speed	VS
VNV Key	Roll Hold (default)	ROL	Vertical Path Tracking*	VPATH
NAV Key	Navigation**	GPS VOR LOC	Pitch Hold (default)	PIT
BC Key	Backcourse***	BC	Pitch Hold (default)	PIT
APR Key	Approach**	GPS VOR LOC	Pitch Hold (default)	PIT
HDG Key	Heading Select	HDG	Pitch Hold (default)	PIT
LVL Button	Level Mode	LVL	Level Mode	LVL

Valid VNV flight plan must be entered before* ***VNV* *Key press activates flight director.*

The selected navigation receiver must have a valid VOR or LOC signal or active GPS course before* ***NAV *or* ***APR*** *Key press activates flight director.*

****The selected navigation receiver must have a valid LOC signal before* ***BC*** *Key press activates flight director.*

Table 7-1 Flight Director Activation

AFCS STATUS BOX

Flight Director mode annunciations are displayed on the PFDs when the Flight Director is active. Flight Director selection, Autopilot, and Autothrottle statuses are shown in the center of the AFCS Status Box. Autothrottle modes are displayed on the far left, Lateral Flight Director Modes are displayed on the left and Vertical Modes on the right. Armed modes are displayed in white. Active modes are displayed in green.

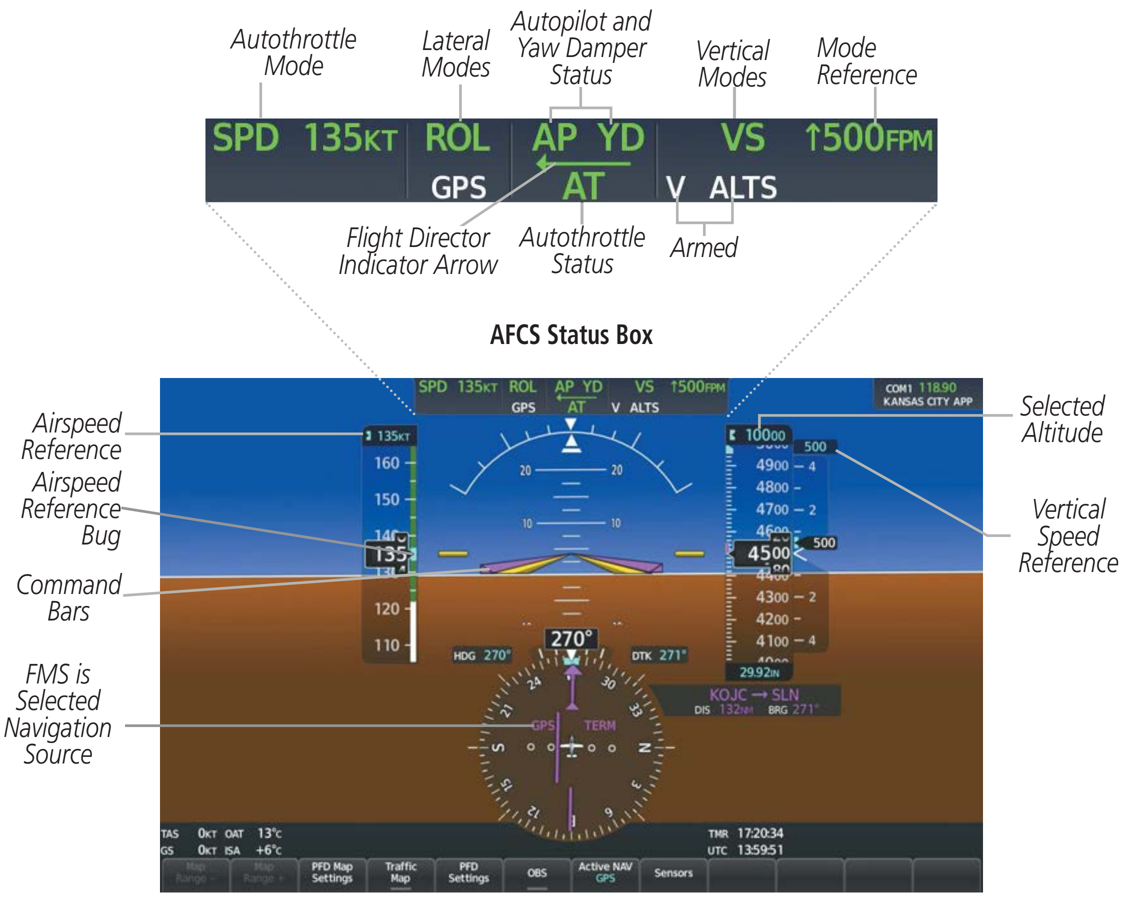


Figure 7-2 PFD AFCS Display

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 control for the active flight director mode is pressed, the flight director reverts to the default mode(s) for the axis(es). Automatic transition from armed to active mode is indicated by the white armed mode annunciation moving to the green active mode field and flashing for 10 seconds.

If the information required to compute a flight director mode becomes invalid or unavailable, the flight director automatically reverts to the default mode for that axis. A flashing yellow mode annunciation and annunciator light indicate loss of sensor (ADC) or navigation data (VOR, LOC, GPS, VNV, SBAS) required to compute commands. When such a loss occurs, the system automatically begins to roll the wings level (enters Roll Hold Mode) or maintain the pitch angle (enters Pitch Hold Mode), depending on the affected axis. The flashing annunciation stops when the affected mode key is pressed or another mode for the axis is selected. If after 10 seconds no action is taken, the flashing annunciation stops.

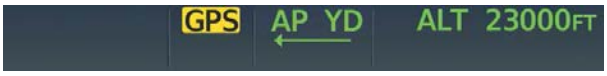


Figure 7-3 Loss of FMS Signal

The flight director is automatically disabled if the attitude information required to compute the default flight director modes becomes invalid or unavailable.

SWITCHING FLIGHT DIRECTORS

The AFCS in the Daher TBM 940 has two flight directors, each operating within an IAU. The autopilot follows the selected flight director only, indicated by an arrow pointing toward either the pilot or copilot side, in the center of the AFCS Status Box. Flight directors may be switched by pressing the **XFR** Key. The annunciator light arrow for the selected flight director is also illuminated beside the **XFR** Key. When the flight directors are switched, the vertical and lateral modes revert to default.

Figure 7-4 Flight Director Selection Indications

COMMAND BARS

Upon activation of the flight director, Command Bars are displayed in magenta on the PFDs as a single-cue. The Command Bars do not override the (yellow) Aircraft Symbol. The single-cue Command Bars (see following figure) move together vertically to indicate pitch commands and bank left or right to indicate roll commands.

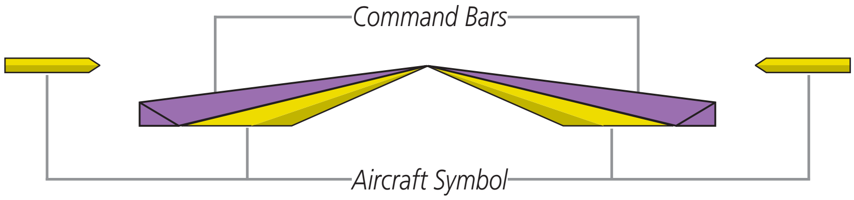


Figure 7-5 Single-cue Command Bars

If the attitude information being sent to the flight director becomes invalid or unavailable, the Command Bars are removed from the display. The flight director Command Bars also disappear if the pitch exceeds +30°/-20° or bank exceeds 65°.

LEVEL MODE

Level Mode is coupled pitch and roll modes 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 (see following figure). While in level mode, all other modes are available by pressing the corresponding button.

Level mode also becomes active as a function of Electronic Stability and Protection (ESP). Refer to the Additional Features section for a detailed discussion of the ESP feature.

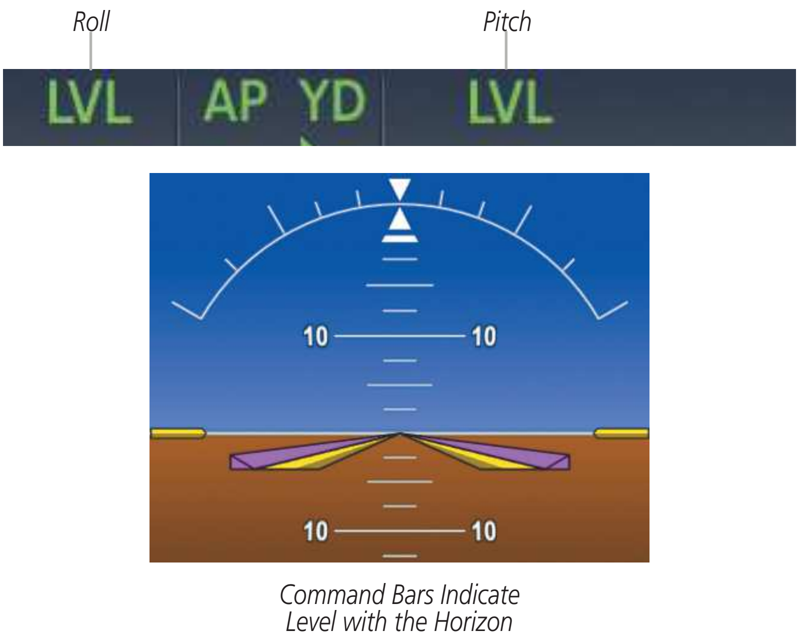


Figure 7-6 Level Mode Annunciation

7.3 AFCS MODES

The AFCS is capable of operating in a variety of independent Lateral Modes, Vertical Modes and Combination of both the Lateral and Vertical Modes.

VERTICAL MODES (PIT, ALT, VS, FLC)

Table 7-2 lists the vertical modes that do not operate in conjunction with a Lateral Mode with their corresponding controls and annunciations. The mode reference is displayed next to the active mode annunciation for Altitude Hold, Vertical Speed, and Flight Level Change modes. The **NOSE UP/DN** Wheel can be used to change the vertical mode reference while operating under Pitch Hold, or Vertical Speed mode Increments of change and acceptable ranges of values for each of these references using the **NOSE UP/DN** Wheel are also listed in the table.

***NOTE:** When FLC Mode is selected, the speed reference can be set using either the **SPD** Knob or the FMS speed schedules.*

Vertical Mode	Description	Control	Annunciation	Reference Range	Reference Change Increment
Pitch Hold	Holds the current aircraft pitch attitude; may be used to climb/descend to the Selected Altitude	(default)	PIT	-15° to +25°	0.5°
Selected Altitude Capture	Captures the Selected Altitude	*	ALTS		
Altitude Hold	Holds the current Altitude Reference	**ALT** Key	ALT nnnnn FT		
Vertical Speed	Maintains the current aircraft vertical speed; may be used to climb/descend to the Selected Altitude	**VS** Key	VS nnnn FPM	-4000 to +3000 fpm	100 fpm
Flight Level Change, IAS Hold	Maintains the current aircraft airspeed (in IAS or Mach) while the aircraft is climbing/descending to the Selected Altitude	**FLC** Key	FLC nnn KT	**(78-100 kts) up to 265 kts	1 kt
Flight Level Change, Mach Hold			FLC M .nnn	M 0.20 to 0.69	M 0.01

** ALTS armed automatically when PIT, VS, FLC, TO, or GA active, and under VPATH when Selected Altitude is to be captured instead of VNV Target Altitude*

***Referenced airspeeds are dependent upon selected flap position*

Table 7-2 Flight Director Vertical Modes

PITCH HOLD MODE (PIT)

When the flight director is activated (the **FD** Key is pressed) or switched (the **XFR** Key is pressed), Pitch Hold Mode is selected by default. Pitch Hold Mode is indicated as the active vertical mode by the 'PIT' annunciation. This mode may be used for climb or descent to the Selected Altitude (shown above the Altimeter), since Selected Altitude Capture Mode is automatically armed when Pitch Hold Mode is activated.

In Pitch Hold Mode, the flight director maintains a constant pitch attitude, the pitch reference. The pitch reference is set to the aircraft pitch attitude at the moment of mode selection. If the aircraft pitch attitude exceeds the flight director pitch command limitations, the flight director commands a pitch angle equal to the nose-up/down limit.

When operating in Pitch Hold Mode, the pitch reference can be adjusted by:

- Using the **NOSE UP/DN** Wheel
- Pressing the **CWS** Button, hand-flying the aircraft to establish a new pitch reference, then releasing the **CWS** Button

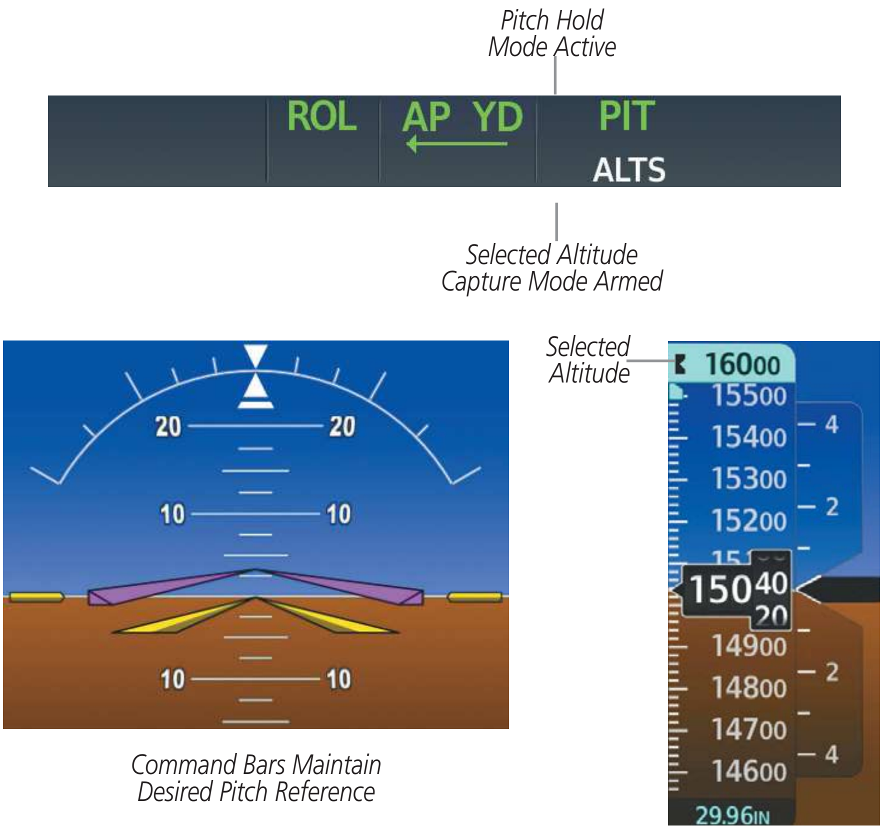


Figure 7-7 Pitch Hold Mode

SELECTED ALTITUDE CAPTURE MODE (ALTS)

Selected Altitude Capture Mode is automatically armed with activation of the following modes:

- Pitch Hold
- Vertical Speed
- Flight Level Change
- Go Around
- Vertical Path Tracking (if the Selected Altitude is to be captured instead of the VNV Target Altitude)

The white 'ALTS' annunciation indicates Selected Altitude Capture Mode is armed (see previous figure) for example). The **ALT** Knob is used to set the Selected Altitude (shown above the Altimeter) until Selected Altitude Capture Mode becomes active.

As the aircraft nears the Selected Altitude, the flight director automatically transitions to Selected Altitude Capture Mode ('ALTS') with Altitude Hold Mode ('ALT')armed (see following figure). This automatic transition is indicated by the green 'ALTS' annunciation flashing for up to 10 seconds and the appearance of the white 'ALT' annunciation. The Selected Altitude is shown as the Altitude Reference beside the 'ALTS' annunciation.

At 50 feet from the Selected Altitude, the flight director automatically transitions from Selected Altitude Capture to Altitude Hold Mode and holds the Selected Altitude (shown as the Altitude Reference). As Altitude Hold Mode becomes active, the white 'ALT' annunciation moves to the active vertical mode field and flashes green for 10 seconds to indicate the automatic transition.

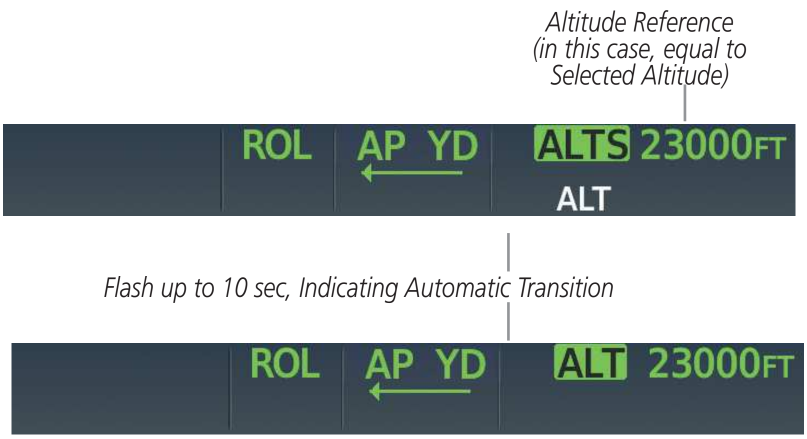


Figure 7-8 Automatic Mode Transitions During Altitude Capture

***NOTE:** Pressing the **CWS** Button while in Selected Altitude Capture Mode does not cancel the mode.*

Use of the **ALT** Knob to change the Selected Altitude while Selected Altitude Capture Mode is active causes the flight director to revert to Pitch Hold Mode with Selected Altitude Capture Mode armed for the new Selected Altitude.

ALTITUDE HOLD MODE (ALT)

Altitude Hold Mode can be activated by pressing the **ALT** Key; the flight director maintains the current aircraft altitude (to the nearest 10 feet) as the Altitude Reference. The flight director's Altitude Reference, shown in the AFCS Status Box, is independent of the Selected Altitude, displayed above the Altimeter. Altitude Hold Mode active is indicated by a green 'ALT' annunciation in the AFCS Status Box.

Altitude Hold Mode is automatically armed when the flight director is in Selected Altitude Capture Mode (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.

***NOTE:** Turning the **ALT** Knob while in Altitude Hold Mode changes the Selected Altitude, but not the flight director's Altitude Reference, and does not cancel the mode.*

With the **CWS** Button depressed, 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.

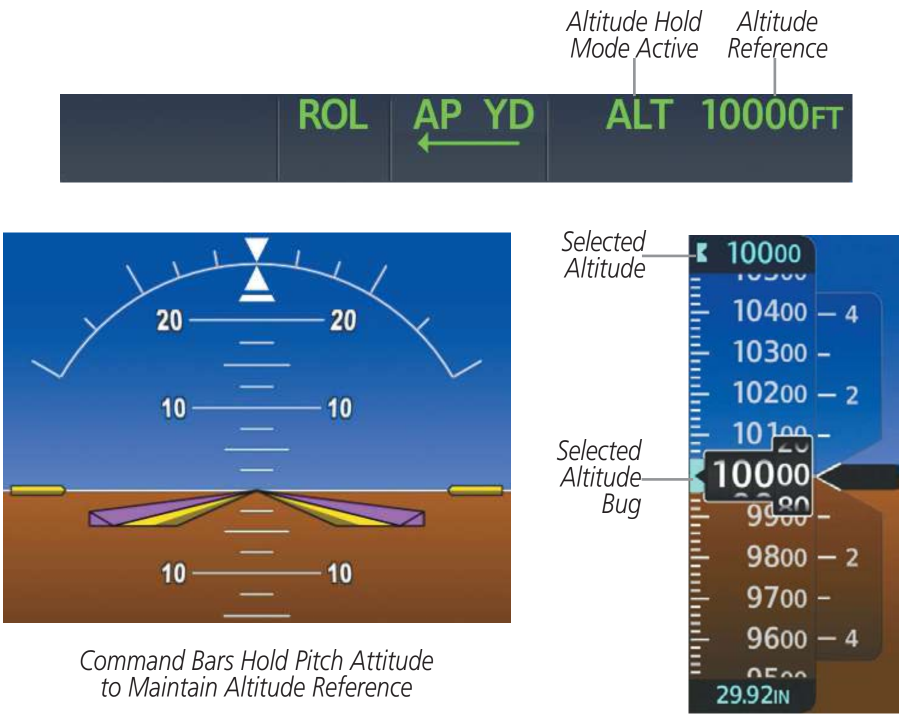


Figure 7-9 Altitude Hold Mode

VERTICAL SPEED MODE (VS)

In Vertical Speed Mode, the flight director acquires and maintains a Vertical Speed Reference. Current aircraft vertical speed (to the nearest 100 fpm) becomes the Vertical Speed Reference at the moment of Vertical Speed Mode activation. This mode may be used for climb or descent to the Selected Altitude (shown above the Altimeter) since Selected Altitude Capture Mode is automatically armed when Vertical Speed Mode is selected.

When Vertical Speed Mode is activated by pressing the **VS** Key, 'VS' is annunciated in green in the AFCS Status Box along with the Vertical Speed Reference. The Vertical Speed Reference is also displayed above the Vertical Speed Indicator. A Vertical Speed Reference Bug corresponding to the Vertical Speed Reference is shown on the indicator.

The Vertical Speed Reference (shown both in the AFCS Status Box and above the Vertical Speed Indicator) may be changed by:

- Using the **NOSE UP/DN** Wheel
- Pressing the **CWS** Button, hand-flying the aircraft to attain a new Vertical Speed Reference, then releasing the **CWS** Button

NOTE: *If the Selected Altitude is reached during CWS maneuvering, the Altitude Reference is not changed. To adjust the Altitude Reference in this case, the* ***CWS*** *Button must be pressed again after the Selected Altitude is reached.*

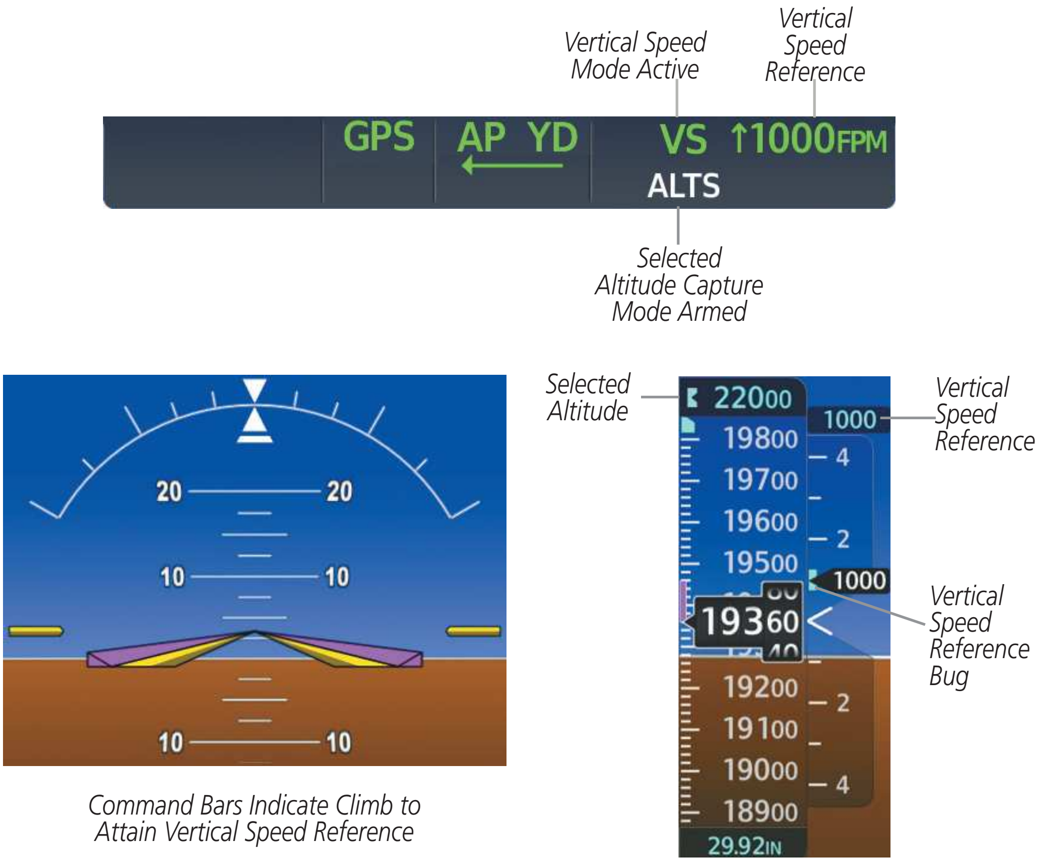


Figure 7-10 Vertical Speed Hold Mode

FLIGHT LEVEL CHANGE MODE (FLC)

***NOTE:** The Selected Altitude must be set before selecting Flight Level Change Mode.*

Flight Level Change Mode is selected by pressing the **FLC** Key. This mode acquires and maintains the Airspeed Reference (in IAS or Mach) while climbing or descending to the Selected Altitude (shown above the Altimeter). When Flight Level Change Mode is active, the Flight Director continuously monitors Selected Altitude, airspeed/Mach, and altitude. When Flight Level Change Mode is used in conjunction with VNAV (V FLC), VNAV Target Altitude Capture is also enabled.

When in Manual Airspeed Mode, the Airspeed Reference (cyan Airspeed Reference Bug) is set to the previously selected Airspeed Reference. When in FMS Airspeed Mode, the Airspeed Reference (magenta Airspeed Reference Pointer) is set to the value programmed in the FMS. Flight Level Change Mode is indicated by a green 'FLC' annunciation in the AFCS Status Box. The Airspeed Reference is displayed directly above the Airspeed Indicator and next to the FLC mode annunciator in the AFCS Status Box, along with an Airspeed Reference Bug corresponding to the Airspeed Reference along the tape. The Airspeed Reference source (FMS or MAN) is selected via the **FMS/MAN** Switch on the AFCS controller.

The Autopilot adjusts the aircraft pitch attitude to maintain the Speed Reference based on the engine thrust setting.

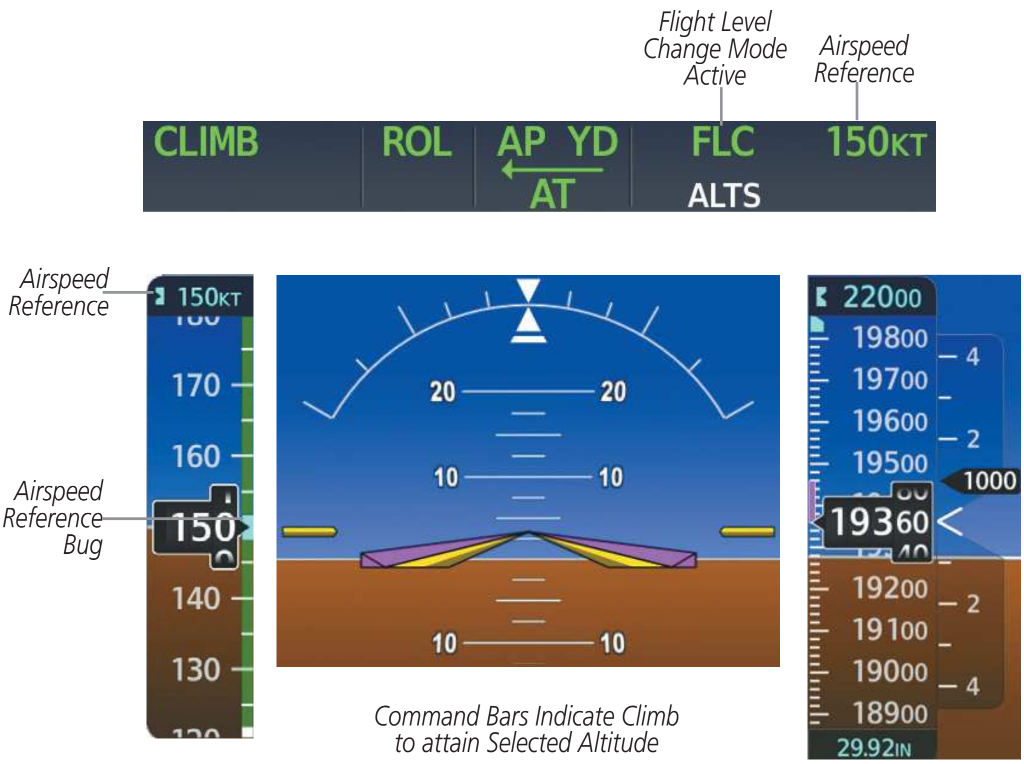


Figure 7-11 Flight Level Change Mode (IAS)

The Airspeed Reference (shown in both the AFCS Status Box and above the Airspeed Indicator) may be adjusted by:

- Using the **SPD** Knob (Manual Airspeed Referenc)
- FMS tab (FMS Airspeed Reference)

***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.*

When the **SPD** Knob is in the FMS position, the target airspeed is dictated by the FMS, therefore the Airspeed Reference is set to the FMS Speed Target. The FMS Speed Target is displayed in magenta directly above the Airspeed Indicator, along with a magenta FMS Speed Target Pointer corresponding to the FMS Speed Target along the airspeed tape, as shown in the next figure. The FMS Speed Target is also displayed in green in the AFCS Status Box. When descending, the system anticipates the time required to achieve the targeted airspeed, therefore, the FMS Speed Target and FMS Speed Target Pointer will be reduced prior to sequencing the active leg of the flight plan if an upcoming speed constraint requires the aircraft to slow down. As the aircraft gets closer to the waypoint, the FMS Speed Target will adjust the required speed.

***NOTE:** The FMS Speed Target may fluctuate while the system tries to meet altitude and airspeed constraints. This is most likely to occur where speed limits apply, such as, when descending through 10,000 feet, entering a hold, or in the vicinity of an airport.*

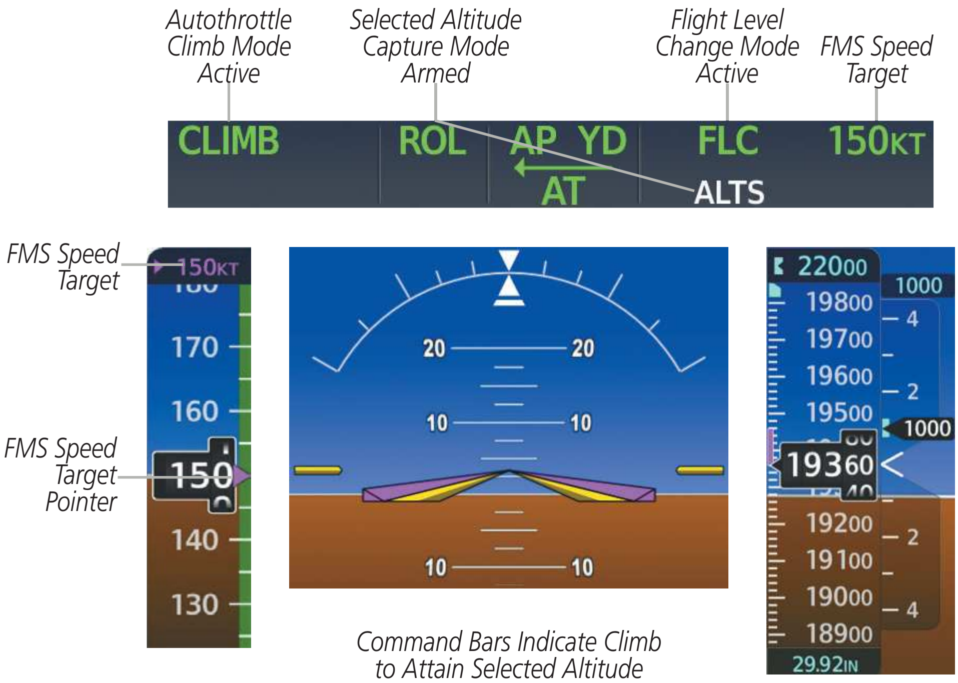


Figure 7-12 Flight Level Change Mode, VNAV Active

LATERAL MODES (ROL, BANK, HDG, NAV)

Table 7-3 lists the lateral modes that do not operate in conjunction with a Vertical Mode with their corresponding controls and annunciations.

NOTE: *The AFCS may generate a lower bank angle than the maximum roll command limit in degrees indicated in table 7-3 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	**BANK** Key	*	15°
Heading Select **	Captures and tracks the Selected Heading	**HDG** Key	HDG	25°
Navigation, GPS **	Captures and tracks the selected navigation source (GPS, VOR, LOC)	**NAV** Key	GPS	25°
Navigation, VOR Enroute Capture/Track **			VOR	25° Capture 10° Track
Navigation, LOC Capture/Track (No Glideslope)			LOC	25° Capture 10° Track

* *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 GPS 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

ROLL HOLD MODE (ROL)

NOTE: *If Roll Hold Mode is activated as a result of a mode reversion, the flight director rolls wings level.*

When the flight director is activated or switched, Roll Hold Mode is selected by default. This mode is annunciated as 'ROL' in the AFCS Status Box. The current aircraft bank angle is held, subject to the bank angle condition.

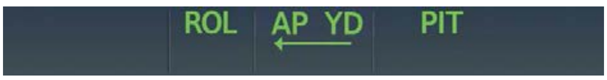


Figure 7-13 Roll Hold Mode Annunciation

Bank Angle	Flight Director Response
< 6°	Rolls wings level
6 to 30°	Maintains current aircraft roll attitude
> 30°	Limits bank to 30°

Table 7-4 Roll Hold Mode Responses

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.

Low Bank Mode can be manually selected/deselected by pressing the **BANK** Key while in Heading Select or Navigation Modes (GPS and VOR). Low Bank Mode is activated automatically climbing above 25,000 ft (FL250), and deactivated when descending below 25,000 ft. The annunciator light next to the **BANK** Key illuminates while Low Bank Mode is selected.

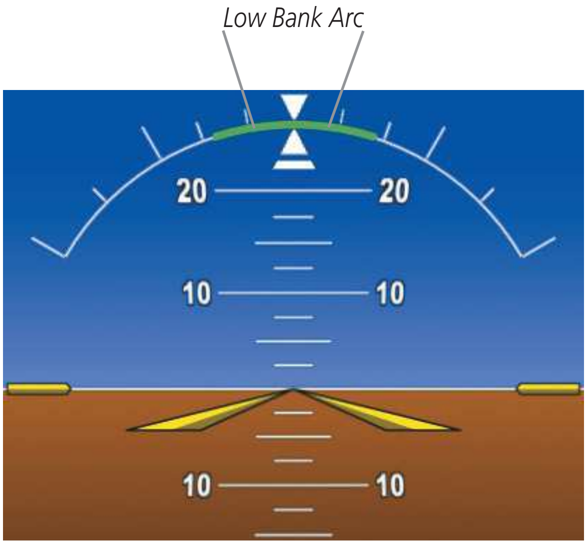


Figure 7-14 Low Bank Mode Limits

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.

NOTE: *Pressing the **HDG** Knob synchronizes the Selected Heading to the current heading.*

The Selected Heading is adjusted using the **HDG** Knob. Pressing the **CWS** Button and hand-flying the aircraft does not change the Selected Heading. The autopilot guides the aircraft back to the Selected Heading upon release of the **CWS** Button.

Turns are commanded in the same direction as Selected Heading Bug movement, even if the bug is turned more than 180° from the present heading (e.g., a 270° turn to the right). However, Selected Heading changes of more than 330° at a time result in turn reversals.

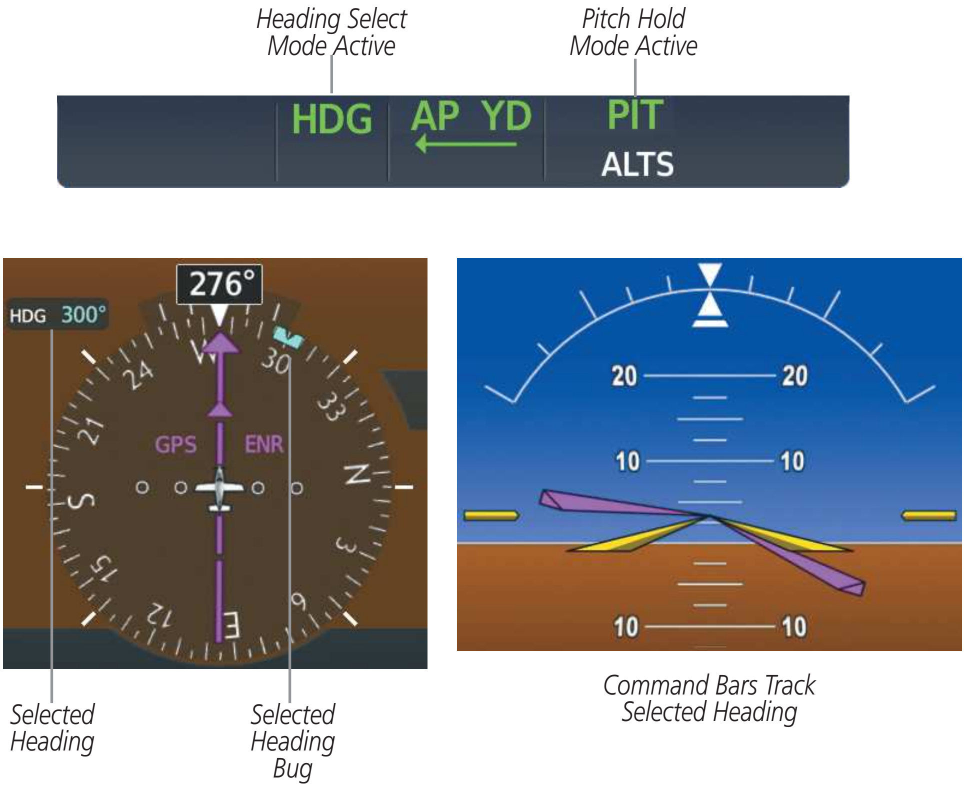


Figure 7-15 Heading Select Mode

NAVIGATION MODES (GPS, VOR, LOC)

***NOTE:** The selected navigation receiver must have a valid VOR or LOC signal or active GPS course for the flight director to enter Navigation Mode.*

Pressing the **NAV** Key selects Navigation Mode. Navigation Mode acquires and tracks the selected navigation source (GPS, VOR, LOC). The flight director follows GPS roll steering commands when GPS is the selected navigation source. When the navigation source is VOR or LOC, the flight director creates roll steering commands from the Selected Course and deviation. Navigation Mode can also be used to fly non-precision GPS and LOC approaches where vertical guidance is not required (See Approach Section below).

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, Navigation Mode is automatically captured when the **NAV** Key is pressed. The armed annunciation appears in white to the left of the active lateral mode.

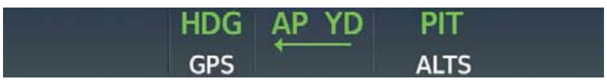


Figure 7-16 FMS Navigation Mode Armed

When the CDI has automatically switched from GPS to LOC during a LOC/ILS approach, GPS Navigation Mode remains active, providing GPS steering guidance until the localizer signal is captured. LOC Navigation Mode is armed automatically when the navigation source switch takes place if the **APR** Key is not pressed prior to the automatic source switch.

If Navigation Mode is active and either of the following occur, the flight director reverts to Roll Hold Mode (wings rolled level):

- Different VOR tuned while in VOR Navigation Mode (VOR Navigation Mode reverts to armed)
- Navigation source manually switched (with the **CDI** Softkey)
- During a LOC/ILS approach, the FAF is crossed while in GPS Navigation Mode after the automatic navigation source switch from GPS to LOC

If the navigation source is VOR or localizer or OBS Mode has been enabled when using GPS, the Selected Course is controlled using the **CRS** Knob corresponding to the selected flight director (**CRS1** for the pilot side, **CRS2** for the copilot side).

Pressing the **CWS** Button and hand-flying the aircraft does not change the Selected Course while in Navigation Mode. The autopilot guides the aircraft back to the Selected Course (or GPS flight plan) when the **CWS** Button is released.

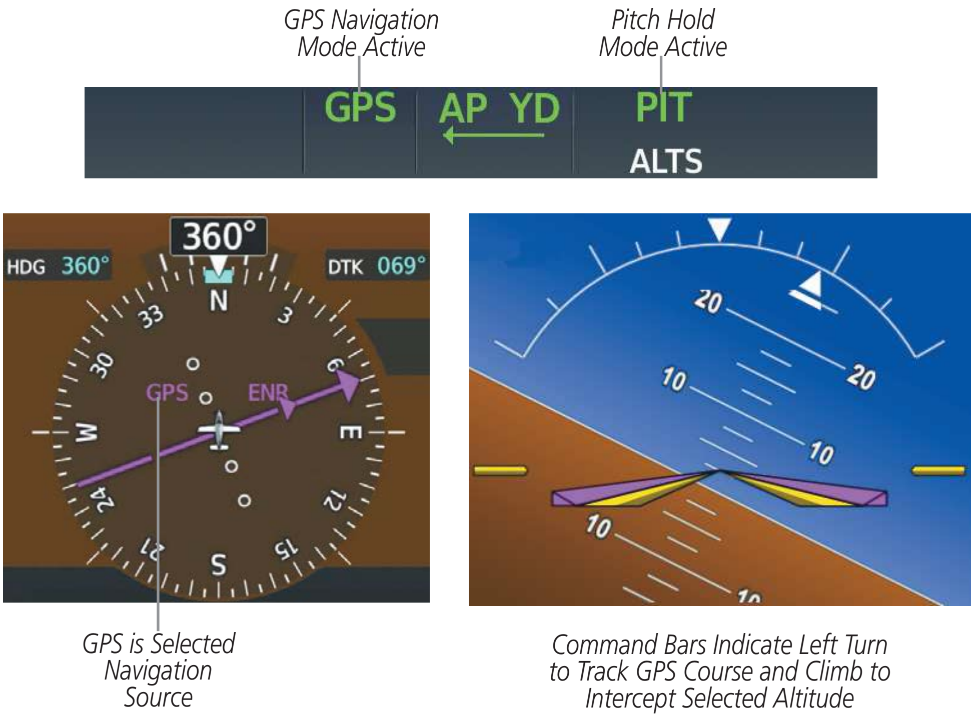


Figure 7-17 Navigation Mode

COMBINATION MODES (VNV, APR, NAV, BC, GA)

Table 7-5 lists the modes that operating by using both Vertical and Lateral Modes with their corresponding controls and annunciations.

Mode	Description	Control	Annunciation	Maximum Roll Command Limit	Reference Range
Vertical Path Tracking	Captures and tracks descent legs of an active vertical profile	**VNV** Key	VPATH		
VNV Target Altitude Capture	Captures the Vertical Navigation (VNV) Target Altitude	*	ALTV		
Glidepath	Captures and tracks the WAAS glidepath on approach	**APR** Key	GP		
Glideslope	Captures and tracks the ILS glideslope on approach		GS		
Navigation, GPS **	Captures and tracks the selected navigation source (GPS, VOR, LOC)	**NAV** Key	GPS	25°	
Navigation, VOR Enroute Capture/ Track **			VOR	25° Capture 10° Track	
Navigation, LOC Capture/Track (No Glideslope)			LOC	25° Capture 10° Track	
Backcourse Capture/Track	Captures and tracks a localizer signal for backcourse approaches	**BC** Key	BC	25° Capture 10° Track	
Approach, GPS	Captures and tracks the selected navigation source (GPS, VOR, LOC)	**APR** Key	GPS	25°	
Approach, VOR Capture/Track			VAPP	25° Capture 10° Track	
Approach, LOC Capture/Track (Glideslope Mode automatically armed)			LOC	25° Capture 10° Track	
Takeoff	Commands a constant pitch angle and wings level on the ground in preparation for takeoff	**GA** Switch	TO	Wings Level	10°
Go Around	Commands a constant pitch angle and wings level in the air		GA	Wings Level	10°

** ALTV armed automatically under VPATH when VNV Target Altitude is to be captured instead of Selected Altitude*

*** The Heading, Navigation GPS and Navigation VOR mode maximum roll command limit will be limited to the Low Bank mode value if it is engaged.*

Table 7-5 Flight Director Combination Modes

TAKEOFF (TO) AND GO AROUND (GA) 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. Selected Altitude Capture Mode (**ALTS**) is automatically armed when the aircraft is at least 400 feet below the Selected altitude at the time Takeoff or Go Around Mode is selected.

Takeoff Mode provides an attitude reference during rotation and takeoff. This mode can be selected only while on the ground by pushing the **GA** Switch. The flight director Command Bars assume a wings-level, pitch-up attitude. Autopilot engagement while Takeoff Mode is active is inhibited while the aircraft is on the ground. When the Autothrottle is engaged , the throttle levers will move to the TO/GA position.

Pressing the **GA** Switch while in the air activates the flight director in a wings-level, pitch-up attitude, allowing the execution of a go around or a missed approach, if an approach was activated. Selecting Go Around Mode will not disengage the autopilot. When the Autothrottle is engaged, the throttle levers will move to the TO/GA position.

Attempts to modify the aircraft attitude (i.e., with the **NOSE UP/DN** Wheel or **CWS** Button) result in reversion to Pitch Hold Mode.

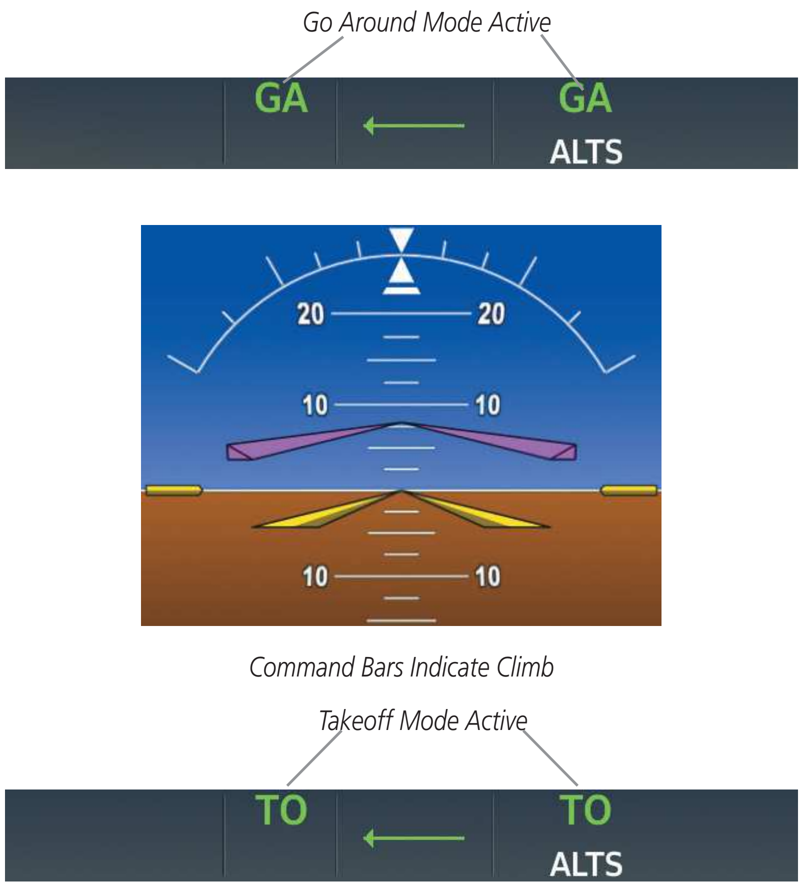


Figure 7-18 Takeoff and Go Around Mode

VERTICAL NAVIGATION MODES (VPATH, ALTV)

***NOTE:** VNV is disabled when parallel track or Dead Reckoning Mode is active. Refer to the Flight Management Section for more information on VNV flight plans.*

***NOTE:** The Selected Altitude takes precedence over any other vertical constraints.*

Vertical Navigation (VNV) flight control is available for enroute/terminal cruise and descent operations when VNV flight planning is available. Conditions for availability include, but are not limited to:

- The selected navigation source is GPS.
- A VNV flight plan (with at least one altitude-constrained waypoint) or vertical direct-to is active.
- VNV is enabled (**VNV ENBL** Softkey pressed on the MFD).
- Crosstrack error is valid and within certain limits.
- Desired/actual track are valid or track angle error is within certain limits.
- The VNV Target Altitude of the active waypoint is no more than 250 ft above the current aircraft altitude.

The flight director may be armed for VNV at any time, but no target altitudes are captured during a climb. The Command Bars provide vertical profile guidance based on specified altitudes (entered manually or loaded from the database) at waypoints in the active flight plan or vertical direct-to. The appropriate VNV flight control modes are sequenced by the flight director to follow the path defined by the vertical profile. Upon reaching the last waypoint in the VNV flight plan, the flight director transitions to Altitude Hold Mode and cancels any armed VNV modes.

Figure 7-19 VNAV Annunciations (Active=Green, Armed=White)

Vertical Path Tracking Mode (VPATH)

***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. 'VPATH' (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 'VPATH' 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).

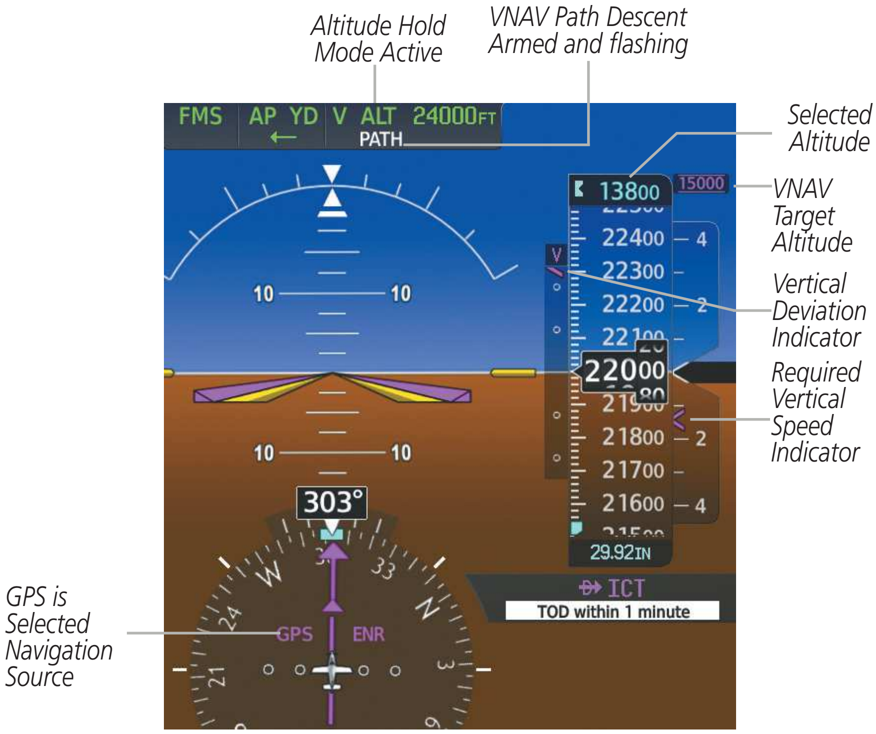


Figure 7-20 Vertical Path Capture

When a descent leg is captured (i.e., vertical deviation becomes valid), Vertical Path Tracking becomes active and tracks the descent profile (see following figure). An altitude capture mode ('ALTS' or 'ALTV') is armed as appropriate.

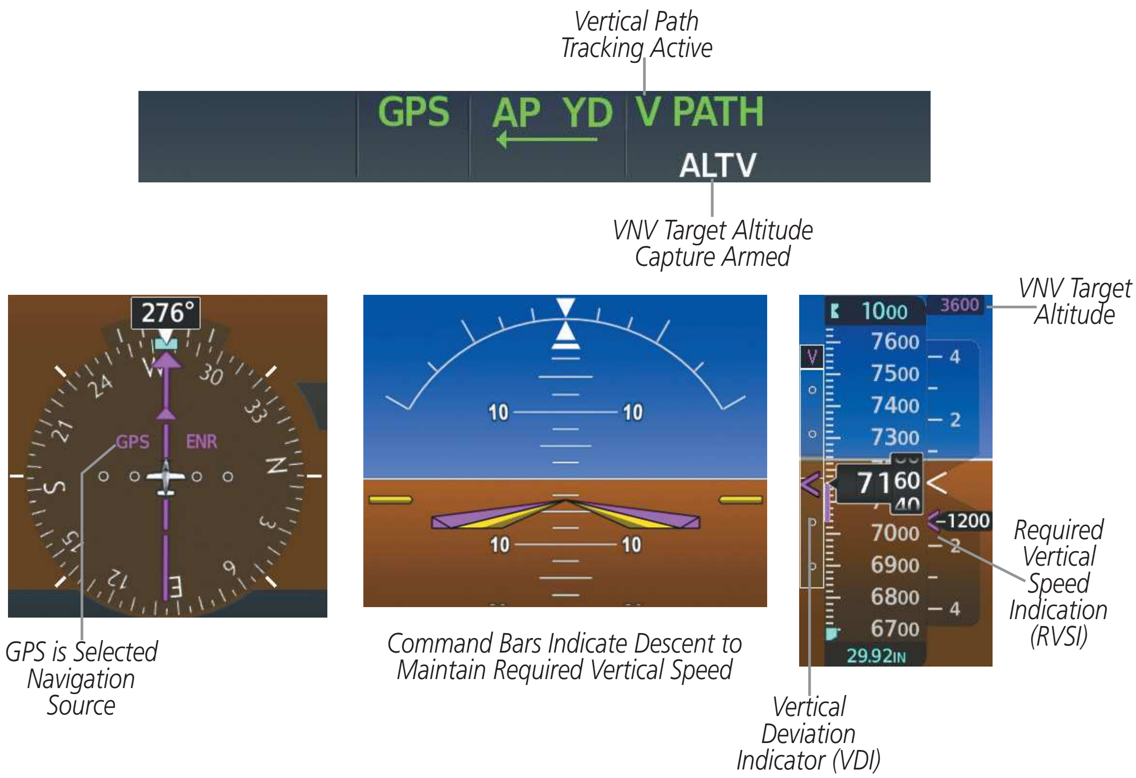


Figure 7-21 Vertical Path Tracking Mode

If the altimeter barometric setting is adjusted while Vertical Path Tracking is active, the flight director increases/decreases the descent rate by up to 500 fpm to re-establish the aircraft on the descent path (without commanding a climb). Adjusting the altimeter barometric setting creates discontinuities in VNV vertical deviation, moving the descent path. For large adjustments, it may take several minutes for the aircraft to re-establish on the descent path. If the change is made while nearing a waypoint with a VNV Target Altitude, the aircraft may not re-establish on the descent path in time to meet the vertical constraint.

Automatic Reversion to Pitch Hold Mode

Several situations can occur while Vertical Path Tracking Mode is active which cause the flight director to revert to Pitch Hold Mode:

- Vertical deviation exceeds 200 feet during an overspeed condition.
- Vertical deviation experiences a discontinuity that both exceeds 200 feet in magnitude and results in the vertical deviation exceeding 200 feet in magnitude. Such discontinuities are usually caused by flight plan changes that affect the vertical profile.
- Vertical deviation becomes invalid (the Vertical Deviation Indicator is removed from the PFD).
- A display enters Reversionary Mode (this does not apply to an active vertical direct-to).

Unless VNV is disabled, Vertical Path Tracking Mode and the appropriate altitude capture mode become armed following the reversion to Pitch Hold Mode to allow for possible profile recapture.

Non-Path Descents

Pitch Hold, Vertical Speed, and Flight Level Change modes can also be used to fly non-path descents while VNV flight control is selected. If the **VS** or **FLC** Key is pressed while Vertical Path Tracking Mode is selected, Vertical Path Tracking Mode reverts to armed along with the appropriate altitude capture mode to allow profile re-capture.

Figure 7-22 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.

VNV Target Altitude Capture Mode (ALTV)

NOTE: *Armed VNV Target Altitude and Selected Altitude capture modes are mutually exclusive. However, Selected Altitude Capture Mode is armed implicitly (not annunciated) whenever VNV Target Altitude Capture Mode is armed.*

VNV Target Altitude Capture is analogous to Selected Altitude Capture Mode and is armed automatically after the **VNV** Key is pressed and the next VNV Target Altitude is to be intercepted before the Selected Altitude. The annunciation 'ALTV' indicates that the VNV Target Altitude is to be captured. VNV Target Altitudes are shown in the active flight plan or vertical direct-to, and can be entered manually or loaded from a database (see the 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.

***NOTE:** When the Selected Altitude is set to the VNV Target Altitude, Selected Altitude Capture Mode (ALTS) will be armed even though the altitude value is part of the active VNAV flight plan.*

As the aircraft nears the VNV Target Altitude, the flight director automatically transitions to VNV Target Altitude Capture Mode with Altitude Hold Mode armed. This automatic transition is indicated by the green 'ALTV' annunciation flashing for up to 10 seconds and the appearance of the white 'ALT" annunciation. The VNV Target Altitude is shown as the Altitude Reference beside the 'ALTV' annunciation and remains displayed above the Vertical Speed Indicator. The Required Vertical Speed Indication (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.

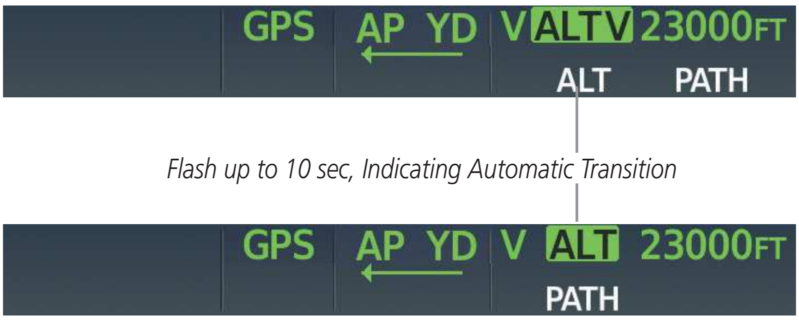


Figure 7-23 VNV Altitude Capture

***NOTE:** Pressing the **CWS** Button while in VNV Target Altitude Capture Mode does not cancel the mode.*

Changing the current VNV Target Altitude while VNV Target Altitude Capture Mode is active causes the flight director to revert to Pitch Hold Mode. Vertical Path Tracking and the appropriate altitude capture mode are armed in preparation to capture the new VNV Target Altitude or the Selected Altitude, depending on which altitude is to be intercepted first.

VNV target altitudes can be changed while editing the active flight plan (see the Flight Management Section for details).

APPROACH MODES (VAPP, GPS/GP, LOC/GS, BC)

***NOTE:** The selected navigation receiver must have a valid VOR or LOC signal or active GPS course for the flight director to enter Approach Mode.*

Approach Mode is activated when the **APR** Key is pressed. Approach Mode acquires and tracks the selected navigation source (GPS, VOR, or LOC), depending on loaded approach. This mode uses the selected navigation receiver deviation and desired course inputs to fly the approach. Pressing the **APR** Key when the CDI is greater than one dot arms the selected approach mode (annunciated in white to the left of the active lateral mode). If the CDI is less than one dot, the LOC is automatically captured when the **APR** Key is pressed.

VOR Approach Mode (VAPP) provides greater sensitivity for signal tracking than VOR Navigation Mode.

Selecting VOR Approach Mode:

1) Ensure a valid VOR frequency is tuned
2) Ensure that VOR is the selected navigation source (use the **CDI** Softkey to cycle through navigation sources if necessary).
3) Press the **APR** Key.

When GPS Approach Mode is armed, Glidepath (**GP**) Mode is also armed.

Selecting GPS Approach Mode without Vertical Guidance:

1) Ensure a GPS approach is loaded into the active flight plan. The active waypoint must be part of the flight plan (cannot be a direct-to a waypoint not in the flight plan).
2) Ensure that GPS is the selected navigation source (use the **CDI** Softkey to cycle through navigation sources if necessary).
3) Press the **APR** or **NAV** Key.

The Flight Director will then supply Lateral Guidance.

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 WAAS-based glidepath. When Glidepath Mode is armed, 'GP' is annunciated in white in the AFCS Status Box.

***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 should be flown to an MDA, untill visual with the landing surface, even though vertical glidepath (GP) information may be provided.*

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

Upon reaching the glidepath, the flight director transitions to Glidepath Mode and begins to capture and track the glidepath.

Figure 7-24 Glidepath Mode Armed

Once the following conditions have been met, the glidepath can be captured:

- The active waypoint is at or after the final approach fix (FAF).
- Vertical deviation is valid.
- The CDI is at less than full scale deviation
- Automatic sequencing of waypoints has not been suspended (no 'SUSP' annunciation on the HSI)

When GPS Approach Mode (**APR**) is armed, Glidepath (**GP**) Mode is also armed.

Selecting GPS Approach Mode with Vertical Guidance:

1) Ensure a GPS approach with vertical guidance (LPV, LNAV/VNAV, LP+V, LNAV+V) is loaded into the active flight plan. The active waypoint must be part of the flight plan (cannot be a direct-to a waypoint not in the flight plan).

2) Ensure that GPS is the selected navigation source (use the **CDI** Softkey to cycle through navigation sources if necessary).

3) Press the **APR** Key.

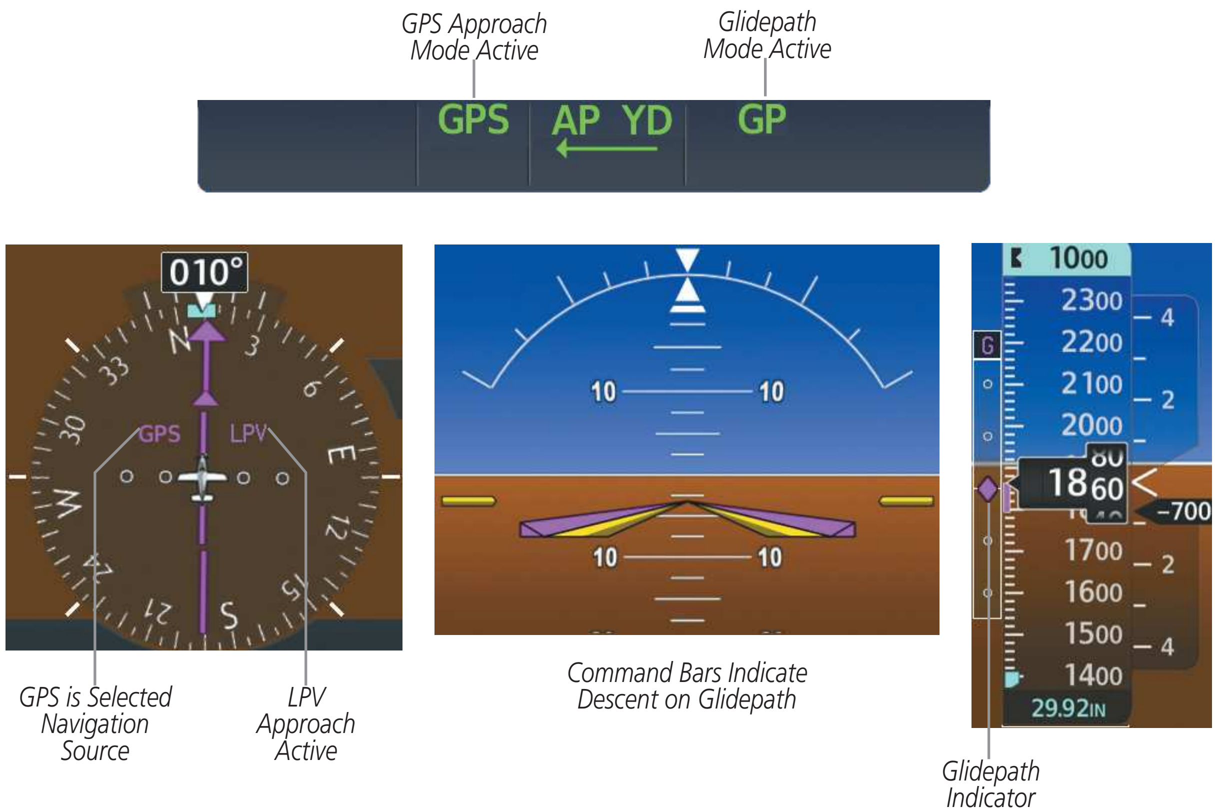


Figure 7-25 Glidepath Mode

Selecting LOC Only Navigation Mode:

1) Ensure a valid localizer frequency is tuned.

2) Ensure that LOC is the selected navigation source (use the **CDI** Softkey to cycle through navigation sources if necessary).

3) Press the **NAV** Key.

Figure 7-26 LOC Approach Mode Active No Glideslope

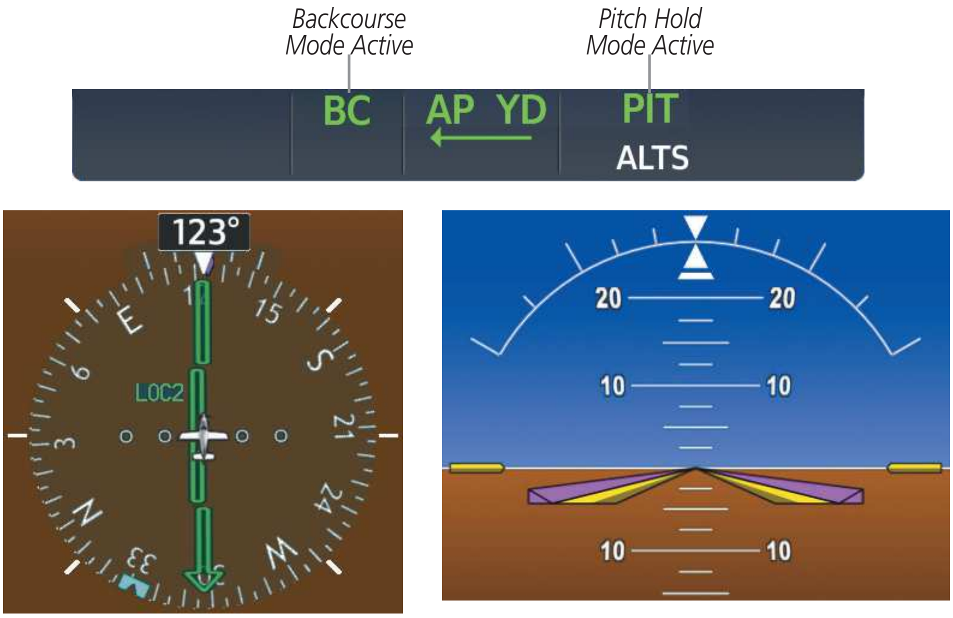
Selecting LOC Backcourse Mode (BC)

1) Ensure a valid localizer frequency is tuned.

2) Ensure that LOC is the selected navigation source (use the **CDI** Softkey to cycle through navigation sources if necessary).

3) Set the Selected Course to the localizer front course

4) Press the **BC** Key.



LOC2 is Selected Navigation Source

Command Bars Hold Pitch Attitude

Figure 7-27 Backcourse Mode

***NOTE:** When making a backcourse approach, set the Selected Course to the localizer front course.*

Backcourse Mode captures and tracks a localizer signal in the backcourse direction. The mode may be selected by pressing the **BC** Key. Backcourse Mode is armed if the CDI is greater than one dot when the mode is selected. If the CDI is less than one dot, Backcourse Mode is automatically captured when the **BC** Key is pressed. The flight director creates roll steering commands from the Selected Course and deviation when in Backcourse Mode.

Glideslope Mode (GS)

***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.*

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

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 mode.

Figure 7-28 Glideslope Mode Armed

Once LOC is the navigation source, the localizer and glideslope can be captured. Upon reaching the glideslope, the flight director transitions to Glideslope Mode and begins to capture and track the glideslope.

LOC Approach Mode allows the autopilot to fly a LOC/ILS approach with a glideslope. When LOC Approach Mode is armed, Glideslope Mode is also armed automatically. LOC captures are inhibited if the difference between aircraft heading and localizer course exceeds 105°.

Selecting LOC with Glideslope Approach Mode:

1) Ensure a valid localizer frequency is tuned.

2) Ensure that LOC is the selected navigation source (use the **CDI** Softkey to cycle through navigation sources if necessary).

3) Press the **APR** Key.

Or:

1) Ensure that GPS is the selected navigation source (use the **CDI** Softkey to cycle through navigation sources if necessary).

2) Ensure a LOC/ILS approach is loaded into the active flight plan.

3) Ensure the corresponding LOC frequency is tuned.

4) Press the **APR** Key.

If the following occurs, the flight director reverts to Roll Hold Mode (wings rolled level):

- Approach Mode is active and a Vectors-To-Final is activated
- Approach Mode is active and Navigation source is manually switched
- During a LOC/ILS approach GPS Navigation Mode is active and the FAF is crossed after the automatic navigation source switch from GPS to LOC

If the navigation source is VOR or localizer or OBS Mode has been enabled when using GPS, the Selected Course is controlled using the **CRS** Knob corresponding to the selected flight director (**CRS1** for the pilot side, **CRS2** for the copilot side).

Pressing the **CWS** Button and hand-flying the aircraft does not change the Selected Course while in Approach/Backcourse Mode. The autopilot guides the aircraft back to the Selected Course (or GPS flight plan) when the **CWS** Button is released.

The **CWS** Button does not change lateral references for Heading Select, Navigation, Backcourse, or Approach Mode. The autopilot guides the aircraft back to the Selected Heading/Course upon release of the **CWS** Button.

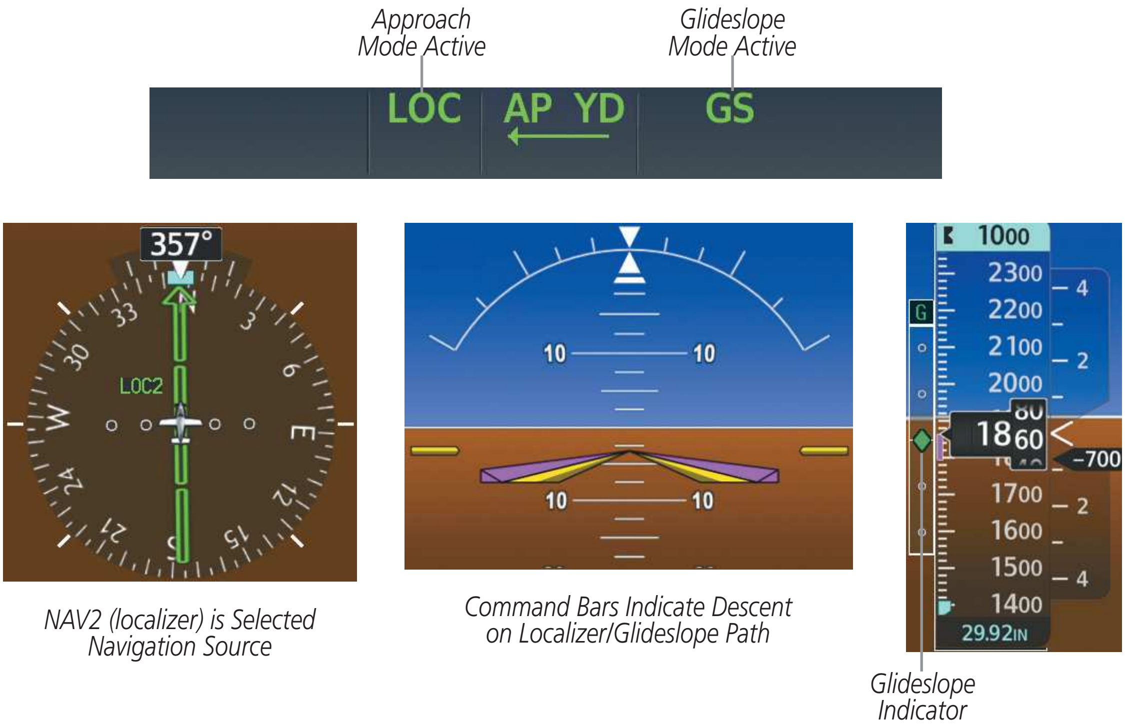


Figure 7-29 Glideslope Mode

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 GPS Navigation Mode is engaged, GPS is the active navigation source on the CDI, and the DME arc segment is the active flight plan leg. It is important to note that automatic navigation of DME arcs is based on GPS. Thus, even if the APR key is pressed and LOC or VOR Approach Mode is armed prior to reaching the Initial Approach Fix (IAF), Approach Mode will not activate until the arc segment is completed.

If the pilot decides to intercept the arc at a location other than the published IAF (i.e. ATC provides vectors to intercept the arc) and subsequently selects Heading Mode or Roll Mode, the AFCS will not automatically intercept or track the arc unless the pilot activates the arc leg of the flight plan and arms GPS Navigation Mode. The AFCS will not intercept and fly a DME arc before reaching an IAF that defines the beginning of the arc segment. Likewise, if at any point while established on the DME arc the pilot deselects GPS Navigation Mode, the AFCS will no longer track the arc.

7.4 AUTOPILOT AND YAW DAMPER OPERATION

NOTE: *Refer to the aircraft current pertinent flight manual for specific instructions regarding emergency procedures.*

The Daher TBM 940 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 940.

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.

ENGAGEMENT

***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.

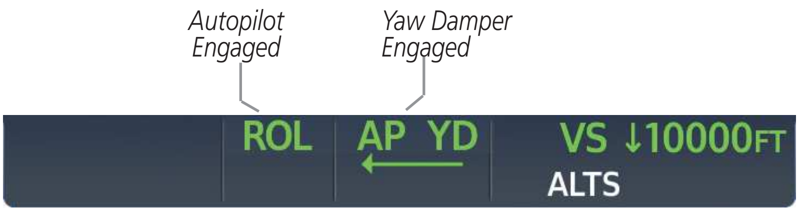


Figure 7-30 Autopilot and Yaw Damper Engaged

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' annunciations, respectively.

CONTROL WHEEL STEERING

During autopilot operation, the aircraft may be hand-flown without disengaging the autopilot. Pressing and holding the **CWS** Button disengages the pitch and roll servos from the flight control surfaces and allows the aircraft to be hand-flown. At the same time, the flight director is synchronized to the aircraft attitude during the maneuver. 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.

DISENGAGEMENT

NOTE: *Pressing the **AP** Key does not disengage the yaw damper.*

The autopilot may be manually disengaged by pushing the **AP DISC**, **GA**, **MERT** Switch, **MEPT ARM** Switch, or the **AP** Key on the AFCS Controller. Manual disengagement is indicated by a five-second flashing yellow 'AP' annunciation and a three-second autopilot disconnect aural alert. The **AP DISC** or **MEPT** ARM Switch may be used to cancel the aural alert.

Figure 7-32 Manual Autopilot and Yaw Damper Disengagement

The **YD** Key, **MEYT** and **AP DISC** Switches can be used to disengage the yaw damper (the autopilot, if engaged, also disengages when the **AP DISC** Switch is pressed). The 'YD' and 'AP' annunciations turn yellow and flash for 5 seconds upon disengagement.

Automatic autopilot disengagement is indicated by a flashing red and white 'AP' annunciation and by the autopilot disconnect aural alert, which continue until acknowledged by pushing the **AP DISC** or **MEPT ARM** Switch. Automatic autopilot disengagement occurs due to:

- System failure
- Invalid sensor data
- Roll Trim input
- Inability to compute default flight director modes (FD also disengages automatically)

Yaw damper disengagement is indicated by a five-second flashing yellow 'YD' annunciation. Automatic yaw damper disengagement occurs when autopilot disengagement is caused by failure in a parameter also affecting the yaw damper. This means the yaw damper can remain operational in some cases where the autopilot automatically disengages. A localized failure in the yaw damper system or invalid sensor data also cause yaw damper disengagement.

Figure 7-33 Automatic Autopilot and Yaw Damper Disengagement

7.5 AUTOTHROTTLE

The Autothrottle system automatically sets the throttle based on phase of flight and Flight Director mode. It also prevents the aircraft from entering an underspeed or overspeed condition regardless of whether the Autothrottle is engaged. The Autothrottle also prevents the aircraft from exceeding engine parameters. The Autothrottle and AFCS are tightly integrated; however, the AFCS can be used without the Autothrottle and the Autothrottle can be used without the AFCS.

PILOT CONTROLS

The Autothrottle system has the following pilot controls:

- **AT Button** — Is located on the GMC 711 and toggles the Autothrottle state between armed/engaged and off.
- **AT DISC Button** — Is located on the front of the throttle and disengages the Autothrottle or takes it out of armed mode.
- **Engine Throttle** — If the Autothrottle is engaged, overpowering the throttle disengages the Autothrottle and the throttle remains in place.
- **SPD Knob** — Is located on the AFCS Controller. This knob is used to set the desired speed while in manual (MAN) speed mode. In FMS speed mode, the Autothrottle follows the airspeed reference scheduled/calculated by the FMS. Pressing the knob toggles between IAS and Mach while in MAN speed mode.
- **FMS/MAN Switch** — Is used to select MAN or FMS speed mode.

AUTOTHROTTLE ENGAGEMENT AND DISENGAGEMENT

To engage the Autothrottle press the **AT** Button. The Autothrottle arms when the airplane is on the ground. If in the air, the Autothrottle will engage into the appropriate mode.

Autothrottle Automatic Engagement

If an underspeed, overspeed or an engine protection condition occurs while the autothrottle is disengaged, the autothrottle will automatically engage and adjust thrust to return to normal operating conditions. Once normal operating conditions exists, the autothrottle will disengage but no aural tone will be played.

If the autothrottle is engaged; underspeed, overspeed, and engine protections occur in the background of the current active autothrottle mode and there is no active protection indication to the pilot.

SPEED MODES

By selecting either MAN or FMS speed mode on the **FMS/MAN** Switch, the pilot can choose to utilize either the **SPD** Knob (MAN) or the FMS as the source for the desired airspeed reference.

MANUAL MODE (MAN)

While in MAN speed mode, a cyan speed bug is displayed on the airspeed indicator. While in MAN mode, the speed set with the **SPD** Knob is used as the source for the desired airspeed reference.

FMS MODE (FMS)

While in FMS speed mode, a solid magenta speed bug in the shape of a triangle is displayed, when in use by the system, on the airspeed indicator. FMS is the source for the desired airspeed reference. (Refer to the Vertical Navigation discussion in the Flight Management Section for more information on FMS speed modes).

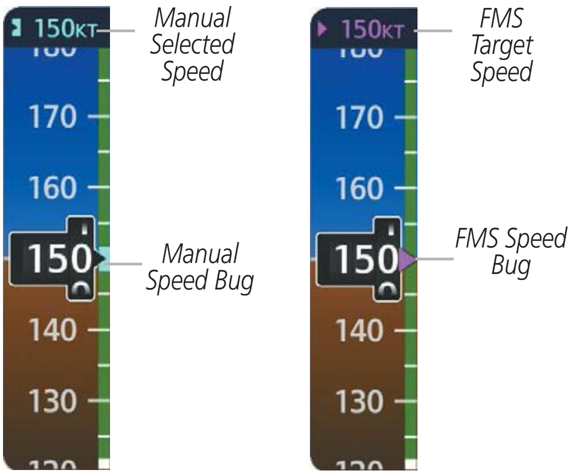


Figure 7-34 Airspeed Indicator with Target Speed Bugs

AUTOTHROTTLE MODES

When the Autothrottle is armed or engaged, an 'AT' annunciation and an Autothrottle mode annunciation appear in the AFCS status box.

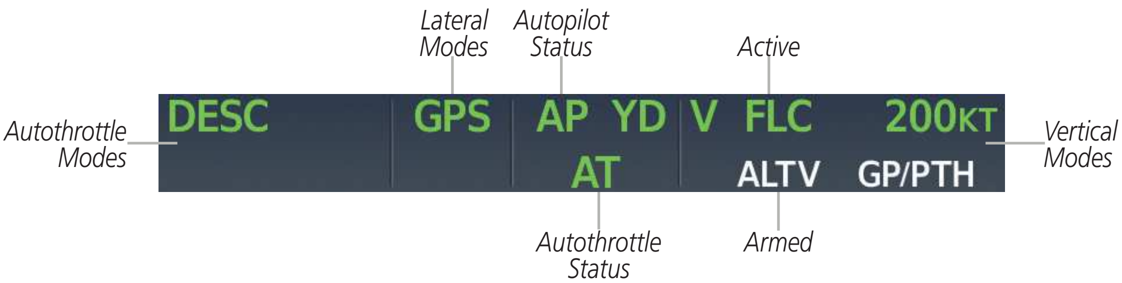


Figure 7-35 Autothrottle Status and Modes

Autothrottle Mode	Description
TO	Takeoff/Go Around thrust setting
CLIMB	Thrust for climb as required when using FLC mode for climb
DESC	Descent thrust when using FLC mode for descent
SPD M .XXX SPD XXXKT	The Autothrottle moves the throttles as required to hold the selected airspeed or Mach. Also displayed for Pilot Defined Cruise.
RCR	The autothrottle moves the throttle to the torque setting for Recommended Cruise
MXCR	The autothrottle moves the throttle to the torque setting for Maximum Cruise
LRCR	The autothrottle moves the throttle to the torque setting for Long Range Cruise
PROT	The Autothrottle engages and protects the aircraft from entering an underspeed or overspeed situation or protects the aircraft from exceeding an engine parameter.

Table 7-6 Autothrottle Modes

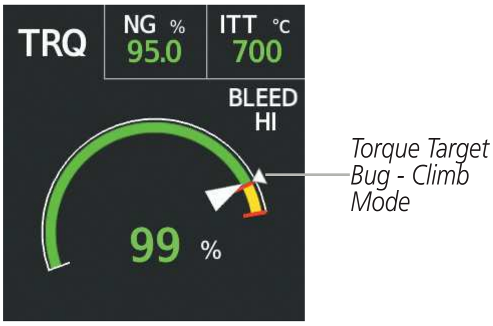


Figure 7-36 AT Target Torque Bug Indication in all Climb Modes

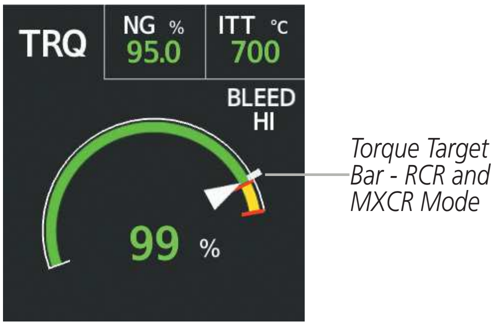


Figure 7-37 AT Target Torque Bar Indication for Recommended Cruise and Maximum Cruise Mode

Figure 7-38 AT Target Torque 'T' Indication in Long Range Cruise Mode

The Autothrottle works in conjunction with the Autopilot/Flight Director to establish and maintain the commanded pitch mode and speed or power target. The following table outlines the correlation between Autopilot/Flight Director Modes and Autothrottle Modes.

Autopilot/Flight Director Mode	Autothrottle Mode Annunciated
None/Off	PROT
PATH, PIT, VS, GS, GP, or LVL	SPD
FLC	CLIMB or DESC
ALT, ALTS, ALTV *	LRCR/RCR/MXCR
ALT, ALTS, ALTV **	SPD
TO	TO
GA	CLB

* If **SPD** Knob is in the FMS position and either LRCR/RCR or MXCR schedule is selected

** If **SPD**Knob is in MAN position or **SPD** Knob is in FMS position and Pilot-Defined Speed Schedule is selected

Table 7-7 Autothrottle Modes

AUTOTHROTTLE ENGINE PROTECTIONS

The engine protection functions continuously monitor the the primary engine parameters (Torque, ITT, Ng) When the engine parameters approach specified limits, the autothrottle will, if engaged, reduce power to maintain the engine parameters within normal operating ranges. This protection works in the background and independent of the current active AT mode and is therfore not annunicated to the pilot.

If not engaged prior to the protection engagement, the autothrottle will engage and reduce power to maintain the engine parameters within normal operating ranges. This is annunciated by a PROT message in the AFCS Status Box. When the engine protection condition is resolved, the autothrottle is automatically disconnected.

7.6 AFCS ANNUNCIATIONS AND ALERTS

AFCS STATUS ALERTS

The annunciations in Table 7-6 (listed in order of increasing priority) can appear on the PFDs above the Airspeed and Attitude indicators. Only one annunciation may occur at a time, and messages are prioritized by criticality.

Figure 7-39 AFCS Status Annunciation

Alert Condition	Annunciation	Description
Rudder Mistrim Right	RUD→	Yaw servo providing sustained force in the indicated direction. Aircraft rudder retrim after substantial pitch and power changes required.
Rudder Mistrim Left	←RUD	
Aileron Mistrim Right	AIL→	Roll servo providing sustained force in the indicated direction
Aileron Mistrim Left	←AIL	
Elevator Mistrim Down	↓ELE	Pitch servo providing sustained force in the indicated direction. May indicate a failure of the pitch trim servo or trim system.
Elevator Mistrim Up	↑ELE	
Pitch Trim Failure (or stuck **MEPT** Switch)	PTRM	If AP engaged, take control of the aircraft and disengage AP If AP disengaged, move **MEPT** switches separately to unstick
Yaw Trim Failure (or stuck **MEYT** Switch)	YTRM	If AP engaged, take control of the aircraft and disengage AP If AP disengaged, move the **MEYT** switch to check if a stuck switch is causing the annunciation
Yaw Damper Failure	YAW	YD control failure; AP also inoperative
Roll Failure	ROLL	Roll axis control failure; AP inoperative
Pitch Failure	PTCH	Pitch axis control failure; AP inoperative
System Failure	AFCS	AP and MEPT are unavailable; FD may still be available
Autothrottle Failure	AT	AT control failure. Autothrottle unavailable; Autopilot may still be available.
Preflight Test	PFT	Performing preflight system test; aural alert sounds at completion Do not press the **AP DISC** Switch during servo power-up and preflight system tests as this may cause the preflight system test to fail or never to start (if servos fail their power-up tests). Power must be cycled to the servos to remedy the situation.
	PFT	Preflight system test failed; aural alert sounds at failure

Table 7-8 AFCS Status Alerts

7.7 ABNORMAL OPERATION

SUSPECTED AUTOPILOT MALFUNCTION

NOTE: *Consult the aircraft documentation for the location of circuit breakers as well as specifics that may supplement or amplify this procedure.*

Suspected Autopilot 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

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.

Autopilot servos preflight inspection:

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

NOTE: *Overspeed protection is not active in ALT, GS or GP Modes.*

While Pitch Hold, Vertical Speed, 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. When an overspeed condition occurs while the Autothrottle is not engaged, the Autothrottle will automatically engage and reduce thrust to slow the aircraft. The PROT annunciation will display to indicate that protection is active. When the overspeed condition is resolved, the Autothrottle is automatically disconnected.

While the Autothrottle is engaged, overspeed protection occurs in the background of the current active Autothrottle mode and there is no active protection indication to the pilot. The annunciation disappears when the overspeed condition is resolved.

Note: When the autopilot is outside normal operating limits, it uses more aggressive commands to return to normal limits.

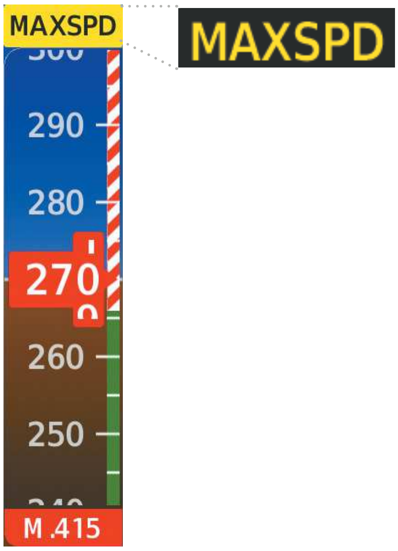


Figure 7-40 Overspeed Annunciation

UNDERSPEED PROTECTION

NOTE: *While underspeed protection is active, the aircraft will deviate from the selected reference.*

Underspeed Protection is available when the optional Underspeed Protection (USP) system is installed, the aircraft is fitted with an AOA sensor, and the autopilot is on. It is designed to discourage aircraft operation below minimum established airspeeds.

When the aircraft reaches a predetermined airspeed (specific to each flap setting), a yellow MINSPD annunciation will appear above the airspeed indicator. When aircraft angle of attack is within four degrees of stall warning, the Pitch Limit Indicator will be displayed approximately four degrees above the aircraft symbol on the pitch attitude indicator. If deceleration continues, the Pitch Limit Indicator will move downward on the pitch attitude indicator until coincident with the aircraft symbol at stall warning angle of attack.

Flaps	MINSPD Annunciation	Airspeed Alert
0%	100 kts	92 kts
Takeoff	90 kts	84 kts
100%	78 kts	72 kts
*Airspeed alert based on speed trend		

Table 7-9 AFCS Status Alerts

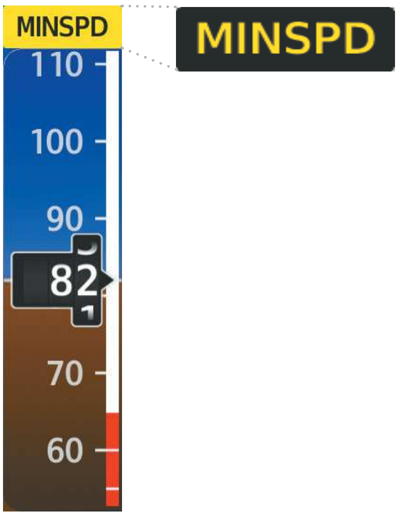


Figure 7-41 Underspeed Annunciation

If the aircraft continues to decelerate, the autopilot underspeed protection engages to protect the airplane from an underspeed situation. When an underspeed condition occurs while the Autothrottle is not engaged, the Autothrottle will automatically engage and increase thrust to accelerate the aircraft. The PROT annunciation will display to indicate that protection is active. When the underspeed condition is resolved, the Autothrottle is automatically disconnected.

While the Autothrottle is engaged, underspeed protection occurs in the background of the current active Autothrottle mode and there is no active protection indication to the pilot.

If the aircraft decelerates to an IAS below MINSPD speed trigger -5 kts, the lateral and vertical flight director modes will change from active to armed, and the autopilot will provide input causing the aircraft to pitch down and the wings to level.

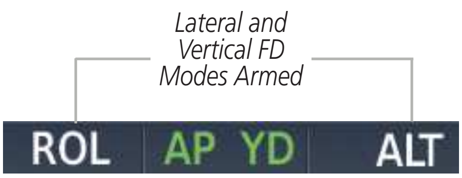


Figure 7-42 Lateral and Vertical Flight Director Modes Armed

An aural "AIRSPEED" alert will sound every five seconds and a red "USP ACTIVE" annunciation will appear in the CAS window. The pitch down force will continue until the aircraft reaches a pitch attitude at which IAS equals the IAS at which stall warning turns off, plus two knots.

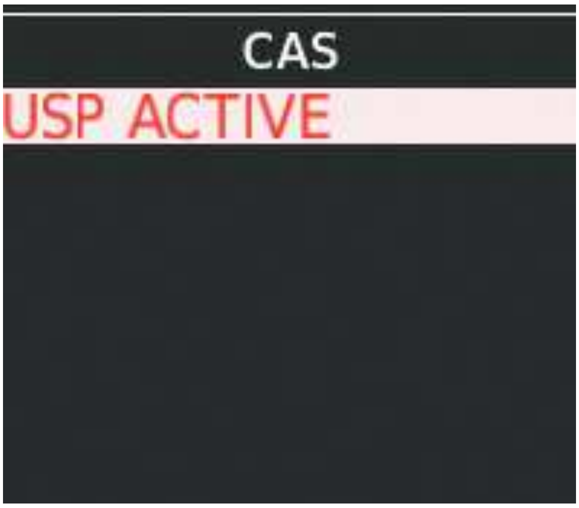


Figure 7-43 USP Active Annunciation

When airspeed increases (as a result of adding power/thrust) to above the IAS at which MINSPD turns off, 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, and when aircraft angle of attack reaches approximately five degrees below stall warning angle of attack, the Pitch Limit Indicator will be removed.

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 940 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. The Autothrottle will engage in DESC mode.

NOTE: *Refer to the aircraft current pertinent flight manual for specific instructions regarding emergency procedures.*

Figure 7-45 Emergency Descent Mode Active

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 advisory will appear and the pilot will have the ability to change AFCS modes as necessary. EDM Mode cannot be reentered until the EDM Override is cleared. To clear the EDM Override the CABIN ALTITUDE CAS warning needs to be cleared and the **AP** Key needs to be cycled off and back on again.

SECTION 8 ADDITIONAL FEATURES

***NOTE:** Regardless of the availability of SafeTaxi® or ChartView, it is necessary to carry another source of charts on-board the aircraft.*

Additional features of the G3000 Integrated Avionics System include the following:

- SafeTaxi® diagrams
- SurfaceWatch™ (optional)
- ChartView (optional) and FliteCharts® electronic charts
- Airport Directory (AOPA™ or AC-U-KWIK)
- Satellite Telephone and SMS Text Messages (Optional)
- SiriusXM® Satellite Radio entertainment (optional)
- Connext® Setup
- Flight Data Logging
- Electronic Stability and Protection (ESP™)
- Electronic Checklists
- Electronic Documents

SafeTaxi diagrams provide detailed taxiway, runway, and ramp information at more than 700 airports in the United States. By decreasing range on an airport that has a SafeTaxi diagram available, a close up view of the airport layout can be seen.

The optional SurfaceWatch™ feature provides voice and visual annunciations to aid in maintaining situational awareness and avoid potential runway incursions during ground and air operations in the airport environment.

ChartView provides on-board electronic terminal procedures charts. Electronic charts offer the convenience of rapid access to essential information.

The AOPA or AC-U-KWIK Airport Directory offers detailed information for a selected airport, such as available services, hours of operation, and lodging options.

Telephone and SMS texting are optional subscription services offered through Garmin Connext and Iridium Satellite LLC. Voice and SMS messaging communications are through the Iridium Satellite Network.

The optional SiriusXM Satellite Radio entertainment audio feature of the SiriusXM Data Link Receiver handles more than 170 channels of music, news, and sports. SiriusXM Satellite Radio offers more entertainment choices and longer range coverage than commercial broadcast stations.

Connext allows for setting up the installed optional Flight Stream Bluetooth Transceiver for a Bluetooth connection between the system and a mobile device running the Garmin Pilot™ application.

The Flight Data Logging feature automatically stores critical flight and engine data on an SD data card. Approximately 1,000 flight hours can be recorded for each 1GB of available space on the card.

The Electronic Stability and Protection (ESP™) system discourages aircraft operation outside the normal flight envelope

Electronic checklists allow a pilot to quickly find the proper procedure for a particular phase of flight.

The Electronic Document function allows viewing of electronic documents on selected display panes.

8.1 SAFETAXI

SafeTaxi is an enhanced feature that gives greater map detail when viewing airports at close range on the Navigation Map or the Inset Map on the PFD. The maximum map ranges for enhanced detail are pilot configurable. When viewing at ranges close enough to show the airport detail, the map reveals taxiways with identifying letters/numbers, airport Hot Spots, and airport landmarks including ramps, buildings, control towers, and other prominent features. Resolution is greater at lower map ranges. When the aircraft's current position is within the SafeTaxi view, the airplane symbol on the airport provides enhanced position awareness. To view the full capability of the SafeTaxi feature, 'Airports' must be enabled in the Map Settings menu on the Touchscreen Controller.

***NOTE:** When obstacles are displayed on the Navigation Map in the vicinity of an airport being viewed with SafeTaxi, the obstacle symbols may be obscured by SafeTaxi feature labels.*

Designated Hot Spots are recognized at airports with many intersecting taxiways and runways, and/or complex ramp areas. Airport Hot Spots are outlined to caution pilots of areas on an airport surface where positional awareness confusion or runway incursions happen most often. Hot Spots are defined with a magenta circle or outline around the region of possible confusion.

Any map display that shows the navigation view can also show the SafeTaxi airport layout within the maximum configured range. The following is a list of displays where the SafeTaxi feature can be seen:

- Navigation Map
- Inset Map (PFD)
- Weather Datalink Pane
- Trip Planning Pane

During ground operations the aircraft's position is displayed in reference to taxiways, runways, and airport features. In the example shown, the aircraft is on taxiway Charlie 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.

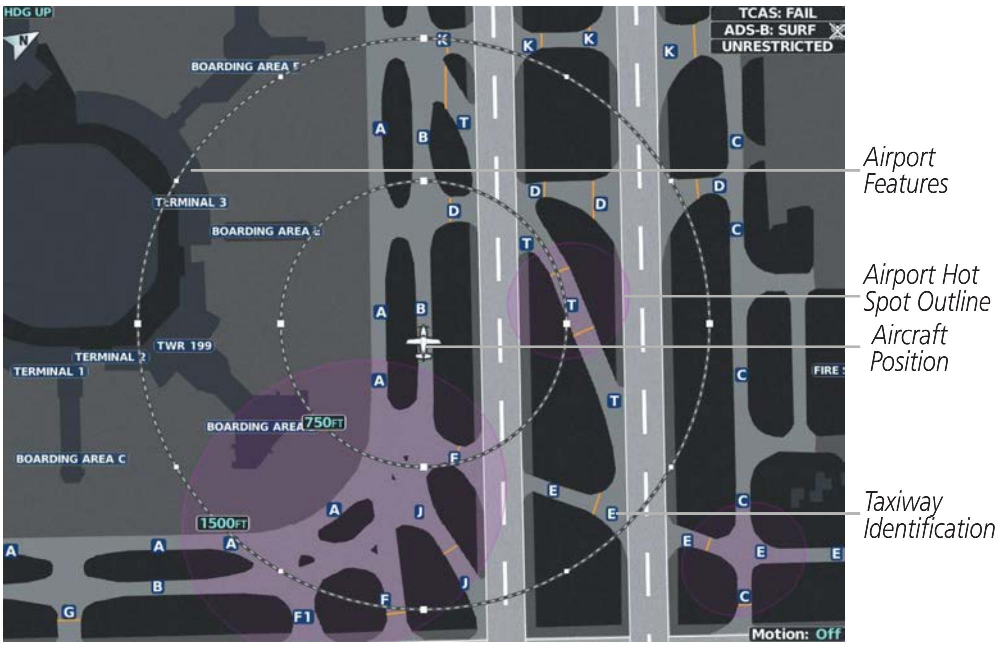


Figure 8-1 SafeTaxi Depiction on the Navigation Map Display

Enabling/Disabling SafeTaxi:

1) From the MFD **Home** Screen, touch **Map Selection** > **Map Settings**.
2) If not already selected, touch the **Aviation** Tab.
3) If necessary, scroll to display the **SafeTaxi** Annunciator Button.
4) Touch the **SafeTaxi** Button to enable or disable 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 the MFD **Home** Screen, touch **Map Selection** > **Map Settings**.
2) If not already selected, touch the **Aviation** Tab.
3) If necessary, scroll to display the **SafeTaxi** Range Button.
4) Touch the SafeTaxi Range Button. A selection of ranges is displayed.
5) Touch the desired range. In the following figure, 4 NM has been selected. With this setting, SafeTaxi will be displayed on the Navigation Map for range settings up to, and including 4 NM.

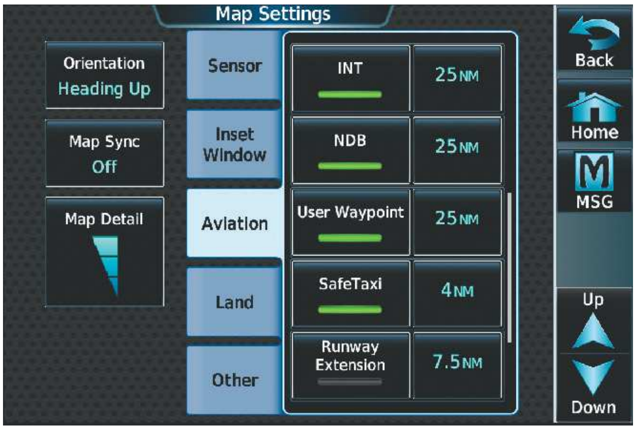


Figure 8-2 SafeTaxi Map Settings

8.2 SURFACEWATCH

The optional SurfaceWatch™ feature provides aural and visual annunciations to help the flight crew maintain situational awareness and avoid potential runway incursions during ground and air operations in the airport environment. The SurfaceWatch feature is comprised of the following key components:

- Alert Annunciations

  Taxiway Takeoff

  Runway Too Short (during takeoff or landing)
  Check Runway (during takeoff or landing)
  Taxiway Landing
- Provides the flight crew with voice alerts for 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.
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.

SURFACEWATCH SETUP

***NOTE:** When using PERF menu for flight planning, the TO and LDG distance information is not updated automatically. This information will need to be added manually.*

Origin/destination airport, runway and distance data entered integrates with SurfaceWatch technology to alert the flight crew to a runway too short for takeoff/landing, or to advise of a potential taxiway takeoff/landing. The runway selected in SurfaceWatch Setup appears on the airport diagram in cyan, and appears outlined in cyan on the synthetic vision representation of the runway on the PFD.

Entering origin/destination airport:

1) From MFD Home, touch **Flight Plan**.
2) Touch the **Add Origin** Button to display the keypad.
3) Select the identifier of the origin waypoint.

   Use the keypad and the **Enter** Button to select a waypoint Identifier.

Selecting origin/destination runway:

1) From Active Flight Plan, touch **Select Runway**
2) Touch the desired runway shown on the drop down list.

Selecting required takeoff/landing distance:

1) From MFD Home, touch **PERF>Takeoff Data.**
2) Touch the **Runway** Tab.
3) The Takeoff Run Available distance will be automatically populated for runways supported with PERF Data.
4) Touch the **Origin** Tab and then touch **Required Takeoff DIS** and use the numeric buttons to enter the required takeoff or landing distance.

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 04 right (RWY 04R). The remaining runway distance is also shown when the aircraft is situated on and aligned with a runway.

If the aircraft is airborne and approaching an airport, 'AIRBORNE TO' and the destination airport identifier will be displayed.

Information is displayed only for objects labeled on the SafeTaxi diagram.

APPROACHING COMPONENT

This component indicates the aircraft is 'APPROACHING' the indicated apron, taxiway, or runway. In the previous figure, the aircraft is currently 'APPROACHING' taxiway H (TWY H). The distance to the taxiway is also shown.

When the aircraft is taxiing and approaching an intersection of multiple taxiways, the taxiway identifiers will be listed in order of proximity and the distance to the nearest is displayed.

When the aircraft is taxiing and crossing an intersection of multiple taxiways, 'CROSSING' will be displayed and no distance will be shown.

CROSSING RUNWAYS

This component lists the runways, from closest to furthest, that are 'CROSSING' the runway the aircraft currently occupies, 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.

SurfaceWatch Alert Annunciation	Associated Voice Alert	Description
TWY TAKEOFF	"Taxiway takeoff"	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 entered.
CHECK RUNWAY	"Check runway"	Issued when the aircraft is taking off from, or landing on, a runway different than that entered in PERF.
TWY LANDING	"Taxiway landing"	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 (See following figure).

Figure 8-5 Typical Taxiway Information Displayed in the Information Box

Runway Too Short

The Runway Too Short (during takeoff) alert is issued when the aircraft attempts to takeoff from a runway and the remaining runway length is less than the required length. The system determines this when the Takeoff phase-of-flight is valid while the aircraft is aligned with a runway that is shorter than the required distance entered in PERF.

Note that while the Runway Too Short alert may be issued for any runway from which the aircraft is taking off, the system will always calculate the runway length for the specific runway entered in PERF.

In addition to the visual and voice alert, the Information Box will contain a textual description of the currently occupied runway and the remaining runway length as shown in the following figure.

Figure 8-6 Typical Runway Information Displayed in the Information Box

Check Runway

The Check Runway alert is issued when the aircraft attempts to takeoff from a runway that does not match the departure runway in PERF. The system determines this when the Takeoff phase-of-flight is valid while the aircraft is aligned with a runway that is not the departure runway entered in the PERF function. The selected airports/runways will only synchronize with changes made to the flight plan when the pilot navigates to the Takeoff page on the GTC.

In addition to the visual and voice alert, the Information Box contains a textual description of the currently occupied runway as shown in the previous figure.

LANDING ALERTS

The On-Final phase-of-flight, as determined by the system, must be valid in order for the system to issue Landing Alerts.

Taxiway Landing

The Taxiway Landing alert is issued when the aircraft attempts to land on a non-runway (e.g. a taxiway). The system determines this when the On-Final phase-of-flight is valid and the aircraft is not aligned with a runway.

In addition to the visual and voice alert, the Information Box will display the destination airport identifier and the text "APPROACHING TWY" to indicate a non-runway landing is being attempted (see following figure).

Figure 8-7 Typical Information Displayed During a Taxiway Landing Alert

Runway Too Short

The Runway Too Short alert is issued when the aircraft attempts to land on a runway where the runway length is less than the required landing runway length as entered in the PERF function. The system determines this when the On-Final phase-of-flight is valid and the aircraft is aligned with a runway that has been entered to be too short.

Note that while the Runway Too Short alert may be issued for any runway with which aircraft is aligned, the system will always calculate the runway length for the specific runway entered in PERF.

In addition to the visual and voice alert, the Information Box will display the destination airport identifier and the text "APPROACHING REMAINING" to indicate a the remaining runway length as indicated in the following figure.

Figure 8-8 Typical Information Displayed During a Runway Too Short Alert

Check Runway

The Check Runway alert is issued when the aircraft attempts to land on a runway that does not match the arrival runway specified in the PERF function. The system determines this when the On-Final phase-of-flight is valid while the aircraft is aligned with a runway that is not the arrival runway entered in the PERF function.

Additionally, the Information Box will display the destination airport identifier, the runway with which the aircraft is aligned, and the distance to the runway (see following figure).

Figure 8-9 Typical Information Displayed During a Check Runway Alert

DISTANCE REMAINING CALLOUTS

With rejected takeoff or during landing rollout, distance remaining voice callouts are issued for the remaining runway distances of 5000', 4000', 3000', 2000', 1000', 500', and 100' while the aircraft is traveling faster than 40 knots.

8.3 CHARTS

Electronic charts that resemble the paper versions of AeroNav Services terminal procedures charts (FliteCharts) and Jeppesen terminal procedures charts (ChartView) can be displayed on the MFD or PFD.

When the databases for both chart types are purchased and loaded in the system, the desired charts brand, or source, can be selected for viewing. The active chart source for a particular procedure is shown on the Chart Options Screen under Preferred Source.

Selecting Preferred Charts Source:

1) From MFD Home, touch **Chart Selection** > **Chart Options > Preferred Source.**
2) Touch either **Chartview** or **FliteCharts** to set as the preferred chart source

. Figure 8-10 Chart Options Preferred Source Button

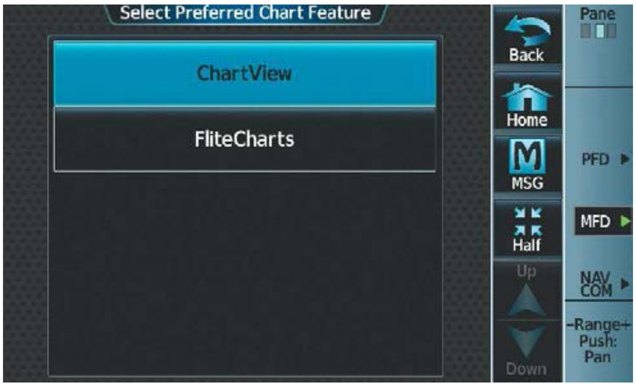


Figure 8-11 Select Preferred Chart Screen

CHARTVIEW (OPTIONAL)

ChartView resembles the paper version of Jeppesen terminal procedures charts. The charts are displayed in full color with high-resolution. The Display Pane depiction shows the aircraft position on the moving map in the plan view of approach charts and on airport diagrams. Airport Hot Spots are outlined in magenta.

The geo-referenced aircraft position is indicated by an aircraft symbol displayed on the chart when the current position is within the boundaries of the chart. Inset boxes (see following figure) are not considered within the chart boundaries. Therefore, when the aircraft symbol reaches a chart boundary line, or inset box, the aircraft symbol is removed from the display.

The following figure shows examples of off-scale areas, indicated by the grey shading. Note, the grey shading is for illustrative purposes only and will not appear on the published chart or Display Pane. These off-scale areas appear on the chart to convey supplemental information. However, the depicted geographical position of this information, as it relates to the chart plan view, is not the actual geographic position. Therefore, when the aircraft symbol appears within one of these areas, the aircraft position indicated is relative to the chart plan view, not to the off-scale area.

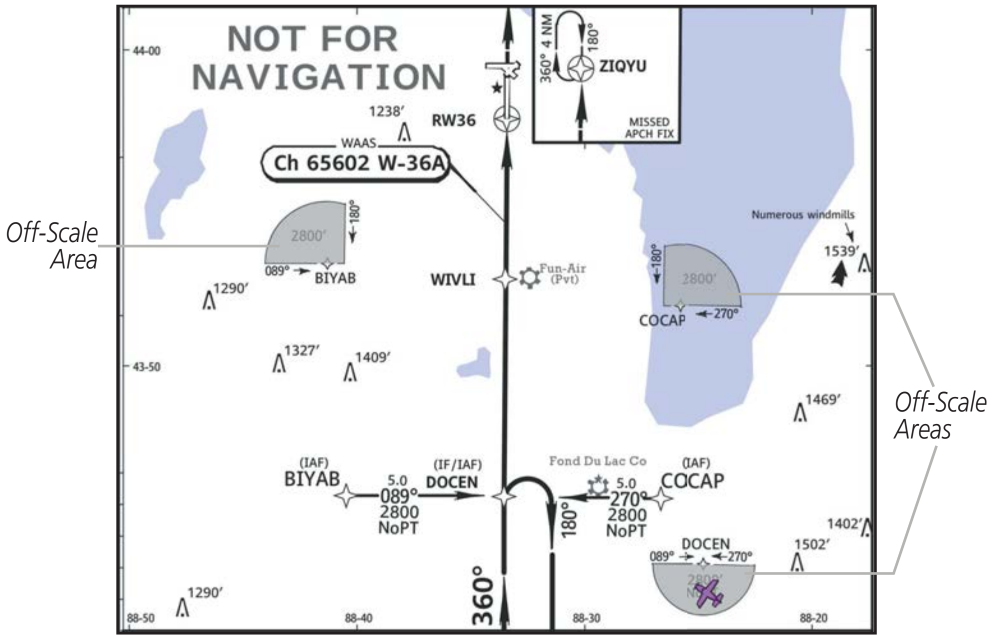


Figure 8-12 Sample Chart Indicating Off-Scale Areas

NOTE: *Do not maneuver the aircraft based solely upon the geo-referenced aircraft symbol.*

The ChartView database subscription is available from Jeppesen, Inc. Available data includes:

- Arrivals (STAR)
- Departure Procedures (DP)
- Approaches
- Airport Diagrams
- Chart NOTAMs

NOTE: *Only NOTAMs applicable to specific information conveyed on the displayed Jeppesen chart are available. There may be other NOTAMs available pertaining to the flight that may not be displayed. Contact Jeppesen for more information regarding Jeppesen database-published NOTAMs.*

CHART SELECTION

When a flight plan is active, or when flying direct-to a destination, the initial set of charts made available pertain to the departure airport. After departing the airport environment, the initial chart set made available pertains to the destination airport. When no flight plan is active, or when not flying to a direct-to destination, the initial chart set is made available for the nearest airport.

Selecting Charts using the Charts Screen:

1) From the MFD **Home** Screen, touch **Charts** > **Chart Selection**.
2) The airport for which charts will be displayed is shown at the top of the Charts Screen. Touch the Airport Button to enter another airport.
3) Touch the **Info** Tab to display the airport information selection buttons for the selected airport (see following figure).

- **Departure** Tab to display a list of possible departures for the selected airport.
- **Arrival** Tab to display a list of possible arrivals for the selected airport.
- **Approach** Tab to display a list of possible approaches for the selected airport.

4) Touch the desired information button in any of these lists to display the applicable chart on the selected Display Pane.

Figure 8-13 Airport Diagram Selection

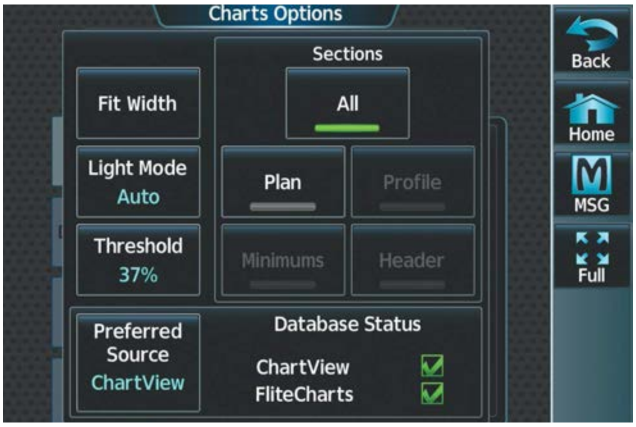


Figure 8-14 Airport Diagram View Options

5) Touch the **Charts Options** Button to select the desired display option for the selected chart (see previous figure).

6) Touch **All** to display the complete Airport Diagram. **Fit Width** displays the full width of the Airport Diagram. **Plan** displays only the diagram portion of the chart. **Minimums** displays only the approach minimums on an approach chart. **Profile** displays only the descent profile on the approach chart. **Header** displays the chart header. Only appropriate views are available for the selected chart.

7) Touch **Back** to return to the Charts Screen.

Zoom-in, zoom-out, pan, and rotate the displayed chart:

1) From the MFD **Home** Screen, 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.

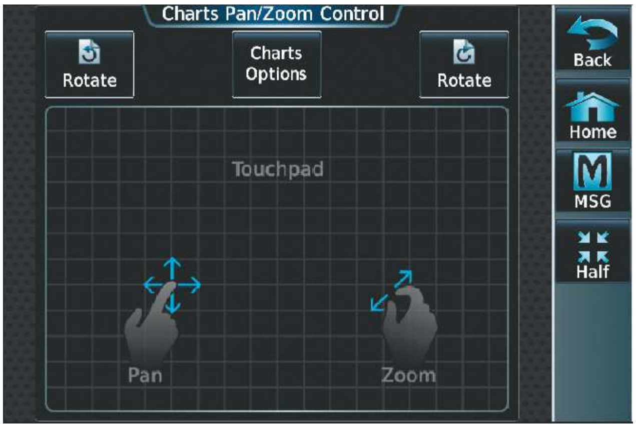


Figure 8-15 Pan and Zoom Touchpad

4) Turn the lower knob, or use the pinch-and-zoom feature on the Touchpad to adjust the chart zoom.

5) Move a finger along the Touchpad, or turn the upper knobs to pan the displayed chart.

6) Touch the **Rotate** Buttons to rotate the chart clockwise or counter-clockwise, as indicated on the button. Each touch of the button rotates the chart 90 degrees in the designated direction.

Selecting Airport Diagrams from the Nearest Airports Screen:

1) From the MFD **Home** Screen, 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 8-16 Airport Diagram Selection

3) Touch the **Airport Chart** Button. The **Info** Tab selections are displayed on the Touchscreen Controller and the Airport Diagram is displayed on the selected Display Pane (see following figure).

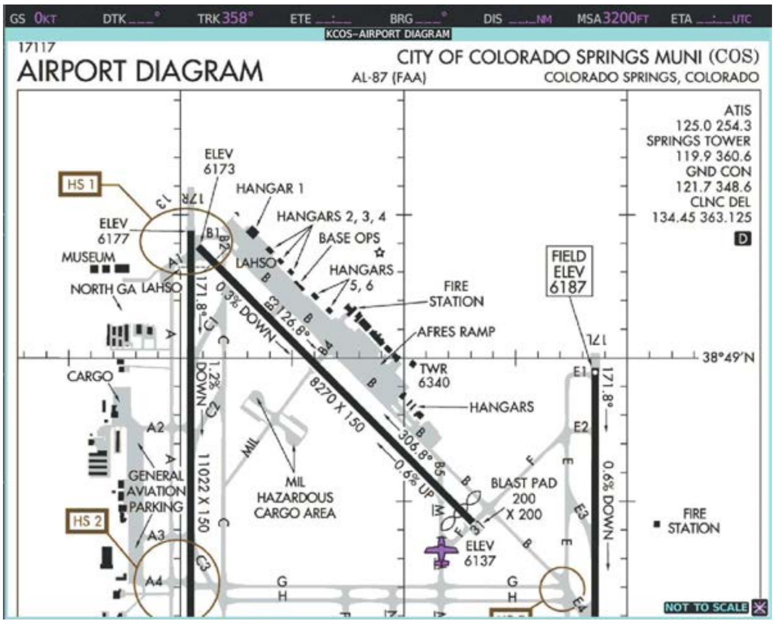


Figure 8-17 Airport Chart for Selected Airport

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 'CHART NOT AVAILABLE' appears on the screen. The 'CHART NOT AVAILABLE' 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 8-18 Chart Not Available Banner

If there is a problem in rendering the data (such as a data error or a failure of an individual chart), the banner 'UNABLE TO DISPLAY CHART' is then displayed.

Unable To Display Chart

Figure 8-19 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 the MFD **Home** Screen, touch **Charts** > **Charts Options**.
2) Touch the **Light Mode** Button.
3) Touch the **Day**, **Night**, or **Auto** button (see following figure). The selection is annunciated on the **Light Mode** Button. When **Auto** is selected, the display will change to the appropriate day or night setting, dependent on ambient lighting.

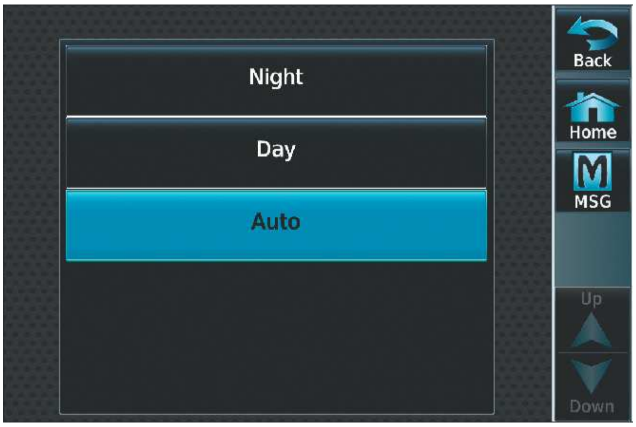


Figure 8-20 Selecting Day/Night View

4) Touch the **Threshold** button (see following figure). The Auto Light Mode Threshold window is displayed.

Select Chart Options   *Adjust Threshold Setting*

Figure 8-21 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.

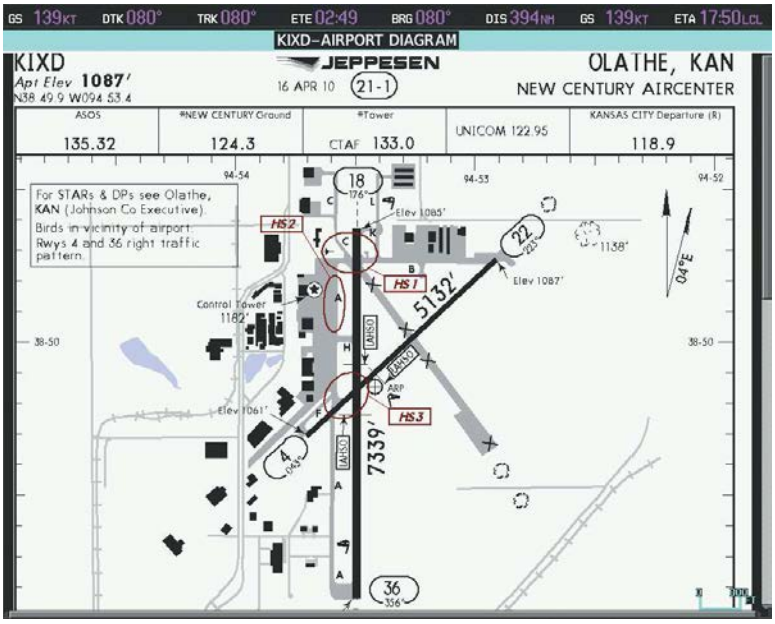


Figure 8-22 Airport Diagram, Day View

Figure 8-23 Airport Diagram, Night View

FLITECHARTS

FliteCharts resemble the paper version of AeroNav Services terminal procedures charts. The charts are displayed with high-resolution and in color for applicable charts.

The geo-referenced aircraft position is indicated by an aircraft symbol displayed on the chart when the current position is within the boundaries of the chart. An aircraft symbol may be displayed within an off-scale area depicted on some charts.

The following figure shows examples of off-scale areas, indicated by the grey shading. Note, these areas are not shaded on the published chart. These off-scale areas appear on the chart to convey supplemental information. However, the depicted geographical position of this information, as it relates to the chart planview, is not the actual geographic position. Therefore, when the aircraft symbol appears within one of these areas, the aircraft position indicated is relative to the chart planview, not to the off-scale area.

The FliteCharts database subscription is available from Garmin. Available data includes:

- Arrivals (STAR)
- Departure Procedures (DP)
- Approaches
- Airport Diagrams

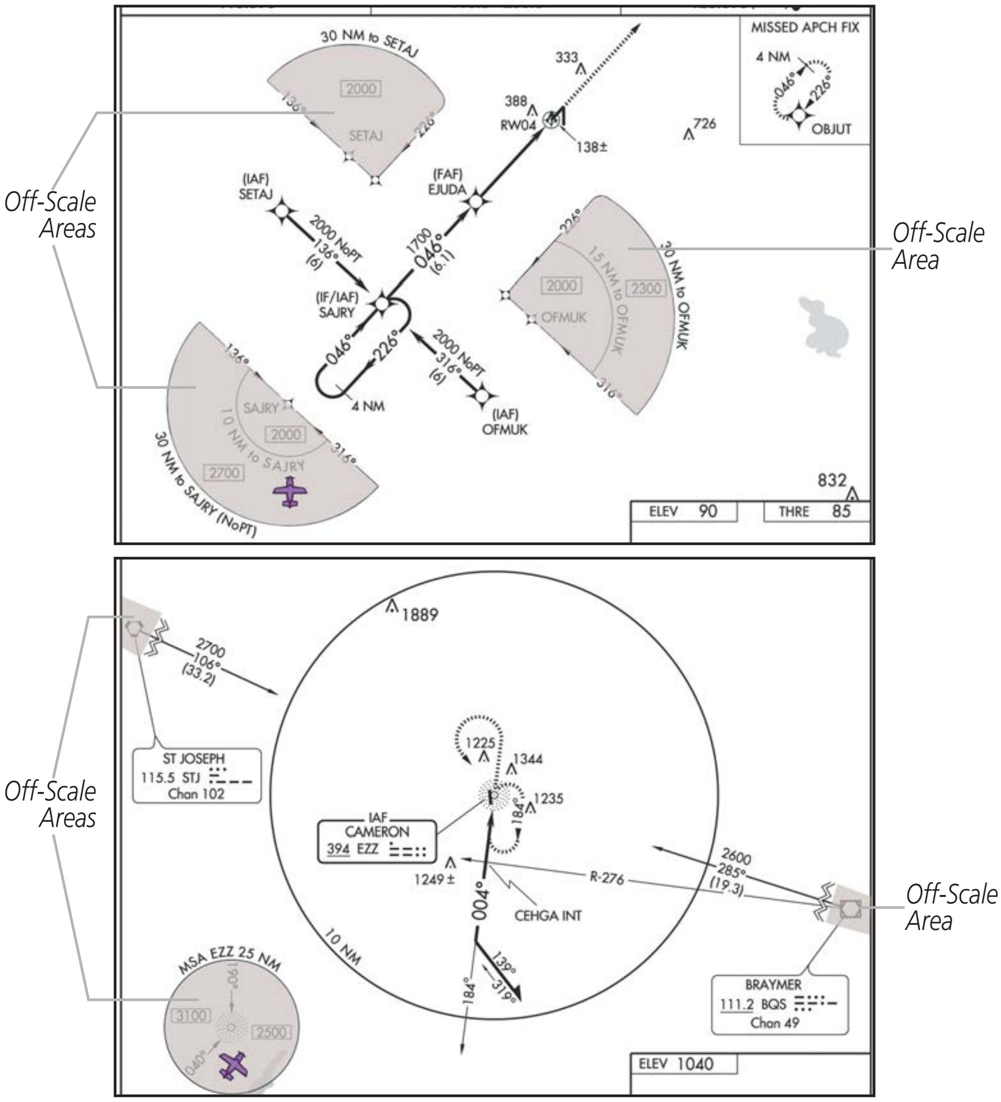


Figure 8-24 Sample Chart Indicating Off-Scale Areas

NOTE: *Do not maneuver the aircraft based solely upon the geo-referenced aircraft symbol.*

CHART SELECTION

When a flight plan is active, or when flying direct-to a destination, the initial set of charts made available pertains to the departure airport. After departing the airport environment, the initial chart set made available pertains to the destination airport. When no flight plan is active, or when not flying to a direct-to destination, the initial chart set is made available for the nearest airport.

Selecting Charts using the Charts Screen:

1) From the MFD **Home** Screen, touch **Charts**.
2) The airport for which charts will be displayed is shown at the top of the Charts Screen. Touch the Airport Button to enter another airport.
3) Touch the **Info** Tab to display the airport information selection buttons for the selected airport (see following figure).
   - **Departure** Tab to display a list of possible departures for the selected airport.
   - **Arrival** Tab to display a list of possible arrivals for the selected airport.
   - **Approach** Tab to display a list of possible approaches for the selected airport.
4) Touch the desired information button in any of these lists to display the applicable chart on the selected Display Pane.

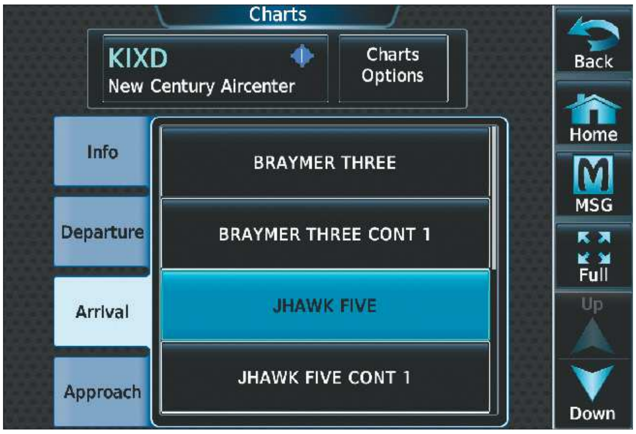


Figure 8-25 Airport Diagram Selection

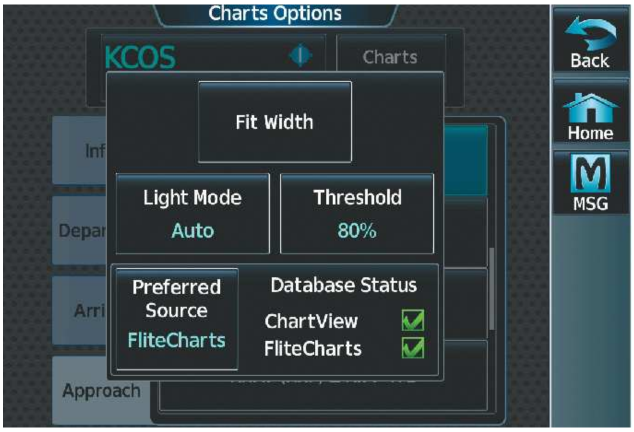


Figure 8-26 Airport Diagram View Options

5) Touch the **Charts Options** Button to display the viewing options available for the selected chart (see previous figure).
6) Touch **Fit Width** to display the full width of the chart.
7) Touch **Back** to return to the Charts Screen.

Selecting Airport Diagrams from the Nearest Airports Screen:

1) From the MFD **Home** Screen, touch **Nearest** > **Airport**.

2) Touch the desired airport button. KCOS is selected in the following figure. The **Waypoint Options** buttons are now displayed.

Figure 8-27 Airport Diagram Selection

3) Touch the **Airport Chart** Button. The **Info** Tab selections are displayed on the Touchscreen Controller (see previous figure) and the Airport Diagram is displayed on the selected Display Pane (see following figure).

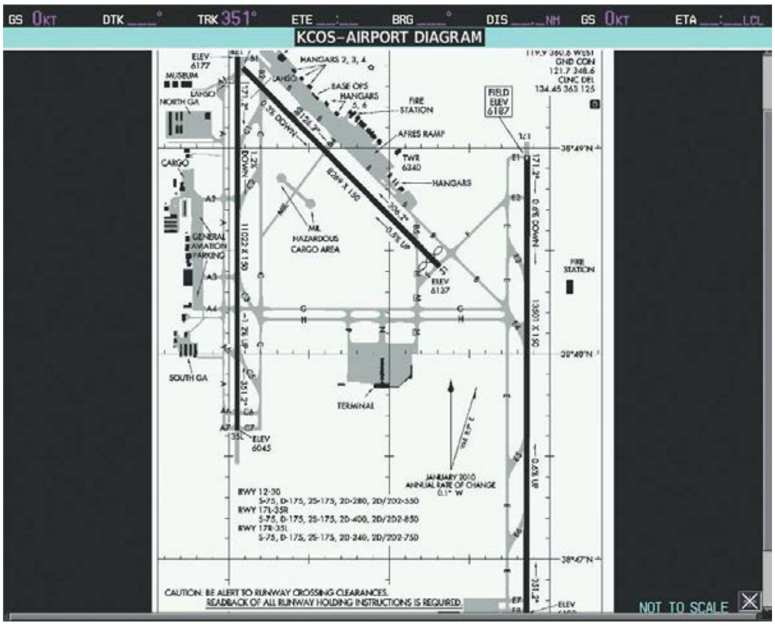


Figure 8-28 Airport Chart for Selected Airport

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 'CHART NOT AVAILABLE' appears on the screen. The 'CHART NOT AVAILABLE' banner does not refer to the Jeppesen subscription, but rather the availability of a particular airport chart selection or procedure for a selected airport.

Figure 8-29 Chart Not Available Banner

If there is a problem in rendering the data (such as a data error or a failure of an individual chart), the banner 'UNABLE TO DISPLAY CHART' is then displayed.

Figure 8-30 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 the MFD **Home** Screen, touch **Charts** > **Charts Options**.

2) Touch the **Light Mode** Button.

3) Touch the **Day**, **Night**, or **Auto** button. The selection is annunciated on the **Light Mode** Button. When **Auto** is selected, the display will change to the appropriate day or night setting, dependent on ambient lighting.

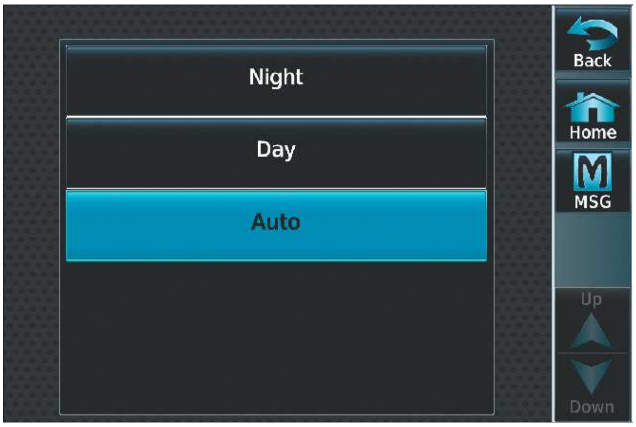
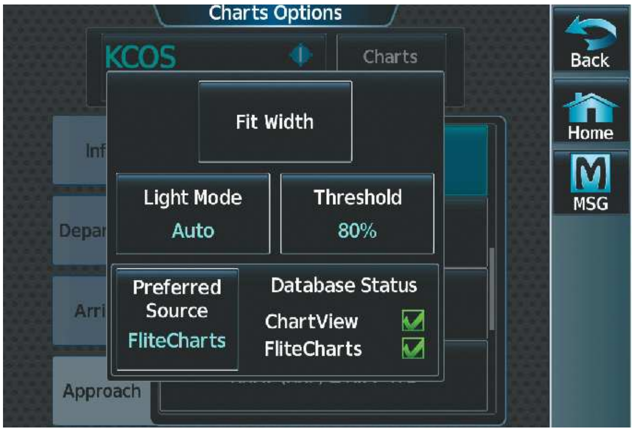
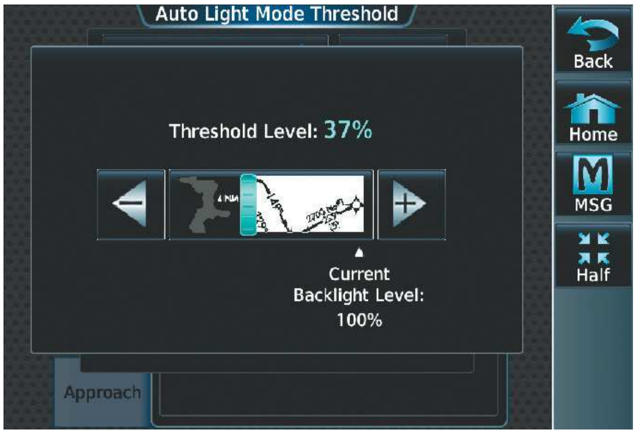


Figure 8-31 Selecting Day/Night View

4) Touch the **Threshold** button (see following figure). The Auto Light Mode Threshold window is displayed.



Select Chart Options



Adjust Threshold Setting

Figure 8-32 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.

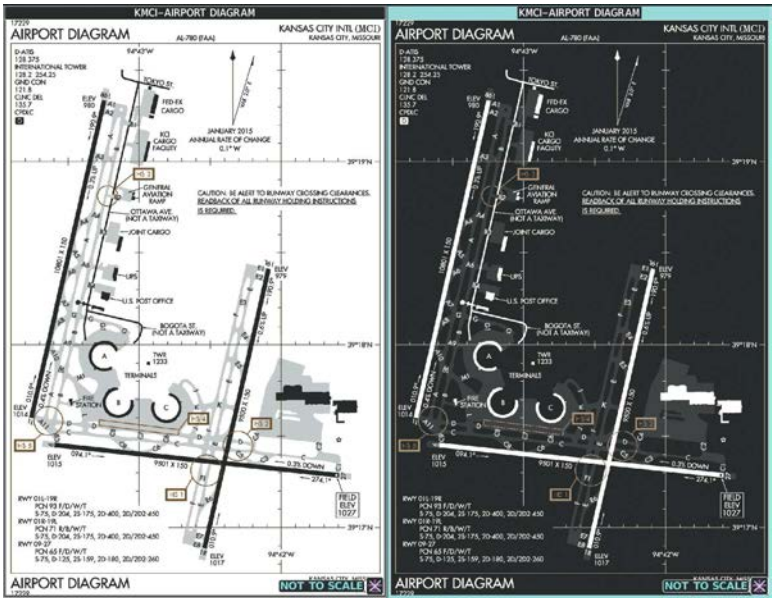


Figure 8-33 Airport Diagram, Split Screen Day/Night View

IFR/VFR CHARTS

The system can display GPS navigation information on a VFR chart, a low altitude IFR chart, or a high altitude IFR chart, if installed. The information overlaid on the IFR/VFR Charts is selected and setup on the Navigation Map, but the IFR/VFR charts will not display some of the selected items. Only the following items will be overlaid on the chart:

- Map Pointer (distance and bearing to pointer, location of pointer, name, and other pertinent information)
- Map Range (17 range choices from 1 nm to 150 nm)
- Map Orientation (always North Up for IFR/VFR Charts)
- Aircraft Icon (representing present position)
- Wind Direction and Speed
- Icons for enabled map features
- Flight Plan Legs
- Track Vector
- Runway Extension
- Missed Approach Preview
- Intersections (only as part of active flight plan)
- Visual Reporting Points
- VNAV Constraints
- Selected Altitude Intercept Arc

Map panning on the IFR/VFR Charts works the same as on the Navigation Map. Map range selected on either the Navigation Map or the IFR/VFR Charts applies to both. However, if the range selected on the Navigation Map it is not a valid chart range, the chart is shown with a range of 7.5 nm.

When different VFR charts exist for the same area the chart type will automatically display according to the range chosen. For example, in an area where both a Sectional and a Terminal Area Chart (TAC) are available, a range of 6 nm or more will show the Sectional chart. Once the range is decreased below 6 nm, the system will automatically change the displayed chart from the Sectional to the TAC.

Due to the potential error involved with the electronic depiction of maps, charts will display a gray 'circle of uncertainty' centered upon the aircraft icon. The aircraft's actual position can be anywhere within the range of the gray circle. The range of the circle will change based on the chart displayed and current zoom range.

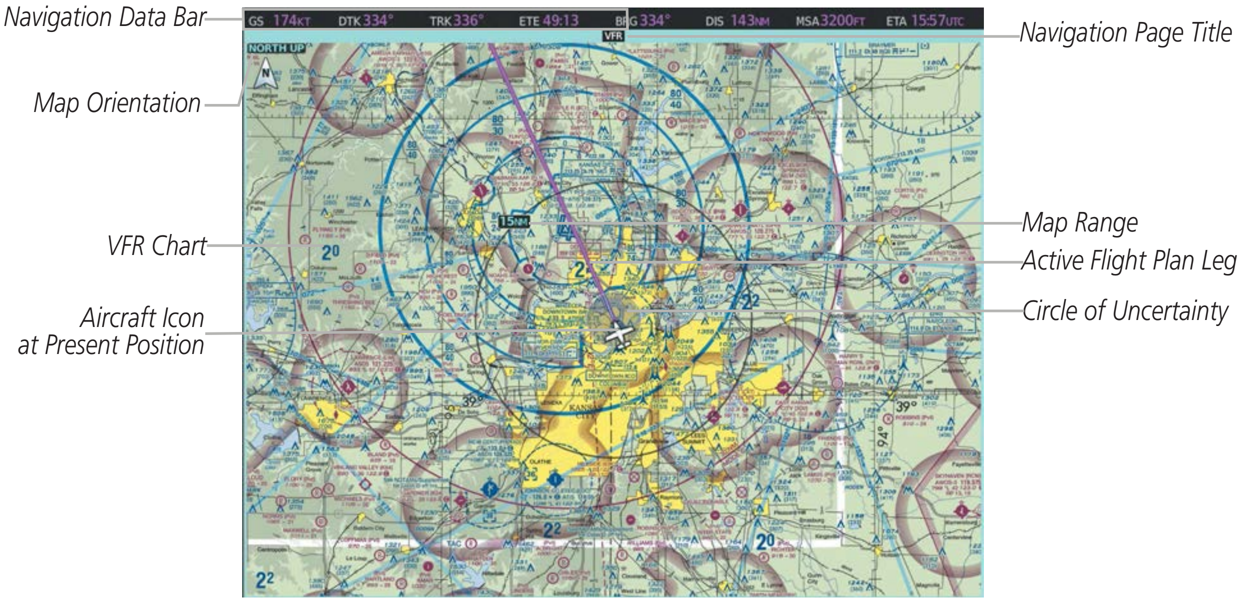


Figure 8-34 GPS Navigation Information on the VFR Chart

Selecting the chart to display:

1) From MFD Home, touch **Map >Map Selection**.
2) Touch the desired Chart Button (VFR, IFR Low, or IFR High)

Modifying the Low IFR and High IFR Chart settings:

1) From MFD Home, touch **Map >Map Selection**.
2) Touch the desired Chart Button. The selected chart is displayed on the active display pane, and the button on the Touchscreen Controller becomes the Chart Settings Button (**IFR Low Settings** Button or **IFR High Settings** Button).
3) Touch the Chart Settings Button to display the IFR/VFR Charts Settings Screen.
4) Touch the desired Light Mode Button. If the **Auto** Button is selected, the Threshhold Level for the light mode may be adjusted by moving the slider left or right, or by touching the **+** Button or the **-** Button.

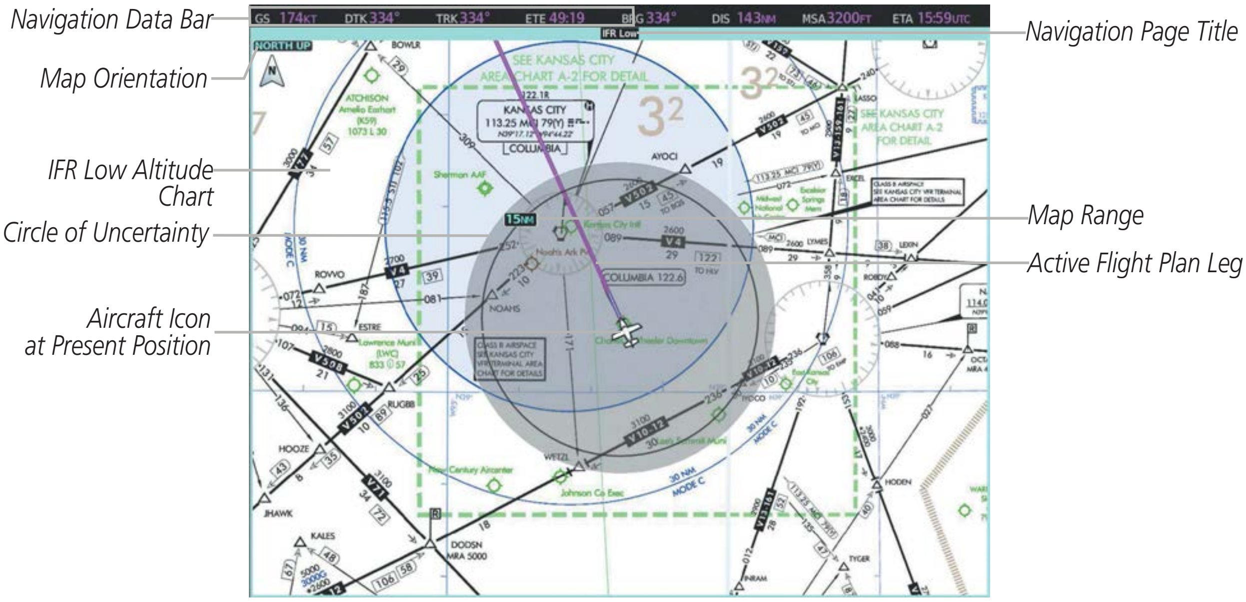


Figure 8-35 GPS Navigation Information on the IFR Low Altitude Chart

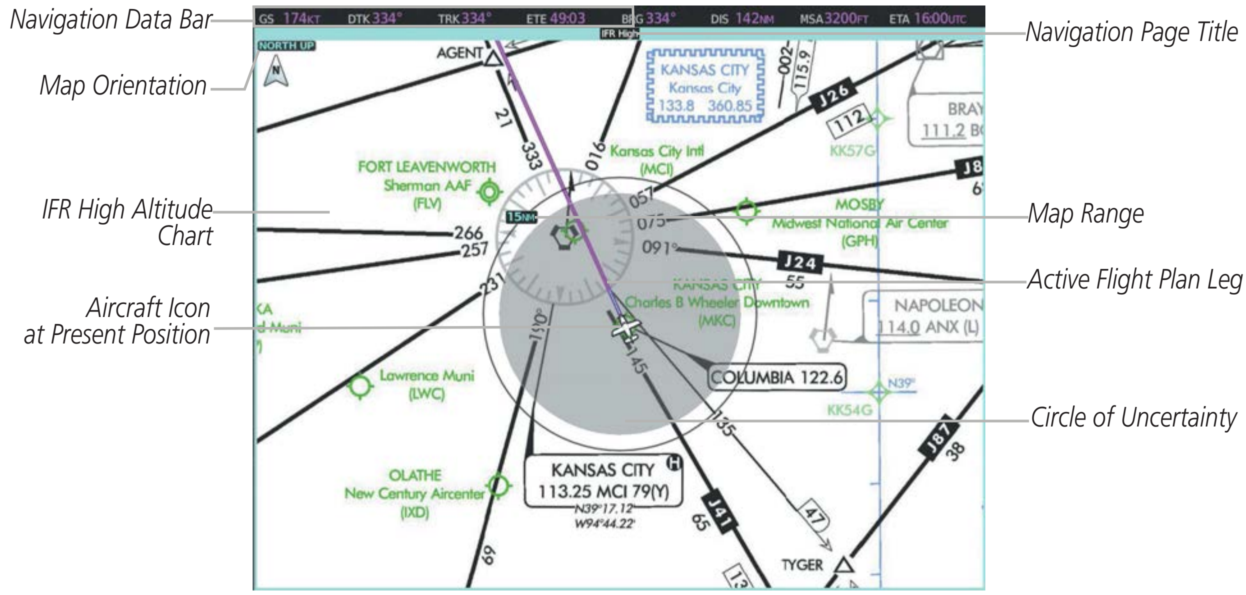


Figure 8-36 GPS Navigation Information on the IFR High Altitude Chart

Map panning on the IFR/VFR Charts works the same as on the Navigation Map. Map range selected on either the Navigation Map or the IFR/VFR Charts applies to both. However, if the range selected on the Navigation Map it is not a valid chart range, the chart is shown with a range of 2.5 nm.

8.4 AIRPORT DIRECTORY

The Aircraft Owners and Pilots Association (AOPA) or AC-U-KWIK Airport Directory databases offer detailed information regarding services, hours of operation, lodging options, and more for various airports. This information is viewed on the Airport Directory Info Screen as shown in the following figure.

Selecting the Airport Directory Info Screen:

1) From the MFD **Home** Screen, touch **Nearest** > **Airports**.
2) A list of the nearest airports to the aircraft present position is displayed, beginning with the closest. Touch the desired airport, in this case KCOS. The **Waypoint Options** buttons are displayed as shown in the following figure.
3) Touch the **Airport Info** Button to display the Airport Directory Info Screen.
4) Touch the **APT DIR** Tab to display the Airport Directory information for the selected airport as shown in the following figure..

Figure 8-37 Nearest Airport Selection

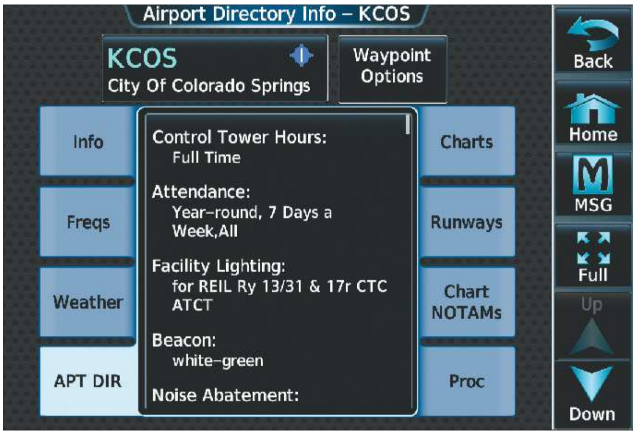


Figure 8-38 AOPA Airport Directory Information

8.5 DATABASE CYCLE NUMBER AND REVISIONS

CYCLE NUMBER AND REVISION

Databases that may be available include FliteCharts, Obstacle, Terrain, IFR/VFR, Navigation, ChartView, SafeTaxi, Airport Directory. Data is revised and expiration dates vary. Data is still viewable during a period that extends from the cycle expiration date to the disables date. When turning on the system, the Power-up Page displays the current status of the databases. As an example, see the table below for the various FliteCharts Power-up Page displays and the definition of each. The expiration date and disables date varies for each database.

Example Power-up Page Display Text
FliteCharts Data: └─ N/A
FliteCharts Data: └─ Expires DD-MMM-YYYY
FliteCharts Data: └─ Disables DD-MMM-YYYY
FliteCharts Data: └─ Disabled

Table 8-2 Database Power-up Page Annunciations

White text, such as 'FliteCharts Data Expires' plus a date, indicates the chart database is current. Yellow text, such as 'Chart data is out of date!' or 'FliteCharts Data: Disabled", indicates charts are no longer viewable and have expired.

Database time critical information can also be found on the 'Avionics Status' page. The database Region, Cycle number, Effective, Expires, and Disables dates of the subscription appear in either blue or yellow text. Dates shown in blue are current data. Dates shown in yellow indicate the data is not within the current subscription period.

***NOTE:** A subdued softkey label indicates the function is disabled.*

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.

Database cycle numbers are in a format such as YYTI or YYII, which are deciphered as follows:

YYTI

YY – Indicates the last two digits of the year (ex. 18 represents 2018)

T – Indicates the database type (ex. S is for SafeTaxi, D is for Airport Directory)

I – Indicates the numerical issue of the database for the year (ex. 5 is the fifth issue of the year)

YYII

YY – Indicates the last two digits of the year (ex. 18 represents 2018)

II – Indicates the numerical issue of the database for the year (ex. 05 is the fifth issue of the year)

Refer to Updating Garmin Databases in Appendix for instructions on revising databases.

Example Power-up Page Display Text	Database Cycle Number Format	Revision Cycle
Navigation	YYII	28 days
Basemap Land	YYMI	Not Applicable
Terrain	YYTI	Not Applicable
Obstacle	YYBI	56 days
SafeTaxi	YYSI	56 days
Airport Directory	YYDI	56 days
FliteCharts	YYII	28 days
ChartView	YYII	14 days
IFR/VFR Charts	YYII	28 days

Table 8-3 Database Cycle Number and Revision

8.6 SATELLITE TELEPHONE AND DATALINK SERVICES

***NOTE:** Separate accounts must be established to access the Iridium satellite network for voice and Garmin Connext for data transmission of maintenance reports.*

An optional Iridium Transceiver provides an airborne low speed data link, Iridium Satellite Telephone service and SMS text messaging.

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 Connext at www.flyGarmin.com.

Registering the system for data link services:

1) From the MFD **Home** Screen, touch **Utilities > Setup** > **Avionics Status**.
2) If necessary, touch the **Airframe** Tab. Note the System ID number as seen in the following figure. This number will be needed when contacting Garmin Connext to establish the account.

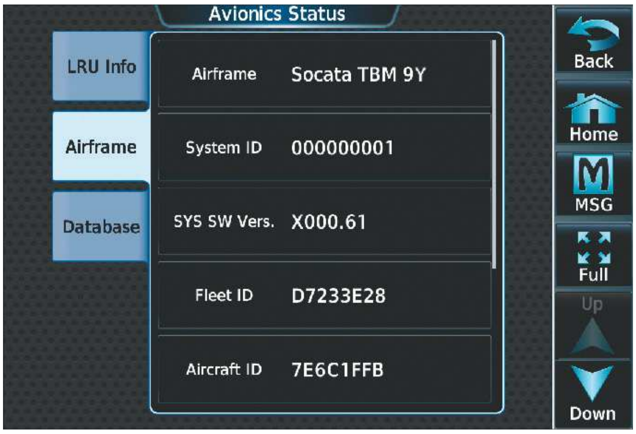


Figure 8-39 System ID Number

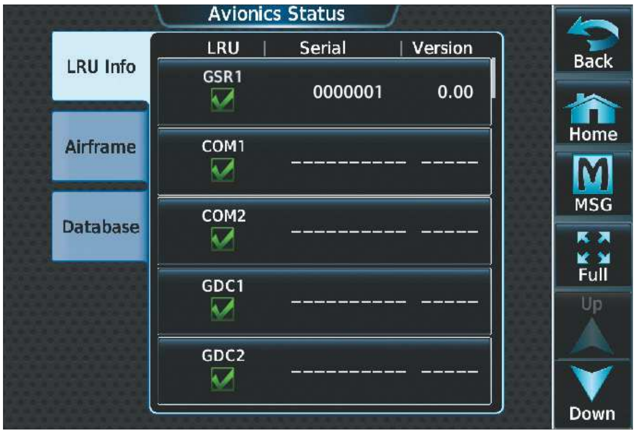


Figure 8-40 Iridium Transceiver Serial Number (GSR1)

3) Touch the **LRU Info** Tab. Scroll to view 'GSR1' and note the serial number (see previous figure), which will also be needed when contacting Garmin Connext.
4) Contact Garmin Connext to establish an account and receive an access code.
5) From the MFD **Home** Screen, touch **Utilities > Setup** > **Connext Registration**.
6) Press **Register** (see following figure)

Figure 8-41 Connext Registration Display

Figure 8-42 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 the MFD **Home** Screen, touch **Services** > **Contacts**.

2) The Contacts Screen is displayed as shown in the following figure.

Figure 8-43 Services Menu

Figure 8-44 Contact List

3) Touch **Create New** (see previous figure).

4) Touch **Name**, shown in the following figure. The Contact Name entry screen is displayed.

Figure 8-45 Enter New Contact Information

Figure 8-46 Enter Name

5) Enter the name of the new contact as the example shows in the previous figure.

6) Touch **Enter**.

7) If desired, touch the **Favorite** Button to designate the new contact as a favorite. A green annunciator indicates the contact is now designated as a favorite, as shown in the following figure.

8) Touch **Telephone Number**. The Telephone Number entry screen is displayed.

Figure 8-47 Select Telephone Number

Figure 8-48 Enter Telephone Number

9) Enter the telephone number of the new contact as the example shows in the previous figure.

10) Touch **Enter**.

11) Touch **Email Address**. The Email Address entry screen is displayed.

Figure 8-49 Select Email Address

Figure 8-50 Enter Email Address

12) Enter the email address of the new contact as the example shows in the previous figure.

13) Touch **Enter**.

14) Touch **Create**. The new contact is created and appears in the list of contacts as shown in the following figure. The star symbol displayed on the right side of the contact button indictes this contact is designated as a favorite.

Figure 8-51 New Contact Info Complete

Figure 8-52 Enter Email Address

TELEPHONE COMMUNICATION (OPTIONAL)

The pilot or copilot can place and answer calls on the Iridium satellite network. Ensure telephone audio is enabled for the pilot and/or copilot when using the satellite telephone feature. See the Audio & CNS section for information regarding enabling and disabling the telephone audio.

Viewing the Telephone Status:

1) From the MFD **Home** Screen, touch **Services** > **Telephone**.

2) The Telephone Screen is displayed as shown in the following figure.

Figure 8-53 Telephone Service Selection

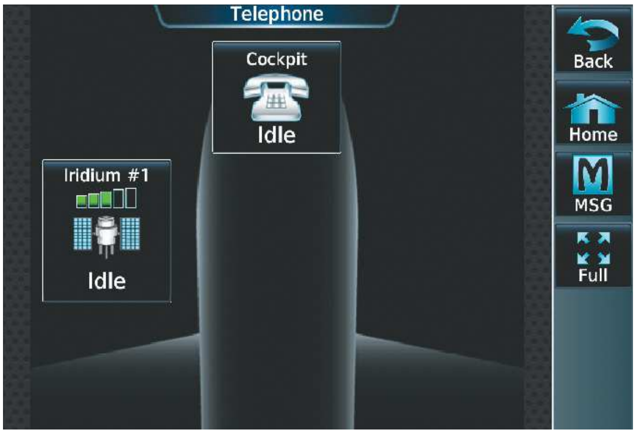


Figure 8-54 Telephone Status Information

ENABLE/DISABLE THE IRIDIUM TELEPHONE SYSTEM

The Iridium Satellite Telephone System may be disabled by the pilot. When disabled, incoming calls will not be received and outgoing calls will not be possible from the cockpit or cabin.

Enabling/disabling the Iridium telephone system:

1) From the MFD **Home** Screen, touch **Services** > **Telephone**.
2) Touch the **Iridium #1** Button to display the Iridium #1 Transceiver Screen, as shown in the following figure.
3) Touch the **Disable Iridium Transmission** Annunciator Button to disable (green annunciator as in the following figure) the transceiver. Touch the button again to enable (gray annunciator) the transceiver.

Figure 8-55 Iridium Transceiver Enabled

Figure 8-56 Iridium Transceiver Disabled

INCOMING CALLS

Incoming voice calls from an external telephone phone through the Iridium Satellite Network are annunciated by a ring tone and flashing **TEL** Button on the GTC Button Bar, as shown in the following figure, as well as a flashing TEL annunciation in the upper left corner of the PFD display.

Answering a call:

1) Touch the flashing **TEL** Button. The Notifications Screen is displayed as in the following figure.

2) Touch the **Answer** Button. The call is now connected as indicated in the following figure. Touching the **Ignore** Button extinguishes the new call annunciation and the call remains disconnected.

Figure 8-57 Incoming Call Notification

Figure 8-58 Telephone Notification Selected

3) When the call is finished, touch **End Call** to disconnect the call.

Figure 8-59 Call Answered

OUTGOING CALLS

Voice calls can be made from the cockpit to an external telephone through the Iridium Satellite Network.

Making a call by entering the telephone number:

1) From the MFD **Home** Screen, touch **Services** > **Telephone**.

2) Touch the **Cockpit** Phone Button. The Cockpit Phone Screen is displayed as shown in the following figure.

3) Touch **Dial**. The phone number entry screen is displayed as shown in the following figure.

Figure 8-60 Cockpit Telephone Status

Figure 8-61 Telephone Number Entry

4) Using the number keys, enter the phone number. Touch the **Find** Button to select a number from the Contacts list.

   The International dialing sequence is necessary to place a call from the cockpit to an external phone: Country Code + City/Area Code (if any) + Telephone Number. The following country codes may be used when calling other satellite telephone systems.

Satellite System	Country Code
Inmarsat	870
ICO	8810 or 8811
Ellipso	8812 or 8813
Iridium	8816 or 8817
Globalstar	8818 or 8819

5) Touch **Enter**. The system initiates the call (see following figure). The system indicates a completed connection when the telephone is answered.

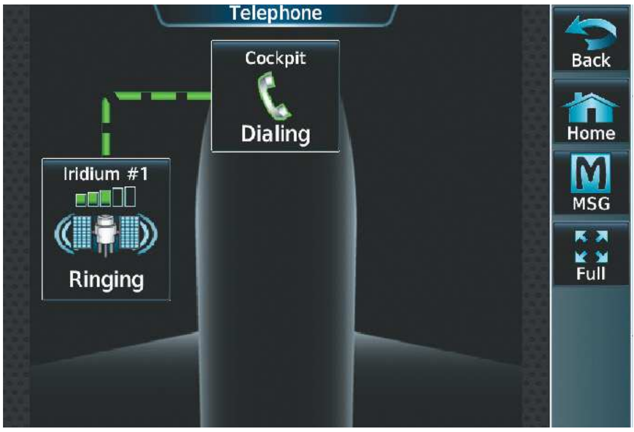


Figure 8-62 Establishing a Connection

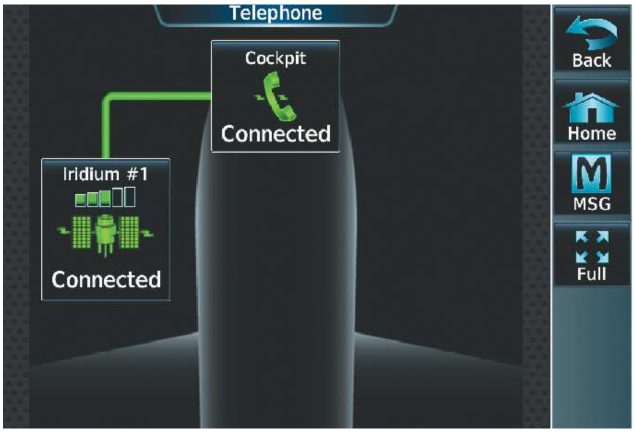


Figure 8-63 Telephone Connected

Making a call by selecting a contact:

1) From the MFD **Home** Screen, touch **Services** > **Contacts**.

2) Touch the button corresponding to the desired contact. The selected contact is displayed (see following figure).

Figure 8-64 Contact List

Figure 8-65 Contact Chosen

3) Touch the **Call or Send Text** Button. A selection screen, as shown in the following figure, is displayed.

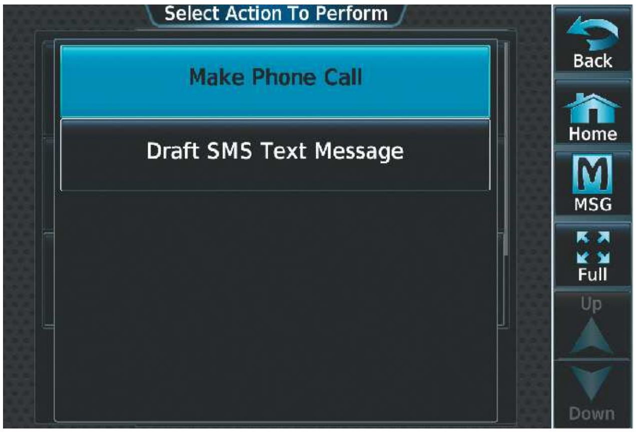


Figure 8-66 Select Action To Perform

4) Touch the **Make Phone Call** Button. The system initiates the call (see following figure). The system indicates a completed connection when the telephone is answered.

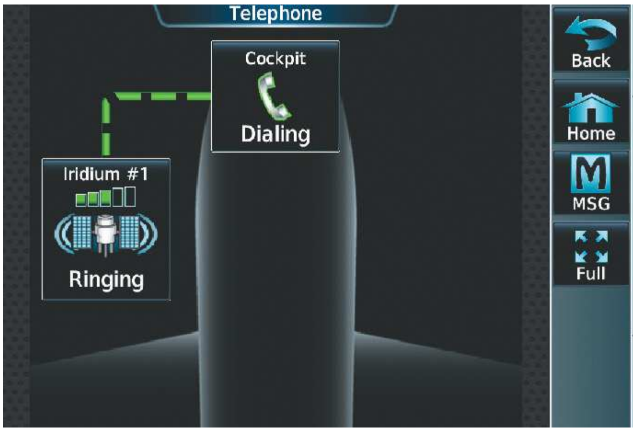


Figure 8-67 Establishing a Connection

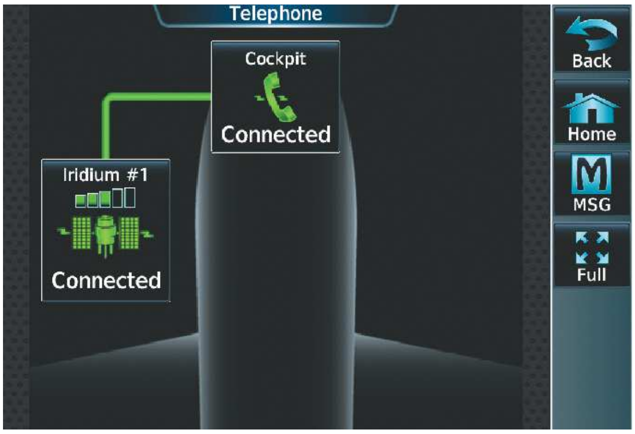


Figure 8-68 Telephone Connected

When numeric entries are required during a call, such as selecting menu items like "dial zero to get an operator", a phone keypad is available to access the numeric softkeys.

Entering numbers during a call:

1) From the MFD **Home** Screen, touch **Services** > **Telephone**.
2) Touch the **Cockpit** Phone Button. The Cockpit Phone Screen is displayed (see following figure).
3) Touch the **Open Keypad** Button. The Phone Keypad Screen is displayed (see following figure).
4) Touch the desired numeric button to send the number. Repeat as necessary.

Figure 8-69 Open Keypad Button

Figure 8-70 Phone Keypad

Ending a call:

1) From the MFD **Home** Screen, touch **Services** > **Telephone**.
2) Touch the **Cockpit** Phone Button. The Cockpit Phone Screen is displayed (see following figure).
3) Touch the **End Call** Button.

Figure 8-71 Ending the Call

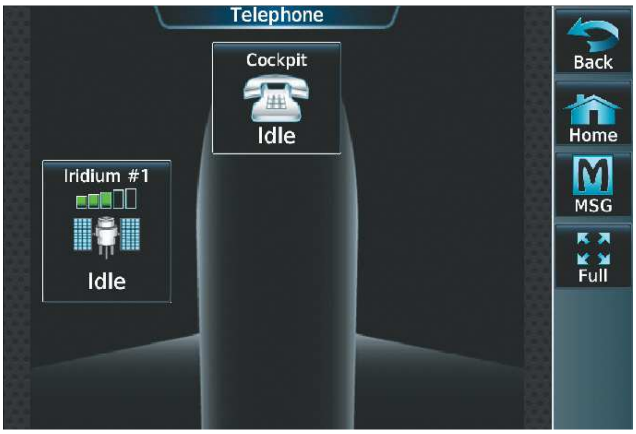


Figure 8-72 System is Idle After Ending Call

MANAGING TELEPHONE AUDIO

NOTE: The Push-to-Talk switch is not utilized for telephone communication. The microphone is active whenever a call is connected and telephone audio is enabled.

When an incoming call is received, or an outgoing call is made, telephone audio (which includes headset and microphone) is automatically enabled for either the pilot or copilot, depending on which Touchscreen Controller was used to make or answer the call. If the pilot or copilot wishes to join an existing call, the telephone audio must be enabled manually on the appropriate Touchscreen Controller. When the call is ended, telephone audio is automatically disabled. The green **Pilot Audio** Annunciator Button in the following figure indicates the enabled pilot audio on the pilot-side Touchscreen Controller. 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.

Enabling/disabling telephone audio and adjusting volume:

1) From the MFD **Home** Screen, touch **Services** > **Telephone**.
2) Touch the **Cockpit** Phone Button. The Cockpit Phone Screen is displayed as shown in the following figure.

Figure 8-73 Managing Telephone Audio

3) Touch the **Pilot Audio** or **Copilot Audio** Annunciator Button to disable telephone audio, including microphone (gray annunciator).
4) Touch the Annunciator Button again to enable telephone audio, including microphone (green annunciator).
5) Touch and move the **Volume** Slider on the appropriate Touchscreen Controller to adjust the telephone volume.

TEXT MESSAGING (SMS)

The pilot or copilot can send and receive text messages on the Iridium satellite network. Messages may be sent to an email address or text message capable cellular telephone. Message length is limited to 160 characters, including the email address.

Incoming SMS messages are annunciated by a flashing **SMS** Button on the Touchscreen Controller Button Bar, as shown in the following figure, as well as a flashing SMS annunciation in the upper left corner of the PFD display.

Viewing a Text Message When Received

1) Touch the flashing **SMS** Button as shown in the following figure. The **SMS Text Inbox** Tab is automatically selected and the newly received text message is shown at the top of the list, as in the following figure.

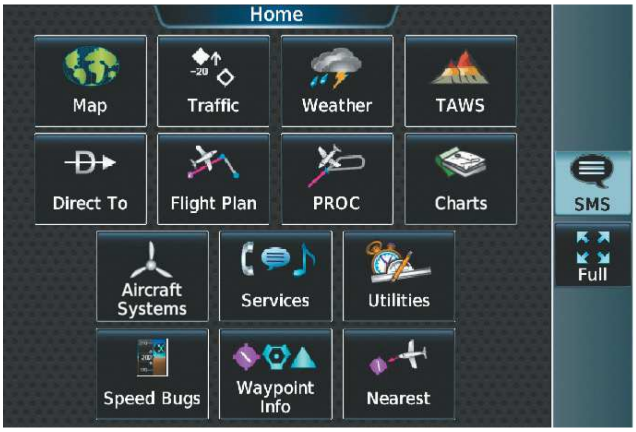


Figure 8-74 New SMS Text Message Annunciation

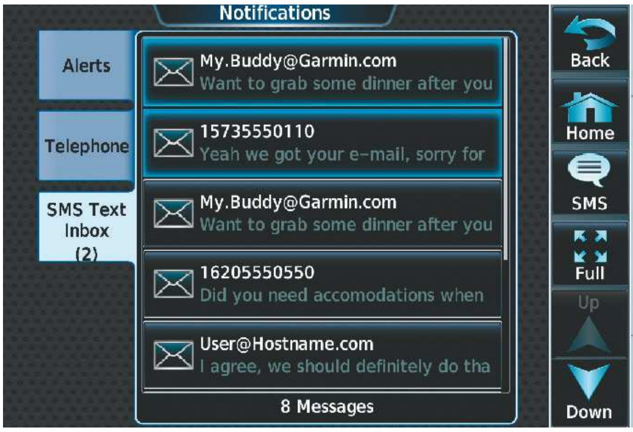


Figure 8-75 New Text Message at Top of List

2) Touch the desired message to display its contents as seen in the following figure.

Figure 8-76 New Text Message Contents

3) If desired, touch **Reply** to create a reply to the message.
4) Touch **Delete** to delete the message from the list.
5) Touching **Save Contact** saves the contact information in the system contact list.

Replying to a Text Message

While viewing the text message content, touch the **REPLY** Button.

Or:

1) From the MFD **Home** Screen, touch **Services** > **SMS Text** (see following figure).

Figure 8-77 SMS Text Services Selection

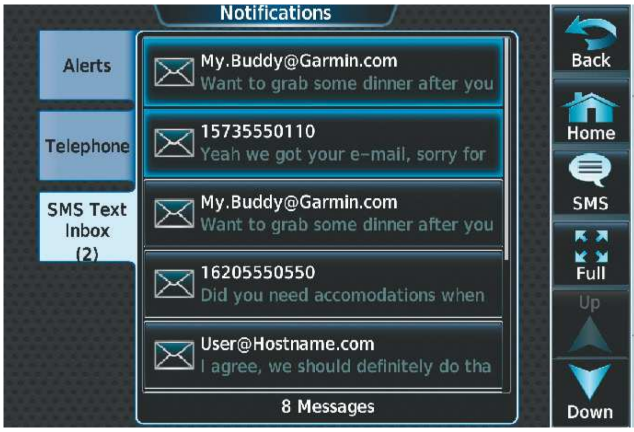


Figure 8-78 Touch Desired Message

2) Touch the desired text message in the Inbox list (see previous figure). If necessary, scroll to the desired message. The text message is displayed (see following figure).

3) Touch the **REPLY** Button. The SMS Text Message Draft Screen is displayed.

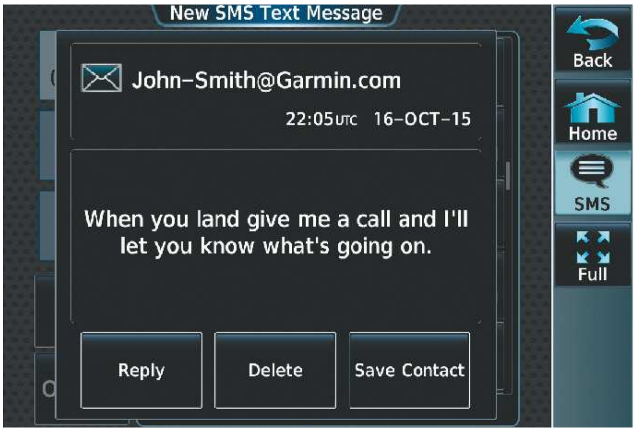


Figure 8-79 Message Content

Figure 8-80 New Reply Message Screen

4) Touch the 'Message' Window to display the alphanumeric buttons.

Figure 8-81 Message Content

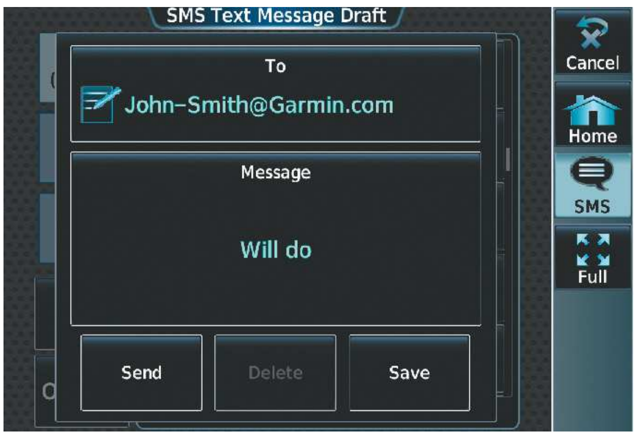


Figure 8-82 Reply Message

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 as in the previous figure.

7) Touch the **Send** Button. The SMS Text Message Replied To Screen is displayed as seen in the following figure.

Figure 8-83 Reply Message Sent

8) If desired, touch the **Reply Again** Button to send another reply.

9) Touch **Delete** to delete the message from the list.

10) Touching **Save Contact** saves the contact information in the system contact list.

Sending a Text Message

1) From the MFD **Home** Screen, touch **Services** > **SMS Text**.

Figure 8-84 SMS Text Services Selection

Figure 8-85 Touch Desired Message

2) Touch the **Draft New** Button. The Opened SMS Text Message Draft Screen is displayed as shown in the previous figure. The Draft New Message button is also available from within the **Drafts** and **Outbox** Tabs.

Figure 8-86 Touch 'To' Window

3) Touch the 'To' Window. A selection screen is displayed like in the following figure. If the text message is to be sent to SMS compatible telephone, touch the **Phone** Button. If the message is to be sent to an email address, touch the **Email** Button.

Figure 8-87 Select Message Destination

Figure 8-88 Enter Number or Address

4) Enter the telephone number or email address as seen in the previous figure. The number or address may be obtained from the Contacts by touching the **Find** Button.

5) Touch the **Enter** Button. The number or address is now displayed as in the following figure.

6) Touch the 'Message' Window. The alphanumeric buttons are displayed as in the following figure.

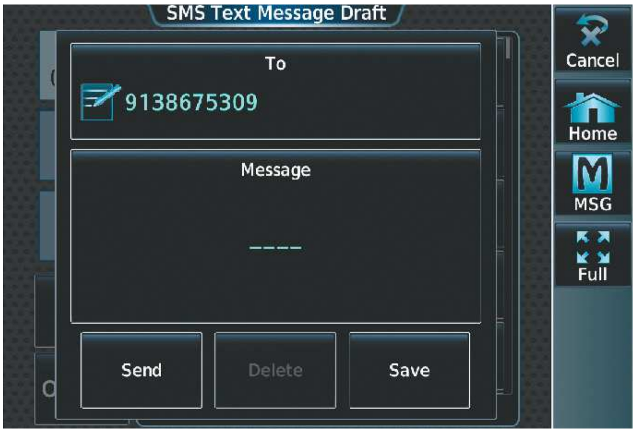


Figure 8-89 Touch Message Window

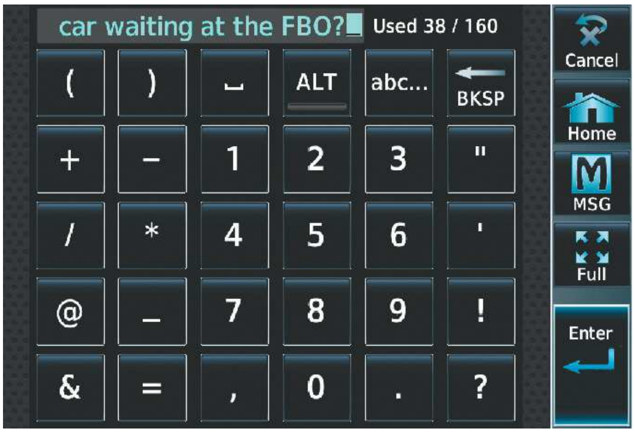


Figure 8-90 Reply Message

7) Enter the message text. The large upper knob on the Touchscreen Controller may be used to move the cursor within the message text in order to select the location for adding new text, or delete existing text.

8) Touch the **Enter** Button. The message text is displayed in the 'Message' Window as shown in the following figure.

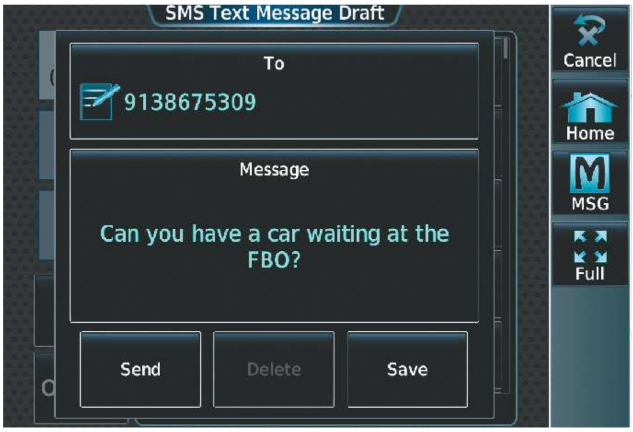


Figure 8-91 Message Ready to Send

9) Touch the **Send** Button.

TEXT MESSAGE BOXES

Received text messages reside in the Inbox as 'Read' or 'Unread' messages. The Outbox contains 'Sent" and 'Unsent' text messages. Saved messages that are meant to be sent later are stored as Drafts.

Viewing Inbox messages:

1) From the MFD **Home** Screen, touch **Services** > **SMS Text**.

2) Touch the **Inbox** Tab. A list of received messages is displayed as in the following figure. The **Inbox** Tab is selected by default when accessing the SMS Text Messaging Screen.

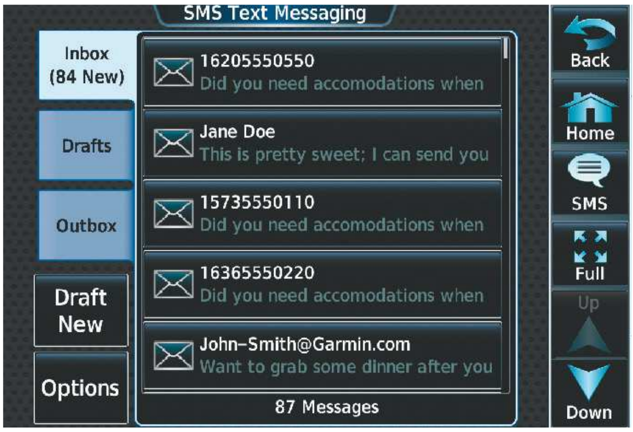


Figure 8-92 SMS Text Inbox

Viewing Draft messages:

1) From the MFD **Home** Screen, touch **Services** > **SMS Text**.
2) Touch the **Draft** Tab. A list of draft messages is displayed as in the following figure, provided messages have been previously saved.
3) Touch a message to access the **Send** or **Delete** Buttons.

Figure 8-93 SMS Text Drafts

Viewing Outbox messages:

1) From the MFD **Home** Screen, touch **Services** > **SMS Text**.
2) Touch the **Outbox** Tab. A list of sent or unsent messages is displayed as in the following figure.
3) Touch a message to access the **Send Again**, **Delete,** and **Save Contact** Buttons.

Figure 8-94 SMS Text Outbox

MANAGING TEXT MESSAGES

The following table illustrates the various message status icons.

Message Symbol	Description
	Received text message that has not been opened
	Received text message that has been opened
	A reply has been sent for this text message
	Saved text message, draft not sent
	System is sending text message
	Text message has been sent
	System failed to send text message

Table 8-4 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 the MFD **Home** Screen, touch **Services** > **SMS Text**.

2) Touch the **Options** Button. The 'Sort Messages By' selections are displayed as in the following figure.

Figure 8-95 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 the MFD **Home** Screen, touch **Services** > **SMS Text**.
2) Touch the **Options** Button. The 'Sort Messages By' selections are displayed as in the previous figure.
3) Touch the **Address** Button. A green annunciator indicates an active selection.
4) Touch the **Back** Button to return to the previously selected message box.

Marking all messages as read:

1) From the MFD **Home** Screen, touch **Services** > **SMS Text**.
2) Touch the **Options** Button. The selection buttons are displayed as in the previous figure.
3) Touch the **Mark All Read** Button to mark all messages as read, and return to the Inbox. All messages in the Inbox now indicate they have been opened.

Deleting all messages:

1) From the MFD **Home** Screen, touch **Services** > **SMS Text**.
2) Touch the **Options** Button. The selection buttons are displayed as in the previous figure.
3) Touch the **Delete All Messages** Button. A confirmation screen is displayed as in the following figure.

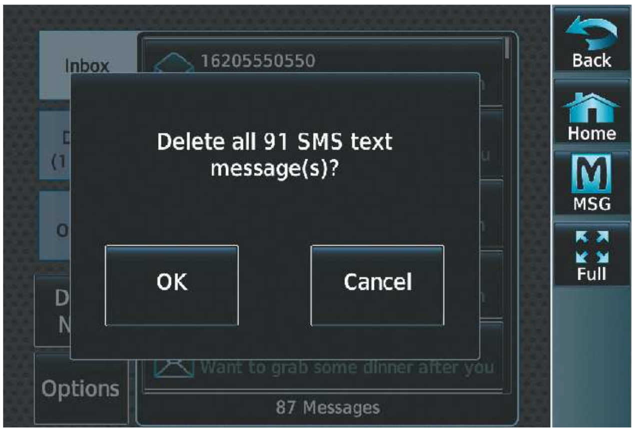


Figure 8-96 Confirm Deletion of Messages

4) Touch the **OK** Button.

8.7 SIRIUSXM SATELLITE RADIO

NOTE: *Refer to the Hazard Avoidance Section for information and activation of SiriusXM Weather products.*

The optional SiriusXM Satellite Radio entertainment feature of the SiriusXM Data Link Receiver provides audio entertainment for the pilots. The SiriusXM Data Link Receiver can receive SiriusXM Satellite Radio entertainment services at any altitude throughout the Continental United States.

SiriusXM Satellite Radio offers a variety of radio programming over long distances without having to constantly search for new stations. Based on signals from satellites, coverage far exceeds land-based transmissions. SiriusXM Satellite Radio services are subscription-based. For more information on specific service packages, visit www.siriusxm.com.

ACTIVATING SIRIUSXM SATELLITE SERVICES

The SiriusXM Radio services are activated by first establishing an account with SiriusXM Satellite Radio. The Audio Radio ID must be provided to SiriusXM Satellite Radio to activate the entertainment subscription.

SiriusXM Satellite Radio uses the coded radio ID to send an activation signal that, when received by the SiriusXM Data Link Receiver, allows it to play entertainment programming.

The Audio Radio ID is located:

- On the label on the back of the Data Link Receiver
- On the XM Information Screen on the Touchscreen Controller.

Contact the installer if the radio ID cannot be located.

Establishing a SiriusXM Satellite Radio account:

1) From the MFD **Home** Screen, 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 8-97 SiriusXM Information Display

USING SIRIUSXM RADIO

The Music Screen provides information and control of the cockpit audio entertainment features of the SiriusXM Satellite Radio. The cabin audio entertainment is a separate system and is not controlled through the system.

Figure 8-98 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 the MFD **Home** Screen, 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 the MFD **Home** Screen, touch **Services > Music** > **Channel**.
2) The numeric keypad is displayed. Enter the desired channel number.
3) Press the **Enter** Button. The selected channel is now shown in the Now Playing field.

ENTERTAINMENT CATEGORIES

The Category field on the Music Screen shows the currently selected entertainment category. Categories of audio entertainment, such as jazz, rock, talk/news, sports, etc., can be selected to list the available channels for a type of music or other contents.

Selecting a category:

1) From the MFD **Home** Screen, touch **Services > Music** > **Category**.
2) The list of categories is displayed as shown in the following figure.

Figure 8-99 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 the MFD **Home** Screen, 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 the MFD **Home** Screen, touch **Services > Music** > **Category**.
2) The list of categories is displayed as shown in the previous figure.
3) If necessary, scroll to view the **Favorites** Button.
4) Touch the **Favorites** Button to view the favorite channel list.
5) Touch the desired channel in the list. The channel is now displayed in the Now Playing field.

ADJUSTING VOLUME

Pilot SiriusXM entertainment audio volume is shown on the **Volume** Button on the Music Screen as a percentage of full volume. Volume can be muted manually, or muting may be initiated automatically when other audio, such as radio, intercom, or aural alerts, is present.

Adjusting the SiriusXM audio volume:

1) From the MFD **Home** Screen, touch **Services** > **Music** > **Volume**.
2) The volume adjustment slider is displayed as shown in the following figure.
3) Touch and drag the slider to the right or left to adjust the volume. Drag to the right increases volume. Drag to the left to decrease the volume.

   Or:

   Turn the Volume Knob on the Touchscreen Controller.

Figure 8-100 Adjusting Volume

Muting or unmuting the SiriusXM audio volume:

1) From the MFD **Home** Screen, touch **Services** > **Music** > **Volume**.
2) Touch the **Music** Annunciator Button to mute or unmute the volume. Muted volume is indicated by a gray annunciator. Unmuted volume is indicated by a green annunciator.
3) Touch the **Back** Button to return to the Music Screen. When the volume is muted, 'Muted' is displayed in the Volume field.

AUTOMATIC MUSIC MUTING

Cockpit music is automatically muted at power-up. Music may be unmuted by the pilot or copilot at any time, but the system will again mute cockpit music when any of the following occur.

- Aircraft is on the ground and accelerates to greater than 40 KIAS
- Aircraft descends below 10,000 feet MSL or 2000 feet AGL
- Aircraft decelerates to less than 150 KIAS
- Aircraft enters an unusual pitch or roll attitude sufficient to cause PFD display decluttering
- MFD enters reversionary mode

When enabled, the system will decrease music volume to a very low level (soft mute) when the following occur:

- Push-to-talk button is pressed for Com radio transmission
- Com radio audio is received
- Intercom is active

Cockpit music will always be soft muted during aural and voice alerts.

Enabling/disabling soft mute settings:

1) From the MFD **Home** Screen, 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 8-101 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.

SIRIUSXM DATA LINK RECEIVER TROUBLESHOOTING

Some quick troubleshooting steps listed below can be performed to find the possible cause of a failure.

- Ensure the owner/operator of the aircraft in which the Data Link Receiver is installed has subscribed to SiriusXM
- Ensure the SiriusXM subscription has been activated
- Check the circuit breakers to ensure that power is applied to the Data Link Receiver

For troubleshooting purposes, check the LRU Information for Data Link Receiver status, serial number, and software version number. If a failure has been detected in the SiriusXM Data Link Receiver the status is marked with a red X.

Checking LRU status:

1) From the MFD **Home** Screen, touch **Utilities** > **Setup** > **Avionics Status**.
2) If necessary, touch the **LRU Info** Tab.
3) Scroll to display the **GDL69** field as shown in the following figure.

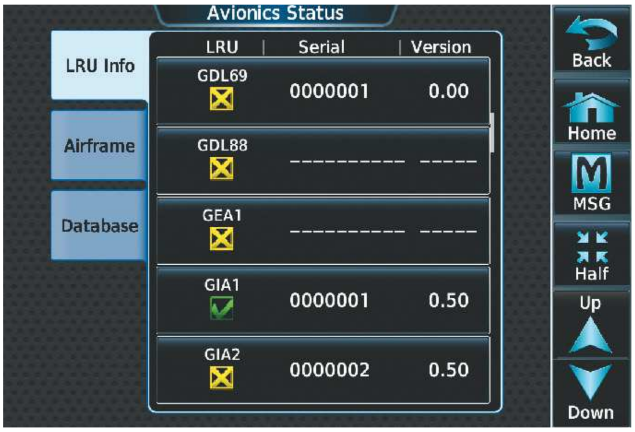


Figure 8-102 Detected Failure in Data Link Receiver

If a failure still exists, the following messages may provide insight as to the possible problem:

Message	Message Location	Description
CHECK ANTENNA	XM Information Screen (Touchscreen Controller)	Data Link Receiver antenna error; service required
UPDATING	XM Information Screen (Touchscreen Controller)	Data Link Receiver updating encryption code
NO SIGNAL	XM Information Screen (Touchscreen Controller) Weather Datalink Display (selected Display Pane)	Loss of signal; signal strength too low for receiver
LOADING	Music Screen (Touchscreen Controller)	Acquiring channel audio or information
OFF AIR	Music Screen (Touchscreen Controller)	Channel not in service
---	Music Screen (Touchscreen Controller)	Missing channel information
WEATHER DATA LINK FAILED	Weather Datalink Display (selected Display Pane)	No communication from Data Link Receiver within last 5 minutes
ACTIVATION REQUIRED	XM Information Screen (Touchscreen Controller) Weather Datalink Display (selected Display Pane)	SiriusXM subscription is not activated

Table 8-5 SiriusXM Data Link Receiver Messages

8.8 CONNEXT SETUP

The Connext Setup Screen allows for setting up the installed optional Flight Stream device for a Bluetooth connection between the system and a mobile device running the Garmin Pilot™ application or the mobile device and the GMA.

The mobile device must be 'paired' with the system in order to use the various functions. Pairing is accomplished by first placing the system in pairing mode by displaying the Connext Setup 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. The Garmin Bluetooth enabled GMA audio panel is also available for Bluetooth pairing with compatible Bluetooth enabled phones and tablets. Audio entertainment sources can be streamed using Bluetooth directly to the GMA audio panel for pilot and passenger entertainment.

Viewing the Connext Setup Screen:

1) From Home, touch **Utilities>Setup>Connext Setup.**

2) Touch **Connext.**

Changing the Bluetooth Name:

1) From the Connext Setup Screen, touch the **Bluetooth** Tab.

2) Touch the **Bluetooth Device Name** Button to display the alphanumeric buttons.

3) Enter the desired name using the alphanumeric buttons.

Selecting the Bluetooth Device:

1) From the Bluetooth Tab, touch the **Select Device Name** Button.

2) Touch the **Bluetooth Device** from the drop down list.

Figure 8-103 Connext Setup Bluetooth Device Info

Figure 8-104 Selecting the Bluetooth Device.

Enabling/disabling Flight Plan Importing from Garmin Pilot:

1) While viewing the Connext Setup Screen, touch the **Import Functions** Tab.
2) Touch the **Enable** Button to enable (green annunciator) Flight Plan Import from Garmin Pilot™

Figure 8-105 Enable/Disable Database and/or Flight Plan Import

Enabling/disabling WiFi Database Importing from Garmin Pilot:

1) While viewing the Connext Setup screen, touch **Import Functions.**
2) Touch **Enable** to enable (green annunciator) WiFi Database Import from Garmin Pilot™

Figure 8-106 Paired Device Status

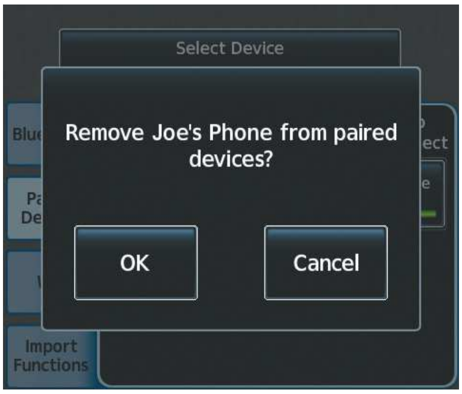


Figure 8-107 Remove Paired Device

Enabling/disabling Automatic Reconnection of a Specific Paired Device:

1) While viewing the Connext Setup Screen, touch the **Paired Devices** Tab.
2) Touch **Enable** to enable (green annunciator) Auto Reconnect to the desired paired device.

Removing a Specific Paired Device from the List of Paired Devices:

1) While viewing the Connext Setup Screen, touch **Paired Devices**.
2) Touch the Bluetooth Device Name to be removed.
3) A confirmation screen is displayed asking to remove the paired Bluetooth device.
4) Touch **OK** to remove the device from the list of paired devices.

Selecting Bluetooth Transceiver Volume Control Device:

1) From the Bluetooth Tab, touch the **Volume Control** Button.
2) Touch **Pilot, Copilot,** or **Pass** to enable (green annunciator) SiriusXM Bluetooth volume control to the respective intercom station.

Figure 8-108 Connext Setup Bluetooth Device Info

Figure 8-109 Bluetooth Volume Control Select.

8.9 FLIGHT DATA LOGGING

***NOTE:** Some aircraft installations may not provide all aircraft/engine data capable of being logged by the system.*

The Flight Data Logging feature will automatically store critical flight and engine data on an SD data card (up to 16GB) inserted into the top card slot of the MFD. Approximately 1,000 flight hours can be recorded for each 1GB of available space on the card. The data recorded by the Flight Data Logging feature is separate from data recorded by the Central Maintenance Computer (CMC).

Data is written to the SD card once each second while the MFD is powered on. All flight data logged on a specific date is stored in a file named in a format which includes the date, time, and nearest airport identifier. The file is created automatically each time the system is powered on, provided an SD card has been inserted.

The .csv file may be viewed with Microsoft Excel® or other spreadsheet applications.

The following is a list of data parameters the system is capable of logging for the Daher TBM 940 aircraft.

- Date
- Time
- GPS altitude (MSL)
- GPS altitude (WGS84 datum)
- Baro-Corrected altitude (feet)
- Baro Correction (in/Hg)
- Indicated airspeed (kts)
- Vertical speed (fpm)
- GPS vertical speed (fpm)
- OAT (degrees C)
- True airspeed (knots)
- Pitch Attitude Angle (degrees)
- Roll Attitude Angle (degrees)
- Lateral and Vertical G Force (g)
- Ground Speed (kts)
- Ground Track (degrees magnetic)
- Latitude (degrees; geodetic; +North)
- Longitude (degrees; geodetic; +East)
- Magnetic Heading (degrees)
- HSI source
- Selected course
- Com1/Com2 frequency
- Nav1/Nav2 frequency
- CDI deflection
- VDI/GP/GS deflection
- Wind Direction (degrees)
- Wind Speed (knots)
- Active Waypoint Identifier
- Distance to next waypoint (nm)
- Bearing to next waypoint (degrees)
- Magnetic variation (degrees)
- Autopilot On/Off
- AFCS roll/pitch modes
- AFCS roll/pitch commands
- GPS fix
- GPS horizontal alert limit
- GPS vertical alert limit
- SBAS GPS horizontal protection level
- SBAS GPS vertical protection level
- Fuel Qty (lbs)
- Fuel Flow (pph)
- Fuel Temperature (deg. C)
- Oil Pressure (psi)
- Oil Temperature (deg. C)
- N1, N2 (percent)
- ITT (deg. C)

The file containing the recorded data will appear in the format shown in the following figure. This file can be imported into most computer spreadsheet applications.

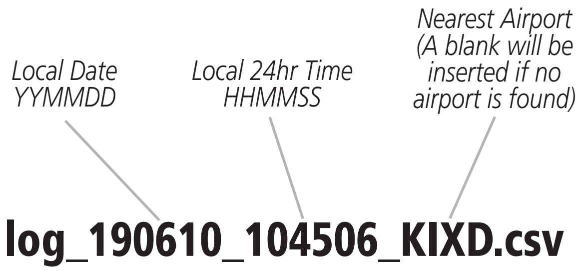


Figure 8-110 Log File Format

8.10 ELECTRONIC STABILITY & PROTECTION (ESP™)

Electronic Stability and Protection (ESP™) is an optional feature that is intended to discourage the exceedance of attitude, established airspeed and angle of attack parameters. Availability of this option is reflected on the system Power-up Screen as shown in the following figure.

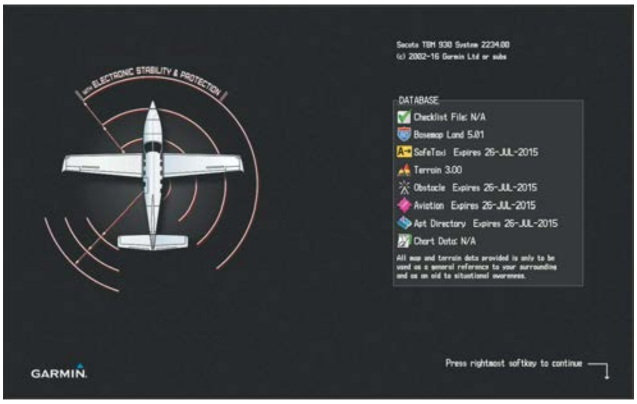


Figure 8-111 Power-Up Screen with ESP Option

This feature will only function when the aircraft is above 200 feet AGL and the autopilot is not engaged.

ESP engages when the aircraft exceeds one or more conditions (pitch, roll, Vmo, Mmo, and/or angle of attack) beyond the normal flight parameters. Enhanced stability for each condition is provided by applying a force to the appropriate control surface to return the aircraft to the normal flight envelope. This is perceived by the pilot as resistance to control movement in the undesired direction when the aircraft approaches a steep attitude, high airspeed, or when a stall is imminent.

As the aircraft deviates further from the normal attitude, 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 Autothrottle also engages in the mode that corresponds to the **SPD** knob selection and/or the Active FMS VNAV/CRUISE tab.

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. Manually disabling of ESP will also disable the Autothrottle and associated engine protections.

Enabling/disabling ESP:

1) From the MFD **Home** Screen, 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.

When ESP is disabled, Autothrottle based ESP and Autothrottle Engine Protections are also disabled.

ESP is automatically enabled on system power up.

ROLL ENGAGEMENT

Roll Limit Indicators are displayed on the roll scale at 45° right and left, indicating where ESP will engage (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.

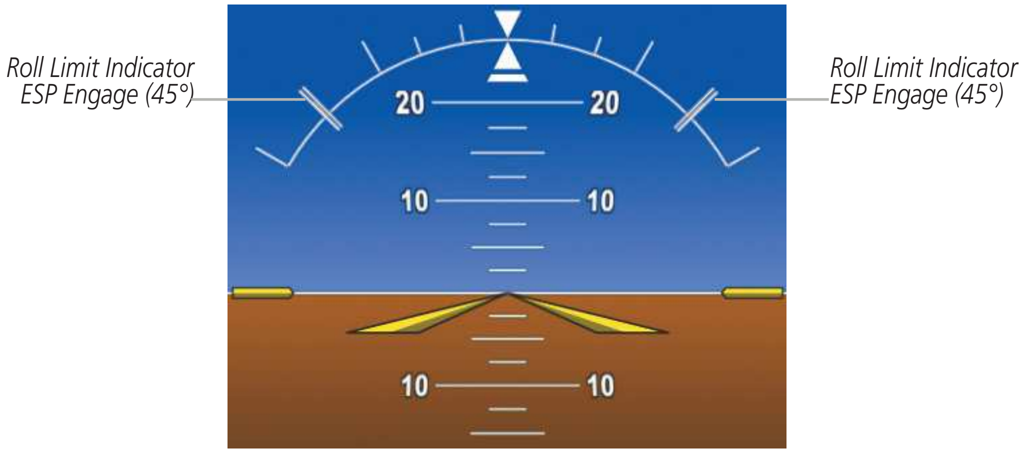
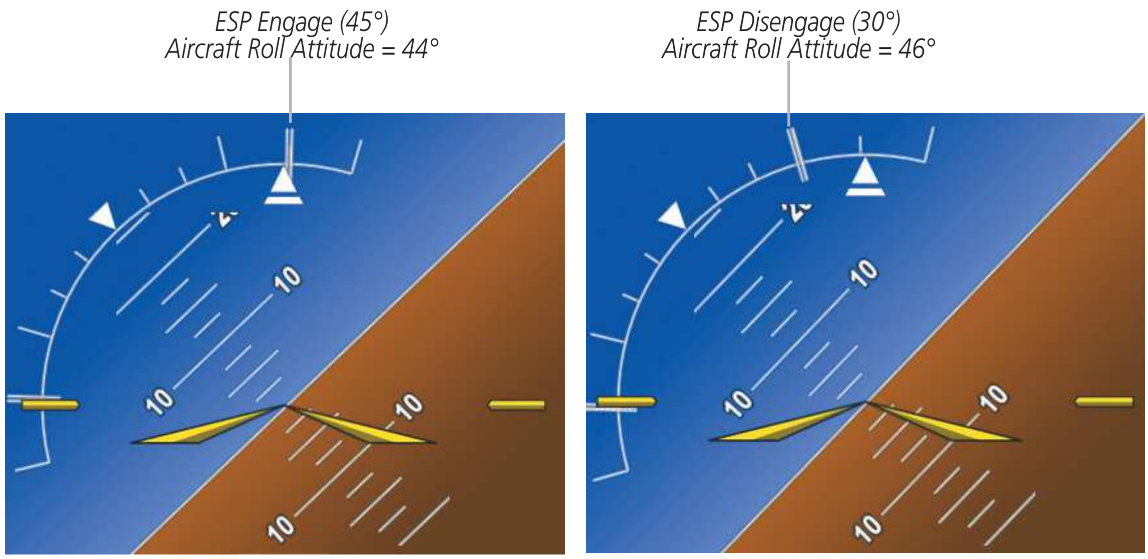


Figure 8-112 ESP Roll Engagement Indication (ESP NOT Engaged)



Before ESP Engage

After ESP Engage

Figure 8-113 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°.

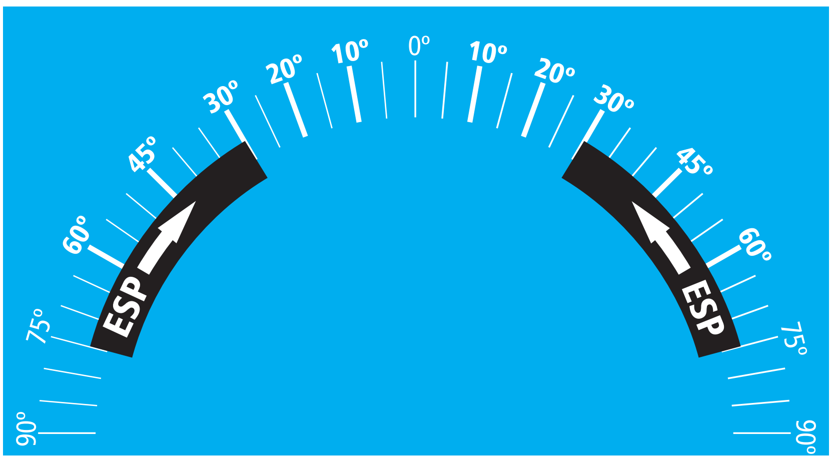


Figure 8-114 ESP Roll Operating Range When Engaged
(Force Increases as Roll Increases & Decreases as Roll Decreases)

ESP is automatically disengaged if the aircraft reaches the autopilot roll engagement attitude limit of 75° (see following figure).

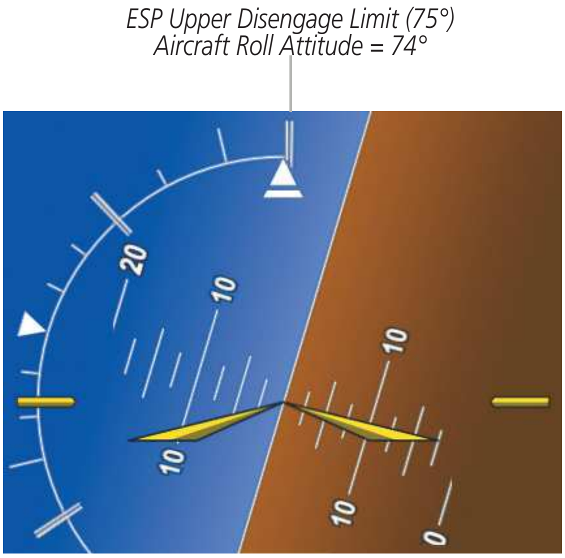


Figure 8-115 Roll Attitude Autopilot Engagement Limit (ESP Engaged)

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.

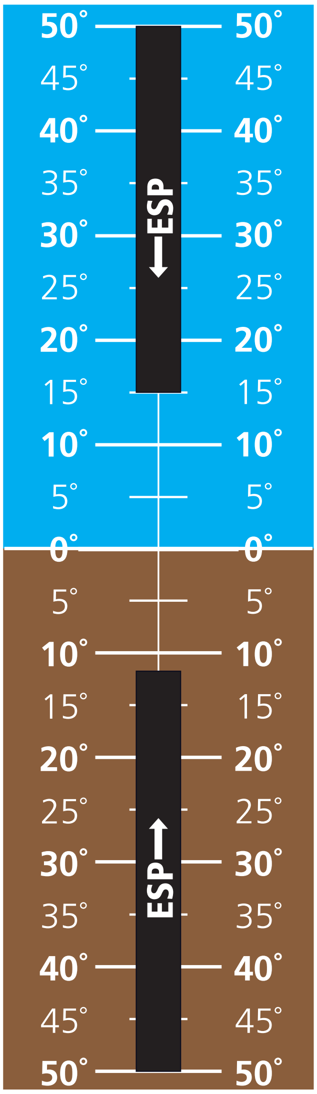


Figure 8-116 ESP Pitch Operating Range When Engaged (Force Increases as Pitch Increases & Decreases as Pitch Decreases)

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 (see following figure). When pitch attitude equals that indicated by the Pitch Limit Indicator, ESP will engage, applying a force in the direction necessary to lower the nose of the aircraft.

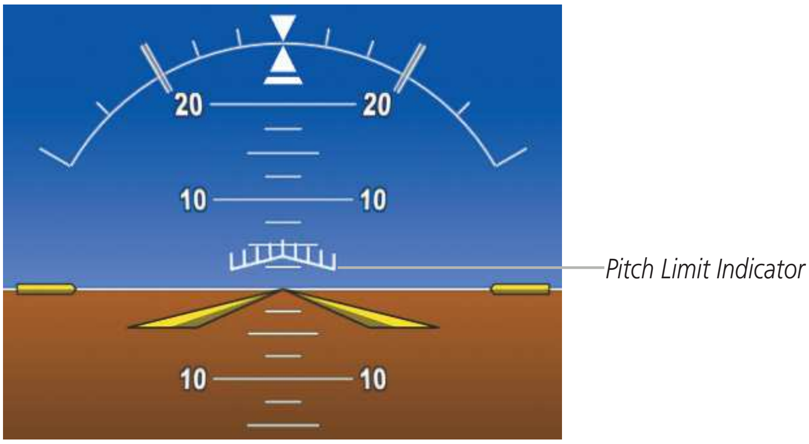


Figure 8-117 Pitch Limit Indicator

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.

8.11 ELECTRONIC CHECKLISTS

NOTE: *The checklist shown in the following illustrations are examples only.*

The Display Panes are able to display optional electronic checklists which allow the pilot to quickly find the proper procedure on the ground and during each phase of flight. The system accesses the checklists from the Secure Digital (SD) cards located in the top card slot of each GDU. In addition to the Perspective Touch controls, the Checklist Advance Button located between the PFD and MFD may be used to check/advance or uncheck/advance checklist items.

The following colors are used for checklist items:

- Cyan - Items not selected or checked
- White - Item is selected
- Green - Item has been checked
- Gray - General notes
- Amber - Caution item
- Red - Warning item

Accessing and navigating checklists:

1) From MFD Home, touch the **Checklist** Button. The checklist structure is displayed as shown in the folowing figure.

Or:

Press the dedicated checklist button. The checklist structure is displayed on the leftmost display pane.

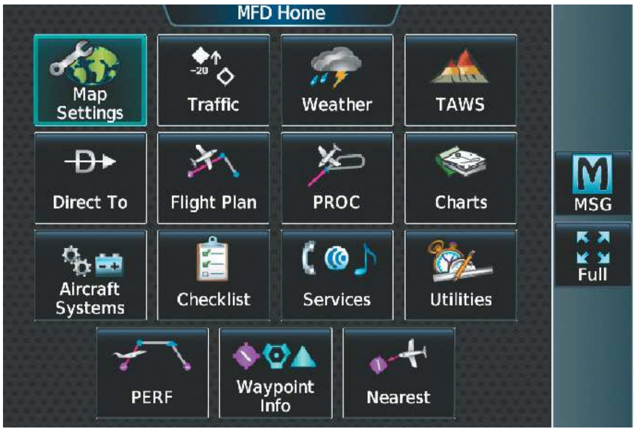


Figure 8-118 MFD Home Screen

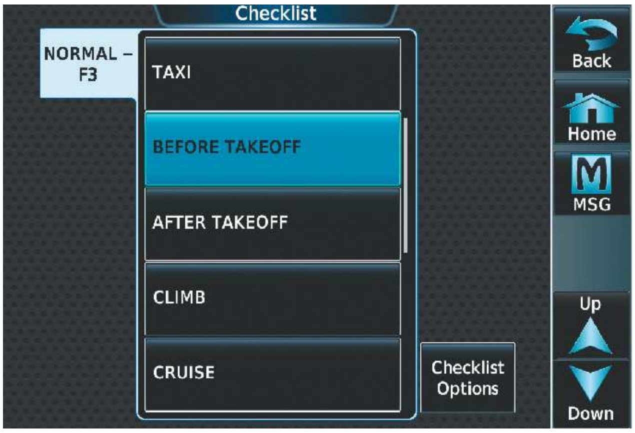


Figure 8-119 List of Checklists

2) Touch the desired checklist from those listed in the center of the screen. If necessary, scroll through the list to see all the available checklists for the selected group. In the previous figure, **BEFORE TAKEOFF** is selected and the checklist is displayed in the previously selected display pane as in the following figure. The first checklist item is selected as indicated by the white text surrounded by a cyan box.

Figure 8-120 First Checklist Item Selected

3) Press the lower knob on the Touchscreen Controller or the Checklist Advance Button to check the selected checklist item. The line item turns green and a checkmark is placed in the associated box as shown in the following figure. The next line item is automatically selected for checking.

Figure 8-121 First Checklist Item Completed and Checked

Turn the lower knob on the Touchscreen Controller to scroll through the checklist and select the desired checklist item.

Selecting a checked item and pressing the lower knob on the Touchscreen Controller or the Checklist Advance Button will return the item to the unchecked state.

Or:

Press the dedicated checklist button. The line item turns green and a checkmark is placed in the associated box. The next line item is automatically selected for checking.

4) When all checklist items have been checked, '*Checklist Finished*' is displayed in green text at the bottom left of the checklist window and 'GO TO NEXT CHECKLIST?' is highlighted as in the following figure. If 'GO TO NEXT CHECKLIST?' is selected prior to checking all the checklist items, '*CHECKLIST NOT FINISHED*' will be displayed in amber text.

Figure 8-122 Checklist Complete

5) While the 'GO TO NEXT CHECKLIST?' text is highlighted, press the lower knob on the Touchscreen Controller or the Checklist Advance Button to display the next checklist in the group or choose another by touching the desired checklist on the Touchscreen Controller.

Resetting a specific checklist:

1) From MFD Home, touch **Checklist**.
2) Touch the desired checklist to reset. **TAXI** is selected in the following figure.
3) Touch the **Checklist Options** Button.
4) Touch the **Reset Current Checklist** Button as seen in the following figure.

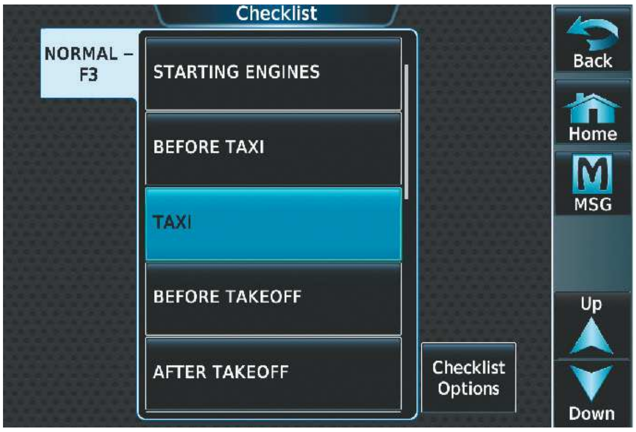


Figure 8-123 Checklist Screen

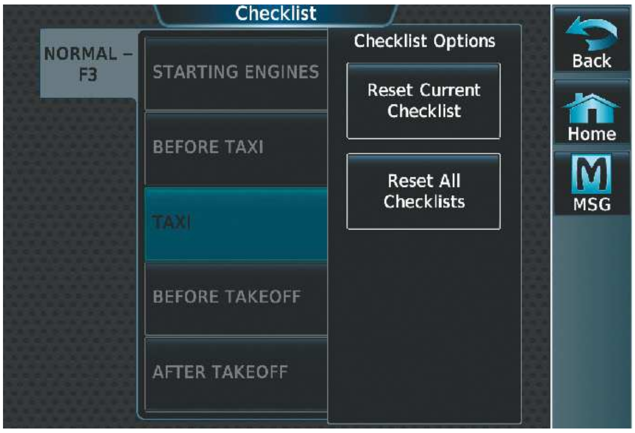


Figure 8-124 Checklist Options

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.

8.12 ELECTRONIC DOCUMENTS

If installed the Electronic Document function allows viewing of electronic documents on the selected Display Pane. The system allows the display of electronic documents from two sources. These sources are Installed and User documents.

INSTALLED DOCUMENTS

'Installed' Documents are typically provided by the aircraft manufacturer. These documents are stored on the Supplemental Data Cards, along with the databases, located in the bottom SD Card slot of each GDU. Each Supplemental Data Card contains identical document files.

USER DOCUMENTS

'User' Documents are those loaded by the crew. User Documents must be in .pdf format and reside on an SD Card no larger than 16GB. The maximum document file size is 1.5GB. The maximum number of pages per document is limited to 9,999. Pages with large and/or numerous images may exceed RAM memory limits, therefore, may not be displayed correctly or not displayed at all.

An SD card must be inserted into the top card slot of each display on which it is desired to view the user documents. Each display can only access electronic documents on the SD Card inserted in that display.

User Documents can be unique to the display on which they are viewed.

SUPPORTED PDF FEATURES

User Documents must be in .pdf format. The following .pdf features are not supported. If a file contains any of these features, the system will ignore the feature and display the document.

- Embedded files (attachments)
- Alternate images (using a different image for display and printing)
- Page labels (alternate page numbers; e.g. for i, ii, iii, iv for table of contents)
- Additional annotations, including file attachment annotation, sound annotation, movie annotation, widget annotation, and trap network annotation.
- Digital signatures
- Javascript
- Logical structure (structuring documents into chapters, paragraphs, headings, footnotes)
- Web capture information (annotations for search engines)
- Prepress support (annotations for newspapers, etc.)

SD CARD FILE STRUCTURE FOR USER DOCUMENTS

User document files must reside on the SD card in a directory named "Documents". The list of available User Documents is limited to 100 documents and are shown in alphabetical order based on filename.

VIEWING ELECTRONIC DOCUMENTS

Selecting a document:

1) From MFD Home, touch **Utilities** > **Documents**. The Document Viewer is now displayed as in the following figure.

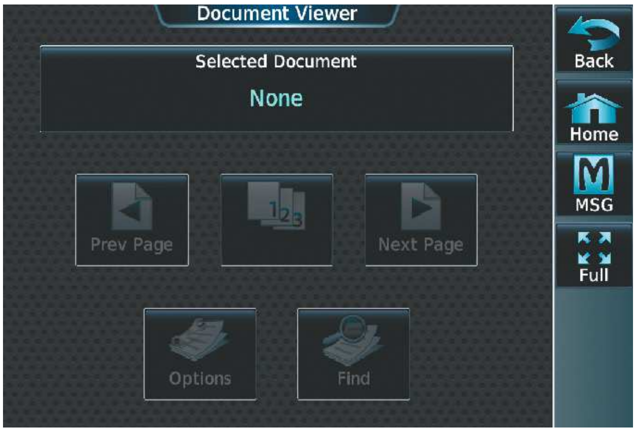


Figure 8-125 Electronic Document Viewer

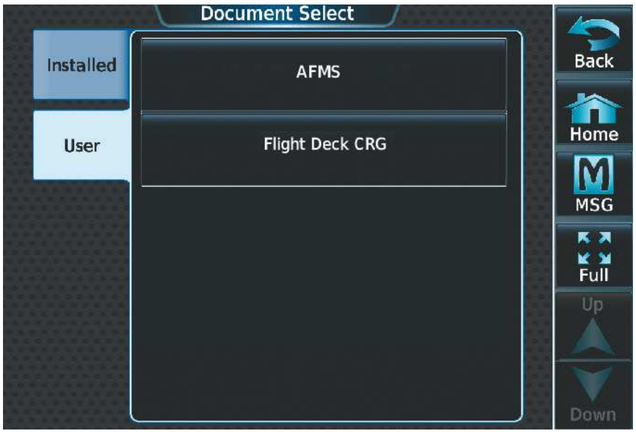


Figure 8-126 Document Selection

2) Touch the **Selected Document** Button.

3) Touch the **Installed** Tab or the **User** Tab to select the desired document source as seen in the previous figure. In this example, User documents are selected.

4) Touch the desired document button. The selected document name is displayed in the **Selected Document** Button, as shown in the following figure. The document is displayed in the selected pane, as shown in the following figure.

Figure 8-127 Selected Document Indicated

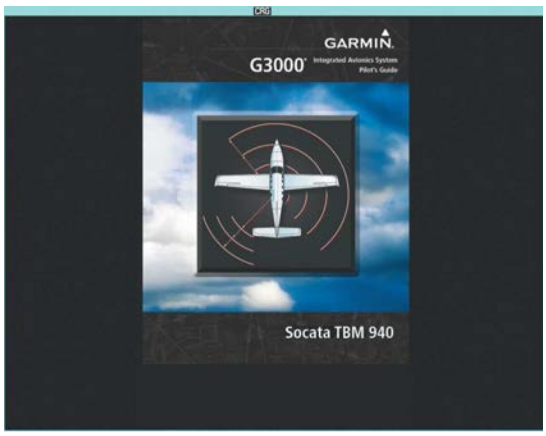


Figure 8-128 Document Viewed on Selected Display Pane

Changing document viewer options:

1) From MFD Home, touch **Utilities** > **Documents** > **Options**. The Document Viewer Options Screen is displayed as in the following figure.

2) Touch the **Document Info** Button to view information pertaining to the document, such as files size and creation date.

Figure 8-129 Document Viewer Options

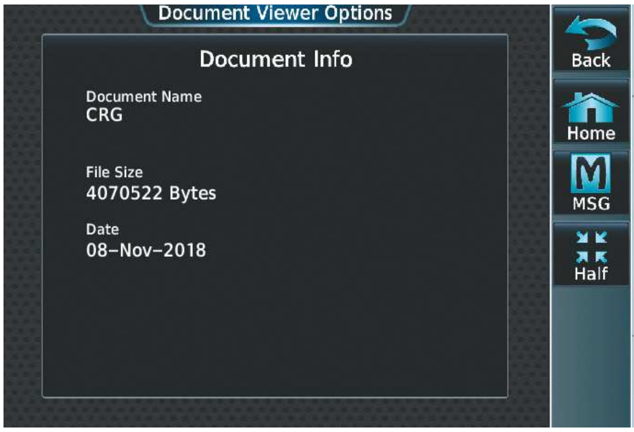


Figure 8-130 Document Information

3) Touch the **Fit Page** Button to view the complete page in the selected pane (see previous figure).
4) Touch the **Fit Width** Button to enlarge the displayed page to fill the width of the selected pane.
5) Touching the Rotate Page buttons will rotate the displayed page 90 degrees to the right or left (depending on button touched) within the selected pane. Each subsequent touch will rotate the page another 90 degrees.
6) Touch and move the **Brightness** Slider to adjust the brightness of the displayed page.

   Or:

   Touch the **+** Button to increase brightness, or the **-** Button to decrease brightness. Each touch increases or decreases the brightness approximately five percent.

Browsing the document:

1) After selecting the desired document, touch the **Next Page** Button to increment one page or the **Prev Page** Button to decrement one page.
2) The Page Select Button (see following figure) shows the number of pages contained in the document and the page currently being displayed. Touch the Page Select Button to jump to a specific page number. The Enter Page Number Screen is displayed, as in the following figure.

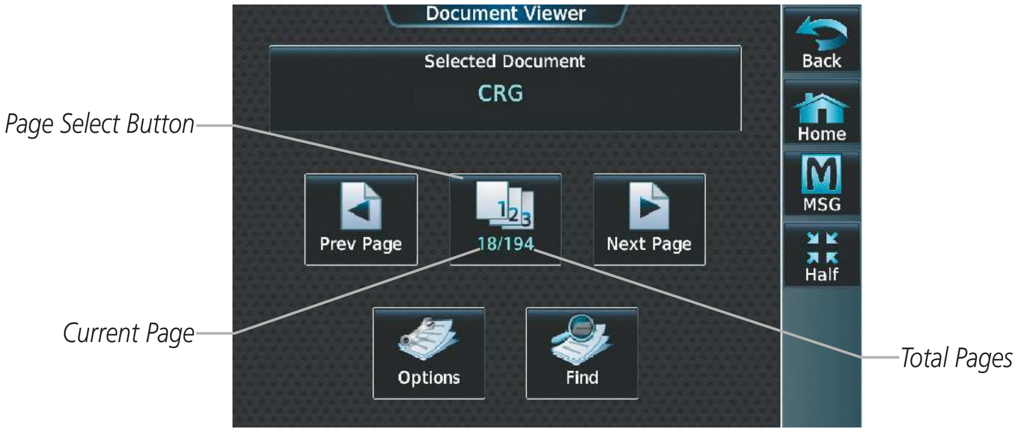


Figure 8-131 Document Browsing Options

Figure 8-132 Enter Document Page Number

3) Touch the **Find** Button to display the Document Viewer Find screen as shown in the following figure.

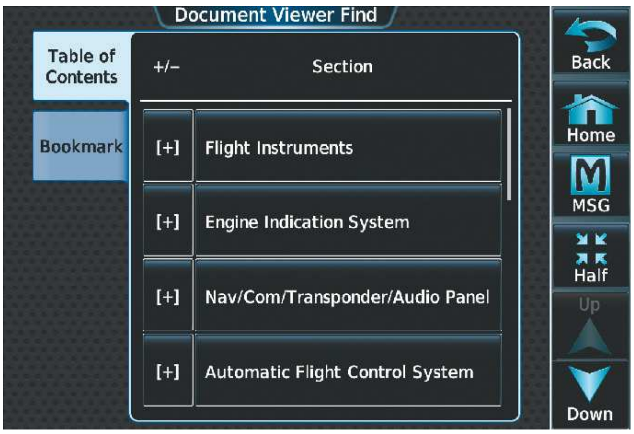


Figure 8-133 Table of Contents

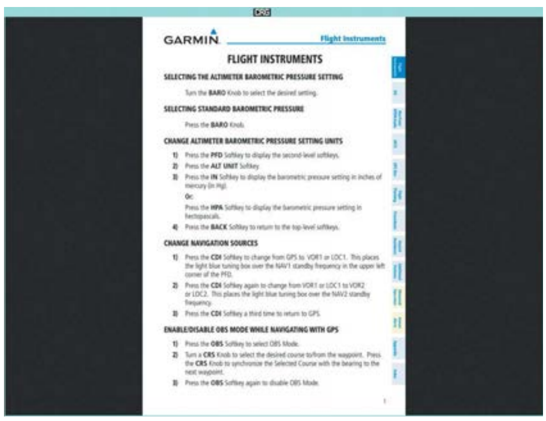


Figure 8-134 Flight Instruments Section Displayed

4) If necessary, touch the **Table of Contents** Tab to display the document Table of Contents.

5) Touch the **[+]** Button to expand a topic. Touch the **[–]** Button to return to the collapsed view of the topic.

6) Touch the desired topic button to jump to that portion of the document. In this example, Flight Instruments is selected and the Flight Instruments section is displayed (see previous figure).

Zooming in and out on a document page:

1) With the document displayed, press the lower knob. The Document Pointer Options Screen is now displayed on the Touchscreen Controller as shown in the following figure. Also, a flashing pointer is shown on the document display as in the following figure.

2) Turn the lower knob, or use the pinch-and-zoom feature on the Touchpad to zoom in or zoom out on the document page display as illustrated in the following figure.

3) Turn the upper knobs, or move a finger across the Touchpad as indicated in the following figure to move the pointer within the document. When the pointer reaches the edge of the display, the display will scroll to show more the document page.

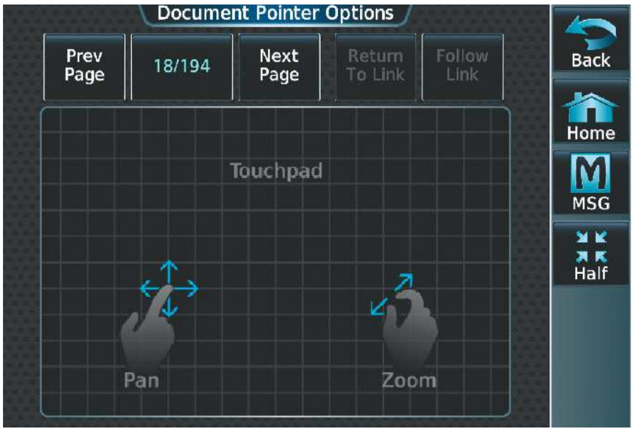
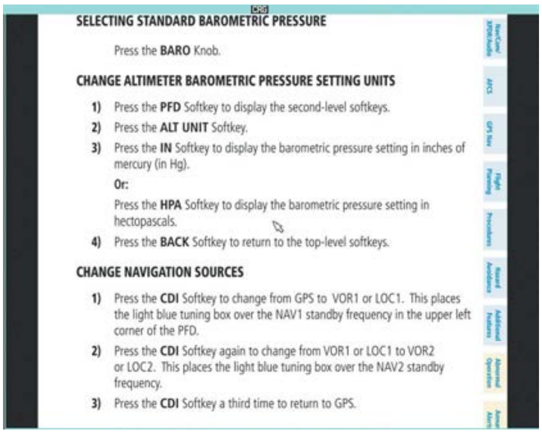


Figure 8-135 Touchpad


SELECTING STANDARD BAROMETRIC PRESSURE

Press the **BARO** Knob.

CHANGE ALTIMETER BAROMETRIC PRESSURE SETTING UNITS

1) Press the **PFD** Softkey to display the second-level softkeys.
2) Press the **ALT UNIT** Softkey.
3) Press the **IN** Softkey to display the barometric pressure setting in inches of mercury (in Hg).
Or:
Press the **HPA** Softkey to display the barometric pressure setting in hectopascals.
4) Press the **BACK** Softkey to return to the top-level softkeys.

CHANGE NAVIGATION SOURCES

1) Press the **CDI** Softkey to change from GPS to VOR1 or LOC1. This places the light blue tuning box over the NAV1 standby frequency in the upper left corner of the PFD.
2) Press the **CDI** Softkey again to change from VOR1 or LOC1 to VOR2 or LOC2. This places the light blue tuning box over the NAV2 standby frequency.
3) Press the **CDI** Softkey a third time to return to GPS.

Figure 8-136 Page Zoom

Navigating links within the document:

1) With the document displayed, press the lower knob. The Document Pointer Options Screen is now displayed on the Touchscreen Controller as shown in the following figure. Also, a flashing pointer is shown on the document display as in the previous figure.

2) Turn the upper knobs, or move a finger across the Touchpad to move the pointer to the desired document link as in the following figure.

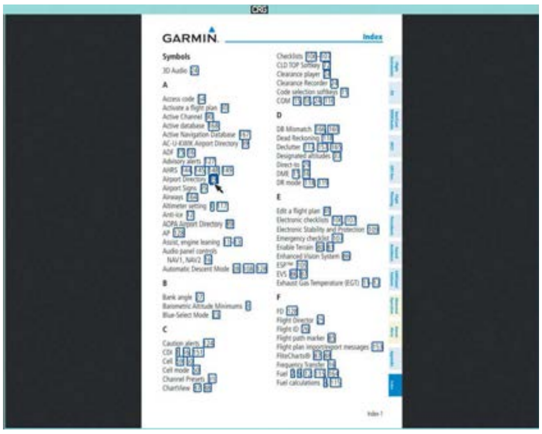


Figure 8-137 Link Selected

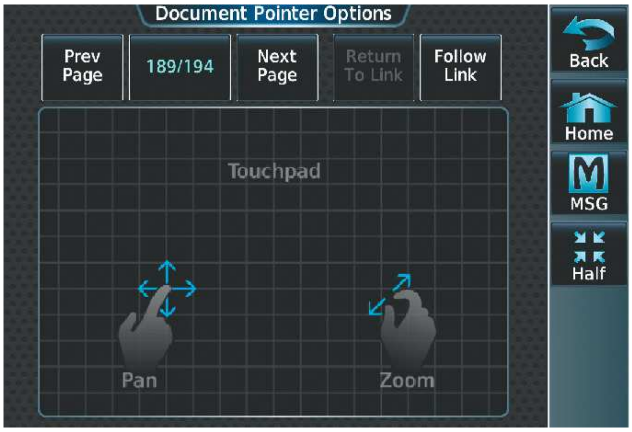


Figure 8-138 Follow Link

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 indicted in the following figure.

Figure 8-139 Link Displayed

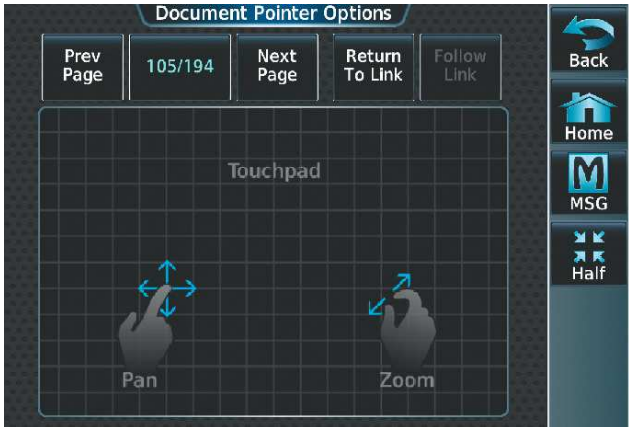


Figure 8-140 Follow Link

4) Touch the **Return To Link** Button (see previous figure) to return to the link origin.

5) Touch the **Back** Button, press the upper knob, or press the lower knob to remove the pointer from the display and return to the Document Viewer Screen.

Creating bookmarks in the document:

1) While viewing the page to bookmark, touch the **Find** Button on the appropriate Touchscreen Controller.

2) Touch the **Bookmark** Tab to display the Bookmark Window as in the following figure.

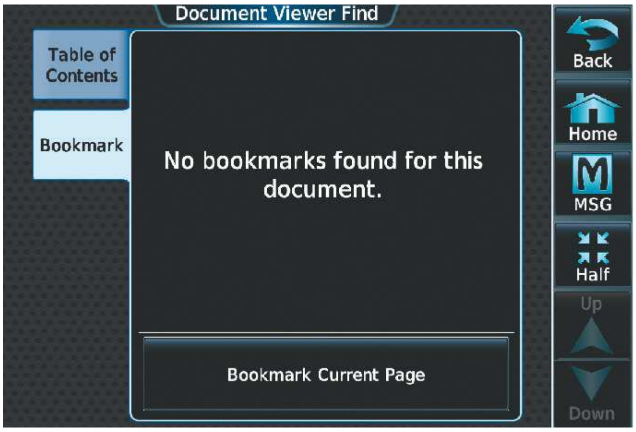


Figure 8-141 Select Bookmark Tab

Figure 8-142 Enter Bookmark Name

3) Touch the **Bookmark Current Page** Button. The Enter Bookmark Name Screen is displayed as shown in the previous figure.

4) Touch **Enter**. A confirmation screen is displayed as seen in the following figure.

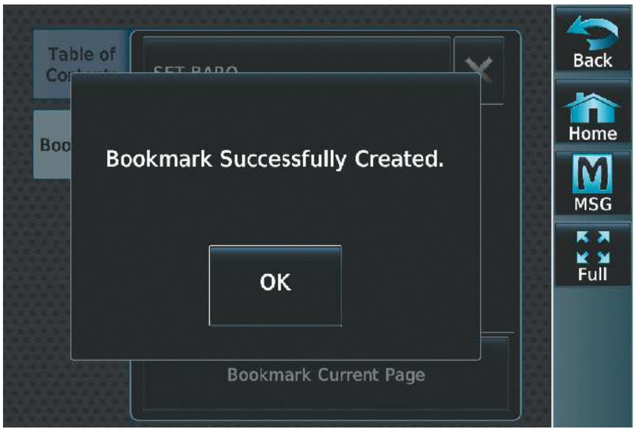


Figure 8-143 Create Bookmark

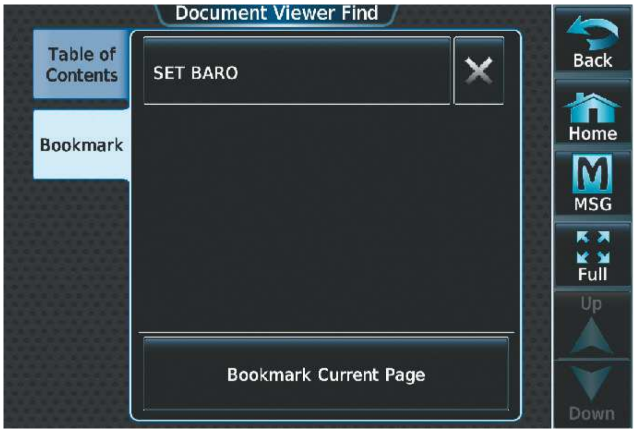


Figure 8-144 Bookmark Created

5) Touch **OK**. The newly created bookmark is displayed as in the previous figure.

Deleting document bookmarks:

1) With the desired document displayed, touch the **Find** Button to display the Document Viewer Find Screen.

2) Touch the **Bookmark** Tab to display the Bookmark Window.

3) Touch the **X** Button next to the bookmark to be deleted (see previous figure).

Figure 8-145 Delete Bookmark

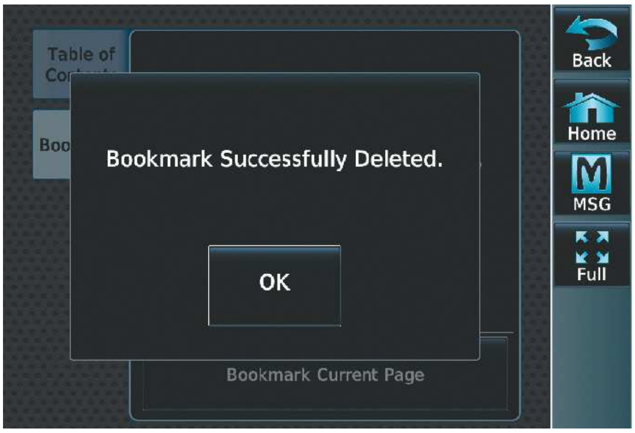


Figure 8-146 Bookmark Deleted

4) Touch **OK** on the confirmation screen as in the previous figure.

5) Touch **OK** to acknowledge deletion of the bookmark (see previous figure), and return to the Document Viewer Find Screen.

ANNUNCIATIONS AND ALERTS

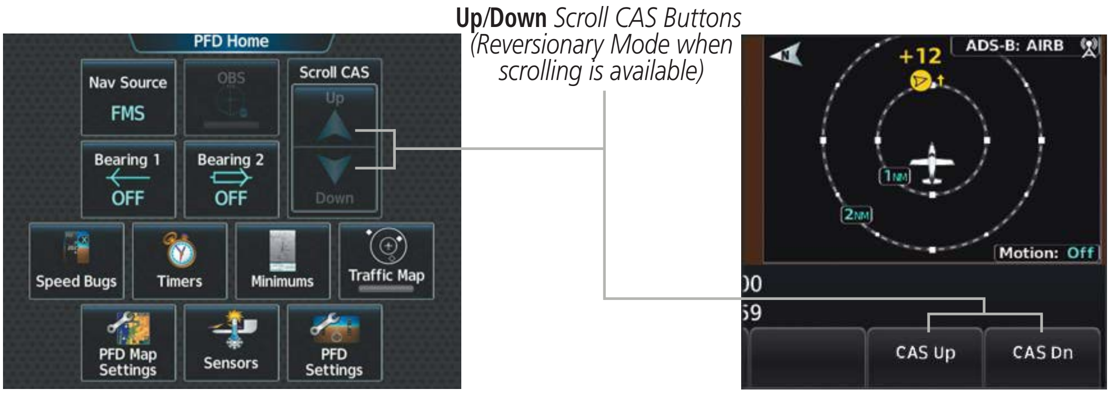
CAS MESSAGES

NOTE: *Refer to the current version of the applicable 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.*

The Crew Alerting System (CAS) Display is located in the lower left corner of the EIS 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 (Figure A-1). In Reversionary Mode, CAS scrolling buttons are available on the Touchscreen Controller PFD Home screen and the lower right corner of the PFD (Figure A-2).

Figure A-1 CAS Message Window (MFD)



Touchscreen Controller PFD Home Screen

PFD Display

Figure A-2 CAS Message Scrolling

CAS messages are grouped by criticality (warning, caution, advisory) 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) – This level of alert provides general information.

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

Master Caution and Warning Indicators

PFD1

Figure A-3 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.

WARNING MESSAGES

Message	Description
ABORT APP	Abort approach due to loss of GPS navigation
AURAL WRN FAIL	Aural warning system failure due to non-communicating LRUs
AURAL WRN 1 CHNL	Aural warning failure of one LRU
CABIN ALTITUDE	Cabin altitude over 10,000 ft
CABIN DIFF PRESS	Cabin pressure differential over 6.4 psi
DOOR	Pilot or cabin door open
ELEC FEATH FAULT	Feathering system failure
EDM	Autopilot has activated emergency descent mode
FIRE	Engine compartment fire (temperature over 200°C; if installed)
FLAPS ASYM	Dissymmetry between left- and right-hand flaps
FUEL OFF	Fuel tank selectors set to "Off"
FUEL PRESS	Fuel pressure below 10 psi
GEAR UNSAFE	Gears are in an unsafe configuration

Message	Description
ITT	Engine start: ITT over 1000°C, 870°C (5 s), or 840°C (20 s) Engine running : ITT over 840°C
NG	Generator speed is more than 104%
OIL PRESS	Oil pressure below 60 psi
O2 CYL CLOSED	Oxygen cylinder closed
PARK BRAKE	Parking brake applied
PRESSU OFF	No bleed air provided to cabin
USP ACTIVE	Underspeed protection is active

CAUTION MESSAGES

Message	Description
AIRFRAME DEICE FAIL	Airframe deice failed.
AP ON YD OFF	The autopilot is ON while the Yaw Damper is OFF
APR DWNGRADE	Approach downgraded, vertical guidance generated by SBAS is unavailable. Use LNAV only minimums.
AUTO SEL	Fuel timer off or out of service
AUX BOOST PMP ON	Electric fuel pump running (manual or automatic mode)
BAT AMP	Battery current over 50 A while on ground
BAT OFF	Battery off
CARGO DOOR	Forward cargo door open
CHIP	Oil chip detector on (if installed)
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 GWX is reporting a fault. The GWX radar system should be serviced
ICE DETECTED	Ice detected
ICE DETECTION FAIL	Ice detection fail
IGNITION	Ignition exciter running
INERT SEP FAIL	Inertial separator failure
ITT HI	Interstage Turbine Temperature (ITT) is more than 820 °C
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%

Message	Description
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 warning 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
USE OXYGEN MASK	Cabin altitude high
VACUUM LOW	Vacuum pressure less than 3.75 in Hg
XPDR1 FAIL	XPDR1 has failed and is inoperative. The system should be serviced
XPDR2 FAIL	XPDR2 has failed and is inoperative. The system should be serviced
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.
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.
** 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.
NO ICE DETECTED	No ice detected
STARTER	Starter generator running

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

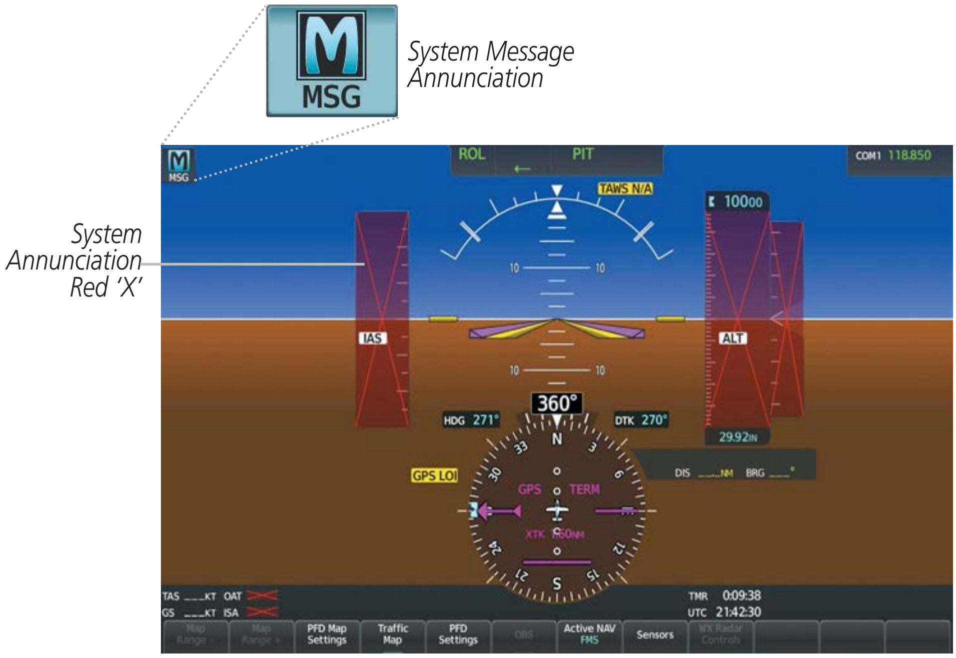


Figure A-6 System Annunciations (PFD)

Figure A-7 System Messages Annunciation (Touchscreen Controller)

Figure A-8 Notifications Screen After MSG Button Touched (Touchscreen Controller)

SYSTEM MESSAGE ADVISORIES

This section describes various Message Advisories. Certain messages are issued due to an LRU or an LRU function failure. Such messages are normally accompanied by a corresponding red 'X' annunciation as shown previously in the System Annunciation section.

***NOTE:** This section provides information regarding Message Advisories that may be displayed by the system. Knowledge of the aircraft, systems, flight conditions, and other existing operational priorities must be considered when responding to a message. Always use sound pilot judgment. The current version of the pertinent flight manual takes precedence over any conflicting guidance found in this section.*

System Message	Comments
ADC1 ALT EC – GDC1 altitude error correction is unavailable.	ADC1 is reporting that the altitude error correction is unavailable.
ADC1 AS EC – GDC1 airspeed error correction is unavailable.	ADC1 is reporting that the airspeed error correction is unavailable.
ADC1 SERVICE – GDC1 needs service. Return unit for repair.	A failure has been detected in the GDC1. The system should be serviced.
ADC2 ALT EC – GDC2 altitude error correction is unavailable.	ADC2 is reporting that the altitude error correction is unavailable.
ADC2 AS EC – GDC2 airspeed error correction is unavailable.	ADC2 is reporting that the airspeed error correction is unavailable.
ADC2 SERVICE – GDC2 needs service. Return unit for repair.	A failure has been detected in the GDC2. The system should be serviced.
AHRS MAG DB – AHRS magnetic model database version mismatch.	The #1 AHRS and #2 AHRS magnetic model database versions do not match.
AHRS1 CAL – AHRS1 calibration version error. Srvc req'd.	The AHRS1 calibration version error. The system should be serviced.
AHRS1 CONFIG – AHRS1 config error. Config service req'd.	AHRS configuration settings do not match those of backup configuration memory. The system should be serviced.
AHRS1 GPS – AHRS1 not receiving any GPS information.	The AHRS1 is not receiving any or any useful GPS information. Check AFMS limitations. The system should be serviced.
AHRS1 GPS – AHRS1 not receiving backup GPS information.	The AHRS1 is not receiving backup GPS information. The system should be serviced.
AHRS1 GPS – AHRS1 operating exclusively in no-GPS mode.	The AHRS1 is operating exclusively in no-GPS mode. The system should be serviced.
AHRS1 GPS – AHRS1 using backup GPS source.	The AHRS1 is using the backup GPS path. Primary GPS path has failed. The system should be serviced when practical.
AHRS1 SERVICE – AHRS1 needs service. Return unit for repair.	A failure has been detected in the #1 AHRS. The system should be serviced.
AHRS1 SRVC – AHRS1 Magnetic-field model needs update.	The AHRS1 earth magnetic field model is out of date. Update magnetic field model when practical.
AHRS1 TAS – AHRS1 not receiving valid airspeed.	The AHRS1 is not receiving true airspeed from the air data computer. The AHRS relies on GPS information to augment the lack of airspeed. The system should be serviced.
AHRS2 CAL – AHRS2 calibration version error. Srvc req'd.	The AHRS2 calibration version error. The system should be serviced.

System Message	Comments
AHRS2 CONFIG – AHRS2 config error. Config service req'd.	AHRS configuration settings do not match those of backup configuration memory. The system should be serviced.
AHRS2 GPS – AHRS2 not receiving any GPS information.	The AHRS2 is not receiving any or any useful GPS information. Check AFMS limitations. The system should be serviced.
AHRS2 GPS – AHRS2 not receiving backup GPS information.	The AHRS2 is not receiving backup GPS information. The system should be serviced.
AHRS2 GPS – AHRS2 operating exclusively in no-GPS mode.	The AHRS2 is operating exclusively in no-GPS mode. The system should be serviced.
AHRS2 GPS – AHRS2 using backup GPS source.	The AHRS2 is using the backup GPS path. Primary GPS path has failed. The system should be serviced when practical.
AHRS2 SERVICE – AHRS2 needs service. Return unit for repair.	A failure has been detected in the #2 AHRS. The system should be serviced.
AHRS2 SRVC – AHRS2 Magnetic-field model needs update.	The AHRS2 earth magnetic field model is out of date. Update magnetic field model when practical.
AHRS2 TAS – AHRS2 not receiving valid airspeed.	The AHRS2 is not receiving true airspeed from the air data computer. The AHRS relies on GPS information to augment the lack of airspeed. The system should be serviced.
APR DWNGRADE – Apr downgraded.	Vertical guidance generated by SBAS is unavailable. Use only LNAV minimums.
APR INACTV – Approach is not active.	The system notifies the pilot the loaded approach is not active. Activate approach when required.
ARSPC AHEAD – Airspace ahead - less than 10 minutes.	Special use airspace is ahead of aircraft. The aircraft will penetrate the airspace within 10 minutes.
ARSPC NEAR – Airspace near – less than 2 nm.	Special use airspace is within 2 nm of the aircraft position.
ARSPC NEAR – Airspace near and ahead.	Special use airspace is near and ahead of the aircraft position.
CHECK ARRIVAL SPEED - [Arrival Speed] KT AT [LOC ID] exceeds M_{mo}	The arrival speed loaded exceeds M_{mo}.
CHECK ARRIVAL SPEED - [Arrival Speed] KT AT [LOC ID] exceeds V_{mo}	The arrival speed loaded exceeds V_{mo}.
CHECK DEPARTURE SPEED - [Departure Speed] KT AT [LOC ID] exceeds V_{mo}	The departure speed loaded exceeds V_{mo}.
CHECK CRS – Database course for LOC1 / [LOC ID] is [CRS]°.	Selected course for LOC1 differs from published localizer course by more than 10 degrees.
CHECK CRS – Database course for LOC2 / [LOC ID] is [CRS]°.	Selected course for LOC2 differs from published localizer course by more than 10 degrees.
CNFG MODULE – PFD1 configuration module is inoperative.	The specified GDU's configuration module backup memory has failed. The system should be serviced.
COM #[1, 2] INOP - CAL - Check COM calibration.	COM 1 and/or COM 2 calibration version error. Check COM calibration.
COM #[1, 2] INOP - CRNT - Check COM current.	COM 1 and/or COM 2 current is low. Check COM current.

System Message	Comments
COM #[1, 2] INOP - NTRL - Com internal fault.	COM 1 and/or COM 2 has an internal fault.
COM #[1, 2] INOP - SYNTH - COM synthesizer lock fault.	The COM 1 and/or COM 2 has a synthesizer lock fault.
COM #[1, 2] INOP - VOLT - Check COM voltage.	The COM 1 and /or COM 2 has low voltage.
COM1 MANIFEST – COM1 software mismatch, communication halted.	The COM 1 has incorrect software installed. The system should be serviced.
COM1 PTT – COM1 push-to-talk key is stuck.	The COM1 external push-to-talk switch is stuck in the enable (or "pressed") position. Press the PTT switch again to cycle its operation. If the problem persists, the system should be serviced.
COM1 RMT XFR – COM1 remote transfer key is stuck.	The COM1 transfer switch is stuck in the enabled (or "pressed") position. Press the transfer switch again to cycle its operation. If the problem persists, the system should be serviced.
COM2 MANIFEST – COM2 software mismatch, communication halted.	The COM 2 has incorrect software installed. The system should be serviced.
COM2 PTT – COM2 push-to-talk key is stuck.	The COM2 external push-to-talk switch is stuck in the enable (or "pressed") position. Press the PTT switch again to cycle its operation. If the problem persists, the system should be serviced.
COM2 RMT XFR – COM2 remote transfer key is stuck.	The COM2 transfer switch is stuck in the enabled (or "pressed") position. Press the transfer switch again to cycle its operation. If the problem persists, the system should be serviced.
CRUISE I – Cruise I conditions met.	Cruise I engine trend data log has been captured.
CRUISE II – Cruise II conditions met.	Cruise II engine trend data log has been captured.
DATA LOST – Pilot stored data was lost. Recheck settings.	The pilot profile data was lost. System reverts to default pilot profile and settings. The pilot may reconfigure the MFD & PFDs with preferred settings, if desired.
DATABASE CHANGE – Verify stored airways.	This occurs when a stored flight plan contains an airway that is no longer consistent with the navigation database. This alert is issued only after a navigation database update. Verify use of airways in stored flight plans and reload airways as needed.
DATABASE CHANGE – Verify user modified procedures.	This occurs when a stored flight plan contains procedures that have been manually edited. This alert is issued only after a navigation database update. Verify the user-modified procedures in stored flight plans are correct and current.
DB MISMATCH – Navigation database mismatch. Xtalk is off.	The GDUs have different navigation database versions or regions installed. Crossfill is off. Check the Avionics Status Screen to determine versions or regions. Also, check the Avionics Status Screen for a database synchronization function not completed. After synchronization is complete, power must be turned off, then on.
DB MISMATCH – Obstacle database mismatch.	The GDUs have different obstacle database versions or regions installed. Check the Avionics Status Screen to determine versions or regions. Also, check the Avionics Status Screen for a database synchronization function not completed. After synchronization is complete, power must be turned off, then on.
DB MISMATCH – 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.

System Message	Comments
DB MISMATCH – Terrain database mismatch.	The GDUs have different terrain database versions or regions installed. Check the Avionics Status Screen to determine versions or regions. Also, check the Avionics Status Screen for a database synchronization function not completed. After synchronization is complete, power must be turned off, then on.
DIG GMA1 MANIFEST – DIG GMA 1 software mismatch, communication halted.	The digital audio controller has incorrect software installed. The system should be serviced.
DME CHECK RANGE – DME range disagreement. Check position sensors.	A failure or disagreement has been detected in a DME receiver. Check position sensors.
ESP CONFIG – ESP config error. Config service req'd.	ESP is not configured properly. The system should be serviced.
EXCEEDANCE – Exceedance data is being logged.	An exceedance log has been captured.
FAILED PATH – A data path has failed.	A data path between two or more LRUs has failed. The system should be serviced when practical.
FPL TRUNC – Flight plan has been truncated.	This occurs when a newly installed navigation database eliminates an obsolete approach or arrival used by a stored flight plan. The obsolete procedure is removed from the flight plan. Update flight plan with current arrival or approach.
FPL WPT LOCK – Flight plan waypoint is locked.	Upon power-up, The system detects that a stored flight plan waypoint is locked. This occurs when an aviation database update eliminates an obsolete waypoint. The flight plan cannot find the specified waypoint and flags this message. This can also occur with user waypoints in flight plans that are deleted. Remove the waypoint from the flight plan if it no longer exists in any database, or update the waypoint name/identifier to reflect the new information.
FPL WPT MOVE – Flight plan waypoint moved.	The system has detected that a waypoint coordinate has changed due to a new navigation database update. Verify that stored flight plans contain correct waypoint locations.
FS510 CARD ERROR – FS510 not detected in MFD Bottom Slot.	The SD card was removed from the bottom card slot of the MFD. The SD card needs to be reinserted.
GDC1 MANIFEST – GDC1 software mismatch, communication halted.	The GDC1 has incorrect software installed. The system should be serviced.
GDC2 MANIFEST – GDC2 software mismatch, communication halted.	The GDC2 has incorrect software installed. The system should be serviced.
GDL69 CONFIG – GDL 69 config error. Config service req'd.	GDL 69A SXM configuration settings do not match those of backup configuration memory. The system should be serviced.
GDL69 FAIL – GDL 69 has failed.	A failure has been detected in the 69A SXM. The receiver is unavailable. The system should be serviced.
GDL69 MANIFEST – GDL69 software mismatch, communication halted.	The 69A SXM has incorrect software installed. The system should be serviced.
GEA # [1, 2] - CAL - Check GEA rigging.	There is a problem with the GEA rigging. Check the rigging.
GEA # [1, 2] - CNFG - Check GEA software and configuration.	There is a problem with the GEA software configuration. Check the configuration. If the problem persists, the system should be serviced.

System Message	Comments
GEA # [1, 2] - COMM - Check GEA config module connection.	There is a problem with the GEA config module connection. Check the connection.
GEA # [1, 2] CM INOP - INTRL - GEA internal fault.	The GEA has an internal fault. The system should be serviced.
GEA # [1, 2] CM INOP - SENS - Check GEA configuration.	There is an error in the GEA configuration. Check the configuration. If the problem persists, the system should be serviced.
GEA # [1, 2] CM INOP - TEMP - Check GEA config module cooling.	The GEA configuration module has insufficient cooling. If the problem persists, the system should be serviced.
GEA # [1, 2] CM INOP - VOLT - Check GEA voltages.	The GEA voltage is low. Check GEA voltages.
GEA1 CONFIG – GEA1 config error. Config service req'd.	The #1 GEA configuration settings do not match those of backup configuration memory. The system should be serviced.
GEA1 MANIFEST – GEA1 software mismatch, communication halted.	The #1 GEA has incorrect software installed. The system should be serviced.
GEA2 CONFIG – GEA2 config error. Config service req'd.	The #2 GEA configuration settings do not match those of backup configuration memory. The system should be serviced.
GEA2 MANIFEST – GEA2 software mismatch, communication halted.	The #2 GEA has incorrect software installed. The system should be serviced.
GEO LIMITS – AHRS1 too far north/south, no magnetic compass.	The aircraft is outside geographical limits for approved AHRS operation. Heading is annunciated as invalid.
GFC MANIFEST – GFC software mismatch, communication halted.	Incorrect servo software is installed, or gain settings are incorrect.
GIA #[1, 2] INOP - CRNT - Check GIA current.	The GIA 1 and/or GIA 2 current is low. The current should be checked.
GIA #[1, 2] INOP - SERIAL - Check GIA serial communication.	Loss of GIA 1 and/or GIA 2 serial communication. Check GIA serial communication.
GIA #[1, 2] INOP - VOLT - Check GIA voltage.	GIA 1 and/or GIA 2 low voltage. Check voltage.
GMA1 AUX MANIFEST – GMA 1 AUX software mismatch, communication halted.	The digital audio controller has incorrect software installed. The system should be serviced.
GMA1 CONFIG – GMA1 config error. Config service req'd.	The audio controller configuration settings do not match backup configuration memory. The system should be serviced.
GMA1 FAIL – GMA1 is inoperative.	The audio controller has detected a failure. The audio controller is unavailable. The system should be serviced.
GMA1 MANIFEST – DIG GMA 1 software mismatch, communication halted.	The audio controller has incorrect software installed. The system should be serviced.
GMA1 SERVICE – GMA1 needs service. Return unit for repair.	The audio controller self-test has detected a problem in the unit. Certain audio functions may still be available, and the audio controller may still be usable. The system should be serviced when practical.
GMC CONFIG – GMC Config error. Config service req'd.	Error in the configuration of the GMC.
GMC FAIL – GMC is inoperative.	A failure has been detected in the GMC. The GMC is unavailable.

System Message	Comments
GMC KEYSTK – GMC [key name] key is stuck.	A key is stuck on the GMC bezel. Attempt to free the stuck key by pressing it several times. The system should be serviced if the problem persists.
GMC MANIFEST – GMC software mismatch. Communication halted.	The GMC has incorrect software installed. The system should be serviced.
GMU1 MANIFEST – GMU1 software mismatch, communication halted.	The GMU1 has incorrect software installed. The system should be serviced.
GPS NAV LOST – Loss of GPS navigation. Enable GPS sensors.	Loss of GPS navigation due to GPS being disabled
GPS NAV LOST – Loss of GPS navigation. GPS fail.	Loss of GPS navigation due to GPS failure.
GPS NAV LOST – Loss of GPS navigation. Position error.	Loss of GPS navigation due to position error.
GRA1 CAL – GRA1 calibration error. Service req'd.	A calibration error has been detected in the GRA. The system should be serviced.
GRA1 CONFIG – GRA1 config error. Config service req'd.	The GRA configuration settings do not match those of backup configuration memory. The system should be serviced.
GRA1 MANIFEST – GRA1 software mismatch, communication halted.	The GRA has incorrect software installed. The system should be serviced.
GRA1 SERVICE – GRA1 needs service. Return unit for repair.	A failure has been detected in the GRA. The system should be serviced.
GRA1 TEMP – GRA1 over temperature.	The GRA temperature is too high. If the problem persists, the system should be serviced.
GRS1 CONFIG – GRS1 config error. Config service req'd.	GRS configuration settings do not match those of backup configuration memory. The system should be serviced.
GRS1 MANIFEST – GRS1 software mismatch, communication halted.	The AHRS1 has incorrect software installed. The system should be serviced.
GRS1 SERVICE – GRS1 needs service. Return unit for repair.	The AHRS1 should be serviced when practical.
GSR1 FAIL – GSR1 has failed.	A failure has been detected in GSR1. The system should be serviced.
GTC1 CARD1 ERR – GTC1 card 1 is invalid.	The internal SD card in the Touchscreen Controller contains invalid data. The system should be serviced.
GTC1 CARD1 REM – GTC1 card 1 was removed. Reinsert card.	The internal SD card in the Touchscreen Controller was removed. The system should be serviced.
GTC1 CONFIG – GTC1 config error. Config service req'd.	Touchscreen Controller configuration settings do not match those of backup configuration memory. The system should be serviced.
GTC1 COOLING – GTC1 has poor cooling. Reducing power usage.	The Touchscreen Controller has insufficient cooling. If the problem persists, the system should be serviced.
GTC1 DB ERR – GTC1 database error exists.	The Touchscreen Controller detected a failure in one or more databases. Ensure the data card is properly inserted. Replace data card. If problem persists, the system should be serviced.
GTC1 FAN FAIL – GTC1 internal fan failure. Unit needs service.	The internal fan in the Touchscreen Controller has failed. The system should be serviced.
GTC1 KEYSTK – GTC1 [key name] key is stuck.	A knob or 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.

System Message	Comments
GTC1 MANIFEST – GTC 1 software mismatch, communication halted.	The Touchscreen Controller has incorrect software installed. The system should be serviced.
GTC1 SERVICE – GTC1 needs service. Return unit for repair.	The Touchscreen Controller should be serviced..
GTC1 VOLTAGE – GTC1 has low voltage. Reducing power usage	The Touchscreen Controller voltage is low. The system should be serviced.
GTC2 CARD1 ERR – GTC2 card 1 is invalid.	The internal SD card in the Touchscreen Controller contains invalid data. The system should be serviced.
GTC2 CARD1 REM – GTC2 card 1 was removed. Reinsert card.	The internal SD card in the Touchscreen Controller was removed. The system should be serviced.
GTC2 CONFIG – GTC2 config error. Config service req'd.	Touchscreen Controller configuration settings do not match those of backup configuration memory. The system should be serviced.
GTC2 COOLING – GTC2 has poor cooling. Reducing power usage.	The Touchscreen Controller has insufficient cooling. If the problem persists, the system should be serviced.
GTC2 DB ERR – GTC2 database error exists.	The Touchscreen Controller detected a failure in one or more databases. Ensure the data card is properly inserted. Replace data card. If problem persists, the system should be serviced.
GTC2 FAN FAIL – GTC2 internal fan failure. Unit needs service.	The internal fan in the Touchscreen Controller has failed. The system should be serviced.
GTC2 KEYSTK – GTC2 [key name] key is stuck.	A knob or key is stuck on the GTC bezel. Attempt to free the stuck control by pushing or turning it several times. The system should be serviced if the problem persists.
GTC2 MANIFEST – GTC 2 software mismatch, communication halted.	The Touchscreen Controller has incorrect software installed. The system should be serviced.
GTC2 SERVICE – GTC2 needs service. Return unit for repair.	The Touchscreen Controller should be serviced..
GTC2 VOLTAGE – GTC2 has low voltage. Reducing power usage	The Touchscreen Controller voltage is low. The system should be serviced.
GTS CONFIG – GTS Config error. Config service req'd.	The GTS and GDU have different copies of the GTS configuration, or the Mode S address is invalid. The system should be serviced.
GTS MANIFEST – GTS software mismatch, communication halted.	The GTS has incorrect software installed. The system should be serviced.
GTX1 MANIFEST – GTX1 software mismatch, communication halted.	The transponder has incorrect software installed. The system should be serviced.
GTX2 MANIFEST – GTX2 software mismatch, communication halted.	The transponder has incorrect software installed. The system should be serviced.
GWX CONFIG – GWX config error. Config service req'd.	GWX configuration settings do not match those of the GDU configuration. The system should be serviced.
GWX MANIFEST – GWX software mismatch, communication halted.	The GWX has incorrect software installed. The system should be serviced.
GWX SERVICE – GWX needs service. Return unit for repair.	A failure has been detected in the GWX. The GWX may still be usable.
HDG FAULT – AHRS1 magnetometer fault has occurred.	A fault has occurred in the #1 GMU 44. Heading is flagged as invalid. The AHRS uses GPS for backup mode operation. The system should be serviced.
HDG FAULT – AHRS2 magnetometer fault has occurred.	A fault has occurred in the #2 GMU 44. Heading is flagged as invalid. The AHRS uses GPS for backup mode operation. The system should be serviced.

System Message	Comments
HOLD EXPIRED – Holding EFC time expired.	Expect Further Clearance (EFC) time has expired for the User Defined Hold.
HW MISMATCH – GIA1 hardware mismatch, GIA1 communication halted.	A GIA mismatch has been detected, where only one is SBAS capable.
INSIDE ARSPC – Inside airspace.	The aircraft is inside the airspace.
LOI – GPS integrity lost. Crosscheck with other NAVS.	GPS integrity is insufficient for the current phase of flight.
LOSS OF GPS NAVIGATION – Poor Satellite Coverage.	Loss of GPS navigation due to insufficient/poor satellite coverage.
LOW BANK ACTIVE – Disengage for approach.	Low Bank mode is active. Disengage to continue approach.
LOW BANK ACTIVE – Disengage for RNP less than 1.0.	Low Bank mode is active. Disengage to continue RNP 1.0.
LRG MAG VAR – Verify all course angles.	The GDU's internal model cannot determine the exact magnetic variance for geographic locations near the magnetic poles. Displayed magnetic course angles may differ from the actual magnetic heading by more than 2°.
MANIFEST – GSR1 software mismatch, communication halted.	The GSR1 has incorrect software installed. The system should be serviced.
MFD1 BACKLIGHT CALIBRATION – MFD1 calibration. Return for repair.	The specified GDU's backlight calibration cannot be found or is invalid. The system should be serviced.
MFD1 CARD 1 ERR – MFD1 card 1 is invalid.	The SD card in the top card slot of the MFD contains invalid data.
MFD1 CARD 1 REM – MFD1 card 1 was removed. Reinsert card.	The SD card was removed from the top card slot of the MFD. The SD card needs to be reinserted.
MFD1 CARD 2 ERR – MFD1 card 2 is invalid.	The SD card in the bottom card slot of the MFD contains invalid data.
MFD1 CARD 2 REM – MFD1 card 2 was removed. Reinsert card.	The SD card was removed from the bottom card slot of the MFD. The SD card needs to be reinserted.
MFD1 CONFIG – MFD1 config error. Config service req'd.	The MFD configuration settings do not match backup configuration memory. The system should be serviced.
MFD1 COOLING – MFD1 has poor cooling. Reducing power usage.	The MFD is overheating and is reducing power consumption by dimming the display. If problem persists, the system should be serviced.
MFD1 DB ERR – MFD1 Airport Directory database error exists.	The MFD detected a failure in the Airport Directory database. Ensure the data card is properly programmed if present. If problem persists, the system should be serviced.
MFD1 DB ERR – MFD1 basemap database error exists.	The MFD detected a failure in the basemap database.
MFD1 DB ERR – MFD1 Chartview database error exists.	The MFD detected a failure in the ChartView database (optional feature). Ensure the data card is properly programmed if present. If problem persists, the system should be serviced.
MFD1 DB ERR – MFD1 FliteCharts database error exists.	The MFD detected a failure in the FliteCharts database (optional feature). Ensure the data card is properly programmed if present. If problem persists, the system should be serviced.
MFD1 DB ERR – MFD1 multiple database errors exists.	The MFD detected a failure in more than one database. If problem persists, the system should be serviced.

System Message	Comments
MFD1 DB ERR – MFD1 navigation database error exists.	The MFD detected a failure in the navigation database. Ensure the data card is properly programmed if present. If problem persists, the system should be serviced.
MFD1 DB ERR – MFD1 obstacle database error exists.	The MFD detected a failure in the obstacle database. Ensure the data card is properly programmed if present. If problem persists, the system should be serviced.
MFD1 DB ERR – MFD1 Safe Taxi database error exists.	The MFD detected a failure in the Safe Taxi database. Ensure the data card is properly programmed if present. If problem persists, the system should be serviced.
MFD1 DB ERR – MFD1 terrain database error exists.	The MFD detected a failure in the terrain database. Ensure the data card is properly programmed if present. If problem persists, the system should be serviced.
MFD1 DB ERR – MFD1 terrain database missing.	The terrain database is present on another LRU, but is missing on the specified LRU. Ensure the data card is properly programmed if present. If problem persists, the system should be serviced.
MFD1 FAN FAIL – MFD1 internal fan failure. Return for repair.	The specified GDU's internal cooling fan has failed. The system should be serviced.
MFD1 KEYSTK – MFD1 [key name] is stuck.	A key is stuck on the MFD bezel. Attempt to free the stuck key by pressing it several times. The system should be serviced if the problem persists.
MFD1 MANIFEST – MFD 1 software mismatch, communication halted.	The MFD has incorrect software installed. The system should be serviced.
MFD1 SERVICE – MFD1 needs service. Return unit for repair.	The MFD self-test has detected a problem. The system should be serviced.
MFD1 SOFTWARE – MFD1 mismatch, communication halted.	The MFD has different software versions installed. The system should be serviced.
MFD1 TERRAIN DSP – MFD1 Terrain awareness display unavailable.	One of the terrain or obstacle databases required for TAWS in the MFD is missing or invalid.
MFD1 VOLTAGE – MFD1 has low voltage. Reducing power usage	The MFD voltage is low. The system should be serviced.
NAV #[1, 2] INOP - CAL - Check COM calibration.	NAV 1 and/or NAV 2 calibration version error. Check COM calibration.
NAV #[1, 2] INOP - CRNT - Check COM current.	NAV 1 and/or NAV 2 current is low. Check COM current.
NAV #[1, 2] INOP - CONFIG - Check NAV software and config.	There is a problem with the NAV 1 and/or NAV 2 software configurations. Check the configuration. If the problems persists, the system should be serviced.
NAV #[1, 2] INOP - INTRL - Com internal fault.	NAV 1 and/or NAV 2 has an internal fault.
NAV #[1, 2] INOP - SERIAL - Check NAV serial communication.	Loss of NAV 1 and/or NAV 2 serial communication. Check NAV serial communication.
NAV #[1, 2] INOP - SYNTH LOCK - COM synthesiser lock fault.	NNAV 1 and/or NAV 2 has a synthesizer lock fault.
NAV DB UPDATED – Active navigation database updated.	System has updated the active navigation database from the standby navigation database.
NAV1 MANIFEST – NAV1 software mismatch, communication halted.	The NAV 1 has incorrect software installed. The system should be serviced.

System Message	Comments
NAV1 RMT XFR – NAV1 remote transfer key is stuck.	The remote NAV1 transfer switch is stuck in the enabled (or "pressed") state. Press the transfer switch again to cycle its operation. If the problem persists, the system should be serviced.
NAV2 MANIFEST – NAV2 software mismatch, communication halted.	The NAV 2 has incorrect software installed. The system should be serviced.
NAV2 RMT XFR – NAV2 remote transfer key is stuck.	The remote NAV2 transfer switch is stuck in the enabled (or "pressed") state. Press the transfer switch again to cycle its operation. If the problem persists, the system should be serviced.
NON-MAG UNITS – Non-magnetic NAV ANGLE display units are active.	Navigation angle is not set to MAGNETIC at power-up.
NON WGS84 WPT – Do not use GPS for navigation to [xxxx]	The position of the selected waypoint [xxxxx] is not calculated based on the WGS84 map reference datum and may be positioned in error as displayed. Do not use GPS to navigate to the selected non-WGS84 waypoint.
PFD POSITIONS DIFFERENT – PFD position mismatch. Check position sensors.	A difference has been detected in the displayed position on the PFDs. Check position sensors.
PFD1 BACKLIGHT CALIBRATION – PFD1 calibration lost. Return for repair.	The PFD1 backlight calibration cannot be found or is invalid. The system should be serviced.
PFD1 CARD 1 ERR – PFD1 card 1 is invalid.	The SD card in the top card slot of PFD1 contains invalid data.
PFD1 CARD 1 REM – PFD1 card 1 was removed. Reinsert card.	The SD card was removed from the top card slot of PFD1. The SD card needs to be reinserted.
PFD1 CARD 2 ERR – PFD1 card 2 is invalid.	The SD card in the bottom card slot of PFD1 contains invalid data.
PFD1 CARD 2 REM – PFD1 card 2 was removed. Reinsert card.	The SD card was removed from the bottom card slot of PFD1. The SD card needs to be reinserted.
PFD1 CONFIG – PFD1 config error. Config service req'd.	The PFD1 configuration settings do not match backup configuration memory. The system should be serviced.
PFD1 COOLING – 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.
PFD1 DB ERR – MFD1 Airport Directory database error exists.	The PFD detected a failure in the Airport Directory database. Ensure the data card is properly programmed if present. If problem persists, the system should be serviced.
PFD1 DB ERR – MFD1 basemap database error exists.	The PFD detected a failure in the basemap database. Ensure the data card is properly programmed if present. If problem persists, the system should be serviced.
PFD1 DB ERR – MFD1 Chartview database error exists.	The PFD detected a failure in the ChartView database (optional feature). Ensure that the data card is properly inserted. Replace data card. If problem persists, the system should be serviced.
PFD1 DB ERR – MFD1 FliteCharts database error exists.	The PFD detected a failure in the FliteCharts database (optional feature). Ensure the data card is properly programmed if present. If problem persists, the system should be serviced.
PFD1 DB ERR – MFD1 obstacle database error exists.	The PFD detected a failure in the obstacle database. Ensure the data card is properly programmed if present. If problem persists, the system should be serviced.
PFD1 DB ERR – MFD1 Safe Taxi database error exists.	The PFD detected a failure in the Safe Taxi database. Ensure the data card is properly programmed if present. If problem persists, the system should be serviced.

System Message	Comments
PFD1 DB ERR – MFD1 terrain database error exists.	The PFD detected a failure in the terrain database. Ensure the data card is properly programmed if present. If problem persists, the system should be serviced.
PFD1 DB ERR – PFD1 basemap database error exists.	The PFD detected a failure in the basemap database.
PFD1 DB ERR – PFD1 multiple database errors exists.	The PFD detected a failure in more than one database. If problem persists, the system should be serviced.
PFD1 DB ERR – PFD1 navigation database error exists.	The PFD detected a failure in the navigation database. Ensure the data card is properly programmed if present. If problem persists, the system should be serviced.
PFD1 DB ERR – PFD1 obstacle database missing.	The obstacle database is present on another LRU, but is missing on the specified LRU.
PFD1 DB ERR – PFD1 Safe Taxi database error exists.	The PFD detected a failure in the Safe Taxi database. Ensure that the data card is properly inserted. If problem persists, the system should be serviced.
PFD1 DB ERR – PFD1 terrain database error exists.	The PFD detected a failure in the terrain database. Ensure that the terrain card is properly inserted in display. If problem persists, the system should be serviced.
PFD1 DB ERR – PFD1 terrain database missing.	The terrain database is present on another LRU, but is missing on the specified LRU.
PFD1 DB ERR – PFD1 terrain database missing.	The terrain database is present on another LRU, but is missing on the specified LRU. Ensure the data card is properly programmed if present. If problem persists, the system should be serviced.
PFD1 FAN FAIL – PFD1 internal fan failure. Unit needs service.	The PFD1 internal cooling fan has failed. The system should be serviced.
PFD1 KEYSTK – 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.
PFD1 MANIFEST – PFD 1 software mismatch, communication halted.	PFD1 has incorrect software installed. The system should be serviced.
PFD1 SERVICE – PFD1 needs service. Return unit for repair.	The PDF1 self-test has detected a problem. The system should be serviced.
PFD1 SOFTWARE – PFD1 mismatch, communication halted.	PFD1 has different software versions installed. The system should be serviced.
PFD1 TERRAIN DSP – PFD1 Terrain awareness display unavailable.	One of the terrain or obstacle databases required for TAWS in PFD1 is missing or invalid.
PFD1 VOLTAGE – PFD1 has low voltage. Reducing power usage	The PFD1 voltage is low. The system should be serviced.
PFD2 BACKLIGHT CALIBRATION – PFD2 calibration lost. Return for repair.	The PFD2 backlight calibration cannot be found or is invalid. The system should be serviced.
PFD2 CARD 1 ERR – PFD2 card 1 is invalid.	The SD card in the top card slot of PFD2 contains invalid data.
PFD2 CARD 1 REM – PFD2 card 1 was removed. Reinsert card.	The SD card was removed from the top card slot of PFD2. The SD card needs to be reinserted.
PFD2 CARD 2 ERR – PFD2 card 2 is invalid.	The SD card in the bottom card slot of PFD2 contains invalid data.

System Message	Comments
PFD2 CARD 2 REM – PFD2 card 2 was removed. Reinsert card.	The SD card was removed from the bottom card slot of PFD2. The SD card needs to be reinserted.
PFD2 CONFIG – PFD2 config error. Config service req'd.	The PFD2 configuration settings do not match backup configuration memory. The system should be serviced.
PFD2 COOLING – 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.
PFD2 DB ERR – PFD2 Airport Directory database error exists.	The PFD detected a failure in the Airport Directory database. Ensure the data card is properly programmed if present. If problem persists, the system should be serviced.
PFD2 DB ERR – PFD2 basemap database error exists.	The PFD detected a failure in the basemap database.
PFD2 DB ERR – PFD2 Chartview database error exists.	The PFD detected a failure in the ChartView database (optional feature). Ensure the data card is properly programmed if present. If problem persists, the system should be serviced.
PFD2 DB ERR – PFD2 FliteCharts database error exists.	The PFD detected a failure in the FliteCharts database (optional feature). Ensure the data card is properly programmed if present. If problem persists, the system should be serviced.
PFD2 DB ERR – PFD2 multiple database errors exists.	The PFD detected a failure in more than one database. If problem persists, the system should be serviced.
PFD2 DB ERR – PFD2 navigation database error exists.	The PFD detected a failure in the navigation database. Ensure the data card is properly programmed if present. If problem persists, the system should be serviced.
PFD2 DB ERR – PFD2 obstacle database error exists.	The PFD detected a failure in the obstacle database. Ensure the data card is properly programmed if present. If problem persists, the system should be serviced.
PFD2 DB ERR – PFD2 Safe Taxi database error exists.	The PFD detected a failure in the Safe Taxi database. Ensure the data card is properly programmed if present. If problem persists, the system should be serviced.
PFD2 DB ERR – PFD2 terrain database error exists.	The PFD detected a failure in the terrain database. Ensure the data card is properly programmed if present. If problem persists, the system should be serviced.
PFD2 DB ERR – PFD1 terrain database missing.	The terrain database is present on another LRU, but is missing on the specified LRU. Ensure the data card is properly programmed if present. If problem persists, the system should be serviced.
PFD2 FAN FAIL – PFD2 internal fan failure. Unit needs service.	The PFD2 internal cooling fan has failed. The system should be serviced.
PFD2 KEYSTK – 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.
PFD2 MANIFEST – PFD 1 software mismatch, communication halted.	PFD2 has incorrect software installed. The system should be serviced.
PFD2 SERVICE – PFD2 needs service. Return unit for repair.	The PDF1 self-test has detected a problem. The system should be serviced.
PFD2 SOFTWARE – PFD2 mismatch, communication halted.	PFD2 has different software versions installed. The system should be serviced.
PFD2 TERRAIN DSP – PFD2 Terrain awareness display unavailable.	One of the terrain or obstacle databases required for TAWS in PFD2 is missing or invalid.
PFD2 VOLTAGE – PFD2 has low voltage. Reducing power usage	The PFD2 voltage is low. The system should be serviced.
PTK FAIL – Parallel track unavailable: bad geometry.	Bad parallel track geometry.

System Message	Comments
PTK FAIL – Parallel track unavailable: invalid leg type.	Invalid leg type for parallel offset.
PTK FAIL – Parallel track unavailable: past IAF.	IAF waypoint for parallel offset has been passed.
RAIM UNAVAIL – 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.
RECORDER SERVICE REQUIRED - The CVDR needs service.	The CVDR should be serviced.
REGISTER CONNEXT – Data services inop, register w/Connext.	The system is not registered with Garmin Connext, or its current registration data has failed authentication.
SCHEDULER [#] – <message>.	Message criteria entered by the user.
SLCT FREQ – Select appropriate frequency for approach.	The system notifies the pilot to load the approach frequency for the appropriate NAV receiver. Select the correct frequency for the approach.
SLCT MAG – Select MAGNETIC NAV ANGLE display units.	The system notifies the pilot to set the Nav Angle units on the Avioncs Settings Screen to Magnetic.
SLCT NAV – Select NAV on CDI for approach.	The system notifies the pilot to set the CDI to the correct NAV receiver. Set the CDI to the correct NAV receiver.
SLCT NON-MAG – Select alternate NAV ANGLE display units.	The system notifies the pilot to set the Nav Angle units on the Avioncs Settings Screen to True.
STEEP TURN – Steep turn ahead.	The computed bank angle needed to execute the turn ahead may exceed the current bank angle limit.
STRMSCP FAIL – Stormscope has failed.	Stormscope has failed. The system should be serviced.
SURFACEWATCH DISABLED - Too far north/south.	The SurfaceWatch system has been disabled.
SURFACEWATCH FAIL - Invalid audio configuration.	The SurfaceWatch system has failed due to an invalid audio configuration.
SURFACEWATCH FAIL - Invalid configurable alerts.	The SurfaceWatch system has failed due to invalid configurable alerts.
SURFACEWATCH FAIL - One or more inputs invalid.	The SurfaceWatch system has failed due to one or more invalid inputs.
SURFACEWATCH INHIBITED - Surfacewatch inhibited.	The SurfaceWatch system has been inhibited.
SVT DISABLED – Out of available terrain region.	Synthetic Vision is disabled because the aircraft is not within the boundaries of the installed terrain database.
SVT DISABLED – Terrain DB resolution too low.	Synthetic Vision is disabled because a terrain database of sufficient resolution (9 arc-second or better) is not currently installed.
TERRAIN AUD CFG – Trn Awareness audio config error. Service req'd.	TAWS is disabled because the audio configuration is invalid. The system should be serviced.
TERRAIN DISABLED – Terrain Awareness DB resolution too low.	TAWS is disabled because a terrain database of sufficient resolution (9 arc-second or better) is not currently installed.

System Message	Comments
TIMER EXPIRD – Timer has expired.	The system notifies the pilot the timer has expired.
TRN AUD FAIL – Trn Awareness audio source unavailable.	TAWS is disabled because an aural alert audio source is unavailable.
UNABLE V WPT – Can't reach current vertical waypoint.	The current vertical waypoint can not be reached within the maximum flight path angle and vertical speed constraints. The system automatically transitions to the next vertical waypoint.
UNABLE VNAV – Excessive cross-track error.	The current cross-track exceeds the limit, causing vertical deviation to go invalid.
UNABLE VNAV – Excessive track angle error.	The current track angle error exceeds the limit, causing the vertical deviation to go invalid.
UNABLE VNAV – Reverted to PIT.	The current VNAV is not supported, the Flight Director has reverted to PIT mode.
UNABLE VNAV – Parallel course selected.	A parallel course has been selected, causing the vertical deviation to go invalid.
UNABLE VNAV – Unsupported leg type in flight plan.	The lateral flight plan contains a procedure turn, vector, or other unsupported leg type prior to the active vertical waypoint. This prevents vertical guidance to the active vertical waypoint.
UNABLE VNAV ALTITUDE – Cannot meet VNAV altitude constraint.	The current vertical speed is insufficient to make the active flight plan altitude constraint prior to crossing the waypoint.
VNAV CONFIG – VNAV config error Config service req'd.	VNAV configuration error. The system should be serviced.
WPT ARRIVAL – Arriving at waypoint - [xxxx]	Arriving at waypoint [xxxx], where [xxxx] is the waypoint name.
WX ALERT – Possible severe weather ahead.	The GWX 70 indicates severe weather within ±10 degrees of the aircraft heading at a range of 80 to 320 nm.
XPDR1 ADS-B 1090 – Datalinik: ADS-B 1090 receiver has failed.	A failure has been detected in the 1090 receiver.
XPDR1 ADS-B NO POS – Transponder: ADS-B is not transmitting position.	The transponder is not able to receive position information.
XPDR1 ADS-B TRFC – Transponder: ADS-B traffic has failed	The Transponder is incapable of processing traffic information.
XPDR1 ADS-B UAT – Datalink: ADS-B in UAT receiver has failed.	A failure has been detected in the UAT receiver.
XPDR1 CONFIG – XPDR1 config error. Config service req'd.	The transponder configuration settings do not match those of backup configuration memory. The system should be serviced.
XPDR1 CSA FAIL - Traffic: ADS-B In traffic alerting has failed.	ADS-B Conflict Situational Awareness (CSA) is unavailable.
XPDR1 FAULT – Datalink: ADSB-B in has failed.	The transponder is unable to receive ADS-B information.
XPDR1 FIS-B WX – Datalink: FIS-B Weather has failed.	The transponder is unable to receive FIS-B weather information.
XPDR1 OVER TEMP - Transponder: Transponder over temp.	The system has detected an over temperature condition in XPDR1. The transmitter operates at reduced power. If the problem persists, the system should be serviced.

System Message	Comments
XPDR1 PRES ALT –Transponder: ADS-B no pressure altitude.	Unable to provide pressure altitude information.
XPDR1 SRVC – XPDR1 needs service. Return unit for repair.	The #1 transponder should be serviced when possible.
XPDR1 UNDER TEMP - Transponder: Transponder under temp.	The system has detected an under temperature condition in XPDR1. The transmitter operates at reduced power. If the problem persists, the system should be serviced.
XPDR2 ADS-B 1090 – Datalinik: ADS-B 1090 receiver has failed.	A failure has been detected in the 1090 receiver.
XPDR2 FIS-B WX – Datalink: FIS-B Weather has failed.	The transponder is unable to receive FIS-B weather information.
XPDR2 ADS-B NO POS – Transponder: ADS-B is not transmitting position.	The transponder is not able to receive position information.
XPDR2 ADS-B TRFC – Transponder: ADS-B traffic has failed	The Transponder is incapable of processing traffic information.
XPDR2 ADS-B UAT – Datalink: ADS-B in UAT receiver has failed.	A failure has been detected in the UAT receiver.
XPDR2 CONFIG – XPDR2 config error. Config service req'd.	The transponder configuration settings do not match those of backup configuration memory. The system should be serviced.
XPDR2 CSA FAIL - Traffic: ADS-B In traffic alerting has failed.	ADS-B Conflict Situational Awareness (CSA) is unavailable.
XPDR2 FAULT – Datalink: ADSB-B in has failed.	The transponder is unable to receive ADS-B information.
XPDR2 PRES ALT –Transponder: ADS-B no pressure altitude.	Unable to provide pressure altitude information.
XPDR2 SRVC – XPDR2 needs service. Return unit for repair.	The #2 transponder should be serviced when possible.
XPDR2 UNDER TEMP - Transponder: Transponder under temp.	The system has detected an under temperature condition in XPDR2. The transmitter operates at reduced power. If the problem persists, the system should be serviced.
XTALK ERROR – Flight display crosstalk error has occurred.	The GDUs and/or GTCs are not communicating with each other. The system should be serviced.

OTHER G3000 AURAL ALERTS

Voice Alert	Description
"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.
"Aural Warning OK"	Played when the aural warning test passes..
"Autothrottle"	Autothrottle has disconnected.
"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.
"Engaging Autopilot"	The autopilot is being engaged automatically by the system. Only available when ESP™ is installed.
"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 (GTS 820 only).
"Incoming Call"	Satellite telephone is receiving a call.
"Landing Gear"	Indicates to the pilot that the landing gear should be down.
"Less than one mile", "One Mile" through "Ten Miles", or "More than ten miles"	Played to indicate distance of traffic from own aircraft (GTS 820 only).
"One o'clock" through "Twelve o'clock" or "No Bearing"	Played to indicate bearing of traffic from own aircraft (GTS 820 only).
"Overspeed"	Indicates that the aircraft is exceeding 269 +/- 3 knots.
"Stall"	Imminent stall is sensed.
"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.
"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.
"Use Oxygen Mask"	Indicates that there is a cabin depressurization and that the pilots should use oxygen mask.

SURFACEWATCH RUNWAY DISTANCE REMAINING CALLOUTS

Remaining Runway Distance Callout	Description
5000, 4000, 3000, 2000, 1000, 500, 100	Rejected takeoff remaining runway distances.

CREW PROFILE IMPORT/EXPORT MESSAGES

The following messages may be displayed when importing and exporting Pilot Profiles.

Pilot Profile Import/Export Results	Description
'No pilot profile plan files found to import.'	Displayed if the SD card does not have one or more valid pilot 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 pilot profiles in use. Delete a profile before importing another.'	Displayed if the maximum number for pilot profiles has been reached.
'Pilot profile import failed.'	Displayed if the importing operation fails for any other reason.
'Pilot 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.
'Pilot profile export failed.'	Displayed if the export operation fails.
'Pilot profile export succeeded.'	Displayed if the export operation succeeds.

FLIGHT PLAN IMPORT/EXPORT MESSAGES

In some circumstances, some 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. One or more of these waypoints did not import successfully.
'Too many points. Flight plan truncated.'	The flight plan on the SD card contains more waypoints than the system can support. The flight plan was imported with as many waypoints as possible.
'Some waypoints not loaded. Waypoints locked.'	The flight plan on the SD card contains one or more waypoints that the system cannot find in the navigation database. The flight plan has been imported, but must be edited within the system before it can be activated for use.
'User waypoint database full. Not all loaded.'	The flight plan file on the SD card contains user waypoints. The quantity of stored user waypoints has exceeded system capacity, therefore not all the user waypoints on the SD card have been imported. Any flight plan user waypoints that were not imported are locked in the flight plan. The flight plan must be edited within the system before it can be activated for use.
'One or more user waypoints renamed.'	One or more imported user waypoints were renamed when imported due to naming conflicts with waypoints already existing in the system.
'Flight plan successfully exported.'	The stored flight plan was successfully exported to the SD card.
'Flight plan export failed.'	The stored flight plan was not successfully exported to the SD card. The SD card may not have sufficient available memory or the card may have been removed prematurely.

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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.

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

The system uses Secure Digital (SD) cards to load various types of data. For basic flight operations, SD cards are required for database updates. Not all SD cards are compatible with the system.

Databases may be loaded through Garmin Pilot and Wireless Transceiver. When loading databases through Garmin Pilot and the Wireless Transceiver, it must be enabled on the system and the multimedia card inserted in the bottom SD slot of the MFD.

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

NOTE: *When loading database updates, the 'DB Mismatch' system message will be displayed until database synchronization is complete, followed by turning system power off, then on. Synchronization can be monitored on the Database Status Screen.*

NOTE: *Loading a database in the system prior to its effective date will result in the expiration date on the Power-up Display and the effective date on the Database Status Screen being displayed in amber.*

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

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

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

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

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

LOADING UPDATED DATABASES

Databases may be loaded through Garmin Pilot and Wireless Transceiver. When loading databases through Garmin Pilot and the Wireless Transceiver, it must be enabled on the system and the multimedia card inserted in the bottom SD slot of the MFD.

The cycles and dates for both standby and active databases are displayed on the "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 that the standby and active databases in that row will be switched on the next power cycle, activating the current standby database. Databases can also be manually selected (or deselected) by touching the database list item, then touching the **Swap** button.

For some databases, multiple regional databases (e.g. North America and Europe) may be loaded and stored on the system. If desired, a database compatible with the aircraft's current region of operation may be selected as the active database, replacing the existing region specific database. To perform this, each applicable individual database must selected from the Database Status Screen. Upon selecting an individual database, the desired region may be chosen to load as the active database at the next power cycle. The 'Preferred Region' for each database will be the region that was selected.

In some cases it may be necessary to obtain an unlock code from Garmin in order to make the database product functional. It may also be necessary to have the system configured by a Garmin authorized service facility in order to use some database features.

The navigation database contains the aeronautical data used by the system for the flight management and flight planning functions. Included is detailed data for waypoints, procedures (arrivals, departures, approaches), and airways. The navigation database is updated every 28 days. Navigation databases are available for multiple regions. Refer to flygarmin.com for a list of navigation databases available.

The basemap database contains data for the topography and land features, such as rivers, lakes, and towns. It is updated only periodically, with no set schedule. There is no expiration date. The basemap database is only available in a "Worldwide' version.

The terrain database contains the terrain mapping data. These databases are updated periodically and have no expiration date. The basemap 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.

The IFR/VFR charts database contains VFR and IFR raster charts. The VFR Charts are digital representations of the Sectional Aeronautical Charts and Terminal Area Charts. The IFR Charts include both IFR High (designed for navigation at or above 18,000 ft) and IFR Low (designed for navigation below 18,000 ft). IFR/VFR Charts are updated every 28 days except for Canadian IFR/VFR Charts which are updated every 56 days. The IFR/VFR charts database is available for multiple regions. Refer to flygarmin.com for a list of IFR/VFR charts databases available.

DATABASE UPDATES USING A SUPPLEMENTAL DATA CARD

All databases are updated through a single SD card in the bottom slot of the MFD. When the card is inserted, the databases on the card will be copied to standby and synchronized across all powered, configured units. After update, the card is removed and the databases are stored on the system. When in standby, databases are not immediately available for use, but stored to be activated at a later time.

Database updates can be obtained by following the instructions detailed in the 'Aviation Databases' section of the Garmin website (flygarmin.com). Once the updated files have been downloaded from the website, a PC equipped with an appropriate SD card reader is used to unpack and program the new databases onto an existing Supplemental Data Card. Equipment required to perform the update is as follows:

- Windows-compatible PC computer
- SD Card Reader: SanDisk SDDR-93, SanDisk SDDR-99, Verbatim #96504, or equivalent
- Updated database obtained from the Garmin website
- Supplemental SD Cards

Updating Databases using an SD Card:

1) With the system OFF, remove the SD Card from the bottom SD card slot of the MFD.

2) Download and install the databases on the SD card.

3) Put the SD Card in the bottom SD card slot of the MFD.

4) Turn the system ON.

5) Press the right most softkey on MFD display to acknowledge the startup screen.

6) Touch the **Database Status** Button on the initialization screen of either touchscreen controller.

Or: From MFD Home, touch **Utilities** > **Setup** > **Database Status**

7) The database update status will appear in the status window at the top of the page. The load is complete when 'Databases Ready' is displayed.

8) A cyan double arrow will appear between the Standby and Active columns to show which standby databases will be transferred to Active at the next power cycle.

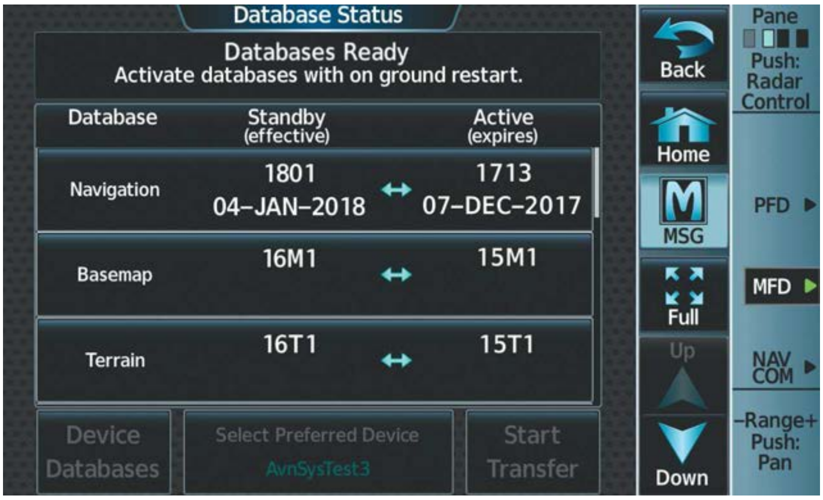

Figure B-1 Database Status Screen before Activation of Standby Databases

9) If desired, change the Preferred Region for the database.

a) Touch a database button from the list.

b) Touch **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)** for additional databases.

Figure B-2 Selecting Preferred Region

10) The system will show a prompt to restart avionics power. Remove and reapply power to the system.

11) Press the right most softkey on MFD display to acknowledge the startup screen.

12) Remove the SD card from the bottom slot of the MFD if desired.

13) From MFD Home, touch **Utilities** > **Setup > Database Status**.

14) Verify that the standby databases transferred and are now in the Active database column.

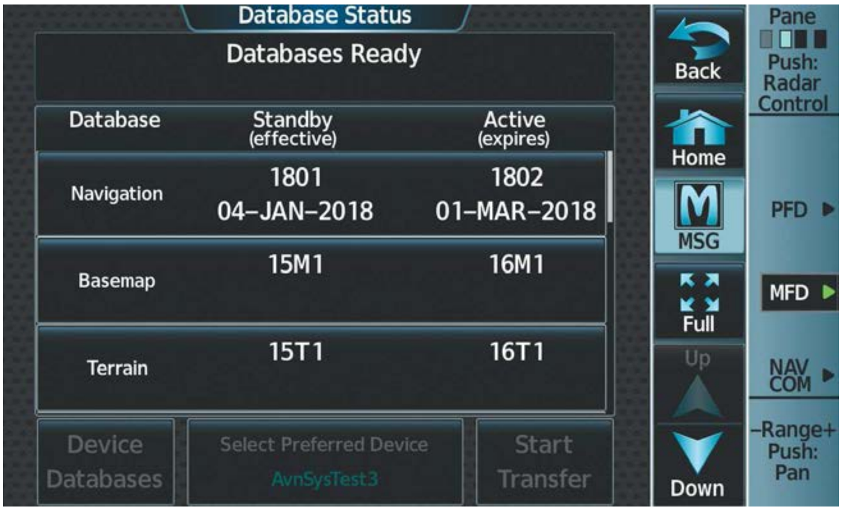

Figure B-3 Database Status Screen after Activation of Standby Databases

15) 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 MFD 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) Verify that the standby databases transferred and are now in the Active database column.

16) To view database status:

a) Touch the **Database Status** Button on the initialization screen of either touchscreen controller.

Or: From MFD Home, touch **Utilities** > **Setup** > **Database Status** > **Database Options.**

b) Scroll through the database information to view database status.

Or:

a) To view database status from Avionics Status Screen, touch **Utilities** > **Setup** > **Avionics Status**.

b) 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 WIRELESS TRANSCEIVER

In order to load databases through Garmin Pilot and the Wireless Transceiver (also known as Flight Stream 510 or FS510), the Wireless Transceiver must be enabled on the system with the 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 (refer to the Additional Features section). Once the system is enabled and a device is available for connection, the system will automatically connect to the device. If multiple devices are available, the system will automatically connect to first available device. If a preferred device has been selected, and is available, the system will automatically connect to the preferred device regardless of other devices being available. A device can be selected as the preferred device on the 'Database Status' Screen on the Touchscreen Controller from a menu list of 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 page 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 their are no database updates required, the system will not provide a WiFi signal.*

***NOTE:** If the mobile device has previously connected to the FS510, and is not connected to another WiFi source, the mobile device should connect automatically to the FS510. If the mobile device is connected to another WiFi source (i.e. hangar wifi), then the FS510 will not connect automatically.*

Updating Databases from the Database Status screen:

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.

3) From MFD Home, touch **Utilities** > **Setup** > **Connext Setup.**

4) Touch the **Functions** Tab to ensure the WiFi Database Import **Enable** Button is selected.

Figure B-4 Wifi Enabled

5) Touch the **Bluetooth** Tab to ensure bluetooth is enabled.

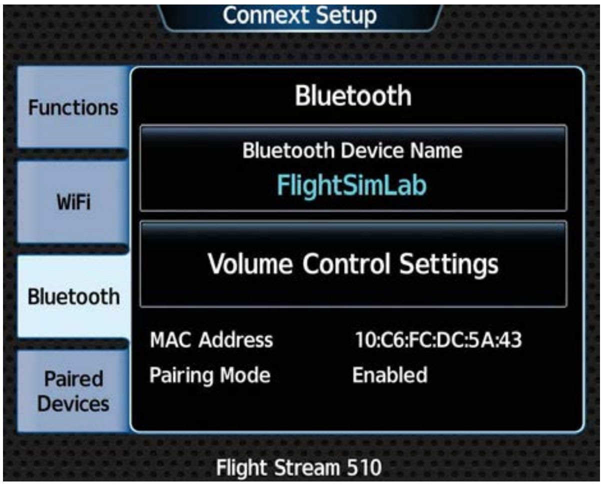

Figure B-5 Bluetooth Setup

6) On the mobile device, connect via Bluetooth to the Wireless Transceiver.

7) Touch the **Database Status** Button on the initialization screen of either touchscreen controller.

Or: From MFD Home, touch **Utilities > Setup > Database Status**

8) Touch the **Start Transfer** button on the Database Status screen.

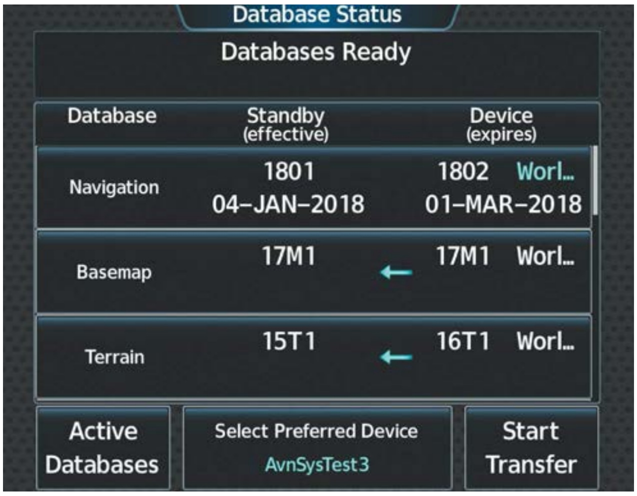

Figure B-6 Database Start Transfer

9) On the mobile device, connect to the indicated SSID Wi-Fi network shown on the **Wifi** Tab of the **Connext Setup** screen.

Figure B-7 WiFi Setup

10) On the mobile device, start Garmin Pilot and touch **Home** > **Connext** > **Database Concierge**.

11) The database update status will appear in the status window at the top of the page. The load is complete when 'Databases Ready' is displayed.

12) A cyan double arrow will appear between the Standby and Active columns to show which standby databases will be transferred to Active at the next power cycle.

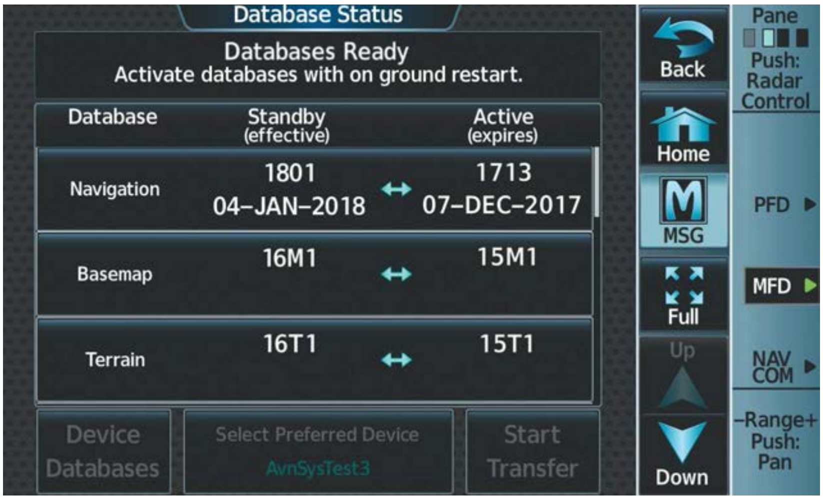

Figure B-8 Database Status Screen before Activation of Standby Databases

13) If desired, change the Preferred Region for the database.

a) Touch a database button from the list.

b) Touch **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-9 Selecting Preferred Region

14) The system will show a prompt to restart avionics power. Remove and reapply power to the system.

15) Press the right most softkey on MFD display to acknowledge the startup screen.

16) Touch the **Database Status** Button on the initialization screen of either touchscreen controller.

Or: From MFD Home, touch **Utilities** > **Setup** > **Database Status**

17) Verify that the standby databases transferred and are now in the Active database column.

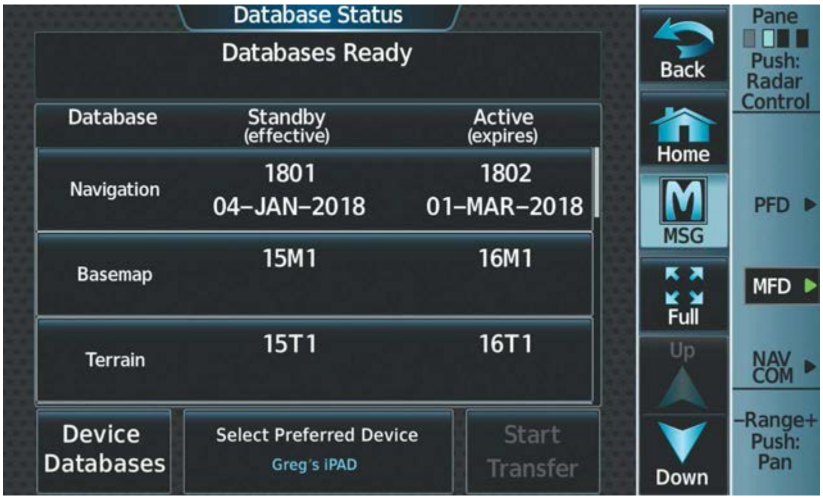

Figure B-10 Database Status Screen after Activation of Standby Databases

18) 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.

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) Verify that the standby databases transferred and are now in the Active database column.

19) To view database status:

a) Touch the **Database Status** Button on the initialization screen of either touchscreen controller.

Or: From MFD Home, touch **Utilities > Setup > Database Status > Database Options.**

b) Scroll through the database information to view database status.

Or:

a) To view database status from Avionics Status Screen, touch **Utilities > Setup > Avionics Status**.

b) 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

When a PFD or MFD is failed, any database updates will not be automatically synchronized to the other displays. When this occurs, the database synchronisation feature allows syncing 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 of either touchscreen controller.

Or: From MFD Home, touch **Utilities > Setup > Database Status.**

3) Scroll down and touch **Database Options** > **Sync Databases**.

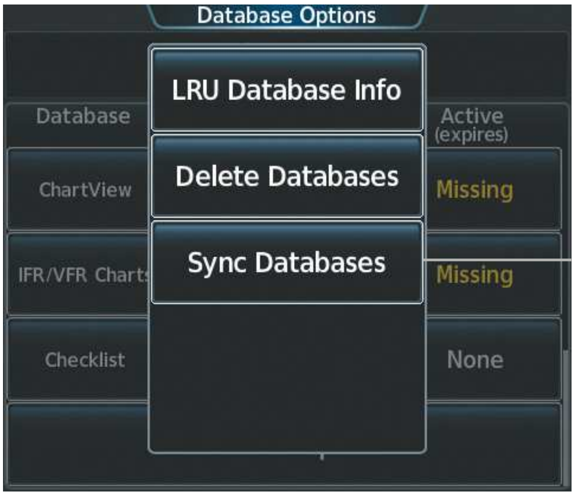

Figure B-11 Sync Databases

4) From the Sync From Display Screen, touch the button for the display that the databases will be synced from (this will be the display containing the SD Card or multimedia card).

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 databases:

1) Touch the **Database Status** Button on the initialization screen of either touchscreen controller.

Or: From MFD Home, touch **Utilities > Setup > Database Status.**

2) Scroll down and touch **Database Options > Delete Databases.**

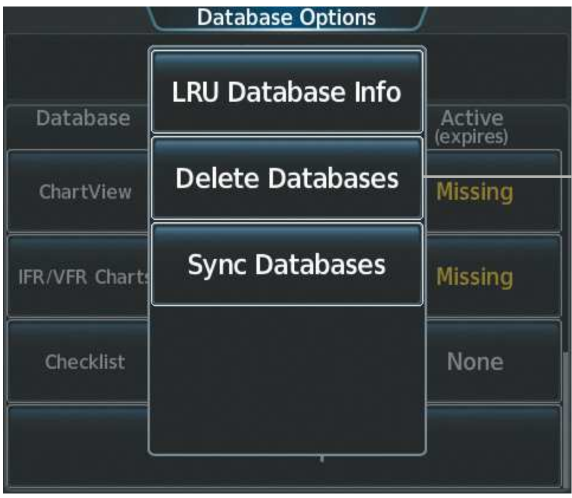

Figure B-12 Delete Databases

3) A prompt will appear to confirm deletion of all internal databases. Touch the **OK** Button.

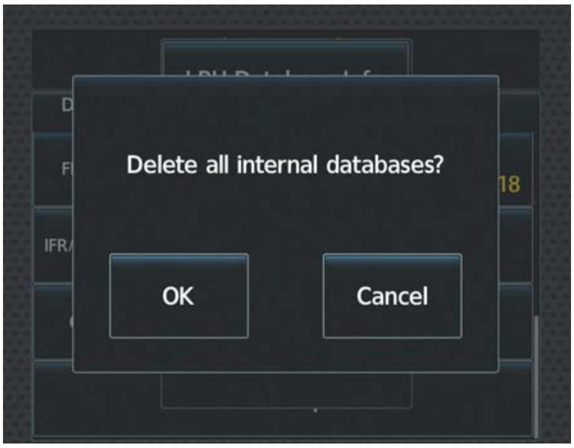

Figure B-13 Confirm Deletion

4) Another confirmation prompt will appear. Touch the **OK** Button.

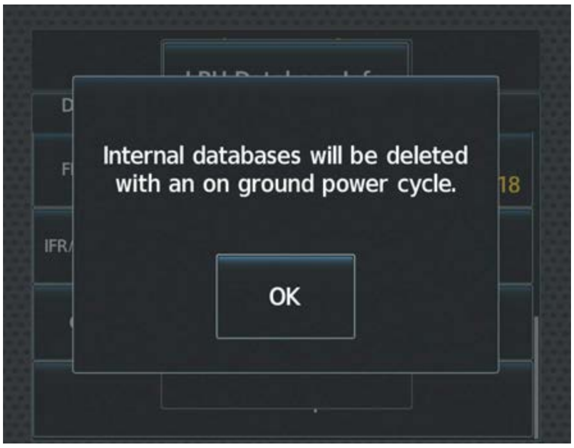

Figure B-14 Ground Power Cycle

5) Touch the **Database Status** Button on the initialization screen of either touchscreen controller.

Or: From MFD 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-15. 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-15 GRS1 Magnetic Field Variation Database Update Prompt (Touchscreen Controller)

Loading the Magnetic Field Variation Database update:

1) With the MV DB prompt displayed, as shown in Figure B-15, touch the **OK** Button. A progress monitor is displayed as shown in Figure B-16.

Figure B-16 Uploading Database to GRS1

2) When the upload is complete, the prompt for the next GRS upload is displayed, as seen in Figure B-17. A database mismatch message, as seen in Figure B-18, indicates the second GRS has not yet been updated.

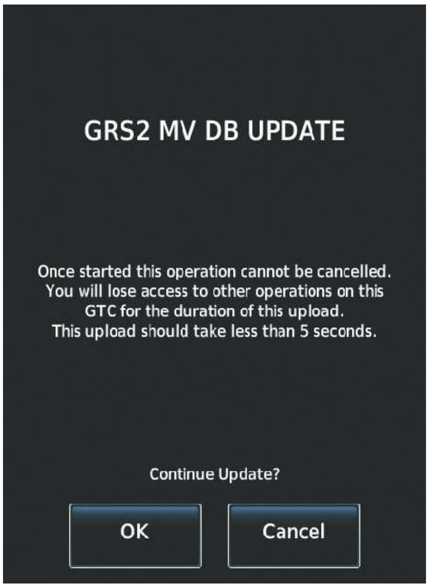

Figure B-17 GRS2 Magnetic Field Variation Database Update Prompt

Figure B-18 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.

AVIATION TERMS AND ACRONYMS

A	Amps
AC	Advisory Circular, Alternating Current
ACARS	Airborne Communications Addressing and Reporting System
ACC	Accuracy
ACK	Acknowledge
ACT, ACTV	Active, Activate, Altitude Compensated Tilt
ADAHRS	Air Data, Attitude and Heading Reference System
ADC	Air Data Computer
ADF	Automatic Direction Finder
ADI	Attitude Direction Indicator
ADIZ	Air Defense Identification Zone
ADM	Administrative Domain
ADS-B	Automatic Dependent Surveillance-Broadcast
ADS-R	Automatic Dependent Surveillance-Rebroadcast
AEA	Aircraft Electronic Association
AF	Arc to Fix Leg
AFCS	Automatic Flight Control System
AFM	Airplane Flight Manual
AFMS	Airplane Flight Manual Supplement
AFN	ATS Facilities Notification
AFRM	Airframe
AFTN	Aeronautical Fixed Telecommunication Network
AGL	Above Ground Level
AHRS	Attitude and Heading Reference System
AIM	Aeronautical Information Manual
AIRB	Airborne
AIRMET	Airman's Meteorological Information
AIRREP	Air Reports
ALRT	Alert
ALT	Altitude
ALT, ALTN	Alternator, Alternate
ALTS	Altitude Select, Selected Altitude Capture Mode
ALTV	VNAV Altitude Capture Mode
AM	Amplitude Modulation
AMPS	Amperes
ANNUNC/ANN	Annunciation/Annunciator
ANT	Antenna
AOA	Angle of Attack, ACARS Over AVLC
AOC	Aeronautical Operational Control
AOG	Aircraft On Ground
AOPA	Aircraft Owners and Pilots Association
AP	Autopilot
AP DISC	Autopilot Disconnect
APPR, APR	Approach
APT	Airport, Aerodrome, Automatic Pitch Trim
APTSIGNS	Airport Signs
APU	Auxiliary Power Unit
APV	Approaches with Vertical Guidance
ARINC	Aeronautical Radio Incorporated
ARSPC	Airspace
ARTCC	Air Route Traffic Control Center
ARV	Arrival
AS	Airspeed
ASB	Aviation Support Branch
ASOS	Automated Surface Observing System
AT	Auto Throttle
ATC	Air Traffic Control
ATCRBS	ATC Radar Beacon System
ATIS	Automatic Terminal Information Service
ATK	Along Track
ATN	Aeronautical Telecommunications Network
ATS	Air Traffic Services
ATT	Attitude
AUD	Audio
AUTO	Automatic
AUTOSEQ	Automatic Sequence
AUX	Auxiliary
AVAIL	Available
AVG	Average
AVLC	Aviation VHF Link Control
AWOS	Automated Weather Observing System

B	Both Runways
B ALT	Barometric Altitude
B/C, BC	Back Course
BARO	Barometer, Barometric
BATT	Battery
Bearing	The compass direction from the present position to a destination waypoint.
BFO	Beat Frequency Oscillator
BKLT	Backlight
BKSP	Backspace
Bluetooth	Wireless standard for data exchange over short distances
BOC	Bottom of Climb
BOD	Bottom of Descent
BRG	see also Bearing
BTM	Bottom
°C	Degrees Celsius
C	Center Runway
CA	Course to Altitude Leg
CAL	Calibrated
CALC	Calculator
Calibrated Airspeed	Indicated airspeed corrected for installation and instrument errors.
CAS	Crew Alerting System
CCG	Current Climb Gradient
CD	Course to DME Distance Leg
CDA	Current Data Authority
CDI	Course Deviation Indicator
CDU	Control Display Unit
CF	Course to Fix Leg
CFG	Configuration
CFIT	Controlled Flight into Terrain
CG	Center of Gravity
CH, CHNL	Channel
CHKLIST	Checklist
CHT	Cylinder Head Temperature
CI	Course to Intercept Leg
CIP	Current Icing Potential
CL	Class
CLB	Climb
CLD	Cloud
CLR	Clear
CLTR	Clutter
CM	Centimeter
CMC	Central Maintenance Computer
CN	Canada
CNS	Communication, Navigation, & Surveillance
CO	Carbon Monoxide
COM	Communication Radio
COMP	Compensated, Compensation
CONFIG	Configuration
CONUS	Continental United States
COOL	Coolant
COPLT	Copilot
Course	The line between two points to be followed by the aircraft.
Course to Steer	The recommended direction to steer in order to reduce course error or stay on course. Provides the most efficient heading to get back to the desired course and proceed along the flight plan.
CPDLC	Controller Pilot Datalink Communications
CPL	Couple
CR	Course to Radial Leg
CRG	Cockpit Reference Guide
CRNT	Current
Crosstrack Error	The distance the aircraft is off a desired course in either direction, left or right.
CRS	see also Course, Course to Steer
CRSR	Cursor
CRU, CRZ	Cruise
CSA	Conflict Situational Awareness
CSC	Current Speed Control
CTA	Control Area
CTR	Center
CTRL	Control
Cumulative, CUM	The total of all legs in a flight plan.
CVDR	Cockpit Voice Data Recorder
CVFP	Charted Visual Flight Procedure
CVR	Cockpit Voice Recorder
CVRG	Coverage
CWS	Control Wheel Steering

CYC CTR	Cyclic Centering
CYL	Cylinder
D ALT	Density Altitude
D-ATIS	Digital Automatic Terminal Info Service
DB, DBASE	Database
dBZ	Decibels 'Z' (Radar Return)
DCL	Departure Clearance
DCLTR, DECLTR	Declutter
DEC FUEL	Decrease Fuel
DEG	Degree
DEIC, DEICE	De-icing
DEP	Departure
DESC	Descent
Desired Track	The desired course between the active "from" and "to" waypoints.
DEST, DES	Destination, Destination Airport Identifier
DEV	Deviation
DF	Direct to Fix Leg
DFLT	Default
DG	Directional Gyro
DGRD	Degrade
DH	Decision Height
DIFF	Differential
Dilution of Precision	A measure of GPS satellite geometry quality on a scale of one to ten (lower numbers equal better geometry, where higher numbers equal poorer geometry).
DIR	Direction
DIS	Distance
Distance	The 'great circle' distance from the present position to a destination waypoint.
DL LTNG	Datalink Lightning
DLS	Data Link System
DME	Distance Measuring Equipment
DN	Down
DNALT	Density Altitude
DOD	Department of Defense
DOP	see also Dilution of Precision
DP	Departure Procedure
DPRT	Departure
DQR	Data Quality Requirements
DR	Dead Reckoning
DSBL	Disabled
DSP	Display, Datalink Service Provider, Digital Signal Processor
DTG	Distance To Go, Remaining distance to last active FPL waypoint
DTK	see also Desired Track
DWNGRADE	Downgrade
E	Empty, East
EAS	Engine and Airframe Systems
EC	Error Correction
ECC	Error Correcting Code
ECR	Excessive Closure Rate
ECS	Environmental Control System
ECU	Engine Control Unit
EDM	Emergency Descent Mode
EDR	Excessive Descent Rate
EFC	Expected Further Clearance
Efficiency	A measure of fuel consumption, expressed in distance per unit of fuel.
EGNOS	European Geostationary Navigation Overlay Service
EGT	Exhaust Gas Temperature
EICAS	Engine Indication and Crew Alerting System
EIS	Engine Indication System
ELEC	Electrical
ELEV	Elevation, Elevator
ELT	Emergency Locator Transmitter
EMER, EMERG, EMERGCY	Emergency
EMI	Electromagnetic Interference
END, ENDUR	Endurance
Endurance	Flight endurance, or total possible flight time based on available fuel on board.
ENG	Engine
ENGD	Engaged
ENR	Enroute; ETE to Final Destination
Enroute Safe Altitude (ESA)	Uses Grid MORAs to determine a safe altitude within ten miles left or right of the desired course on an active flight plan or direct-to.
ENT	Enter

EPE	see also Estimated Position Error
EPU	Estimated Position Uncertainty
ERR	Error
ES	Extended Squitter
ESA	see also Enroute Safe Altitude
ESP	Electronic Stability and Protection
Estimated Position Error (EPE)	A measure of horizontal GPS position error derived by satellite geometry conditions and other factors.
Estimated Time Enroute (ETE)	The estimated time it takes to reach the destination waypoint from the present position, based upon current groundspeed.
Estimated Time of Arrival (ETA)	The estimated time at which the aircraft should reach the destination waypoint, based upon current speed and track.
ETA	see also Estimated Time of Arrival
ETE	see also Estimated Time Enroute
EVS	Enhanced Vision System
EXPIRD	Expired
EXT	External
°F	Degrees Fahrenheit
FA	Course From Fix to Altitude Leg
FAA	Federal Aviation Administration
FADEC	Full Authority Digital Engine Control
FAF	Final Approach Fix
FAIL	Failure
FANS	Future Air Navigation System
FAR	Federal Aviation Regulations
FBO	Fixed Base Operator
FC	Course From Fix to Distance Leg
FCC	Federal Communication Commission
FCST	Forecast
FD	Flight Director, Course From Fix to DME Distance Leg
FDE	Fault Detection and Exclusion
FDR	Flight Data Recorder
FF, FFLOW	see also Fuel Flow
FIS-B	Flight Information Services-Broadcast
FISDL	Flight Information Service Data Link
FIT	Flight Into Terrain
FL	Flight Level
FLC	Flight Level Change
FLT	Flight, Flight Timer
FLTA	Forward Looking Terrain Avoidance
FM	Course From Fix to Manual Termination Leg
FMS	Flight Management System
FOB	see also Fuel On Board
FOD	see also Fuel Over Destination
FPA	Flight Path Angle
FPL	Flight Plan
FPM	Feet Per Minute, Flight Path Marker
FREQ	Frequency
FRMT	Format
FRZ	Freezing
FSM	Flight System Messages
FSS	Flight Service Station
FT	Foot/Feet
Fuel Flow	The fuel flow rate, expressed in units of fuel per hour.
Fuel On Board	The total amount of usable fuel on board the aircraft.
Fuel Over Destination	The estimated fuel remaining when the aircraft reaches the destination waypoint, based upon current fuel flow.
FWD	Forward
G/S	Glideslope
GA	Go-Around
GAGAN	GPS Aided GEO Augmented Navigation
GAGL	GPS AGL Altitude
GAL, GL	Gallon(s)
GBAS	Ground Based Augmentation System
GBOX	Gearbox
GBT	Ground Based Transceiver
GCS	Ground Clutter Suppression
GCU	Garmin Control Unit
GDC	Garmin Air Data Computer
GDL	Garmin Satellite Data Link
GDR	Garmin Data Radio
GDU	Garmin Display Unit
GEA	Garmin Engine/Airframe Unit
GEN	Generator

GEO	Geographic
GFC	Garmin Flight Control
GHz	Gigahertz
GIA	Garmin Integrated Avionics Unit
GLONASS	Global Orbiting Navigation Satellite Landing System
GLS	Global Navigation Satellite Landing System
GMA	Garmin Audio Panel System
GMC	Garmin Mode Controller
GMT	Greenwich Mean Time
GMU	Garmin Magnetometer Unit
GND	Ground
GOLD	Global Operational Data Link
GP	Glidepath
GPH	Gallons per Hour
GPN	Garmin Part Number
GPS	Global Positioning System
GPWS	Ground Proximity Warning System
Grid MORA (Minimum Off-Route Altitude)	One degree latitude by one degree longitude in size and clears the highest elevation reference point in the grid by: a) 1,000 feet where the highest elevation is <5001MSL or b) 2,000 feet where the highest elevation is >5000MSL
Ground Track	See Track
Groundspeed	The velocity that the aircraft is travelling relative to a ground position.
GRS	Garmin Reference System
GS	Ground Speed, Glideslope
GSA	Garmin Servo Adapter
GSD	Glideslope/Glidepath Deviation, Garmin Data Concentrator
GSL	Geodetic Sea Level
GSR	Garmin Satellite Radio
GSU	Garmin Sensor Unit
GTC	Garmin Touchscreen Controller
GTS	Garmin Traffic System
GTX	Garmin Transponder
GW	Gross Weight
GWX	Garmin Weather Radar
HA	Hold Terminating at Altitude Leg
HDG	see also Heading
HDOP	Horizontal Dilution of Precision
Heading	The direction an aircraft is pointed, based upon indications from a magnetic compass or a properly set directional gyro.
HF	High Frequency, Hold Terminating at Fix Leg
HFOM	see also Horizontal Figure of Merit
Hg	Mercury
HI	High
HI SENS	High Sensitivity
HM	Hold with Manual Termination Leg
HNS	Hybrid Navigation System
Horizontal Figure of Merit	A measure of the uncertainty in the aircraft's horizontal position.
HOV	Hover
HOV-P	Hover Prediction
hPa	Hectopascal
HPI	Hover Power Indicator
HPL	Horizontal Protection Level
HR	Hour
HRZN HDG	Horizon Heading
HSDB	High-Speed Data Bus
HSI	Horizontal Situation Indicator
HT	Heat
HTR	Heater
HUL	Horizontal Uncertainty Level
HYD	Hydraulic
Hz	Hertz (cycles per second)
I	Inner Marker
IAF	Initial Approach Fix
IAP	Instrument Approach Procedure
IAS	Indicated Air Speed
IAT	Indicated Air Temperature
IATA	International Air Transport Association
IAU	Integrated Avionics Unit
IBD, INBD	Inboard
ICAO	International Civil Aviation Organization
ICS	Intercom System
ID	Identification/Morse Code Identifier
IDENT, IDNT	Identification

IEEE	Institute of Electrical & Electronics Engineers
IF	Initial Fix
IFR	Instrument Flight Rules
IG	Imperial Gallon
IGE	In Ground Effect
ILI	Imminent Line Impact
ILS	Instrument Landing System
IMC	Instrument Meteorological Conditions
IN	Inch
IN Hg	Inches of Mercury
INACTV	Inactive
INC FUEL	Increase Fuel
IND	Indicator, Indicated
Indicated	Information provided by properly calibrated and set instrumentation on the aircraft panel.
INFO	Information
INH	Inhibit
INOP	Inoperative
INS	Inertial Navigation System
INT	Intersection(s)
INTEG	Integrity (RAIM unavailable)
INTERN, INTRL	Internal
INV	Invalid
IOI	Imminent Obstacle Impact
IR	Infrared
IrDA, IRDA	Infrared Data Association
ISA	International Standard Atmosphere; ISA Relative Temperature
ISO	International Standards Organization
ITI	Imminent Terrain Impact
ITT	Inter-Turbine Temperature, Interstage Turbine Temperature
KEYSTK	Key Stuck
KG	Kilogram
kHz	Kilohertz
KM	Kilometer
KT	Knot
L	Left, Left Runway
LAT	Latitude, Lateral
LB	Pound
LBL	Label
LCD	Liquid Crystal Display
LCL	Local
LDA	Landing Distance Available
LDG	ETA at Final Destination
LED	Light Emitting Diode
Left Over Fuel On Board	The amount of fuel remaining on board after the completion of one or more legs of a flight plan or direct-to.
Left Over Fuel Reserve	The amount of flight time remaining, based on the amount of fuel on board after the completion of one or more legs of a flight plan or direct-to, and a known consumption rate.
Leg	The portion of a flight plan between two waypoints.
LGND	Legend
LIFR	Low Instrument Flight Rules
LI-ION	Lithium Ion
LIM	Limit
LMM	Location Middle Marker
LNAV	Lateral Navigation
LO	Low
LOA	Letter of Authorization
LOC	Localizer
LOI	Loss of Integrity (GPS)
LOM	Location Outer Marker
LON	Longitude, Longitudinal
LP	Localizer Performance
LPV	Localizer Performance with Vertical Guidance
LRU	Line Replaceable Unit
LSB V	Lower Sideband Voice
LT	Left
LTNG	Lightning
LVL	Level
M	Meter, Middle Marker, Mach
Mach Number	Mach number is the ratio of the true airspeed to the speed of sound.
MAG	Magnetic
MAG VAR	Magnetic Variation

MAHP	Missed Approach Hold Point
MAN	Manual
MAN IN	Manifold Pressure (inches Hg)
MAN SQ	Manual Squelch
MANSEQ	Manual Sequence
MAP	Missed Approach Point
MASQ	Master Avionics Squelch
MAX	Maximum
MAXSPD	Maximum Speed (overspeed)
MB	Marker Beacon
MCP	Maximum Continuous Power
MDA	Barometric Minimum Descent Altitude
MEM	Memory
MEPT	Manual Electric Pitch Trim
MET	Manual Electric Trim
METAR	Aviation Routine Weather Report
METRO	Metropolitan
MFD	Multi Function Display
MGRS	Military Grid Reference System
MGT	Measured Gas Temperature
MHz	Megahertz
MIC	Microphone
MID	Middle
MIN	Minimum
Minimum Safe Altitude (MSA)	Uses Grid MORAs to determine a safe altitude within ten miles of the aircraft present position.
MKR	Marker Beacon
MMO (VMO)	Maximum Speed
MOA	Military Operations Area
MON	Monitor
MORA	Minimum Off-Route Altitude
MOV	Movement
MPEL	Maximum Permissible Exposure Level
MPM	Meters per Minute
MSA	see also Minimum Safe Altitude
MSAS	Multi-functional Satellite Augmentation System
MSG	Message

MSL	Mean Sea Level
MT, M	Meter
MTN	Mountain
mV	Millivolt(s)
MVFR	Marginal Visual Flight Rules
N	North
NATS	North Atlantic Tracks System
NAV	Navigation
NAVAID	Navigation Aid
NCR	Negative Climb Rate
NDA	Next Data Authority
NDB	Non-Directional Beacon
NEXRAD	Next Generation Radar
NG	Gas Producer Rotation Speed
NM	Nautical Mile(s)
NoPT	No Procedure Turn Required (procedure shall not be executed without ATC clearance)
NOTAM	Notice To Airman
NP	Power Turbine Speed
NR	Rotor Speed
NRST	Nearest
NWS	National Weather Service
O	Outer Marker
OAT	Outside Air Temperature
OBD, OUTBD	Outboard
OBS	Omni Bearing Selector
OBSCR	Obscuratiion
OCL	Oceanic Clearance
OEM	Original Equipment Manufacturer
OFST	Offset
OGE	Out of Ground Effect
OOOI	Out of the gate, Off the ground, On the ground, and In the gate
OVR	Override
OXY	Oxygen
P ALT	Pressure Altitude
P. POS	Present Position
PA	Passenger Address, Proximity Advisory

PASS	Passenger(s)
PC	Personal Computer
PDA	Premature Descent Alerting
PDC	Pre-Departure Clearance
PED	Personal Electronic Device
PERF	Performance
PFD	Primary Flight Display
PG	Pilot's Guide
PI	Procedure Turn to Course Intercept Leg
PIREP	Pilot Report
PIT, PTCH	Pitch
POA	Plain Old ACARS
POF	Phase of Flight
POH	Pilot's Operating Handbook
POHS	Pilot's Operating Handbook Supplement
POS, POSN	Position
PPH	Pounds per Hour
PPM	Parts per Million
PRES, PRESS	Pressure
PREV	Previous
PRN	Pseudo Random Noise
PROC	Procedure(s), Procedure Turn
PROP	Propeller
PROX	Proximity
PSI	Pounds per Square Inch, Power Situation Indicator
PT	Procedure Turn
PTK	Parallel Track
PTT	Push-to-Talk
PWR	Power
Q	Engine Torque
QFE	Field Elevation Pressure
QNH	Sea Level Pressure
QTY	Quantity
R	Right, Right Runway
RA	Resolution Advisory, Radio Altimeter
RAD	Radial
RAD ALT	Radio Altimeter
RAIM	Receiver Autonomous Integrity Monitoring
RAM	Random Access Memory
RAT	Ram Air Temperature
RCVR	Receiver
RDR	Radar
RECIRC	Recirculate/Recirculating
REF	Reference
REM	Remaining (fuel remaining), Reminder, Removed
REQ	Required
RES	Reserve (fuel reserve entered by pilot)
REV	Reverse, Revision, Revise
RF	Radio Frequency, Constant Radius Turn to Fix Leg
RFM	Rotorcraft Flight Manual
RLC	Required Line Clearance
RMI	Radio Magnetic Indicator
RMT	Remote
RNAV	Area Navigation
RNG	Range
RNP	Required Navigation Performance
RNWY, RWY	Runway
ROC	Required Obstacle Clearance
ROL	Roll
ROM	Read Only Memory
RPM	Revolutions Per Minute
RQRD	Required
RST FUEL	Reset Fuel
RSV	Reserve (fuel reserve entered by pilot)
RT	Right
RTC	Required Terrain Clearance
RTR	Router
RUDICS	Router-Based Unrestricted Digital Interworking Connectivity Solution
RVRSNRY	Reversionary
RVSI	Required Vertical Speed Indicator
RVSM	Reduced Vertical Separation Minimums
RX	Receive
S	South
SA	Selective Availability
SAIB	Special Airworthiness Information Bulletin
SAR	Search and Rescue

SAT	Static Air Temperature
SATCOM	Satellite Communication
SBAS	Satellite-Based Augmentation System
SCIT	Storm Cell Identification and Tracking
SD	Secure Digital
SEC	Second(s)
SEL, SLCT	Select
SELCAL	Selective Calling
SENS	Sense
SFC	Surface
SIAP	Standard Instrument Approach Procedures
SID	Standard Instrument Departure
SIG/AIR	SIGMET/AIRMET
SIGM	SIGMET
SIGMET	Significant Meteorological Information
SIM	Simulator
SITA	Societe Internationale de Telecommunications
SLD	Supercooled Large Droplet
SLP/SKD	Slip/Skid
SMBL	Symbol
SMS	Short Message System
SNGL	Single
SPC	Space
SPD	Speed
SPI	Special Position Identification
SPKR	Speaker
SQ, SQL	Squelch
SRVC, SVC	Service
SSEC	Static Source Error Correction
SSID	Wireless Service Set Identifier
STAB	Stabilization
STAL	Stall
STAR	Standard Terminal Arrival Route
STATS	Statistics
STBY	Standby
STC	Sensitivity Time Constant, Supplemental Type Certificate
STD	Standard
STR	Strip
STRMSCP	Stormscope
SUA	Special Use Airspace
SUPPRESS	Suppression
SURF	Surface
SUSP	Suspend
SVT	Synthetic Vision Technology
SW	Software
SYN TERR	Synthetic Terrain
SYN VIS	Synthetic Vision
SYNC	Synchronize
SYNTH	Synthesizer
SYS	System
T	True
T HDG	True Heading
T/R	Thrust Reverser
TA	Traffic Advisory
TACAN	Tactical Air Navigation System
TAF	Terminal Aerodrome Forecast
TAS	True Airspeed, Traffic Advisory System
TAT	Total Air Temperature
TAWS	Terrain Awareness and Warning System
TCA	Terminal Control Area
TCAS	Traffic Alert Collision Avoidance System
TEL	Telephone
TEMP	Temperature
TERM	Terminal
TF	Track Between Two Fixes Leg
TFR	Temporary Flight Restriction
TGT	Target
THR	Thrust
TIS	Traffic Information Service
TIS-B	Traffic Information Service-Broadcast
TIT	Turbine Inlet Temperature
TKE	see also Track Angle Error
TLA	Throttle Lever Angle, Thrust Lever Angle
TMA	Terminal Maneuvering Area
TMR/REF	Timer/Reference
TO	Takeoff
TOC	Top of Climb
TOD	Top of Descent, Time to TOD

TOGA, TO/GA	Take-Off, Go-Around
TOLD	Takeoff and Landing Data
TOPO	Topographic
TORA	Takeoff Run Available
TOT	Total
TPA	Traffic Pattern Altitude
Track	Direction of aircraft movement relative to a ground position; also 'Ground Track'.
Track Angle Error	The angle difference between the desired track and the current track.
TRFC	Traffic
TRK	see also Track
TRN	Terrain
TRSA	Terminal Radar Service Area
TRUNC	Truncated
TSO	Technical Standard Order
TTL	Total
TURB	Turbulence
TURN	Procedure Turn
TWIP	Terminal Weather Information for Pilots
TX	Transmit
UA	Routine PIREP
UAT	Universal Access Transceiver
UHF	Ultra-High Frequency
UNAVAIL	Unavailable
US	United States
USB V	Upper Sideband Voice
USR	User
UTC	Coordinated Universal Time
UTM/UPS	Universal Transverse Mercator/ Universal Polar Stereographic Grid
UUA	Urgent PIREP
V	Volts, Vertical
V DEV	Vertical Deviation
V, Vspeed	Velocity (airspeed)
V_1	Takeoff Decision Speed
V_2	Takeoff Safety Speed
V_A	Maneuvering Speed
VA	Heading Vector to Altitude Leg
VAC	Volts Alternating Current
VAPP	VOR Approach Mode
V_{APP}, V_{AC}	Approach Climb Speed
VAR	Variation
VCO	Voice Call Out
VD	Heading Vector to DME Distance Leg
VDC	Volts Direct Current
VDI	Vertical Deviation Indicator
VDL	VHF Datalink
VECT	Vector
VERT	Vertical
Vertical Figure of Merit	A measure of the uncertainty in the aircraft's vertical position.
Vertical Speed Required	The vertical speed necessary to descend/climb from a current position and altitude to a defined target position and altitude, based upon current groundspeed.
V_{FE}	Maximum Flap Extended Speed
VFOM	see also Vertical Figure of Merit
VFR	Visual Flight Rules
VHF	Very High Frequency
VI	Heading Vector to Intercept Leg
V_{LE}	Maximum Landing Gear Extended Speed
V_{LNDx}	Approach Speed (Flaps at x°)
V_{LO}	Maximum Landing Gear Operating Speed
VLOC	VOR/Localizer Receiver
VM	Heading Vector to Manual Termination Leg
V_{MC}	Minimum Control Speed
VMC	Visual Meteorological Conditions
V_{MO} (M_{MO})	Maximum Operating Speed
VNAV, VNV	Vertical Navigation
V_{NE}	Never-Exceed Speed
VOL	Volume
VOR	VHF Omnidirectional Range
VORTAC	VHF Omnidirectional Range Station and Tactical Air Navigation
VPATH, VPTH	Vertical Path
VPL	Vertical Protection Level
VPROF	VNAV Profile, Vertical Profile

V_R	Takeoff Rotate Speed
VR	Heading Vector to Radial Leg
V_{REF}	Landing Approach Speed, Reference Landing Speed
VRP	Visual Reporting Point
VS	Vertical Speed
V_{SB}	Maximum Speedbrake Speed
VSD	Vertical Situation Display
VSI	Vertical Speed Indicator
V_{SR}	Stall Speed
VSR, VS REQ	see also Vertical Speed Required
V_T	Takeoff Flap Retraction Speed
VTF	Vector to Final
V_{TIRE}	Maximum Tire Speed
V_X	Best Angle of Climb Speed
V_Y	Best Rate of Climb Speed
V_{YSE}	Best Single-Engine Rate of Climb Speed
W	Watt(s), West
WAAS	Wide Area Augmentation System
WARN	Warning
WATCH	Weather Attenuated Color Highlight
WGS-84	World Geodetic System - 1984
WI-FI, WIFI	Wireless Local Area Network based on IEEE 802.11
WILCO	Will Comply
WOG	Weight on Gear
WOW	Weight on Wheels
WPT	Waypoint(s)
WT	Weight
WW	World Wide
WX	Weather
XFER, XFR	Transfer
XFLOW	Crossflow
XM LTNG	SiriusXM Lightning
XMIT	Transmit
XMSN	Transmission
XPDR	Transponder
XTALK	Cross-Talk
XTK	Cross-Track, Crosstrack Error
YD	Yaw Damper
Z	Reflectivity Factor

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FREQUENTLY ASKED QUESTIONS

If a particular aspect of system operational capability is not addressed by these commonly asked questions or in the index, contact Garmin (see the copyright page or back cover for contact information) or a Garmin-authorized dealer. Garmin is dedicated to supporting its products and customers.

What is SBAS?

The Satellite Based Augmentation System (SBAS) uses a system of ground stations to correct any GPS signal errors. These ground stations correct for errors caused by ionospheric disturbances, timing, and satellite orbit errors. It also provides vital integrity information regarding the health of each GPS satellite. The signal correction is then broadcast through geostationary satellites. This correction information can then be received by any SBAS-enabled GPS receiver.

SBAS is designed to provide the additional accuracy, availability, and integrity necessary to enable users to rely on GPS for all phases of flight.

There are several SBAS systems serving different parts of the world. The Wide Area Augmentation System (WAAS) is currently available in the United States, including Alaska and Hawaii. The European Geostationary Navigation Overlay Service (EGNOS) offers coverage of Europe, parts of the middle east and northern Africa. The Multi-functional Satellite Augmentation System (MSAS) covers mainly Japan. The GPS aided GEO augmented navigation (GAGAN) offers covers mainly India.

How does SBAS affect approach operations?

Both LNAV/VNAV and LPV 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 LPV approaches further improves precision approach capabilities. LPV approaches are designed to make full use of the improved GPS signal from the SBAS. This approach combines the LNAV/VNAV vertical accuracy with lateral guidance similar to the typical Instrument Landing System (ILS). 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 LOI annunciation flagging on the HSI.*

For RAIM to work correctly, the GPS receiver must track at least five satellites. A minimum of six satellites is required to allow RAIM to eliminate a single corrupt satellite from the navigation solution.

RAIM ensures that satellite geometry allows for a navigation solution calculation within a specified protection limit (2.0 nm for oceanic and en route, 1.0 nm for terminal, and 0.3 nm for non-precision approaches). The system monitors RAIM and issues an alert message when RAIM is not available (see Appendix A). Without RAIM, GPS position accuracy cannot be monitored. If RAIM is not available when crossing the FAF, the pilot must fly the missed approach procedure.

What is GSL altitude?

GSL (Geodetic Sea Level) altitude is the height above Mean Sea Level (MSL), as calculated geometrically, generally using a global positioning system (GPS) as the primary data source. The calculated result may or may not include a barometric component, but the primary source is geometric.

Why are there not any approaches available for a flight plan?

Approaches are available for the final destination airport in a flight plan or as a direct-to (keep in mind that some VOR/VORTAC identifiers are similar to airport identifiers). If a destination airport does not have a published approach, the system indicates "NONE" for the available procedures.

What happens when an approach is selected? Can a flight plan with an approach, a departure, or an arrival be stored?

When an approach, departure, or arrival is loaded into the active flight plan, a set of approach, departure, or arrival waypoints is inserted into the flight plan, along with a header line showing the title of the selected instrument procedure. The original en route portion of the flight plan remains active, unless the instrument procedure is activated. This may be done either when the procedure is loaded or at a later time.

Flight plans can also be stored with an approach, a departure, or an arrival. Note that the active flight plan is erased when the system is turned off. Also, the active flight plan is overwritten when another flight plan is activated. When storing flight plans with an approach, a departure, or an arrival, the system uses the waypoint information from the current database to define the waypoints. If the database is changed or updated, the system automatically updates the information, provided the procedure has not been modified. Should an approach, departure, or arrival procedure no longer be available, the flight plan becomes locked until the procedure is deleted from the flight plan.

Can "slant Golf" ('/G') 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 approved Airplane 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 AFM/AFMS.

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.

MAP SYMBOLS

NOTE: *Refer to the Flight Management Section for the topography legend and the Hazard Avoidance Section for XM WX Satellite Weather Product legends.*

MISCELLANEOUS

Item	Symbol
ARTCC Frequency or FSS Frequency	
Map Pointer (when panning)	
Elevation Pointer (on Topography Scale when panning)	
Measuring Pointer	
Wind Vector	
Overzoom Indicator	
Vertical Navigation Along Track Waypoint	
Parallel Track Waypoint	
Unanchored Flight Path Waypoint	
Displayed when aircraft GPS location is valid, but heading is invalid.	
Top of Descent (TOD)	
Bottom of Descent (BOD)	
Navigating using Dead Reckoning	

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GARMIN®

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

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

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

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

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

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