



GARMIN®

G3000® Integrated Avionics System Pilot's Guide



Piper M600

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This manual reflects the operation of System Software version 2039.05 or later for the Piper M600. Some differences in operation may be observed when comparing the information in this manual to later software versions.

Garmin International, Inc.

1200 East 151st Street
Olathe, Kansas 66062, U.S.A.
Tel: 913.397.8200
Fax: 913.397.8282
Aircraft On Ground (AOG) Hotline: 913.397.0836
Aviation Dealer Technical Support: 888.606.5482

Garmin AT, Inc.

2345 Turner Road SE
Salem, OR 97302, U.S.A.
Tel: 503.581.8101
Fax 503.364.2138

Garmin (Europe) Ltd.

Liberty House, Houndsdown Business Park
Southampton, Hampshire SO40 9LR U.K.
Tel: +44 (0) 238 052 4000
Fax: +44 (0) 238 052 4004
Aviation Support: +44 (0) 370 850 1243

Garmin Corporation

No. 68, Zhangshu 2nd Road
Xizhi District, New Taipei City, Taiwan
Tel: 34-93-357-2608
Fax: 34-93-429-4484

Web Site Address: www.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 significantly older than the indicated weather product age.



WARNING: The displayed minimum safe altitude (MSAs) are only advisory in nature and should not be relied upon as the sole source of obstacle and terrain avoidance information. Always refer to current aeronautical charts for appropriate minimum clearance altitudes.



WARNING: Always obtain qualified instruction prior to operational use of this equipment.



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



WARNING: Do not use 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: When using the autopilot to fly 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: Because of variation in the earth's magnetic field, do not rely on the accuracy of attitude and heading indications (GRS 77 installations only) in the following geographic areas: 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: Intruder aircraft at or below 500 ft. AGL may not appear on the Garmin SVT display or may appear as a partial symbol.



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



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



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



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



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



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



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



CAUTION: Repairs should only be made by an authorized Garmin service center. Unauthorized repairs or modifications could void both the warranty and affect the airworthiness of the aircraft.



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



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



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



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



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



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



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



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



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



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

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



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



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



NOTE: If the pilot/operator wants or needs to adjust the database, contact Garmin Product Support 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 'Aviation Data Error Report'.



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 G3000 system power through at least one cycle in a period of four days of continuous operation to avoid an autonomous system reboot.

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Part Number	Revision	Date	Page Range	Description
190-01928-00	A	6/7/16	All	Initial release at GDU 6.56
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SECTION 1 SYSTEM OVERVIEW

1.1 SYSTEM DESCRIPTION

This section provides an overview of the G3000® Integrated Avionics System as installed in the Piper M600 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. The system consists of the following Line Replaceable Units (LRUs):

- **GDU 1200W (3)** – The GDU 1200W features a 12-inch light emitting diode (LED) backlit widescreen display with a 1280 x 800 resolution. The unit installed on the left/pilot side is designated as PFD1. In normal operations, it shows a Primary Flight Display (PFD), and may also show a Display Pane. The center unit is designated as the MFD. In normal operations it shows the Engine Indication System (EIS) display, in addition to one or two Display Panes. The unit installed on the right/copilot side is designated as PFD2. In normal operations, it shows a PFD, and may also show a Display Pane. The GDUs communicate with each other, the Touchscreen Controllers, and with the on-side GIA 63W Integrated Avionics Unit (IAU) through a High-Speed Data Bus (HSDB) Ethernet connection.
- **GTC 570 (2)** – The Touchscreen Controller provides GDU Display Pane control, in addition to Flight Management System (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 its respective on-side PFD, as well as the MFD, using an HDSB connection.
- **GMA 36 (1)** – The Remote Audio Processor integrates navigation/communication radio (NAV/COM) digital audio, intercom, and marker beacon audio. The unit is connected to the #1 Touchscreen Controller using an HSDB interface.
- **GIA 63W (2)** – The Integrated Avionics Units (IAU) function as the main communications hub, linking several LRUs with each on-side GDU. Each IAU contains a GPS Satellite-Based Augmentation System (SBAS) receiver, a very high frequency (VHF) communication/navigation/glideslope (COM/NAV/GS) receiver, a Flight Director (FD) and system integration microprocessors.
- **GDC 74A (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 G3000 system, and it communicates with both GIA 63Ws, the on-side GDU 1200W and the on-side GRS 77, using an ARINC 429 digital interface (it also interfaces directly with the on-side GTP 59). The GDC 74A is designed to operate in Reduced Vertical Separation Minimum (RVSM) airspace.
- **GTP 59 (2)** – Provides Outside Air Temperature (OAT) data to the on-side GDC 74A.
- **GEA 71 (1)** – The Engine Airframe Unit receives and processes signals from the engine and airframe sensors. This unit communicates with both IAUs using an RS-485 digital interface.
- **GTX 33/33D (1 or 2)** – The solid-state Transponder provides Modes A/C/S capability, 1090 MHz Extended Squitter Automatic Dependent Surveillance - Broadcast (ADS-B) transmission, and communicates with both IAUs through an RS-482/422 digital interface.

- **GRS 77** (2) – The Attitude and Heading Reference System (AHRS) provides aircraft attitude and heading information via ARINC 429 protocol to the on-side and cross-side IAU, the on-side GDU, and to the MFD. An RS-232 backup path connects each AHRS to each IAU. The AHRS contains advanced sensors (including accelerometers and rate sensors) and interfaces with the Magnetometer to obtain magnetic field information, with the ADC to obtain air data, and with both IAUs to obtain GPS information. AHRS operation is discussed in System Operation, later in this section.
- **GMU 44** (2) – The Magnetometer measures local magnetic field and sends data to the AHRS for processing to determine aircraft magnetic heading. The magnetometer receives power directly from the AHRS and communicates with it via an RS-485/422 and RS-232 digital interface.
- **GDL 69A** (1) (optional) – The Satellite Data Link Radio Receiver receives weather information, as well as digital audio entertainment. The Data Link Receiver communicates with the MFD via an HSDB connection. A subscription to SiriusXM Weather and/or SiriusXM Satellite Radio service is required to enable the GDL 69A capability.
- **GMC 710** – The AFCS Mode Controller provides AFCS control through an RS-232 digital interface. The unit connects to PFD1 and PFD2.
- **GSA 80** (1), **GSA 81** (2), and **GSA 9000** (1) – The GSA 80 Servo is used for automatic control of pitch. The GSA 81 Servos are used for automatic control of roll and yaw. The GSA 9000 Servo is used for control of pitch trim. These units interface with each IAU using RS-482/422 connections.
- **GSM 86** (3) and **GSM 9100** (1) – The GSM 86 and GSM 9100 Servo Gearboxes are responsible for transferring the output torque of the servo actuators to the mechanical flight-control surface linkages.
- **GWX 70** (1) – The GWX 70 provides airborne real-time weather and ground mapped radar data to the GDUs. The unit is connected to the PFD2 via an HSDB connection.
- **GAE 43** (1) – The Altitude Encoder provides a backup altitude source. This unit communicates with both IAUs using an RS-232 digital interface.
- **GSR 56** (1) (optional) – The Iridium Transceiver provides voice communication by means of pilot and copilot headsets. The transceiver can also send and receive short message service (SMS) text messages. The GSR 56 also receives data link weather products from the Garmin Connex weather service through the Iridium satellite network. The GSR 56 is connected to the #2 GIA 63W with an RS-232 digital interface.
- **GTS 825/855** (1)(optional) – The GTS 825 Traffic Advisory System (TAS), and the GTS 855 TCAS I, use active interrogations of Mode S and Mode C transponders to provide traffic information to the pilot independent of the air traffic control system. It is connected to the PFD2 via HSDB.
- **Flight Stream 110** (1) (optional) – The Flight Stream 110 allows access and sharing of information between mobile devices and your Connex-capable avionics. This unit communicates with the GDL 69A using an RS-232 digital interface.

A top-level G3000 system block diagram is shown in Figure 1-1 (it does not include the GSM 86/9100).

The G3000 is capable of interfacing with the following non-Garmin equipment:

- **KN 63** DME
- **RA-3504** ADF
- **ELT-1000** ELT
- **KAPS II** Pressurization System
- **WX-500** Lightning Detection
- Stall Warning Computer



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

The Piper M600 is also equipped with a Garmin Automated Flight Control System (AFCS), providing the Flight Director (FD), Autopilot (AP), manual electric trim, and control wheel steering (CWS) functions of the G3000 Integrated Avionics System.



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

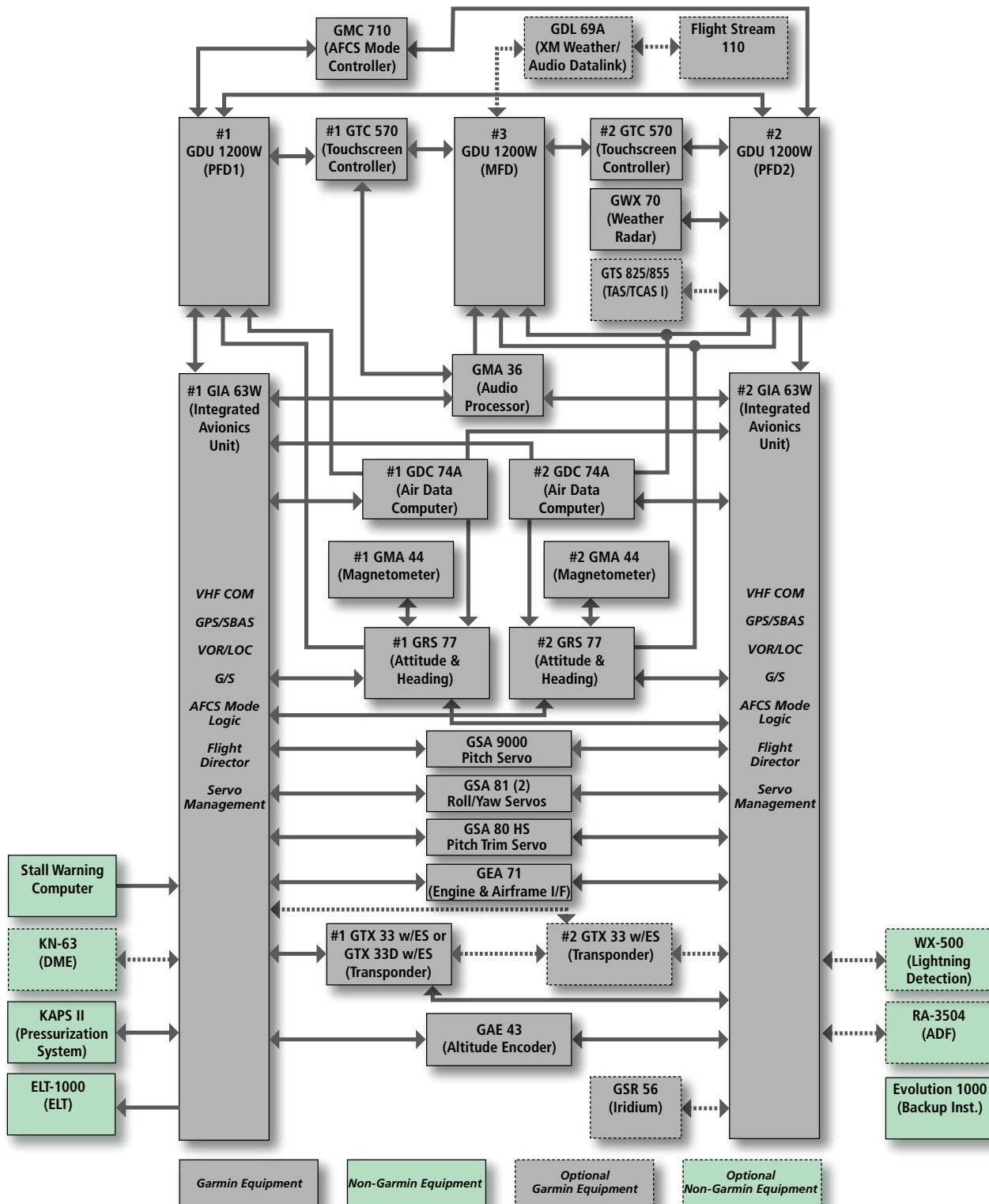


Figure 1-1 Basic System Block Diagram

1.2 SYSTEM POWER-UP



NOTE: See the Airplane Flight Manual (AFM) for specific procedures concerning avionics power application and emergency power supply operation.



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

The G3000 is integrated with the aircraft electrical system and receives power directly from electrical busses. The GDUs, 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.

During system power-up, the system displays test annunciations, as shown in Figure 1-2. All system annunciations should be extinguished typically within the first minute of power-up. Upon power-up, annunciator lights on the AFCS Controller illuminate momentarily.

On PFD1 and PFD2, the AHRS begins to initialize and displays “AHRS ALIGN: Keep Wings Level”. The AHRS should display valid attitude and heading fields typically within the first minute of power-up. The AHRS can align itself both while taxiing in a straight line and during level flight.

When the MFD powers up, the splash screen (Figure 1-3) displays the following information:

- | | |
|-------------------------------------|--|
| • System version | • Obstacle database name and version |
| • Copyright | • Navigation database name, version, and effective dates |
| • Land database name and version | • Airport Directory name, version and effective dates |
| • Safe Taxi database information | • ChartView database information |
| • Terrain database name and version | |

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

Pressing the right-most softkey on the MFD acknowledges this information, and the MFD then shows the EIS (Engine Indication System) Display and two Navigation Map Panes 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 1-2 PFD1 Power-Up

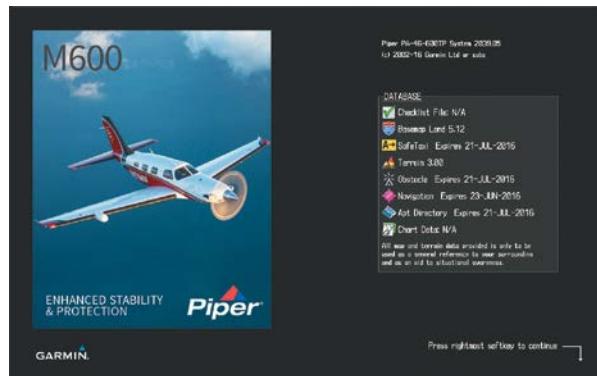


Figure 1-3 MFD Power-Up



Figure 1-4 Touchscreen Controller
Initialization Screen

1.3 G3000 CONTROLS

The G3000 controls have been designed to simplify operation of the system and minimize workload and the time required to access sophisticated functionality. Controls are located on the PFD1 and PFD2 bezels, the Touchscreen Controllers, and the AFCS Controller. PFD controls and the Touchscreen Controllers are discussed in this section. AFCS controls are described in the AFCS section. See the Audio and CNS Section for more information about NAV/COM controls.

PFD CONTROLS



Figure 1-5 PFD Controls

Selection softkeys are located along the bottom of PFD1 and PFD2. The five softkeys on the left are not available when the PFD is in Split Mode. 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).

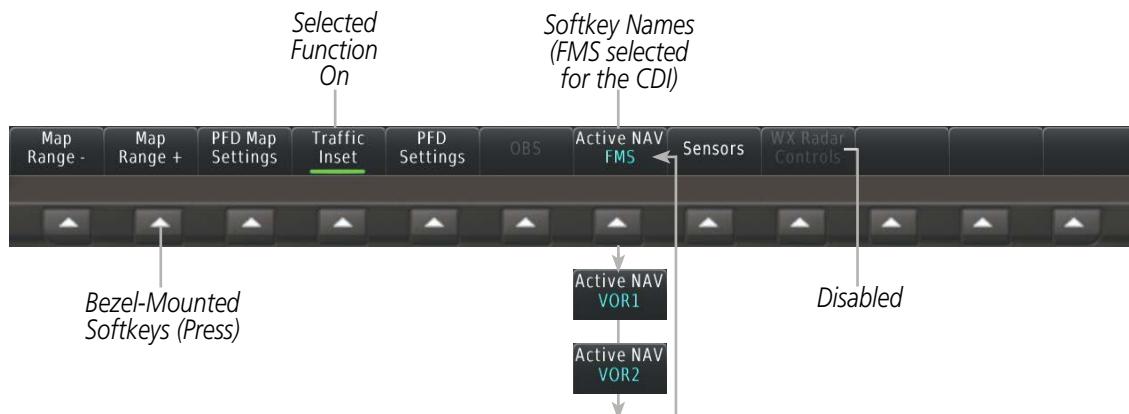


Figure 1-6 Top Level PFD Softkeys - Full Mode

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

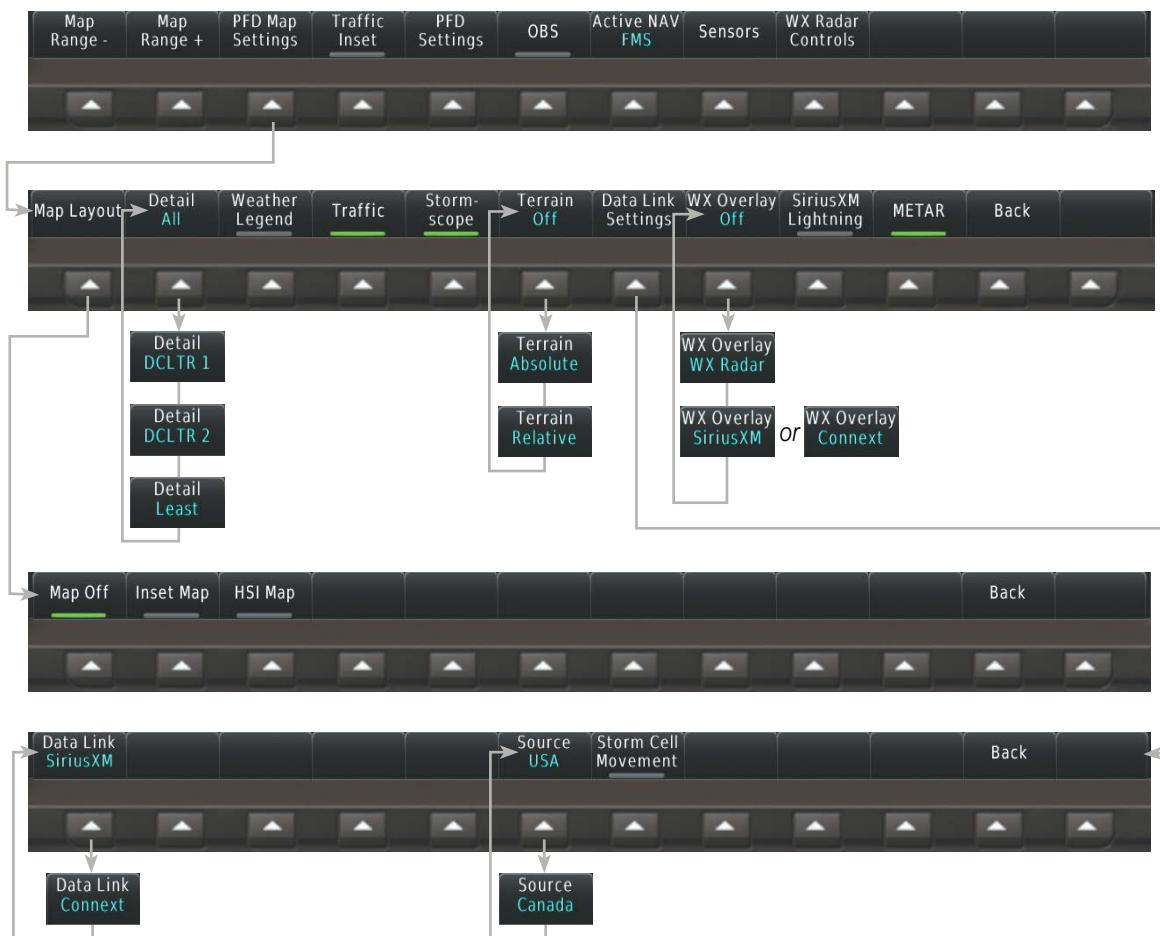


Figure 1-7 PFD Map Settings Softkeys



Figure 1-8 PFD Settings Softkeys

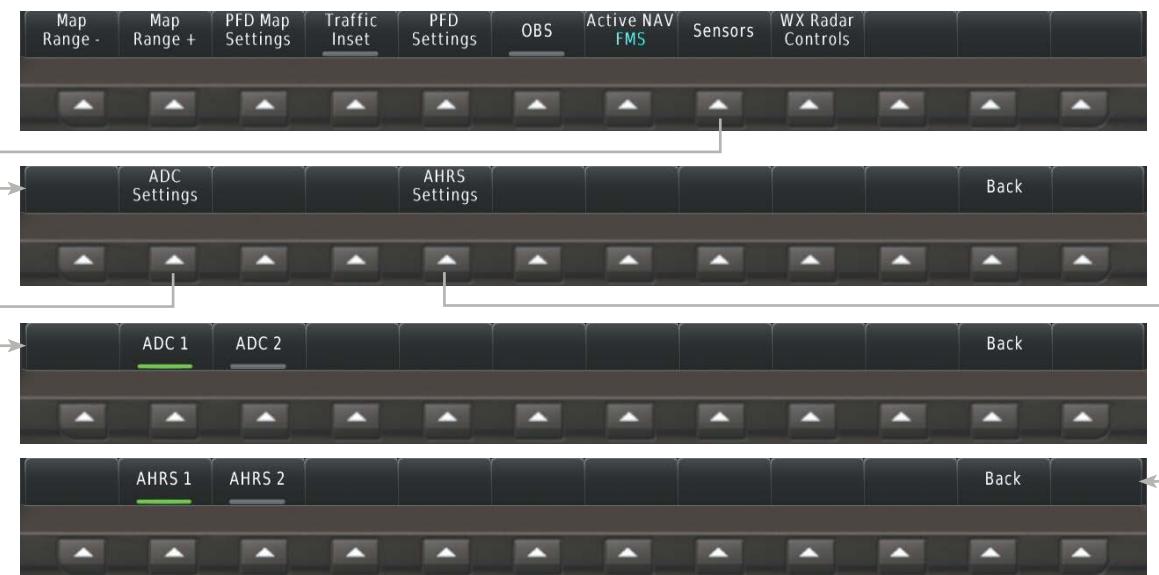


Figure 1-9 Sensor Softkeys



Figure 1-9 WX Radar Control Softkeys

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 the PFD Map selection softkeys
		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
	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, Connex) 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			Selects the display of terrain information on the PFD Map: 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 the PFD Map data link settings softkeys
		Data Link		Selects the data link weather source for the PFD Map: SiriusXM : PFD Map data link weather source is SiriusXM. Connex : PFD Map data link weather source is Connex.
		Source		This softkey is available when SiriusXM is selected as the data link weather source. Selects the SiriusXM coverage area for the PFD Map: USA : SiriusXM coverage area is USA Canada : SiriusXM coverage area is Canada
		Storm Cell Movement		This softkey is available when SiriusXM is selected as the data link weather source. Adds or removes the display of Storm Cell Movement information on the PFD Map. The softkey annunciator is green when the function is on. When the function is off, the annunciator is gray.

Level 1	Level 2	Level 3	Level 4	Description
	Wx Overlay			Selects the display of weather information on the PFD Map: Off: Removes weather information from the PFD Map. Wx Radar: Displays airborne weather radar information on the HSI Map only. Not available if Inset Map displayed. SiriusXM or Connex: Displays SiriusXM or Connex weather information (based on data link weather source selection) on the PFD Map.
	SiriusXM Lightning Or Connex Lightning			Adds/removes the display of SiriusXM or Connex lightning information (based on data link weather source selection) 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 or Connex METAR data (based on data link weather source selection) on the PFD Map. The softkey annunciator is green when the METAR data is on. When the METAR data is off, the annunciator is gray.
Traffic Inset				Replaces the Inset Map with a dedicated traffic display. The softkey annunciator is green when the dedicated traffic display is on. When the Inset Map is off, the softkey annunciator is gray.
PFD Settings				Displays the PFD settings softkeys.
	Attitude Overlays			Displays the softkeys for enabling or disabling Synthetic Vision features.
		Pathways		Displays Pathway Boxes on the Synthetic Vision Display.
		Synthetic Terrain		Enables synthetic terrain depiction.
		Horizon Heading		Displays compass heading along the Zero-Pitch line.
		Airport Signs		Displays position markers for airports within approximately 15 nm of the current aircraft position. Airport identifiers are displayed when the airport is within approximately 9 nm.
		FPA Ref Settings		
			FPA Ref	Displays the FPA reference line on the SVT pitch ladder at the selected angle
			-1	Decreases the pitch reference angle by one degree
			-0.1	Decreases the pitch reference angle by 0.1 degree
			+0.1	Increases the pitch reference angle by 0.1 degree
			+1	Increases the pitch reference angle by one degree

Level 1	Level 2	Level 3	Level 4	Description
	PFD Mode			<p>Enables or disables a multi-function Display Pane to the right or left (depending on pilot-side or copilot-side) on the PFD.</p> <p>FULL: Display Pane is disabled. The PFD display occupies the full screen.</p> <p>Split: Display Pane is enabled. The PFD screen is split between the PFD display and the Display Pane.</p>
	Bearing 1			Cycles the Bearing 1 Information Window through NAV1, NAV2, GPS/waypoint identifier and GPS-derived distance information, ADF/frequency, and Off.
	Bearing 2			Cycles the Bearing 2 Information Window through NAV1, NAV2, GPS/waypoint identifier and GPS-derived distance information, ADF/frequency, and Off.
	Other PFD Settings			Displays additional PFD settings softkeys.
		Wind		Displays the wind option softkeys
		Option 1		Headwind/Tailwind and crosswind components.
		Option 2		Wind direction arrow and speed.
		Option 3		Wind direction arrow with direction and speed.
		Off		Information not displayed.
		Altitude Units		Displays softkeys to select altitude unit parameters.
		Meters		When enabled, displays altimeter in meters.
		IN		Press to display the BARO setting as inches of mercury
		HPA		Press to display the BARO setting as hectopascals.
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 FMS, NAV1, and NAV2 navigation modes on the CDI.
Sensors				Displays the sensor selection softkeys.
	ADC Settings			Displays the ADC selection softkeys.
		ADC 1		Selects the number 1 ADC. The softkey annunciator is green when selected.
		ADC 2		Selects the number 2 ADC. The softkey annunciator is green when selected.

Level 1	Level 2	Level 3	Level 4	Description
	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 Control softkeys (only available if HSI Map is enabled)
	Radar On			Turns the weather radar on. Initial mode is Standby.
	Mode			Selects weather radar mode: Standby: Radar is on, but not transmitting Weather: Normal operating mode for weather detection Ground: Operating mode for ground returns
	Bearing Left			Press the softkey once to move the bearing line left a small amount. Press and hold the softkey for continuous movement to the left.
	Bearing Right			Press the softkey once to move the bearing line right a small amount. Press and hold the softkey for continuous movement to the right.
	Tilt Down			Press the softkey once to adjust the antenna tilt angle down in 0.25° increments. Press and hold the softkey for continuous adjustment downward.
	Tilt Up			Press the softkey once to adjust the antenna tilt angle up in 0.25° increments. Press and hold the softkey for continuous adjustment upward.
	Gain -			Press the softkey once to decrease the gain by 0.5, or press and hold the softkey for continuous adjustment. A manual setting of '0.0' is equivalent to the calibrated gain setting.
	Gain +			Press the softkey once to increase the gain by 0.5, or press and hold the softkey for continuous adjustment. A manual setting of '0.0' is equivalent to the calibrated gain setting.

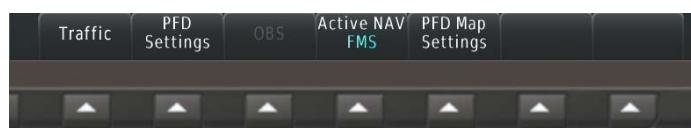


Figure 1-6 Top Level PFD Softkeys - Split Mode



Figure 1-7 PFD Map Settings Softkeys - Split Mode



Figure 1-7 PFD Settings Softkeys - Split Mode

Level 1	Level 2	Level 3	Level 4	Level 5	Description
Traffic					Switches the Map Pane to the Traffic Map display.
PFD Settings					Displays the PFD settings softkeys.
	Attitude Overlays				Displays the softkeys for enabling or disabling Synthetic Vision features.
		SVT Terrain			Displays additional SVT overlay softkeys
			Pathways		Displays Pathway Boxes on the Synthetic Vision Display.
			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.
		Synthetic Terrain			Enables synthetic terrain depiction.
		Horizon Heading			Displays compass heading along the Zero-Pitch line.
		FPA Ref Settings			Displays FPA Reference softkeys
			FPA Ref		Displays the FPA reference line on the SVT pitch ladder at the selected angle
			-1		Decreases the pitch reference angle by one degree
			-0.1		Decreases the pitch reference angle by 0.1 degree
			+0.1		Increases the pitch reference angle by 0.1 degree
			+1		Increases the pitch reference angle by one degree
	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, ADF/frequency, and Off.
	Bearing 2				Cycles the Bearing 2 Information Window through NAV1, NAV2, GPS/waypoint identifier and GPS-derived distance information, ADF/frequency, and Off.
	Other PFD Settings				Displays additional PFD settings softkeys.
		Wind			Displays the wind option softkeys
			Option 1		Headwind/Tailwind and crosswind components.
			Option 2		Wind direction arrow and speed.

Level 1	Level 2	Level 3	Level 4	Level 5	Description
			Option 3		Wind direction arrow with direction and speed.
			Off		Information not displayed.
		Altitude Units			Displays softkeys to select altitude unit parameters.
			Meters		When enabled, displays altimeter in meters.
			IN		Press to display the BARO setting as inches of mercury
			HPA		Press to display the BARO setting as hectopascals.
		Sensors			Displays the sensor selection softkeys.
			ADC Settings		Displays the ADC selection softkeys.
				ADC 1	Selects the number 1 ADC. The softkey annunciator is green when selected.
				ADC 2	Selects the number 2 ADC. The softkey annunciator is green when selected.
			AHRS Settings		Displays the AHRS selection softkeys.
				AHRS 1	Selects the number 1 AHRS. The softkey annunciator is green when selected.
				AHRS 2	Selects the number 2 AHRS. The softkey annunciator is green when selected.
OBS					Selects OBS mode on the CDI when navigating by GPS (only available with active leg). When OBS is on, the softkey annunciator is green.
Active NAV					Cycles through FMS, NAV1, and NAV2 navigation modes on the CDI.
PFD Map Settings					Displays the PFD Map display settings softkeys
	HSI Map				Displays/removes the HSI Map
	Map Range -				Decreases the HSI Map display range (only available if HSI Map is enabled)
	Map Range +				Increases the PFD Map display range (only available if HSI Map is enabled)
	WX Radar Controls				Displays the Wx Radar Control softkeys (only available if HSI Map is enabled)
		Radar On			Turns the weather radar on. Initial mode is Standby.
		Mode			Selects weather radar mode: Standby: Radar is on, but not transmitting Weather: Normal operating mode for weather detection Ground: Operating mode for ground returns

Level 1	Level 2	Level 3	Level 4	Level 5	Description
		Bearing/ Tilt			Displays the bearing and tilt control softkeys
			Bearing Left		Press the softkey once to move the bearing line left a small amount. Press and hold the softkey for continuous movement to the left.
			Bearing Right		Press the softkey once to move the bearing line right a small amount. Press and hold the softkey for continuous movement to the right.
			Tilt Down		Press the softkey once to adjust the antenna tilt angle down in 0.25° increments. Press and hold the softkey for continuous adjustment downward.
			Tilt Up		Press the softkey once to adjust the antenna tilt angle up in 0.25° increments. Press and hold the softkey for continuous adjustment upward.
		Gain -			Press the softkey once to decrease the gain by 0.5, or press and hold the softkey for continuous adjustment. A manual setting of '0.0' is equivalent to the calibrated gain setting.
		Gain +			Press the softkey once to increase the gain by 0.5, or press and hold the softkey for continuous adjustment. A manual setting of '0.0' is equivalent to the calibrated gain setting.
Map Overlays					Displays the Map Overlay softkeys (only available if HSI Map is enabled)
					Selects the display of terrain information on the HSI Map: Off: Removes terrain information from the HSI Map Absolute: Displays absolute terrain information on the HSI Map Relative: Displays relative terrain information on the HSI Map
		Data Link Settings			Displays the HSI Map data link settings softkeys
			Data Link		Selects the data link weather source for the HSI Map: SiriusXM: HSI Map data link weather source is SiriusXM. Connex: HSI Map data link weather source is Connex.
			Source		This softkey is available when SiriusXM is selected as the data link weather source. Selects the SiriusXM coverage area for the HSI Map: USA: SiriusXM coverage area is USA Canada: SiriusXM coverage area is Canada
			Storm Cell Movement		This softkey is available when SiriusXM is selected as the data link weather source. Adds or removes the display of Storm Cell Movement information on the HSI Map. The softkey annunciator is green when the function is on. When the function is off, the annunciator is gray.

Level 1	Level 2	Level 3	Level 4	Level 5	Description
		Wx Overlay			Selects the display of weather information on the HSI Map: Off: Removes weather information from the HSI Map Wx Radar: Displays airborne weather radar information on the HSI Map SiriusXM or Connex: Displays SiriusXM or Connex weather information (based on data link weather source selection) on the HSI Map.
		SiriusXM Lightning Or Connex Lightning			Adds/removes the display of SiriusXM or Connex lightning information (based on data link weather source selection) on the HSI Map. The softkey annunciator is green when the lightning function is on. When the lightning function is off, the annunciator is gray.
		More			Displays more Map Overlay softkeys
		METAR			Adds or removes the display of SiriusXM or Connex METAR data (based on data link weather source selection) on the HSI Map. The softkey annunciator is green when the METAR data is on. When the METAR data is off, the annunciator is gray.
		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, Connex) and the weather product icon and age box (for enabled weather products).
		Traffic			Adds or removes the display of traffic on the HSI Map. The softkey annunciator is green when the traffic function is on. When the traffic function is off, the annunciator is gray.
		Storm-scope			Adds or removes the display of Stormscope information on the HSI Map. The softkey annunciator is green when the function is on. When the function is off, the annunciator is gray.

TOUCHSCREEN CONTROLLER

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

The touchscreen uses a grid of infrared beams to determine the location of the touch, even when the operator is wearing gloves. Objects or debris on the touchscreen can interfere with these infrared beams and cause unintended activation of buttons.

Radio tuning can be accomplished using the CNS Bar at the top of the Touchscreen Controller screen (refer to the Audio Panel and CNS Section for more information about NAV/COM tuning).

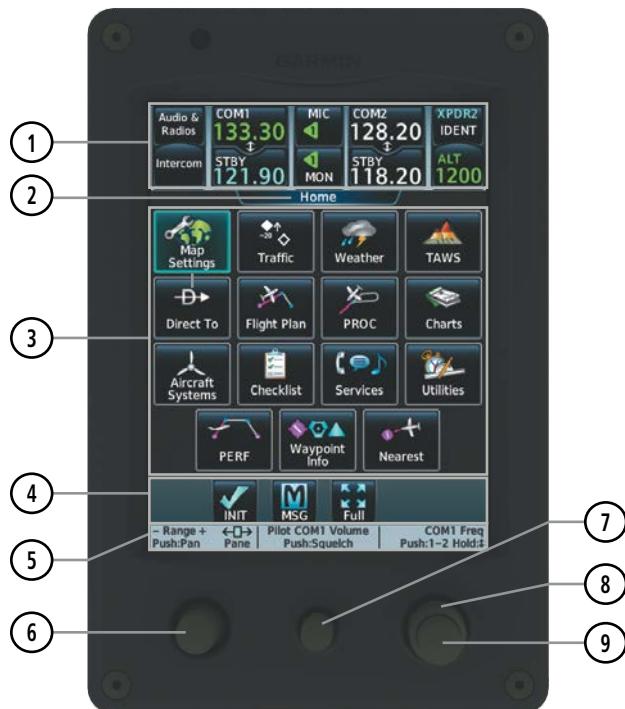


Figure 1-11 GTC 570 Touchscreen Controller

1	CNS Bar	Displays/controls COM, NAV, XPDRA, and ICS functions
2	Screen Title	Displays the title of the current screen
3	Screen	Displays set of context sensitive controls and data
4	Button Bar	Displays System level buttons (e.g. Home, MSG, Full/Half, Scroll Up/Down, Back, Enter, Cancel)
5	Label Bar	Displays labels to show status and current functions of joystick and knobs
6	Joystick	Provides functions as labeled on the screen (e.g. Map Panning, Map Range)
7	Middle Knob	Provides functions as labeled on the screen (e.g. COM volume/squelch)
8	Large Right Knob	Provides functions as labeled on the screen (e.g. COM Freq/switching, Data Entry)
9	Small Right Knob	Provides functions as labeled on the screen (e.g. COM Freq/switching/Hold, Data Entry)

The Touchscreen Controller's functions are arranged by screen. Each screen has a title which appears at the top of the screen area (and below the CNS bar). The contents of each screen change dynamically in response to pilot or system input.

All of the Touchscreen Controller's available functions 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 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.

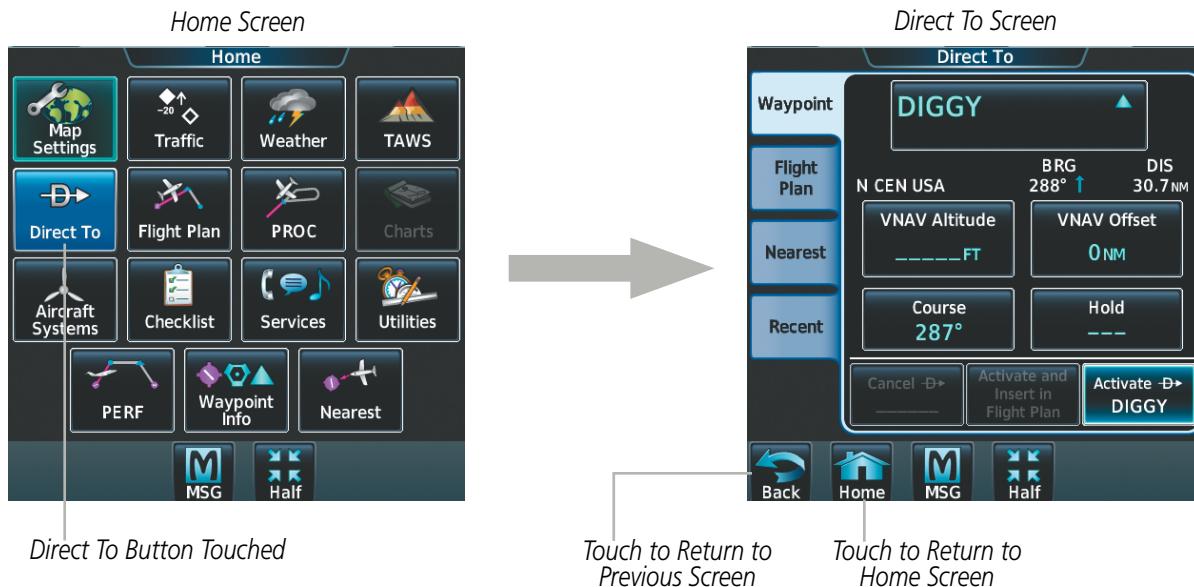


Figure 1-12 Touchscreen Controller Screen Navigation

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.

The CNS Bar, positioned above the screen area, is always displayed during system operation and is accessible at any time. Some functions on the CNS Bar will cause another screen to be displayed (in the screen area below the CNS Bar); however, touching the Back or Cancel Button will return to the previous screen.



Figure 1-13 Accessing Screens with the CNS Bar

The Button Bar, displayed below the screen area, displays the system-level buttons which are context-sensitive. For example, if scrolling is available on a screen, the Button Bar includes corresponding **Up** and **Down** Scroll Arrow buttons.



Figure 1-14 Button Bar Displays System-Level Buttons

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

	Returns to the Home Screen		Selects half-display mode on the MFD.
	Returns to the previous screen		Selects full-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 SMS Text Inbox window on Touchscreen Controller. Flashes when a new SMS message is received.		Cancels data entry and returns to the previous screen
	Accepts entered data into the system.		

Table 1-1 Button Bar Buttons with Functions

The Label Bar, near the bottom of the Touchscreen Controller and above the Joystick and Knobs 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.

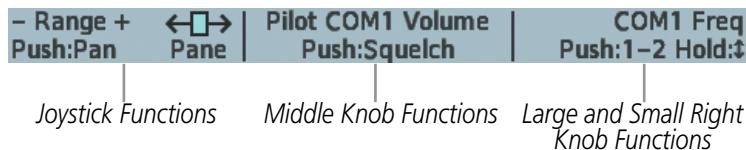


Figure 1-15 Label Bar Indicates Context-Sensitive Joystick and Knob Functions

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 will also indicate 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 Joystick.

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

Some adjustments are made using horizontal or vertical sliders. To use, simply touch within the slider box and slide the finger in the desired slider bar direction, then release the finger. The finger may move outside of the slider box during adjustment; slider movement stops when either the finger is released or the slider has reached its maximum travel.

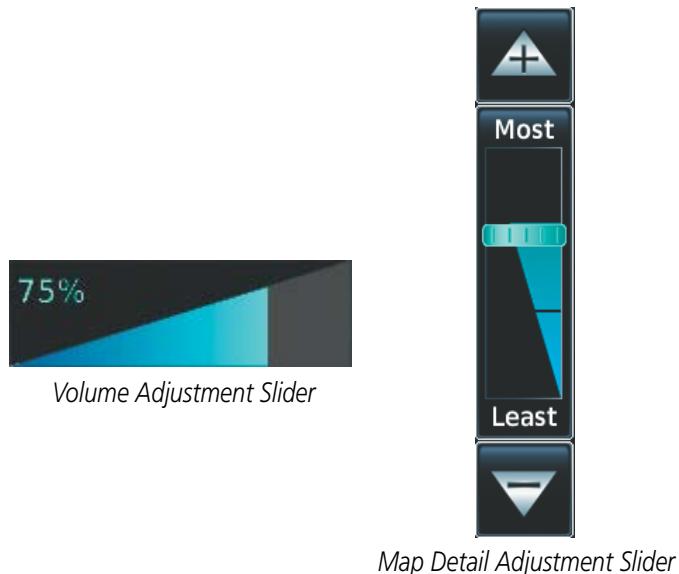


Figure 1-16 Sliders on the Touchscreen Controller

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

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



Figure 1-17 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, pilot editable or configurable fields are displayed in cyan.

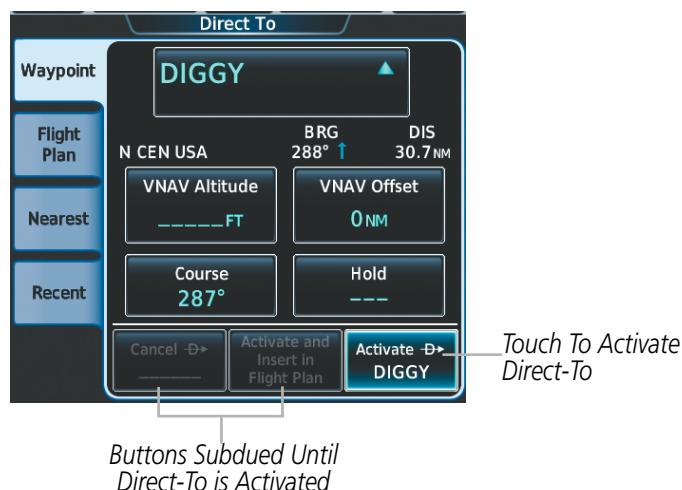


Figure 1-18 Subdued Buttons on Touchscreen Controller

BUTTON TYPES

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



Figure 1-19 Touchscreen Controller Annunciator Buttons

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

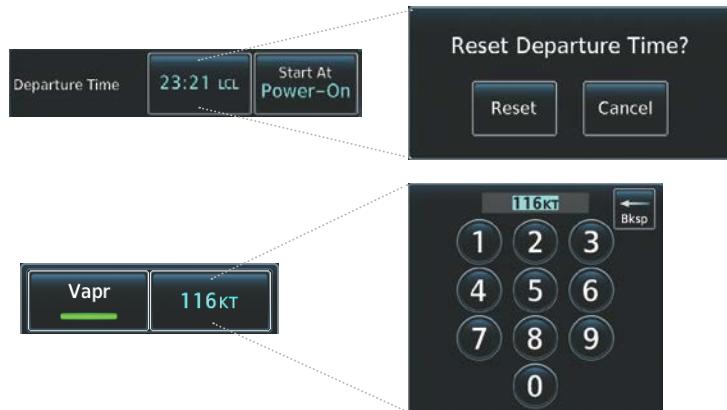


Figure 1-20 Touchscreen Controller Datafield Buttons

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.



Figure 1-21 Failed Function on Touchscreen Controller

SCREENS

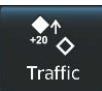


NOTE: Screen appearance varies based on the installed options.

HOME SCREEN



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



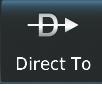
Shows Traffic Map Display in the selected Display Pane. Touch the button again to access Traffic Map Settings Display on Touchscreen Controller.



Shows Weather Display in the selected Display Pane. Touch the button again to access Weather Selection Display on Touchscreen Controller.



Shows the TAWS Display in the selected Display Pane. Touch the button again to access TAWS Settings screen on Touchscreen Controller.



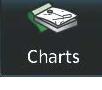
Accesses Direct-To Screen on Touchscreen Controller.



Accesses Active Flight Plan Screen on the Touchscreen Controller. A Flight Plan display is shown on the selected Display Pane.



Accesses Procedures Screen on Touchscreen Controller. Additional map displays may be shown as procedures are selected.



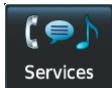
Accesses Charts Screen on Touchscreen Controller. Charts are shown on the selected Display Page.



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 means to perform and monitor system tests.



Accesses the Checklists for display in the selected Display Pane.



Accesses Services Menu Screen on Touchscreen Controller. Includes optional phone and text messaging services, SiriusXM Satellite Radio controls, and Contacts.



Trip Planning functions, Minimums, Trip Statistics, Timer, Scheduled Messages, GPS Status, Initialization, Electronic Documents, Screen Cleaning, Crew Profile, and Setup.



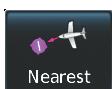
Accesses the PERF Screen on the Touchscreen Controller. Provides controls for entering takeoff and landing airport/runway information, enabling/disabling speed bugs, and entering Weight and Fuel information. This button replaces the Speed Bugs Button when SurfaceWatch is installed.

Or:

Accesses the Speed Bugs Screen on the Touchscreen Controller. Provides controls for enabling/disabling speed bugs and manually entering speed bug values. This button replaces the PERF Button when SurfaceWatch is not installed.

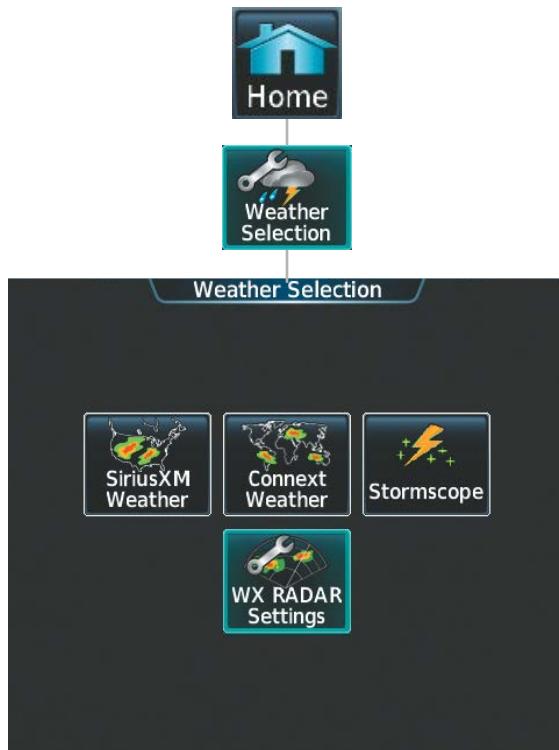


Provides information about Airports, Intersections, VORs, NDBs, User Waypoints. Also allows creation of User Waypoints.



Provides information about the nearest Airports, Intersections, VORs, NDBs, User Waypoints, Airspace, ARTCC facilities, Flight Service Stations, and Weather reporting stations.

WEATHER SELECTION SCREEN





Shows SiriusXM Weather data in the selected Display Pane. Touch the button again to access SiriusXM Weather Settings on Touchscreen Controller.



Shows Connex Weather data in the selected Display Pane. Touch the button again to access Connex Weather Settings on Touchscreen Controller.

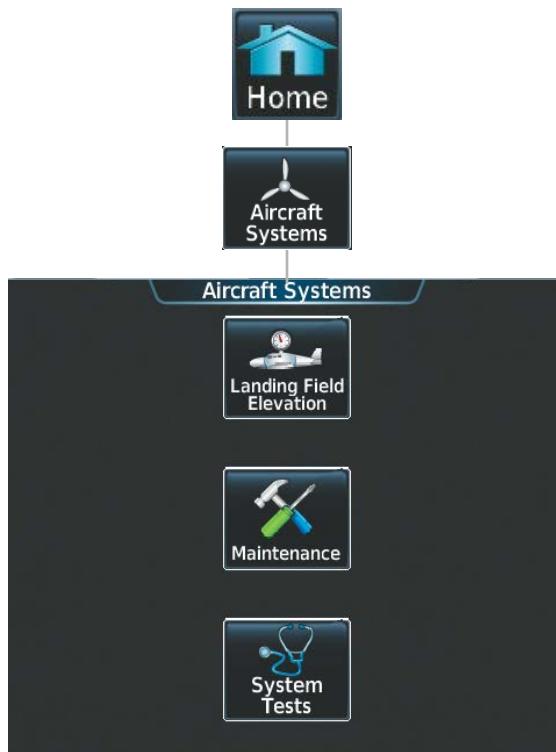


Shows Stormscope data in the selected Display Pane. Touch the button again to access Stormscope Settings on Touchscreen Controller.



Shows Weather Radar data in the selected Display Pane. Touch the button again to access Weather Radar Settings on Touchscreen Controller.

AIRCRAFT SYSTEMS SCREEN



Displays the Landing Field Elevation Screen on the Touchscreen Controller. Allows for manual or FMS entry of field elevation.



Provides functions accessible to maintenance personnel.



Displays the System Tests Screen. This screen allows for initiation of system tests for the following systems: Annunciator, FUEL RTN (only available in Maintenance mode), TCAS/TAS, and TAWS.

SERVICES SCREEN

Music Screen provides controls for SiriusXM Satellite Radio including channel selection, volume, and muting settings.



Contacts Screen provides management of contact information including phone and email addresses. Also provides quick access to stored contacts via phone, SMS, or email.

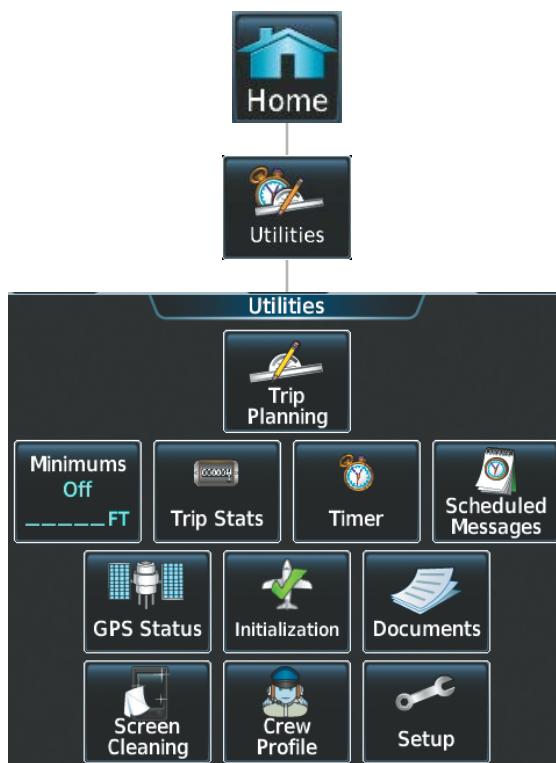


Telephone Screen shows the status of the Iridium satellite telephone connection and provides telephone controls.



SMS Text Messaging Screen provides management of incoming and outgoing SMS (short message service) text messages.

UTILITIES SCREEN



Accesses the Weight and Fuel screen on the Touchscreen Controller. This button is only present when SurfaceWatch is not installed.



Accesses the Trip Planning screen on the Touchscreen Controller.



Accesses the Minimums screen on the Touchscreen Controller. Provides controls for the Minimum Descent Altitude/Decision Height alerting function. Button displays the current minimums altitude and source if provided.



Accesses the Trip Statistics screen on the Touchscreen Controller. Shows information regarding Flight Time, Departure Time, Odometer, Trip Odometer, Average Ground Speed, and Maximum Ground Speed. Also provides controls for trip statistic configuration.



Accesses the Timer screen on the Touchscreen Controller. Controls the timer on the PFD.



Used to create custom messages to be displayed one-time or periodically. The Touchscreen Controller displays these messages on the Messages Screen on the Touchscreen Controller.



Accesses the GPS Status Screen for control of GPS sensors. Shows the GPS Status Pane in the Selected Display Pane.



Displays the Initialization Screen.



Shows controls for viewing electronic documents on the Touchscreen Controller, and displays documents in the selected Display Pane.



Feature temporarily disables touchscreen glass input to allow for manual cleaning. Turn or press any knob on the Touchscreen Controller to exit Screen Cleaning Mode.

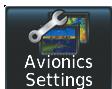
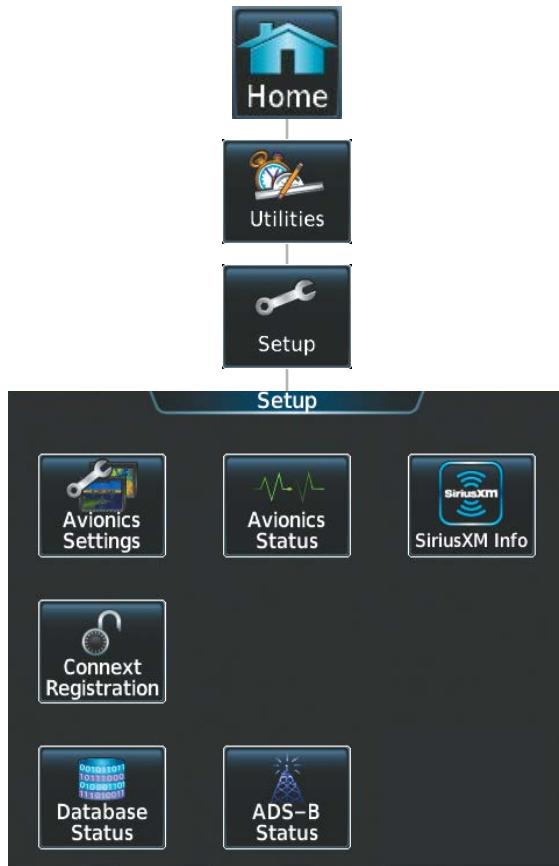


Controls for activating and managing crew profiles.



Avionics Settings and Status, Data Link Services registration and status., Database status, ADS-B status

SETUP SCREEN



Provides controls for changing system avionics settings, such as, time format, units of measure, airspace alert settings, and MFD Data Bar Fields.



Displays information on the Touchscreen Controller for installed LRUs, system software, and databases.



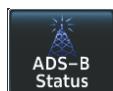
Shows the SiriusXM Information Screen on the Touchscreen Controller. Used to activate audio and data services from SiriusXM Satellite Radio and to verify subscriptions of SiriusXM Weather products.



Used to register with Garmin Connex. Also provides information on current Connex registration.

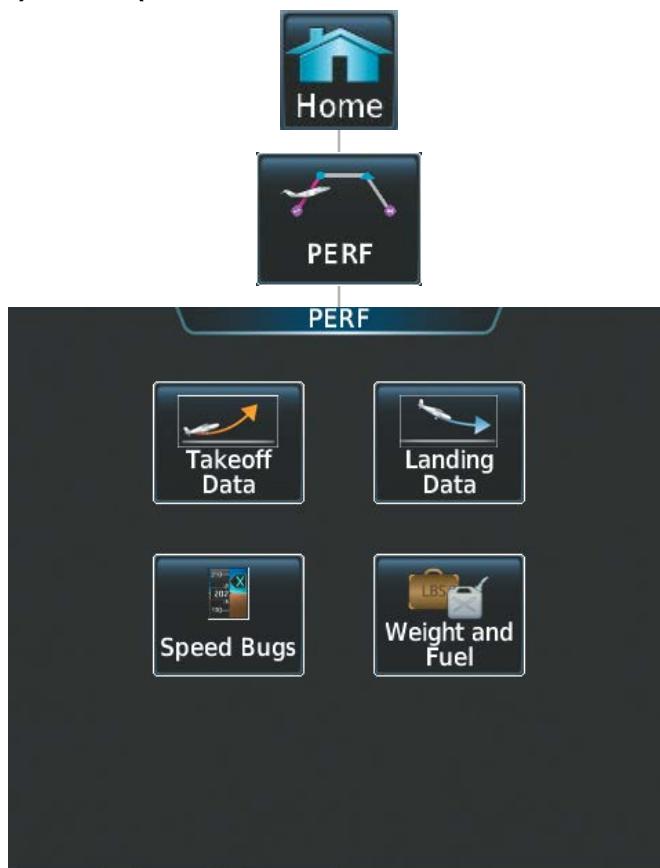


Provides access to the Database Status Screen for checking database cycle information.



Provides access to the optional ADS-B Status Screen for information on the reception of ADS-B services.

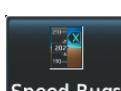
PERF (PERFORMANCE) SCREEN (ONLY PRESENT WHEN SURFACEWATCH IS ENABLED)



Accesses the Takeoff Data screen for entering departure runway data and conditions, takeoff configuration, and other takeoff data.



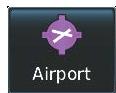
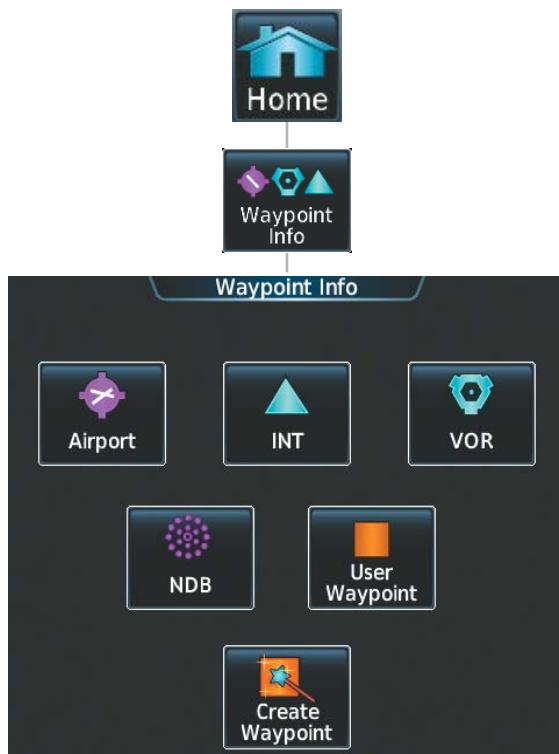
Accesses the Landing Data screen for entering destination runway data and conditions, landing configuration, and other takeoff data.



Accesses the Speed Bugs screen on Touchscreen Controller, where the speed bugs can be configured.



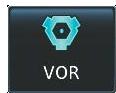
Accesses Weight and Fuel screen on the Touchscreen Controller. Provides for input of weight and fuel data and performs calculations.

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.

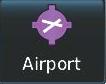
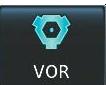


Provides location information for User Waypoints including a list of User Waypoints.



Create User Waypoints based on present position or a designated location.

NEAREST SCREEN

-  Displays a list of the nearest airports, with runway, bearing, and distance information.
-  Displays a list of the nearest intersections with bearing and distance information.
-  Displays a list of the nearest VORs with bearing, distance, and frequency information.
-  Displays a list of the nearest NDBs with bearing, distance, and frequency information.
-  Displays a list of the nearest User Waypoints with bearing and distance information.
-  Displays information about the nearest airspace and status.
-  Displays information about the nearest ARTCC facilities including bearing, distance, and frequencies.
-  Displays the nearest Flight Service Stations with bearing, distance, and frequency information.
-  Displays the nearest weather reporting sources, bearings, distances, and frequencies.

TOUCHSCREEN CONTROLLER JOYSTICK AND KNOBS

The functions of the Joystick and Knobs on the Touchscreen Controller (Figure 1-22) are context-sensitive. The Label Bar, shown above each corresponding control, indicates which function(s) currently apply to each control.

The Joystick may be turned to increase or decrease map range, or to increase or decrease detail on certain system displays. When the Joystick is pushed, the Map Pointer is activated for Map Panning (push again to deactivate Map Pointer). In addition, when the Weather Radar Pane is active, pressing the Joystick will display the weather radar controls. A subsequent press will remove the weather radar controls.

The middle knob is turned to increase or decrease the selected audio source volume. If a COM radio is selected, pushing the middle knob activates/deactivates squelch. If a NAV radio is selected (on the Audio & Radios Screen), pushing the middle knob enables NAV audio to be heard for identification.

The large and small right knobs are used for radio tuning and selection, frequency transfer, and data entry. Turning the large right knob tunes the selected radio frequency in 1 MHz increments; the small right knob adjusts the frequency in 1 KHz increments. Push the small right knob momentarily to change the selected COM radio source (COM 1 or COM 2) for tuning. Push and hold the small right knob for 1.5 seconds to transfer the selected Standby COM frequency to the active COM frequency.

During data entry, turn the large right knob to move the cursor position. Turn the small right knob to select a character for the highlighted cursor position. Push the small right knob to enter the data (see the Data Entry discussion later in this section for more information about Data Entry methods.)

CONTROLLING DISPLAY PANES

The Touchscreen controllers provide a means to select and control Display Panes. The Joystick on each Touchscreen Controller moves the Pane Selector left or right on the display to highlight the Display Pane in the location to be controlled. The Pane Selector (Figure 1-22) is cyan for GTC1, and dark purple for the GTC2. The Pane Selector outlines the border of the Display Pane presently being controlled.

In normal operations, GTC1 controls the outboard Display Pane location on PFD1, and the left Display Pane location on the MFD (in Half Mode). GTC2 controls the outboard Display Pane location of PFD2 and the right Display Pane area of the MFD (in Half Mode). Either Touchscreen Controller may also select and control a Full Mode Display Pane on the MFD, although both Touchscreen Controllers cannot control an MFD Full Mode Display Pane simultaneously.

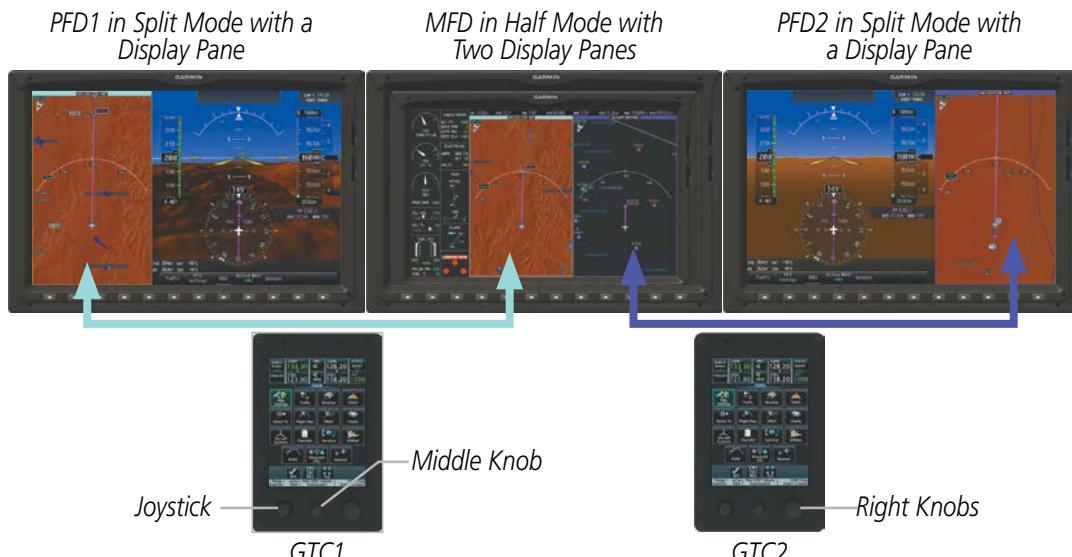


Figure 1-22 Display Pane Control (Normal Operations, MFD in Split Mode)

Some buttons on the Touchscreen Controllers are associated with showing a Display Pane. For example, touching the **Map** Button on the Home Screen shows the Navigation Map Pane on the GDU at the selected Display Pane location.

Each Display Pane location has a currently designated Display Pane. When the Pane Selector highlights a Display Pane, the Touchscreen Controller shows the button associated with the designated Display Pane in cyan (when the Home Screen is shown on the Touchscreen Controller). This indicates the system will resume display of the designated Display Pane should another (non-designated) Display Pane be shown subsequently in the same pane location. However, if another designated Display Pane is selected instead, the new selection then becomes the designated Display Pane for the Display Pane location, and its associated button border is highlighted in cyan. The system designates the following Display Panes when they are selected;

- Navigation Map Pane
- Charts Pane
- Weather Panes (Datalink Weather, WxRadar)
- Traffic Pane
- TAWS Pane

When the system is powered-up on the ground, the system designates the Navigation Map Pane to the PFD1 and PFD2 Display Pane locations (viewed when Split Mode is selected), and the MFD Display Pane locations when the MFD is viewed in Half 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 EIS and a single, enlarged Display Pane. In Half Mode, the MFD shows the EIS and two Display Panes (mode selections do not affect the EIS display formatting).

When the system is powered-up on the ground, following acknowledgement of the MFD splash display, The MFD begins operation in Half Mode with each Touchscreen Controller able to control its respective Display Pane on the MFD.

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 (Figure 1-23).



Figure 1-23 Controlling Half Mode Display Panes

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

The Touchscreen Controller which enabled a Full Mode has control of the Full Mode Display Pane. For example, if GTC1 enabled Full Mode on the Navigation Map Pane, GTC1 then controls the settings for this Display Pane (e.g. map range, overlays) while in Full Mode. The cross-side Touchscreen Controller cannot control the same Full Mode Display Pane at the same time, but may select Half Mode as necessary. The cross-side Touchscreen Controller displays a message when attempting to control a Full Mode Display Pane currently controlled by the other Touchscreen Controller (Figure 1-24).



Figure 1-24 Controlling Half Mode Display Panes

The Touchscreen Controller which enabled Full Mode automatically continues to select the MFD Display Panes in Full Mode until any of the following occur:

- The Touchscreen Controller which enabled Full Mode subsequently selects a Display Pane which is only available in Half Mode (for example, Display Panes associated with the **Checklist** Button on the Home Screen.)
- The Touchscreen Controller which did **not** enable Full Mode subsequently selects the **Half** Button, or selects a button with an associated Display Pane while the **Half** Button is shown. If the **Half** Button is not shown, the Pane Selector may be on another GDU. Move the Joystick left or right, as appropriate, toward the MFD, and the **Half** Button appears. Then touch the **Half** Button, or touch any button with an associated Display Pane, to enter Half Mode on the MFD. The on-side pane selector will be visible once **Half** Mode is selected.

The MFD Full and Half Modes are not available when the MFD is operating in Reversionary Mode.

DATA ENTRY

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

Besides character-by-character data entry, the system also provides a shortcut for entering waypoint identifiers. When the cursor is on a field awaiting entry of a waypoint identifier, touching the Find button accesses four different lists of waypoint identifiers for quick selection: Recent, Nearest, Flight Plan (if active flight plan waypoints are available), and a Favorite waypoints list. In addition, the system provides the ability to search by Facility Name or by City. The system will automatically fill in 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 the Touchscreen Controller for which data entry is required (i.e. waypoint, radio frequency, etc.). A keypad will appear, and the Datafield Button will be highlighted in cyan.
- 2) Touch the desired letters or numbers, one at a time.
- 3) If an alphabetic keypad is displayed and numbers are desired, touch the **123...** Button.
- 4) If the numeric keypad is displayed and letter 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.

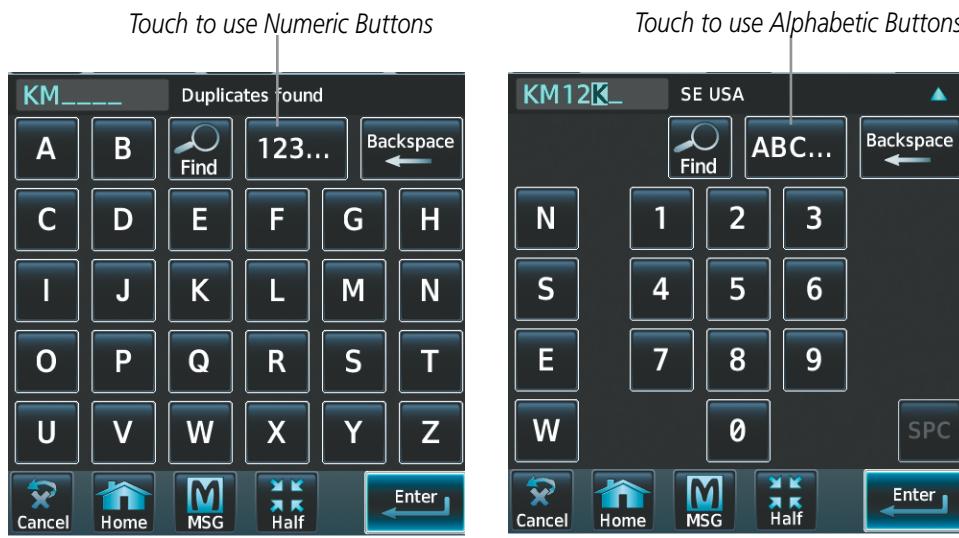


Figure 1-25 Entering a Waypoint on the Touchscreen Controller's Alphanumeric Keypads

It is not necessary to touch the **Enter** Button to complete certain data fields for which a specific number of characters is always required. For example, after entering four digit transponder squawk code, the system automatically accepts this data 1.5 seconds after the fourth button has been pressed (if the entry has not been cancelled).

Using the Touchscreen Controller's large and small right knob to enter data:

- 1) Select a datafield button on the Touchscreen Controller for which data entry is required (i.e. waypoint, radio frequency, etc.). A keypad will appear, and the data field will be highlighted in cyan.
- 2) Begin entering data by turning the small right 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 right knob to move the cursor to the next placeholder in the field.
- 4) Repeat, using the small right knob to select a character and the large right knob to move the cursor, until the field is complete.
- 5) Press the right knob to confirm entry. Otherwise, touch the **Back** or **Home** button to exit the field without saving the entry.

1.4 SYSTEM OPERATION

This section provides a discussion of basic operation of the G3000 Integrated Avionics System.

NORMAL OPERATION

PFD/MFD

In normal operations, PFD1 and PFD2 present graphical flight instrumentation (such as heading, airspeed, altitude, vertical speed) on Primary Flight Displays (PFD) in either Full Mode or Split Mode. In Full Mode, the PFD (including its softkeys) occupies the entire display portion of the display. In Split Mode, the PFD is condensed to accommodate a Display Pane on the outboard portion of the display.

The MFD shows an Engine Indication on the left portion of the display. It also shows either a single Display Pane in Full Mode, or two Display Panes side-by-side in Half Mode. Either Touchscreen Controller selects the Full and Half Modes for the MFD.

TOUCHSCREEN CONTROLLERS

In normal operations, GTC1 or pilot's side Touchscreen Controller controls the PFD1 Display Pane (in Split Mode), and the MFD left Display Pane (in Half Mode). GTC2 or copilot's side Touchscreen Controller controls the PFD2 Display Pane (in Split Mode) and the right Display Pane on the MFD. Either Touchscreen Controller may also control a single MFD Display Pane in Full Mode. 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 joysticks select Display Panes for control. Moving the joystick left or right highlights the active Display Pane as indicated by a cyan border on the pilot's side, or a dark purple border on the copilot side.



Figure 1-26 G3000 Normal Operation

REVERSIONARY DISPLAY OPERATION



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

PFD/MFD FAILURE

In the event of a GDU failure, the system automatically switches to reversionary (backup) mode.

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

Reversionary mode can be activated manually by pressing a dedicated reversionary switch installed in the cockpit. Pressing this switch again deactivates reversionary mode.

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

- **PFD1** – By pressing the left reversionary switch.
- **MFD** – By pressing the left or right reversionary switch..
- **PFD2** – By pressing the right reversionary switch.

The MFD will only go into reversionary mode if the display reversion button is pushed or if both PFD1 and PFD2 are offline. In the event that the MFD is in reversionary mode then GTC1 is in control of the MFD reversionary pane and GTC 2 will have a yellow X over the main homepage. Audio panel commands, COM tuning, MSG window, and XPNDR will still be available on GTC2 but no other functions are available.

TOUCHSCREEN CONTROLLER FAILURE

If either Touchscreen Controller fails or is off-line, the operating Touchscreen Controller controller controls the Display Panes for all displays. In addition, the single Touchscreen Controller provides audio and CNS control for both the pilot and copilot.

AHRS OPERATION



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



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

In addition to using internal sensors, the GRS 77 AHRS uses GPS information, magnetic field data and air data to assist in attitude/heading calculations. In normal mode, the AHRS relies upon GPS and magnetic field measurements. If either of these external measurements is unavailable or invalid, the AHRS uses air data information to assist in attitude determination. Four AHRS modes of operation are available (see Figure 1-27) and depend upon the combination of available sensor inputs. Loss of air data, GPS, or magnetometer sensor inputs is communicated to the pilot by message advisory alerts.

The AHRS (GRS 77) corrects for shifts and variations in the Earth's magnetic field by applying the Magnetic Field Variation Database. The Magnetic Field Variation Database is derived from the International Geomagnetic

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

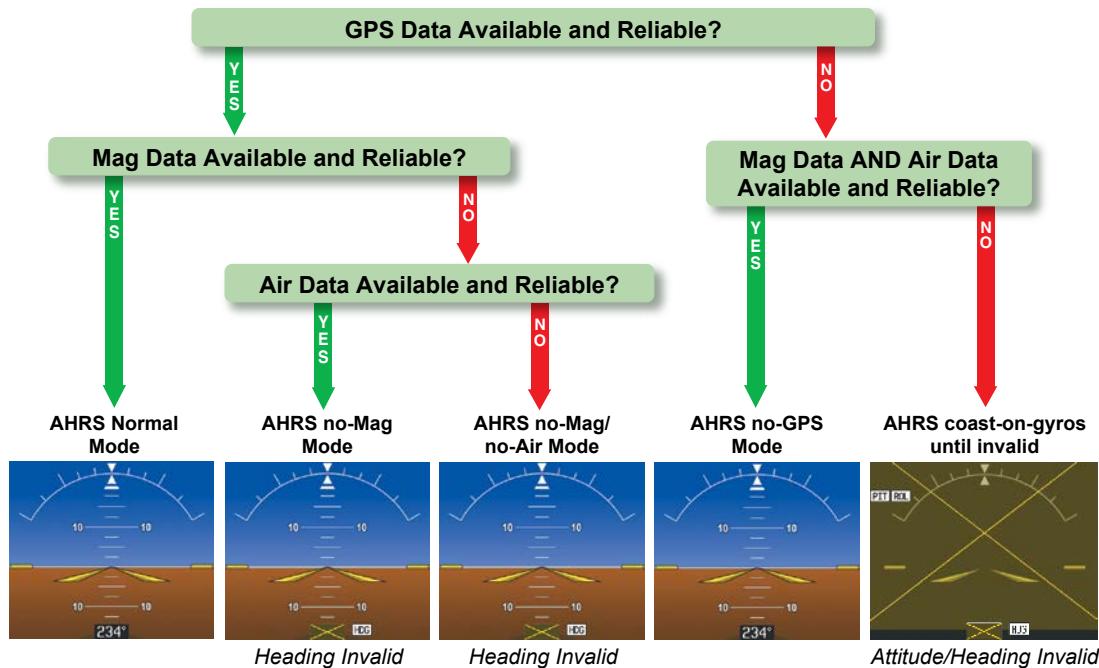


Figure 1-27 AHRS Operation

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 an alert 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 No-Magnetometer modes and continues to output valid attitude information. However, if the aircraft is airborne, the heading output on the PFD does become invalid (as indicated by an amber "X").

AIR DATA INPUT FAILURE

Failure of the air data input has no 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.

GPS RECEIVER OPERATION

Each GIA 63W Integrated Avionics Unit (IAU) contains a GPS receiver. Information collected by the specified receiver (GPS 1 for the #1 IAU or GPS 2 for the #2 IAU) may be viewed on the GPS 1 or GPS 2 STATUS Pane and the GPS Status Screen on the Touchscreen Controller (refer to Figure 1-28).



NOTE: A sensor 'Check Position' System Message may be displayed due to sensor differences resulting from interference when taxiing around hangers or other structures.

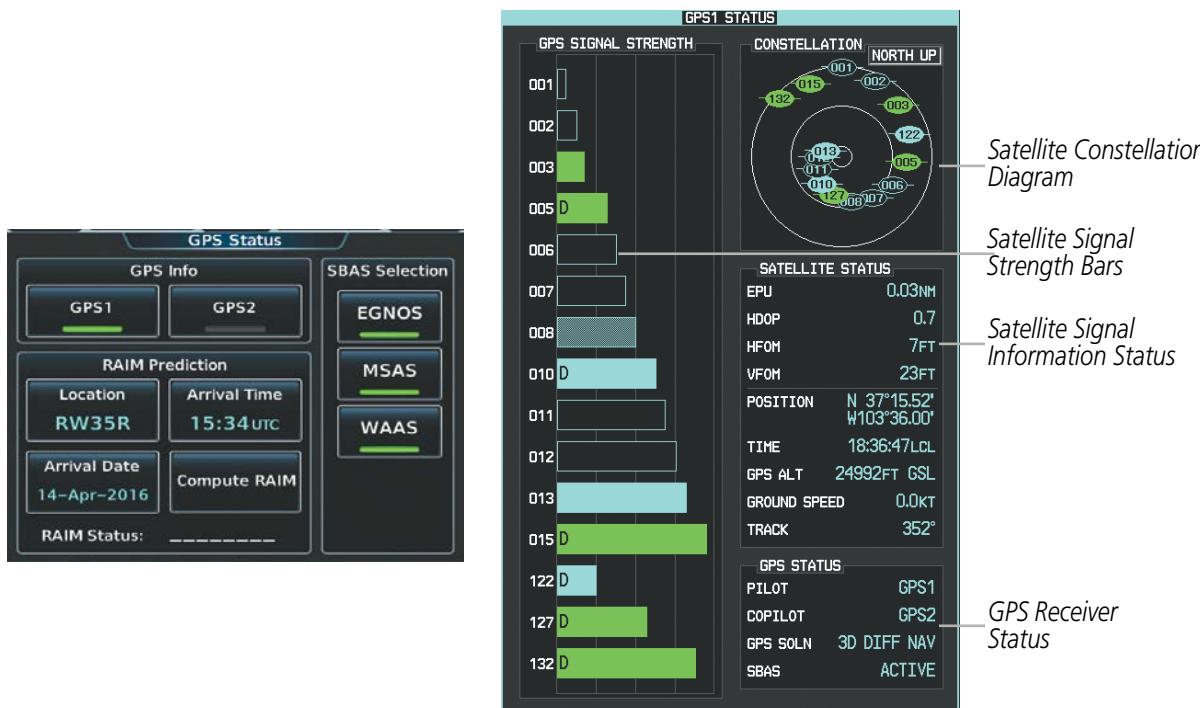


Figure 1-28 GPS Receiver Information

Selecting the GPS receiver information to display on the highlighted pane:

- 1) From **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 will be green when selected on. The system displays the GPS2 STATUS Pane.

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

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

If the sensor annunciation persists, check for a system failure message by touching the **MSG** Button on Touchscreen Controller. If no failure message exists, check the GPS STATUS Pane and compare the information for GPS 1 and GPS 2. Discrepancies may indicate a problem.

SATELLITE CONSTELLATION DIAGRAM

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

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

SATELLITE SIGNAL STATUS

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

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

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

GPS RECEIVER STATUS

The GPS solution type (ACQUIRING, 2D NAV, 2D DIFF NAV, 3D NAV, 3D DIFF NAV) for the active GPS receiver (GPS 1 or GPS 2) is shown in the right center of the GPS 1 and GPS 2 STATUS Display. When the receiver is in the process of acquiring enough satellite signals for navigation, the receiver uses satellite orbital data (collected continuously from the satellites) and last known position to determine the satellites that should be in view. ACQUIRING is indicated as the solution until a sufficient number of satellites have been acquired for computing a solution.

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

GPS SATELLITE SIGNAL STRENGTHS

The GPS1 and GPS2 STATUS Panes can be helpful in troubleshooting weak (or missing) signal levels due to poor satellite coverage or installation problems. As the GPS receiver locks onto satellites, a signal strength bar is displayed for each satellite in view, with the appropriate satellite PRN number (01-32 or 120-138 for WAAS) below each bar. The progress of satellite acquisition is shown in three stages, as indicated by signal bar appearance:

- No bar—Receiver is looking for the indicated satellite
- Hollow bar—Receiver has found the satellite and is collecting data
- Cyan bar—Receiver has collected the necessary data and the satellite signal can be used
- Green bar—Satellite is being used for the GPS solution
- Checkered bar—Receiver has excluded the satellite (Fault Detection and Exclusion)
- “D” indication—Denotes the satellite is being used as part of the differential computations

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

SBAS SELECTION

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

Enabling/Disabling Individual SBAS Providers:

- 1) From **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.

RAIM (RECEIVER AUTONOMOUS INTEGRITY MONITORING) PREDICTION

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

Receiver Autonomous Integrity Monitoring (RAIM) is a GPS receiver function that performs a consistency check on all tracked satellites. RAIM ensures 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 GPS STATUS Pane cannot be viewed in a reversionary display pane. Use the Joystick to highlight the PFD to access RAIM prediction, or highlight a non-reversionary display pane to view the GPS STATUS Pane and/or access RAIM prediction.

Predicting RAIM availability:

- 1) From **Home**, touch **Utilities > GPS Status**.
- 2) Touch the **Location** 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 or touch the **Waypoint** Button to enter waypoint information.
- 3) If the **Waypoint** Button was touched in step 2, enter the waypoint identifier using the alphanumeric buttons. If the **Present Position** Button was touched in step 2, proceed to step 5.
- 4) Touch the **Enter** Button.
- 5) The location selected for RAIM prediction is now displayed on the **Location** Button.
- 6) Touch the **Arrival Time** Button.
- 7) Enter the planned arrival time for the selected location using the numeric buttons
- 8) Touch the **Enter** Button. The time is now displayed on the **Arrival Time** Button.
- 9) Touch the **Arrival Date** Button.
- 10) Touch the button for the desired year. If necessary, touch and drag in the window, or use the **Up** and **Down** buttons to display the desired year.
- 11) Touch the button for the desired month. If necessary, touch and drag in the window, or use the **Up** and **Down** buttons to display the desired month.
- 12) Touch the button for the desired day. If necessary, touch and drag in the window, or use the **Up** and **Down** buttons to display the desired day. The selected date is now displayed on the **Arrival Date** Button.
- 13) Touch the **Compute RAIM** Button. One of the following will be displayed in the RAIM Status field.
 - 'Computing'—RAIM calculation in progress
 - 'Available'—RAIM is predicted to be available for the specified waypoint, time, and date
 - 'Not Available'—RAIM is predicted to be unavailable for the specified waypoint, time, and date
 - '_____'—RAIM has not been computed for the specified waypoint, time, and date combination

ANNUNCIATIONS

When an LRU or an LRU function fails, a large 'X' is typically displayed on windows associated with the failed data (Figure 1-29). Depending on the LRU, the 'X' may be amber or red. Upon system power-up, certain instruments remain invalid as equipment begins to initialize. All windows should be operational within one minute of power-up. If any window remains flagged, the system should be serviced by a Garmin-authorized repair facility.



NOTE: For a detailed description of all annunciations and alerts, refer to Appendix A. Refer to the Airplane Flight Manual (AFM) for additional information regarding pilot responses to these annunciations.



Figure 1-29 System Failure Annunciations

1.5 FMS INITIALIZATION

FMS Initialization is a process that prompts the flight crew to perform system checks and enter data to enable FMS functions and is completed prior to each flight using the Touchscreen Controllers. The Initialization Screen that appears on the Touchscreen Controllers upon power-up includes tasks prompting the crew to select a Crew Profile, set weight and fuel values and enter a flight plan. Figure 1-47 shows an example of the Initialization Screen.



Figure 1-47 Initialization Screen

Each Initialization Task is represented on the Initialization Screen by a button, which includes a descriptive icon and a check box. Each button provides a shortcut to the Touchscreen Controller screen represented by the button's icon. Upon successful completion of each Initialization Task, a green check mark will appear in the corresponding check box on the Initialization Screen.

Once all Initialization Tasks are marked complete, touch **Accept Initialization** to exit the Initialization Screen and open 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 Figure 1-48. Touching the **OK** Button on the pop-up screen acknowledges the incomplete initialization and opens the Home Screen; touching the **Cancel** Button removes the pop-up.

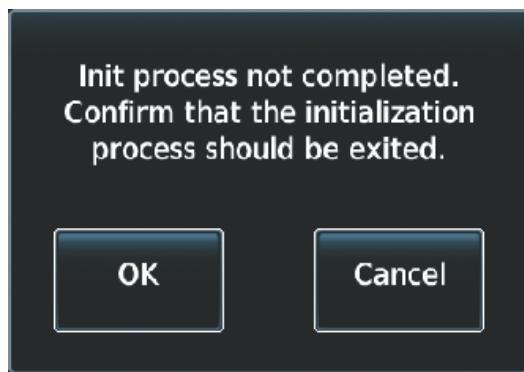


Figure 1-48 System Initialization Exit Confirmation

Failure to complete each Initialization Task may result in degraded FMS performance, but any of these tasks may be completed or revised at any time during the same power cycle. The G3000 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 **Home > Utilities > Initialization**.

FMS 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 FMS:

- 1) Touch **Crew Profile** and select a Crew Profile from the list of available profiles. (See the discussion on Crew Profiles later in this section for more information on creating, importing, and exporting Crew Profiles)
- 2) Touch **Weight and Fuel** to proceed to the Weight and Fuel Screen to input values for Operating Weight, Payload, Fuel, Takeoff and Landing. (See Weight and Fuel details in the Flight Management > Weight and Fuel Planning section).
- 3) Touch **Next** to proceed to the Active Flight Plan Screen to add the origin airport, add enroute waypoints, and add the destination airport. (See Flight Management > Flight Planning for details).
- 4) Touch the **INIT** Button to return the Initialization Screen. As each task is completed a green checkmark appears in the Completed column on the Initialization Screen



Figure 1-49 FMS Initialization Tasks Completed

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

1.6 SYSTEM MANAGEMENT

The Touchscreen Controllers allow management of various system parameters, in addition to providing status and database information for the system.

AVIONICS SETTINGS

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

SYSTEM SETTINGS

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



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 **Home**, touch **Utilities > Setup > Avionics Settings**.
- 2) If necessary, touch the **System** tab.
- 3) Touch the Time Format button (displays currently selected time format in cyan).
- 4) Touch a time format option button (**Local 12hr**, **Local 24hr**, or **UTC**).

Setting the Time Offset value (not available if time format is UTC):

- 1) From **Home**, touch **Utilities > Setup > Avionics Settings**.
- 2) If necessary, from the **System** Tab.
- 3) Touch the Time Offset button (currently selected time offset shown in cyan).
- 4) Input the desired value using the numeric keypad or the large and small right knobs.
- 5) Touch the **Enter** Button.

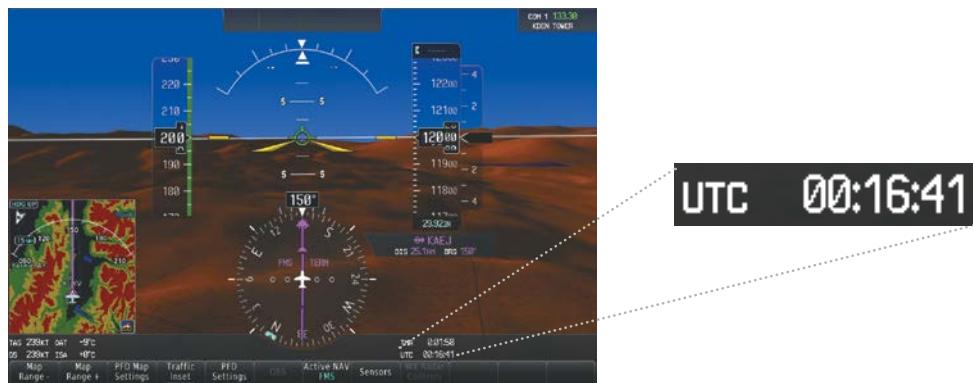


Figure 1-50 System Time (UTC Format)

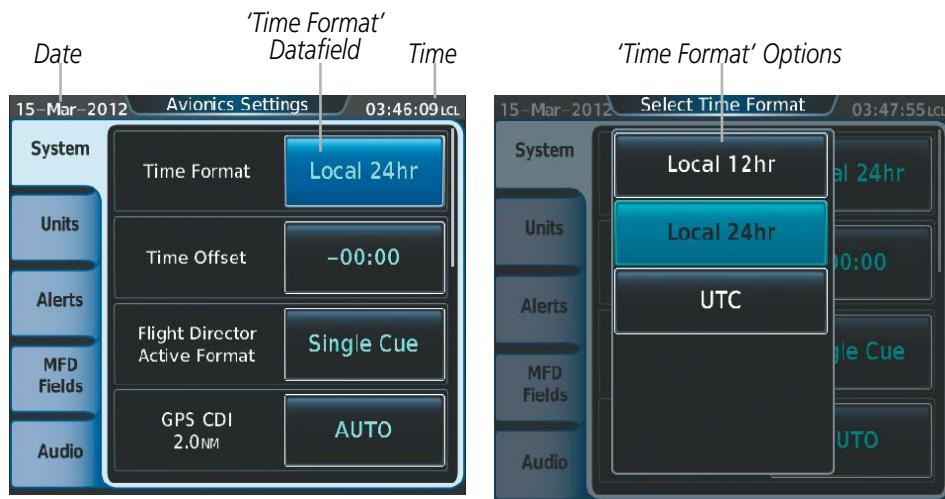


Figure 1-51 Time Format Settings

Setting the Flight Director Active Format:

- 1) From **Home**, touch **Utilities > Setup > Avionics Settings**.
- 2) If necessary, touch the **System** tab.
- 3) Touch the Flight Director Active Format button to display a list of Flight Director formats (button displays currently selected Flight Director Active Format in cyan).
- 4) Touch either the **Single Cue** or **Dual Cue** Buttons.

GPS CDI

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

Setting the GPS CDI Range:

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

COM CHANNEL SPACING

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

Setting COM Channel Spacing:

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

STABILITY AND PROTECTION

The Stability and Protection System can be enabled or disabled.

Enabling/disabling the stability and protection system:

- 1) From **Home**, touch **Utilities > Setup > Avionics Settings**.
- 2) If necessary, touch the **System** tab.
- 3) Scroll to and touch the Stability & Protection **Enable** Button to enable/disable the system. Button annunciator is green when system is enabled, gray when disabled.

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 . Default settings are 3000 feet (or meters) for runway length and “HARD Only” for runway surface type.

Setting the Nearest Airport surface matching criteria:

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

Setting the Nearest Airport Minimum Runway Length matching criteria:

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

SHOW AIRPORT CHART ON LANDING

The system will automatically display the destination airport chart upon landing.

Turning Show Airport Chart on Landing on/off:

- 1) From **Home**, touch **Utilities > Setup > Avionics Settings**.
- 2) If necessary, touch the **System** tab.
- 3) Scroll to and touch the **Show Airport Chart on Landing** Button to display the On or Off option.
- 4) Touch the **On** Button to enable the function.

Or:

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

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. Also affects the BRG, DTK, TKE, TRK, and XTK fields.

- Distance/Speed (nautical, metric)

Affects all distance/speed displays.

- Altitude/Vertical Speed (feet/feet per minute, meters/meters per minute)

Affects all altitude/vertical speed displays.

- External Temperature (Celsius (°C), Fahrenheit (°F))

Affects displayed external temperature readout.

- Fuel (gallons, pounds)

Affects all fuel displays.

- Position Format (HDDD°MM.MM', HDDD°MM'SS.S")

Affects all position displays.

Changing unit settings:

- 1) From **Home**, touch **Utilities > Setup > Avionics Settings**.
- 2) If necessary, touch the **Units** tab.
- 3) Scroll if necessary and touch button corresponding to the units to be changed (current units selection displayed in cyan).
- 4) Touch a units button from the list.

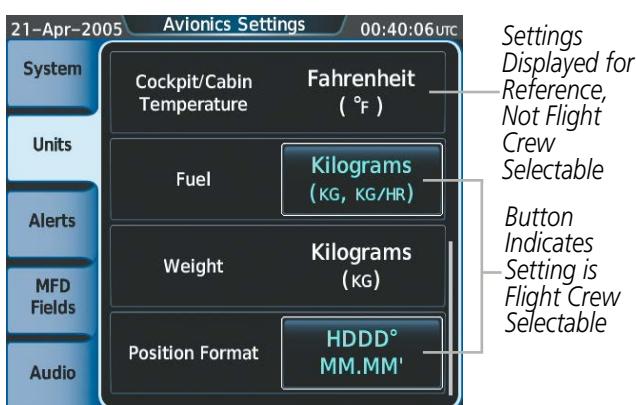


Figure 1-52 Viewing Unit Data on the Avionics Settings Screen

ALERTS SETTINGS



- Baro transition alert climb
- Baro transition alert descent
- SurfaceWatch alert inhibit
- Airspace alert altitude buffer
- Arrival Alert
- Class B/TMA airspace alert
- Class C/TCA airspace alert
- Class D airspace alert
- Restricted airspace alert
- MOA (Military) airspace alert
- Other (ADIZ) airspace alert

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

- Baro transition alert (climb and descent)
- SurfaceWatch alert inhibit
- Altitude buffer distance alert
- Arrival alerts
- Airspace alerts

BARO TRANSITION ALERT SETTINGS

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

Configuring the Baro Transition Alerts:

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

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.

Inhibiting/enabling SurfaceWatch:

- 1) From the **Home** Screen, touch **Utilities > Setup > Avionics Settings**.
- 2) If necessary, touch the **Alerts** Tab.
- 3) Touch the **SurfaceWatch Inhibit** Button. SurfaceWatch is inhibited when button annunciator is green, enabled when gray.

ARRIVAL ALERT SETTINGS

Enabling/disabling Arrival Alerts:

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

Setting the Arrival Alert distance:

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

AIRSPACE ALERTS

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

Alerts for the following airspaces can be turned enabled/disabled:

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

Enabling/disabling an airspace alert:

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

- 3) Scroll as necessary and touch any of the following buttons to enable/disable the corresponding alert: **CLASS B/TMA**, **CLASS C/TCA**, **CLASS D, RESTRICTED**, **MOA (MILITARY)**, **OTHER/ADIZ**. Button annunciator is green when alert is enabled, gray when disabled.

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

Setting the altitude buffer distance:

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

MFD FIELDS SETTINGS



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

The MFD Navigation Status Bar can display up to eight navigation data bar fields. By default, the Navigation Status Bar displays Ground Speed (GS), Desired Track (DTK), Track (TRK), Estimated Time Enroute (ETE), Bearing (BRG), Distance (DIS), Minimum Safe Altitude (MSA), and Estimated Time of Arrival (ETA). The system assigns each data bar field a corresponding number, 1 through 8, as displayed from left-to-right in the MFD Navigation Status Bar.

Change the information shown in an MFD Data Bar field:

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

- 3) Scroll as needed and touch the MFD Data Bar Field button to be changed (1 through 8); current selection for each data bar field displayed in cyan.
- 4) Scroll as needed and touch the button corresponding to the desired data to be shown in the selected MFD Data Bar Field.

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

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

AUDIO SETTINGS



- Audio Alert Voice

AUDIO

From the **Audio** Tab the audio alert voice gender can be set to male or female.

To change the audio alert voice:

- 1) From **Home**, touch **Utilities > Setup > Avionics Settings**.
- 2) If necessary, touch the **Audio** Tab.
- 3) Touch the Audio Alert Voice button (current voice gender displayed in cyan).
- 4) Touch the audio alert voice gender button (**Male** or **Female**).

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 on the Crew Profile screen. By default, 'DEFAULT PROFILE' is the active crew profile. This profile cannot be deleted or renamed.

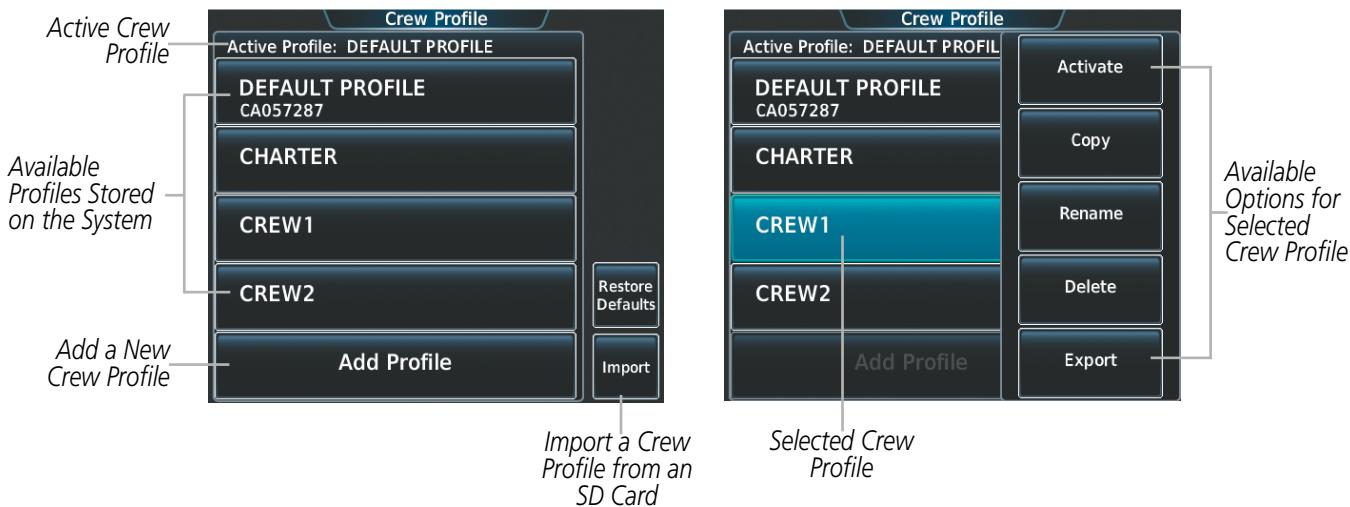


Figure 1-53 Managing Crew Profiles on the Crew Profile Screen

Adding a new crew profile:

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

Activating a crew profile:

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

Copying an existing crew profile:

- 1) From **Home**, touch **Utilities > Crew Profile**.
- 2) Scroll if necessary, and touch the button for the crew profile to be copied.
- 3) Touch the **Copy** Button.
- 4) Input the name to assign to the copied crew profile using the keypad or the large and small right knobs. Crew Profiles may be up to 16 characters long, and cannot share the exact name of another crew profile.
- 5) Touch the **Enter** Button or press the right knob. The Crew Profile screen displays the name of the copied profile in the list.

Renaming an existing crew profile:

- 1) From **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 right knobs. Crew Profiles may be up to 16 characters long, and cannot share the exact name of another crew profile.
- 5) Touch the **Enter** Button or press the right knob. 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 **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 **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 **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.

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 LRU. An amber 'X' box indicates a failed LRU. Inform a service center or Garmin dealer a LRU has failed.

Viewing LRU information:

- 1) From **Home**, touch **Utilities > Setup > Avionics Status**.
- 2) If necessary, touch the **LRU Info** Tab.
- 3) Scroll as needed and touch a LRU button to display a pop-up window with additional information for the selected LRU.
- 4) When finished, touch **Back** or **Home**.

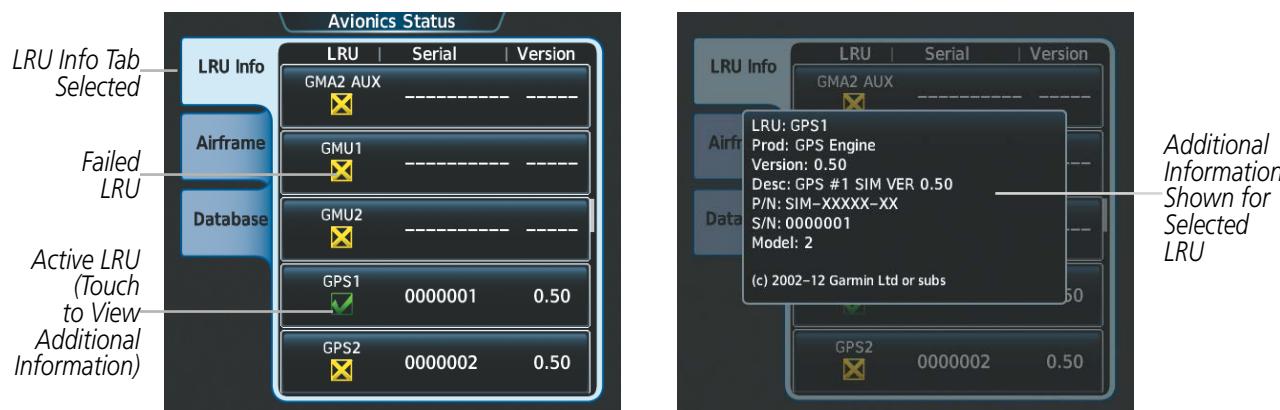


Figure 1-54 Viewing LRU Info Information on the Touchscreen Controller

AIRFRAME

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

Viewing airframe information:

- 1) From **Home**, touch **Utilities > Setup > Avionics Status**.
- 2) If necessary, touch the **Airframe** Tab.
- 3) Scroll as needed to view the airframe information.

DATABASE

The Database Tab of the Avionics Status screen displays pertinent information on all system databases (PFD1, PFD2, MFD1, GTC1, and GTC2).

Viewing database information:

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

SIRIUSXM INFORMATION



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

Viewing SiriusXM Information:

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

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

It is not required to activate both the entertainment and weather service subscriptions with the GDL 69A. Either or both services can be activated. SiriusXM uses one or both of the coded IDs to send an activation signal.

These IDs are located:

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

Activating SiriusXM Weather and SiriusXM Satellite Radio:

- 1) Position the aircraft so the GDL 69A antenna has an unobstructed view of the sky.
- 2) From **Home**, touch **Utilities > Setup > SiriusXM Info > Start**. Touchscreen Controller displays 'ACTIVATING'.
- 3) When system indicates activation has completed, touch '**Lock**' to save the activation changes, or touch '**Cancel**' to exit without saving changes.

SYSTEM TESTS



NOTE: Refer to the Airplane Flight Manual (AFM) for system test procedures and corrective actions.

The System Tests screen on the Touchscreen Controller provides a central location for testing the following aircraft systems:

- Annunciators
- Fuel RTN (only available in Maintenance mode)
- Traffic Collision & Avoidance System/Traffic Avoidance System (TCAS/TAS) Self Test
- Terrain Avoidance & Warning System (TAWS)

System tests may be executed by touching the associated test button on the Touchscreen Controller. Two sequences are available. If a test is not available (for example, a particular test may not be unavailable on the ground), the associated test button will have a diminished appearance, and it cannot be selected. While a test sequence is active, the other test buttons are unavailable for selection.



Figure 1-55 System Tests Screen

If a system has not been tested since the last power cycle, or a test is otherwise incomplete, the test button displays cyan dashes. While a system test is occurring, the test button displays an animated cyan 'In Progress' indication. Only one system test may occur at a time; if another test is selected, the currently active test is cancelled and the selected test is then activated.

While a system test is occurring, visual or aural annunciations may occur depending on the test. Refer to the AFM for specific procedures associated with each test. When the test is complete, the test button displays a cyan 'Done', green 'Pass', or amber 'Fail' indication.

Testing an individual system:

- 1) From **Home**, touch **Aircraft Systems > System Tests**.
- 2) Touch an available test button. Button displays an animated 'In Progress' indication while a test is occurring.

Cancelling an individual system test in progress:

On the System Tests screen, touch the button indicating 'In Progress'.

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 **Home**, touch **Utilities > Screen Cleaning**.
- 2) The Touchscreen Controller indicates the screen may be cleaned. Clean the screen as needed.
- 3) Press or turn any knob to return to the Utilities Screen.

1.7 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). 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.

Setting the generic timer:

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

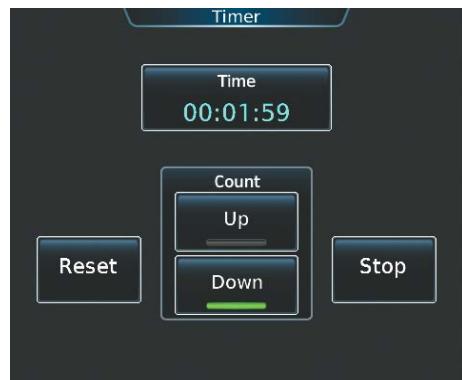


Figure 1-56 Timer (Touchscreen Controller)



Figure 1-57 Timer (PFD)

TRIP STATS

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 **Home**, touch **Utilities > Trip Stats**.
- 2) Touch the Flight Time **Start At** Button (Figure 1-58).
- 3) Touch either the **Power On** or **In-Air** Button to select the Start At time and return to the Trip Statistics Screen.

Resetting the flight timer:

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



Figure 1-58 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 time criterion:

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

Resetting the departure time:

- 1) From **Home**, touch **Utilities > Trip Stats**.
- 2) Touch the 'Departure Time' Datafield Button.
- 3) Touch the **Reset** Button to reset the departure time or touch the **Cancel** Button.

ARRIVAL TIME

The system records the time at which arrival occurs. The arrival time is reset when the system is powered-up, when the aircraft becomes airborne, or manually.

Setting the arrival time reset criterion:

- 1) From **Home**, touch **Utilities > Trip Stats**.
- 2) Touch the Arrival Time **Reset** Button.
- 3) Touch either the **Power On, In-Air** or **Manually** Button to select the reset mode and return to the Trip Statistics Screen.

Resetting the arrival time:

- 1) From **Home**, touch **Utilities > Trip Stats**.
- 2) Touch the 'Arrival Time' Datafield Button.
- 3) Touch the **Reset** Button to reset the arrival time or touch the **Cancel** Button.

ODOMETER

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

Setting the odometer reset criterion:

- 1) From **Home**, touch **Utilities > Trip Stats**.
- 2) Touch the Odometer **Reset** Button.
- 3) Touch the **Power On, In-Air, or Manually** Button to select the reset mode and return to the Trip Statistics Screen. Note manual reset is always available even if an automatic reset mode is selected.

Manually resetting the odometer:

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

TRIP ODOMETER

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

Setting the Trip Odometer automatic reset criterion:

- 1) From **Home**, touch **Utilities > Trip Stats**.
- 2) Touch the Trip Odometer **Reset** Button.
- 3) Touch the **Power On, In-Air, or Manually** Button to select the reset mode and return to the Trip Statistics Screen. Note manual reset is always available even if an automatic reset mode is selected.

Manually resetting the Trip Odometer:

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

AVERAGE GROUND SPEED

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

Setting the average ground speed reset criterion:

- 1) From **Home**, touch **Utilities > Trip Stats**.
- 2) Scroll to display the 'Avg Ground Speed' buttons.
- 3) Touch the Avg Ground Speed **Reset** Button.
- 4) Touch the **Power On, In-Air, or Manually** Button to select the reset mode and return to the Trip Statistics Screen. Note manual reset is always available even if an automatic reset mode is selected.

Manually resetting the average ground speed:

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

MAXIMUM GROUND SPEED

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

Setting the Maximum Ground Speed reset criterion:

- 1) From **Home**, touch **Utilities > Trip Stats**.
- 2) Scroll to display the 'Max Ground Speed' buttons.
- 3) Touch the Max Ground Speed **Reset** Button.
- 4) Touch the **Power On, In-Air, or Manually** Button to select the reset mode and return to the Trip Statistics Screen. Note manual reset is always available even if an automatic reset mode is selected.

Manually resetting the maximum ground speed:

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

TRIP AIR ODOMETER

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

Setting the Trip Airborne Odometer automatic reset criterion:

- 1) From the **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 **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 **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 **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 **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 **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.

1.8 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 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, 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.

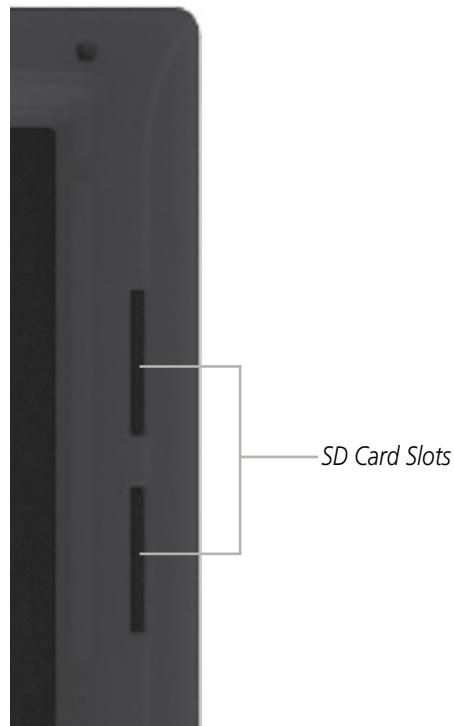


Figure 1-59 Display Bezel SD Card Slots

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SECTION 2 FLIGHT INSTRUMENTS



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

Increased situational awareness is provided by replacing the traditional instruments on the panel with 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 flags
 - True airspeed
 - Mach number
- Attitude Indicator with slip/skid indication
- Altimeter, showing
 - Trend vector
 - Barometric setting
 - Selected altitude
- Vertical Deviation, Glideslope, and Glidepath Indicators
- Vertical Speed Indicator (VSI)
- Vertical Navigation (VNV) indications
- 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
 - DME Information Window
- Transponder Mode, Code, and Ident/Reply
- Timer/References Window, showing
 - Generic timer
 - Vspeed values
 - Barometric minimum descent altitude (MDA)
- Wind data

The PFDs also display various alerts and annunciations.



Figure 2-1 Primary Flight Display (Default)

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

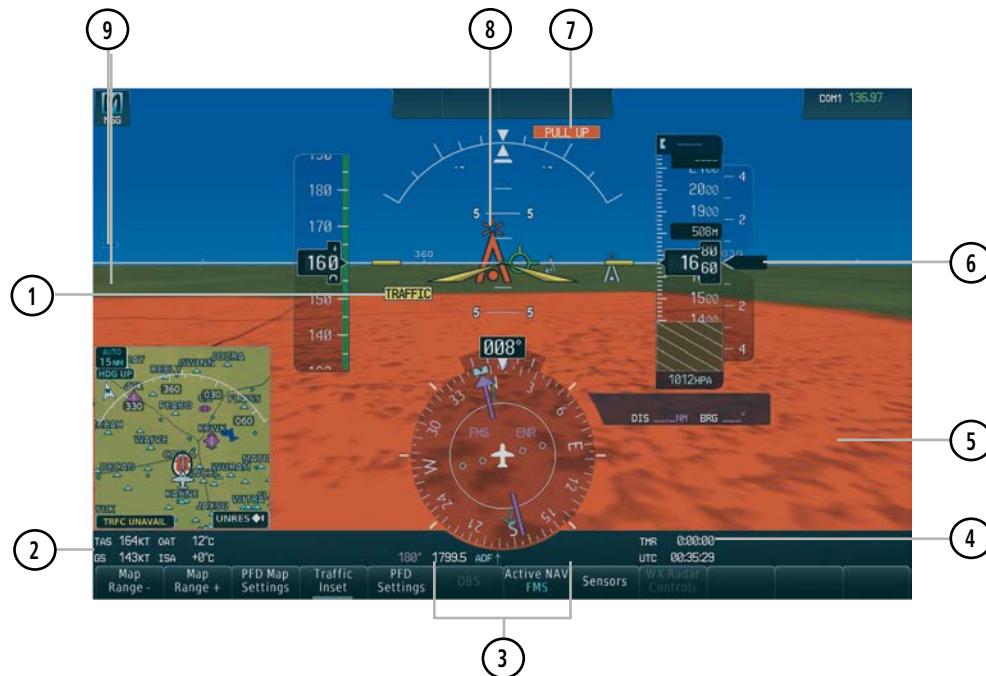


Figure 2-2 Primary Flight Display (Additional Information)

- ① Traffic Annunciation
- ② True Air Speed, Ground Speed
- ③ Bearing Information Windows
- ④ Timer
- ⑤ Terrain Warning
- ⑥ Current Vertical Speed
- ⑦ Pull Up Annunciation
- ⑧ Obstacle Alert
- ⑨ Airport Sign

2.1 FLIGHT INSTRUMENTS

AIRSPED INDICATOR



NOTE: Refer to the Pilot's Operating Handbook (POH) 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 V_{MO} .

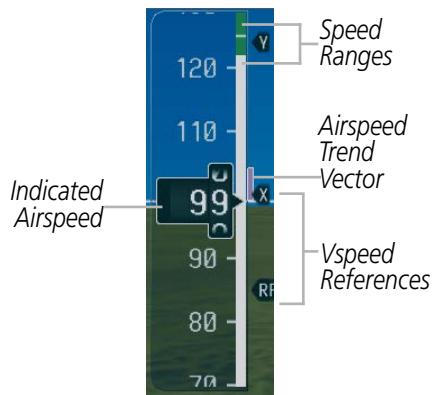


Figure 2-3 Airspeed Indicator

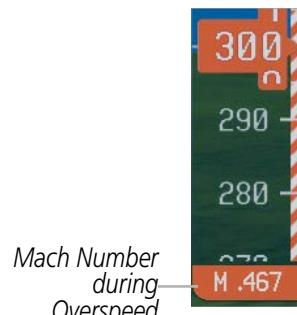


Figure 2-4 Overspeed Indications

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

The 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.

Vspeeds (V_R , V_X , V_Y , and V_{APP}) can be changed and the Vspeed flags can be turned on/off from the Performance Window. When active (on), the Vspeeds are displayed at their respective locations to the right of the airspeed scale. All Vspeed values are reset and all Vspeed flags are turned off during power up.

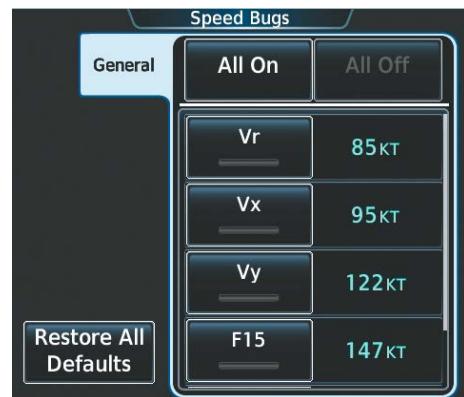


Figure 2-5 Speed Bugs

Enabling/disabling Vspeed bugs as a group:

- 1) From **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 **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.

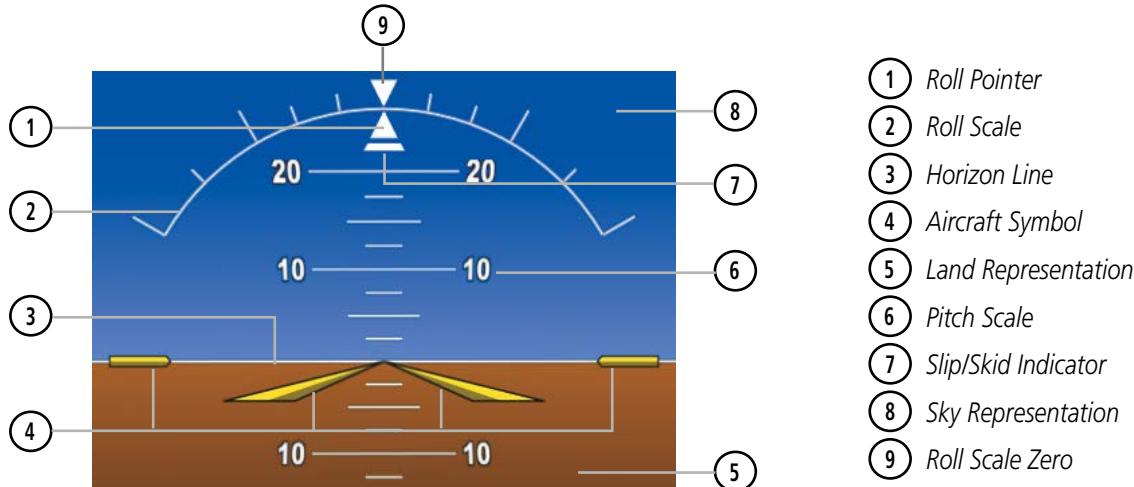


Figure 2-6 Attitude Indicator

The horizon line is part of the pitch scale. Above and below the horizon line, major pitch marks and numeric labels are shown 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°.

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

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



Figure 2-7 Slip/Skid Indication

The white symbolic aircraft on the Attitude Indicator changes appearance based on selection of AFCS Flight Director Command Bar format (see the AFCS Section for details). Both PFDs show the same Command Bar format and Aircraft Symbol. The Command Bar format (single cue or dual cue) may be selected on the Touchscreen Controller Avionics Settings Screen (Figure 2-8).



Figure 2-8 Flight Director Format Settings

Changing Command Bar and Aircraft Symbol format:

- 1) From Home Screen, touch **Utilities> Setup> Avionics Settings**.
- 2) Touch the **System** Tab.
- 3) Touch the **Flight Director Active Format** Data Field.
- 4) Touch desired setting (**Single Cue or Dual Cue**)

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 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.

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.

SELECTED ALTITUDE

Setting the Selected Altitude:

Turn the **ALT SEL** Knob to set the Selected Altitude in 100-ft increments (increments reduce to 10 feet for approach) up to the aircraft's service ceiling. When meters are displayed, Selected Altitude is adjusted in 50 meter increments.

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

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

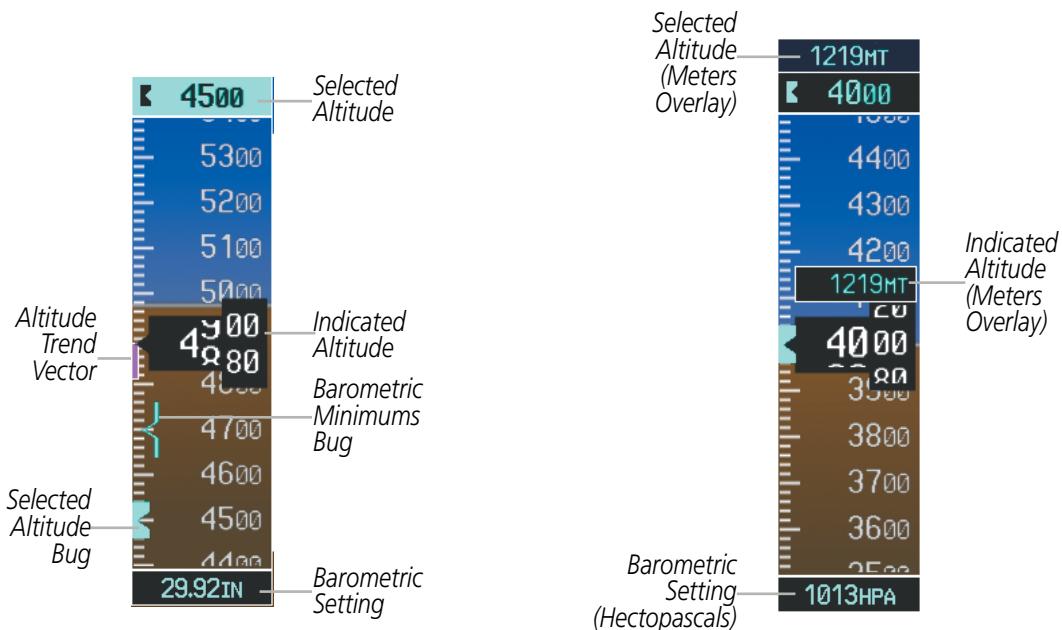


Figure 2-9 Altimeter (Standard and Metric)

ALTITUDE DISPLAY UNITS

Altitudes can also be displayed in meters as an overlay (Figure 2-9). Note that the altitude tape does not change scale. When the metric value is selected, it is displayed in a separate box above the Selected Altitude, and above the current altitude. Note the altitude tape does not change scale when the metric overlays are enabled.

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.

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

ALTIMETER SETTING



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.



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

Selecting the altimeter barometric pressure setting:

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

Selecting standard barometric pressure (STD BARO):

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

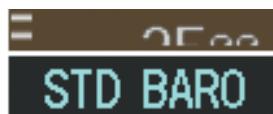


Figure 2-10 Standard Barometric Altimeter Setting

Changing altimeter barometric pressure setting units:

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

If the barometric altimeter settings differ between PFDs the readouts turn amber (Figure 2-11). The settings can be synchronized from the AUX - System Setup Page on the MFD. Once the settings are synchronized (BARO SYNCHRONIZATION turned on), they remain synchronized for the entire flight.

Synchronizing the altimeter barometric pressure settings:

- 1) From the **Home** Screen, 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 setting synchronization setting (**On** or **Off**).

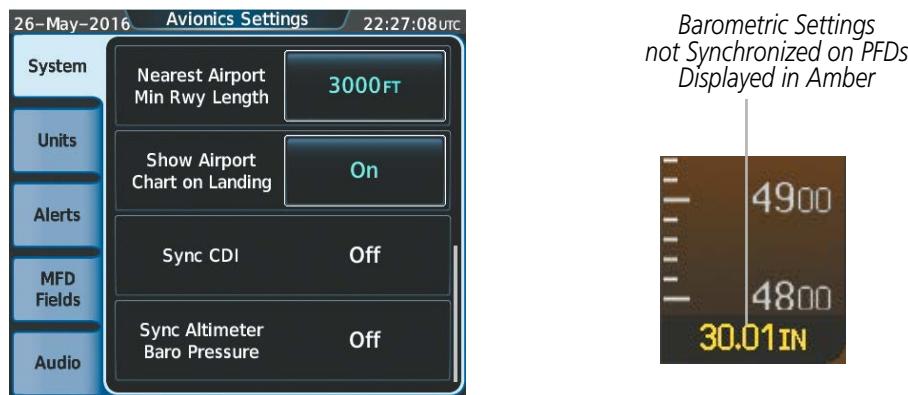


Figure 2-11 Sync Altimeter Baro Pressure

BAROMETRIC TRANSITION ALTITUDE ALERT

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

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

Setting the Baro Transition Alert:

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



Figure 2-12 Baro Transition Alert

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 (Figure 2-13). 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 Section 2.2, Supplemental Flight Data, for more information about VNV indications on the PFD.

VERTICAL DEVIATION



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

The Vertical Deviation Indicator (VDI) is a magenta chevron to indicate the vertical deviation when Vertical Navigation (VNV) is being used. The VDI (Figure 2-13) appears in conjunction with the “TOD within 1 minute” alert. Full-scale deflection (two dots) is 1000 feet. The VDI is removed from the display if vertical deviation becomes invalid. See the Flight Management and AFCS sections for details on VNV features, and refer to Section 2.3, Supplemental Flight Data, for more information about VNV indications on the PFD.

The Glideslope Indicator (Figure 2-14) 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.



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

The Glidepath Indicator (Figure 2-15) is a vertical deviation scale for FMS approach service levels supporting SBAS vertical guidance (LNAV+V, L/VNAV, LPV, LP+V). The Glidepath Indicator, a magenta diamond (Figure 2-15) appears on the display as soon as the Final Approach Fix (FAF) becomes the active waypoint, and FMS is the selected navigation source. Full-scale deflection (two dots), is angular with upper and lower limits. The upper limit is +/-492 feet (150 meters) and lower limits depend on approach service level.

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

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

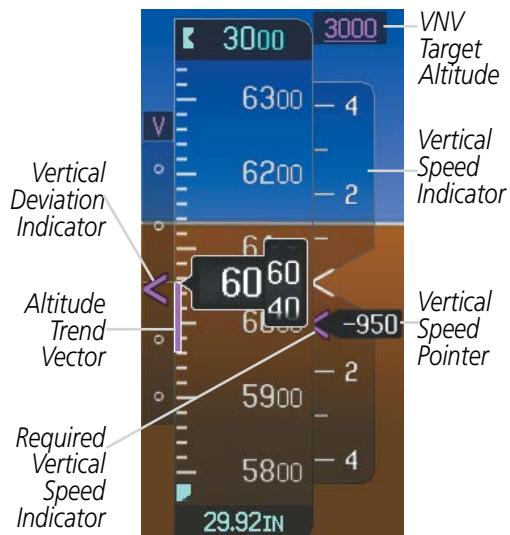


Figure 2-13 Vertical Speed and Deviation Indicators (VSI and VDI)

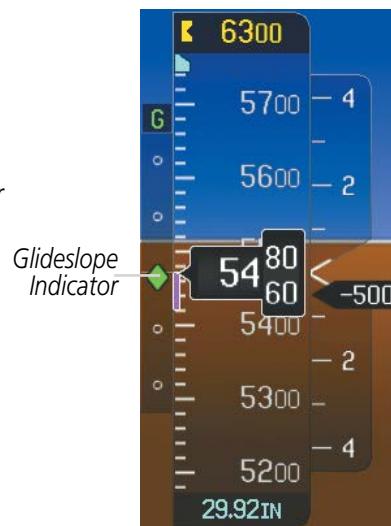


Figure 2-14 Glideslope Indicator



Figure 2-15 Glidepath Indicator

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).

Changing the HSI display format:

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

The 360° HSI 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. With the HSI Map function enabled, an inset map is inserted into the HSI and shows the above items as well.

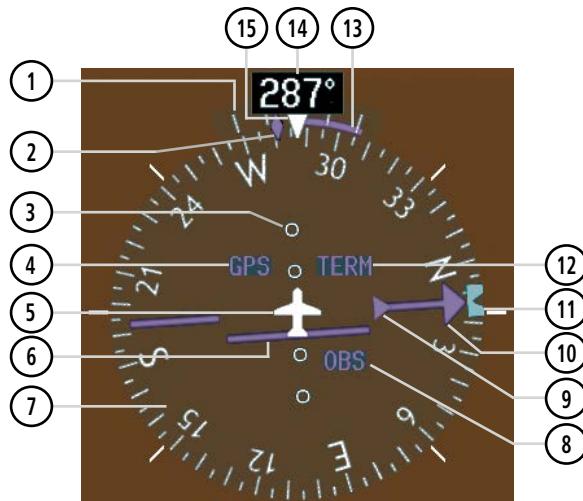


Figure 2-16 Horizontal Situation Indicator (HSI)

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

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

Adjusting the Selected Heading:

Turn the **HDG** Knob to set the Selected Heading.

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

The Selected Course is shown to the upper right of the HSI for three seconds after being adjusted. While the HSI is displayed as an arc, the Selected Course is displayed whenever the Course Pointer is not within the 140° currently shown.

Adjusting the Selected Course:

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

Press 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 2-17 Heading and Course Indications

Navigation angles (track, heading, course, bearing) are corrected to the computed magnetic variation (Mag Var) or referenced to true north (T), set on the MFD 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 2-18 Heading and Course Indications (True)

Changing the navigation angle setting:

- 1) From **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 2-19 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 2-20 Turn Rate Indicator and Trend Vector

BEARING POINTERS AND INFORMATION WINDOWS

Two bearing pointers and associated information can be displayed on the HSI for NAV, FMS, and ADF sources by pressing the **PFD Settings** Softkey then the **Bearing 1** or **Bearing 2** Softkey. The bearing pointers are cyan and are single-line (Bearing 1) or double-line (Bearing 2). A pointer symbol is shown in the information windows to indicate the navigation source. The bearing pointers never override the CDI and are visually separated from the CDI by a white ring. Bearing pointers may be selected but not necessarily visible due to data unavailability.

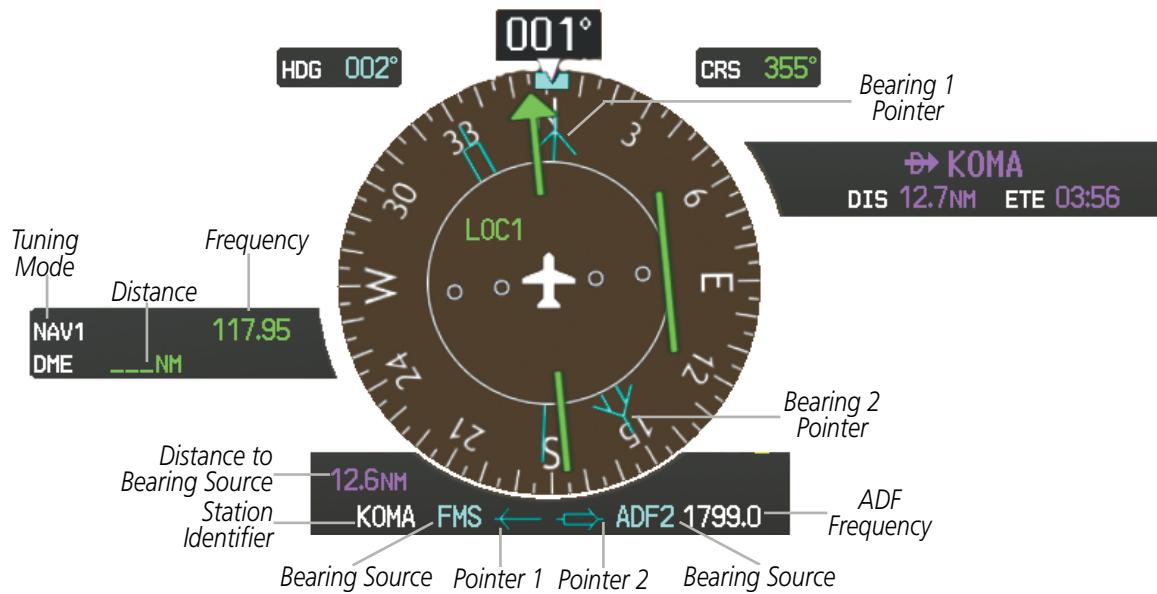


Figure 2-21 HSI with Bearing and Distance Information

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

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

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

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

Selecting bearing display and changing sources:

- 1) 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 FMS or ADF.
- 4) To remove the bearing pointer and information window, select the **Bearing** Softkey again.

DME INFORMATION WINDOW

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

COURSE DEVIATION INDICATOR (CDI)

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

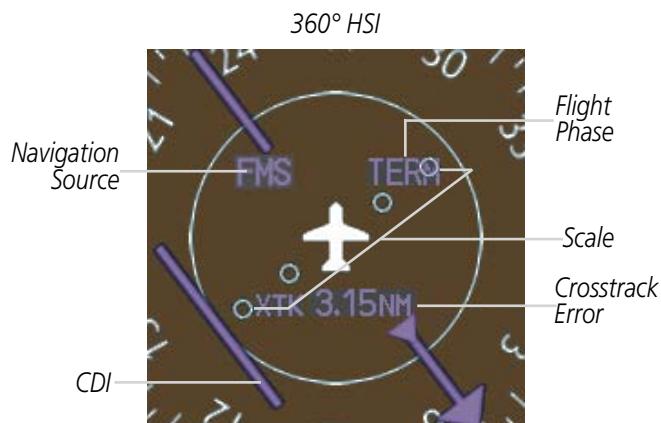


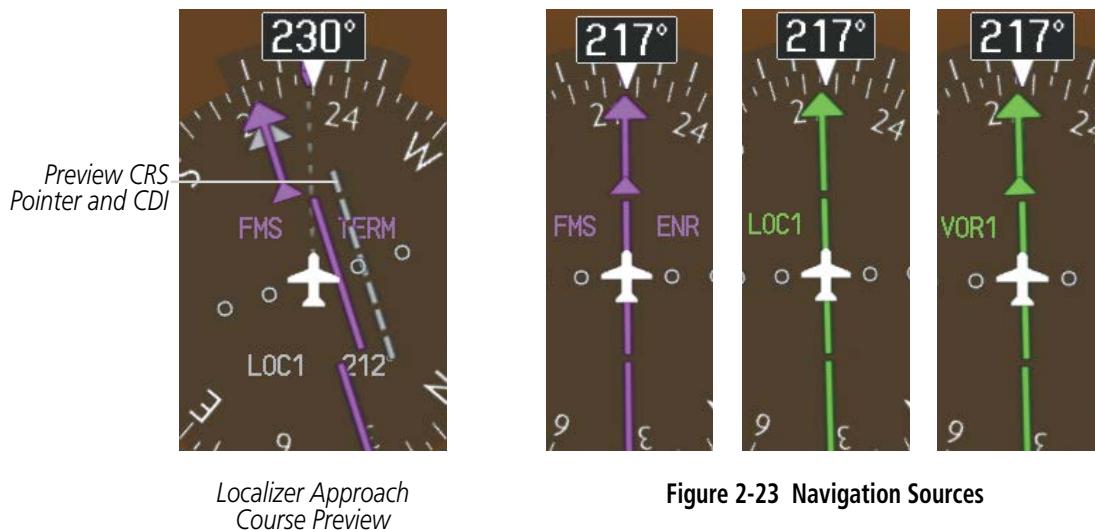
Figure 2-22 Course Deviation Indicator

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

An approach course preview appears as a dashed gray pointer and CDI on the HSI as shown on the left of Figure 2-23 when FMS is the selected navigation source and all of the following conditions are met:

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

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



Changing navigation sources:

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

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

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

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

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

If the same VOR/LOC navigation source is selected on both PFDs, the navigation source annunciation is amber on both displays if not synchronized. If the CDIs are synchronized ('Sync CDI' enabled), they indicate the same thing. When powering on the system for use, it recalls the last CDI synchronization setting.

Synchronizing the CDIs:

- 1) From the **Home** Screen, touch **Utilities >Setup > Avionics Settings**.
- 2) Touch the **System** Tab.
- 3) Scroll and touch the Sync CDI data field.
- 4) Touch a button for the desired setting (**On** or **Off**).



Figure 2-24 CDI Synchronization

On some ILS approaches where the glideslope intercept point is at or in close proximity to the FAF (see Figure 2-25), 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.

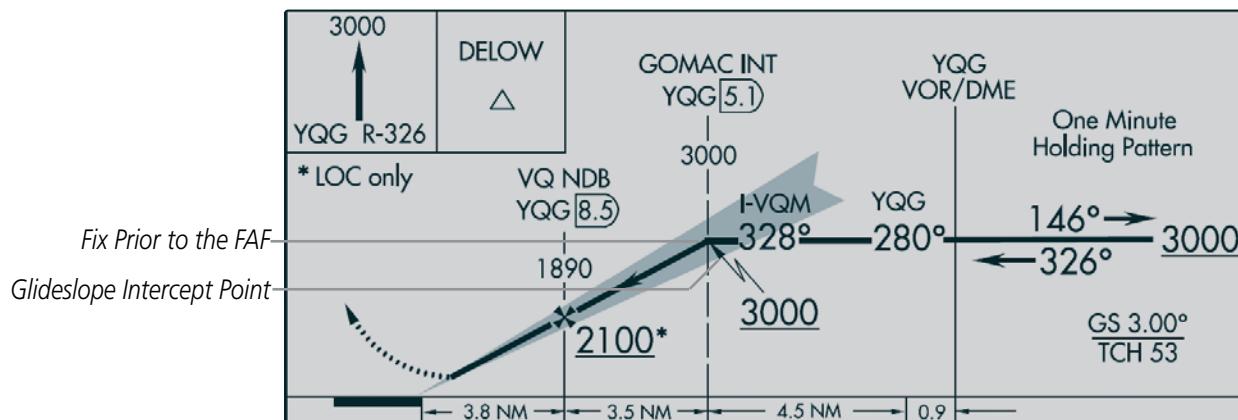


Figure 2-25 ILS Approach with Glideslope Intercept Point at Fix Prior to the FAF

GPS CDI SCALING

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

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

Changing the selected FMS CDI setting:

- 1) From **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 2-26 GPS CDI Settings

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

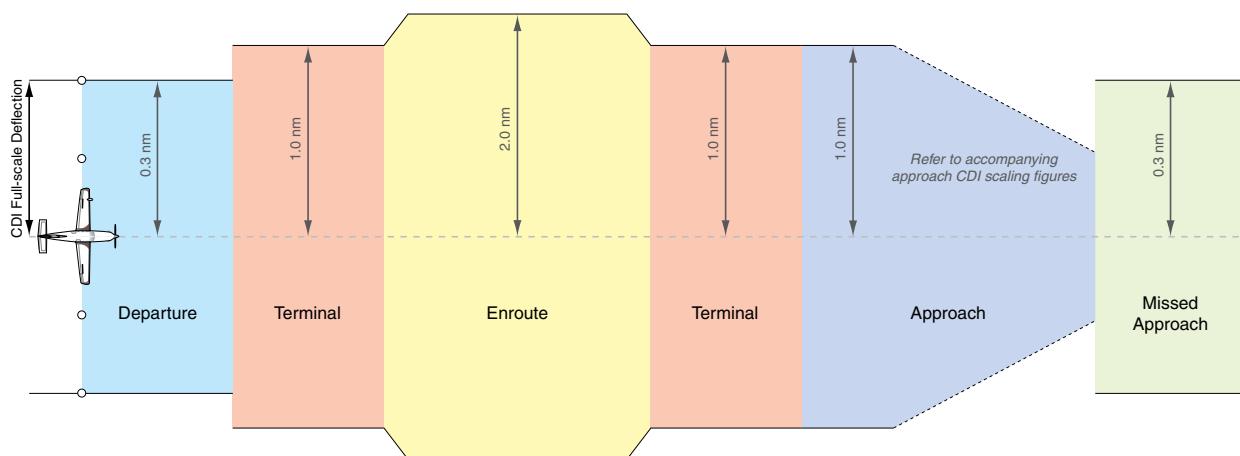


Figure 2-27 Automatic CDI Scaling

- 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 Glossary for leg type definitions)
 - After any leg in the departure procedure that is not a CA or FA
- At 30 nm from the departure airport, the **enroute** phase of flight is automatically entered and CDI scaling changes to 2.0 nm over a distance of 1.0 nm, except under the following conditions:
 - When navigating with an active departure procedure, the flight phase and CDI scale does not change until the aircraft arrives at the last departure waypoint (if more than 30 nm from the departure airport) or the leg after the last departure waypoint has been activated or a direct-to waypoint is activated.

- If after completing the departure procedure the nearest airport is more than 200 nm away from the aircraft and the approach procedure has not yet commenced, the CDI is scaled for **oceanic** flight (4.0 nm).
- Within 31 nm of the destination airport (**terminal** area), the CDI scale gradually ramps down from 2.0 nm to 1.0 nm over a distance of 1.0 nm; except under the following conditions:
 - Upon reaching the first waypoint of an arrival route that is more than 31 nm from the destination airport, the flight phase changes to terminal and the CDI scale begins to transition down from 2.0 nm to 1.0 nm over a distance of 1.0 nm.
- During **approach**, the CDI scale ramps down even further (see Figures 2-28 and 2-29). 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.

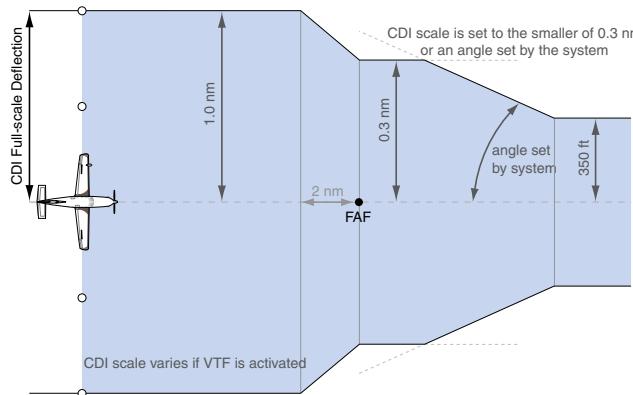


Figure 2-28 Typical LNAV and LNAV+V Approach Service Level CDI Scaling

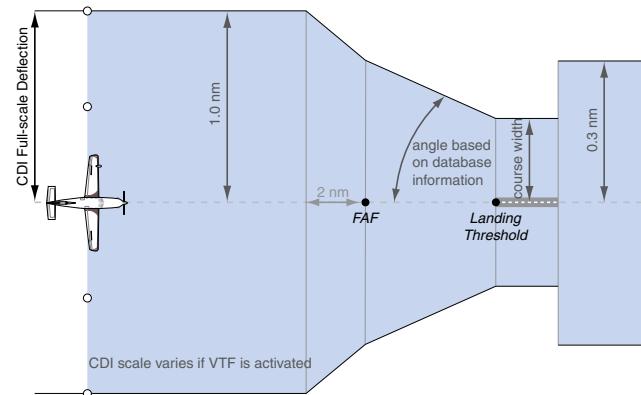


Figure 2-29 Typical LNAV/VNAV, LP, LP+V and LPV Approach Service Level CDI Scaling

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

Flight Phase	Annunciation*	Automatic CDI Full-scale Deflection
Departure	DPRT	0.3 nm
Terminal	TERM	1.0 nm
Enroute	ENR	2.0 nm
Oceanic	OCN	4.0 nm
Approach (Non-precision)	LNAV	1.0 nm decreasing to 350 feet depending on variables (see Figure 2-30)
Approach (Non-precision with Vertical Guidance)	LNAV + V	
Approach (LNAV/VNAV)	L/VNAV	
Approach (LP)	LP	1.0 nm decreasing to a specified course width, then 0.3 nm, depending on variables (see Figure 2-31)
Approach (LP+V)	LP+V	
Approach (LPV)	LPV	
Missed Approach	MAPR	0.3 nm

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

Table 2-1 Automatic GPS CDI Scaling

OBS MODE



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

Enabling Omni-bearing Selector (OBS) Mode suspends the automatic sequencing of waypoints in a 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 2-30 Omni-bearing Selector (OBS) Mode

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. Press the **CRS** Knob to synchronize the Selected Course with the bearing to the next waypoint.
- 3) Press the **OBS** Softkey again to return to automatic waypoint sequencing.

As the aircraft crosses the missed approach point (MAP), automatic approach waypoint sequencing is suspended. SUSP appears on the HSI at the lower right of the aircraft symbol. The **OBS** Softkey label changes to indicate the suspension is active as shown in Figure 2-31. Selecting the **SUSP** Softkey deactivates the suspension and resumes automatic sequencing of approach waypoints.



Figure 2-31 Suspension of 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.

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 yellow shading on the PFD.

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

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

The following SVT enhancements appear on the PFD:

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



Figure 2-32 Synthetic Vision Imagery

SVT OPERATION

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

SVT functions are displayed on three levels of softkeys. The **PFD Settings** Softkey leads into the PFD function Softkeys, including synthetic vision. Pressing the **Attitude Overlays** Softkey displays the SVT feature softkeys. The softkeys are labeled **Pathways**, **Synthetic Terrain**, **Horizon Heading**, **Airport Signs**, **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 **Airport Signs** softkey is only available when the **Synthetic Terrain** Softkey is activated (softkey annunciator is green). When the **Synthetic Terrain** Softkey is activated the Flight Path Marker is automatically displayed on the PFD.

- **Pathways** Softkey enables display of rectangular boxes that represent course guidance.
- **Synthetic Terrain** Softkey enables synthetic terrain depiction.
- **Horizon Heading** Softkey enables the display of heading marks and digits on the zero pitch line.
- **Airport Signs** Softkey enables airport signposts.
- **FPA Ref Settings** Softkey enables flight path angle reference selection.

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.

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.

Activating and deactivating Horizon Headings:

- 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.

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.

Activating and deactivating 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 approriate Angle Ref Softkeys to select reference angle.
- 5) Press the **FPA Ref** Softkey to activate/deactivate.

SVT FEATURES

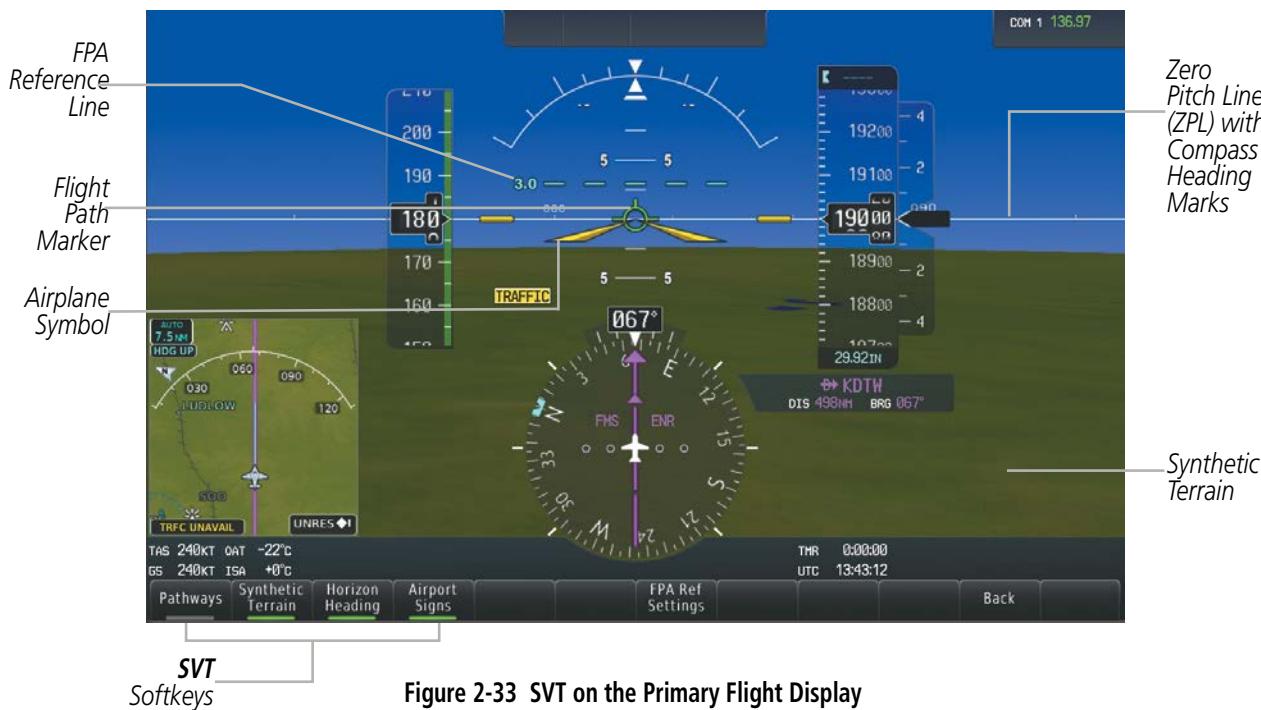


Figure 2-33 SVT on the Primary Flight Display



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

FLIGHT PATH MARKER

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

The FPM 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 2-34 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.

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.

FLIGHT PATH ANGLE REFERENCE

Flight Path Angle Reference provides a visual indication of the desired climb/descent angle on the SVT pitch ladder. When activated, the Flight Path Angle Reference will serve as a guide for the flight path marker to ensure the proper vertical flight profile is achieved. Flight Path Angle Reference can be set between -10 and +10 degrees of pitch. Flight Path Angle Reference can be activated and deactivated by pressing FPA Ref

Settings Softkey, pressing the desired Flight Path Angle Reference value Softkeys, pressing the FPA Ref Softkey to set the desired Flight Path Angle Reference on the PFD.



Figure 2-35 Airport Signs

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 2-36 Airport Runways

TAWS ALERTING

Terrain alerting on the synthetic terrain display is triggered by Forward Looking Terrain Avoidance (FLTA) alerts. In addition to the yellow terrain shading for a caution alert and the red shading for a warning alert, TAWS alerting will also indicate potential impact points. A potential impact point is depicted as a red or yellow X symbol on the PFD Inset Map (as shown in Figure 2-37), MFD Navigation Map page, and MFD TAWS Page. For more detailed information regarding TAWS, refer to the Hazard Avoidance Section.

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



Figure 2-37 Terrain Alert

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

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



Figure 2-38 Obstacle Alert

FIELD OF VIEW

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

Enabling or Disabling the field of view indication:

- 1) From **Home**, touch **Map** > **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 turned on. When the PFD is in Split Mode, the field of view representation on the Navigation Map changes to reflect the narrow field of view.



Figure 2-39 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) is displayed in degrees Celsius (°C) by default in the lower left of the PFD under normal display conditions, or below the true airspeed in reversionary mode.

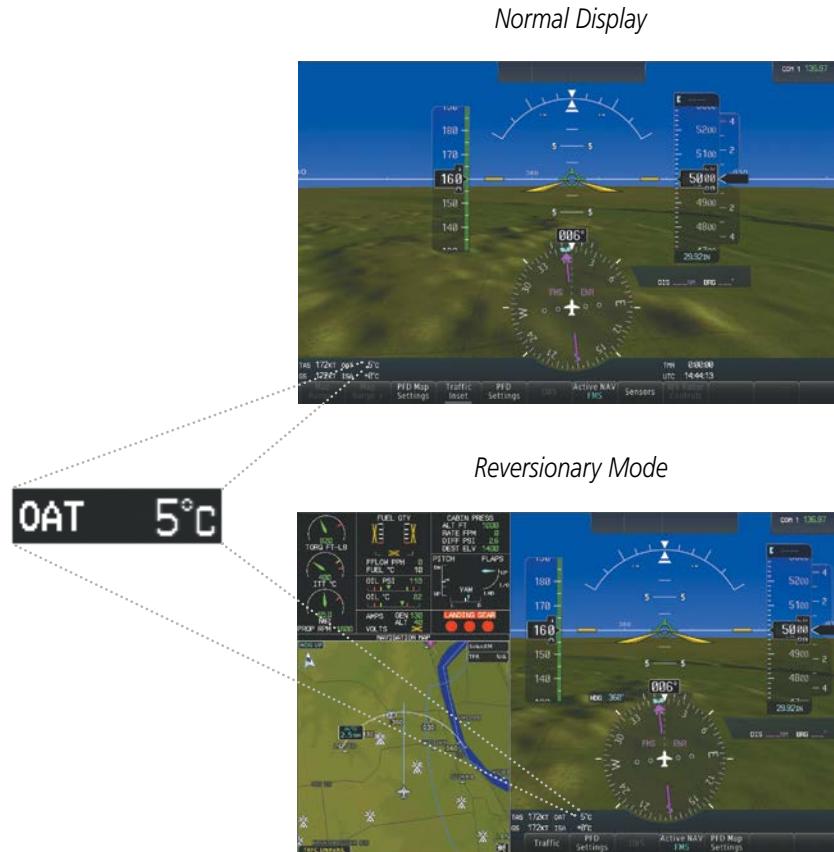


Figure 2-40 Outside Air Temperature

Changing temperature display units:

- 1) From Home, touch the **Utilities** button.
- 2) Touch the **Setup** button.
- 3) Touch the **Avionics Settings** button.
- 4) If not already selected, touch the **Units** tab.
- 5) Scroll if necessary and touch the button for **External Temperature** and select preferred units, Celcius or Fahrenheit.



Figure 2-41 Temperature Selection Setting

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 2-42 Wind Data

Displaying wind data:

- 1) Press the **PFD Settings** Softkey.
- 2) Press the **Other PFD Settings**.
- 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:** Wind direction arrow and speed
 - **Option 2:** Wind direction arrow with direction and speed
 - **Option 3:** Wind direction arrow with headwind (H) or tailwind (T) and crosswind (X) speed components
- 5) To remove the window, press the **Off** Softkey.

VERTICAL NAVIGATION (VNV) INDICATIONS

When a VNV flight plan has been activated, VNV indications (VNV Target Altitude, RVSI, VDI) appear on the PFD in conjunction with the “TOD within 1 minute message” and “Vertical track” voice alert. See the Flight Management and AFCS sections for details on VNV features. VNV indications are removed from the PFD according to the criteria listed in Table 2-2.



Figure 2-43 Vertical Navigation Indications (PFD)

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

SYSTEM ALERTING

The System Messages Window conveys messages to the flight crew regarding problems with the G3000 System. When a new message is issued, the **MSG** icon at the top left of the PFD flashes to alert the flight crew. It continues to flash until addressed. When the **MSG** button is pressed on the GTC, messages for conditions which are no longer active turn gray. Messages generated while the window is open are not automatically displayed, but cause the **MSG** button to begin flashing again. Pressing the **MSG** button while the System Messages Window is open closes the window unless the **MSG** Softkey is flashing.

Critical values generated by redundant sensors are monitored by comparators. If differences in the sensors exceed a specified amount, the Comparator Window appears in the upper right corner of the PFD and the discrepancy is annunciated in the Comparator Window as a MISCOMP (miscompare). If one or both of the sensed values are unavailable, it is annunciated as a NO COMP (no compare).

Reversionary sensor selection is annunciated in a window on the right side of the PFD. These annunciations reflect reversionary sensors selected on one or both PFDs. Pressing the **SENSORS** Softkey accesses the **ADC Settings** and **AHRS Settings** Softkeys. Pressing the **ADC Settings** accesses **ADC1**, **ADC2**, pressing the **AHRS Settings** Softkey accesses **AHRS1**, and **AHRS2** softkeys. These softkeys allow switching of the sensors being viewed on each PFD. With certain types of sensor failures, the system may make some sensor selections automatically. The GPS sensor cannot be switched manually.

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 Panel and CNS Section for more information on Marker Beacon Annunciations.

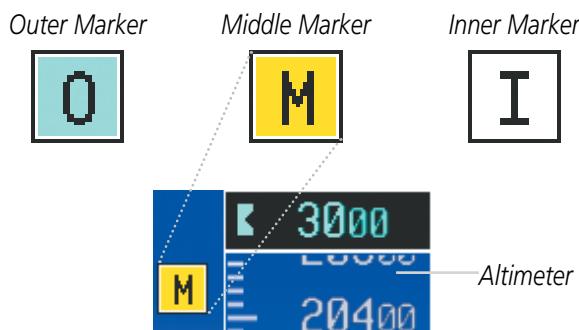


Figure 2-44 Marker Beacon Annunciations

TRAFFIC ANNUNCIATION



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

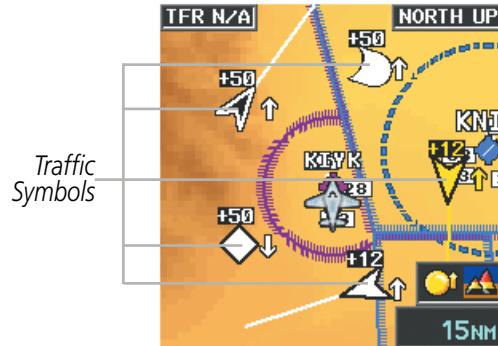
Traffic is displayed symbolically on the Inset Map (PFD), the Navigation Map Page (MFD), and various other MFD page maps. Refer to the Hazard Avoidance Section and Appendix F for more details about Traffic alerts. When a Traffic Advisory (TA) is detected, the following automatically occurs:

- The PFD Inset Map is enabled, displaying traffic
- A flashing black-on-amber TRAFFIC annunciation appears to the top left of the HSI for five seconds and remains displayed until no TAs are detected in the area
- The traffic system issues a voice alert.

If additional TAs appear, new aural and visual alerts are generated.

TRAFFIC

PFD Traffic Annunciation



PFD Inset Map with Traffic Displayed

Figure 2-45 Traffic Annunciation and Inset Map with Traffic Displayed

TERRAIN ANNUNCIATIONS

Terrain Awareness and Warning System (TAWS) or Terrain-SVT annunciations appear on the PFD to the upper left of the altimeter. Refer to the Hazard Avoidance Section and Appendix A for information on terrain alerts and annunciations.



Figure 2-46 Traffic and Example Terrain 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 2-47 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 2-48 Low Altitude on GPS SBAS Approach

MINIMUM DESCENT ALTITUDE/DECISION HEIGHT ALERTING

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

- When the aircraft altitude descends to within 2500 feet of the MDA/DH 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 passes through 100 feet of the MDA/DH, the bug and text turn white.
- Once the aircraft reaches the MDA/DH, the bug and text turn amber and the aural alert, "Minimums Minimums", is heard.

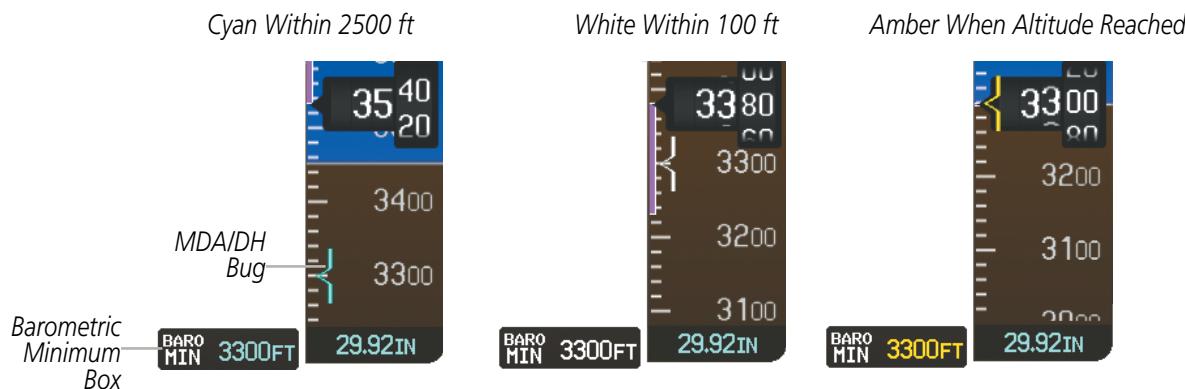


Figure 2-49 Barometric MDA/DH Alerting Visual Annunciations

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

Setting the Minimum Descent Altitude/Decision Height and bug:

- 1) From the **Home** Screen, touch **Utilities > Minimums > Minimums**.
- 2) Touch **Baro** or **Temp Comp**.
 - 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 and touch **Enter**.

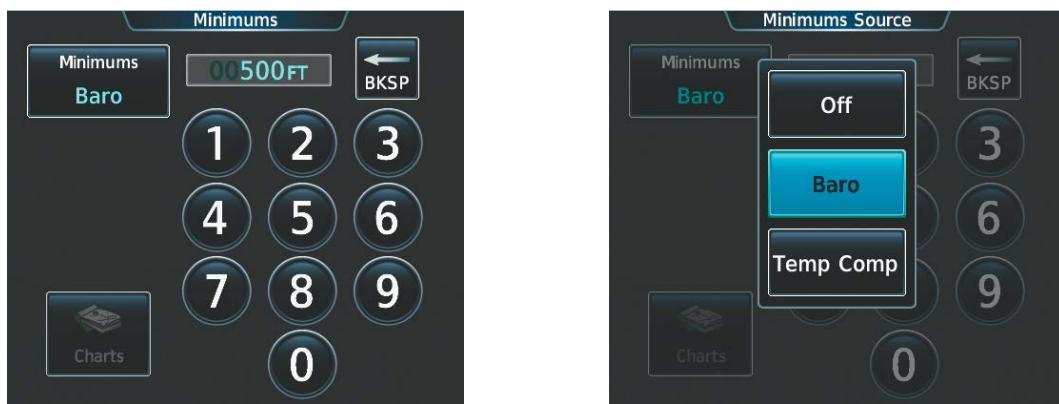


Figure 2-50 Minimum Descent Altitude/Decision Height

2.5 ABNORMAL OPERATIONS

ABNORMAL GPS CONDITIONS

The annunciations listed in Table 2-4 can appear on the HSI when abnormal GPS conditions occur (Figure 2-51). Refer to the Flight Management Section for more information on Dead Reckoning Mode.

Annunciation	Location	Description
GPS LOI	Left of the HSI	Loss of Integrity Monitoring—GPS integrity is insufficient for the current phase of flight
INTEG OK	Left of the 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 2-3 Abnormal GPS Conditions Announced on HSI

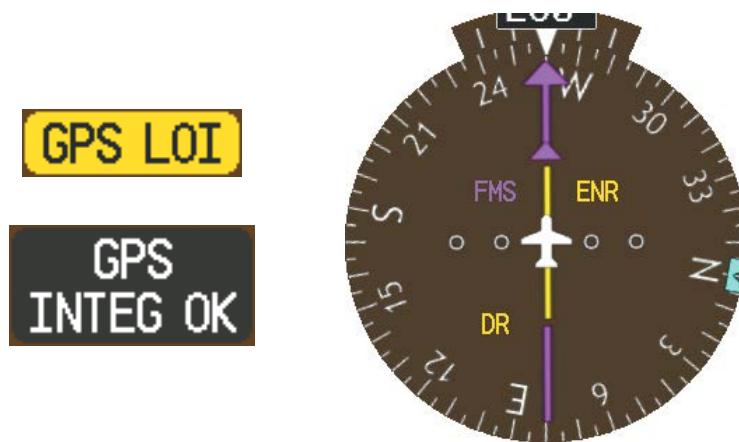


Figure 2-51 Abnormal GPS Condition Annunciations

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 G1000 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.

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.

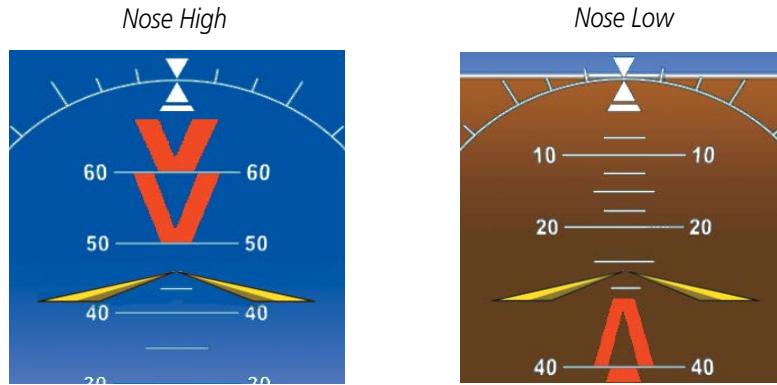


Figure 2-52 Pitch Attitude Warnings

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 readout
- Selected Course readout
- Transponder Status Box
- System Time
- PFD Setup Menu
- Windows displayed in the lower right corner of the PFD:
 - Timer/References
 - Nearest Airports
 - Flight Plan
 - Messages
 - Procedures
 - ADF/DME Tuning
- Minimum Descent Altitude/Decision Height readout
- Vertical Deviation, Glideslope, and Glidepath Indicators
- Altimeter Barometric Setting
- Selected Altitude
- VNV Target Altitude

SECTION 3 ENGINE AND AIRFRAME SYSTEMS



NOTE: Refer to the Airplane Flight Manual (AFM) for limitations.

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

- The **Engine Indication System** (EIS) displays electrical, fuel, oil, engine, pressurization, flight control, and landing gear information on the left side of the Multi Function Display (MFD).
- The Aircraft Systems Screen on the Touchscreen Controller provides additional display and control information for system tests, and landing field elevation.



Figure 3-1 EIS (Normal)

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



Figure 3-2 EIS (Reversionary Mode)

3.1 ENGINE AND AIRFRAME INDICATION SYSTEM (EIS)



NOTE: Refer to the Airplane Flight Manual (AFM) for the appropriate engine limits.

EIS information is presented using gauges and digital display. During normal operating conditions, gauge pointers and display text appear in green. When unsafe operating conditions occur, gauge pointers and display change color to indicate caution (amber) or warning (red). Refer to each indicator description for additional details on display behavior.

If the time limit for an unsafe condition is exceeded, the color of the pointers and digits may change to denote an increase in priority level. Parameters out of the range of the display are shown as amber dashes. If sensor data for a parameter becomes invalid or unavailable, an amber “X” is displayed across the indicator and/or display.

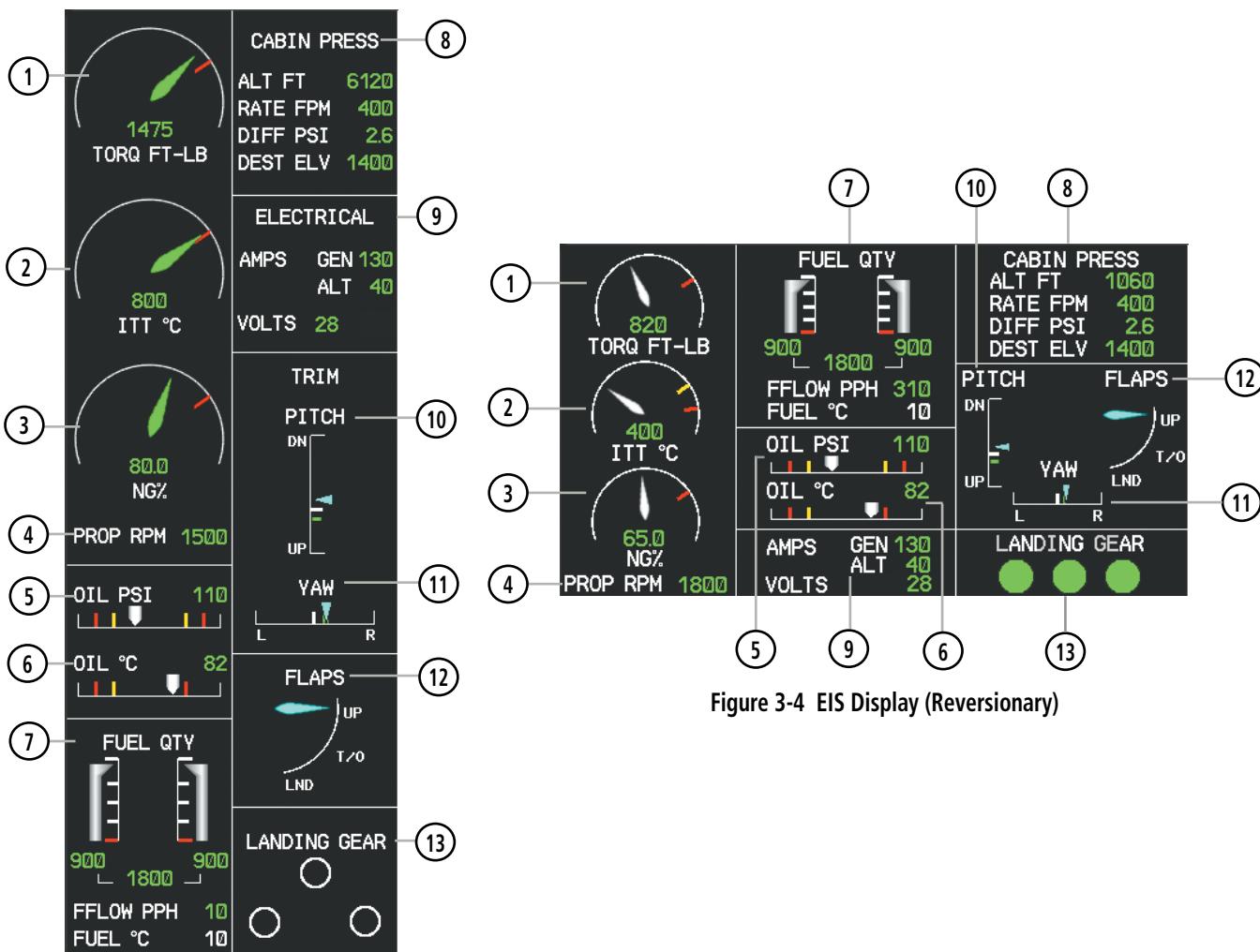


Figure 3-3 EIS Display (Normal)

Figure 3-4 EIS Display (Reversionary)

- ① **Torque Gauge (TORQ-FT LB)** Displays engine torque in foot-pounds (ft-lb)
- ② **Interstage Turbine Temperature Gauge (ITT °C)** Displays Interstage Turbine Temperature (ITT) in degrees Celsius (°C)
- ③ **Gas Generator Speed Gauge (NG%)** Displays generator speed as a percentage of maximum safe operating speed (rpm). If the generator speed exceeds the maximum a warning condition occurs
- ④ **Propeller Speed Gauge (PROP RPM)** Displays propeller speed in revolutions per minute (rpm)
- ⑤ **Oil Pressure Gauge (OIL P PSI)** Displays pressure of oil supplied to the engines in pounds per square inch (psi)
- ⑥ **Oil Temperature Gauge (OIL T °C)** Displays oil temperature in degrees Celsius (°C)
- ⑦ **Fuel Display**
 - Displays total fuel quantity in pounds
 - Displays individual fuel tank quantities
 - Displays current fuel flow in pounds per hour (PPH)
 - Displays fuel temperature in degrees Celsius (°C)
 - Displays cabin altitude in feet (ALT FT)
 - Displays change rate in feet per minute (RATE FPM)
 - Displays pressure differential (DIFF PSI)
 - Displays Landing Field Elevation (DEST ELV)
- ⑧ **Cabin Pressure Display**
- ⑨ **Electrical Display**
- ⑩ **Pitch Trim Indicator**
- ⑪ **Yaw Trim Indicator**
- ⑫ **Flap Position Indicator**
- ⑬ **Landing Gear Indicator**

ENGINE PARAMETERS

The M600 EIS displays torque, interturbine temperature, propeller speed, and gas generator speed using arc gauges.

TORQUE GAUGE

The Torque Gauge displays values in foot-pounds. If torque exceeds the maximum safe operating range, the analog pointer will change to red and the numerical and text displays will flash red.



Figure 3-5 Torque Gauge

ITT GAUGE



NOTE: Refer to the Pilot's Operating Handbook (POH) for engine operating limitations.

The Interstage Turbine Temperature (ITT) Gauge ranges differ for engine off/start and running conditions. When in exceedance of the maximum safe operating range, the analog pointer, numerical display and text will change to amber (caution) or will flash red (warning).

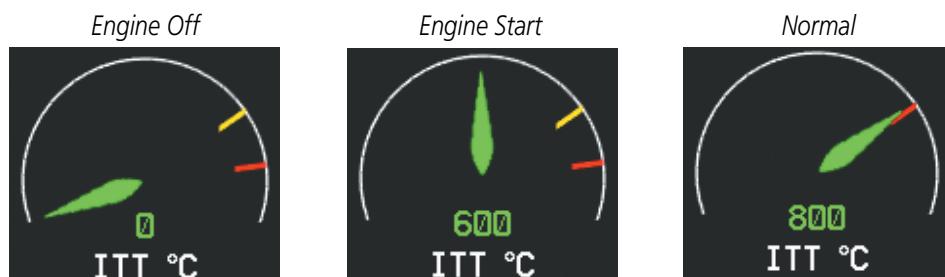


Figure 3-6 ITT Gauge Status Annunciation

PROPELLER RPM GAUGE

Propeller speed is shown in revolutions per minute (rpm). If a propeller underspeed or overspeed condition occurs, the numerical and text displays will flash red.



Figure 3-7 Propeller RPM Gauge

GAS GENERATOR SPEED GAUGE

Generator speed is indicated as a percentage of maximum safe operating speed (rpm). If the generator speed exceeds the maximum safe range, the analog pointer will change to red and the numerical and text displays will flash red.

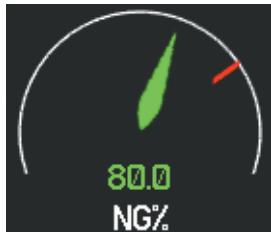


Figure 3-8 Gas Generator Speed Gauge

OIL PRESSURE AND TEMPERATURE GAUGES

Engine oil pressure and temperature are shown along horizontal bar indicators below the engine gauges. Oil pressure is shown in pounds per square inch (psi) and temperature in degrees Celsius (°C). When oil temperature and/or pressure are outside of safe operating ranges, the numerical display and text will change to amber, or will flash red.

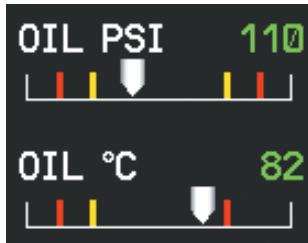


Figure 3-9 Oil Pressure and Temperature Gauges

FUEL INFORMATION

The fuel display shows the fuel quantity in each tank (fuel qty, lbs), fuel flow (fflow pph), and fuel temperature (fuel °C). Fuel quantity for each tank is shown along a slider scale. When fuel quantity is below safe operating levels, the pointers, digits and text will change to amber, or will flash red.

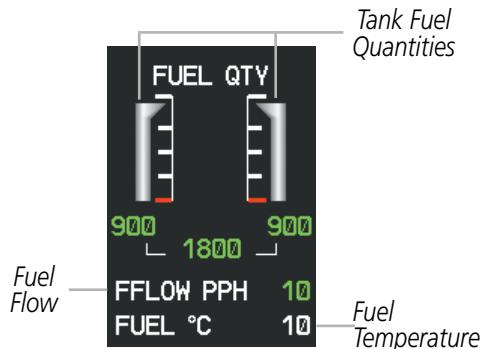


Figure 3-10 Fuel Display

ELECTRICAL INFORMATION

Displays DC current for the alternator and generator in amps. Displays DC bus voltage. Main bus and emergency bus voltage is monitored and the higher of the two values is displayed. When any of the values are outside of safe operating ranges, the numeric and text displays will flash red.

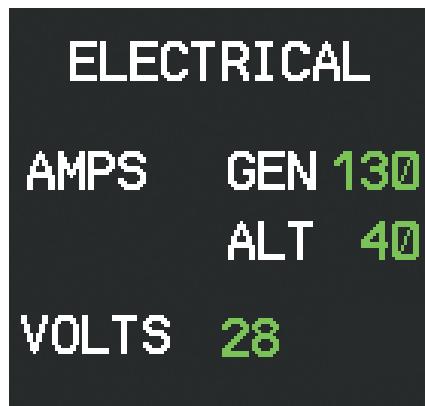


Figure 3-11 Electrical Display

CABIN PRESSURIZATION

The Cabin Display shows cabin pressurization information (cabin altitude, pressure change rate, differential pressure and destination elevation).

CABIN ALTITUDE

The cabin altitude (ALT FT) is shown on a digital display. Three amber dashes are displayed if cabin altitude is invalid. When the aircraft is beyond normal operating altitudes, the numerical display and text will change to amber or red. During a warning condition (red), the numerical and text displays will flash.

PRESSURE CHANGE RATE

The trend of cabin pressure altitude rate change (RATE FPM) is indicated by a text display. If the pressure change rate is invalid or unavailable, the digits are replaced with amber dashes.

DIFFERENTIAL PRESSURE

The Differential Pressure (DIFF PSI) value is obtained by subtracting external pressure from internal pressure. Normal pressure values are green, high pressure values are red, and invalid values are amber dashes.

LANDING FIELD ELEVATION

The Landing Field Elevation (DEST ELV) is shown on the EIS display and on the Touchscreen Controller. The numeric display on the EIS display is shown in green. If data is invalid or not available, the digits are replaced with amber dashes.

On the Touchscreen Controller, magenta dashes are shown until a flight plan destination is entered. Automatically entered values reflect the current flight plan and appear in magenta. Once a flight plan is entered, the Landing Field Elevation is updated to display the new value. The Landing Field Elevation may be manually entered, and the values will appear in cyan.

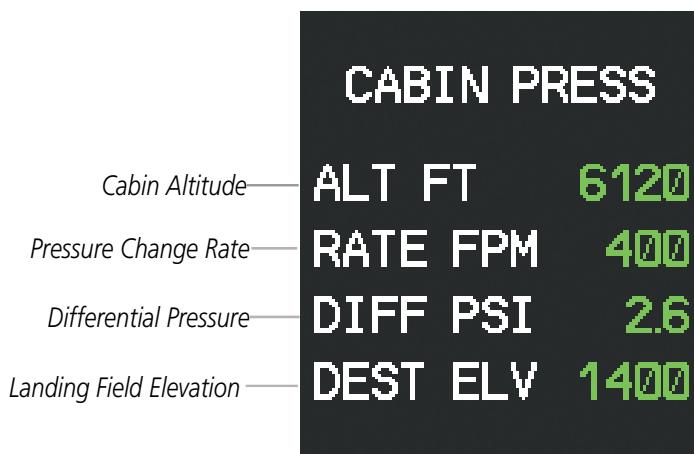


Figure 3-12 Cabin Pressure Display

Setting the landing field elevation:

- 1) From **Home**, touch **Aircraft Systems > Landing Field Elevation**.
- 2) Touch the **FMS** Mode Button to set the Landing Elevation to the value for the destination airport in the current flight plan.
Or:
Touch the **Manual** Button to set the desired elevation using the keypad.
- 3) To confirm the new Landing Field Elevation value, touch the **Enter** Button.
Or:
- 4) Touch the **Use FMS Destination** Button to use the value for the destination airport in the current flight plan.

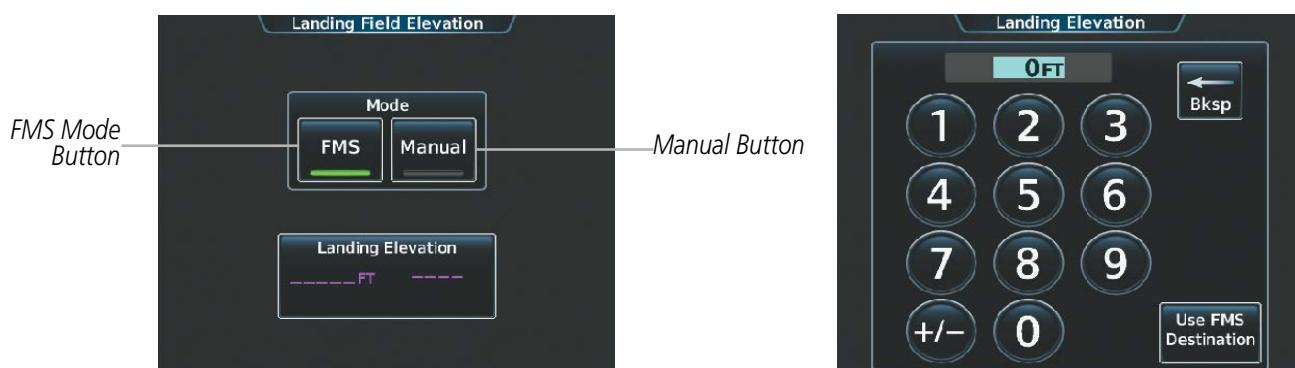


Figure 3-13 Landing Field Elevation

TRIM INDICATORS

The Pitch Trim indication is shown along a vertical slide bar. The Yaw trim indicator is shown on a horizontal slide bar. The green bands indicate takeoff position for each indicator.



Figure 3-14 Trim Indicators

FLAP INDICATORS

Flap position (Figure 3-15) is displayed using a rotating pointer. Flap positions are labeled UP, T/O and LND.

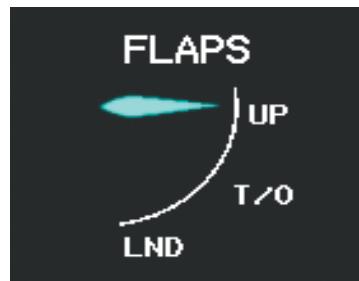


Figure 3-15 Flap Indicator

LANDING GEAR INDICATOR

Landing Gear statuses are shown using the indications in Table 3-1.

Position	Normal	Reversionary
Up & Locked	LANDING GEAR ○ ○ ○	LANDING GEAR ○ ○ ○
In Transition	LANDING GEAR █ █ █	LANDING GEAR █ █ █
Down and Locked	LANDING GEAR ● ● ●	LANDING GEAR ● ● ●
Warning	LANDING GEAR ● ● ●	LANDING GEAR ● ● ●

Table 3-1 Landing Gear Indications

3.2 SYSTEM TESTS

System Tests are required for FMS Initialization (refer to section 1.5 FMS Initialization) and should be completed prior to dispatch. The System Test Screen (Figure 3-16) on the Touchscreen Controller provides testing functions for various aircraft systems including Annunciator, TAWS, and TCAS.

Touching a button for a specific test activates that particular System Test. While a test is active, the button displays “In Progress” in cyan. The “In Progress” text pulses so that the crew can quickly identify which test is currently in progress. When the test is complete, the button displays ‘Done’ (in cyan) or ‘Pass’ (in green). All tests are mutually exclusive. If a System Test is selected while another test is already running, the currently active test is cancelled and the new test is activated. Pressing an Active System Test shall deactivate that test. Refer to the System Overview for more information on System Tests.

Refer to Table 3-2 for the expected results of each system test.

Accessing the System Tests:

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



Figure 3-16 Aircraft System Tests Screen

System Test	Expected Results
Annunciator	<ul style="list-style-type: none">• AFCS control panel buttons illuminate
Fuel RTN	<ul style="list-style-type: none">• Test not applicable. Active in Maintenance Mode only.
TAWS	<ul style="list-style-type: none">• TEST MODE message is displayed during the test on the MFD.• If the test passes, a “TAWS System Test OK” aural message is heard <p>If the test fails, a “TAWS System Test failed” aural message is heard</p>
TCAS/TAS	<ul style="list-style-type: none">• TEST MODE message is displayed during the test on the MFD.• If the test passes, a “TAS System Test passed” or “TCAS I System Test Passed” aural message is heard <p>If the test fails, a “TAS System Test failed” or “TCAS I System Test Failed” aural message is heard</p>

Table 3-2 System Tests

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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 Touchscreen Controllers, 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 primary 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, a marker beacon receiver, and a COM clearance recorder.

The Mode S transponder is controlled with the Touchscreen Controller. The Transponder Code Button is located in the upper right of the touchscreen, right below the Transponder Mode Button. The Transponder Code Button displays the active four-digit code, mode, and reply status (Figure 4-1).

During normal operations Touchscreen Controller 1 controls the pilot and passenger Audio & Radios Screen, and Touchscreen Controller 2 controls the co-pilot and passenger Audio & Radios Screen.

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

- COM
- NAV
- Marker Beacon Receiver
- ADF/DME
- Transponder
- Mono/Stereo Headsets
- Speaker
- Intercom
- Passenger Address (PA) System
- Clearance Recorder and Player
- SiriusXM Radio Entertainment
- Satellite Telephone
- Audio Feedback (Clicks)

TOUCHSCREEN CONTROLLER AUDIO AND CNS CONTROLS



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

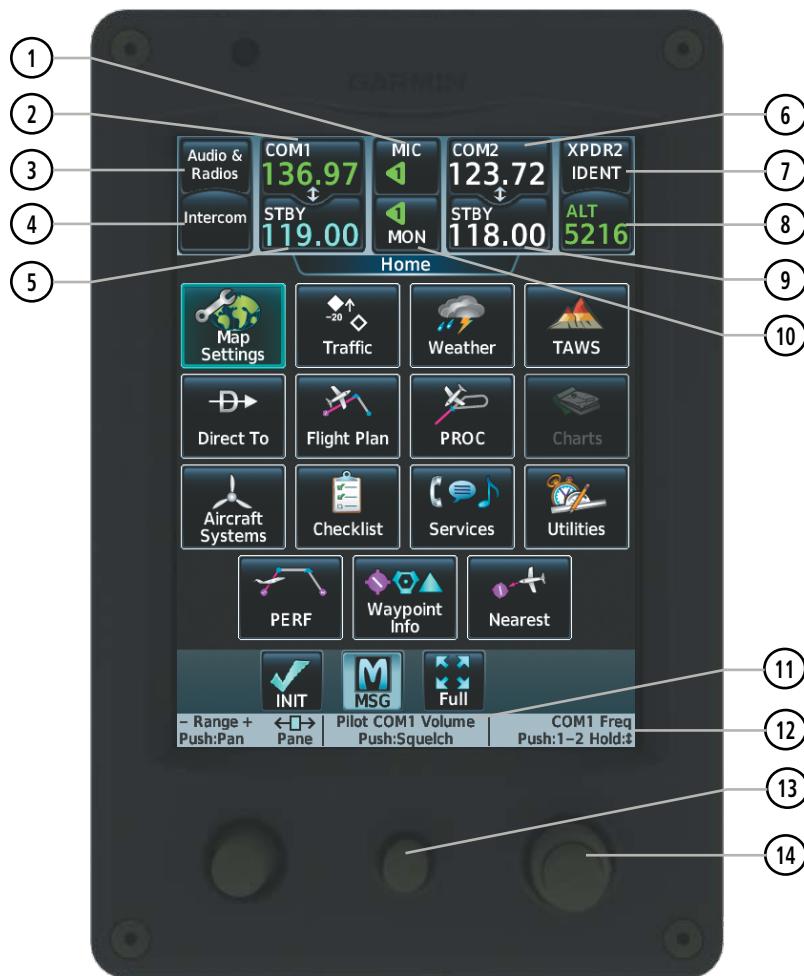


Figure 4-1 Touchscreen CNS Bar Controls

- ① **MIC** Button – Switches between the #1 COM transceiver and the #2 COM transceiver.
- ② **COM1** Button – Transfers the standby and active COM1 frequencies.
- ③ **Audio & Radios** Button – Displays/removes the Audio & Radios Screen. The Audio & Radios Screen is used to control the Communication/Navigation/Surveillance (CNS) and Audio settings for the pilot and copilot.
- ④ **Intercom** Button – Displays/removes the Intercom Screen. The Intercom Screen is used to control the intercom isolation, volume, and squelch settings for the pilot and copilot.

- ⑤ **STBY** Button (COM1) – Displays/removes the COM1 Standby Screen. The COM1 Standby Screen is used to enter and transfer COM1 frequencies.
- ⑥ **COM2** Button – Transfers the standby and active COM2 frequencies.
- ⑦ Transponder **IDENT** Button – Displays the active transponder. The Transponder **IDENT** Button is also used to send a distinct identity indication to Air Traffic Control (ATC), by pressing the **IDENT** Button. When selected, the word IDENT is displayed in green and pulsates for the duration of the transmission. While the transponder is replying to an interrogation, an R is displayed on the button.
- ⑧ Transponder Mode/Code Button – Displays/removes the Transponder Screen. The Transponder Screen is used to select the transponder modes and the transponder code using the keypad.
- ⑨ **STBY** Button (COM2) – Displays/removes the COM2 Standby Screen. The COM2 Standby Screen is used to enter and transfer COM2 frequencies.
- ⑩ **MON** Button – Controls which receivers are being explicitly monitored.
- ⑪ Function Label – Indicates middle knob function. *Typical:* Pilot COM1/COM2 Volume, Push: Squelch
- ⑫ Function Label – Indicates right large and small knob function. *Typical Frequency Entry:* COM1/COM2 Frequency, Push: 1-2, Hold: \uparrow *Typical Data Entry:* Data Entry, Push: Enter, Hold: \downarrow
- ⑬ Middle Knob – Function as labeled (see #12)
- ⑭ Large/Small Right Knob – Function as labeled (see #12). *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. Press the small knob to confirm the frequency. Press and hold to transfer the standby frequency to the active frequency.

PFD COM/NAV DISPLAY AND CONTROLS

Figure 4-2 Active NAV Window and Active COM Frequency Box

- ① **Active NAV Window** – Displays active NAV station ID, frequency, and DME distance.
- ② **Selected Source/Frequency Box** – Displays selected communication source, frequency, and the communication source description (if available).

4.2 COM OPERATION

COM TRANSCEIVER SELECTION AND ACTIVATION



NOTE: When turning on the G3000 for use, the system remembers the last frequencies used and the active COM transceiver state prior to shutdown.

The COM1 and COM2 Frequencies are shown on the CNS Bar and also shown on the Audio & Radios Screen. The active COM frequency is also displayed in the upper right corner of the PFD. The COM transceiver can be selected for transmitting on the Touchscreen Controller. During reception of audio from the COM radio selected for transmission, audio from the other COM radio is muted. If enabled, changing an active or monitored COM source or frequency will be accompanied with an aural tone.

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 right knobs, the entire standby frequency button is highlighted in cyan. The other standby frequency is white.

Selecting a COM Radio for transmission:

Touch the **MIC** Button in the CNS Bar to switch between COM1 and COM2 radios until the desired COM is selected.

Or:

- 1) 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:

Touch the **MON** Button in the CNS Bar to monitor the COM not selected for transmission.

Or:

- 1) Touch the **Audio & Radios** Button to display the Audio & Radios Screen.
- 2) Touch the **COM1** Button or **COM2** Button to select the COM radio for monitoring.

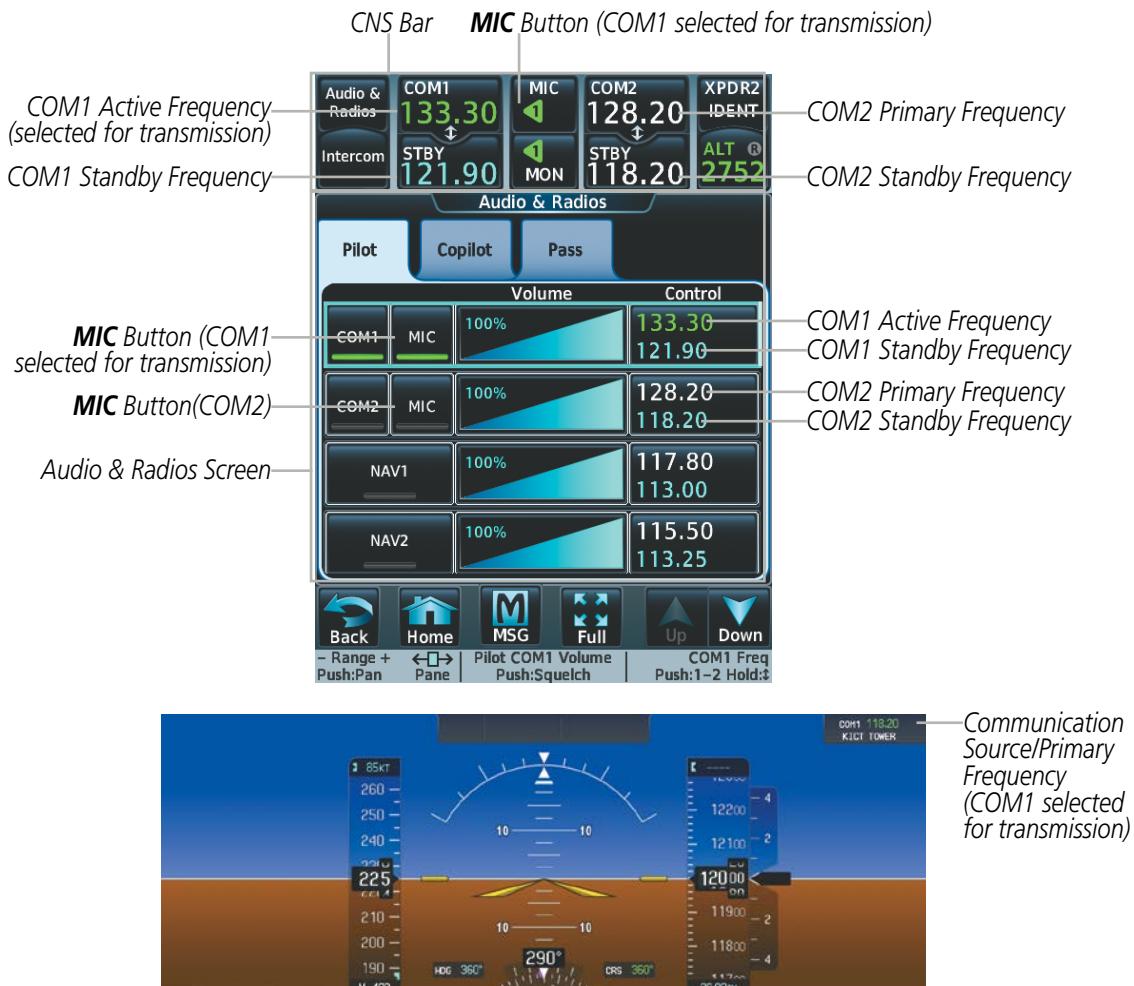


Figure 4-3 Selecting a COM Radio for Transmission

CNS Bar Symbol	Description
	COM1 selected for transmission/monitoring
	COM2 selected for transmission/monitoring
	An additional audio source is manually selected for monitoring
	Public Address is selected for transmission

Table 4-1 CNS Bar MIC/MON Button Symbols

TRANSMIT/RECEIVE INDICATIONS

During COM transmission, a white TX appears by the active COM frequency. During COM signal reception, a white RX appears by the active COM frequency.



Figure 4-4 COM Radio Transmit and Receive Indications

COM FREQUENCY TUNING

Selecting a COM1/2 frequency using the Touchscreen Controller:

- 1) Touch the COM1 **STBY** Button or COM2 **STBY** Button in the CNS Bar to display the COM1/COM2 Standby Screen.
- 2) Use the keypad to select the frequency.
- 3) Touch the **Enter** Button to accept the new frequency as the COM1/COM2 standby frequency; or touch the **XFER** Button to accept the new frequency as the COM1/COM2 active frequency and transfer the previously active frequency to the standby frequency; or touch the COM1/COM2 active frequency on the CNS Bar to accept the new frequency as the COM1/COM2 active frequency and transfer the previously active frequency to the standby frequency.

Or:

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



Figure 4-5 COM Frequency Tuning Keypad

Or:

- 1) Touch the **Audio & Radios** Button to display the Audio & Radios Screen.
- 2) Touch the COM1/COM2 volume slider, or press the small right knob, to select COM1/COM2 for tuning.
- 3) Turn the large and small right knobs to select the frequency (Large knob increases/decreases MHz; Small knob increases/decreases kHz).
- 4) Press the small right knob to accept the new frequency as the standby frequency; or press and hold the small right knob to accept the new frequency as the COM1/COM2 active frequency and transfer the previously active frequency to the standby frequency; or touch the COM1/COM2 active frequency on the CNS Bar to accept the new frequency as the COM1/COM2 active frequency and transfer the previously active frequency to the standby frequency.



Figure 4-6 Audio & Radios Screen - COM1/COM2 Frequency Tuning

Or:

- 1) Touch the **Audio & Radios** Button to display the Audio & Radios Screen.
- 2) Touch the COM1/COM2 frequency button to display the COM1/COM2 Standby Screen.
- 3) Use the keypad to select the desired frequency.
- 4) Touch the **Enter** Button to accept the new frequency as the COM1/COM2 standby frequency; or touch the **XFER** Button to accept the new frequency as the COM1/COM2 active frequency and transfer the previously active frequency to the standby frequency; or touch the COM1/COM2 active frequency on the CNS Bar to accept the new frequency as the COM1/COM2 active frequency and transfer the previously active frequency to the standby frequency.

Finding and selecting a COM frequency from the CNS Bar:

- 1) Touch the **COM1 STBY** Button (CNS Bar) or the **COM2 STBY** Button (CNS Bar) to display the COM1/2 Standby Screen.
- 2) Touch the **Find** Button to display the Find COM Frequency Screen.
- 3) Touch the tab for the desired type of frequency (Recent, Nearest, Dest, Flight Plan, or Favorite).
- 4) Scroll the list to find the desired frequency.
- 5) Touch the frequency button to accept the new frequency as the COM1/COM2 standby frequency.



Figure 4-7 Find COM Frequency Screen

Finding and selecting a COM frequency from the Airport Info Screen:

- 1) From the Touchscreen Controller **Home** Screen, touch **Waypoint Info** > **Airport** to display the Airport Information Screen.
- 2) If needed, touch the airport button to enter/find the desired airport.
- 3) Touch the **Freqs** Tab to display the Airport Frequencies Screen.
- 4) Scroll the list to find the desired frequency.

- 5) Touch the frequency button to display the Load Frequency Screen.
- 6) Touch the location button to load the frequency to COM1/2 Active/Standy or Favorites.

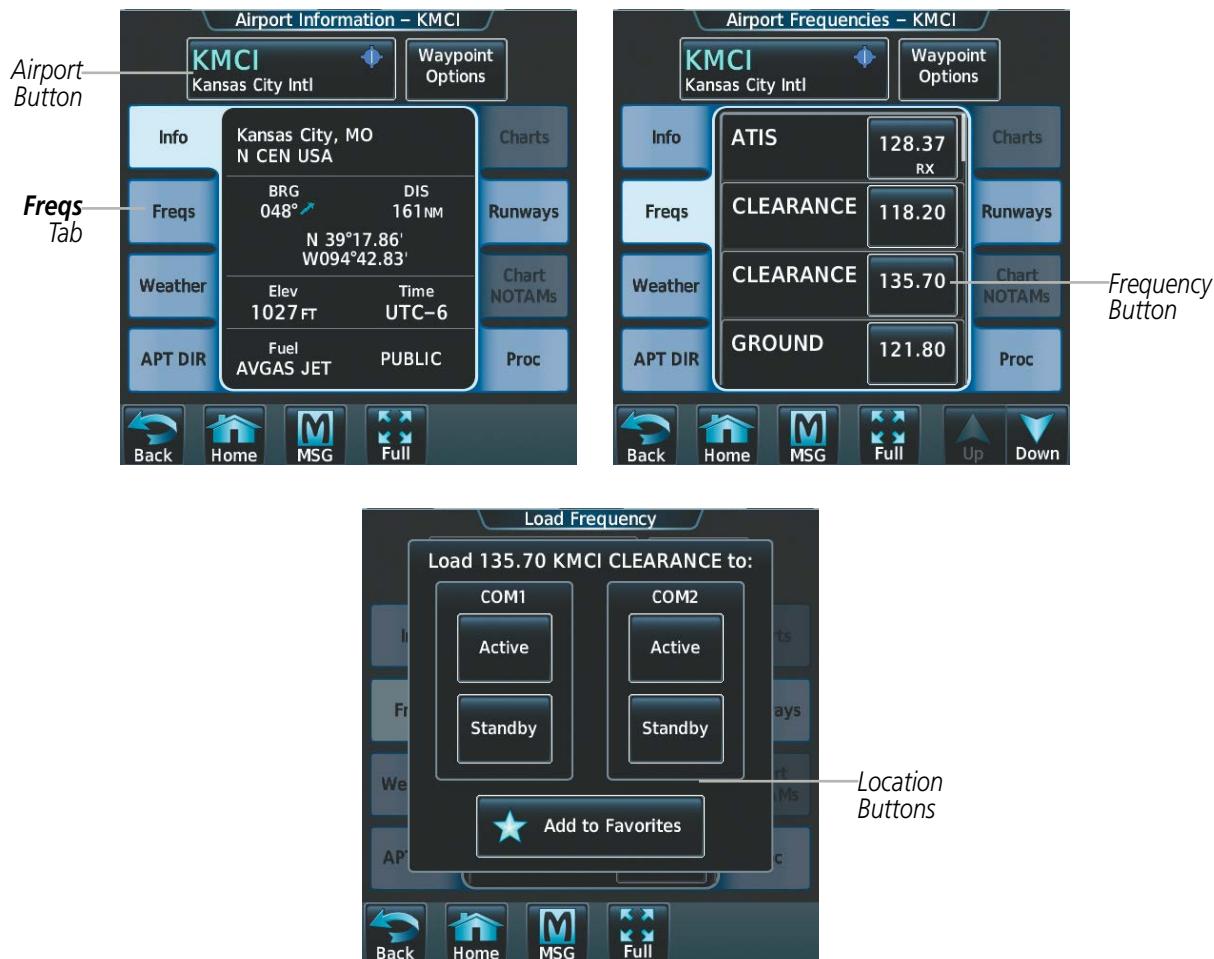


Figure 4-8 Airport Info Screen Tuning

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

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

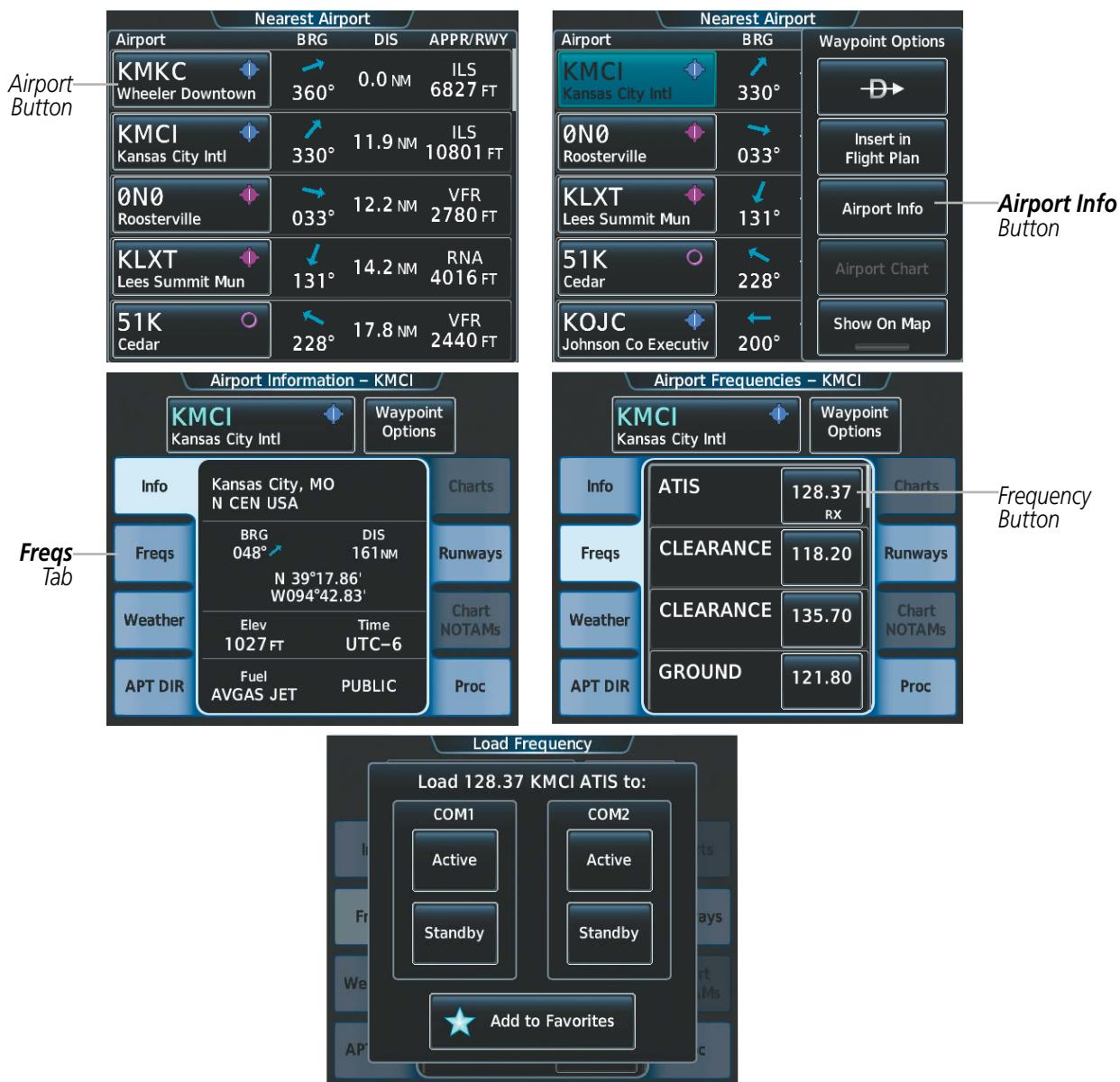


Figure 4-9 Nearest Airport Tuning

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

- 1) From the Touchscreen Controller **Home** Screen, touch the **Nearest > (Airspace or ARTCC or FSS or Weather)** to display the Nearest (Airspace or ARTCC or FSS or Weather) Screen.
- 2) Scroll the list to find the desired frequency.
- 3) Touch the frequency button to display the Load Frequency Screen.
- 4) Touch the location button to load the frequency to COM1/2 Active/Standy or Favorites.

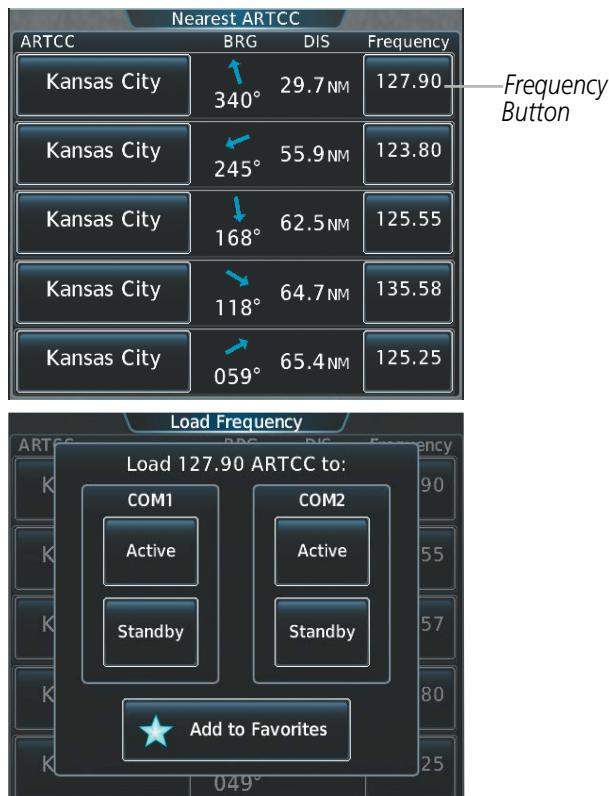


Figure 4-10 Nearest Airspace/ARTCC/FSS/Weather Tuning

FREQUENCY SPACING

The COM radios can tune either 25-kHz spacing (118.000 to 136.975 MHz) or 8.33-kHz spacing (118.000 to 136.990 MHz) for 760-channel or 3040-channel configuration. When 8.33-kHz channel spacing is selected, all of the 25-kHz channel spacing frequencies are also available in the complete 3040-channel list.



Figure 4-11 COM Channel Spacing

Changing COM frequency channel spacing:

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



Figure 4-12 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, press the middle knob. When Automatic Squelch is disabled, COM audio reception is always on. Continuous static noise is heard over the headsets and speaker, if selected. Pressing the middle knob again enables Automatic Squelch.

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



Figure 4-13 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 middle 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 in the CNS Bar, and remains for two seconds after the change. When the Audio & Radios Screen is displayed, the volume changes are not shown in the CNS Bar.

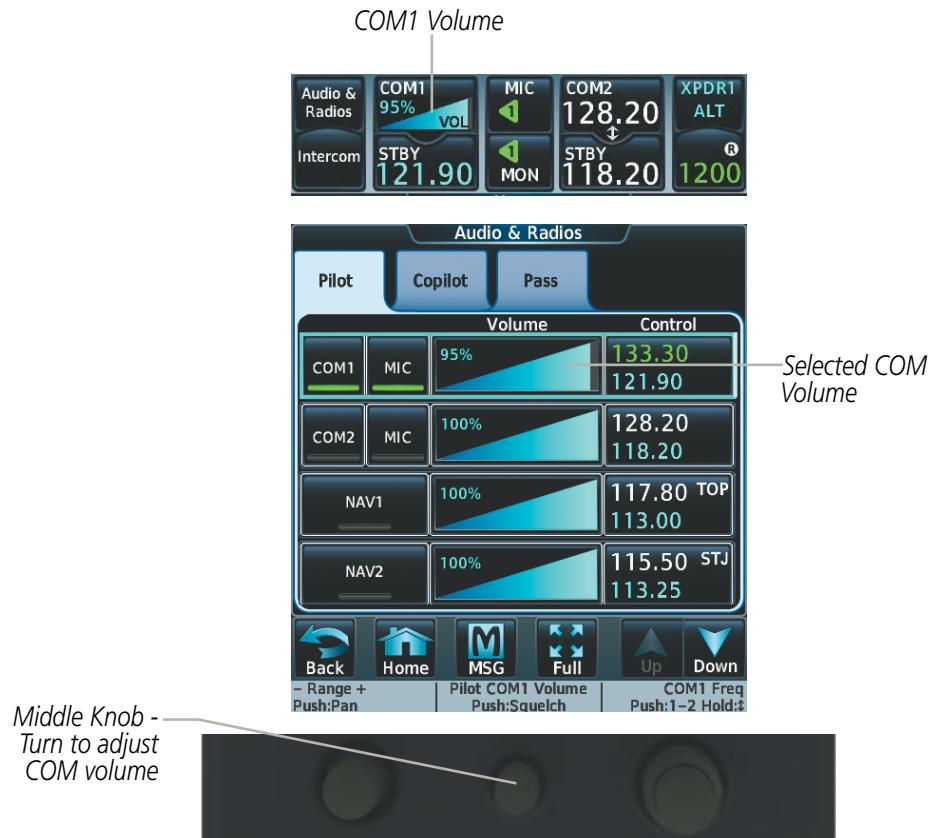


Figure 4-14 COM Volume Level

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 Touchscreen Controller.

A NAV radio is selected for navigation by selecting the **Active NAV** Softkey located on the PFD. The NAV frequency selected for navigation is displayed in green. Selecting the **Active NAV** Softkey once selects NAV1 as the navigation radio. Selecting the **Active NAV** Softkey a second time selects NAV2 as the navigation radio. Selecting the **Active NAV** Softkey a third time activates FMS mode. Selecting the **Active NAV** Softkey again cycles back to NAV1.

The three navigation modes that can be cycled through are:

- VOR1 (or LOC1) – If NAV1 is selected, a green single line arrow (shown) labeled either VOR1 or LOC1 is displayed on the HSI and the active NAV1 frequency is displayed in green.
- VOR2 (or LOC2) – If NAV2 is selected, a green double line arrow (not shown) labeled either VOR2 or LOC2 is displayed on the HSI and the active NAV2 frequency is displayed in green.
- FMS – If FMS Mode is selected, a magenta single line arrow (not shown) appears on the HSI and neither NAV radio is selected. Both active NAV frequencies are displayed in white on the Touchscreen Controller.



Figure 4-15 Selecting a NAV Radio for Navigation

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

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 4-16 Selecting a NAV Radio for Monitoring

Selecting/deselecting a navigation radio for monitoring:

- 1) 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 4-17 Audio & Radios Screen - NAV Frequency Tuning

Selecting a NAV frequency using the Touchscreen Controller:

- 1) Touch the **Audio & Radios** Button to display the Audio & Radios Screen.
- 2) Touch the NAV1/NAV2 frequency button to select NAV1/NAV2 for tuning, and display the NAV1/NAV2 frequency tuning screen.
- 3) Use the keypad to select the desired frequency.
- 4) Touch the **Enter** Button to enter the new frequency as the NAV1/NAV2 standby frequency; or touch the **XFER** Button to enter the new frequency as the NAV1/NAV2 standby frequency and transfer it to the active frequency.



Figure 4-18 NAV Frequency Tuning Window

Or:

- 1) 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 right knobs to tune the frequency (Large knob increases/decreases MHz; Small knob increases/decreases kHz).
- 4) Press the small right knob to enter the new frequency as the NAV1/NAV2 standby frequency; or press and hold the small right knob to transfer the new standby frequency to the active frequency.

Finding and selecting a NAV frequency from the Airport Info Screen:

- 1) From **Home**, touch **Waypoint Info > Airport** to display the Airport Information Screen.
- 2) If needed, touch the airport button to enter/find the desired airport.
- 3) Touch the **Freqs** Tab to display the Airport Frequencies Screen.
- 4) Scroll the list to find the desired frequency.
- 5) Touch the frequency button to display the Load Frequency Screen.
- 6) Touch the location button to load the frequency to NAV1/2 Active/Standy or Favorites.



Figure 4-19 Airport Info Screen Tuning

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

- 1) From **Home**, touch **Waypoint Info > VOR** to display the VOR Information Screen.
- 2) If needed, touch the VOR button to enter/find the desired airport.
- 3) Touch the frequency button to display the Load Frequency Screen.
- 4) Touch the location button to load the frequency to NAV1/2 Active/Standy or Favorites.



Figure 4-20 VOR Info Screen Tuning

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

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

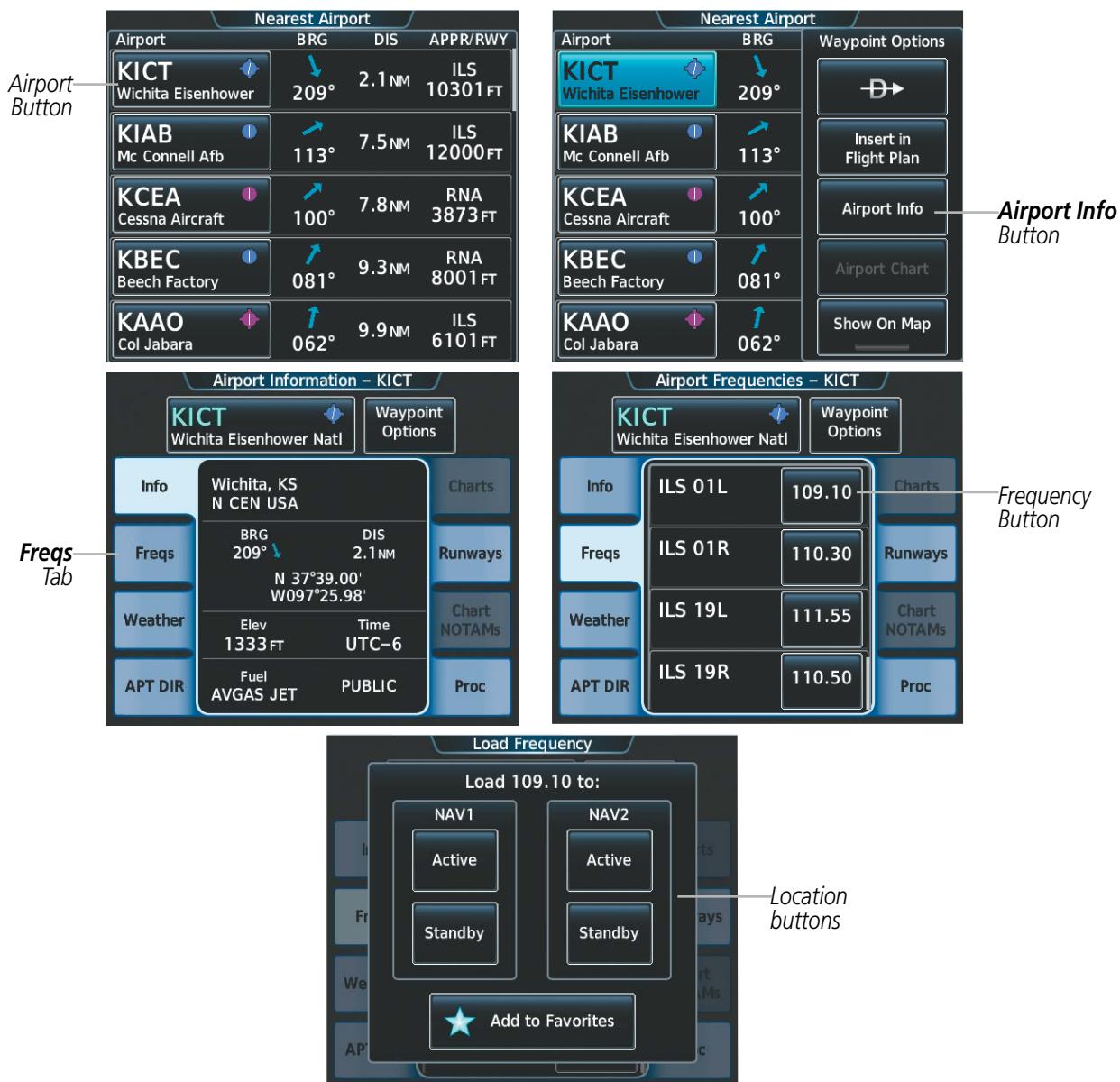


Figure 4-21 Nearest Airport Tuning

Finding and selecting a NAV frequency from the Nearest VOR/FSS/Weather Screen:

- 1) From **Home**, touch the **Nearest > (VOR or FSS or Weather)** to display the Nearest (Airspace or FSS or Weather) Screen.
- 2) Scroll the list to find the desired frequency.
- 3) Touch the frequency button to display the Load Frequency Screen.
- 4) Touch the location button to load the frequency to NAV1/2 Active/Standy or Favorites.

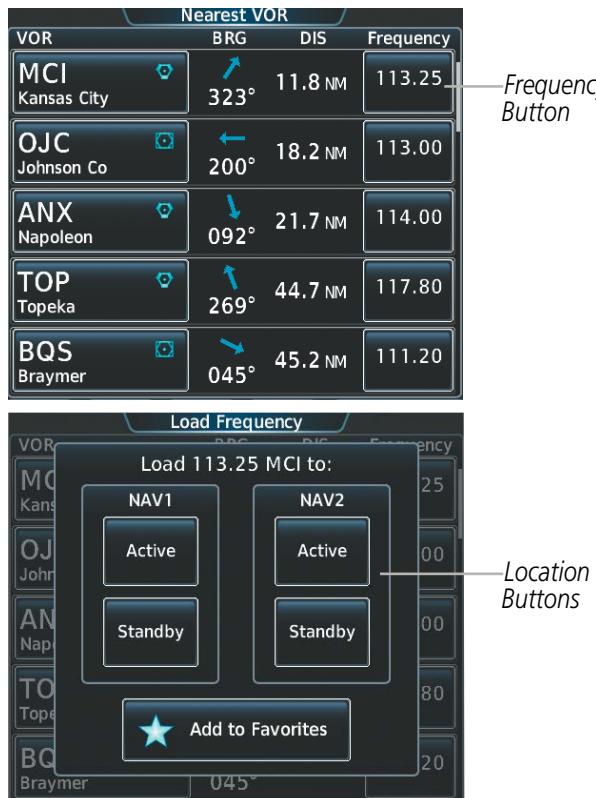


Figure 4-22 Nearest VOR/FSS/Weather Tuning

VOR/LOC ID

When the Morse code identifier audio is on for a NAV radio, a white ID appears to the right of the active NAV frequency. Pressing the middle knob turns off the Morse code audio only for the selected radio. To turn off both NAV IDs, select each NAV in turn and press the middle knob to turn the Morse code 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 Touchscreen Controller on the NAV Frequency Button, as shown in the following figure. Audio verification of the selected station identifier is still required.



Figure 4-23 VOR/LOC ID Locations

VOLUME

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



Figure 4-24 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 loaded by the FMS and the AFCS APPR mode is armed, the NAV source automatically switches to LOC when the AFCS captures the LOC mode (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 FMS, 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 FMS, 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 field 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.

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

Table 4-2

MARKER BEACON RECEIVER



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

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

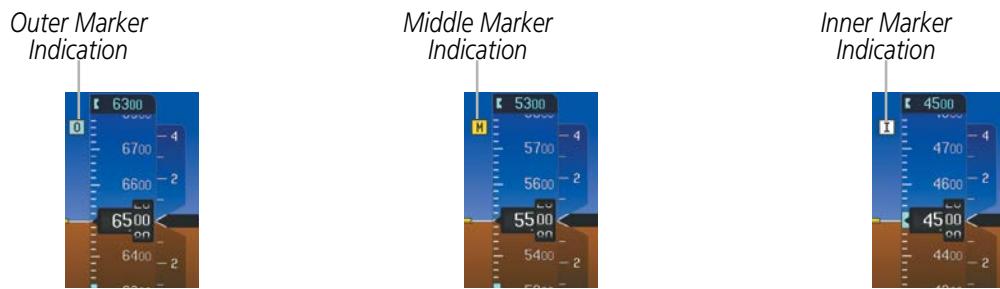


Figure 4-25 Marker Beacon Annunciations on the PFD



Figure 4-26 Marker Beacon Keys

The Touchscreen Controller provides three different states of marker beacon audio operation; Selected, Muted, and Deselected. Pressing the **MARKER** Button selects/deselects marker beacon audio. The button annunciator indicates when marker beacon audio is selected.

During marker beacon audio reception, pressing the flashing **MUTE** Button 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.

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 middle 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.

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 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 4-27 ADF/DME Tuning

The selected ADF/DME volume level can be adjusted from 0 to 100% on the touchscreen controller by turning the middle knob or by sliding your finger right or left 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) Touch **Audio & Radios** 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) 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 4-28 ADF Mode/Tuning Screen

Or:

- 1) 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) Turn the large and small right knobs to tune the frequency (Large knob increases/decreases kHz; Small knob selects .5 kHz).
- 5) Press the small right knob to enter the new frequency as the ADF standby frequency; or press and hold the small right knob to transfer the new standby frequency to the active frequency.

Finding and selecting an ADF frequency:

- 1) 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 **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 4-29 Finding an ADF Frequency

Transferring the active and standby ADF frequencies:

- 1) 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) Press and hold the small right knob to transfer the frequencies.



Figure 4-30 ADF Frequency Transfer

SELECTING ADF RECEIVER MODE

The following modes can be selected: (In all modes NDB audio can be heard by selecting the **ADF1** Button on the Touchscreen Controller.)

- ANT (Antenna) – The ADF bearing pointer parks on the HSI at 90 degrees. 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 parks on the HSI at 90 degrees while 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) Touch **Audio & Radios** 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 4-31 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 4-32 DME Mode Selection

Selecting a DME mode:

- 1) Touch **Audio & Radios** to display the Audio & Radios Screen.
- 2) Scroll the list to find the DME.
- 3) Touch the DME mode control button to display the DME Mode Window.
- 4) Touch the **NAV1 Mode**, **NAV2 Mode**, or **HOLD Mode** Button to select the DME mode. An 'H' is appended to the end of the frequency on the PFD to represent DME Hold mode.



Figure 4-33 DME Hold Mode on PFD

4.4 MODE S TRANSPONDER

The GTX 33 Mode S Transponder and GTX 33D Diversity Mode S Transponder provide Mode A, Mode C, and Mode S interrogation and reply capabilities. Diversity incorporates antennas mounted on the top and bottom of the aircraft for dependable operation while maneuvering. Selective addressing or Mode Select (Mode S) capability includes the following features:

- Level-2 reply data link capability (used to exchange information between aircraft and ATC facilities)
- Surveillance identifier capability
- Flight ID (Flight Identification) reporting – The Mode S Transponder reports aircraft identification as either the aircraft registration or a unique Flight ID.
- Altitude reporting
- Airborne status determination
- Transponder capability reporting
- Mode S Enhanced Surveillance (EHS) requirements
- Mode S Elementary Surveillance (ELS) 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, Flight ID entry, and IDENT activation are controlled and displayed on the Touchscreen Controller.



Figure 4-34 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 Mode/Code Button. If equipped with an optional second transponder, the active transponder is selected by touching the **Active** Button on the Transponder Screen, and selecting **XPDR1** or **XPDR2**.

Selecting a transponder mode:

- 1) Touch the Transponder Mode Button to display the Transponder Screen.
- 2) Touch a Mode/Code Selection Button to activate the transponder mode.

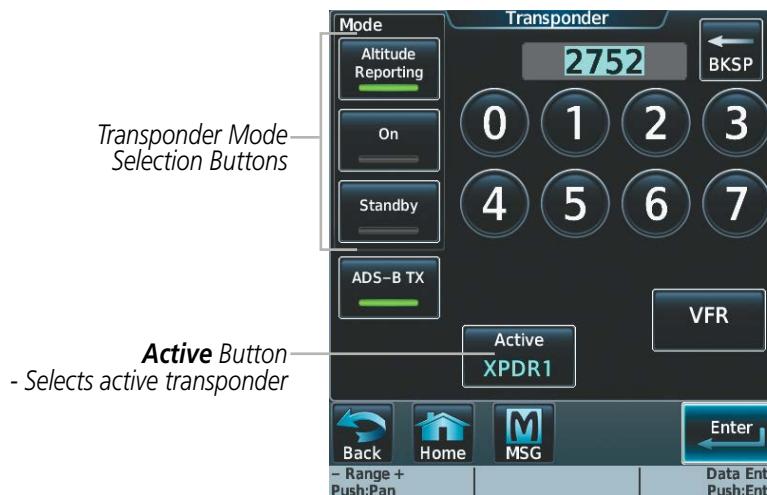


Figure 4-35 Active Transponder and Transponder Mode/Code Selection

STANDBY MODE



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

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



Figure 4-36 Standby Mode

MANUAL ON MODE

ON Mode can be selected at any time by selecting 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 S replies will not include altitude information. Mode C altitude reporting is inhibited.



Figure 4-37 On Mode

ALTITUDE REPORTING MODES

The white Altitude Reporting Mode is normally selected automatically when the aircraft is on the ground. The white ALT Mode may also be selected manually by selecting the **Altitude Reporting** Button on the Transponder Screen. A white ALT indication appears in the Transponder Mode/Code Button and the transponder code is also white. White Altitude Mode generates Mode S replies to discrete interrogations as well as transmission of acquisition and extended squitters, including ADS-B out. Mode A, Mode C, and Mode S all-call replies are inhibited.



Figure 4-38 Altitude Reporting Mode (White)

The green Altitude Reporting Mode is automatically selected when the aircraft becomes airborne. The green Altitude Reporting Mode may also be selected manually by selecting the **Altitude Reporting** Button on the Transponder Screen. Green Altitude Mode generates Mode A, Mode C, and Mode S replies as well as transmissions of acquisition and extended squitters including ADS-B out.

If the green Altitude Mode is selected, a green ALT indication appears in the Transponder Mode/Code Button, and all transponder replies requesting altitude information are provided with pressure altitude information.



Figure 4-39 Altitude Reporting Mode (Green)

REPLY STATUS

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



Figure 4-40 Altitude Reporting Mode

ADS-B TRANSMIT

The transmission of the ADS-B information is enabled/disabled by touching the **ADS-B TX** Button. ADS-B transmission defaults to enabled at each power cycle. Do not disable ADS-B transmission unless requested by ATC.

Even with the ADS-B TX enabled, transmission of extended squitters containing ADS-B out information will vary based on transponder mode.

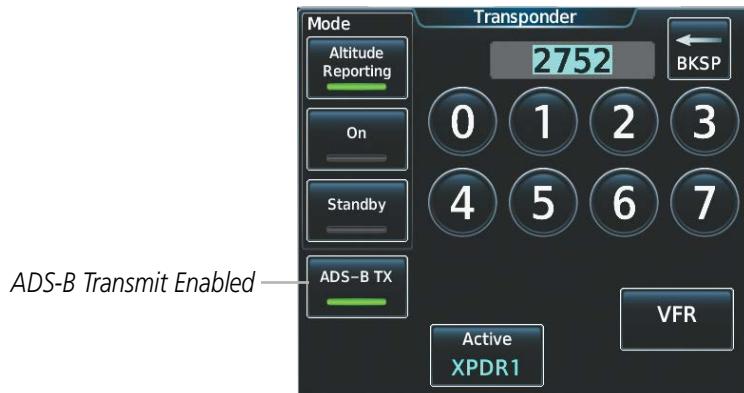


Figure 4-41 ADS-B Transmit Enable/Disable

ENTERING A TRANSPONDER CODE

Entering a transponder code with the keypad:

- 1) Touch the Transponder Mode/Code 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.

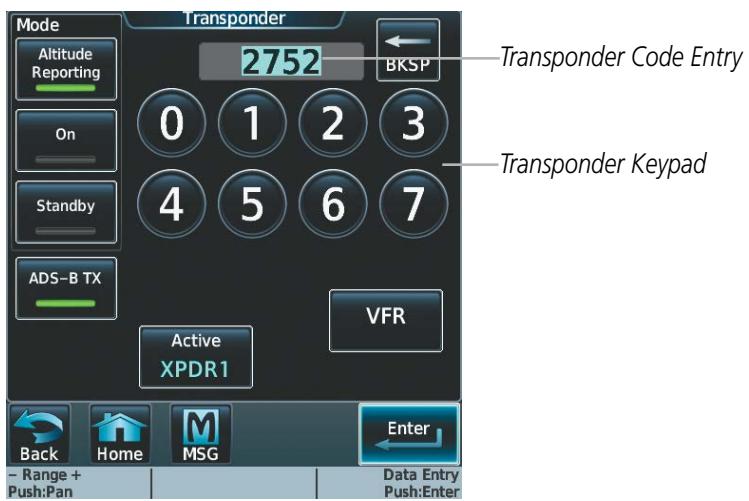


Figure 4-42 Transponder Code Entry

Entering a transponder code with the knobs:

- 1) Touch the Transponder Mode/Code Button to display the Transponder Screen.
- 2) Turn the large right knob one click either way to place the editing cursor on the first digit of the existing code.
- 3) Turn the small right knob to enter the first digit.
- 4) Turn the large right knob to move the cursor to the next digit.
- 5) Turn the small right knob to enter the next digit, repeat steps 4 and 5 until complete.
- 6) Touch the **Enter** Button, or push the small right knob, to enter the new code.

Or:

- 1) Touch the Transponder Mode/Code Button to display the Transponder Screen.
- 2) Turn the small right knob one click either way to erase the previous code and place the editing cursor on the first digit.
- 3) Turn the small right knob to enter the first digit.
- 4) Turn the large right knob to move the cursor to the next digit.
- 5) Turn the small right knob to enter the next digit, repeat steps 4 and 5 until complete.
- 6) Touch the **Enter** Button, or push the small right 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 touching the **VFR** Button and then touching the **Enter** 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 a Garmin-authorized service center for configuration.



Figure 4-43 Transponder IDENT Indication

IDENT FUNCTION



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

Selecting the Transponder Ident Button on the Transponder Screen sends a distinct identity indication to Air Traffic Control (ATC). The indication distinguishes the identifying transponder from all the others on the air traffic controller's screen. When the Transponder Ident Button is selected, the word IDENT turns green and pulsates for the duration of the identity indication.



Figure 4-44 Transponder IDENT Indication

4.5 ADDITIONAL AUDIO FUNCTIONS

MONO/STEREO HEADSETS

Stereo headsets are recommended for use in this aircraft.

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

SPEAKER

All of the radios can be heard over the cabin speaker. Pressing the **Speaker** Button selects and deselects the cabin speaker. Speaker audio is muted when the PTT is pressed. Certain aural alerts and warnings (autopilot, traffic, altitude) are always heard on the speaker, even when the speaker is not selected.

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

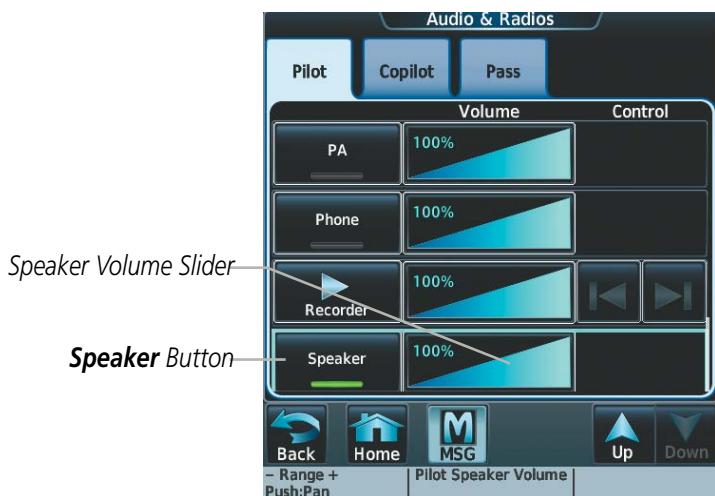


Figure 4-45 Speaker Audio Selection

INTERCOM

The G3000 includes an eight-mode intercom system (ICS) and two stereo music inputs for the pilot, copilot and passengers. The intercom provides Pilot and Copilot isolation from the passengers and aircraft radios. Each of the three link arrows are selected/deselected by touching the arrow.

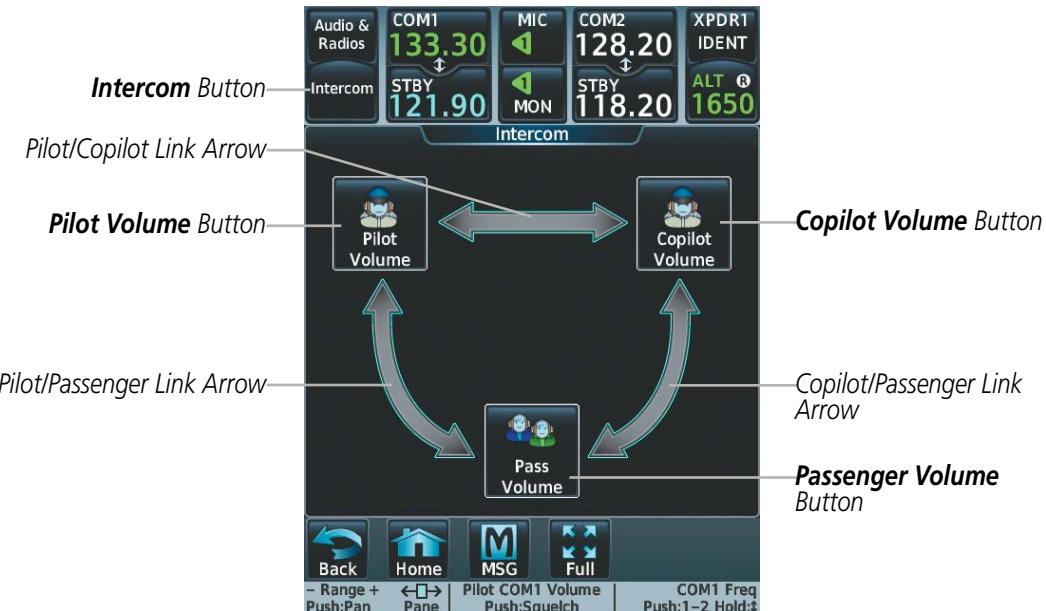


Figure 4-46 Intercom Controls

Touch the Link Arrow to enable (green) or disable (gray) the link. A green arrow connecting two positions (pilot/copilot, pilot/passenger, or copilot/passenger) indicates the two positions can hear each other.

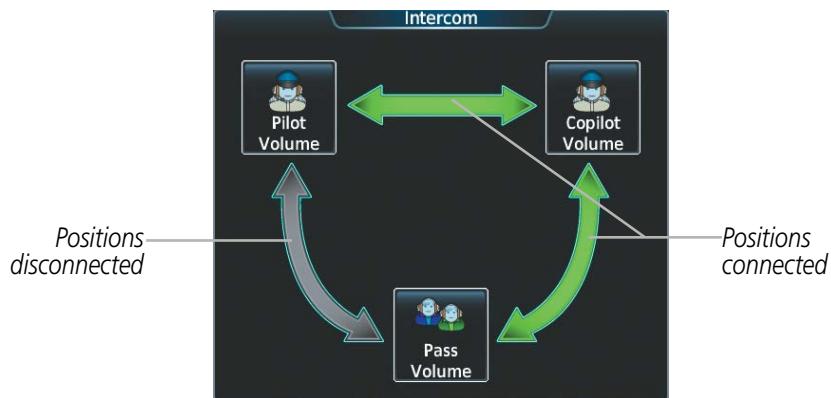


Figure 4-47 Intercom Screen

INTERCOM VOLUME AND VOX MIC

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

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

Adjusting intercom volume:

- 1) Touch the **Intercom** Button to display the Intercom Screen.
- 2) Touch the **Pilot Volume**, **Copilot Volume** or **Pass Volume** button to display the Intercom Settings Screen for that position.
- 3) Adjust the volume by using the middle knob or by sliding your finger on the volume slider.

Adjusting intercom squelch:

- 1) Touch the **Intercom** Button to display the Intercom Screen.
- 2) Touch the **Pilot Volume**, **Copilot Volume** or **Pass Volume** button to display the Pilot or Copilot Intercom Settings Screen for that position.
- 3) Touch the Squelch Mode Button to disable Auto Squelch.
- 4) Adjust the squelch by using the middle knob or by sliding your finger on the squelch slider.

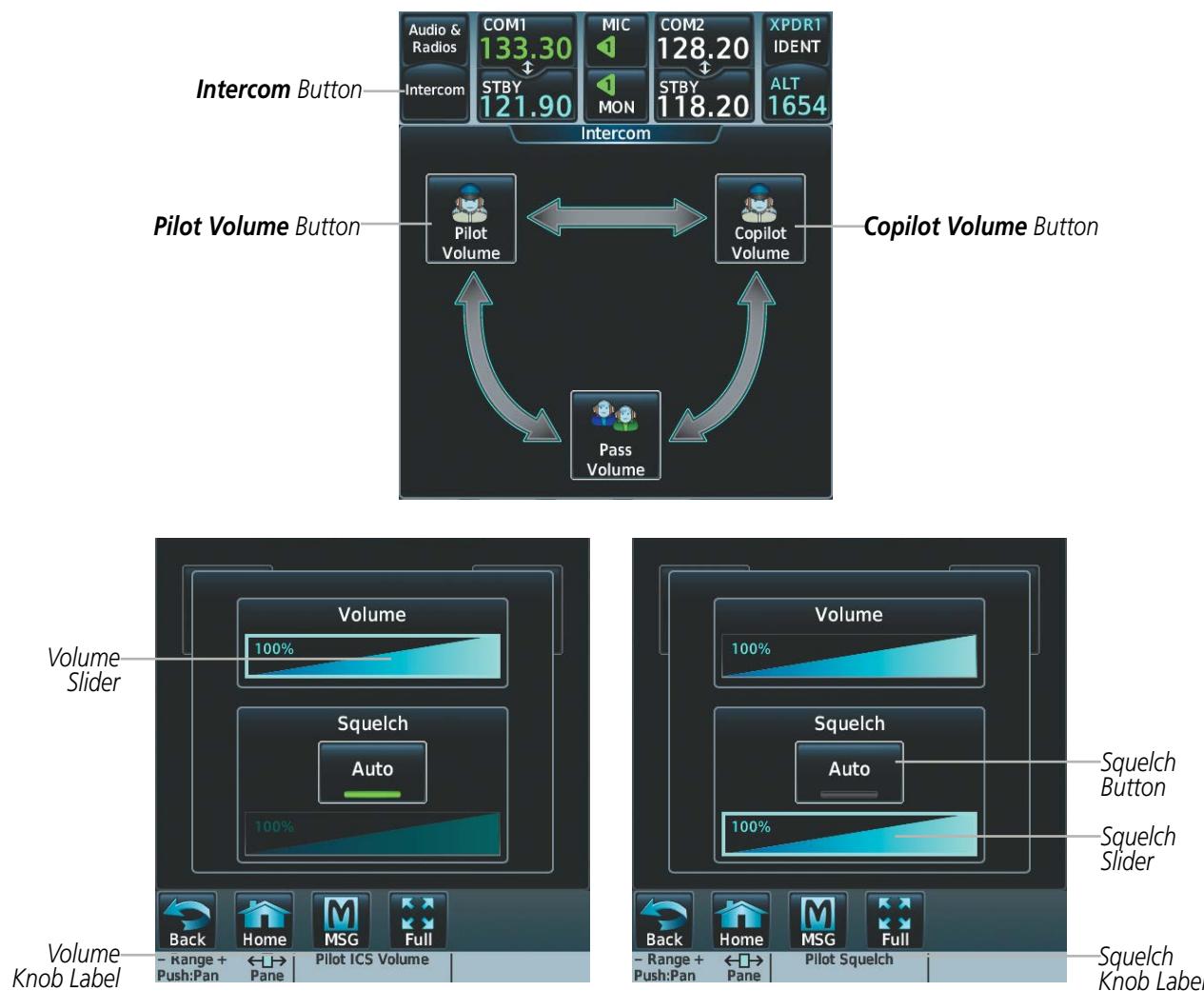


Figure 4-48 Intercom Volume/Squelch Controls

PASSENGER ADDRESS (PA) SYSTEM



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

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



Figure 4-49 PA Controls

Selecting the PA system for transmission:

- 1) Touch the **Audio & Radios** Button to display the Audio & Radios Screen.
- 2) Scroll the list to find the PA.
- 3) Touch the **PA** Button on the Audio & Radios Screen to select the PA for transmission.

CLEARANCE RECORDER AND PLAYER

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

Touching the **Playback** (Play) Button plays the latest recorded memory block. The **Playback** (Stop) Button is displayed while the audio is playing. When the present memory block has finished playing the **Playback** (Play) Button is displayed again.

Touching the **Playback** (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.

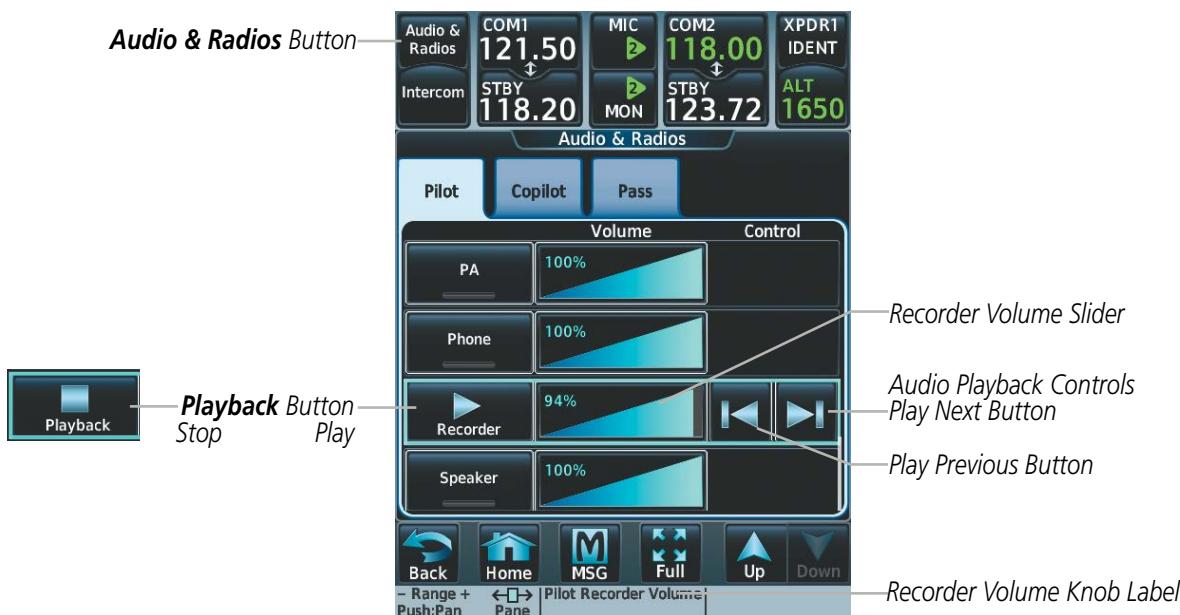


Figure 4-50 Recorder Controls

SIMULTANEOUS COM OPERATION

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

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

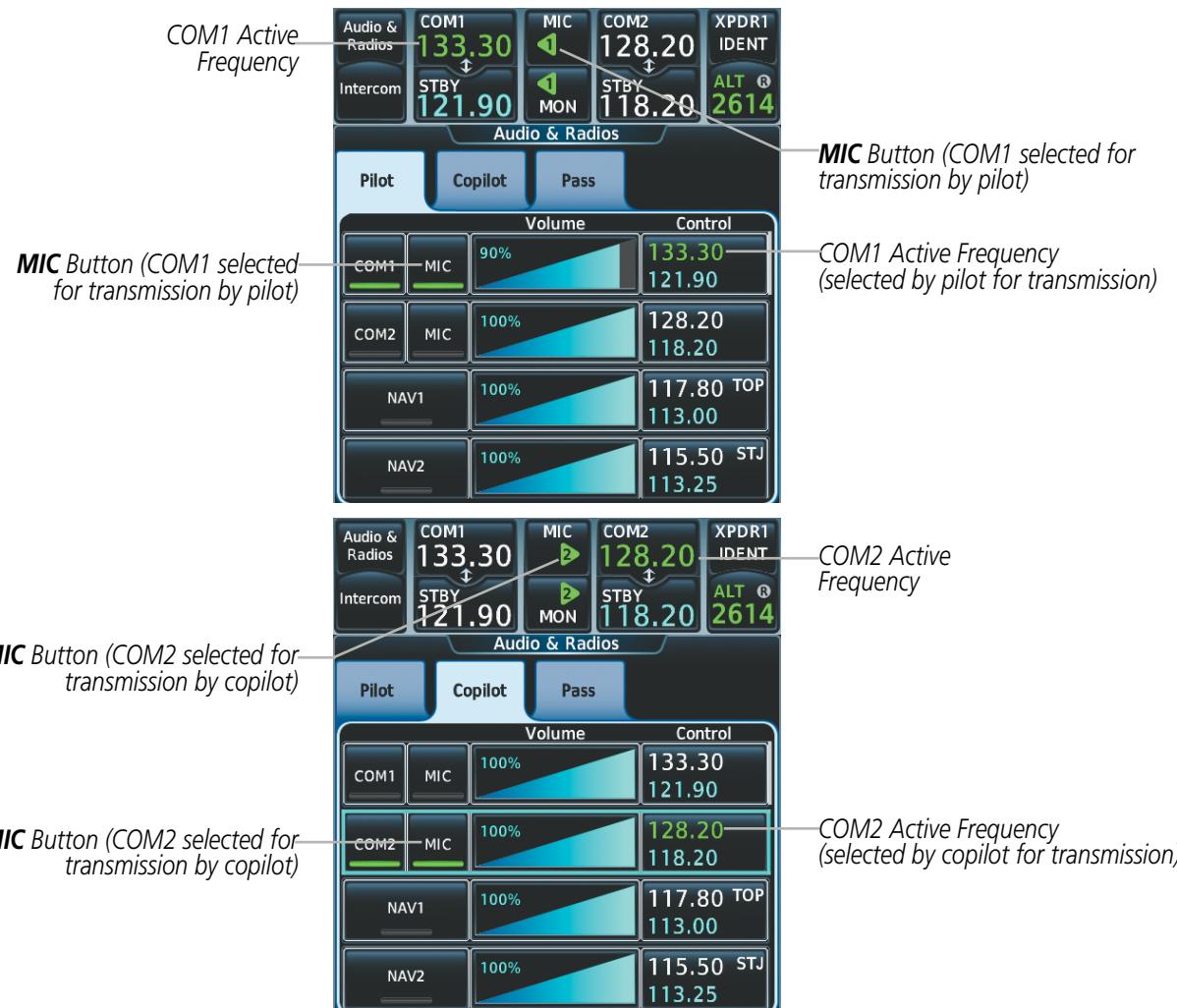


Figure 4-51 Simultaneous COM Operation

ENTERTAINMENT INPUTS

The Audio Controller provides two audio entertainment inputs. The **Music 1** Button controls the audio for the optional SiriusXM Satellite Radio. The **Music 2** Button controls audio for the auxillary audio input.



Figure 4-52 Entertainment Audio Controls

MUSIC 1 (SIRIUSXM SATELLITE RADIO)

SIRIUSXM RADIO ENTERTAINMENT

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

Selecting/Deselecting SiriusXM Audio:

- 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 optional **Pass** Tab.
- 3) Scroll the list to find the **Music 1** Button.
- 4) Touch the **Music 1** Button to select/deselect the SiriusXM Radio input for the selected position (pilot, copilot, or passengers (optional)).

The SiriusXM audio volume can be adjusted from 0 to 100% on the touchscreen controller by turning the middle knob or by sliding your finger right or left on the volume slider.

SIRIUSXM AUDIO MUTING

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

Configuring SiriusXM audio Mute Settings:

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

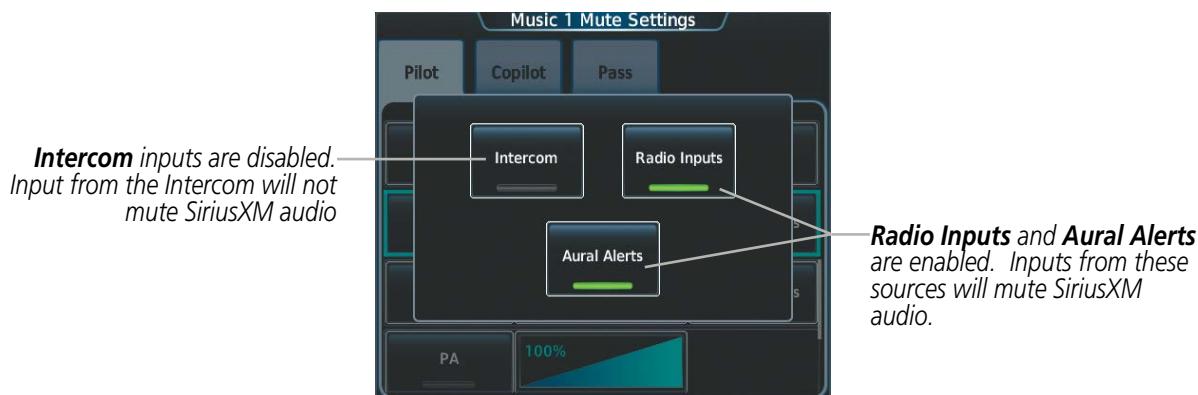


Figure 4-53 Music Mute Settings

MUSIC 2 (AUXILIARY AUDIO INPUT)

This input is compatible with popular portable entertainment devices such as MP3 players and tablets.

Selecting/deselecting the Auxiliary Audio input:

- 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 2**.
- 4) Touch the **Music 2** Button to select/deselect the auxiliary input for the selected position (pilot, copilot, or passengers (optional)).

The auxiliary audio volume can be adjusted from 0 to 100% on the touchscreen controller by turning the middle knob or by sliding your finger right or left on the volume slider.

AUXILIARY AUDIO MUTING

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

Configuring 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 optional **Pass** Tab.
- 3) Scroll the list to find **Music 2**.
- 4) Touch the **Mute Settings** Button to display the Music 2 Mute Settings Window.
- 5) Select the **Intercom**, **Radio Inputs**, and/or **Aural Alerts** Buttons to enable/disable which items will mute auxiliary audio.

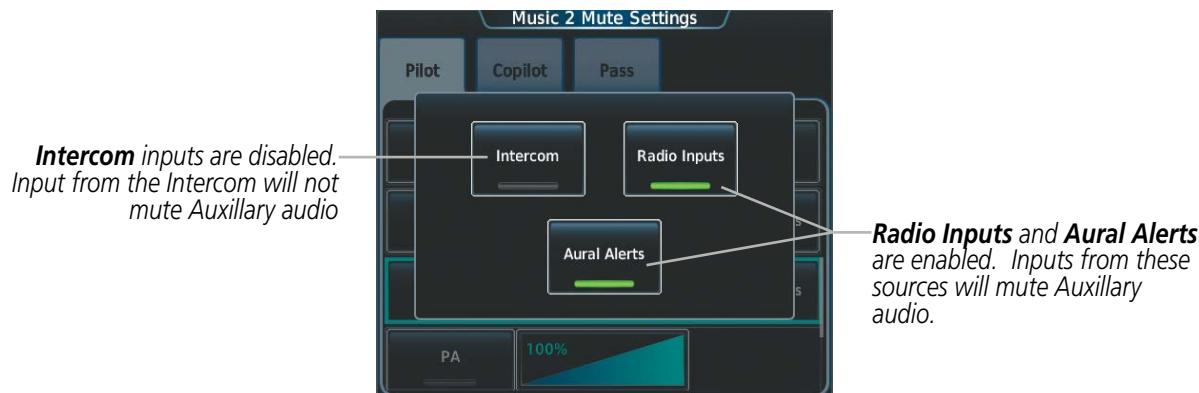


Figure 4-54 Music Mute Settings

SATELLITE TELEPHONE

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

Selecting/deselecting the Satellite Telephone audio:

- 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 **Telephone** Button.
- 4) Touch the **Telephone** Button to select/deselect the Satellite Telephone input for the selected position (pilot or copilot).

The Satellite Telephone volume can be adjusted from 0 to 100% on the touchscreen controller by turning the middle knob or by sliding your finger right or left on the volume slider.

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.
- 5) Touch the desired audio feedback setting.

Setting	Description
Off	No feedback is audible for the selected position.
Errors Only	Only error tones will be audible. Error tones from both the pilot and copilot Touchscreen Controller positions will be audible to the selected position.
On	All audio feedback from the pilot or copilot Touchscreen Controller positions will be audible to the selected 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 middle knob or by sliding your finger right or left on the volume slider.



Figure 4-55 Audio Feedback (Clicks)

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 yellow X.

STUCK MICROPHONE

If the push-to-talk (PTT) Key becomes stuck, the COM transmitter stops transmitting after 35 seconds of continuous operation. An alert appears on the Touchscreen Controller to advise the pilot of a stuck microphone.

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

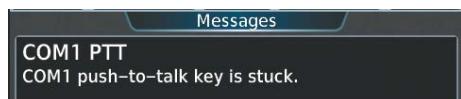


Figure 4-56

COM TUNING FAILURE

In case of a COM system tuning failure, the radio will remain tuned to the active frequency. Depending on the failure mode, a yellow X may appear on the frequency display.



Figure 4-57 COM Tuning Failure

AMBER COM FREQUENCY DIGITS

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

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, the intercom continues to work.

TOUCHSCREEN CONTROLLER FAILURE

In case of a Touchscreen Controller failure, the operational Touchscreen Controller will control the pilot, co-pilot, and passenger audio and radios. In case of dual Touchscreen Controller failure, the GIA will automatically switch the active COM to the emergency frequency.

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SECTION 5 FLIGHT MANAGEMENT

5.1 INTRODUCTION

The G3000 is an integrated flight, engine, communication, navigation and surveillance system. This section of the Pilot's Guide explains GPS navigation using the G3000.

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. See examples in Figure 5-1 and Figure 5-2. Detailed descriptions of GPS navigation functions are discussed later in this section.

A brief description of the GPS navigation data on the PFD and MFD follows.

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

The Inset Map is a small version of the Navigation Map and can be displayed in the lower left corner of the PFD. When the system is in reversionary mode, the Inset Map is not displayed. The Inset Map is displayed by pressing the **PFD Map Settings** Softkey, pressing the **Map Layout** Softkey, then pressing the **Inset Map** Softkey. Selecting the **Map Off** Softkey 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, pressing the **Map Layout** Softkey, then pressing the **HSI Map** Softkey. Selecting the **Map Off** Softkey removes 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 selecting the **Detail** Softkey on the PFD for the Inset Map, and by the Map Detail Slider on the Touchscreen Controller for navigation maps. The Navigation Map can be oriented three different ways: North Up (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 corresponding **Joystick** 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



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



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

NAVIGATION STATUS BAR

The PFD Navigation Status Bar located to the right of the HSI contains two fields displaying the following information:



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
	Left Procedure Turn		Left DME Arc
	Vector to Final		

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

BRG	Bearing
DES	Destination Airport Identifier
DIS	Distance
DTG	Distance to Destination
DTK	Desired Track
END	Endurance
ENR	ETE to Final Destination
ESA	Enroute Safe Altitude
ETA	Estimated Time of Arrival
ETE	Estimated Time Enroute
FLT	Flight Timer

FOB	Fuel on Board
FOD	Fuel over Destination
GS	Ground Speed
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

GS 267KT DTK 287° TRK 287° ETE 04:12 BRG 287° DIS 18.7 NM MSA 3700FT ETA 18:43UTC

MFD Navigation Data Bar

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

Changing a field in the MFD Navigation Data Bar:

- 1) From **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 - 6 as necessary.



Figure 5-4 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 or offside independently, or for all displays.

Enabling/disabling map settings synchronization:

- 1) From **Home**, touch **Map** > **Map Settings** > **Map Sync**.
- 2) Touch the **Onside** Button or the **All** Button.
- 3) Touch the **PFD1**, **MFD Left**, **PFD2**, or **MFD Right** 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 5-5 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 5-6 Map Orientation

- North up (NORTH UP) aligns the top of the map display to north.
- Track up (TRK UP) aligns the top of the map display to the current ground track.
- Heading up (HDG UP) aligns the top of the map display to the current aircraft heading (default setting).

Changing the Navigation Map orientation:

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

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

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

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

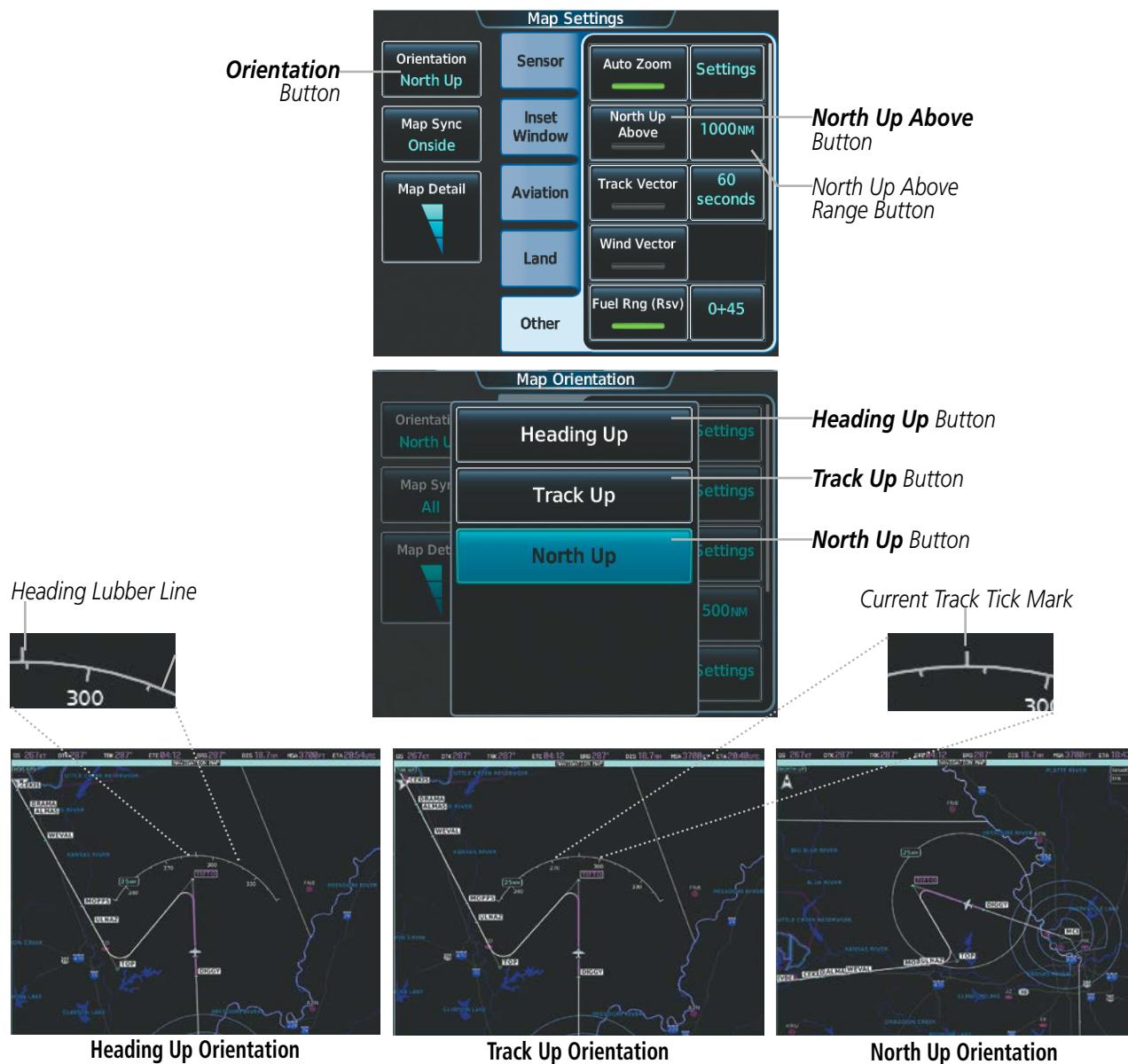


Figure 5-7 Map Orientation Selection

The range arcs include tick marks indicating compass directions. Track Up indicates current track with a tick mark on the outside of the arc. Heading Up indicates current heading with a heading lubber line.

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 corresponding **Joystick** 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. To change the Inset Map or HSI Map range, use the **Map Range -** and the **Map Range +** softkeys.



Figure 5-8 Map Range

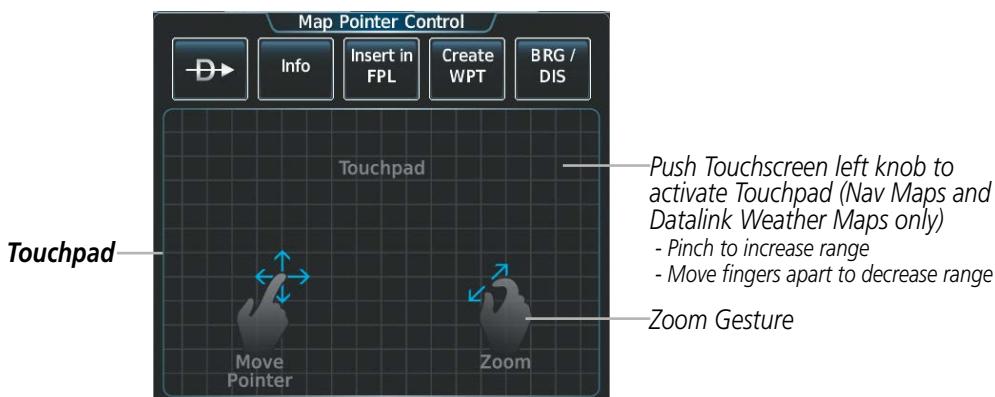


Figure 5-9 Touchpad Map Range Control

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 adjusting the range with the **Joystick** 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 points. 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 '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 '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 **Home**, touch **Map > Map Settings**.
- 2) If necessary, touch the **Other** Tab to display the options list.
- 3) Touch the **Auto Zoom** Button to enable/disable auto zoom.
- 4) Touch the **Auto Zoom Settings** Button to display the Auto Zoom Settings Screen.
- 5) Touch the **Auto Zoom Max Look Fwd** Button to display the numeric keyboard.
- 6) Use the keypad to enter the maximum look forward time. Times are from zero to 999 minutes.
- 7) Repeat steps 5 and 6 for 'Min Look Fwd' (zero to 99 minutes) and 'Time Out' (zero to 99 minutes).

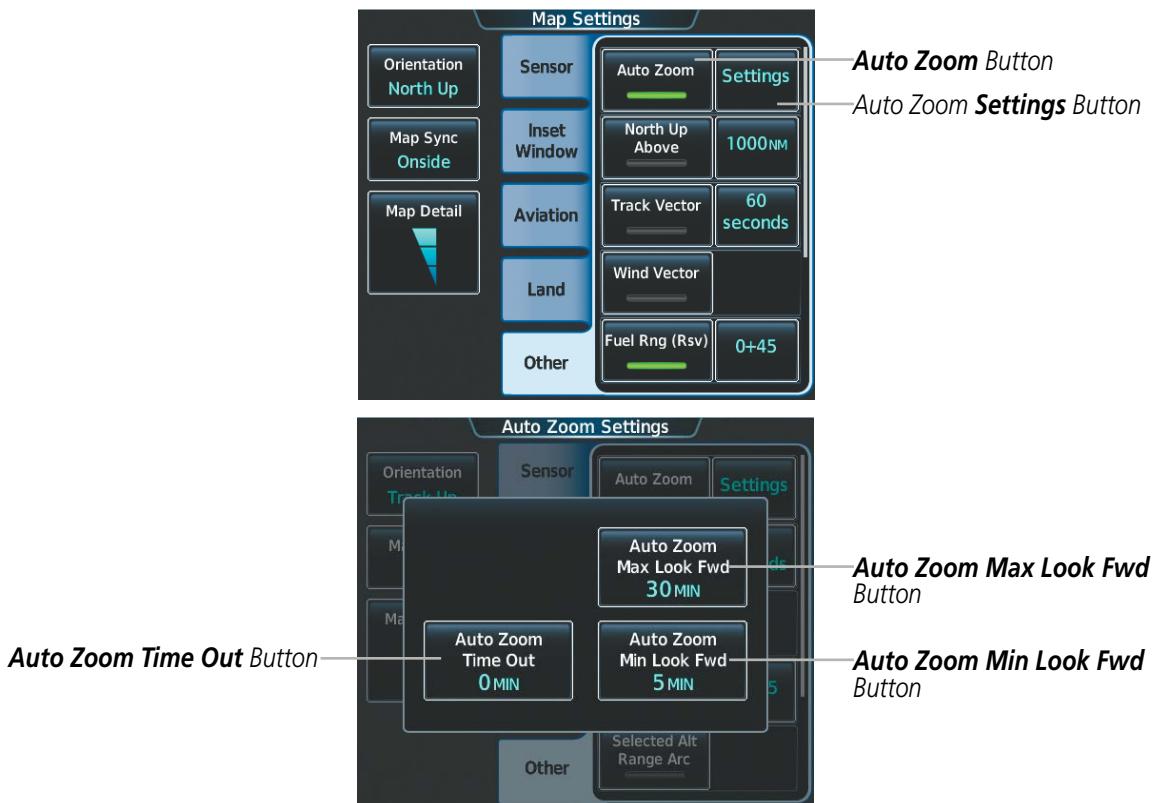


Figure 5-10 Auto Zoom Setup

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 (**Joystick** or **Touchpad**)
- Highlight and select locations on the map (**Joystick** or **Touchpad**)
- Graphically initiate a Direct To a selected airport, NAVAID (VOR, Intersection, NDB), or user waypoint (**DP** 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)
- Review airspace, obstacle and airway information in a pop-up window on the navigation map

When the Map Pointer function is selected by pressing the **Joystick**, 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.

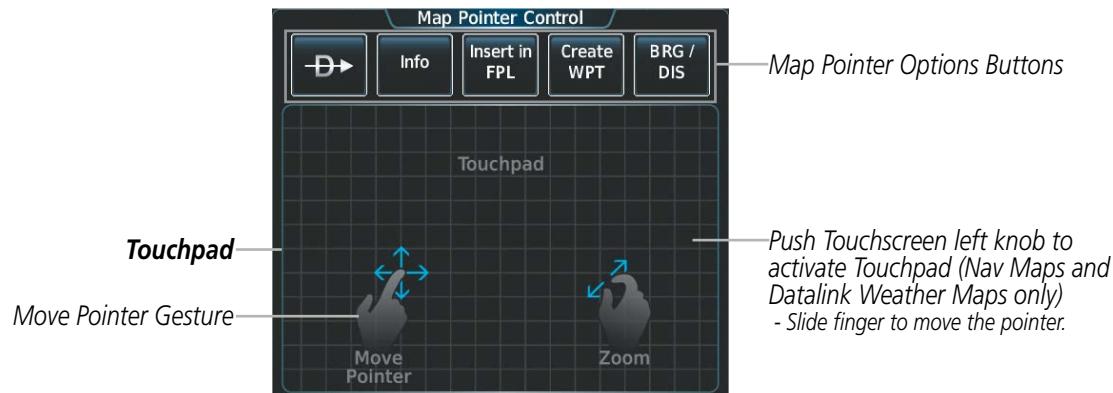


Figure 5-11 Touchpad Map Pointer Control

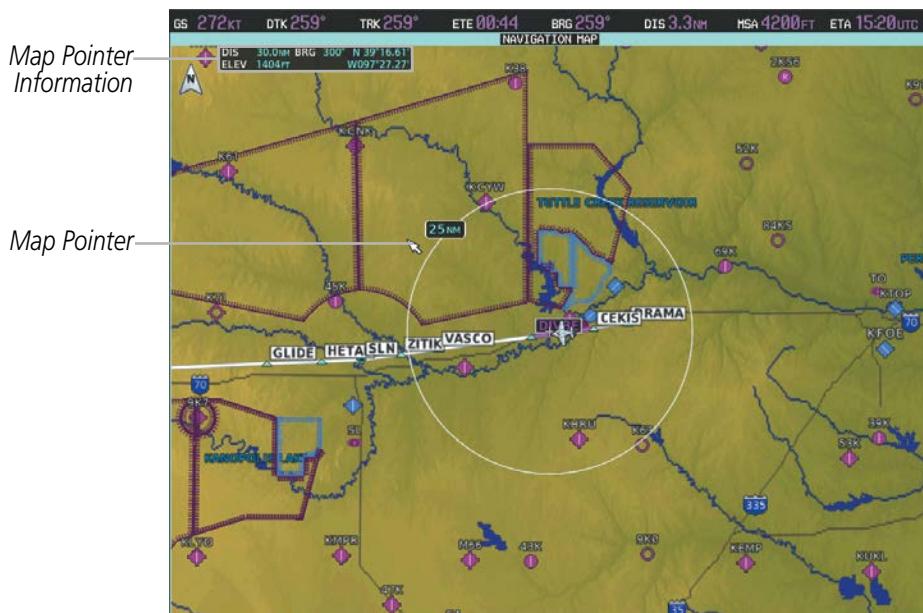


Figure 5-12 Navigation Map - Map Pointer Activated

Panning the map:

- 1) Press the **Joystick** to display the Map Pointer.
 - 2) Move the **Joystick**, 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 the **Joystick** to remove the Map Pointer and recenter the map on the aircraft's current position.

Or:

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

When the Map Pointer is placed on 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.

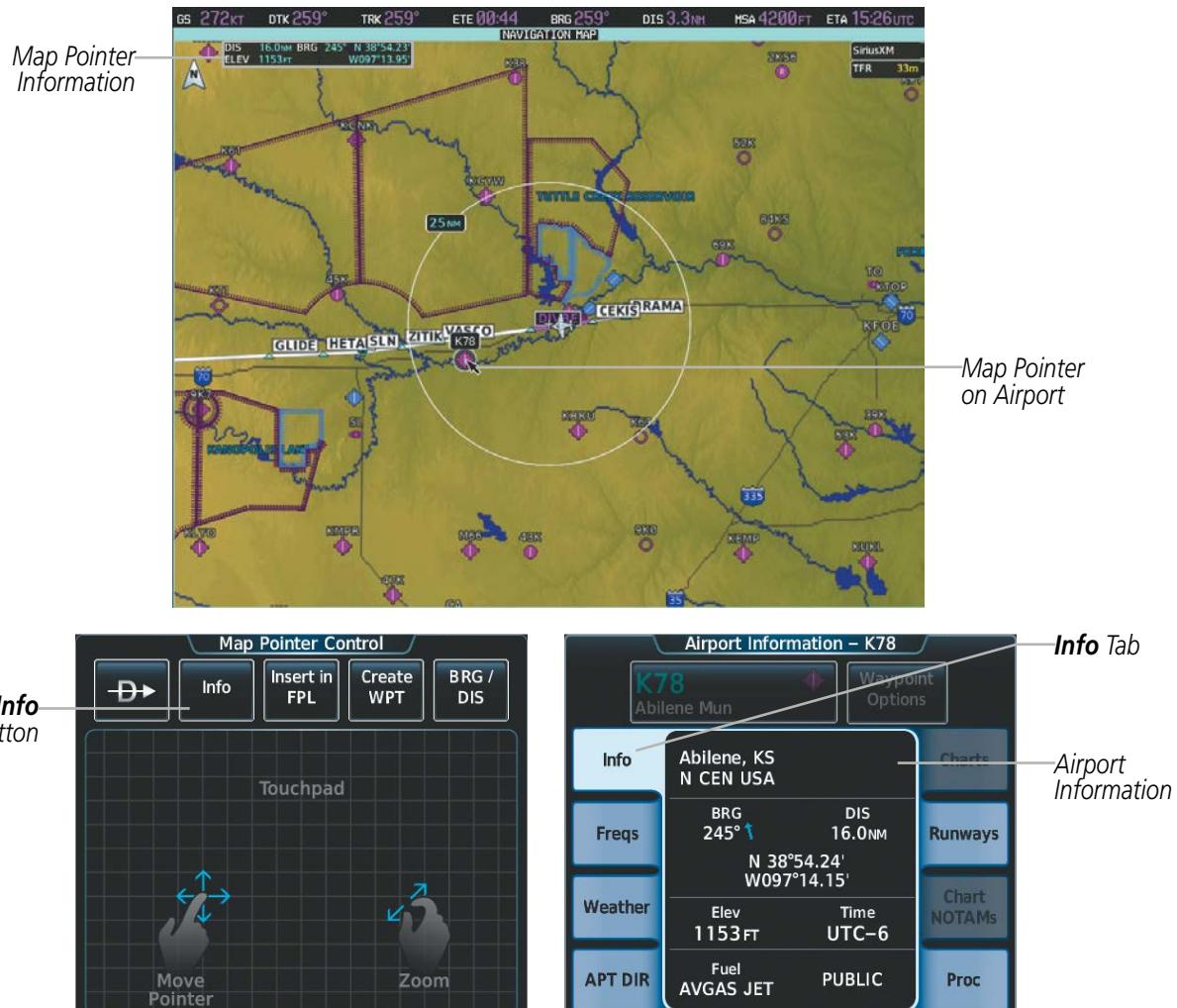


Figure 5-13 Navigation Map - Map Pointer on Airport

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 the **Joystick** 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.

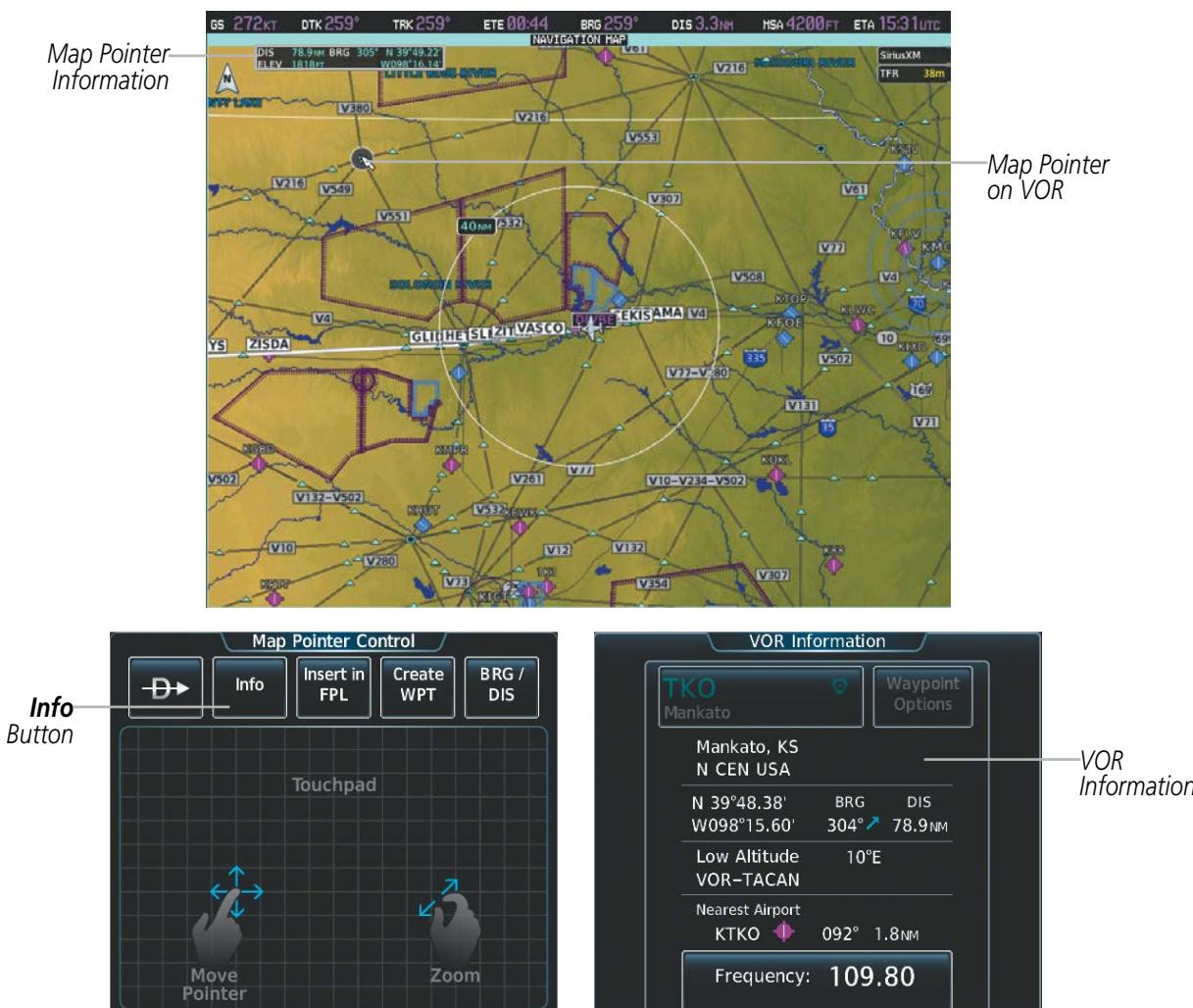


Figure 5-14 Navigation Map - Map Pointer on VOR

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.

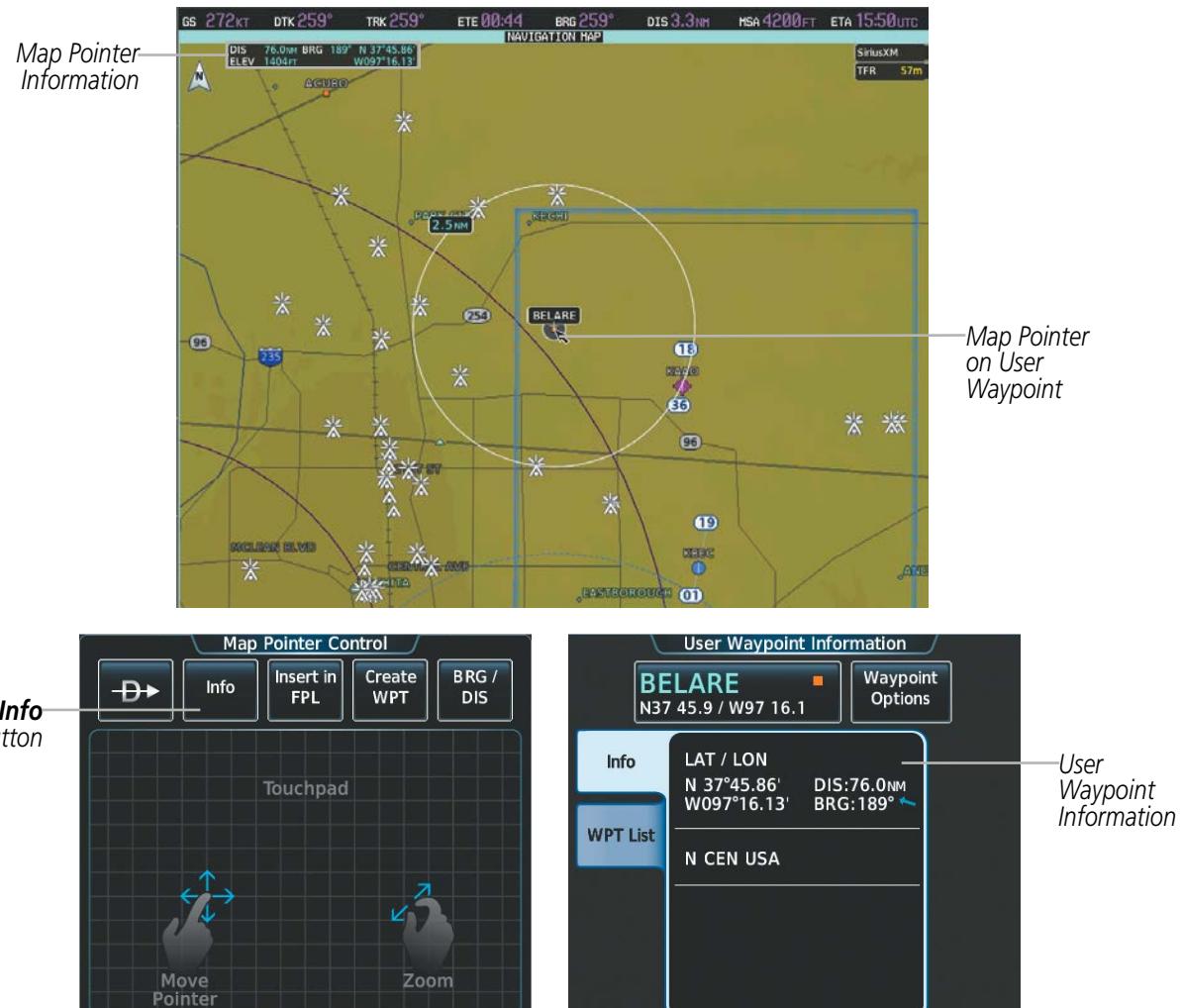


Figure 5-15 Navigation Map - Map Pointer on User Waypoint

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.

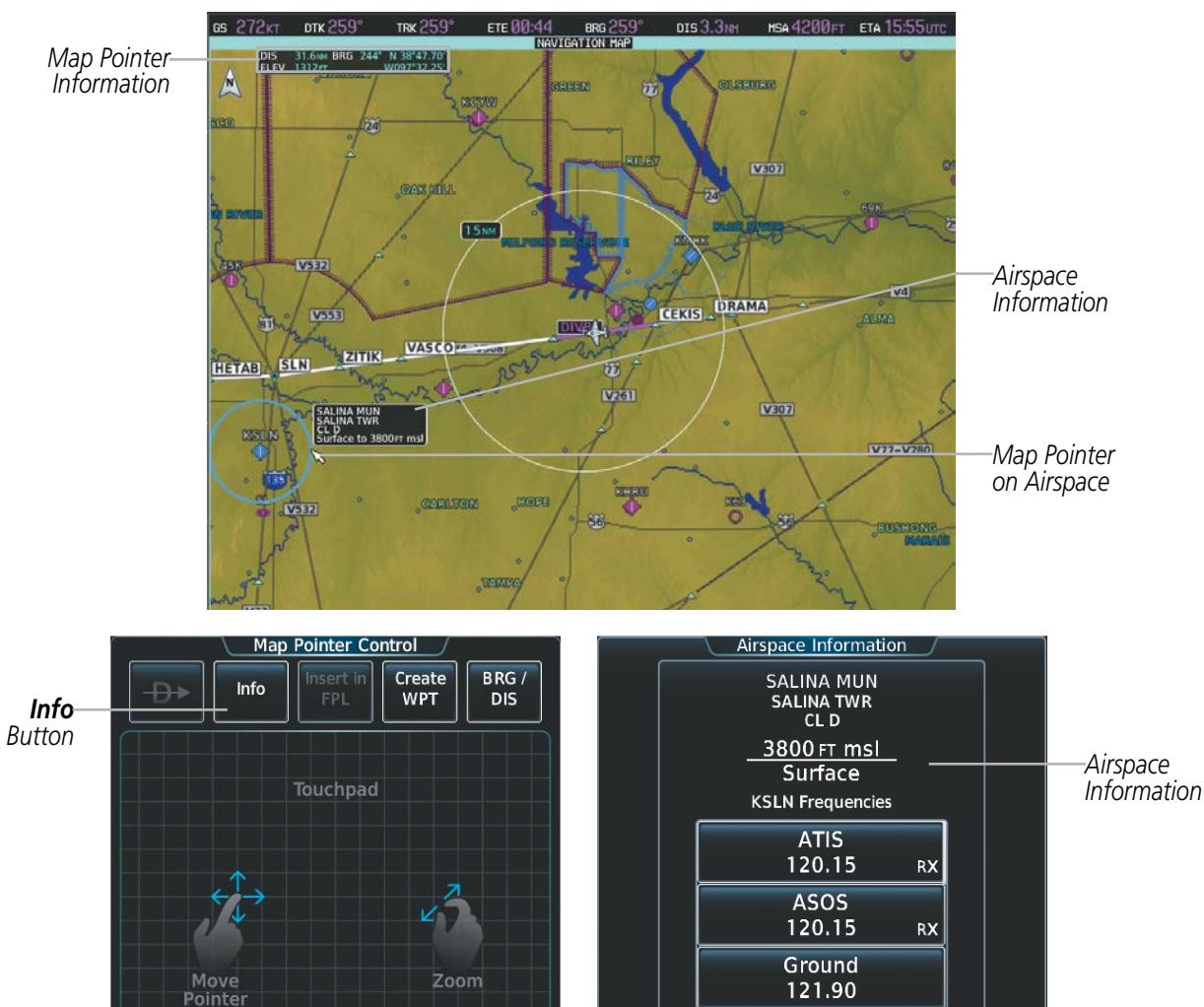


Figure 5-16 Navigation Map - Map Pointer on Airspace

Reviewing information for a special use or controlled airspace:

- 1) Place the Map Pointer on a waypoint.
- 2) Touch the **Info** Button to display the Airspace 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 the **Joystick** to exit the waypoint information screen, remove the Map Pointer from the Navigation Map, and recenter the map on the aircraft's current position.

MEASURING BEARING AND DISTANCE

Distance and bearing can be measured on a navigation map or on a data link weather map using the **Joystick** 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 **Joystick** (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 **Joystick** 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 **Joystick** or touch the **Back** Button.

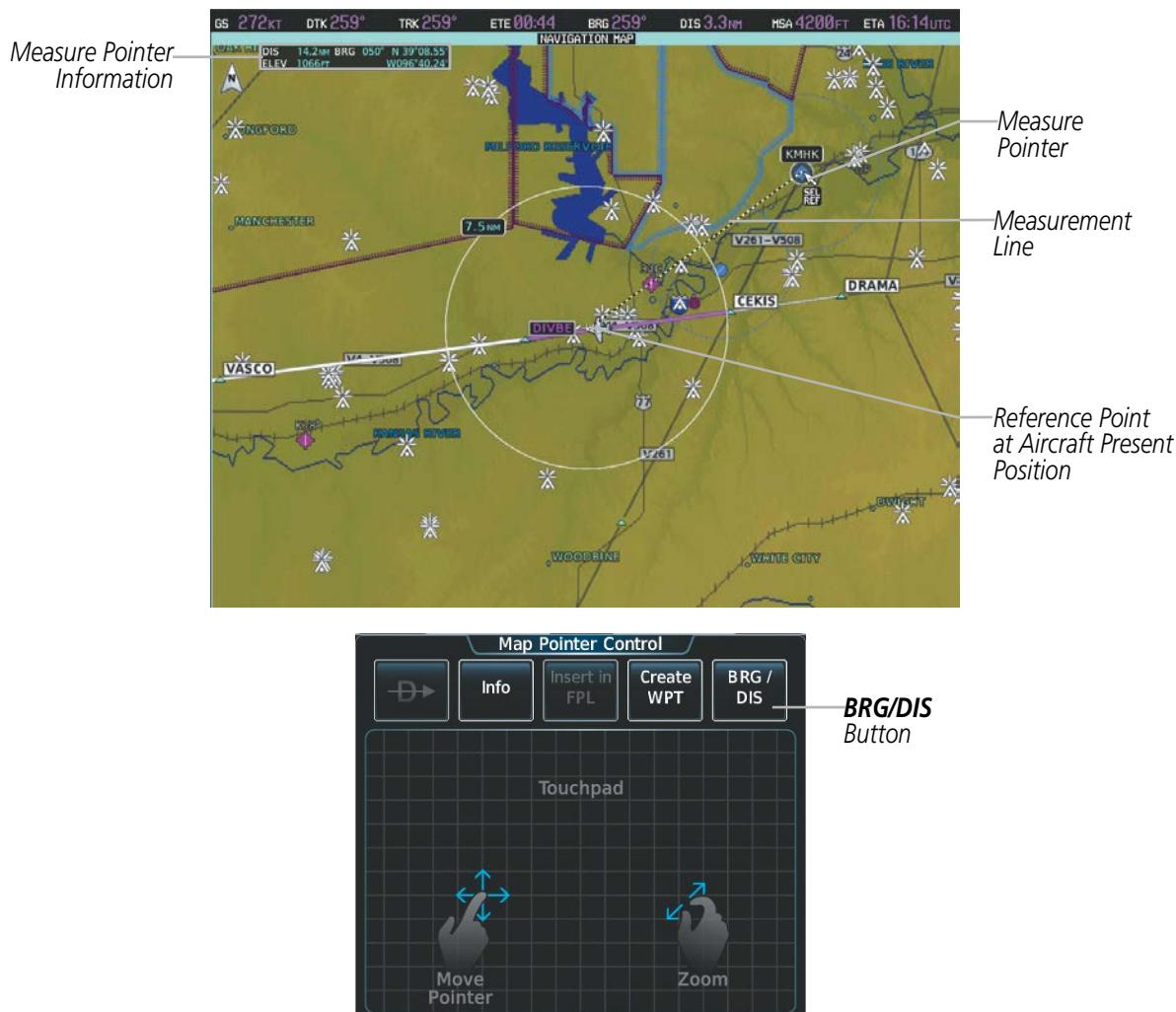


Figure 5-17 Navigation Map - Measuring Bearing/Distance from Aircraft Present Position

Measuring bearing and distance between any two points:

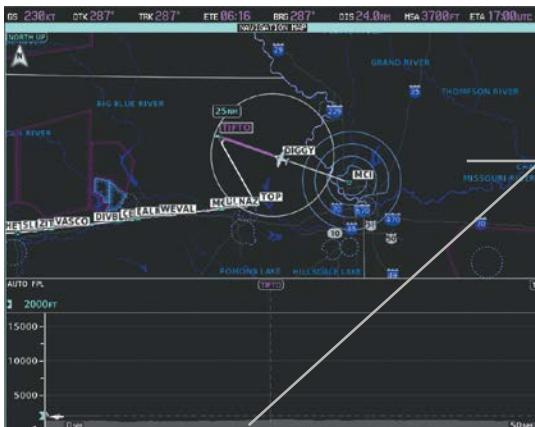
- 1) Press the **Joystick** (with a navigation map or data link weather map displayed).
- 2) Touch the **BRG/DIS** Button. A Measure Pointer is displayed on the map at the aircraft's present position.
- 3) Move the pointer using the **Joystick** or the **Touchpad** to the desired reference location. 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 **Joystick** 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 the **Joystick** or touch the **Back** Button.



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

ABSOLUTE TERRAIN

All navigation maps can display various shades of absolute terrain colors representing land elevation, similar to aviation sectional charts. Absolute terrain data can be displayed or removed as described in the following procedures.



Absolute Terrain Off



Absolute Terrain On

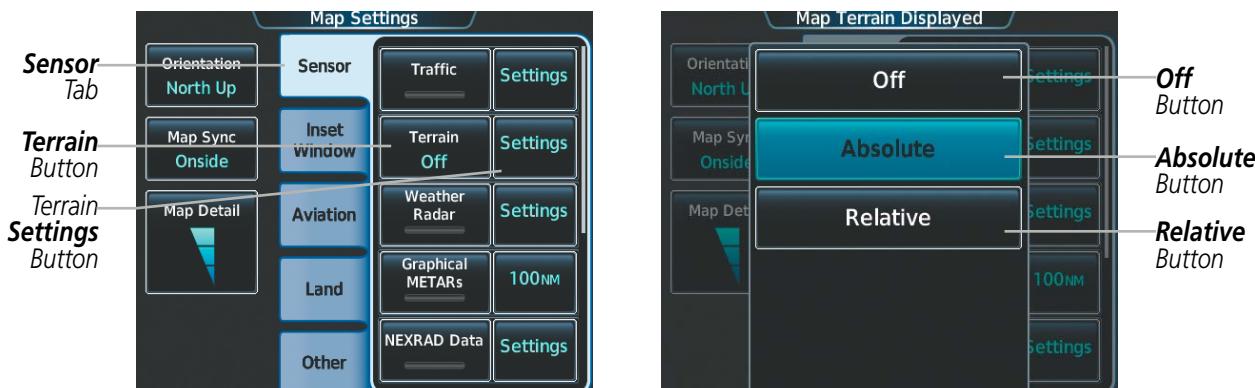


Figure 5-19 Navigation Map - Absolute Terrain Data

Displaying/removing absolute terrain data on navigation maps:

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

Relative terrain is discussed in the Hazard Avoidance section.



Figure 5-20 PFD Inset Map - Absolute Terrain Data

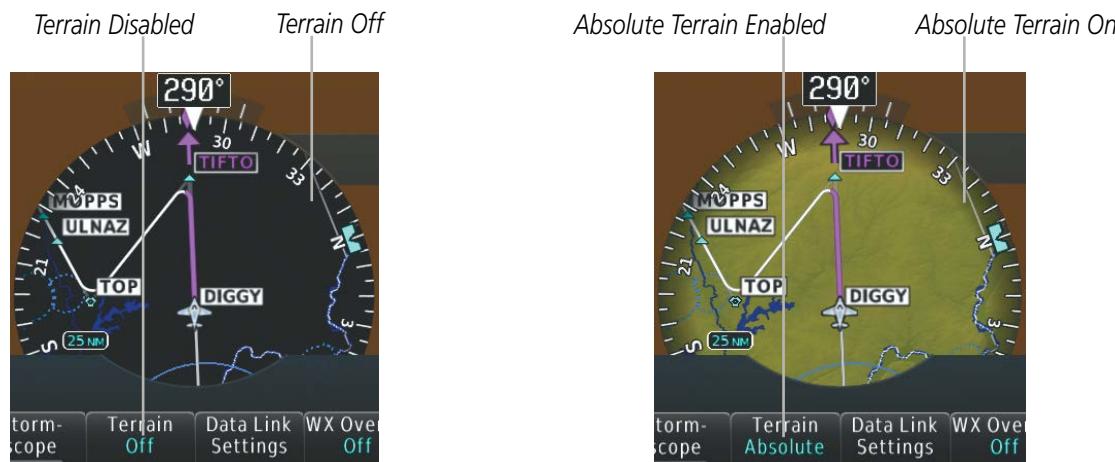


Figure 5-21 HSI Map - Absolute Terrain Data

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

- 1) Press the **PFD Map Settings** Softkey on the PFD.
- 2) Press the **Terrain** Softkey until 'Absolute' is selected to display absolute terrain data on the PFD Inset Map or the HSI Map.
- 3) Press the **Terrain** Softkey until 'Off' is selected to remove absolute terrain data from the PFD Inset Map or the HSI Map.
- 4) 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.

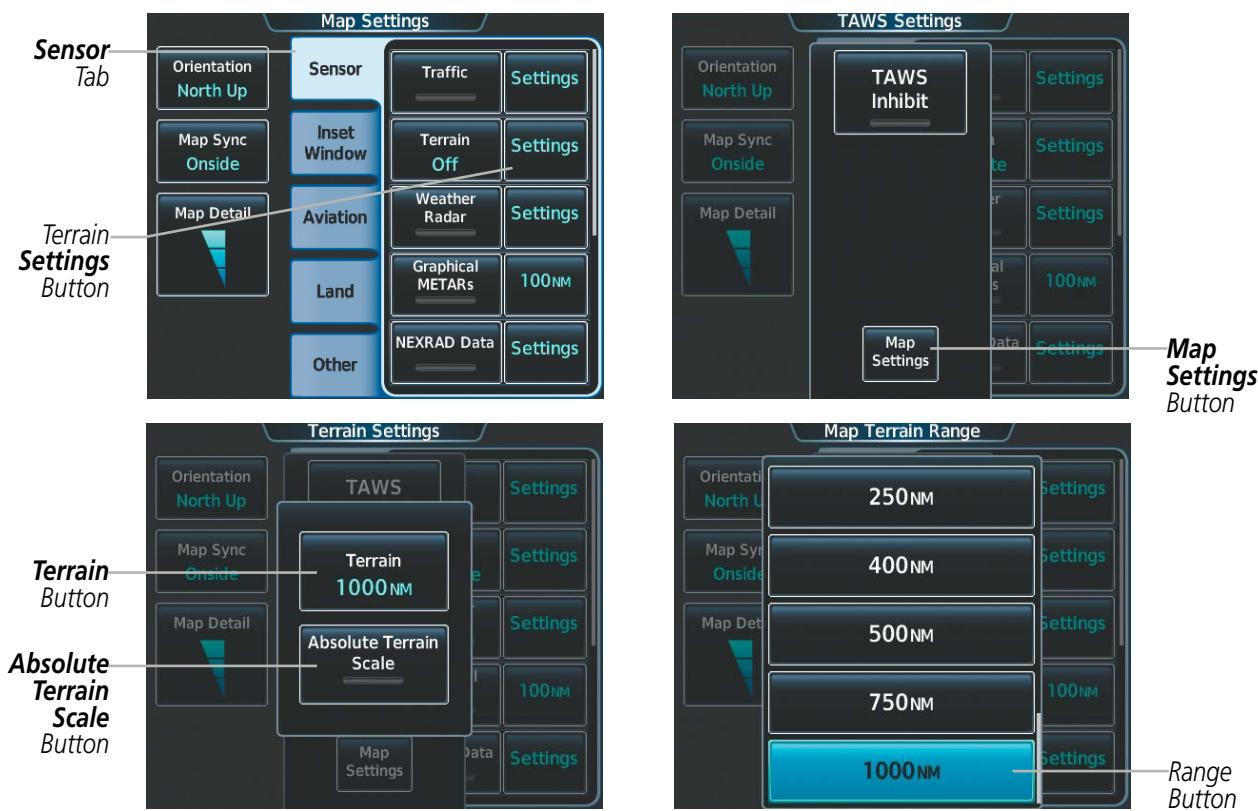


Figure 5-22 Navigation Map - Absolute Terrain Data

Selecting an absolute terrain data range on navigation map displays:

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

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



Figure 5-23 Navigation Map - Absolute Terrain Scale

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

- 1) From **Home**, touch **Map > Map Settings**.
- 2) Touch the **Sensor Tab**, if necessary.
- 3) Touch the **Terrain Settings** Button to display the TAWS Settings Window.
- 4) Touch the **Map Settings** Button to display the Terrain Settings Window.
- 5) Touch the **Absolute Terrain Scale** Button to display/remove the absolute terrain scale.

MAP SYMBOLS

This section discusses the types of land and aviation symbols that can be displayed. Each listed type of symbol can be turned on or off, and the maximum range to display each symbol can be set. The decluttering of the symbols from the Inset 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	Maximum Range (nm)
Obstacle Data	See Appendix E	25
Roads		
Interstate Highway (Freeway)		400
International Highway (Freeway)		400
US Highway (National Highway)		150
State Highway (Local Highway)		100
Local Road (Local Road)	N/A	25
Railroad		25
Large City (> 200,000)		1000
Medium City (> 50,000)		400
Small City (> 5,000)		100
State/Province		1000
Rivers and Lakes (River/Lake)		100

Table 5-1 Land Symbol Information

AVIATION SYMBOLS

The following items are configured on the Aviation Tab of the Map Settings Screen:

Aviation Symbols	Symbol	Maximum Range (nm)
Low Altitude Airways		100
High Altitude Airways		100
Class B/TMA		150
Class C/TCA)		100
Class D		100
Restricted		100
MOA (Military)		250
Other/ADIZ		75
Class B Airspace Altitude Label (ceiling/floor)		25
Class C Airspace Altitude Label (ceiling/floor)		25
Class D Airspace Altitude Label (ceiling)		25
Large Airport (Longest Runway \geq 8100 ft)		1000
Medium Airport (8100 ft > Longest Runway \geq 5000 ft)		400
Small Airport (Longest Runway < 5000 ft) (Medium Airport if it has a tower frequency)		150
VOR Waypoint		250
INT Waypoint		40
NDB Waypoint		50
User Waypoint		1000
SafeTaxi	See Additional Features	5
Runway Extension		150
Missed Approach Preview On/Off		NA
Altitude/Speed Constraints On/Off		1000

Table 5-2 Aviation Symbol Information

SYMBOL SETUP

All navigation maps can display aviation and land symbols. Aviation and land symbol types (e.g. runway extensions, railroads) can be removed individually.

Displaying/removing a navigation or land symbol type:

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

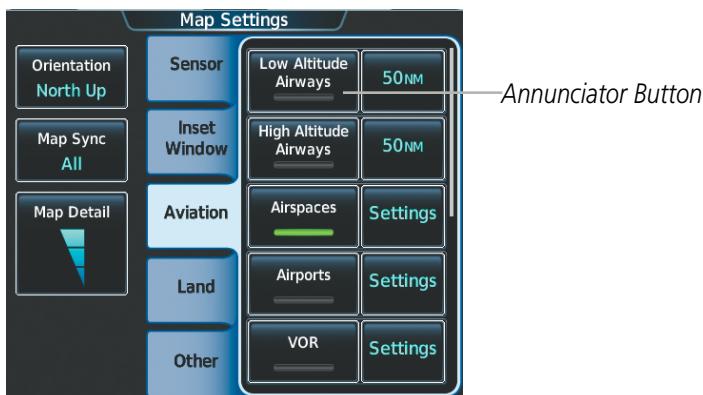


Figure 5-24 Map Settings Screen - Individual Items On/Off

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

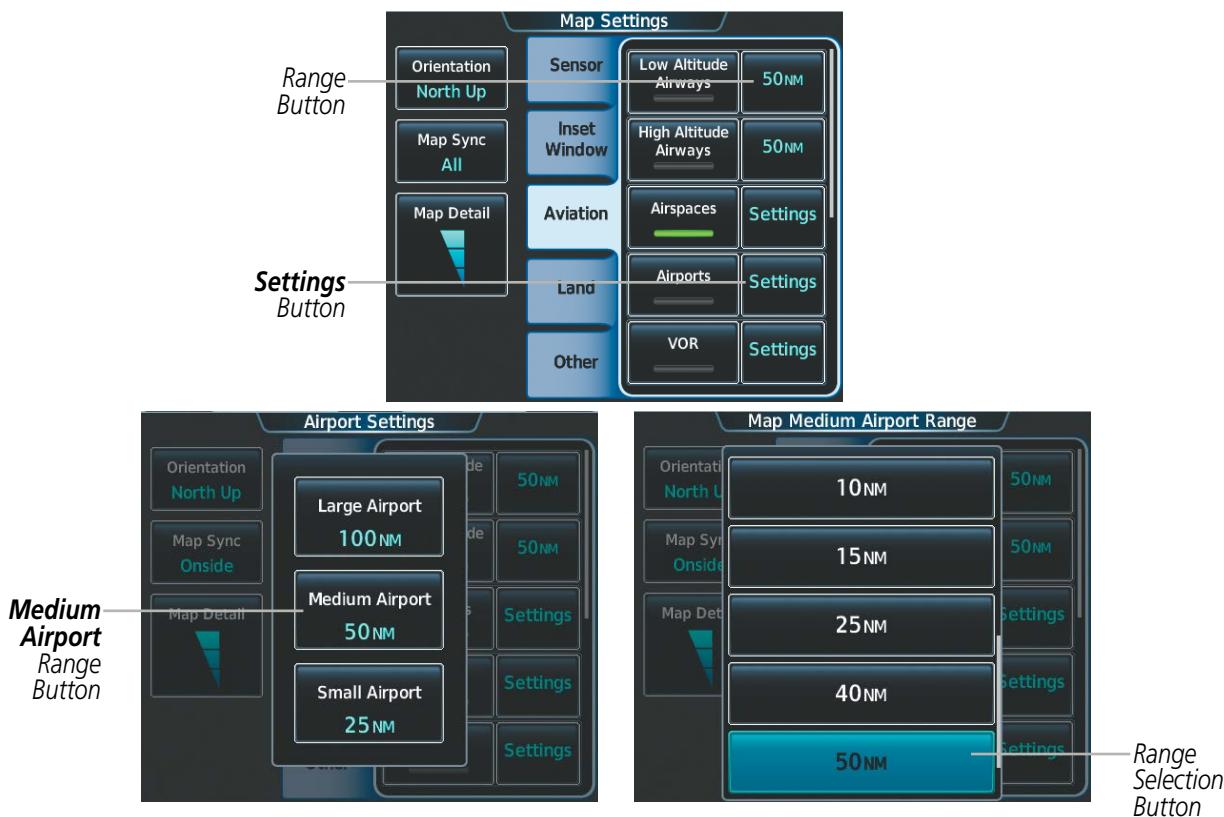


Figure 5-25 Map Settings Screen - Aviation Data Setup

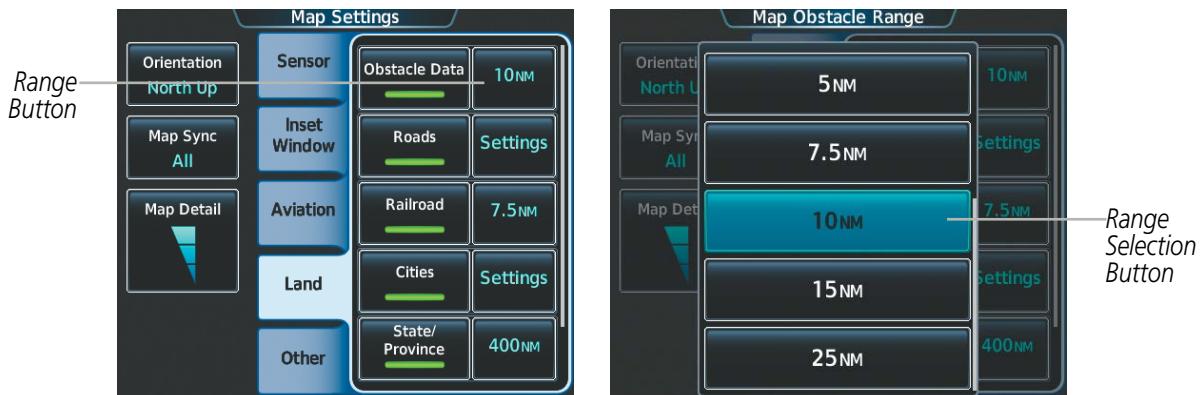


Figure 5-26 Map Settings Screen - Land Data Setup

Displaying/removing the VOR compass rose:

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

MAP DETAIL

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

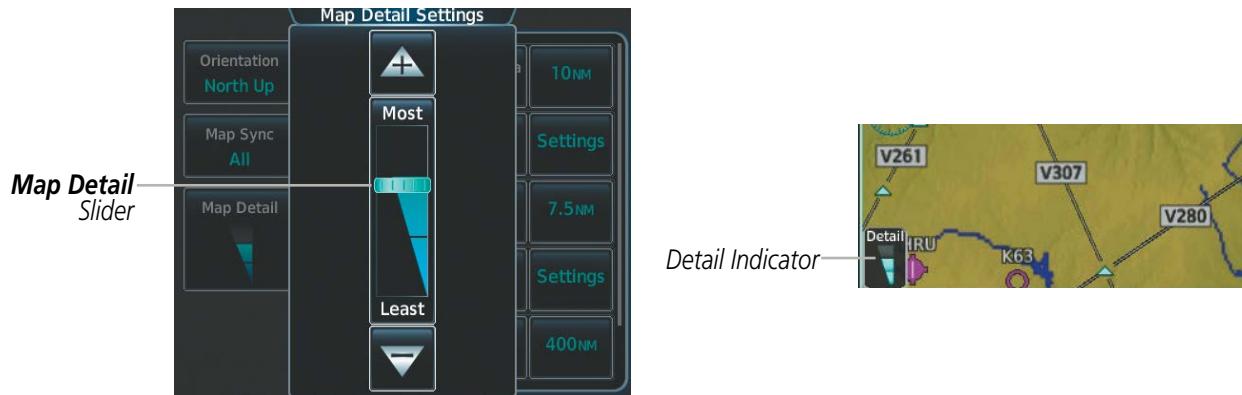


Figure 5-27 Navigation Map - Map Detail

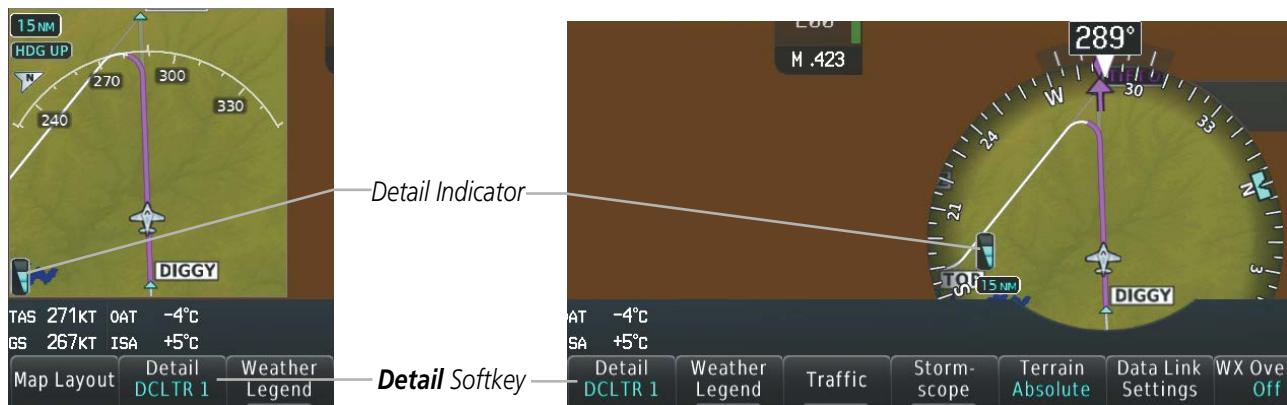


Figure 5-28 PFD Inset Map/HSI Map - Map Detail

Adjusting the navigation map detail:

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

Adjusting the PFD Inset Map or the HSI Map detail:

- 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
User Waypoints		X	X
Latitude/Longitude Grid		X	X
NAVAIDs (does not clutter if used to define airway)		X	X
Intersections (does not clutter 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 5-3 Navigation Map Items Decluttered for each Detail Level

AIRWAYS

This airways discussion is based upon the North American airway structure. The airway structure in places other than North America vary by location, etc. and are not discussed in this book. Low Altitude Airways (Victor Airways or T-Routes) start 1,200 feet above ground level (AGL) and extend up to 18,000 feet mean sea level (MSL). Low Altitude Airways are designated with a "V" or a "T" before the airway number.

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

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

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



Figure 5-29 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 **Home**, touch **Map > 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 5-30 Map Options 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 **Home**, touch **Map > 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 5-4 Airway Range Information

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.

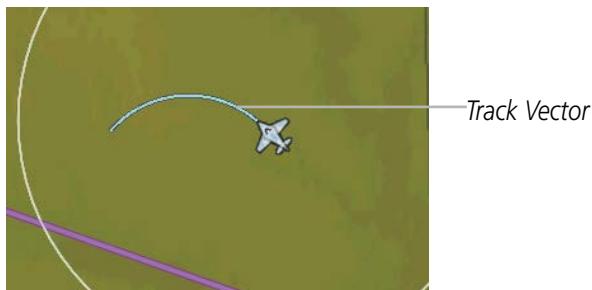


Figure 5-31 Navigation Map - Track Vector

Displaying/removing the track vector:

- 1) From **Home**, touch **Map** > **Map Settings**.
- 2) Touch the **Other** Tab, if necessary.
- 3) Touch the **Track Vector** Button to display/remove the track vector.



Figure 5-32 Map Options Screen - Track Vector Setup

Selecting track vector look-ahead time:

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

NAVIGATION MAP WIND VECTOR

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



Figure 5-33 Navigation Map - Wind Vector



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

Displaying/removing the navigation map wind vector:

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

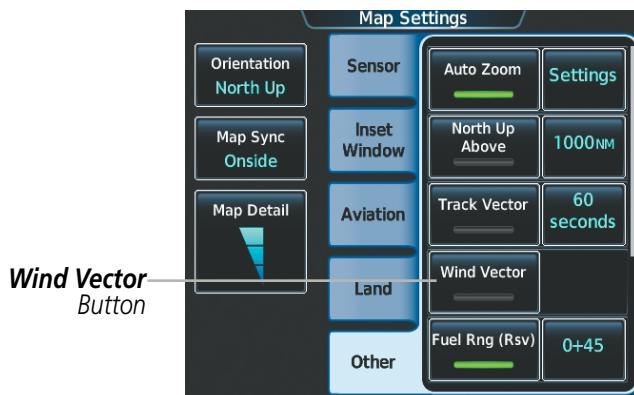


Figure 5-34 Map Options Screen - Wind Vector Setup

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 5-35 Navigation Map - Fuel Range Ring

Displaying/removing the fuel range ring:

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

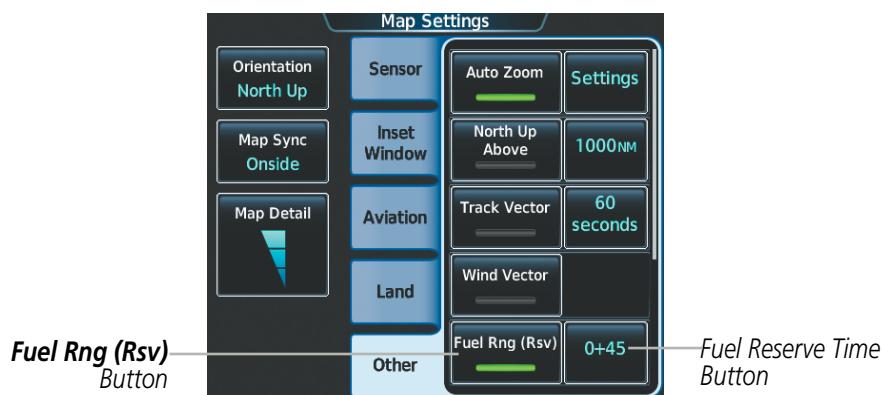


Figure 5-36 Map Options Screen - Fuel Range Ring Setup

Selecting fuel reserve time:

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

FIELD OF VIEW (SVT)

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

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

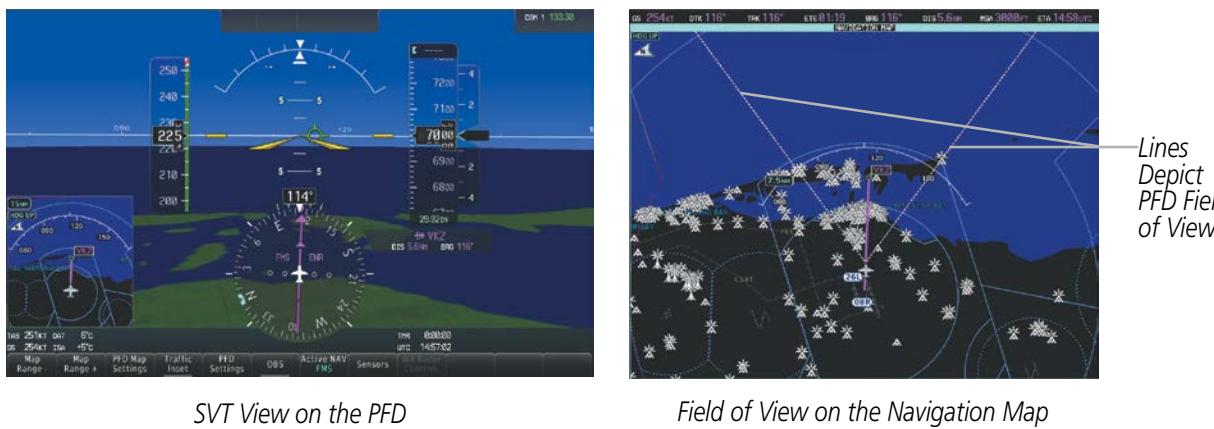


Figure 5-37 PFD and Navigation Map Field of View Comparison

Displaying/removing the field of view indication on the navigation map:

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

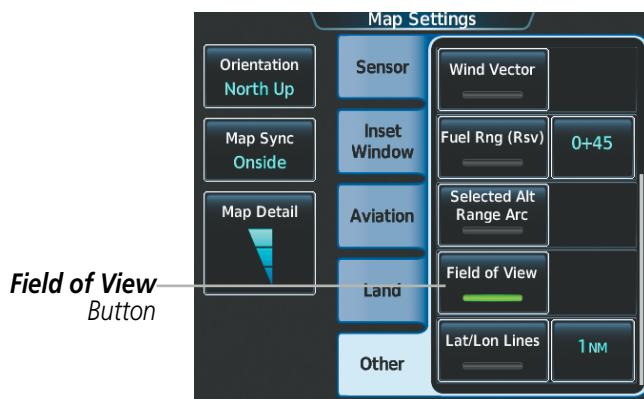


Figure 5-38 Map Settings Screen - Field of View Setup

SELECTED ALTITUDE INTERCEPT ARC

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

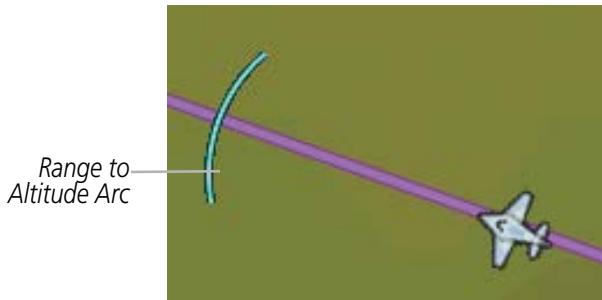


Figure 5-39 Navigation Map - Range to Altitude Arc

Displaying/removing the selected altitude intercept arc:

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

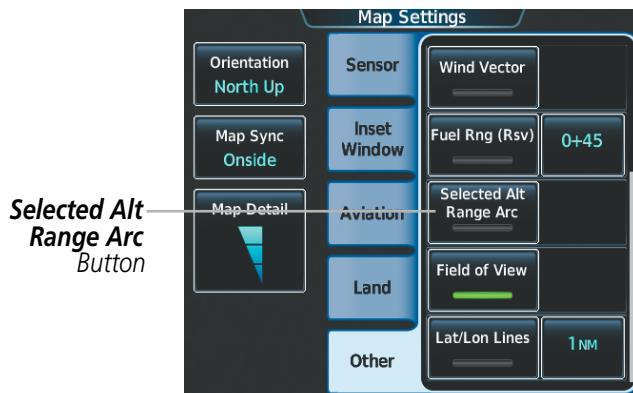


Figure 5-40 Map Options Screen - Selected Altitude Intercept Arc Setup

LATITUDE/LONGITUDE LINES

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



Figure 5-41 Navigation Map - Latitude/Longitude Lines

Displaying/removing lat/lon lines:

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



Figure 5-42 Map Settings Screen - Lat/Lon Lines Setup

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 **Home**, touch **Map > 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.

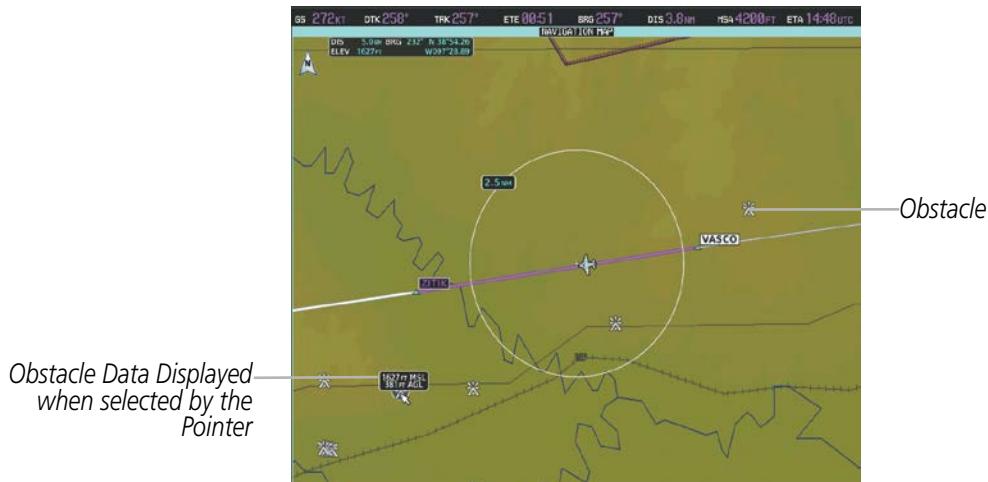


Figure 5-43 Navigation Map - Obstacles

Displaying/removing obstacles:

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



Figure 5-44 Map Options Screen - Obstacle Setup

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 **Home**, touch **Map** > **Map Settings**.
- 2) Touch the **Land** Tab, if necessary.
- 3) Touch the 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.

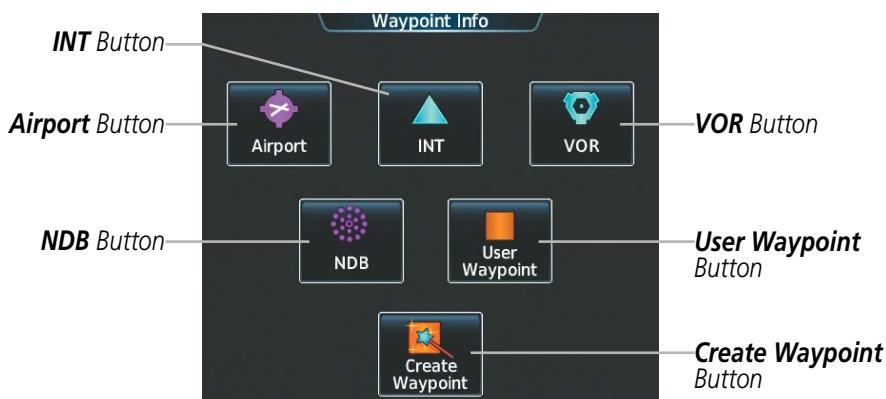


Figure 5-45 Waypoint Info Screen

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



Figure 5-46 Waypoint Duplicates Screen

AIRPORTS



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

The AIRPORT INFORMATION Display on the MFD displays a map of the currently selected airport and surrounding area, and the Airport Information Screen on the Touchscreen Controller allows the pilot to view airport information, load frequencies, review runways, and review instrument procedures that may be involved in the flight plan. For airports with multiple runways, information for each runway is available. See the Audio and CNS Section for more information on finding and tuning frequencies. After avionics power-up, the AIRPORT INFORMATION Display defaults to the airport where the aircraft is located. After a flight plan has been loaded, it defaults to the destination airport. On a flight plan with multiple airports, it defaults to the airport which is the current active waypoint.

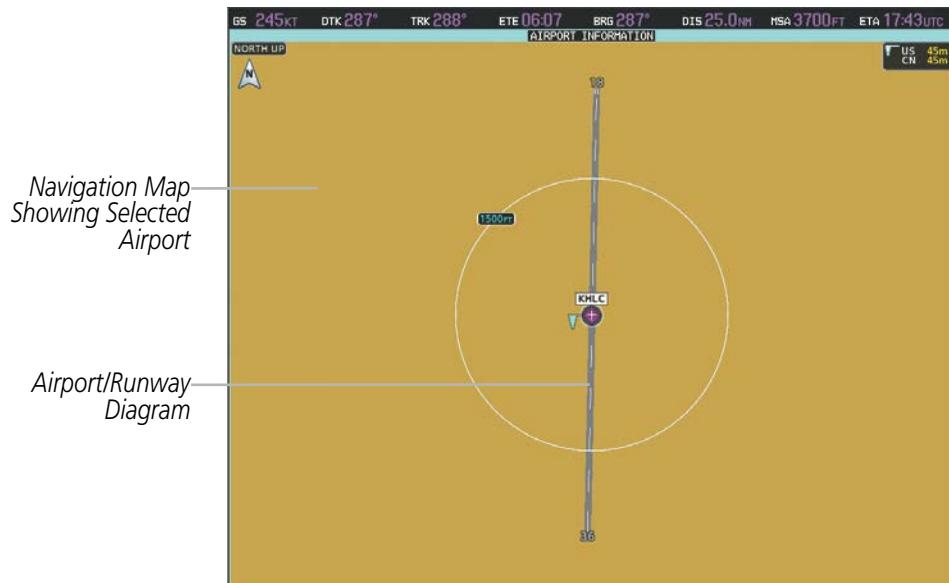


Figure 5-47 AIRPORT INFORMATION Display on MFD



Figure 5-48 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 5-49 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*, Gate, Ground, Helicopter, Multicom, Other, Pre-Taxi, Radar, Ramp, Terminal*, TMA*, Tower, TRSA*, Unicorn * May include Additional Information
NAV Frequencies: ILS, LOC

See the Hazard Avoidance section for the description of the information shown on the **Weather** Tab. See the Procedures discussion later in this section about loading procedures from the **Proc** Tab. See the Additional Features section for the description of the information shown on the **Charts** Tab and the **Chart NOTAMs** Tab.

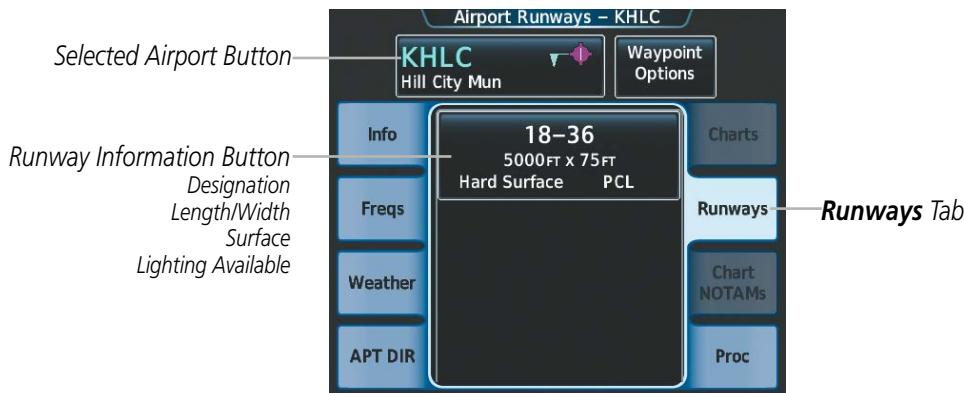


Figure 5-50 Airport Runways Screen

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)

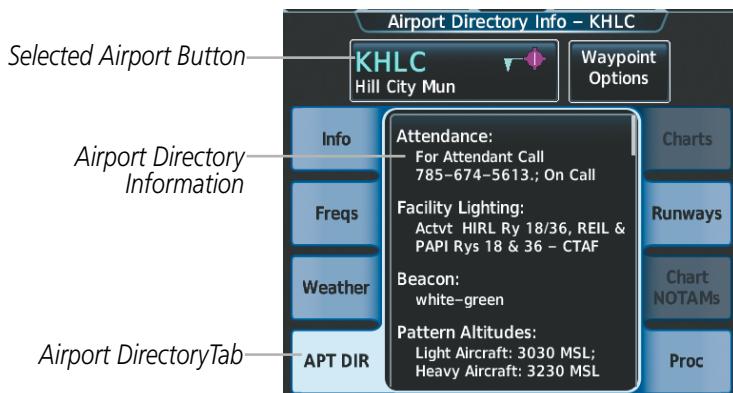


Figure 5-51 Airport Directory Info Screen

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

Airport: Identifier, Site Number, Name, City, State	Traffic Pattern Altitudes (TPA): Aircraft Class/Altitude
Phones: Phone/Fax Numbers	Weather: Service Type, Frequency, Phone Number
Hours: Facility, Light, Tower, Beacon	Flight Service Station (FSS): Name, Phone Numbers
Location: Sectional, Magnetic Variation	Instrument Approaches: Published Approach, Frequency
Frequencies: Type/Frequency	NAVAIDS: Type, Identifier, Frequency, Radial, Distance
Transportation: Ground Transportation Type Available	Noise: Noise Abatement Procedures
Approach: Facility Name, Frequency, Frequency Parameter	Charts: Low Altitude Chart Number
Runway: Headings, Length, Width, Obstructions, Surface	Notes: Airport Notes
Obstructions: General Airport Obstructions	Pilot Controlled Lighting: High/Med/Low Clicks/Second
Special Operations at Airport	Services Available: Category, Specific Service (e.g. Lodging)
FBO: Type, Frequencies, Services, Fees, Fuel, Credit Cards, Phone/Fax Numbers	

Selecting an airport for review by identifier:

- 1) From **Home**, touch **Waypoint Info > Airport**.
- 2) Touch the **Info** Tab, if necessary.
- 3) Touch the selected airport button to display the keypad.
- 4) Use the keypad to enter the airport identifier.
- 5) Touch the **Enter** Button to accept the identifier and display the airport information on the Touchscreen Controller.
- 6) Touch the **Waypoint Options** Button, then the **Show on Map** Button to display the AIRPORT INFORMATION Display, if necessary.

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

- 1) From **Home**, touch **Waypoint Info > Airport**.
- 2) Touch the **Info** Tab, if necessary.
- 3) Touch the selected airport button to display the keypad.
- 4) Touch the **Find** Button to display the Find Waypoint Screen.
- 5) Touch the **Search** Tab to display the **Search By** Button.
- 6) If necessary, touch the **Search By** Button to choose Search by City or Search by Facility.
- 7) Touch the **Facility Name** Button or the **City Name** Button to display the keypad.
- 8) Use the keypad to enter the name.
- 9) Touch the **Enter** Button to accept the entry and display the search results.
- 10) Touch an airport selection button to display the airport information on the Touchscreen Controller.
- 11) Touch the **Waypoint Options** Button, then the **Show on Map** Button to display the AIRPORT INFORMATION Display, if necessary.

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

- 1) From **Home**, touch **Waypoint Info > Airport**.
- 2) Touch the **Info** Tab, if necessary.
- 3) Touch the selected airport button to display the keypad.
- 4) Touch the **Find** Button to display the Find Waypoint Screen.
- 5) Touch the **Recent**, **Nearest**, **Flight Plan**, or **Favorites** Tab to display a list of airports in the selected category.
- 6) Touch an airport selection button to display the airport information on the Touchscreen Controller.
- 7) Touch the **Waypoint Options** Button, then the **Show on Map** Button to display the AIRPORT INFORMATION Display, if necessary.

Selecting a runway:

- 1) From **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.

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

The Nearest Airports Screen displays a list of up to 25 nearest airports (five entries can be displayed at one time). If there are more than five, they are displayed in a scrollable list. If there are no nearest airports available, "NONE WITHIN 200NM" is displayed.

A dashed white line is drawn on the NEAREST AIRPORT Display from the aircraft position to the selected nearest airport.



Figure 5-52 NEAREST AIRPORT Display

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

Nearest Airport Buttons (Identifier, Name, Symbol)

Figure 5-53 Nearest Airport Screen

Viewing information for a nearest airport:

- 1) From **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 Display.
- 3) Touch the **Airport Info** Button to display the Airport Information Screen.
- 4) Touch a Tab to display the desired information on the Touchscreen Controller.

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

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

Selecting nearest airport surface matching criteria:

- 1) From **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.



Figure 5-54 Nearest Airport Runway Surface Selection

Selecting nearest airport minimum runway length matching criteria:

- 1) From **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.



Figure 5-55 Nearest Airport Runway Length Selection

INTERSECTIONS



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

The INTERSECTION INFORMATION Display shows a map of the currently selected intersection and surrounding area, and the Intersection Information Screen on the Touchscreen Controller allows the pilot to view intersection information.



Figure 5-56 INTERSECTION INFORMATION Display



Figure 5-57 Intersection Information Screen

Selecting an intersection:

- 1) From **Home**, touch **Waypoint Info > INT**.
- 2) Touch the selected intersection button to display the keypad.
- 3) Use the keypad to enter the intersection identifier.
- 4) Touch the **Enter** Button to accept the identifier and display the intersection information on the Touchscreen Controller.
- 5) Touch the **Waypoint Options** Button, then the **Show on Map** Button to display the INTERSECTION INFORMATION Display, if necessary.

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

- 1) From **Home**, touch **Waypoint Info > INT**.
- 2) Touch the selected intersection button to display the keypad.
- 3) Touch the **Find** Button to display the Find Waypoint Screen.
- 4) Touch the **Recent**, **Nearest**, **Flight Plan**, or **Favorites** Tab to display a list of intersections in the selected category.
- 5) Touch an intersection selection button to display the intersection information on the Touchscreen Controller.
- 6) Touch the **Waypoint Options** Button, then the **Show on Map** Button to display the INTERSECTION INFORMATION Display, if necessary.

The Nearest Intersecton Display shows a map of the nearest intersection and surrounding area, and the Nearest Intersection Screen on the Touchscreen Controller allows the pilot to view intersection information, and intitiate a direct-to or insert the intersection in the flight plan.

The Nearest Intersection Screen displays a list of up to 25 nearest intersections (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 nearest intersections available, "NONE WITHIN 200NM" is displayed.

A dashed white line is drawn on the NEAREST INTESECTION Display from the aircraft position to the selected nearest intersection.



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

Navigation Map
Showing Nearest
Intersection

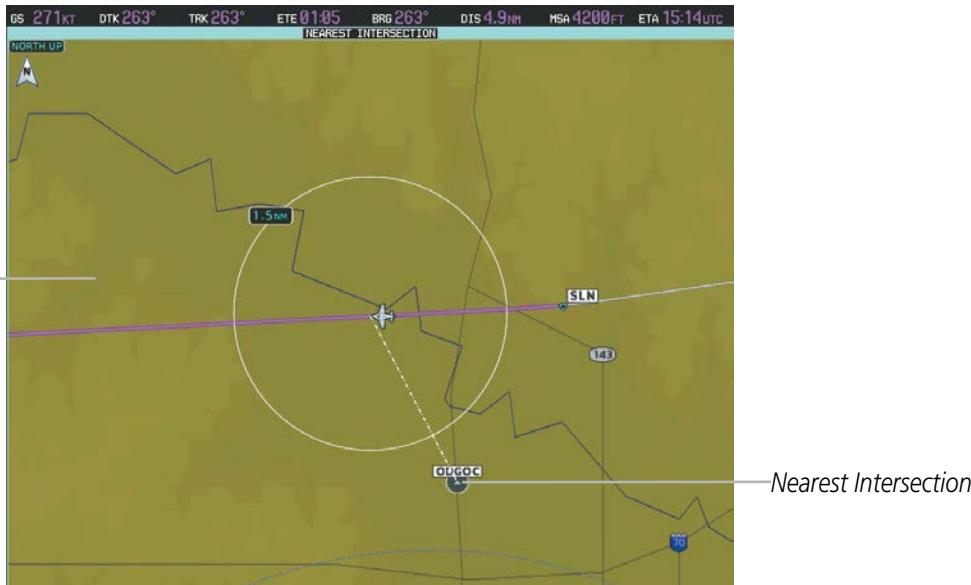


Figure 5-58 NEAREST INTESECTION Display

Nearest Intersection Buttons
(Identifier, Symbol)

Nearest Intersection Information
Bearing
Distance

Nearest Intersection		
Intersection	BRG	DIS
ODGOC ▲	144°	2.1 NM
KOWDU ▲	010°	4.6 NM
JOTIN ▲	157°	4.6 NM
HETAB ▲	263°	4.7 NM
HIXZA ▲	217°	5.6 NM

Figure 5-59 Nearest Intersection Screen

Viewing information for a nearest intersection:

- 1) From **Home**, touch **Nearest > INT**.
- 2) Touch a nearest intersection button to display the Waypoint Options Window.
- 3) Touch the **Show on Map** Button to display the NEAREST INTESECTION Display, if necessary.
- 4) Touch the **Intersection Info** Button to display the Intersection Information Screen.

NDBs

The NDB INFORMATION Display shows a map of the currently selected NDB and surrounding area, and the NDB Information Screen on the Touchscreen Controller allows the pilot to view NDB information.



Figure 5-60 NDB INFORMATION Display

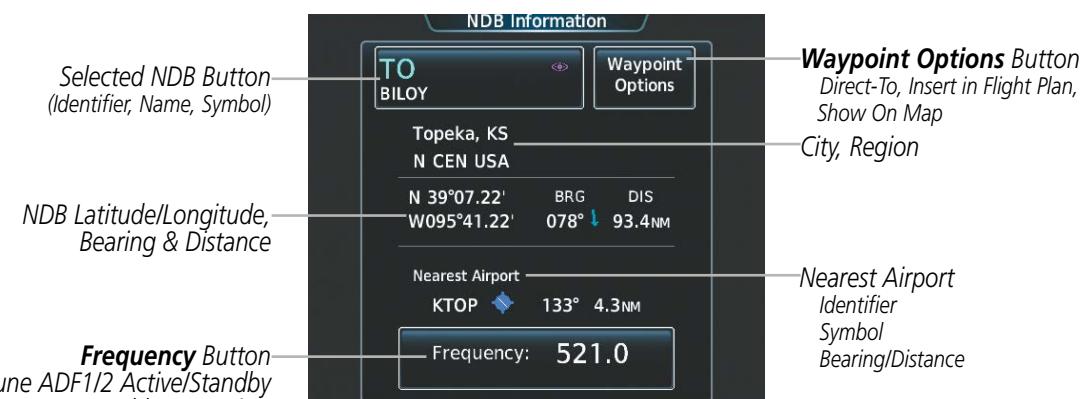


Figure 5-61 NDB Information Screen



NOTE: Compass locator (LOM, LMM): a low power, low or medium frequency radio beacon installed in conjunction with the instrument landing system. When LOM is used, the locator is at the Outer Marker; when LMM is used, the locator is at the Middle Marker.

Selecting an NDB:

- 1) From **Home**, touch **Waypoint Info > NDB**.
- 2) Touch the selected NDB button to display the keypad.

- 3) Use the keypad to enter the NDB identifier.
- 4) Touch the **Enter** Button to accept the identifier and display the NDB information on the Touchscreen Controller.
- 5) Touch the **Waypoint Options** Button, then the **Show on Map** Button to display the NDB INFORMATION Display, if necessary.

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

- 1) From **Home**, touch **Waypoint Info > NDB**.
- 2) Touch the selected NDB 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 necessary, 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 an NDB selection button to display the NDB information on the Touchscreen Controller.
- 10) Touch the **Waypoint Options** Button, then the **Show on Map** Button to display the NDB INFORMATION Display, if necessary.

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

- 1) From **Home**, touch **Waypoint Info > NDB**.
- 2) Touch the selected NDB button to display the keypad.
- 3) Touch the **Find** Button to display the Find Waypoint Screen.
- 4) Touch the **Recent, Nearest, Flight Plan, or Favorites** Tab to display a list of NDBs in the selected category.
- 5) Touch an NDB selection button to display the NDB information on the Touchscreen Controller.
- 6) Touch the **Waypoint Options** Button, then the **Show on Map** Button to display the NDB INFORMATION Display, if necessary.

The NEAREST NDB Display shows a map of the nearest NDB and surrounding area, and the Nearest NDB Screen on the Touchscreen Controller allows the pilot to view NDB information, and initiate a direct-to or insert the NDB in the flight plan.

The Nearest NDB Screen displays a list of up to 25 nearest NDBs (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 nearest NDBs available, "NONE WITHIN 200NM" is displayed.

A dashed white line is drawn on the NEAREST NDB Display from the aircraft position to the selected nearest NDB.



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



Figure 5-62 NEAREST NDB Display

Nearest NDB			
NDB	BRG	DIS	Frequency
SL FLORY	171°	14.5 NM	344.0
MPR MC PHERSON	177°	34.4 NM	227.0
CYW CLAY CENTER	036°	36.3 NM	362.0
CNK CONCORDIA	357°	37.8 NM	335.0
CVY CAVALRY	077°	41.4 NM	314.0

Nearest NDB Buttons (Identifier, Name, Symbol)

Nearest NDB Information Bearing/Distance

NDB Frequency Button Tune ADF1 Active/Standy Frequency Add to Favorites

Figure 5-63 Nearest NDB Screen

Viewing information for a nearest NDB:

- 1) From **Home**, touch **Nearest > NDB**.
- 2) Touch a nearest NDB button to display the Waypoint Options Window.
- 3) Touch the **Show on Map** Button to display the NEAREST NDB Display, if necessary.
- 4) Touch the **NDB Info** Button to display the NDB Information Screen.

VORs

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.

The VOR INFORMATION Display shows a map of the currently selected VOR and surrounding area, and the VOR Information Screen on the Touchscreen Controller allows the pilot to view VOR information.



Figure 5-64 VOR INFORMATION Display

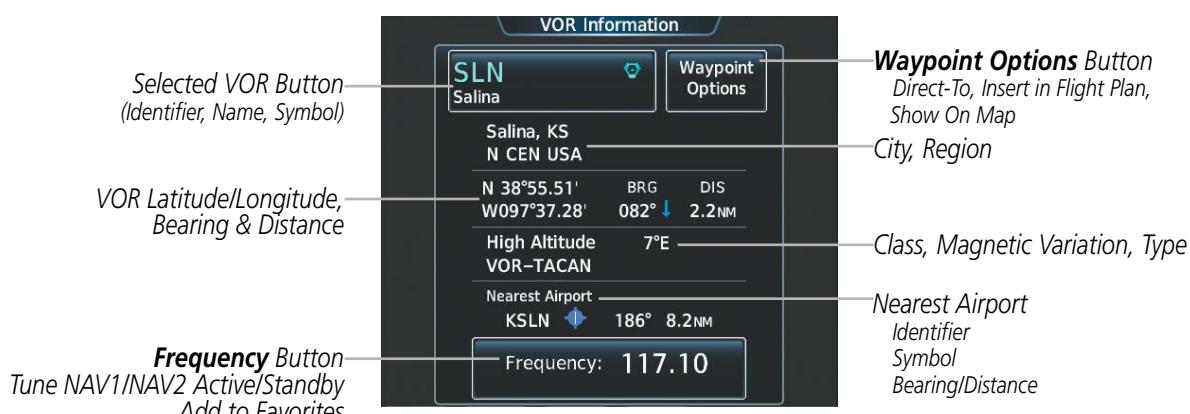


Figure 5-65 VOR Information Screen

The VOR classes used are: Low Altitude, High Altitude, and Terminal.

Selecting a VOR:

- 1) From **Home**, touch **Waypoint Info > VOR**.
- 2) Touch the selected VOR button to display the keypad.

- 3) Use the keypad to enter the VOR identifier.
- 4) Touch the **Enter** Button to accept the identifier and display the VOR information on the Touchscreen Controller.
- 5) Touch the **Waypoint Options** Button, then the **Show on Map** Button to display the VOR INFORMATION Display, if necessary.

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

- 1) From **Home**, touch **Waypoint Info > VOR**.
- 2) Touch the selected VOR 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 necessary, 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 VOR selection button to display the VOR information on the Touchscreen Controller.
- 10) Touch the **Waypoint Options** Button, then the **Show on Map** Button to display the VOR INFORMATION Display, if necessary.

Finding and selecting a VOR by category (Recent, Nearest, Flight Plan, or Favorites):

- 1) From **Home**, touch **Waypoint Info > VOR**.
- 2) Touch the selected VOR button to display the keypad.
- 3) Touch the **Find** Button to display the Find Waypoint Screen.
- 4) Touch the **Recent, Nearest, Flight Plan, or Favorites** Tab to display a list of VORs in the selected category.
- 5) Touch a VOR selection button to display the VOR information on the Touchscreen Controller.
- 6) Touch the **Waypoint Options** Button, then the **Show on Map** Button to display the VOR INFORMATION Display, if necessary.

The NEAREST VOR Display shows a map of the nearest VOR and surrounding area, and the Nearest VOR Screen on the Touchscreen Controller allows the pilot to view VOR information, initiate a direct-to, insert the VOR in the flight plan, or tune a NAV frequency.

The Nearest VOR Screen displays a list of up to 25 nearest VORs (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 nearest VORs available, "NONE WITHIN 200NM" is displayed.

A dashed white line is drawn on the NEAREST VOR Display from the aircraft position to the selected nearest VOR.



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



Figure 5-66 NEAREST VOR Display

Nearest VOR			
VOR	BRG	DIS	Frequency
SLN Salina	082°	2.2 NM	117.10
FRI Fort Riley	081°	37.9 NM	109.40
MHK Manhattan	069°	48.6 NM	110.20
HUT Hutchinson	188°	56.9 NM	116.80
TKO Mankato	328°	59.7 NM	109.80

Nearest VOR Buttons (Identifier, Name, Symbol)

Nearest VOR Information Bearing/Distance

VOR Frequency Button Tune NAV1/2 Active/Standy Frequency Add to Favorites

Figure 5-67 Nearest VOR Screen

Viewing information for a nearest VOR:

- 1) From **Home**, touch **Nearest > VOR**.
- 2) Touch a nearest VOR button to display the Waypoint Options Window.
- 3) Touch the **Show on Map** Button to display the NEAREST VOR Display, if necessary.
- 4) Touch the **VOR Info** Button to display the VOR Information Screen.

USER WAYPOINTS

The system can create and store up to 1,000 user-defined waypoints. User waypoints can be created from any map display (except Trip Planning or Procedure) by selecting a position on the map using the **Joystick** or the **Touchpad**, or from the User Waypoint Information Screen by referencing a bearing/distance from an existing waypoint, bearings from two existing waypoints, or latitude and longitude. Once a waypoint has been created, it can be renamed, deleted, or moved. Temporary user waypoints are erased upon system power down.

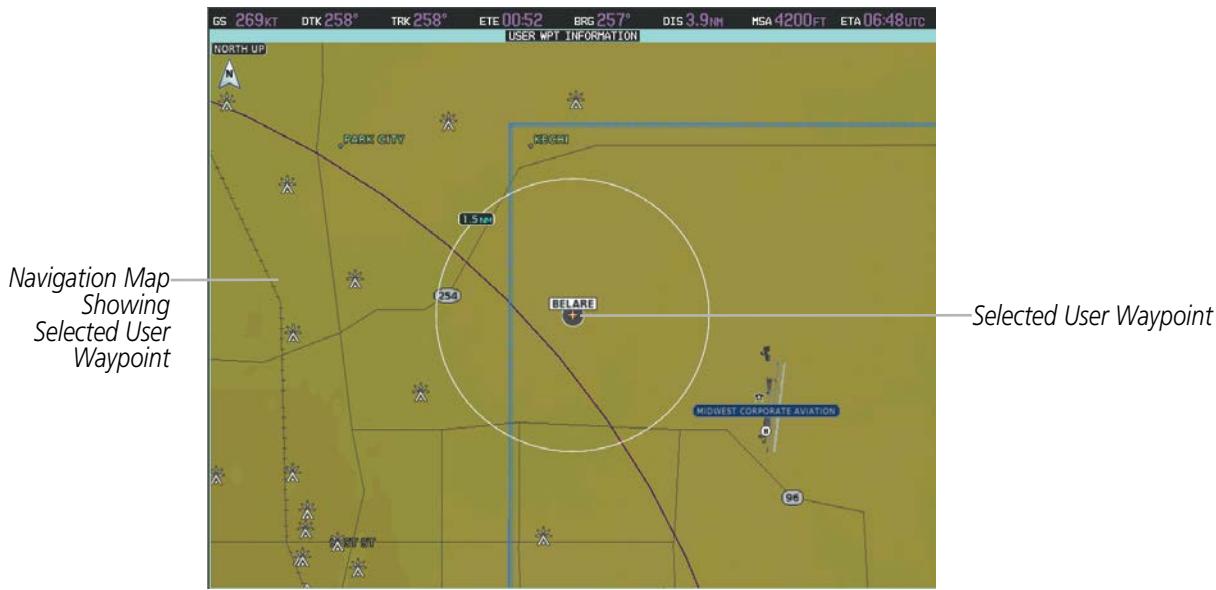


Figure 5-68 USER WPT INFORMATION Display

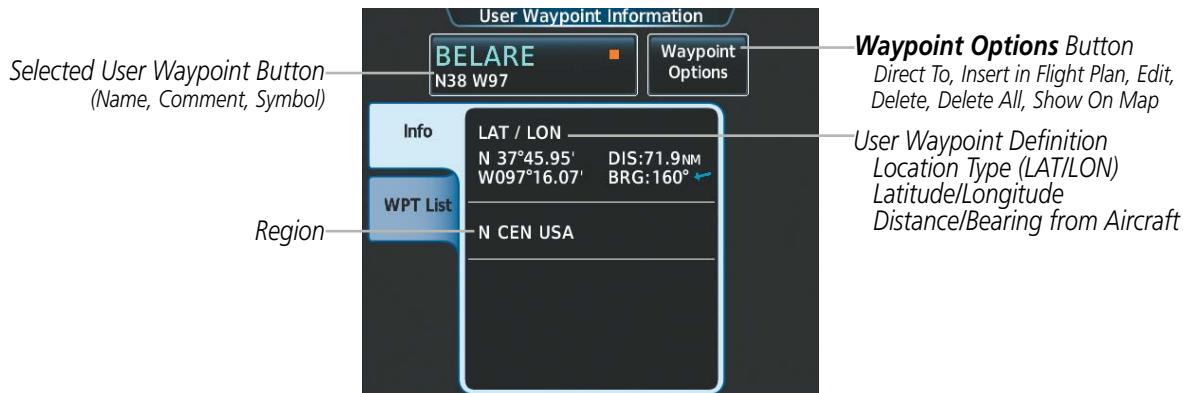


Figure 5-69 User Waypoint Information Screen (defined by latitude/longitude)

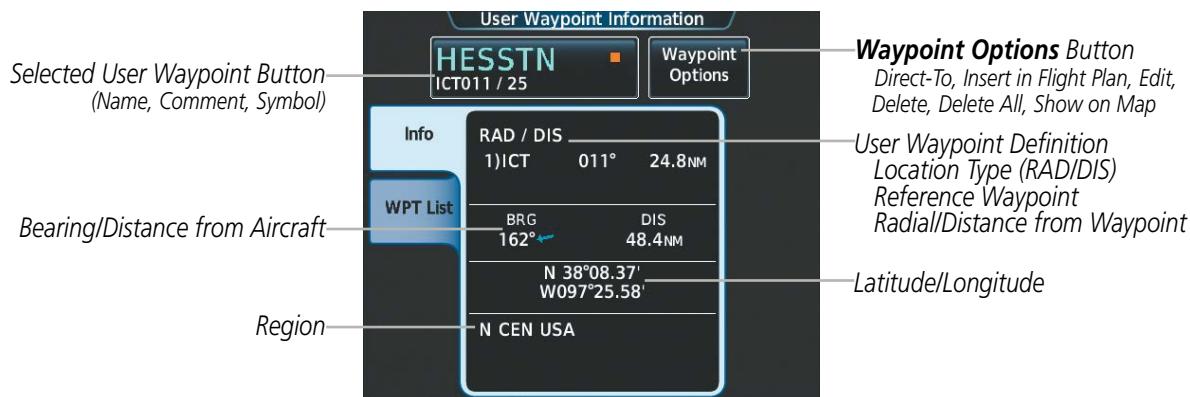


Figure 5-70 User Waypoint Information Screen (defined by radial/distance from waypoint)

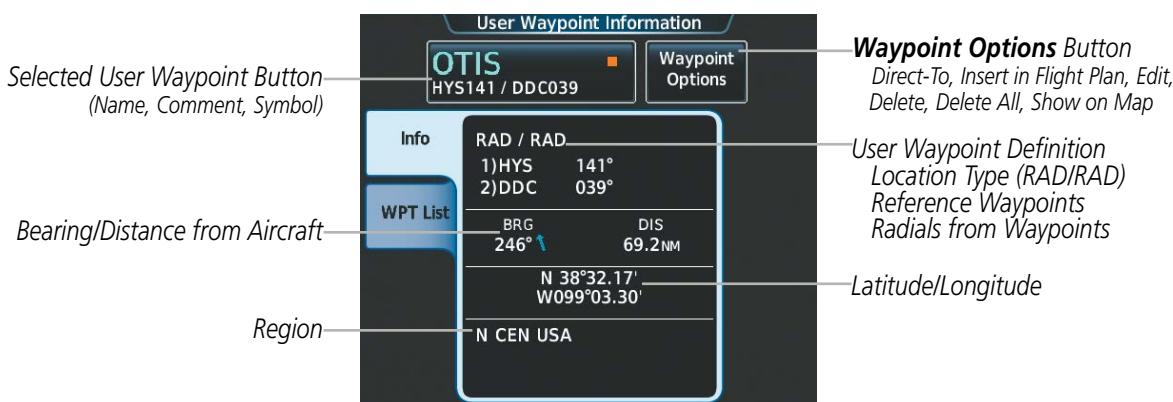


Figure 5-71 User Waypoint Information Screen (defined by radials from two waypoints)

Selecting a user waypoint:

- 1) From **Home**, touch **Waypoint Info > User Waypoint**.
- 2) Touch the selected user waypoint button to display the keypad.
- 3) Use the keypad to enter the user waypoint name.
- 4) Touch the **Enter** Button to accept the name and display the user waypoint information on the Touchscreen Controller.
- 5) Touch the **Waypoint Options** Button, then the **Show on Map** Button to display the USER WPT INFORMATION Display, if necessary.

Finding and selecting a user waypoint for review by facility name or city name:

- 1) From **Home**, touch **Waypoint Info > User Waypoint**.
- 2) Touch the selected user 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 necessary, 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 user waypoint button to display the user waypoint information on the Touchscreen Controller.
- 10) Touch the **Waypoint Options** Button, then the **Show on Map** Button to display the USER WPT INFORMATION Display, if necessary.

Finding and selecting a user waypoint by category (Recent, Nearest, Flight Plan, or Favorites):

- 1) From **Home**, touch **Waypoint Info > User Waypoint**.
- 2) Touch the selected user waypoint button to display the keypad.
- 3) Touch the **Find** Button to display the Find Waypoint Screen.
- 4) Touch the **Recent**, **Nearest**, **Flight Plan**, or **Favorites** Tab to display a list of user waypoints in the selected category.
- 5) Touch a user waypoint button to display the user waypoint information on the Touchscreen Controller.
- 6) Touch the **Waypoint Options** Button, then the **Show on Map** Button to display the USER WPT INFORMATION Display, if necessary.

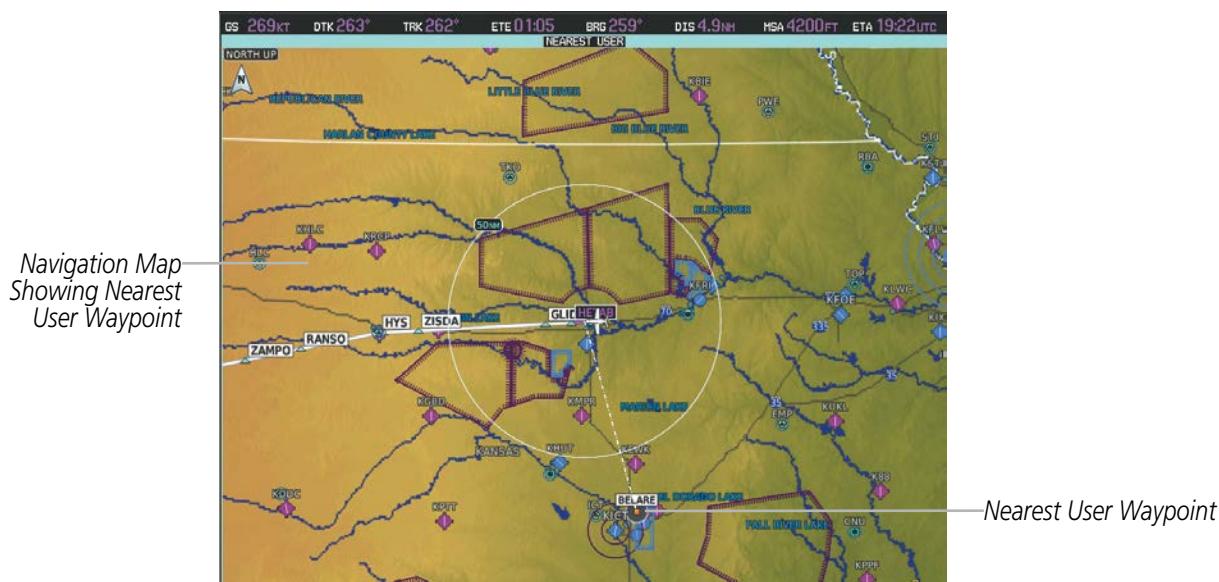


Figure 5-72 NEAREST USER Display



Figure 5-73 Nearest User Waypoint Screen

Viewing information for a nearest user waypoint:

- 1) From **Home**, touch **Nearest > User**.
- 2) Touch a nearest user waypoint button to display the Waypoint Options Window.
- 3) Touch the **Show on Map** Button to display the Nearest User Display, if necessary.
- 4) Touch the **User Waypoint Info** Button to display the User Waypoint Information Screen.

CREATING USER WAYPOINTS

User waypoints can be created from the User Waypoint Information Screen in the following ways:

Creating user waypoints from the User Waypoint Information Screen:

- 1) From **Home**, touch **Waypoint Info > Create Waypoint**. The current aircraft position is the default location of the new waypoint.
- 2) Touch the user waypoint name button to display the keypad.
- 3) Use the keypad and the **Enter** Button to select a user waypoint name (up to six characters).
- 4) If desired, define the type and location of the waypoint in one of the following ways:
 - a) Touch the **Type** Button to display the User Waypoint Type Window.
 - 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 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.



Figure 5-74 Create User Waypoint Screen (defined by bearing/distance from a waypoint)

Or:

- a) Touch the **Type** Button to display the User Waypoint Type Window.
- b) Touch the **RAD/RAD** Button to select the bearings from two waypoints type.
- c) Touch the **REF1** Button to display the keypad.
- d) Use the keypad and the **Enter** Button, or the Find function, to select the waypoint.
- e) Touch the **RAD1** Button to display the keypad.
- f) Use the keypad and the **Enter** Button to select the radial.
- g) Repeat steps c – f for the second reference waypoint and radial.



Figure 5-75 Create User Waypoint Screen (defined by radials from two waypoints)

Or:

- a) Touch the **Type** Button to display the User Waypoint Type Window.
- 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.



Figure 5-76 Create User Waypoint Screen (defined by latitude/longitude)

- 5) If desired, change the waypoint comment.
 - a) Touch the **Comment** Button to display the keypad.
 - b) Use the keypad and the **Enter** Button to select the comment.
- 6) If desired, touch the **Temporary** Button to change the waypoint storage method. When the annunciator on the button is green, the waypoint is only stored until the next power cycle. When the annunciator is gray, the waypoint is stored until manually erased.
- 7) Touch the **Create** Button to accept the new user waypoint. If RAD/RAD was used to define the waypoint, and the radials do not intersect, a message 'The radials entered do not intersect' will be displayed. Touch the **OK** Button to return to the Create User Waypoint Screen.

Creating user waypoints from map pages:

- 1) Press 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, change the waypoint comment. The comment defaults to the abbreviated latitude/longitude of the user waypoint.
 - a) Touch the **Comment** Button to display the keypad.
 - b) Use the keypad and the **Enter** Button to select the comment.
- 7) Press the **Create** Button to create the new waypoint.
- 8) Press the **Joystick** to deactivate the panning function and return to the previous display on the Touchscreen Controller.



Figure 5-77 Create User Waypoint Screen (initiated from map page)

EDITING USER WAYPOINTS

Editing a user waypoint comment:

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

Editing a user waypoint type and location:

- 1) From **Home**, touch **Waypoint Info > User Waypoint**.
- 2) If necessary, touch the **WPT List Tab** to display the list of user waypoints, and touch the desired user waypoint selection button.
- 3) Touch the **Waypoint Options** Button to display the Waypoint Options Window.
- 4) Touch the **Edit** Button to display the Edit User Waypoint Screen.
- 5) Touch the **Type** Button to display the User Waypoint Type Window.
- 6) Touch the **RAD/DIS** Button, the **RAD/RAD** Button, or the **LAT/LON** Button to select the waypoint type.
- 7) Touch the **REF** Button, the **RAD** Button, the **DIS** Button, or the **LAT/LON** Button, as required, to bring up the keypad.
- 8) Use the keypad and the **Enter** Button to select the user waypoint location.
- 9) Touch the **Save** Button to accept the new type and location.
- 10) Touch the **OK** Button in response to the question "Are you sure you want to modify this waypoint?".

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

- 1) From **Home**, touch **Waypoint Info > User Waypoint**.
- 2) If necessary, touch the **WPT List** Tab to display the list of user waypoints, and touch the desired user waypoint selection button.
- 3) Touch the **Waypoint Options** Button to display the Waypoint Options Window.
- 4) Touch the **Edit** Button to display the Edit User Waypoint Screen.
- 5) Touch the **Type** Button to display the User Waypoint Type Window.
- 6) Touch the **P. POS** Button to select the aircraft present position as the location.
- 7) Touch the **Save** Button to accept the new name.
- 8) Touch the **OK** Button in response to the question "Are you sure you want to modify this waypoint?".

DELETING USER WAYPOINTS**Deleting a single user waypoint:**

- 1) From **Home**, touch **Waypoint Info > User Waypoint**.
- 2) If necessary, touch the **WPT List** Tab to display the list of user waypoints, and touch the desired user waypoint selection button.
- 3) Touch the **Waypoint Options** Button to display the Waypoint Options Window.
- 4) Touch the **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 **Home**, touch **Waypoint Info > User Waypoint**.
- 2) If necessary, touch the **WPT List** Tab to display the list of user waypoints, and touch the desired user waypoint selection button.
- 3) Touch the **Waypoint Options** Button to display the Waypoint Options Window.
- 4) Touch the **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, MOA (Military), Other Airspace, Air Defense Interdiction Zone (ADIZ), and Temporary Flight Restriction (TFR).

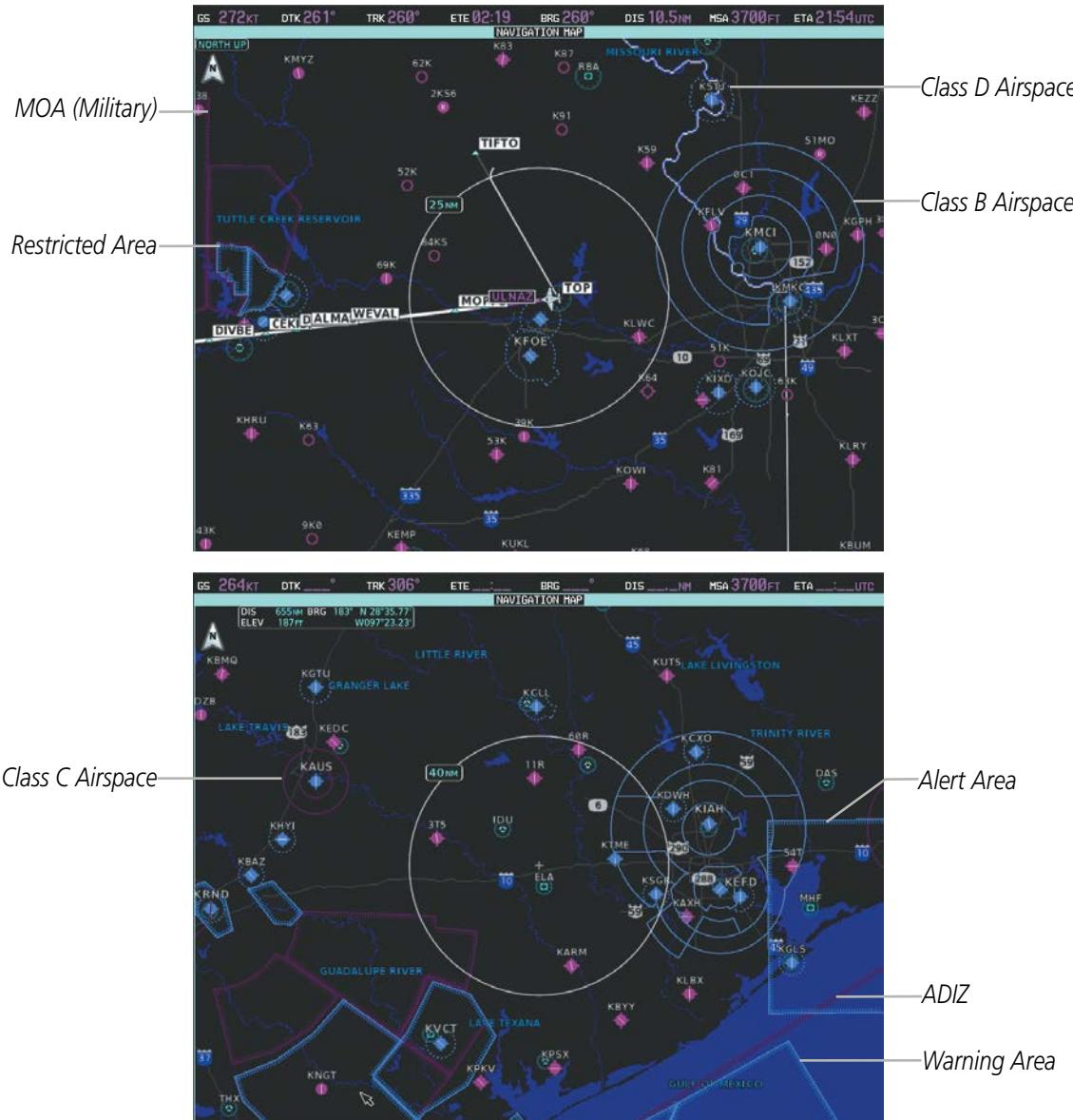


Figure 5-78 Airspaces

The Nearest Airspace Screen and the Message window on the Touchscreen Controller provide additional information about airspaces and the location of the aircraft in relationship to them.

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 Display. It simply turns on/off the alert provided when the aircraft is approaching or near an airspace.

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.

Changing the altitude buffer distance setting:

- 1) From **Home**, touch **Utilities > Setup > Avionics Settings**.
- 2) Touch the **Alerts** Tab to display the list of alert settings.
- 3) Touch the Airspace Alert Alt Buffer Button to display the keypad.
- 4) Use the keypad and the **Enter** Button to select the buffer distance.

Turning an airspace alert on or off:

- 1) From **Home**, touch **Utilities > Setup > Avionics Settings**.
- 2) Touch the **Alerts** Tab to display the list of alert settings.
- 3) Scroll the list if necessary.
- 4) Touch the airspace alert enable button to enable/disable the alert.

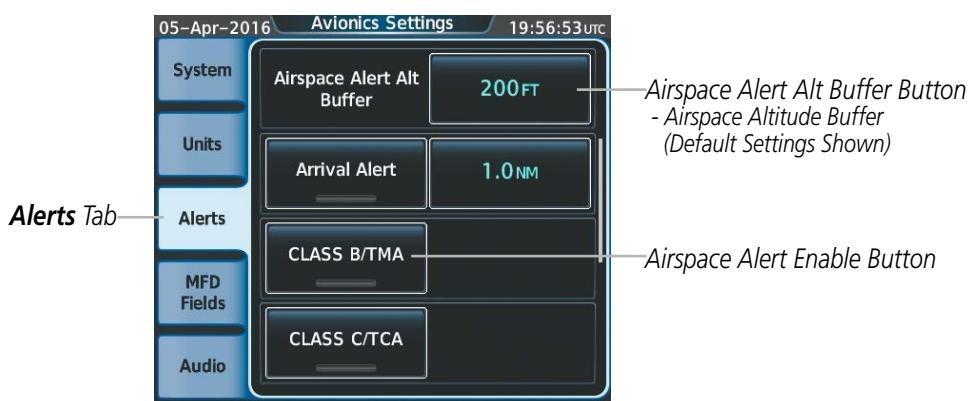


Figure 5-79 Avionics Settings Screen - Alerts Tab

Map ranges for the airspace boundaries are selected on the Aviation Tab on the Map Settings Screen. See Table 5-2 for the default and maximum ranges for each type of airspace and the symbol used to define the airspace area.

The Nearest Airspace Screen and the Nearest Airspace Display can be used to quickly find airspaces close to the flight path. The Nearest Airspace Display 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 5-80 NEAREST AIRSPACE Display



Figure 5-81 Nearest Airspace Screen

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

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

Selecting and viewing an airspace alert with its associated information:

- 1) From **Home**, touch **Nearest > Airspace**.
- 2) Touch an airspace info button to display the Airspace Options Window.
- 3) Touch the **Show on Map** Button to display the Nearest Airspace Information Display, if necessary.
- 4) Touch the **Details** Button to see more information about the airspace.

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 message window:

Message	Comments
INSIDE ARSPC – Inside airspace.	The aircraft is inside the airspace.
ARSPC AHEAD – Airspace ahead – less than 10 minutes.	Special use airspace is ahead of aircraft. 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 5-5 Airspace Alert Messages

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.

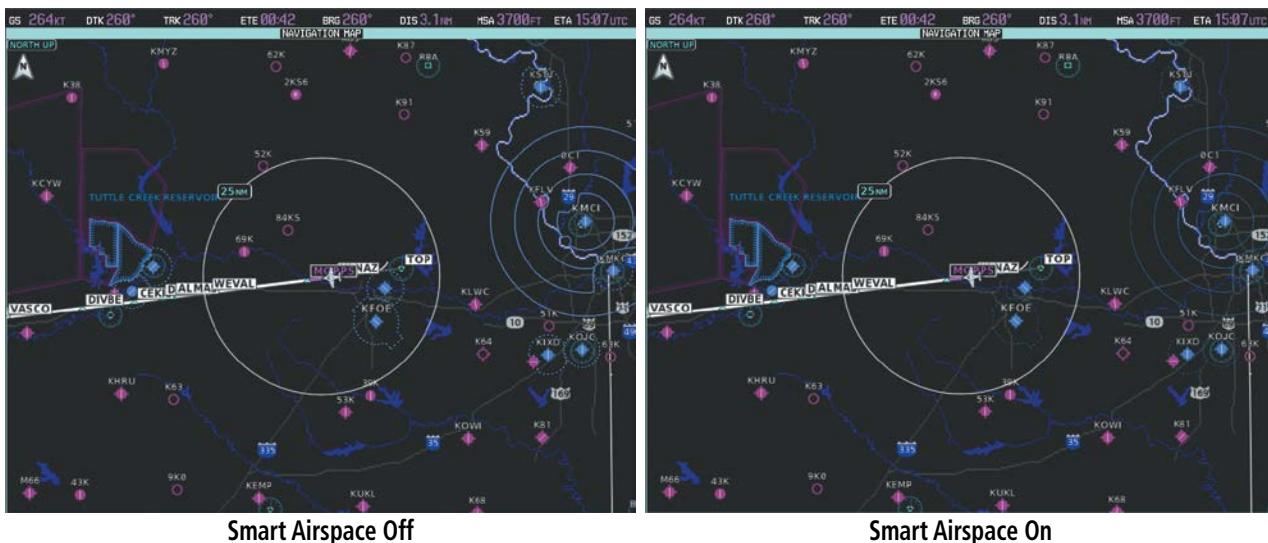


Figure 5-82 Smart Airspace

Enabling/disabling the Smart Airspace function:

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

5.5 DIRECT-TO-NAVIGATION

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

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

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

The Direct To 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.

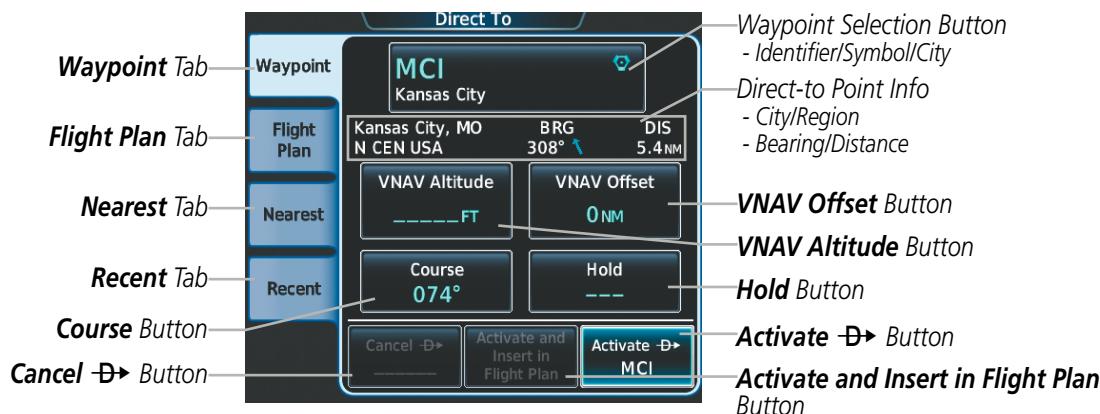


Figure 5-83 Direct To Screen



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

Selecting a waypoint as the direct-to destination by identifier:

- 1) From **Home**, touch **Direct To**.
- 2) Touch the waypoint selection button to display the keypad.
- 3) Use the keypad to select the waypoint identifier.
- 4) Touch the **Enter** Button to accept the identifier, and return to the Direct To Screen.
- 5) Touch the **Activate ->** Button to activate the direct-to.

Or:

- a) Touch the **Activate and Insert in Flight Plan** Button (only available if the selected waypoint is not in the flight plan) to display the Insert and Activate -> <waypoint> Before? Window.
- b) Touch the waypoint selection button to select the flight plan location to insert the direct to waypoint, and to activate the direct-to.

Finding and selecting a waypoint as the direct-to destination by facility name or city name:

- 1) From **Home**, touch **Direct To**.
- 2) Touch the waypoint selection 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 necessary, 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 select the name.
- 8) Touch the **Enter** Button to accept the entry and display the search results.
- 9) Touch a waypoint selection button to choose the waypoint as the direct-to destination, and return to the Direct To Screen.
- 10) Touch the **Activate ➔** Button to activate the direct-to.

Or:

- a) Touch the **Activate and Insert in Flight Plan** Button (only available if the selected waypoint is not in the flight plan) to display the Insert and Activate ➔ <waypoint> Before? Window.
- b) Touch the waypoint selection button to select the flight plan location to insert the direct to waypoint, and to activate the direct-to.

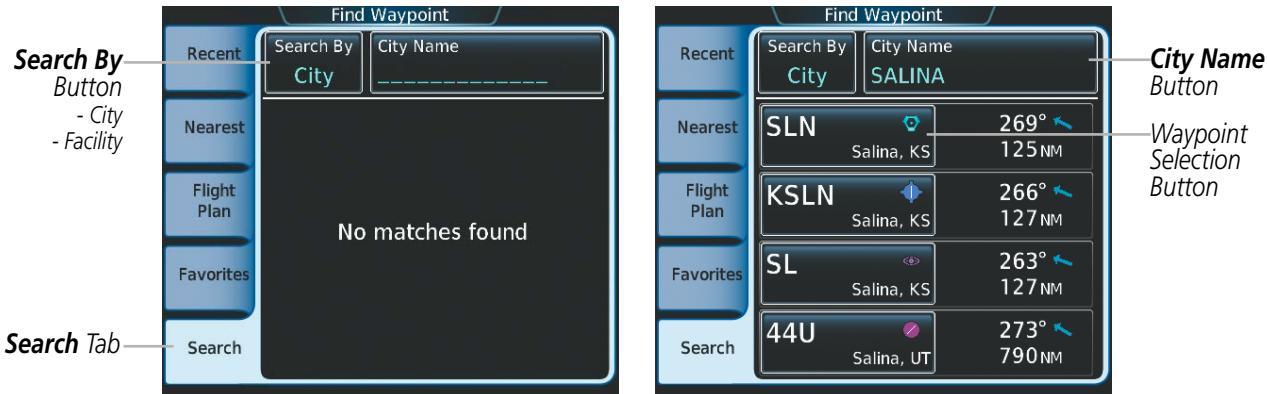


Figure 5-84 Find Waypoint Screen - Search by City Name

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

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

Or:

- 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 \rightarrow <waypoint> Before? Window.
- Touch the waypoint selection button to select the flight plan location to insert the direct to waypoint, and to activate the direct-to.



Figure 5-85 Direct To Screen - Nearest Tab

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

- From **Home**, touch **Flight Plan**.
- Touch a waypoint selection button to display the Waypoint Options Screen.
- Touch the \rightarrow button to choose the waypoint as the direct-to destination and display the Direct To Screen.
- Touch the **Activate \rightarrow** Button to activate the direct-to.

Or:

- From **Home**, touch **Direct To**.
- Touch the **Flight Plan** Tab.
- 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.
- Touch the **Activate \rightarrow** Button to activate the direct-to.

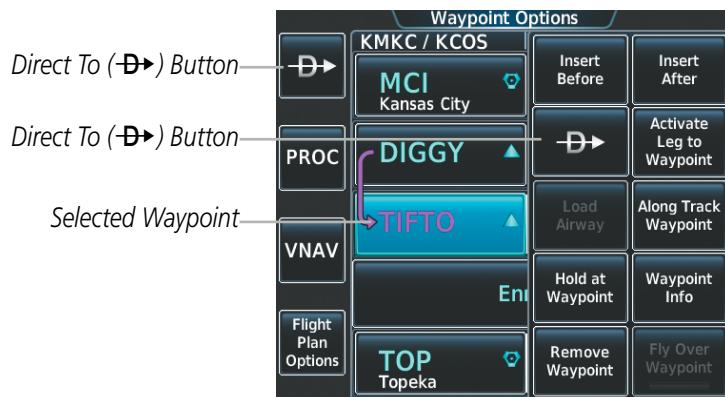


Figure 5-86 Waypoint Options Screen

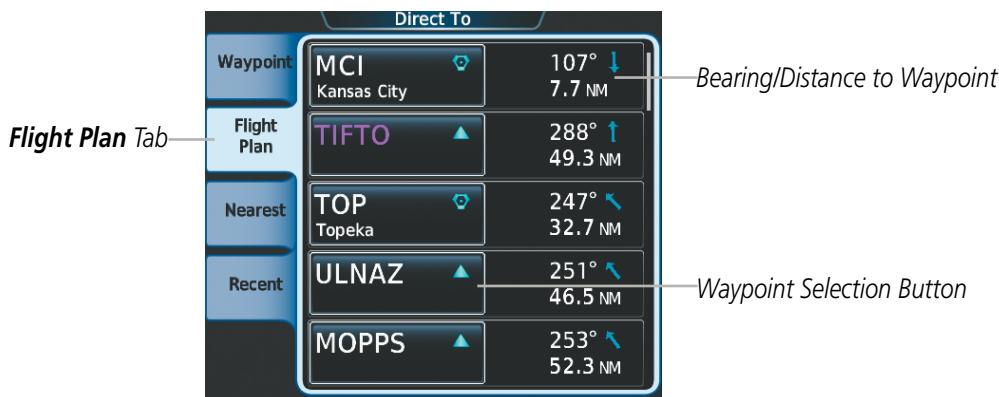


Figure 5-87 Direct To Screen - Flight Plan Tab

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

- 1) From **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 **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, 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 active). Direct-to requests on waypoint information screens or nearest waypoint screens default to the displayed waypoint.

Selecting any waypoint as a direct-to destination:

- 1) Select the screen containing the desired waypoint type and select the desired waypoint.
- 2) Touch the **Waypoint Options** Button.
- 3) Touch the **-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 \rightarrow <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 **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 \rightarrow button to choose the waypoint as the direct-to destination, and display the Direct To Screen.
- 4) Touch the **Activate \rightarrow** 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 \rightarrow <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 **Joystick** to display the pointer.
- 2) Use the **Joystick** 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 \rightarrow** 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 \rightarrow <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 **Home**, touch **Direct To**.
- 2) Touch the **Cancel ➔** Button.
- 3) Touch the **OK** Button in response to the question "Cancel ➔ XXXXXX".



Figure 5-88 Cancelling a Direct To

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 **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 ➔** Button to activate the direct-to using the manually selected course.



Figure 5-89 Direct To - Selecting a Manual Course

Reselecting the direct course from the current position:

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

A direct-to with altitude constraints creates a descent path (and provides guidance to stay on the path) from the aircraft's current altitude to the altitude of the direct-to waypoint. The altitude is reached at the waypoint, or at the specified distance along the flight path if an offset distance has been entered. All 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. See the section on Vertical Navigation for more information regarding the use and purpose of VNAV altitudes and offset distances.

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

- 1) From **Home**, touch **Direct To**.
- 2) Touch the **VNAV Altitude** Button to display the keypad.
- 3) Touch the **Climb** or **Cruise** Button to choose the type of flight phase.
- 4) Use the keypad to select the altitude.
- 5) Touch the **Enter** Button to accept the altitude, and return to the Direct To Screen.
- 6) Touch the **VNAV Offset** Button to display the keypad.
- 7) Touch the **(Before)** - Button or the **(After)** + Button, if necessary.
- 8) Use the keypad to select the offset distance.
- 9) Touch the **Enter** Button to accept the offset distance, and return to the Direct To Screen.
- 10) Touch the **Activate -D>** Button to activate the direct-to using the VNAV constraints.



Figure 5-90 Direct To - Setting VNAV Constraints

Removing a VNAV constraint:

- 1) From **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 ➔** Button to activate the direct to without the VNAV constraints.

Or:

- 1) From **Home**, touch **Flight Plan**.
- 2) Scroll the active flight plan to display the direct-to waypoint.
- 3) Touch the VNAV Altitude Button for the direct-to waypoint to display the VNAV Constraint Window.
- 4) Touch the **Remove Constraint** Button.
- 5) Touch the **Yes** Button in response to the question "Remove Altitude Constraint?".

5.6 FLIGHT PLANNING

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* (Absolute Terrain On)	
Active Course Leg* (Absolute Terrain Off)	
Active Heading Leg* (Absolute Terrain On)	
Active Heading Leg* (Absolute Terrain Off)	
Active Roll Steering Path*† (Absolute Terrain On)	
Active Roll Steering Path*† (Absolute Terrain Off)	
Course Leg in the current flight segment (Absolute Terrain On)	
Course Leg in the current flight segment (Absolute Terrain Off)	
Course Leg not in the current flight segment (Absolute Terrain On)	
Course Leg not in the current flight segment (Absolute Terrain Off)	
Heading Leg (Absolute Terrain On)	
Heading Leg (Absolute Terrain Off)	
Roll Steering Path † (Absolute Terrain On)	
Roll Steering Path † (Absolute Terrain Off)	
Future Roll Steering Path ‡ (Absolute Terrain On)	
Future Roll Steering Path ‡ (Absolute Terrain Off)	
Turn Anticipation Arc (Absolute Terrain On/Absolute Terrain Off)	

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

† A roll steering path is a computed transition between two disconnected legs.

‡ A roll steering path in the flight plan that is beyond the next leg appears as a future roll steering path. When a future roll steering path becomes the next leg in the flight plan, it appears as a roll steering path.

Table 5-6 Flight Plan Leg Symbols

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

Whenever an approach, departure, or arrival procedure is loaded into the active flight plan, a set of approach, departure, or arrival waypoints is inserted into the flight plan along with a header line describing the instrument procedure the pilot selected. The original enroute portion of the flight plan remains active (unless an instrument procedure is activated) when the procedure is loaded.

When the database is updated, 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.

FLIGHT PLAN CREATION

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

- Active Flight Plan Screen on the Touchscreen Controller (create/modify the active flight plan)
- Flight Plan Catalog Screen on the Touchscreen Controller (create/modify a stored flight plan)
- Active Flight Plan Text on the navigation map (view the active flight plan)
- Vertical Situation Display on the navigation map (view the active flight plan)



Figure 5-91 Active Flight Plan Screen



Figure 5-92 Flight Plan Catalog Screen



Figure 5-93 Active Flight Plan displayed on Navigation Map

The active flight plan is listed on the Active Flight Plan Screen on the Touchscreen Controller, and in the Flight Plan Window on the PFD. It is the flight plan to which the system is currently providing guidance, and is shown on the navigation maps. Stored flight plans are listed on the Flight Plan Catalog Screen and are available for activation (become the active flight plan).

An active or stored flight plan can be previewed on the navigation by selecting the Show on Map option. When a waypoint in a flight plan is selected, the Waypoint Options Screen 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.



Figure 5-94 Waypoint Options Screen - Previous/Next Waypoint Buttons



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

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** 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.

Active flight plan information or active flight plan progress can be displayed on the navigation map.



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

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

- 1) From **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 information.

Creating an active flight plan using the Touchscreen Controller:

- 1) From **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.

Or:

Use the right knobs to select a waypoint identifier.

Or:

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

Or:

- a) Touch the **Find** Button to display the Find Waypoint Screen.
- b) Touch the **Search** Tab to display the **Search By** Button.
- c) If necessary, touch the **Search By** Button to choose Search by City or Search by Facility.
- d) Touch the **Facility Name** Button or the **City Name** Button to display the keypad.
- e) Use the keypad to select the name, and the **Enter** Button to accept the entry and display the search results.
- f) 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 Active Flight Plan Screen.
- 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 Screen. 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 Active Flight Plan Screen.
- 8) Touch the **Add Enroute Waypoint** Button to display the keypad.
- 9) Select the identifier of the enroute waypoint using one of the step 3 procedures.
- 10) Repeat step numbers 8 and 9 to enter each additional enroute waypoint.
- 11) If you are finished adding enroute waypoints, touch the **Done** Button to remove the **Add Enroute Waypoint** Button and the **Done** Button from the Active Flight Plan Screen.

- 12) If needed, touch the **Origin** Options Button to display the Origin Options Screen to select a new origin airport, departure runway, departure procedure or to remove the origin airport.
- 13) If needed, touch the **Destination** Options Button to display the Destination Options Screen to select a new destination airport, arrival runway, arrival procedure, approach procedure, or to remove the destination airport.

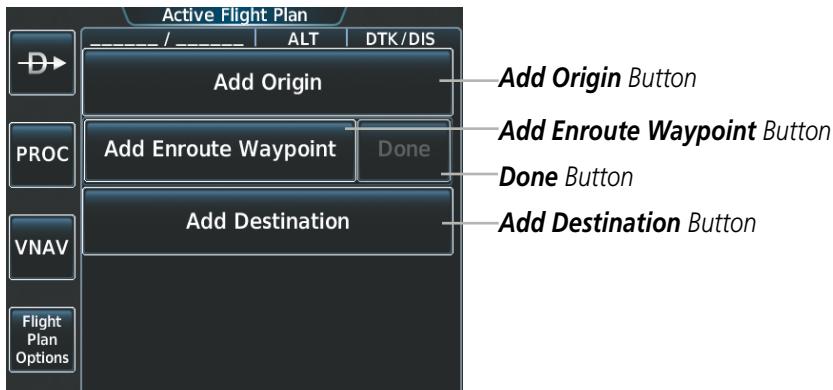


Figure 5-95 Active Flight Plan Screen - Empty

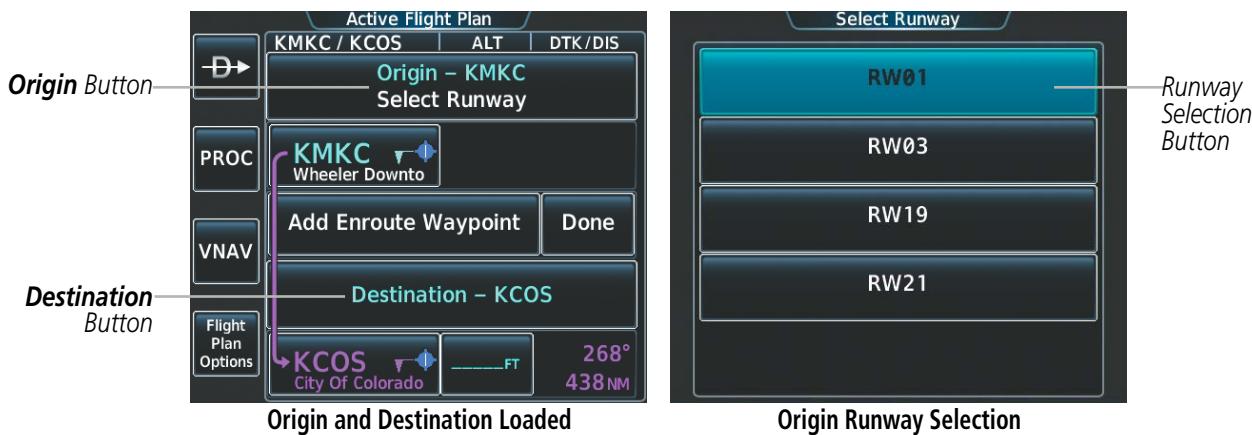


Figure 5-96 Active Flight Plan Screen - Origin and Destination Loaded



Figure 5-97 Active Flight Plan Screen - Origin and Destination Options

The origin and destination option screens provide access to the selection of procedures. The description of loading procedures into the active flight plan can be found in the Procedures section.

Creating a stored flight plan using the Touchscreen Controller:

- 1) From **Home**, touch **Flight Plan > Flight Plan Options**.
- 2) Touch the **Flight Plan Catalog** Button to display the Flight Plan Catalog Screen.
- 3) Touch the **Create New Catalog Flight Plan** Button to display the Edit Stored Flight Plan Screen.
- 4) Touch the **Add Origin** Button to display the keypad.
- 5) Select the identifier of the origin waypoint.

Use the keypad and the **Enter** Button to select a waypoint Identifier.

Or:

Use the right knobs to select a waypoint identifier.

Or:

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

Or:

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

- 6) 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 Active Flight Plan Screen.
- 7) Touch the **Add Destination** Button to display the keypad.
- 8) Select the identifier of the destination waypoint using one of the step 3 procedures.
- 9) If needed, touch the **Destination** Button to display the Destination Options Screen. 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 Active Flight Plan Display.
- 10) Touch the **Add Enroute Waypoint** Button to display the keypad.
- 11) Select the identifier of the enroute waypoint using one of the step 5 procedures.
- 12) Repeat step numbers 10 and 11 to enter each additional enroute waypoint.
- 13) If you are finished adding enroute waypoints, touch the **Done** Button to remove the **Add Enroute Waypoint** Button and the **Done** Button from the Active Flight Plan Screen.

14) If needed, touch the **Origin** Options Button to display the Origin Options Screen to select a new origin airport, departure runway, departure procedure or to remove the origin airport.

15) If needed, touch the **Destination** Options Button to display the Destination Options Screen to select a new destination airport, arrival runway, arrival procedure, approach procedure, or to remove the destination airport.

The description of loading procedures into a stored flight plan can be found in the Adding Procedures to a Stored Flight Plan section.

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 **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.

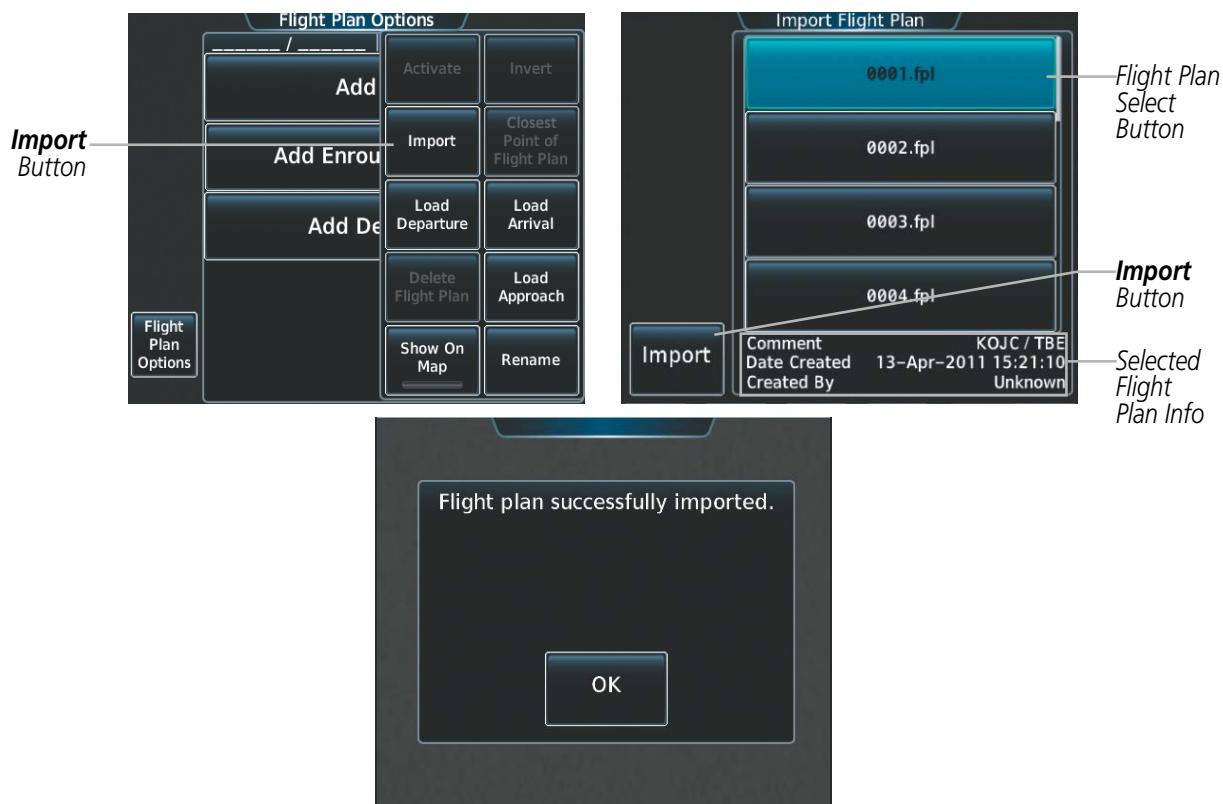


Figure 5-98 Flight Plan Import



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 **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 Screen.



NOTE: The exported flight plan will not contain any procedures or airways.

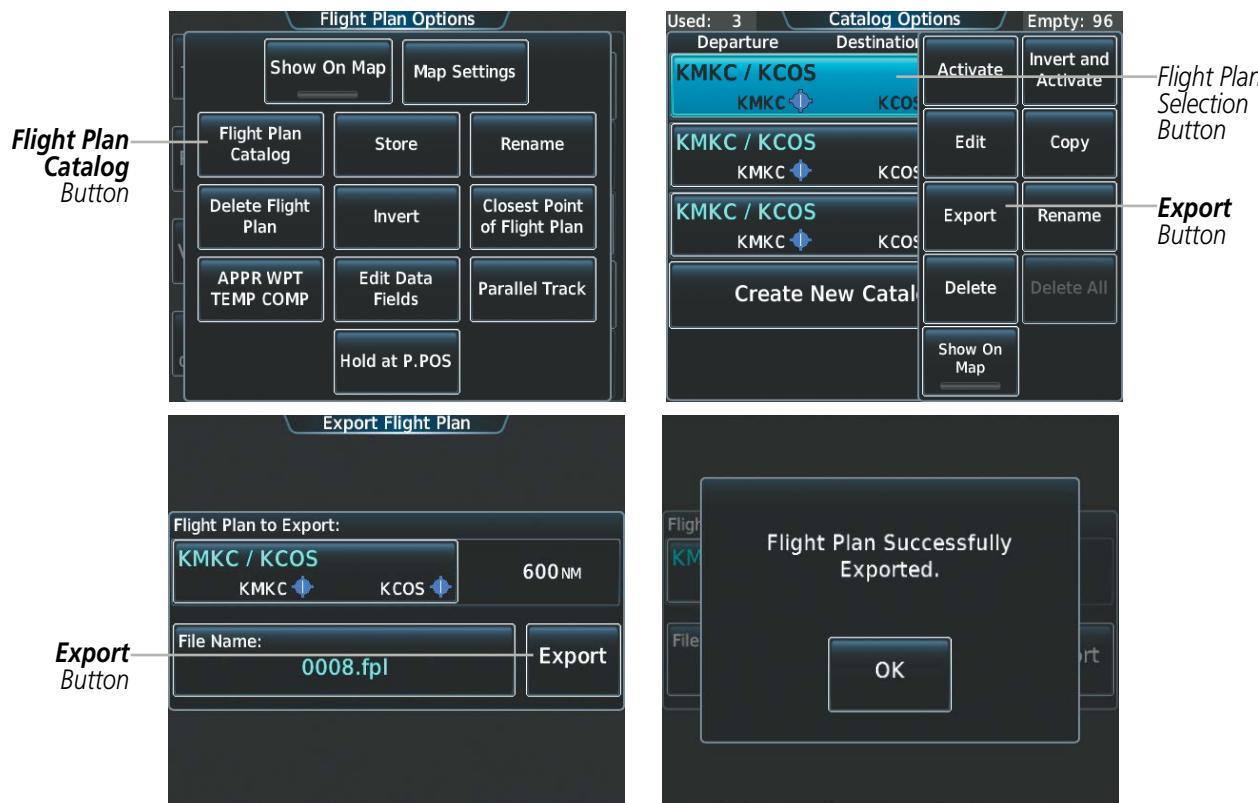


Figure 5-99 Stored Flight Plan Export

ADDING WAYPOINTS TO AN EXISTING FLIGHT PLAN

Waypoints can be added to the active flight plan or any stored flight plan. Choose the flight plan, select the desired point of insertion, then select the waypoint to be added to the flight plan. 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.



Figure 5-100 Edit Stored Flight Plan Screen

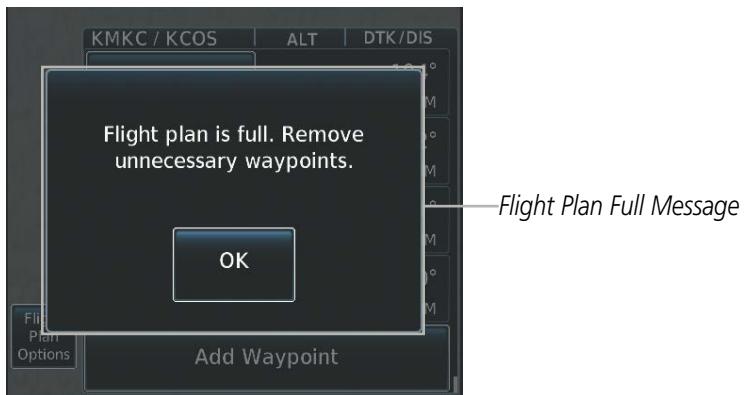


Figure 5-101 Edit Stored Flight Plan Screen - Flight Plan Full

Adding a waypoint to a stored flight plan:

- 1) From **Home**, touch **Flight Plan > Flight Plan Options**.
- 2) Touch the **Flight Plan Catalog** Button to display the Flight Plan Catalog Screen.
- 3) Touch a flight plan selection button to display the Catalog Options Window.
- 4) Touch the **Edit** Button to display the Edit Stored Flight Plan Screen.
- 5) Touch a waypoint options button to display the Waypoint Options Window.
- 6) 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.

- 7) Use the keypad, right knobs, or the Find function to select the new waypoint.
- 8) Touch the **Enter** Button to accept the waypoint and place it in the flight plan.



Figure 5-102 Edit Stored Flight Plan Screen - Waypoint Options Window

Or:

- 1) From **Home**, touch **Flight Plan > Flight Plan Options**.
- 2) Touch the **Flight Plan Catalog** Button to display the Flight Plan Catalog Screen.
- 3) Touch a flight plan selection button to display the Catalog Options Window.
- 4) Touch the **Edit** Button to display the Edit Stored Flight Plan Screen.
- 5) Scroll, if necessary to show the **Enroute** Button.
- 6) Touch the **Enroute** Button to display the Enroute Options Screen.
- 7) Touch the **Insert Waypoint** Button to display the keypad.
- 8) Use the keypad, right knobs, or the Find function to select the new waypoint.
- 9) Touch the **Enter** Button to accept the waypoint and place it in the flight plan.



Figure 5-103 Edit Stored Flight Plan Screen - Adding a Waypoint to the beginning of the Enroute segment of the Flight Plan

Or:

- 1) From **Home**, touch **Flight Plan > Flight Plan Options**.
- 2) Touch the **Flight Plan Catalog** Button to display the Flight Plan Catalog Screen.
- 3) Touch a flight plan selection button to display the Catalog Options Window.
- 4) Touch the **Edit** Button to display the Edit Stored Flight Plan Screen.
- 5) Scroll, if necessary to show the **Add Enroute Waypoint** Button.
- 6) Touch the **Add Enroute Waypoint** Button to display the keypad.
- 7) Use the keypad, right knobs, or the Find function to select the new waypoint.
- 8) Touch the **Enter** Button to accept the waypoint and place it in the flight plan.

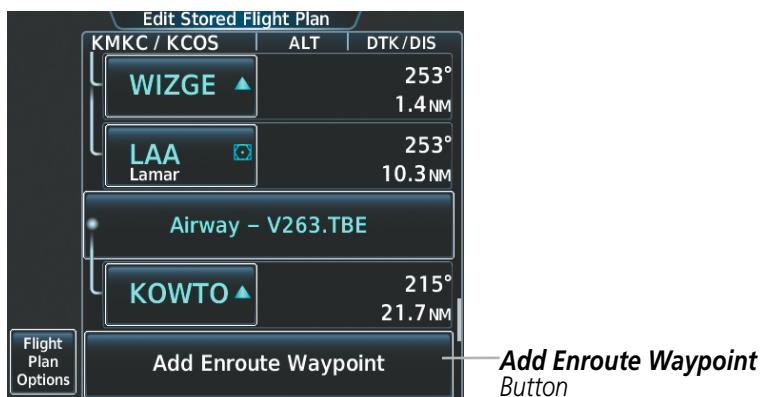


Figure 5-104 Edit Stored Flight Plan Screen - Adding a Waypoint to the end of the Enroute segment of the Flight Plan



NOTE: If the identifier entered in the Waypoint Information Window has duplicates, a 'Duplicates found' message is shown. Touch the **Enter** Button and the Waypoint Duplicates Screen is displayed. Touch a waypoint selection button to select the correct waypoint.



Figure 5-105 Duplicate Waypoints

Waypoints can be added to the active flight plan using the following procedures on the Active Flight Plan Screen.

Adding a waypoint to the active flight plan:

- 1) From **Home**, touch **Flight Plan**.
- 2) Touch a waypoint button to display the Waypoint Options Window.
- 3) 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.
- 4) Use the keypad, right knobs, or the Find function to select the new waypoint.
- 5) Touch the **Enter** Button to accept the waypoint and place it in the flight plan.



Figure 5-106 Active Flight Plan Screen - Waypoint Options Window

Or:

- 1) From **Home**, touch **Flight Plan**.
- 2) Scroll, if necessary to show the **Enroute** Button.
- 3) Touch the **Enroute** Button to display the Enroute Options Screen.
- 4) Touch the **Insert Waypoint** Button to display the keypad.
- 5) Use the keypad, right knobs, or the Find function to select the new waypoint.
- 6) Touch the **Enter** Button to accept the waypoint and place it in the flight plan.



Figure 5-107 Active Flight Plan Screen - Adding a Waypoint to the beginning of the Enroute segment of the Flight Plan

Or:

- 1) From **Home**, touch **Flight Plan**.
- 2) Scroll, if necessary to show the **Add Enroute Waypoint** Button.
- 3) Touch the **Add Enroute Waypoint** Button to display the keypad.
- 4) Use the keypad, right knobs, or the Find function to select the new waypoint.
- 5) Touch the **Enter** Button to accept the waypoint and place it in the flight plan.
- 6) If you are finished adding waypoint at the end of the enroute segment, touch the **Done** Button to remove the **Add Enroute Waypoint** Button and the **Done** Button from the Flight Plan Screen.



Figure 5-108 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) Press the **Joystick** to the display Map Pointer Control Screen on the Touchscreen Controller, and to activate the map pointer on the Navigation Map Display. 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 flight plan, the **Insert in FPL** Button is activated.
- 2) Touch the **Insert In Flight Plan** Button. The Insert Before Waypoint Screen is displayed.
- 3) Touch the waypoint selection button to select where to insert the new waypoint. The waypoint is inserted into the flight plan before the selected waypoint, and the Touchscreen Controller returns to the Map Pointer Options Screen.
- 4) Press the **Joystick** to deactivate the map pointer and return to the previous screen.

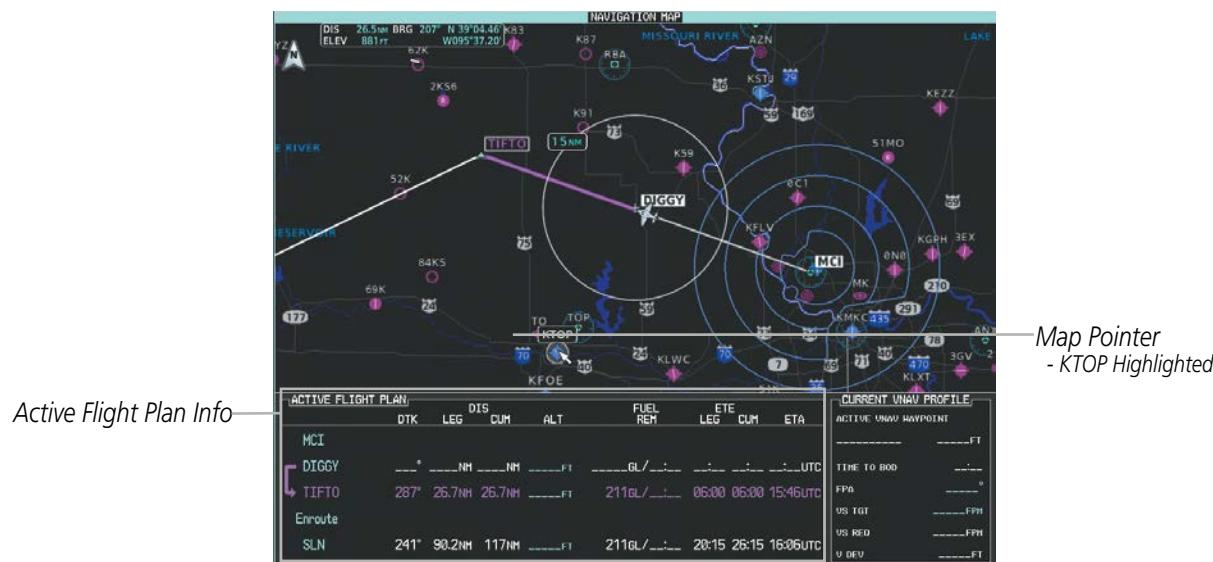


Figure 5-109 Active Flight Plan Display - Map Pointer Active



Figure 5-110 Inserting Waypoint in Active Flight Plan



Figure 5-111 KTOP in Flight Plan

Flight plan waypoints which are not part of a procedure can be defined as fly over waypoints. The aircraft will fly over the waypoint before turning to the next leg instead of turning short to the next leg.

Enabling/disabling a fly over waypoint:

- 1) From MFD Home, touch Flight Plan.
- 2) Touch a waypoint button to display the Waypoint Options Window.
- 3) Touch the **Fly Over Waypoint** Button to enable/disable the waypoint as a fly over waypoint.

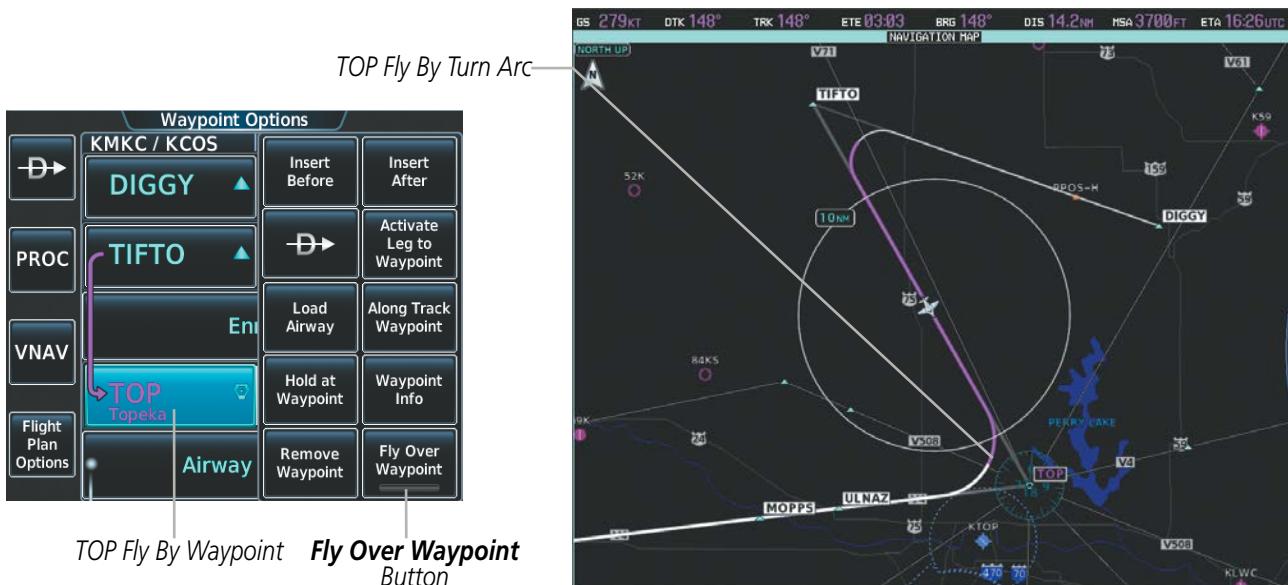


Figure 5-112 TOP Defined as a Fly By Waypoint



Figure 5-113 TOP Defined as a Fly Over Waypoint

ADDING AIRWAYS TO A FLIGHT PLAN

Airways can be added to the active flight plan or any stored flight plan. An airway can only be loaded 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.

Adding an airway to the active flight plan:

- 1) From **Home**, touch **Flight Plan**.
- 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 and display the Airway Waypoint Sequence.
- 7) Touch the **Load Airway** Button to insert the airway into the active flight plan.



Figure 5-114 Adding an Airway to the Active Flight Plan

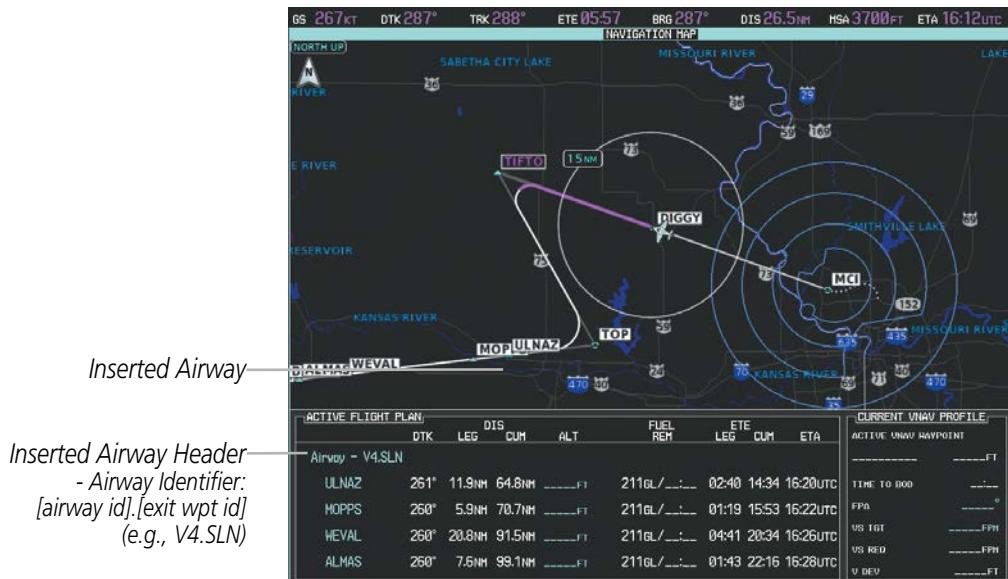


Figure 5-115 Active Flight Plan Display - V4 Airway Loaded

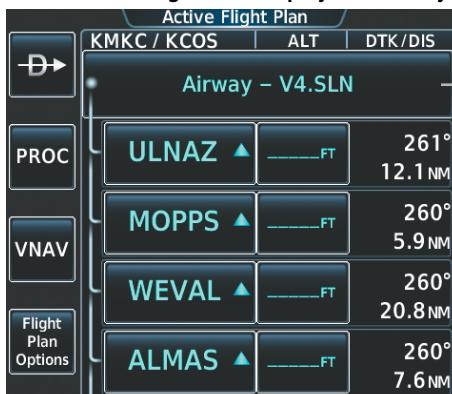


Figure 5-116 Active Flight Plan Screen - V4 Airway Loaded

Adding an airway to a stored flight plan:

- 1) From **Home**, touch **Flight Plan > Flight Plan Options**.
- 2) Touch the **Flight Plan Catalog** Button to display the Flight Plan Catalog Screen.
- 3) Touch a flight plan selection button to display the Catalog Options Window.
- 4) Touch the **Edit** Button to display the Edit Stored Flight Plan Screen.
- 5) Scroll the list if necessary and touch a waypoint options button to display the Waypoint Options Window.
- 6) Touch the **Load Airway** Button to display the Airway Selection Screen.
- 7) Scroll the list if necessary and touch an airway exit point selection button to select the airway and display the Select Exit Window.
- 8) Scroll the list if necessary and touch an airway exit point selection button to select the airway exit point and display the Airway Waypoint Sequence.
- 9) Touch the **Load Airway** Button to insert the airway into the stored flight plan.

RESTRICTIONS ON ADDING AIRWAYS

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

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

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

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

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

ADDING PROCEDURES TO A STORED FLIGHT PLAN

The system allows the pilot to insert pre-defined instrument procedures from the navigation database into a flight plan. The procedures are designed to facilitate routing of traffic leaving an airport (departure), arriving at an airport (arrival), and landing at an airport (approach). See the Procedures section for more details.



Figure 5-117 Edit Stored Flight Plan Screen - Flight Plan Options

DEPARTURE (DP)

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. The route is defined by selection of a departure, the transition waypoints, and a runway.

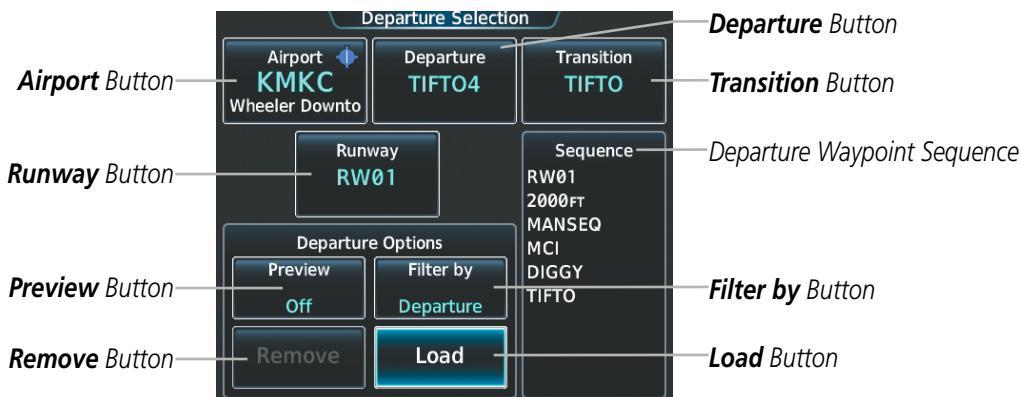


Figure 5-118 Departure Selection Screen

The Filter by Button on the Departure Selection Screen changes the selection order between: Filter by Departure - selecting the departure first, then showing only the transitions and runways available for that departure; or Filter by Runway - selecting the runway first, then showing only the departures and transitions available for that runway. Any of the buttons can still be selected in any order you choose.



Figure 5-119 Departure Display - Preview of the Selected Departure

Loading a departure procedure into a stored flight plan:

- 1) From **Home**, touch **Flight Plan > Flight Plan Options**.
- 2) Touch the **Flight Plan Catalog** Button to display the Flight Plan Catalog Screen.
- 3) Touch a flight plan selection button to display the Catalog Options Window.
- 4) Touch the **Edit** Button to display the Edit Stored Flight Plan Screen.
- 5) Touch the **Flight Plan Options** Button to display the Flight Plan Options Window.
- 6) Touch the **Load Departure** Button to display the Departure Selection Screen.

- 7) Touch the **Departure** Button to display the Select Departure Screen with a list of available departures.
- 8) Scroll the list if necessary and touch a departure selection button to select the departure and return to the Departure Selection Screen.
- 9) Touch the **Transition** Button to display the Select Transition Screen with a list of available transitions.
- 10) Scroll the list if necessary and touch a transition selection button to select the transition and return to the Departure Selection Screen.
- 11) Touch the **Runway** Button to display the Select Runway Screen with a list of available runways.
- 12) Scroll the list if necessary and touch a runway selection button to select the runway and return to the Departure Selection Screen.
- 13) Touch the **Preview** Button, then the **Show on Map** Button to show the preview of the departure on the navigation map or touch the **Show Chart** Button to show the departure chart instead of the navigation map.
- 14) Touch the **Load** Button to insert the departure into the stored flight plan.



Figure 5-120 Edit Stored Flight Plan Screen - Departure Inserted



Figure 5-121 Stored Flight Plan Display - Departure Inserted

ARRIVAL (STAR)

A Standard Terminal Arrival (STAR) is loaded at the destination airport in the flight plan. Only one arrival can be loaded at a time in a flight plan. The route is defined by selection of an arrival, the transition waypoints, and a runway.

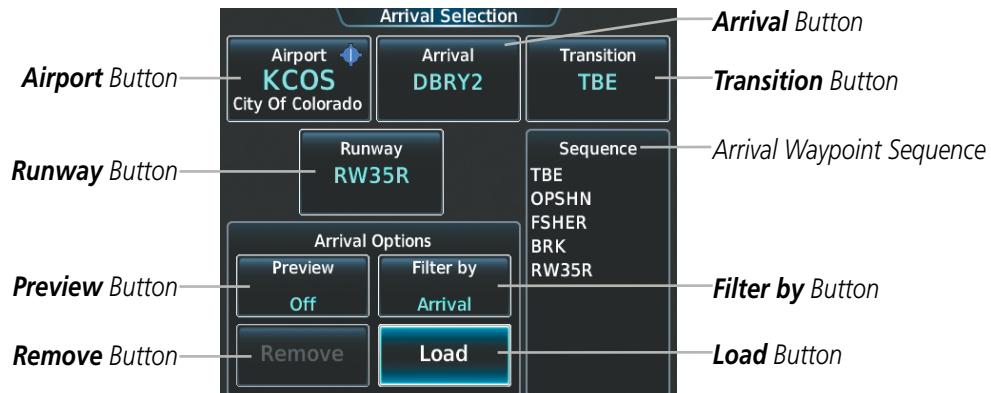


Figure 5-122 Arrival Selection Screen

The Filter by Button on the Arrival Selection Screen changes the selection order between: Filter by Arrival - selecting the arrival first, then showing only the transitions and runways available for that arrival; or Filter by Runway - selecting the runway first, then showing only the arrivals and transitions available for that runway. Any of the buttons can still be selected in any order you choose.



Figure 5-123 Arrival Display - Preview of the Selected Arrival

Loading an arrival procedure into a stored flight plan:

- 1) From **Home**, touch **Flight Plan > Flight Plan Options**.
- 2) Touch the **Flight Plan Catalog** Button to display the Flight Plan Catalog Screen.
- 3) Touch a flight plan selection button to display the Catalog Options Window.
- 4) Touch the **Edit** Button to display the Edit Stored Flight Plan Screen.

- 5) Touch the **Flight Plan Options** Button to display the Flight Plan Options Window.
- 6) Touch the **Load Arrival** Button to display the Arrival Selection Screen.
- 7) Touch the **Arrival** Button to display the Select Arrival Screen with a list of available arrivals.
- 8) Scroll the list if necessary and touch an arrival selection button to select the arrival and return to the Arrival Selection Screen.
- 9) Touch the **Transition** Button to display the Select Transition Screen with a list of available transitions.
- 10) Scroll the list if necessary and touch a transition selection button to select the transition and return to the Arrival Selection Screen.
- 11) Touch the **Runway** Button to display the Select Runway Screen with a list of available runways.
- 12) Scroll the list if necessary and touch a runway selection button to select the runway and return to the Arrival Selection Screen.
- 13) Touch the **Preview** Button, then the **Show on Map** Button to show the preview of the arrival on the navigation map or touch the **Show Chart** Button to show the arrival chart instead of the navigation map.
- 14) Touch the **Load** Button to insert the arrival into the stored flight plan.



Figure 5-124 Edit Stored Flight Plan Screen - Arrival Inserted

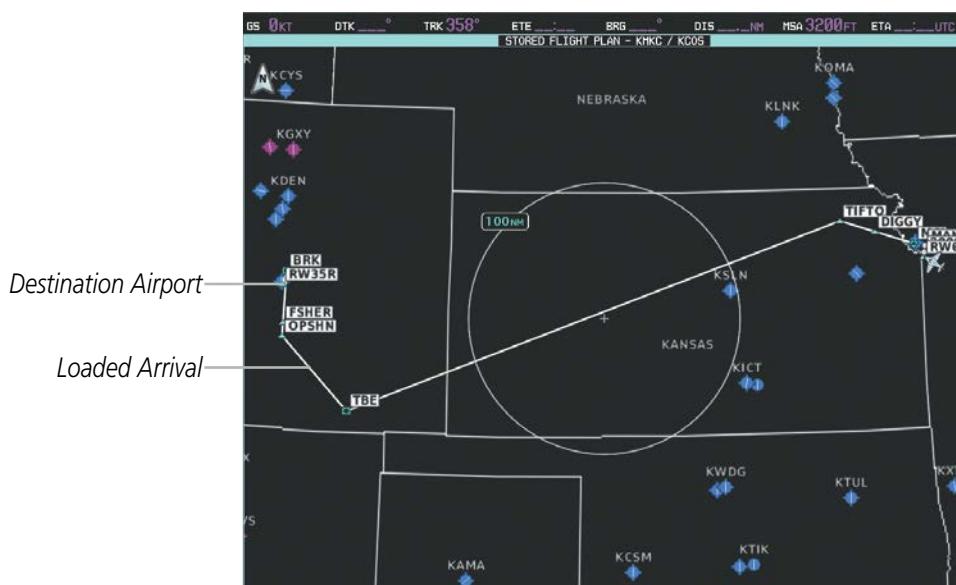


Figure 5-125 Stored Flight Plan Display - Arrival Inserted

APPROACH (APPR)

An Approach Procedure (APPR) can be loaded at any airport that has an approach available. Only one approach can be loaded at a time in a stored flight plan. The route for a selected approach is defined by designating transition waypoints.

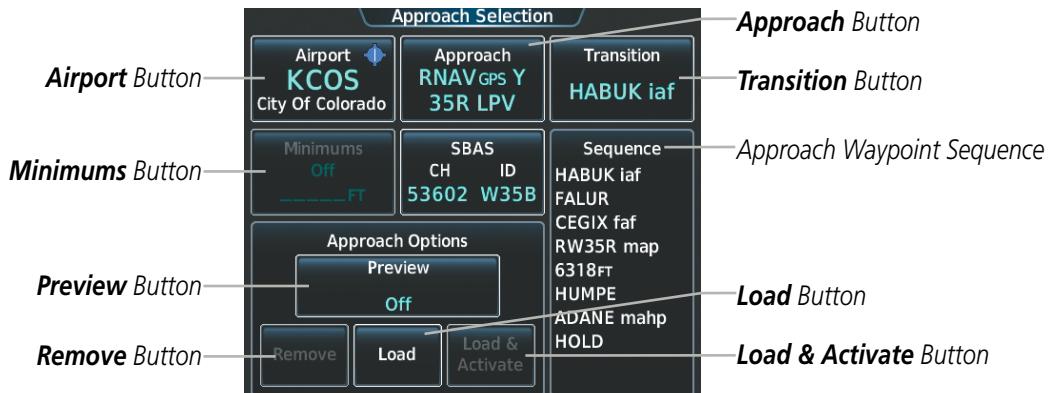


Figure 5-126 Approach Selection Screen

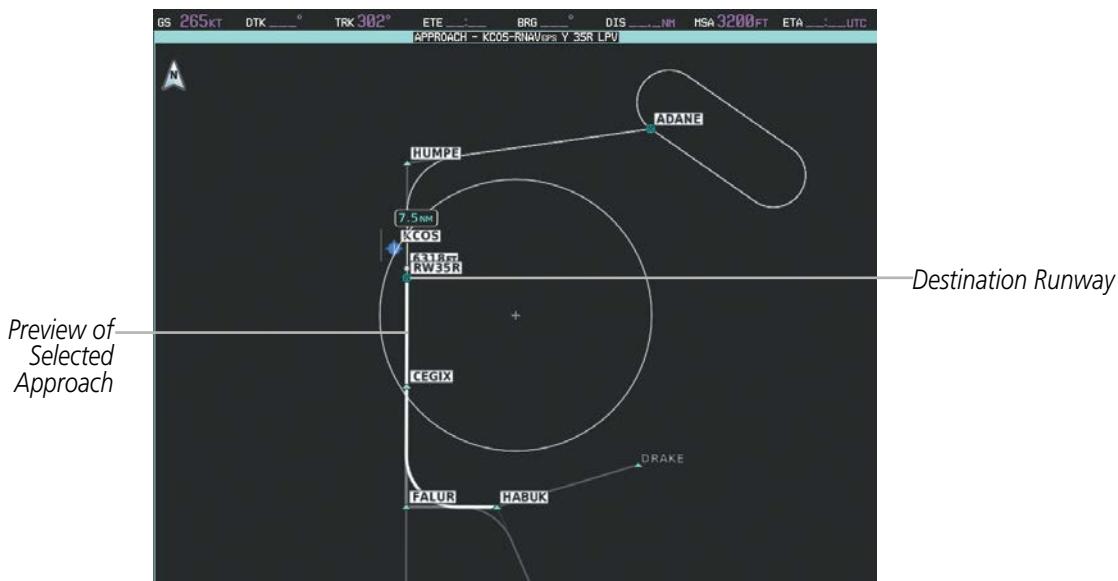


Figure 5-127 Approach Display - Preview of the Selected Approach

Loading an approach procedure into a stored flight plan:

- 1) From **Home**, touch **Flight Plan** > **Flight Plan Options**.
- 2) Touch the **Flight Plan Catalog** Button to display the Flight Plan Catalog Screen.
- 3) Touch a flight plan selection button to display the Catalog Options Window.
- 4) Touch the **Edit** Button to display the Edit Stored Flight Plan Screen.

- 5) Touch the **Flight Plan Options** Button to display the Flight Plan Options Window.
 - 6) Touch the **Load Approach** Button to display the Approach Selection Screen.
 - 7) Select the airport and approach:
 - a) If necessary, touch the **Airport** Button to display the keypad and use it to select the approach airport.
 - b) Touch the **Enter** Button to accept the approach airport.
 - c) If necessary, touch the **Approach** Button to display the Select Approach Screen with a list of available approaches.
 - d) Scroll the list if necessary and touch an approach selection button to select the approach and return to the Approach Selection Screen.
 - Or:
 - a) If the **SBAS** Button is available , touch the **SBAS** Button to display the keypad and use it to select the SBAS channel number (The SBAS channel button is only available when an RNAV or GPS based approach is selected, or no approach is selected).
If the **SBAS** Button is not available , touch the **Approach** Button to display the Select Approach Screen, scroll to the bottom of the list, touch the **Select by SBAS Channel** Button to display the keypad, and use it to select the SBAS channel number
 - b) Touch the **Enter** Button to accept the SBAS channel and return to the Approach Selection Screen with the airport and approach selected.
- 8) Touch the **Transition** Button to display the Select Transition Screen with a list of available transitions.
 - 9) Scroll the list if necessary and touch a transition selection button to select the transition and return to the Approach Selection Screen.
 - 10) Touch the **Preview** Button, then the **Show on Map** Button to show the preview of the approach on the navigation map or touch the **Show Chart** Button to show the approach chart instead of the navigation map.
 - 11) Touch the **Load** Button to insert the approach into the stored flight plan.

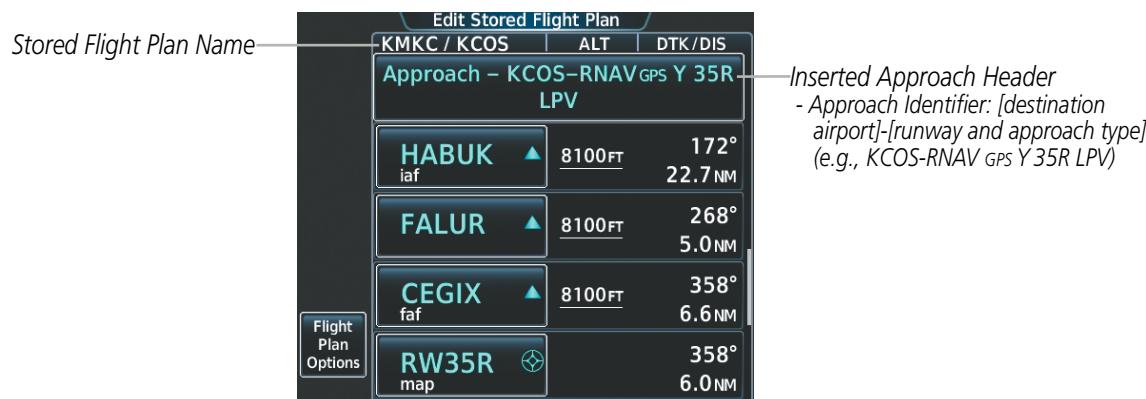


Figure 5-128 Edit Stored Flight Plan Screen - Approach Inserted



Figure 5-129 Stored Flight Plan Display - Approach Inserted

FLIGHT PLAN STORAGE

The system can store up to 99 flight plans. The active flight plan is erased when the system is turned off. The active flight plan is overwritten when another flight plan is activated. Details about each stored flight plan can be viewed on the Flight Plan Catalog Screen.

Viewing information about a stored flight plan:

- 1) From **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 5-130 Flight Plan Catalog Screen



Figure 5-131 Edit Stored Flight Plan Screen

Storing a flight plan from the Active Flight Plan Screen:

- 1) From **Home**, touch **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 FLIGHT PLAN

Activating a stored flight plan erases the active flight plan and replaces it with the flight plan being activated. Inverting and activating a stored flight plan reverses the waypoint order, erases the active flight plan, and replaces it with the flight plan being activated (the stored flight plan is not changed).

Activating a stored flight plan:

- 1) From **Home**, touch **Flight Plan > Flight Plan Options**.
- 2) Touch the **Flight Plan Catalog** Button to display the Flight Plan Catalog Screen.
- 3) Touch a stored flight plan button to display the Catalog Options Window.
- 4) Touch the **Activate** Button.
- 5) Touch the **OK** Button in response to "Activate Selected Flight Plan and Replace Current Active Route?". To cancel the request, touch the **Cancel** Button.

Inverting and activating a stored flight plan:

- 1) From **Home**, touch **Flight Plan > Flight Plan Options**.
- 2) Touch the **Flight Plan Catalog** Button to display the Flight Plan Catalog Screen.
- 3) Scroll the list if necessary and touch a flight plan selection button to display the Catalog Options Window.
- 4) Touch the **Invert and Activate** Button.
- 5) Touch the **OK** Button in response to "Invert and Activate Selected Flight Plan and Replace Current Active Route?". The stored flight is inverted 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.

Copying a stored flight plan to another flight plan memory slot:

- 1) From **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.

DELETE A STORED FLIGHT PLAN

Individual flight plans can be deleted from the system memory.

Deleting a stored flight plan:

- 1) From **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.

FLIGHT PLAN EDITING

The active flight plan or any stored flight plan can be edited. The edits made to the active flight plan affect navigation as soon as they are entered.

DELETING THE ACTIVE FLIGHT PLAN

The system allows deleting the active flight plan. Deleting the active flight plan suspends navigation by the system.

Deleting the active flight plan:

- 1) From **Home**, touch **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.

REMOVING FLIGHT PLAN ITEMS

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



NOTE: When a flight plan contains multiple instances of the same waypoint, editing any occurrence may affect the active leg. Verify all flight plan edits result in the desired active waypoint.



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

Removing an individual waypoint from the active flight plan:

- 1) From **Home**, touch **Flight Plan**.
- 2) Scroll the list if necessary and touch a waypoint options button to display the Waypoint Options Window.
- 3) Touch the **Remove Waypoint** Button.
- 4) Touch the **OK** Button in response to "Remove <waypoint name>?". The waypoint is removed. To cancel the request, touch the **Cancel** Button.

Removing an entire airway from the active flight plan:

- 1) From **Home**, touch **Flight Plan**.
- 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.

Removing an entire procedure from the active flight plan:

- 1) From **Home**, touch **Flight Plan**.
- 2) Scroll the list if necessary and touch a departure, arrival, or approach selection button to display the Departure, Arrival, or Approach Options Window.
- 3) Touch the **Remove Departure** Button, the **Remove Arrival** Button, or the **Remove Approach** Button.
- 4) Touch the **OK** Button in response to "Remove <procedure> -<procedure name> from flight plan?". The procedure is removed. To cancel the request, touch the **Cancel** Button.



NOTE: The origin airport/runway remains when removing a departure; the destination airport/runway remains if after deleting the procedure, there is no longer a procedure at the destination airport. A procedure replaces the respective destination/runway waypoint.

Removing an individual waypoint from a stored flight plan:

- 1) From **Home**, touch **Flight Plan > Flight Plan Options**.
- 2) Touch the **Flight Plan Catalog** Button to display the Flight Plan Catalog Screen.
- 3) Scroll the list if necessary and touch a stored flight plan button to display the Catalog Options Window.
- 4) Touch the **Edit** Button.
- 5) Scroll the list if necessary and touch a waypoint options button to display the Waypoint Options Window.
- 6) Touch the **Remove Waypoint** Button.
- 7) Touch the **OK** Button in response to "Remove <waypoint name>?". The waypoint is removed. To cancel the request, touch the **Cancel** Button.

Removing an entire airway from a stored flight plan:

- 1) From **Home**, touch **Flight Plan > Flight Plan Options**.
- 2) Touch the **Flight Plan Catalog** Button to display the Flight Plan Catalog Screen.
- 3) Scroll the list if necessary and touch a stored flight plan button to display the Catalog Options Window.
- 4) Touch the **Edit** Button.
- 5) Scroll the list if necessary and touch an airway selection button to display the Airway Options Window.
- 6) Touch the **Remove Airway** Button.
- 7) Touch the **OK** Button in response to "Remove <airway name>?". The airway is removed, but the starting and ending waypoints remain in the flight plan. To cancel the request, touch the **Cancel** Button.

Removing an entire procedure from a stored flight plan:

- 1) From **Home**, touch **Flight Plan > Flight Plan Options**.
- 2) Touch the **Flight Plan Catalog** Button to display the Flight Plan Catalog Screen.
- 3) Scroll the list if necessary and touch a stored flight plan button to display the Catalog Options Window.
- 4) Touch the **Edit** Button.
- 5) Scroll the list if necessary and touch a departure, arrival, or approach selection button to display the Departure, Arrival, or Approach Options Window.
- 6) Touch the **Remove Departure** Button, the **Remove Arrival** Button, or the **Remove Approach** Button.
- 7) Touch the **OK** Button in response to "Remove <procedure> -<procedure name> from flight plan?". The procedure is removed. To cancel the request, touch the **Cancel** Button.

CHANGING FLIGHT PLAN COMMENTS (NAMES)

The comment field (or name) of each flight plan can be changed to something that is useful for identification and sorting.

Changing the active flight plan comment:

- 1) From **Home**, touch **Flight Plan > Flight Plan Options**.
- 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 Options Screen.

Changing a stored flight plan comment:

- 1) From **Home**, touch **Flight Plan > Flight Plan Options**.
- 2) Touch the **Flight Plan Catalog** Button to display the Flight Plan Catalog Screen.
- 3) Scroll the list if necessary and touch a stored flight plan button to display the Catalog Options Window.
- 4) Touch the **Rename** Button to display the keypad.
- 5) Use the keypad to select the comment.
- 6) Touch the **Enter** Button to accept the comment, and return to the Flight Plan Catalog Screen.

ALONG TRACK OFFSETS

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



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

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

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

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



Figure 5-132 Inserting an Along Track Offset Waypoint

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

- 1) From **Home**, touch **Flight Plan**.
- 2) Touch a waypoint options button to display the Waypoint Options Screen.
- 3) Touch the **Along Track Waypoint** Button to bring up the Along Track Waypoint Offset Screen.
- 4) Use the keypad to select the distance in the range of 1 to 999 nm (limited by leg distances).
- 5) Touch the **(Before)** - Button or the **(After)** + Button to select the offset waypoint direction.
- 6) Touch the **Enter** Button to insert the offset waypoint into the flight plan.

Removing an along track offset waypoint from the active flight plan:

- 1) From **Home**, touch **Flight Plan**.
- 2) Touch the along track offset waypoint options button to display the Waypoint Options Screen.
- 3) Touch the **Remove Waypoint** Button.
- 4) Touch the **OK** Button to delete the waypoint from the flight plan.



Figure 5-133 Adding an Altitude Constraint

Adding an altitude constraint at an along track offset waypoint:

- 1) From **Home**, touch **Flight Plan**.
- 2) Touch an Along Track Offset Waypoint Altitude Constraint Button to display the Enter Altitude Screen.
- 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 accept the altitude entry and display the VNAV Constraint window.
- 6) Touch the **Enter** Button to add the altitude constraint to the flight plan.

Removing an altitude constraint from an along track offset waypoint:

- 1) From **Home**, touch **Flight Plan**.
- 2) Touch the Along Track Offset Waypoint Altitude Constraint Button to display the VNAV Constraint 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 pages shows the parallel course, and waypoint names have a lower case “-p” placed after the identifier.

While flying a parallel track:

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

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



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



Figure 5-134 Active Flight Plan Display - Prior to Activating Parallel Track

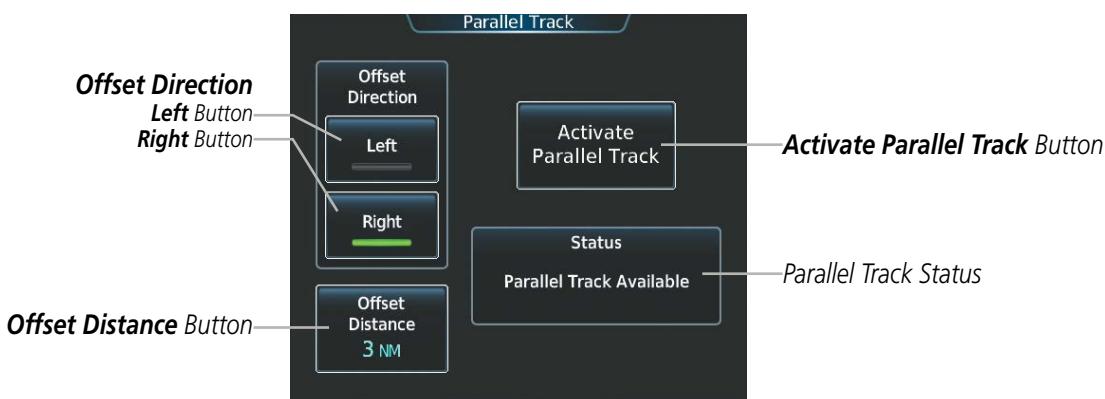


Figure 5-135 Parallel Track Screen - Selecting Parallel Track

Activating parallel track:

- 1) From **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.

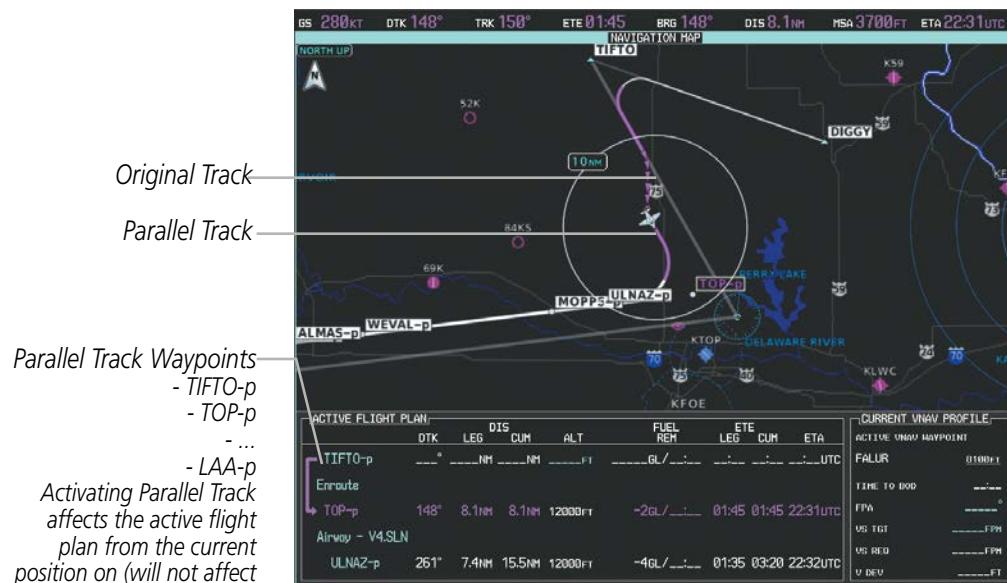


Figure 5-136 Active Flight Plan Display - Parallel Track Active

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’).

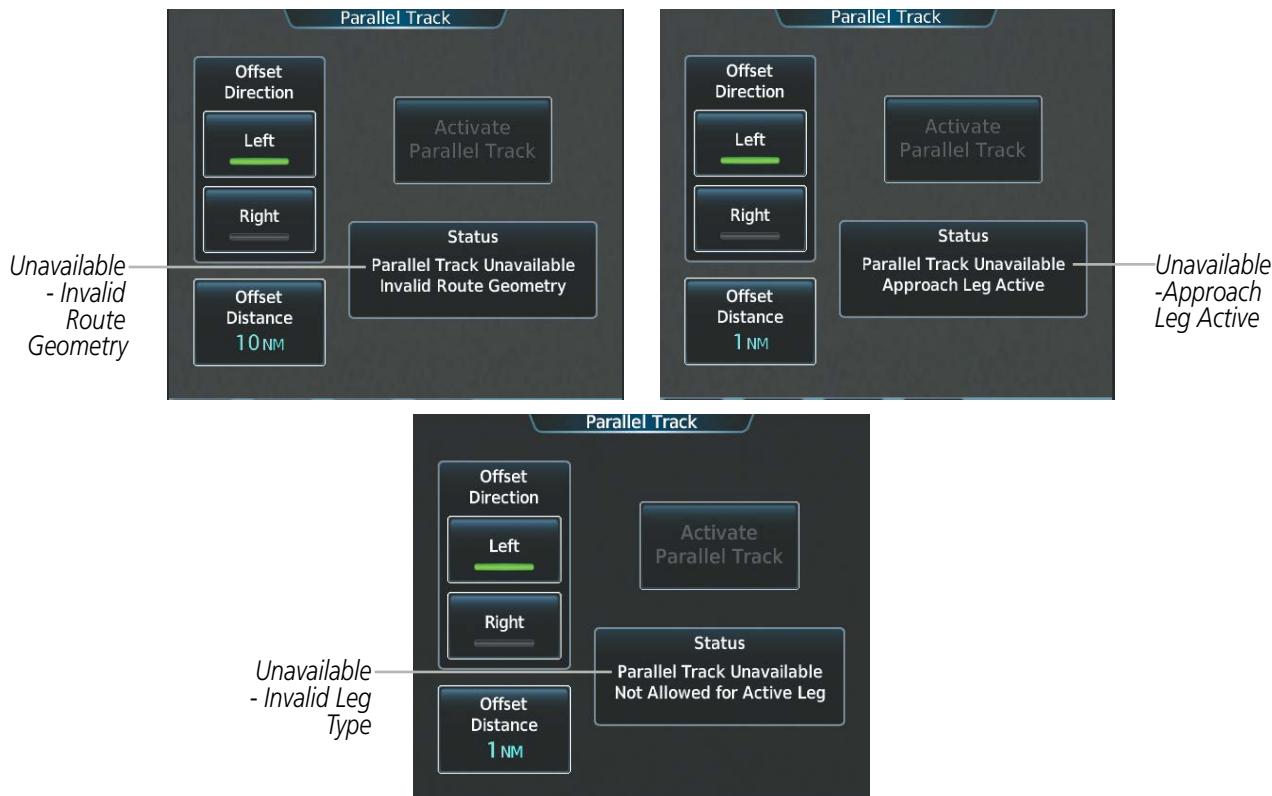


Figure 5-137 Parallel Track Unavailable

Cancelling parallel track:

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

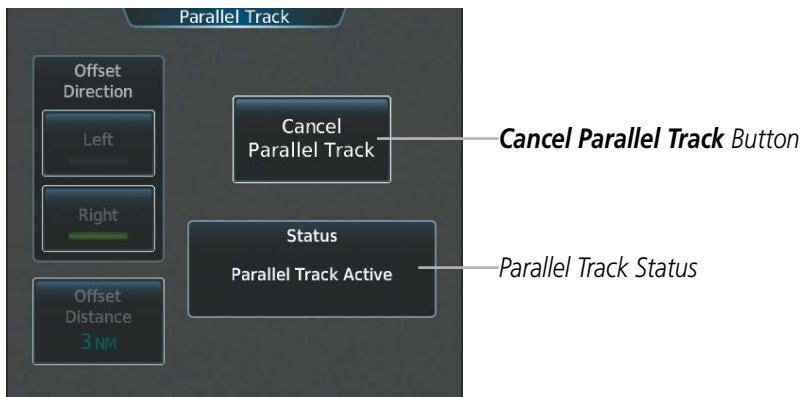


Figure 5-138 Parallel Track Screen - Cancelling Parallel Track

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 **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.

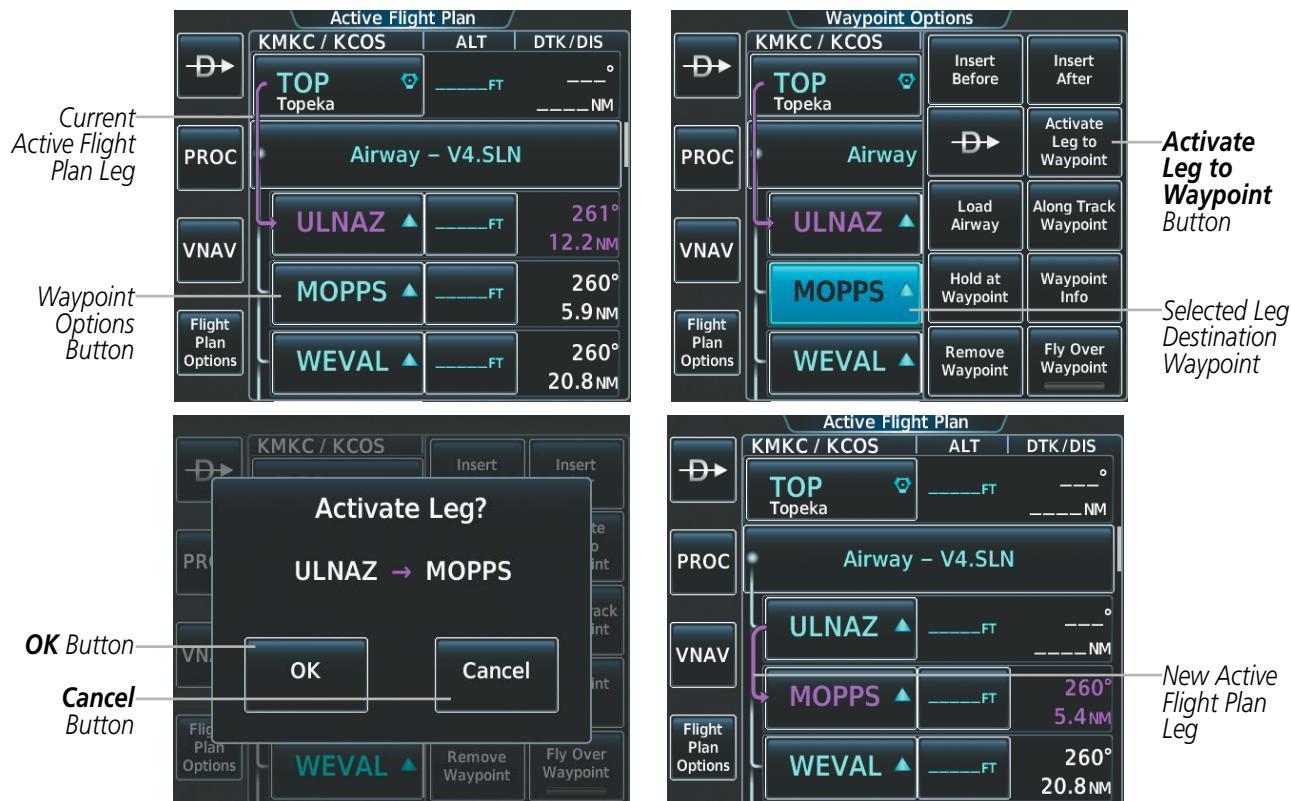


Figure 5-139 Active Flight Plan Screen - Activating a Flight Plan Leg

INVERTING A FLIGHT PLAN

Any flight plan may be inverted (reversed) for navigation back to the original origin point.

Inverting the active flight plan:

- 1) From **Home**, touch **Flight Plan**.
- 2) Touch the **Flight Plan Options** Button to display the Flight Plan Options Screen.
- 3) Touch the **Invert** Button.
- 4) Touch the **OK** Button in response to "Invert flight plan?". The flight plan is inverted. To cancel the request, touch the **Cancel** Button.

Inverting and activating a stored flight plan:

- 1) From **Home**, touch **Flight Plan > Flight Plan Options**.
- 2) Touch the **Flight Plan Catalog** Button to display the Flight Plan Catalog Screen.
- 3) Scroll the list if necessary and touch a flight plan selection button to display the Catalog Options Window.
- 4) Touch the **Invert and Activate** Button.
- 5) Touch the **OK** Button in response to “Invert and Activate Selected Flight Plan and Replace Current Active Route?”. The stored flight is inverted and becomes the active flight plan. The stored flight plan is not modified. To cancel the request, touch the **Cancel** Button.

COLLAPSING AIRWAYS

The system allows airways on the active flight plan to be collapsed or expanded from the Active Flight Plan Screen. 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 Page 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. When an airway is loaded, the airway is automatically expanded or collapsed, based on the selection on the **Load New Airways** Button.



Figure 5-140 Expanded/Collapsed Airways

Collapsing/expanding all airways in the active flight plan:

- 1) From **Home**, touch **Flight Plan**.
- 2) Scroll the list if necessary and touch an airway selection button to display the Airway Options Window.
- 3) Touch the **Collapse All** Button or the **Expand All** Button to collapse/expand all airways and return to the Active Flight Plan Screen.

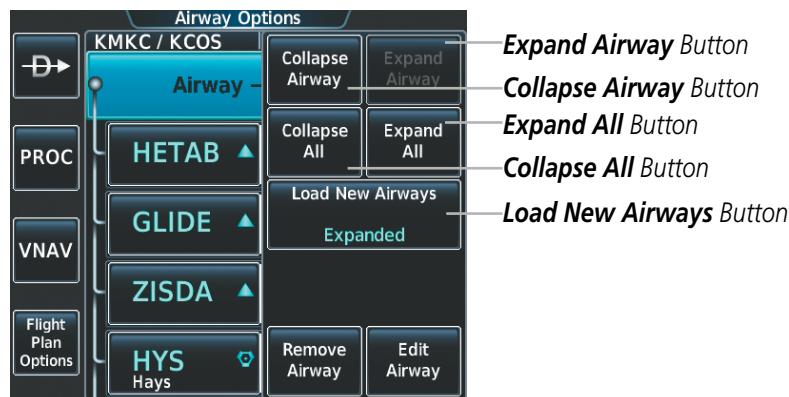


Figure 5-141 Airway Options Screen - Collapsing/Expanding Airways

Collapsing/expanding one airway in the active flight plan:

- 1) From **Home**, touch **Flight Plan**.
- 2) Scroll the list if necessary and touch an airway selection button to display the Airway Options Window.
- 3) Touch the **Collapse Airway** Button or the **Expand Airway** Button to collapse/expand the airway and return to the Active Flight Plan Screen.

Setting the system to load airways as collapsed/expanded in the active flight plan:

- 1) From **Home**, touch **Flight Plan**.
- 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 to display the Load New Airways Settings Screen.
- 4) Touch the **Collapsed** Button or the **Expanded** Button to set the default and return to the Airway Options Window.

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 flight plan to a selected waypoint:

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

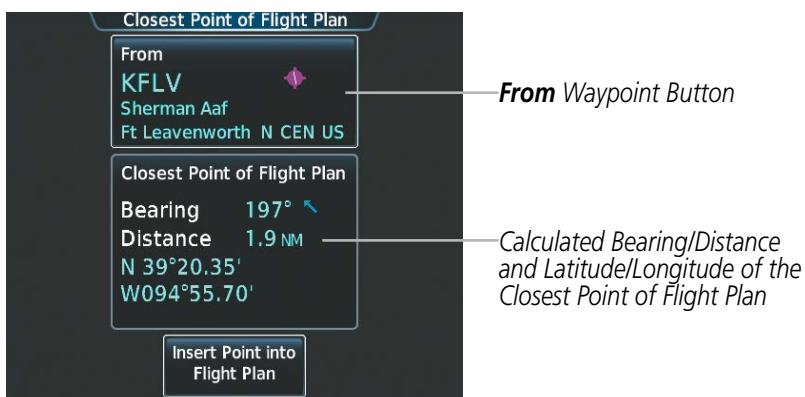


Figure 5-142 Closest Point of Flight Plan



Figure 5-143 Closest Point of Flight Plan inserted in Active Flight Plan

USER-DEFINED HOLDING PATTERNS

A holding pattern can be defined at any active flight plan waypoint, at the aircraft present position, or at a direct-to waypoint.

Creating a user-defined hold at an active flight plan waypoint:

- 1) From **Home**, touch **Flight Plan**.
- 2) Scroll the list, if necessary, and touch the waypoint options button to select the waypoint at which to define the holding pattern. The Waypoint Options Window is displayed.
- 3) Touch the **Hold at Waypoint** Button. The Hold at Waypoint Screen is displayed.
- 4) Touch the **Turn** Button, and touch the **Right** Button or the **Left** Button to select the turn direction.
- 5) Touch the Course Direction 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 **Create** Button to add the hold into the flight plan.

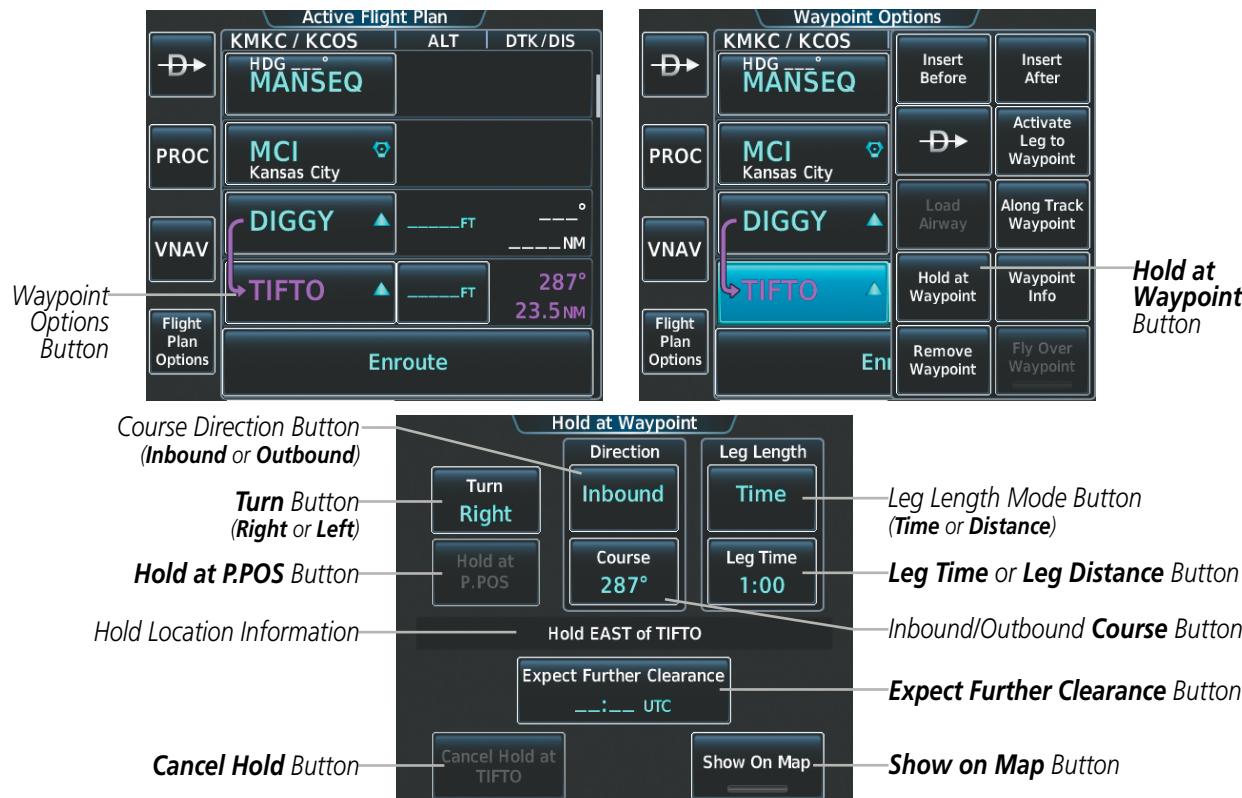


Figure 5-144 Creating a User Defined Holding Pattern at an Active Flight Plan Waypoint

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

- 1) From **Home**, touch **Flight Plan > Flight Plan Options**.
- 2) Touch the **Hold at P.POS** Button. The Hold at Waypoint Screen is displayed.
- 3) Touch the **Turn** Button, and touch the **Right** Button or the **Left** Button to select the turn direction.
- 4) Touch the Course Direction Button, and touch the **Inbound** Button or the **Outbound** Button to select the course direction.
- 5) Touch the Inbound/Outbound **Course** Button to display the keypad. Use the keypad and the **Enter** Button to select the inbound or outbound course.
- 6) Touch the Leg Length Mode Button, and touch the **Distance** Button or the **Time** Button to select the length mode.
- 7) Touch the **Leg Time** Button or the **Leg Distance** Button to display the keypad. Use the keypad and the **Enter** Button to select the length of the leg.
- 8) Touch the **Expect Further Clearance** Button to display the keypad. Use the keypad and the **Enter** Button to select the time for a reminder.
- 9) Touch the **Create** Button to create an Offroute Direct-to hold waypoint at the aircraft present position.
- 10) If desired, to enter the hold into the flight plan, touch the PPOS-H waypoint options button to display the Direct-To Screen.
- 11) Touch the **Insert in Flight Plan** Button. The Insert → PPOS-H Before? Screen is displayed.
- 12) Touch the desired waypoint selection button, and the hold is inserted in the flight plan before the selected waypoint.



NOTE: When a user-defined hold is created at the aircraft present position (shown as "Offroute →", "→PPOS-H", at the top of the Active Flight Plan Screen), the hold is the only part of the active flight plan shown on the map display. The hold must be canceled using the 'Removing a user-defined hold at the aircraft present position' procedure, which immediately removes the hold from the active flight plan, provides guidance to the active leg, and resumes automatic waypoint sequencing. The system will not follow the hold to the inbound course before resuming automatic waypoint sequencing. Following the steps in the procedure to insert the hold into the active flight plan will enable the Exit Hold capability.

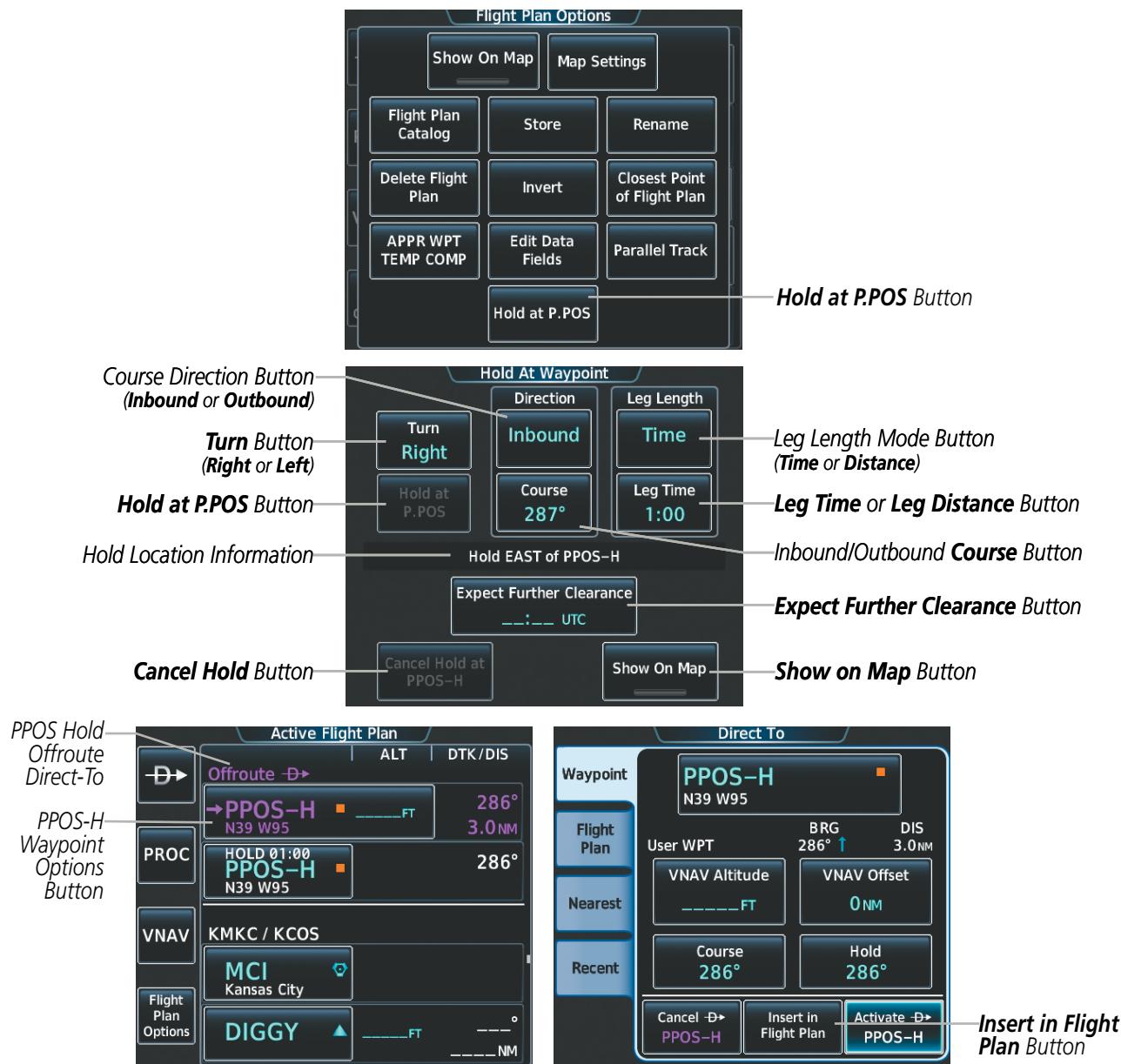


Figure 5-145 Creating a User Defined Holding Pattern at the Aircraft Present Position



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

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

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

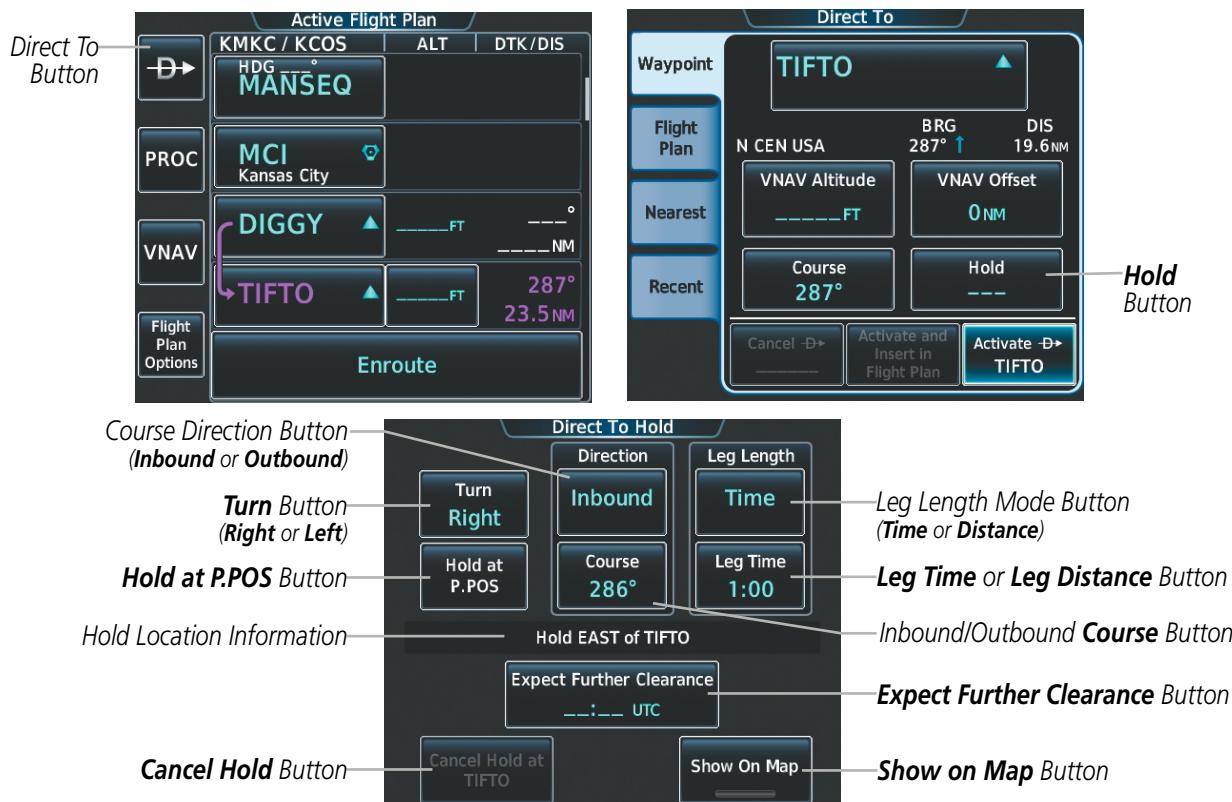


Figure 5-146 Creating a User Defined Holding Pattern at a Direct To Waypoint

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

- 1) From **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.

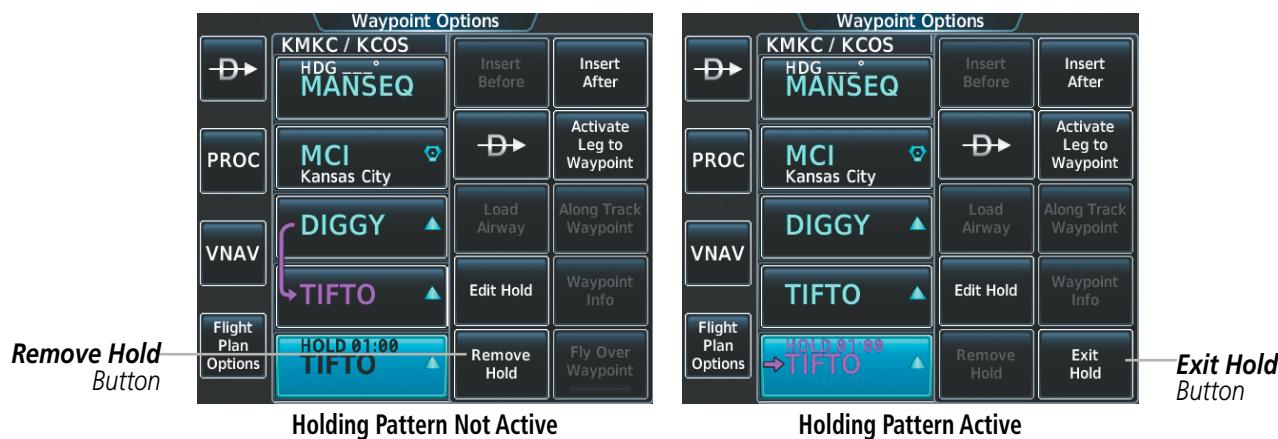


Figure 5-147 Removing a User Defined Holding Pattern at an Active Flight Plan Waypoint

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

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



Figure 5-148 Removing a User Defined Holding Pattern at the Aircraft Present Position

5.7 VERTICAL NAVIGATION



NOTE: The system supports vertical path guidance and altitude constraints for the following leg types: AF, CD, CF, CI, CR, DF, FC, FD, PI, RF, and TF. 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. It includes vertical path guidance for descending paths. The guidance is provided as a linear deviation from the desired path. The desired path is defined by a line joining two waypoints with specified altitudes or as a vertical angle from a specified waypoint/altitude. The vertical waypoints are integrated into the active flight plan. Both manual and autopilot-coupled guidance are supported. Guidance is also provided for ascending paths, but does not include vertical deviation nor AFCS path coupling.



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. 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 5-149 VNAV Profile Screen - Enable/Disable VNAV



Figure 5-150 Active Flight Plan Display - VNAV Enabled

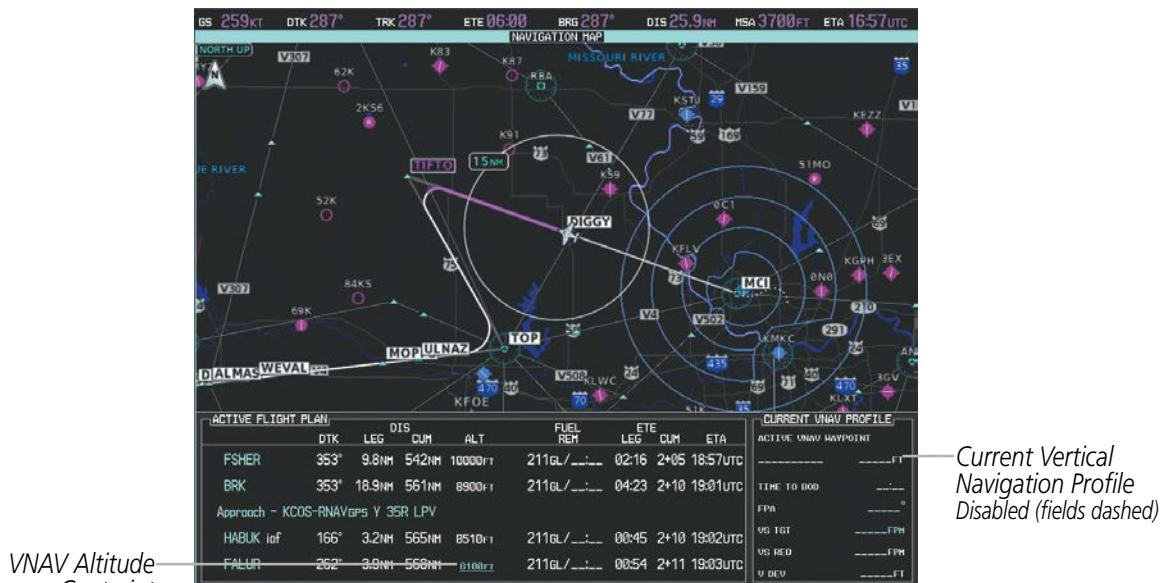


Figure 5-151 Active Flight Plan Display - VNAV Disabled

Enabling/Disabling VNAV guidance:

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

Cancelling 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) going invalid. The Vertical Deviation Indicator (VDI) and Required Vertical Speed Indicator (RVSI) on the PFD are removed, and the V DEV, VS REQ, and TIME TO TOD/BOD items displayed in the CURRENT VNAV PROFILE box are dashed. 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.

Modifying the VS Target and FPA:

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

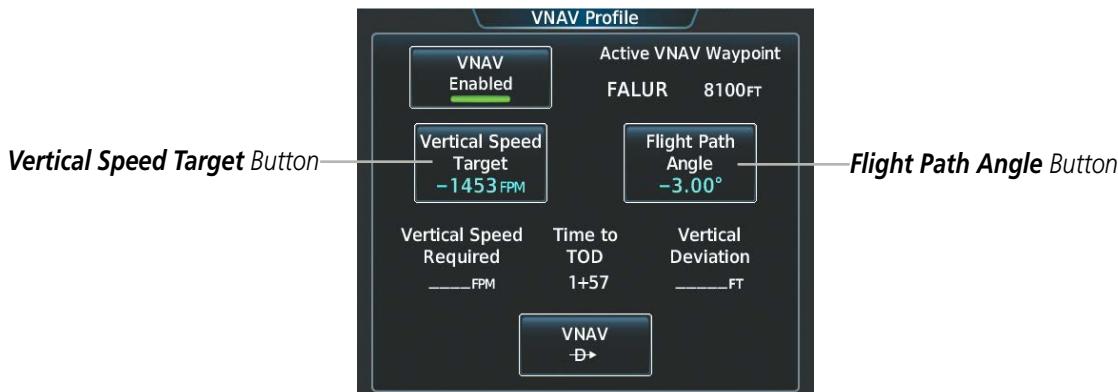


Figure 5-152 VNAV Profile Screen - Vertical Navigation Profile Modification

ALTITUDE CONSTRAINTS

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

Altitude Constraint Examples	Displayed Text Examples
5000FT Cross AT or ABOVE 5,000 ft	10200FT 353° 18.9 NM Cyan Text with Pencil Icon
2300FT Cross AT 2,300 ft	9270FT 166° 3.2 NM White Text
3000FT Cross AT or BELOW 3,000 ft	8100FT 262° 4.1 NM Cyan Text
5000FT 3000FT Cross BETWEEN 3,000 ft & 5,000 ft	7898FT Temperature Compensated White Text with Altitude Restriction Bars

Figure 5-153 Active Flight Plan Screen - Waypoint Altitude Constraints

White Text	Cyan Text
5000FT Altitude calculated by the system estimating the altitude of the aircraft as it passes over the navigation point. No white line above or below to indicate a potential constraint. 5000FT Altitude retrieved from the navigation database. White line above or below indicates the type of constraint, as shown in the preceding figure. These altitudes are provided as a reference, and are not designated to be used in determining vertical guidance.	5000FT Altitude is designated for use in determining vertical guidance. A pencil icon indicates manual designation or manual data entry. 5000FT The system cannot use this altitude in determining vertical guidance because of an invalid constraint condition.

Table 5-7 Altitude Constraint Color Coding

Altitudes associated with arrival and approach procedures are “auto-designated”. This means the system will automatically use the altitudes loaded with the approach for giving vertical speed and deviation guidance. Note that these altitudes are displayed as cyan text up to, but not including, the FAF. The FAF is always a “reference only” altitude and cannot be designated, unless the selected approach does not provide vertical guidance. In this case, the FAF altitude can be designated.

Altitudes that are not designated for use in vertical guidance can be “designated”. The altitude is now displayed as cyan text and is used to give vertical guidance. Other displayed altitudes may change due to re-calculations or be rendered invalid as a result of manually changing an altitude to a designated altitude.

Altitudes that have been designated for use in vertical guidance can be “un-designated”. The altitude is now displayed only as a reference. It is not used to give vertical guidance. Other displayed altitudes may change due to re-calculations or be rendered invalid as a result of manually changing an altitude to a non-designated altitude.

Altitude constraints are displayed and entered to the nearest foot mean sea level (MSL) or flight level to the nearest hundred feet. An altitude constraint in feet above ground level (AGL) format is supported for airports. When a database altitude restriction is displayed, the system allows entry of a different altitude, effectively overriding the database restriction. When a database altitude restriction of type “AT or ABOVE” or “AT or BELOW” is activated, the system uses the “AT” portion of the restriction to define the vertical profile.



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.

An altitude constraint is invalid if:

- Meeting the constraint requires the aircraft to climb
- Meeting the constraint requires the maximum flight path angle or maximum vertical speed to be exceeded
- The altitude constraint results in a TOD behind the aircraft present position
- The constraint is within a leg type for which altitude constraints are not supported

- The altitude constraint is added to the FAF of an approach that provides vertical guidance (i.e., ILS or GPS SBAS approach)
- The altitude constraint is added to a waypoint past the FAF



Figure 5-154 Active Flight Plan Screen - Waypoint Altitude Designation

Entering, modifying or designating an altitude constraint to be used for vertical guidance:

- 1) From **Home**, touch **Flight Plan**.
- 2) Scroll the list, if necessary, and touch a VNAV ALT button to display the VNAV Altitude Window. Review the altitude constraint information. If it is correct, skip to step 5 to designate the altitude constraint for vertical guidance.
- 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 **Enter** Button to designate the altitude constraint. The altitude is now shown in cyan, indicating it is usable for vertical guidance.

Altitude constraints can be modified or deleted after having been added to the flight plan. In the event an altitude constraint is deleted and the navigation database contains an altitude restriction for the lateral waypoint, the system displays the altitude restriction from the database provided no predicted altitude can be provided. (The predicted altitude is the crossing altitude for the waypoint, computed by the system, based upon the next vertical constraint in the flight plan.) The system also provides a way to reinstate a published altitude constraint that has been edited.

Removing/undesignating an altitude constraint:

- 1) From **Home**, touch **Flight Plan**.
- 2) Scroll the list, if necessary, and touch a VNAV ALT 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. 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.

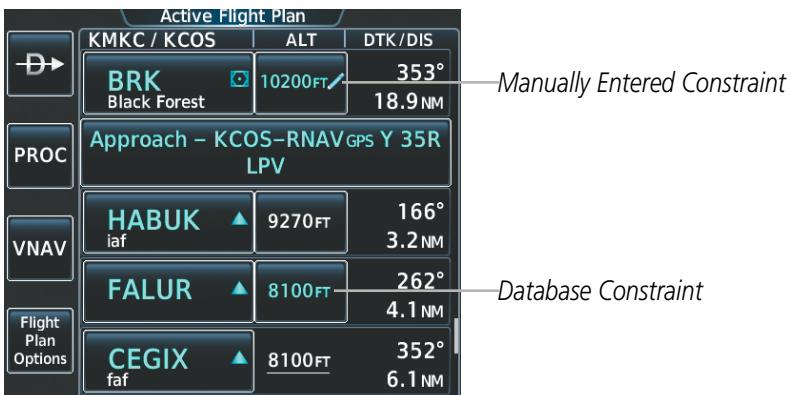


Figure 5-155 Active Flight Plan Screen - Deleting Altitude Constraints

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

- 1) From **Home**, touch **Flight Plan**.
- 2) Scroll the list, if necessary, and touch a VNAV ALT button to display the VNAV Altitude Window.
- 3) Touch the **Remove VNAV ALT** Button. A 'Remove or Revert to published VNAV altitude of nnnnnFT?' confirmation window is displayed.
- 4) Touch the **Revert** Button. The altitude is now the database altitude and is shown in cyan, indicating it is usable for vertical guidance.

A Vertical Situation Display (VSD) can be shown on the bottom of the Navigation Map Pane. The terrain, obstacles, vertical track vector, selected altitude, and active flight plan information (active flight plan information consists of waypoints, associated altitude constraints, current VNAV profile, TOD/BOD, and destination runway) can be displayed on the VSD, depending on the selected mode. See the Hazard Avoidance section for information about winds aloft, obstacles, and relative terrain on the VSD.



NOTE: Certain leg types (e.g. holds, heading legs) do not support VNAV PATH descents because the lateral distance of those legs is unknown. The VSD will not show a VNAV profile for any legs that have no vertical path guidance.

The VSD horizontal range is equal to the navigation map indicated range when the VSD is in Track mode. When the VSD is in Flight Plan mode, the horizontal range is the lower of twice the navigation map indicated range or the lowest range the displays all of the remaining active flight plan. The VSD altitude range automatically changes when the navigation map range is changed to keep a constant ratio of altitude range to horizontal range, until both minimum and maximum display limits have been met. At ranges above the maximum, the altitude range remains constant at the maximum.

The aircraft symbol is displayed on the left side of the VSD. The position of the aircraft symbol on the vertical scale is close to the top for a descent phase, at the bottom for on-ground or a climb phase, and in the middle for a cruise phase or if the phase is unknown.

If two waypoints are close together, and their labels or constraint values overlap enough to obscure any text, one waypoint label/constraint value is removed and the vertical dashed line for that waypoint is displayed as darker gray. The priority for which waypoint remains displayed is: (1) the current TO waypoint, (2) waypoint with an altitude constraint, and (3) waypoint closer to the aircraft.

Enabling/disabling the VSD:

- 1) From Home, touch **Map > Map Settings**.
- 2) Touch the Inset Window Tab
- 3) Touch the **VERT Situation Display** Button to enable/disable display of the VSD.

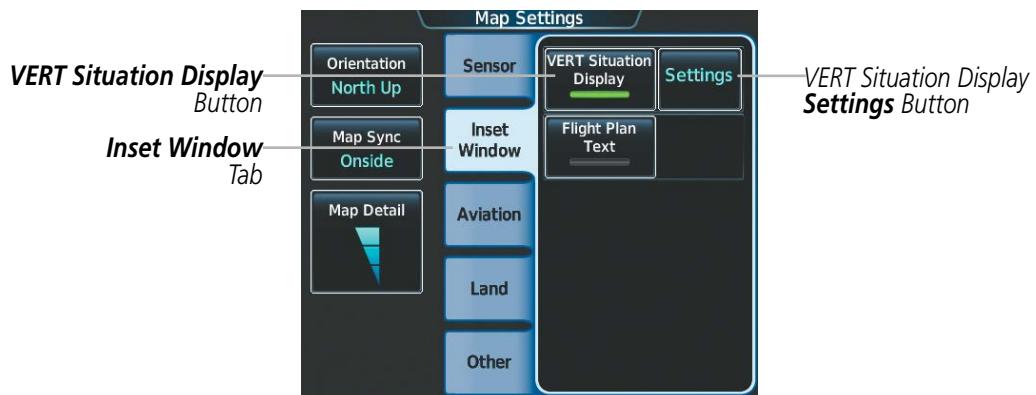


Figure 5-156 Map Settings Screen - Enabling/disabling the VSD

Changing the VSD Mode:

- 1) From Home, touch **Map > Map Settings**.
- 2) Touch the Inset Window Tab
- 3) Touch the VERT Situation Display **Settings** Button.
- 4) Touch the **Mode** Button to display the Mode Selection Screen.
- 5) Touch a Mode button to select the mode and return to the Vertical Situation Display Settings Screen.

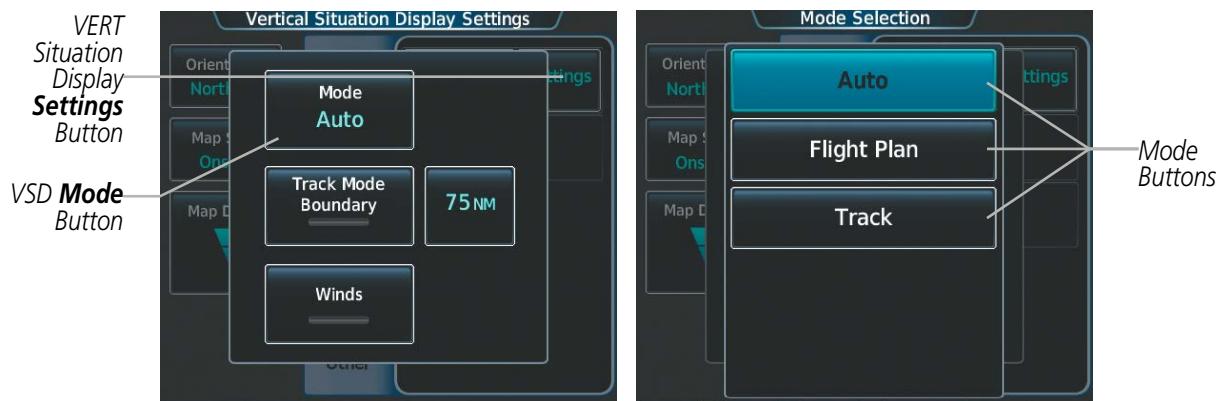


Figure 5-157 Map Settings Screen - Selecting VSD Mode

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 VNAV profile, TOD/BOD, and destination runway			



Figure 5-158 Vertical Situation Display (VSD)

Terrain/obstacles are available on the VSD, and will be shown if the aircraft altitude is low enough for the terrain/obstacles to be in view (terrain will be shown in gray if the terrain is selected Off on the navigation map). The depicted terrain profile represents an approximate forward-looking contour of the terrain based upon the highest reported terrain elevations, measured at intervals defined by the terrain database resolution, within a predefined width along the active flight plan between the aircraft present position and the end of the map range or active flight plan. The predefined width is determined by the flight phase.

Flight Phase	Width of Swath
Approach, Departure	0.6 nm
Terminal	2.0 nm
En Route, Oceanic	4.0 nm

The system allows a vertical navigation direct-to to any waypoint in the active flight plan with an altitude descent constraint that can be “designated” for vertical guidance. Touching the **VNAV ➔** Button on the VNAV Constraint Window 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.

A lateral direct-to with an altitude constraint (activated by pressing the ➔ Key) also provides vertical guidance, but would bypass flight plan waypoints between the current position in the flight plan and the direct-to waypoint.

Activating a vertical navigation direct to:

- 1) From **Home**, touch **Flight Plan > VNAV**.
- 2) Touch the **VNAV ➔** Button to display the Select VNAV Direct To Screen with a list of possible Vertical navigation direct to choices.
- 3) Scroll the list, if necessary, and touch a VNAV waypoint selection button.
- 4) Touch the **OK** Button in response to “Activate Vertical ➔: 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.

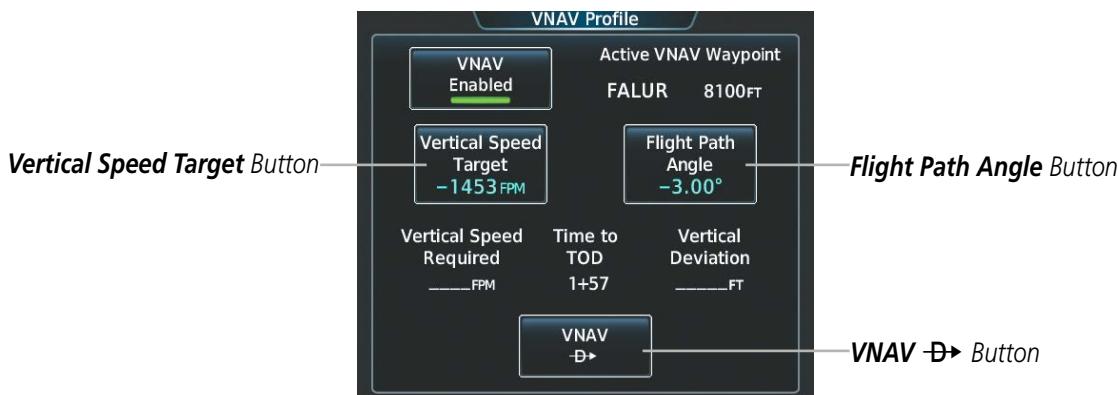


Figure 5-159 VNAV Profile Screen - Vertical Navigation Profile Modification

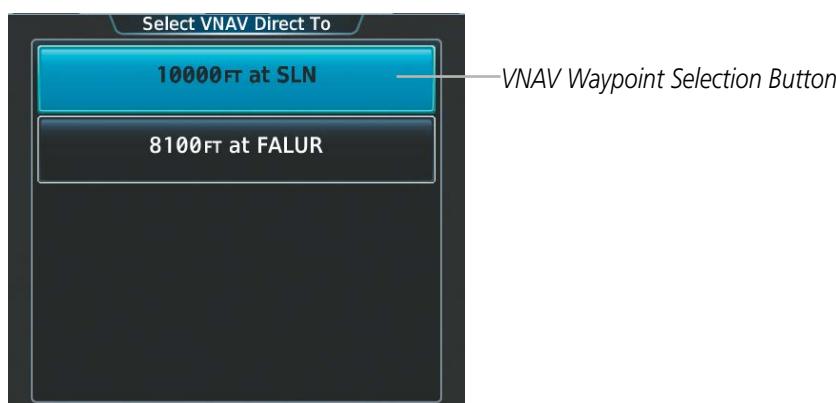


Figure 5-160 Selecting the VNAV Direct To Waypoint

Or:

- 1) From **Home**, touch **Flight Plan**
- 2) Scroll the list, if necessary, and touch a VNAV ALT button to display the VNAV Altitude Window.
- 3) Touch the **VNAV ➔** Button to initiate the vertical navigation direct to. Vertical guidance begins to the altitude constraint for the selected waypoint.



Figure 5-161 VNAV Altitude Window - Initiating a VNAV Direct-To



Figure 5-162 Active Flight Plan Display - VNAV Direct To Active

Cancelling a vertical navigation direct to:

- 1) From **Home**, touch **Flight Plan**.
 - 2) Scroll the list, if necessary, and touch the VNAV ALT button for the VNAV Direct-To waypoint 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. 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.



Figure 5-163 VNAV Altitude Window - Cancelling a VNAV Direct-To



Figure 5-164 Active Flight Plan Display - VNAV Direct To Not Active

5.8 PROCEDURES

The system can access the whole range of instrument procedures available. Departures (DPs), arrivals (STARs), and non-precision and precision approaches (APPRs) are stored within the database and can be loaded using the Touchscreen Controller.

The selected procedure for the origin or destination airport is added to the active flight plan. No waypoints are required to be in the flight plan to load procedures; however, if the origin and destination airport (or runway) are already loaded, the procedure selection screen defaults to the appropriate airport, saving some time selecting the correct airport. Whenever an approach is selected, the choice to either “Load” and/or “Load & Activate” is given (“Load & Activate” is only available for the active flight plan, and is the only choice available if the active flight plan is completely empty). “Loading” adds the approach to the end of the flight plan without immediately using it for navigation guidance. This allows continued navigation via the intermediate waypoints in the original flight plan, but keeps the procedure available for quick activation when needed. “Activating” also adds the procedure to the end of the flight plan but immediately begins to provide guidance to the first waypoint in the approach.

The system adds terminal procedures to the flight plan based on leg types coded within that procedure in the navigation database. If the terminal procedure in the flight plan contains an identifier like ‘2000FT’, that indicates a leg that terminates 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 011°’). A flight plan leg requiring the pilot to manually initiate sequencing to the next leg displays ‘MANSEQ’ as the identifier.

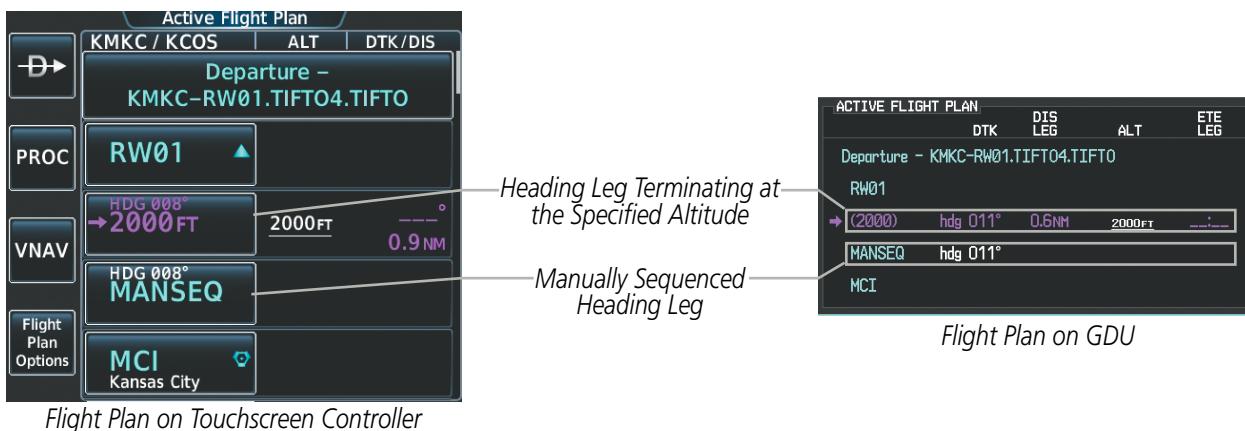


Figure 5-165 Procedure Leg Identifiers

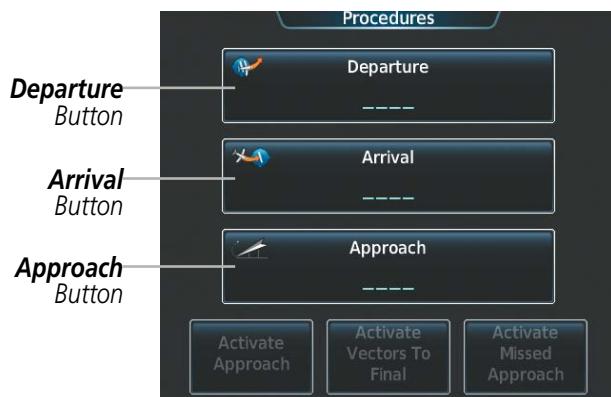


Figure 5-166 Loading Procedures on the Touchscreen Controller

Viewing available procedures at an airport:

- 1) From **Home**, touch **Waypoint Info > Airport**.
- 2) If necessary, touch the **Airport Selection Button** to display the keypad and use it to select the airport.
- 3) Touch the **Proc Tab** to display the **Airport Procedures Screen**.
- 4) Scroll the list if necessary and touch a procedure selection button. The procedure selection screen is displayed on the Touchscreen Controller for the selected procedure.
- 5) Touch the **Preview Button**, then the **Show on Map Button** to show the procedure on the navigation map or touch the **Show Chart Button** to show the chart instead of the navigation map.
- 6) Touch the **Back Button** to return to the **Airport Procedures Screen** to view another procedure.
- 7) Repeat steps 4 through 6 as necessary.

Loading a procedure into the active flight plan from the Airport Information Screen:

- 1) From **Home**, touch **Waypoint Info > Airport**.
- 2) If necessary, touch the **Airport Selection Button** to display the keypad and use it to select the airport.
- 3) Touch the **Proc Tab** to display the **Airport Procedures Screen**.
- 4) Scroll the list, if necessary, and touch a procedure selection button. The procedure selection screen is displayed on the Touchscreen Controller for the selected procedure.
- 5) Touch the **Preview Button**, then the **Show on Map Button** to show the preview of the procedure on the navigation map or touch the **Show Chart Button** to show the procedure chart instead of the navigation map.
- 6) Select a different procedure, if desired.
- 7) Touch the **Load Button** to insert the procedure into the active flight plan.

Loading a procedure into the active flight plan from the Nearest Airport Screen:

- 1) From **Home**, touch **Nearest > Airport**.
- 2) If necessary, scroll the list to find the airport and touch the airport selection button to display the Waypoint Options Window for the selected airport. If the airport is not listed, touch any airport selection button to display the Waypoint Options Window.
- 3) Touch the **Airport Info** Button to display the Airport Information Screen. If in the previous step, the airport was not listed, touch the airport button and use the keypad to select the destination airport.
- 4) Touch the **Proc** Tab to display the Airport Procedures Screen.
- 5) Scroll the list, if necessary, and touch a procedure selection button. The procedure selection screen is displayed on the Touchscreen Controller for the selected procedure.
- 6) Touch the **Preview** Button, then the **Show on Map** Button to show the preview of the procedure on the navigation map or touch the **Show Chart** Button to show the procedure chart instead of the navigation map.
- 7) Select a different procedure, if desired.
- 8) Touch the **Load** Button to insert the procedure into the active flight plan.



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

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 ACTIVE FLIGHT PLAN

Loading a departure into the active flight plan using the Touchscreen Controller:

- 1) From **Home**, touch **PROC**.
- 2) Touch the **Departure** Button to display the Departure Selection Screen.
- 3) If necessary, 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) If necessary, touch the **Departure** Button to display the Select Departure Screen with a list of available departures.
- 6) Scroll the list if necessary and touch a departure selection button to select the departure.
- 7) If necessary, touch the **Transition** Button to display the Select Transition Screen with a list of available transitions.
- 8) Scroll the list if necessary and touch a transition selection button to select the transition.
- 9) If necessary, touch the **Runway** Button to display the Select Runway Screen with a list of available runways.

- 10) Scroll the list if necessary and touch a runway selection button to select the runway and return to the Departure Selection Screen.
- 11) Touch the **Preview** Button, then the **Show on Map** Button to show the preview of the departure on the navigation map or touch the **Show Chart** Button to show the departure chart instead of the navigation map.
- 12) Touch the **Load** Button to insert the departure into the active flight plan.

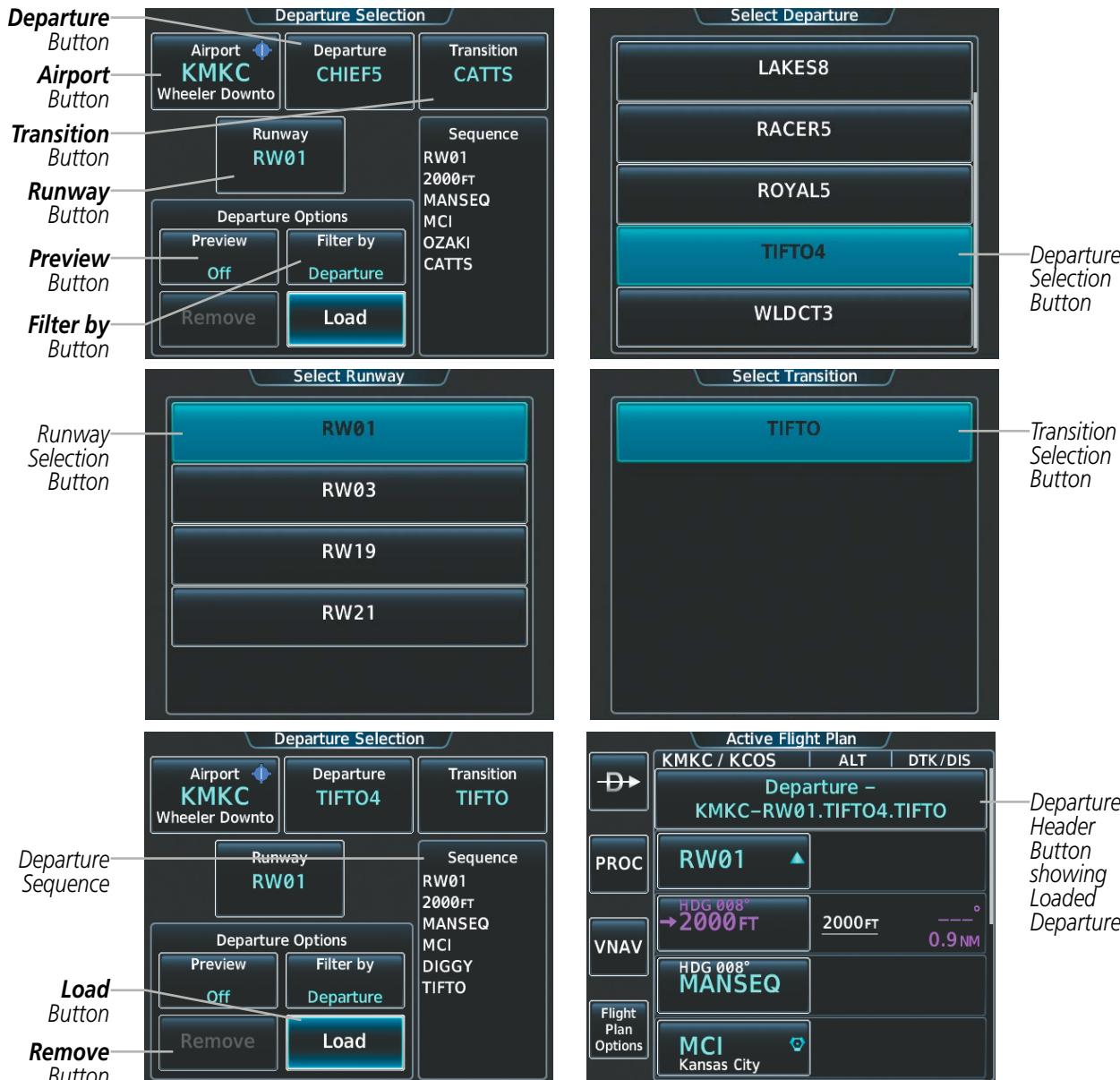


Figure 5-167 Loading a Departure into the Active Flight Plan

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 order you choose.

REMOVING A DEPARTURE FROM THE ACTIVE FLIGHT PLAN

When plans change while flying IFR, departures can be easily removed from the flight plan.

Removing a departure from the active flight plan using the Touchscreen Controller:

- 1) From **Home**, touch **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) From **Home**, touch **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.

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 FLIGHT PLAN

Loading an arrival into the active flight plan using the Touchscreen Controller:

- 1) From **Home**, touch **PROC**.
- 2) Touch the **Arrival** Button to display the Arrival Selection Screen.
- 3) If necessary, 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) If necessary, touch the **Arrival** Button to display the Select Arrival Screen with a list of available arrivals.
- 6) Scroll the list if necessary and touch an arrival selection button to select the arrival.
- 7) If necessary, touch the **Transition** Button to display the Select Transition Screen with a list of available transitions.
- 8) Scroll the list if necessary and touch a transition selection button to select the transition.
- 9) If necessary, touch the **Runway** Button to display the Select Runway Screen with a list of available runways.

10) Scroll the list if necessary and touch a runway selection button to select the runway and return to the Arrival Selection Screen.

11) Touch the **Preview** Button, then the **Show on Map** Button to show the preview of the arrival on the navigation map or touch the **Show Chart** Button to show the arrival chart instead of the navigation map.

12) Touch the **Load** Button to insert the arrival into the flight plan.

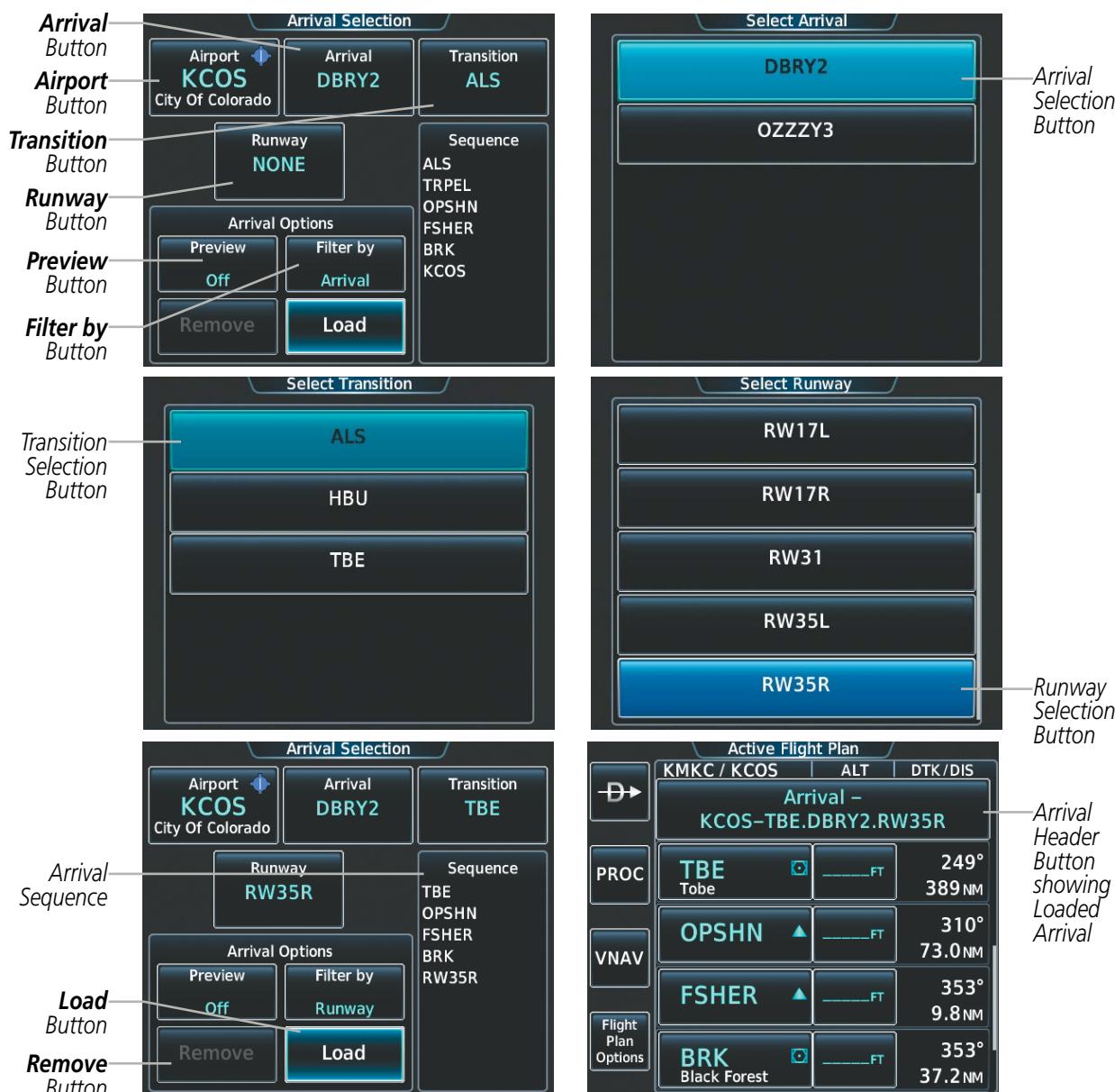


Figure 5-168 Loading an Arrival into the Active Flight Plan

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 order you choose.

REMOVING AN ARRIVAL FROM THE ACTIVE FLIGHT PLAN

When plans change while flying IFR, arrivals can be easily removed from the flight plan.

Removing an arrival from the active flight plan using the Touchscreen Controller:

- 1) From **Home**, touch **PROC**.
- 2) Touch the **Arrival** Button to display the Arrival Selection Screen.
- 3) Touch the **Remove** Button. A 'Remove arrival?' window is displayed.
- 4) Touch the **Yes** Button. The arrival is removed from the flight plan. To cancel the request, touch the **No** Button.

Or:

- 1) From **Home**, touch **Flight Plan**.
- 2) Touch the Arrival Header Button to display the Arrival Options Window.
- 3) Touch the **Remove Arrival** Button. A 'Remove Arrival- <arrival identifier> from flight plan?' window is displayed.
- 4) Touch the **OK** Button. The arrival is removed from the flight plan. To cancel the request, touch the **Cancel** Button.

APPROACHES



NOTE: If certain GPS parameters (SBAS, RAIM, etc.) are not available, some published approach procedures for the desired airport may not be displayed in the list of available approaches.

An Approach Procedure (APPR) can be loaded at any airport that has one available, and provides guidance for non-precision and precision approaches to airports with published instrument approach procedures. If an approach is loaded when another approach is already in the flight plan, the new approach replaces the previous approach, unless the active leg is past the missed approach point. In this case, the second approach is loaded at the end of the previous approach, and the previous approach remains as waypoints (no longer part of an APPR). The approach sequence is defined by selection of an approach and the transition waypoints.

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.

When selecting an approach, a "GPS" designation to the right of the approach type (e.g. RNAV) indicates the procedure can be flown using the GPS receiver. Some procedures do not have this designation, meaning the GPS receiver can be used for supplemental navigation guidance only. If the GPS receiver cannot be used for primary guidance, the appropriate navigation receiver must be used for the selected approach (e.g., VOR or ILS). The final course segment of ILS approaches, for example, must be flown with the NAV receiver tuned to the proper frequency and selecting that NAV receiver on the CDI.

If GPS navigation becomes unavailable on an RNAV GPS approach after the FAF, the approach aborts with an APR ABORT message. When this happens, the CDI is removed, the VDI is flagged 'NO GP', the approach service

level (LPV, LP, L/VNAV, etc.) on the HSI is amber, and the UNABLE RNP and GPS NAV LOST system messages occur. The CDI will not be restored for missed approach guidance until the messages are acknowledged and a position source is available (e.g. restored GPS, DME-DME, or Dead Reckoning).

The SBAS GPS allows for flying LNAV, LNAV+V, LNAV/VNAV, LP, LP+V, LPV, and RNP approach service levels according to the published chart. The '+V' designation adds advisory vertical guidance for assistance in maintaining a constant vertical glidepath similar to an ILS glideslope on approach. This guidance is displayed on the system PFD in the same location as the ILS glideslope using a magenta diamond. Baro VNAV guidance is displayed on the system PFD in the same location as the ILS glideslope using a magenta pentagon. The active approach service level is annunciated on the HSI as shown in the following table:

Approach Service Level (as shown on HSI)	Description	LNAV/VNAV or LNAV Database Minima Available?	If SBAS becomes unavailable prior to one minute to FAF, at one minute to FAF will initiate a switch/downgrade to:
LNAV	RNAV GPS approach using published LNAV minima	LNAV	N/A
LNAV+V	RNAV GPS approach using published LNAV minima. Advisory vertical guidance is provided	LNAV	N/A
L/VNAV	RNAV GPS approach using published LNAV/VNAV minima	LNAV/VNAV	LNAV
LP (available only if SBAS available)	RNAV GPS approach using published LP minima	LNAV	LNAV
LP+V (available only if SBAS available)	RNAV GPS approach using published LP minima. Advisory vertical guidance is provided	LNAV	LNAV
		No LNAV	Approach Aborted
LPV (available only if SBAS available)	RNAV GPS approach using published LPV minima	LNAV/VNAV	LNAV
		LNAV Only	LNAV
		Neither	Approach Aborted
		Approach Service Level - LNAV, LNAV+V, L/VNAV, LP, LP+V, LPV	

Table 5-10 Effects of SBAS Unavailability on Approaches

LNAV/VNAV DOWNGRADE

If SBAS becomes unavailable prior to one minute to the FAF on an RNAV LNAV/VNAV approach, L/VNAV will be shown in amber to indicate that a downgrade is imminent. At one minute to the FAF, the system will switch to LNAV service level (LNAV shown in magenta), and an APR ADVISORY system message will be generated (the VDI will be flagged NO GP until the APR ADVISORY system message has been acknowledged). If the APR ADVISORY system message is not acknowledged prior to the FAF, the system will automatically downgrade to LNAV service level (LNAV shown in magenta), the VDI will remain flagged 'NO GP', and no additional downgrade system message will be generated.

If SBAS becomes unavailable after one minute to the FAF, the system will downgrade to LNAV service level, with no downgrade system message generated. If SBAS becomes unavailable after one minute to the FAF, and there is no LNAV/VNAV or LNAV database minima, the approach will abort when past the FAF waypoint.

LP DOWNGRADE

If SBAS becomes unavailable prior to one minute to the FAF on an RNAV LP approach, LP will be shown in amber to indicate that a downgrade is imminent, but the CDI will continue to be shown. At one minute to the FAF, the system will downgrade to LNAV service level (LNAV shown in magenta), and an APR DWNGRADE system message will be generated (the CDI will be removed until the APR DWNGRADE system message has been acknowledged).

If SBAS becomes unavailable after one minute to the FAF, the approach will abort.

LP+V DOWNGRADE

If SBAS becomes unavailable prior to one minute to the FAF on an RNAV LP+V approach, LP+V will be shown in amber to indicate that a downgrade is imminent and the VDI will be flagged NO GP, but the CDI will continue to be shown. At one minute to the FAF, the system will downgrade to LNAV service level (LNAV shown in magenta), and an APR DWNGRADE system message will be generated (the CDI will be removed until the APR DWNGRADE system message has been acknowledged).

If SBAS becomes unavailable after one minute to the FAF, the approach will abort.

LPV DOWNGRADE

If SBAS becomes unavailable prior to one minute to the FAF on an RNAV LPV approach, LPV will be shown in amber to indicate that a downgrade is imminent, but the VDI will continue to be shown. At one minute to the FAF, the system will downgrade to LNAV service level (LNAV shown in magenta), the VDI will be flagged 'NO GP', and an APR DWNGRADE system message will be generated.

If SBAS becomes unavailable after one minute to the FAF, the system will downgrade to LNAV service level when past the FAF, with no downgrade system message generated.

LOADING AN APPROACH INTO THE ACTIVE FLIGHT PLAN

Loading an approach into the active flight plan using the Touchscreen Controller:

- 1) From **Home**, touch **PROC**.
- 2) Touch the **Approach** Button to display the Approach Selection Screen.
- 3) Select the airport and approach:
 - a) If necessary, touch the **Airport** Button to display the keypad and use it to select the approach airport.
 - b) Touch the **Enter** Button to accept the approach airport.
 - c) If necessary, touch the **Approach** Button to display the Select Approach Screen with a list of available approaches.
 - d) Scroll the list if necessary and touch an approach selection button to select the approach.

Or:

- a) If the **SBAS** Button is available, touch the **SBAS** Button to display the keypad and use it to select the SBAS channel number (The SBAS channel button is only available when an RNAV, GPS, or no approach is selected).
If the **SBAS** Button is not available, touch the **Approach** Button to display the Select Approach Screen, scroll to the bottom of the list, touch the **Select by SBAS Channel** Button to display the keypad, and use it to select the SBAS channel number.
 - b) Touch the **Enter** Button to accept the SBAS channel and return to the Approach Selection Screen with the airport and approach selected.
- 4) If necessary, touch the **Transition** Button to display the Select Transition Screen with a list of available transitions.
 - 5) Scroll the list if necessary and touch a transition selection button to select the transition.
 - 6) To set the minimums, touch the **Minimums** Button to display the Minimums Screen. If the minimums were Off, then Baro is automatically selected.
 - a) If Baro is desired, use the keypad to select the barometric minimum altitude.
 - b) Touch the **Enter** Button to accept the barometric minimum altitude and return to the Approach Selection Screen.
- Or:
- a) If a radio altitude minimum is desired, touch the **Minimums** Button to display the Minimums Source Window.
 - b) Touch the **Radio Alt** Button to select radio altitude minimums and return to the Minimums Screen.
 - c) Use the keypad to select the minimums altitude.
 - d) Touch the **Enter** Button to accept the radio altitude minimums and return to the Approach Selection Screen.
- Or:
- a) If temperature compensated minimum is desired, touch the **Minimums** Button to display the Minimums Source Window.
 - b) Touch the **Temp Comp** Button to select temperature compensated minimums and return to the Minimums Screen.
 - c) Use the numeric keypad to select the destination temperature.
 - d) Touch the **Enter** Button to accept the destination temperature and return to the Minimums Screen.
 - e) Use the keypad to select the minimums altitude.
 - f) Touch the **Enter** Button to accept the temperature compensated minimums and return to the Approach Selection Screen.
- 7) Touch the **Preview** Button, then the **Show on Map** Button to show the preview of the approach on the navigation map or touch the **Show Chart** Button to show the approach chart instead of the navigation map.
 - 8) Touch the **Load** Button to insert the approach into the flight plan.



NOTE: When GPS is not approved for the selected final approach course, the FMS provides guidance to the approach, but the HSI must be switched to a NAV receiver to fly the final course of the approach, either manually or automatically. Refer to the Flight Instruments section for details on CDI switching.

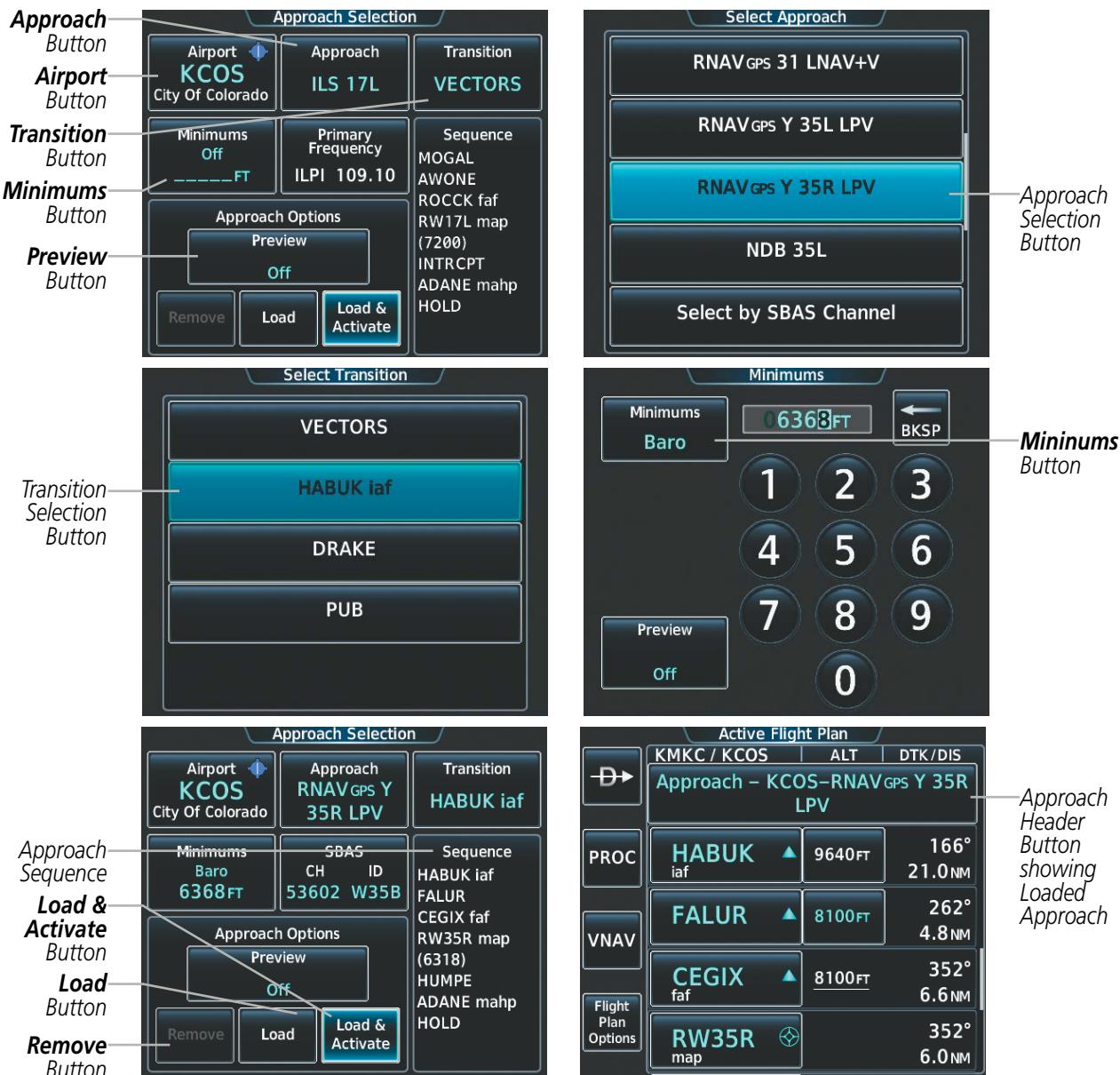


Figure 5-169 Loading an Approach into the Active Flight Plan

ACTIVATING AN APPROACH

“Activate Approach” creates a direct path to the first approach waypoint. The approach mode will not become active until the first leg of the approach becomes active. A previously loaded approach can be activated from the Procedures Screen, the Active Flight Plan Screen, or the Procedures Window on the PFD.

Activating a previously loaded approach using the Touchscreen Controller:

- 1) From **Home**, touch **PROC**.
- 2) Touch the **Activate Approach** Button to activate the approach.
Or:
- 1) From **Home**, touch **Flight Plan**.
- 2) Touch the Approach Header Button to display the Approach Options Window.
- 3) Touch the **Activate Approach** Button to activate the approach.

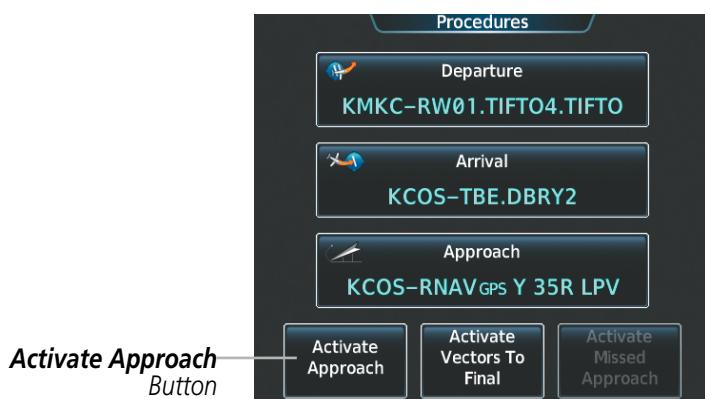


Figure 5-170 Activating an Approach on the Touchscreen Controller

In many cases, it may be easiest to “load” the full approach while still some distance away, enroute to the destination airport. Later, if vectored to final, activate Vectors To Final, which makes the inbound course to the FAF waypoint active.

Activating a previously loaded approach with vectors to final using the Touchscreen Controller:

- 1) From **Home**, touch **PROC**.
- 2) Touch the **Activate Vectors To Final** Button to activate vectors to final.
Or:
- 1) From **Home**, touch **Flight Plan**.
- 2) Touch the Approach Header Button to display the Approach Options Window.
- 3) Touch the **Activate Vectors To Final** Button to activate vectors to final.

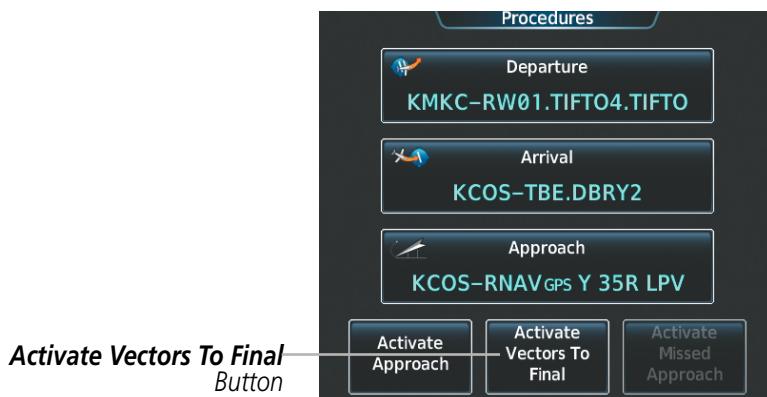


Figure 5-171 Activating Vectors to Final on the Touchscreen Controller

REMOVING AN APPROACH FROM THE ACTIVE FLIGHT PLAN

When plans change while flying IFR, approaches can be easily removed from the flight plan.

Removing an approach from the active flight plan using the Touchscreen Controller:

- 1) From **Home**, touch **PROC**.
- 2) Touch the **Approach** Button to display the Approach Selection Screen.
- 3) Touch the **Remove** Button. A 'Remove approach?' window is displayed.
- 4) Touch the **OK** Button. The approach is removed from the active flight plan. To cancel the request, touch the **Cancel** Button.

Or:

- 1) From **Home**, touch **Flight Plan**.
- 2) Touch the Approach Header Button to display the Approach Options Window.
- 3) Touch the **Remove Approach** Button. A 'Remove Approach- <approach identifier> from flight plan?' window is displayed.
- 4) Touch the **OK** Button. The approach is removed from the active flight plan. To cancel the request, touch the **Cancel** Button.

MISSED APPROACH

Activating a missed approach in the active flight plan:

Press the TO/GA Button. The system begins automatic sequencing through the missed approach waypoints to the MAHP. See the AFCS section for more details.

Or:

- 1) From **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 **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.



Figure 5-172 Activating a Missed Approach on the Touchscreen Controller

In the missed approach procedure shown in the following figure, the altitude immediately following the MAP (in this case '1314FT') 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 (1,314 feet) after crossing the MAP, a direct-to is established to provide a course on runway heading until an altitude of 1,430 feet reached. After reaching 1,430 feet, a direct-to is established to the next waypoint (in this case DUSTN). If the aircraft altitude is above the specified altitude after crossing the MAP, a direct-to is established to the published fix (DUSTN) to begin the missed approach procedure.



Figure 5-173 Course to Altitude

In some missed approach procedures this Course to Altitude leg may be part of the published procedure. For example, the procedure dictates a climb to 5,500 feet, then turn left and proceed to the Missed Approach Hold Point (MAHP). In this case, the altitude would appear in the list of waypoints as '(5500)'. Again, if the aircraft altitude is lower than the prescribed altitude after crossing the MAP, a direct-to is established on a Course to Altitude leg when the missed approach procedure is activated.

TEMPERATURE COMPENSATED ALTITUDES

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.

Enabling/disabling temperature compensated waypoint altitude:

- 1) From **Home**, touch **Flight Plan > Flight Plan Options**.
- 2) Touch the **APPR WPT TEMP COMP** Button to display the Temp Compensation Screen.
- 3) Touch the **Temp Compensation** Annunciator Button to enable/disable temperature compensation.
- 4) Touch the **<airport> Temp** 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 MDA/DH.



NOTE: Enabling/disabling temperature compensation for the loaded approach altitudes does not enable/disable temperature compensated minimums (MDA/DH), nor does enabling/disabling temperature compensated minimums enable/disable temperature compensated approach altitudes.



Figure 5-174 Temperature Compensation for Approach Waypoints

A temperature compensated minimum descent altitude can be computed and used for a loaded approach.

Entering a temperature compensated minimum into an approach using the Touchscreen Controller:

- 1) From **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 **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.

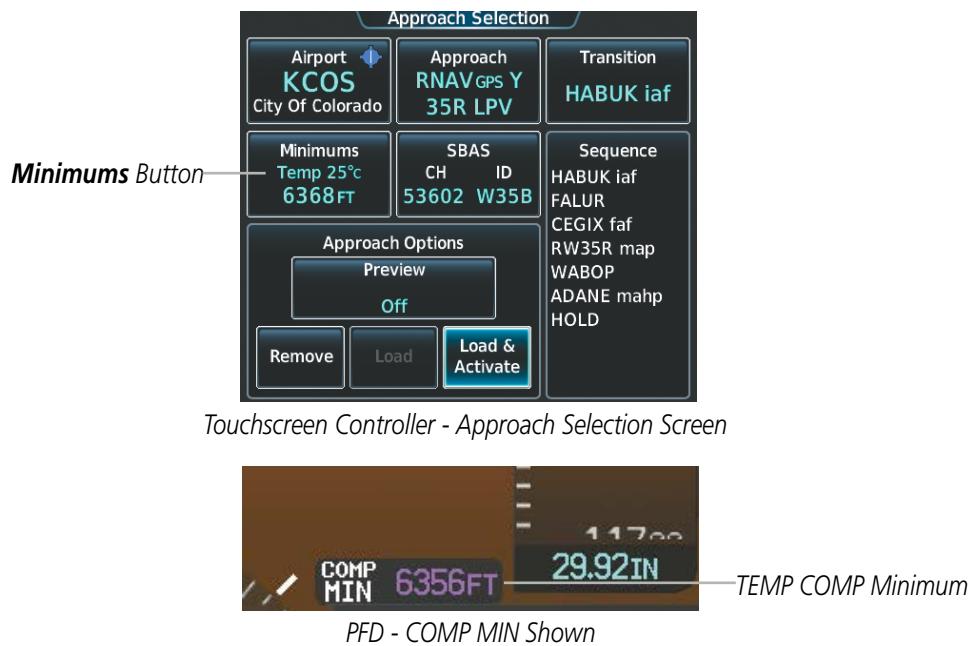


Figure 5-175 Entering Temp Comp Minimums on the Touchscreen Controller

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 5-176 Trip Planning Screen - Automatic Mode

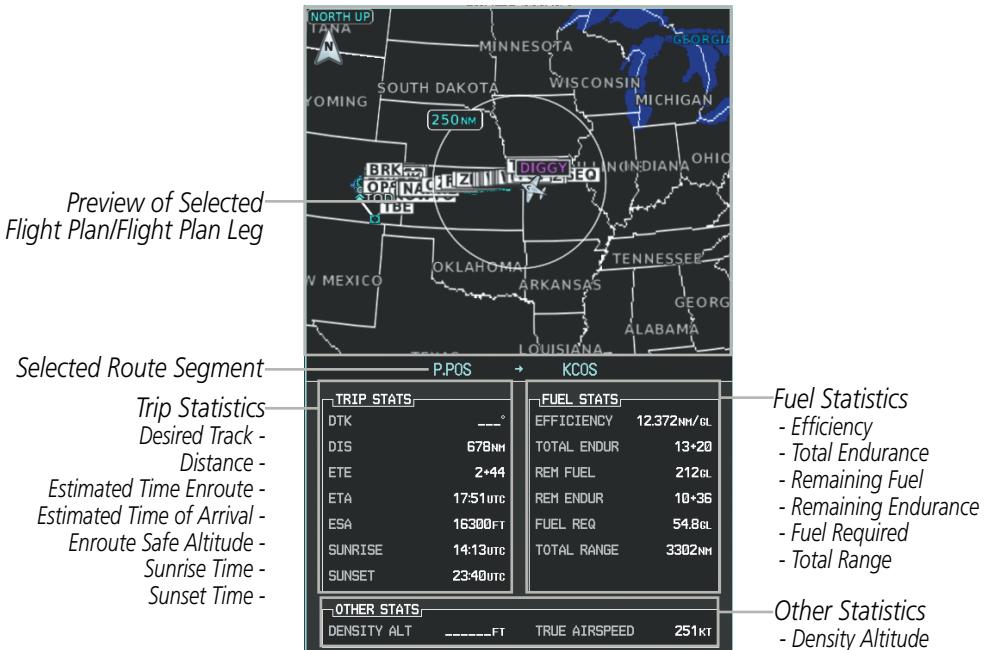


Figure 5-177 Trip Planning Display

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 are dashed when the selected leg of the active flight plan has already been flown.

- Desired Track (DTK) - DTK is shown as nnn° and is the desired track between the selected waypoints. It is dashed unless only a single leg is selected.
- Distance (DIS) - The distance is shown in tenths of units up to 99.9, and in whole units up to 9999.
- Estimated time enroute (ETE) - ETE is shown as hours:minutes until less than an hour, then it is shown as minutes:seconds.
- Estimated time of arrival (ETA) - ETA is shown as hours:minutes. If the time is denoted as LCL, then the time is shown based on the time zone of the destination.
 - If in waypoint mode then the ETA is the ETE added to the departure time.
 - If a stored flight plan is selected it shows the ETA by adding to the departure time all of the ETEs of the legs up to the selected leg. If the entire flight plan is selected, then the ETA is calculated as if the last leg of the flight plan was selected.
 - If the active flight plan is selected the ETA reflects the current position of the aircraft and the current leg being flown. The ETA is calculated by adding to the current time the ETEs of the current leg up to and including the selected leg. If the entire flight plan is selected, then the ETA is calculated as if the last leg of the flight plan was selected.
- Enroute safe altitude (ESA) - The ESA is shown as nnnnnFT
- Destination sunrise and sunset times (SUNRISE, SUNSET) - These times are shown as hours:minutes. If the time is denoted as LCL, then the time is shown based on the time zone of the aircraft present position.

FUEL STATISTICS

The fuel statistics are calculated based on the selected starting and ending waypoints and the trip planning inputs. Some of the calculated trip statistics are dashed when the selected leg of the active flight plan has already been flown.

- Fuel efficiency (EFFICIENCY) - This value is calculated by dividing the current ground speed by the current fuel flow.
- Time of fuel endurance (TOTAL ENDUR) - 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 (REM 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 (REM ENDUR) - 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 REQ) - This value is calculated by multiplying the time to go by the fuel flow.
- Total range at entered fuel flow (TOTAL RANGE) - This value is calculated by multiplying the time of fuel endurance by the ground speed.

OTHER STATISTICS

These statistics are calculated based on the system sensor inputs or the manual trip planning inputs.

- Density altitude (DENSITY ALT)
- True airspeed (TRUE AIRSPEED)

Selecting the Stored Flight Plan - Cumulative trip route mode:

- 1) From **Home**, touch **Utilities > Trip Planning**.
- 2) Touch the **Trip Route** Button to display the Input Selection Window.
- 3) Touch the **Select from Flight Plan** Button to display the Select Flight Plan Screen.
- 4) Scroll the list, if necessary, and touch a stored flight plan button to display the Select Flight Plan Leg Screen.
- 5) Touch the **Cumulative Flight Plan** Button to select the mode and return to the Trip Planning Screen.

Selecting the Stored Flight Plan - Leg trip route mode:

- 1) From **Home**, touch **Utilities > Trip Planning**.
- 2) Touch the **Trip Route** Button to display the Input Selection Window.
- 3) Touch the **Select from Flight Plan** Button to display the Select Flight Plan Screen.
- 4) Scroll the list, if necessary, and touch a stored flight plan button to display the Select Flight Plan Leg Screen.
- 5) Scroll the list, if necessary, and touch a flight plan leg selection button to select the mode and return to the Trip Planning Screen.

Selecting the Active Flight Plan - Remaining trip route mode:

- 1) From **Home**, touch **Utilities > Trip Planning**.
- 2) Touch the **Trip Route** Button to display the Input Selection Window.
- 3) Touch the **Select from Flight Plan** Button to display the Select Flight Plan Screen.
- 4) Scroll the list, if necessary, and touch the active flight plan button to display the Select Flight Plan Leg Screen.
- 5) Touch the **Remaining Flight Plan** Button to select the mode and return to the Trip Planning Screen.

Selecting the Active Flight Plan - Leg trip route mode:

- 1) From **Home**, touch **Utilities > Trip Planning**.
- 2) Touch the **Trip Route** Button to display the Input Selection Window.
- 3) Touch the **Select from Flight Plan** Button to display the Select Flight Plan Screen.
- 4) Scroll the list, if necessary, and touch the active flight plan button to display the Select Flight Plan Leg Screen.
- 5) Scroll the list, if necessary, and touch a flight plan leg selection button (P.POS → Waypoint or Waypoint → Waypoint) to select the mode and return to the Trip Planning Screen.

Selecting the waypoints trip route mode:

- 1) From **Home**, touch **Utilities > Trip Planning**.
- 2) Touch the **Trip Route** Button to display the Input Selection Window.
- 3) Touch the **Select Starting and Ending Waypoints** Button to display the Select Starting and Ending Locations Window.
- 4) Touch the starting waypoint button to display the Select Starting Location Window.
- 5) Select the starting waypoint:

Touch the **Present Position** Button to use the present position of the aircraft and return to the Select Starting and Ending Locations Window.

Or:

- Touch the **Waypoint** Button to select a waypoint using the keypad and return to the Select Starting and Ending Locations Window.
- 6) Touch the ending waypoint button to to select a waypoint using the keypad and return to the Select Starting and Ending Locations Window.
 - 7) Touch the **Accept** Button to select the mode and return to the Trip Planning Screen.

When the manual entry mode is selected, the other eight trip input data fields must be entered by the pilot, in addition to flight plan and leg selection.

Entering manual data for trip statistics calculations:

- 1) From **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 pilot and stores weight.

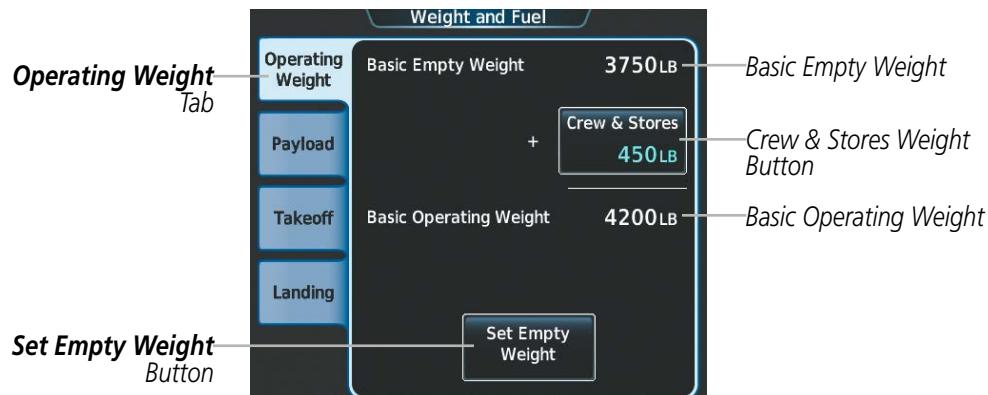


Figure 5-178 Weight and Fuel Screen - Operating Weight Tab

Calculating basic operating weight:

- 1) From **Home**, touch **PERF** > **Weight and Fuel**.
- 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** weight 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 5-179 Weight and Fuel Screen - Payload Tab

Calculating zero fuel weight:

- 1) From **Home**, touch **PERF > Weight and Fuel**.
- 2) Touch the **Payload** Tab to display the zero fuel weight calculation.
- 3) Touch the number of passengers (**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 average passenger weight (**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** weight 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.

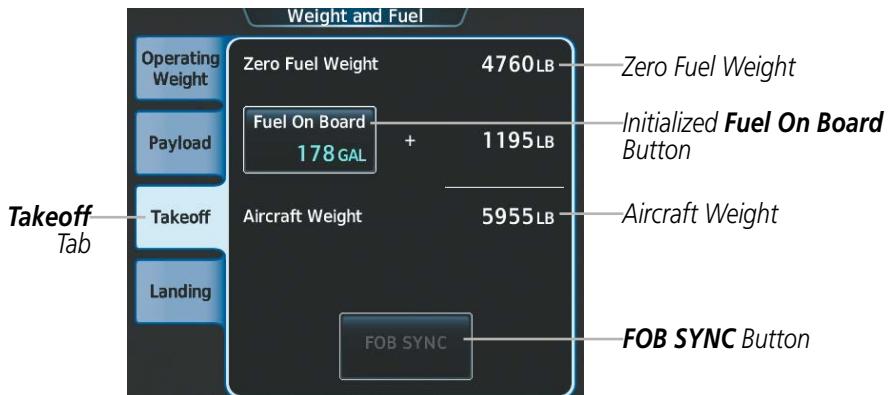


Figure 5-180 Weight and Fuel Screen - Takeoff Tab

Calculating aircraft weight:

- 1) From **Home**, touch **PERF > Weight and Fuel**.
- 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 **Home**, touch **PERF > Weight and Fuel**.
- 2) Touch the **Takeoff Tab** to display the aircraft weight calculation.
- 3) Touch the **FOB SYNC** Button to insert the fuel weight from the fuel sensors.



NOTE: Aircraft Weight is based on the Initialized FOB value (set by touching the FOB SYNC Button, or by manually entering Fuel on Board). The Initialized FOB and Takeoff Weight on the Takeoff Tab do not decrease as fuel is burned.

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 5-181 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.

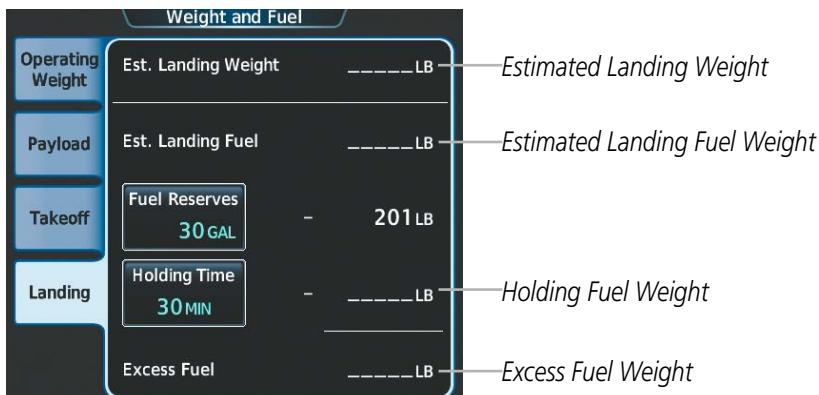


Figure 5-182 Weight and Fuel Screen - Landing Tab with Invalid Fields

Entering fuel reserve and estimated holding time:

- 1) From **Home**, touch **PERF > Weight and Fuel**.
- 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 weight.
- 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.

If the estimated landing weight is greater than the maximum allowable landing weight, then the estimated landing weight is displayed in amber.

If the estimated landing fuel weight is positive, but less than or equal to the fuel reserves weight, the following values are displayed in amber:

- Estimated 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 Takeoff and Landing Data functions allow the pilot to enter the airport, runway, and required takeoff/ landing distances to support SurfaceWatch.

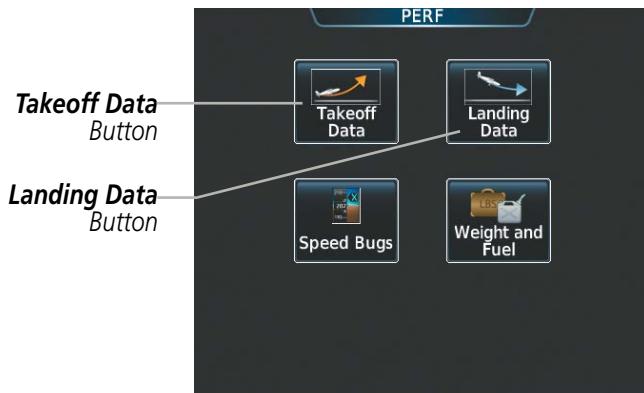


Figure 5-183 PERF Screen

TAKEOFF DATA

The Takeoff Data Screen allows entry of the origin airport, origin runway, and required takeoff distance.

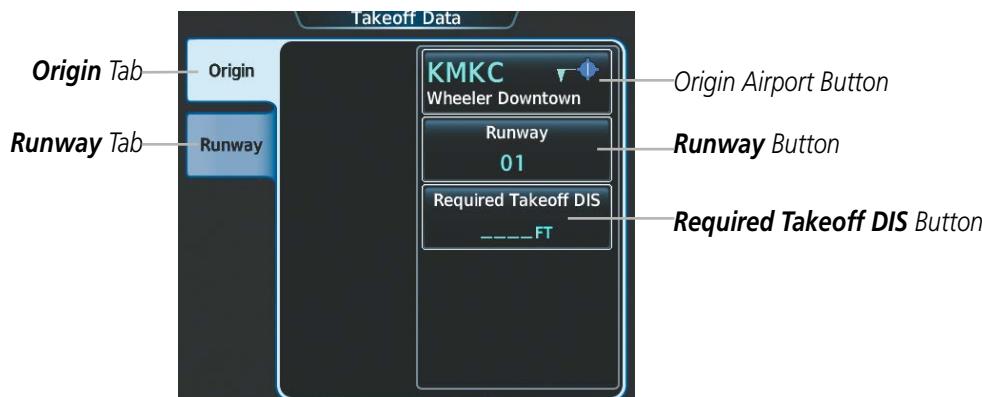


Figure 5-184 Takeoff Data Screen - Origin Tab

The origin airport and runway default to the active flight plan selections, if available. If there is not an origin airport in the active flight plan, the system will attempt to default to a nearest airport.

Selecting an origin airport, runway, and required takeoff distance on the Takeoff Data Screen:

- 1) From **Home**, touch **PERF > Takeoff Data**.
- 2) Touch the **Origin** Tab, if necessary, to display the origin airport and runway data.
- 3) 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

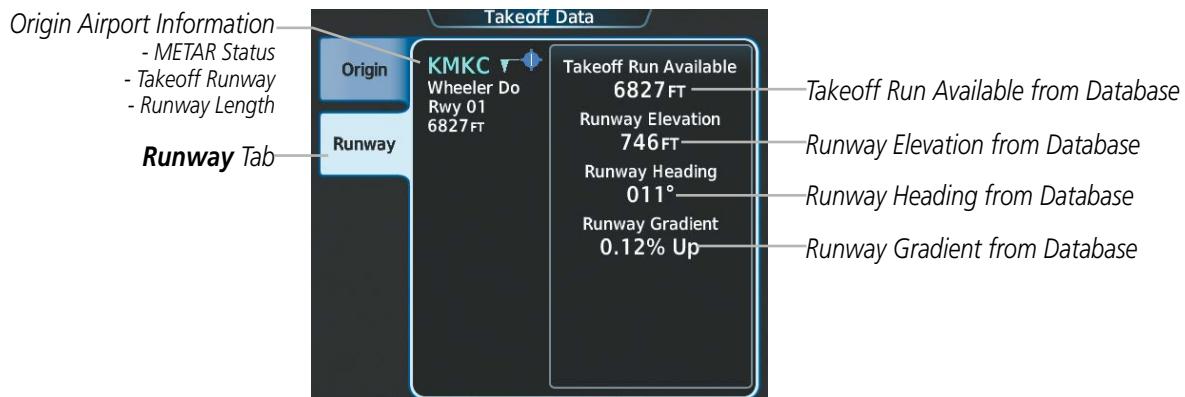


Figure 5-185 Takeoff Data Screen - Runway Tab

LANDING DATA

The Landing Data Screen allow entry of the destination airport, destination runway, and required landing distance.

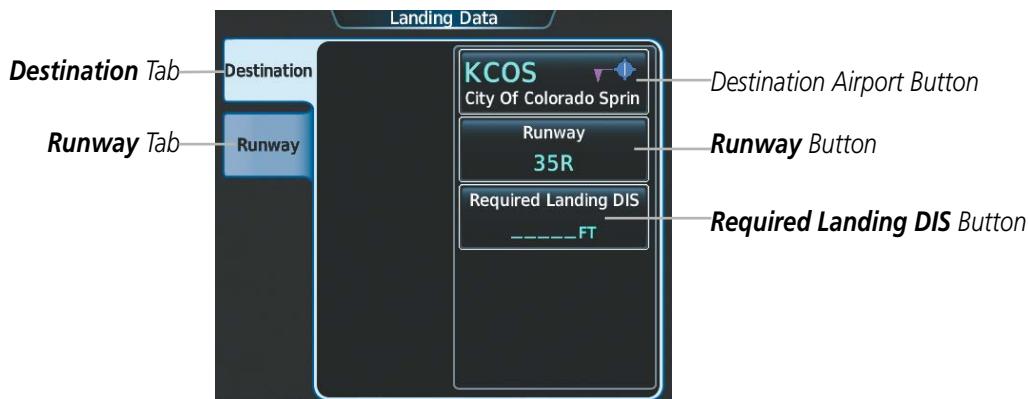


Figure 5-186 Landing Data Screen - Destination Tab

The destination airport and runway default to the arrival or origin airport, if available. It will be the origin airport if the aircraft is within 30 nm of the origin airport and no runway has been set for the destination. It will be the arrival airport and runway if one is available in the active flight plan. If neither is available, the destination airport and runway are shown as dashes, allowing manual entry.

Selecting a destination airport, runway, and required landing distance on the Landing Data Screen:

- 1) From **Home**, touch **PERF > Landing Data**.
- 2) Touch the **Destination** 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.

The destination airport on the Runway Tab is the same as the one selected on the Destination Tab.

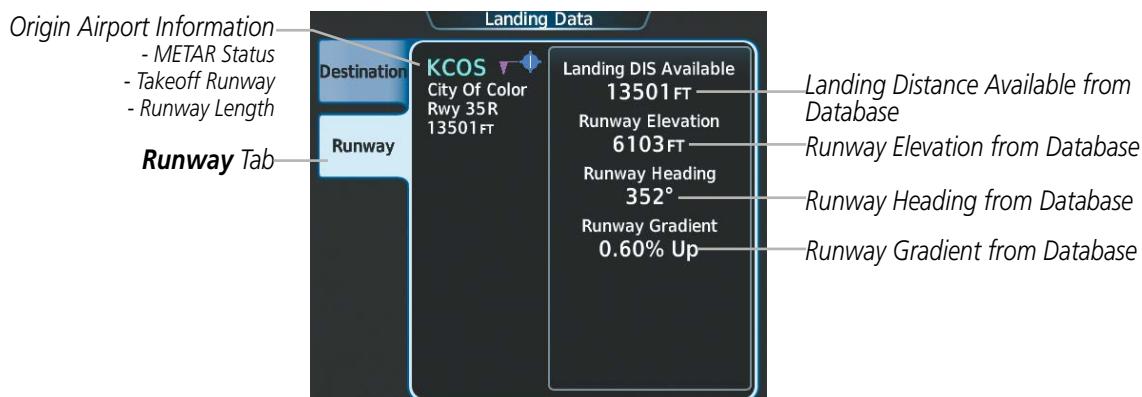


Figure 5-187 Landing Data Screen - Runway Tab

5.12 ABNORMAL OPERATION

FMS DEGRADATION

The Flight Management System operates in different modes, depending on the availability of GPS.

Available Position Sensors	FMS Navigation Mode
GPS	
Yes	GPS
No	DR

Loss of GPS position is indicated on the system by the message ‘GPS LOI’ displayed in amber to the left of the HSI as shown in Figure 5-188. 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.

In DR mode, the system uses its last-known position combined with continuously updated airspeed and heading data (when available) to calculate and display the aircraft’s current estimated position.

It is important to note that estimated navigation data supplied by the system in DR mode may become increasingly unreliable and must not be used as a sole means of navigation. If while in DR mode airspeed and/or heading data is also lost or not available, the DR function may not be capable of accurately tracking estimated position and, consequently, the system may display a path that is different than the actual movement of the aircraft. Estimated position information displayed by the system through DR while there is no heading and/or airspeed data available should not be used for navigation.

DR mode is inherently less accurate than the other modes due to the lack of satellite measurements or DME inputs needed to determine a position. Changes in wind speed and/or wind direction compound the relative inaccuracy of DR mode. Because of this degraded accuracy, other navigation equipment must be relied upon for position awareness until other position data is restored.

DR mode is indicated on the system by the appearance of the letters ‘DR’ displayed in amber on the HSI below and to the left of the aircraft symbol on the CDI, and on top of the aircraft symbol on navigation maps, as shown in Figure 5-188. 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.)

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.

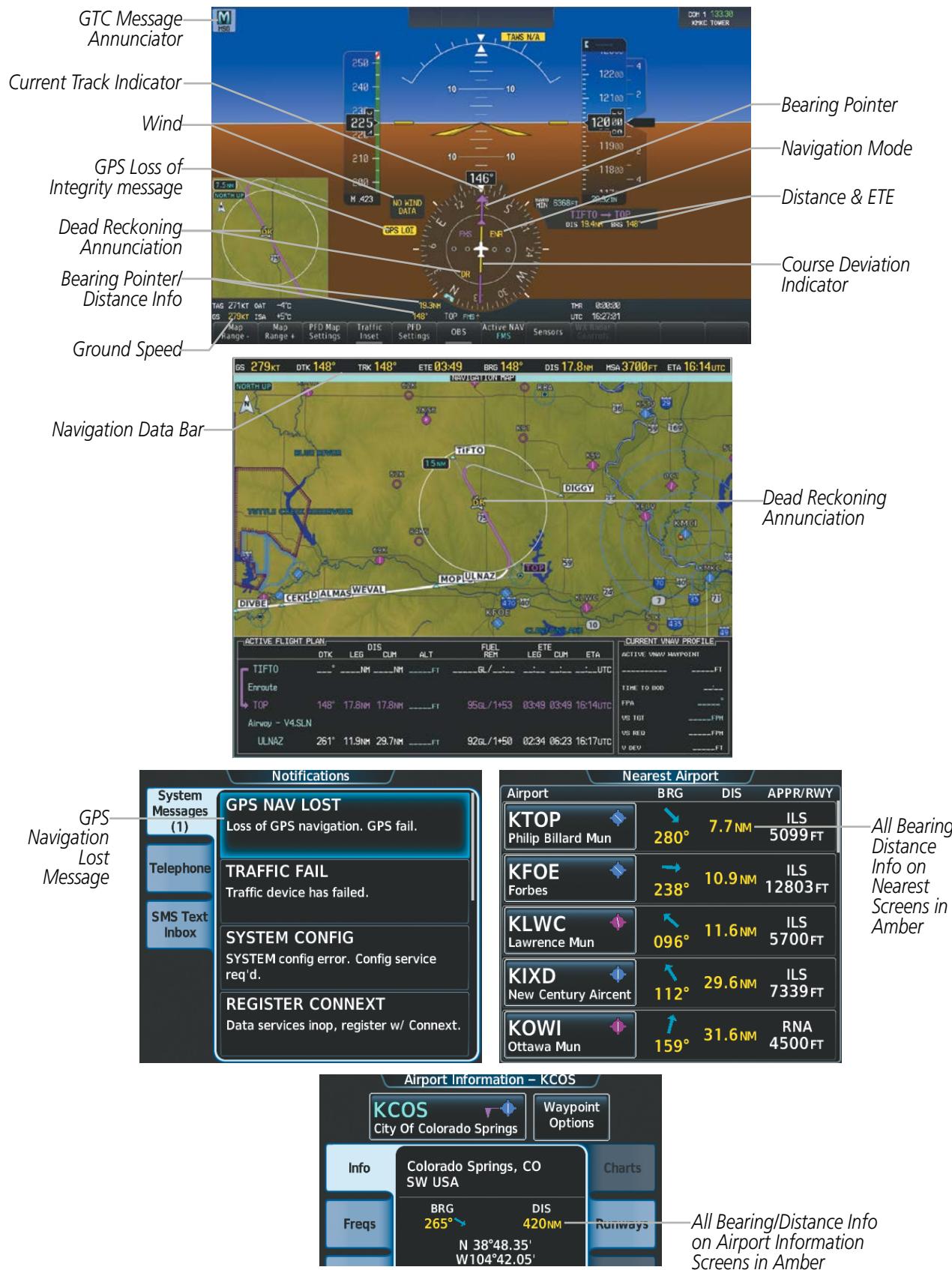


Figure 5-188 Dead Reckoning Mode - GPS Derived Data Shown in Amber

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SECTION 6 HAZARD AVOIDANCE

Hazard avoidance features available for the G3000 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 (Subscription Optional)
- GSR 56 Garmin Connex Weather (Subscription Optional)
- L-3 Stormscope Lightning Detection System (Optional)
- GWX 70 Airborne Color Weather Radar (Optional)

Terrain Avoidance

- Terrain Proximity
- Terrain SVT (Optional)
- Terrain Awareness and Warning System Class-B (TAWS-B)

Traffic

- Traffic Information Service (TIS)
- Garmin GTS 825 Traffic Advisory System (TAS) (Optional)
- Garmin GTS 855 Traffic Alert and Collision Avoidance System I (TCAS I) (Optional)

6.1 SIRIUSXM 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 significantly older than the indicated weather product age.



NOTE: Do not rely on data link weather information to discern precise values for any weather-related measurements. Data link weather information is presented for informational purposes only, and should never be used as a replacement for official sources of in-flight weather information.

The Garmin GDL 69A SXM is a remote-mounted satellite data link receiver. It provides SiriusXM Weather information to the system. The displays show graphical weather information and its associated text. The GDL 69A SXM can also receive SiriusXM Satellite Radio entertainment services. Both weather data and audio entertainment programming operate in the S-band frequency range to provide continuous reception capabilities at any altitude throughout North America.

SiriusXM services require subscriptions. For more information on specific subscription packages, visit www.siriusxm.com.

ACTIVATING 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 GDL 69A SXM. SiriusXM Satellite Radio (audio) and SiriusXM Weather (data) services each have coded IDs. 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 the Touchscreen Controller (Figure 6-1)
- The XM Satellite Radio Activation Instructions included with the unit
- The label on the back of the GDL 69A data link receiver

Contact the installer if the Audio and Data Radio IDs cannot be located.

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 **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 using the phone number listed on its website, www.siriusxm.com. Follow the instructions provided by SiriusXM customer service.

Activating SiriusXM Weather services:

- 1) Position the aircraft so the data link receiver antenna has an unobstructed view of the sky.
- 2) From **Home**, touch **Utilities > Setup > SiriusXM Info**.
- 3) Touch the **Start** Button in the Activation Window (Figure 6-1). The Activation Window shows 'ACTIVATING' while processing the activation.
- 4) In the Weather Products Window, scroll as needed to view available weather products. Available weather products appear in white text; unavailable weather products appear in gray (subdued) text. It may take several minutes before all subscribed-to weather products are indicated as available.
- 5) When the available weather products match the current SiriusXM Weather Data subscription package, touch the **Lock** Button to save the activation changes, or touch the **Cancel**, **Back**, or **Home** Buttons to exit without saving changes.

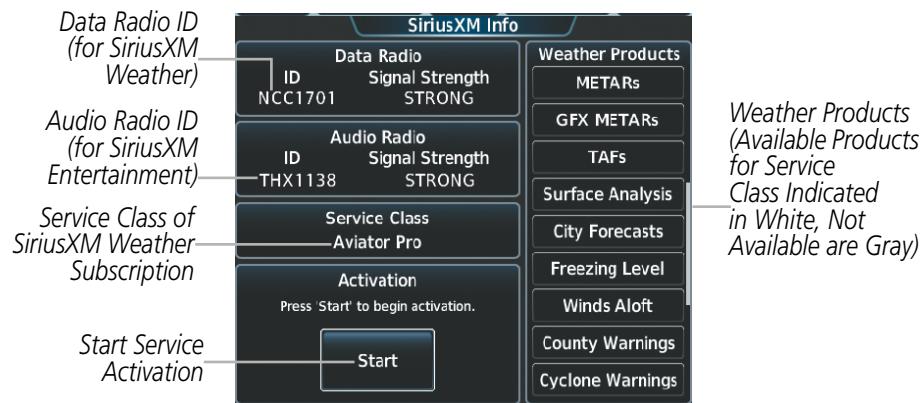


Figure 6-1 SiriusXM Info Screen After Activation

ACCESSING SIRIUSXM WEATHER PRODUCTS

The SiriusXM Weather Pane (Figure 6-2) is the principal map pane for viewing SiriusXM Weather information. This is the only map pane capable of showing information for all available SiriusXM Weather products.

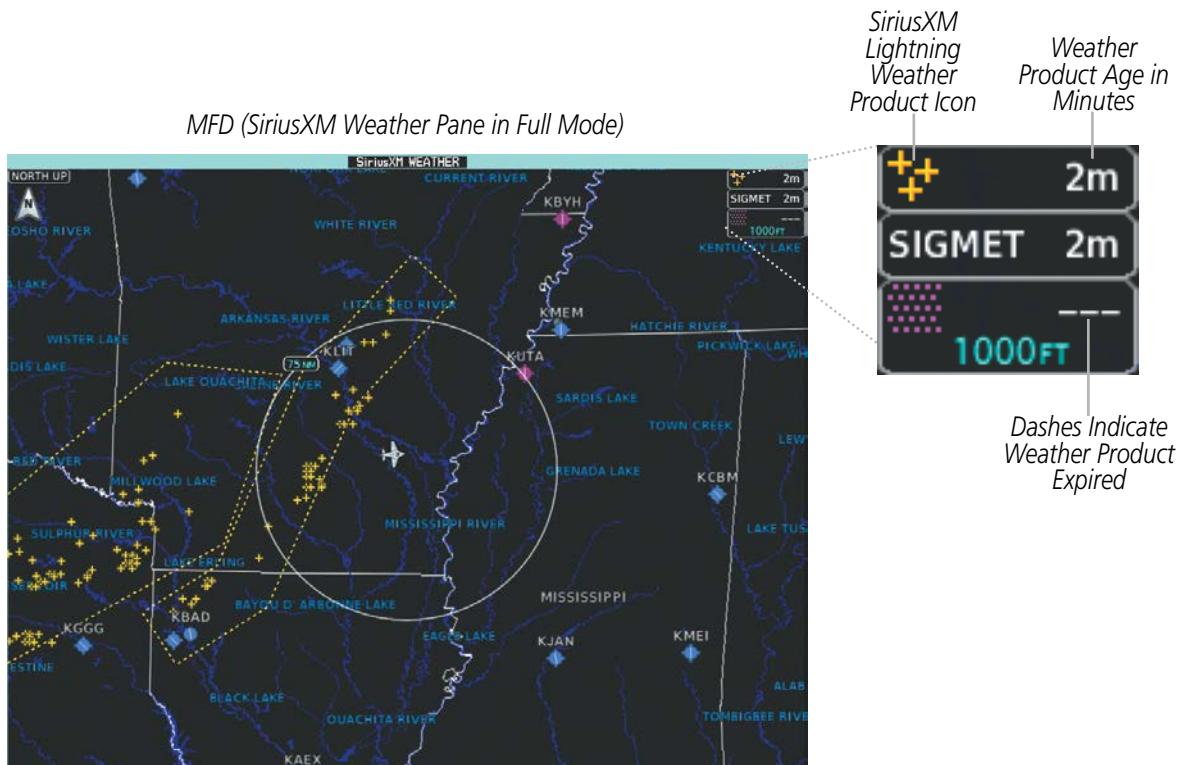


Figure 6-2 SiriusXM Weather Pane with Product Icons and Age Information

Viewing the SiriusXM Weather Pane:

- 1) From **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 'SiriusXM Weather' is shown (such as 'Weather Radar' in the pane title), continue with the procedure to view the SiriusXM Weather Pane.
- 2) Touch the **Weather Selection** Button. The Weather Selection Screen appears.

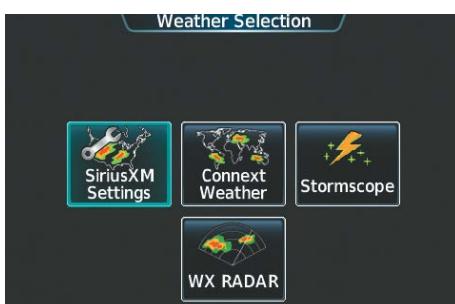


Figure 6-3 Weather Selection Screen

- 3) Touch the **SiriusXM Weather** Button. Button is highlighted and becomes **SiriusXM Settings** Button. The system shows the SiriusXM Weather Pane.
- 4) If necessary, touch the **SiriusXM Settings** Button to access controls for the SiriusXM Weather Pane.

For each enabled SiriusXM Weather product, 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.

The weather product icon or name and the product age appear automatically for SiriusXM Weather products enabled on the SiriusXM Weather Pane and Navigation Map Pane. For the Inset Map and HSI Map, this information may be enabled/disabled using the PFD Softkeys.

Enabling/disabling weather product information for the Inset Map:

- 1) With the Inset Map or HSI Map shown, press the **PFD Map Settings** Softkey.
- 2) Press the **Weather Legend** Softkey. Information is enabled when the softkey annunciator is green, disabled when gray.

The SiriusXM Weather service broadcasts weather products at specific intervals (defined in the **Broadcast Rate** column in Table 6-1). If for any reason, a product is not broadcast within the **Expiration Time** intervals (see Table 6-1), the system removes the expired data from the display, and shows dashes instead of the product age. This ensures the displayed information is consistent with what is currently being transmitted by the SiriusXM Weather service. If more than half of the expiration time has elapsed, the color of the product age changes to amber. If data for a weather product is not available or has not been received, the system displays 'N/A' next to the weather product symbol instead of the product age.

Table 6-1 shows the weather product symbols, the expiration times and the broadcast rates. The broadcast rate represents when the SiriusXM Weather service transmits new signals that may or may not contain updated weather products. It does not represent the rate at which the weather information is updated or when the Data Link Receiver receives new data. SiriusXM 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)	Broadcast Rate (Minutes)
Next-generation Radar (NEXRAD)		30	5 (U.S.) 10 (Canada)
Cloud Tops		60	30
Echo Tops		30	7.5
SiriusXM Lightning		30	5
Storm Cell Movement		30	12
SIGMETs	SIGMET	60	12
AIRMETs	AIRMET	60	12
METARs		90	12
City Forecast		90	12
Surface Analysis		60	12
Freezing Levels		120	12
Winds Aloft		90	12
County Warnings		60	5
Cyclone (Hurricane) Warnings		60	12
Icing Potential (CIP and SLD)		90	22
Pilot Weather Report (PIREPs)		90	12
Air Report (AIREPs)		90	12
Turbulence		180	12
No Radar Coverage	no product symbol	30	5
Temporary Flight Restrictions (TFRs)	TFR	60	12
Terminal Aerodrome Reports (TAFs)	no product symbol	60	12

Table 6-1 SiriusXM Weather Product Symbols and Data Timing

Table 6-2 shows which SiriusXM Weather products can be displayed (indicated with a '+' symbol) on specific maps.

SiriusXM Weather Product	PFD Inset Navigation Map	Navigation Map Pane	SiriusXM Weather Pane	VSD Inset Window
NEXRAD	+	+	+	
No Radar Coverage (Displayed with NEXRAD)	+	+	+	
Cloud Tops			+	
Echo Tops			+	
SiriusXM Lightning	+	+	+	
Storm Cell Movement	+	+	+	
SIGMETs/AIRMETs			+	
METARs	+	+	+	
City Forecast			+	
Surface Analysis			+	
Freezing Levels			+	
Winds Aloft		+	+	+
County Warnings			+	
Cyclone Warnings			+	
Current Icing Potential			+	
PIREPs			+	
AIREPs			+	
Turbulence			+	
TFRs	+	+	+	

Table 6-2 Weather Product Display Maps

Softkeys control which weather products are shown on the PFD Inset Map. The Touchscreen Controller controls the display of weather information on display panes.

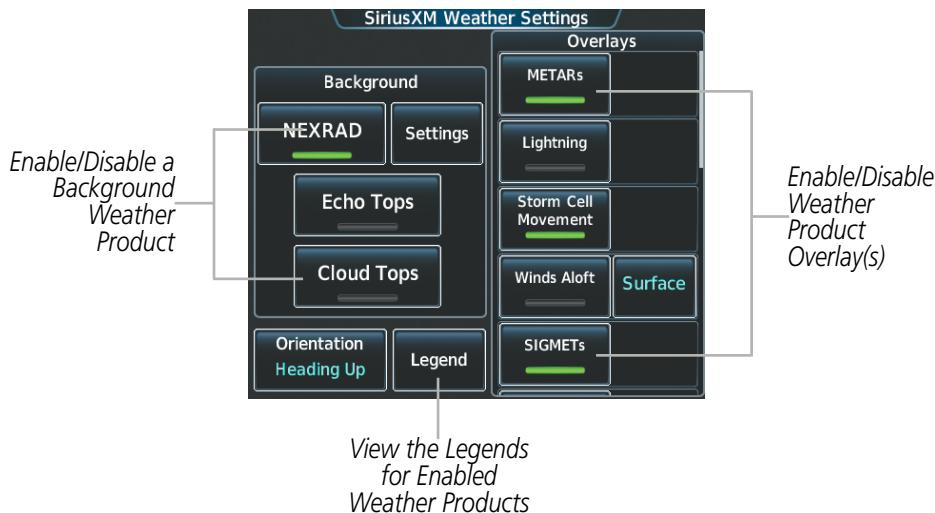


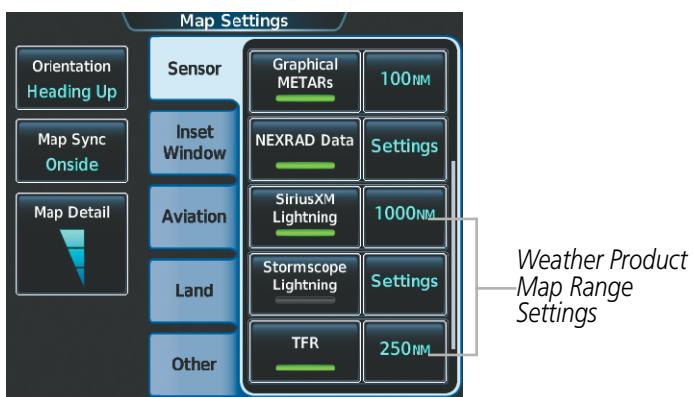
Figure 6-4 SiriusXM Weather Settings Screen

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.

The SiriusXM Weather Settings Screen controls the enabling/disabling of weather products on the SiriusXM Weather Pane. The Map Settings Screen controls the enabling/disabling of weather products on navigation maps.

Setting up and customizing the SiriusXM Weather Products on Navigation Maps:

- 1) From **Home**, touch **Map > 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 6-5 Map Settings Screen
(Sensor Tab Selected)

The system provides the ability to select a map orientation for the SiriusXM Weather Pane for the selected display pane location (e.g., PFD, MFD Left, MFD Right). 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 SiriusXM Weather Pane:

- 1) From **Home**, touch **Weather > Weather Selection > SiriusXM Weather > SiriusXM 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**).

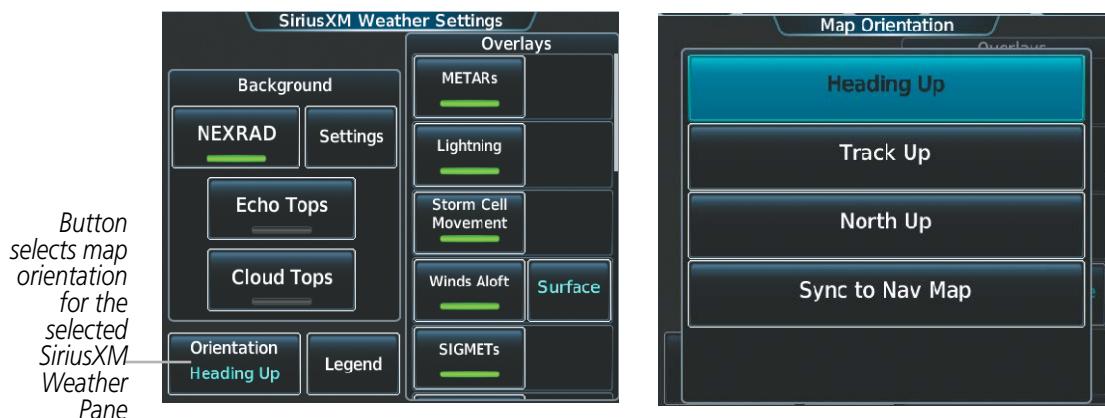


Figure 6-6 Selecting a Map Orientation for the SiriusXM Weather Pane

If more than one weather data link weather source has been installed (such as Garmin Connex Weather), the system provides the option to select a source of weather information for each Navigation Map Pane and Inset Map.

Selecting a Weather Data Link Source for Navigation Map Panes:

- 1) From **Home**, touch **Map > Map Settings**.
- 2) If necessary, touch the Sensor tab.
- 3) Scroll 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** or **Connex**, if installed).

Selecting a Weather Data Link Source for the Inset Map and HSI Map:

- 1) Press the **PFD Map Settings** Softkey.
- 2) Press the **Data Link Settings** Softkey. The **Data Link** Softkey appears with the currently selected data link weather source displayed in cyan on the softkey.
- 3) Press the **Data Link** Softkey as needed to cycle through the data link weather sources (such as SiriusXM, or Connex, if installed).

The available **Inset Map Settings** Softkeys correspond to the selected data link weather source.

Navigation Maps displaying data link weather products show the name of the selected source ('Connexx WX' or 'SiriusXM') in a box on the map while data link weather products are displayed.

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 SiriusXM Weather Pane:

- 1) From **Home**, touch **Weather > Weather Selection > SiriusXM Weather > SiriusXM 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**.

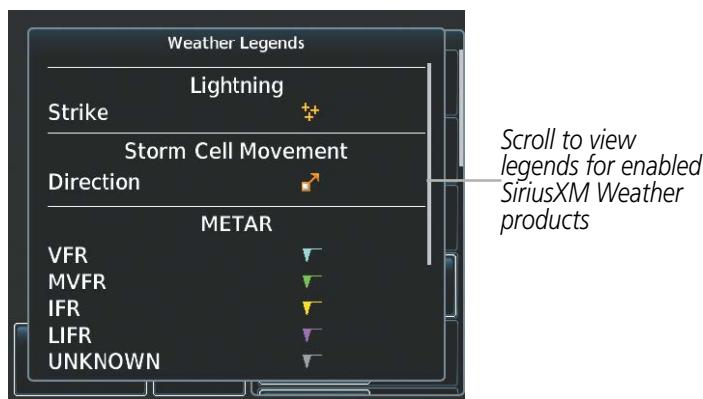


Figure 6-7 Weather Legends Window (SiriusXM)

The system displays additional information about the following weather products by panning over the product on the map with the Map Pointer.

- Cloud Tops
- Storm Cell Movement
- SIGMETs
- AIRMETs
- METARs
- County Warnings
- TFRs
- PIREPSs
- AIREPs

The **Joystick** or **Touchpad** control the Map Pointer. These controls also adjust the map range. If the map range is adjusted while panning is enabled, the map is re-positioned on the Map Pointer.

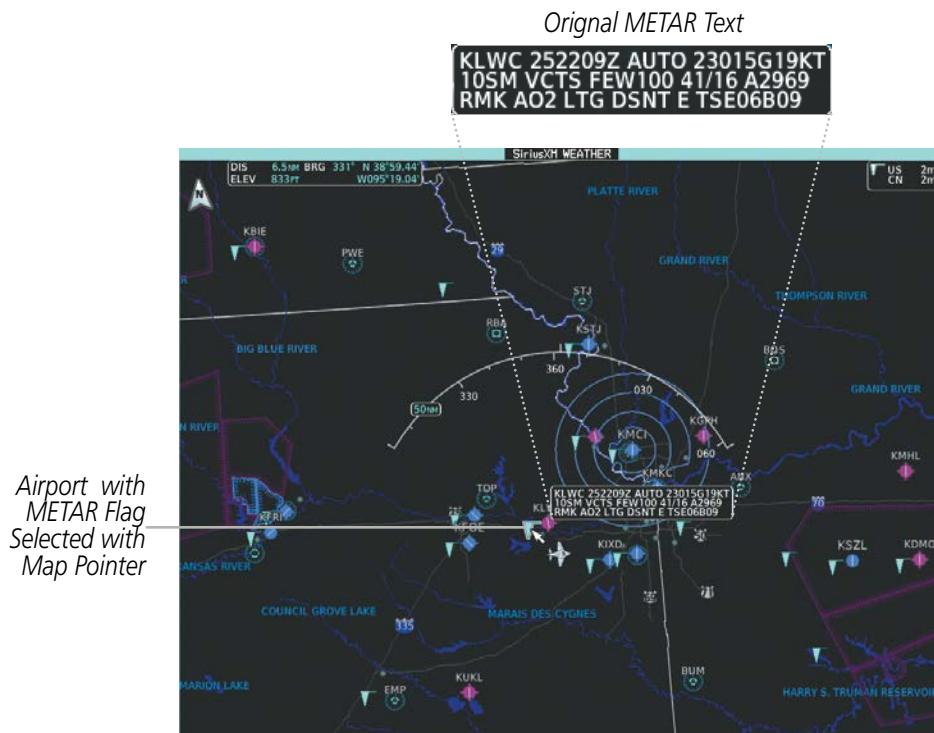


Figure 6-8 Panning on the SiriusXM Weather Pane

NEXRAD



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 156 high-resolution Doppler radar systems. The NEXRAD network provides centralized meteorological information for the continental United States and selected overseas locations. The maximum range of a single NEXRAD site is 250 nm.

Individual NEXRAD sites supply the network with radar images, and the images from each radar site may arrive at the network at different rates and times. Periodically, the weather data provider compiles the available individual site images from the network to form a composite image, and assigns a single time to indicate when it created the image. This image becomes the NEXRAD weather product. Individual images--gathered from each NEXRAD site--differ in age, and are always older than the displayed NEXRAD weather product age. The data provider then sends the NEXRAD data to the SiriusXM Weather service, whose satellites transmit this information during the next designated broadcast time for the NEXRAD weather product.

Because of the time required to detect, assemble, and distribute the NEXRAD weather product, the displayed weather information contained within the product may be significantly older than the current radar synopsis and may not depict the current weather conditions. The NEXRAD weather product should never be used as a basis for maneuvering in, near, or around areas of hazardous weather regardless of the information it contains.

For radar sites in the United States, the NEXRAD weather product shows a composite reflectivity image. This shows the highest radar energy received from multiple antenna tilt angles at various altitudes. For radar sites based in Canada, the NEXRAD weather product shows radar returns from the lowest antenna tilt angle, known as base reflectivity. The display of the information is color-coded to indicate the intensity of the echoes and the type of precipitation, if known.

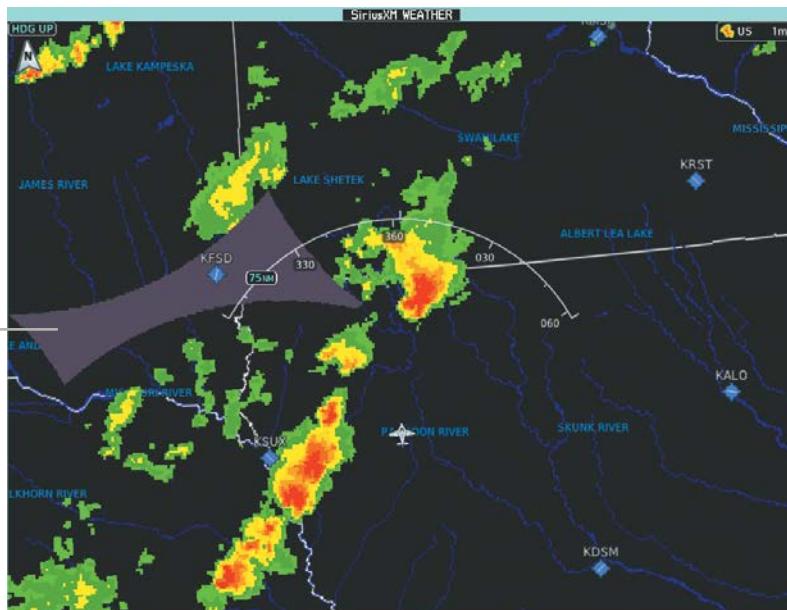


Figure 6-9 NEXRAD Data on the SiriusXM Weather Pane

Displaying NEXRAD weather information (SiriusXM Weather Pane):

- 1) From **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 **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 **Home**, touch **Map > 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 **Home**, touch **Map > Map Settings**.
- 2) If necessary, touch the Sensor Tab.
- 3) Scroll as needed and touch the NEXRAD Data Settings Button in the Overlays Window.
- 4) Touch the **NEXRAD Data** coverage Button (displaying either 'USA' or 'Canada' in cyan).
- 5) Touch the **US** 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) Press the **PFD Map Settings** Softkey.
- 2) Press the **WX Overlay** Softkey. Each softkey press cycles through the available options. NEXRAD data is enabled on the map when 'SiriusXM' is displayed on the softkey, and disabled when 'Off' is displayed on the softkey.

Changing the NEXRAD coverage area (PFD Inset Map or HSI Map):

- 1) Press the **PFD Map Settings** Softkey.
- 2) Press the **Data Link Settings** Softkey.
- 3) Press the **Source** Softkey. Each press cycles through a coverage area, displayed in cyan on the softkey ('USA' or 'Canada').

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 Controller. For the NEXRAD legend (Figure 6-10), touch the **Legend** Button when NEXRAD is enabled for display on the SiriusXM Weather Settings Screen.

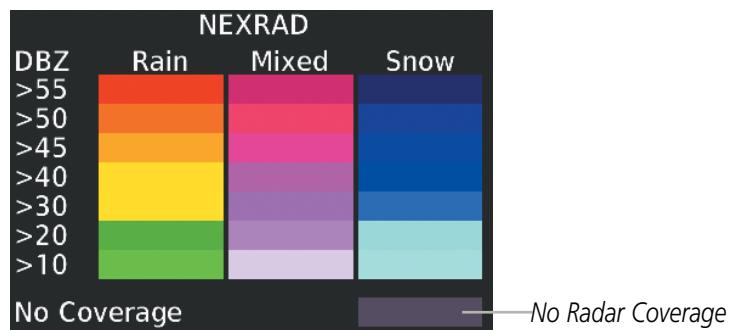


Figure 6-10 NEXRAD Legend

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 (Figure 6-10).

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.

The following may cause abnormalities in displayed NEXRAD radar images:

- Ground clutter
- Strobes and spurious radar data
- Sun strobes (when the radar antenna points directly at the sun)
- Interference from buildings or mountains, which may cause shadows
- Metallic dust (chaff) from military aircraft, which can cause alterations in radar scans

NEXRAD LIMITATIONS (CANADA)

- Radar coverage extends to 55°N.
- Any precipitation displayed between 52°N and 55°N is displayed as mixed regardless of actual precipitation type.

ECHO TOPS



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 (Figure 6-11) shows the location and elevation of the highest radar echo. The highest radar echo does not indicate the actual top of a storm or clouds. It indicates the highest altitude at which NEXRAD radar was able to detect precipitation. Note this Echo Tops altitude may be significantly higher than the highest altitude airborne weather radar was able to detect precipitation, particularly at longer ranges from the airborne weather radar antenna. See section 6.3 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.

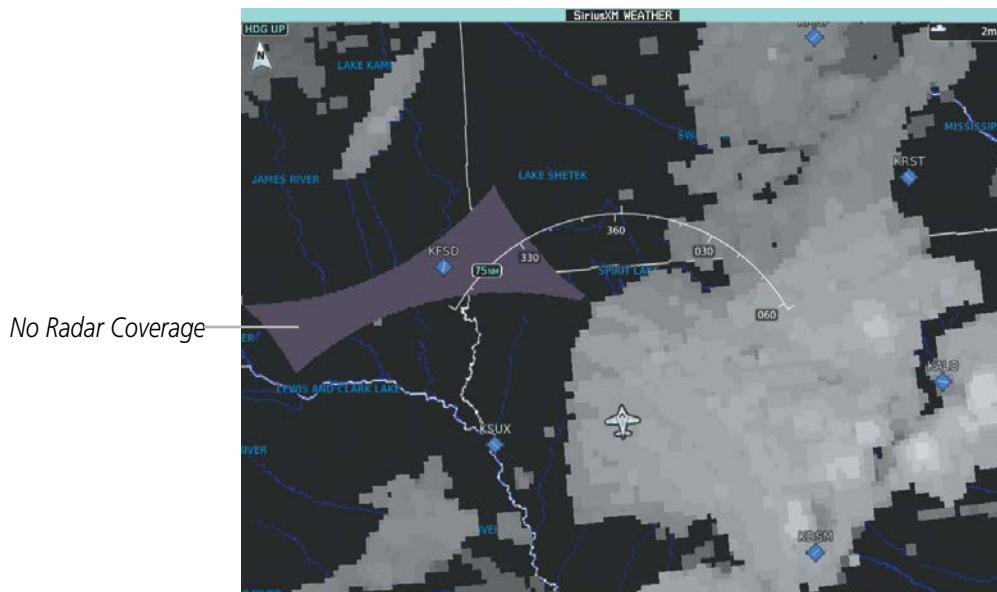


Figure 6-11 Echo Tops Weather Product

Enabling/Disabling Echo Tops information:

- 1) From **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.

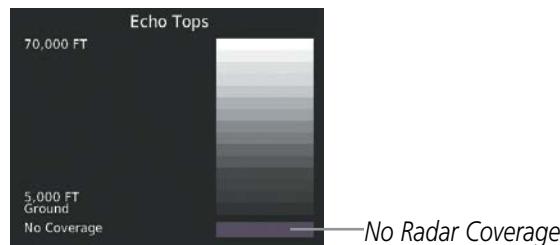


Figure 6-12 Echo Tops Legend

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 (Figure 6-12).

CLOUD TOPS



NOTE: The Cloud Tops and Echo Tops weather products cannot be displayed at the same time on the SiriusXM Weather pane.

The Cloud Tops weather product (Figure 6-13) 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 Top.



NOTE: The broadcast rate for Cloud Tops is 30 minutes. As with all SiriusXM Weather products, the product age becomes amber when it reaches half of the expiration time, which is 60 minutes for Cloud Tops. Therefore, this weather product age may be amber during routine operation.

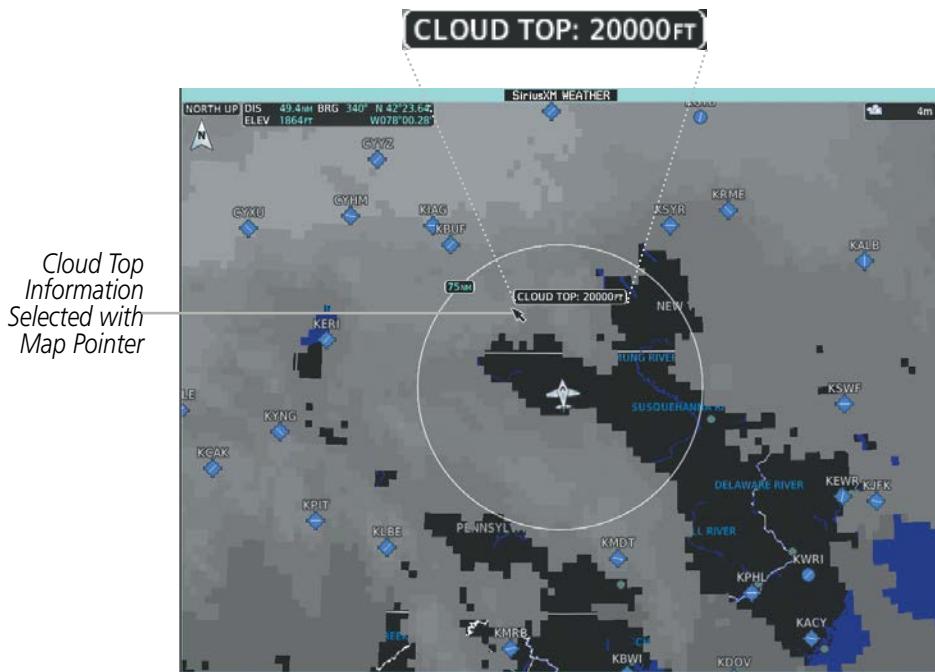


Figure 6-13 Cloud Tops Weather Product

Enabling/Disabling Cloud Tops information:

- 1) From **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 6-14 Cloud Tops Legend

SIRIUSXM LIGHTNING

The SiriusXM Lightning weather product (Figure 6-15) 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.

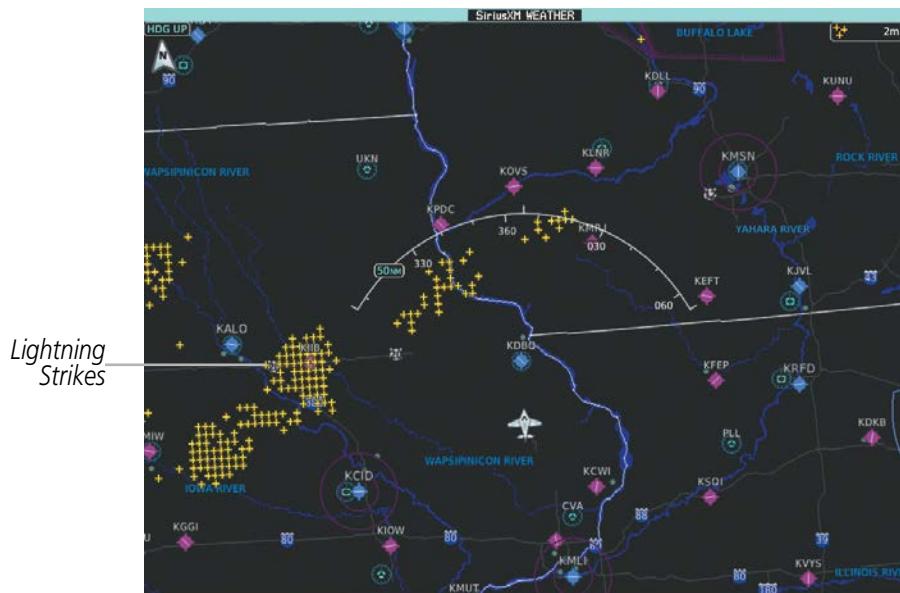


Figure 6-15 SiriusXM Lightning Weather Product

Enabling/Disabling SiriusXM Lightning information (SiriusXM Weather Pane):

- 1) From **Home**, touch **Weather** > **Weather Selection** > **SiriusXM Weather** > **SiriusXM 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**.

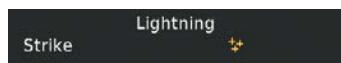


Figure 6-16 SiriusXM Lightning Legend

Displaying SiriusXM Lightning information (navigation map panes):

- 1) From Home, touch **Map > Map Settings**.
- 2) If necessary, touch the Sensor Tab.
- 3) Scroll as needed and touch the **SiriusXM Lightning** Button.

Displaying SiriusXM Lightning information (PFD Inset Navigation Map):

- 1) Press the **PFD Map Settings** Softkey
- 2) Press the **SiriusXM Lightning** Softkey.

STORM CELL MOVEMENT

The Cell Movement weather product (Figure 6-17) shows the location and movement of storm cells as identified by the ground-based system. Orange squares represent cells, with short arrows indicating 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.



Figure 6-17 Storm Cell Movement Weather Product



NOTE: The Storm Cell base height is not available with a GDL 69 SXM data link receiver. In this case, the Storm Cell base height is displayed as 0 feet when the map pointer selects a storm cell.

Enabling/Disabling Storm Cell Movement Information (SiriusXM Weather Pane)

- 1) From 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 **Back** or **Home**.

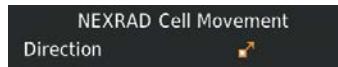


Figure 6-18 Cell Movement Legend

Displaying Storm Cell Movement Information (Navigation Map Panes)

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

The pilot can choose to display Storm Cell Movement with the NEXRAD weather product on the Inset Map and HSI Map. When chosen, enabling/disabling NEXRAD on the Inset Map also enables/disables Storm Cell Movement on the Inset Map.

Choosing to display Storm Cell Movement with NEXRAD (Inset Map and HSI Map):

- 1) Press the **PFD Map Settings** Softkey.
- 2) If the PFD is in Full Mode, press the **Data Link Settings** Softkey.
Or:
 - a) If the PFD is in Split Mode, press the **Map Overlays** Softkey.
 - b) Press the **Data Link Settings** Softkey.
- 3) Press the Storm Cell Movement Softkey. When softkey annunciator is green, Storm Cell Movement is shown when NEXRAD is enabled on the Inset Map or HSI Map. When softkey annunciator is gray, Storm Cell Movement is not shown when NEXRAD is enabled on the Inset Map or HSI Map.

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. A localized SIGMET is a significant weather condition occurring at a localized geographical position.



NOTE: The SIGMET and AIRMET weather products are not available unless at least one SIGMET or AIRMET has been received. The weather product age indicates 'N/A' when no SIGMET or AIRMET is available.

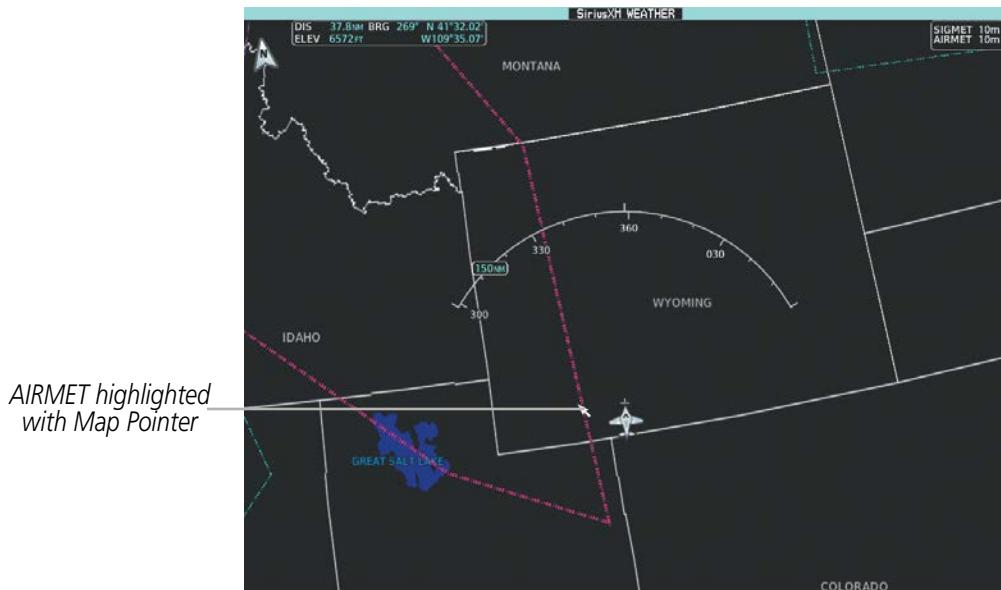


Figure 6-19 AIRMET and SIGMET Weather Products

Enabling/Disabling AIRMET and SIGMET information:

- 1) From **Home**, touch **Weather > Weather Selection > SiriusXM Weather > SiriusXM 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 **Joystick** and move the map pointer with the **Joystick** or **Touchpad** over the SIGMET or AIRMET until it is highlighted.
- 4) Touch the **Info** Button to show the AIRMET / SIGMET Information Screen with the selected AIRMET or SIGMET.
- 5) Scroll as needed to view full text of the report, then touch **Back** or **Home**.

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.

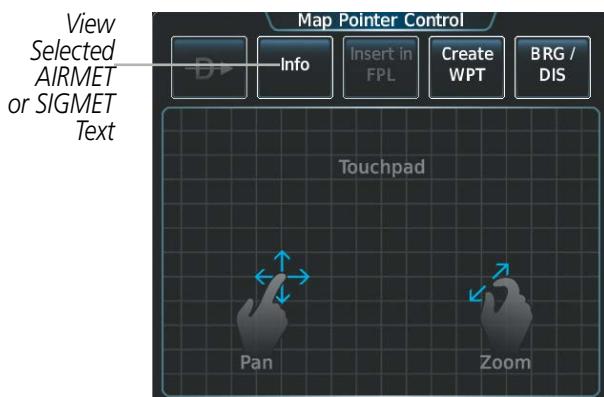


Figure 6-20 Map Pointer Control Screen

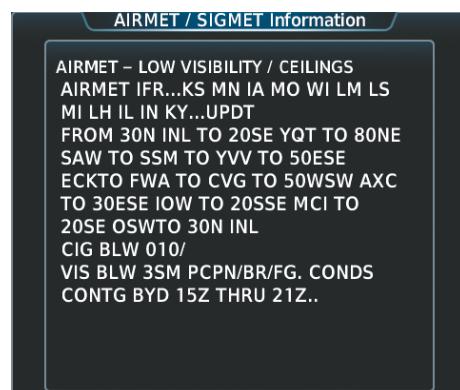


Figure 6-21 AIRMET/SIGMET Information Screen

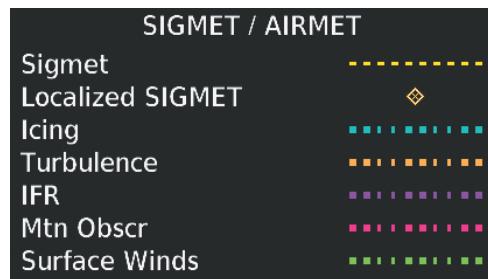


Figure 6-22 SIGMET/AIRMET Legend

METARS AND TAFS



NOTE: Atmospheric pressure as reported for METARs is given in hectopascals (hPa), except for in the United States, where it is reported in inches of mercury (in Hg). Temperatures are reported in Celsius.

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.

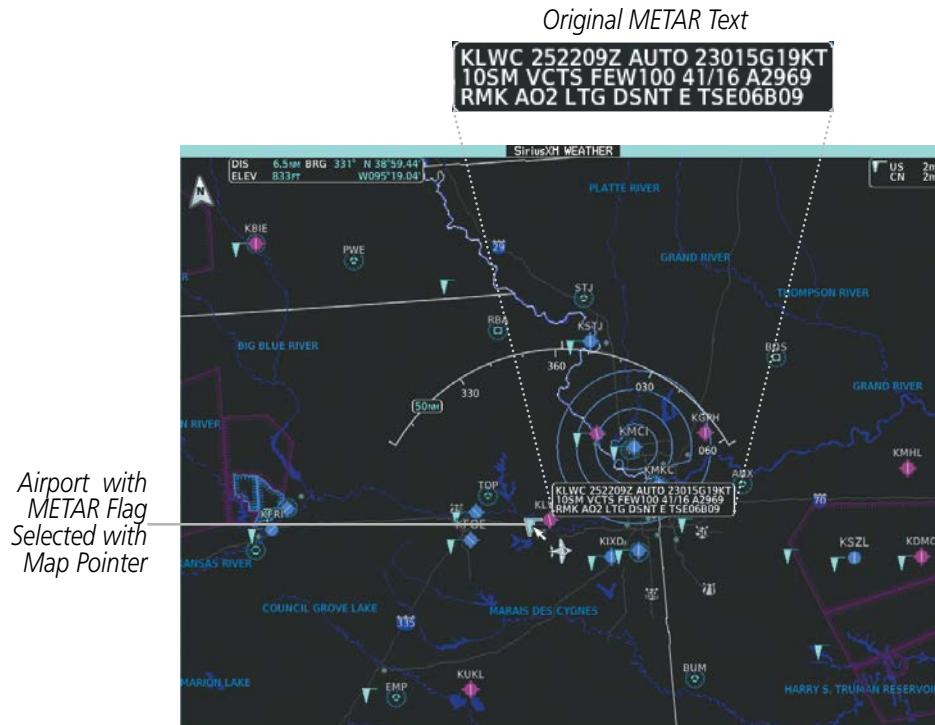


Figure 6-23 Displaying METARS on the SiriusXM Weather Pane

Showing METAR text (SiriusXM Weather Pane):

- 1) From **Home**, touch **Weather > Weather Selection > SiriusXM Weather > SiriusXM Settings**.
- 2) Touch the **METARs** Button in the Overlays Window. The system displays METAR flags at available reporting stations when METARs are enabled (button annunciator is green).
- 3) To view METAR text, press the **Joystick** and move the map pointer with the **Joystick** or **Touchpad** over a METAR flag. The system displays the original METAR text near the METAR flag. If the GDU has not yet received the METAR text associated with the selected flag, it displays "Waiting for METAR text," until it receives this information.

Touch the **Legend** Button on the SiriusXM Weather Settings Screen to display weather legend(s) for weather product(s) enabled on the SiriusXM Weather Pane. Scroll as necessary to view the information, then touch **Back** or **Home**.

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 SiriusXM Weather service was unable to categorize the METAR.

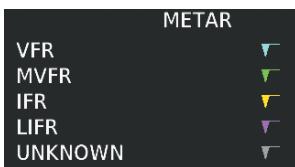


Figure 6-24 METAR Legend

Showing METAR information (Navigation Map Pane):

- 1) From **Home**, touch **Map > 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 **Joystick** and move the map pointer with the **Joystick** 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.

Showing METAR information (Inset Map)

- 1) Select the **Inset Map Settings** Softkey.
- 2) Select the **METAR** Softkey. The system displays METAR flags at available reporting stations when METARs are enabled (button annunciator is green).

Textual METAR/TAF information is available on the Airport Information Screen on the Touchscreen Controller for airports with a requested METAR available. This textual METAR/TAF information may come from any data link weather source available to the system (such as SiriusXM or Garmin Connex), if more than one source is installed. In this case, the system automatically displays the newest available METAR. If

the METAR age is identical from all available data link sources, the system selects one METAR to display in the following order of source priority: SiriusXM, then Garmin Connexx.

The textual display of METAR information on the Touchscreen Controller begins with a time stamp, followed by the original METAR text. A decoded METAR appears below the original. Note the original METAR text may contain additional information not present in the decoded version. The TAF, if available for the selected airport, appears below the decoded METAR text. The system displays the data link weather source of the displayed METAR/TAF at the end of the report.

Viewing textual METAR information on the Airport Information Screen:

- 1) From **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) Input the airport identifier using the keypad or the large and small right knobs, then touch **Enter** or push the right knob.
- 5) Touch the Weather Tab.
- 6) Scroll as necessary to view the time stamp and the original METAR text, followed by the decoded version. Note the original METAR text may contain additional information not present in the decoded version. The Touchscreen Controller indicates 'No METAR data available.' if the METAR text has not been received, has expired, or is currently unavailable on the selected Touchscreen Controller.



Figure 6-25 METAR information on the Airport Weather Screen

SURFACE ANALYSIS AND CITY FORECAST

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.

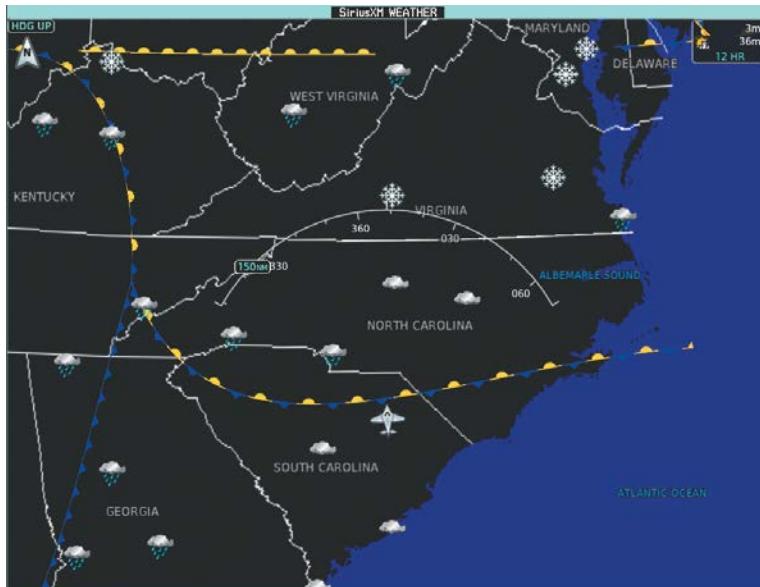


Figure 6-26 Current Surface Analysis Weather Product

Displaying Surface Analysis and City Forecast information:

- 1) From **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 pop-up 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 6-27 Surface Analysis and City Forecast Legend

FREEZING LEVELS

Freezing Level data shows the color-coded contour lines for the altitude and location at which the first isotherm is found (Figure 6-28). 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.

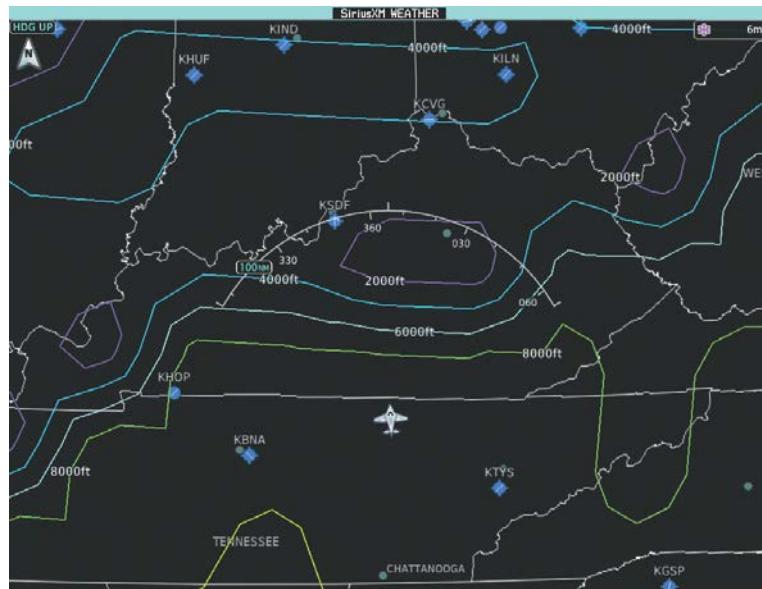


Figure 6-28 Freezing Level Weather Product

Displaying Freezing Level information:

- 1) From **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 6-29 Freezing Level Legend

WINDS ALOFT

The Winds Aloft weather product (Figure 6-30) 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 **Home**, touch **Weather > Weather Selection > SiriusXM Weather > SiriusXM 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 from the pop-up Window.

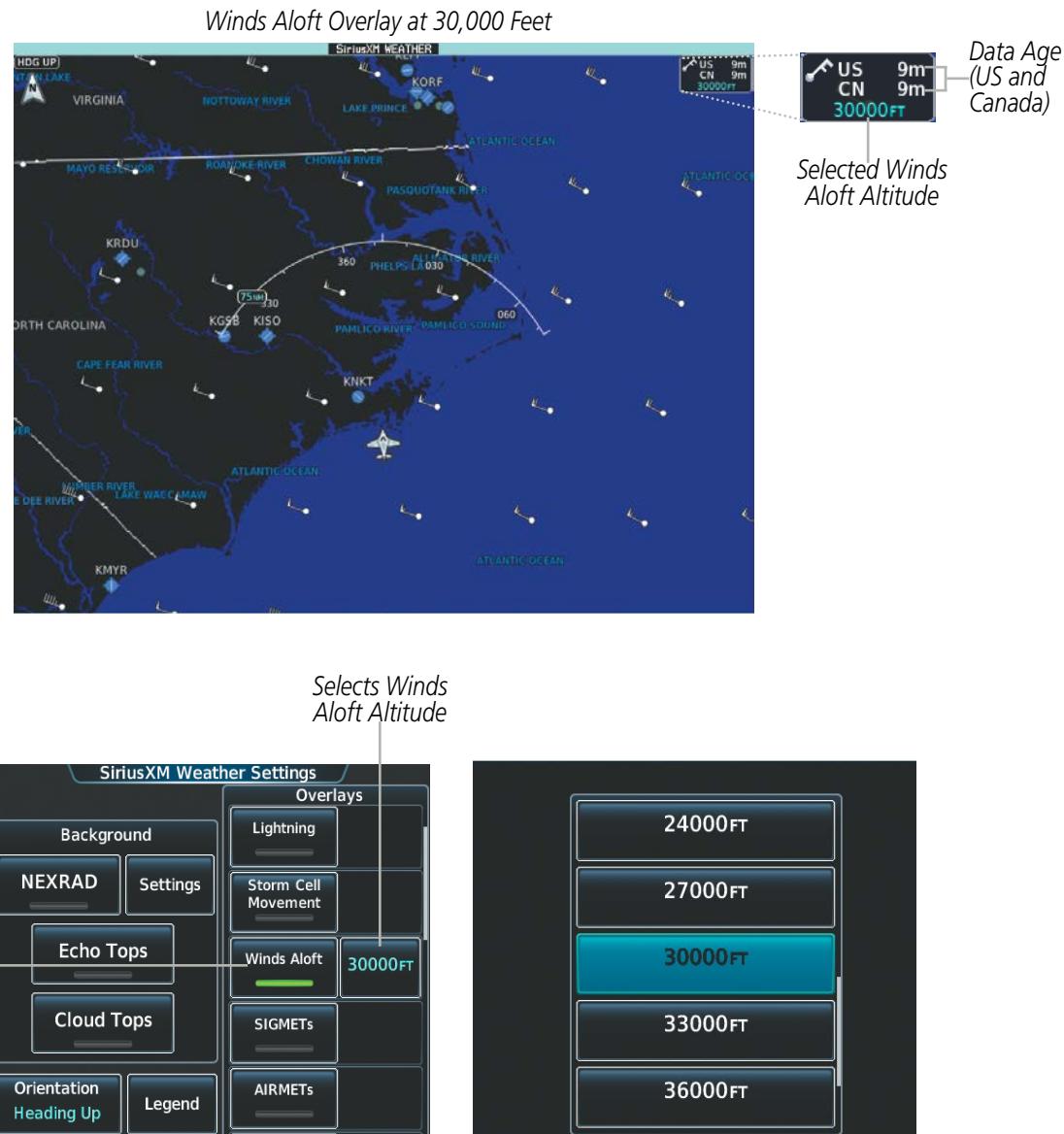


Figure 6-30 Selecting a Winds Aloft Altitude on the SiriusXM Weather Settings Screen

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**.

Winds Aloft	
0 Knots	•
5 Knots or Less	•—
10 Knots or Less	•—
50 Knots or Less	•—

Figure 6-31 Winds Aloft Data Legend

Headwind and tailwind components aloft are available inside the Vertical Situation Display (VSD) Inset Window on the Navigation Map Pane (Figure 6-32). 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 6-32 VSD Inset Window with Winds Aloft Information

Arrows pointing to the left indicate headwind components; tailwind component arrows point to the right, as shown in Table 6-3.

Headwind Symbol	Tailwind Symbol	Headwind/Tailwind Component
None	None	Less than 5 knots
		5 knots
		10 knots
		50 knots

Table 6-3 Profile View Headwind/Tailwind Component Symbols

Enabling/Disabling VSD (containing winds aloft data)

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

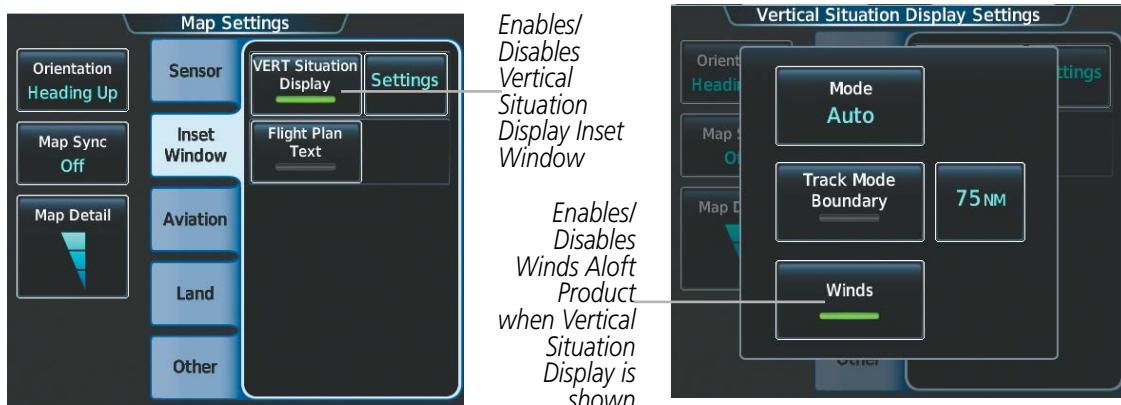


Figure 6-33 Controlling the display of Winds Aloft information for VSD Inset Window

COUNTY WARNINGS

The County Warnings weather product (Figure 6-34) 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.

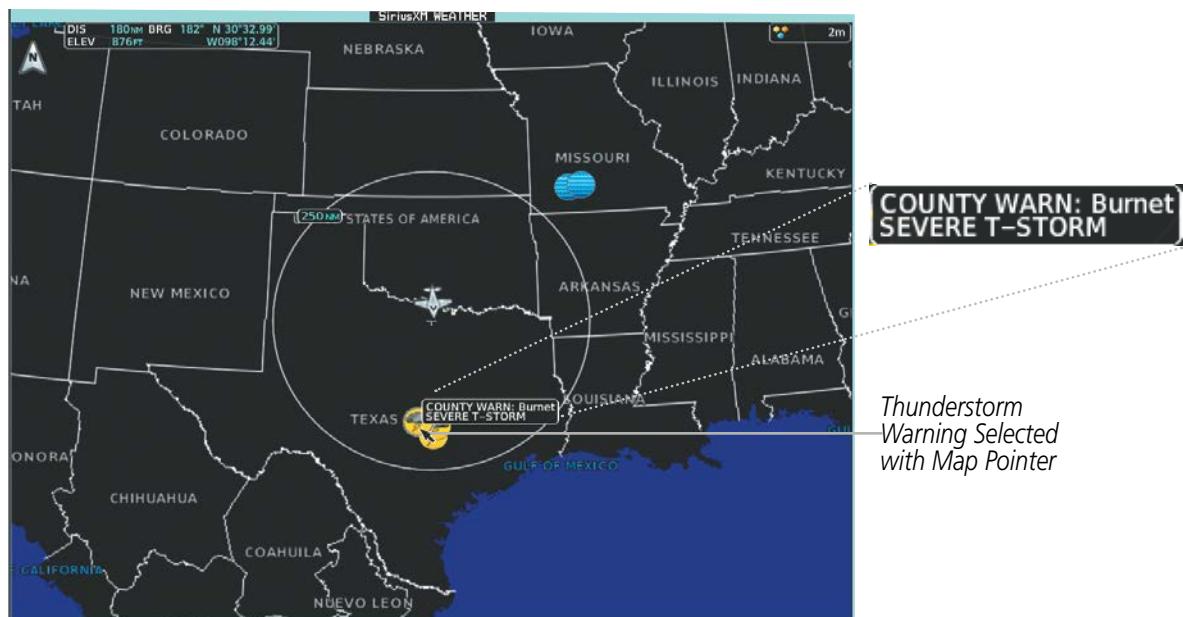


Figure 6-34 County Warnings Weather Product

Displaying County Warning information:

- 1) From **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 **Joystick** to activate the map pointer and move the **Joystick** to highlight a selected County Warning. County Warning information appears in a box near the map pointer.
- 4) When finished, press the **Joystick** 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 6-35 County Warnings Legend

CYCLONE WARNINGS

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.

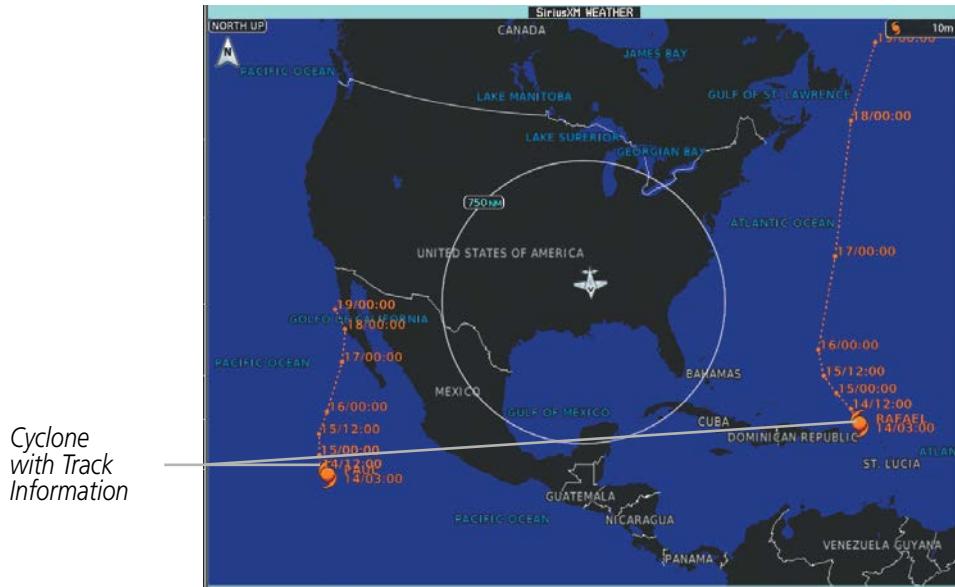


Figure 6-36 Cyclone (Hurricane) Weather Product



NOTE: The Cyclone weather product is not available unless at least one cyclone or tropical storm has been received. The weather product age indicates 'N/A' when no cyclone or tropical storm has been received.

Enabling/Disabling cyclone (hurricane) weather product:

- 1) From **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**.

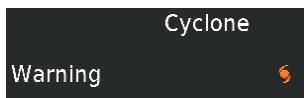


Figure 6-37 Cyclone Legend

ICING (CIP & SLD)



NOTE: *Icing data cannot be displayed at the same time as NEXRAD data.*

The Current Icing Potential (CIP) weather product (Figure 6-38) 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 **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.)

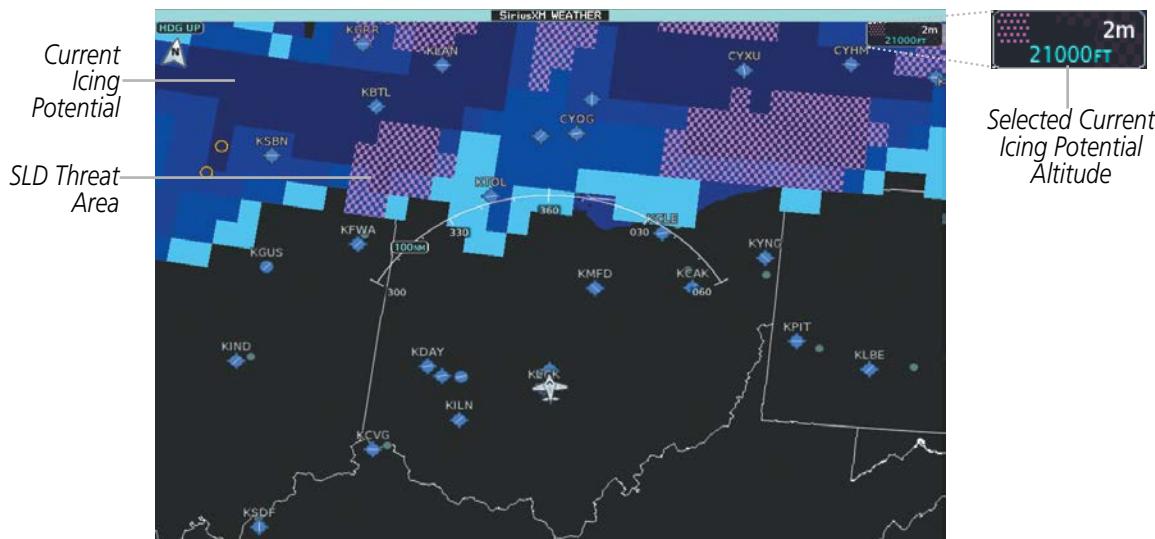


Figure 6-38 Current Icing Potential Overlay at 21,000 Feet

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 6-39 Icing Legend

TURBULENCE



NOTE: The Turbulence weather product cannot be displayed at the same time as NEXRAD weather product.

The Turbulence weather product (Figure 6-40) 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 **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).

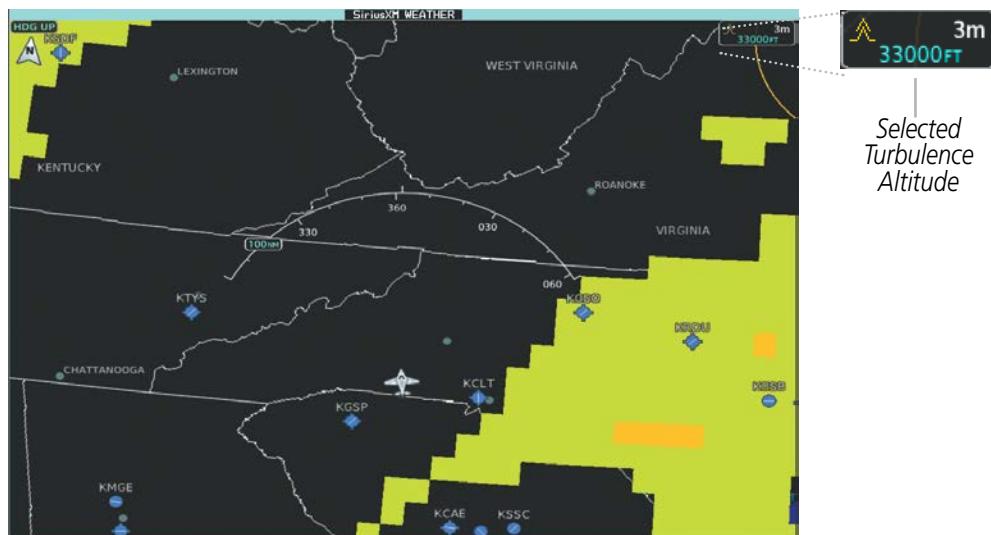


Figure 6-40 Turbulence Weather Product at 33,000 Feet

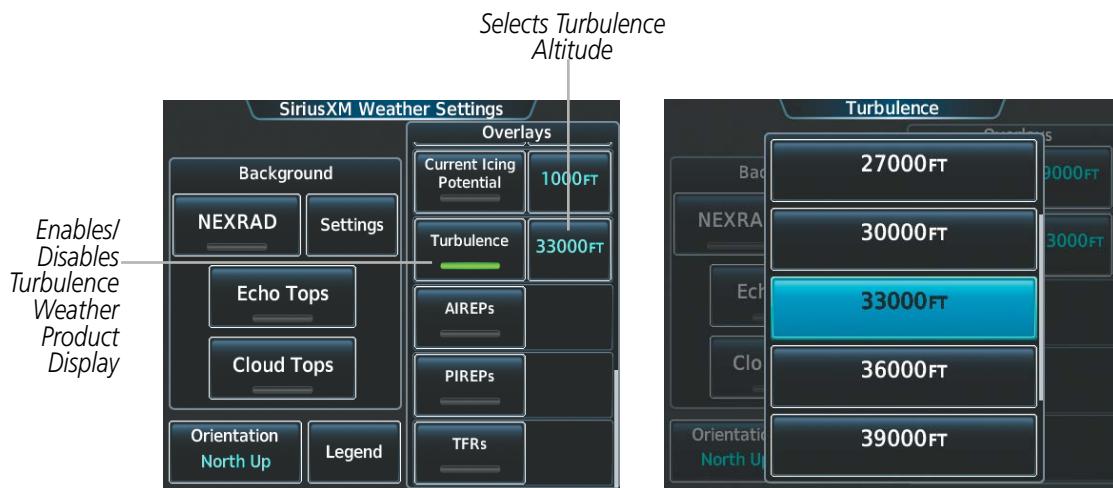


Figure 6-41 Selecting a Turbulence Altitude on the SiriusXM Weather Settings Screen

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**.

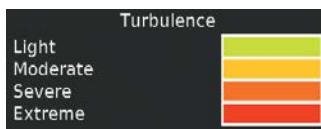


Figure 6-42 Turbulence Legend

PIREPS AND AIREPS

Pilot Weather Reports (PIREPs) (Figure 6-43) 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). AIREPs are used almost exclusively by commercial airlines.

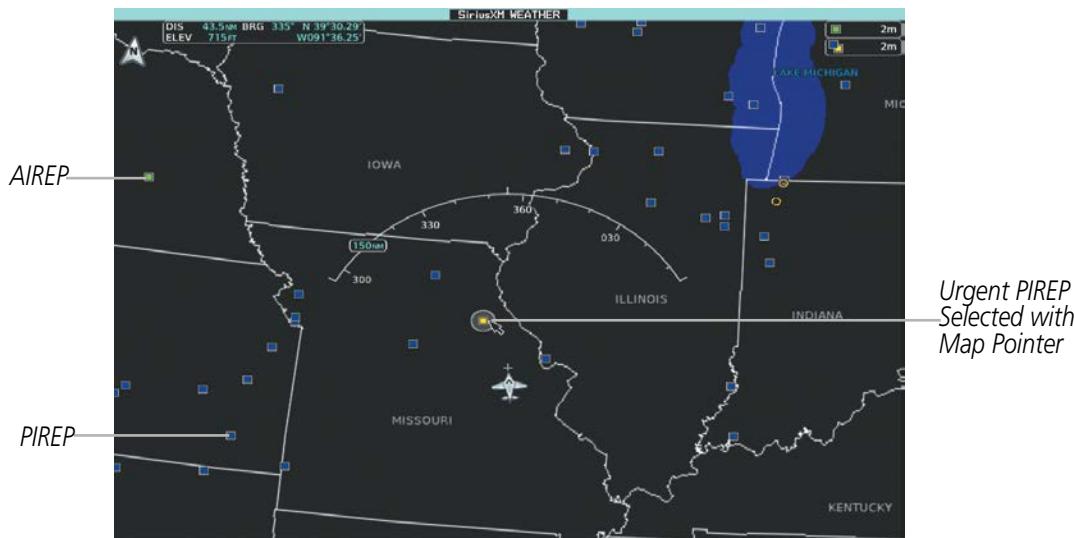


Figure 6-43 AIREPs and PIREPs on the SiriusXM Weather Pane

Displaying PIREP or AIREP information:

- 1) From **Home**, touch **Weather > Weather Selection > SiriusXM Weather > SiriusXM Settings**.
- 2) Scroll in the Overlays Window as needed and touch the **AIREPs** or **PIREPs** Buttons.
- 3) To view PIREP/AIREP text, push the joystick to activate the map pointer and move the pointer with the joystick until the selected report is highlighted, then touch the **Info** Button.
- 4) Scroll as needed through the report text, then touch **Back** or **Home**.



Figure 6-44 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 6-45 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.

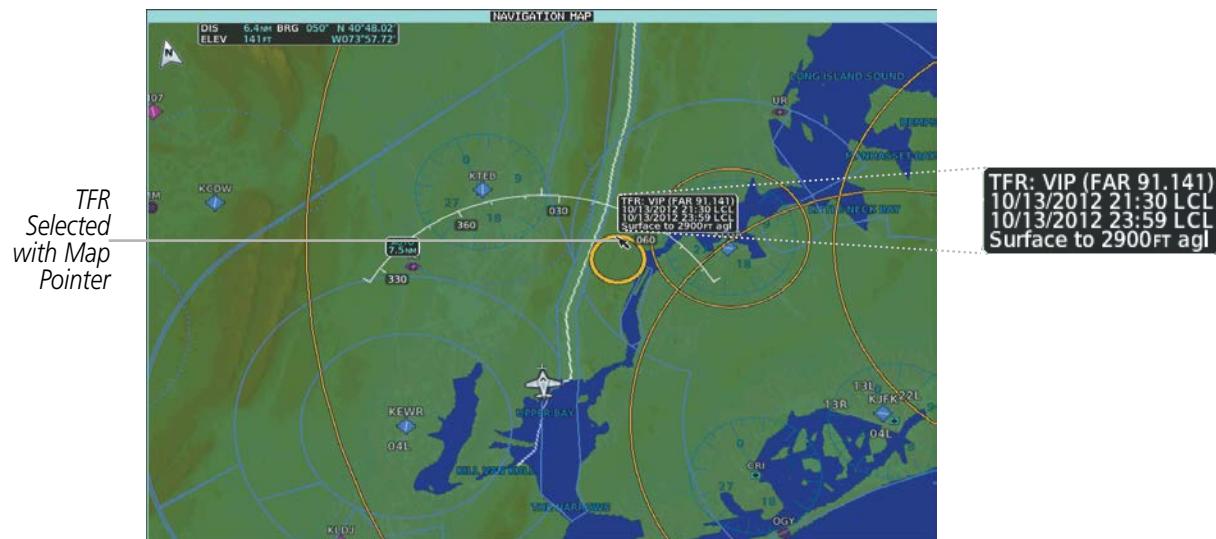


Figure 6-46 TFR Text for TFR Selected with Map Pointer

Enabling/disabling TFR information (SiriusXM Weather Pane):

- 1) From Home, touch **Weather > Weather Selection > SiriusXM Weather > SiriusXM Settings**.
- 2) Scroll in the Overlays Window as needed and touch the **TFRs** Button.
- 3) To view TFR text, push the **Joystick** to activate the map pointer and move the pointer with the **Joystick** or **Touchpad** until the selected TFR is highlighted. The TFR text appears near the map pointer for the selected TFR.
- 4) When finished, push the **Joystick**, or touch **Back** or **Home**.

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. To control the display of TFR information for on the PFD Inset Map, enable Split Mode on the PFD, then follow the following procedures.

Enabling/disabling TFR information (Navigation Maps)

- 1) From **Home**, touch **Map > Map Settings**.
- 2) If necessary, touch the Sensor Tab.
- 3) Scroll to find the **TFR** Button, and touch to enable/disable TFR information.

Setting up and customizing TFR data for maps on which TFR data can be displayed:

- 1) From **Home**, touch **Map > 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 6-47 Customizing TFR display settings for Navigation Maps

6.2 GARMIN CONNEXT 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 significantly older than the indicated weather product age.



NOTE: Do not rely on data link weather information to discern precise values for any weather-related measurements. Data link weather information is presented for informational purposes only, and should never be used as a replacement for official sources of in-flight weather information.



NOTE: The availability of specific Garmin Connnext Weather products varies by region and by subscription type. For Garmin Connnext weather product coverage information, refer to <http://sites.garmin.com/connnext>.

The optional Garmin GSR 56 Iridium Satellite data link provides the system with Garmin Connnext Weather information. Graphical weather information and associated text are available on the map displays, with additional information and controls on the Touchscreen Controllers.

The system retrieves weather data after the flight crew selects either an immediate or automatically recurring weather data request to the Garmin Connnext Weather service using the Touchscreen Controllers.

In order to receive Connnext Weather data, an account must first be established with Garmin Connnext services. Refer to the Additional Features section, for more information.

REGISTERING THE SYSTEM FOR GARMIN CONNEXT SERVICES

When an account is established, Garmin Connnext services provides an Access Code which must be entered and transmitted to Garmin in order to receive Garmin Connnext weather data.

Registering the system to receive Garmin Connnext Weather:

- 1) Ensure the aircraft is outside with an unobstructed view of the sky.
- 2) From **Home**, touch **Utilities > Setup > Connnext Registration**. If the Registration Information Window indicates 'Not Registered', continue with this procedure.
- 3) Touch the **Register** Button.
- 4) Use the Touchscreen Controller Keypad or large and small right knobs to supply the access code provided from Garmin Connnext customer service.
- 5) Touch the **Enter** Button or press the right knob. The system contacts the Garmin Connnext 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 6-48 Connexx Registration Screen Prior to Registration



Figure 6-49 Enter Access Code Provided by Garmin Connexx Customer Service

ACCESSING GARMIN CONNEXX WEATHER PRODUCTS

The Connexx Weather Pane is the principal map display for viewing Connexx Weather information (Figure 6-50). This is the only map display capable of showing information for all available Connexx Weather products.

Viewing the Connexx Weather Pane:

From **Home**, touch **Weather > Weather Selection > Connexx Weather**.

In order for the system to display Garmin Connexx weather information, the flight crew must first send a Connexx Weather Data Request using the Connexx Weather Settings Screen on the Touchscreen Controller.

TFR information enabled but not available

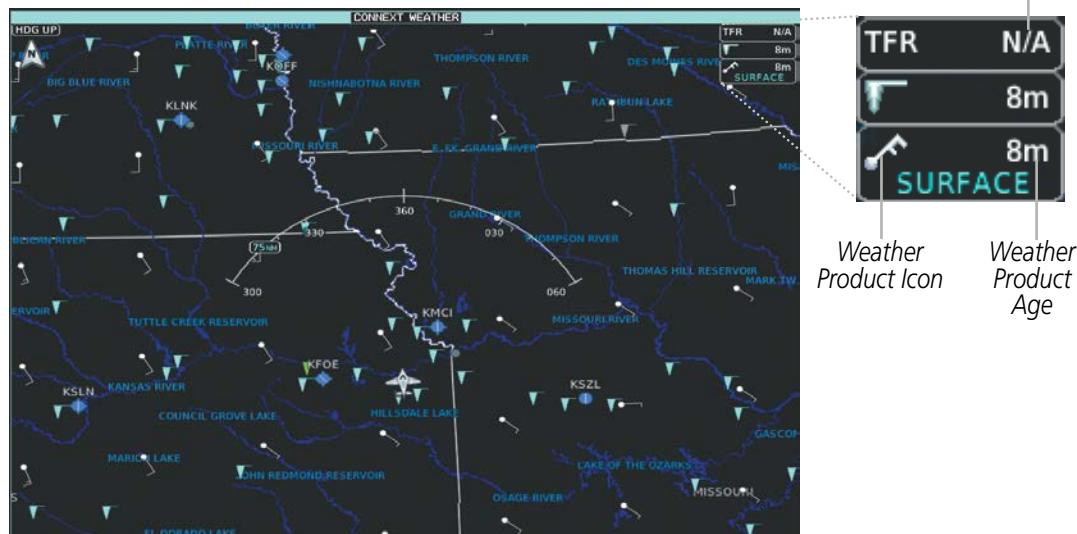


Figure 6-50 Connexx Weather Pane with METARS and Winds Aloft Enabled

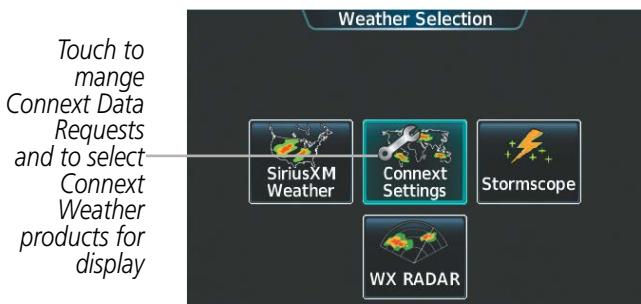


Figure 6-51 Weather Selection Screen

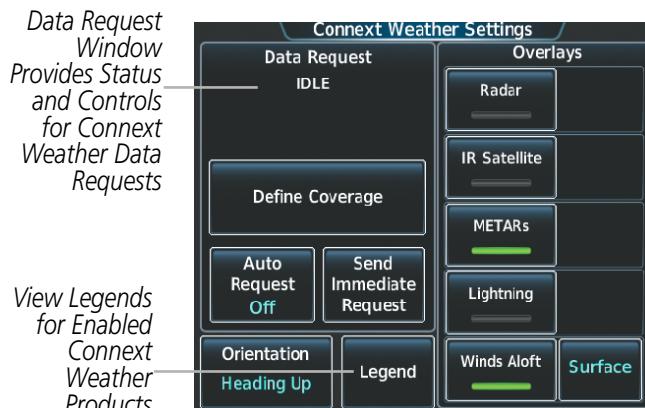


Figure 6-52 Connex Weather Settings Screen

When a weather product is enabled on the Connex Weather Pane, a box containing the icon or name for the product and its age (in minutes) appears in the upper right of the pane (Figure 6-50). If weather data has not been requested or is not currently available from Garmin Connex, 'N/A' is shown next to the product symbol instead of an age. The age of the weather product is based on the time difference between when the data was assembled on the ground and the current GPS time. Weather products are updated continuously or refreshed at specific intervals (defined in the **Refresh Rate** column in Table 6-4).

If for any reason, a weather product is not refreshed within the defined **Expiration Time** intervals (see Table 6-4), the data is considered expired and is removed from the display. The age of the expired product is replaced by dashes. If more than half of the expiration time has elapsed, the color of the product age changes to amber.

The weather product age and availability information can also be displayed for Garmin Connex Weather products enabled on the PFD Inset Map.

Displaying/Removing Weather Product Age Information on the PFD Inset Map:

- 1) Press the **Inset Map Settings** Softkey.
- 2) Press the **Weather Legend** Softkey to enable/disable the weather product age information.

Table 6-4 shows the Garmin Connex Weather product symbols, the expiration time and the refresh rates. The refresh rate represents the interval at which Garmin Connex weather services makes available the most current known weather data. It does not necessarily represent the rate at which new content is received from various weather sources.



NOTE: The availability of specific Garmin Connex Weather products varies by region and by subscription type. For Garmin Connex weather product coverage information, refer to <http://sites.garmin.com/connex>.

Garmin Connex Weather Product	Symbol	Expiration Time (Minutes)	Refresh Rate (Minutes)
Connex Radar		30	U.S.: 3* Canada: 3*† Europe: 15 Australia: 15^
Infrared Satellite		60	30
Connex Lightning		30	Continuous
SIGMETs/AIRMETs		60	Continuous
Meteorological Aerodrome Report (METARs)		90	Continuous
Winds Aloft		90	Continuous
Pilot Weather Reports (PIREPs)		90	Continuous
Temporary Flight Restrictions (TFRs)	no product image	60	Continuous
Terminal Aerodrome Reports (TAFs)		60	Continuous

* The composite radar 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.

^ Australian radar precipitation data provided by the Australia Bureau of Meteorology

Table 6-4 Garmin Connex Weather Product Symbols and Data Timing

Table 6-5 shows which Garmin Connex Weather products can be displayed (indicated with a '+' symbol) on specific maps.

Garmin Connex Weather Product	PFD Inset Map	Navigation Map Pane	Garmin Connex Weather Pane	VSD Inset Window
Garmin Connex Radar	+	+	+	
No Radar Coverage	+	+	+	
Infrared Satellite			+	
Lightning	+	+	+	
SIGMETs			+	
AIRMETs			+	
METARs	+	+	+	
Winds Aloft			+	+
PIREPs			+	
TFRs	+	+	+	

Table 6-5 Garmin Connex Weather Product Display Maps

Softkeys control which weather products are shown on the PFD Inset Map. The Touchscreen Controller controls the display of weather information on display panes.

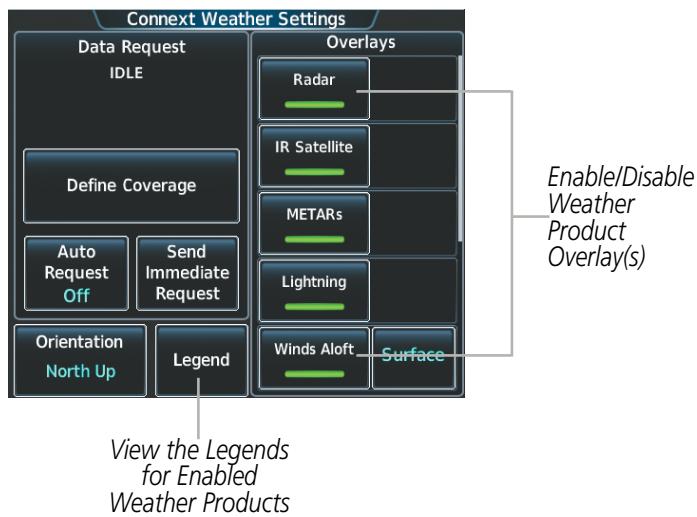


Figure 6-53 Connex Weather Settings Screen

The Map Settings Screen controls the enabling/disabling of Garmin Connex Weather information on Navigation Map Panes.

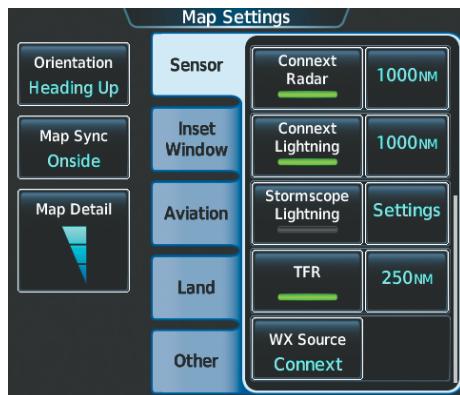


Figure 6-54 Map Settings Screen

For Navigation Maps (including the Inset Map), the flight crew can select the maximum map range to display each Garmin Connex Weather product. If the flight crew increases the map range beyond the selected maximum map range for a given weather product, the system removes the product from the map. The maximum map range settings are accessible using the Map Settings Screen.

Selecting Maximum Navigation Map Range for Garmin Connex Weather Products:

- 1) From **Home**, touch **Map > Map Settings**.
- 2) If necessary, touch the **Sensor** Tab.
- 3) Scroll through the list to view the available weather products.
- 4) Touch a range button next to the corresponding weather product, then touch to select the maximum navigation map range at which the system will display the selected weather product.

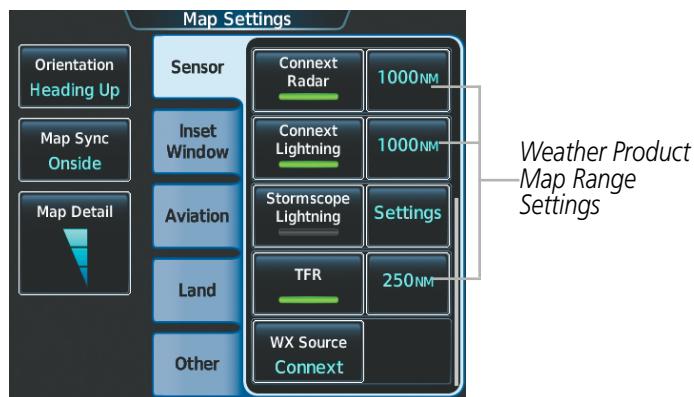


Figure 6-55 Map Settings Screen
(Sensor Tab Selected)

The system provides the ability to select a map orientation for the Connex 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 Connex Weather Pane orientation to the Navigation Map Pane orientation.

Selecting a map orientation for the Connex Weather Pane:

- 1) From **Home**, touch **Weather > Weather Selection > Connex Weather > Connex 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 6-56 Selecting a Map Orientation for the Connex Weather Pane

If more than one weather data link weather service has been installed (such as SiriusXM Weather), the system provides the option to select a source of weather information for each Navigation Map Pane and Inset Map.

Selecting a Weather Data Link Source for Navigation Map Panes:

- 1) From **Home**, touch **Map > 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 service to be used (such as Connex or SiriusXM).

Selecting a Weather Data Link Source for the Inset Map:

- 1) Press the **Inset Map Settings** Softkey. The **Wx Source** Softkey appears with the currently selected data link weather source displayed in cyan on the softkey.
- 2) Press the **Wx Source** Softkey as needed to cycle through the data link weather sources (such as SiriusXM, Connex).

The available **Inset Map Settings** Softkeys correspond to the selected data link weather source.

Navigation Maps displaying data link weather products show the name of the selected source ('Connex WX' or 'SiriusXM') in the upper-right corner of the map while data link weather products are enabled for display.

The Connex Weather Settings Screen on the Touchscreen Controller can display a legend for each weather product currently enabled on the Connex Weather Pane.

Viewing legends for weather products enabled on the Connex Weather Pane:

- 1) From Home, touch **Weather > Weather Selection > Connex Weather > Connex 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**.

The system provides additional information about the following weather products by panning over the product on the map:

- Infrared Satellite
- METARs
- SIGMETs
- AIRMETs
- TFRs
- PIREPSs

The **Joystick** or **Touchpad** control the Map Pointer. These controls also adjust the map range. If the map range is adjusted while panning is enabled, the map is re-positioned on the Map Pointer.

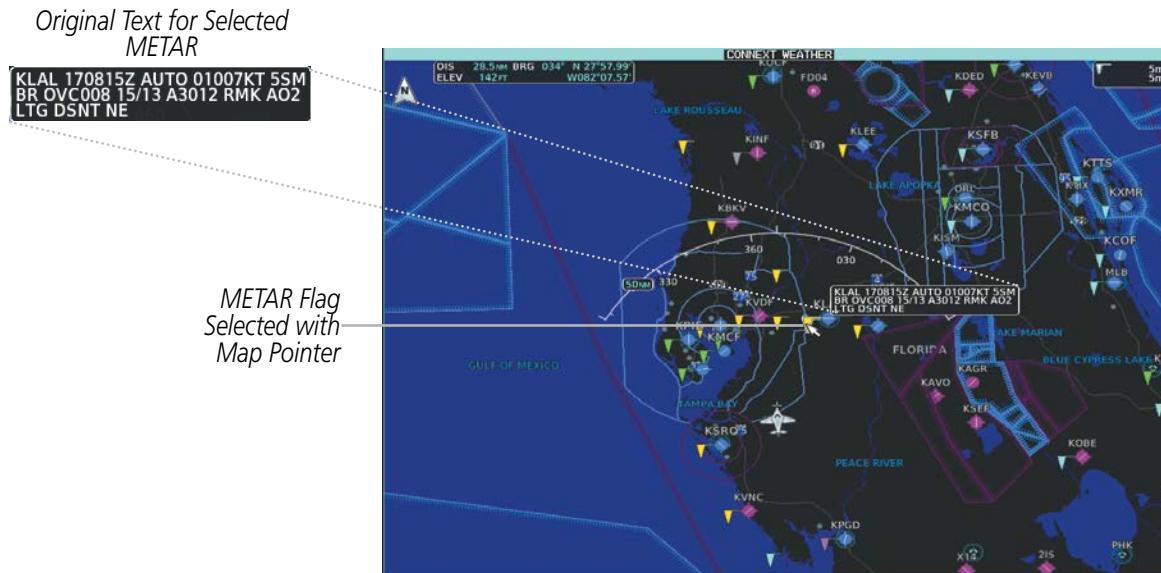


Figure 6-57 Panning with the Map Pointer for Additional Information

CONNEX WEATHER DATA REQUESTS

The Data Request Window on the Connex Weather Settings Screen provides the flight crew with the options to define weather data request coverage areas, select automatic weather data request intervals, and provides the ability to send an manual data request immediately. The Data Request Window also displays the status of the Connex Data Request process.

Before the system can retrieve weather information, a valid coverage area must be defined from which all available Garmin Connex Weather products will be retrieved (regardless of which weather products are currently enabled for display). The flight crew may define the coverage area by enabling/disabling one or more of the following buttons at any time:

- **P.POS** (Present Position)
- **Flight Plan** (active)
- **Destination** (as part of the active flight plan)
- **Waypoint**

It is not necessary to provide the system with the destination, flight plan, or waypoint prior to enabling these buttons. However, if none of this information is supplied, the present position must be included in the Connex Data Request. Otherwise, the Data Request Window indicates 'INVALID COVERAGE AREA' when performing a data request, because the system has insufficient information to define the coverage area.

Defining Weather Data Request Coverage Area:

- 1) From **Home**, touch **Weather > Weather Selection > Connex Weather > Connex Settings**.
- 2) Touch the **Define Coverage** Button.
- 3) To change the diameter and route width of the weather data request coverage area, touch the **Diameter/Width** Button. Scroll as needed and touch the desired distance button in the pop-up 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 knobs to enter a waypoint to include in the weather data request, then touch the **Enter** Button or press the small knob.
- 9) When finished, touch the **Back** Button to return to the Connex Weather Settings Screen, or touch **Home**.

Sending/Cancelling an Immediate Weather Data Request:

- 1) From **Home**, touch **Weather > Weather Selection > Connex Weather > Connex Settings**.
- 2) Touch the **Send Immediate Request** Button. The system contacts Garmin Connex services and displays the status in the Data Request Window. System displays 'Completed' when finished.
- 3) If desired, touch the **Cancel Immediate Request** Button while a request is occurring. Data Request Window displays 'Cancelled'.

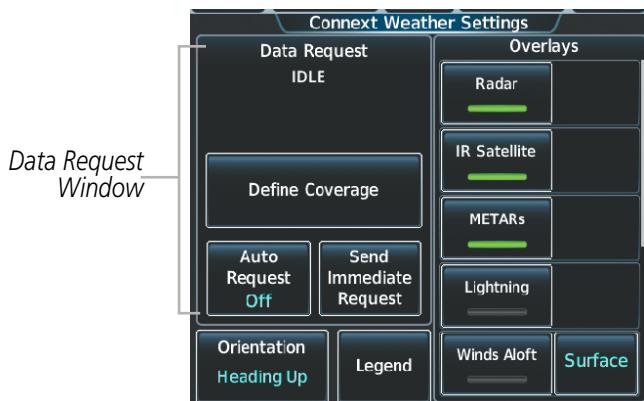


Figure 6-58 Connex Weather Settings Screen



Figure 6-59 Selecting coverage area for Connex Data Request

During a weather data request, the Data Request Window initially displays “Contacting Connex...”. Once a connection is established, the Data Request Window displays “Receiving Wx Data... Time Remaining:” with an estimated data transfer time (either minutes or seconds). Connex Data Requests typically take between one to four minutes to complete depending on the size of the selected weather coverage area and the data link signal strength. If the system cannot complete the data request, the Data Request Window displays an error; see the Abnormal Operations discussion later in this section for more information.

The system retrieves all available Connex Weather products within the selected coverage area during an initial weather data request, regardless of which products (if any) are currently enabled for display. On subsequent weather data requests, previously retrieved textual products (such as METARs and TAFS) are retained if not expired, while new textual weather data matching the current coverage area and all graphical weather data is downloaded during every data request.

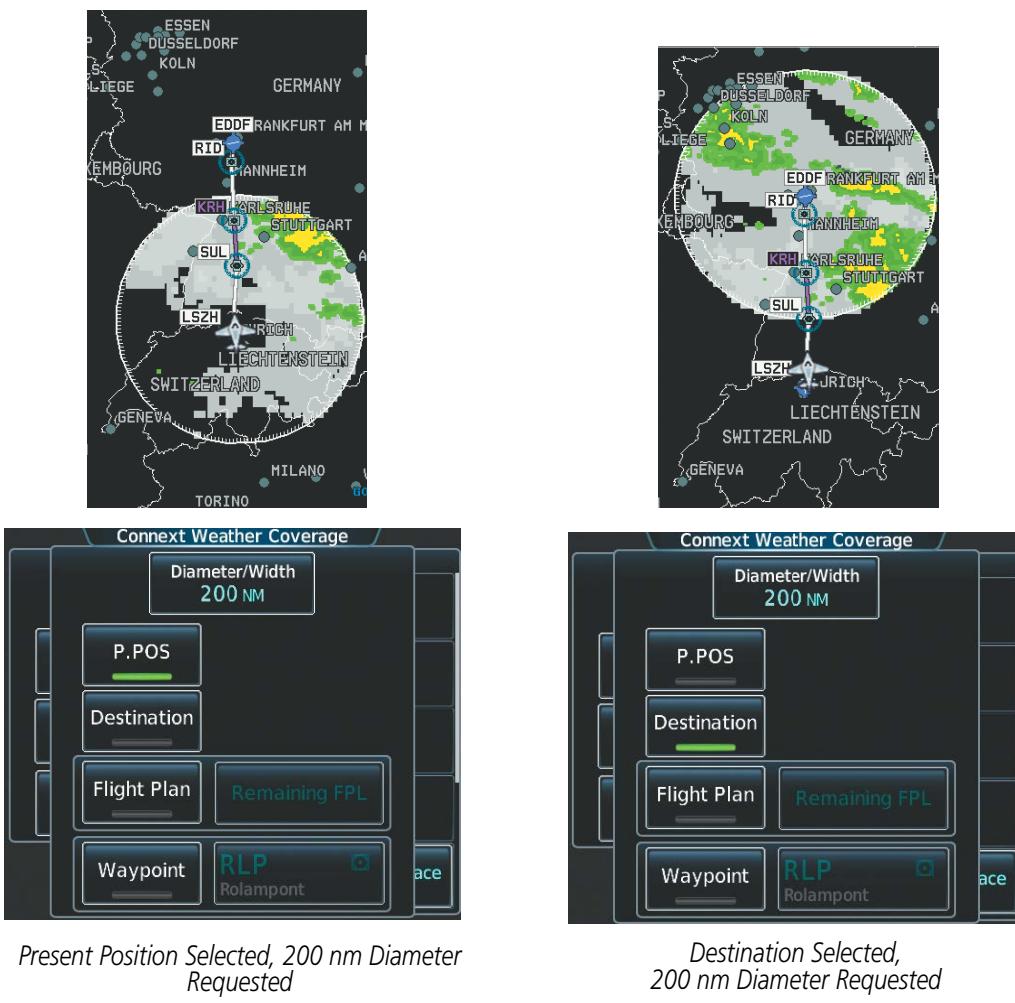


Figure 6-60 Connex Weather Coverage Options for Present Position and Destination

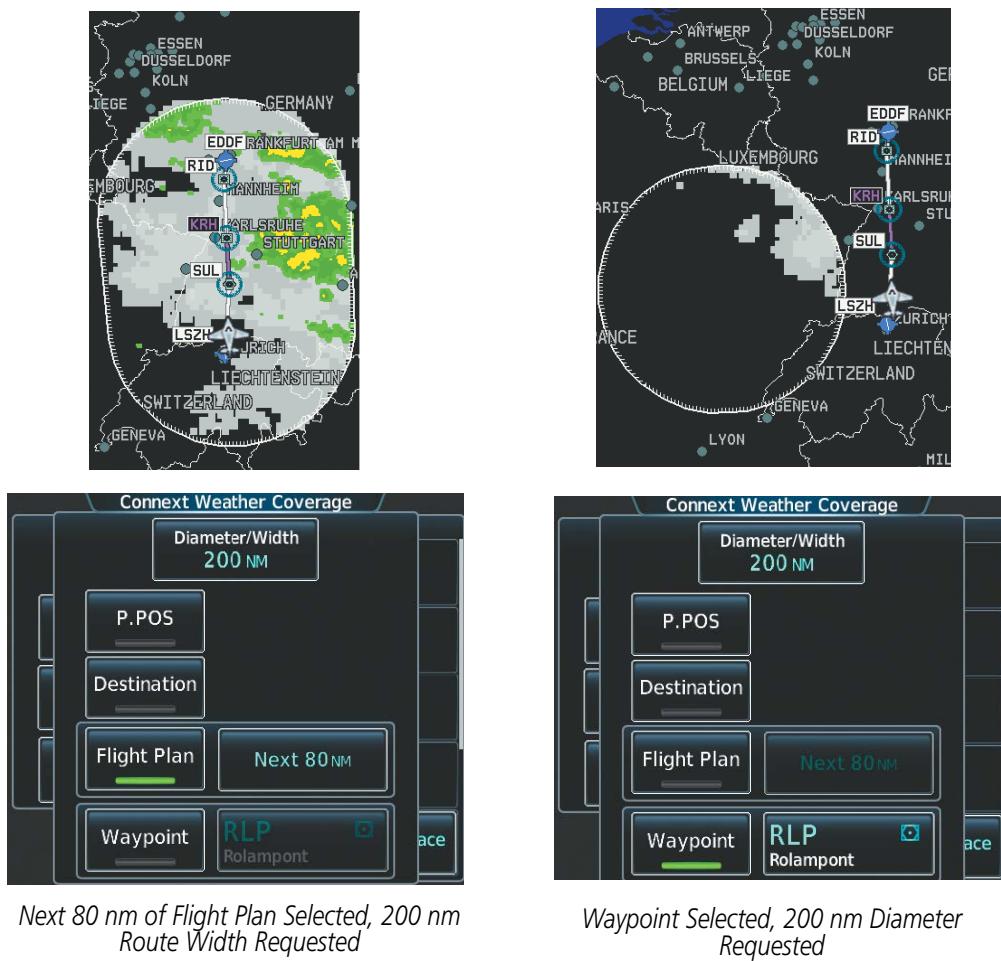


Figure 6-61 Connext Weather Coverage Options based on Flight Plan and Waypoint Selections

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 unto the next Automatic data request occurs.

Enabling/disabling automatic Connext Data Requests:

- 1) From **Home**, touch **Weather > Weather Selection > Connext Weather > Connext Settings**.
- 2) Touch the **Auto Request** Button.
- 3) From the pop-up 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.

GARMIN CONNEXXT WEATHER PRODUCTS

RADAR

The Garmin Connexxt 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 Connexxt Weather service collects these images, and assigns a single time to indicate when it created the image. This composite image becomes the Garmin Connexxt 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 Connexxt 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.

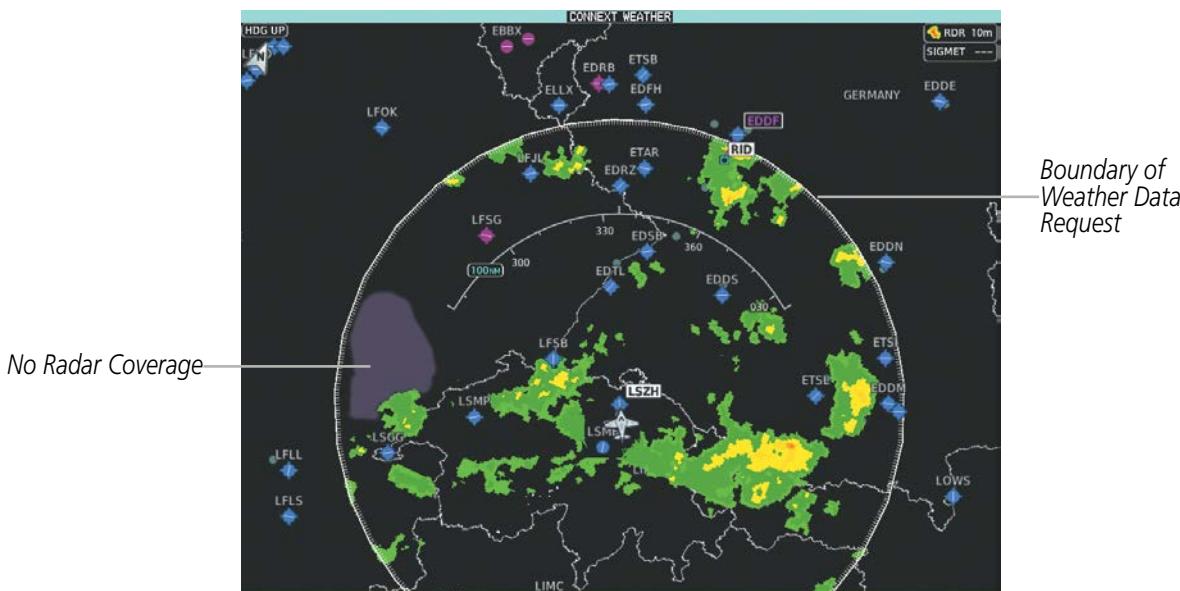


Figure 6-62 Connexxt Weather Pane with Connexxt Radar Enabled

Enabling/Disabling NEXRAD weather information (PFD Inset Navigation Map)

- 1) Press the **Inset Map Settings** Softkey.
- 2) Press the **Connexxt Radar** Softkey.

Displaying Garmin Connexxt Radar information (navigation maps)

- 1) From **Home**, Touch **Map > Map Settings**.
- 2) If necessary, touch the **Sensor** tab.
- 3) Scroll if needed and touch the **Connexxt Radar** Button

Displaying Garmin Connex Weather Radar information (Connex Weather Pane)

- 1) From **Home**, touch **Weather > Weather Selection > Connex Weather > Connex Settings**.
- 2) Touch the **Radar** Button in the Overlays Window.

Connex Weather Radar data shown represents lowest level, base reflectivity, of radar returns. The display of the information is color-coded to indicate the weather severity level. All weather product legends can be viewed on the Connex Weather Pane. For the Connex Radar legend (Figure 6-63), touch the **Legend** Button on the Connex Weather Settings Screen when Connex Weather is enabled for display.

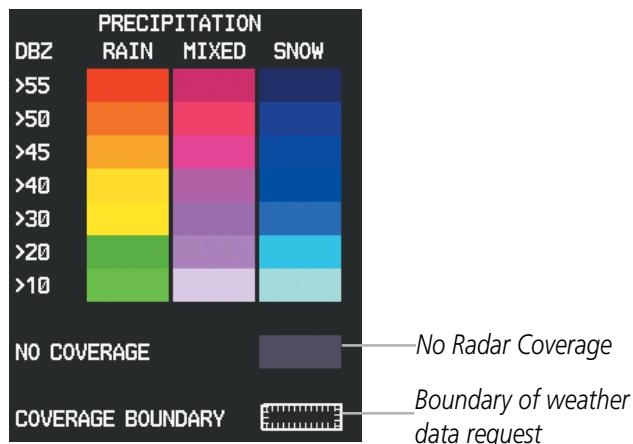


Figure 6-63 Connex Weather Radar Legend

The display of no radar coverage is enabled when Garmin Connex Radar is enabled for display. Areas where radar coverage is not currently available or is not being collected are indicated in a gray shade of purple. A white boundary line with white tick marks depicts the selected coverage area of the Connex Data Request (as defined in the Data Request Window). This boundary encloses the precipitation data when this weather product is displayed. This boundary assists the flight crew in differentiating an area without precipitation from an area outside of the Connex Data Request coverage area.

REFLECTIVITY

Reflectivity is the amount of transmitted power returned to the radar receiver. Colors on the Precipitation display directly correlate to the level of detected reflectivity. Reflectivity as it relates to hazardous weather can be very complex.

The role of radar is essentially to detect moisture in the atmosphere. Simply put, certain types of weather reflect radar better than others. The intensity of a radar reflection is not necessarily an indication of the weather hazard level. For instance, wet hail returns a strong radar reflection, while dry hail does not. Both wet and dry hail can be extremely hazardous.

The different radar echo intensities are measured in decibels (dB) relative to reflectivity (Z). Weather radars measure the reflectivity ratio, or the energy reflected *back to* the radar receiver (designated by the letter Z). The value of Z increases as the returned signal strength increases.

RADAR LIMITATIONS

Radar images may have certain limitations:

- Radar base reflectivity does not provide sufficient information to determine cloud layers or precipitation characteristics (wet hail vs. rain). For example, it is not possible to distinguish between wet snow, wet hail, and rain.
- 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.

The following may cause abnormalities in displayed radar images:

- Ground clutter
- Strobes and spurious radar data
- Sun strobes (when the radar antenna points directly at the sun)
- Interference from buildings or mountains, which may cause shadows
- Metallic dust (chaff) from military aircraft, which can cause alterations in radar scans

INFRARED SATELLITE

The Infrared (IR) Satellite weather product (Figure 6-64) 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.

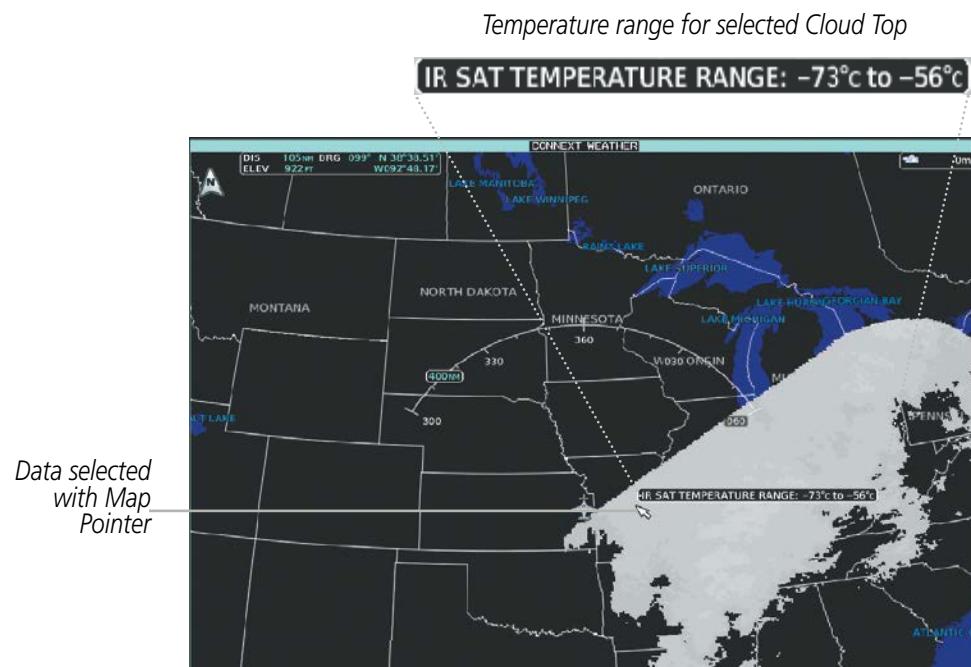


Figure 6-64 Cloud Tops Weather Product on Connex Weather Pane

Displaying Cloud Tops information (Connext Weather Pane):

- 1) From **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 (Figure 6-65), touch the **Legend** Button on the Connext Weather Settings Screen when the Cloud Tops weather product is enabled for display.

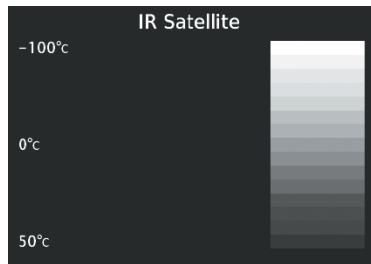


Figure 6-65 Infrared Satellite Legend

GARMIN CONNEXXT LIGHTNING

The Garmin Connexxt Lightning weather product (Figure 6-66) shows the approximate location of cloud-to-ground lightning strikes. A strike icon represents a strike that has occurred within a two-kilometer region. Neither cloud-to-cloud nor the exact location of the lightning strike is displayed.



Figure 6-66 Lightning Strikes on Connexxt Weather Pane

Displaying Connexxt Lightning information (Connexxt Weather Pane):

- 1) From **Home**, touch **Weather > Weather Selection > Connexxt Weather > Connexxt Settings**.
- 2) Touch the **Lightning** Button in the Overlays Window.

To display the Lightning legend on the Touchscreen Controller (Figure 6-67), touch the **Legend** Button on the Connexxt Weather Settings Screen when the Connexxt Lightning weather product is enabled for display.

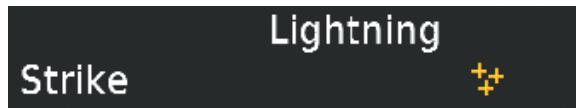


Figure 6-67 Connexx Lightning Legend

Displaying Connexx Lightning information (Navigation Map Pane):

- 1) From **Home**, touch **Map > Map Settings**.
- 2) If necessary, touch the Sensor tab.
- 3) Scroll as needed in the Overlays Window and touch the **Connexx Lightning** Button.

Displaying Connexx Lightning (Inset Map):

- 1) Select the **Inset Map Settings** Softkey.
- 2) Select the **Connexx Lightning** Softkey.

SIGMETs AND AIRMETS

SIGMETs (SIGnificant METeorological Information) and AIRMETs (AIRmen's METeorological Information) are issued for potentially hazardous weather. A Convective SIGMET is issued for hazardous convective weather such as severe or widespread thunderstorms. A localized SIGMET can be displayed when significant weather conditions are not widespread.

The entire SIGMET or AIRMET is displayed as long as any portion of it occurs within the boundaries defined during the weather data request.

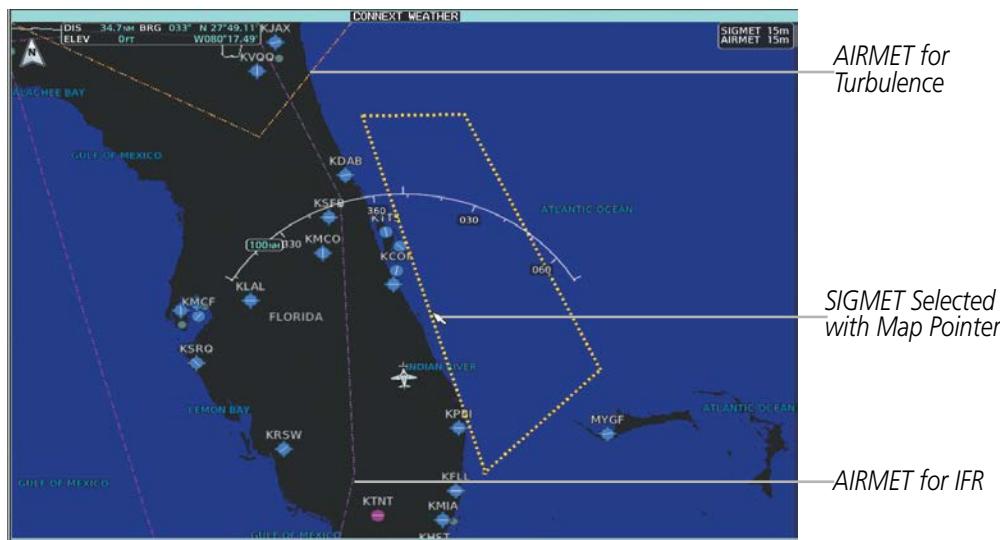


Figure 6-68 SIGMETs and AIRMETs on the Connexx Weather Pane

Enabling/Disabling SIGMETs and AIRMETs (Connexx Weather Pane):

- 1) From **Home**, touch **Weather > Weather Selection > Connexx Weather > Connexx Settings**.
- 2) Scroll in the Overlays Window and touch the **SIGMETs** and/or **AIRMETs** Buttons.

- 3) To view the text of an AIRMET or SIGMET, press the **Joystick** and move the map pointer with the **Joystick** or **Touchpad** over the SIGMET or AIRMET until it is highlighted.
- 4) Touch the **Info** Button to show the AIRMET / SIGMET Information Screen with the selected AIRMET or SIGMET.
- 5) Scroll as needed to view full text of the report, then touch the **Back** or **Home** buttons.

To display the SIGMET / AIRMET legend, touch the **Legend** Button on the Connx Weather Settings Screen when either product is enabled for display. Scroll as needed to view the legend, then touch **Back** or **Home**.

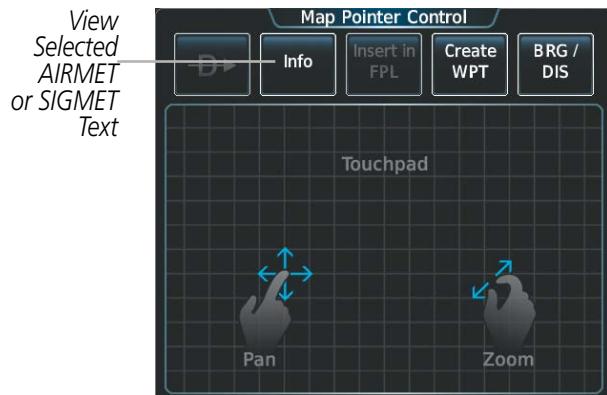


Figure 6-69 Map Pointer Control Screen

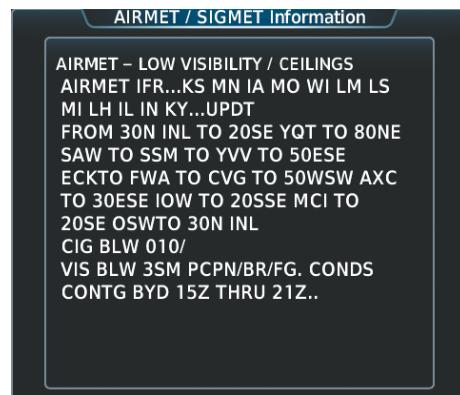


Figure 6-70 AIRMET/SIGMET Information Screen

METARS



NOTE: METAR information is only displayed within the installed navigation database service area.

METARS (METeorological Aerodrome Reports) typically contain information about the temperature, dewpoint, wind, precipitation, cloud cover, cloud 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 that provide them.

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.

Original Text for Selected METAR

KLAL 170815Z AUTO 01007KT 5SM
BR OVC008 15/13 A3012 RMK AO2
LTG DSNT NE

METAR Flag
Selected with
Map Pointer

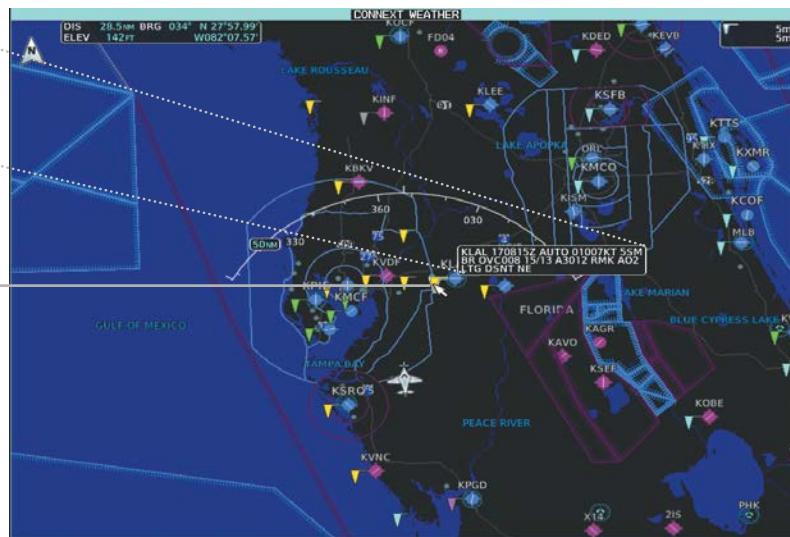


Figure 6-71 METAR Weather Product on Connex Weather Pane

Showing METAR text (Connex Weather Pane):

- 1) From **Home**, touch **Weather** > **Weather Selection** > **Connex Weather** > **Connex Settings**.
- 2) Touch the **METARs** Button in the Overlays Window.
- 3) To view METAR text, press the **Joystick** and move the Map Pointer with the **Joystick** or **Touchpad** over a METAR flag.

Showing METAR text (Navigation Map Pane):

- 1) From **Home**, touch **Map** > **Map Settings**.
- 2) If needed, touch the Sensor tab.
- 3) Touch the **Graphical METARs** Button.

The METAR flag color is determined by the information in the METAR text. The system displays a gray METAR flag when the METAR text does not contain adequate information.

Touch the **Legend** Button on the Connex Weather Settings Screen to display weather legend(s) for weather product(s) enabled on the Connex Weather Pane. Scroll as necessary to view the information, then touch **Back** or **Home**.

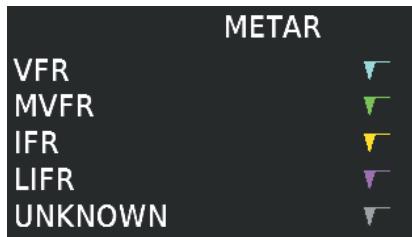


Figure 6-72 METAR Legend

Textual METAR/TAF information is available on the Airport Information Screen on the Touchscreen Controller for airports with a requested METAR available. This textual METAR/TAF information may come from any data link weather source available to the system (such as SiriusXM or Garmin Connexx), 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, then Garmin Connexx.

The textual display of METAR information on the Touchscreen Controller begins with the decoded version, followed by the original METAR text. Note the original METAR text may contain additional information not present in the decoded version. The TAF, if available for the selected airport, appears below the original METAR text. The system displays the data link weather source of the displayed METAR/TAF at the end of the report.

Viewing textual METAR and TAF information on the Airport Information Screen:

- 1) From **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 right knobs, then touch **Enter** or push the right knob.
- 5) Touch the METAR/TAF Tab.
- 6) Scroll as necessary to view METAR text. System indicates 'No METAR data available' if METAR information has not been received, has expired, or is not available.

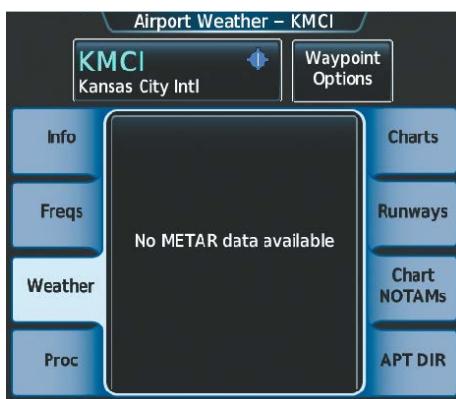


Figure 6-73 METAR information on the Airport Weather Screen

WINDS ALOFT

The Winds Aloft weather product (Figure 6-74) 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 **Home**, touch **Weather > Weather Selection > Connex Weather > Connex Settings**.
- 2) Scroll if needed in the Overlays Window and touch the **Winds Aloft** Button.
- 3) Touch the Winds Aloft altitude button (to the right of the **Winds Aloft** Button) and touch the desired winds aloft altitude from Surface to 42,000 feet MSL in the pop-up window.

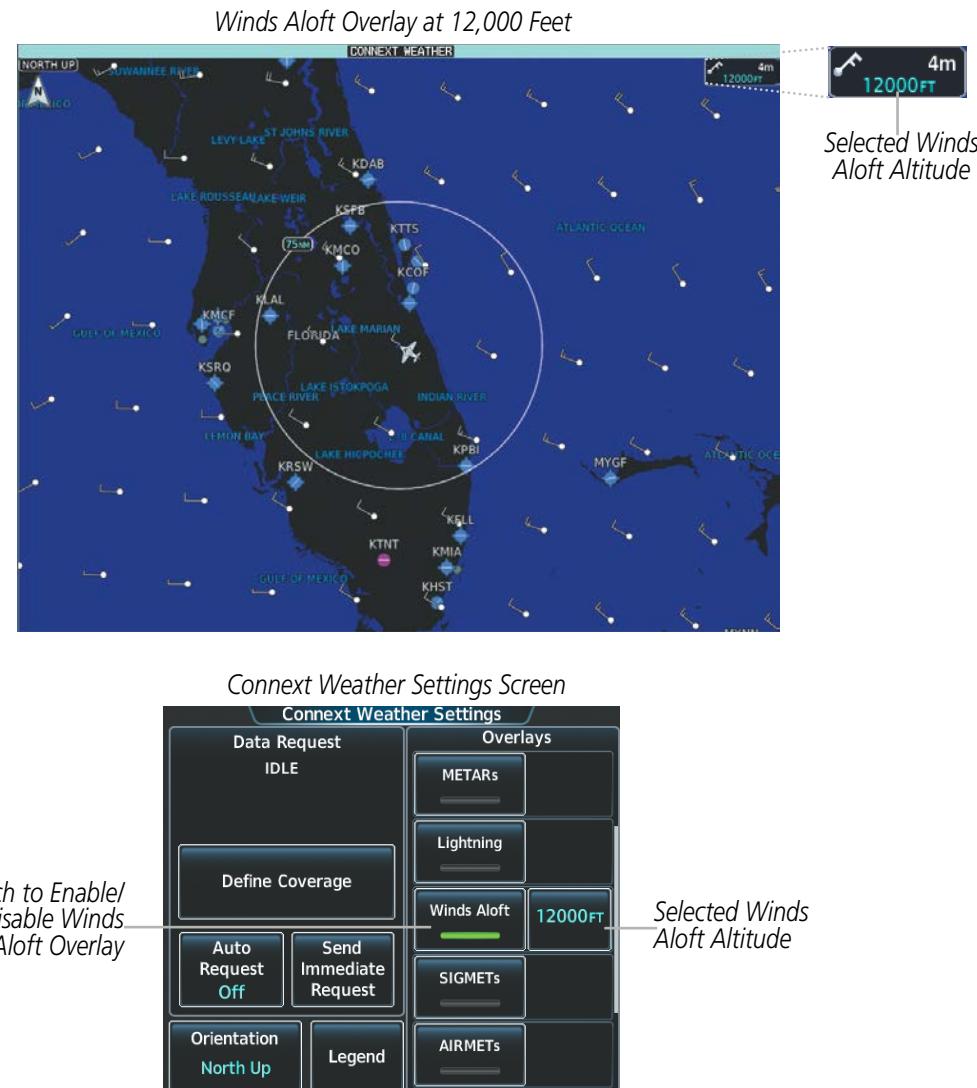


Figure 6-74 Displaying Winds Aloft Forecast

To display the Winds Aloft Legend (Figure 6-75), touch the **Legend** Button on the Connex Weather Settings Screen when the Winds Aloft weather product is enabled. Scroll as needed to view the legend information, then touch **Back** or **Home**.

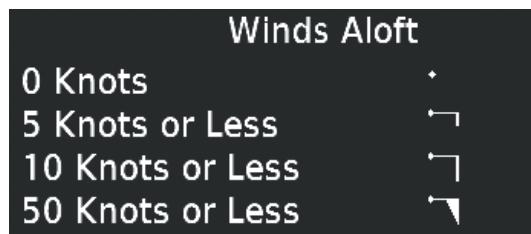


Figure 6-75 Winds Aloft Legend

Headwind and tailwind components aloft are available inside the Vertical Situation Display (VSD) Inset Window on the Navigation Map Pane (Figure 6-76). 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.

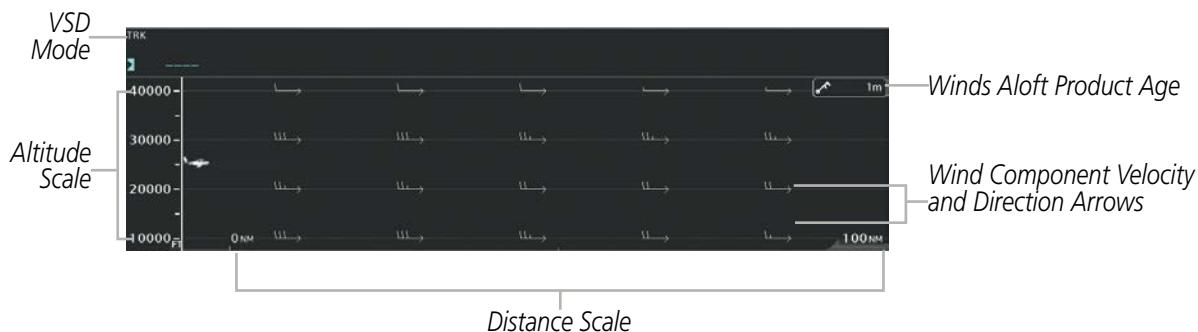


Figure 6-76 VSD Inset Window with Winds Aloft Information

Arrows pointing to the left indicate headwind components; tailwind component arrows point to the right, as shown in Table 6-6.

Headwind Symbol	Tailwind Symbol	Headwind/Tailwind Component
None	None	Less than 5 knots
		5 knots
		10 knots
		50 knots

Table 6-6 VSD Headwind/Tailwind Component Symbols

Enabling/Disabling VSD (containing winds aloft data)

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

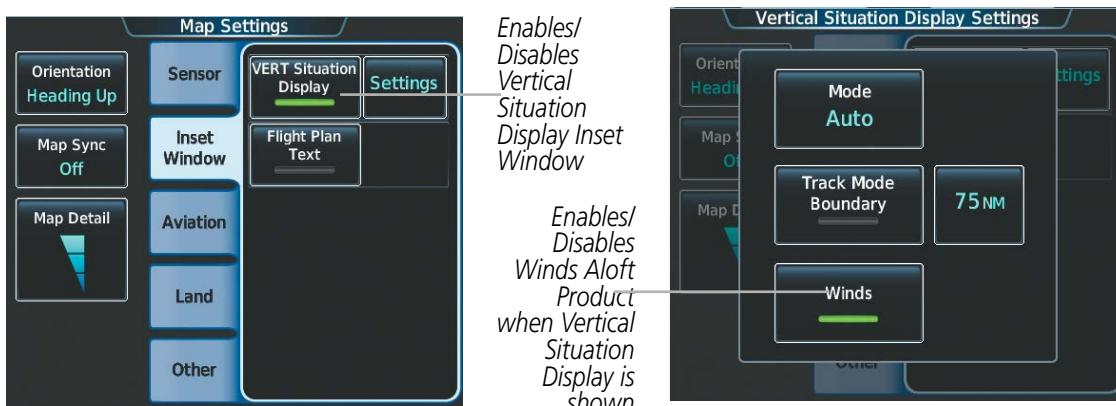


Figure 6-77 Controlling the display of Winds Aloft information for VSD Inset Window

PIREPS

Pilot Weather Reports (PIREPs) describe in-flight weather collected from pilots. A PIREP may contain adverse weather conditions, such as low in-flight visibility, icing conditions, wind shear, turbulence, and type of aircraft flown. PIREPs are classified as either Routine (UA) or Urgent (UUA).

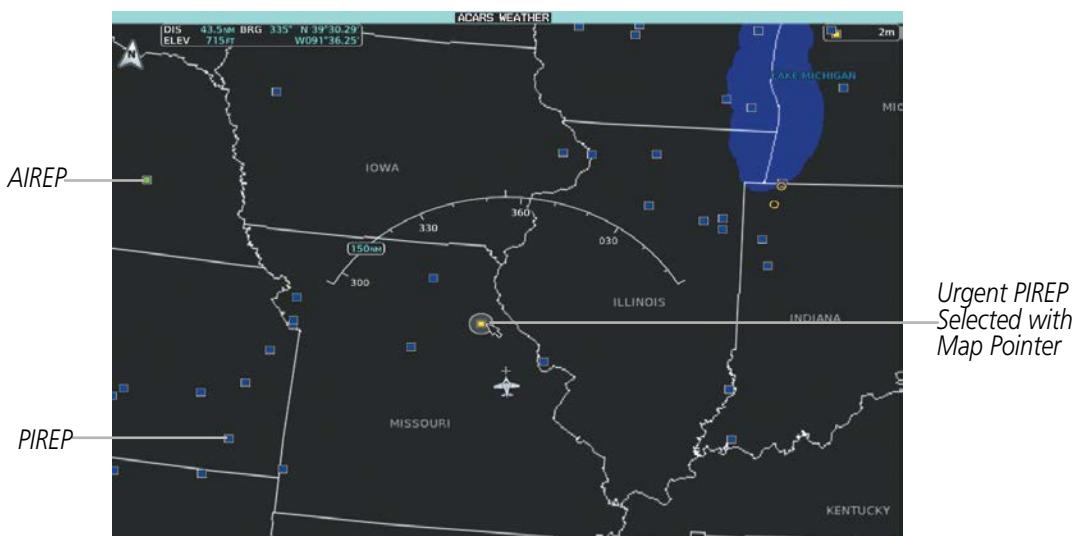


Figure 6-78 AIREPs and PIREPs on the Connext Weather Pane

Displaying PIREP information:

- 1) From **Home**, touch **Weather > Weather Selection > Connx Weather > Connx Settings**.
- 2) Scroll in the Overlays Window as needed and touch the **PIREPs** Button.
- 3) To view PIREP text, push the **Joystick** to activate the map pointer and move the pointer with the **Joystick** until the selected report is highlighted, then touch the **Info** Button.
- 4) Scroll as needed through the report text, then touch **Back** or **Home**.



Figure 6-79 Displaying PIREPs on the Touchscreen Controller

To display the PIREPs legend (Figure 6-80), touch the **Legend** Button on the Connx Weather Settings Screen when the PIREPs weather product is enabled on the Connx Weather Pane. Scroll as needed to view the legend information, then touch **Back** or **Home**.



Figure 6-80 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.

The system does not display the age of the TFR product; however, 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.

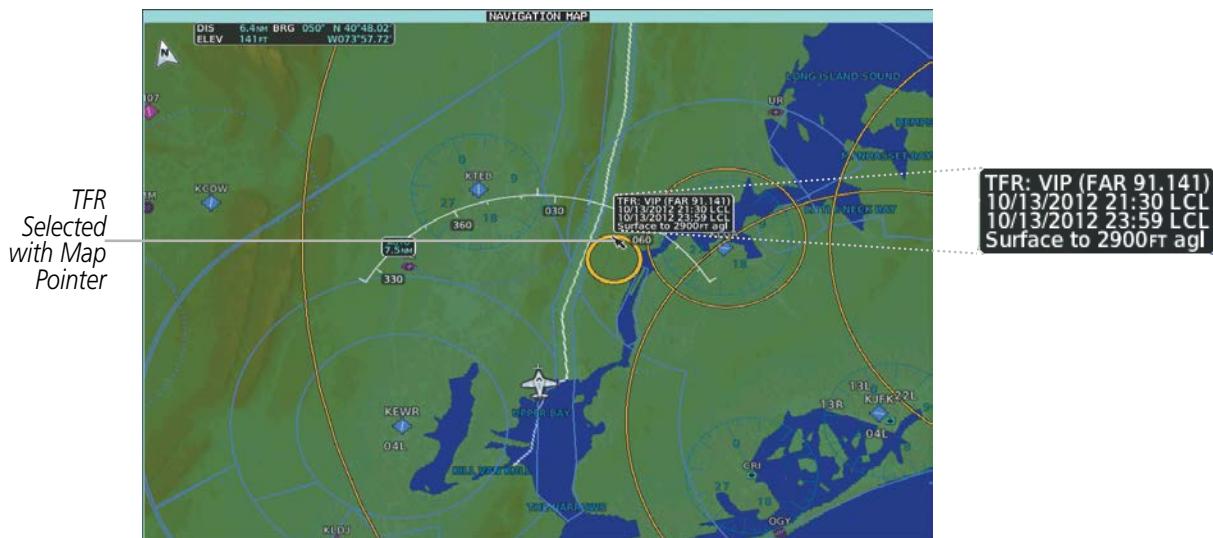


Figure 6-81 TFR Text for TFR Selected with Map Pointer

Enabling/disabling TFR information (Connex Weather Pane):

- 1) From **Home**, touch **Weather** > **Weather Selection** > **Connex Weather** > **Connex Settings**.
- 2) Scroll in the Overlays Window as needed and touch the **TFRs** Button.
- 3) To view TFR text, push the **Joystick** to activate the map pointer and move the pointer with the **Joystick** or **Touchpad** until the selected TFR is highlighted. The TFR text appears near the map pointer for the selected TFR.
- 4) When finished, push the **Joystick**, or touch **Back** or **Home**.

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. To control the display of TFR information for on the PFD Inset Map, enable Split Mode on the PFD, then follow the following procedures.

Enabling/disabling TFR information (Navigation Maps)

- 1) From **Home**, touch **Map > Map Settings**.
- 2) If necessary, touch the Sensor Tab.
- 3) Scroll to find the **TFR** Button, and touch to enable/disable TFR information.

Setting up and customizing TFR data for maps on which TFR data can be displayed:

- 1) From **Home**, touch **Map > 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 6-82 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.
Connxet Comm Error [2]	A communications error has occurred with the GIA. The system should be serviced.
Connxet Comm Error [4]	This occurs if multiple automatic weather data requests have recently failed, or the GIA is off-line.
Connxet Comm Error [5]	The Iridium or Garmin Connxet services are not accessible. Check Iridium signal strength. If this error persists, the system should be serviced.
Connxet Comm Error [6]	A communications error has occurred. If this error persists, the system should be serviced.
Connxet Comm Error [7]	A weather data transfer has timed out. Check Iridium signal strength and re-send the Connxet Data Request.
Connxet Comm Error [8]	A server error has occurred or invalid data received.
Connxet Login Invalid	There is a problem with the Garmin Connxet registration. In the United States, contact Garmin Connxet services at 1-866-739-5687. Outside the United States, call 913-397-8200, wait for the operator, and request extension 1135.
Connxet Server Temporarily Inop	The Garmin Connxet weather data server is temporarily out of service, but is expected to return to service in less than 30 minutes.
Connxet Server Inop	The Garmin Connxet weather data server will be out of service for at least 30 minutes.
Invalid Coverage Area	The Connxet Data Request does not sufficiently define a coverage area on which to retrieve weather data. Verify the selections in the Connxet Weather Coverage Window, then issue another Connxet Data Request.
No Connxet Subscription	The system is not currently subscribed to the Garmin Connxet Weather service, or the access code is incorrect. Verify the access code. In the United States, contact Garmin Connxet services at 1-866-739-5687. Outside the United States, call 913-397-8200, wait for the operator, and request extension 1135.
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.
Weather Link Unavailable	A communications data path is not available. Verify all displays are on-line. If the message persists, the system should be serviced.

Table 6-7 Abnormal Weather Data Request Status Messages

6.3 AIRBORNE COLOR WEATHER RADAR

SYSTEM DESCRIPTION

The Garmin GWX 70 Airborne Color Weather Radar is a solid-state pulsed Doppler radar. It combines excellent range, sensitivity, and adjustable scanning profiles with high-definition, real-time target information. The effective pulse length is 27.31 microseconds (μs), and the system optimizes the pulse length to maximize resolution at each range setting. This reduces the targets smearing together on the displays for better target definition at close range.

This aircraft uses a 10-inch phased array antenna that is fully stabilized to accommodate 30° of pitch and roll.

To focus radar scanning on specific areas, Sector Scanning offers crew-adjustable horizontal scan angles of 20°, 40°, 60°, or a full 90° scan. A vertical scanning function helps to analyze storm tops, gradients, and cell buildup activity at various altitudes.

Radar features include:

- Independent weather radar settings for each map display. For example, the pilot may select a vertical scan on one map and a horizontal scan on another map, each with different range settings and features enabled.
- 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.
- 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 as the aircraft altitude changes.
- Weather Alert that looks ahead for intense cell activity in the 80-320 nm range, even if these ranges are not currently displayed.

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.

Airborne weather radar information should be used to avoid areas of 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 detects rain or hail, not 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. Only Doppler radar can detect turbulence.

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.

ANTENNA BEAM ILLUMINATION

The radar beam is much like the beam of a spotlight. The further the beam travels, the wider it becomes. The radar is only capable of seeing what is inside the boundaries of the beam. The following figure depicts a radar beam's characteristics. The figure illustrates vertical dimensions of the radar beam, although the same holds true for the horizontal dimensions. In other words, the beam is as wide as it is tall. Note that it is possible to miss areas of precipitation on the radar display because of the antenna tilt setting. With the antenna tilt set to zero in this illustration, the beam overshoots the precipitation at less than 15 nautical miles.

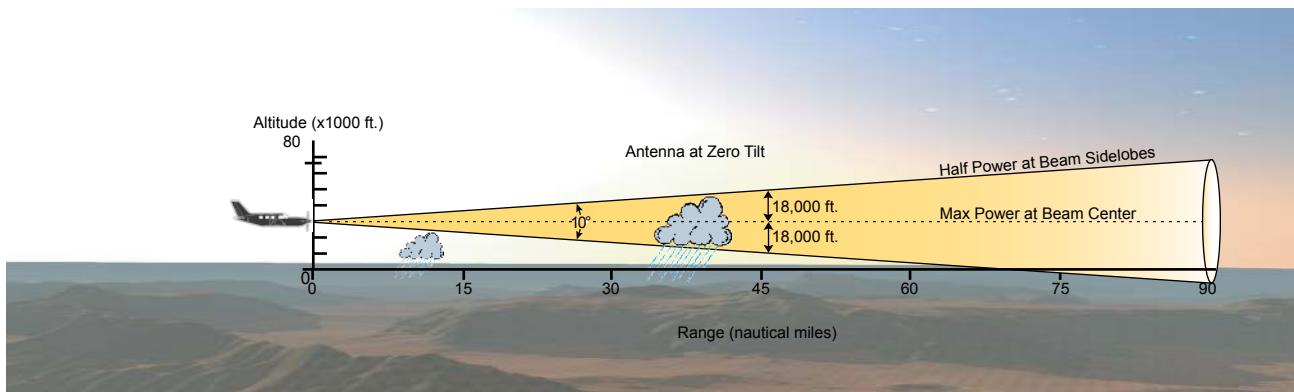


Figure 6-83 Radar Beam from a 10 inch Antenna

The curvature of the earth can also be a factor in missing areas of precipitation, especially at range settings of 150 nautical miles or more. Here the beam overshoots the precipitation at less than 320 nautical miles.

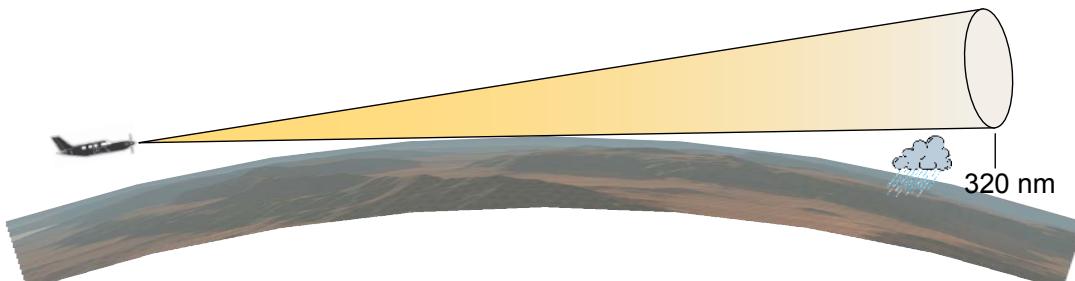


Figure 6-84 Radar Beam in Relation to the Curvature of the Earth

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 because 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 GWX 70 Weather Radar system compensates for much of this type of distance attenuation. Radar echoes from precipitation

occurring at greater distances from the airborne weather, particularly of lower intensity, may not be displayed at all because the returned energy may have attenuated below the minimum display threshold (Table 6-8).

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 GWX 70 Weather Radar system can help in identifying 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

The weather radar detects precipitation and objects more dense than water, such as the surface of the earth or solid structures. 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 are often 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.

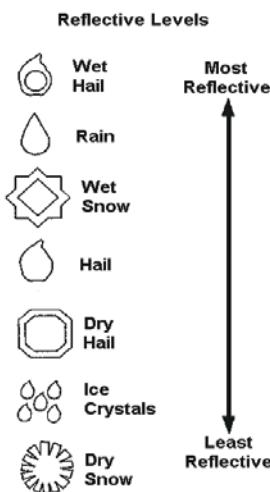


Figure 6-85 Precipitation Type and Reflectivity

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.

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.

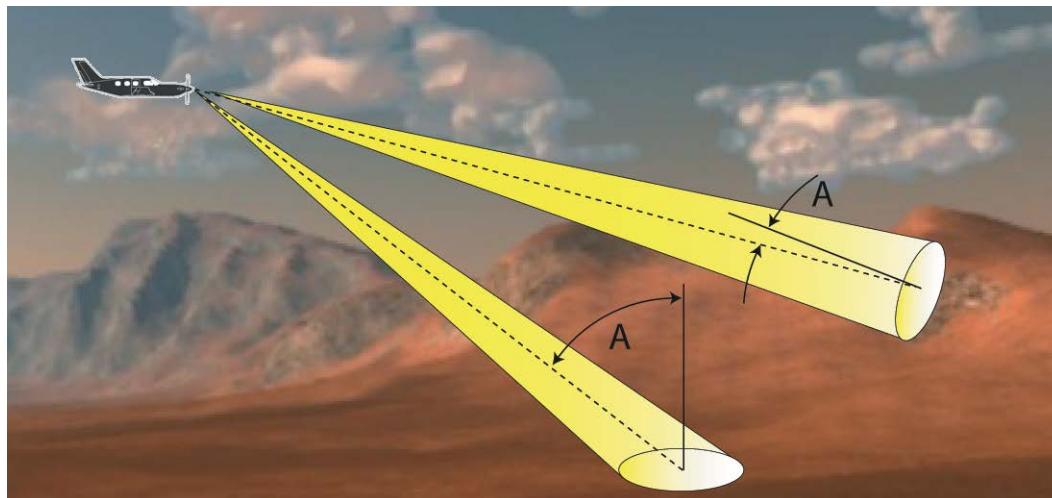


Figure 6-86 Angle of Incidence

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.

MAXIMUM PERMISSIBLE EXPOSURE LEVEL (MPEL)

The zone in which the radiation level exceeds the US Government standard of 1 mW/cm² is the semicircular area of at least 9.16 feet from the 10-inch antenna. All personnel must remain outside of this zone. With a scanning or rotating beam, the averaged power density at the MPEL boundary is significantly reduced.

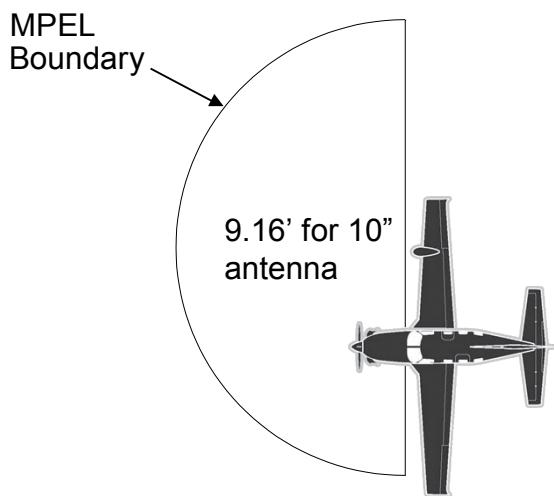


Figure 6-87 MPEL Boundary

BASIC ANTENNA TILT SETUP

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 threats. Ultimately, it is desired to have the antenna tilted so that the bottom of the radar beam is four degrees below parallel with the ground. The following example explains one way of achieving this.

With the aircraft flying level, adjust the antenna tilt so ground returns are displayed at a distance that equals the aircraft's current altitude (AGL) divided by 1,000. For example, if the aircraft is at 14,000 feet, adjust the tilt so the front edge of ground returns are displayed at 14 nautical miles. Note this antenna tilt angle setting. Now, raise the antenna tilt 6 degrees above this setting. The bottom of the radar beam is now angled down 4° from parallel with the ground.

PRACTICAL APPLICATION USING THE BASIC TILT SETUP

With the antenna tilt set as previously described, any displayed target return should be scrutinized when flying at altitudes between 2,000 and 30,000 feet AGL. If the displayed target advances on the display to within 5 nautical miles of the aircraft, avoid it. This may be either weather or ground returns that are 2,000 feet or less below the aircraft. Raising the antenna tilt 4 degrees can help separate ground returns from

weather returns in relatively flat terrain. This aligns the bottom of the radar beam parallel with the ground. Return the antenna tilt to the previous setting after a few sweeps.

If the aircraft is above 29,000 feet, be cautious of any target return that gets to within 30 nautical miles. This is likely a thunderstorm that has a top high enough that the aircraft cannot fly over it safely.

If the aircraft altitude is 15,000 feet or lower, setting the displayed range to 60 miles may be more helpful. Closely monitor anything that enters the display.

Also, after setting up the antenna tilt angle as described previously, ground returns can be monitored for possible threats. The relationship between antenna tilt angle, altitude, and distance is one degree of tilt equals 100 feet of altitude for every one nautical mile.

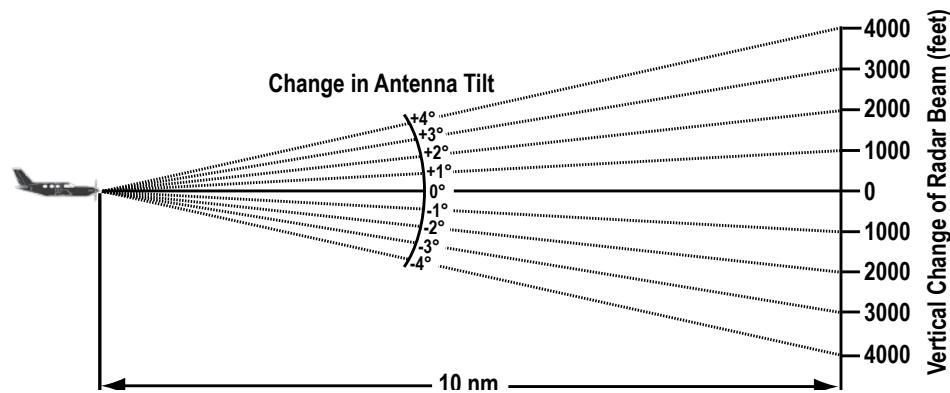


Figure 6-88 Vertical Change in Radar Beam per Nautical Mile

Therefore, with the antenna tilt set so that the bottom of the beam is four degrees below parallel with the ground, a target return at 10 nm is approximately 4,000 feet below the aircraft; at 20 nm, 8,000 feet; at 50 nm, 20,000 feet. In other words, at this tilt setting, a ground return (such as a mountain peak) being displayed at 10 nm would have a maximum distance below the aircraft of 4,000 feet. A ground target return being displayed at 5 nm would have a maximum distance below the aircraft of 2,000 feet. This setup provides a good starting point for practical use of the GWX 70. There are many other factors to consider in order to become proficient at using weather radar in all situations.

ALTITUDE COMPENSATED TILT (ACT)

The Altitude Compensated Tilt feature of the GWX 70 enables the system to automatically adjust the antenna beam tilt angle setting based on aircraft altitude changes. 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 setting with ACT enabled.

WEATHER DISPLAY AND INTERPRETATION

When evaluating various target 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

Table 6-8 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.

- In areas where the displayed target intensity is red (indicating large amounts of precipitation), the turbulence is considered severe.
- Areas that show steep color gradients (intense color changes) over thin bands or short distances suggest irregular rainfall rate and strong turbulence.
- Areas that show red 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.

Along squall lines (multiple cells or clusters of cells in a line) individual cells may be in different stages of development. Areas between closely spaced, intense targets may contain developing clouds not having enough moisture to produce a return. However, these areas could have strong updrafts or downdrafts. Targets showing wide areas of green are generally precipitation without severe turbulence.

Irregularities in the target return may also indicate turbulence, appearing as hooks, fingers, or scalloped edges. These irregularities may be present in green areas with no yellow or red areas and should be treated as highly dangerous areas. Avoid these areas as if they are red.

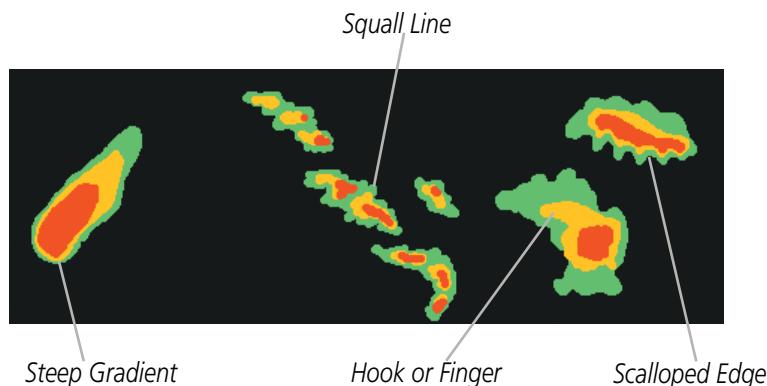


Figure 6-89 Cell Irregularities

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.

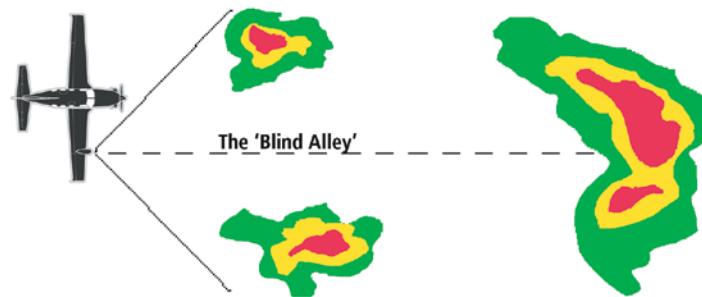
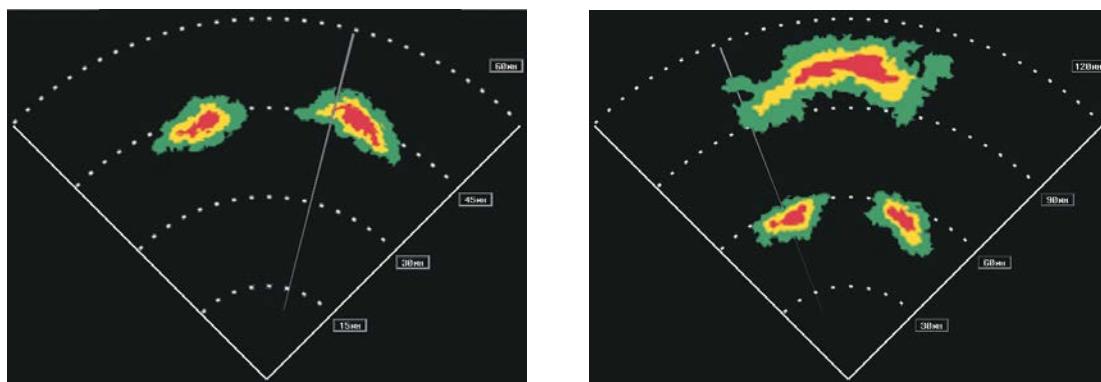


Figure 6-90 The Blind Alley - Horizontal Scan

In areas of multiple heavy cells, use the Vertical Scan feature along with antenna tilt management to examine the areas. Remember to avoid shadowed areas behind targets.



The Blind Alley at Close Range

The Large Storm Behind

Figure 6-91 The Blind Alley

TORNADOES

There are no conclusive radar target return characteristics which identify a tornado. However, tornadoes may be present if the following characteristics are observed:

- A narrow, finger-like portion extends and in a short time curls into a hook and closes on itself.
- A hook, which may be in the general shape of the numeral 6 (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. Vertically scanning the target return can give the radar top of a thunderstorm that contains hail. Radar top is the top of a storm cell as detected by radar. It is not the actual top, or true top of the storm. The actual top of a storm cell is seen with the eyes in clear air and may be much higher than the radar top. Neither the radar top nor the actual top necessarily indicate the top of the hazardous area, which may be much higher.

Hail can fall below the minimum reflectivity threshold for radar detection. It can have a film of water on its surface, making its reflective characteristics similar to a very large water droplet. Because of this film of water, and because hail stones usually are larger than water droplets, thunderstorms with large amounts of wet hail return stronger signals than those with rain. Some hail shafts are extremely narrow (100 yards or less) and make poor radar targets. In the upper regions of a cell where ice particles are dry (no liquid coating), target returns are less intense.

Hail shafts are associated with the same radar target return characteristics as tornados. U-shaped cloud edges three to seven miles across can also indicate hail. These target returns appear quite suddenly along any edge of the cell outline. They also change in intensity and shape in a matter of seconds, making vigilant monitoring essential.

STRATUS PRECIPITATION

Detecting areas of low altitude, stratus precipitation while the aircraft altitude is significantly above the precipitation is difficult to accomplish with airborne weather radar. This is because as the radar beam detects the low altitude precipitation, it also receives significant ground returns which are displayed with the precipitation. Raising the antenna tilt angle may reduce the ground returns, however the radar beam is likely to overshoot the low-altitude precipitation when the aircraft is at a high altitude above the precipitation.

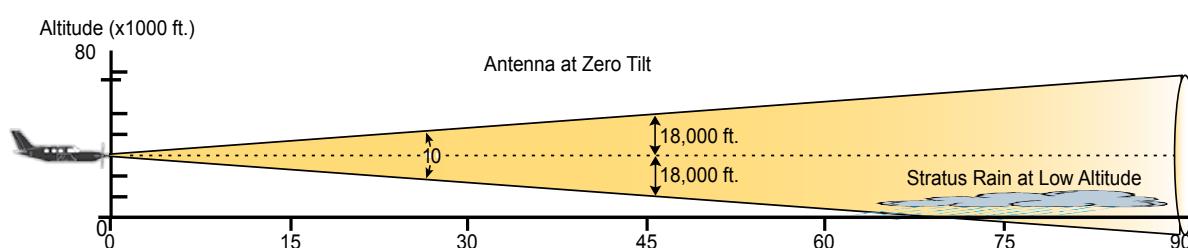


Figure 6-92 Stratus Rain Combines with Ground Returns when Aircraft is at Higher Altitudes

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.

AIRBORNE WEATHER RADAR AND NEXRAD

Airborne weather radar and NEXRAD are prominent tools for hazardous weather avoidance. Each technology has distinct characteristics to consider when evaluating potentially hazardous weather conditions. Refer to Section 6.1 for a general description of NEXRAD.

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.

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.** For example, NEXRAD may display light precipitation as green, while airborne weather radar may not show the same precipitation at all if it is below the display threshold unique to airborne weather radar. Refer to Table 6-8 for precipitation intensity levels and colors for airborne weather radar, and to the NEXRAD reflectivity legend shown in Figure 6-10.

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.

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 9.16 feet of the antenna.



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

The airborne weather radar allows the flight crew to display weather radar information on multiple Display Panes, 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 may select Standby Mode for the first map display, Weather Mode with a vertical scan for the second map display, and Ground Mode with a horizontal scan for the third map display. 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 six separate radars. Each radar has an independent display and controls, therefore, operating independently of one another. All radar functions and operations may be performed on any, or all radar displays. As stated previously, since scanning is “shared” between radar displays, the greater the number of radars displayed, the slower the scan update for each display. 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 or Softkey, all display panes or map overlays showing weather radar enter Standby Mode and the weather radar performs an antenna clearance check to ensure proper antenna movement within the radome. When the **Radar On** Button or Softkey is disabled (gray annunciator), all display panes or map overlays showing weather radar are placed in Off Mode.



WARNING: Do not assume weather radar transmission is disabled unless **all** displays showing weather radar are set to Standby Mode, and are displaying ‘STANDBY’ for the weather radar mode. 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.

When the weather radar system is in the Weather or Ground Map mode, the system automatically places the radar in Standby mode on landing.

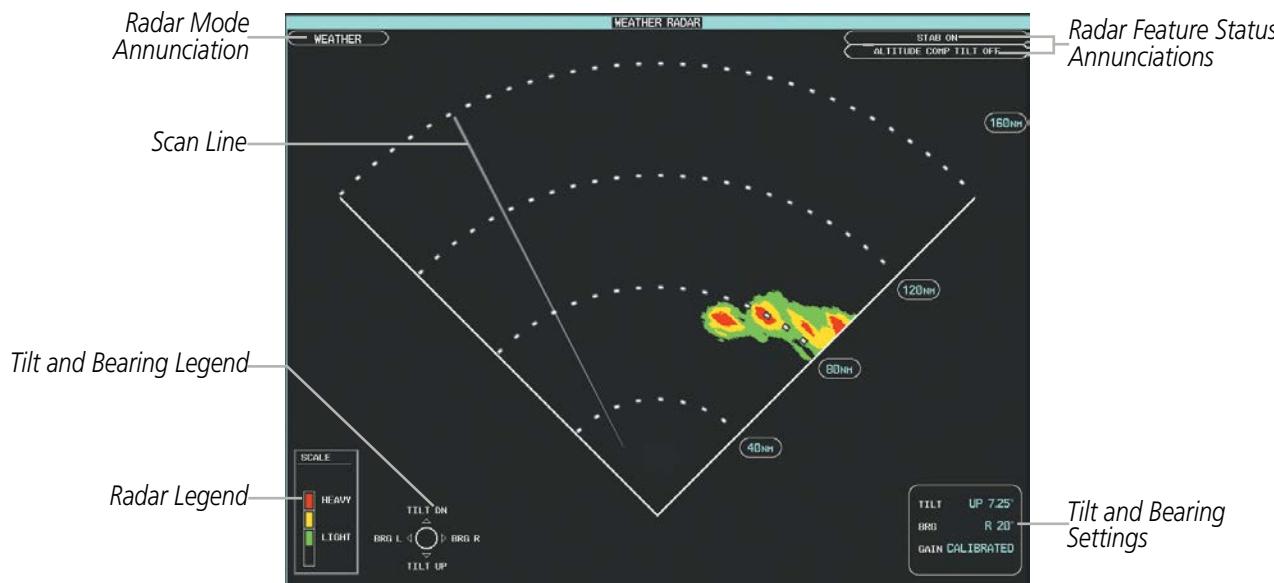


Figure 6-93 Weather Radar Pane with a Horizontal Scan

Showing Weather Radar Information on the Weather Radar Pane:

- 1) From **Home**, touch **Weather** > **Weather Selection** > **WX RADAR** > **WX RADAR Settings**.
- 2) If necessary, touch the **Radar On** Button to enable weather radar controls for the selected Weather Radar Pane. If the **Radar On** Button was previously disabled, enabling the **Radar On** Button causes all weather radar displays to enter Standby Mode.
- 3) Touch the **Display Mode** Button.
- 4) Touch the **Weather** Button. If the aircraft is airborne, a 'WEATHER' annunciation appears in the upper-left of the Weather Radar Pane.
- 5) If the aircraft is on the ground, the Touchscreen Controller displays a prompt shown in the following figure to confirm radar activation. Touch the **OK** Button to begin transmitting, or touch the **Cancel** Button to return to the Weather Radar Settings screen, and the radar remains in Standby Mode.



Figure 6-94 Confirm Activating Radar while on Ground

- 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."

Vertically scanning a storm cell on the Weather Radar Pane:



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 **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 **Joystick**. This enables the **Joystick** to set the Bearing Line position and displays a bearing and tilt **Joystick legend**.
- 4) Move the **Joystick** left or right to place the Bearing Line on the desired storm cell or other area to be vertically scanned.

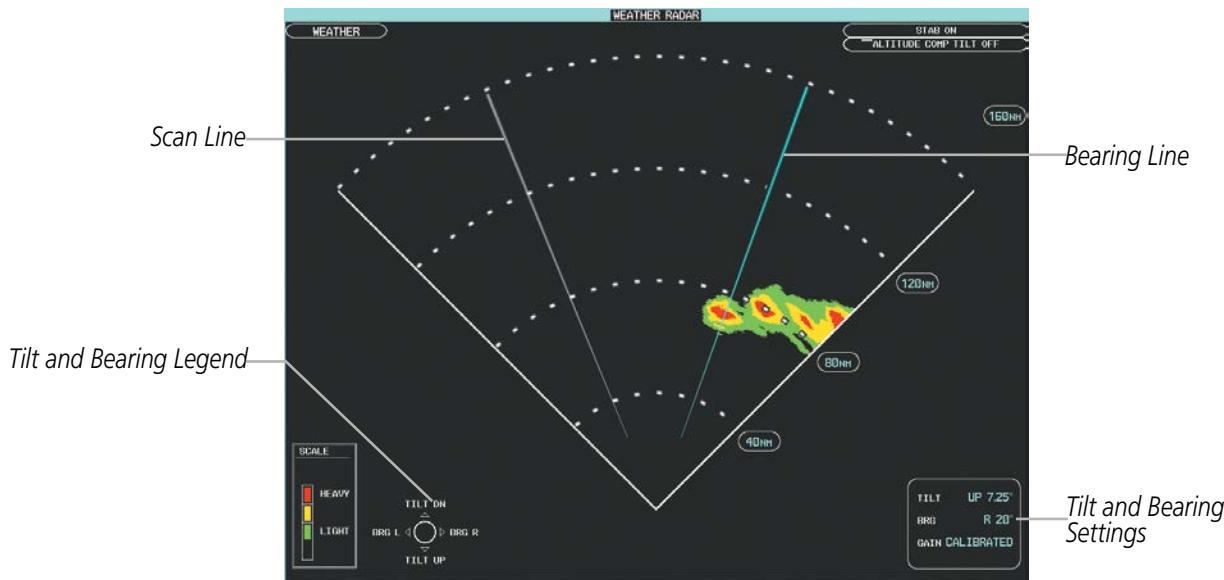


Figure 6-95 Weather Radar Pane with a Horizontal Scan

- 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.

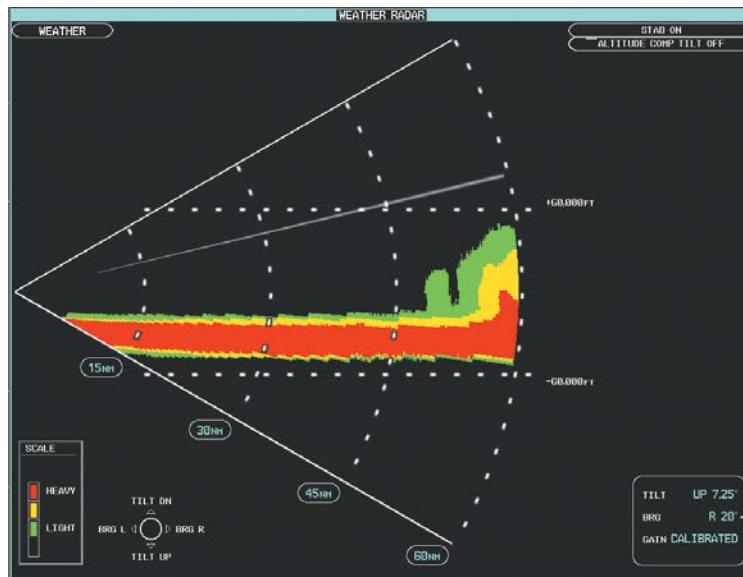


Figure 6-96 Weather Radar Display with Vertical Scan Mode Selected

ADJUSTING ANTENNA TILT ANGLE

In order to make an accurate interpretation of a storm cell, the radar beam should be pointed at the wet part of the weather cell to record the proper rainfall intensity (color level). The ideal aiming point is just below the freezing level of the storm. The best way to find this point is to use the Vertical Scan feature. The antenna tilt angle can be centered on the strongest return area in the vertical scan to get a more accurate view of the coverage and intensity of the target in the horizontal scan.

Adjusting antenna tilt on the Weather Radar Pane in Horizontal Scan Mode:

- 1) Push the **Joystick** to activate the tilt adjustment function of the **Joystick**. The Weather Radar displays a bearing and tilt **Joystick** legend.
- 2) Move the **Joystick** to adjust the antenna tilt angle.
- 3) Press the **Joystick** again to disable the tilt adjustment function of the **Joystick** and remove the legend.

Adjusting antenna tilt on the Weather Radar Display in Vertical Scan Mode:

- 1) Press the **Joystick** to activate the tilt and bearing adjustment functions.
- 2) Move the **Joystick** to adjust the tilt angle.
- 3) Press the **Joystick** to disable the tilt adjustment function of the **Joystick**.

The selected tilt angle will apply when Horizontal Scan Mode is enabled again.

ALTITUDE COMPENSATED TILT (ACT) ANGLE ADJUSTMENT

The Attitude 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 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'.

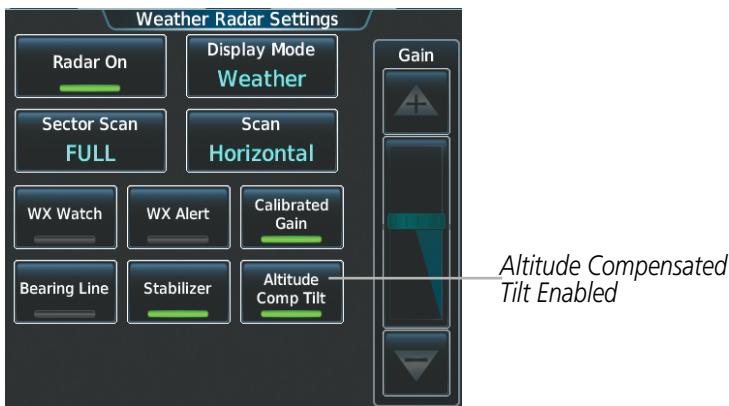


Figure 6-97 Enabling Altitude Compensated Tilt

ADJUSTING GAIN



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

The Weather Radar Gain is set to calibrated gain setting when the Weather Radar is powered on.

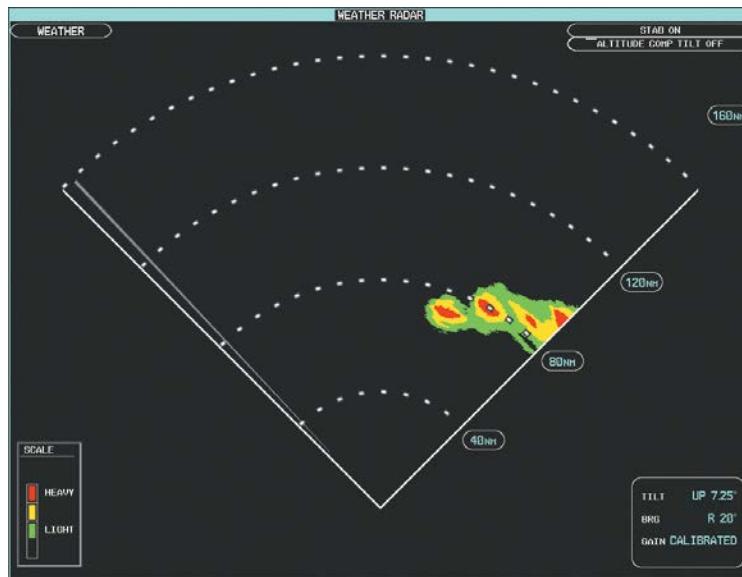
Adjusting the gain on the Weather Radar Pane:

- 1) From **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 as shown in Figure 6-99.

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 (Figure 6-98).

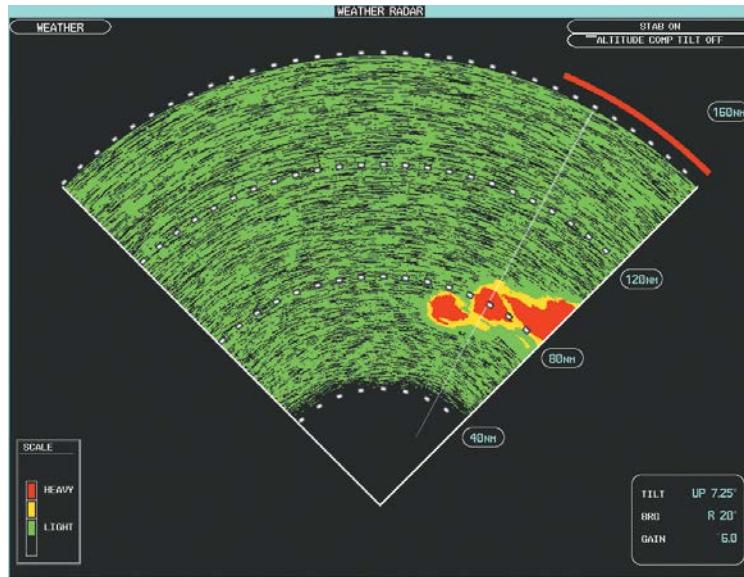


Weather Radar Pane with Calibrated Gain Setting

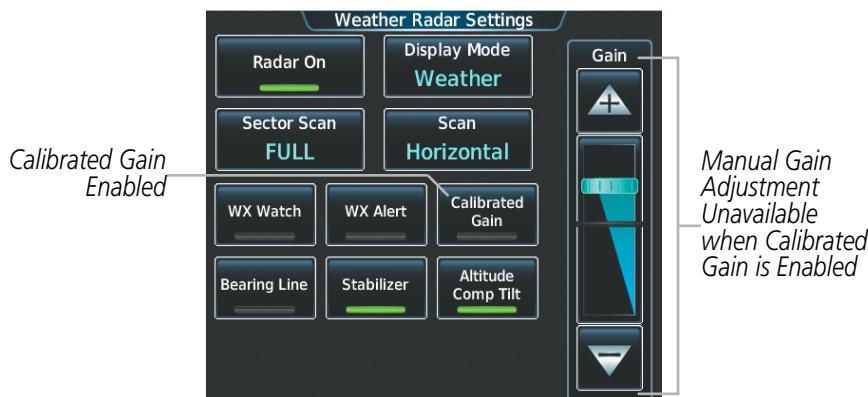


Touchscreen Controller with Calibrated Gain Setting Enabled

Figure 6-98 Calibrated Gain



Weather Radar Pane with Gain Set Above Calibrated



Touchscreen Controller with Manual Gain Adjustment Controls Available

Figure 6-99 Manually Adjusting Gain

SECTOR SCAN

The Sector Scan feature enables the flight crew to define a specific horizontal area to scan for each weather radar display.

Enabling Sector Scan:

- 1) From **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 **Joystick** to enable bearing pointer adjustment.
- 4) Move the **Joystick** left or right to place the Bearing Line in the desired position. The location of the Bearing Line will become the center point of the Sector Scan.
- 5) Touch the **Sector Scan** Button.

- 6) Touch a button to select a 20°, 40°, 60°, or touch the **FULL** Button to resume a 90° degree scan.
- 7) If desired, readjust the Bearing Line as discussed previously to change the center of the Sector Scan.
- 8) Press the **Joystick** again to remove the bearing selection function of the **Joystick**.

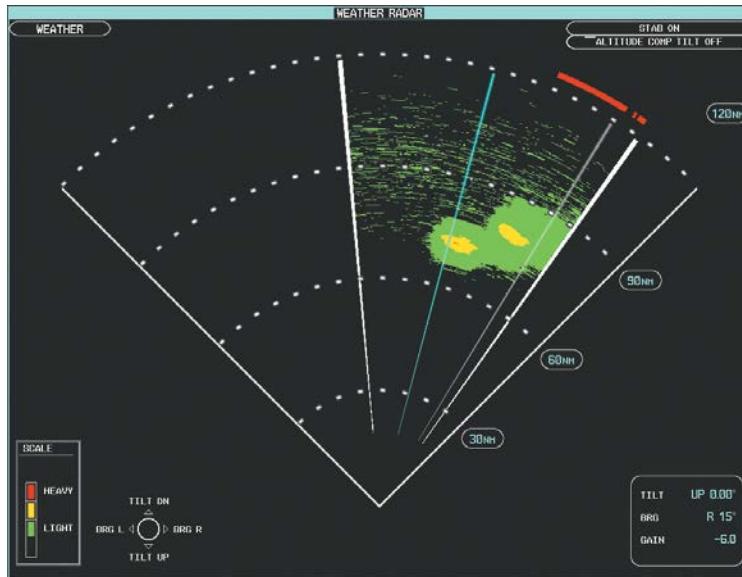


Figure 6-100 Weather Radar Pane with a 40 Degree Sector Scan Selected

ANTENNA STABILIZATION

When radar antenna stabilization is enabled, the radar tilt is corrected for pitch and roll, and therefore is kept steady with respect to an earth-fixed reference. The commanded tilt angle is kept constant with respect to the earth. When the stabilization is disabled, corrections are no longer made for pitch and roll, and the radar tilt angle is kept constant with respect to the aircraft reference system.

Enabling/disabling antenna stabilization on the Weather Radar Pane:

- 1) From **Home**, touch **Weather** > **Weather Selection** > **WX RADAR** > **WX RADAR Settings**.
- 2) To activate or deactivate the antenna stabilization, touch the **Stabilizer** Button. Antenna stabilization is enabled when button annunciator is green; stabilization is disabled when button annunciator is gray. The system indicates the current stabilization condition in the upper right of the Weather Radar Display.

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 Home, touch **Weather** > **Weather Selection** > **WX RADAR** > **WX RADAR Settings**.
- 2) To activate or deactivate the WATCH feature, touch the **WX Watch** Button.

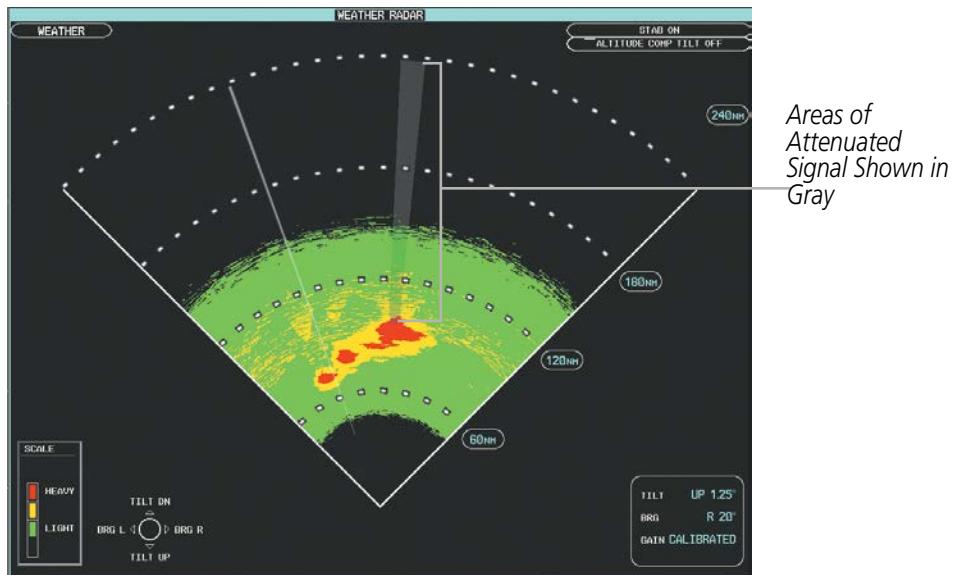


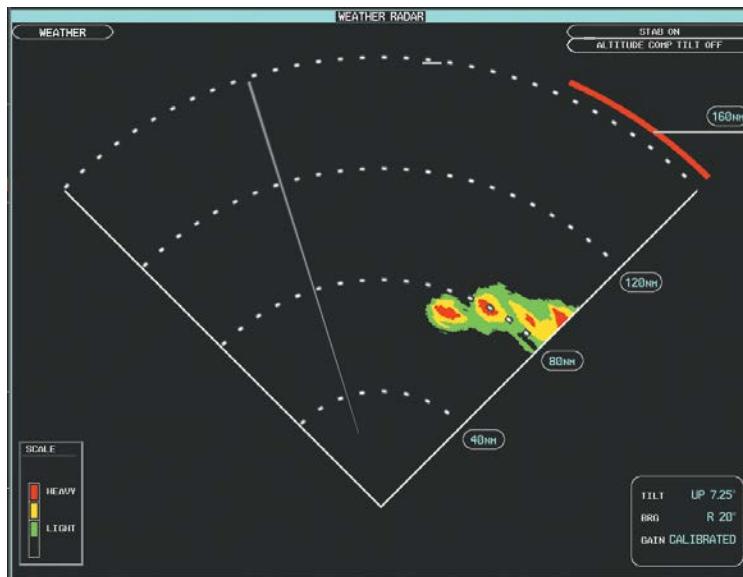
Figure 6-101 Horizontal Scan with WATCH® Enabled

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 targets appear as red bands along the outer range ring at the approximate azimuth of the detected returns on the Weather Radar Pane.

If a Weather Alert is detected within $\pm 10^\circ$ of the aircraft heading, and the **WX Alert** Button is enabled on the Weather Radar Settings Screen, a System Message appears on the Touchscreen Controllers (Figure 6-103). The red Weather Alert target bands appear on the Weather Radar Pane regardless of whether the **WX Alert** Button is enabled or disabled. The bands 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.)



Red band shows possible severe weather beyond selected map range

Figure 6-102 Weather Radar Pane with Weather Alert Indication



Figure 6-103 Weather Alert System Message on the Touchscreen Controller

Enabling/disabling Weather Alert System Message:



NOTE: The **WX Alert** Button enable/disable setting is synchronized on both Touchscreen Controllers.

- 1) From **Home**, touch **Weather** > **Weather Selection** > **WX Radar** > **WX Radar Settings**.
Or:
 - a) From **Home**, touch **Map** > **Map Settings**.
 - b) If necessary, touch the Sensor Tab.
 - c) Touch the Weather Radar **Settings** Button.
- 2) Touch the **WX Alert** Button. Weather Alert System Message enabled when button annunciator is gray, disabled when 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 target returns are defined in the following table. Use of the Gain and Tilt controls help improve contrast so that specific ground targets can be recognized more easily. As previously discussed, the type and orientation of the target in relation to the aircraft affects the intensity displayed.

When the weather radar system is in either the Weather or Ground Map mode, the system automatically switches to Standby mode upon landing.

Ground Map Mode Color	Intensity
Black	0 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 6-9 Ground Target Return Intensity Levels

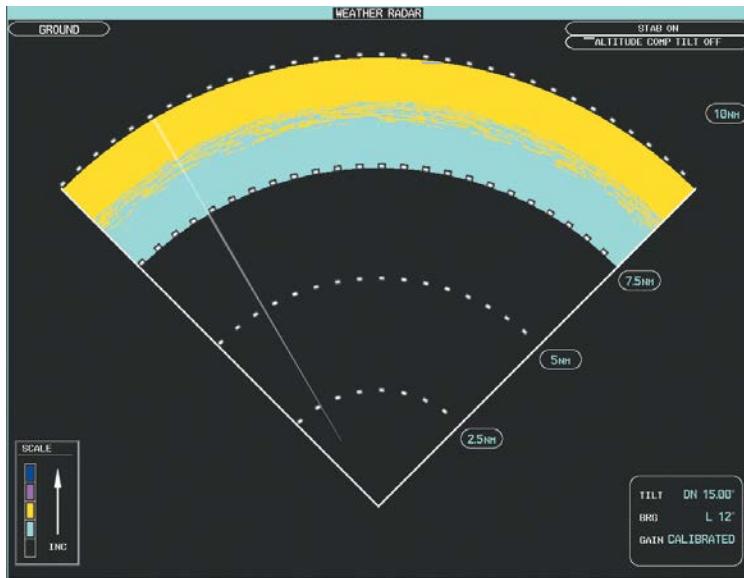


Figure 6-104 Weather Radar Pane with Ground Map Mode Enabled

Operation in Ground Map Mode on the Weather Radar Pane:

- 1) From **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 **Joystick** to activate the antenna tilt selection function.
- 5) Move the **Joystick** up or down to desired antenna tilt angle.
- 6) When ground returns are shown at the desired distance, press the **Joystick** to disable the tilt adjustment function of the **Joystick**.

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 airborne weather radar features. Airborne weather radar information is also available as an overlay on the navigation maps (with the exception of the Inset Map) as an additional reference to the Weather Radar Pane. The radar range increases or decreases automatically as the map range increases or decreases.

When the pilot initially enables the airborne weather overlay on a navigation map, the weather radar is in Standby Mode for that map. The weather radar mode ('GROUND', 'STANDBY', 'WEATHER', or 'OFF') appears in a radar status box on the selected navigation map, in addition to the antenna tilt direction, tilt angle, and radar range ('RNG'). For the HSI Map, the radar status box appears momentarily while the radar range or settings are adjusted on the HSI Map, and then the system declutters the status box from the HSI Map.

The pilot may enable airborne weather radar information with other map overlays on navigation maps, such as traffic, absolute terrain information, and aviation data. However, relative terrain and data link weather radar (such as NEXRAD) cannot be enabled simultaneously with GWX 70 information on the same navigation map. If relative terrain or data link radar is enabled, the system automatically disables the airborne weather radar overlay for the selected map.

Enabling/disabling the display of Weather Radar information on Navigation Map Panes:

- 1) From **Home**, touch **Map > 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 Navigation Map Pane.
- 4) To access controls for weather radar information on the Navigation Map Pane, touch the **Weather Radar Settings** Button.

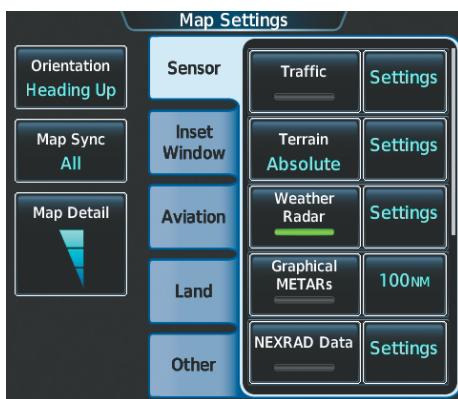
Adjusting bearing or antenna tilt angle on Navigation Map Panes:

- 1) With the weather radar overlay enabled on the selected pane, push the **Joystick** twice. The bearing and tilt legend appears in the lower-left corner of the pane and the Touchscreen Controller displays the Weather Radar Settings Screen.
- 2) Move the **Joystick** left or right to move the bearing line. The bearing line appears as white dashes on navigation maps.
- 3) Turn the **Joystick** up or down to adjust the antenna tilt angle in 0.25° increments.

- 4) When finished, push the **Joystick** to remove the bearing and tilt legend, and return to the previous screen on the Touchscreen Controller, or touch the **Back** Button.



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 6-105 Displaying Weather Radar Information on the Navigation Map Pane

Enabling/disabling the display of Weather Radar information on the HSI Map:



NOTE: The aircraft must be in the air in order for HSI Map airborne weather radar softkeys to become available.

- 1) If necessary, enable the HSI Map on the PFD.
- 2) If necessary, enable the weather radar overlay for the HSI Map.
 - a) Press the **PFD Map Settings** Softkey.

- b) Press the **WX Overlay** Softkey to cycle through the available options until 'WX Radar' is displayed in cyan on the softkey.
 - c) Press the **Back** Softkey.
- 3) If the PFD is in Full Mode, press the **WX Radar Controls** Softkey.
- Or:
- a) If the PFD is in Split mode, press the **PFD Map Settings** Softkey.
 - b) Press the **WX Radar Controls** Softkey.
- 3) The following softkeys are available:

Radar On: When disabled, all weather radar displays are in Off Mode and the radar is not transmitting. When softkey is first enabled, all weather radar displays are in Standby Mode.

Mode: With the radar on, press the Mode Softkey to cycle though the available modes for the HSI Map (Standby, Weather, Ground); the selected mode is displayed in cyan on the softkey.

Bearing Left and **Bearing Right:** Press the softkey once to move the white dotted bearing line in the desired direction a small amount. Press and hold the softkey to continue movement in the desired direction while the softkey is held.

Tilt Up and **Tilt Down:** Press the softkey once to adjust the antenna tilt angle up or down in 0.25° increments. Press and hold the softkey to continue adjustment while the softkey is held.

Gain- and **Gain+:** Press the softkey once to decrease/increase the gain in increments of 0.5, or press and hold the softkey to continue adjustment while the softkey is held. A manual setting of '0.0' is equivalent to the calibrated gain setting.



NOTE: If the **Calibrated Gain** button is enabled on the Weather Radar Settings Screen for the HSI Map, 'GAIN CAL' appears in the box on the HSI when settings are adjusted using the softkeys. To adjust gain using the softkeys, it will be necessary to first disable the Calibrated Gain Button on the Weather Radar Settings Screen, then adjust the gain manually using either the softkeys or Weather Radar Settings Screen for the HSI Map.

Control of weather radar settings on navigation maps is similar to control on the Weather Radar Pane discussed previously. However, the WATCH attenuation features are not available on the navigation maps. In addition, the Horizontal Scan mode is the only scan mode available on navigation maps.

Bearing and antenna tilt angle are adjustable on the Navigation Map Pane when viewing its associated Weather Radar Settings Screen.

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.

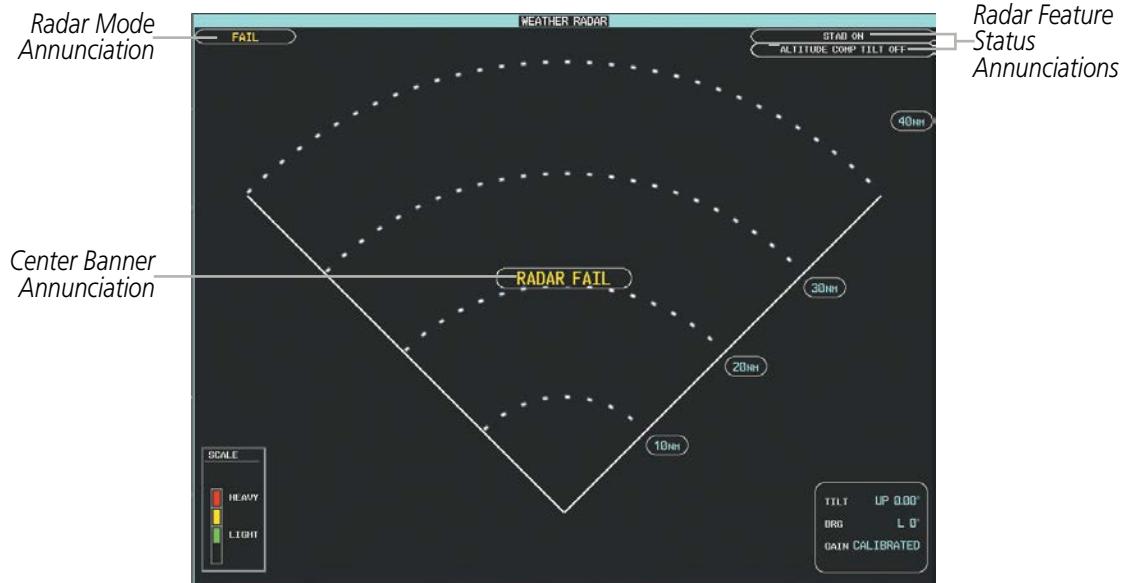


Figure 6-106 Radar System Status Indications on Weather Radar Pane

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 6-12 for additional failure annunciations

Table 6-10 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 ON	Antenna stabilization is selected on.
STAB OFF	Antenna stabilization is selected off.
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.

Table 6-11 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 6-12 Abnormal Radar Status Annunciations on the Weather Radar Page

6.4 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: Stormscope lightning information cannot be displayed simultaneously with data link lightning weather products on the same map.

The optional Stormscope lightning detection system displays lightning cell and strike information on the Stormscope Pane and navigation maps using the symbology shown in the following table.

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 6-13 Lightning Age and Symbols

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 Stormscope operating mode and lightning strike rate in the upper right corner of the pane. The selected map range appears in a box on the range arc.

The Stormscope Pane also displays the active flight plan (if present),



Stormscope Pane Operating in Strike Mode



Stormscope Settings Screen

Figure 6-107 Displaying Stormscope Lighting on the Stormscope Pane

Displaying the Stormscope Pane:

From **Home**, touch **Weather > Weather Selection > Stormscope**.

The **Joystick** on the Touchscreen Controller controls the map range shown on the Stormscope Pane. Turn the **Joystick** clockwise to increase the map range shown, or counter-clockwise to decrease the map range. Map ranges of 25 nm to 200 nm are available.

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 Home, touch **Weather > Weather Selection > Stormscope > Stormscope Settings**.
- 2) Touch the **Clear Stormscope Lightning** Button (Figure 6-107).

STORMSCOPE INFORMATION ON NAVIGATION MAPS

Stormscope lightning information is available as an overlay on navigation maps.

Enabling/disabling Stormscope information on the Inset Map or HSI Map:

- 1) Press the **PFD Map Settings** Softkey.
- 2) If the PFD is in Full Mode, press the **Stormscope** Softkey.

Or:

- a) If the PFD is in Split Mode, press the **Map Overlays** Softkey.
- b) Press the **More** Softkey.
- c) Press the **Stormscope** Softkey.

Enabling/disabling Stormscope information on Navigation Map Panes:

- 1) From **Home**, touch **Map > Map Settings**.
- 2) If necessary, touch the Sensor Tab.
- 3) Scroll as needed and touch the **Stormscope Lightning** Button.



Figure 6-108 Stormscope Information on the Navigation Map Pane

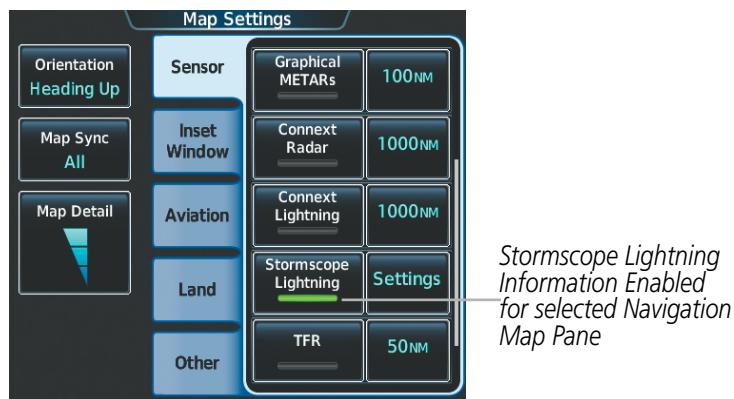


Figure 6-109 Enabling Stormscope Information for the Navigation Map Pane

Clearing the Stormscope Pane removes any previously displayed cell or lightning strike information from the navigation maps.



Figure 6-110 Stormscope Settings for the Navigation Map Pane

Clearing Stormscope information on the Navigation Map Pane:

- 1) From **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.

Selecting a maximum Stormscope map range on the Navigation Map Pane:

- 1) From **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 range button (current range setting displayed in cyan).
- 6) Scroll as needed and touch a desired map range setting from the list.

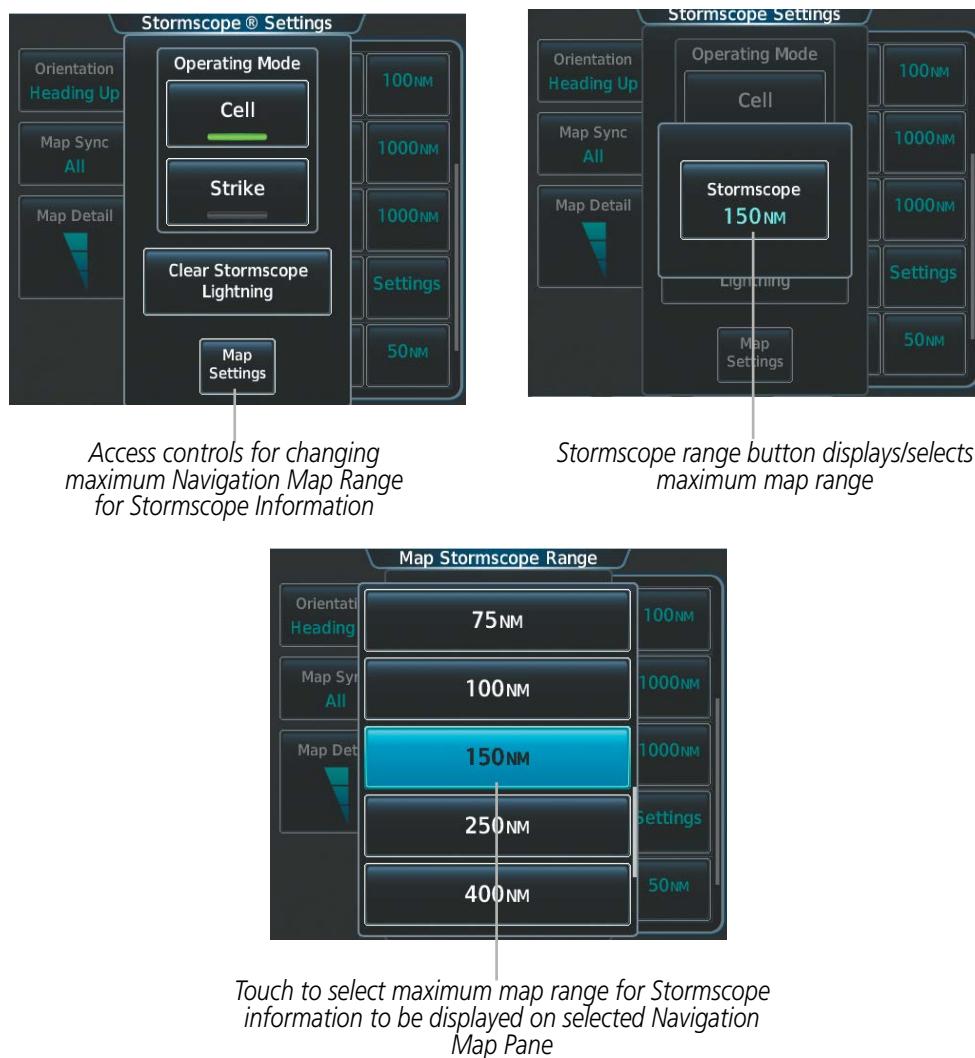


Figure 6-111 Selecting maximum Navigation Map Pane range to display Stormscope Lightning information

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.

6.5 VSD RELATIVE TERRAIN

A Vertical Situation Display (VSD) can be shown on the bottom of the Navigation Map Pane. Terrain, obstacles, winds aloft forecasts, and flight plan information can be displayed on the VSD. Refer to the SiriusXM and Garmin Connexx Weather discussions for more information about displaying winds aloft information on the VSD. See the Flight Management section for information about other items which can be shown on the VSD.

Although the VSD does not display TAWS alerts and potential impact areas, the VSD does use many of the same colors and symbols as TAWS to depict relative terrain and obstacles within the VSD. Refer to the TAWS discussion for more information about relative terrain and obstacle color correlation and symbols.

Enabling/Disabling VSD Inset Window:



NOTE: Only one inset window may be shown per display pane. If another inset window is selected, it replaces the previously selected inset window.

- 1) From **Home**, touch **Map > Map Settings**.
- 2) If necessary, touch the Inset Window Tab.
- 3) Touch the **VERT Situation Display** Button to enable/disable the VSD Inset Window.

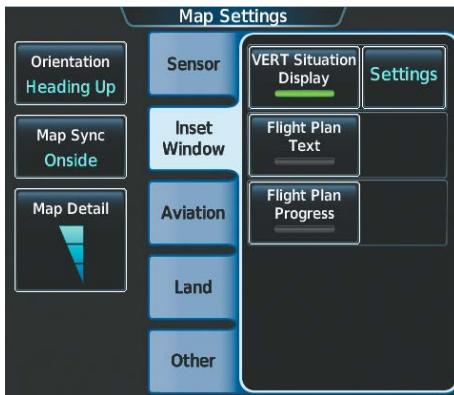


Figure 6-112 Enabling Vertical Situation Display Inset Window on the Map Settings Screen

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 on the VSD.

Enabling/disabling Relative Terrain information on the VSD and Navigation Map Pane:

- 1) From **Home**, touch **Map > 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 6-113 Enabling Relative Terrain for the Profile View Inset Window and Navigation Map Pane

Enabling/disabling Obstacle information in the VSD and Navigation Map Pane:

- 1) From **Home**, touch **Map > Map Settings**.
- 2) If necessary, touch the **Land** Tab.
- 3) Touch the **Obstacle Data** Button to enable/disable the display of Obstacle information on the Navigation Map Pane and VSD.

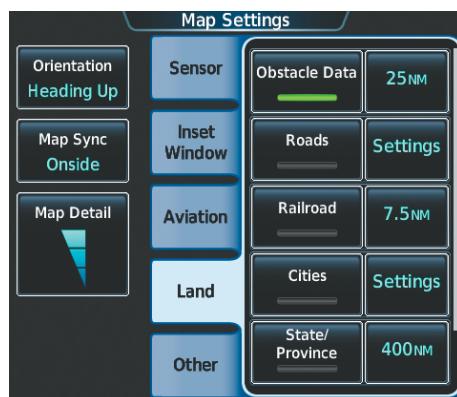


Figure 6-114 Enabling Obstacle information for the VSD and Navigation Map Pane

Terrain and obstacles appear on the VSD if the aircraft altitude is low enough for the terrain and obstacles to be in view (all terrain will be shown in gray if the terrain is selected Off on the navigation map). The depicted terrain profile represents an approximate forward-looking contour of the terrain based upon the highest reported terrain elevations, measured at intervals defined by the terrain database resolution, within a predefined width along the active flight plan or ground track 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 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. Refer to the Flight Management section for information about selecting VSD Modes.



NOTE: *The same obstacle may be depicted twice in the VSD Inset Window if the obstacle is near a turn in an FMS flight plan, and the VSD is showing the flight plan.*

VSD INSET WINDOW

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 that displays all of the remaining active flight plan. The VSD altitude range automatically changes when the navigation map range is changed to keep a constant ratio of altitude range to horizontal range, until both minimum and maximum display limits have been met. At ranges above the maximum, the altitude range remains constant at the maximum.

The aircraft symbol is displayed on the left side of the VSD. The position of the aircraft symbol on the vertical scale is close to the top for a descent phase, at the bottom for on-ground or a climb phase, and in the middle for a cruise phase or if the phase is unknown.

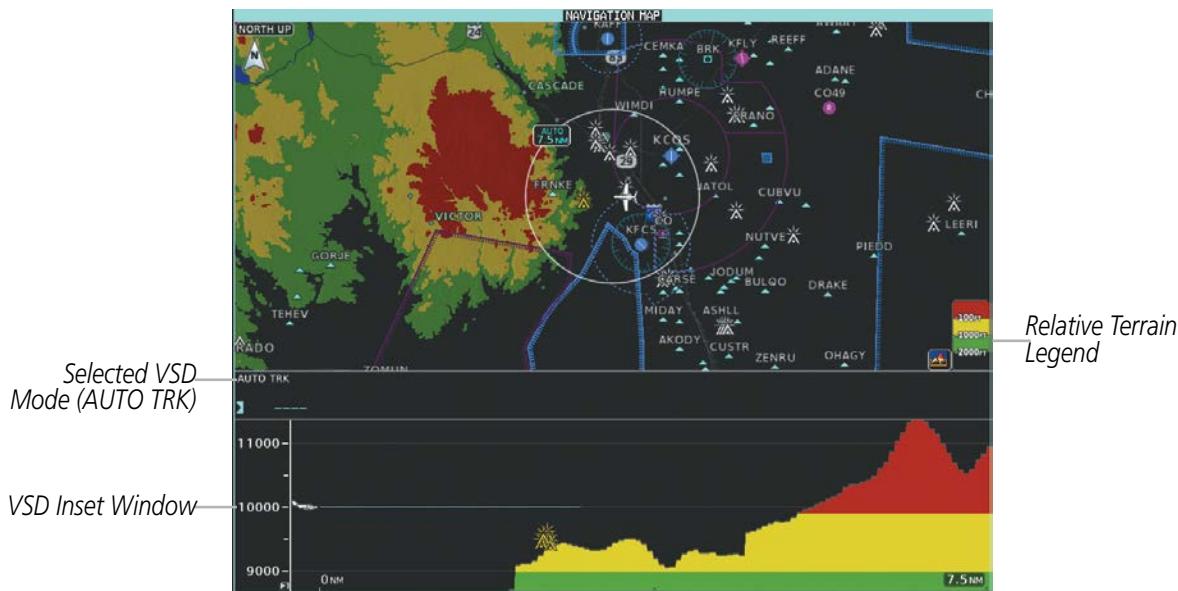


Figure 6-115 Navigation Map Pane with VSD Inset Window and Relative Terrain Enabled

The Relative Terrain colors on the VSD are the same colors shown on the Relative Terrain Legend, with one exception. When the aircraft is in the air, relative terrain shown in black on the Navigation Map Pane is gray on the VSD.

6.6 TERRAIN PROXIMITY



WARNING: Do not use Terrain Proximity information for primary terrain avoidance. Terrain Proximity is intended only to enhance situational awareness.



NOTE: Terrain data is not available when the aircraft is outside of the installed terrain database coverage area.



NOTE: If another terrain option is installed, such as Terrain-SVT or TAWS-B, it will take precedence over Terrain Proximity.



NOTE: The terrain system is not available north of 89° North latitude and south of 89° South latitude.

Terrain Proximity is a terrain awareness system that does not comply with TSO-C151b certification standards. It increases situational awareness and aids in reducing controlled flight into terrain (CFIT). Do not confuse Terrain Proximity with a Terrain Awareness and Warning System (TAWS). TAWS is more sophisticated and robust, and it is TSO-C151b certified. Terrain Proximity does not provide warning annunciations or voice alerts. It only provides color indications on map displays when terrain and obstacles are within a certain altitude threshold from the aircraft. Although the terrain and obstacle color map displays are similar, TAWS uses more sophisticated algorithms to assess aircraft distance from terrain and obstacles.

Terrain Proximity requires the following components to operate properly:

- Valid 3-D GPS position
- Valid terrain/obstacle database

Terrain Proximity displays altitudes of terrain and obstructions relative to the aircraft position and altitude with reference to a database that may contain inaccuracies. Terrain and obstructions are shown only if they are in the database. Terrain and obstacle information should be used as an aid to situational awareness. They should never be used to navigate or maneuver around terrain.

Note that all obstructions may not be available in the terrain and obstacle database. No terrain and obstacle information is shown without a valid 3-D GPS position.

The GPS receiver provides the horizontal position and altitude. GPS altitude is derived from satellite position. GPS altitude is then converted to the height above geodetic sea level (GSL), which is the height above mean sea level calculated geometrically. The system uses GSL altitude to determine terrain and obstacle proximity. 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.

Terrain and obstacle databases are referenced to MSL. Using the GPS position and altitude, the Terrain Proximity feature portrays a 2-D picture of the surrounding terrain and obstacles relative to the position and altitude of the aircraft. GPS position and GSL altitude are used to calculate and predict the aircraft's flight path in relation to the surrounding terrain and obstacles.

TERRAIN PROXIMITY SYMBOLOLOGY

Terrain Proximity uses colors and symbols to represent terrain and obstacles (with heights greater than 200 feet above ground level, AGL) present in the databases relative to aircraft altitude. The system dynamically adjusts these colors as the aircraft altitude changes, and after takeoff and landing.

While the aircraft is on the ground, the system displays relative terrain 400 feet or more above the aircraft altitude using red, and terrain at less than 400 feet above aircraft altitude using black, as shown on the On-Ground Legend shown in Figure 6-116. 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 shown in Figure 6-116. As the aircraft transitions from on-ground to in-air, or from in-air to on-ground, the display of relative terrain momentarily fades into the corresponding colors. If any type of terrain alert occurs, the relative terrain colors will transition to the In-Air Legend if in the On-Ground Legend was shown in order to provide the flight crew with the most information possible.



Figure 6-116 Terrain SVT Relative Terrain Legends

The colors and symbols in Figure 6-117 and Table 6-14 represent terrain and obstacles.

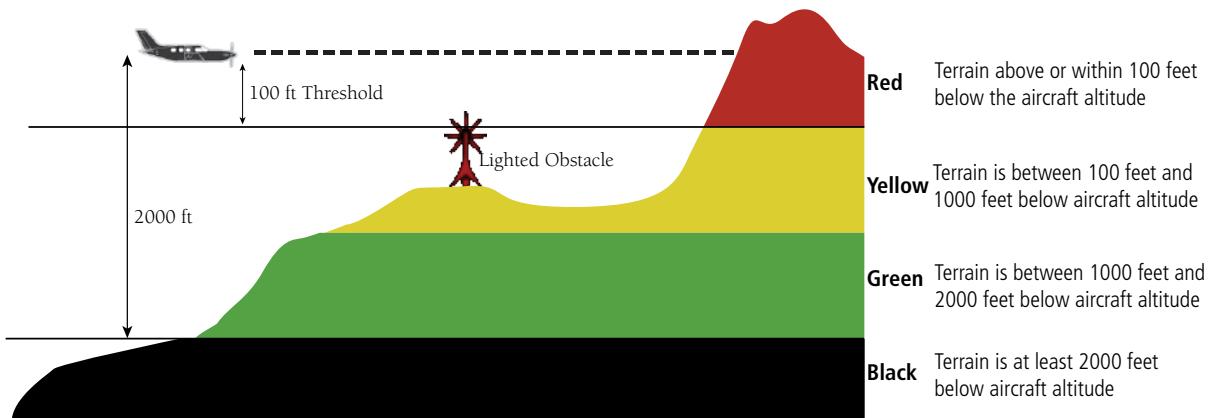


Figure 6-117 In-Air Terrain Altitude/Color Correlation for Terrain Proximity

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 Proximity Relative Obstacle Symbols and Colors

DISPLAYING RELATIVE TERRAIN INFORMATION

The Terrain Proximity Pane is the principal map pane for viewing relative terrain information. Relative Terrain information is also available for display on navigation maps.

TERRAIN PROXIMITY PANE

The Terrain Proximity Pane shows terrain and obstacle information in relation to the aircraft's current altitude, without clutter from the basemap.

Aircraft orientation on the Terrain Proximity Pane is heading up unless there is no valid heading. A box on the map range arc indicates the selected map range. Turn the **Joystick** clockwise to increase the map range, or counter-clockwise to decrease the map range.

The Terrain Proximity Pane also shows system status banner annunciations in the center of the pane during abnormal operations.

Showing the Terrain Proximity Pane:

From **Home**, touch the **Terrain Proximity** Button.

The Terrain Proximity 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 data on the Terrain Proximity Pane:

- 1) From **Home**, touch **Terrain Proximity > Terrain Settings**.
- 2) Touch the **Show Aviation Data** Button to display/remove aviation data (airports, VORs, NDBs, Intersections) on the Terrain Proximity Pane.

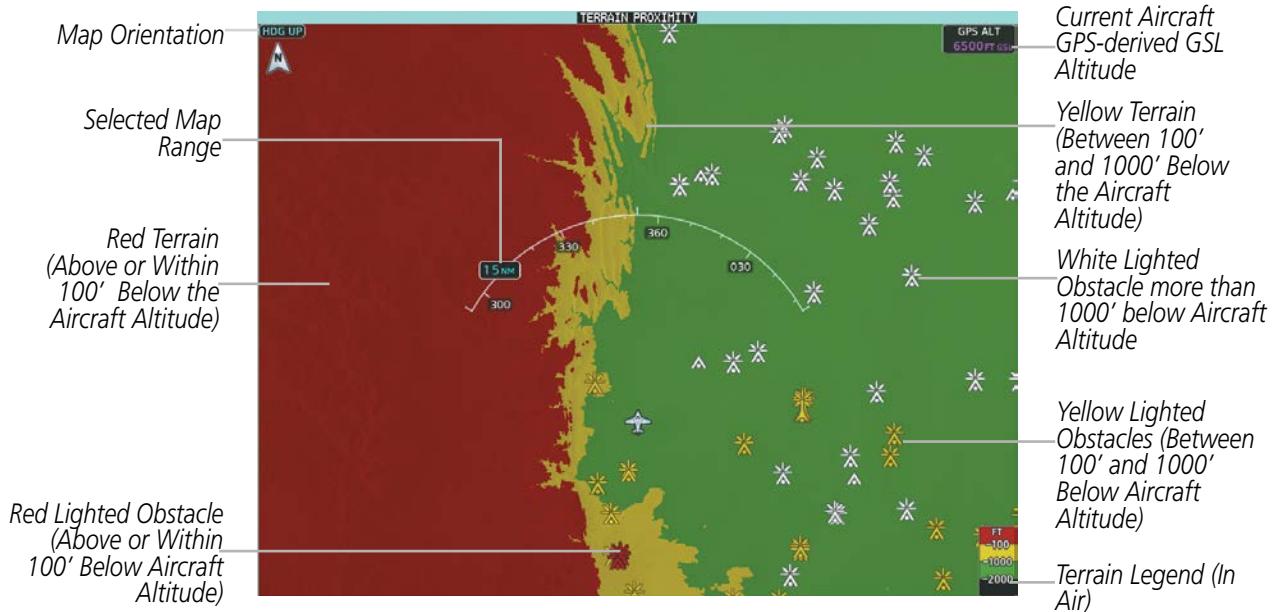


Figure 6-118 Terrain Proximity Pane with Aircraft in the Air

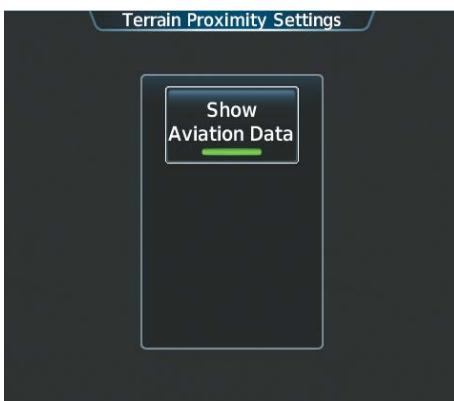


Figure 6-119 Terrain Proximity Settings Screen

RELATIVE TERRAIN AND OBSTACLES ON THE NAVIGATION MAPS

Terrain Proximity provides relative terrain and obstacle information for the navigation maps. When relative terrain information is enabled on a navigation map, the system displays a relative terrain icon and legend. If Terrain SVT is not available or has failed, a white 'X' appears over the terrain icon.

Controlling Relative Terrain Information (Navigation Map Panes):

- 1) From **Home**, touch **Map > 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 Map and HSI Map):

- 1) With the Inset Map or HSI Map displayed, press the PFD Map Settings Softkey.
- 2) Press the **Terrain** Softkey. Each softkey press cycles through an available option (Off, Absolute, Relative). The current selection is displayed in cyan on the softkey.

Controlling Obstacle Information on Navigation Maps:

- 1) From **Home**, touch **Map > Map Settings**.
- 2) If necessary, touch the Land Tab.
- 3) Touch the **Obstacle Data** Button to enable/disable the display of relative obstacle information.
- 4) To change the maximum map range to display obstacle information, touch the Obstacle Data Range Button, then scroll and select a maximum map range from the list.

6.7 TERRAIN SVT



WARNING: Do not use Terrain SVT information for primary terrain avoidance. Terrain SVT is intended only to enhance situational awareness.



NOTE: Terrain data is not available when the aircraft is outside of the installed terrain database coverage area.



NOTE: If the TAWS-B option is installed, it will take precedence over Terrain SVT.



NOTE: The terrain system is not available north of 89° North latitude and south of 89° South latitude.

Terrain SVT is a terrain awareness system included with the Garmin Synthetic Vision Technology (SVT) system option. It provides visual annunciations and voice alerts to indicate the presence of threatening terrain and obstacles relevant to the projected flight path. For detailed information regarding SVT, refer to the Flight Instruments section of this Pilot's Guide.

Terrain SVT does not comply with TSO-C151b certification standards. It increases situational awareness and aids in reducing controlled flight into terrain (CFIT) and obstacles. Do not confuse Terrain SVT with a Terrain Awareness and Warning System (TAWS). TAWS is more sophisticated and robust, and it is TSO-C151b certified. Although the terrain and obstacle color map displays are the same, TAWS uses more sophisticated algorithms to assess aircraft distance from terrain and obstacles and provides additional alerts.

Terrain SVT does **not** provide the following:

- Premature Descent Alerting (PDA)
- Excessive Descent Rate (EDR)
- Negative Climb Rate (NCR)
- Altitude Voice Callout (VCO)

Terrain SVT requires the following components to operate properly:

- Valid 3-D GPS position
- Valid terrain database
- Valid obstacle database

Terrain SVT uses terrain and obstacle information from government sources. Terrain information is based on terrain elevation information in a database that may contain inaccuracies. Individual obstructions may be shown if available in the database. Garmin verifies the data to confirm accuracy of the content, per TSO-C151b. However, the displayed information should never be understood as being all-inclusive and data may be inaccurate.

Terrain SVT uses information 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. Terrain SVT uses GSL altitude to calculate alerts. GSL altitude accuracy is affected by satellite geometry, but is not subject to variations in pressure

and temperature that normally affect pressure altitude sensors. GSL altitude does not require local altimeter settings to determine MSL altitude. It is a widely-used MSL altitude source. Therefore, GSL altitude provides a highly accurate and reliable MSL altitude source to calculate terrain and obstacle alerts.

Terrain SVT terrain and obstacle databases are referenced to MSL. Using the GPS position and GSL altitude, Terrain SVT displays a 2-D picture of the surrounding terrain and obstacles relative to the position and altitude of the aircraft. Furthermore, the system uses GPS position and GSL altitude to calculate and project the aircraft's flight path in relation to the surrounding terrain and obstacles. In this manner, Terrain SVT can provide advanced alerts for predicted dangerous terrain and obstacle 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.

RELATIVE TERRAIN SYMBOLOGY

Terrain SVT uses colors and symbols to represent terrain and obstacles (with heights greater than 200 feet above ground level, AGL) present in the databases relative to aircraft altitude. The system dynamically adjusts these colors as the aircraft altitude changes, and after takeoff and landing.

While the aircraft is on the ground, the system displays relative terrain 400 feet or more above the aircraft altitude using red, and terrain at less than 400 feet above aircraft altitude using black, as shown on the On-Ground Legend shown in Figure 6-120. 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 shown in Figure 6-120. As the aircraft transitions from on-ground to in-air, or from in-air to on-ground, the display of relative terrain momentarily fades into the corresponding colors. If a terrain alert occurs, the relative terrain colors will transition to the In-Air Legend if in the On-Ground Legend was shown in order to provide the flight crew with the most information possible.



Figure 6-120 Terrain SVT Relative Terrain Legends

During an alert, the system shows potential impact areas over terrain or obstacles using bright yellow (caution) or bright red (warning) on navigation maps and on the Terrain SVT Pane.

The colors and symbols in Figure 6-121 and Tables 6-15 and 6-16 represent terrain, obstacles, and potential impact areas.

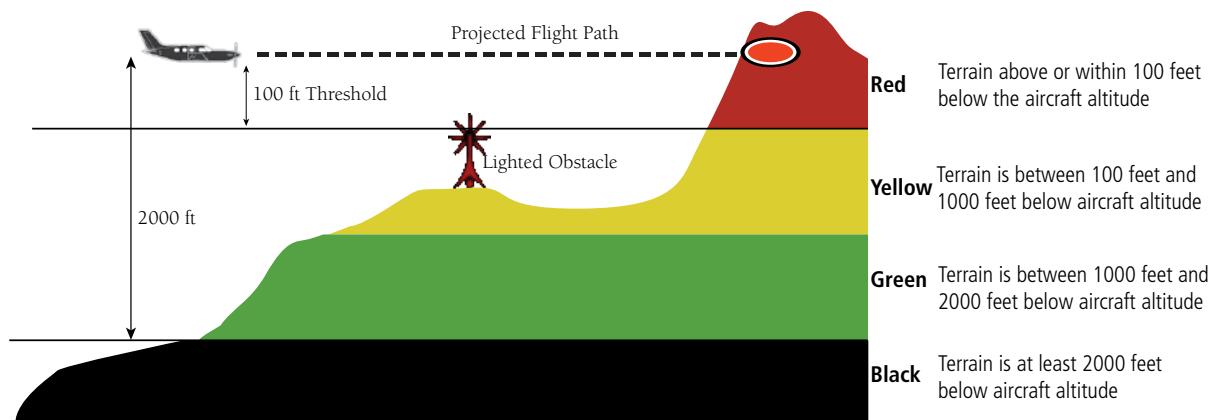


Figure 6-121 In-Air Terrain Altitude/Color Correlation for Terrain SVT

Unlighted Obstacle		Lighted Obstacle		Obstacle Location
< 1000' AGL	> 1000' AGL	< 1000' AGL	> 1000' AGL	
				Red obstacle is above or within 100 ft below the aircraft altitude
				Yellow obstacle is between 100 ft and 1000 ft below the aircraft altitude
				White obstacle is more than 1000 ft below aircraft altitude

Table 6-15 Terrain SVT Relative Obstacle Symbols and Colors

Potential Impact Area Examples	Alert Type	Example Annunciation
or	Warning	
or	Caution	

Table 6-16 Terrain SVT Potential Impact Areas with Annunciations

DISPLAYING RELATIVE TERRAIN INFORMATION

The Terrain SVT Pane is the principal map pane for viewing relative terrain information. Relative Terrain information is also available for display on navigation maps.

TERRAIN SVT PANE

The Terrain SVT Pane shows terrain, obstacle, and potential impact area information in relation to the aircraft's current altitude, without clutter from the basemap. If terrain or obstacles and the projected flight path of the aircraft intersect, the system automatically adjusts the map range if necessary to emphasize the display of the potential impact area(s).

Aircraft orientation on the Terrain SVT Pane is heading up unless there is no valid heading. A box on the map range arc indicates the selected map range. Turn the **Joystick** clockwise to increase the map range, or counter-clockwise to decrease the map range.

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.

Showing the Terrain SVT Pane:

From **Home**, touch the **Terrain SVT** Button.

The Terrain SVT 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 data on the Terrain SVT Pane:

- 1) From **Home**, touch **Terrain SVT > Terrain SVT Settings**.
- 2) Touch the **Show Aviation Data** Button to display/remove aviation data (airports, VORs, NDBs, Intersections) on the Terrain SVT Pane.

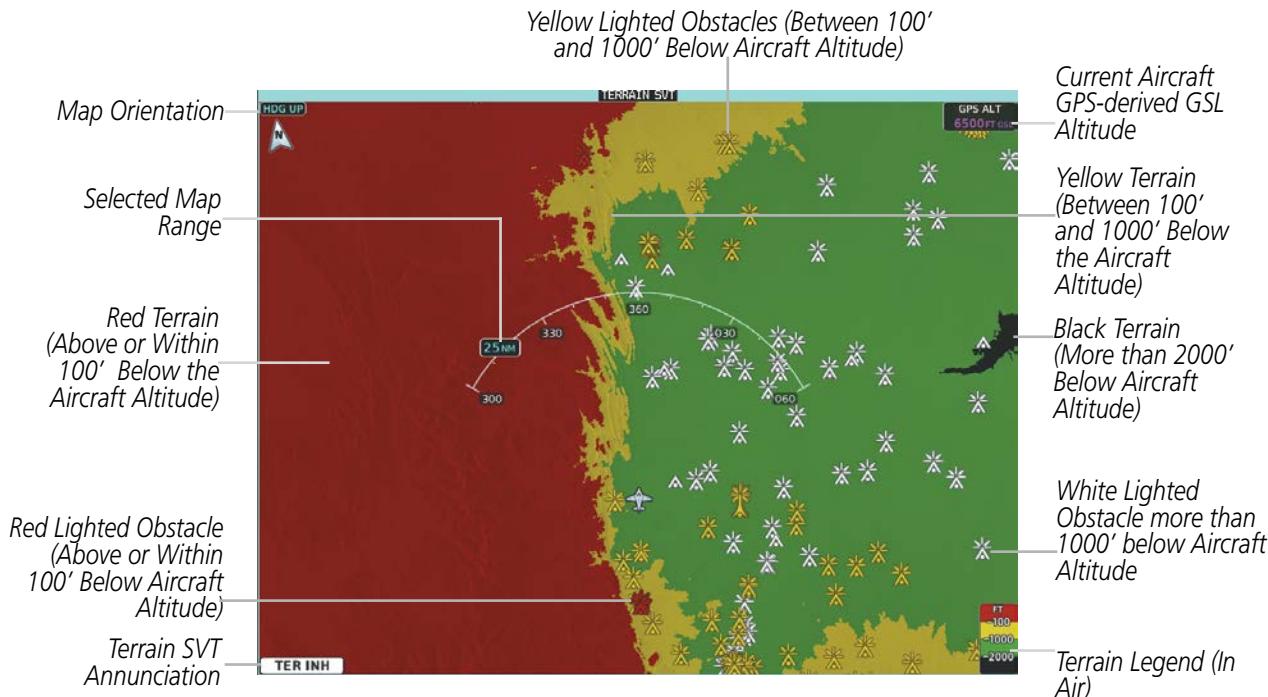


Figure 6-122 Terrain SVT Pane with Aircraft in the Air

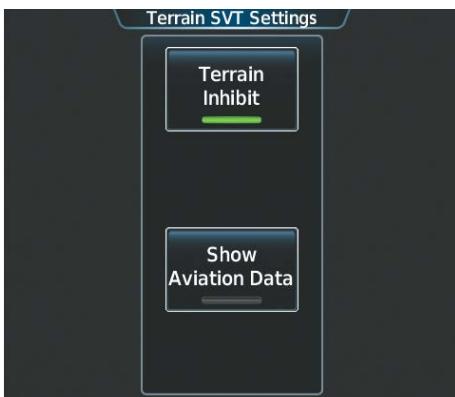


Figure 6-123 Terrain SVT Settings Screen

RELATIVE TERRAIN ON THE NAVIGATION MAPS

Terrain SVT provides relative terrain information for the Navigation Maps. This includes the display of relative terrain, obstacles, and potential impact areas. When relative terrain information is enabled on a navigation map, the system displays a relative terrain icon and legend. If Terrain SVT is not available or has failed, a white 'X' appears over the terrain icon. If the system calculates a potential impact area, it appears on any navigation map, independent of whether relative terrain information is enabled/disabled.

Controlling Relative Terrain Information (Navigation Map Panes):

- 1) From **Home**, touch **Map > 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 Map and HSI Map):

- 1) With the Inset Map or HSI Map displayed, press the **PFD Map Settings** Softkey.
- 2) Press the **Terrain** Softkey. Each softkey press cycles through an available option (Off, Relative, Absolute). The current selection is displayed in cyan on the softkey.

Controlling Obstacle Information on Navigation Maps:

- 1) From **Home**, touch **Map > Map Settings**.
- 2) If necessary, touch the Land Tab.
- 3) Touch the **Obstacle Data** Button to enable/disable the display of relative obstacle information.
- 4) To change the maximum map range to display obstacle information, touch the Obstacle Data Range Button, then scroll and select a maximum map range from the list.

The system issues alerts when flight conditions meet parameters set within Terrain SVT software algorithms. Terrain SVT alerts employ a CAUTION or a WARNING alert severity level, or both. When the system issues an alert, visual annunciations and aural alerts occur simultaneously. Table 6-17 shows Terrain SVT alert types with corresponding annunciations and voice alerts.

When the system issues an alert, annunciations appear on the PFD, the Terrain SVT Pane on the MFD, and on the Touchscreen Controllers. The Terrain SVT Alert Annunciation is shown to the upper left of the Altimeter on the PFD and on the lower left of the Terrain SVT Pane. A pop-up alert appears on the Touchscreen Controllers. To acknowledge the pop-up alert, do one of the following:

- Touch the **Terrain SVT** Button (accesses the Terrain SVT Pane), or
- Touch the **Inhibit Terrain** Button to inhibit Terrain SVT alerting, or
- Touch the **Ok** Button remove the pop-up alert from the Touchscreen Controller.

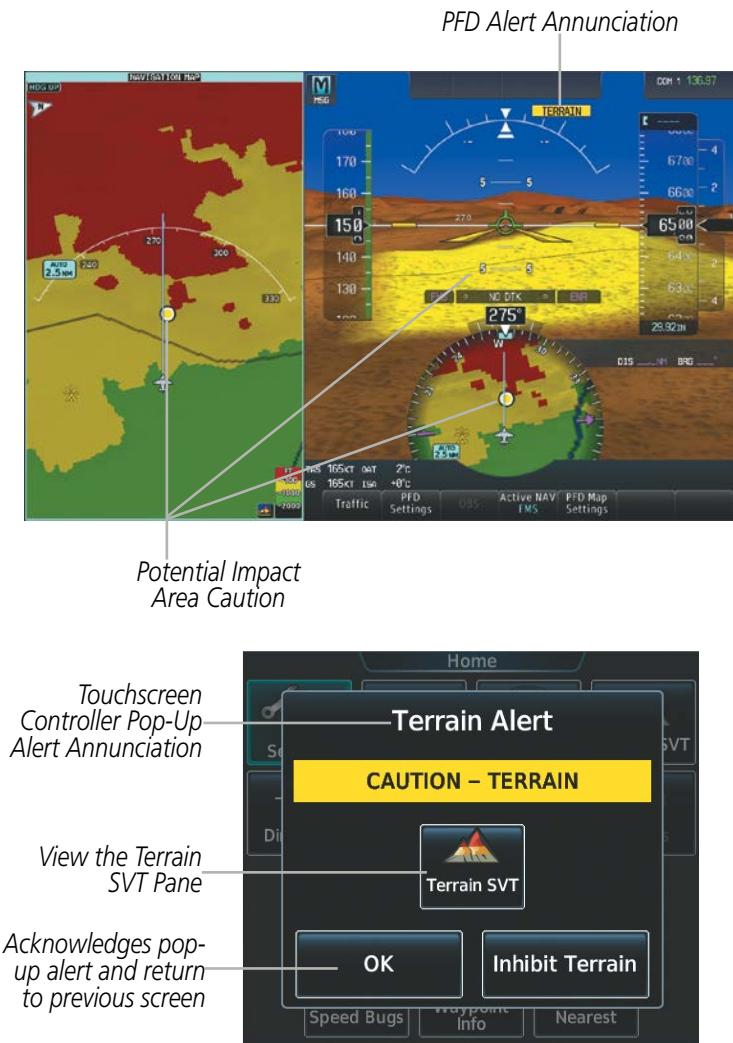


Figure 6-124 Terrain SVT Alert Annunciations

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

FORWARD LOOKING TERRAIN AVOIDANCE

The Forward Looking Terrain Avoidance (FLTA) feature of Terrain-SVT compares the aircraft's projected flight path with known terrain and obstacles in their respective databases and issues four types of alerts as either a caution or a warning:

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 Figure 6-125. The system shows a potential impact point on the navigation map (if terrain display is enabled) and on the Terrain SVT Display with an RTC alert.

The system issues **Imminent Terrain Impact (ITI)** and **Imminent Obstacle Impact (IOI)** alerts when the aircraft is below the elevation of a terrain or obstacle cell in the aircraft's projected path. The system shows a potential impact point on the navigation map (if terrain display is enabled) and on the Terrain SVT Display with an ITI or IOI alert. The system issues an alert when the projected vertical flight path is within the minimum clearance altitudes in Figure 6-125.



Figure 6-125 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. When Terrain SVT alerting is manually inhibited, the system displays the status annunciation 'TER INH' on the PFD and in the lower-left corner of the Terrain SVT Pane

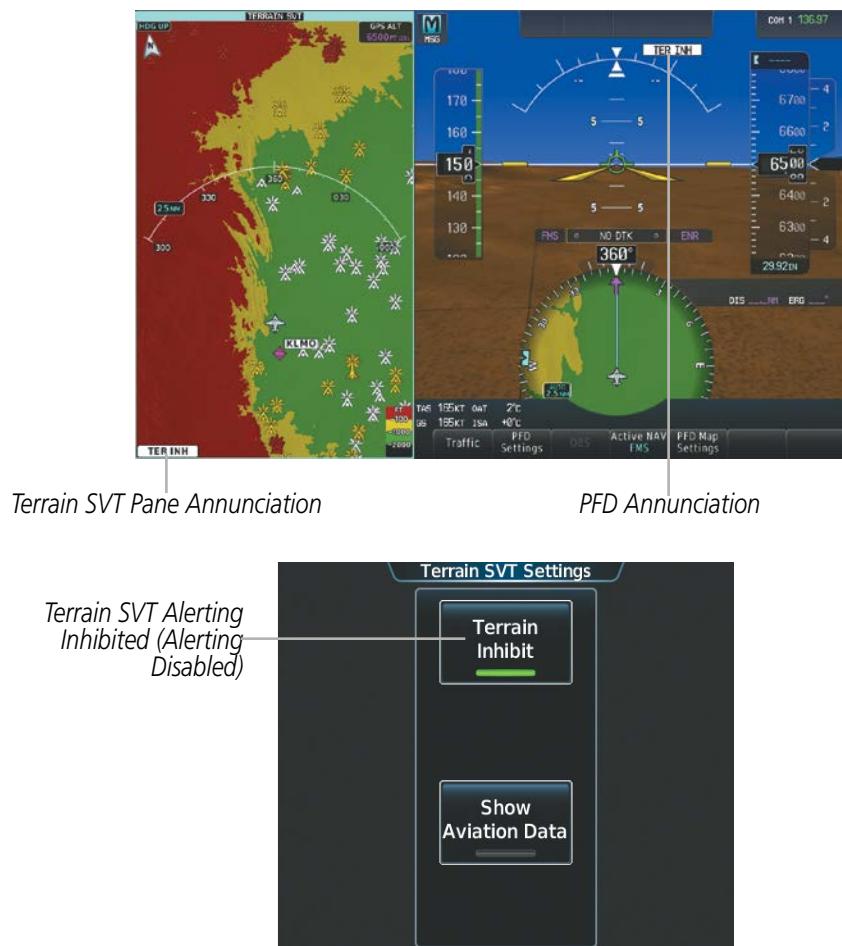


Figure 6-126 Inhibiting Terrain SVT Alerting

Inhibiting/enabling Terrain SVT alerting:

- 1) From **Home**, touch **Terrain SVT > Terrain SVT Settings**.
Or:
 - a) From **Home**, touch **Map > Map Settings**.
 - b) If necessary, touch the Sensor Tab.
 - 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.

If Terrain SVT alerts are inhibited when the Final Approach Fix is the active waypoint in a GPS SBAS approach, the system may show a 'LOW ALT' annunciation on the PFD next to the Altimeter if the current aircraft altitude is at least 164 feet below the prescribed altitude at the Final Approach Fix. See the Flight Instruments Section for details.

SYSTEM STATUS

During power-up, Terrain SVT conducts a system test. The system issues a voice alert when the test is finished.

Terrain SVT continually monitors several system-critical items such as database validity, hardware status, and GPS status. If the terrain/obstacle database is not available, the system generates the voice alert "**Terrain System Failure**" along with the 'TER FAIL' alert annunciation.

Terrain SVT 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 system generates the aural message "**Terrain System Not Available**" along with the visual 'TER N/A' annunciation. When sufficient GPS signal is returns and the aircraft is within the terrain/obstacle database coverage area, the system generates the voice alert "**Terrain System Available**".

Alert Type	PFD/Terrain SVT Pane Annunciation	Terrain SVT Pane Center Banner Annunciation	Voice Alert
System Test in Progress	TER TEST	TERRAIN TEST	None
System Test Pass	None	None	"Terrain System Test OK"
Terrain Alerting Inhibited	TER INH	None	None
No GPS position	TER N/A	NO FMS POSITION	"Terrain System Not Available" *
Excessively degraded GPS signal; or Out of database coverage area	TER N/A	None	"Terrain System Not Available" *
Terrain System Test Fail; Terrain or Obstacle database unavailable or invalid; Invalid software configuration; or System audio fault	TER FAIL	TERRAIN FAIL	"Terrain System Failure"
MFD Terrain or Obstacle database unavailable or invalid, and Terrain SVT operating with PFD Terrain or Obstacle databases	None	TERRAIN DATABASE FAILURE	None

* "Terrain System Available" will be heard when sufficient GPS signal is received, or Terrain database coverage area re-entered.

Table 6-18 Terrain SVT System Status Annunciations

6.8 TAWS-B



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



NOTE: Government agencies provide data for the TAWS databases. Garmin accurately processes and cross-validates the data but cannot guarantee the accuracy and completeness of the data.



NOTE: Terrain or obstacle information is not available if the aircraft is outside of the installed terrain or obstacle database coverage area.



NOTE: The terrain system is not available north of 89° North latitude and south of 89° South latitude.

TAWS-B (Terrain Awareness and Warning System - Class B) is a feature that provides increased situational awareness and aids in reducing controlled flight into terrain (CFIT) and obstacles. TAWS-B provides visual annunciations and voice alerts when terrain and obstacles are within the given altitude threshold from the aircraft.

TAWS-B satisfies TSO-C151b Class B requirements for certification.

TAWS-B requires information from the following sources:

- A valid terrain and obstacle database
- A valid 3-D GPS position solution

TAWS-B uses terrain and obstacle information supplied by government sources. Terrain information is based on terrain elevation information in a database that may contain inaccuracies. Individual obstructions may be shown if available in the database. Garmin verifies the data, per TSO-C151b. However, the displayed information should never be understood as being all-inclusive and data may be inaccurate.

TAWS-B uses information from the GPS receiver to provide a horizontal position and altitude. GPS altitude is derived from satellite measurements. GPS altitude is then converted to a height above geodetic sea level (GSL), which is the height above mean seal level (MSL) calculated geometrically. GSL altitude accuracy is affected by factors such as satellite geometry, but it is not subject to variations in pressure and temperature that normally affect pressure altitude devices. GSL altitude does not require local altimeter settings to determine MSL altitude. Therefore, GSL altitude provides a highly accurate and reliable altitude to calculate terrain and obstacle alerts.

The terrain and obstacle databases are referenced to mean sea level (MSL). Using the GPS position and GSL altitude, the system displays a 2-D picture of the surrounding terrain and obstacles relative to the position and altitude of the aircraft. Furthermore, the system uses GPS position and GSL altitude to calculate and project the aircraft's flight path in relation to the surrounding terrain and obstacles. In this manner, TAWS-B can provide advanced alerts of predicted dangerous terrain and obstacle 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 displayed GPS-GSL altitude. This variation results in the aircraft's true altitude differing from the baro-corrected altitude.

TAWS-B provides the following types of alerts:

- Forward Looking Terrain Avoidance (FLTA) Alerting, which consists of:
 - Required Terrain Clearance (RTC) / Required Obstacle Clearance (ROC) Alerting
 - Imminent Terrain Impact (ITI) / Imminent Obstacle Impact (IOI) Alerting
- Premature Descent Alerting (PDA)
- Excessive Descent Rate (EDR) Alerting
- Negative Climb Rate (NCR) after takeoff Alerting
- Altitude Voice Call Out (VCO) Alerting

RELATIVE TERRAIN SYMBOLOGY

TAWS-B uses colors and symbols to represent terrain and obstacles (with heights greater than 200 feet above ground level, AGL) present in the databases relative to aircraft altitude. The system dynamically adjusts these colors as the aircraft altitude changes, and after takeoff and landing.

While the aircraft is on the ground, the system displays relative terrain 400 feet or more above the aircraft altitude using red, and terrain at less than 400 feet above aircraft altitude using black, as shown on the TAWS On-Ground Legend shown in Figure 6-127. When the aircraft is in the air, the system displays relative terrain information using red, yellow, green, and black, as shown on the TAWS In-Air Legend shown in Figure 6-127. As the aircraft transitions from on-ground to in-air, or from in-air to on-ground, the display of relative terrain momentarily fades into the corresponding colors. If any type of TAWS alert occurs, the relative terrain colors will transition to the TAWS In-Air Legend if the TAWS On-Ground Legend was shown in order to provide the flight crew with the most information possible.

TAWS On-Ground Legend



TAWS In-Air Legend



Figure 6-127 TAWS Relative Terrain Legends

During an alert, the system shows potential impact areas over terrain or obstacles using bright yellow (caution) or bright red (warning) on navigation maps and on the TAWS Pane.

The colors and symbols in Figure 6-128 and Tables 6-19 and 6-20 represent terrain, obstacles, and potential impact areas.

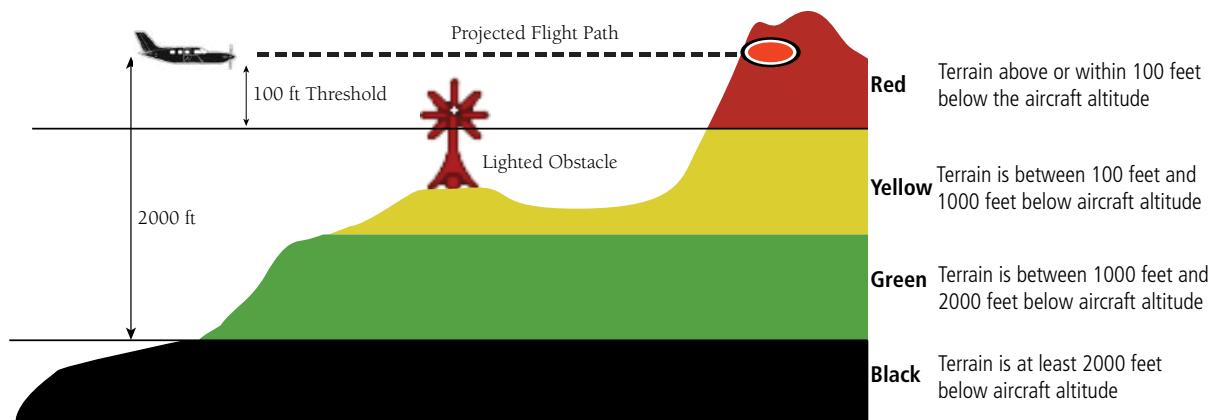


Figure 6-128 In-Air Terrain Altitude/Color Correlation for TAWS

Unlighted Obstacle		Lighted Obstacle		Obstacle Location
< 1000' AGL	> 1000' AGL	< 1000' AGL	> 1000' AGL	
				Red obstacle is above or within 100 ft below the aircraft altitude
				Yellow obstacle is between 100 ft and 1000 ft below the aircraft altitude
				White obstacle is more than 1000 ft below aircraft altitude

Table 6-19 TAWS Relative Obstacle Symbols and Colors

Potential Impact Area Examples	Alert Type	Example Annunciation
 or 	Warning	
 or 	Caution	

Table 6-20 TAWS-B Potential Impact Point Areas with Annunciations

DISPLAYING RELATIVE TERRAIN INFORMATION

The TAWS Pane is the principal map pane for viewing relative terrain information. Relative Terrain information is also available for display on navigation maps.

TAWS PANE

The TAWS Pane shows terrain, obstacle, and potential impact area information in relation to the aircraft's current altitude, without clutter from the basemap. If terrain or obstacles and the projected flight path of the aircraft intersect, the system automatically adjusts the map range if necessary to emphasize the display of the potential impact area(s).

Aircraft orientation on the TAWS Pane is heading up unless there is no valid heading. A box on the map range arc indicates the selected map range. Turn the **Joystick** clockwise to increase the map range, or counter-clockwise to decrease the map range.

The TAWS Pane also displays annunciations in the lower-left corner of the pane, in addition to banner annunciations in the center of the pane.

Showing the TAWS Pane:

From **Home**, touch the **TAWS** Button.

The TAWS 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 data on the TAWS Pane:

- 1) From **Home**, touch **TAWS > TAWS Settings**.
- 2) Touch the **Show Aviation Data** Button to display/remove aviation data (such as airports, VORs, NDBs, Intersections) on the TAWS Pane.

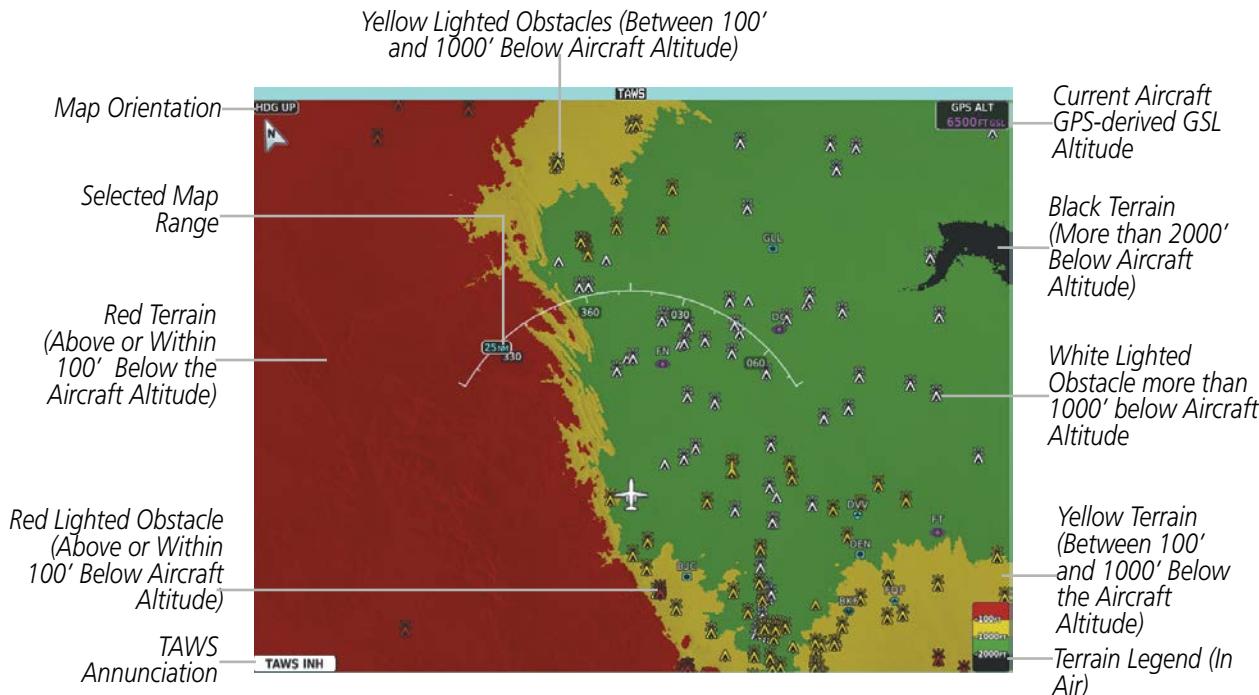


Figure 6-129 TAWS Pane with Aircraft in the Air (TAWS-B)

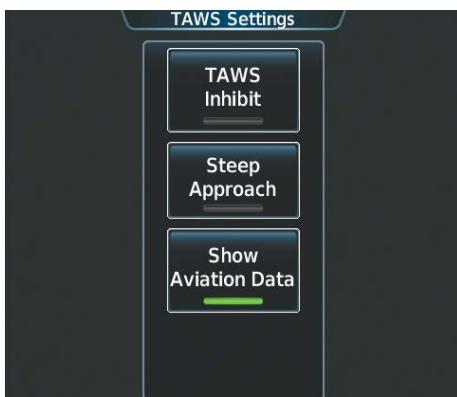


Figure 6-130 TAWS Settings Screen (TAWS-B)

RELATIVE TERRAIN ON THE NAVIGATION MAPS

TAWS provides relative terrain information for the Navigation Maps. This includes the display of relative terrain, obstacles, and potential impact areas. When relative terrain information is enabled on a navigation map, the system displays a TAWS icon and legend. If TAWS is not available or has failed, a white 'X' appears over the TAWS Icon. If the system calculates a potential impact area, it appears on any navigation map, regardless of whether relative terrain information is enabled/disabled.

Controlling Relative Terrain Information (Navigation Map Panes):

- 1) From **Home**, touch **Map > Map Settings**.
- 2) If necessary, touch the Sensor Tab.
- 3) Touch the **Terrain** Button.
- 4) Touch the **Relative** Button to enable Relative Terrain, or **Off** to remove terrain information.

Controlling Obstacle Information on Navigation Maps:

- 1) From **Home**, touch **Map > Map Settings**.
- 2) If necessary, touch the Land Tab.
- 3) Touch the **Obstacle Data** Button to enable/disable the display of relative obstacle information.
- 4) To change the maximum map range to display obstacle information, touch the Obstacle Data Range Button, then scroll and select a maximum map range from the list.
- 5) If necessary, touch the **Map Sync** Button to enable map synchronization. This is used to synchronize map settings (including obstacle settings) with other Navigation Maps.
- 6) Touch the **Onside** Button to synchronize the selected Navigation Map settings to onside Navigation Maps, then touch either the **PFD 1** or **MFD Left** Buttons to select which Navigation Map settings should be initially be applied to onside Navigation Maps.

Or:

Touch the **All** Button to synchronize all navigation maps, then touch a button to select which Navigation Map settings should initially be applied to all Navigation Maps (**MFD Left**, **MFD Right**, **PFD1**, **PFD2**).

TAWS-B TERRAIN AND OBSTACLE ALERTS

The system issues alerts when flight conditions meet parameters that are set within TAWS-B software algorithms. The system issues TAWS-B terrain/obstacle alerts as a caution or warning severity level. Alerts include visual annunciations and voice alerts (Table 6-21).

When the system issues an alert, annunciations appear on the PFDs, the TAWS Pane, and on the Touchscreen Controllers. The PFD shows the annunciation to the left of the altitude tape. The 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 **TAWS** Button to display the TAWS Pane and the TAWS Settings Screen.
- Touch the **OK** Button to remove the pop-up alert.
- Touch the **Inhibit TAWS** Button to inhibit the TAWS system from issuing alerts.

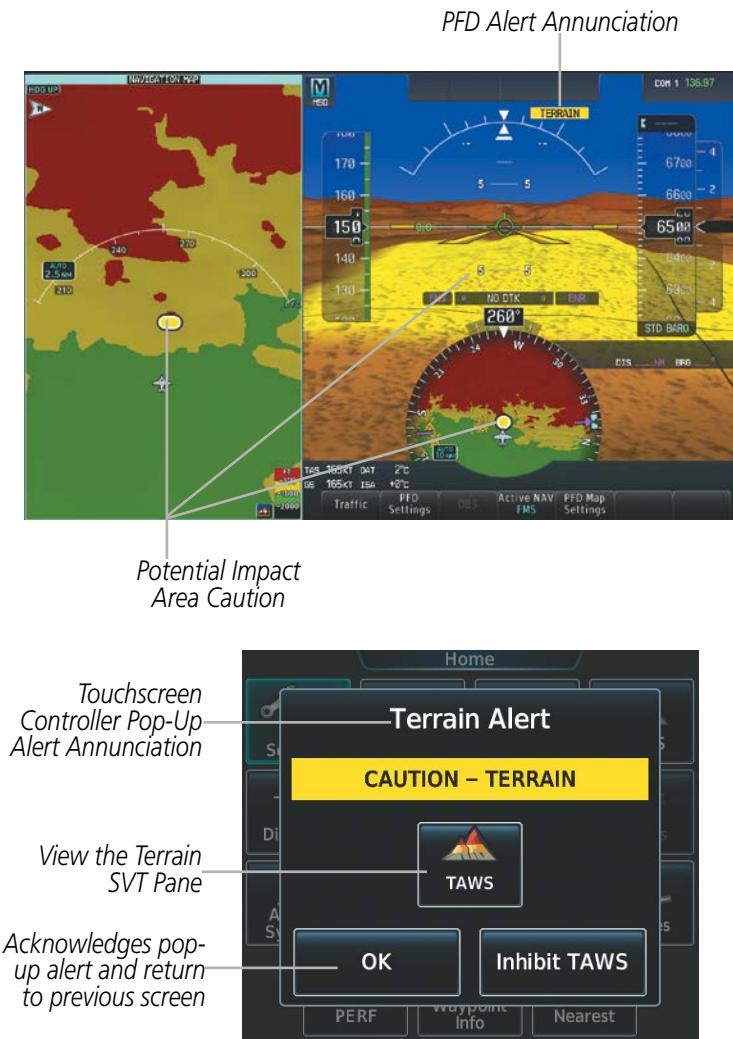


Figure 6-131 TAWS-B Alert Annunciations (SVT Terrain Enabled)

Alert Type	PFD/MFD** Alert Annunciation	MFD Pop-Up Alert (except TAWS-B Page)	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"
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	DON'T SINK * or TOO LOW - TERRAIN	"Don't Sink" * or "Too Low, Terrain"

* Alerts with multiple messages are configurable at installation and are installation-dependent. Alerts for the default configuration when more than one option is available are indicated with asterisks.

** Annunciation is displayed on the MFD when terrain display is enabled.

Table 6-21 TAWS-B Alerts Summary

FORWARD LOOKING TERRAIN AVOIDANCE (FLTA)

The Forward Looking Terrain Avoidance (FLTA) feature of TAWS-B compares the projected flight path as derived from GPS data with terrain features and obstacles from the 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 Figure 6-132. When an RTC alert is issued, the system displays a potential impact area on navigation maps and the TAWS Pane.

Imminent Terrain Impact (ITI) and **Imminent Obstacle Impact (IOI)** alerts occur when the aircraft is below the elevation of a terrain or obstacle in the aircraft's projected path. ITI and IOI alerts are accompanied by a potential impact area on navigation maps and the TAWS Pane. The alert occurs when the projected vertical flight path is calculated to come within minimum clearance altitudes in Figure 6-132.

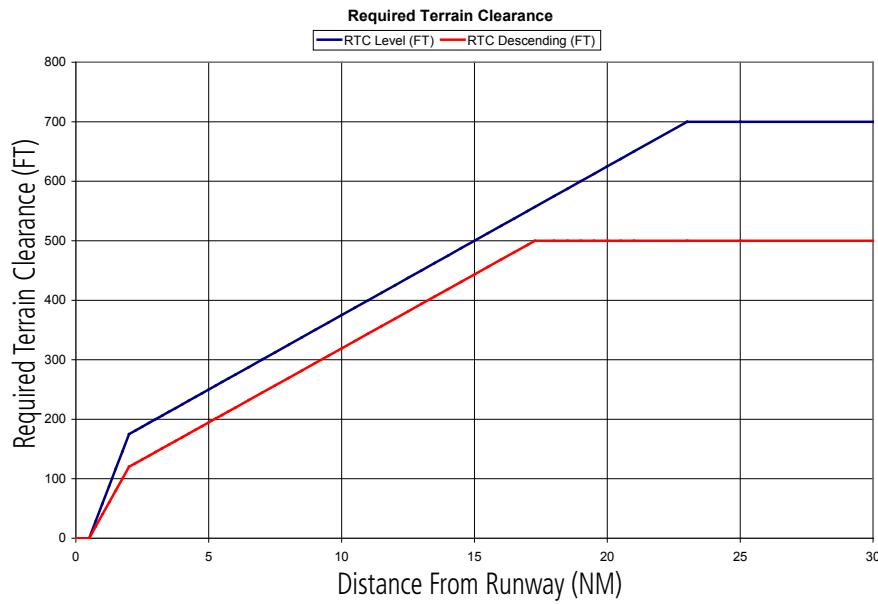


Figure 6-132 FLTA Alert Minimum Terrain and Obstacle Clearance Values

The system automatically disables FLTA alerts when the aircraft is less than 200 feet above the destination runway elevation while within 0.5 nm of the approach runway, or the aircraft is between runway ends.

PREMATURE DESCENT ALERTING

A **Premature Descent Alert (PDA)** occurs when the system detects that the aircraft is significantly below the normal approach path to a runway (Figure 6-133).

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.

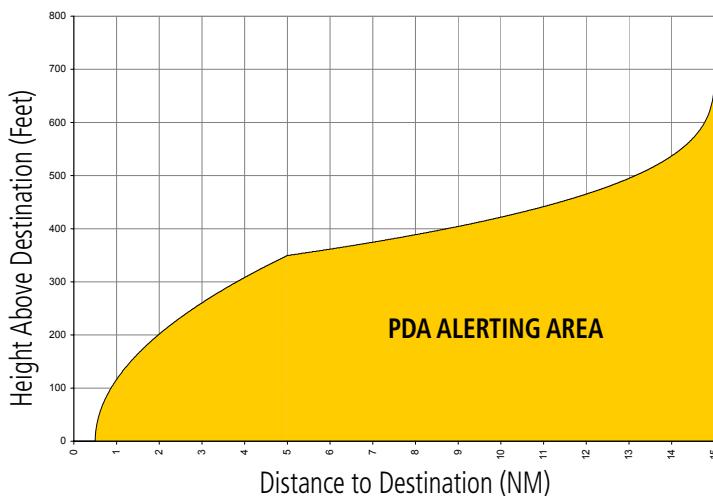


Figure 6-133 PDA Alerting Threshold

INHIBITING FLTA AND PDA ALERTS

The flight crew can manually inhibit FLTA and PDA visual annunciations and voice alerts. Discretion should be used when inhibiting alerts and the system should be enabled when appropriate. When PDA and FLTA alerts are inhibited, the system status annunciation 'TAWS INH' appears on the TAWS Pane and on the PFDs.



NOTE: Inhibiting TAWS alerts inhibits FLTA and PDA alerts only. EDR and VCO alerts remain enabled even when TAWS is inhibited.

TAWS INH

Figure 6-134 TAWS Alerting Disabled (TAWS Inhibited) Pane Annunciation

Inhibiting/enabling TAWS-B FLTA and PDA alerting:

- 1) From **Home**, touch **TAWS > TAWS Settings**.

Or:

- a) From **Home**, touch **Map > Map Settings**.
- b) If necessary, touch the Sensor Tab.
- c) Touch the Terrain **Settings** Button.

- 2) Touch the **TAWS Inhibit** Button. TAWS-B alerting is inhibited when the button annunciator is green, enabled when gray.

Inhibiting TAWS-B alerting while an alert is occurring:

- 1) Touch the **Inhibit TAWS** Button on the Terrain Alert pop-up window on either 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 TAWS alerting is manually inhibited (or the TAWS system is not available or has failed), the system may display a 'LOW ALT' annunciation on the PFDs next to the altitude tape if the following conditions are met:

- The aircraft is on a GPS 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.

EXCESSIVE DESCENT RATE ALERT

The **Excessive Descent Rate (EDR)** alert occurs when the system determines the aircraft is closing (descending) upon terrain at an excessive speed. Figure 6-135 shows the parameters for the alert as defined by TSO-C151b.

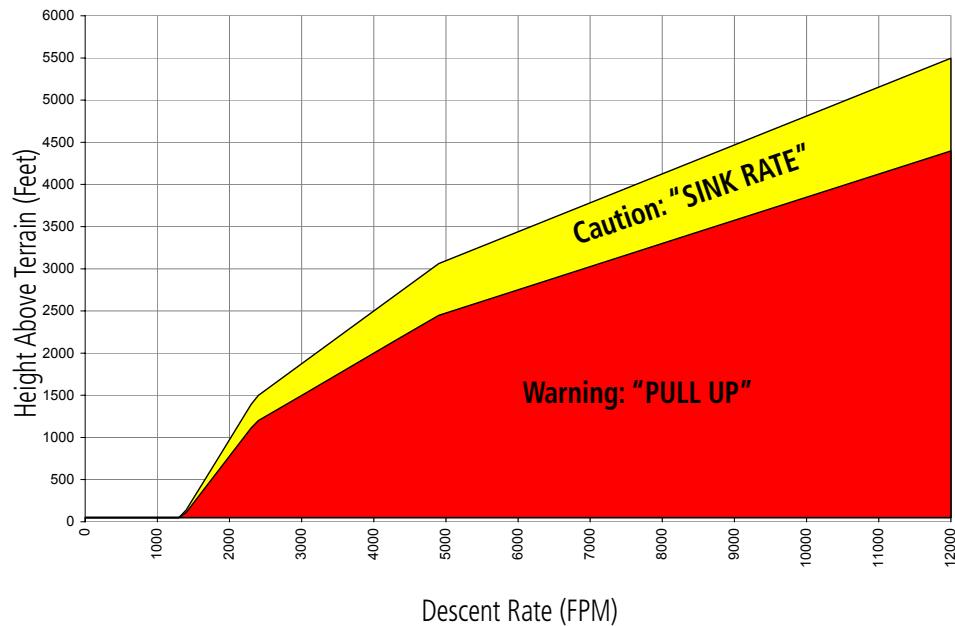


Figure 6-135 Excessive Descent Rate Alert Criteria

NEGATIVE CLIMB RATE AFTER TAKEOFF ALERT

The **Negative Climb Rate (NCR) After Takeoff** alert (also referred to as "Altitude Loss After Takeoff") provides alerts when the system determines the aircraft is losing altitude (closing upon terrain) after takeoff. The voice alert "Don't Sink" is given for NCR alerts, accompanied by an annunciation and a pop-up terrain alert on the Touchscreen Controllers. NCR alerting for TAWS-B 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 (Figure 6-136) or sink rate (6-137).

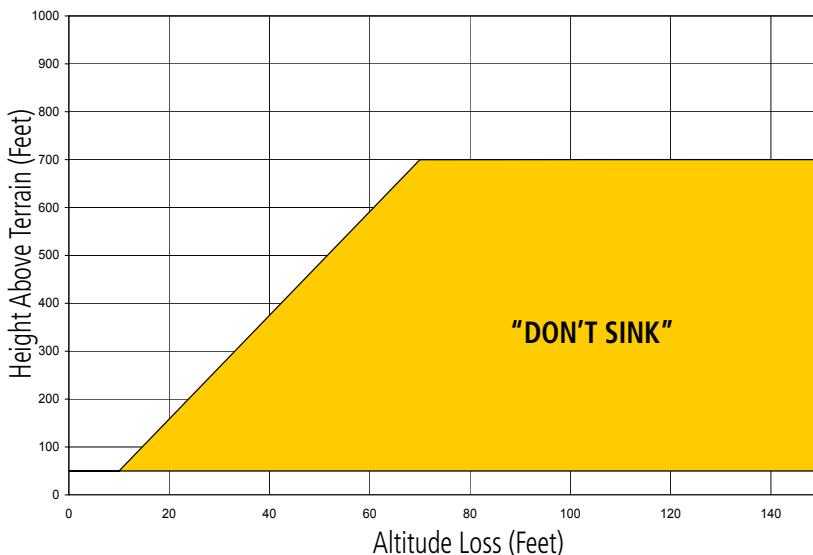


Figure 6-136 Negative Climb Rate (NCR) Altitude Loss

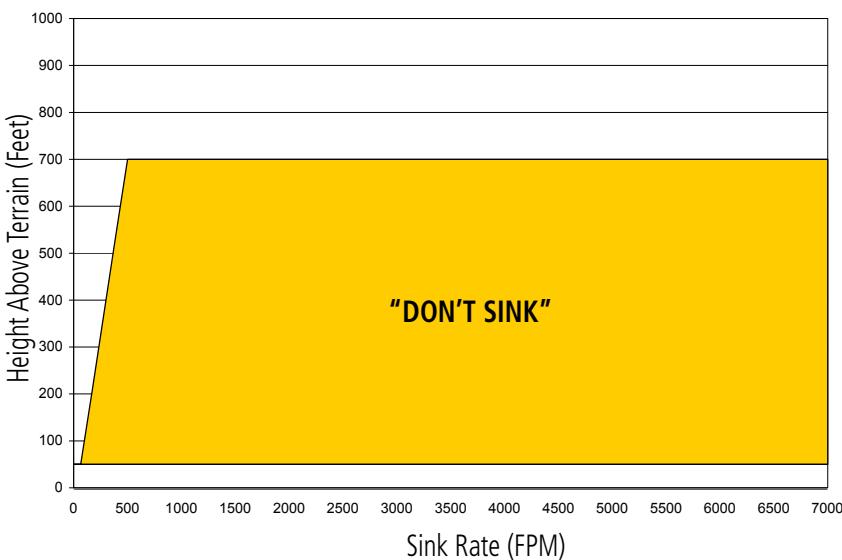


Figure 6-137 Negative Climb Rate (NCR) Sink Rate

ALTITUDE VOICE CALLOUT (VCO)

TAWS-B provides a voice alert as the aircraft descends, at 500 feet above the terrain (if greater than five nm from the nearest airport) or 500 feet above the nearest runway threshold elevation (if less than five nm from the nearest airport). Upon descent to this altitude, TAWS-B issues the voice alert **“Five Hundred”**.

There are no display annunciations or pop-up alerts that accompany the VCO alert. This voice alert cannot be inhibited.

SYSTEM STATUS

During power-up, TAWS conducts a system test of its alerting capabilities. The system test can also be manually initiated. A voice alert occurs at test completion. TAWS system testing is disabled when ground speed exceeds 30 knots. TAWS terrain alerts will not be issued while a test is in progress.

Manually testing the TAWS System:

- 1) From **Home**, touch **Aircraft Systems > System Tests**.
- 2) Touch the **TAWS** Button. Button displays 'In Progress' during test.

Alert Type	PFD/ TAWS Pane Annunciation	TAWS Pane Center Banner Annunciation	Voice Alert
System Test in Progress	[TAWS TEST]	TAWS TEST	None
System Test Pass	None	None	"TAWS System Test OK"
PDA/FLTA Alerting Inhibited	[TAWS INH]	None	None
No FMS position	[TAWS N/A]	NO FMS POSITION	"TAWS Not Available"*
Excessively degraded GPS signal; or Out of database coverage area	[TAWS N/A]	None	"TAWS Not Available"*
Terrain System Test Fail; Terrain or Obstacle database unavailable or invalid; Invalid software configuration; or System audio fault	[TAWS FAIL]	TERRAIN FAIL	"TAWS System Failure"
MFD Terrain or Obstacle database unavailable or invalid, and TAWS operating with PFD Terrain or Obstacle databases	None	[TERRAIN DATABASE FAILURE]	None

* "TAWS Available" will be heard when sufficient GPS signal is received, or Terrain database coverage area re-entered.

Table 6-22 TAWS System Status Annunciations

TAWS-B ABNORMAL OPERATIONS

TAWS-B continually monitors several system-critical items such as database validity and GPS status.

If no display 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 PFDs. The voice alert “**TAWS Not Available**” is also generated if the aircraft is in the air. 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	PFD and TAWS Pane Annunciation	TAWS Pane Center Banner Annunciation
TAWS System Test Fail; Terrain, Airport Terrain or Obstacle database unavailable or invalid on all GDUs; software mismatch among GDUs; TAWS audio fault	TAWS FAIL	TAWS FAIL
MFD Terrain or Obstacle database unavailable or invalid. TAWS operating with PFD Terrain or Obstacle databases	None	TERRAIN DATABASE FAILURE
No FMS position	TAWS N/A	NO FMS POSITION
Excessively degraded GPS signal, or out of database coverage area	TAWS N/A	
Sufficient GPS signal reception restored	None	None

Table 6-23 TAWS-B Abnormal Status Alerts

6.9 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: 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: TIS is disabled if another traffic system is installed.

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 symbology shown in the table below.

TIS Symbol	Description
	Other Traffic
	Traffic Advisory (TA)
	Traffic Advisory Off Scale

Table 6-24 TIS Traffic Symbols

Traffic Advisories (TA) alert the crew to intruding aircraft. When traffic meets the advisory criteria for the TA, a solid amber circle symbol is generated. 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 (Figure 6-138 and Traffic Inset Map and in a banner at the lower left corner of navigation maps with traffic enabled (Figure 6-140).

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. 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.

To view the Traffic Map Pane, touch the **Traffic** Button on the Home Screen of the Touchscreen Controller when in MFD Mode. If the PFD is in Split Mode, pressing the **Traffic** Softkey on the PFD also displays the Traffic Map Pane on the PFD.

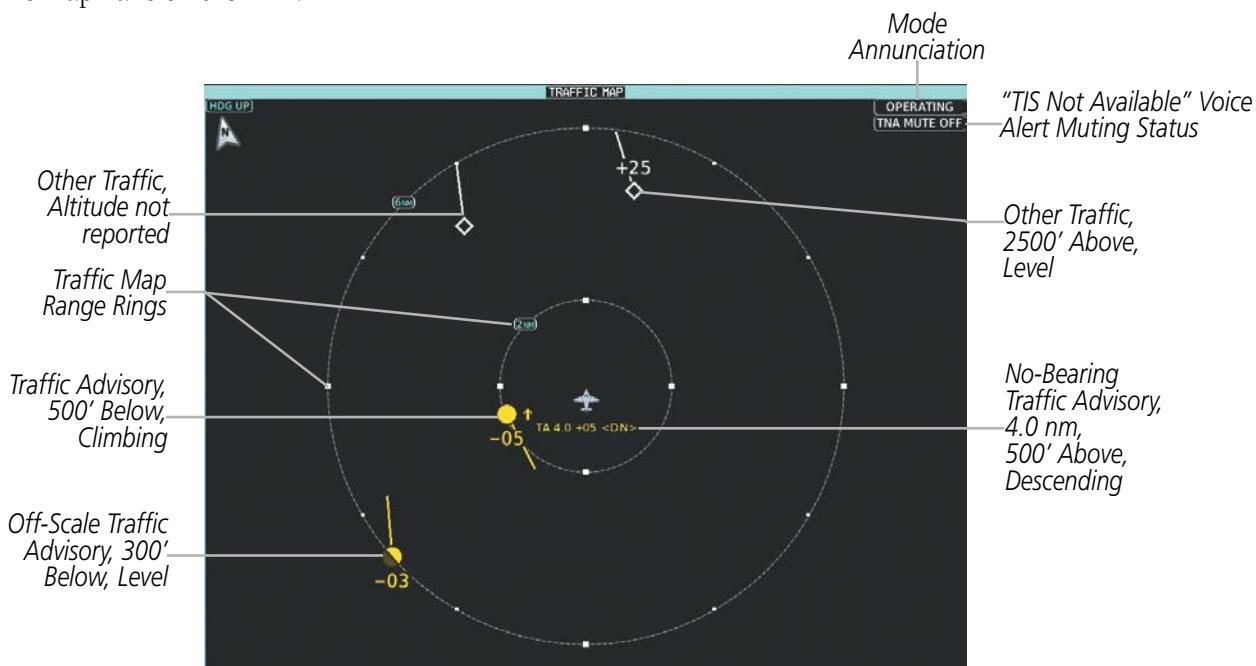


Figure 6-138 Traffic Map Pane with TIS Traffic (MFD in Full Mode)

The traffic mode is annunciated in the upper right corner of the Traffic Map. When the aircraft is on the ground, TIS automatically enters Standby 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 airborne, TIS switches to Operating Mode and traffic information is displayed. The mode can be changed manually using the Touchscreen Controller.

Selecting a TIS mode:

- 1) From **Home**, touch **Traffic > Traffic Settings**.

Or:

- a) From **Home**, touch **Map > Map Settings**.
- b) If necessary, touch the Sensor Tab.
- c) Touch the **Traffic Settings** Button.



Figure 6-139 Traffic Setting Screen for the Traffic Map Pane

DISPLAYING TRAFFIC DATA ON NAVIGATION MAPS

The Traffic Map Page 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 Page.

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 Page:

- 1) From **Home**, touch **Map > 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 Page, a status icon is shown to indicate the feature is enabled for display.



Figure 6-140 TIS Traffic on Navigation Map Page

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 **PFD Map Settings** Softkey.
- 2) Press the **Traffic** Softkey to display traffic data on the PFD Inset navigation map.

Displaying/removing the Traffic Inset Map on the PFD:

Press the **Traffic Inset** Softkey.

The Navigation Map Page Setup Menu provides a means in addition to the softkey for enabling/disabling display of traffic. The setup menu also controls the map range settings above which traffic data (symbols and labels) are decluttered from the display. If a map range larger than the map range setting is selected, the data is removed from the map. Maps besides the Traffic Map Page use settings based on those selected for the Navigation Map Page.

Customizing traffic display on the navigation maps:

- 1) From **Home**, touch **Map > Map Settings**.
- 2) If necessary, touch the Sensor Tab.
- 2) 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.

TIS ALERTS

When the number of TAs on the Traffic Map Page increases from one scan to the next, the following occur:

- The system issues a single “**Traffic**” voice alert.
- A ‘TRAFFIC’ Annunciation appears to the bottom left of the Attitude 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 6-141 Traffic Annunciation (PFD)

A “**TIS 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 “**TIS 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 “TIS Not Available” voice alert:

- 1) From **Home**, touch **Traffic > Traffic Settings**.
- 2) Touch the **Mute “Traffic Not Available”** Button (Figure 6-142). ‘TNA MUTE ON’ appears in the upper right corner of the Traffic Map.

Or:

- 1) From **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.

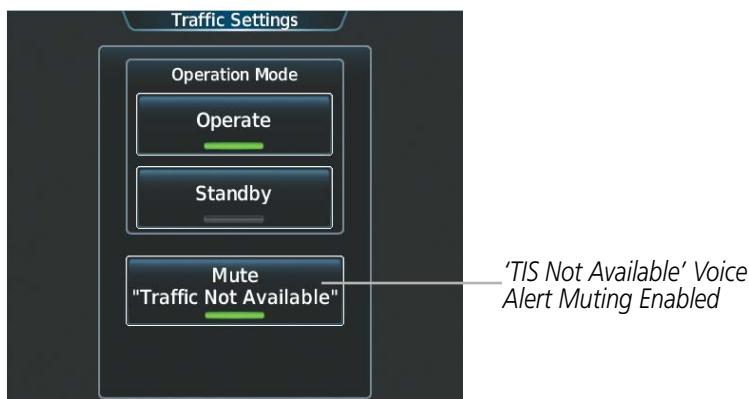


Figure 6-142 Traffic Settings Screen for TIS

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	[X]	Data is being received from the transponder, but a failure is detected in the data stream*
NO DATA	TRFC FAIL	[X]	Data is not being received from the transponder*
OPERATING	None	[diamond up]	TIS is operating and is receiving traffic data from a data link.
OPERATING	UNAVAILABLE	[X]	TIS is operating, but the traffic service is currently unavailable or is out of reception range.
STANDBY	STANDBY	[X]	TIS is in Standby Mode.
UNIT FAILED	TRFC FAIL	[X]	The transponder has failed*

* Contact a service center or Garmin dealer for corrective action

Table 6-25 TIS Modes and Status Annunciations



Figure 6-143 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 (Table 6-26).

Traffic Status Banner Annunciation	Description
TA OFF SCALE*	A Traffic Advisory is outside the selected display range Annunciation is removed when traffic comes within the selected display range
TA X.X ± XX <UP> or <DN>**	System cannot determine bearing of Traffic Advisory Annunciation indicates distance in nm, altitude separation in hundreds of feet, and 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 6-26 TIS Traffic Status Annunciations

6.10 GARMIN TAS/TCAS I TRAFFIC



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



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

The optional Garmin GTS 825 is a Traffic Advisory System (TAS). The optional Garmin GTS 855 is a Traffic Alert and Collision Avoidance System I (TCAS I). Differences between the traffic systems, where applicable, are discussed throughout this section. The traffic system enhances flight crew situational awareness by monitoring the airspace for transponder-equipped aircraft. The system also provides visual annunciations and voice alerts to help the pilot visually acquire traffic.

The traffic 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.

The traffic system also receives Automatic Dependent Surveillance-Broadcast (ADS-B) traffic information from suitably equipped participating aircraft, ground vehicles, and FAA ground stations using the 1090 MHz Extended Squitter (1090 ES) transponder.

TAS/TCAS I THEORY OF OPERATION

When the traffic system is in Operating Mode, the system interrogates the transponders of other aircraft while monitoring for transponder replies. The system uses this information to derive the distance, relative bearing, and if received, 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.

TAS/TCAS I SURVEILLANCE VOLUME AND SYMBOLOLOGY

The traffic system actively monitors the airspace within $\pm 10,000$ feet of own altitude, and up to 40 nm in the forward direction under ideal conditions. TAS/TCAS I range is reduced to the sides and aft of own aircraft due to the directional interrogation signal patterns.

In areas of greater transponder traffic density or when Traffic Alert and Collision and Alerting Systems II (TCAS II) systems are detected, the system automatically reduces its interrogation transmitter power (and therefore range) in order to limit potential interference from other signals.

ADS-B SYSTEM OVERVIEW

ADS-B is a core technology in the FAA NextGen air traffic control system. It includes air-to-air, air-to-ground, and ground-to-air transmission of aircraft position and velocity data to provide pilots and controllers with a more comprehensive view air traffic to improve flight safety and efficiency.

ADS-B relies on 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.

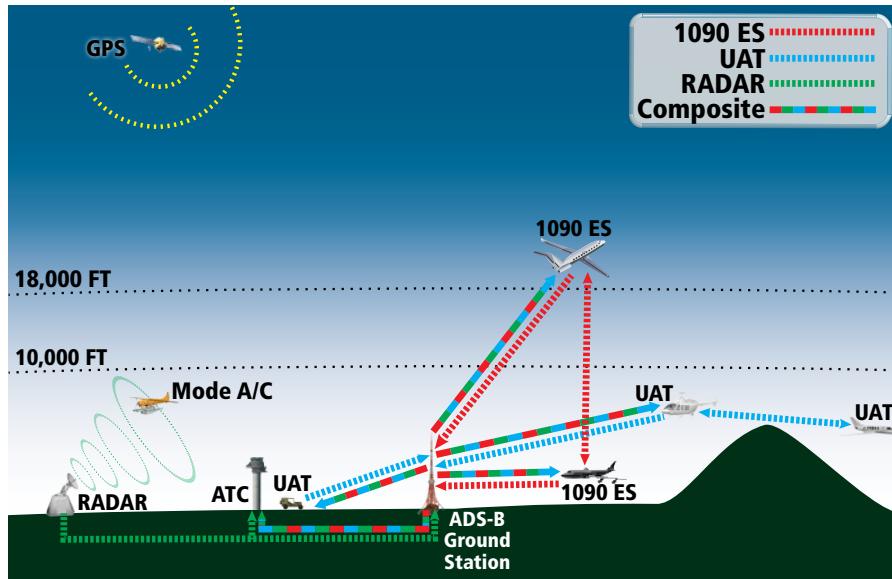


Figure 6-144 ADS-B System

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.

A participating aircraft may use either a 1090 MHz Extended Squitter (1090 ES) transponder or a 979 MHz Universal Access Transceiver (UAT) to communicate in the ADS-B system. Some aircraft are equipped to operate on both frequencies.

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 ES and 978 MHz UAT data links, a method exists to get data from one data link to the other. ADS-R is the rebroadcast of ADS-B data by FAA ground stations, which provide this service by taking data from one link and rebroadcasting it on the other. For example, two aircraft are in the service volume for a ground station, and one is transmitting on 1090 MHz and the other on 978 MHz, the ground station retransmits the data from each aircraft on the other link to ensure the two aircraft can "see" each other.

An aircraft with a GTS 825/855 and a 1090 MHz ES transponder, without an installed UAT, cannot see an aircraft providing only UAT data without the presence of a ground station. However, if the UAT aircraft also has an operating transponder, the GTS 825/855 may detect still this aircraft using TAS/TCAS I interrogations if it is within its TAS/TCAS I surveillance volume.

TRAFFIC INFORMATION SERVICE-BROADCAST (TIS-B)

TIS-B provides the bridge between the radar-based ATC system and the ADS-B-based system. When an ADS-B In or Out capable aircraft is within the service volume of an FAA ADS-B ground station, the ground station broadcasts a portion of the ATC radar data to the aircraft. This aircraft is then included in the list of aircraft being provided TIS-B service and is then considered a “TIS-B participant.”

TIS-B coverage is available when the aircraft is within ground station coverage, in Secondary Surveillance Radar coverage, and the other aircraft is also in Secondary Surveillance Radar coverage, and is transmitting its altitude.

The ground station provides ATC radar information for other aircraft within ±3,500 feet and 15 NM of the participant, to include altitude, position, ground speed, and ground track. TIS-B broadcasts occur once every three to thirteen seconds, depending on the characteristics of the ground station providing the TIS-B service.

ADS-B WITH TAS/TCAS I

The Garmin traffic system attempts to match (or “correlate”) TAS/TCAS I-detected traffic with ADS-B received traffic. When a correlation is made, the only the traffic with the most accurate information is displayed to the flight crew. Any traffic that is not correlated (i.e., only detected by one system but not the other) is also displayed for the flight crew. This correlation of traffic improves the accuracy of the traffic displayed, while reducing the occurrence of the same aircraft being displayed twice.



NOTE: *When operating on the edges of ATC radar coverage or when the TAS/TCAS I system providing intermittent traffic data, a single aircraft may be briefly or periodically depicted as two aircraft on the display.*

In order to display ADS-B traffic, the TAS/TCAS I system must be in Operating Mode, and the ADS-B Display button must be enabled on the Traffic Settings Screen.

TRAFFIC SYMBOLS

The symbols used to display TAS/TCAS I and ADS-B traffic are shown in Table 6-27. Above or below the traffic symbol is the traffic identifier, and altitude. A small up or down arrow next to the traffic symbol indicates that the traffic is climbing or descending at a rate of at least 500 feet per minute.

Symbol	Description
	Traffic Advisory with directional information. Points in the direction of the intruder aircraft track.
	Traffic Advisory without directional information.
	Traffic Advisory out of the selected display range. Displayed at outer range ring at proper bearing.
	Proximity Advisory with directional information. Points in the direction of the aircraft track.
	Proximity Advisory without directional information.

	Non-threat traffic with directional information. Points in the direction of the intruder aircraft track.
	Non-threat traffic without directional information.
	Traffic located on the ground with directional information. Points in the direction of the aircraft track. Ground traffic is only displayed when ADS-B is in Surface (SURF) Mode or own aircraft is on the ground.
	Ground traffic without directional information. Ground traffic is only displayed when ADS-B is in Surface (SURF) Mode or own aircraft is on the ground.
	Non-aircraft ground traffic. Ground traffic is only displayed when ADS-B is in Surface (SURF) Mode or own aircraft is on the ground.

Table 6-27 Traffic Symbology

A Traffic Advisory (TA), displayed as an amber circle or triangle, alerts the crew to a potentially hazardous intruding aircraft, if the closing rate, distance, and vertical separation meet TA criteria. A Traffic Advisory that is beyond the selected display range (off scale) is indicated by a half TA symbol at the edge of the screen at the relative bearing of the intruder.

A Proximity Advisory (PA), displayed as a solid white diamond or triangle, indicates the intruding aircraft is within ± 1200 feet and is within a 6 nm range, but is still not considered a TA threat.

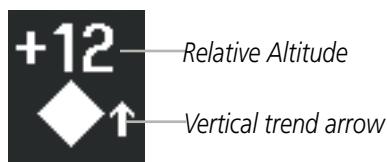
A Non-threat Advisory, shown as an open white diamond or triangle, is displayed for traffic beyond 6 nm that is neither a TA or PA.

A brown triangle represents an aircraft with directional information on the ground, and a brown diamond represents an aircraft on the ground without directional information. Participating ground vehicles appear with a brown vehicle icon.

Aircraft in the air show relative altitude, when available, above or below the corresponding intruder symbol in hundreds of feet (Figures 6-145, 6-146). When this altitude is above own aircraft, it is preceded by a '+' symbol; a minus sign '-' indicates traffic is below own aircraft.

The system displays the altitude vertical trend as an up/down arrow (for speeds vertical greater than 500 fpm in either direction) to the right of the intruder symbol (Figures 6-145 6-146).

If the intruding aircraft is providing ADS-B track information, a motion vector line extending beyond the traffic symbol in the direction of the track may also be displayed (Figure 6-146) when motion vectors are enabled.

**Figure 6-145 Intruder Altitude and Vertical Trend Arrow****Figure 6-146 Intruder Traffic with ADS-B Directional Information and Track**

TAS/TCAS I TA ALERTING CONDITIONS

The traffic system automatically adjusts its TA sensitivity level to reduce the likelihood of nuisance TA alerting in certain conditions. The system applies Level A sensitivity when the groundspeed is less than 120 knots.

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.
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 range is less than 20 seconds.

Table 6-28 TA Sensitivity Level for TAS/TCAS I Detected Traffic

CONFLICT SITUATIONAL AWARENESS

Conflict Situational Awareness (CSA) is an alerting algorithm which provides ADS-B traffic alerting.

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	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 6-29 CSA Alerting Thresholds for ADS-B Traffic

TRAFFIC ALERTS

When the system detects a new Traffic Advisory (TA), the following occur:

- The system issues a single “**Traffic!**” voice alert, followed by additional voice information about the bearing, relative altitude, and approximate distance from the intruder that triggered the TA (Table 6-30). For example,

the announcement “**Traffic! 12 o'clock, high, four miles**,” would indicate the traffic is in front of own aircraft, above own altitude, and approximately four nautical miles away.

- A ‘TRAFFIC’ annunciation appears at the top right of the airspeed tape on the PFD, flashes for five seconds, and remains displayed until no TAs are detected in the area (Figure 6-147).
- If the PFD is operating in Full Mode and no inset map shown, the system displays the Traffic Inset Map. If the Inset Navigation Map was shown prior to the alert, the system enables the display of traffic on the PFD Inset Navigation Map. When operating in Split Mode, pressing the **Traffic** Softkey displays the Traffic Map Pane.

A TA will be displayed for at least eight seconds, even if the condition(s) that initially triggered the TA are no longer a factor.



Figure 6-147 Traffic Annunciation (PFD)

Bearing	Relative Altitude	Approximate Distance (nm)
“One o'clock” through “Twelve o'clock” or “No Bearing”	“High”, “Low”, “Same Altitude” (if within 200 feet of own altitude), or “Altitude not available”	“Less than one mile”, “One Mile” through “Ten Miles”, or “More than ten miles”

Table 6-30 TA Descriptive Voice Alert



NOTE: ADS-B traffic voice alerts are suppressed when below 500 feet.

AIRBORNE AND SURFACE APPLICATIONS

The ADS-B system 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 application is on, the system displays airborne and on-the-ground traffic. At

a Traffic Map range of two nm or less, the airport environment (including taxiways and runways) appears in addition to traffic. The airport displays are derived from the SafeTaxi database. Refer to the Additional Features section for more information about SafeTaxi displays.

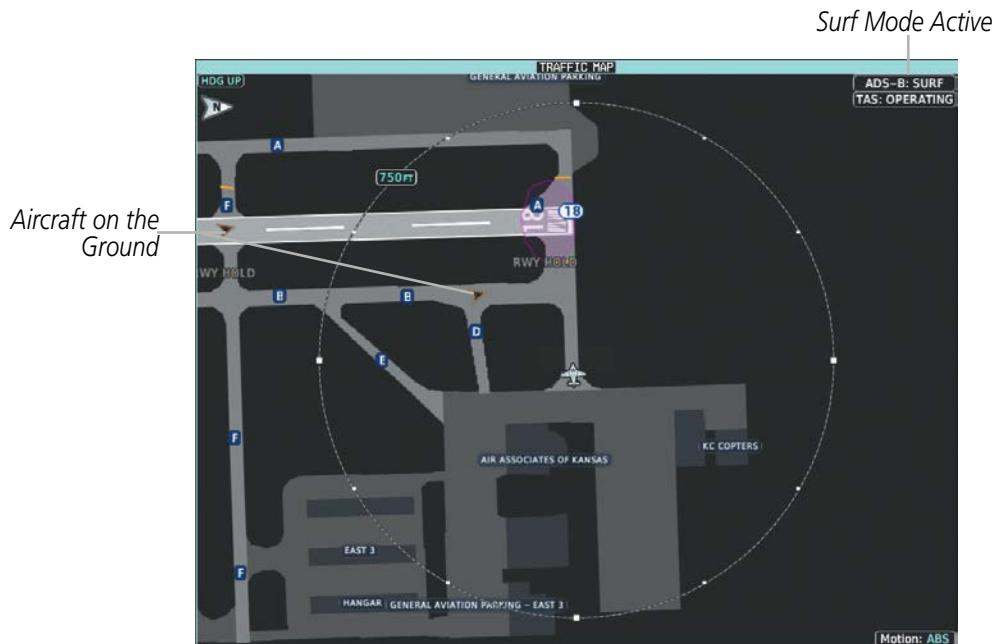


Figure 6-148 Traffic Map Pane, Surf Mode, 750 ft Map Range



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, all traffic targets may not be depicted on the traffic display. Because higher data precision is required for display in the SURF environment, some traffic eligible for AIRB will not be displayed while SURF is on. Individual eligibility for AIRB and SURF is depicted on the AUX-ADS-B Status Page, discussed later in this section.

OPERATIONS

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.

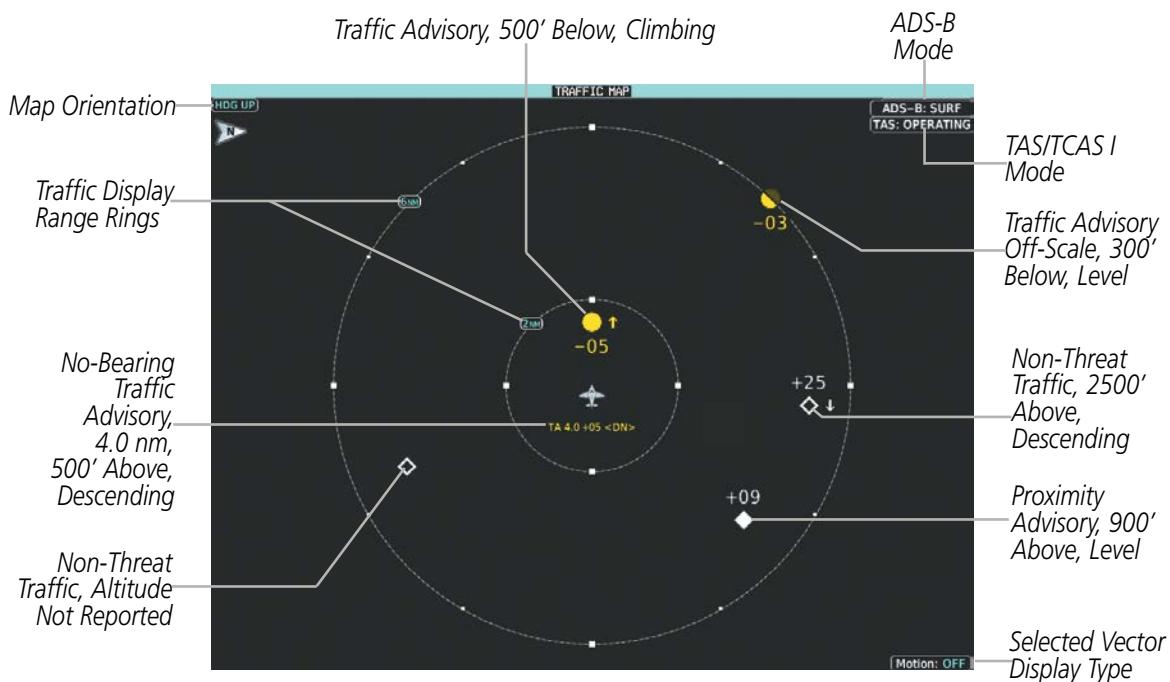


Figure 6-149 Traffic Map Pane

Displaying the Traffic Map Pane:

From **Home** on the Touchscreen Controller, touch the **Traffic** Button.

Or:

If the PFD is in Split Mode, press the **Traffic** Softkey.

Selecting a TAS/TCAS I mode:

- 1) From **Home**, touch **Traffic > Traffic Settings**.

Or:

- a) From **Home**, touch **Map > Map Settings**.
- b) If necessary, touch the Sensor Tab.
- c) Touch the **Traffic Settings** Button.

- 2) Touch the **Operate** or **Standby** Button.

Enabling/disabling the display of ADS-B Traffic:

- 1) From **Home**, touch **Traffic > Traffic Settings**.

Or:

- a) From **Home**, touch **Map > Map Settings**.
- b) If necessary, touch the Sensor Tab.
- c) Touch the **Traffic Settings** Button.

- 2) If the **Operate** Button is disabled, touch the **Operate** Button to enable the TAS/TCAS I system.

- 3) Touch the **ADS-B** Display Button to enable/disable the display of ADS-B traffic while the TAS/TCAS I system is operating.

Testing the Traffic System:

- 1) From **Home**, touch **Aircraft Systems > System Tests**.
- 2) Touch the **TCAS/TAS Self** Button.

A pattern of traffic symbols appears on the Traffic Map, and a 'TRAFFIC' annunciation appears on the PFDs. After approximately ten seconds, a voice alert announces if the test has passed or failed.

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 Home, touch **Traffic > Traffic Settings**.
Or:
 - a) From **Home**, touch **Map > Map Settings**.
 - b) If necessary, touch the Sensor Tab.
 - c) Touch the **Traffic Settings** Button.
- 2) Touch the **Altitude Range** Button.
- 3) Touch one of the following buttons:
 - **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 6-150 Selecting an Altitude Mode on the Traffic Settings Screen

DISPLAYING MOTION VECTORS

When Absolute Motion Vectors are selected, the vectors extending from the traffic symbols depict the traffic's reported track and speed over the ground. When Relative Motion Vectors are selected, the vectors extending from the traffic symbols display how the traffic is moving relative to own aircraft. These vectors are calculated using the traffic's track and ground speed and own aircraft's track and ground speed. These two values are combined to depict where the traffic is moving purely with respect to own aircraft, and provide a forecast of where the traffic will be, relative to own aircraft, in the near future.

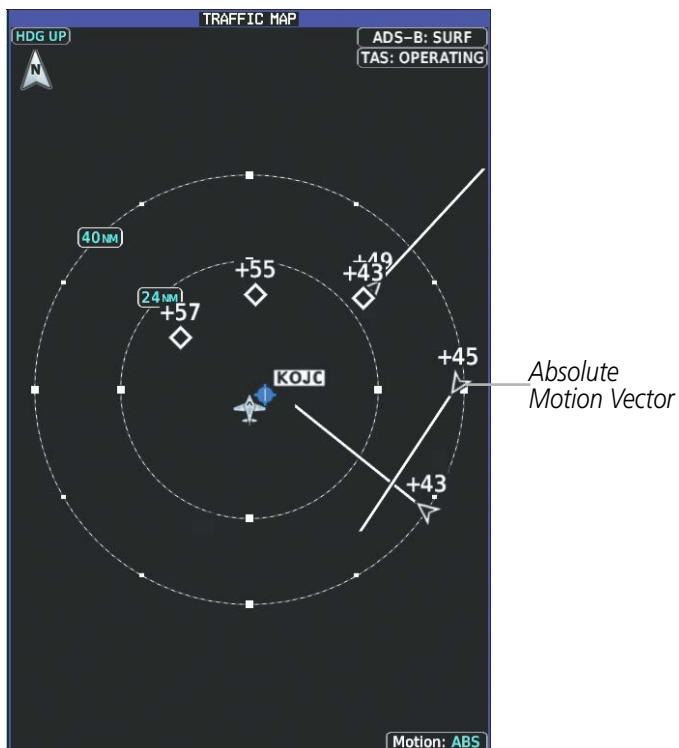


Figure 6-151 Traffic Map Pane with Absolute Motion Vectors Enabled

Enabling/disabling the Motion Vector display:

- 1) From **Home**, touch **Traffic > Traffic Settings**.
Or:
 - a) From Home, touch **Map > Map Settings**.
 - b) If necessary, touch the Sensor Tab.
 - c) Touch the Traffic **Settings** Button.
- 2) Touch the **Motion Vector** Button.
- 3) Touch one of the following buttons:
 - **Off**: Disables the display of the motion vector.
 - **Absolute**: Displays the motion vector pointing in the absolute direction.
 - **Relative**: Displays the motion vector relative to own aircraft

Adjusting the duration for the Motion Vector projected time:

- 1) From Home, touch **Traffic > Traffic Settings**.
Or:
 - a) From Home, touch **Map > Map Settings**.
 - b) If necessary, touch the Sensor Tab.
 - c) Touch the **Traffic Settings** Button.
- 2) Touch the **Vector Duration** Button.
- 3) Touch a button for the desired duration (**30 SEC, 1 MIN, 2 MIN, 5 MIN**).

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:

- 1) From Home, touch **Traffic > Traffic Settings**.
Or:
 - a) From Home, touch **Map > Map Settings**.
 - b) If necessary, touch the Sensor Tab.
 - c) Touch the **Traffic Settings** Button.
- 2) Touch the **Target Selection** Button. A cyan circle highlights the first selected traffic symbol. Additional information appears in a window in the upper-right corner of the Traffic Map Pane
- 3) To select a different aircraft symbol, turn the **Joystick** until the next selected symbol is highlighted.
- 4) When finished, touch the **Target Selection** Button again to disable the button.

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 **Home**, touch **Map > 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) If necessary, enable the PFD Inset Map or HSI Map.
- 2) Press the **PFD Map Settings** Softkey.
- 3) If the PFD is operating in Full Mode, press the Traffic Softkey to enable/disable the traffic overlay.

Or:

- a) If the PFD is operating in Split Mode, press the **Map Overlays** Softkey.
- b) Press the **More** Softkey.
- c) Press the **Traffic** Softkey to enable/disable the traffic overlay.

When the display of traffic is enabled on the Navigation Map Pane or PFD Inset Navigation Map, the system shows a traffic status icon and the selected altitude range in the lower right corner of the map (Figure 6-153).



Figure 6-152 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 **Home**, touch **Map > 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, 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** or **Home**.

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 to display or remove the Traffic Inset Map.

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.

Enabling/disabling additional traffic information:

- 1) From Home, touch Traffic > Traffic Settings.
- 2) Touch the **Target Selection** Button to enable the selection of ADS-B traffic.
- 3) The system selects an aircraft icon on the map, which pulsates (expands and contracts with regular movements). Information about the selected aircraft appears in a box in the upper right of the Traffic Map Pane.
- 4) To select a different aircraft icon, turn the upper knob until the desired icon is selected.
- 5) To disable the selection feature, touch the **Target Selection** Button again.

SYSTEM STATUS

The traffic system mode appears in the upper right corner of the Traffic Map Pane.

TAS/TCAS I System Mode	Traffic Map Mode Annunciation	Traffic Overlay Status Icon
Operating	TAS: OPERATING	
Standby	TAS: STANDBY (also shown in white in center of Traffic Map Pane)	
Failed*	TAS: UNIT FAILED	

* See Table 6-33 for additional failure annunciations.

Table 6-31 TAS/TCAS I Modes

ADS-B Mode	Traffic Mode Annunciation (Traffic Map Page)	Traffic Map Page Center Banner Annunciation	Traffic Display Status Icon (Other Maps)
ADS-B System Test Initiated	ADS-B: TEST	TEST MODE	
ADS-B Operating in Airborne Mode	ADS-B: AIRB	None	
ADS-B Operating in Surface Mode	ADS-B: SURF	None	
ADS-B Traffic Off	ADS-B: OFF	ADS-B TRFC OFF	
ADS-B Traffic Not Available	ADS-B: N/A	ADS-B TRFC N/A	
ADS-B Failed*	ADS-B: FAIL	ADS-B TRFC FAIL	

* See Table 6-55 for additional failure annunciations

Table 6-32 ADS-B 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 Status annunciations appear in banners at the lower left corner of navigation map panes.

Traffic Status Banner Annunciation	Description
TA OFF SCALE	A Traffic Advisory is outside the selected display range*. Annunciation is removed when traffic comes within the selected display range.
TA X.X ± XX <UP> or <DN>	System cannot determine bearing of Traffic Advisory**. Annunciation indicates distance in nm, altitude separation in hundreds of feet, and an altitude trend ('<UP>' indicates climbing, '<DN>' indicates descending), if a trend of at least 500 fpm is detected.
TRFC FAIL	The traffic unit has failed (unit is self-reporting a failure or sending incorrectly formatted data)
NO TRFC DATA	Data is not being received from the traffic unit

*Shown as symbol on Traffic Map Pane

**Shown in center of Traffic Map Pane

Table 6-33 Traffic Banner Annunciations

After a system test, the TAS/TCAS I system issues a voice alert to announce the test outcome.

System Status Voice Alert	Description
"TAS System Test Passed"	The TAS system has passed the system test.
"TAS System Test Failed"	The TAS system has failed the system test.
"TCAS One System Test Passed"	The TCAS I system has passed the system test.
"TCAS One System Test Failed"	The TCAS I system has failed the system test.

Table 6-34 TAS/TCAS I System Status Voice Alerts

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 **Home**, touch **Utilities > Setup > ADS-B Status**.
- 2) Scroll if necessary to view all ADS-B status information.



Figure 6-153 ADS-B Status Screen

ADS-B Status Screen Item	Status Message	Description
Traffic Application Status: Airborne (AIRB), Surface (SURF), Airborne Alerts (CSA)	On	Traffic application is currently on. Required input data is available, and it meets performance requirements.
	Available to Run	Traffic application is not currently active, but application is ready to run when condition(s) determine the application should be active. Required input data is available, and it meets performance requirements.
	Not Available	Traffic application is not available. Required input data is available, but it does not meet performance requirements.
	Fault	Traffic application is not available. Required input data is not available or the application has failed.
	Not Configured	Traffic application is not available, because it has not been configured. If this annunciation persists, the system should be serviced.
	-----	Traffic application status is invalid or unknown.

Table 6-35 ADS-B Status Screen Messages for ADS-B Traffic

SECTION 7 AUTOMATIC FLIGHT CONTROL SYSTEM



NOTE: The approved Airplane Flight Manual (AFM) always supersedes the information in this Pilot's Guide.



NOTE: A failure of the primary (#1) GIA 63W Integrated Avionics Unit (IAU) results in loss of the Flight Director. Any IAU failure results in loss of the Autopilot and manual electric trim.

In addition to the discussion throughout this section, Appendix F provides an example of navigating a flight plan while employing some of the features of the Garmin Automatic Flight Control System (AFCS). Referring to Appendix F will aid in putting the following information in context.

The Garmin AFCS is a digital Automatic Flight Control System, fully integrated within the System avionics architecture. The System Overview section provides a block diagram to support this system description.

The AFCS can be divided into these main operating functions:

- **Flight Director (FD)** — The Piper PA-46 M600 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.

7.1 AFCS CONTROLS

The AFCS Control Unit is positioned above the MFD, and has the following controls:

- | | |
|---------------------------|---|
| (1) HDG Key | Selects/deselects Heading Select Mode |
| (2) APR Key | Selects/deselects Approach Mode |
| (3) NAV Key | Selects/deselects Navigation Mode |
| (4) FD Key | Activates/deactivates the Flight Director only
Pressing once turns on the selected Flight Director in the default vertical and lateral modes. Pressing again deactivates the Flight Director and removes the Command Bars. If the Autopilot is engaged, the key is disabled. |
| (5) XFR Key | Transfers between the active Flight Director and standby Flight Director |
| (6) ALT Key | Selects/deselects Altitude Hold Mode |
| (7) VS Key | Selects/deselects Vertical Speed Mode |
| (8) FLC Key | Selects/deselects Flight Level Change Mode |
| (9) (17) CRS Knobs | Adjusts the Selected Course in 1° increments on the Horizontal Situation Indicator (HSI) of the corresponding PFD
Press to re-center the Course Deviation Indicator (CDI) and return course pointer directly TO the bearing of the active waypoint/station |
| (10) SPD Key | Toggles the Airspeed Reference units between IAS and Mach |
| (11) UP/DN Wheel | Adjusts the reference in Pitch Hold, Vertical Speed, and Flight Level Change modes (see Table 7-2 for change increments in each mode) |
| (12) VNV Key | Selects/deselects VNAV Path Descent Mode for Vertical Navigation flight control |
| (13) ALT SEL Knob | Controls the Selected Altitude in 100-ft increments (a finer resolution of one foot is available under approach conditions) |
| (14) YD Key | Engages/disengages the Yaw Damper |
| (15) AP Key | Engages/disengages the Autopilot |
| (16) BANK Key | Manually selects/deselects Low Bank Mode |
| (18) BC Key | Selects/deselects Backcourse Mode |
| (19) HDG Knob | Adjusts the Selected Heading and bug in 1° increments on the HSI (both PFDs)
Press to synchronize the Selected Heading to the current heading |

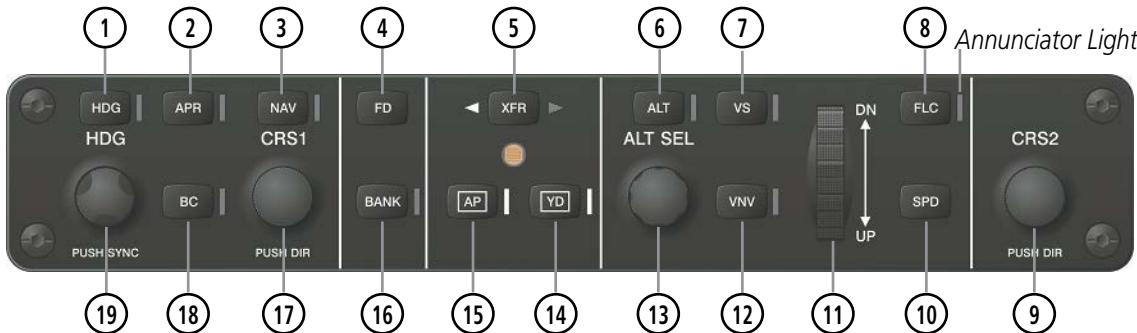


Figure 7-1 GMC 710 AFCS Control Unit

The following AFCS controls are located separately from the AFCS Control Unit:

**AP DISC Switch
(Autopilot
Disconnect)** Disengages the autopilot, 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 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.

**TO/GA Switch
(Takeoff/Go
Around)** Selects flight director Takeoff (on ground) or Go Around (in air) Mode
If an approach procedure is loaded this button also activates the missed approach when the selected navigation source is GPS or when the navigation source is VOR/LOC and a valid frequency has been tuned.

The **TO/GA** Switch is located on the left throttle.

**MEPT Switch
(Manual Electric
Pitch Trim)** Used to command manual electric pitch trim
An **MEPT** Switch is located on each control wheel.
This composite switch is split into left and right sides. The left switch is the ARM contact and the right switch controls the DN (forward) and UP (rearward) contacts. Pushing the **MEPT** ARM Switch disengages the autopilot, if currently engaged, but does not affect yaw damper operation. The **MEPT** ARM Switch may be used to acknowledge an autopilot disconnect alert and mute the associated aural tone.

Manual trim commands are generated only when both sides of the switch are operated simultaneously. If either side of the switch is active separately for more than three seconds, MEPT function is disabled and 'PTRM' (Pitch Trim Failure) is displayed as the AFCS Status Annunciation on the PFDs. The function remains disabled until both sides of the switch are inactivated.

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°, +17.5°) and roll (22°) 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 activates the Flight Director in the listed modes.

Control Pressed	Modes Selected			
	Lateral		Vertical	
FD Key	Roll Hold (default)	ROL	Pitch Hold (default)	PIT
AP Key	Roll Hold (default)	ROL	Pitch Hold (default)	PIT
CWS Button	Roll Hold (default)	ROL	Pitch Hold (default)	PIT
TO/GA Switch	Roll Hold (default)	TO	Takeoff (on ground)	TO
	Roll Hold (default)	GA	Go Around (in air)	GA
ALT Key	Roll Hold (default)	ROL	Altitude Hold	ALT
VS Key	Roll Hold (default)	ROL	Vertical Speed	VS
VNV Key	Roll Hold (default)	ROL	VNAV Path Descent*	V PATH
NAV Key	Navigation**	FMS	Pitch Hold (default)	PIT
		VOR		
		LOC		
BC Key	Backcourse***	BC	Pitch Hold (default)	PIT
APR Key	Approach**	FMS	Pitch Hold (default)	PIT
		VAPP		
		LOC		
HDG Key	Heading Select	HDG	Pitch Hold (default)	PIT

* Valid VNAV flight plan must be entered before **VNV** Key press activates Flight Director. When the **VNV** Key is pressed in conjunction with another mode selection, a 'V' is displayed with the selected mode annunciation.

The selected navigation receiver must have a valid VOR or LOC signal or active FMS course before **NAV or **APR** Key press activates Flight Director.

***The selected navigation receiver must have a valid LOC signal before **BC** Key press activates Flight Director.

Table 7-1 Flight Director Activation

FLIGHT DIRECTOR SELECTION

The Garmin AFCS in the Piper PA-46 M600 has two flight directors, each operating within an IAU. Only one flight director is active (selected) at a time. Flight directors may be switched by pressing the **XFR** Key. Both PFDs display the selected flight director, indicated by an arrow pointing toward either the pilot or copilot side, in the center of the AFCS Status Box. The annunciator light arrow for the selected flight director is also illuminated beside the **XFR** Key. When the flight directors are switched, the vertical and lateral modes revert to default.

The currently active flight director may be turned off and the Command Bars removed from the displays by pressing the active **FD** Key again. Pressing the **FD** Key for the inactive flight director only removes the Command Bars from the corresponding display. The **FD** key for the selected flight director is disabled when the autopilot is engaged.



Figure 7-2 Flight Director Selection Indications

AFCS STATUS BOX

Flight director mode annunciations are displayed on the PFDs when the flight director is active. Flight director selection and autopilot and yaw damper statuses are shown in the center of the AFCS Status Box. Lateral flight director modes are displayed on the left and vertical modes on the right. Armed modes are displayed in white. Active modes are displayed in magenta when using FMS navigation, or green when using other navigation sources.

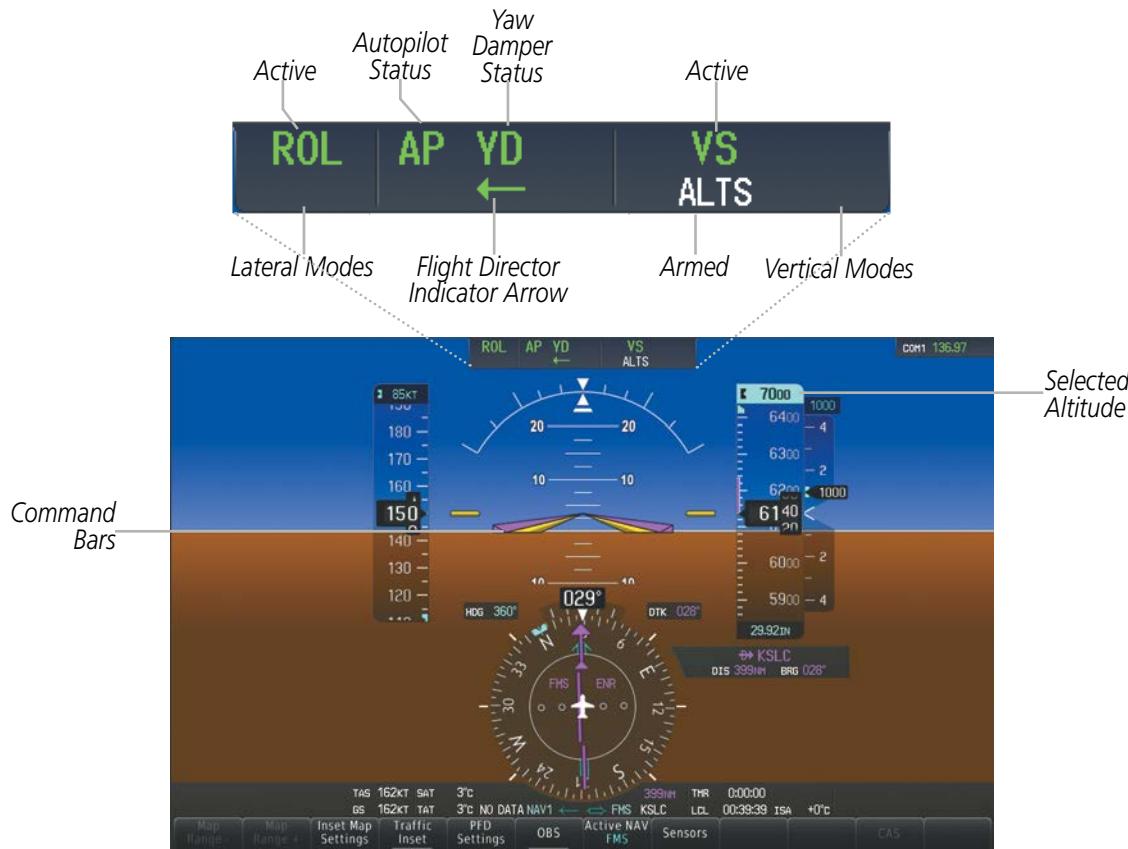


Figure 7-3 PFD AFCS Display

COMMAND BARS

Upon activation of the flight director, Command Bars are displayed in magenta on the PFDs as single cue or dual cue. The aircraft symbol (in yellow) changes to accommodate the Command Bar format; the Command Bars do not override the aircraft symbol. The single cue Command Bars move together vertically to indicate pitch commands and bank left or right to indicate roll commands. Command Bars displayed as a cross pointer move independently to indicate pitch (horizontal bar) and roll (vertical bar) commands. Both PFDs show the same Command Bar format.

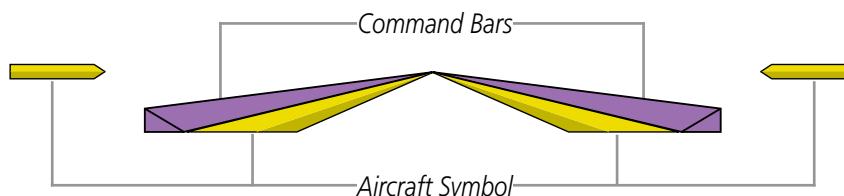


Figure 7-4 Single Cue Command Bars

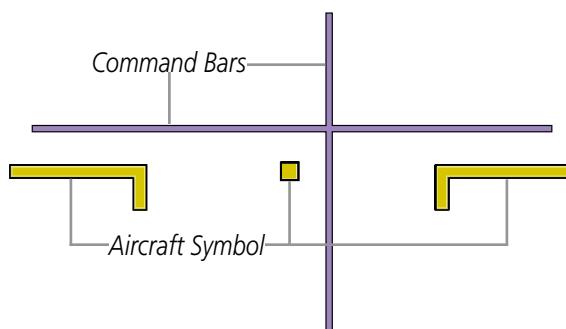


Figure 7-5 Dual Cue Command Bars

Changing the selected Flight Director format:

- 1) From the **Home** Screen, touch **Utilities >Setup >Avionics Settings**.
- 3) Touch the **System** Tab.
- 4) Touch the **Flight Director Active Format** Data Field.
- 5) Touch desired setting (**Single Cue** or **Dual Cue**).



Figure 7-6 Flight Director Format Settings

FLIGHT DIRECTOR MODES

Flight director modes are normally selected independently for the pitch and roll axes. Unless otherwise specified, all mode keys are alternate action (i.e., press on, press off). In the absence of specific mode selection, the flight director reverts to the default pitch and/or roll modes(s).

Under normal operation when the control for the active flight director mode is pressed, the flight director reverts to the default modes(s) for the axis(es). Automatic transition from armed to active mode is indicated by the white armed mode annunciation moving to the green or magenta 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, FMS, SBAS) required to compute commands. When such a loss occurs, the system automatically rolls the wings level and then enters Roll Hold Mode, or maintains 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.

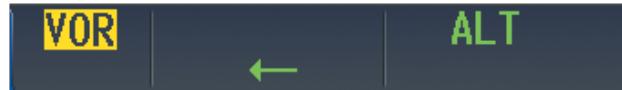


Figure 7-7 Loss of VOR Signal

The flight director is automatically disabled if the attitude information required to compute the default flight director modes becomes invalid or unavailable.

7.3 VERTICAL MODES

Table 7-2 lists the vertical modes with their corresponding controls and annunciations. The mode reference (Altitude, Vertical Speed, Air Speed, or FMS Speed Target) is displayed next to the active mode annunciation for Altitude Hold, Vertical Speed, and Flight Level Change modes. The **UP/DN** Wheel can be used to change the vertical mode reference while operating under Pitch Hold, Vertical Speed, or Flight Level Change Mode. Increments of change and acceptable ranges of values for each of these references using the **UP/DN** Wheel are also listed in the table where applicable.

Vertical Mode	Description	Control	Annunciation	Reference Range	Reference Change Increment
Pitch Hold	Holds aircraft pitch attitude; may be used to climb/descend to the Selected Altitude	(default)	PIT	-15° to +20°	0.5°
Selected Altitude Capture	Captures the Selected Altitude	*	ALTS		
Altitude Hold	Holds current Altitude Reference	ALT Key	ALT nnnnnnFT		
Vertical Speed	Holds aircraft vertical speed; may be used to climb/descend to the Selected Altitude	VS Key	VS nnnnnFPM	-4000 to +2300 fpm	100 fpm
Flight Level Change	Holds aircraft airspeed while aircraft is climbing/descending to the Selected Altitude	FLC Key	FLC nnnnKT	90 to 251 kts	1 kt
VNAV Path Descent	Captures and tracks descent legs of an active vertical profile	VNV Key	V PATH		
VNAV Target Altitude Capture	Captures the Vertical Navigation (VNAV) Target Altitude	**	ALTV		
Glidepath	Captures and tracks the SBAS glidepath on approach	APR Key	GP		
Glideslope	Captures and tracks the ILS glideslope on approach		GS		
Takeoff	Commands a constant pitch angle and wings level on the ground in preparation for takeoff	GA Switch	TO	9.0°	
Go Around	Commands a constant pitch angle and wings level		GA	7.0°	
Level	Autopilot engages and commands pitch angle necessary to establish zero vertical fpm	***	LVL	N/A	

* ALTS is armed automatically when the Selected Altitude is to be captured instead of the VNAV Target Altitude.

** ALTV is armed automatically when the VNAV Target Altitude is to be captured instead of the Selected Altitude.

*** Level mode can only become activated as a function of Electronic Stability and Protection (ESP). Refer to the Additional Features section for a detailed discussion of the optional ESP feature.

Table 7-2 Flight Director Vertical Modes

PITCH HOLD MODE (PIT)

When the flight director is activated (the **FD** Key is pressed), Pitch Hold Mode is selected by default. Pitch Hold Mode is indicated as the active pitch mode by the green annunciation 'PIT'. This mode may be used for climb or descent to the Selected Altitude (shown above the Altimeter), since Selected Altitude Capture Mode is automatically armed when Pitch Hold Mode is activated.

In Pitch Hold Mode, the flight director maintains a constant pitch reference attitude. The pitch reference attitude is set to the aircraft pitch attitude at the moment of mode selection. If the aircraft pitch attitude exceeds the flight director pitch command limitations, the flight director commands a pitch angle equal to the nose-up/down limit.

CHANGING THE PITCH REFERENCE

When operating in Pitch Hold Mode, the pitch reference can be adjusted by:

- Using the **UP/ DN** Wheel
- By pressing the **CWS** Button, hand-flying the aircraft to establish a new pitch reference, then releasing the **CWS** Button

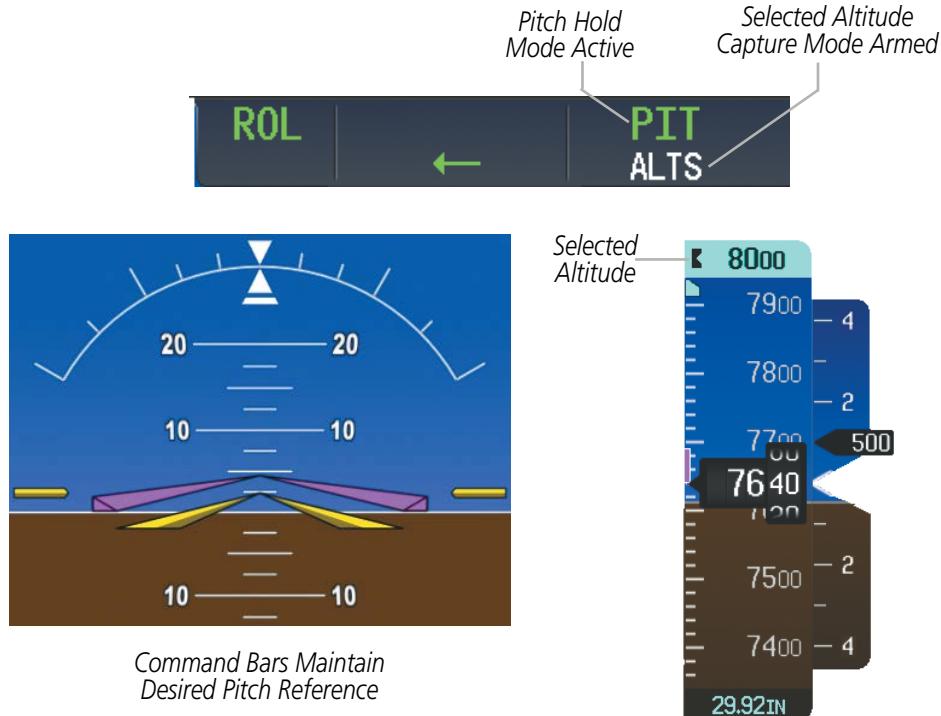


Figure 7-8 Pitch Hold Mode

SELECTED ALTITUDE CAPTURE MODE (ALTS)

Selected Altitude Capture Mode is automatically armed with activation of the following modes:

- Pitch Hold
- Vertical Speed
- Flight Level Change
- Takeoff/Go Around (if the Selected Altitude is at least 400 feet above the current aircraft altitude)
- Vertical Path Tracking (if the Selected Altitude is to be captured instead of the VNAV Target Altitude)

The white 'ALTS' annunciation indicates Selected Altitude Capture Mode is armed (see Figure 7-2 for example). The **ALT SEL** Knob is used to set the Selected Altitude (shown above the Altimeter) until Selected Altitude Capture Mode becomes active.

As the aircraft nears the Selected Altitude, the flight director automatically transitions to Selected Altitude Capture Mode with Altitude Hold Mode armed (Figure 7-9). This automatic transition is indicated by the green 'ALTS' annunciation flashing for up to 5 seconds and the appearance of the white 'ALT' annunciation.

At 50 feet from the Selected Altitude, the flight director automatically transitions from Selected Altitude Capture to Altitude Hold Mode and holds the Selected Altitude. As Altitude Hold Mode becomes active, the white 'ALT' annunciation moves to the active vertical mode field and flashes green for 5 seconds to indicate the automatic transition.



Figure 7-9 Automatic Mode Transitions During Altitude Capture

CHANGING THE SELECTED ALTITUDE



NOTE: Pressing the **CWS** Button while in Selected Altitude Capture Mode does not cancel the mode.



NOTE: While ALTS is active, the reference altitude cannot be changed by using FLC, VS, or VNAV Modes. Change to another selected altitude to deactivate ALTS, then re-activate the desired vertical mode.

Use of the **ALT SEL** Knob to change the Selected Altitude while Selected Altitude Capture Mode is active causes the flight director to revert to Pitch Hold Mode with Selected Altitude Capture Mode armed for the new Selected Altitude.

ALTITUDE HOLD MODE (ALT)

If Altitude Hold Mode is activated by pressing the **ALT** Key; the flight director maintains the current aircraft altitude (to the nearest 10 feet). Altitude Hold Mode active is indicated by an 'ALT' annunciation in the AFCS Status Box.

Altitude Hold Mode is automatically armed when the flight director is in either of the following modes:

- Selected Altitude Capture
- VNV Target Altitude Capture

The transition to Altitude Hold Mode automatically occurs when the altitude error is less than 50 feet. In this case, the Selected or VNV Target Altitude becomes the flight director's altitude reference. The active mode annunciation 'ALT' appears if the transition was made from VNV Target Altitude Capture Mode.

While VNAV is active, V ALT indicates that VNAV Target Altitude sequencing is enabled. If a climb will be resumed at the next Bottom of Climb (BOC) point, FLC will be shown as the armed mode and will automatically activate after the BOC has been reached. VS must be manually activated if that mode is desired. If a descent will be resumed at the next Top of Descent (TOD) point, PATH will be shown as the armed mode.

CHANGING THE ALTITUDE REFERENCE



NOTE: Turning the **ALT SEL** Knob while in Altitude Hold Mode changes the Selected Altitude, but not the flight director's altitude reference, and does not cancel the mode.

With the **CWS** Button pressed, the aircraft can be hand-flown to a new altitude reference. When the **CWS** Button is released at the desired altitude, the new altitude is established as the altitude reference.

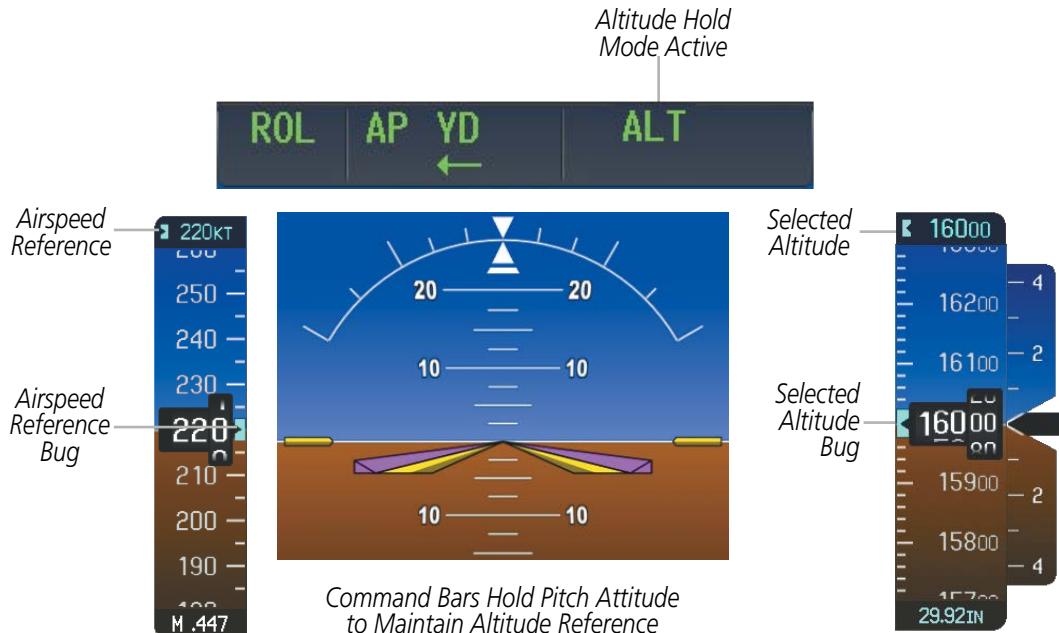


Figure 7-10 Altitude Hold Mode

VERTICAL SPEED MODE (VS)

In Vertical Speed Mode, the flight director acquires and maintains a Vertical Speed Reference (shown above the Vertical Speed Indicator). Current aircraft vertical speed (to the nearest 100 fpm) becomes the Vertical Speed Reference at the moment of Vertical Speed Mode activation. This mode may be used for climb or descent to the Selected Altitude (shown above the Altimeter) since Selected Altitude Capture Mode is automatically armed when Vertical Speed Mode is selected.

When Vertical Speed Mode is activated by pressing the **VS** Key, 'VS' is annunciated in green in the AFCS Status Box. The Vertical Speed Reference is displayed above the Vertical Speed Indicator. A Vertical Speed Reference Bug corresponding to the Vertical Speed Reference is shown on the indicator.

CHANGING THE VERTICAL SPEED REFERENCE

The Vertical Speed Reference (shown above the Vertical Speed Indicator) may be changed by:

- Using the **UP/DN** Wheel
- Pressing the **CWS** Button, hand-flying the aircraft to attain a new Vertical Speed Reference, then releasing the **CWS** Button

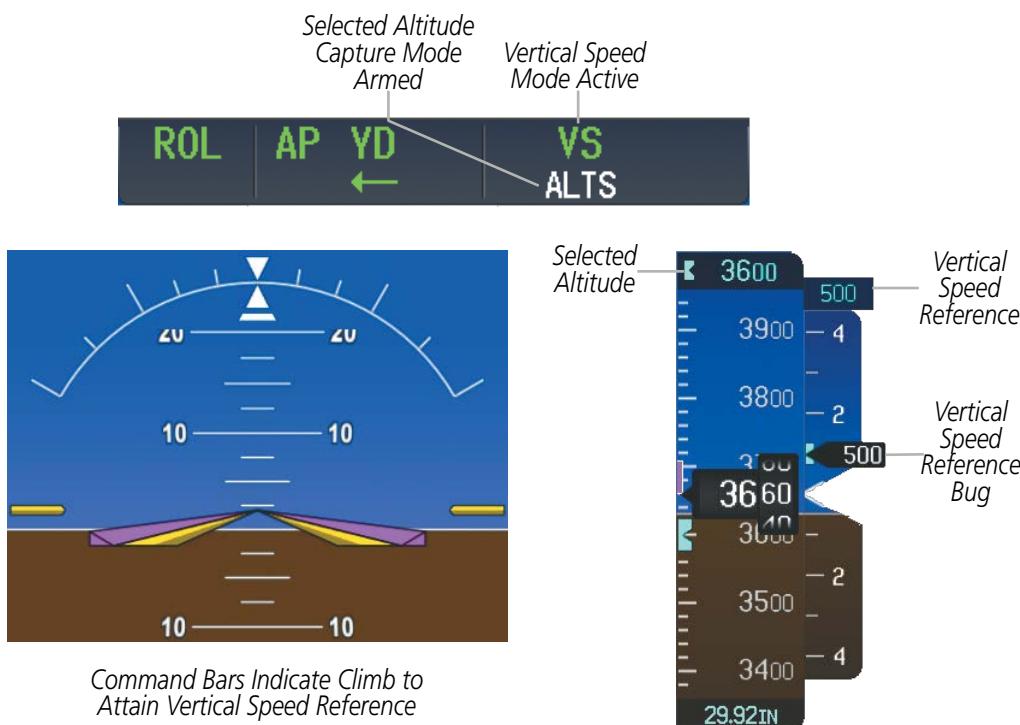


Figure 7-11 Vertical Speed Mode

FLIGHT LEVEL CHANGE MODE (FLC)



NOTE: The Selected Altitude should be set before engaging Flight Level Change Mode.

Flight Level Change Mode is selected by pressing the **FLC** Key. This mode acquires and maintains the Airspeed Reference while climbing or descending to the Selected Altitude (shown above the Altimeter). When Flight Level Change Mode is active, the flight director continuously monitors Selected Altitude, airspeed, and altitude.

The Airspeed Reference is set to the current airspeed upon mode activation. Flight Level Change Mode is indicated by an 'FLC' annunciation beside the Airspeed Reference in the AFCS Status Box. The Airspeed Reference is also displayed directly above the Airspeed Indicator, along with a bug corresponding to the Airspeed Reference along the tape.

Engine power must be adjusted to allow the autopilot to fly the aircraft at a pitch attitude corresponding to the desired flight profile (climb or descent) while maintaining the Airspeed Reference. The flight director maintains the current altitude until either engine power or the Airspeed Reference are adjusted and does not allow the aircraft to climb or descend away from the Selected Altitude.

CHANGING THE AIRSPEED REFERENCE

The Airspeed Reference (shown in both the AFCS Status Box and above the Airspeed Indicator) may be adjusted by:

- Using the **UP/DN** Wheel
- Pressing the **CWS** Button, hand-flying the aircraft to a new airspeed, then releasing the **CWS** Button to establish the new Airspeed Reference



NOTE: If the Selected Altitude is reached during CWS maneuvering, the Airspeed Reference is not changed. To adjust the Airspeed Reference in this case, the **CWS** Button must be pressed again after the Selected Altitude is reached.

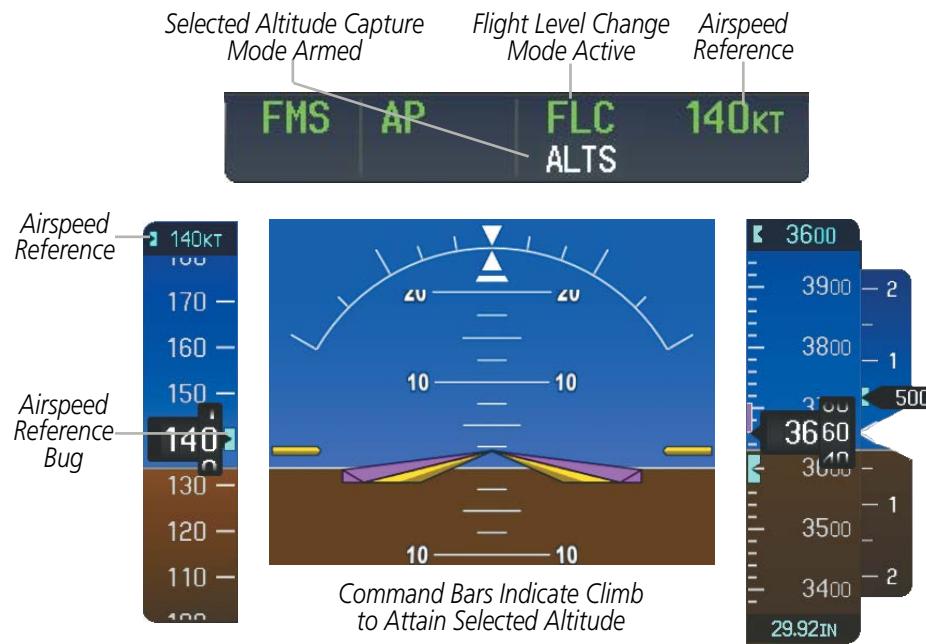


Figure 7-12 Flight Level Change Mode

VERTICAL NAVIGATION MODES (VPTH, ALTV)



NOTE: VNAV is disabled when parallel track or dead reckoning mode is active.



NOTE: The Selected Altitude takes precedence over any other vertical constraints.

Vertical Navigation (VNAV) flight control is available for enroute/terminal cruise and descent operations any time that VNAV flight planning is available. Refer to the Flight Management Section for more information on VNAV flight plans. Conditions for availability include, but are not limited to:

- The selected navigation source is FMS.
- A VNAV flight plan (with at least one altitude-constrained waypoint) or vertical direct-to is active.
- VNAV is enabled.
- Crosstrack error is valid and within certain limits.
- Desired/actual track are valid or track angle error is within certain limits.
- The VNAV Target Altitude of the active waypoint is no more than 250 ft above the current aircraft altitude.

The flight director may be armed for VNAV 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 VNAV flight control modes are sequenced by the flight director to follow the path defined by the vertical profile. Upon reaching the last waypoint in the VNAV flight plan, the flight director transitions to Altitude Hold Mode and cancels any armed VNAV modes.

VERTICAL PATH TRACKING MODE (VPTH)



NOTE: If another pitch 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 (VNAV flight plan) is active and the **VNV** Key is pressed, Vertical Path Tracking Mode is armed in preparation for descent path capture. 'VPTH' (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 VNAV Target Altitude (ALTV) or the Selected Altitude (ALTS), whichever is greater.



Figure 7-13 Vertical Path Tracking Armed Annunciations

Prior to descent path interception, the Selected Altitude must be set below the current aircraft altitude by at least 75 feet. For the flight director to transition from Altitude Hold to Vertical Path Tracking Mode, acknowledgment is required within 5 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 'VPTH' annunciation starts to flash. Flashing continues until acknowledged or the descent path is intercepted. If the descent is not confirmed by the time of interception, Vertical Path Tracking Mode remains armed and the descent is not captured.

In conjunction with the "TOD [top of descent] within 1 minute" annunciation in the Navigation Status Box and the "Vertical track" voice message, VNAV indications (VNAV Target Altitude, vertical deviation, and vertical speed required) appear on the PFD in magenta (Following Figure).

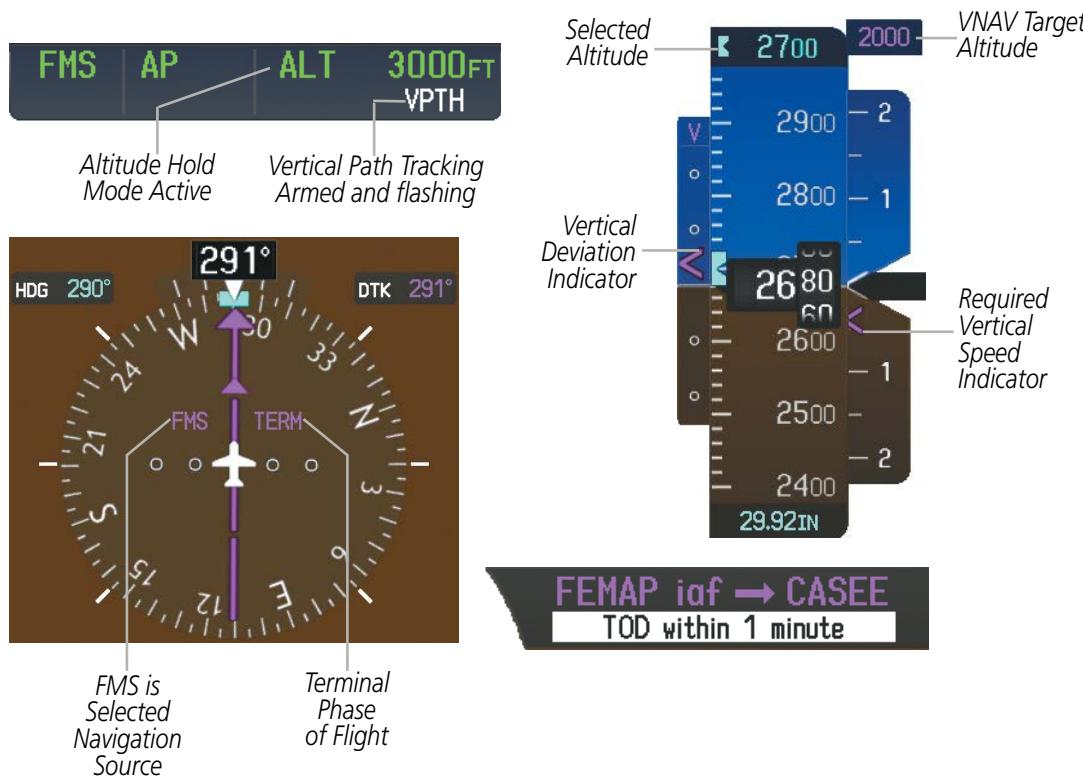


Figure 7-14 Vertical Path Capture

When a descent leg is captured (i.e., vertical deviation becomes valid), Vertical Path Tracking becomes active and tracks the descent profile (Following Figure). An altitude capture mode ('ALTS' or 'ALTV') is armed as appropriate.

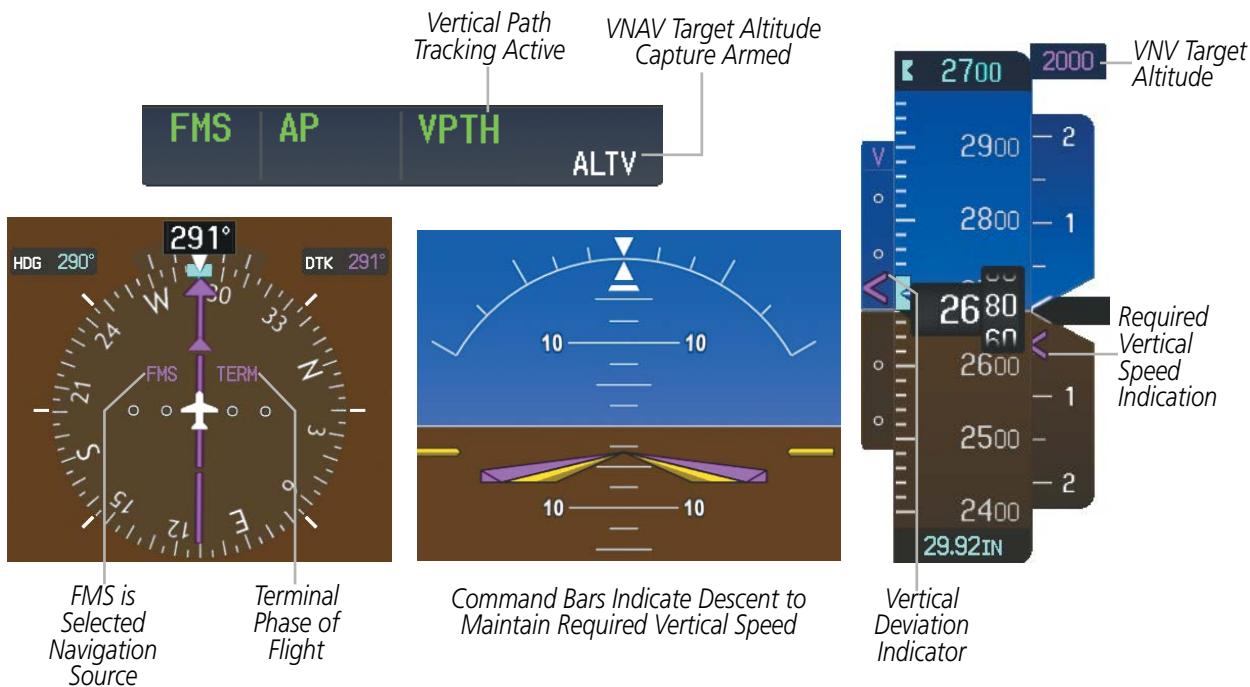


Figure 7-15 Vertical Path Tracking Mode

If the Altimeter's barometric setting is adjusted while Vertical Path Tracking is active, the flight director increases/decreases the descent rate by up to 500 fpm to re-establish the aircraft on the descent path (without commanding a climb). Adjusting the altimeter barometric setting creates discontinuities in VNAV vertical deviation, moving the descent path. For large adjustments, it may take several minutes for the aircraft to re-establish on the descent path. If the change is made while nearing a waypoint with a VNAV Target Altitude, the aircraft may not re-establish on the descent path in time to meet the vertical constraint.

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 VNAV 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 VNAV is enabled. 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 7-16 Flight Level Change VNV Non-Path Descent

To prevent immediate profile re-capture, the following must be satisfied:

- At least 10 seconds have passed since the non-path transition was initiated
- Vertical deviation from the profile has exceeded 250 feet, but is now less than 200 feet

Pressing the **VNV** Key twice re-arms Vertical Path Tracking for immediate profile re-capture.

VNAV TARGET ALTITUDE CAPTURE MODE (ALTV)



NOTE: Armed VNAV Target Altitude and Selected Altitude capture modes are mutually exclusive. However, Selected Altitude Capture Mode is armed implicitly (not annunciated) whenever VNAV Target Altitude Capture Mode is armed.

VNAV Target Altitude Capture is analogous to Selected Altitude Capture Mode and is armed automatically after the **VNV** Key is pressed and the next VNAV Target Altitude is to be intercepted before the Selected Altitude. The annunciation 'ALTV' indicates that the VNAV Target Altitude is to be captured. VNAV Target Altitudes are shown in the active flight plan or vertical direct-to, and can be entered manually or loaded from a database (see the Flight Management Section for details). At the same time as "TOD within 1 minute" is annunciated in the Navigation Status Box, the active VNAV Target Altitude is displayed above the Vertical Speed Indicator.

As the aircraft nears the VNAV Target Altitude, the flight director automatically transitions to VNAV Target Altitude Capture Mode with Altitude Hold Mode armed. This automatic transition is indicated by the green 'ALTV' annunciation flashing for up to 10 seconds and the appearance of the white 'ALT' annunciation. The VNAV Target Altitude is shown as the Altitude Reference beside the 'ALTV' annunciation and remains displayed above the Vertical Speed Indicator. The Required Vertical Speed Indication (RVSI) is removed once VNAV Target Altitude Capture Mode becomes active.

At 50 feet from the VNAV Target Altitude, the flight director automatically transitions from VNAV Target Altitude Capture to Altitude Hold Mode and tracks the level leg. As Altitude Hold Mode becomes active, the white 'ALT' annunciation moves to the active vertical mode field and flashes green for 10 seconds to indicate the automatic transition. The flight director automatically arms Vertical Path Tracking, allowing upcoming descent legs to be captured and subsequently tracked.

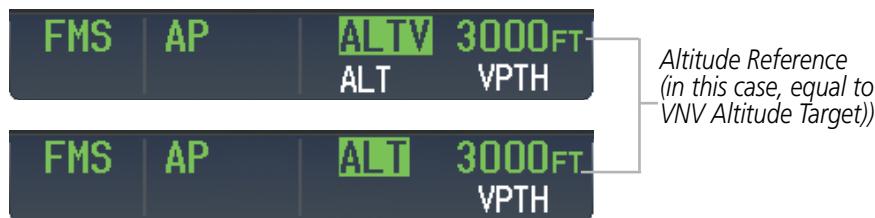


Figure 7-17 Automatic Mode Transitions During Altitude Capture

CHANGING THE VNAV TARGET ALTITUDE



NOTE: Pressing the **CWS** Button while in VNAV Target Altitude Capture Mode does not cancel the mode.

Changing the current VNAV Target Altitude while VNAV 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 VNAV Target Altitude or the Selected Altitude, depending on which altitude is to be intercepted first.

VNAV target altitudes can be changed while editing the active flight plan (see the Flight Management Section for details).

GLIDEPATH MODE (GP) (SBAS ONLY)



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 SBAS-based glidepath. When Glidepath Mode is armed, 'GP' is annunciated in white in the AFCS Status Box.

Selecting Glidepath Mode:

- 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 FMS is the selected navigation source (use the **Active Nav** Softkey to cycle through navigation sources).
- 3) Press the **APR** Key.



NOTE: Some RNAV (FMS) 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 should be flown to an MDA, until visual with the landing surface, even though vertical glidepath (GP) information may be provided.



WARNING: When flying an LNAV approach (with vertical descent angle) with the autopilot coupled, the aircraft will not level off at the MDA even if the MDA 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 7-18 Glidepath Mode Armed

Once the following conditions have been met, the glidepath can be captured:

- A GPS approach with vertical guidance (LPV, LP+V, LNAV/VNAV, LNAV+V) is loaded into the active flight plan.
- The active waypoint is at or after the final approach fix (FAF).
- Vertical deviation is valid.
- The CDI is at less than full scale deviation
- Automatic sequencing of waypoints has not been suspended (no 'SUSP' annunciation on the HSI)

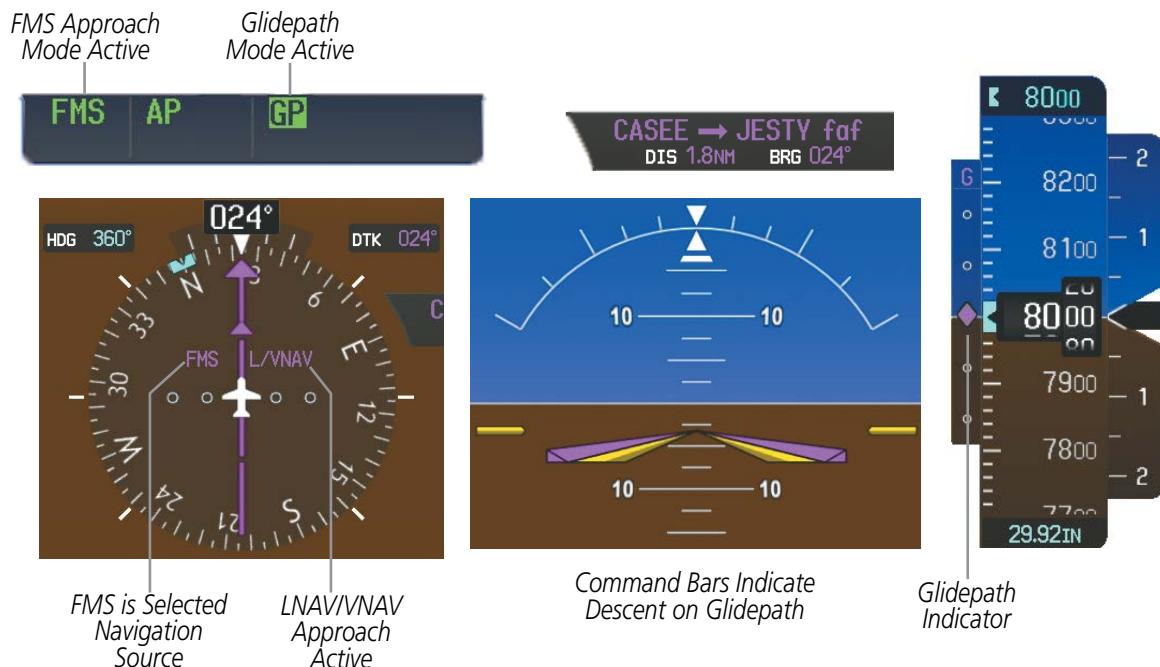


Figure 7-19 Glidepath Mode

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.

Glideslope Mode is available for LOC/ILS approaches to capture and track the glideslope. When Glideslope Mode is armed (annunciated as 'GS' in white), LOC Approach Mode is armed as the lateral flight director mode.

Selecting Glideslope Mode:

- 1) Ensure a valid localizer frequency is tuned.
- 2) Ensure that LOC is the selected navigation source (use the **Active Nav** Softkey to cycle through navigation sources).
- 3) Press the **APR** Key.

Or:

- 1) Ensure that FMS is the selected navigation source (use the **Active Nav** Softkey to cycle through navigation sources).
- 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.



Figure 7-20 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 intercept and track the glideslope.

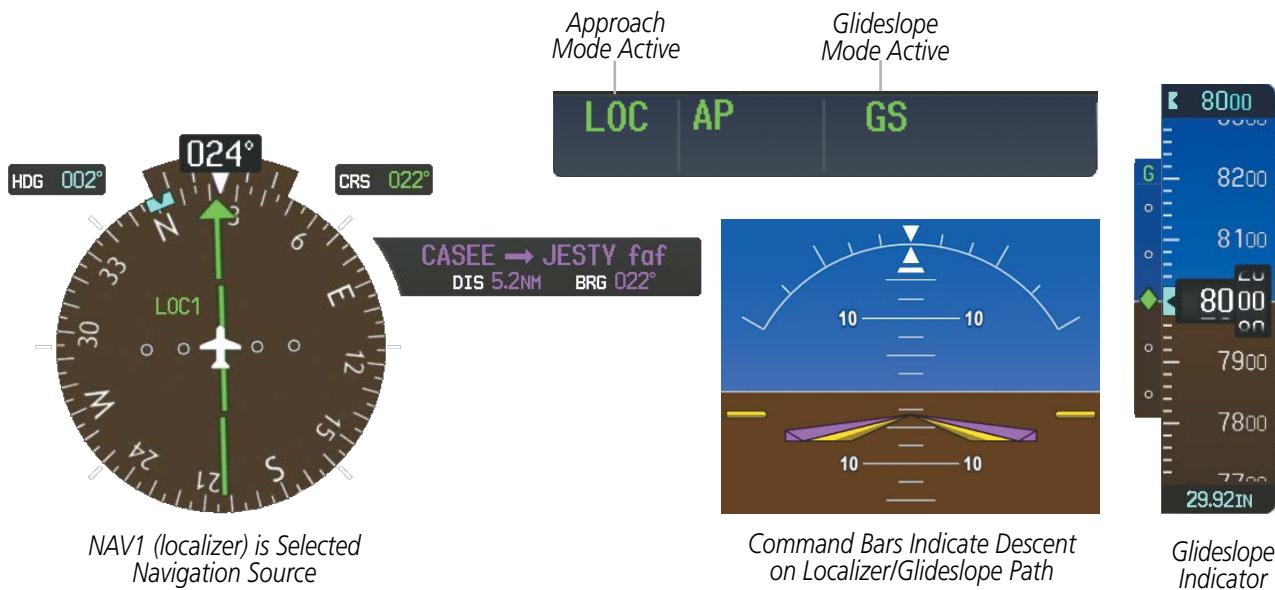


Figure 7- 21 Glideslope Mode

TAKE OFF AND GO AROUND MODES (TO/GA)

In Takeoff and Go Around modes, the flight director commands a constant set pitch attitude. The **TO/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 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 **TO/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.

Pressing the **TO/GA** Switch while in the air activates the flight director in a wings-level, pitch-up attitude, allowing the execution of a missed approach or a go around. Attempts to modify the aircraft attitude (i.e., with the **NOSE UP** and **NOSE DN** Keys or **CWS** Button) result in reversion to Pitch Hold Mode.

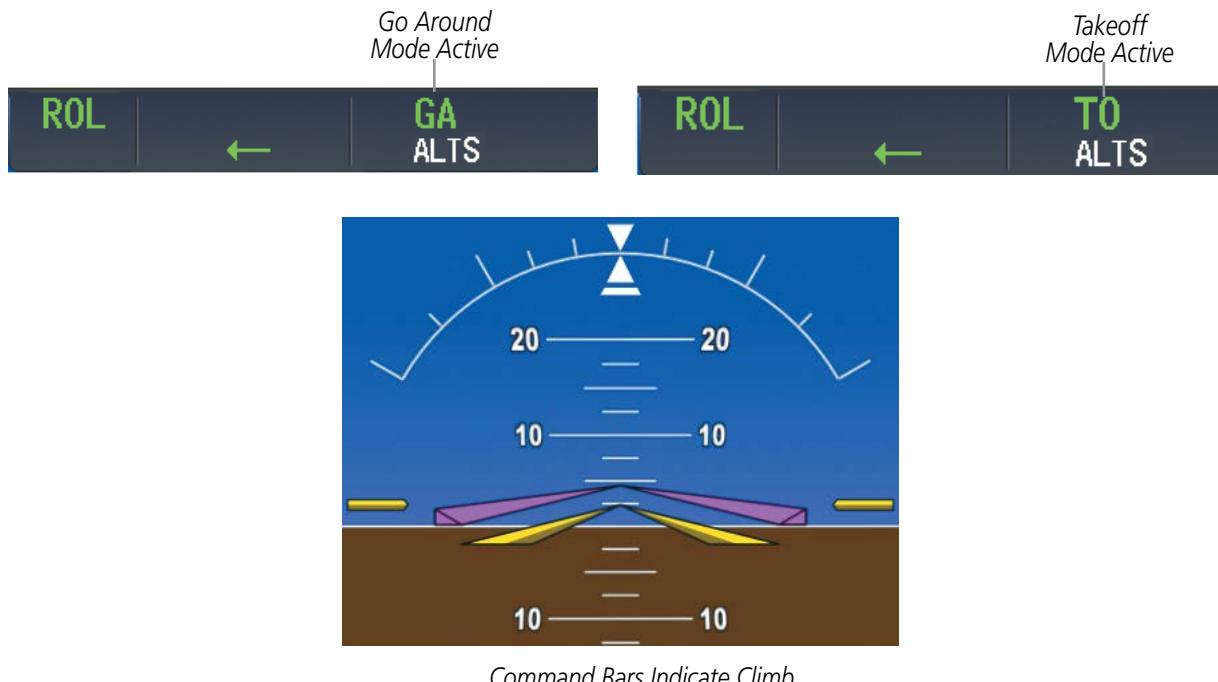


Figure 7-22 Takeoff and Go Around Modes

LEVEL MODE (LVL)

Level (LVL) mode becomes active only as a function of Electronic Stability and Protection (ESP). Refer to the Additional Features section for a detailed discussion of the optional ESP feature.

When the normal flight envelope thresholds have been exceeded for more than 50% of the last 20 seconds, Level mode is activated. The autopilot will engage and provide input to bring the aircraft back into straight and level flight based on zero degrees roll angle and zero feet per minute vertical speed. An aural "ENGAGING AUTOPILOT" alert sounds and the lateral and vertical flight director annunciations will display "LVL". The AFCS will remain in Level mode until the pilot selects another mode.

7.4 LATERAL MODES

The following table relates each AFCS lateral mode to its respective control and annunciation.

Lateral Mode	Description	Control	Annunciation	Maximum Roll Command Limit
Roll Hold	Holds the current aircraft roll attitude or rolls the wings level, depending on the commanded bank angle	(default)	ROL	30°
Low Bank	Limits the maximum commanded roll angle	BANK Key	*	15°
Heading Select	Captures and tracks the Selected Heading	HDG Key	HDG	30°
Navigation, FMS	Captures and tracks the selected navigation source (FMS, VOR, LOC)	NAV Key	FMS	30°
Navigation, VOR Enroute Capture/Track			VOR	22° Capture 10° Track
Navigation, LOC Capture/Track (No Glideslope)			LOC	22° Capture 10° Track
Backcourse	Captures and tracks a localizer signal for backcourse approaches	BC Key	BC	22° Capture 10° Track
Approach, FMS	Captures and tracks the selected navigation source (FMS, VOR, LOC)	APR Key	FMS	30°
Approach, VOR Capture/Track			VAPP	22° Capture 10° Track
Approach, LOC Capture/Track (Glideslope Mode automatically armed)			LOC	22° Capture 10° Track
Level	Autopilot engages and commands wings level	*	LVL	Wings Level

* Level mode can only become activated as a function of Electronic Stability and Protection (ESP). Refer to the Additional Features section for a detailed discussion of the optional ESP feature.

The Garmin AFCS may generate a lower bank angle than the maximum roll command limit in degrees indicated in the table above by the amount needed to produce a turn rate equal to or less than standard rate.

Table 7-3 Lateral Modes

The **CWS** Button does not change lateral references for Heading Select, Navigation, Backcourse, or Approach modes. The autopilot guides the aircraft back to the Selected Heading/Course upon release of the **CWS** Button.

ROLL HOLD MODE (ROL)



NOTE: If Roll Hold Mode is activated as a result of a mode reversion, the flight director rolls the wings level.

When the flight director is activated, Roll Hold Mode is selected by default. This mode is annunciated as 'ROL' in the AFCS Status Box. The current aircraft bank angle is held, subject to the bank angle conditions listed in Table 7-4.



Figure 7-23 Roll Hold Mode Annunciation

Bank Angle	Flight Director Response
< 6°	Rolls wings level
6° to 22°	Maintains current aircraft roll attitude
> 22°	Limits bank to 22°

Table 7-4 Roll Hold Mode Responses

CHANGING THE ROLL REFERENCE

The roll reference can be changed by pressing the **CWS** Button, establishing the desired bank angle, then releasing the **CWS** Button.

LOW BANK MODE

When in Low Bank Mode, the flight director limits the maximum commanded roll angle to 15°. Low bank arc limits are displayed in green along the Roll Scale.

Low Bank Mode can be manually selected/deselected by pressing the **BANK** Key while in Heading Select or Navigation Modes (GPS and VOR). The annunciator light next to the **BANK** Key illuminates while Low Bank Mode is selected.

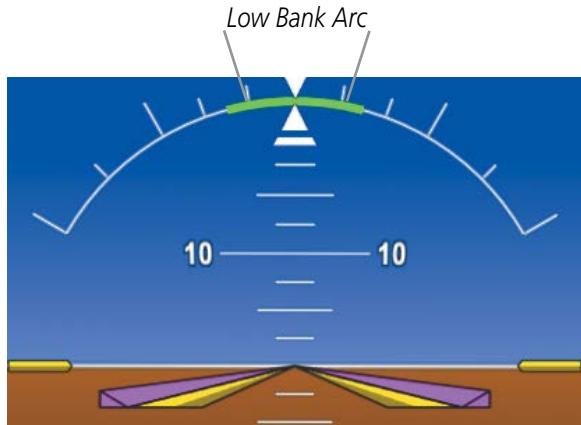


Figure 7-24 Low Bank Mode Limits

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 light blue bug on the HSI and in the box to the upper left of the HSI.

CHANGING THE SELECTED HEADING



NOTE: Pressing the **HDG** Knob synchronizes the Selected Heading to the current heading.

The Selected Heading is adjusted using the **HDG** Knob. Pressing the **CWS** Button and hand-flying the aircraft does not change the Selected Heading. The autopilot guides the aircraft back to the Selected Heading upon release of the **CWS** Button.

Turns are commanded in the same direction as Selected Heading Bug movement, even if the Bug is turned more than 180° from the present heading (e.g., a 270° turn to the right). However, Selected Heading changes of more than 340° at a time result in turn reversals.



Figure 7-25 Heading Select Mode

NAVIGATION MODES (FMS, VOR, LOC)



NOTE: The selected navigation receiver must have a valid VOR or LOC signal or active FMS course for the flight director to enter Navigation Mode.



NOTE: When intercepting a flight plan leg, the flight director gives commands to capture the active leg at approximately a 45° angle to the track between the waypoints defining the active leg. The flight director does not give commands fly to the starting waypoint of the active leg.

Pressing the **NAV** Key selects Navigation Mode. Navigation Mode acquires and tracks the selected navigation source (FMS, VOR, LOC). The flight director follows FMS roll steering commands when FMS is the selected navigation source. When the navigation source is VOR or LOC, the flight director creates roll steering commands from the Selected Course and deviation. Navigation Mode can also be used to fly non-precision FMS and LOC approaches where glideslope capture is not required.

If the Course Deviation Indicator (CDI) shows greater than one dot when the **NAV** Key is pressed, the selected mode is armed. If the CDI is less than one dot, Navigation Mode is automatically captured when the **NAV** Key is pressed. The armed annunciation appears in white to the left of the active roll mode.



Figure 7-26 FMS Navigation Mode Armed

When the CDI has automatically switched from FMS to LOC during a LOC/ILS approach, FMS Navigation Mode remains active, providing FMS steering guidance until the localizer signal is captured. LOC Navigation Mode is armed when the automatic navigation source switch takes place. If the **APR** Key is pressed prior to the automatic navigation source switch, LOC Navigation Mode is armed.

LOC Navigation Mode automatically reverts to Backcourse Mode if the localizer front course is greater than 105° from the aircraft heading. Refer to the discussion (in this section) on Backcourse Mode for more information on this topic.

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 **Active Nav** Softkey)
- During a LOC/ILS approach, the FAF is crossed while in FMS Navigation Mode after the automatic navigation source switch from FMS to LOC

CHANGING THE SELECTED COURSE

The Selected Course is controlled using the **CRS** Knob (while in VOR, LOC, or OBS Mode). Pressing the **CWS** Button and hand-flying the aircraft does not change the Selected Course while in Navigation Mode. The autopilot guides the aircraft back to the Selected Course (or FMS flight plan) when the **CWS** Button is released.

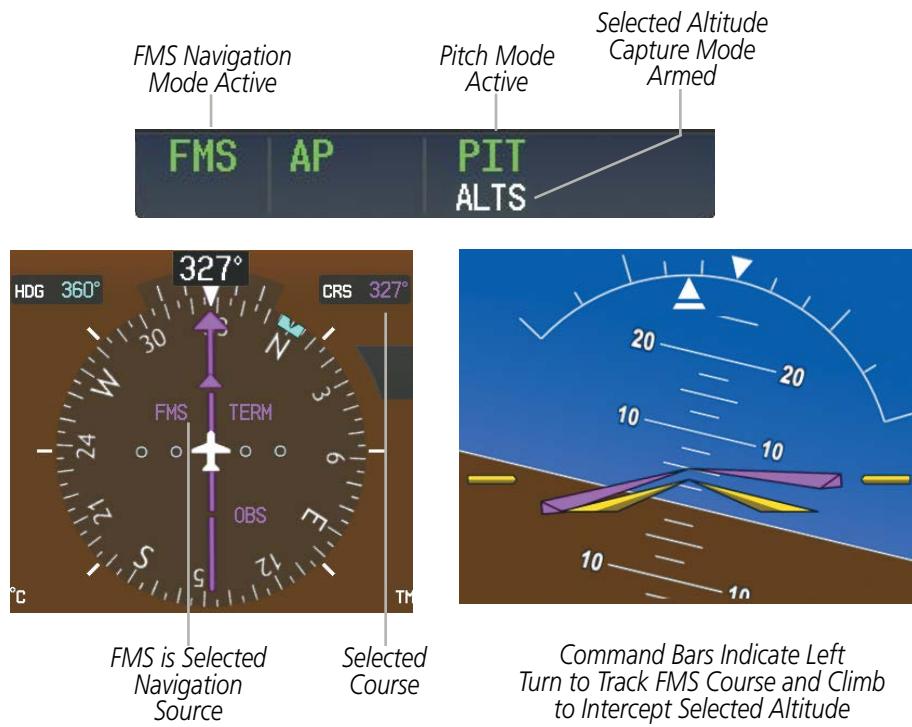


Figure 7-27 Navigation FMS Mode

APPROACH MODES (FMS, VAPP, LOC)



NOTE: The selected navigation receiver must have a valid VOR or LOC signal or active FMS course for the flight director to enter Approach Mode.

Approach Mode is activated when the **APR** Key is pressed. Approach Mode acquires and tracks the selected navigation source (FMS, VOR, or LOC), depending on the loaded approach. This mode uses the selected navigation receiver deviation and desired course inputs to fly the approach. Pressing the **APR** Key when the CDI is greater than one dot arms the selected approach mode (annunciated in white 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 **Active Nav** Softkey to cycle through navigation sources if necessary).
- 3) Press the **APR** Key.

When FMS Approach Mode is armed, Glidepath Mode is also armed.

Selecting FMS Approach Mode:

- 1) Ensure a FMS approach is loaded into the active flight plan. The active waypoint must be part of the flight plan (cannot be a direct-to a waypoint not in the flight plan).
- 2) Ensure that FMS is the selected navigation source (use the **Active Nav** Softkey to cycle through navigation sources if necessary).
- 3) Press the **APR** Key.



Figure 7-28 Navigation/Approach Mode Armed

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 Approach Mode:

- 1) Ensure a valid localizer frequency is tuned.
- 2) Ensure that LOC is the selected navigation source (use the **Active Nav** Softkey to cycle through navigation sources if necessary).
- 3) Press the **APR** Key.

Or:

- 1) Ensure that FMS is the selected navigation source (use the **Active Nav** Softkey to cycle through navigation sources if necessary).
- 2) Ensure a LOC/ILS approach is loaded into the active flight plan.
- 3) Ensure the corresponding LOC frequency is tuned.
- 4) Press the **APR** Key.

When LOC Approach Mode is armed the Glideslope is armed as well.

If you want to fly a LOC only approach press the **NAV** Key instead of 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, FMS Navigation Mode is active and the FAF is crossed after the automatic navigation source switch from FMS to LOC

CHANGING THE SELECTED COURSE

The Selected Course is controlled using the **CRS** Knob (while in VOR, LOC, or OBS Mode). Pressing the **CWS** Button and hand-flying the aircraft does not change the Selected Course while in Approach Mode. The autopilot guides the aircraft back to the Selected Course (or FMS flight plan) when the **CWS** Button is released.

INTERCEPTING AND FLYING A DME ARC

The AFCS will intercept and track a DME arc that is part of the active flight plan provided that FMS Navigation Mode is engaged, FMS is the active navigation source on the CDI, and the DME arc segment is the active flight plan leg. It is important to note that automatic navigation of DME arcs is based on FMS. Thus, even if the APR key is pressed and LOC or VOR Approach Mode is armed prior to reaching the Initial Approach Fix (IAF), Approach Mode will not activate until the arc segment is completed.

If the pilot decides to intercept the arc at a location other than the published IAF (i.e. ATC provides vectors to intercept the arc) and subsequently selects Heading Mode or Roll Mode, the AFCS will not automatically intercept or track the arc unless the pilot activates the arc leg of the flight plan and arms FMS Navigation Mode. The AFCS will not intercept and fly a DME arc before reaching an IAF that defines the beginning of the arc segment. Likewise, if at any point while established on the DME arc the pilot deselects FMS Navigation Mode, the AFCS will no longer track the arc.

BACKCOURSE MODE (BC)



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, the 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. The annunciation 'BC' in the AFCS Status Box indicates Backcourse Mode (Figure 7-25).

LOC Navigation Mode automatically (i.e., without pressing the BC key) reverts to Backcourse Mode if the localizer front course is greater than 105° from the aircraft heading. Refer to the previous discussion (in this section) on Navigation Modes for more information on LOC Navigation Mode.

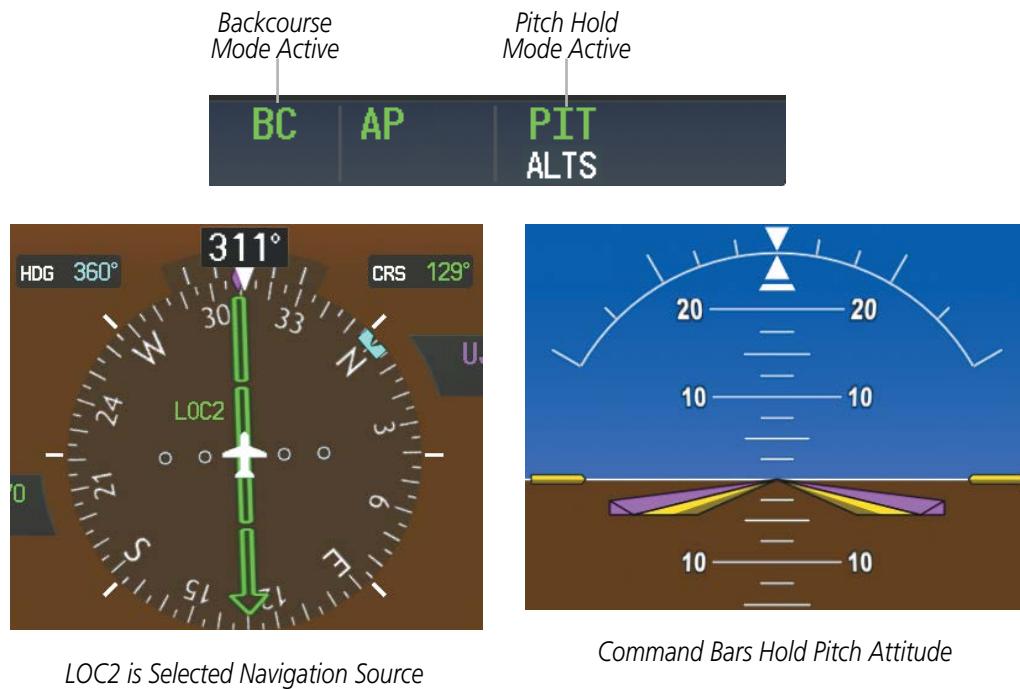


Figure 7-29 Navigation Backcourse Mode

CHANGING THE SELECTED COURSE

The Selected Course is controlled using the **CRS** Knob. Pressing the **CWS** Button and hand-flying the aircraft does not reset any reference data while in Backcourse Mode. The autopilot guides the aircraft back to the Selected Course when the **CWS** Button is released.

LEVEL MODE (LVL)

Level (LVL) mode becomes active only as a function of Electronic Stability and Protection (ESP). Refer to the Additional Features section for a detailed discussion of the optional ESP feature.

When the normal flight envelope thresholds have been exceeded for more than 50% of the last 20 seconds, Level mode is activated. The autopilot will engage and provide input to bring the aircraft back into straight and level flight based on zero degrees roll angle and zero feet per minute vertical speed. An aural "ENGAGING AUTOPILOT" alert sounds and the lateral and vertical flight director annunciations will display "LVL". The AFCS will remain in Level mode until the pilot selects another mode.

7.5 AUTOPILOT AND YAW DAMPER OPERATION



NOTE: Refer to the Airplane Flight Manual (AFM) for specific instructions regarding emergency procedures.

The autopilot and yaw damper operate the flight control surface servos to provide automatic flight control. The autopilot controls the aircraft pitch and roll attitudes following commands received from the flight director. Pitch 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.

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

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.

ENGAGING THE AUTOPILOT AND YAW DAMPER



NOTE: Autopilot engagement/disengagement is not equivalent to servo engagement/disengagement. Use the **CWS** Button to disengage the pitch and roll servos while the Autopilot remains active.

When the **AP** Key is pressed, the Autopilot, Yaw Damper, and Flight Director (if not already active) are activated. The Flight Director engages in Pitch and Roll Hold Modes when initially activated. When the **YD** Key is pressed, the system engages the Yaw Damper independently of the Autopilot. 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.

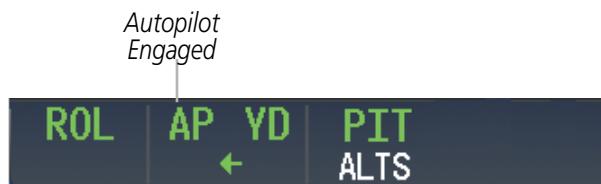


Figure 7-30 Autopilot and Yaw Damper Engaged

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. Pitch trim operation is interrupted during CWS activity; Yaw Damper engagement is unaffected.

The 'AP' annunciation is temporarily replaced by 'CWS' in white for the duration of CWS maneuvers.

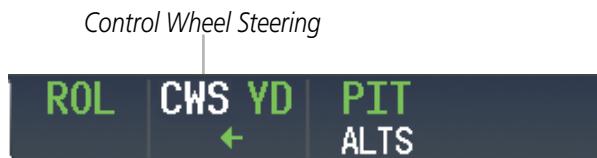


Figure 7-31 CWS Annunciation

DISENGAGING THE AUTOPILOT AND YAW DAMPER



NOTE: Pressing the **AP** Key does not disengage the Yaw Damper.

Manual Autopilot disengagement is indicated by a flashing red 'AP' annunciation and an Autopilot disconnect aural alert, "Autopilot". The Autopilot is manually disengaged by pushing the **AP** Key on the AFCS Control Unit, the **GA** Switch, the MEPT Switches, or the **AP/TRIM DISC** Switch (also disengages the Yaw Damper, if engaged).



Figure 7-32 Automatic Autopilot Disengagement

Autopilot disengagement is indicated by a flashing red and white 'AP' annunciation and the Autopilot disconnect aural alert, which continues until acknowledged by pushing the **AP/TRIM DISC** Switch. Automatic Autopilot disengagement occurs due to:

- System failure
- Invalid sensor data
- Stall warning (YD also disengages)
- Inability to compute default Flight Director modes (FD also disengages automatically)

Pressing the **YD** Key disengages the yaw damper. Upon disengagement, the 'YD' annunciation flashes amber for five seconds and is then removed. The yaw damper automatically disengages 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 causes yaw damper disengagement.



Figure 7-33 Yaw Damper Disengagement

7.6 EXAMPLE PROCEDURES



NOTE: The following example flight plan and diagrams (not to be used for navigation) in this section are for instructional purposes only and should be considered not current. Numbered portions of accompanying diagrams correspond to numbered procedure steps.

This section provides a scenario-based set of procedures showing various Garmin AFCS modes used during a flight. In this scenario, the aircraft departs Charles B. Wheeler Downtown Airport (KMKC), enroute to Colorado Springs Airport (KCOS). After departure, the aircraft climbs to 12,000 ft and airway V4 is intercepted, following ATC vectors.

Airway V4 is flown to Salina VOR (SLN) using VOR navigation, then airway V244 is flown using FMS Navigation. The ILS approach for runway 35L and LPV (WAAS) approach for runway 35R are shown and a missed approach is executed.

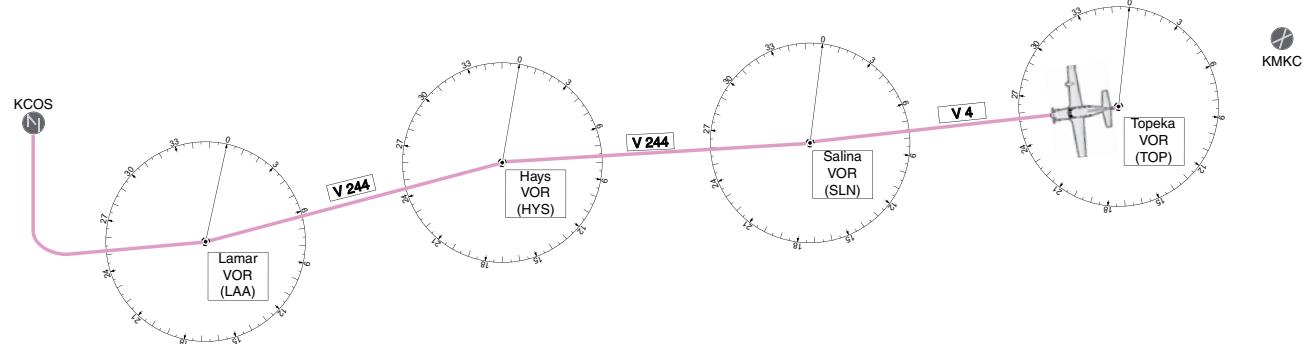


Figure 7-34 Flight Plan Overview

DEPARTURE

Climbing to the Selected Altitude and flying an assigned heading:

- 1) Before takeoff, set the Selected Altitude to 12,000 feet using the **ALT** Knob.
- 2) In this example, Vertical Speed Mode is used to capture the Selected Altitude (Pitch Hold, Vertical Speed, or Flight Level Change Mode may be used).
 - a) Press the **VS** Key to activate Vertical Speed Mode.



The Vertical Speed Reference may be adjusted after Vertical Speed Mode is selected using the **UP/DN** Wheel or pushing the **CWS** Button while hand-flying the aircraft to establish a new Vertical Speed Reference.

- b) Press the **AP** Key to engage the autopilot in a climb using Vertical Speed Mode.



- 3) Use the **HDG** Knob to set the Selected Heading, complying with ATC vectors to intercept Airway V4.

Press the **HDG** Key to activate Heading Select Mode while the autopilot is engaged in the climb. The autopilot follows the Selected Heading Bug on the HSI and turns the aircraft to the desired heading.



- 4) As the aircraft nears the Selected Altitude, the flight director transitions to Selected Altitude Capture Mode, indicated by the green 'ALTS' annunciation flashing for up to 10 seconds.



At 50 feet from the Selected Altitude, the green 'ALT' annunciation flashes for up to 10 seconds; the autopilot transitions to Altitude Hold Mode and levels the aircraft.



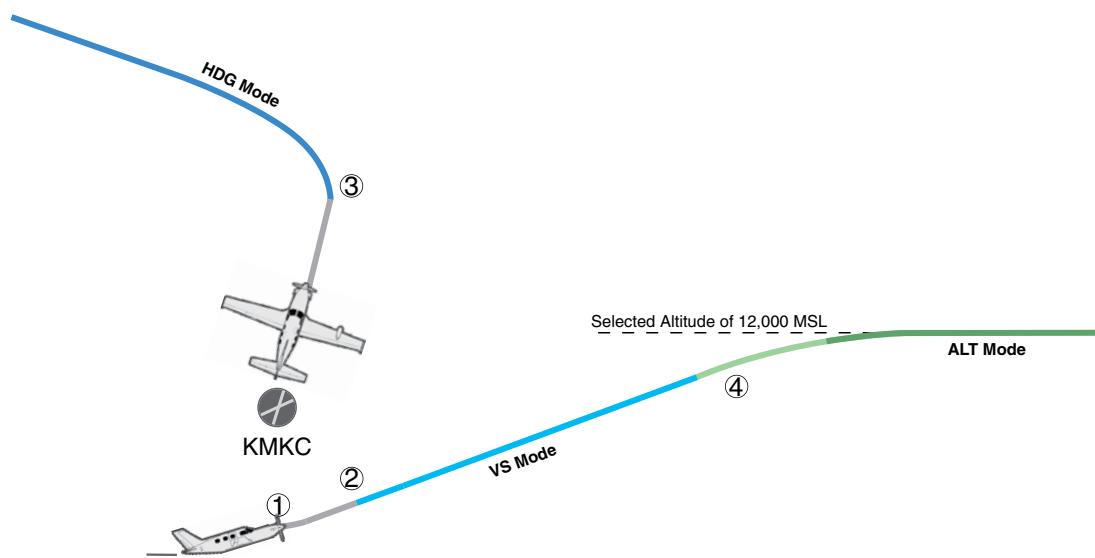


Figure 7-35 Departure

INTERCEPTING A VOR RADIAL

During climb-out, the autopilot continues to fly the aircraft in Heading Select Mode. Airway V4 to Salina VOR (SLN) should now be intercepted. Since the enroute flight plan waypoints correspond to VORs, flight director Navigation Mode using either VOR or FMS as the navigation source may be used. In this scenario, VOR Navigation Mode is used for navigation to the first VOR waypoint in the flight plan.

Intercepting a VOR radial:

- 1) Arm VOR Navigation Mode:
 - a) Tune the VOR frequency.
 - b) Press the **Active Nav** Softkey to set the navigation source to VOR.
 - c) Use the **CRS** Knob to set the Selected Course to 255°. Note that at this point, the flight director is still in Heading Select Mode and the autopilot continues to fly 290°.
 - d) Press the **NAV** Key. This arms VOR Navigation Mode and the white 'VOR' annunciation appears to below the active lateral mode.



- 2) As the aircraft nears the Selected Course, the flight director transitions from Heading Select to VOR Navigation Mode and the 'VOR' annunciation flashes green. The autopilot begins turning to intercept the Selected Course.



- 3) The autopilot continues the turn until the aircraft is established on the Selected Course.

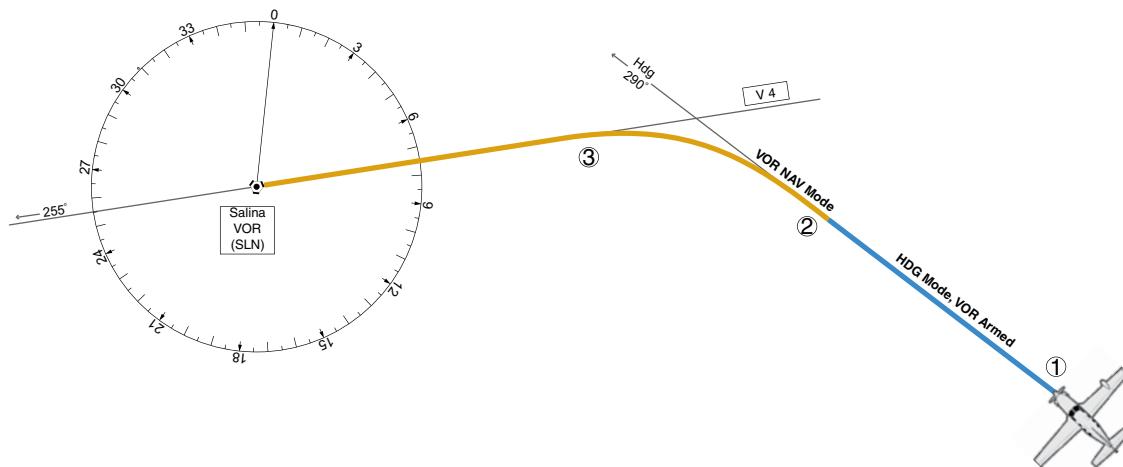


Figure 7-36 Intercepting a VOR Radial

FLYING A FLIGHT PLAN/FMS COURSE



NOTE: Changing the navigation source cancels Navigation Mode and causes the flight director to revert back to Roll Hold Mode (wings rolled level).

As the aircraft closes on Salina VOR, FMS is used to navigate the next leg, airway V244. The aircraft is currently tracking inbound on Airway V4.

Flying a FMS flight plan:

- 1) Transition from VOR to FMS Navigation Mode:
 - a) Press the **Active Nav** Softkey until FMS is the selected navigation source.
 - b) Press the **NAV** Key to activate FMS Navigation Mode. The autopilot guides the aircraft along the active flight plan leg.



- 2) Following the flight plan, the autopilot continues to steer the aircraft under FMS guidance.

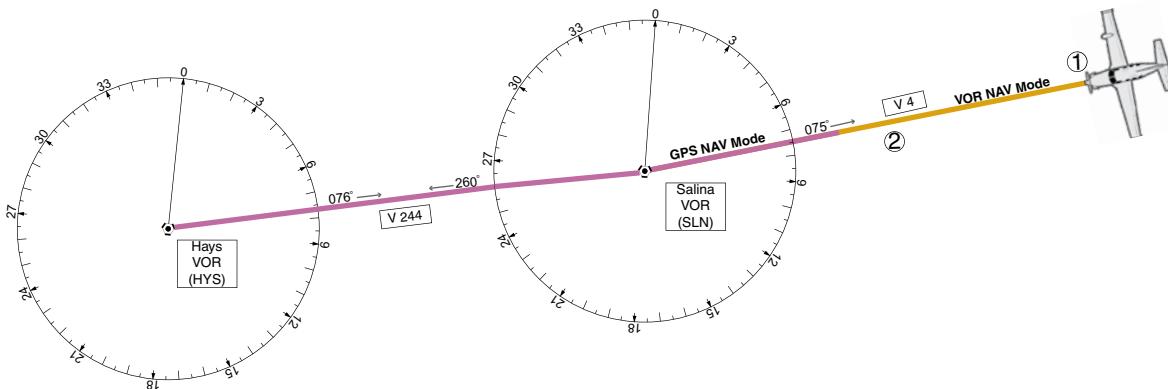


Figure 7-37 Transition to GPS Flight Plan

DESCENT

While flying the arrival procedure, the aircraft is cleared for descent in preparation for the approach to KCOS. Three methods are presented for descent:

- Flight Level Change descent – Flight Level Change Mode can be used to descend to the Selected Altitude at a constant airspeed. This descent method does not account for flight plan waypoint altitude constraints.
- Vertical Path Tracking descent – Vertical Path Tracking Mode is used to follow the vertical descent path defined in the FMS flight plan. Altitude constraints correspond to waypoints in the flight plan. Before VNAV flight control can provide vertical profile guidance, a VNAV flight plan must be entered and enabled.
- Non-path descent in a VNAV scenario – A VNAV flight plan is entered and enabled, however Pitch Hold, Vertical Speed, or Flight Level Change Mode can be used to descend to the VNAV Target Altitude prior to reaching the planned TOD. Flight Level Change Mode is used in the example.

Flight Level Change descent:

- 1) Select Flight Level Change Mode:
 - a) Using the **ALT** Knob, set the Selected Altitude to 10,000 feet.
 - b) Press the **FLC** Key to activate Flight Level Change Mode. The annunciation 'FLC' appears next to the Airspeed Reference, which defaults to the current aircraft airspeed. Selected Altitude Capture Mode is armed automatically.



- 2) Use the **UP/DN** Wheel or push the **CWS** Button while hand-flying the aircraft to adjust the commanded airspeed while maintaining the same power, or reduce power to allow descent in Flight Level Change Mode while the autopilot maintains the current airspeed.
- 3) As the aircraft nears the Selected Altitude, the flight director transitions to Selected Altitude Capture Mode, indicated by the green 'ALTS' annunciation flashing for up to 10 seconds.



The green 'ALT' annunciation flashes for up to 10 seconds upon reaching 50 feet from the Selected Altitude; the autopilot transitions to Altitude Hold Mode and levels the aircraft.

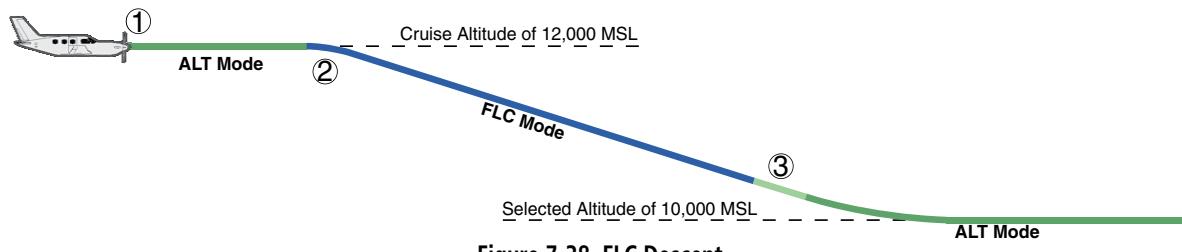


Figure 7-38 FLC Descent

Vertical Path Tracking descent to VNAV Target Altitude:

- 1) Select coupled VNAV:

a) Press the **VNV** Key to arm Vertical Path Tracking Mode. The white annunciation 'VPTH' appears.



- b) Using the **ALT** Knob, set the Selected Altitude 75 feet below the flight plan's VNAV Target Altitude of 10,000 feet.

If the Selected Altitude is not at least 75 feet below the VNAV Target Altitude, the flight director captures the Selected Altitude rather than the VNAV Target Altitude once Vertical Path Tracking Mode becomes active (ALTS is armed rather than ALTV).

- c) If Vertical Path Tracking Mode is armed more than 5 minutes prior to descent path capture, acknowledgment is required for the flight director to transition from Altitude Hold to Vertical Path Tracking Mode. To proceed with descent path capture if the white 'VPTH' annunciation begins flashing, do one of the following
- Press the **VNV** Key
 - Turn the **ALT** Knob to adjust the Selected Altitude
- 2) When the top of descent (TOD) is reached, the flight director transitions to Vertical Path Tracking Mode and begins the descent to the VNAV Target Altitude. Intention to capture the VNAV Target Altitude is indicated by the white 'ALTV' annunciation.



- 3) As the aircraft nears the VNAV Target Altitude, the flight director transitions to VNAV Target Altitude Capture Mode, indicated by the green 'ALTV' annunciation flashing for up to 10 seconds.



The green 'ALT' annunciation flashes for up to 10 seconds upon reaching 50 feet from the VNAV Target Altitude; the autopilot transitions to Altitude Hold Mode and levels the aircraft at the vertical waypoint.



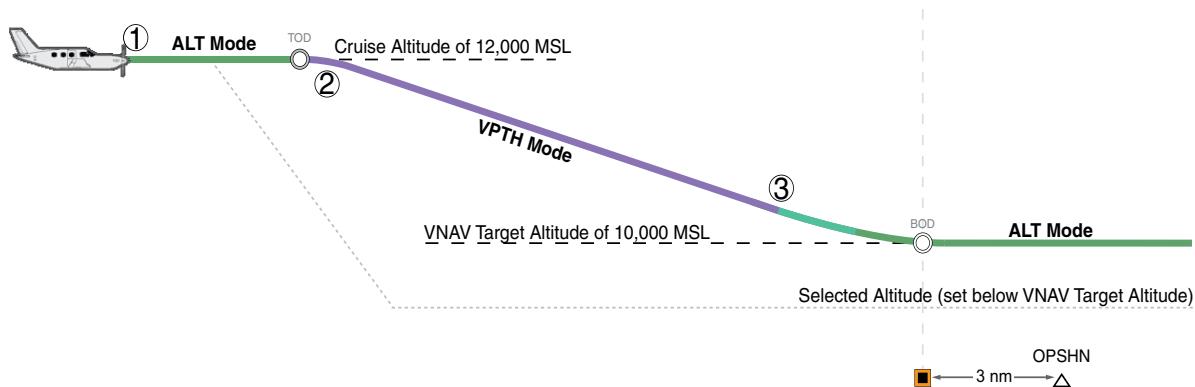


Figure 7-39 VPTH Descent

Non-path descent using Flight Level Change Mode:

- 1) Using Flight Level Change Mode, command a non-path descent to an intermediate altitude above the next VNAV flight plan altitude:
 - a) Using the **ALT** Knob, set the Selected Altitude below the current aircraft altitude to an altitude (in this case, 9,400 feet) at which to level off between VNAV flight plan altitudes.
 - b) Press the **FLC** Key before the planned TOD during an altitude hold while VPTH is armed. The Airspeed Reference defaults to the current aircraft airspeed. Vertical Path Tracking and Selected Altitude Capture Mode are armed automatically.



- 2) Reduce power to allow descent in Flight Level Change Mode. The autopilot maintains the Airspeed Reference.
- 3) As the aircraft nears the Selected Altitude, the flight director transitions to Selected Altitude Capture Mode, indicated by the green 'ALTS' annunciation flashing for up to 10 seconds.



The green 'ALT' annunciation flashes for up to 10 seconds upon reaching 50 feet from the Selected Altitude; the autopilot transitions to Altitude Hold Mode and levels the aircraft. After leveling off, reset selected altitude at or below 9,000 ft.



- 4) When the next TOD is reached, Vertical Path Tracking becomes active (may require acknowledgment to allow descent path capture).



- 5) As the aircraft nears the VNAV Target Altitude, the flight director transitions to VNAV Target Altitude Capture Mode, indicated by the green 'ALTV' annunciation flashing for up to 10 seconds.



The green 'ALT' annunciation flashes for up to 10 seconds upon reaching 50 feet from the VNAV Target Altitude; the autopilot transitions to Altitude Hold Mode and levels the aircraft at the vertical waypoint.

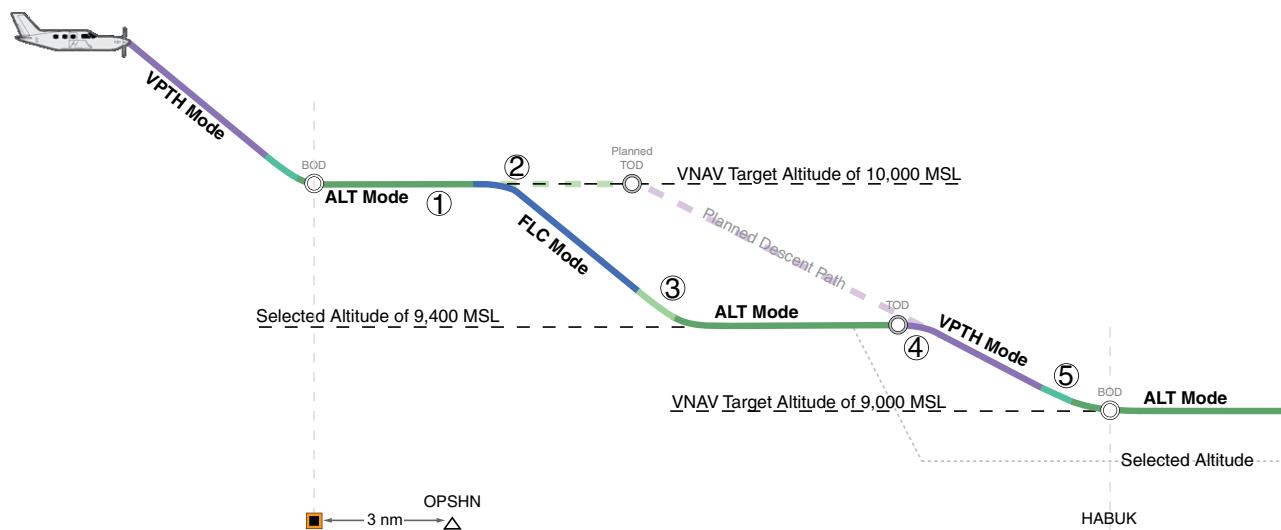


Figure 7-40 Non-path Descent

APPROACH

Flying an ILS approach:

- 1) Transition from FMS Navigation Mode to Heading Select Mode.
 - a) Select the Runway 35L ILS approach for KCOS and select 'VECTORS' for the transition. Load and activate the approach into the flight plan.
 - b) Use the **HDG** Knob to set the Selected Heading after getting vectors from ATC.
 - c) Press the **HDG** Key. The autopilot turns the aircraft to the desired heading.
 - d) Use Heading Select Mode to comply with ATC vectors as requested.



- 2) Arm LOC Approach and Glideslope modes.
 - a) Ensure the appropriate localizer frequency is tuned.
 - b) Press the **APR** Key when cleared for approach to arm Approach and Glideslope modes. 'LOC' and 'GS' appear in white as armed mode annunciations.



- 3) The navigation source automatically switches to LOC. After this switch occurs, the localizer signal can be captured and the flight director determine when to begin the turn to intercept the final approach course. The flight director now provides guidance to the missed approach point.
- 3) There are two options available at this point, as the autopilot flies the ILS approach:
 - Push the **AP DISC** Switch at the decision height and land the aircraft.
 - Use the **GA** Switch to execute a missed approach.

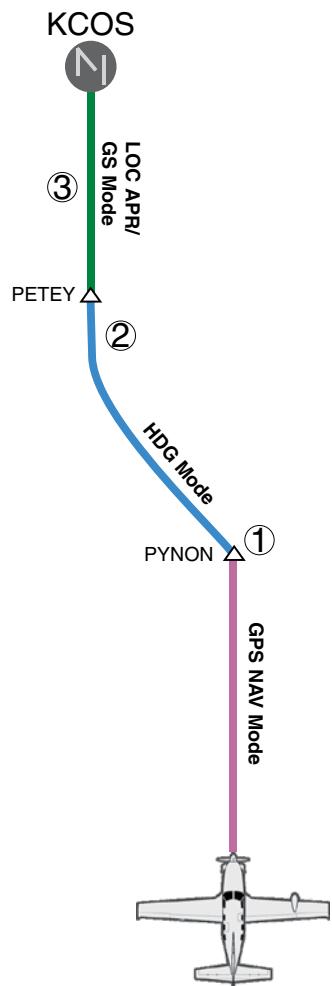


Figure 7-41 ILS Approach to KCOS

Flying a RNAV FMS approach with vertical guidance:

- 1) Arm flight director modes for a RNAV FMS approach with vertical guidance:
 - a) Make sure the navigation source is set to FMS (use **Active Nav** Softkey to change navigation source).
 - b) Select the Runway 35R LPV approach for KCOS. Load and activate the approach into the flight plan.
- 2) Press the **APR** Key once clearance for approach has been received. FMS Approach Mode is activated and Glidepath Mode is armed.



- 3) Once the glidepath is captured, Glidepath Mode becomes active. The flight director now provides guidance to the missed approach point.



- 4) There are two options available at this point, as the autopilot flies the approach:
 - Push the **AP DISC** Switch at the Decision height and land the aircraft.
 - Use the **GA** Switch to execute a missed approach.

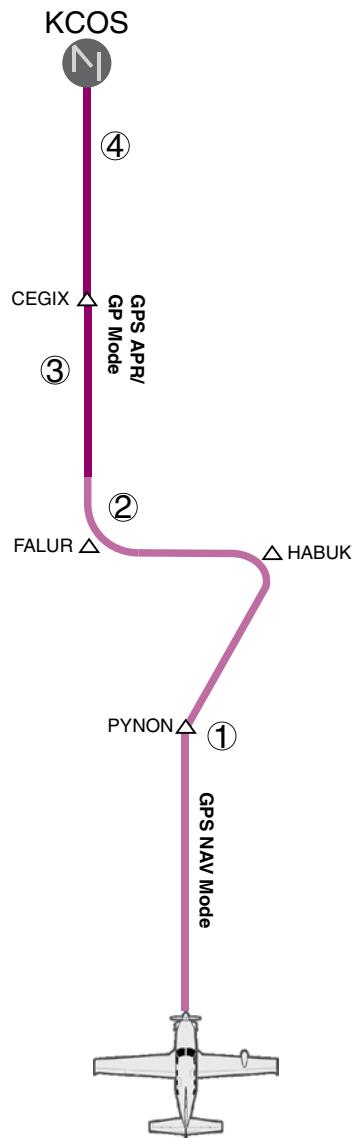


Figure 7-42 LPV Approach to KCOS

GO AROUND/MISSED APPROACH



NOTE: As a result of calculations performed by the system while flying the holding pattern, the display may re-size automatically and the aircraft may not precisely track the holding pattern as depicted on the PFD and MFD.

Flying a missed approach:

- 1) Push the **GA** Switch at the Decision height and apply go-around power to execute a missed approach. The flight director Command Bars establish a nose-up climb to follow. If flying an ILS or LOC approach the CDI also switches to FMS as the navigation source. When the **GA** Switch is pushed, the missed approach is activated.
- 2) Start the climb to the prescribed altitude in the published Missed Approach Procedure (in this case, 10,000 ft). Press the **NAV** Key to have the autopilot fly to the hold.



- 3) Use the **ALT** Knob to set a Selected Altitude to hold.

To hold the current airspeed during the climb, press the **FLC** Key.



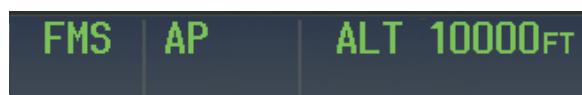
As the aircraft nears the Selected Altitude, the flight director transitions to Selected Altitude Capture Mode, indicated by the green 'ALTS' annunciation flashing for up to 10 seconds.



The green 'ALT' annunciation flashes for up to 10 seconds upon reaching 50 feet from the Selected Altitude; the autopilot transitions to Altitude Hold Mode and levels the aircraft.



- 4) The autopilot flies the holding pattern after the missed approach is activated. Annunciations are displayed in the Navigation Status Box, above the AFCS Status Box.



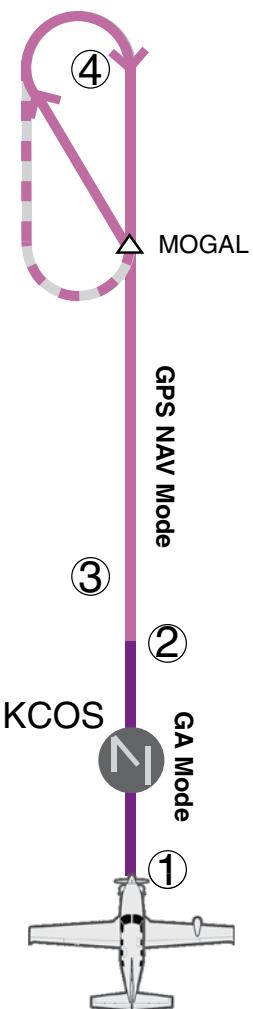


Figure 7-43 Go Around/Missed Approach

7.7 AFCS ANNUNCIATIONS AND ALERTS

AFCS STATUS ALERTS

The annunciations in Table 7-5 (listed in order of increasing priority) can appear on the PFD above the Airspeed and Attitude indicators. Only one annunciation occurs at a time, and messages are prioritized by criticality.

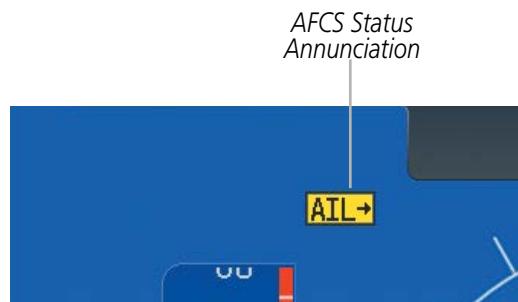


Figure 7-44 AFCS Status Annunciation

Alert Condition	Annunciation	Description
Rudder Mistrim Right	RUD→	Yaw servo providing sustained force in the indicated direction
Rudder Mistrim Left	←RUD	
Aileron Mistrim Right	AIL→	Roll servo providing sustained force in the indicated direction
Aileron Mistrim Left	←AIL	
Elevator Mistrim Down	↓ELE	Pitch servo providing sustained force in the indicated direction
Elevator Mistrim Up	↑ELE	
Pitch Trim Failure (or stuck MEPT Switch)	PTRM	If AP engaged, take control of the aircraft and disengage AP If AP disengaged, move MEPT switches separately to unstick
Yaw Damper Failure	YAW	YD control failure
Roll Failure	ROLL	Roll axis control failure; AP inoperative
Pitch Failure	PTCH	Pitch axis control failure; AP inoperative
System Failure	AFCS	AP and MEPT are unavailable; FD 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 7-5 AFCS Status Alerts

OVERSPEED PROTECTION



NOTE: Overspeed protection is not active in ALT, GS or GP Modes.

While Pitch Hold, Vertical Speed, Flight Level Change, Vertical Path Tracking, or an altitude capture mode is active, airspeed is monitored by the flight director. Pitch commands are not changed until overspeed protection becomes active. Overspeed protection is provided in situations where the flight director cannot acquire and maintain the mode reference for the selected vertical mode without exceeding 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. Engine power should be reduced and/or the pitch reference adjusted to slow the aircraft. The annunciation disappears when the overspeed condition is resolved.

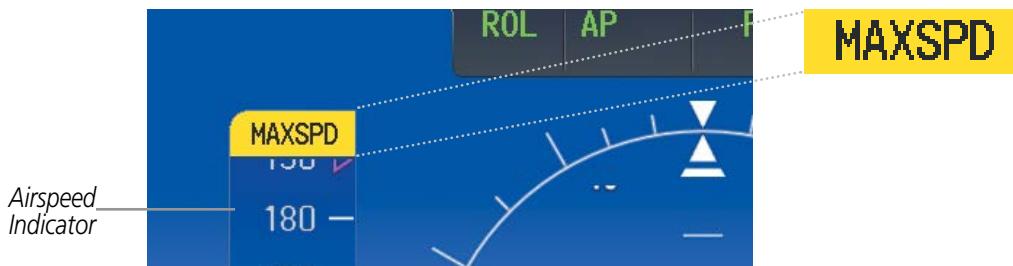


Figure 7-45 Overspeed Annunciation

UNDERSPEED PROTECTION

Underspeed Protection is designed to discourage aircraft operation below minimum established airspeeds and is available when the Flight Director is on.

When the aircraft reaches a predetermined airspeed, a yellow MINSPD annunciation will appear above the airspeed indicator. When the airspeed trend vector reaches a predetermined airspeed, a single aural "AIRSPEED" will sound, alerting the pilot to the impending underspeed condition.

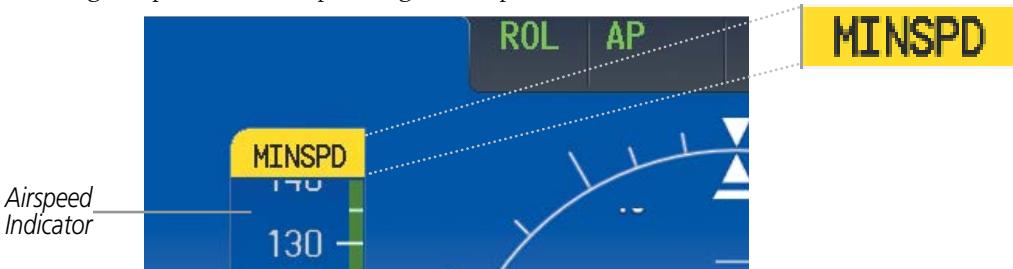


Figure 7-46 MINSPD Annunciation

If the aircraft continues to decelerate, Underspeed Protection functionality depends on which vertical flight director mode is selected. For the purpose of this discussion, the vertical flight director modes can be divided into two categories: Those in which it is important to maintain altitude for as long as possible (altitude-critical modes), and those in which maintaining altitude is less crucial (non-altitude critical modes).

ALTITUDE-CRITICAL MODES (ALT, GS, GP, TO, GA)

If the aircraft decelerates to stall warning, the lateral and vertical flight director modes will change from active to armed. The autopilot will provide input causing the aircraft to pitch down to maintain an airspeed no less than stall warning activation speed plus two knots, and the wings to level.

An aural “AIRSPEED” alert will sound twice and a flashing red “USP ACTIVE” CAS message will appear.



Figure 7-47 Underspeed Protect Active Annunciation

When airspeed increases (as a result of adding power/thrust) to above the IAS at which stall warning turns off, plus two knots, the autopilot will cause the aircraft to pitch up until recapturing the vertical reference. The vertical and lateral flight director modes will change from armed to active.

NON-ALTITUDE CRITICAL MODES (VS, VNAV)

If the aircraft decelerates to an IAS below the minimum commandable autopilot airspeed, a red “UNDERSPEED PROTECT ACTIVE” annunciation (Figure 7-43) will appear to the right of the vertical speed indicator. The vertical flight director mode will change from active to armed, and the autopilot will cause the aircraft to pitch down until reaching a pitch attitude at which IAS equals the minimum commandable autopilot airspeed.

When sufficient power/thrust is available, the autopilot will recapture the previously selected vertical reference and the flight director mode will change from armed to active.



NOTE: When the autopilot is outside normal operating limits, it uses more aggressive commands to return to normal limits.

EMERGENCY DESCENT MODE

The Emergency Descent Mode of the AFCS consists of four phases – the Primary Descent to 14,000 ft, rest at 14,000 ft, the Secondary Descent to 12,500 ft, final rest at 12,500 ft. Each descent phase will use the IAS mode of the autopilot and be performed at the maximum allowable airspeed as defined by the aircraft gains and configuration. Usually this will be VMO. The unacknowledged ‘AUTO DESCENT’ warning CAS message will continue to be annunciated and warning aural played throughout the entire process. Once EDM has been started, a red EDM annunciation will be displayed on the PFD. During either the primary or secondary descent, EDM can only be aborted by disconnect the autopilot as described.

Once AFCS begins the Primary Descent phase, IAS mode will be used to fly a VMO descent to 14,000 ft. No change will be made to the lateral guidance. Once the selected altitude is captured, the AFCS will transition to ALT mode and hold 14,000 ft. Additionally, upon completion of the Primary Descent, the GFD will start an inactivity timer. If, after four (4) minutes of inactivity, the Autopilot has not been disconnected, the GDU will command the Secondary Descent to 12,500ft which will be flown using IAS mode at VMO. Once the selected altitude is captured, the AFCS will transition to ALT mode and hold 12,500 ft indefinitely.

7.8 ABNORMAL OPERATION

SUSPECTED AUTOPILOT MALFUNCTION



NOTE: Consult the aircraft documentation for the location of circuit breakers as well as specifics that may supplement or amplify this procedure.

If an Autopilot failure or trim failure is suspected to have occurred, perform the following steps:

- 1) Firmly grasp the control wheel.
- 2) Press and hold the **AP/TRIM 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/TRIM DISC** Switch.

OVERPOWERING AUTOPILOT SERVOS

In the context of this discussion, “overpowering” refers to any pressure or force applied to the pitch controls when the Autopilot is engaged. A small amount of pressure or force on the pitch controls can cause the Autopilot automatic trim to run to an out-of-trim condition. Therefore, any application of pressure or force to the controls should be avoided when the Autopilot is engaged.

Overpowering the Autopilot during flight will cause the Autopilot’s automatic trim to run, resulting in an out-of-trim condition or cause the trim to hit the stop if the action is prolonged. In this case, larger than anticipated control forces are required after the Autopilot is disengaged.

The following steps should be added to the preflight check:

- 1) Check for proper Autopilot operation and ensure the Autopilot can be overpowered.
- 2) Note the forces required to overpower the Autopilot servo clutches.

SECTION 8 ADDITIONAL FEATURES



NOTE: Regardless of the availability of SafeTaxi® or ChartView, it may be 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™
- ChartView electronic charts
- Airport Directory (AOPA or AC-U-KWIK)
- Iridium satellite telephone
- Data Link Services
- SiriusXM Satellite Radio entertainment
- Scheduled Messages
- Electronic Documents
- Electronic Checklists
- Flight Data Logging

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 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 Data Link Services are optional subscription services offered through Garmin Connexx and Iridium Satellite LLC. Voice and SMS messaging communications are through the Iridium Satellite Network. Data communications are through Iridium Data Services, or a wireless network (Wi-Fi) when the aircraft is on the ground. Incorporated in this feature set is a System Data Logging function which records aircraft system parameters specified by the aircraft manufacturer. This data is then uploaded to Garmin Connexx through one of the data communications options.

The optional SiriusXM Satellite Radio entertainment audio feature of the GDL 69A 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.

The Scheduled Messages feature can be used to enter and display short term or long term reminder messages such as RVSM checks, Change oil, or Altimeter-Transponder Check in the Messages display on the Touchscreen Controller.

The Electronic Document function allows viewing of electronic documents on selected GDU displays.

Optional Electronic Checklists help to quickly find the proper checklist procedure on the ground or during flight.

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.

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 displays that show 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 **Home** Screen, touch **Map > Map Settings**.
- 2) If not already selected, touch the **Aviation** Tab.
- 3) If necessary, scroll to display the **SafeTaxi** Annunciator Button.
- 4) Touch the **SafeTaxi** Button to enable or disable the display of SafeTaxi on the Navigation and Inset maps. A green annunciator on the button indicates SafeTaxi is enabled.

Configuring SafeTaxi range:

- 1) From the **Home** Screen, touch **Map > Map Settings**.
- 2) If not already selected, touch the **Aviation** Tab.
- 3) If necessary, scroll to display the **SafeTaxi** Range Button.
- 4) Touch the SafeTaxi Range Button. A selection of ranges is displayed.
- 5) Touch the desired range. In Figure 8-2, 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

SAFETAXI DATABASE INFORMATION

The SafeTaxi database is revised every 56 days. SafeTaxi is available for use after the expiration date. When turning on the system, the MFD Power-up Display indicates the expiration date and status of the database.

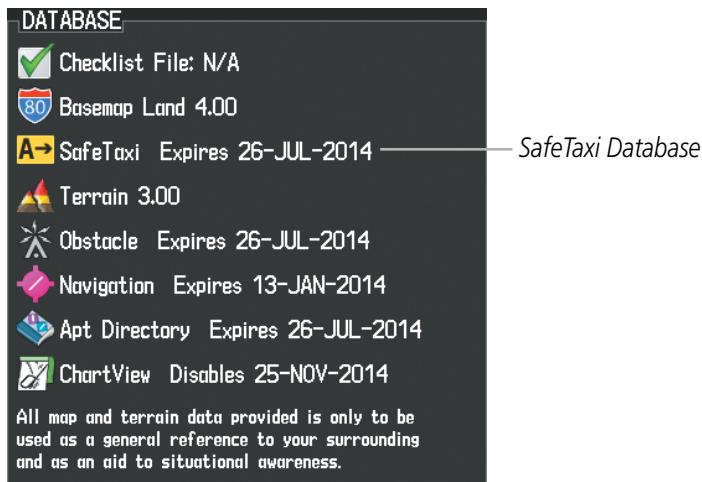


Figure 8-3 Power-up Page, SafeTaxi Database

Power-up Page Display	Definition
SafeTaxi Expires 26-JUL-2014	Normal operation. SafeTaxi database is valid and within current cycle.
SafeTaxi Expires 26-JUL-2014	SafeTaxi database has expired.
SafeTaxi: N/A	Database card contains no SafeTaxi data.

Table 8-1 SafeTaxi Annunciation Definitions

The SafeTaxi Region, Version, Cycle, Effective date and Expires date of the database cycle can be viewed by selecting the MFD1, PFD1, and PFD2 Databases Screen.

Viewing SafeTaxi database information:

- 1) From the **Home** Screen, touch **Utilities > Setup > Avionics Status**.
- 2) If not already selected, touch the **Database** Tab.
- 3) Touch the desired button (**PFD1, PFD2, or MFD1**).
- 4) Scroll to view the SafeTaxi database information, as shown in Figure 8-4.



Figure 8-4 MFD SafeTaxi Database Information

The SafeTaxi database cycle number shown in the figure, 14S3, is deciphered as follows:

14 – Indicates the year 2014

S – Indicates the data is for SafeTaxi

3 – Indicates the third issue of the SafeTaxi database for the year

The SafeTaxi ‘Effective’ date 3–MAY–2014 is the beginning date for the current database cycle. The SafeTaxi ‘Expires’ date 26–JUL–2014 is the revision date for the next database cycle.

The ‘Effective’ date is the beginning date for this database cycle. The ‘Effective’ date appears in amber when the current date is before the effective date (Figure 8-5). The ‘Expires’ date is the revision date for the next database cycle. The ‘Expires’ date appears in amber when expired. ‘Not Available’ indicates the SafeTaxi database is not available on the database card or no database card is inserted. An expired SafeTaxi database is not disabled and will continue to function indefinitely.

Refer to Appendix B for instructions on updating the SafeTaxi database.

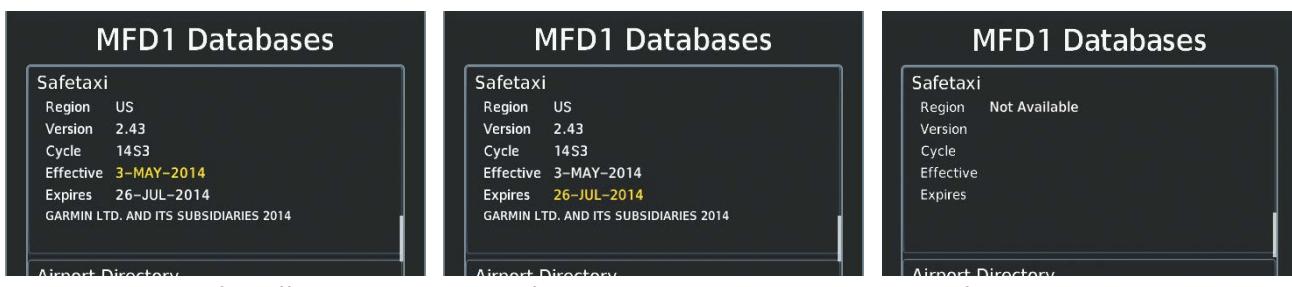


Figure 8-5 SafeTaxi Database Status

8.2 SURFACEWATCH



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

The 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 callouts for runway distance remaining.
- Provides information on the Primary Flight Display (PFD) that contains runway and taxiway information as the aircraft moves through the airport environment.

The SurfaceWatch feature is not available in Reversionary Mode.



Figure 8-6 SurfaceWatch Information on the PFD

Enable/disable SurfaceWatch:

- 1) From the **Home** Screen, touch **Utilities > Setup > Avionics Settings**.
- 2) If not already selected, touch the **Alerts** Tab and scroll to view SurfaceWatch.
- 3) Touch the SurfaceWatch **Inhibit** Button to enable or disable SurfaceWatch. A green annunciator indicates SurfaceWatch is inhibited, or disabled. The inhibit setting will be canceled after a power cycle.

INFORMATION DISPLAY

The SurfaceWatch™ Information Box is displayed on the PFD to the left of the HSI. It contains runway and taxiway information that dynamically changes as the aircraft moves through the airport environment. The information that is displayed in the Information Box is the aircraft's relative position to nearby aprons, taxiways, and runways.

There are three components to the SurfaceWatch™ Information Box as shown in Figure 8-7. These components are Currently Occupied, Approaching, and Crossing Runways.

			Crossing Runway
Currently Occupied		Approaching	
ON RWY 04R	REMAINING 8000FT	APPROACHING TWY H	ON RWY 15R REMAINING 8100FT CROSSING DIS RWY 04L/22R 1100FT

Figure 8-7 Information Types Displayed in the Information Box

CURRENTLY OCCUPIED

This component indicates the aircraft is 'ON' the indicated apron, taxiway, or runway. In Figure 8-7, 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 Figure 8-7, the aircraft is currently 'APPROACHING' taxiway H (TWY H). The distance to the taxiway is also shown. Note, when approaching a runway, the distance displayed does not take into account the position of Hold Line for the runway. Do not cross the Hold Line until authorized.

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 RUNWAY

This component lists the closest runway that this 'CROSSING' the runway the aircraft currently occupies, as seen in Figure 8-7. The distance to the runway is also shown. Runways behind the aircraft are not depicted.

The Crossing Runway 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, as shown in Figure 8-6. 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"	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 remaining distance less than needed as calculated by the TOLD function.
CHECK RUNWAY	"Check runway"	Issued when the aircraft is taking off from, or landing on, a runway different than that entered in TOLD.
TWY LANDING	"Taxiway"	Issued when the aircraft is landing on a non-runway (e.g. a taxiway).

Table 8-2 SurfaceWatch Alert Annunciations

TAKEOFF ALERTS

The system will issue Takeoff Alerts when the thrust levers are advanced to the CRU position or higher.

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 thrust levers are advanced and the aircraft is not aligned with a runway.

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 thrust levers are advanced while the aircraft is aligned with a runway and the system TOLD function has calculated the remaining distance to be too short.

The Runway Too Short alert may be issued for any runway from which the aircraft is taking off, even if the runway is not the one entered in TOLD.

CHECK RUNWAY

The Check Runway alert is issued when the aircraft attempts to takeoff from a runway that does not match the departure runway in TOLD, or the active flight plan when TOLD is not used. The system determines this when the thrust levers are advanced while the aircraft is aligned with a runway that is not the departure runway entered in the TOLD function or the active flight plan.

LANDING ALERTS

The system will issue Landing Alerts when the aircraft is below 250 feet AGL and within one nautical mile of the runway threshold.

TAXIWAY LANDING

The Taxiway Landing alert is issued when the aircraft attempts to land on a non-runway (e.g. a taxiway). The system determines this when the aircraft is below 250 feet AGL and within one nautical mile of the runway threshold and the aircraft is not aligned with the runway.

RUNWAY TOO SHORT

The Runway Too Short alert is issued when the aircraft attempts to land on a runway where the remaining runway length is less than the required landing runway length as calculated by the TOLD function.

The Runway Too Short alert may be issued for any runway with which aircraft is aligned, even if the runway is not the one entered in TOLD.

CHECK RUNWAY

The Check Runway alert is issued when the aircraft attempts to land on a runway that does not match the arrival runway specified in the TOLD function. The system determines this when the aircraft is below 250 feet AGL and within one nautical mile of the runway threshold while the aircraft is aligned with a runway that does not match the runway entered in the TOLD function.

When the aircraft becomes aligned with a runway while on the ground, the “On Runway” voice alert is heard.

DISTANCE REMAINING CALLOUTS

During a 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'. Callouts are not issued when the groundspeed decreases below 30 knots.

8.3 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 planview 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 (Figure 8-8) 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.

Figure 8-8 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 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.

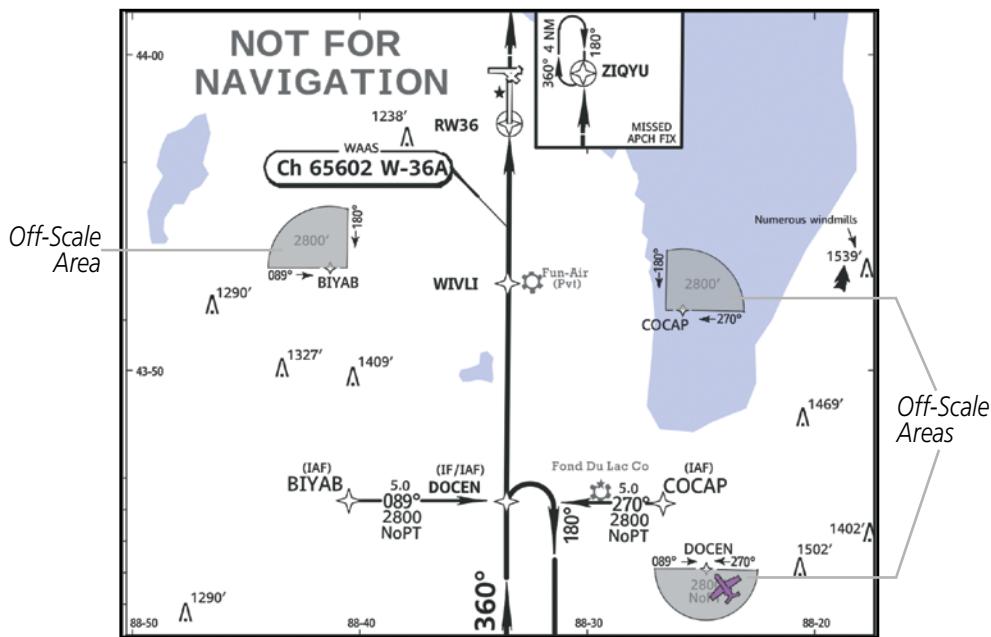


Figure 8-8 Sample Chart Indicating Off-Scale Areas



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 **Home** Screen, touch **Charts** (select **Chart Selection** if necessary).
- 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 (Figure 8-9).
 - **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.

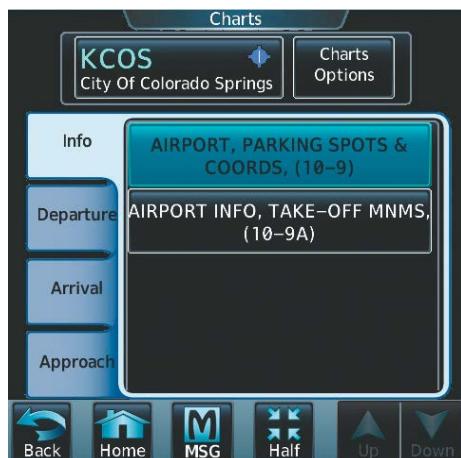


Figure 8-9 Airport Diagram Selection



Figure 8-10 Airport Diagram View Options

- 5) Touch the **Charts Options** Button to select the desired display option for the selected chart (Figure 8-10).
- 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 heading. Only appropriate views are available for the selected chart.
- 7) Touch **Back** to return to the Charts Screen.

Selecting Airport Diagrams from the Nearest Airports Screen:

- 1) From the **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 Figure 8-11.



Figure 8-11 Airport Diagram Selection

- 3) Touch the **Airport Chart** Button. The **Info** Tab selections are displayed on the Touchscreen Controller (Figure 8-9) and the Airport Diagram is displayed on the selected Display Pane (Figure 8-12).

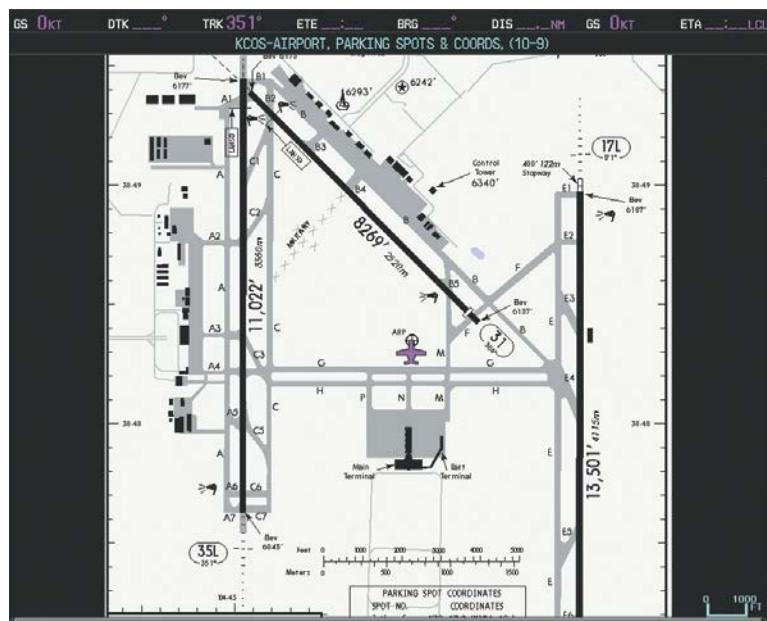


Figure 8-12 Airport Chart for Selected Airport

The aircraft symbol is shown on the chart only if the chart is to scale and the aircraft position is within the boundaries of the chart. The aircraft symbol is not displayed when the Aircraft Not Shown Icon appears. If the Chart Scale Box displays a banner 'NOT TO SCALE', the aircraft symbol is not shown. The Aircraft Not Shown Icon may appear at certain times, even if the chart is displayed to scale.

When no terminal procedure chart is available for the nearest airport or the selected airport, the banner '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.



CHART NOT AVAILABLE

Figure 8-13 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 8-14 Unable To Display Chart Banner

DAY/NIGHT VIEW

ChartView can be displayed on a white or black background for day or night viewing. The Day View offers a better presentation in a bright environment. The Night View gives a better presentation for viewing in a dark environment.

Selecting Day, Night, or Auto View:

- 1) From the **Home Screen**, touch **Charts > Charts Options**.
- 2) Touch the **Light Mode** Button (Figure 8-10).
- 3) Touch the **Day, Night, or Auto** button (Figure 8-15). 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 8-15 Selecting Day/Night View

- 4) Touch the **Threshold** button (Figure 8-16). The Auto Light Mode Threshold window is displayed.

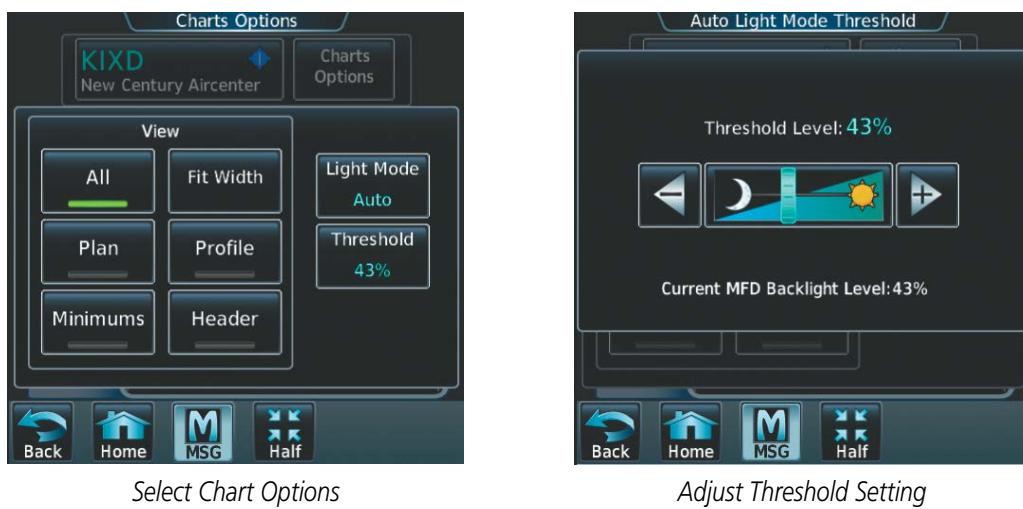


Figure 8-16 Setting Day/Night Switching Threshold

- 5) Move the slider left or right to set the desired threshold. Setting the Threshold Level percentage to the same percentage shown as the Current MFD Backlight Level will cause the Day/Night view to switch at the current backlight setting. Adjusting the Threshold Level setting larger than the Current MFD Backlight Level will cause the display to remain in Night Mode longer. Adjusting the Threshold Level setting smaller than the Current MFD Backlight Level will cause the display to change to Day Mode sooner.

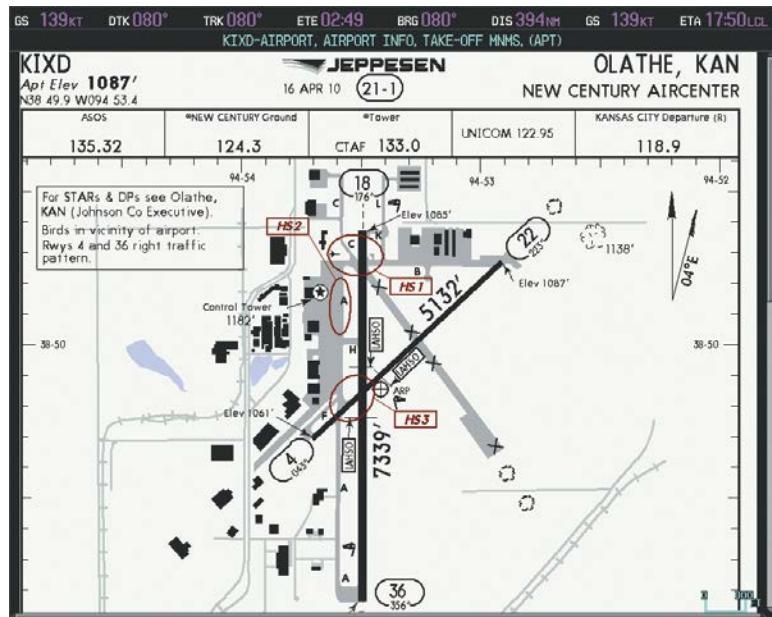


Figure 8-17 Airport Diagram, Day View

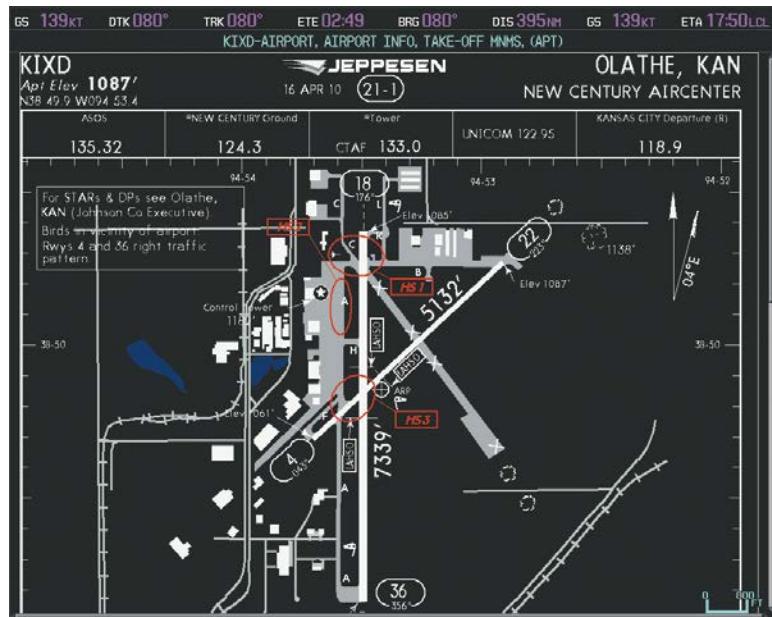


Figure 8-18 Airport Diagram, Night View

CHARTVIEW DATABASE INFORMATION

The ChartView database is revised every 14 days. Charts are still viewable during a period that extends from the cycle expiration date to the disables date. ChartView is disabled 70 days after the expiration date and is no longer available for viewing. When turning on the system, the MFD Power-up Display shows the current status of the ChartView database. See Table 8-3 for the various ChartView Power-up Display annunciations and the definition of each.

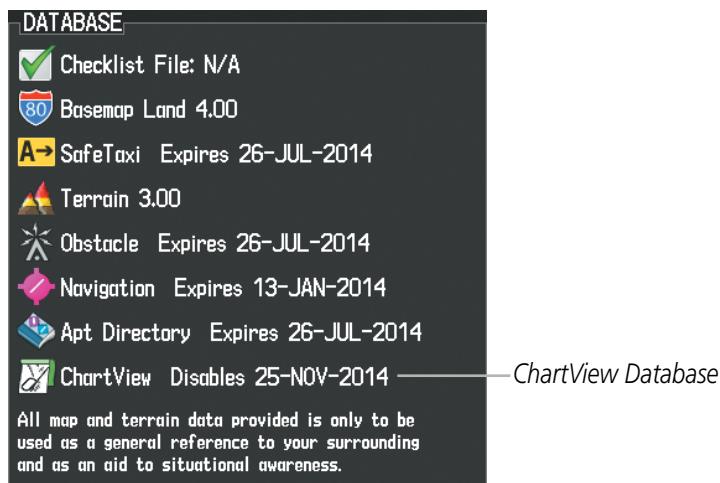


Figure 8-19 Power-up Page, ChartView Database

Power-up Display	Definition
	Blank Line. System is not configured for ChartView. Contact a Garmin-authorized service center for configuration.
Chart Data: N/A	System is configured for ChartView but no chart database is installed. Contact Jeppesen for a ChartView database.
ChartView Disables 25-NOV-2014	Normal operation. ChartView database is valid and within current cycle.
Chart data update available.	ChartView database is within 1 week after expiration date. A new cycle is available for update.
Chart data is out of date!	ChartView database is beyond 1 week after expiration date, but still within the 70 day viewing period.
Chart data is disabled.	ChartView database has timed out. Database is beyond 70 days after expiration date. ChartView database is no longer available for viewing.
Verify chart database cycle.	System time is not available. GPS satellite data is unknown or the system has not yet locked onto satellites. Check database cycle number for effectiveness.
Verifying Chart data	System is verifying chart database when new cycle is installed for the first time.
Chart Data is Corrupt!	After verifying, chart database is found to be corrupt. ChartView is not available.

Table 8-3 ChartView Annunciations and Definitions

The ChartView status information can be found on the MFD1, PFD1, PFD2, GTC1, and GTC2 Databases Screen (Figure 8-20). The ‘Expires’ date is the revision date for the next database cycle. The ‘Expires’ date appears in amber when expired. ChartView becomes inoperative 70 days after the ChartView ‘Expires’ date is reached. This is shown as the ‘Disables’ date. When the disables date is reached, the date is displayed in amber. Also, the **Charts** Button on the Home Screen appears subdued and is disabled until a new issue of ChartView is installed.

Viewing ChartView database information:

- 1) From the **Home** Screen, 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 ChartView database information as shown in Figure 8-20.



Figure 8-20 MFD ChartView Database Information

The ChartView database cycle number shown in Figure 8-20, 1418, is deciphered as follows:

14 – Indicates the year 2014

18 – Indicates the eighteenth issue of the ChartView database for the year

The ‘Expires’ date 16–SEP–2014 is the date that this database should be replaced with the next issue.

The ‘Disables’ date 25–NOV–2014 is the date that this database becomes inoperative.

The ChartView database is obtained directly from Jeppesen. Refer to Updating Jeppesen Databases in Appendix B for instructions on updating the ChartView database.

Example database currency conditions are shown in Figure 8-21. The ‘Expires’ date, in amber, is the revision date for the next database cycle. The ‘Disables’ date, in amber, is the date that this database cycle is no longer viewable. ‘Not Available’ indicates no ChartView data is available on the database card or no database card is inserted.

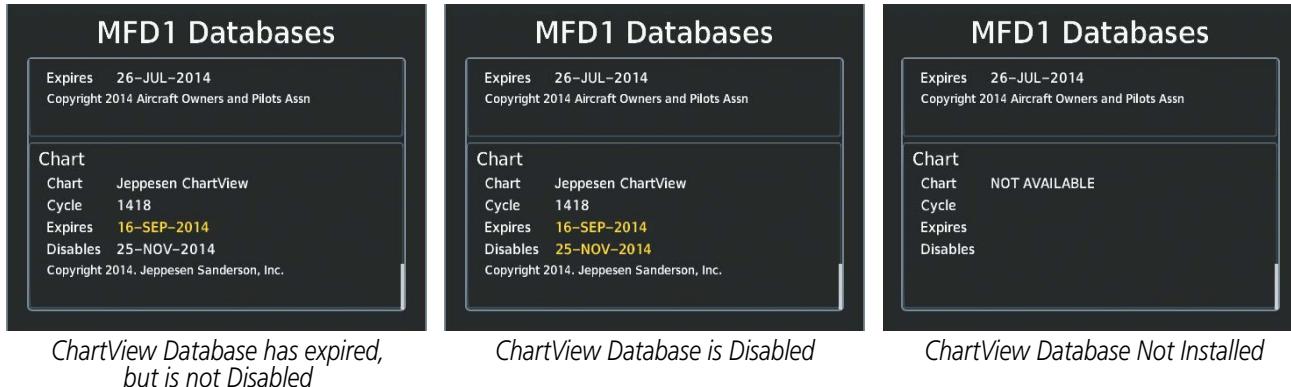


Figure 8-21 ChartView Database Status

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 Figure 8-22.

Selecting the Airport Directory Info Screen:

- 1) From the **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 Figure 8-22.
- 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 Figure 8-23.

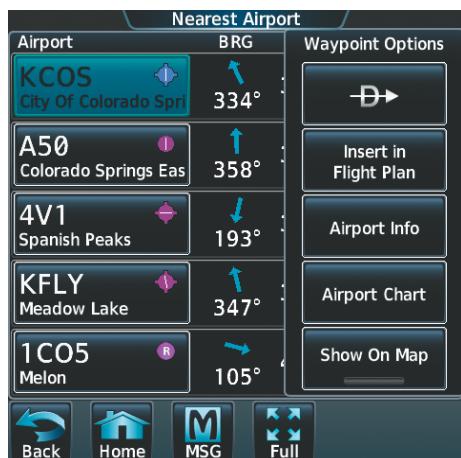


Figure 8-22 Nearest Airport Selection

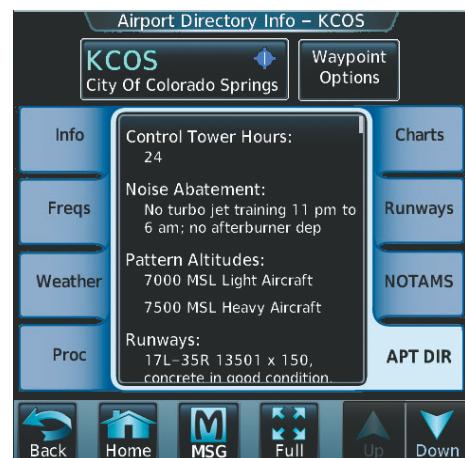


Figure 8-23 AOPA Airport Directory Information

AIRPORT DIRECTORY DATABASE CYCLE NUMBER AND REVISION

The Airport Directory database is revised every 56 days. Check fly.garmin.com for the current database. The Airport Directory is always available for use after the expiration date. When turning on the system, the Power-up Display indicates whether the databases are current, out of date, or not available.

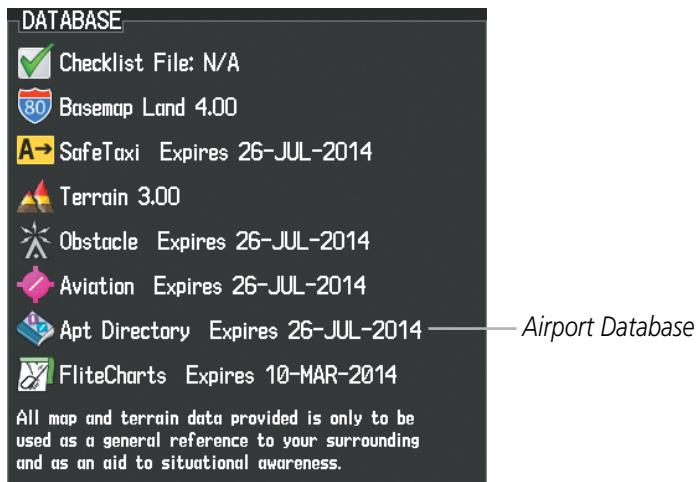


Figure 8-24 Power-up Page, Airport Directory Database

Power-up Page Display	Definition
Apt Directory Expires 10-MAR-2014	Normal operation. Airport Directory database is valid and within current cycle.
Apt Directory Expires 10-MAR-2014	Airport Directory database has expired.
Apt Directory N/A	Database card contains no Airport Directory data.

Table 8-4 Airport Directory Annunciation Definitions

The Airport Directory ‘Region’, ‘Version’, ‘Cycle’, ‘Effective’ date and ‘Expires’ date of the database cycle can also be found on the Touchscreen Controller, as seen in Figure 8-25.

Viewing Airport Directory database information:

- 1) From the **Home** Screen, 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 Airport Directory database information as shown in Figure 8-23.



Figure 8-25 MFD Airport Directory Database Information

The Airport Directory database cycle number shown in the figure, 14D3, is deciphered as follows:

14 – Indicates the year 2014

D – Indicates the data is for Airport Directory

3 – Indicates the third issue of the Airport Directory database for the year

The Airport Directory ‘Effective’ date 31–MAY–2014 is the beginning date for the current database cycle. The Airport Directory ‘Expires’ date 26–JUL–2014 is the revision date for the next database cycle.

The ‘Effective’ date appears in amber when the current date is before the effective date. The ‘Expires’ date appears in amber when expired (Table 8-4). ‘Not Available’ appears in the ‘Region’ field if Airport Directory data is not available on the database card. An expired Airport Directory database is not disabled and will continue to function indefinitely.

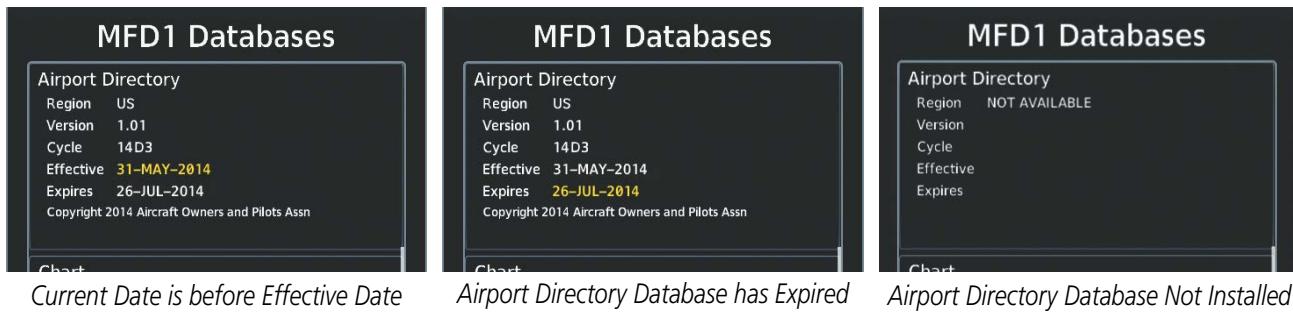


Figure 8-26 Airport Directory Airport Database Status

8.5 SATELLITE TELEPHONE AND DATALINK SERVICES



NOTE: Separate accounts must be established to access the Iridium satellite network for voice and Garmin Connex for data transmission of maintenance reports.

One or two optional GSR 56 Iridium Transceivers provide an airborne low speed data link, Iridium Satellite Telephone service and SMS text messaging.

REGISTERING WITH GARMIN CONNEXT

A subscriber account must be established prior to using the Iridium Satellite System. Before setting up an Iridium account, obtain the System ID and serial number of the Iridium Transceiver (GSR1) by performing the following procedure. Contact Garmin Connex at 1-866-739-5687 in the United States or 913-397-8200, ext. 1135.

Registering the system for data link services:

- 1) From the **Home** Screen, touch **Utilities > Setup > Avionics Status**.
- 2) If necessary, touch the **Airframe** Tab. Note the System ID number as seen in Figure 8-27. This number will be needed when contacting Garmin Connex to establish the account.



Figure 8-27 System ID Number

Avionics Status		
LRU Info	Serial	Version
GSR1	0000001	0.00
GTA PTCH TRM	-----	-----
GTC1	-----	3.07an
GTS	012345	2.02
GTX1	-----	-----

Back Home MSG Full Up Down

Figure 8-28 Iridium Transceiver Serial Number (GSR1)

- 3) Touch the **LRU Info** Tab. Scroll to view 'GSR1' and note the serial number (Figure 8-28), which will also be needed when contacting Garmin Connex.
- 4) Contact Garmin Connex to establish an account and receive an access code.
- 5) From the **Home** Screen, touch **Utilities > Setup > Connex Registration > Register** (Figure 8-29).



Figure 8-29 Connxxt Registration Display



Figure 8-30 Entering the Access Code

- 6) Enter the access code as shown in Figure 8-30.
- 7) 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 **Home** Screen, touch **Services > Contacts**.

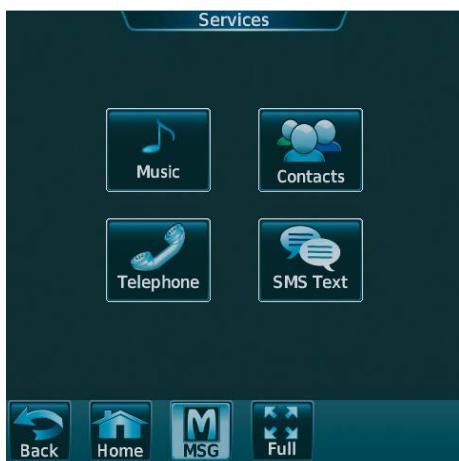


Figure 8-31 Services Menu



Figure 8-32 Contact List

- 2) Touch **Create New** at the left of the list (Figure 8-32).
- 3) Touch **Name**, shown in Figure 8-33. The Contact Name entry screen is displayed.



Figure 8-33 Enter New Contact Information



Figure 8-34 Enter Name

- 4) Enter the name of the new contact as the example shows in Figure 8-34.
- 5) Touch **Enter**.
- 6) Touch **Telephone Number**. The Telephone Number entry screen is displayed.



Figure 8-35 Select Telephone Number



Figure 8-36 Enter Telephone Number

- 7) Enter the telephone number of the new contact as the example shows in Figure 8-36.
- 8) Touch **Enter**.
- 9) Touch **Email Address**. The Email Address entry screen is displayed.



Figure 8-37 Select Email Address



Figure 8-38 Enter Email Address

- 10) Enter the email address of the new contact as the example shows in Figure 8-38.
- 11) Touch **Enter**.
- 12) Touch **Create**. The new contact is created and appears in the list of contacts as shown in Figure 8-40.



Figure 8-39 New Contact Info Complete

Contacts	
Name	Phone Number / Email
New Contact...	----
BOB BELL	1-816-555-9977 IRESAUCE@TACO.NET
JANE DOE	13165550440 JDOE@GARMIN.COM
JOE HENN	19135557799 ROOSTER@FOULPLAY.NET
JOHN SMITH	19135550000 John-Smith@Garmin.com

Figure 8-40 Enter Email Address

TELEPHONE COMMUNICATION (OPTIONAL)

The pilot or copilot can place and answer calls on the Iridium satellite network.

Viewing the Telephone Status:

- 1) From the **Home** Screen, touch **Services > Telephone**.
- 2) The Telephone Screen is displayed as shown in Figure 8-42. A white 'X' displayed on the Iridium or Cockpit box indicates the telephone and/or the Iridium system is not available.



Figure 8-41 Telephone Service Selection

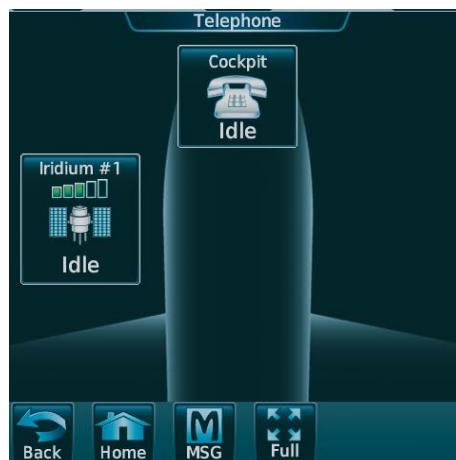


Figure 8-42 Telephone Status Information

ENABLE/DISABLE THE IRIDIUM TELEPHONE SYSTEM

The Iridium Satellite Telephone System may be turned on or off by using the page menu.

To enable/disable the Iridium telephone system:

- 1) From the **Home** Screen, touch **Services > Telephone**.
- 2) Touch the **Iridium #1** Button to display the Iridium #1 Transceiver Screen, as shown in Figure 8-43.
- 3) Touch the **Disable Iridium Transmission** Annunciator Button to disable (green annunciator as in Figure 8-44) the transceiver. Touch the button again to enable (gray annunciator) the transceiver.

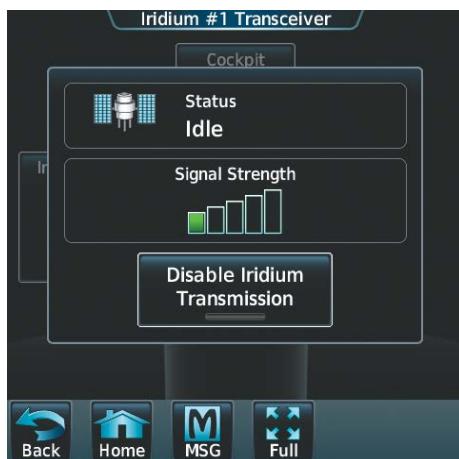


Figure 8-43 Iridium Transceiver Enabled

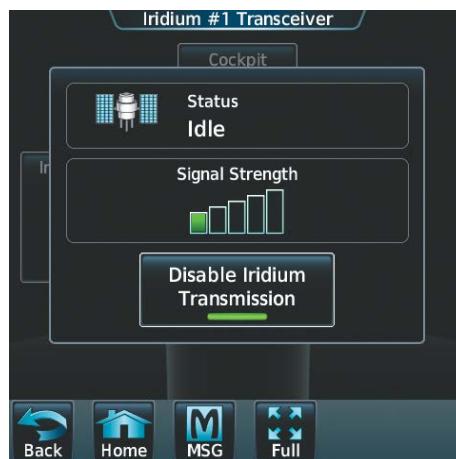


Figure 8-44 Iridium Transceiver Disabled

INCOMING CALLS

Incoming voice calls from an external telephone phone through the Iridium Satellite Network are annunciated by a flashing **TEL** Button on the Touchscreen Controller Button Bar, as shown in Figure 8-45, as well as a flashing TEL annunciation in the upper left corner of the PFD display.

To answer a call:

- 1) Touch the flashing **TEL** Button. The Notifications Screen is displayed as in Figure 8-46.
- 2) Touch the **Answer** Button. The call is now connected as indicated in Figure 8-47. Touching the **Ignore** Button extinguishes the new call annunciation and the call remains disconnected.



Figure 8-45 Incoming Call Notification



Figure 8-46 Telephone Notification Selected

- 3) When the call is finished, touch **End Call** to disconnect the call.

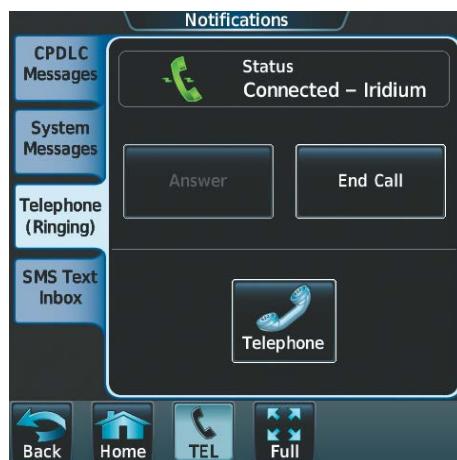


Figure 8-47 Call Answered

OUTGOING CALLS

Voice calls can be made from the cockpit to an external telephone through the Iridium Satellite Network.

To make a call:

- 1) From the **Home** Screen, touch **Services > Telephone**.
- 2) Touch the **Cockpit** Phone Button. The Cockpit Phone Screen is displayed as shown in Figure 8-48.
- 3) Touch **Dial**. The phone number entry screen is displayed as shown in Figure 8-49.



Figure 8-48 Cockpit Telephone Status



Figure 8-49 Telephone Number Entry

- 4) Using the number keys, enter the phone number. Touch **Find** to select a phone number from the Contact List.

When entering a phone number, enter country code + area code + phone number when calling a non-satellite telephone system. Enter Satellite Country Code (shown in the following table) + phone number when placing a call to another satellite telephone system.

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 now begins establishing a connection as indicated by the dashed green line in Figure 8-50. The system will indicate a completed connection, as shown by the solid green line in Figure 8-51, when the telephone to which the call is made is answered.



Figure 8-50 Establishing a Connection



Figure 8-51 Telephone Connected

To end a call:

- 1) From the **Home** Screen, touch **Services > Telephone**.
- 2) Touch the **Cockpit** Phone Button. The Cockpit Phone Screen is displayed as shown in Figure 8-52.
- 3) Touch **End Call**.



Figure 8-52 Ending the Call

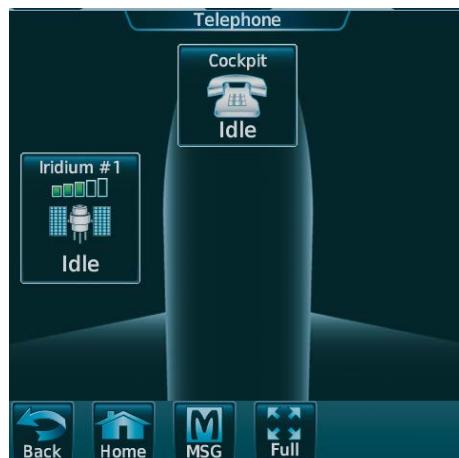


Figure 8-53 System is Idle After Ending Call

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 Figure 8-54 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.

To enable/disable telephone audio and adjust volume:

- 1) From the **Home** Screen, touch **Services > Telephone**.
- 2) Touch the **Cockpit** Phone Button. The Cockpit Phone Screen is displayed as shown in Figure 8-54.



Figure 8-54 Conferencing in Cabin Phone

- 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 Figure 8-55, 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 Figure 8-55. The **SMS Text Inbox** Tab is automatically selected and the newly received text message is shown at the top of the list, as in Figure 8-56.



Figure 8-55 New SMS Text Message Annunciation

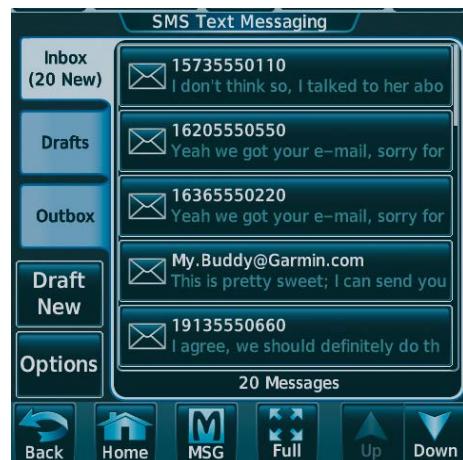


Figure 8-56 New Text Message at Top of List

- 2) Touch the desired message to display its contents as seen in Figure 8-57.

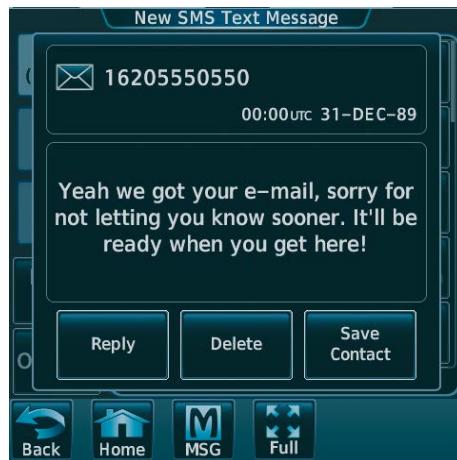


Figure 8-57 New Text Message Contents

- 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.

REPLY TO A TEXT MESSAGE

While viewing the text message content, touch the **REPLY** Button.

Or:

- 1) From the **Home** Screen, touch **Services > SMS Text** (Figure 8-58).



Figure 8-58 SMS Text Services Selection



Figure 8-59 Touch Desired Message

- 2) Touch the desired text message in the Inbox list as in Figure 8-59. If necessary, scroll to the desired message. The text message is displayed as in Figure 8-60.
- 3) Touch the **REPLY** Button. The Opened SMS Text Message Screen is displayed as shown in Figure 8-61.

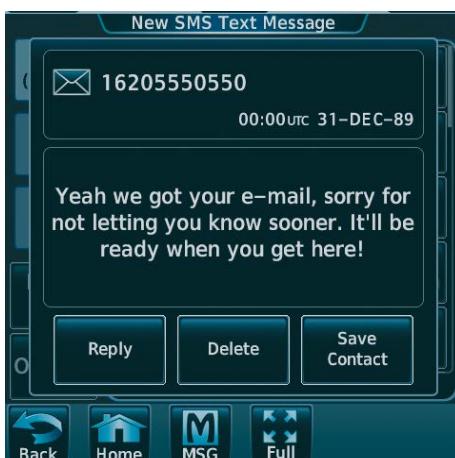


Figure 8-60 Message Content

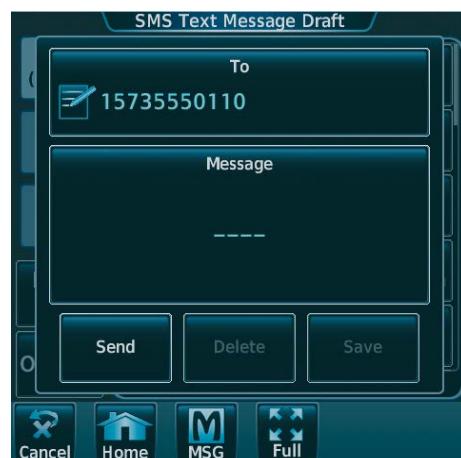


Figure 8-61 New Reply Message Screen

- 4) Touch the 'Message' Window to display the alphanumeric buttons.



Figure 8-62 Message Content

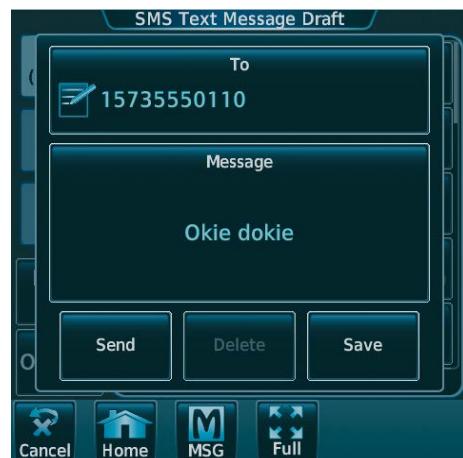


Figure 8-63 Reply Message

- 5) Enter the reply text as seen in Figure 8-62.
6) Touch the **Enter** Button. The reply message is displayed as in Figure 8-63.
7) Touch the **Send** Button. The SMS Message Replied To Screen is displayed as seen in Figure 8-64.



Figure 8-64 Reply Message Sent

- 8) If desired, touch the **Reply Again** Button to resend the 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

- From the **Home** Screen, touch **Services > SMS Text**.

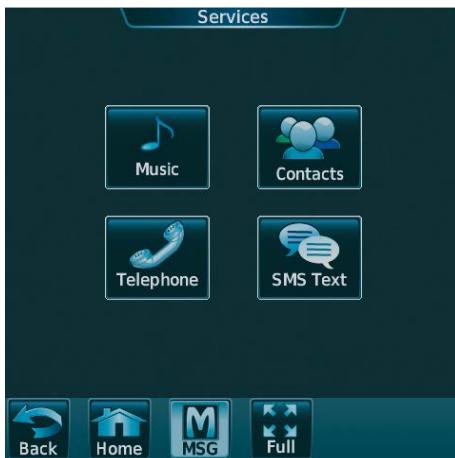


Figure 8-65 SMS Text Services Selection



Figure 8-66 Select Options

- Touch the **Draft New** Button as seen in Figure 8-66.
- The Opened SMS Text Message Draft Screen is displayed as shown in Figure 8-67. The Draft New Message option is also available from within the **Drafts** and **Outbox** Tabs.

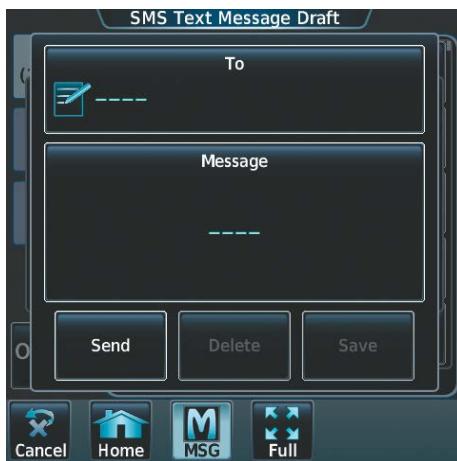


Figure 8-67 Touch 'To' Window

- Touch the 'To' Window. A selection screen is displayed like in Figure 8-68. 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 **Email**.



Figure 8-68 Select Message Destination



Figure 8-69 Enter Number or Address

- 5) Enter the telephone number or email address as seen in Figure 8-69. The number or address may be obtained from the Contacts by touching the **Find** Button.
- 6) Touch the **Enter** Button. The number or address is now displayed as in Figure 8-70.
- 7) Touch the 'Message' Window. The alphanumeric buttons are displayed as in Figure 8-71.

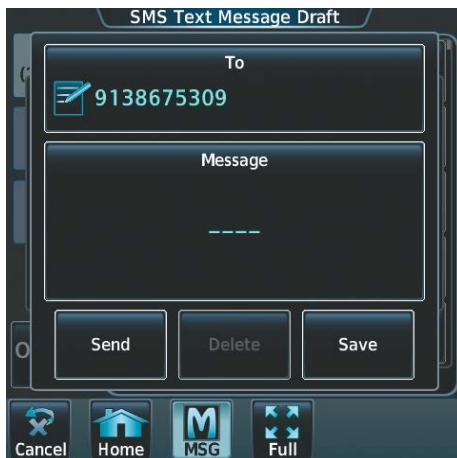


Figure 8-70 Touch Message Window



Figure 8-71 Reply Message

- 8) Enter the message text.
- 9) Touch the **Enter** Button. The message text is displayed in the 'Message' Window as shown in Figure 8-72.



Figure 8-72 Message Ready to Send

- 10) 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.

View Inbox messages:

- 1) From the **Home** Screen, touch **Services > SMS Text**.
- 2) Touch the **Inbox** Tab. A list of received messages is displayed as in Figure 8-73. The **Inbox** Tab is selected by default when accessing the SMS Text Messaging Screen.



Figure 8-73 SMS Text Inbox

View Draft messages:

- 1) From the **Home** Screen, touch **Services > SMS Text**.
- 2) Touch the **Drafts** Tab. A list of draft messages is displayed as in Figure 8-74, provided messages have been previously saved.
- 3) Touch a message to access the **Send** or **Delete** Buttons.



Figure 8-74 SMS Text Drafts

View Outbox messages:

- 1) From the **Home** Screen, touch **Services > SMS Text**.
- 2) Touch the **Outbox** Tab. A list of sent or unsent messages is displayed as in Figure 8-75.
- 3) Touch a message to access the **Send Again**, **Delete**, and **Save Contact** Buttons.



Figure 8-75 SMS Text Outbox

MANAGING TEXT MESSAGES

The following table illustrates the various message status icons.

Message Symbol	Description
	Received text message that has not been opened
	Received text message that has been opened
	A reply has been sent for this text message
	Saved text message, draft not sent
	System is sending text message
	Text message has been sent
	System failed to send text message

Table 8-5 Text Message Symbols

The viewed messages in the Inbox, Outbox, or Drafts may be listed according to the date/time the message was sent or received or by message address.

Viewing messages sorted by message date/time:

- 1) From the **Home** Screen, touch **Services > SMS Text**.
- 2) Touch the **Options** Tab. The 'Sort Messages By' selections are displayed as in Figure 8-89.

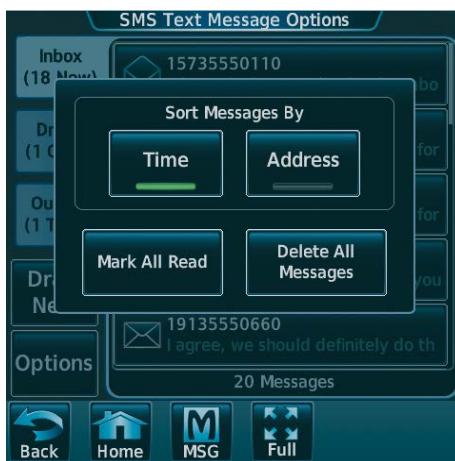


Figure 8-76 Message Sort Options

- 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 **Home** Screen, touch **Services > SMS Text**.
- 2) Touch the **Options** Tab. The 'Sort Messages By' selections are displayed as in Figure 8-76.
- 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 **Home** Screen, touch **Services > SMS Text**.
- 2) Touch the **Options** Tab. The selection buttons are displayed as in Figure 8-76.
- 3) Touch the **Mark All Read** Button.
- 4) Touch the **Back** Button to return to the Inbox. All messages in the Inbox now indicate they have been opened.

Delete all messages:

- 1) From the **Home** Screen, touch **Services > SMS Text**.
- 2) Touch the **Options** Tab. The selection buttons are displayed as in Figure 8-76.
- 3) Touch the **Delete All Messages** Button. A confirmation screen is displayed as in Figure 8-77.

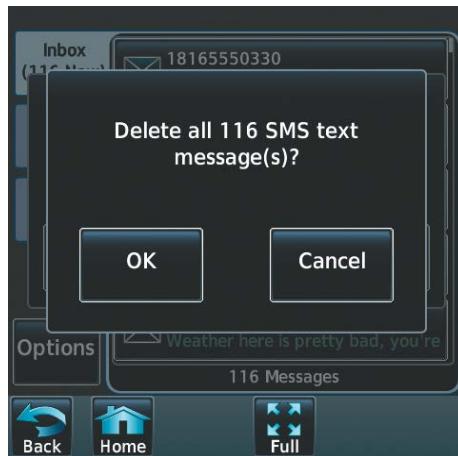


Figure 8-77 Confirm Deletion of Messages

- 4) Touch the **OK** Button.

8.6 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 GDL 69A Data Link Receiver provides audio entertainment for passengers and crew. The GDL 69A 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 GDL 69A, 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 (Figure 8-78)

Contact the installer if the radio ID cannot be located.

Establishing a SiriusXM Satellite Radio account:

- 1) From the **Home** Screen, touch **Utilities > Setup > SiriusXM Info**.
- 2) Note the Audio Radio ID and/or Data Radio ID as seen in Figure 8-78.
- 3) Contact SiriusXM Satellite Radio. Follow the instructions provided by SiriusXM Satellite Radio services.



Figure 8-78 XM Information Display

USING SIRIUSXM RADIO

The Music Screen provides information and control of the audio entertainment features of the SiriusXM Satellite Radio.



Figure 8-79 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 **Home** Screen, touch **Services > Music** to access the Music Screen as in Figure 8-79.
- 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 **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 **Home** Screen, touch **Services > Music > Category**.
- 2) The list of categories is displayed as shown in Figure 8-80.



Figure 8-80 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.

Save a channel to favorites list:

- 1) From the **Home** Screen, touch **Services > Music** to access the Music Screen as in Figure 8-79.
- 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'.

Select a favorite channel for listening:

- 1) From the **Home** Screen, touch **Services > Music > Category**.
- 2) The list of categories is displayed as shown in Figure 8-80.
- 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

Entertainment audio volume is shown in the **Volume** field (Figure 8-81) 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 volume:

- 1) From the **Home** Screen, touch **Services > Music > Volume**.
- 2) The volume adjustment slider is displayed as shown in Figure 8-81.
- 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 8-81 Adjusting Volume

Entertainment audio adjustment may also be accessed by touching the **Audio & Radios** Button on the Touchscreen Controller, then scrolling to display the **Music** Button.

Muting or unmuting the volume:

- 1) From the **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

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.

Enable/disable soft mute settings:

- 1) From the **Home** Screen, touch **Services > Music > Volume > Mute Settings**.
- 2) Touch the **Intercom** Annunciator Button (Figure 8-82) to select/deselect automatic soft muting of entertainment audio when intercom audio is present. This function is active when the annunciator is green.



Figure 8-82 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 an aural or voice alert is issued. This function is active when the annunciator is green.
- 5) Touch the **Back** Button to return to the Music Screen.

8.7 SCHEDULED MESSAGES

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

Entering a scheduled message:

- 1) From the **Home** Screen, touch **Utilities > Scheduled Messages**.
- 2) Touch the **Add Message** Button as shown in Figure 8-83.
- 3) Touch the **Message** Button as shown in Figure 8-84.



Figure 8-83 Touch Add Message

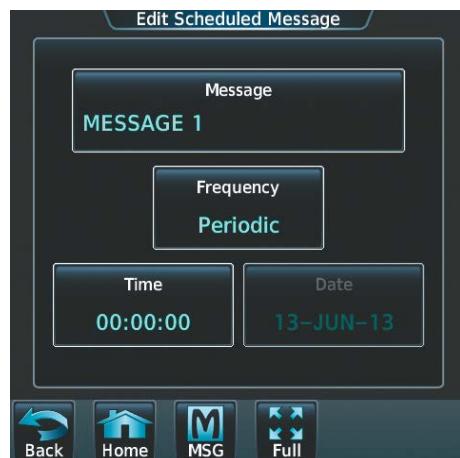


Figure 8-84 Touch Message Button

- 4) The keypad is displayed as in Figure 8-85. Enter the message name using the keypad. The large and small Right Knob can also be used to enter the characters.
- 5) Touch the **Enter** Button. The message name is displayed on the **Message** Button.
- 6) Touch the **Frequency** Button as shown in Figure 8-86.



Figure 8-85 Enter Message Name

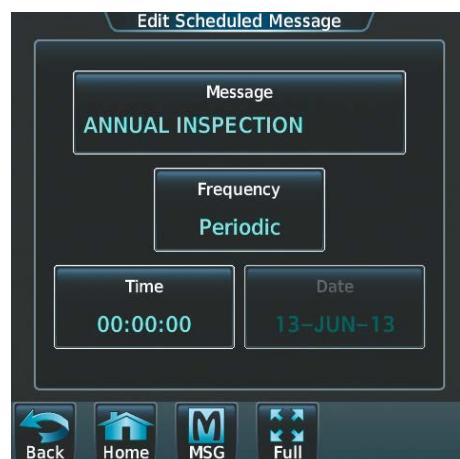


Figure 8-86 Touch Frequency Button

- 7) Touch **Event**, **One Time**, or **Periodic**. The selection is displayed on the **Frequency** Button as in Figure 8-87.



Figure 8-87 Touch One Time Button

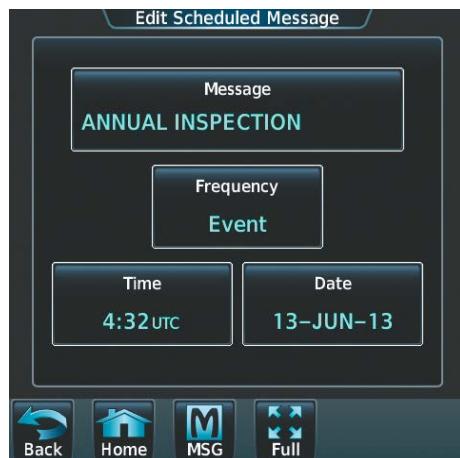


Figure 8-88 Touch Time Button

- 8) Touch the **Time** Button as seen in Figure 8-88.

- 9) The numeric keypad is displayed as in Figure 8-89. Enter the time value using the keypad. If **Event** was selected in step 7, time is entered in a clock format (HH:MM LCL) as local time. If **One Time** or **Periodic** 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.



Figure 8-89 Enter Time



Figure 8-90 Message

- 11) If **Event** was selected in step 7, touch the **Date** Button. The **Date** Button is subdued and disabled when **One Time** or **Periodic** were selected in step 7.

- 12) Touch the desired year, as in Figure 8-91, then the month followed by the day.



Figure 8-91 Event Date Entry

Edit a scheduled message:

- 1) From the **Home** Screen, touch **Utilities > Scheduled Messages**.
- 2) Touch the name of the message to be edited. The Message Options Window is displayed as in Figure 8-92.
- 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.



Figure 8-92 Select Message for Editing



Figure 8-93 Select Edit Option

Deleting a scheduled message:

- 1) From the **Home** Screen, touch **Utilities > Scheduled Messages**.
- 2) Touch the name of the message to be deleted. The Message Options Window is displayed as in Figure 8-93.
- 3) Touch the **Delete Message** Button. Touch the **Delete All Messages** Button to delete all saved messages.

When a scheduled message is activated, the **MSG** Button flashes inverse video (Figure 8-94) and 'MSG' icon flashes inverse video on the PFD (Figure 8-95). Touching the **MSG** Button on the Touchscreen Controller opens the Messages Screen (Figure 8-96) 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 Messages Screen from view, and the scheduled message is deleted from the message queue.

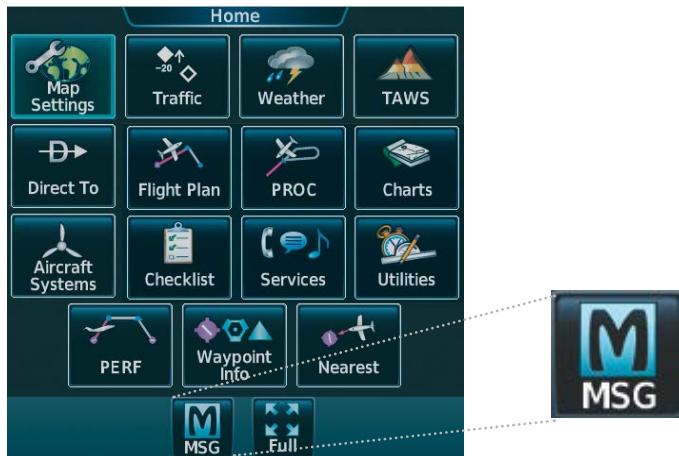


Figure 8-94 Message Annunciation on Touchscreen Controller



Figure 8-95 Message Annunciation on PFD

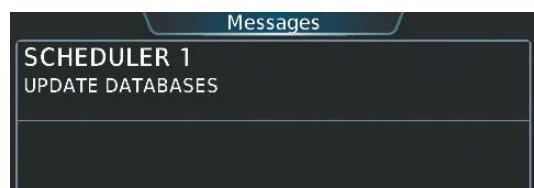


Figure 8-96 Scheduled Message Example

8.8 ELECTRONIC DOCUMENTS

The Electronic Document function allows viewing of electronic documents on the selected Display Pane. The system allows the display of electronic documents from two sources. These sources are Installed 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 Cards that are 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

To select a document:

- 1) From the **Home** Screen, touch **Utilities > Documents**. The Document Viewer is now displayed as in Figure 8-97.



Figure 8-97 Electronic Document Viewer

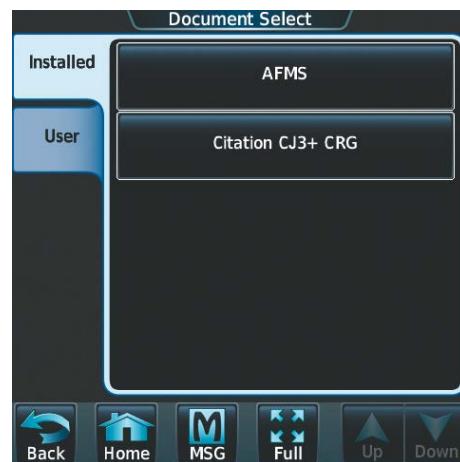


Figure 8-98 Document Selection

- 2) Touch the **Selected Document** Button.
- 3) Touch the **Installed** or **User** Tab to select the desired document source as seen in Figure 8-98. In this example, Installed documents is selected.
- 4) Touch the desired document button. The selected document name is displayed in the **Selected Document** Button, as shown in Figure 8-99. The document is displayed in the selected pane, as shown in Figure 8-100.



Figure 8-99 Selected Document Indicated



Figure 8-100 Document Viewed on Selected Display Pane

To change Document Viewer options:

- 1) From the **Home** Screen, touch **Utilities > Documents > Options**. The Document Viewer Options Screen is displayed as in Figure 8-101.
- 2) Touch **Document Info** to view information pertaining to the document, such as files size and creation date as seen in Figure 8-102.



Figure 8-101 Document Viewer Options

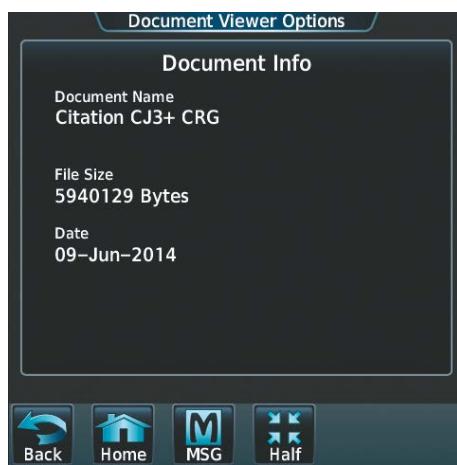


Figure 8-102 Document Information

- 3) Touch **Fit Page** to view the complete page in the selected pane (Figure 8-101).
- 4) Touch **Fit Width** 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 the Brightness Slider to adjust the brightness of the displayed page.

To browse the document:

- 1) After selecting the desired document, touch the **Next Page** and **Prev Page** buttons to increment and decrement one page with each touch.
- 2) The Page Select Button (Figure 8-103) shows the number of pages contained in the document and the page currently being displayed. Touch the Page Select Button (Figure 8-103) to jump to a specific page number. The Enter Page Number screen is displayed, as in Figure 8-104.

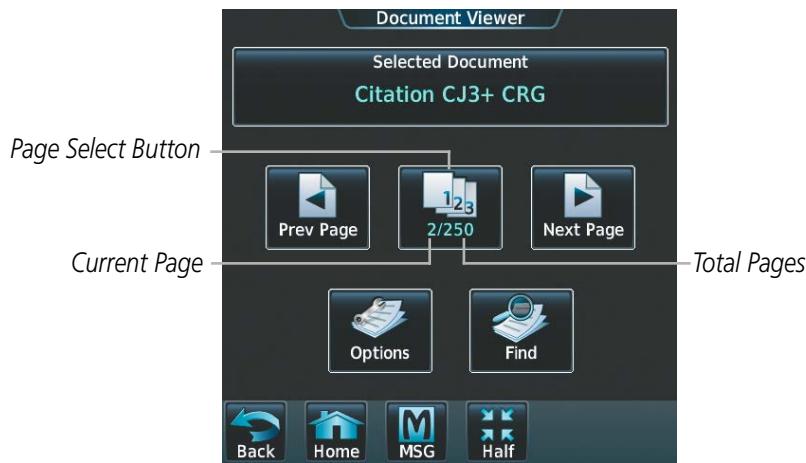


Figure 8-103 Document Browsing Options



Figure 8-104 Enter Document Page Number

- 3) Touch the **Find** Button to display the Document Viewer Find screen as shown in Figure 8-103.



Figure 8-105 Table of Contents

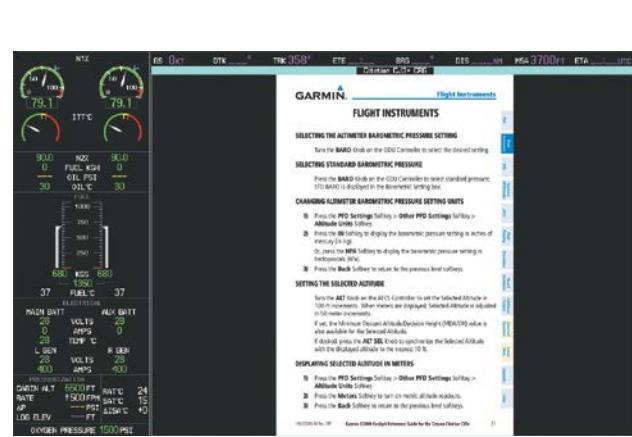


Figure 8-106 Flight Instruments Section Displayed

- 4) If necessary, touch the **Table of Contents** Tab to display the document Table of Contents (Figure 8-105).
- 5) Touch [+] to expand a topic. Touch [-] to return to the collapsed view of the topic.
- 6) Touch the desired topic to jump to that portion of the document. In this example, Flight Instruments is selected and the Flight Instruments section is displayed (Figure 8-106).

Navigating links within the document:

- 1) With the document displayed, press the Joystick. The Document Pointer Options Screen is now displayed on the Touchscreen Controller as shown in Figure 8-107. Also, a flashing pointer is shown on the document display as in Figure 8-107.

- 2) Move the Joystick, or move a finger across the Touchpad to move the pointer to the desired document link as in Figure 8-107.

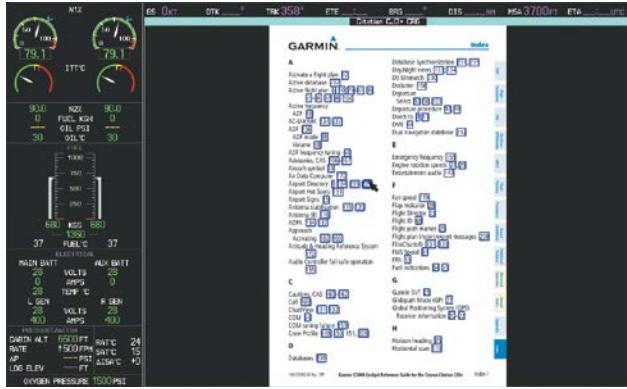


Figure 8-107 Link Selected

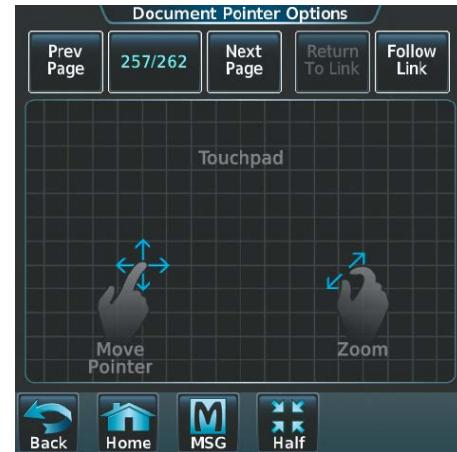


Figure 8-108 Follow Link

- 3) With the link highlighted, touch the **Follow Link** Button shown in Figure 8-108. The selected link destination is now displayed in the selected pane as indicated in Figure 8-109.



Figure 8-109 Link Displayed

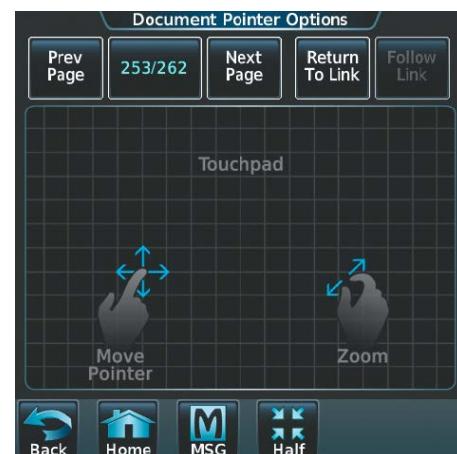


Figure 8-110 Follow Link

- 4) Touch the **Return To Link** Button (Figure 8-110) to return to the link origin.
 5) Touch the **Back** Button or press the Joystick to remove the pointer from the display.

Creating bookmarks in the document:

- 1) While viewing the page to bookmark, touch the **Find** Button on the appropriate Touchscreen Controller.
- 2) Touch the **Bookmark** Tab to display the Bookmark Window as in Figure 8-111.

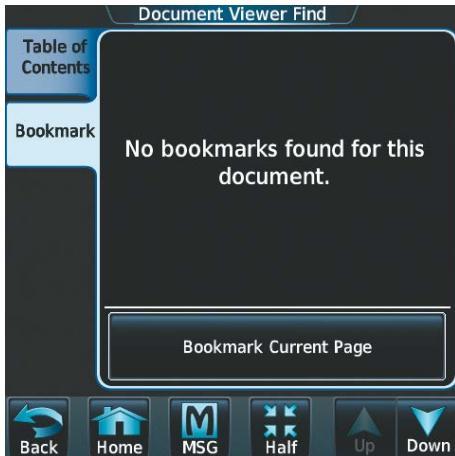


Figure 8-111 Select Bookmark Tab



Figure 8-112 Enter Bookmark Name

- 3) Touch the **Bookmark Current Page** Button. The Enter Bookmark Name Screen is displayed as shown in Figure 8-112.
- 4) Touch **Enter**. A confirmation screen is displayed as seen in Figure 8-113.

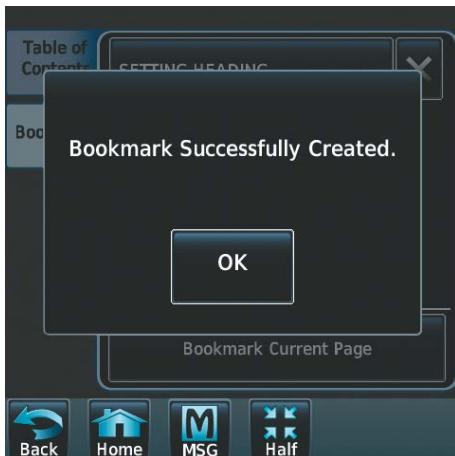


Figure 8-113 Create Bookmark

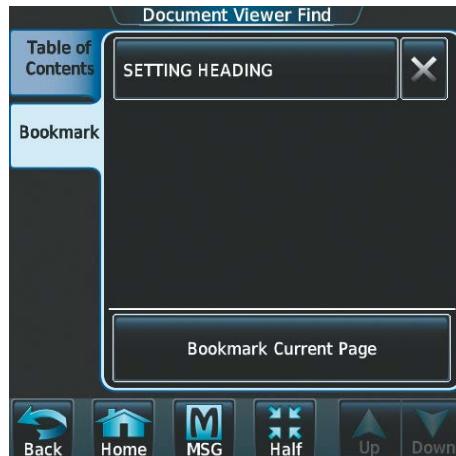


Figure 8-114 Bookmark Created

- 5) Touch **OK**. The newly created bookmark is displayed as in Figure 8-114.

Deleting document bookmarks:

- 1) With the desired document displayed, touch the **Find** Button (Figure 8-103) 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 (Figure 8-115).

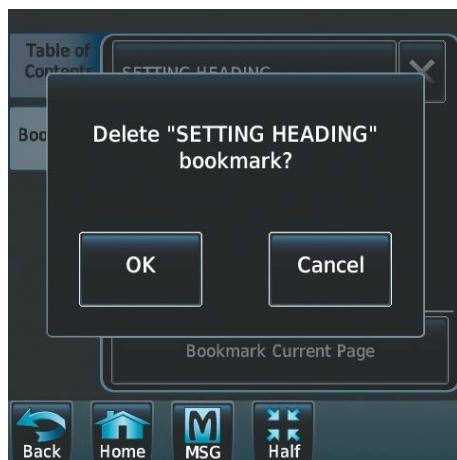


Figure 8-115 Delete Bookmark

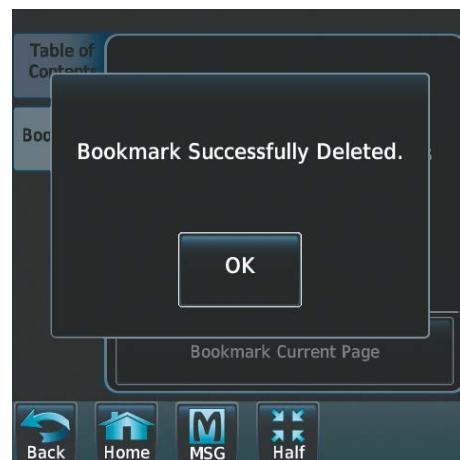


Figure 8-116 Bookmark Deleted

- 4) Touch **OK** on the confirmation screen as in Figure 8-116.
- 5) Again, touch **OK**.

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 G3000 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 Piper M600 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 Figure 8-117. This file can be imported into most computer spreadsheet applications.

Local Date
YYMMDD Local 24hr Time
HHMMSS Nearest Airport
(A blank will be
inserted if no
airport is found)

log_140610_104506_KIXD.csv

Figure 8-117 Log File Format

8.10 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 Supplemental Data Cards located in the bottom card slot of each GDU.

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 the **Home** Screen, touch **Checklist**. The checklist structure is displayed as shown in Figure 8-118.



Figure 8-118 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 Figure 8-119, **BEFORE TAKEOFF** is selected and the checklist is displayed in the previously selected GDU Display Pane as in Figure 8-120. The first checklist item is selected as indicated by the white text surrounded by a white box.



Figure 8-120 First Checklist Item Selected

- 3) Press the small right knob on the Touchscreen Controller to check the selected checklist item. The line item turns green and a checkmark is placed in the associated box as shown in Figure 8-121. The next line item is automatically selected for checking.



Figure 8-121 First Checklist Item Completed and Checked

Turn either of the right knobs on the Touchscreen Controller to scroll through the checklist and select the desired checklist item.

Selecting a checked item and pressing the small right knob on the Touchscreen Controller will return the item to the unchecked state.

- 4) When all checklist items have been checked, '***Checklist Finished***' is displayed in green text at the bottom left of the checklist window and 'GO TO NEXT CHECKLIST?' is highlighted as in Figure 8-122. 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 small right knob on the Touchscreen Controller to display the next checklist in the group or choose another by touching the desired checklist on the Touchscreen Controller.

Resetting A Specific Checklist:

- 1) From the **Home** Screen, touch **Checklist**.
- 2) Touch the desired checklist to reset. **Taxi** is selected in Figure 8-123.
- 3) Touch the **Checklist Options** Button.
- 4) Touch **Reset Current Checklist** as seen in Figure 8-124.

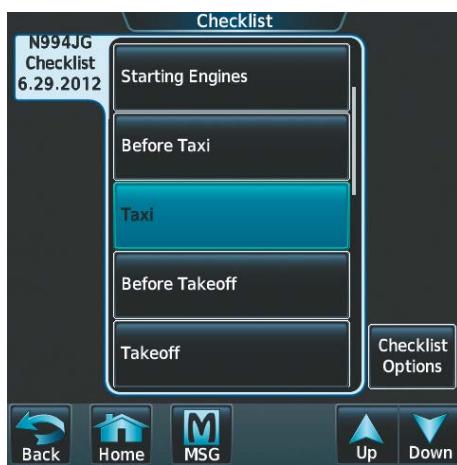


Figure 8-123 Checklist Screen

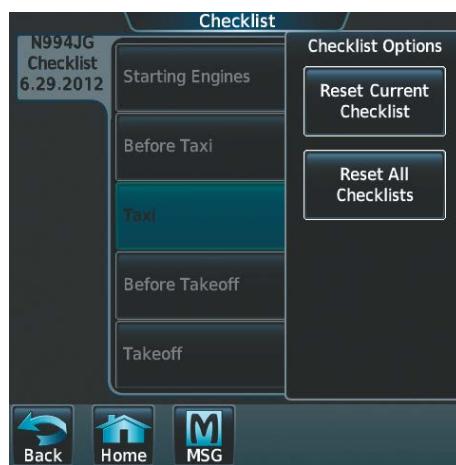


Figure 8-124 Checklist Options

Resetting All Checklists:

- 1) From the **Home** Screen, touch **Checklist**.
- 2) Touch the **Checklist Options** Button shown in Figure 8-123.
- 3) Touch **Reset All Checklists** as seen in Figure 8-124.

8.11 ELECTRONIC STABILITY & PROTECTION (ESP™)

Electronic Stability and Protection (ESP™) is an optional feature that is intended to discourage the exceedance of attitude, established airspeed and angle of attack parameters. This feature will only function when the aircraft is above 200 feet AGL and the autopilot is not engaged.

ESP engages when the aircraft exceeds one or more conditions (pitch, roll, Vmo, Mmo, and/or angle of attack) beyond the normal flight parameters. Enhanced stability for each condition is provided by applying a force to the appropriate control surface to return the aircraft to the normal flight envelope. This is perceived by the pilot as resistance to control movement in the undesired direction when the aircraft approaches a steep attitude, high airspeed, or when a stall is imminent.

As the aircraft deviates further from the normal attitude, angle of attack, or airspeed continues to increase, the force increases (up to an established maximum) to encourage control movement in the direction necessary to return to the normal attitude and/or airspeed range. Except in the case of high airspeed, when maximum force is reached, force remains constant up to the maximum engagement limit. Above the maximum engagement limit, forces are no longer applied. There is no maximum engagement related to a high airspeed condition.

The pilot can interrupt ESP by pressing and holding Autopilot Disconnect (**AP DISC**) switch. Upon releasing the **AP DISC** switch, ESP force will again be applied, provided aircraft attitude, angle of attack and/or airspeed are within their respective engagement limits. ESP can also be overridden in the roll axis by overpowering the servo's mechanical torque limit.

ESP can be enabled or disabled on the System Tab of the Avionics Settings Screen on the Touchscreen Controller.

Enabling/disabling ESP:

- 1) From the **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.

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 Figure 8-125). As roll attitude exceeds 45°, ESP will engage and the on-side Roll Limit Indicator will move to 30°, as shown in Figure 8-126. The Roll Limit Indicator is now showing where ESP will disengage as roll attitude decreases.

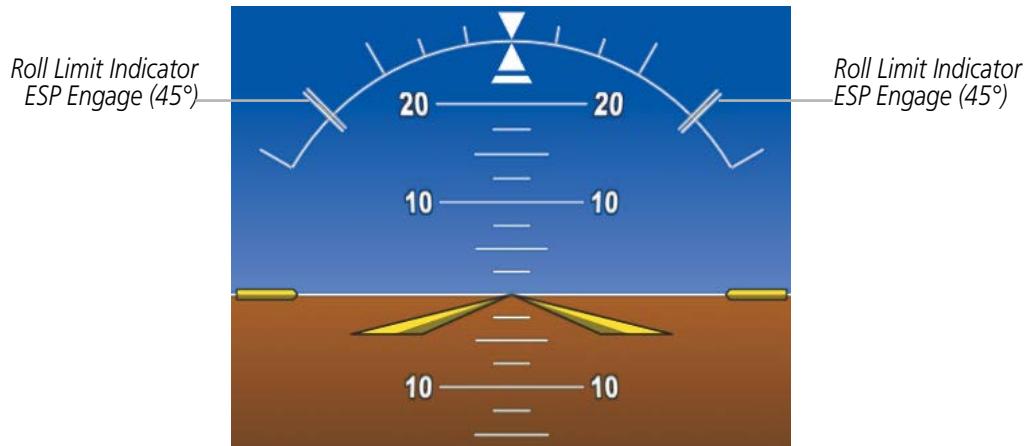


Figure 8-125 ESP Roll Engagement Indication (ESP NOT Engaged)

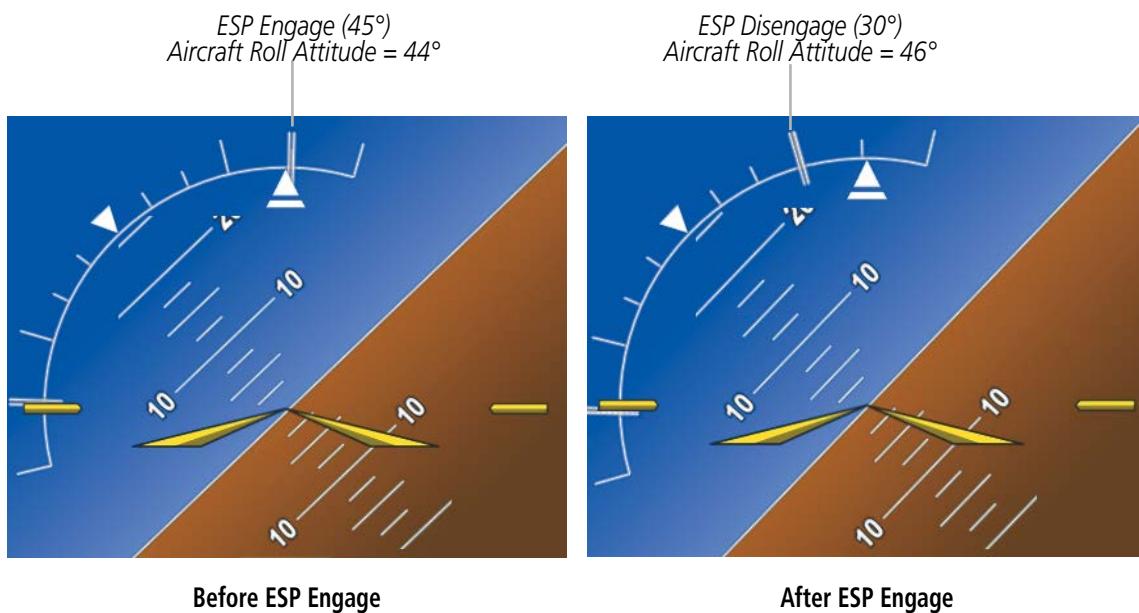
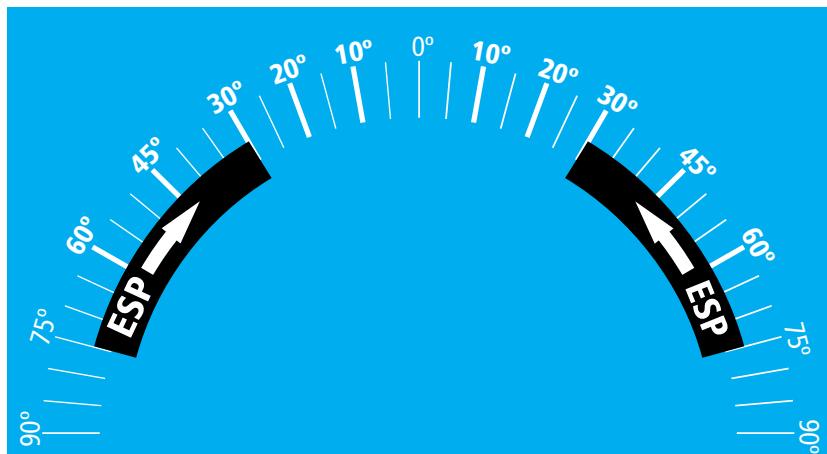


Figure 8-126 Roll Increasing to ESP Engagement

Once engaged, ESP force will be applied between 30° and 75° , as illustrated in Figure 8-127. 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 8-127 ESP Roll Operating Range When Engaged
(Force Increases as Roll Increases & Decreases as Roll Decreases)**

ESP is automatically disengaged if the aircraft reaches the autopilot roll engagement attitude limit of 75° (Figure 8-128).

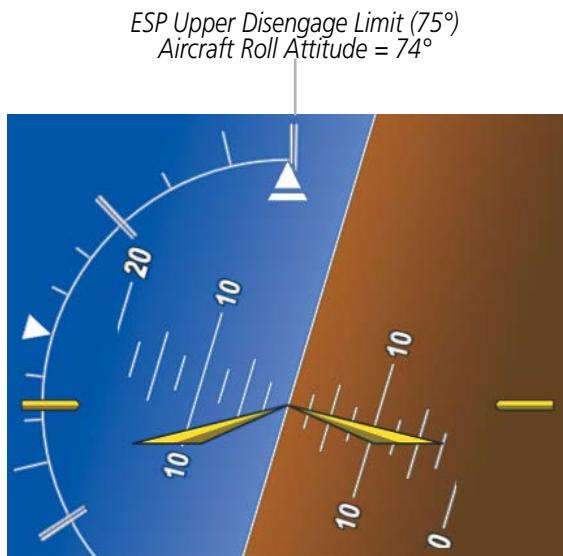


Figure 8-128 Roll Attitude Autopilot Engagement Limit (ESP Engaged)

PITCH ENGAGEMENT

ESP engages at 20° nose-up and 17° nose-down. Once ESP is engaged, it will apply opposing force between 15° and 50° nose-up and between 12° and 50° nose-down, as indicated in Figure 8-129. Maximum opposing force is applied between 25° and 50° nose-up and between 22° and 50° nose-down.

The opposing force increases or decreases depending on the pitch angle and the direction of pitch travel. This force is intended to encourage movement in the pitch axis in the direction of the normal pitch attitude range for the aircraft.

There are no indications marking the pitch ESP engage and disengage limits in these nose-up and nose-down conditions.

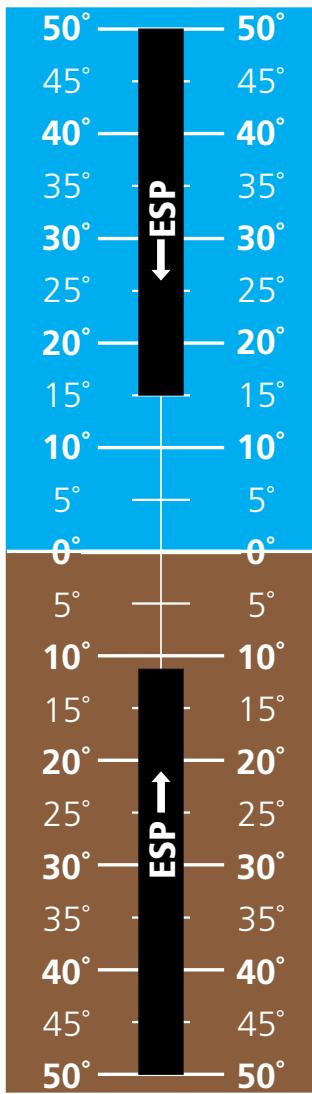


Figure 8-129 ESP Pitch Operating Range When Engaged
(Force Increases as Pitch Increases & Decreases as Pitch Decreases)

HIGH AIRSPEED PROTECTION

Exceeding Vmo or Mmo will result in ESP applying force to raise the nose of the aircraft. When the high airspeed condition is remedied, ESP force is no longer applied.

8.12 ABNORMAL OPERATION

GDL 69A 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 (GDL 69A) status, serial number, and software version number. If a failure has been detected in the GDL 69A the status is marked with a red X.

To check LRU status:

- 1) From the **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 Figure 8-130.

Avionics Status			
LRU	Serial	Version	
GDC2	-----	-----	X
GDL69	0000001	0.00	✓
GEA1	-----	-----	X
GIA1	-----	-----	X
GIA2	-----	-----	X

Back Home MSG Full Up Down

Figure 8-130 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	SiriusXM Info Screen (Touchscreen Controller)	Data Link Receiver antenna error; service required
UPDATING	Music Screen (Touchscreen Controller)	Data Link Receiver updating encryption code
NO SIGNAL	SiriusXM Info Screen, Music Screen (Touchscreen Controller) SiriusXM Weather Pane	Loss of signal; signal strength too low for receiver
Loading Music Channels...	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
No Channels Available Please Check Connection	Music Screen (Touchscreen Controller)	System has not acquired any channels. Verify antenna is outside with a clear view of the sky.
WEATHER DATA LINK FAILED	Weather Data Link (XM) Pane	No communication from Data Link Receiver within last 5 minutes
DETECTING ACTIVATION	Weather Data Link (XM) Pane	SiriusXM subscription is activating
WAITING FOR DATA....	Weather Data Link (XM) Pane	SiriusXM subscription confirmed. Downloading weather data.

Table 8-7 GDL 69A Data Link Receiver Messages

ANNUNCIATIONS AND ALERTS



NOTE: The Airplane Flight Manual (AFM) supersedes information found in this document. Refer to the AFM for recommended pilot actions.

The G3000 Alerting System conveys alerts to the pilot using the following items:

- **Alerts Window:** The Alerts Window (Figure A-1) automatically appears in the lower-right of the PFD when condition(s) warrant. The window contains abbreviated annunciation text. The text color is based on the alert levels described in the following section. Warning (red) and caution (amber) annunciations cause a corresponding red **WARNING** or amber **CAUTION** Softkey to flash until the alert is acknowledged by pressing the respective softkey. Advisory (white) annunciations do not have a corresponding flashing softkey or acknowledgement. All warning alerts appear within view in the Alerts Window. If a new warning or caution alert is issued while the Alerts Window is already displayed, the new alert appears at the top of the window, separated by a divider line from the existing alerts. After the new warning or caution alert is acknowledged, the alert appears at the top of its respective level of alerts, and the divider line is removed. Higher priority alerts are displayed toward the top of the Alerts Window. A maximum of 12 alerts can be displayed in the alerts window.
- **Softkey Annunciation:** During a warning or caution alert, a red **WARNING** or amber **CAUTION** Softkey appears as a flashing annunciation to accompany the Alerts Window text. Press the flashing softkey to acknowledge the alert and to extinguish the flashing softkey annunciation.
- **Notifications Screen:** The Notifications Screen on the Touchscreen Controller displays prioritized G3000 System Messages and Aircraft Advisory Messages as text. These appear when the System Messages tab is selected. When the system issues a new message, the PFD displays a flashing 'MSG' annunciation, and the Touchscreen Controller displays a flashing **MSG** Button. Touch the **MSG** Button on the Touchscreen Controller to acknowledge the message and display the Notifications Screen on the Touchscreen Controller. The System Messages Tab momentarily indicates the number of new system messages in parenthesis. Touch the **MSG** Button a second time to remove the Notifications Screen. The **Back** or **Home** Buttons also remove the Notifications Screen in addition to their respective functions. When the Touchscreen Controller is displaying the Notifications Screen, the pilot can also scroll through the messages. Active messages are shown in white text. If a message becomes inactive while the Notifications Screen is already displayed, the inactive message text becomes gray.
- **System Annunciations:** Typically, a large amber or red 'X' appears in a window associated with information from a failed LRU. The color of the 'X' is dependent on the window. For example, a red 'X' appears over the Airspeed Indicator in a failure condition; an amber 'X' appears over a failed Vertical Speed Indicator. See the G3000 System Annunciations section for more information.
- **Audio Alerting System:** The system issues audio alert tones or voice alerts when specific system conditions are met. See the CAS Message Priorizations section for more information.



Figure A-1 G3000 Alerting System (PFD)

CAS MESSAGES

CAS MESSAGE PRIORITIZATION



NOTE: Information on CAS messages in this pilot's guide is always superseded by the AFM.

CAS messages are grouped by criticality (warning, caution, advisory) and sorted by order of appearance (most recent messages on top). The color of the message is based on its urgency and on required action.

- **Warning (red)** – Immediate crew awareness and action required. The system displays a warning alert in the Alerts Window with a triple chime. Text appearing in the Alerts Window is red. A warning alert is accompanied by a flashing red **WARNING** Softkey annunciation, as shown in Figure A-2. Pressing the **WARNING** Softkey acknowledges the presence of the warning alert, stops the aural chime, and extinguishes the **WARNING** Softkey annunciation.
- **Caution (amber)** – Immediate crew awareness and possible future corrective action required. The system displays a caution alert in the Alerts Window with a double chime. Text appearing in the Alerts Window is amber. A caution alert is accompanied by a flashing amber **CAUTION** Softkey annunciation, as shown in Figure A-2. Pressing the **CAUTION** Softkey acknowledges the presence of the caution alert and extinguishes the **CAUTION** Softkey annunciation.
- **Advisory (white)** – Crew awareness required and subsequent action may be required. The system displays a white advisory alert in the Alerts Window with a single chime. No softkey annunciations accompany an advisory alert.



Figure A-2 Warning and Caution PFD Softkey Annunciations

A CAS message does not appear more than once at a given time. Warning and caution CAS messages flash when they are generated, and continue to flash until acknowledged. Advisory CAS messages do not flash.

After the acknowledgment, a message remains displayed at the top of its respective priority group in the CAS Window until either a newer message of the same priority appears or the condition(s) that caused the alert to display no longer exist.

WARNING MESSAGES

See the Airplane Flight Manual (AFM) for recommended pilot actions. Warning messages are accompanied by an associated aural alert.

Warning Messages	Description
ALTERNATOR FAIL	Alternator has failed
AUTO DESCENT	HYPOXIA ALERT has been active for 60 seconds, aircraft will begin descent in 60 seconds. Double chime.
AUTO DESCENT	AUTO DESCENT has been active for 60 seconds, EDM activated.
AUTO DESCENT	No interaction detected for four minutes after aircraft reaches 14,000 feet.
BLEED OVERTEMP	Engine bleed air is over temperature
CABIN ALT 12K	Cabin altitude above 12,000 feet
CHECK GEAR	Landing gear not down and locked, or landing gear selected up when on ground
DOOR AJAR	Cabin door is not closed
ENGINE FIRE	Engine fire
FLAP FAIL	A flap system failure has occurred
FUEL PRESS LOW	Fuel pressure is low
FUEL QTY	Total fuel quantity is less than 100 lbs
GEAR SYS	A component of the gear system has failed
GENERATOR FAIL	Generator has failed
HYDR PUMP ON	Hydraulic pump is on while the aircraft is on the ground
PITOT HT FAIL	Pitot heat failure
PROP HEAT FAIL	Propeller heat failure
STALL HEAT FAIL	Stall heat system failure
USP ACTIVE	Underspeed protection is active

CAUTION MESSAGES

See the Airplane Flight Manual (AFM) for recommended pilot actions. Caution messages are accompanied by associated aural alert.

Caution Messages	Description
BETA	Propeller is operating in Beta mode
CABIN ALT 10K	Cabin altitude is above 10,000 feet
CHECK GEAR	Landing gear not down and locked
CHIP DETECT	Engine oil is contaminated
CPCS FAIL	Carbon Pressure Controller has failed or lost ARINC communication on the ground
CPCS FAULT	Carbon Pressure Controller has lost ARINC communication
FEATHER	Propeller is feathered and either RPM > 1350 or aircraft not on ground
FUEL FILTER	Fuel filter is contaminated
FUEL IMBALANCE	Fuel imbalance >40 lbs for 60 seconds

Caution Messages	Description
FUEL QTY	Total fuel quantity <180 lbs
GEAR SYS	A component of the gear system has failed
HYDR PUMP ON	Hydraulic pump is on for more than 20 seconds
HYPOXIA ALERT	ARE YOU ALERT? has been active for 60 seconds
L PITOT HT FAIL	Left pitot heat has failed
OXYGEN	Oxygen system has been turned on
PITOT HEAT OFF	Pitot heat is off
R PITOT HT FAIL	Right pitot heat has failed
STALL WARN FAIL	Failure detected in stall warning system
START ENGAGED	Starter engaged when Ng is more than 56% for more than 10 seconds
SURF DEICE FAIL	Surface de-ice system fail
WNDSHLD OVRTEMP	Windshield heat overtemp

ADVISORY MESSAGES

See the Airplane Flight Manual (AFM) for recommended pilot actions.

Advisory Messages	Description
ALTERNATOR OFF	The alternator switch is selected off
ARE YOU ALERT?	A period of inactivity exceeding limits has been detected
BETA	Propeller is operating in Beta mode
DOOR AJAR	Cabin door is not closed
EMER BLEED ON	Emergency bleed air is on
FEATHER	Prop is feathered
FIRE DETECT FAIL	Fire detection system has failed
L FUEL PUMP ON	Left fuel pump is on. Inhibited if fuel pump is on for fuel autobalance when imbalance < 40 lbs
R FUEL PUMP ON	Right fuel pump is on. Inhibited if fuel pump is on for fuel autobalance when imbalance < 40 lbs
FIRE DETECT FAIL	The fire detect system has failed
FUEL TEMP	Fuel temperature < -34°F
GENERATOR OFF	The generator switch is selected off
IGNITION ON	Engine ignition is on
OXYGEN	Oxygen system has been turned on
S WARN ICE SCHD*	Stall Warning Ice stall scheduling is active due to activation of surface deice during the flight
START ENGAGED	Starter engaged when Ng is less than 56%

*For Flight into Known Icing (FIKI) equipped aircraft only

VOICE ALERTS

The following audio alerts are announced by the system using a voice of male or female gender (see the AUX - System Setup Page to change the audio alert voice). If the optional Terrain Awareness and Warning System is installed, voice alerts are also generated (refer to the TAWS Alerts section).

Voice Alert	Alert Trigger
"Airspeed"	Airspeed has exceeded V_{NE} .
"Check Gear"	The 'CHECK GEAR' CAS message has been triggered.
"Engaging Autopilot"	The ESP system is engaging the autopilot. See the AFCS section for more details.
"Incoming Call"	A call has been received via the Iridium system.
"Minimums, Minimums"	The aircraft has descended below the preset minimum descent altitude or decision altitude.
"Stall"	Imminent stall is sensed by the stall vane(s).
"Timer Expired"	Countdown timer on the PFD has reached zero.
"Vertical Track"	The aircraft is one minute from Top of Descent (only if vertical navigation is enabled).
"Traffic"	Played when a Traffic Advisory (TA) is issued with the TIS system or the optional TAS/TCAS I system. See the Hazard Avoidance section for additional details on GTS 825/855 voice alerts.
"TIS Not Available"	The aircraft is outside the TIS coverage area (not available with TAS/TCAS I installed).
"TAS System Test Passed"	Played when the optional TAS system passes a pilot-initiated self test.
"TAS System Test Failed"	Played when the optional TAS system fails a pilot-initiated self test.
"TCAS One System Test Passed"	Played when the optional TCAS I system passes a pilot-initiated self test.
"TCAS One System Test Failed"	Played when the optional TCAS I system fails a pilot-initiated self test.

TAS/TCAS I VOICE ALERTS

Traffic Advisory Alert (TA)	Bearing	Relative Altitude	Approximate Distance (nm)
"Traffic"	"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"

TA Descriptive Voice Alerts

SELECTING THE ALERT VOICE

A male or female voice can be selected for voice alerts.

- 1) From Home, touch **Utilities > Setup > Avionics Settings**.
- 2) If necessary, touch the **Audio** Tab.
- 3) Touch the Audio Alert Voice button to display the alert voice choices.
- 4) Touch to select an alert voice (**Male** or **Female**).

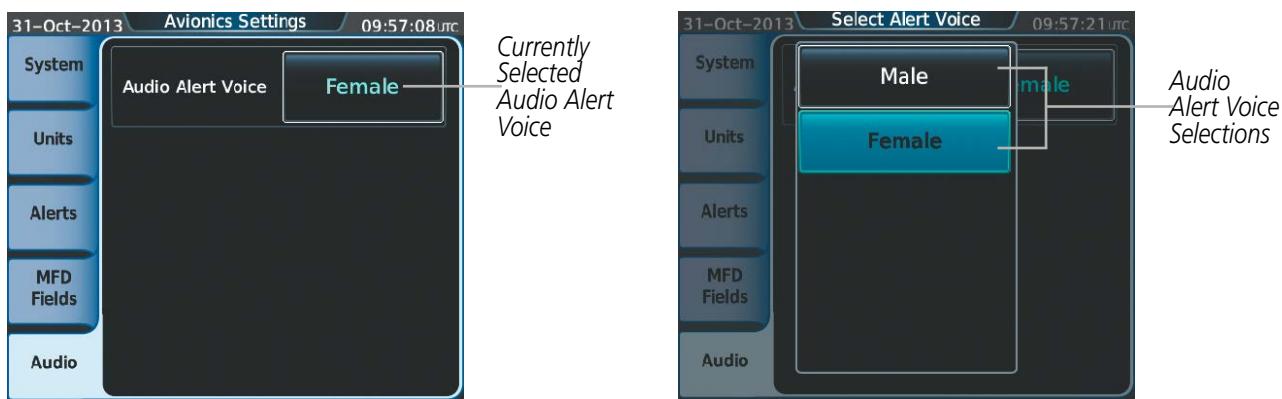


Figure A-3 Selecting the Audio Alert Voice

COMPARATOR ANNUNCIATIONS

The Comparator monitors critical values generated by redundant sensors. If differences in the sensors exceed a specified amount, a comparator annunciation is displayed in black text on an amber background. If one or both of the sensed values are unavailable, the comparator annunciation is black text on a white background (Figure A-4). The following is a list of the possible annunciations:

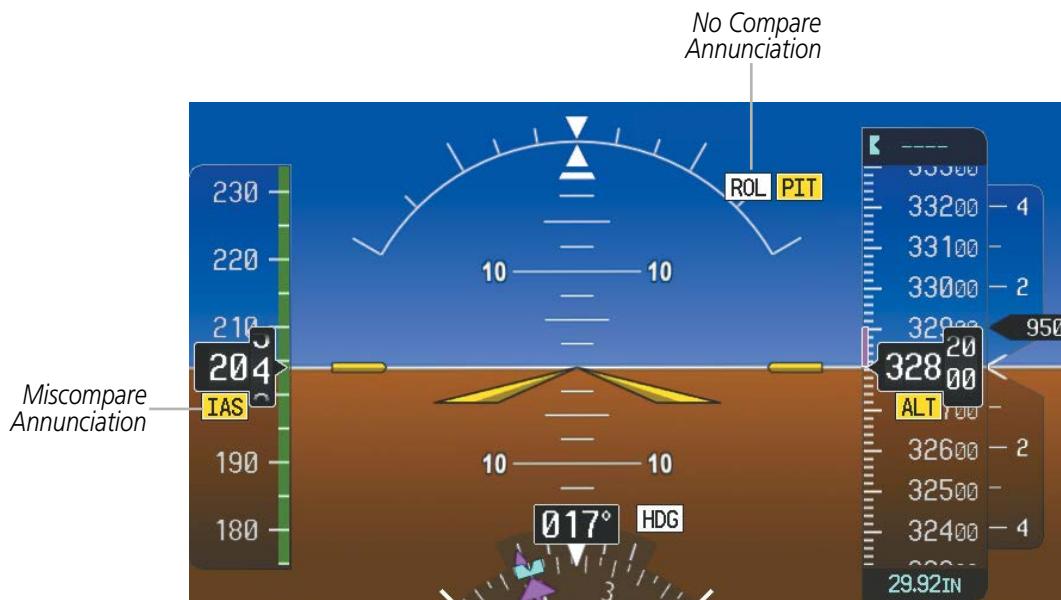


Figure A-4 Sensor Comparator Window on the PFD

Comparator Annunciation		Condition
ALT	Altitude Miscompare	Difference in altitude sensors is ≥ 200 ft.
IAS	Indicated Airspeed Miscompare	If both airspeed sensors detect < 35 knots, this is inhibited.
		If either airspeed sensor detects ≥ 35 knots, and the difference in sensors is > 10 knots.
		If either airspeed sensor detects ≥ 80 knots, and the difference in sensors is > 7 knots.
HDG	Heading Miscompare	Difference in heading sensors is > 6 degrees.
PIT	Pitch Miscompare	Difference in pitch sensors is > 5 degrees.
ROL	Roll Miscompare	Difference in roll sensors is > 6 degrees.
ALT	Altitude No compare	No data from one or both altitude sensors.
IAS	Indicated Airspeed No compare	No data from one or both airspeed sensors.
HDG	Heading No compare	No data from one or both heading sensors.
PIT	Pitch No compare	No data from one or both pitch sensors.
ROL	Roll No compare	No data from one or both roll sensors..

REVERSIONARY SENSOR ANNUNCIATIONS

Reversionary sensor selection for attitude/heading, air data, and GPS is annunciated in the Reversionary Sensor Windows, as shown in Figure A-5. These annunciations reflect reversionary sensors selected on one or both PFDs. Selecting the **Sensors** Softkey gives access to **ADC 1**, **ADC 2**, **AHRS 1**, and **AHRS 2** Softkeys. These softkeys allow manual switching of the ADC and AHRS sensors. In the case of certain types of sensor failures (e.g. GPS), the G3000 may make some sensor selections automatically.

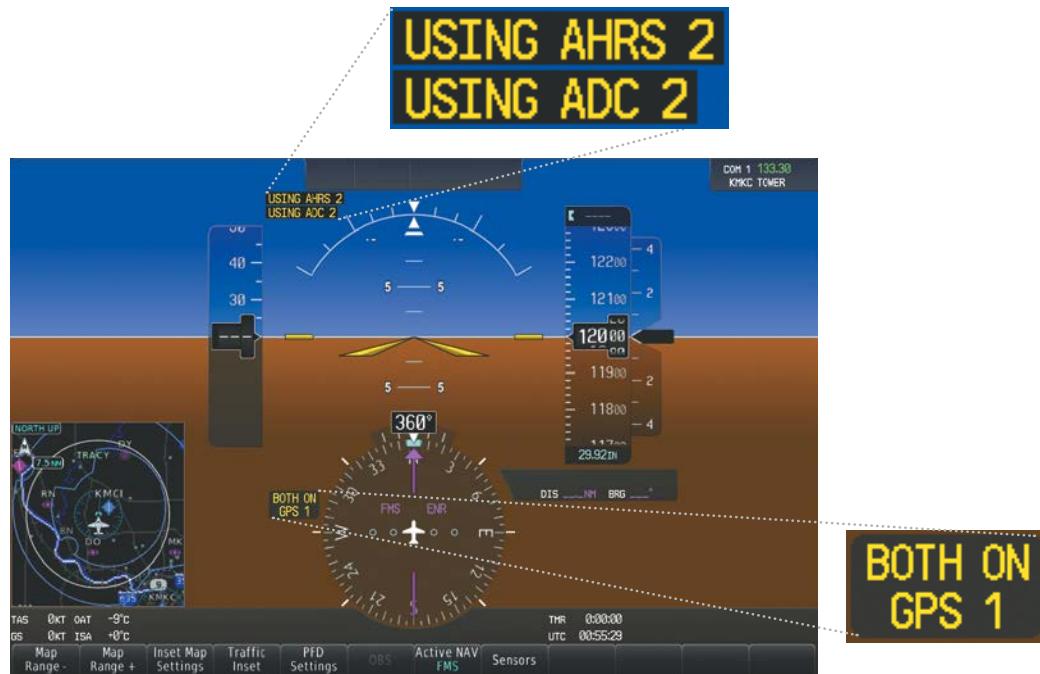


Figure A-5 Reversionary Attitude/Heading and Air Data Sensor Annunciations (PFD)

Reversionary Sensor Window Text	Condition
BOTH ON ADC 1	Both PFDs are displaying data from the #1 Air Data Computer.
BOTH ON ADC 2	Both PFDs are displaying data from the #2 Air Data Computer.
BOTH ON AHRS 1	Both PFDs are displaying data from the #1 Attitude & Heading Reference System.
BOTH ON AHRS 2	Both PFDs are displaying data from the #2 Attitude & Heading Reference System.
BOTH ON GPS 1	Both PFDs are displaying data from the #1 GPS.
BOTH ON GPS 2	Both PFDs are displaying data from the #2 GPS.
USING ADC 1	PFD2 is displaying data from the #1 Air Data Computer.
USING ADC 2	PFD1 is displaying data from the #2 Air Data Computer.
USING AHRS 1	PFD2 is displaying data from the #1 AHRS.
USING AHRS 2	PFD1 is displaying data from the #2 AHRS.
USING GPS1	PFD2 is displaying data from the #1 GPS.
USING GPS2	PFD1 is displaying data from the #2 GPS.

G3000 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 or amber 'X' (depending on the LRU) is typically displayed on items associated with the failed data. The following section describes various system annunciations. Refer to the Airplane Flight Manual (AFM) 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.

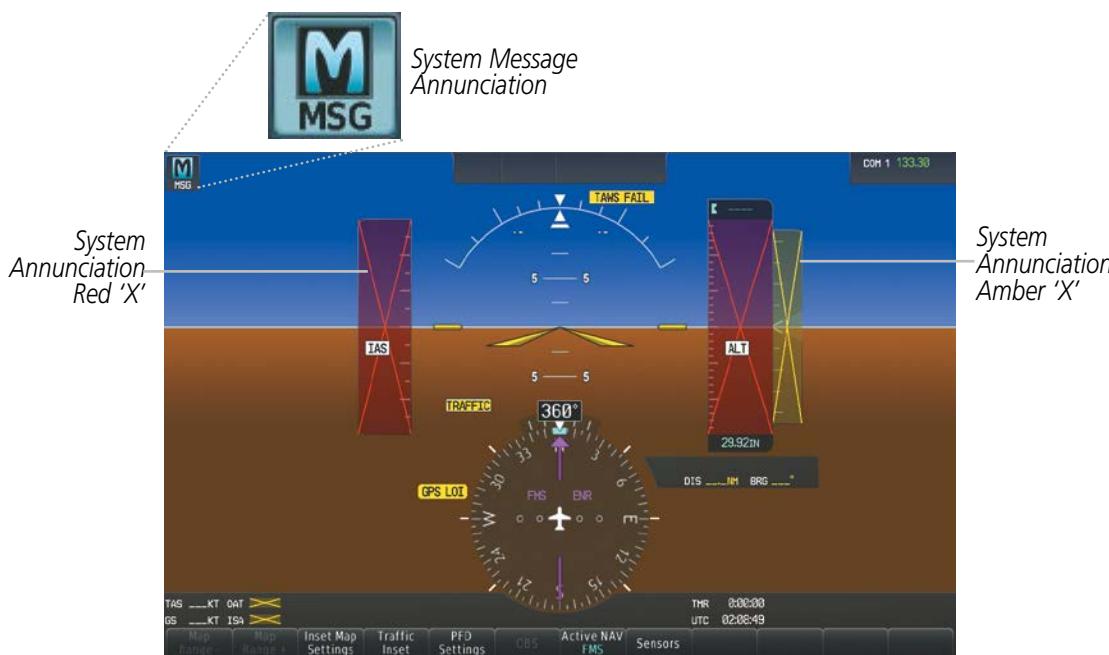


Figure A-6 System Annunciations (PFD)

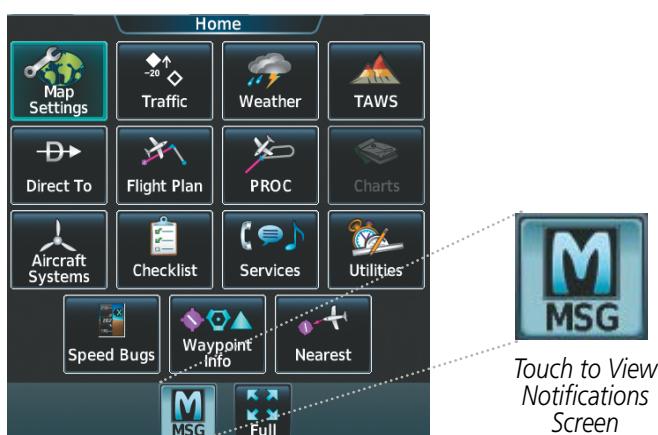


Figure A-7 System Messages Annunciation (Touchscreen Controller)



Figure A-8 Notifications Screen After MSG Button Touched (Touchscreen Controller)

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

G3000 SYSTEM MESSAGES



NOTE: This Section provides information regarding system message advisories that may be displayed by the system. Knowledge of the aircraft, systems, flight conditions, and other existing operational priorities must be considered when responding to a message. Always use sound pilot judgment. The Airplane Flight Manual (AFM) takes precedence over any conflicting guidance found in this section.

This section describes various system message advisories. Certain messages are issued due to an LRU or LRU function failure. Such messages are normally accompanied by a corresponding red or amber 'X' annunciation as shown previously in the G3000 System Annunciations section.

G3000 SYSTEM MESSAGES

System Message	Comments
ABORT APR – Loss of GPS navigation. Abort approach.	Abort approach due to loss of GPS navigation. This message may also be displayed if the active flight plan is deleted while an RNAV approach that requires SBAS is active
ADC1 ALT EC – ADC1 altitude error correction is unavailable.	GDC1 is reporting that the altitude error correction is unavailable.
ADC1 AS EC – ADC1 airspeed error correction is unavailable.	GDC1 is reporting that the airspeed error correction is unavailable.
ADC1 SERVICE – ADC1 needs service. Return unit for repair.	A failure has been detected in the GDC1. The system should be serviced.
ADC2 ALT EC – ADC2 altitude error correction is unavailable.	GDC2 is reporting that the altitude error correction is unavailable.
ADC2 AS EC – ADC2 airspeed error correction is unavailable.	GDC2 is reporting that the airspeed error correction is unavailable.
ADC2 SERVICE – ADC2 needs service. Return unit for repair.	A failure has been detected in the GDC2. The system should be serviced.
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. Srv 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.

System Message	Comments
AHRS1 TAS – AHRS1 not receiving valid airspeed.	The AHRS1 is not receiving true airspeed from the air data computer. The AHRS relies on GPS information to augment the lack of airspeed. The system should be serviced.
AHRS2 CAL – AHRS2 calibration version error. Srvc req'd.	The AHRS2 calibration version error. The system should be serviced.
AHRS2 CONFIG – AHRS2 config error. Config service req'd.	AHRS configuration settings do not match those of backup configuration memory. The system should be serviced.
AHRS2 GPS – AHRS2 not receiving any GPS information.	The AHRS2 is not receiving any or any useful GPS information. Check 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 ADVISORY – SBAS VNAV not available. Using Baro VNAV.	SBAS VNAV not available. Check GPS signal.
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.
AUDIO MANIFEST - Audio software mismatch, communication halted.	The GMA36 has incorrect software installed. The system should be serviced.
AV FWD FAN FAIL – The cooling fan for remote avionics has failed.	A failure has been detected in the cooling fan for the fwd remote avionics.
AV AFT FAN FAIL – The cooling fan for remote avionics has failed.	A failure has been detected in the cooling fan for the aft remote avionics.
BARO MISMATCH – Correct baro mismatch for VNAV guidance.	Altimeter setting is not the same on PFD1 and PFD2. Synchronize settings for VNAV guidance.
CHECK CRS – Database course for LOC1 / [LOC ID] is [CRS] $^{\circ}$.	Selected course for LOC1 differs from published localizer course by more than 10 degrees.

System Message	Comments
CHECK CRS – Database course for LOC2 / [LOC ID] is [CRS] $^{\circ}$.	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.
COM1 CONFIG – COM1 config error. Config service req'd.	The COM1 configuration settings do not match backup configuration memory. The system should be serviced.
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.
COM1 SERVICE – COM1 needs service. Return unit for repair.	The system has detected a failure in COM1. COM1 may still be usable. The system should be serviced when practical.
COM1 TEMP – COM1 over temp. Reducing transmitter power.	The system has detected an over temperature condition in COM1. The transmitter operates at reduced power. If the problem persists, the system should be serviced.
COM2 CONFIG – COM2 config error. Config service req'd.	The COM2 configuration settings do not match backup configuration memory. The system should be serviced.
COM2 MANIFEST – COM2 software mismatch, communication halted.	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.
COM2 SERVICE – COM2 needs service. Return unit for repair.	The system has detected a failure in COM2. COM2 may still be usable. The system should be serviced when practical.
COM2 TEMP – COM2 over temp. Reducing transmitter power.	The system has detected an over temperature condition in COM2. The transmitter operates at reduced power. If the problem persists, the system should be serviced.
COPILOT RADIOS MUTED – Copilot radios are muted.	The copilot radios are set on mute.
CPCS CONFIG ERROR – Unexpected Config Strapping.	The CPCS configuration is incorrect.
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.

System Message	Comments
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.
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.
DOC VIEWER MISMATCH – See Document Viewer Page for detailed info.	The documents on the database cards do not match. Ensure the aircraft manufacturer installed documents on the bottom card of each display match.

ESP CONFIG – ESP config error. Config service req'd.	ESP is not configured properly. The system should be serviced.
ESP DEGRADE – ESP IAS mode is inoperative.	IAS mode of ESP is inoperative. The system should be serviced.
ESP FAIL – ESP is inoperative.	The ESP function has failed and is inoperative. The system should be serviced.
ESP OFF – ESP selected off.	Electronic Stability and Protection has been disabled on the Avionics Settings Screen.

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.

System Message	Comments
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.
FUEL QTY COMP - Fuel quantity temp compensation has failed.	A failure of the fuel temperature probe has been detected. Fuel weight may not contain accurate fuel temperature compensation data.
G/S1 FAIL – G/S1 is inoperative.	A failure has been detected in glideslope receiver 1. The system should be serviced.
G/S1 SERVICE – G/S1 needs service. Return unit for repair.	A failure has been detected in glideslope receiver 1. The receiver may still be available. The system should be serviced when practical.
G/S2 FAIL – G/S2 is inoperative.	A failure has been detected in glideslope receiver 2. The system should be serviced.
G/S2 SERVICE – G/S2 needs service. Return unit for repair.	A failure has been detected in glideslope receiver 2. The receiver may still be available. The system should be serviced when practical.
GAE 43 FAILURE - Using Cabin Controller information.	A failure of the GAE 43 Altitude Encoder has been detected. KAPS II pressurization system being used. for cabin pressurization information..
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 GDL 69A SXM. The receiver is unavailable. The system should be serviced.
GDL69 MANIFEST – GDL69 software mismatch, communication halted.	The GDL 69A SXM has incorrect software installed. The system should be serviced.
GEA1 CONFIG – GEA1 config error. Config service req'd.	The GEA1 configuration settings do not match those of backup configuration memory. The system should be serviced.
GEA1 MANIFEST – GEA1 software mismatch, communication halted.	The GEA1 has incorrect software installed. The system should be serviced.
GEO LIMITS – AHRS1 too far north/south, no magnetic compass.	The aircraft is outside geographical limits for approved AHRS operation. Heading is annunciated as invalid.
GEO LIMITS – AHRS2 too far north/south, no magnetic compass.	The aircraft is outside geographical limits for approved AHRS operation. Heading is annunciated as invalid.
GFC MANIFEST – GFC software mismatch, communication halted.	Incorrect servo software is installed, or gain settings are incorrect.
GIA1 CONFIG – GIA1 audio config error. Config service req'd.	The GIA1 have an error in the audio configuration. The system should be serviced.
GIA1 CONFIG – GIA1 config error. Config service req'd.	The GIA1 configuration settings do not match backup configuration memory. The system should be serviced.
GIA1 COOLING – GIA1 over temperature.	The GIA1 temperature is too high. If problem persists, the system should be serviced.
GIA1 COOLING – GIA1 temperature too low.	The GIA1 temperature is too low to operate correctly. Allow units to warm up to operating temperature.

System Message	Comments
GIA1 MANIFEST – GIA1 software mismatch, communication halted.	The GIA1 has incorrect software installed. The system should be serviced.
GIA1 SERVICE – GIA1 needs service. Return the unit for repair.	The GIA1 self-test has detected a problem in the unit. The system should be serviced.
GIA2 CONFIG – GIA2 audio config error. Config service req'd.	The GIA2 have an error in the audio configuration. The system should be serviced.
GIA2 CONFIG – GIA2 config error. Config service req'd.	The GIA2 configuration settings do not match backup configuration memory. The system should be serviced.
GIA2 COOLING – GIA2 over temperature.	The GIA2 temperature is too high. If problem persists, the system should be serviced.
GIA2 COOLING – GIA2 temperature too low.	The GIA2 temperature is too low to operate correctly. Allow units to warm up to operating temperature.
GIA2 MANIFEST – GIA2 software mismatch, communication halted.	The GIA 2 has incorrect software installed. The system should be serviced.
GIA2 SERVICE – GIA2 needs service. Return the unit for repair.	The GIA2 self-test has detected a problem in the unit. The system should be serviced.
GMA1 AUX MANIFEST – GMA1 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.
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.
GMU2 MANIFEST – GMU2 software mismatch, communication halted.	The GMU1 has incorrect software installed. The system should be serviced.

System Message	Comments
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.
GPS1 CHECK POSITION – Position difference. Check position sensors.	A difference has been detected in the current position. Check position sensors.
GPS1 FAIL – GPS1 is inoperative.	A failure has been detected in GPS1 receiver. The system should be serviced.
GPS1 SERVICE – GPS1 needs service. Return unit for repair.	A fault has been detected in the GPS1 receiver. The receiver may still be available. If the message persists through a normal power cycle, the system should be serviced when practical.
GPS2 CHECK POSITION – Position difference. Check position sensors.	A difference has been detected in the current position. Check position sensors.
GPS2 FAIL – GPS2 is inoperative.	A failure has been detected in GPS2 receiver. The system should be serviced.
GPS2 SERVICE – GPS2 needs service. Return unit for repair.	A fault has been detected in the GPS2 receiver. The receiver may still be available. If the message persists through a normal power cycle, the system should be serviced when practical.
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.
GRS2 CONFIG – GRS2 config error. Config service req'd.	GRS configuration settings do not match those of backup configuration memory. The system should be serviced.
GRS2 MANIFEST – GRS2 software mismatch, communication halted.	The AHRS2 has incorrect software installed. The system should be serviced.
GRS2 SERVICE – GRS2 needs service. Return unit for repair.	The AHRS2 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.

System Message	Comments
GTC1 KEYSTK – GTC1 [key name] key is stuck.	A knob or joystick is stuck on the Touchscreen Controller bezel. Attempt to free the stuck control by pushing or turning it several times. The system should be serviced if the problem persists.
GTC1 MANIFEST – GTC 1 software mismatch, communication halted.	The Touchscreen Controller has incorrect software installed. The system should be serviced.
GTC1 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 joystick is stuck on the Touchscreen Controller bezel. Attempt to free the stuck control by pushing or turning it several times. The system should be serviced if the problem persists.
GTC2 MANIFEST – GTC 2 software mismatch, communication halted.	The Touchscreen Controller has incorrect software installed. The system should be serviced.
GTC2 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 FAIL – GWX is inoperative.	The GDU is not receiving status packet from the GWX or the GWX is reporting a fault. The radar system should be serviced.
GWX MANIFEST – GWX software mismatch, communication halted.	The GWX has incorrect software installed. The system should be serviced.

System Message	Comments
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.
HOLD EXPIRED – Holding EFC time expired.	Expect Further Clearance (EFC) time has expired for the User Defined Hold.
HW MISMATCH – GIA hardware mismatch, GIA2 communication halted.	A GIA mismatch has been detected, where only one is SBAS capable.
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.
INVALID ADM – Invalid ADM: ATN communication halted.	Data link avionics were not configured correctly and therefore will not be able to communicate with the ground network.

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.

System Message	Comments
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 database error exists.	The MFD 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.
MFD1 DB ERR – MFD1 Obstacle database missing.	The obstacle database is present on another LRU, but is missing on the specified MFD. Ensure that the data card is properly inserted. Replace data card. 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 MFD. Ensure that the data card is properly inserted. Replace data card. 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, airport 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 DB UPDATED – Active navigation database updated.	System has updated the active navigation database from the standby navigation database.
NAV1 MANIFEST – NAV1 software mismatch, communication halted.	The NAV 1 has incorrect software installed. The system should be serviced.
NAV1 RMT XFR – NAV1 remote transfer key is stuck.	The remote NAV1 transfer switch is stuck in the enabled (or "pressed") state. Press the transfer switch again to cycle its operation. If the problem persists, the system should be serviced.
NAV1 SERVICE – NAV1 needs service. Return unit for repair.	A failure has been detected in the NAV1 receiver. The receiver may still be available. The system should be serviced.
NAV2 MANIFEST – NAV2 software mismatch, communication halted.	The NAV 2 has incorrect software installed. The system should be serviced.

System Message	Comments
NAV2 RMT XFR – NAV2 remote transfer key is stuck.	The remote NAV2 transfer switch is stuck in the enabled (or "pressed") state. Press the transfer switch again to cycle its operation. If the problem persists, the system should be serviced.
NAV2 SERVICE – NAV2 needs service. Return unit for repair.	A failure has been detected in the NAV2 receiver. The receiver may still be available. The system should be serviced.
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 [xxxx] is not calculated based on the WGS84 map reference datum and may be positioned in error as displayed. Do not use GPS to navigate to the selected non-WGS84 waypoint.
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 – PFD1 database error exists.	PFD1 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.
PFD1 DB ERR – PFD1 Obstacle database missing.	The obstacle database is present on another LRU, but is missing on the specified LRU.
PFD1 DB ERR – PFD1 Terrain database missing.	The terrain database is present on another LRU, but is missing on the specified LRU.
PFD1 FAN FAIL – 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 PFD1 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.

System Message	Comments
PFD1 TERRAIN DSP – PFD1 Terrain awareness display unavailable.	One of the terrain, airport 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 – PFD1 card 2 is invalid.	The SD card in the bottom card slot of PFD2 contains invalid data.
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 database error exists.	PFD2 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.
PFD2 DB ERR – PFD2 Obstacle database missing.	The obstacle database is present on another LRU, but is missing on PFD2.
PFD2 DB ERR – PFD2 Terrain database missing.	The terrain database is present on another LRU, but is missing on PFD2.
PFD2 FAN FAIL – PFD2 internal fan failure. Unit needs service.	The PFD2 internal cooling fan has failed. The system should be serviced.
PFD2 KEYSK – 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 2 software mismatch, communication halted.	PFD2 has incorrect software installed. The system should be serviced.
PFD2 SERVICE – PFD2 needs service. Return unit for repair.	The PFD2 self-test has detected a problem. The system should be serviced.
PFD2 SOFTWARE – PFD2 mismatch, communication halted.	PFD2 has different software versions installed. The system should be serviced.
PFD2 TERRAIN DSP – PFD2 Terrain awareness display unavailable.	One of the terrain, airport 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.
PILOT RADIOS MUTED – Copilot radios are muted.	The pilot radios are set on mute.
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.
REGISTER CONNEXT – Data services inop, register w/Connex.	The system is not registered with Garmin Connex, or its current registration data has failed authentication.
SCHEDULER [#] – <message> .	Message criteria entered by the user.
SLCT FREQ – Select appropriate frequency for approach.	The system notifies the pilot to load the approach frequency for the appropriate NAV receiver. Select the correct frequency for the approach.
SLCT MAG – Select MAGNETIC NAV ANGLE display units.	The system notifies the pilot to set the Nav Angle units on the 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 INHIBIT - 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 – Trr 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 EXPIRED – Timer has expired.	The system notifies the pilot the timer has expired.
TRAFFIC FAIL – Traffic device has failed.	The system is no longer receiving data from the traffic system. The traffic device should be serviced.
TRN AUD FAIL – Trn Awareness audio source unavailable.	TAWS is disabled because an aural alert audio source is unavailable.

UNABLE 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.
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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 FAIL – XPDR1 unable to transmit ADS-B messages.	ADS-B is inoperative. Other transponder functions may be available. Transponder should be serviced when practical
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 FAIL – XPDR1 is inoperative.	There is no communication with the #1 transponder.
XPDR1 SERVICE – XPDR1 needs service. Return unit for repair.	The #1 transponder should be serviced when practical.
XPDR2 ADS-B FAIL – XPDR2 unable to transmit ADS-B messages.	ADS-B is inoperative. Other transponder functions may be available. Transponder should be serviced when practical
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.

System Message	Comments
XPDR2 FAIL – XPDR2 is inoperative.	There is no communication with the #2 transponder.
XPDR2 SERVICE – XPDR2 needs service. Return unit for repair.	The #2 transponder should be serviced when practical.
XTALK ERROR – Flight display crosstalk error has occurred.	The GDUs and/or GTCs are not communicating with each other. The system should be serviced.

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. 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.

PILOT 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.

AFCS ALERTS



Figure A-9 AFCS System Status Field

The following alert annunciations appear in the AFCS System Status field on the PFD.

Alert Condition	Annunciation	Description
Rudder Mistrim Right	RUD→	Yaw servo providing sustained force in the indicated direction
Rudder Mistrim Left	←RUD	
Aileron Mistrim Right	AIL→	Roll servo providing sustained force in the indicated direction
Aileron Mistrim Left	←AIL	
Elevator Mistrim Down	↓ELE	Pitch servo providing sustained force in the indicated direction
Elevator Mistrim Up	↑ELE	
Pitch Trim Failure (or stuck MEPT Switch)	PTRM	If AP engaged, take control of the aircraft and disengage AP If AP disengaged, move MEPT switches separately to unstick
Yaw Damper Failure	YAW	YD control failure
Roll Failure	ROLL	Roll axis control failure; AP inoperative
Pitch Failure	PTCH	Pitch axis control failure; AP inoperative
System Failure	AFCS	AP and MEPT are unavailable; FD 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

AFCS Status Alerts

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"

Terrain SVT Alerts Summary

TERRAIN-SVT SYSTEM STATUS ANNUNCIATIONS

Alert Type	PFD/Terrain SVT Pane Annunciation	Terrain SVT Pane Center Banner Annunciation	Voice Alert
System Test in Progress	TER TEST	TERRAIN TEST	None
System Test Pass	None	None	"Terrain System Test OK"
Terrain Alerting Inhibited	TER INH	None	None
No GPS position	TER N/A	NO FMS POSITION	"Terrain System Not Available"*
Excessively degraded GPS signal; or Out of database coverage area	TER N/A	None	"Terrain System Not Available"*
Terrain System Test Fail; Terrain or Obstacle database unavailable or invalid; Invalid software configuration; or System audio fault	TER FAIL	TERRAIN FAIL	"Terrain System Failure"
MFD Terrain or Obstacle database unavailable or invalid, and Terrain SVT operating with PFD Terrain or Obstacle databases	None	TERRAIN DATABASE FAILURE	None

* "Terrain System Available" will be heard when sufficient GPS signal is received, or Terrain database coverage area re-entered.

TAWS-B ALERTS

Alert Type	PFD/MFD** Alert Annunciation	MFD Pop-Up Alert (except TAWS-B Page)	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"
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	DON'T SINK * or TOO LOW - TERRAIN	"Don't Sink" * or "Too Low, Terrain"

* Alerts with multiple messages are configurable at installation and are installation-dependent. Alerts for the default configuration when more than one option is available are indicated with asterisks.

** Annunciation is displayed on the MFD when terrain display is enabled.

TAWS-B Alerts Summary

Alert Type	PFD/ TAWS Pane Annunciation	TAWS Pane Center Banner Annunciation	Voice Alert
System Test in Progress	TAWS TEST	TAWS TEST	None
System Test Pass	None	None	"TAWS System Test OK"
PDA/FLTA Alerting Inhibited	TAWS INH	None	None
No FMS position	TAWS N/A	NO FMS POSITION	"TAWS Not Available"*
Excessively degraded GPS signal; or Out of database coverage area	TAWS N/A	None	"TAWS Not Available"*
Terrain System Test Fail; Terrain or Obstacle database unavailable or invalid; Invalid software configuration; or System audio fault	TAWS FAIL	TERRAIN FAIL	"TAWS System Failure"
MFD Terrain or Obstacle database unavailable or invalid, and TAWS operating with PFD Terrain or Obstacle databases	None	TERRAIN DATABASE FAILURE	None

* "TAWS Available" will be heard when sufficient GPS signal is received, or Terrain database coverage area re-entered.

TAWS System Status Annunciations

TAWS-B ABNORMAL OPERATIONS

Alert Cause	PFD and TAWS Pane Annunciation	TAWS Pane Center Banner Annunciation
TAWS System Test Fail; Terrain, Airport Terrain or Obstacle database unavailable or invalid on all GDUs; software mismatch among GDUs; TAWS audio fault	TAWS FAIL	TAWS FAIL
MFD Terrain or Obstacle database unavailable or invalid. TAWS operating with PFD Terrain or Obstacle databases	None	TERRAIN DATABASE FAILURE
No FMS position	TAWS N/A	NO FMS POSITION
Excessively degraded GPS signal, or out of database coverage area	TAWS N/A	
Sufficient GPS signal reception restored	None	None

TAWS-B Abnormal Status Alerts

TAS/TCAS I ALERTS AND ANNUNCIATIONS

The traffic system mode appears in the upper right corner of the Traffic Map Pane.

TAS/TCAS I System Mode	Traffic Map Mode Annunciation	Traffic Overlay Status Icon
Operating	TAS: OPERATING	
Standby	TAS: STANDBY (also shown in white in center of Traffic Map Pane)	
Failed*	TAS: UNIT FAILED	

TAS/TCAS I Modes

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.

TAS/TCAS I Failure Annunciations

Traffic Status Banner Annunciation	Description
TA OFF SCALE	A Traffic Advisory is outside the selected display range*. Annunciation is removed when traffic comes within the selected display range.
TA X.X ± XX <UP> or TA X.X ± XX <DN>	System cannot determine bearing of Traffic Advisory**. Annunciation indicates distance in nm, altitude separation in hundreds of feet, and altitude trend ('<UP>' indicates climbing, '<DN>' indicates descending).
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

TAS/TCAS I Traffic Status Annunciations

WEATHER RADAR ANNUNCIATIONS

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

Radar Modes on the Weather Radar Pane

Radar Feature Status	Description
STAB ON	Antenna stabilization is selected on.
STAB OFF	Antenna stabilization is selected off.
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.

Radar Feature Status Annunciations on 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.

Abnormal Radar Status Annunciations on the Weather Radar Page

SURFACEWATCH ALERTS AND ANNUNCIATIONS

SurfaceWatch Alert Annunciation	Associated Voice Alert	Description
TWY TAKEOFF	"Taxiway"	Issued when the aircraft is taking off from a non-runway (e.g. a taxiway)
RWY TOO SHORT	"Runway too short"	Issued when the aircraft is taking off from, or landing on, a runway with a remaining distance less than needed as calculated by the TOLD function.
CHECK RUNWAY	"Check runway"	Issued when the aircraft is taking off from, or landing on, a runway different than that entered in TOLD.
TWY LANDING	"Taxiway"	Issued when the aircraft is landing on a non-runway (e.g. a taxiway).

SurfaceWatch Alert Annunciations

ADS-B ALERTS AND ANNUNCIATIONS

ADS-B Mode	Traffic Mode Annunciation (Traffic Map Page)	Traffic Map Page Center Banner Annunciation	Traffic Display Status Icon (Other Maps)
ADS-B System Test Initiated	ADS-B: TEST	TEST MODE	
ADS-B Operating in Airborne Mode	ADS-B: AIRB	None	
ADS-B Operating in Surface Mode	ADS-B: SURF	None	
ADS-B Traffic Off	ADS-B: OFF	ADS-B TRFC OFF	
ADS-B Traffic Not Available	ADS-B: N/A	ADS-B TRFC N/A	
ADS-B Failed*	ADS-B: FAIL	ADS-B TRFC FAIL	

Traffic Modes

ADS-B Status Screen Item	Status Message	Description
Traffic Application Status: Airborne (AIRB), Surface (SURF), Airborne Alerts (CSA)	On	Traffic application is currently on. Required input data is available, and it meets performance requirements.
	Available to Run	Traffic application is not currently active, but application is ready to run when condition(s) determine the application should be active. Required input data is available, and it meets performance requirements.
	Not Available	Traffic application is not available. Required input data is available, but it does not meet performance requirements.
	Fault	Traffic application is not available. Required input data is not available or the application has failed.
	Not Configured	Traffic application is not available, because it has not been configured. If this annunciation persists, the system should be serviced.
	-----	Traffic application status is invalid or unknown.

ADS-B Status Screen Messages for ADS-B Traffic

GDL 69A SXM DATA LINK RECEIVER MESSAGES

Message	Message Location	Description
CHECK ANTENNA	SiriusXM Info Screen (Touchscreen Controller)	Data Link Receiver antenna error; service required
UPDATING	Music Screen (Touchscreen Controller)	Data Link Receiver updating encryption code
NO SIGNAL	SiriusXM Info Screen, Music Screen (Touchscreen Controller) SiriusXM Weather Pane	Loss of signal; signal strength too low for receiver
Loading Music Channels...	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
No Channels Available Please Check Connection	Music Screen (Touchscreen Controller)	System has not acquired any channels. Verify antenna is outside with a clear view of the sky.
WEATHER DATA LINK FAILED	Weather Data Link (XM) Pane	No communication from Data Link Receiver within last 5 minutes
DETECTING ACTIVATION	Weather Data Link (XM) Pane	SiriusXM subscription is activating
WAITING FOR DATA...	Weather Data Link (XM) Pane	SiriusXM subscription confirmed. Downloading weather data.

GDL 69A SXM Data Link Receiver Messages

DATABASE MANAGEMENT



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

The system uses Secure Digital (SD) cards to load and store various types of data. For basic flight operations, SD cards are required for database storage as well as Navigation Database updates. Not all SD cards are compatible with the system.



CAUTION: When downloading updates to the Jeppesen Navigation Database, copy the data to an SD card other than a Garmin Supplemental Data Card. Otherwise, data corruption can occur.



NOTE: When loading database updates, the 'DB Mismatch' message will be displayed until database synchronization is complete, followed by turning system power off, then on. Synchronization can be monitored on the Avionics Status Screen on the Touchscreen Controller.



NOTE: Loading a database in the system prior to its effective date will result in the expiration date on the power-up screen and the effective date on the Avionics 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 <http://fly.garmin.com> by selecting 'Type 2 LOA Status.'
- Use of a current Garmin or Jeppesen database in your Garmin equipment is required for compliance with established FAA regulatory guidance, but does not constitute authorization to fly any and all terminal procedures that may be presented by the system. It is the pilot's responsibility to operate in accordance with established AFM(S) and regulatory guidance or limitations as applicable to the pilot, the aircraft, and installed equipment.



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



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



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

NAVIGATION DATABASES

The Navigation Database is updated on a 28-day cycle. There are two possible methods for updating the navigation database. If the 28-day cycle of your navigation database has already ended, you must update the active navigation database. However, if the expiration date of the navigation database hasn't already been reached, you may load a standby navigation database. The system will then automatically update the active database at the first aircraft power-on when the new navigation becomes effective.



NOTE: After the Navigation Database is installed, the card may be removed.

Updating the active navigation database (not using the Dual Navigation Database or Automatic Database Synchronization Features):



NOTE: To do this procedure, use a new SD card to copy the navigation database. Garmin SD Cards (bottom SD card slots) shall not be used. The use of SanDisk SD Card is recommended to store the navigation database file. Before utilization, it is recommended to format the SD Card with the FAT32 file system so that displays will read it. After the navigation database is loaded or copied, the top SD card may be removed.

- 1) Go to www.flygarmin.com or www.jeppesen.com. Download the applicable software and install the navigation database on a blank SD card.
- 2) With the system OFF, insert the SD card containing the new navigation database version into the top card slot of PFD1, (label of SD card facing left).
- 3) Turn the system ON. A prompt is displayed in the upper left corner of the display:

DO YOU WANT TO UPDATE THE STANDBY NAVIGATION DATABASE ON THE BOTTOM CARD?
THE STANDBY DATABASE WILL BE ACTIVATED UPON THE FIRST ON-GROUND POWER CYCLE ON OR
AFTER 00:00 SYSTEM TIME ON THE EFFECTIVE DATE.
FROM TO
REGION: WORLDWIDE WORLDWIDE
CYCLE: 1511 1512
EFFECTIVE: 26-OCT-2015 23-NOV-2015
EXPIRES: 23-NOV-2015 21-DEC-2015

NO WILL BE ASSUMED IN 21 SECONDS.

Figure B-1 Standby Navigation Database Prompt

- 4) Press the **NO** Softkey to proceed to loading the active database.
- 5) A prompt similar to the following is displayed. Press the **YES** Softkey to update the active navigation database.

DO YOU WANT TO UPDATE THE ACTIVE NAVIGATION DATABASE?
SELECTING YES WILL OVERWRITE THE ACTIVE NAVIGATION DATABASE.
FROM TO
REGION: WORLDWIDE WORLDWIDE
CYCLE: 1511 1512
EFFECTIVE: 26-OCT-2015 23-NOV-2015
EXPIRES: 23-NOV-2015 21-DEC-2015

NO WILL BE ASSUMED IN 8 SECONDS.
UPDATING THE ACTIVE NAVIGATION DATABASE, PLEASE WAIT.
. .
UPDATED 1 FILES SUCCESSFULLY!
PRESS ANY KEY TO CONTINUE.
CONTINUING IN 8 SECONDS.

Figure B-2 Database Update Confirmation

- 6) After the update completes, the display starts in normal mode.
- 7) Turn the system OFF and remove the SD card from the top card slot.
- 8) Repeat steps 1 through 7 for the remaining displays.
- 9) Apply power to the system and press the right most softkey to acknowledge the startup screen.
- 10) From the Home Screen, touch **Utilities > Setup > Database Status**.
- 11) Monitor the Navigation Database synchronization until it finishes.



NOTE: The new database from the display units are synchronized to the touchscreen controllers in this step.

- 12) Remove and reapply power to the system.
- 13) Press the soft key on the far right side of the MFD to acknowledge the startup screen.
- 14) From the Home Screen, touch **Utilities > Setup > Database Status**.
- 15) Verify the correct cycle is indicated in the Navigation Database field.



NOTE: Updates shown for the standby navigation database on the Database Status screen are a composite of the updates for all displays.

- 16) To view standby navigation database update information of each display, scroll down the list shown in the Database Status screen and touch **LRU Database Info**.
- 17) Touch a button from the list to view database information associated with that display.

Database Status			
Check Database Cycle			
DATABASE	CYCLE	EFFECTIVE	EXPIRES
Navigation	1606	30-MAY-2016	27-JUN-2016
STBY Navigation	1607	27-JUN-2016	25-JUL-2016
Basemap	5.01	N/A	N/A
Terrain	16T1	03-FEB-2016	N/A
Obstacle	16B3	02-MAY-2016	27-JUN-2016
Safetaxi	16S3	02-MAY-2016	27-JUN-2016
Airport Directory	16D3	02-MAY-2016	27-JUN-2016
Checklist	NOT AVAILABLE		

Figure B-3 Activate Nav

- 18) On the Touchscreen Controller, touch the **MSG** button and verify if any message related to databases is active.
- 19) Remove power from the system.

DUAL NAVIGATION DATABASE FEATURE

The dual navigation database feature allows each display to store an upcoming navigation database on the bottom SD card so that the system can automatically load it to replace the active database when the new database becomes effective (the next cycle becomes available seven days prior to its effective date).

If a navigation database loader card is inserted into the top SD card slot of a display, and an SD card is in the bottom slot, the system will prompt the user (upon on-ground power up) as to whether the database should be stored on the bottom SD card as the standby database. If the user responds affirmatively, the system will copy the navigation database from the top SD card to the bottom SD card. As long as the bottom SD card remains in the card slot, this standby navigation database will be available for the system to use as the active database as soon as it becomes effective.

The system checks the active and standby databases upon (on-ground only) power-up. If the standby database is current and the active database is out of date, the display will upload the standby database into the active internal database location. Uploading the standby database to the active location takes approximately 45-55 seconds. The pilot is alerted that the update is complete by a system alert message, 'NAV DB UPDATED'.

Loading a standby navigation database:



NOTE: To do this procedure, use a new SD card to copy the navigation database. Garmin SD Cards (bottom SD card slots) shall not be used. The use of SanDisk SD Card is recommended to store the navigation database file. Before utilization, it is recommended to format the SD Card with the FAT32 file system so that displays will read it. After the navigation database is loaded or copied, the top SD card may be removed.

- 1) Go to www.flygarmin.com or www.jeppesen.com. Download the applicable software and install the navigation database on a blank SD card.
- 2) With the system OFF, insert the SD card containing the new navigation database version into the top card slot of PFD 1.
- 3) Verify that an SD card is inserted in the bottom slot of each PFD and the MFD.
- 4) Turn the system ON. A prompt is displayed:

DO YOU WANT TO UPDATE THE STANDBY NAVIGATION DATABASE ON THE BOTTOM CARD?
THE STANDBY DATABASE WILL BE ACTIVATED UPON THE FIRST ON-GROUND POWER CYCLE ON OR
AFTER 00:00 SYSTEM TIME ON THE EFFECTIVE DATE.
FROM TO
REGION: WORLDWIDE WORLDWIDE
CYCLE: 15 11 15 12
EFFECTIVE: 26-OCT-2015 23-NOV-2015
EXPIRES: 23-NOV-2015 21-DEC-2015

NO WILL BE ASSUMED IN 21 SECONDS.

Figure B-4 Standby Navigation Database Prompt

- 5) Press the **YES** Softkey. The navigation database is copied to the SD card in the bottom card slot of the PFD 1.
- 6) After the navigation database files are copied to the bottom SD card, press any key to continue, as instructed.

INITIALIZING SYSTEM

DO YOU WANT TO UPDATE THE STANDBY NAVIGATION DATABASE ON THE BOTTOM CARD?
THE STANDBY DATABASE WILL BE ACTIVATED UPON THE FIRST ON-GROUND POWER CYCLE ON OR
AFTER 00:00 SYSTEM TIME ON THE EFFECTIVE DATE.

FROM	TO
REGION: WORLDWIDE	WORLDWIDE
CYCLE: 1411	1412
EFFECTIVE: 26-AUG-2014	18-NOV-2014
EXPIRES: 23-SEP-2014	16-DEC-2014

NO WILL BE ASSUMED IN 18 SECONDS.
UPDATING STANDBY NAVIGATION DATABASE, PLEASE WAIT.

.

UPDATED STANDBY NAVIGATION DATABASE SUCCESSFULLY.
PRESS ANY KEY TO CONTINUE.
CONTINUING IN 9 SECONDS.

Figure B-5 Standby Navigation Database Update Complete

- 7) Again, press any key to continue as instructed on the display.

DATABASE NAVIGATION WILL BE VERIFIED BEFORE USE.
DATABASE STANDBY NAV WILL BE VERIFIED BEFORE USE.
PRESS ANY KEY TO CONTINUE.
CONTINUING IN 6 SECONDS.

Figure B-6 Navigation Database Verification Prompt

- 8) Press the **NO** Softkey. The display now starts in normal mode. Since the database effective date is not yet valid, it should not be loaded as the active database. The display now starts in normal mode. Do not remove power while the display is starting.

DO YOU WANT TO UPDATE THE ACTIVE NAVIGATION DATABASE?
SELECTING YES WILL OVERWRITE THE ACTIVE NAVIGATION DATABASE.

FROM	TO
REGION: WORLDWIDE	WORLDWIDE
CYCLE: 1511	1512
EFFECTIVE: 26-OCT-2015	23-NOV-2015
EXPIRES: 23-NOV-2015	21-DEC-2015

NO WILL BE ASSUMED IN 8 SECONDS.

Figure B-7 Active Navigation Database Prompt

- 9) Press any key to acknowledge the startup screen.
- 10) From the Home Screen on the Touchscreen Controller, touch **Utilities > Setup > Avionics Status**.
- 11) If necessary, touch the **Database** Tab. The Touchscreen Controller shows a list of displays on which databases reside.
- 12) The new database is copied to the SD card in the bottom card slot of PFD1 and PFD2. While the database is copying, progress can be monitored at the bottom of the applicable database field. When copying is finished, 'Sync Complete' is displayed.
- 13) Turn system power OFF.
- 14) Remove the SD card from the top card slot of the MFD.
- 15) Apply power to the system.

- 16) From the **Home** Screen on the Touchscreen Controller, touch **Utilities > Setup > Avionics Status**.
- 17) If necessary, touch the **Database** Tab. The Touchscreen Controller shows a list of displays on which databases reside.
- 18) Touch a button from the list to view database information associated with that display.
- 19) Scroll through the database information and verify the standby navigation database cycle information is correct.
- 20) Touch **Back** to return to the list of displays, and repeat steps 17 through 19 to verify the standby navigation cycle information for each display.
- 21) When finished, touch **Back** or **Home**.

Database Status			
Check Database Cycle			
DATABASE	CYCLE	EFFECTIVE	EXPIRES
Navigation	1606	30-MAY-2016	27-JUN-2016
STBY Navigation	1607	27-JUN-2016	25-JUL-2016
Basemap	5.01	N/A	N/A
Terrain	16T1	03-FEB-2016	N/A
Obstacle	16B3	02-MAY-2016	27-JUN-2016
Safetaxi	16S3	02-MAY-2016	27-JUN-2016
Airport Directory	16D3	02-MAY-2016	27-JUN-2016
Checklist	NOT AVAILABLE		

Figure B-8 Activate STBY Nav

Manually activating the standby navigation database:

- 1) From the **Home** Screen, touch **Utilities > Setup > Database Status**.
- 2) If a Standby Navigation Database has already been copied to the bottom card, touch the **Activate STBY Nav** Button in the upper right corner of the screen (Figure B-9).

Database Status			
Check Database Cycle			
DATABASE	CYCLE	EFFECTIVE	EXPIRES
Navigation	1406	30-MAY-2014	27-JUN-2014
STBY Navigation	1407	27-JUN-2014	25-JUL-2014
ChartView	1411	N/A	06-JUN-2014
Basemap	4.00	N/A	N/A
Terrain	14T1	03-FEB-2014	N/A
Obstacle	14B3	02-MAY-2014	27-JUN-2014
Safetaxi	14S3	02-MAY-2014	27-JUN-2014
Airport Directory	14D3	02-MAY-2014	27-JUN-2014

Figure B-9 Activate STBY Nav

- 3) A prompt similar to Figure B-10 is displayed, touch **Yes** to overwrite the Active Navigation Database with the Standby Navigation Database. Touch **No** to cancel.

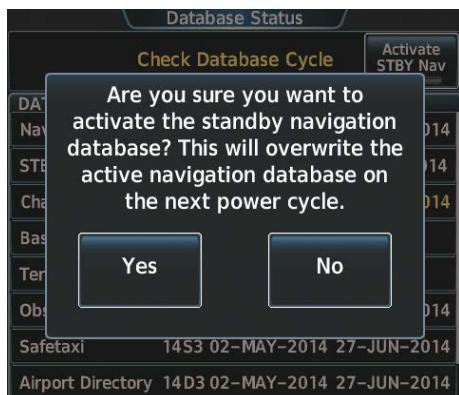


Figure B-10 Update Active Prompt

AUTOMATIC DATABASE SYNCHRONIZATION FEATURE

When updating the active navigation database, the automatic database synchronization feature automatically transfers the navigation database from a single SD Card to the internal memory of all GDUs and Touchscreen Controllers. When updating all other databases (including the standby navigation database) the data is transferred from a single SD card to the remaining SD cards on each GDU, as well as the internal memory of each Touchscreen Controller. After power-up, the system compares all copies of each applicable database. If similar databases do not match, the most recent valid database is automatically copied to each card in the system that does not already contain that database.

The following databases are checked and/or synchronized: Navigation, Basemap, SafeTaxi, Terrain, Obstacle, ChartView or FliteCharts, and Airport Directory.



NOTE: The terrain database may take as long as 100 minutes to synchronize using this method. Therefore the user may want to transfer the data using a PC, or connect the system to a ground power source while performing the database synchronization.

The synchronization progress may be monitored on the Database Status Screen on the Touchscreen Controller (Figure B-10). This screen shows the synchronization status of each applicable database as follows:

- ‘Sync in Progress’ with percent complete and time remaining
- ‘Sync Complete’
- ‘Sync Error’

While database synchronization is occurring, ‘Sync in Progress’ is displayed along with percent complete and time remaining. When the synchronization is complete for the selected GDU or Touchscreen Controller Database Status Screen, the status is listed as ‘Sync Complete’ (Figure B-11). The synchronization status is only present when a sync is occurring or has occurred on the current power-up.

An indication of ‘Sync Complete’ still requires a power cycle before the synchronized databases will be used by the system.

To view database status:

- 1) From the Home Screen, touch **Utilities > Setup > Database Status**
- 2) Scroll through the database information to view the status of each database.

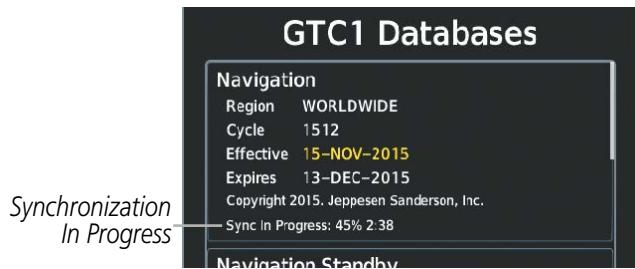


Figure B-11 Avionics Status Screen,
Database Information Window,
Navigation Database Sync in Progress

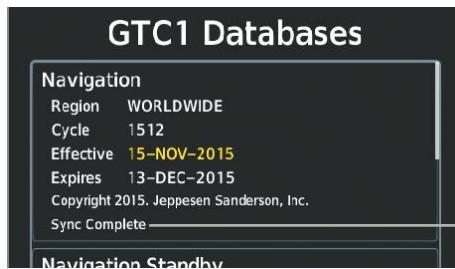


Figure B-12 Avionics Status Screen,
Database Information Window,
Navigation Database Sync Complete

- 3) If necessary to view database info for each display, scroll down and press **LRU Database Info**.
- 4) Touch a button from the list to view database information associated with that display.
- 5) Scroll through the database information to view database status.

If an error occurs during the synchronization, ‘Sync Error’ is displayed in the synchronization status field (Figure B-13). If synchronization completes for one display, but an error occurs for another, the error message will be displayed on the Database Status Screen for the affected display. When an error message is displayed, the problem must be corrected before the synchronization can be completed. A power cycle is required to restart synchronization.



Figure B-13 Synchronization Error Message

GARMIN DATABASES

The following databases are stored on Supplemental Data Cards provided by Garmin:

- Expanded basemap
- Terrain
- Obstacle
- FliteCharts or ChartView
- Airport Directory (AOPA or AC-U-KWIK)

After subscribing to the desired database product, these database products will be downloaded and ultimately stored on three Supplemental Data Cards. A Supplemental Data Card resides in the bottom card slot of each GDU, as shown in Figure B-14.

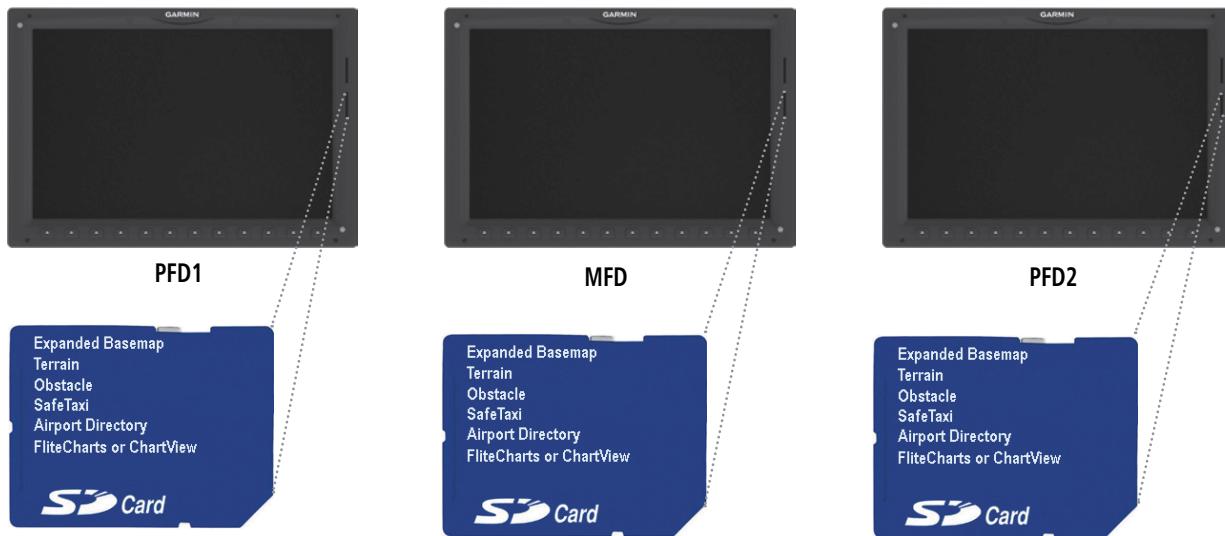


Figure B-14 Correct Database Locations

Databases residing on Supplemental Data Cards are not stored internally in the displays (except for the Touchscreen Controllers); therefore, a Supplemental Data Card containing identical database versions must be kept in the bottom card slot each GDU.

The basemap database contains data for the topography and land features, such as rivers, lakes, and towns. It is updated only periodically, with no set schedule. There is no expiration date.

The terrain database contains the terrain mapping data. This database is updated periodically and has no expiration date.

The obstacle database contains data for obstacles, such as towers, that pose a potential hazard to aircraft. Obstacles 200 feet and higher are included in the obstacle database. It is very important to note that not all obstacles are necessarily charted and; therefore, may not be contained in the obstacle database. This database is updated on a 56-day cycle.



NOTE: The data contained in the terrain and obstacle databases comes from government agencies. Garmin accurately processes and cross-validates the data, but cannot guarantee the accuracy and completeness of the data.

The SafeTaxi database contains detailed airport diagrams for selected airports. These diagrams aid in following ground control instructions by accurately displaying the aircraft position on the map in relation to taxiways, ramps, runways, terminals, and services. This database is updated on a 56-day cycle.

The AOPA or AC-U-KWIK Airport Directory provides data on airports and heliports throughout the U.S. or worldwide, respectively, and offers detailed information for over 5,300 airports, along with the names and phone numbers of thousands of FBOs. These databases are updated every 56 days.

The FliteCharts database contains procedure charts for the United States, Canada and Europe 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 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 www.jeppesen.com or www.flygarmin.com. It should be copied to Garmin supplied Supplemental Data Cards which will reside in the bottom card slot on of each GDU.

The Garmin and Jeppesen database updates can be obtained by following the instructions detailed in the 'Databases' section of the Garmin website (fly.garmin.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 (running Windows XP, Vista, or Windows 7)
- SD Card Reader: SanDisk SDDR-93, SanDisk SDDR-99, Verbatim #96504, or equivalent
- Updated database obtained from the Garmin website
- Existing Supplemental Database SD Cards (010-00330-42, or -43) from each GDU.

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.

UPDATING BASEMAP, SAFETAXI, OBSTACLE, AIRPORT DIRECTORY, DATABASES



NOTE: The Basemap, SafeTaxi, Obstacle and Airport Directory databases may be copied to one Supplemental Data Card, then automatically synchronized to other cards in the system.

- 1) With the system OFF, remove the MFD database SD Card from the bottom SD slot of the MFD.
- 2) Go to www.flygarmin.com. Download the applicable software and install the navigation database on a blank SD card.
- 3) Put the database SD Card back in the bottom SD card slots the MFD.
- 4) Turn the system ON.
- 5) During **MFD** power-up screen, make sure that the database is initialized and shown on the database information.



Figure B-15 Database Information on the Power-up Screen

- 6) Press the right most softkey on MFD display to acknowledge the startup screen.
- 7) From the **Home** Screen on the Touchscreen Controller, touch **Utilities > Setup > Database Status**.
- 8) Monitor the updated database synchronization (if applicable) until it finishes.



NOTE: The new database from the display units are synchronized to the touchscreen controllers in this step. Only the Airport Directory (AOPA) database requires synchronization.

- 9) Remove and reapply power to the system.
- 10) Press the right most softkey on MFD display to acknowledge the startup screen.
- 11) From the Home Screen on the Touchscreen Controller, touch **Utilities > Setup > Database Status**.
- 12) Verify the correct cycle is indicated for the updated databases.
- 13) To view database update information of each display, scroll down the list shown in the Database Status screen and touch **LRU Database Info**.
- 14) Touch a button from the list to view database information associated with that display.
- 15) Scroll through the database information to view database status.
- 16) On Touchscreen Controller, touch the **MSG** Button and determine if any message related to databases is active.
- 17) Remove power from the system.

UPDATING TERRAIN, FLITECHARTS AND JEPPESEN CHARTVIEW DATABASES



NOTE: The Terrain, FliteCharts and Jeppesen ChartView Databases databases must be copied to all three Supplemental Data Cards.



NOTE: Jeppesen ChartView can be updated at either www.flygarmin.com or www.jeppesen.com, but must be purchased first from Jeppesen.

- 1) With the system OFF, remove the database SD Cards from the bottom SD slot of each flight display unit.
- 2) Go to www.flygarmin.com or www.jeppesen.com (for ChartView only). Download the applicable software and install the navigation database on a blank SD card.
- 3) Put the database SD Cards back in the bottom SD card slots of each flight display unit.
- 4) Turn the system ON.
- 5) During **MFD** power-up screen, make sure that the database is initialized and shown on the database information.

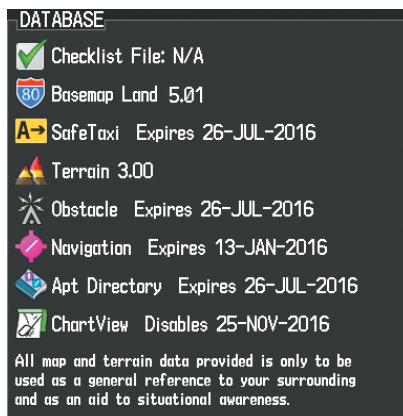


Figure B-16 Database Information on the Power-up Screen

- 6) Press the right most softkey on MFD display to acknowledge the startup screen.
- 7) From the **Home** Screen on the Touchscreen Controller, touch **Utilities > Setup > Database Status**. If necessary, touch the **Database** Tab.
- 8) Monitor the updated database synchronization (if applicable) until it finishes.



NOTE: The new database from the display units are synchronized to the touchscreen controllers in this step. Only the ChartView and FliteCharts databases require synchronization.

- 9) Remove and reapply power to the system.
- 10) Press the right most softkey on MFD display to acknowledge the startup screen.
- 11) From the Home Screen on the Touchscreen Controller, touch **Utilities > Setup > Database Status**.
- 12) Verify the correct cycle is indicated for the updated databases.
- 13) To view database update information of each display, scroll down the list shown in the Database Status screen and touch **LRU Database Info**.
- 14) Touch a button from the list to view database information associated with that display.
- 15) Scroll through the database information to view database status.
- 16) On Touchscreen Controller, touch the **MSG** Button and determine if any message related to databases is active.
- 17) Remove power 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-17. 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-17 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-17, touch the **OK** Button. A progress monitor is displayed as shown in Figure B-18.



Figure B-18 Uploading Database to GRS1

- 2) When the upload is complete, the prompt for the next GRS upload is displayed, as seen in Figure B-19. A database mismatch message, as seen in Figure B-20, indicates the second GRS has not yet been updated.



Figure B-19 GRS2 Magnetic Field Variation Database Update Prompt



Figure B-20 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.

GARMIN AVIATION GLOSSARY

ACARS	Airborne Communications Addressing and Reporting System	APTSIGNS	Airport Signs
ACC	Accuracy	ARINC	Aeronautical Radio Incorporated
ACT, ACTV	Active, Activate, Altitude Compensated Tilt	ARSPC	Airspace
ADC	Air Data Computer	ARTCC	Air Route Traffic Control Center
ADF	Automatic Direction Finder	ARV	Arrival
ADI	Attitude Direction Indicator	AS	Airspeed
ADIZ	Air Defense Identification Zone	ASB	Aviation Support Branch
ADS-B	Automatic Dependent Surveillance-Broadcast	ASOS	Automated Surface Observing System
ADS-R	Automatic Dependent Surveillance-Rebroadcast	ATC	Air Traffic Control
AF	Arc to Fix Leg	ATCRBS	ATC Radar Beacon System
AFCS	Automatic Flight Control System	ATIS	Automatic Terminal Information Service
AFM	Airplane Flight Manual	ATK	Along Track
AFMS	Airplane Flight Manual Supplement	AUTOSEQ	Automatic Sequence
AFRM	Airframe	AUX	Auxiliary
AGL	Above Ground Level	AVG	Average
AHRS	Attitude and Heading Reference System	AVLC	Aviation VHF Link Control
AIM	Aeronautical Information Manual	AWOS	Automated Weather Observing System
AIRB	Airborne	B	Both Runways
AIRMET	Airman's Meteorological Information	B ALT	Barometric Altitude
ARREP	Air Reports	BARO	Barometer, Barometric
ALRT	Alert	BATT	Battery
ALT	Altitude	BC	Backcourse
ALT, ALTN	Alternator	Bearing	The compass direction from the present position to a destination waypoint.
ALTS	Selected Altitude Capture Mode	BFO	Beat Frequency Oscillator
ALTV	VNAV Altitude Capture Mode	BKSP	Backspace
AMPS	Amperes	Bluetooth	Wireless standard for data exchange over short distances
ANNUNC/ANN	Annunciation/Annunciator	BOC	Bottom of Climb
ANT	Antenna	BOD	Bottom of Descent
AOA	Angle of Attack, ACARS Over AVLC	BRG	see also Bearing
AOC	Aeronautical Operational Control	°C	Degrees Celsius
AOG	Aircraft On Ground	C	Center Runway
AOPA	Aircraft Owners and Pilots Association	CA	Course to Altitude Leg
AP	Autopilot	CAL	Calibrated
AP DISC	Autopilot Disconnect	CALC	Calculator
APPR, APR	Approach	Calibrated Airspeed	Indicated airspeed corrected for installation and instrument errors.
APT	Airport, Aerodrome		

CAS	Crew Alerting System	CTRL	Control
CD	Course to DME Distance Leg	Cumulative, CUM	The total of all legs in a flight plan.
CDI	Course Deviation Indicator	CVDR	Cockpit Voice Data Recorder
CDU	Control Display Unit	CVR	Cockpit Voice Recorder
CF	Course to Fix Leg	CVRG	Coverage
CG	Center of Gravity	CWS	Control Wheel Steering
CH, CHNL	Channel	CYL	Cylinder
CHT	Cylinder Head Temperature		
CHKLIST	Checklist	D ALT	Density Altitude
CI	Course to Intercept Leg	D-ATIS	Digital Automatic Terminal Info Service
CLD	Cloud	DB, DBASE	Database
CLR	Clear	dBZ	Decibels 'Z' (Radar Return)
CM	Centimeter	DCL	Departure Clearance
CMC	Central Maintenance Computer	DCLTR, DECLTR	Declutter
CN	Canada	DEC FUEL	Decrease Fuel
CNS	Communication, Navigation, & Surveillance	DEG	Degree
CO	Carbon Monoxide	DEIC, DEICE	De-icing
COM	Communication Radio	DEP	Departure
CONFIG	Configuration	Desired Track	The desired course between the active "from" and "to" waypoints.
COOL	Coolant	DEST	Destination
COPLT	Copilot	DEV	Deviation
Course	The line between two points to be followed by the aircraft.	DF	Direct to Fix Leg
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.	DFLT	Default
CPDLC	Controller Pilot Datalink Communications	DG	Directional Gyro
CPL	Couple	DGRD	Degrade
CR	Course to Radial Leg	DH	Decision Height
CRG	Cockpit Reference Guide	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).
CRNT	Current	DIR	Direction
Crosstrack Error	The distance the aircraft is off a desired course in either direction, left or right.	DIS	Distance
CRS	see also Course, Course to Steer	Distance	The 'great circle' distance from the present position to a destination waypoint.
CRSR	Cursor	DL LTNG	Datalink Lightning
CSA	Conflict Situational Awareness	DME	Distance Measuring Equipment
CSC	Current Speed Control	DN	Down
CTA	Control Area	DOP	see also Dilution of Precision
CTR	Center	DP	Departure Procedure

DPRT	Departure	Estimated Position Error (EPE)	A measure of horizontal GPS position error derived by satellite geometry conditions and other factors.
DR	Dead Reckoning	Estimated Time of Arrival (ETA)	The estimated time at which the aircraft should reach the destination waypoint, based upon current speed and track.
DSBL	Disabled	Estimated Time Enroute (ETE)	The estimated time it takes to reach the destination waypoint from the present position, based upon current groundspeed.
DTK	see also Desired Track	ETA	see also Estimated Time of Arrival
DQR	Data Quality Requirements	ETE	see also Estimated Time Enroute
E	Empty, East	EVS	Enhanced Vision System
EAS	Engine and Airframe Systems	EXPIRED	Expired
ECU	Engine Control Unit	°F	Degrees Fahrenheit
EDM	Emergency Descent Mode	FA	Course From Fix to Altitude Leg
EFC	Expected Further Clearance	FAA	Federal Aviation Administration
Efficiency	A measure of fuel consumption, expressed in distance per unit of fuel.	FADEC	Full Authority Digital Engine Control
EGNOS	European Geostationary Navigation Overlay Service	FAF	Final Approach Fix
EGT	Exhaust Gas Temperature	FAIL	Failure
EICAS	Engine Indication and Crew Alerting System	FBO	Fixed Base Operator
EIS	Engine Indication System	FC	Course From Fix to Distance Leg
ELEV	Elevation, Elevator	FCC	Federal Communication Commission
ELT	Emergency Locator Transmitter	FCST	Forecast
EMER, EMERG, EMERGCY	Emergency	FD	Flight Director, Course From Fix to DME Distance Leg
EMI	Electromagnetic Interference	FDE	Fault Detection and Exclusion
END, ENDUR	Endurance	FF, FFLOW	see also Fuel Flow
Endurance	Flight endurance, or total possible flight time based on available fuel on board.	FIS-B	Flight Information Services-Broadcast
ENG	Engine	FISDL	Flight Information Service Data Link
ENGD	Engaged	FL	Flight Level
ENR	Enroute; ETE to Final Destination	FLC	Flight Level Change
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.	FLTA	Forward Looking Terrain Avoidance
ENT	Enter	FM	Course From Fix to Manual Termination Leg
EPE	see also Estimated Position Error	FMS	Flight Management System
EPU	Estimated Position Uncertainty	FOB	see also Fuel On Board
ERR	Error	FOD	see also Fuel Over Destination
ES	Extended Squitter	FPA	Flight Path Angle
ESA	see also Enroute Safe Altitude	FPL	Flight Plan
ESP	Electronic Stability and Protection	FPM	Feet Per Minute, Flight Path Marker
		FREQ	Frequency

FRMT	Format	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
FRZ	Freezing	Groundspeed	The velocity that the aircraft is travelling relative to a ground position.
FSM	Flight System Messages	Ground Track	See Track
FSS	Flight Service Station	GRS	Garmin Reference System
FT	foot/feet	GS	Ground Speed, Glideslope
Fuel Flow	The fuel flow rate, expressed in units of fuel per hour.	GSA	Garmin Servo Adapter
Fuel On Board	The total amount of usable fuel on board the aircraft.	GSD	Garmin Data Concentrator
Fuel Over Destination	The estimated fuel remaining when the aircraft reaches the destination waypoint, based upon current fuel flow.	GSL	Geodetic Sea Level
FWD	Forward	GSR	Garmin Satellite Radio
G/S	Glideslope	GTC	Garmin Touchscreen Controller
GA	Go-Around	GTS	Garmin Traffic System
GAL, GL	Gallon(s)	GTX	Garmin Transponder
GBOX	Gearbox	GWX	Garmin Weather Radar
GBT	Ground Based Transceiver	HA	Hold Terminating at Altitude Leg
GCU	Garmin Control Unit	HDG	see also Heading
GCS	Ground Clutter Suppression	HDOP	Horizontal Dilution of Precision
GDC	Garmin Air Data Computer	Heading	The direction an aircraft is pointed, based upon indications from a magnetic compass or a properly set directional gyro.
GDL	Garmin Satellite Data Link	HF	High Frequency, Hold Terminating at Fix Leg
GDR	Garmin Data Radio	HFOM	see also Horizontal Figure of Merit
GDU	Garmin Display Unit	Hg	Mercury
GEA	Garmin Engine/Airframe Unit	HI	High
GEO	Geographic	HI SENS	High Sensitivity
GFC	Garmin Flight Control	HM	Hold with Manual Termination Leg
GIA	Garmin Integrated Avionics Unit	HNS	Hybrid Navigation System
GLONASS	Global Orbiting Navigation Satellite Landing System	Horizontal Figure of Merit	A measure of the uncertainty in the aircraft's horizontal position.
GLS	Global Navigation Satellite Landing System	hPa	Hectopascal
GMA	Garmin Audio Panel System	HPL	Horizontal Protection Level
GMC	Garmin Mode Controller	HR	Hour
GMT	Greenwich Mean Time	HRZN HDG	Horizon Heading
GMU	Garmin Magnetometer Unit	HSDB	High-Speed Data Bus
GND	Ground	HSI	Horizontal Situation Indicator
GPH	Gallons per Hour		
GPN	Garmin Part Number		
GPS	Global Positioning System		
GPWS	Ground Proximity Warning System		

HT	Heat	KT	Knot
HUL	Horizontal Uncertainty Level	L	Left, Left Runway
Hz	Hertz (cycles per second)	LAT	Latitude
I	Inner Marker	LBL	Label
IAF	Initial Approach Fix	LB	Pound
IAS	Indicated Air Speed	LCD	Liquid Crystal Display
IAT	Indicated Air Temperature	LCL	Local
IAU	Integrated Avionics Unit	LDA	Landing Distance Available
ICAO	International Civil Aviation Organization	LDG	ETA at Final Destination
ICS	Intercom System	LED	Light Emitting Diode
ID	Identification/Morse Code Identifier	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.
IDENT, IDNT	Identification	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.
IEEE	Institute of Electrical & Electronics Engineers	Leg	The portion of a flight plan between two waypoints.
IF	Initial Fix	LGND	Legend
IFR	Instrument Flight Rules	LIFR	Low Instrument Flight Rules
IG	Imperial Gallon	LMM	Location Middle Marker
ILS	Instrument Landing System	LNAV	Lateral Navigation
IMC	Instrument Meteorological Conditions	LO	Low
IN	Inch	LOA	Letter of Authorization
INACTV	Inactive	LOC	Localizer
INC FUEL	Increase Fuel	LOI	Loss of Integrity (GPS)
IND	Indicator, Indicated	LOM	Location Outer Marker
Indicated	Information provided by properly calibrated and set instrumentation on the aircraft panel.	LON	Longitude
INFO	Information	LP	Localizer Performance
IN Hg	Inches of Mercury	LPV	Localizer Performance with Vertical Guidance
INS	Inertial Navigation System	LRU	Line Replaceable Unit
INT	Intersection(s)	LT	Left
INTEG	Integrity (RAIM unavailable)	LTNG	Lightning
IrDA, IRDA	Infrared Data Association	LVL	Level
ISA	International Standard Atmosphere; ISA Relative Temperature	M	Meter, Middle Marker, Mach
ITT	Interstage Turbine Temperature, Inter-Turbine Temperature	M_{MO} (V_{MO})	Maximum Speed
KEYSTK	Key Stuck	Mach Number	Mach number is the ratio of the true airspeed to the speed of sound.
KG	Kilogram		
kHz	Kilohertz		
KM	Kilometer		

MAG	Magnetic	NAVAID	Navigation Aid
MAG VAR	Magnetic Variation	NDB	Non-Directional Beacon
MAHP	Missed Approach Hold Point	NEXRAD	Next Generation Radar
MAN IN	Manifold Pressure (inches Hg)	NM	Nautical Mile(s)
MAN SQ	Manual Squelch	NoPT	No Procedure Turn Required (procedure shall not be executed without ATC clearance)
MAP	Missed Approach Point	NOTAM	Notice To Airman
MASQ	Master Avionics Squelch	NRST	Nearest
MAX	Maximum	O	Outer Marker
MAXSPD	Maximum Speed (overspeed)	OAT	Outside Air Temperature
MB	Marker Beacon	OBS	Omni Bearing Selector
MDA	Barometric Minimum Descent Altitude	OFST	Offset
MEPT	Manual Electric Pitch Trim	OOOI	Out of the gate, Off the ground, On the ground, and In the gate
MET	Manual Electric Trim	OXY	Oxygen
METAR	Aviation Routine Weather Report	P ALT	Pressure Altitude
MFD	Multi Function Display	PA	Passenger Address, Proximity Advisory
MFW	Multi Function Window	PASS	Passenger(s)
MGRS	Military Grid Reference System	PC	Personal Computer
MHz	Megahertz	PDC	Pre-Departure Clearance
MIC	Microphone	PFD	Primary Flight Display
MIN	Minimum	PG	Pilot's Guide
Minimum Safe Altitude (MSA)	Uses Grid MORAs to determine a safe altitude within ten miles of the aircraft present position.	PI	Procedure Turn to Course Intercept Leg
MKR	Marker Beacon	PIREP	Pilot Report
MOA	Military Operations Area	PIT, PTCH	Pitch
MON	Monitor	POA	Plain Old ACARS
MOV	Movement	POH	Pilot's Operating Handbook
MORA	Minimum Off-Route Altitude	POHS	Pilot's Operating Handbook Supplement
MPEL	Maximum Permissible Exposure Level	POS, POSN	Position
MPM	Meters per Minute	PPH	Pounds per Hour
MSA	see also Minimum Safe Altitude	PPM	Parts per Million
MSAS	Multi-functional Satellite Augmentation System	P. POS	Present Position
MSG	Message	PRES, PRESS	Pressure
MSL	Mean Sea Level	PROC	Procedure(s), Procedure Turn
MT, M	Meter	PROP	Propeller
mV	Millivolt(s)	PROX	Proximity
MVFR	Marginal Visual Flight Rules	PSI	Pounds per Square Inch
N	North	PT	Procedure Turn
NAV	Navigation		

PTK	Parallel Track	S	South
PTT	Push-to-Talk	SA	Selective Availability
PWR	Power	SAR	Search and Rescue
		SAT	Static Air Temperature
QFE	Field Elevation Pressure	SBAS	Satellite-Based Augmentation System
QNH	Sea Level Pressure	SCIT	Storm Cell Identification and Tracking
QTY	Quantity	SD	Secure Digital
		SEC	Second(s)
R	Right, Right Runway	SEL, SLCT	Select
RA	Resolution Advisory, Radio Altimeter	SELCAL	Selective Calling
RAD	Radial	SENS	Sense
RAD ALT	Radio Altimeter	SFC	Surface
RAIM	Receiver Autonomous Integrity Monitoring	SIAP	Standard Instrument Approach Procedures
RAM	Random Access Memory	SID	Standard Instrument Departure
RAT	Ram Air Temperature	SIG/AIR	SIGMET/AIRMET
RCVR	Receiver	SIGMET	Significant Meteorological Information
REF	Reference	SIM	Simulator
REM	Remaining (fuel remaining), Reminder	SLD	Supercooled Large Droplet
REQ	Required	SLP/SKD	Slip/Skid
RES	Reserve (fuel reserve entered by pilot)	SMBL	Symbol
REV	Reverse, Revision, Revise	SMS	Short Message System
RF	Radio Frequency, Constant Radius Turn to Fix Leg	SNGL	Single
RMI	Radio Magnetic Indicator	SPC	Space
RMT	Remote	SPD	Speed
RNAV	Area Navigation	SPI	Special Position Identification
RNG	Range	SPKR	Speaker
RNP	Required Navigation Performance	SQ	Squelch
RNWy, RWY	Runway	SRVC, SVC	Service
ROL	Roll	SSID	Wi-Fi Service Set Identifier
ROM	Read Only Memory	STAB	Stabilization
RPM	Revolutions Per Minute	STAL	Stall
RST FUEL	Reset Fuel	STAR	Standard Terminal Arrival Route
RSV	Reserve (fuel reserve entered by pilot)	STATS	Statistics
RT	Right	STBY	Standby
RVRSNRY	Reversionary	STD	Standard
RVSM	Reduced Vertical Separation Minimums	STRMSCP	Stormscope
RX	Receive	SUA	Special Use Airspace
		SURF	Surface
		SUSP	Suspend

SVT	Synthetic Vision Technology	TRSA	Terminal Radar Service Area
SW	Software	TRUNC	Truncated
SYNC	Synchronize	TTL	Total
SYN TERR	Synthetic Terrain	TURB	Turbulence
SYN VIS	Synthetic Vision	TURN	Procedure Turn
SYS	System	TWIP	Terminal Weather Information for Pilots
		TX	Transmit
T	True		
TA	Traffic Advisory	UAT	Universal Access Transceiver
TACAN	Tactical Air Navigation System	UHF	Ultra-High Frequency
TAF	Terminal Aerodrome Forecast	UNAVAIL	Unavailable
TAS	True Airspeed, Traffic Advisory System	US	United States
TAT	Total Air Temperature	USR	User
TAWS	Terrain Awareness and Warning System	UTC	Coordinated Universal Time
TCA	Terminal Control Area	UTM/UPS	Universal Transverse Mercator/ Universal Polar Stereographic Grid
TCAS	Traffic Alert Collision Avoidance System		
TEL	Telephone	V	Volts
TEMP	Temperature	V, Vspeed	Velocity (airspeed)
TERM	Terminal	V₁	Takeoff Decision Speed
TF	Track Between Two Fixes Leg	V₂	Takeoff Safety Speed
TFR	Temporary Flight Restriction	V_A	Maneuvering Speed
TGT	Target	V_{APP}, V_{AC}	Approach Climb Speed
T HDG	True Heading	V_{FE}	Maximum Flap Extended Speed
TIS	Traffic Information Service	V_{LE}	Maximum Landing Gear Extended Speed
TIS-B	Traffic Information Service-Broadcast	V_{LNDx}	Approach Speed (Flaps at x°)
TIT	Turbine Inlet Temperature	V_{LO}	Maximum Landing Gear Operating Speed
TKE	see also Track Angle Error	V_{MC}	Minimum Control Speed
TMA	Terminal Manuevering Area	V_{MO} (M_{MO})	Maximum Operating Speed
TMR/REF	Timer/Reference	V_{NE}	Never-Exceed Speed
TOC	Top of Climb	V_R	Takeoff Rotate Speed
TOD	Top of Descent	V_{REF}	Landing Approach Speed, Reference Landing Speed
TOGA, TO/GA	Take-Off, Go-Around	V_{SB}	Maximum Speedbrake Speed
TOLD	Takeoff and Landing Data	V_{SR}	Stall Speed
TOPO	Topographic	V_T	Takeoff Flap Retraction Speed
TORA	Takeoff Run Available	V_{TIRE}	Maximum Tire Speed
TOT	Total	V_X	Best Angle of Climb Speed
TPA	Traffic Pattern Altitude	V_Y	Best Rate of Climb Speed
Track	Direction of aircraft movement relative to a ground position; also 'Ground Track'.	V_{YSE}	Best Single-Engine Rate of Climb Speed
Track Angle Error	The angle difference between the desired track and the current track.	V DEV	Vertical Deviation
TRK	see also Track	VA	Heading Vector to Altitude Leg

VAC	Volts Alternating Current	WATCH	Weather Attenuated Color Highlight
VAPP	VOR Approach	WGS-84	World Geodetic System - 1984
VAR	Variation	WI-FI	Wireless Local Area Network based on IEEE 802.11
VD	Heading Vector to DME Distance Leg	WOW	Weight on Wheels
VDC	Volts Direct Current	WPT	Waypoint(s)
VDL	VHF Datalink	WT	Weight
VERT	Vertical	WW	World Wide
Vertical Figure of Merit	A measure of the uncertainty in the aircraft's vertical position.	WX	Weather
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.	XFER, XFR	Transfer
VFOM	see also Vertical Figure of Merit	XM LTNG	SiriusXM Lightning
VFR	Visual Flight Rules	XPDR	Transponder
VHF	Very High Frequency	XTALK	Cross-Talk
VI	Heading Vector to Intercept Leg	XTK	Cross-Track, Crosstrack Error
VLOC	VOR/Localizer Receiver	YD	Yaw Damper
VM	Heading Vector to Manual Termination Leg		
VMC	Visual Meteorological Conditions		
VNAV, VNV	Vertical Navigation		
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		
VR	Heading Vector to Radial Leg		
VRP	Visual Reporting Point		
VS	Vertical Speed		
VSD	Vertical Situation Display		
VSI	Vertical Speed Indicator		
VSR, VS REQ	see also Vertical Speed Required		
VTF	Vector to Final		
W	Watt(s), West		
WAAS	Wide Area Augmentation System		
WARN	Warning		

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FREQUENTLY ASKED QUESTIONS

If a particular aspect of the G3000 operational capability is not addressed by these commonly asked questions or in the index, contact Garmin (see the copyright page or back cover for contact information) or a Garmin-authorized dealer. Garmin is dedicated to supporting its products and customers.

WHAT IS SBAS?

The Satellite Based Augmentation System (SBAS) uses a system of ground stations to correct any GPS signal errors. These ground stations correct for errors caused by ionospheric disturbances, timing, and satellite orbit errors. It also provides vital integrity information regarding the health of each GPS satellite. The signal correction is then broadcast through geostationary satellites. This correction information can then be received by any SBAS-enabled GPS receiver.

SBAS is designed to provide the additional accuracy, availability, and integrity necessary to enable users to rely on GPS for all phases of flight.

There are several SBAS systems serving different parts of the world. The Wide Area Augmentation System (WAAS) is currently available in the United States, including Alaska and Hawaii. The European Geostationary Navigation Overlay Service (EGNOS) offers coverage of Europe, parts of the middle east and northern Africa. The Multi-functional Satellite Augmentation System (MSAS) covers mainly Japan and parts of northern Australia.

HOW DOES SBAS AFFECT APPROACH OPERATIONS?

LNAV/VNAV and LPV RNAV approaches use the accuracy of SBAS to include vertical (glide path) guidance capability. The additional accuracy and vertical guidance capability allows improved instrument approaches to an expanded number of airports throughout the U.S.

The implementation of RNAV LP and LPV approaches further improves approach capabilities. RNAV LPV approaches are designed to make full use of the improved GPS signal from the SBAS. This approach combines localizer precision lateral guidance with vertical guidance similar to the typical Instrument Landing System (ILS). RNAV LPV approaches allow lower approach minimums.

WHAT IS RAIM AND HOW DOES IT AFFECT APPROACH OPERATIONS?

RAIM is an acronym for Receiver Autonomous Integrity Monitoring. RAIM is a GPS receiver function that performs the following functions:

- Monitors and verifies integrity and geometry of tracked GPS satellites
- Notifies the pilot when satellite conditions do not provide the necessary coverage to support a certain phase of flight
- Predicts satellite coverage of a destination area to determine whether the number of available satellites is sufficient to satisfy requirements



NOTE: If RAIM is not predicted to be available for the final approach course, the approach does not become active, as indicated by the "RAIM not available from FAF to MAP" message and the GPS LOI annunciation flagging on the HSI.

For RAIM to work correctly, the GPS receiver must track at least five satellites. A minimum of six satellites is required to allow RAIM to eliminate a single corrupt satellite from the navigation solution.

RAIM ensures that satellite geometry allows for a navigation solution calculation within a specified protection limit (2.0 nm for oceanic and en route, 1.0 nm for terminal, and 0.3 nm for non-precision approaches). The system monitors RAIM and issues an alert message when RAIM is not available (see Appendix A). Without RAIM, GPS position accuracy cannot be monitored. If RAIM is not available when crossing the FAF, the pilot must fly the missed approach procedure.

WHY MIGHT THERE BE NO APPROACHES AVAILABLE FOR A FLIGHT PLAN?

Approaches are available for the final destination airport in a flight plan or as a direct-to (keep in mind some VOR/VORTAC identifiers are similar to airport identifiers). If a destination airport does not have a published approach, the system indicates “NONE” for the available procedures.

WHAT HAPPENS WHEN AN APPROACH IS SELECTED? CAN A FLIGHT PLAN WITH AN APPROACH, A DEPARTURE, OR AN ARRIVAL BE STORED?

When an approach, departure, or arrival is loaded into the active flight plan, a set of approach, departure, or arrival waypoints is inserted into the flight plan, along with a header line showing the title of the selected instrument procedure. The original enroute portion of the flight plan remains active, unless the instrument procedure is activated. This may be done either when the procedure is loaded or at a later time.

Flight plans can also be stored with an approach, a departure, or an arrival. Note when the current aircraft position is different from the origin of the active flight plan, the active flight plan is erased when the system is turned off. Also, the active flight plan is overwritten when another flight plan is activated. When storing flight plans with an approach, a departure, or an arrival, the system uses the waypoint information from the current database to define the waypoints. If the database is changed or updated, the system automatically updates the information, provided the procedure has not been modified. Should an approach, departure, or arrival procedure no longer be available, the flight plan becomes locked until the procedure is deleted from the flight plan.

CAN “SLANT GOLF” ('/G') AND “SLANT LIMA” ('/L') BE FILED USING THE G3000?

Yes, '/G' may be filed for a flight plan. '/L' may also be filed if the operator is authorized by the FAA for RVSM operation. GPS approaches are not to be flown with an expired database. See the approved Airplane Flight Manual (AFM) 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 manual sequencing of waypoints. Activating OBS mode sets the current active-to waypoint as the primary navigation reference and prevents the system from sequencing to the next waypoint.

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 destination, the CDI scale smoothly transition from 2.0 nm back to 1.0 nm (terminal mode). At 2.0 nm before the FAF during an active approach, the CDI scale transitions down further based on the service level of approach activated (LNAV, LNAV/VNAV, LP, LPV). When a missed approach is activated, the CDI is set to 0.3 nm. See the Flight Instruments Section for more details on CDI scaling.

WHY DOES THE HSI NOT RESPOND LIKE A VOR WHEN OBS MODE IS ACTIVE?

Unlike a VOR, the CDI scale used on GPS equipment is based on the crosstrack distance to the desired course, not on the angular relationship to the destination. Therefore, the CDI deflection on the GPS is constant regardless of the distance to the active waypoint and does not become less sensitive when further away from the destination.

WHAT IS THE CORRECT MISSED APPROACH PROCEDURE? HOW IS THE MISSED APPROACH HOLDING POINT SELECTED?

To comply with TSO specifications, the 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

AIRPORTS

Item	Symbol
Unknown Airport	?
Non-towered, Non-serviced Airport	/
Towered, Non-serviced Airport	/
Non-towered, Serviced Airport	+
Towered, Serviced Airport	+
Restricted (Private) Airport	R
Heliport	H

BASEMAP

Item	Symbol
Interstate Highway	Blue shield
State Highway	Light gray oval
US Highway	Gray shield
National Highway	Medium gray rectangle
City	Dark gray circle
State/Province Border	-- ST/PRV BORDER --
International Border	-- INTL BORDER --
Road	Black solid line
Railroad	Black dashed line
Latitude/Longitude	Dashed blue line

NAVAIDS

Item	Symbol
Intersection	▲
LOM (compass locator at outer marker)	●
NDB (non-directional radio beacon)	●
VOR	●
VOR/DME	●
VOR/ILS	●
VORTAC	●
TACAN	●

AIRSPACE BOUNDARIES

Item	Symbol
ICAO Control Area	Black solid line
Class B Airspace	Black solid line
Mode C Tower Area	Dashed black line
Warning Area	Prohibited Area
Alert Area	Restricted Area
Caution Area	Training Area
Danger Area	Unknown Area
Class C	Black solid line
Terminal Radar Service Area	Purple solid line
Mode C Area	Black solid line
Military Operations Area (MOA)	Pink dotted line

HAZARD AVOIDANCE FEATURES

Feature	Symbol
Terrain Proximity/TAWS display enabled	
Traffic display enabled	
NEXRAD display enabled	
Cloud Top display enabled	
Echo Top display enabled	
XM Lightning display enabled	
Cell Movement display enabled	
SIGMETs/AIRMETs display enabled	
METARs display enabled	
City Forecast display enabled	
Surface Analysis display enabled	
Freezing Levels display enabled	
Winds Aloft display enabled	
County Warnings display enabled	
Cyclone Warnings display enabled	
Loss of hazard avoidance feature (loss of GPS position)	

TRAFFIC

Item	Symbol
Non-threat Traffic	
Proximity Advisory	
Traffic Advisory, Out of Range	
Traffic Advisory	

MISCELLANEOUS

Item	Symbol
ARTCC Frequency or FSS Frequency	
Map Pointer (when panning)	
Elevation Pointer (on Topography Scale when panning)	
Measuring Pointer	
Wind Vector	
Overzoom Indicator	
User Waypoint	
Vertical Navigation Along Track Waypoint	
Parallel Track Waypoint	
Unanchored Flight Path Waypoint	
Top of Descent (TOD)	
Bottom of Descent (BOD)	
Navigating using Dead Reckoning	

OBSTACLE DATABASE

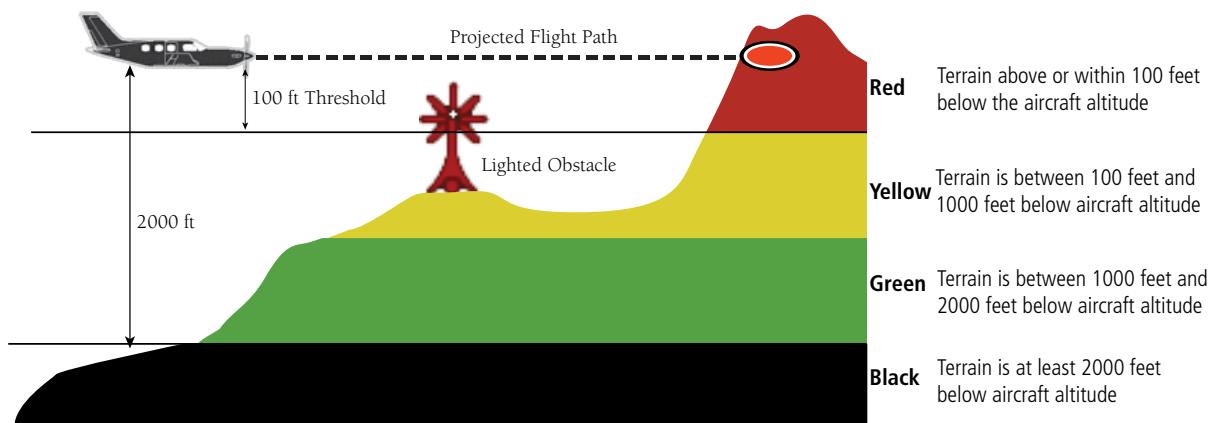


Figure E-1 In-Air Terrain Altitude/Color Correlation for TAWS

Unlighted Obstacle		Lighted Obstacle		Obstacle Location
< 1000' AGL	> 1000' AGL	< 1000' AGL	> 1000' AGL	
				Red obstacle is above or within 100 ft below the aircraft altitude
				Yellow obstacle is between 100 ft and 1000 ft below the aircraft altitude
				White obstacle is more than 1000 ft below aircraft altitude

Table E-1 TAWS Relative Obstacle Symbols and Colors

Potential Impact Area Examples	Alert Type	Example Annunciation
or	Warning	
or	Caution	

Table E-2 Potential Impact Point Areas with Annunciations

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Fax 503.364.2138

Garmin (Europe) Ltd.

Liberty House, Hounslow Business Park
Southampton, Hampshire SO40 9LR U.K.

Tel: +44 (0) 238 052 4000

Fax: +44 (0) 238 052 4004

Aviation Support: +44 (0) 370 850 1243

Garmin Corporation

No. 68, Zhangshu 2nd Road
Xizhi District,

New Taipei City, Taiwan

Tel: 34-93-357-2608

Fax: 34-93-429-4484

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