GARMIN®

AXIS™ Flight Displays
by Garmin

Pilot's Guide for Experimental Aircraft

System Software Version 2.21 or later

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WARNINGS, CAUTIONS & NOTES

The following definitions apply to WARNINGS, CAUTIONS, and NOTES throughout this Pilot's Guide:

⚠ WARNING

Operating procedures, techniques, etc., which may result in personal injury or loss of life in not carefully followed.

⚠ CAUTION

Operating procedures, techniques, etc., which may result in damage to equipment if not carefully followed.

NOTE

Operating procedures, techniques, etc., which are considered essential to emphasize or pay special attention to.

⚠ WARNING

To reduce the risk of unsafe operation, carefully review and understand all aspects of the AXIS™ Pilot's Guide documentation and the Pilot's Operating Handbook of the aircraft. Thoroughly practice basic operation prior to actual use. During flight operations, carefully compare indications from the AXIS to all available navigation sources, including the information from other NAVAIDs, visual sightings, charts, etc. For safety purposes, always resolve any discrepancies before continuing navigation.

⚠ WARNING

The altitude calculated by AXIS internal GPS receivers is geometric height above Mean Sea Level and could vary significantly from the altitude displayed by pressure altimeters. Always use pressure altitude displayed by the AXIS PFD when determining or selecting aircraft altitude.

⚠ WARNING

Do not use outdated database information. Databases used in the AXIS system must be updated regularly in order to ensure the information remains current. Pilots using any outdated database do so entirely at their own risk.

⚠ WARNING

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.

⚠ WARNING

The illustrations in this guide are only examples. Never use the AXIS to attempt to penetrate a thunderstorm. Both the FAA Advisory Circular, Subject: Thunderstorms, and the Aeronautical Information Manual (AIM) recommend avoiding "by at least 20 miles any thunderstorm identified as severe or giving an intense radar echo."

⚠ WARNING

Because of variation in the earth's magnetic field, operating the AXIS within the following areas could result in loss of reliable heading indications. 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 use the approach information provided by the VFR navigation database residing within the AXIS as a means of navigating any instrument approach. The AXIS VFR navigation database is limited to present only the waypoints for the final approach leg of a published procedure. These waypoints and associated course line are made available for monitoring purposes only.

⚠ WARNING

Do not rely solely upon the fuel quantity indications or calculated fuel quantity. It is the responsibility of the pilot to perform proper flight planning and verify that indicated fuel quantity values are accurate prior to each flight.

⚠ WARNING

For safety reasons, AXIS operational procedures must be learned on the ground.

⚠ WARNING

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

⚠ WARNING

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

⚠ WARNING

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

⚠ WARNING

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

⚠ WARNING

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

⚠ WARNING

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

⚠ WARNING

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

⚠ WARNING

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

⚠ WARNING

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

⚠ WARNING

Do not rely on the AFCS to level the aircraft at the MDA/DH when flying a coupled approach with GP or GS Mode active. The AFCS will not level the aircraft at the MDA/DH even if the MDA/DH is set in the altitude preselect.

⚠ WARNING

Navigation is not authorized north of 89° North latitude or South of 89° latitude.

⚠ CAUTION

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

⚠ CAUTION

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

⚠ CAUTION

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

NOTE

The Garmin AXIS has a very high degree of functional integrity. However, the pilot must recognize that providing monitoring and/or selftest capability for all conceivable system failures is not practical. Although unlikely, it may be possible for erroneous operation to occur without a fault indication shown by the AXIS. It is thus the responsibility of the pilot to detect such an occurrence by means of cross-checking with all redundant or correlated information available in the cockpit.

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

The AXIS automatically logs flight data including, but not limited to, primary flight data, engine parameters, and system status information. This data can be downloaded to a flash drive, when the aircraft is on the ground. The downloaded data can be viewed using common computer software. It is not possible to disable the logging of this data and can only be deleted in configuration mode. The AXIS flight display(s) will store the logged data internally and will only be transmitted or transferred in the event that a government agency is investigating an accident or incident involving your aircraft and/or the parties to any resulting legal proceedings that may be related to the aircraft accident or incident.

NOTE

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NOTE

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

NOTE

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

NOTE

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

NOTE

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

NOTE

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

NOTE

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

NOTE

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

NOTE

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

NOTE

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

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

NOTE

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

NOTE

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

NOTE

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

NOTE

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

NOTE

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

NOTE

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

NOTE

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

NOTE

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

NOTE

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

NOTE

Some RNAV (GPS) approaches provide advisory vertical guidance as an aid in flying a stabilized approach. These approaches are NOT considered Approaches with Vertical Guidance (APV). Approaches that are annunciated on the HSI as 'LNAV+V' or 'LP+V' should be flown in compliance with any stepdown altitude constraints and to an MDA, until visual reference with the landing environment is established, even though vertical glidepath (GP) information may be provided.

When flying an autopilot-coupled 'LNAV+V' or 'LP+V' approach with GP Mode active, the aircraft will not level off at the MDA even if the MDA is set in the altitude preselect. A different vertical mode (e.g., VS or FLC) must be selected prior to MDA (as altitude preselect) to arm ALTS Mode.

CHANGE SUMMARY

Part Number	Change Summary
190-03123-21	Initial Release

Rev	Date	Description
A	July, 2026	Production Release
B	October, 2026	Added GDU 80P. Clerical updates for UI changes in software version 2.21. Updated the Engine Indication System.

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SECTION 1 SYSTEM OVERVIEW

1.1 SYSTEM DESCRIPTION

The AXIS™ flight displays offer next-generation avionics capabilities. The system presents flight instrumentation, position, navigation, communication, and identification information to the pilot using full HD (1920x1080) flat-panel color display(s).

The AXIS Flight Display System is a highly configurable Garmin® System that allows the interface of several Garmin avionics units. The AXIS Flight Display System is centered around a panel-mounted touchscreen Garmin Display Unit (GDU) which may be configured as a Primary Flight Display (PFD) in single display installs, or a PFD and Multi-Function Display (MFD) when more than one display is installed.

All functions of the AXIS are controlled by the touchscreen, two Dual Concentric Knobs (DCKs), and six bezel softkeys. Touching any of the buttons on the screen will display a context sensitive window or menu that can be interacted with using the capacitive touchscreen or the dual concentric knobs and softkeys. For more information on system controls, refer to the *Controls* section later in this chapter.

NOTE

This Pilot's Guide provides guidance for common configurations of the AXIS flight displays. Because the system is highly configurable, certain features or functions may differ based on custom settings and Line Replaceable Unit installations. The information presented in this Pilot's Guide is intended to assist the user in understanding core concepts of AXIS flight displays. For more information on specific configurations, settings, and installations not covered in this Pilot's Guide refer to other appropriate resources (e.g. Pilots Operating Handbook, AXIS Installation Manual, other relevant technical documentation or Garmin Product Support).

LINE REPLACEABLE UNITS

The AXIS™ flight display(s) are compatible with the following Line Replaceable Units (LRUs).

LRU DISPLAYS

The AXIS™ flight displays are highly configurable to give the pilot exactly what is desired in a display unit. If one display is installed it is configured as a PFD. If multiple displays are installed, one must be a PFD with the option of configuring the others as additional PFD's or MFD's.

GDU™ 116B/C/NC

The AXIS™ flight displays may be used in multiple configurations. No more than two C/NC models are to be installed in one system.

- 116B GDU — Includes a GPS receiver limited to VFR navigation only. This variant can be used as an indicator for IFR navigation if linked to a compatible external IFR navigator.
- 116C GDU — Includes a GPS receiver that is certified for IFR navigation. This variant also includes a 10W VHF COM radio and optional internal Audio Panel with a four place intercom.

- 116NC GDU — Includes a GPS receiver and a VHF NAV receiver that is certified for IFR navigation. This variant also includes a 10W VHF COM radio and optional internal Audio Panel with a four place intercom.

Figure 1: GDU116

GDU™ 80P/L

The AXIS™ flight displays may be used in multiple configurations.

- 80P/L GDU — Designed for use as a PFD or MFD, this display can be oriented in landscape (L) or portrait (P) configurations, increasing the available customizations of the AXIS flight displays.

Figure 2: GDU 80P (Portrait)

Figure 3: GDU 80L (Landscape)

ADAHRS, AHRS, AND/OR ADC LRU'S

The Air Data, Attitude, and Heading Reference System (ADAHRS) senses aircraft attitude and air data to be used to display primary flight data to the pilot for use by other installed systems. ADAHRS requires GPS and airspeed inputs for aiding the system. AXIS™ requires an interfaced magnetometer to determine magnetic heading and uses an OAT probe to measure the Outside Air Temperature (OAT). An OAT probe is required to display the Static and International Standard Atmosphere (ISA) relative temperatures on the AXIS flight display.

The following LRU's comprise the ADAHRS/AHRS/ADC interface:

- **ADAHRS** — (At least one GSU must be installed to interface with AXIS.)
  - **GSU 25** — (required if a GFC 500X is configured)
  - **GSU 73**
  - **GSU 75**
  - **GRS 77 / 79**
  - 3rd party and other ADAHRS
- ADC
  - **GDC 72 / 74**
- AHRS
  - **LCR 100**
- **Magnetometers** — The Magnetometer measures the local magnetic field and sends data to the (AD)AHRS for processing to determine aircraft magnetic heading.

- GMU 11
- GMU 22
- GMU 44B

- **Temperature Probes** — The Temperature Probe provides raw air temperature data. At least one temperature probe must be installed for each type of AHRS installed in the system.
  - GTP 59

STANDBY INDICATOR LRU'S

NOTE

The G5 and GI 275 are compatible with the AXIS™ flight displays. However, the GI 275 is not capable of communicating with the GFC 500X using the AXIS and may be configured to interface with a third party autopilot.

GI 275

The GI 275 Multi-Function Instrument (MFI) is a fully integrated back-up flight instrument that provides the AXIS™ with control for third party autopilots, revisionary display capabilities, and ADAHRS redundancy. For more information on the GI 275 MFI refer to the appropriate GI 275 documentation.

Figure 4: GI 275 Multi-Function Instrument

G5

The G5 Electronic Flight Instrument is a fully integrated back-up flight instrument that provides the AXIS™ with back-up autopilot control, revisionary display capabilities, and ADAHRS redundancy. For more information on the G5 Electronic Flight Instrument refer to the appropriate G5 documentation.

Figure 5: G5 Electronic Flight Instrument

LRU ADAPTERS

The following Line Replaceable Unit adapters provide different capabilities such as angle of attack information, power stabilization for electrical interfaces, and navigation/GPS/autopilot integration with the AXIS™ flight display(s).

- **GAP 26/GI 260** — The Air Data Probe sends dynamic air pressure data to the ADAHRS for angle of attack (AOA) calculations.
- **GAD 13** — The adapter connects to a compatible OAT probe, converting the gathered information from analog to digital data. It communicates with the system using the CAN Bus.
- **GAD 27** — The GAD 27 provides electronic flap position control, configurable dimming for lighting circuits, 3-axis aircraft trim mixing, “wig-wag” exterior lighting control, configurable discrete inputs, and voltage bus stabilization to keep all essential avionics online during engine startup.
- **GAD 29** — The GPS/Navigation Data Interface Adapter provides one option for the AXIS flight display to interface with IFR GPS LRU's providing GPS steering, WAAS LPV vertical Guidance, HSI map navigation, and coupled VNAV. The GAD 29D can enable the flight display to utilize the GTS 800 series active traffic system (if installed).

COMPATIBLE AUTOPILOT LRU'S

The AXIS™ flight display has a fully integrated Garmin Automatic Flight Control System (AFCS) using the internal GFC 500X (optional) that interfaces with the avionics using the GMC 305, 307, or 507. The AFCS controller allows for remote control of autopilot engagement state, and flight director mode selection. For more information on AFCS system

operation refer to the *Automatic Flight Control System (AFCS)* Section. The following autopilot interfaces are compatible with the AXIS flight display(s).

GMC 305

The GMC 305 provides a user interface for the autopilot and the flight director function of the AXIS™ system.

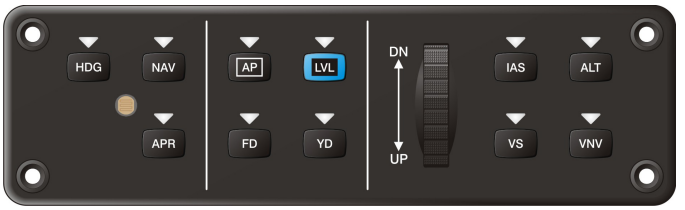

Figure 6: GMC 305

GMC 307

The GMC 307 provides a user interface for the autopilot and the flight director function of the AXIS™ system. It is also able to provide adjustment of the heading and altitude bug.

Figure 7: GMC 307

GMC 507

The GMC 507 provides a user interface for the autopilot and the flight director function of the AXIS™ system. It is also able to provide adjustment of the heading or track bug and the altitude bug.

Figure 8: GMC 507

3RD PARTY AUTOPILOT SYSTEMS

The following 3rd party autopilot systems are compatible to interface with the AXIS™ flight display(s) only if a GAD 29 is installed and configured to interface with the system.

• Trio • Century II • Century 21 • Century 2000 • Cessna 400 IFCS • Cessna 400B IFCS • Collins AP-106/107 • Honeywell KAP 140 • Honeywell KFC 150 • Honeywell KFC 250 • STEC 20, 30, 40, 50, 60-1 • STEC 55 • STEC 3100	• Bendix M4C • Century III • Century 31 • Cessna 400B • Cessna 800 IFCS • Cessna 800B IFCS • Avidyne DFC90 • Honeywell KAP 150 • Honeywell KFC 200 • Honeywell KFC 300 • STEC 60-2, 65 • STEC 1500/2100 AC	• Bendix M4D • Century IV • Century 41 • Cessna 300 IFCS • Cessna 300B IFCS • Cessna 1000 IFCS • Honeywell KAP 100 • Honeywell KAP 200 • Honeywell KFC 225 • Sperry SPZ-200A/500 • STEC 55X • STEC 1500/2100 DC

GSA 28

The Autopilot Servos are used for automatic control of pitch, roll, and yaw.

Figure 9: GSA 28

AUDIO PANEL LRU'S

The AXIS™ flight display is compatible to interface with an installed audio panel LRU. This allows the pilot to remotely control (with the proper audio panel installed) all audio panel functions using the internal audio window presented on the touchscreen display. Refer to the specific audio panel Pilot's Guide for more information pertaining to the capabilities of the audio panel installed.

GMA 245

The GMA 245 Audio Panel provides the traditional audio selector functions of microphone, receiver audio selection, intercom system (ICS), and speaker output. The GMA 245 also contains a COM clearance recorder, USB power jack, and Bluetooth® audio. The GMA 245 is fully integrated with the AXIS™ flight display for remote control of the GMA 245 using the display.

Figure 10: GMA 245

GMA 342

The GMA 342 Audio Panel provides the traditional audio selector functions of microphone and receiver audio selection. The Audio Panel includes an intercom system (ICS), a marker beacon receiver, a COM clearance recorder, and a 3.5 mm music or phone jack (no Bluetooth capability). This GMA 342 has limited integration with the AXIS™ flight display, displaying the MIC selected COM in green (in place of the standard white) on the CNS Bar at the top of the display.

Figure 11: GMA 342

GMA 345

The GMA 345 Audio Panel provides the traditional audio selector functions of microphone and receiver audio selection. The Audio Panel includes an intercom system (ICS), a marker beacon receiver, a COM clearance recorder, USB power jack, and Bluetooth audio. This GMA 345 has limited integration with the AXIS™ flight display, displaying the MIC selected COM in green (in place of the standard white) on the CNS Bar at the top of the display.

Figure 12: GMA 345

ENGINE INDICATION SYSTEM (EIS) AND FULL AUTHORITY DIGITAL ENGINE CONTROL (FADEC) LRU'S

Multiple EIS and FADEC systems may interface with the AXIS™ flight display. These LRU's monitor engine perimeters and process the information to be displayed as gauges, annunciations, and other graphical depictions on the PFD, MFD or both (depending on configuration). For information on EIS/FADEC refer to the appropriate manual, and for more information on the EIS display for the AXIS refer to the *EIS* chapter in this pilot's guide.

The following LRU's are compatible with the AXIS flight display:

- **GEA 24/24B** — An engine indication system that requires communication using the CAN Bus and may also (optionally) communicate with the system via RS-232 for redundancy in the EIS datapath.
- **GSU 73** — An engine indication system that requires communication using the CAN Bus.
- **GEA 110** — An engine indication system that requires using the RS-485 for communication with the system. At least one GDU 116C/NC must be installed on the aircraft for the system to display the data from the GEA 110.
- **GEA 71B** —

The following are third party FADEC compatible LRU's that allow for the engine indications to be displayed on the AXIS:

- **Rotax 91X iS**
- **Lycoming ie2**
- **UL Power**

NAV/COM RADIO AND GPS LRU'S

NOTE

For navigation systems that communicate using High Speed Data Bus (HSDB) between the GPS NAV LRU and AXIS™, the system's GPS CDI indication is "FMS". For navigation systems using a serial connection (the Nav LRU communicates one way to the AXIS) the system's GPS CDI indication is "GPS". When the navigation source is only from the AXIS Display and the display is not qualified for IFR GPS operation, the system's GPS CDI indication is "VFR". For more information on the difference between FMS, GPS, and VFR modes of operation, refer to FMS/GPS/VFR Navigation Systems.

The following LRU's may provide GPS, navigation radio, communication radio, and in many cases the LRU's from the list below provide a combination of those three. For more information regarding a radio or GPS in the following table, refer to the appropriate manual or pilot's guide. For more information on the navigation features of the AXIS flight display(s) refer to the *Flight Management* section of this pilot's guide. For more information in NAV/COM radio features refer to the *Audio and CNS* section of this pilot's guide.

LRU	NAV	COM	GPS
GPS 400W			X
GNC 420W		X	X
GNS 430W	X	X	X
GPS 500W			X
GPS 530W	X	X	X
GNS 480	X	X	X
GTN 725xi			X
GTN 750xi	X	X	X
GIA 64	X	X	X
GTN 625xi			X

LRU	NAV	COM	GPS
GTN 635xi		X	X
GTN 650xi	X	X	X
GTN 725			X
GTN 750	X	X	X
GNC 355		X	X
GNC 255	X	X	
SL 30	X	X	
SL 40		X	
GNC 215	X	X	
GTN 625			X
GTN 635		X	X
GTN 650	X	X	X
GPS 175			X
GNX 375			X
GPS 20A			X
GTR 20		X	
GTR 200(B)		X	
GTR 225		X	
GTR 205/205(R)		X	

CARBON MONOXIDE DETECTOR LRU'S

The following Carbon Monoxide Detectors interface with the AXIS™ flight display to provide prompt alerting should the carbon monoxide exposure reach potentially harmful levels for cabin occupants.

- **GCO 14**
- **ELT**
- **CO Guardian**

TRANSPONDERS AND WEATHER DETECTION LRU'S

GDL 50/50R

The GDL® 50 (a Satellite Datalink Receiver) is a portable transponder unit that receives ADS-B In data and delivers real-time weather and traffic information to the AXIS™ flight display(s) and compatible EFB's. The GDL 50R is a remote mounted option that provides the same Datalink functionality.

It receives dual-band ADS-B traffic (978 UAT and 1090 ES) and subscription-free FIS-B weather, including radar, METARs, TAFs, NOTAMs, and winds aloft.

GDL 52/52R

The GDL® 52 (a Satellite Datalink Receiver) is a portable transponder that receives ADS-B In data and delivers real-time weather and traffic information to the AXIS™ flight display(s)

and compatible EFB's. The GDL 52R is a remote mounted option that provides the same Datalink functionality.

It receives dual-band ADS-B traffic (978 UAT and 1090 ES) and subscription-free FIS-B weather, including radar, METARs, TAFs, NOTAMs, and winds aloft.

The GDL 52 (a Satellite Datalink Receiver) is a portable transponder that combines ADS-B and subscription-based SiriusXM capabilities into a single remote mounted system providing full redundancy and maximum capability. This weather and traffic information is delivered in real time to the AXIS flight display(s) and compatible EFB's. The GDL 52R is a remote mounted option that provides the same Datalink functionality.

The GDL 52R receives dual-band ADS-B traffic and FIS-B weather while also receiving SiriusXM satellite weather and audio, allowing pilots to use both data sources simultaneously. It provides WAAS GPS position, backup attitude (AHRS), and pressure data.

GTX 32X

The GTX™ 32X is a panel-mounted solid-state transponder which provides Modes A and Mode C capability. The GTX 32X has remote interface capability, providing full transponder control using the AXIS™ flight display.

GTX 33X

The GTX™ 33X is a panel-mounted Mode S digital transponder that provides aircraft identification, altitude reporting, and traffic surveillance functions to air traffic control (ATC) and other aircraft. The GTX 33X provides Traffic Information Services (TIS-A) which allows the AXIS™ to display traffic information in real time. The GTX 33X has remote interface capability, providing full transponder control using the AXIS flight display.

GTX 335/335R

The GTX™ 335 operates as a Mode S Extended Squitter (ES) transponder that transmits ADS-B Out on 1090 MHz. It broadcasts aircraft identity, altitude, position, velocity, and heading to ATC and other aircraft using a WAAS GPS source.

The GTX 335R is a remote mounted version of the GTX 335 providing the same functionality but controlled using the AXIS™ flight display interface.

GTX 23/32

The GTX™ 23 operates as a remote Mode S transponder. It responds to ATC interrogations with Mode A/C/S data and does not support ADS-B Out capability.

The GTX 32 operates as a remote Mode A/C transponder. It transmits squawk code and pressure altitude to ATC but does not support Mode S or ADS-B.

GTX 35R

The GTX™ 35R functions as a remote mounted Mode S ES transponder designed to integrate with the AXIS™ flight display(s). It provides ADS-B Out capability and provides control and system-level integration using the AXIS flight display(s).

GTX 45R

The GTX™ 45R operates as a remote mounted Mode S ES transponder with both ADS-B Out and ADS-B In capability. As well as transmitting ADS-B Out data, the GTX 45R receives ADS-B In traffic and weather information, delivering that information to both the AXIS™ flight display systems and compatible mobile/portable devices.

GTX 345/345R

The GTX™ 345 is a panel mounted Mode S ES transponder with both ADS-B Out and ADS-B In capability that interfaces with the AXIS™ flight display(s). It also streams data wirelessly to compatible mobile devices and provides traffic alerts and tracking technology using TargetTrend™. The GTX 345R is a remote mounted version that is controlled using the AXIS flight display interface.

GNX 375

The GNX™ 375 is a panel mounted transponder that combines a WAAS GPS navigator with a Mode S ES transponder. As well as transmitting ADS-B Out data, the GNX 375 receives ADS-B In traffic and weather information, delivering that information to both the AXIS™ flight display systems and compatible mobile/portable devices.

GDL 50

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GDL 50

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GARMIN TRAFFIC SYSTEMS

NOTE

ADS-B In functionality provided by the GTS™ Traffic Systems is only available when no other ADS-B In capable transponders are installed.

Garmin GTS Traffic Systems are a family of Traffic Advisory Systems (TAS) and Traffic Alert and Collision Avoidance Systems (TCAS). The systems feature both active interrogation of aircraft transponders and reception of 1090 MHz Extended Squitter ADS-B broadcasts (ADS-B In).

These LRU's enhance traffic surveillance features and integrate with the AXIS™ flight displays to provide the pilot with flight identification, position, altitude, velocity and heading information of other aircraft within the area.

Product	TAS or TCAS I	Max Range	# Targets Tracked
GTS 800	TAS	22 NM	45
GTS 820	TAS	40 NM	75
GTS 825	TAS	40 NM	75
GTS 850	TCAS I	40 NM	75
GTS 855	TCAS I	80 NM	75

Table 1: GTS Series Range and Targets Tracked

GDL 50

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WX-500 STORMSCOPE

This 3rd party LRU detects electrical discharges associated with thunderstorms within a 200 NM radius of the aircraft. Integration with the AXIS™ flight display(s) allows this lightning data to be displayed directly on the weather application page of the MFW.

GDL 50

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3RD PARTY TRANSPONDERS

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RADIO ALTIMETER/HEIGHT ABOVE GROUND SENSOR LRU'S

The following LRU's provides an AGL altitude reference to be displayed on the PFW and provide terrain awareness integration with the AXIS™ flight display(s):

- **GRA 55/5500**
- **GHA 15**
- **3rd Party RA's**

AVIONICS INFORMATION

The 'LRU Information' Window displays the status, serial numbers, and software version numbers for all detected system LRUs. The system displays a green check for each active LRU. A yellow '!' indicates a failed or missing LRU. Inform a service center or Garmin® dealer if an LRU has failed. Pertinent information about the airframe including the system ID number, system software version number, and aircraft IDs can be found by touching the AXIS™ button in the 'LRU Information' Window.

Figure 13: Viewing LRU Information

1.2 SYSTEM CONTROLS AND DISPLAY

NOTE

Only Projective Capacitive (PCAP) gloves (but not all) are compatible with Garmin touchscreen displays. During aircraft preflight, while on the ground, verify that gloves are compatible with Garmin touchscreen displays. Refer to Appendix D for more details on glove selection and qualification. If in flight and gloves are no longer effective, either use the bezel controls or remove gloves.

The system controls simplify operation, minimize crew workload, and reduce the time required to access sophisticated functionality. The system is controlled by buttons and knobs on the bezel and touchscreen interaction. The Display Units are discussed in this section.

DISPLAY OVERVIEW

When the AXIS™ flight display is configured as a Primary Flight Display, it will have a primary function of displaying all critical flight information (e.g. attitude, heading, air data and navigation information) on a Primary Flight Window (PFW). The secondary function of a PFD will be to display supplemental flight information on a Multi-Function Window (MFW). If a flight display is configured as a PFD, the PFW will always be displayed with the option to split the display into two 'windows' as a PFW and MFW.

When the AXIS flight display is configured as a Multifunction Display (MFD) the primary function of the display will be to display supplemental flight information that provides pilot awareness of factors that may affect the overall conduct of the flight. The MFD may also display a PFW. The display can be expanded to show only one MFW (full-screen), or it can be

separated (split-screen) into two MFW's for a greater sense of situational awareness. (Refer to *Switching between Full and Split Screen* for more information)

Figure 14: Display Overview (Split-Screen)

PFD AND MFD DISPLAY EXAMPLE

A typical dual display panel would have the left GDU configured as a full-screen PFD and the right GDU configured as a full-screen MFD.

Figure 15: PFD/MFD Option Example

DUAL PFD WITH MFD DISPLAY EXAMPLE

A three panel display will have the left and right GDU configured as a full-screen PFD and the center GDU configured as a full-screen MFD.

Figure 16: Two PFDs with an MFD

DUAL DISPLAY GDU™ 116 AND GDU 80P

The GDU 80P/L displays can be incorporated into the flight deck options increasing the customization of the display layout in the cockpit.

PFD (GDU 116)

MFD (GDU 80P)

Figure 17: GDU 116 (PFD) with GDU 80P (MFD)

USING AXIS FLIGHT DISPLAYS WITH AN EXTERNAL GPS NAVIGATOR

⚠ WARNING

If a 116C/NC fails and navigation reverts to a 116B, do not use the approach information provided by the internal navigation of the GDU™ 116B (VFR only) as a means of navigating any instrument approach. The consumer GPS provided in the GDU 116B AXIS™ flight display does not provide IFR qualified GPS data and is not suitable for IMC flight. These waypoints and associated course lines are made available for monitoring purposes only.

⚠ CAUTION

IFR external navigation may only be used if the CDI Source on the PFD is synced to the external navigation source.

NOTE

No approach vertical guidance will be provided for published instrument procedures when loaded into the GDU 116B AXIS flight display.

NOTE

If unsure whether or not your system uses an RS 232 connection for external GPS navigators contact your dealer or Garmin Product Support for clarification.

NOTE

The GDU 116B internal GPS flight plan is for VFR use only.

In a configuration which includes one or more external GPS navigators (i.e., GTN or GNS Series), the AXIS flight display presents the selected external GPS Navigator's flight plan and guidance information on the PFW and MFW. When a serial GPS/NAV/COM LRU is connected to the AXIS the **CDI** Selection Button will display the available functions for that CDI. Example: if the external nav unit is capable of providing GPS and VOR/LOC navigation, the button will indicate "GPS VOR" or "GPS LOC". The button will have the currently selected navigation source displayed by highlighting it by the appropriate navigation color; satellite based navigation is displayed in magenta and radio based navigation in green. The CDI source that is not currently selected will be displayed in white. The radio navigation indication of VOR or LOC changes based on the tuned frequency in the navigator.

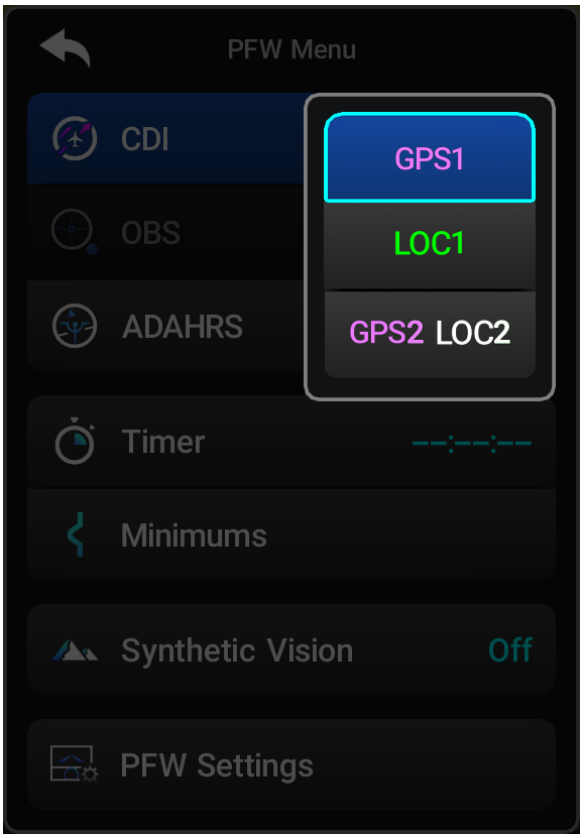


Figure 18: CDI Source Button Indications

When an external navigator is configured the internal GPS can still be used for VFR navigation unless one of the following HSDB navigation LRU's are installed:

- **GPS 175**
- **GNX 375**
- **GTN 625Xi**
- **GTN 725Xi**
- **GNC 355**
- **GDU 116C**
- **GTN 635Xi**

SYNCING THE CDI SOURCE TO AN EXTERNAL GPS NAVIGATOR:

1 Access the 'PFW Menu':
   a) Touch the HSI on the PFW.
   Or:
   a) Press the **MENU** Softkey on the PFD. (Use the PFW side of the display when in split screen mode.)
2 Touch the **CDI** Selection Button.
3 Touch the desired external GPS source if one is available.

USING A USB-C FLASH DRIVE

NOTE

Refer to Appendix B for more information on USB-C use and databases.

NOTE

Ensure the system is powered off before inserting the USB-C.

NOTE

Use a 32 GB (minimum), solid state USB stick to perform database updates through the panel mounted USB Data Loader.

The AXIS™ flight display USB-C Port uses a solid state USB stick with at least 32 GB of memory space and is located in the center of the bezel beneath the display. A flash drive can be used for software updates, checklist files, flight data logging, exporting Track Logs/User Waypoints, and Importing/Exporting Flight Plans.

INSERTING A USB STICK:

Gently push the flash drive in the USB-C port on the GDU bezel.

REMOVING A USB STICK:

Gently pull the flash drive from the USB-C port on the GDU bezel.

CONTROLS

The AXIS™ flight display is controlled using the buttons and knobs on the bezel of the GDU™. As well as the bezel controls, the AXIS flight display features a touchscreen with selectable buttons for displaying menus, keypads, system alert window messages, and selecting full and split-screen options. The display recognizes input based on a touch or a gesture (such as sliding a finger). It is not necessary to apply pressure, as the touchscreen surface detects only the presence and movement of the finger, not pressure.

BEZEL CONTROLS

1	**DCK**	The dual concentric knobs are used to navigate the AXIS™ system. The **DCK** can also be pushed for selection of different data fields.
2	**BACK** Softkey	Press to return to the previous screen. (MFW side) Press and hold to return to the base-level of the active application. If already at the base-level of any application, pressing and holding will toggle the display between split and full screen. (PFW side) Press and hold to toggle between full-screen and split-screen modes.
3	**MENU** Softkey	Press once to view the active windows application menu. Press a second time to open the 'Apps' Window.
4	**EMER** Softkey	Press once to display the emergency window. Long press to activate Smart Glide™ if enabled
5	**Direct-To** Softkey	Press to activate the Direct-To function, enter a destination waypoint and establish a direct-to course to the selected destination. Long press to activate Smart Glide if enabled

KNOB OPERATION

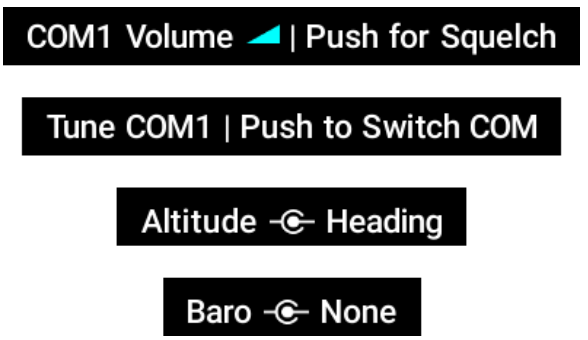
The display bezel is equipped with two dual-concentric knobs (DCKs). These DCK knobs have a large outer knob and a small inner knob that can be used for system navigation on the display. After navigating to specific locations on the display, the DCK knobs can be pressed inward to select the highlighted button. On the PFD the DCKs are pilot configurable and can be used for altitude bug selection, heading bug adjustments, barometric pressure adjustments, course adjustments, communication radio tuning, and communication radio volume. If the DCKs are pressed while on the PFW they will sync the heading bug to the current aircraft heading, sync the barometric pressure between standard atmospheric pressure (STD) and the previous barometric setting, switch between COM1 and COM2 (if multiple communication radios are configured), and/or squelch the active communication radio depending on pilot configuration.

The default settings on the PFD for the left DCK controls the altitude bug (outer knob) and heading bug (inner knob). Pressing the left DCK will sync the heading bug to the current aircraft heading. The default setting for the right inner DCK will control the HSI course selection (in OBS mode) or the VLOC course, depending on the current CDI source. The default setting for the right outer DCK will control the barometric setting. Pushing the right DCK will adjust the barometric setting to the standard (STD) setting. Using the DCKs for radio controls is also available to be configured by the pilot. The COM Tuning function will allow the user to adjust the standby frequency of the active communication radio; The outer knob adjusting the MHz, the inner DCK adjusts the decimal places of the frequency, and pushing the knob switches between COM1 and COM2 (if two communication radios are configured). The COM Volume function will allow the pilot to control the squelch (push the DCK then turn to adjust) or adjust the volume of the active radio.

The MFW does not support pilot configuration. The controls the DCKs on the MFW provide control of the specific application or window that is being displayed.

When the display is in split screen mode (PFW/MFW) the DCK on the PFW side of the display will continue to control the default setting for that DCK. The function of the DCK knob is displayed above it to show the user what it controls. The ability to switch the DCK controls is accessed through the PFW Settings window.

Figure 19: DCK Knob Function Display



CUSTOMIZING PFW KNOB ACTIONS:

NOTE

Navigation of procedures by the pilot may be completed by using the touch screen features, softkeys on the bezel, and/or the Dual Concentric Knobs on the AXIS™ flight display(s). Unless otherwise noted, most procedures are written to utilize the touchscreen feature but may also be navigated by using the softkeys and Dual Concentric Knobs for redundancy in the case of a touch screen failure.

1 Access the 'PFW Settings' on the PFD:

a) Press the **MENU** Softkey (on the PFW side of the bezel while in split screen mode) to open the 'PFW Menu'.

Or:

a) Touch anywhere within the HSI to open the 'PFW Menu'

b) Touch the **PFW Settings** Button.

2 To access the 'PFW Menu' on the MFD:
   a) Display the PFW on the MFD by touching the **Applications** Icon **> Primary** Tab **> PFW**.
   b) Complete steps 1a / b.
3 Scroll to and touch **Primary Knob Action** Selection Button or **Secondary Knob Action** Selection Button.
4 Select the desired action for the left or right FMS knob.

TOUCHSCREEN CONTROLS

Selectable buttons on the PFW/MFW display feature rounded corners and a slightly different colored background. Some selectable buttons, such as OBS or CRS, are displayed when the appropriate FMS Navigation Mode is selected.

An AXIS™ flight display may be split into two windows. A PFD can be split to display a PFW (or traditional primary flight display) on one side of the screen, and a MFW (traditional multi-functional display) on the other side of the screen. A MFD can be split to display two separate MFW's to enable the pilot to have greater situational awareness during the flight.

The screen can be toggled between Full and Split in the following ways:

- Touch the **Split** / **Full** Button located in the top right or left corner of the display.
- Press and hold the **BACK** Softkey for approximately two seconds.

When the display is in split screen mode, the softkeys on the bezel will control the corresponding side of the display.

Figure 20: PFW Selectable Buttons

The EIS display strip (if enabled) is also selectable for quick navigation to the Engine Application Page on the MFW. For more information refer to the *EIS section*.

MFW APPLICATIONS BAR

The MFW Applications Bar (App Bar) appears below the MFW. All applications on the App Bar are also available for selection through the **Applications** Icon in the far right corner of the App Bar. The icons on the App Bar can be touched to access the specific page, or the Outer **DCK** may be used to cycle through the pages.

Figure 21: MFW Applications Bar

When the space is limited on the Applications Bar for all the available app icons (usually in Split-Screen Mode), an arrow appears to the side of the bar that has hidden applications. To access the hidden applications on the bar, the Outer **DCK** must be used to navigate to that app page.

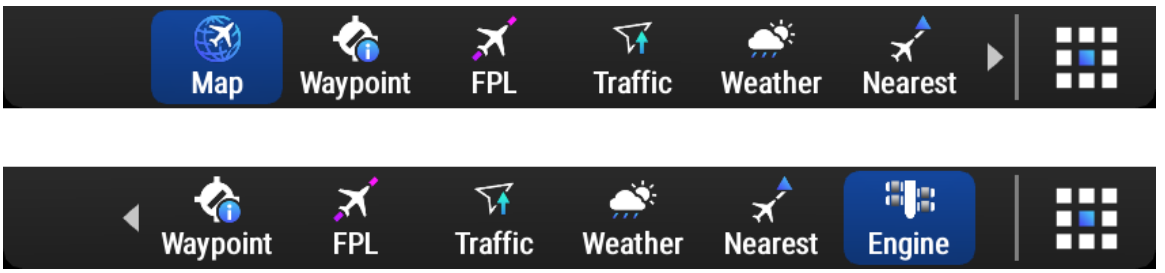


Figure 22: Hidden Apps on the Applications Bar

The **Applications** Icon may also be touched to access other system settings and tools.

COMMUNICATION AND NAVIGATION STATUS (CNS) BAR

The Communication and Navigation Status (CNS) Bar appears across the top of the AXIS™ flight display. It is always present during system operation and is accessible at any time. Some functions on the CNS Bar will cause another screen to be displayed. Touching the **Back Arrow** or **BACK** Softkey will return to the previous screen. For more information on the CNS Bar, refer to the *4 Audio and CNS* section.

Figure 23: CNS Bar

DATA BAR

The Data Bar is the strip of data that is displayed across the top of the AXIS™ flight display. It is able to display many pertinent fields of data for the pilot to have quick reference to. Up to eight fields of data from the following list can be displayed across the top of the screen. The amount of data fields displayed depend upon the amount of space available on the CNS bar. If, for example, only one communication radio and one navigation radio are displayed, the amount of available space in the upper portion of the screen is enough to display eight fields of data. If the Emergency Button (**EMER**) is then enabled to be displayed, the space at the top of the

screen is prioritized to fit the most pertinent information, consequently removing the last data field from the data bar.

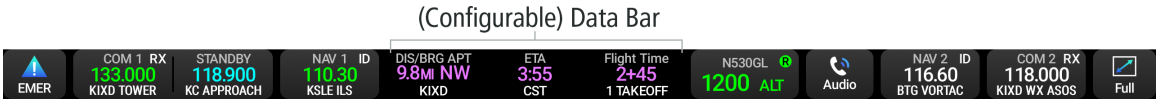


Figure 24: (Configurable) Data Bar

- Bearing to Next Waypoint
- Distance/Bearing to Destination
- Desired Track to Next Waypoint
- Estimated Time of Arrival at Destination
- Estimated Time Enroute to Next Waypoint
- Glide Ratio
- Landing Field Elevation
- Mach Number
- Radar Altitude
- True Airspeed
- Time Over Target (Next)
- VOR/LOC Info
- Ceiling and Visibility at Destination
- Current Cabin Altitude
- Destination
- Enroute Safe Altitude to Destination
- Estimated Time of Arrival at Next Waypoint
- G Meter
- Ground Speed
- Local 12H Time
- Minimum Safe Altitude
- Ram Air Temperature
- Track Angle Error
- Current Track
- Vertical Speed Requirement
- Cross-Track error
- Current Climb Gradient
- Density Altitude
- Enroute Safe Altitude to Next Waypoint
- Estimated Time Enroute to Destination
- GPS AGL Altitude
- Difference from STD TEMP
- Local 24H Time
- Present Position Lat/Lon
- Current Time at Destination
- Time to Top of Descent
- UTC Time
- Winds at Destination
- OFF

Table 2: Optional Data Bar Fields

ADDING/REMOVING DISPLAY FIELDS IN THE DATA BAR:

NOTE

Navigation of procedures by the pilot may be completed by using the touch screen features, softkeys on the bezel, and/or the Dual Concentric Knobs on the AXIS™ flight display(s). Unless otherwise noted, most procedures are written to utilize the touchscreen feature but may also be navigated by using the softkeys and Dual Concentric Knobs for redundancy in the case of a touch screen failure.

1. Navigate to the 'Apps' window:
   a) Press the the **MENU** Softkey two times.

      Or:

   a) Touch the **Applications** Icon on the App Bar.
2. Touch the **Settings & Tools** Tab.
3. Touch **Display > Data Bar > Max Displayed Field Count** Selection Button.
4. In the 'Max Displayed Field Count' Window, touch the number of display fields to be displayed on the Data Bar.

CHANGING DATA FIELDS ON THE DATA BAR:

1 Navigate to the 'Apps' window:
   a) Press the the **MENU** Softkey two times.
      Or:
   a) Touch the **Applications** Icon on the App Bar.
2 Touch the **Settings & Tools** Tab.
3 Touch **Display > Data Bar > Change Data Fields**.
4 Select the data field to be changed. A list will open of all the optional data fields.
5 Touch the desired data to be displayed.

RADIAL MENU

The Radial Menu is displayed by touching anywhere on the 'Map' Application Page of the MFW. The Radial Menu displays context-sensitive buttons for information found within the inner radius of the menu. The context sensitive buttons provide details for airports, navigation aids, airspace, airways, obstacles, traffic, logbook tracks, elevation, estimated time enroute, and weather products. No matter where the Radial Menu appears, it will always provide the option to navigate direct to the location, create a user waypoint or graphically create/edit a flight plan. To reposition the Radial Menu, simply tap-drag it to a new location. Tap outside of the Radial Menu to close. Navigation data must be downloaded in order to make use of the Radial Menu. For more information refer to the *Radial Menu* section in the Flight Management chapter.

Radial Menu Symbol	Description	Radial Menu Symbol	Description
	Airport		Hot Spot
	Airspace		NOTAM
	Airway		Obstacles
	Create Waypoint		Menu
	Direct-To		METAR
	Datalink Radar		User Waypoint
	Intersection		Insert in Flight Plan
	More		Reroute
	NDB		Insert Flight Plan
	VORTAC		User Airspace
	Visual Reporting Point (VRP)		

Table 3: Radial Menu Symbols

Information displayed in the Radial Menu is determined by what is set in the Map/ Chart Settings. For example if airspace is turned off in the Map Settings, airspace information will not be presented in Radial Menu searches.

ACCESSING THE RADIAL MENU:

1 With the 'Map' Application Page displayed on the MFW touch anywhere on the map to display the **Radial** Menu.
2 Touch anywhere outside of the **Radial** Menu to exit.

REPOSITIONING THE RADIAL MENU:

1 With the 'Map' Application Page displayed on the MFW touch anywhere on the map to display the **Radial** Menu.
2 Touch and hold inside the **Radial** Menu and drag to reposition over a new area.

ENABLING/DISABLING MAP FEATURES/DETAILS:

NOTE

Navigation of procedures by the pilot may be completed by using the touch screen features, softkeys on the bezel, and/or the Dual Concentric Knobs on the AXIS™ flight display(s). Unless otherwise noted, most procedures are written to utilize the touchscreen feature but may also be navigated by using the softkeys and Dual Concentric Knobs for redundancy in the case of a touch screen failure.

1 Access the 'Map' application:
   a) Touch the **Map** Button on the MFW App Bar.

      Or:

   a) Touch the **Applications** Icon on the MFW App Bar.
   b) Touch the **Map** Button.

      Or:

   a) Use the Outer **DCK** (on the MFW side of the PFD while in split screen mode) to scroll to the 'Map' application.
2 With the 'Map' application displayed on the MFW, press the **MENU** Softkey (on the MFW side of the PFD while in split screen mode) to open the 'Map Menu' Window.
3 Touch the **Map Settings** Button
4 Touch one of the following tabs to display a list of features and/or details to be displayed on the Map Page.
   - **Weather** Tab
   - **Aviation** Tab
   - **Airspace** Tab
   - **Land** Tab
5 Touch the desired feature or detail to be enabled or disabled (green indication signifies it is enabled).
6 To navigate back to the Map application, touch the **Back Arrow**, press the **BACK** Softkey, or press and hold the **BACK** Softkey.

HORIZONTAL AND VERTICAL SLIDERS

Some adjustments are made using horizontal or vertical sliders. To use sliders, 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. When a horizontal or vertical slider window is present on the display, the Inner **DCK** is a redundant source of control for the movement of the slider.

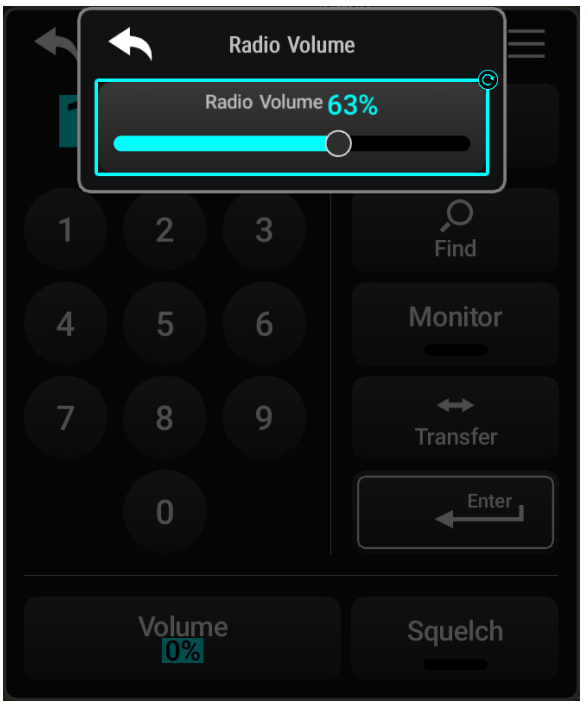


Figure 25: Slider Adjustments

SCROLL BAR AND TABS

A scroll bar appears when content exceeds the visible display area. To scroll, place and hold your finger within the scrollable area, then drag it up or down. Dragging your finger more rapidly increases the scrolling speed. Scrolling can also be performed by turning the Inner **DCK** when the cursor is present inside the scrollable content. Some windows provide tabs grouping multiple categories of information or buttons. Touch the desired tab to display its contents and manage settings or information. The selected tab is highlighted in blue.

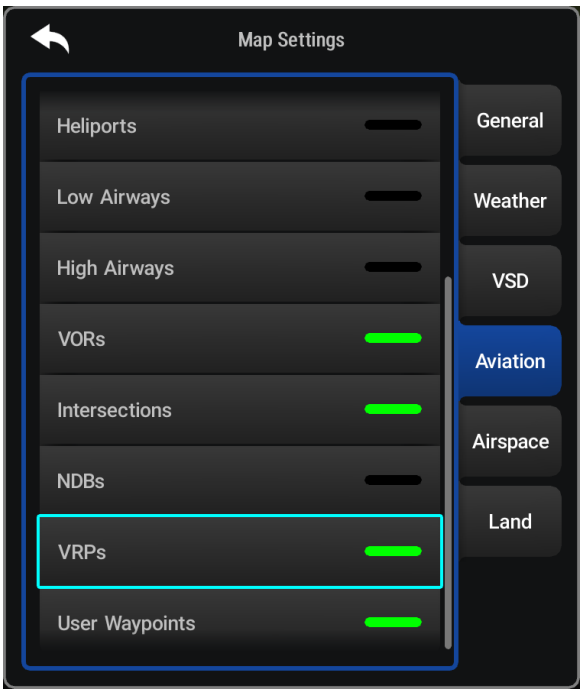


Figure 26: Tabs and Scroll Arrows

SUBDUED ELEMENTS

Elements on the displays (such as buttons and sliders) may appear subdued to indicate their functions are currently not available. When an element is subdued, it normally indicates that there are optional procedures to be completed before the subdued element will become available.

Figure 27: Subdued Buttons

ANNUNCIATION BUTTONS

Annunciation buttons operate in an on/off state. An 'on' (or enabled) button displays a green annunciator. An 'off' (or disabled) button displays a subdued (black) annunciator. Touch the annunciation button to change its state. Annunciation buttons are present on all display types.

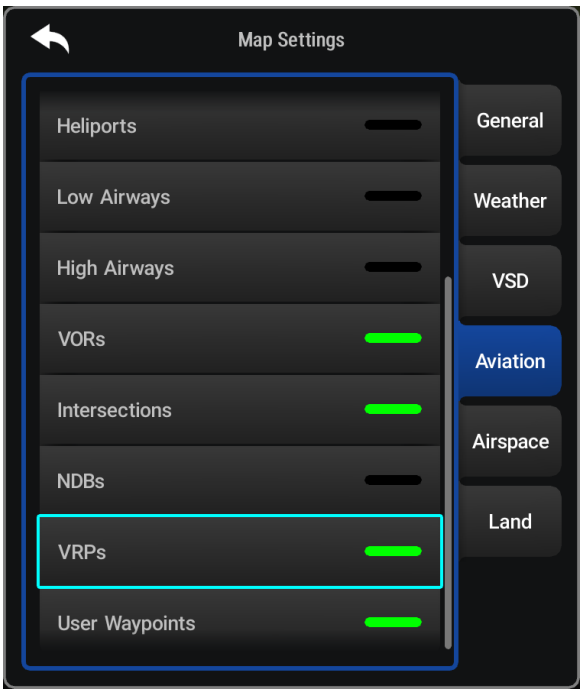


Figure 28: Annunciation Buttons

DATAFIELD BUTTONS

Datafield buttons can be modified based on information the crew can enter or change, and often contain cyan alphanumeric text. Touching datafield buttons will display a pop-up alphanumeric keypad, numeric keypad, or date selection window to input the data. Refer to the *Data Entry* portion of this section for more information.

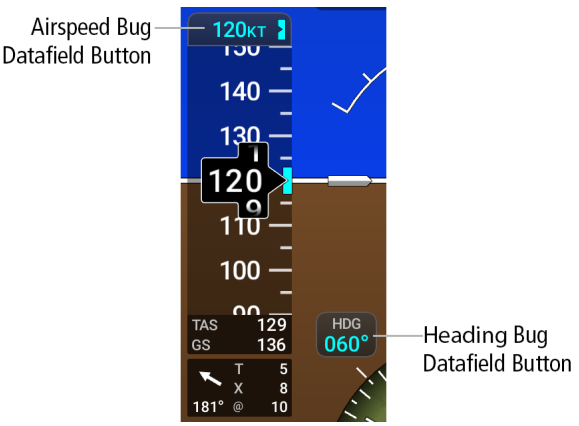


Figure 29: Datafield Buttons

SELECTION BUTTONS

Selection buttons are Datafield Buttons where touching the button allows the user to usually select from a list of options for the field. The current selection is always displayed in cyan. In some cases, each touch cycles through available options; in others, touching the button opens a second window that lists available options. Scroll as needed and select the desired option, the highlighted blue button indicates the currently selected option or setting.

Figure 30: Selection Buttons

BUTTONS IN SYSTEM FAILURE

NOTE

Refer to the original POH, Aircraft Flight Manual, or Supplemental AFM for pilot actions in cases of system failure.

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

Figure 31: Failed Transponder Button

DATA ENTRY

Alphanumeric and numeric keypads are made available for directly entering data (e.g., waypoint identifiers, barometric minimum descent altitude) into the system. In some instances, such as when entering an identifier, the system's FastFind function will try to predict the identifier using predictive logic based on the characters being entered and current location. In these cases, if the desired identifier appears at the bottom of the kyepad window, touch it to confirm the entry without entering the rest of the identifier manually. The pilot also has the

option to use the **DCK** to enter data by using the inner knob to change the character and the outer knob to advance to the next character in the data field. Push the **DCK** to confirm the entry.

The alphanumeric keypad layout will have alphanumeric keys together in one display. Refer to the *Flight Management* Section for details on using this flight planning alphanumeric keypad for route (waypoint and airway) entry. All other functions requiring a keypad will utilize keypads that display alphabetic or numeric keys separately.

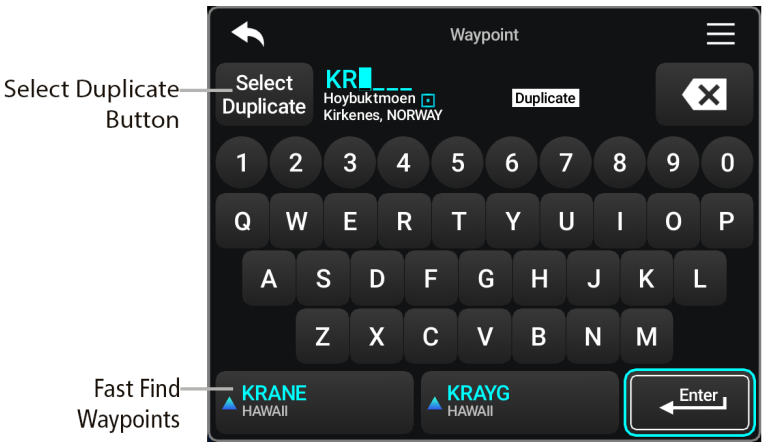


Figure 32: Alphanumeric Keypad

Besides character-by-character data entry, the system also provides a shortcut for entering waypoint identifiers. 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.

As a waypoint identifier is being entered the 'Fast Find' function will populate waypoints below the alphanumeric keyboard to allow for quick selection of nearby waypoints that begin with the same characters.

When an identifier has been entered and multiple waypoints exist with that same identifier, the **Find** Button is replaced with a **Select Duplicate** Button. Touching this **Select Duplicate** Button will open a list of all waypoint duplicates.

USING THE KEYBOARD TO ENTER ALPHANUMERIC DATA:

1 Touch the desired letters and/or numbers.

Or:

Using the **DCK**, turn the inner knob to change the character and turn the outer knob to advance to the next character in the data field.

2 Touch **Enter** Button.

Or:

Push the **DCK** to accept the entry.

USING THE DUAL CONCENTRIC KNOBS TO ENTER DATA ON THE KEYBOARD:

1 Turn the inner or outer **DCK** on the side of the display the keypad is on to activate the cursor.
2 Turn the Inner **DCK** to cycle through letters and numbers of the selected character space.
3 Turn the Outer **DCK** clockwise to move the cursor to the next character position.

Or:

Turn the Outer **DCK** counterclockwise to move the cursor to the previous character position.

4 Repeat steps 2 and 3 as necessary.
5 Push the **DCK** to accept the entry.

USING THE FIND FUNCTION:

NOTE

Navigation of procedures by the pilot may be completed by using the touch screen features, softkeys on the bezel, and/or the Dual Concentric Knobs on the AXIS™ flight display(s). Unless otherwise noted, most procedures are written to utilize the touchscreen feature but may also be navigated by using the softkeys and Dual Concentric Knobs for redundancy in the case of a touch screen failure.

1 Touch **Find**.
2 Touch **Recent**, **Nearest**, **Flight Plan**, **Favorites**, or **Search** Tab.
3 Touch the desired waypoint from the list.
4 If using the **Nearest** Tab:
   a) Touch the **Type** Selection Button.
   b) Touch the desired type of nearest waypoint to be displayed.

   Or:

   a) Touch the left and right arrows of the **Type** Selection Button to scroll through the available options for the type of nearest waypoints.
5 If using the **Search** tab:
   a) Touch the **Search Term** Datafield Button, opening an alphanumeric keypad.
   b) Enter the desired airport, waypoint, intersection, or city to be searched using the alphanumeric keyboard and touch the **Enter** Button.
   c) Scroll the displayed list of locations and touch the desired button to select it. If no search results are displayed, "No items to display" is displayed in the window.

CALENDAR DATE DATAFIELD BUTTON

In rare circumstances a date will need to be entered for certain criteria. In these cases, a date selection window will open displaying a calendar. To the left of the calendar are a **Year** Selection Button and **Month** Selection Button. Touching the **Year** or **Month** Buttons allows the pilot to select from a list of years and months. The calendar will be displayed outlining every day of the selected year/month the previously displayed day will appear shaded in blue, and the day that will be selected is outlined in cyan. To select a day, the pilot can scroll through the days using the Inner **DCK** and then select the desired date by pushing the **DCK**, or simply

touch the day of the month displayed to be selected. No **Enter** Button appears to accept the entered date, instead, the window will close as soon as the day of the month is selected.

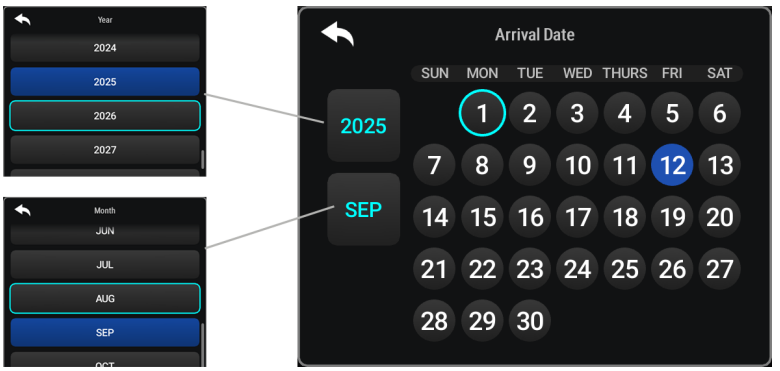


Figure 33: Date Selection Window

1.3 SYSTEM OPERATION

This section discusses applying power to the system, initialization, normal and reversionary display operation, system status, ADAHRS modes of operation, and GPS receiver operation.

APPLYING POWER TO THE SYSTEM

NOTE

Refer to the current version of the pertinent flight manual for specific procedures concerning avionics power application and emergency power supply operation.

NOTE

Refer to Appendix A for system-specific annunciations and alerts

The system is integrated with the aircraft electrical system and receives power directly from electrical busses. The AXIS™ flight display and its supporting sub-systems include both power-on and continuous built-in test features that exercise the processors, memory, and external inputs/outputs to provide safe operation.

When power is applied, the PFW momentarily displays test annunciations, which should extinguish typically within the first minute of operation. On the PFW the Air Data and Attitude and Heading Reference System (ADAHRS) begins to initialize. The ADAHRS should display valid attitude and altitude typically within the first minute of operation.

Figure 34: System Initialization

SYSTEM INITIALIZATION

Initialization is the process of performing system checks and entering data required to enable FMS functions. Complete initialization before each flight using the Initialization screen, which appears when power is applied. During this process, review database status, set or verify fuel values, and review aircraft and engine tachometer readings.

NOTE

*If the database status information is amber, touch the **View** Button opening the database page to view more detailed information. Refer to Appendix B (Database Information) for more information.*

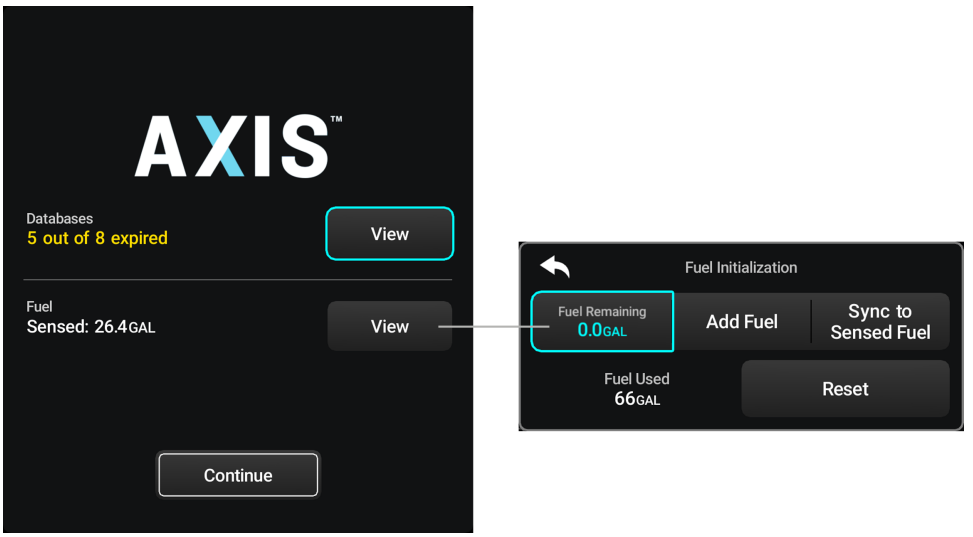


Figure 35: Database Information

To acknowledge the initialization screen touch the **Continue** Button, any field on the CNS Bar, the PFW keyboard, or any bezel softkey.

NORMAL OPERATION

NOTE

Refer to the AXIS™ flight display installation manual for more information on configuring the displays.

DISPLAY UNITS

In normal operations, the PFW(s) present graphical flight instrumentation (attitude, heading, airspeed, altitude, vertical speed) in either Full Screen or Split Screen Mode. In Full Screen Mode, the PFW occupies the entire display area. In Split Mode, the PFW is condensed to accommodate an MFW on the inboard portion of the display, with the PFW shown on the outboard portion of the display, reduced in size.

The MFD can be set by the pilot to display a single MFW in Full Screen Mode or can be split to display two MFWs or a PFW and MFW side-by-side in Split Mode. In normal operations, the MFW(s) present flight applications to allow for reduced workload and greater situational awareness.

Any display can select Full or Split Screen Mode.

Figure 36: PFD in Full Screen Mode

Figure 37: PFD in Split Screen Mode

Figure 38: MFD in Full Screen Mode

Figure 39: MFD in Split Screen Mode

SWITCHING BETWEEN FULL AND SPLIT SCREEN:

Touch the **Split** or **Full** icon in the upper corner of the screen.

Or:

Press and hold the **BACK** Softkey to toggle between split and full screen.

ENABLING/DISABLING THE PFW ON THE MFD:

1 Navigate to the 'Apps' window by pressing the **MENU** Softkey two times.

Or:

Touch the **Applications** Icon on the Applications Bar.

2 If necessary, touch the **Primary** Tab.

3 Touch the **PFW** Button to display the PFW on the MFD.

4 To disable the PFW on the MFD, follow steps 1 and 2 then touch the **Exit PFW** Button.

Or:

Touch the Back Arrow above the Airspeed Indicator,

PFD/MFD DEFAULT PAGE CONFIGURATION

The "Startup Mode" of the display may be configured by the pilot to display a desired layout of the screen after system initialization when power has been applied to the display. By default in single PFD installations, the "Startup Mode" is set to split and the MFW is configured to show the 'Map' Application Page. The "Startup Mode" can be set to **Split** or **Full** and any MFW page may be set by the pilot to be the default startup application page after system initialization.

CONFIGURING THE DEFAULT MFW STARTUP PAGE:

1 Navigate to the 'Apps' window by pressing the **MENU** Softkey two times.

Or:

Touch the **Applications** Icon on the Applications Bar.

2 Touch the **Settings & Tools** Tab.

3 Touch **Display > Startup Page**.

4 Select the desired page to be displayed on start up from the list of options.

PFW/MFW OPTIONS

On the PFD, pressing the **MENU** Softkey Key (on the PFW side of the bezel while in split-screen mode) or anywhere on the HSI at any time will open the 'PFW Menu' window. The pilot can access the **Timer**, **Minimums**, **Synthetic Vision**, and **PFW Settings** options in this window. Touching the **Applications** Icon or pressing the **MENU** Softkey twice will open the 'Apps' window providing access to all the applications on the Applications bar (in the **Primary** Tab) and other system features using the **Quick Actions** Tab and the **Settings & Tools** Tab. The selected application will open on the screen being used. The **Primary** Tab in the 'Applications' Menu allows the pilot to select from the following (when enabled):

Icon	Application	Description
	Application Menu	Permanently fixed to the Applications Bar. Touch to open the 'Apps' window.
	Map	Displays the navigation map.
	Waypoint	Displays waypoint information.
	Flight Plan (FPL)	Displays the active flight plan.
	Traffic	Displays traffic information.
	Charts	Displays aviation charts.
	Weather	Displays weather information
	Nearest	Displays information of nearest airports, waypoints, and navigation aids.
	Video	Displays video options for the display.
	Engine (Piston)	Displays engine systems health information.
	Engine (Turbine)	
	Checklists	Displays available checklists.

Table 4: Application Icon Descriptions

WIDGETS

When enabled, widgets are only viewable to the side of the PFW in full screen mode on the GDU 116. Three different widgets are displayed at one time on the display. The pilot can configure what applications are displayed and if they are on top, middle, or bottom of the widget window display. Most widget options provide a shortcut to their respective application. After touching the widget, the PFW will split to display the MFW application of the widget that was touched.

Widgets are also available on the GDU 80L, allowing the pilot to enable two widgets to view on the display.

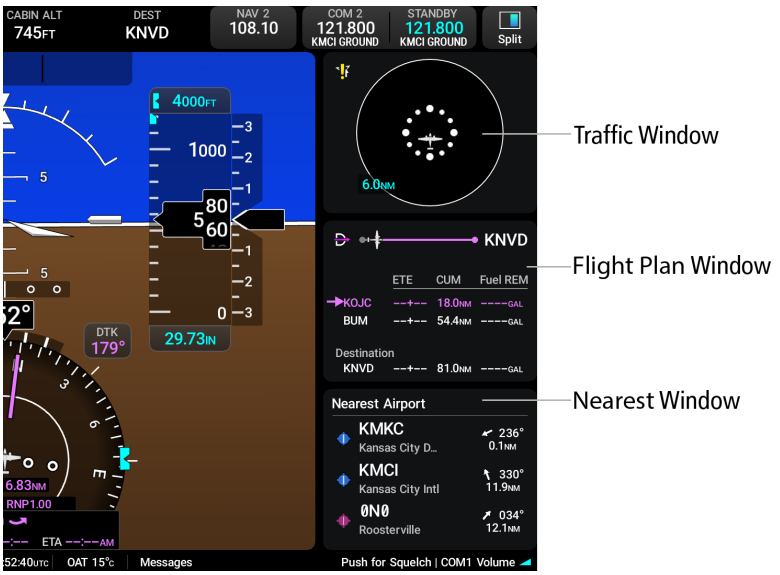


Figure 40: Widgets on the PFD

ENABLING AND CONFIGURING WIDGETS ON THE DISPLAY:

NOTE

The widget selections will only be applied to the display on which this procedure is performed. Widgets may be displayed on the MFD but only when the PFW is enabled on the MFD and in full screen mode.

1. Navigate to the 'Apps' window by pressing the **MENU** Softkey two times.

   Or:

   Touch the **Applications** Icon on the Applications Bar.
2. Touch the **Settings & Tools** Tab.
3. Touch the **Display** Button.
4. Scroll down to the 'Widgets' section of the display settings and touch **Widgets** Annunciation Button to enable the widgets on the display (green annunciator indicates the feature is enabled).
5. Touch the **Top**, **Middle**, or **Bottom** Selector Buttons and touch an option from the menu to display in that location in the widget window.

   Widget options include:

   - **Map**
   - **Flight Plan**
   - **Weather** (if applicable)
   - **Traffic**(if applicable)
   - **Nearest**
   - **Video**
   - **G-Meter**
   - **EIS Trend**

TIMERS

A System Timer for measuring arbitrary things is displayed at the bottom of the display and is also an indicator button for accessing the 'Quick Timer' window. If no timer is set "**--:--:--**" appears in the place of the indicator button. This window can also be accessed using the **MENU** Softkey on the PFW (PFW side of the bezel in split-screen mode). If more than one AXIS™ flight display is installed, the 'Quick Timer' may be accessed on any display.

The timer can be set using the Elapsed Time Function (counting up from zero), or set using the Count Down Function to measure remaining time. If the crew creates a countdown timer the system will generate a message in the 'Messages' Window, notifying the crew when the timer has expired with a flashing "System" Button. The countdown timer will begin to count up in cyan after expiring.

User Timers can also be created and saved to allow for notifications to populate for any recurring event. After creating a User Timer, it can be started, stopped, reset, edited, and deleted from the 'Messages' Window in the 'Timers & MSG' tab. The maximum amount of timers that can be created by the pilot is 30.

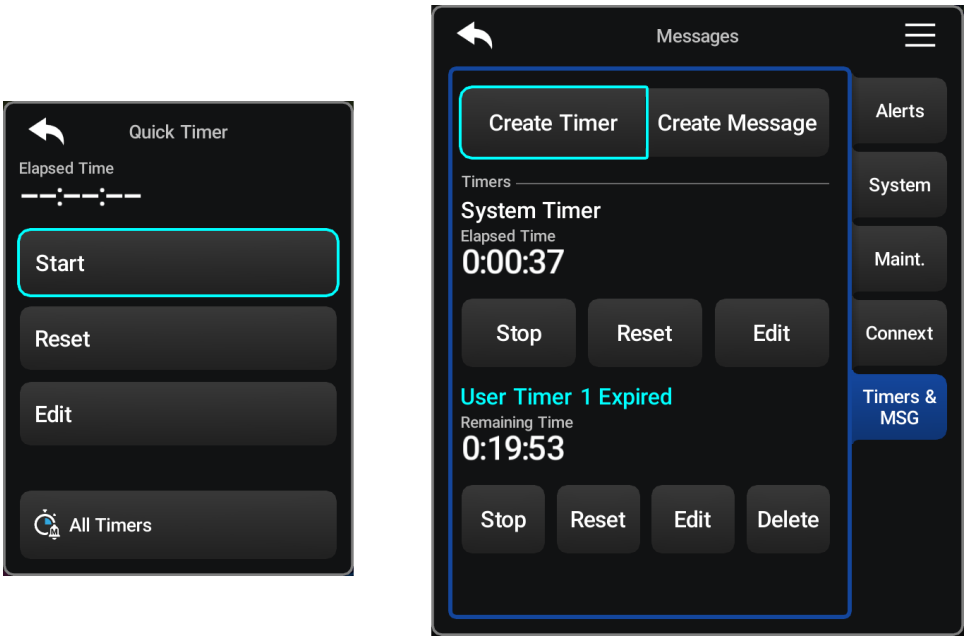


Figure 41: Quick Timer and Timers & MSG Windows

UTILIZING THE QUICK TIMER:

1 Touch the **Timer** Indicator Button ("**- -:- -:- -**") at the bottom of the display.

Pressing the **MENU** Softkey (on the PFW side of bezel if in split screen) and then touching the **Timer** Button will access the same "Quick Timer" window.

2 Touch **Start** Button.

The timer will begin to count up from zero if the function is set to 'Elapsed Time' or down from a specified amount of time the crew set if the function is set to 'Count Down'.

3 Once the timer is started, the **Start** button is replaced with the **Stop** Button. Touching the **Stop** Button will stop the timer.

4 Touch **Reset** at any time to reset the timer back to zero or its starting time.

If the **Reset** Button is touched before touching **Stop** the timer will reset to zero or the predetermined time and continue to track the time.

EDITING THE QUICK TIMER:

1 There are four ways to navigate to the 'System Timer' creating/edit a Quick Timer:
- Touch the **Timer** Indicator Button at the bottom of the display ("**- -:- -:- -**").
- Touch the **System** Indicator Button on the bottom of the display then touch the **Timers & MSG** Tab.
- Touch **Applications** Icon **> Settings & Tools** Tab **> Timers**.
- Press the **MENU** Softkey (on the PFW side of bezel if in split screen) then touch **Timer**.

2 Touch **Edit**.

3 Touch the **Function** Selector Button to choose between 'Elapsed Time' or 'Count Down'.

4 If 'Count Down' is selected touch the **Time** Button to enter a desired time using the keypad.

NOTE

*If 'Elapsed Time' is the displayed function, entering a countdown time using the **Time** Button will automatically switch the **Function** Selector Button to 'Count Down'.*

5 Touch **Save & Start** to start the timer.

CREATING A USER TIMER:

NOTE

There is a character limit of 21 for system messages.

1 There are four ways to navigate to the 'Messages' Window for creating a User Timer:
- Touch the **Timer** Indicator Button at the bottom of the display ("**- -:- -:- -**") then touch the **All Timers** button.
- Touch the **System** Indicator Button at the bottom of the display then touch the **Timers & MSG** Tab.
- Touch **Applications** Icon **> Settings & Tools** Tab **> Timers**.
- Press the **MENU** Softkey (on the PFW side of bezel if in split screen) then touch **Timer > All Timers**.

2 Touch **Create Timer**.

3 Touch the **Function** Button to choose between 'Elapsed Time' or 'Count Down'.

4 If 'Count Down' is selected touch the **Time** Button to enter a desired time using the keypad.

5 If desired touch the **Message** Button to add a user message to display after the time has expired.

6 Touch **Save & Start** to start the timer and save it to the system for future use.

Touching the **Back** Arrow or **Delete** Button at any time will take the user back to the 'Messages' Window.

To delete a User Timer see *"Deleting a Timer or Scheduled Message"*.

SCHEDULED MESSAGES

The scheduled messages feature can be used to enter and display reminder messages (e.g., contact FBO, check fuel, etc.) on the 'Messages' Window with an associated flashing **System** Messages Button. The following 'Types' of messages can be created:

- **Scheduled Event** - A message displayed based on a specific time and date.
- **One - Time** - A message that is created when the timer reaches zero one time.
- **Periodic** - A reoccurring message that is created every time the countdown timer reaches zero.
- **Fuel Reminder** - A reoccurring timer that alerts the pilot after a specified amount of fuel has been used.
- **Distance Before Waypoint** - A message that is created when the aircraft is a specific distance from a waypoint.
- **Time Before Waypoint** - A message that is created when the aircraft is a specific time from a waypoint.
- **Passing Waypoint** - A message that is created when passing a waypoint.

NOTE

*A flight plan must be active for the **Distance Before Waypoint**, **Time Before Waypoint**, and **Passing Waypoint** messages to be created.*

All saved messages are retained through power cycles until they have been deleted. Event messages that are triggered while the system is powered off will be displayed on the next power cycle. The maximum amount of messages that can be created by the pilot is 30.

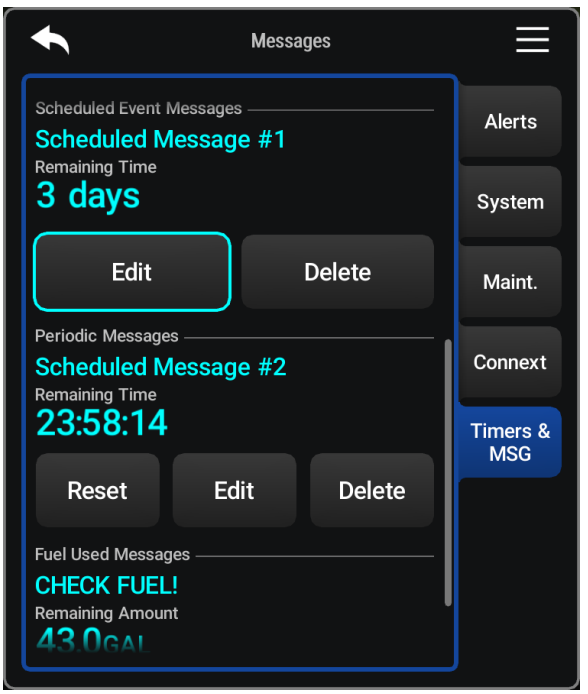


Figure 42: Scheduled Messages in the Messages Window

A 'SCHEDULED MESSAGE' alert is displayed below the HSI upon expiration of a created message. Touching the 'SCHEDULED MESSAGE' acknowledges the message, indicated by the removal of the message annunciation on the PFW. If more than one scheduled message triggers before dismissing the alert on the PFW, the messages will be displayed in the order they have expired. After creating a scheduled message, it can be started, stopped, reset, edited, and deleted from the 'Messages' Window.

CREATING A SCHEDULED MESSAGE:

NOTE

There is a character limit of 21 for system messages.

1 There are four ways to navigate to the 'Messages' Window for creating a scheduled message:
   - Touch the **Timer** Indicator Button on the bottom of the display ("**- -:- -:- -**") then touch the **All Timers** button.
   - Touch the **System** Indicator Button on the bottom of the display then touch the **Timers & MSG** Tab.
   - Touch **Applications** Icon **> Settings & Tools** Tab **> Timers**.
   - Press the **MENU** Softkey (on the PFD side of bezel if in split screen) then touch **Timer > All Timers**.
2 Touch **Create Message**.
3 Touch the **Type** Selection Button and scroll if necessary to select what kind of scheduled message is desired.

   Depending on the Type of message, the data required for the message to populate will change (e.g. **Time Interval**, **Time** and **Date**, **Fuel Amount**, **Distance**, **Time**, and/or **Waypoint**).
4 Enter the required data for the specific type of message.
5 Touch the **Message** Datafield Button and enter the desired message to display when the scheduled message is generated in the system (maximum of 21 characters).
6 Touch the **Save & Start** Button to save the entered data and begin generating scheduled messages.

   Touching the **Back** Arrow at any time will take the user back to the 'Messages' Window, if doing so before saving, the data will be erased and the procedure will have to start again at Step 2.

   To delete a Scheduled Message see *"Deleting a Timer or Scheduled Message"*.

DELETING A TIMER OR SCHEDULED MESSAGE:

1 Navigate to the 'Messages' Window (see step 1 in *"Creating a User Timer"* or *"Creating a Scheduled Message"*.
2 Scroll to the desired timer or scheduled message to be deleted and touch **Delete**.

   The pilot will be prompted by a window verifying they want to delete the timer or scheduled message.
3 Touch the **OK** Button to permanently delete the Timer or Scheduled message.

   Or:

Touch the **Cancel** Button if deleting the timer or scheduled message is not the intent.

SCREEN CLEANING

⚠ CAUTION

Do not use chemical cleaning agents, as these may damage the coating on the glass surface.

Screen Cleaning Mode temporarily deactivates touch input to facilitate cleaning. The screen can be cleaned using a micro fiber or soft cotton cloth, lightly dampened with clean water.

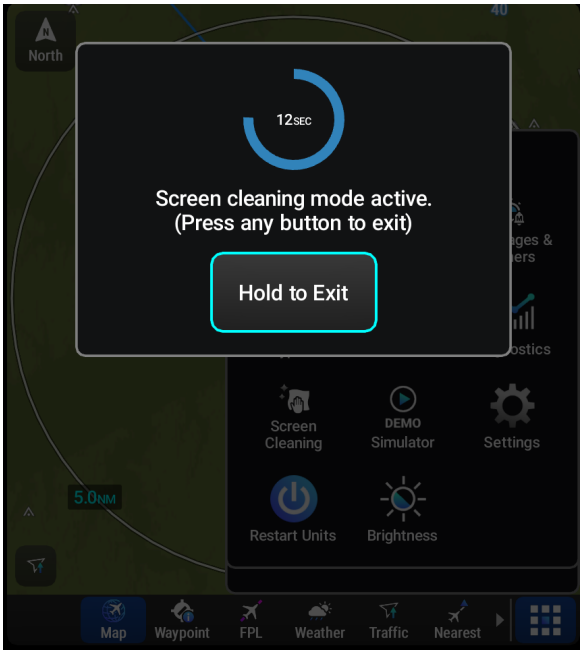


Figure 43: Screen Cleaning Mode Active

ENTERING SCREEN CLEANING MODE:

⚠ CAUTION

Refrain from enabling screen cleaning mode during critical phases of flight as it will take 5-15 seconds to complete, inhibiting the pilot from utilizing the full functionality of the AXIS™ flight display(s).

1. Navigate to the 'Apps' window by pressing the **MENU** Softkey two times.

   Or:

   Touch the **Applications** Icon on the Applications Bar.
2. Touch the **Settings & Tools** Tab.
3. Touch the **Screen Cleaning** Button.

   A 'Screen cleaning mode active' Window will appear disabling the screen to any touch inputs with a countdown timer beginning at 15 seconds.
4. Touch and hold the **Hold to Exit** Button to accelerate the timer and exit the screen cleaning mode quicker.

REVERSIONARY DISPLAY MODES

When at least two AXIS™ flight displays are installed, failure of one GDU™ will cause one or more of the remaining GDU(s) to automatically display a reversionary format. In Reversionary Mode, a display will show a split screen format with PFD/MFD/EIS windows (if EIS is installed). Radio tuning, audio panel, and transponder controls may also be displayed if the remaining GDU(s) are able to interface to these equipment.

Due to interface limitations of the base GDU 116B, there are some installations where a combination of GDU 116B, GEA 110, and GSU 75 may result in loss of EIS and/or primary ADAHRS display in Reversionary Mode. The following table describes display reversion behavior for different combinations of equipment.

Display Configuration	Single Display Failure Effects	Exceptions
Single PFD	If PFD fails, all PFD/MFD/EIS function is lost, use standby instruments for attitude/air data	
PFD1/PFD2	If PFD1 fails, PFD2 will enter Reversionary Mode	If a GEA 110 is installed with GDU 116B as PFD2, loss of PFD1 results in loss of EIS
	If PFD2 fails, PFD1 will enter Reversionary Mode	
PFD/MFD	If PFD fails, MFD will enter Reversionary Mode	If a GEA 110 is installed with GDU 116B MFD, loss of PFD results in loss of EIS
		If GSU 75 and pneumatic standby instruments are installed with GDU 116B MFD, the MFD cannot display ADAHRS data in Reversionary Mode
		Note: if GSU 75 is installed with G5 or GI275 and a GDU 116B MFD, the MFD can only display standby ADAHRS data in Reversionary Mode
	If MFD Fails, PFD will enter Reversionary Mode	

Display Configuration	Single Display Failure Effects	Exceptions
PFD/MFD1/MFD2	If PFD fails, MFD1 and MFD2 will enter Reversionary Mode	If a GEA 110 is installed with dual GDU 116B MFD's, loss of PFD will result in loss of EIS
		If GSU 75 and pneumatic standby instruments are installed with dual GDU 116B MFD's, neither MFD can display ADAHRS data in Reversionary Mode
		Note: if GSU 75 is installed with G5 or GI275 and dual GDU 116B MFD's, the MFD's can only display standby ADAHRS data in Reversionary Mode
	If MFD1 or MFD2 fails, PFD will enter Reversionary mode	
PFD1/MFD/PFD2	If PFD1 fails, MFD will enter Reversionary Mode and display data from ADAHRS #2	If a GEA 110 is installed with GDU 116B as MFD & PFD2, loss of PFD1 will result in loss of EIS
	If MFD or PFD2 fails, PFD1 will enter Reversionary Mode	

Table 5: AXIS Display Reversionary Modes

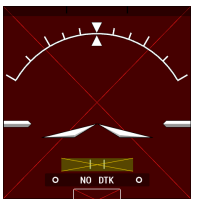
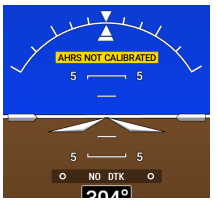
Refer to *Appendix A* for more information on system specific alerts and failures. Refer to the AXIS installation manual for more information on reversionary information based on installation options.

SYSTEM ANNUNCIATIONS

NOTE

Refer to the original POH, Aircraft Flight Manual, or Supplemental AFM for pilot actions in cases of system failure.

When the system issues a message, the **System** Messages Button flashes white until the pilot opens the 'Messages' Window to view the alert. When an LRU or an LRU function fails, a large red 'X' is typically displayed over the instrument(s) or data experiencing the failure. Upon AXIS™ power-up, certain instruments remain invalid as equipment begins to initialize. All instruments should be operational within one minute of power-up. If any instrument remains flagged, and it is not likely an installation related problem, the AXIS display should be serviced by a Garmin-authorized repair facility. Refer to *Appendix A* for more information on system alerts, annunciations, and failures and messages.

System Annunciation	Comment
	Display system is not receiving attitude information from the ADAHRS.
	ADAHRS calibration incomplete or configuration module failure.
	GPS information is either not present or is degraded such that it is invalid for navigation use. Note that ADAHRS utilizes GPS inputs during normal operation may be degraded if GPS signals are not present (see current version of aircraft flight manual).
	Display system is not receiving airspeed input from the Air Data Computer.
	Display system is not receiving vertical speed input from the Air Data Computer.
	Display system is not receiving valid heading input from the ADAHRS or Magnetometer.
	Display system is not receiving altitude input from the Air Data Computer.

System Annunciation	Comment
	Display system is not receiving valid COM1 information.
Other Various Red or Amber X Indications	A red or amber 'X' through any other display field (such as engine instrumentation fields) indicates the field is no longer receiving data, or the data is invalid.

Table 6: System Annunciations

ADAHRS OPERATION

The Air Data and Attitude and Heading Reference System (ADAHRS) performs attitude, heading, and vertical acceleration calculations for the AXIS™ System, utilizing GPS, magnetometer, and air data in addition to information from its internal sensors. Attitude and heading information are updated on the PFD while the AHRS receives appropriate combinations of information from the external sensor inputs.

The ADAHRS (GSU) 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 5 years. Failure to update this database could lead to erroneous heading information being displayed to the pilot.

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

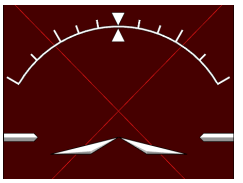
ADAHRS Mode	GPS Data Available	Mag Data Available	Air Data Available	Condition	Attitude Indicator
ADAHRS coast-on-gyros until invalid	No	Yes	No	Invalid Pitch/Roll/ Heading.	
ADAHRS no-Mag/coast-on-gyros until invalid	No	No	No		

Table 7: ADAHRS Operation

Loss of GPS, magnetometer, or air data inputs is communicated to the pilot by message advisory alerts. Any failure of the internal ADAHRS inertial sensors results in loss of attitude and heading information (indicated by red ‘X’ flags over the corresponding flight instruments). If the AXIS flight display senses that the magnetic heading measurement is valid, but possibly outside of the internal accuracy limits, the numeric heading value on the PFD is displayed in yellow.

If GPS input fails, the ADAHRS can continue to provide attitude and heading information to the PFD as long as magnetometer and airspeed data are available and valid.

If the magnetometer input fails, the ADAHRS continues to output valid attitude information; however, the heading output on the PFD Page is flagged as invalid with a red ‘X’.

Failure of the air data input has no effect on the ADAHRS output while ADAHRS is receiving valid GPS information. Invalid/unavailable airspeed data in addition to GPS failure results in loss of all attitude and heading information. Likewise, loss of magnetometer (heading) data, in combination with loss of GPS data results in a loss of all attitude and heading information.

In installations that include multiple AHRS units (AXIS supports up to three AHRS sources) if data from an AHRS source is lost the AXIS will automatically switch sources, when a failure is detected. Reversionary sensor selection is annunciated in a window on the right side of the PFD. These annunciations reflect reversionary sensors selected on the PFD. The GPS sensor cannot be switched manually.

If a standby flight display (such as a Garmin G5 Electronic Flight Instrument) is installed, it will also provide a redundant source of attitude and air data in addition to that provided by the dedicated ADAHRS unit. If the sensor source selection is **AUTO** and attitude or air data is unavailable from any dedicated ADAHRS unit, the PFD will automatically revert to displaying data from the standby display. This will be annunciated on the PFD with an 'ON AHRS (#)' or 'ON ADC (#)' or 'ON SFD (#)' or 'ON SFD (#) ADC' message.

SELECTING ADAHRS SOURCES:

NOTE

This procedure is only available if there are multiple GSU's or other Standby Flight Display's (SFD's) configured to interface with the system.

1 Open the 'PFW Menu' by:

a) Pressing the **MENU** Softkey (PFW side of the bezel while in split screen mode).

Or:

a) Touching the HSI on the PFW.

2 On the 'PFW Menu' touch the **ADAHRS** Button.

3 Select the desired AHRS Source from the selection window (**Auto**, **ADAHRS1**, **ADAHRS2**, **ADAHRS3**, **SFD1**, or **SFD2**).

GPS RECEIVER OPERATION

DISPLAYING GPS RECEIVER INFORMATION

Continuous built in tests are performed to ensure the GPS receiver is providing accurate data to the display(s).

The AXIS™ flight displays can be configured to share GPS information (refer to the AXIS Installation Manual for configuration information). For example, a GDU can be configured to share its GPS position, velocity, and time data with another GDU. If a GDU is not using its own GPS receiver, the name of the GDU providing the data (i.e., '3D GPS Location (PFD)' or '3D GPS Location (MFD)') is displayed on the PFW.

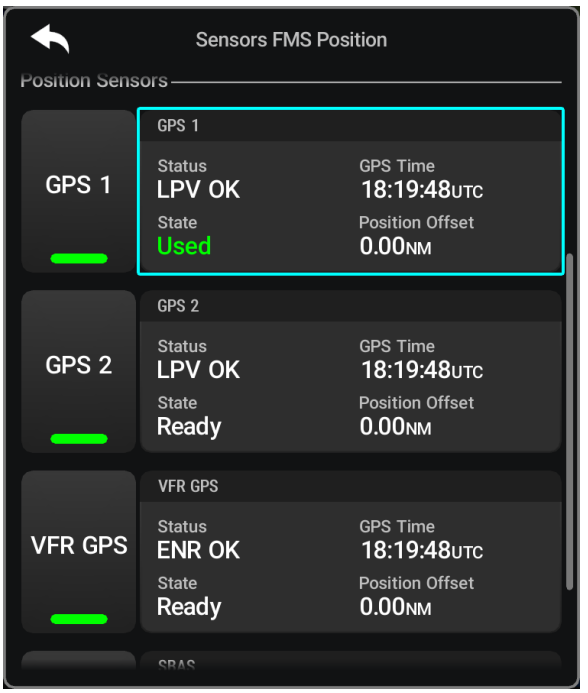


Figure 44: GPS Status

The GPS Status will display one of the following conditions:

- ACQUIRING — The sensor is in the process of acquiring enough satellites for navigation.
- ENR OK — The sensor is tracking a sufficient number of satellites to compute a 3 dimensional navigation solution suitable for GPS-based enroute operation.

- TERM OK — The sensor is tracking a sufficient number of satellites to compute a 3 dimensional navigation solution suitable for GPS-based terminal operation.
- LNAV OK — The sensor is tracking a sufficient number of satellites to compute a 3 dimensional navigation solution suitable for non-precision GPS-based approach operation.
- LPV OK — The sensor is tracking a sufficient number of satellites to compute a 3 dimensional navigation solution and suitable for LNAV/VNAV and LPV approach operation using SBAS corrections.

VIEWING GPS RECEIVER INFORMATION:

NOTE

Navigation of procedures by the pilot may be completed by using the touch screen features, softkeys on the bezel, and/or the Dual Concentric Knobs on the AXIS™ flight display(s). Unless otherwise noted, most procedures are written to utilize the touchscreen feature but may also be navigated by using the softkeys and Dual Concentric Knobs for redundancy in the case of a touch screen failure.

1. Navigate to the 'Apps' window by pressing the **MENU** Softkey two times.

   Or:

   Touch the **Applications** Icon on the Applications Bar.
2. Touch the **Settings & Tools** Tab.
3. Touch the **Sensors** Button.
4. Touch the desired Position Sensor for viewing the GPS receiver information.

ACQUIRING SATELLITES

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 the systems last known position to determine the satellites that should be in view. “Acquiring Satellites” 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 differential GPS solution, “3D GPS Location” is indicated as the solution until the 3D differential fix has finished acquisition.

SATELLITE INFORMATION

Satellites currently in view are shown at their respective positions on a satellite constellation diagram. The outer circle of the constellation diagram represents the horizon, the inner circle represents 45° above the horizon, and the center point shows the position directly overhead. Each satellite is represented by a satellite icon containing the Pseudo-Random Noise (PRN) number (i.e., satellite identification number).

The 'Sensor Status' Page 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 33-64 for WAAS) below each bar and inside each satellite icon. A "D" indicator in or above the signal strength bar indicates that satellite is processing a 3D Differential GPS Solution which provides a more reliable and accurate positioning

solution. The progress of satellite acquisition is shown in three stages, as indicated by signal bar appearance:

- Hollow bar/icon—Receiver is looking for the indicated satellite
- White bar/icon—Satellite is ready to be used for the GPS solution
- Gray bar/icon—Receiver has collected the necessary data and the satellite signal can be used
- Green bar/icon—Satellite is being used for the GPS solution

Figure 45: GPS Sensor Signal Strength and Constellation Diagram

SBAS SELECTION

In certain situations, such as when the aircraft is outside or on the fringe of the WAAS, EGNOS, GAGAN, 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:

NOTE

Navigation of procedures by the pilot may be completed by using the touch screen features, softkeys on the bezel, and/or the Dual Concentric Knobs on the AXIS™ flight display(s). Unless otherwise noted, most procedures are written to utilize the touchscreen feature but may also be navigated by using the softkeys and Dual Concentric Knobs for redundancy in the case of a touch screen failure.

1 Navigate to the 'Apps' window by pressing the **MENU** Softkey two times.

Or:

Touch the **Applications** Icon on the Applications Bar.

2 Touch the **Settings & Tools** Tab.
3 Touch the **Sensors** Button.
4 Scroll to the 'SBAS' window and touch it to select specific SBAS annunciation button options from the menu. (**WAAS**, **EGNOS**, **GAGAN**, and **MSAS**).

RECEIVER AUTONOMOUS INTEGRITY MONITORING PREDICTION

⚠ CAUTION

The RAIM prediction capabilities on the AXIS™ flight display(s) do not meet all RAIM prediction requirements. Reference the RAIM/Fault Detection and Exclusion (FDE) Prediction Tool at flyGarmin.com®*, as required.*

In most cases, performing a Receiver Autonomous Integrity Monitoring (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.

RAIM is a GPS receiver function that performs a consistency check on all tracked satellites. RAIM ensures the available satellite geometry allows the receiver to calculate a position within a specified RAIM protection limit (2.0 nautical miles for enroute and 0.3 NM for 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.

PREDICTING RAIM AVAILABILITY:

NOTE

Navigation of procedures by the pilot may be completed by using the touch screen features, softkeys on the bezel, and/or the Dual Concentric Knobs on the AXIS™ flight display(s). Unless otherwise noted, most procedures are written to utilize the touchscreen feature but may also be navigated by using the softkeys and Dual Concentric Knobs for redundancy in the case of a touch screen failure.

1 Navigate to the 'Apps' window by pressing the **MENU** Softkey two times.

   Or:

   Touch the **Applications** Icon on the Applications Bar.
2 Touch the **Settings & Tools** Tab.
3 Touch the **Sensors** Button.
4 On the 'Sensors FMS Position Page' scroll, if necessary, to a GPS position sensor and select it.

   NOTE

   Due to the nature of the VFR GPS position sensor being incapable to provide IFR guidance capabilities, it will be unable to predict RAIM coverage.
5 At the top of the 'GPS (#) Sensor Status' page touch the **RAIM Prediction** Button.

6 Touch the **Location** Selection Button to select between **Waypoint** or **P POS**.
   a) If **Waypoint** is selected touch the **Waypoint Identifier** Datafield Button. Use the alphanumeric keypad or the **Find** Button to enter a waypoint identifier.
7 Touch the **Arrival Time** Datafield Button. Use the numeric keypad to enter an arrival time and touch the **Enter** Button.
8 Touch the **Arrival Date** Datafield Button. Use the calendar selection window to enter an arrival date.
9 Touch the **Compute RAIM** Button. Under 'RAIM Status' on the 'RAIM Prediction' page "**Computing**" will be displayed. When the computation is complete, either "**Available**" or "**Unavailable**" will be displayed.

1.4 ACCESSING SYSTEM FUNCTIONALITY

The system is highly configurable and allows for management of the various system parameters, in addition to providing status and database information for the system.

PFW SETTINGS

The PFW Settings provide access to the following:

- **Orientation**: The Orientation Button when pressed allows the pilot to choose **Heading** or **Auto**.
- **HSI Style**: The HSI Style Button when pressed allows the pilot to choose **Basic**, **Map**, or **Traffic**.
- **CDI**: Enables or disables the course deviation indicator on the HSI (green annunciator indicates enabled).
- **Topo**: Enables the topographical map to be displayed on the HSI when touched (HSI style must be displaying the map).
- **Traffic**: Enables Traffic to be displayed on the HSI when touched (HSI style must be displaying the map).
- **Weather**: Displays weather on the HSI when touched (HSI style must be displaying the map).
- **Terrain**: Displays terrain information on the HSI when touched (HSI style must be displaying the map).
- **Bearing Pointer 1**/**Bearing Pointer 2**: Provides the pilot with available options for what indications the bearing pointers display (**OFF**, **Flight Plan**, **VOR**, **Best**, or **Nearest**).
- **Mach Indication** (Optional): Allows the pilot to choose to display the mach indication on the PFD in the 'Mach Indication' Window (**Hide** or **Show**).
- **Meters Overlay** or **Feet Overlay**: Enables or disables the altitude and overlay for the current altitude and selected altitude on the PFW altimeter (green annunciator indicates enabled).
- **Slip/Skid Indication**: Allows the pilot to choose to display the slip/skid indication as either a ball or a ball in the 'Slip/Skid Indication' Window (**Ball** or **Bar**).

- **Flight Director Style**: Allows the pilot to choose the aircraft attitude symbol and flight director format to be displayed on the attitude indicator (**COM Volume**, **COM Tuning**, **Single Cue**, or **Dual Cue**)
- **Primary Knob Action** Selection Button: Allows the pilot to customize the action of the left knob on the GDU in the 'Left Knob Action' Window (**Altitude/Heading** or **Course/Baro**).
- **Secondary Knob Action** Selection Button: Allows the pilot to customize the action of the right knob on the GDU in the 'Right Knob Action' Window (**Altitude/Heading** or **Course/Baro**).
- **Transition Altitude**: Allows the pilot to adjust at what altitude the altimeter setting will begin flashing to alert the pilot to transition to/from the standard barometric pressure setting.
- **Transition Level**: Allows the pilot to adjust at what flight level the altimeter setting will begin flashing to alert the pilot to transition to/from the standard barometric pressure setting or the preset baro setting.
- **SFD Baro Sync**: Enables or disables the barometric pressure setting synchronization with the standby flight display (green annunciator indicates enabled).
- **Traffic Symbols**: Enables or disables the traffic symbols on the PFW (green annunciator indicates enabled).
- **Airport Signs**: Enables or disables airport signs to be viewed on the PFW (green annunciator indicates enabled).
- **Horizon Heading**: Enables or disables the horizon heading marks to be displayed on the zero pitch line (green annunciator indicates enabled).
- **Runway Locator**: Enables or disables the Runway Locator feature of SVT™ (green annunciator indicates enabled).
- **Flight Path Marker**: Enables or disables the Flight Path Marker on the PFW (green annunciator indicates enabled).
- **Pathways**: Enables or disables the Pathways feature on the PFW (green annunciator indicates enabled).
- **G-Meter**: Enables the G-Force meter to display and can be set to **Off**, **Auto**, or **On**.

ACCESSING PFW SETTINGS:

1. Access the 'PFW Settings' on the PFD:
   a) Press the **MENU** Softkey (on the PFW side of the bezel while in split screen mode) to open the 'PFW Menu'.

      Or:

   a) Touch anywhere within the HSI to open the 'PFW Menu'
   b) Touch the **PFW Settings** Button.
2. To access the 'PFW Menu' on the MFD:
   a) Display the PFW on the MFD by touching the **Applications** Icon **> Primary** Tab **> PFW**.
   b) Complete steps 1a / b.

SYSTEM SETTINGS & TOOLS

The majority of AXIS™ flight display settings can be accessed using the **Settings & Tools** Tab or after accessing the 'Apps' window. The following is a list of user setting features that can be adjusted by the pilot:

- **Connectivity**: Allows the pilot to modify Bluetooth and Wi-Fi connections. (Refer to *Additional Features* for more information)
- **Timers**: Accesses the 'Messages' window and allows the pilot to create and modify system timers and messages. (Refer to the discussion on *Timers* in System Overview for more information.)
- **Databases**: Provides access to the 'Database Status' window and allows the pilot to manage active, standby, and catalog databases. (Refer to *Database Management* in Appendix B for more information.)
- **Flight Data**: Provides access to the 'Flight Data Logs' window and allows pilot access to export and view flight data information. (Refer to the discussion on *Data Logging* in Additional Features for more information.)
- **Diagnostics**: Allows the pilot to view diagnostic information about system parameters.
- **LRU Info**: Provides access to critical information about the LRU's configured in the system.
- **Screen Clean**: Allows the pilot to shut off the capacitive touch feature of the screen for a short while to facilitate cleaning of the screen without inadvertently accessing or enabling any features on the display.
- **Sensors**: Allows access to the 'Sensors FMS Position' Window and allows the pilot to view critical information about installed position sensors and their SBAS capabilities. (Refer to *GPS Receiver Operation* in System Overview for more information.)
- **Display** Button: Allows the pilot to adjust display settings. (Refer to *Normal Operation* for more information)
- **Units & Time**: Allows the pilot to modify the time and units of measurement in the AXIS system. (Refer to *System Units* and *System Time* for more information)
- **Alerts**: Allows the pilot to adjust alerting criteria for the airframe. (Refer to *Hazard Avoidance* for more information)
- **Autopilot** Button: Allows the pilot to calibrate Pitch, Roll, and Yaw Axis servos. (Refer to *AFCS* for more information)
- **Trim**: Allows the pilot to calibrate the trim airspeed settings and pitch/roll/yaw trim axis settings. (Refer to *AFCS* for more information)
- **Angle of Attack**: Allows the pilot to calibrate the angle of attack minimum, warning, stall, and approach speeds and adjust the enablement and disablement speed at which an indication will appear. (Refer to *Angle of Attack (AoA)* in Flight Instruments for more information)
- **Restart Units**: Allows the pilot to restart the AXIS flight display avionics unit and is only available when the system is in the installation mode.
- **Brightness**: Allows the pilot to adjust the screen brightness settings for the flight display. **Lighting Bus** connects the brightness controls to the aircraft's internal lighting controls,

Auto controls the level of brightness using the photocell sensor on the flight display, and **Manual** allows the pilot to control the level of brightness using the horizontal slider control.

- **Inhibits**: Allows the pilot to enable or disable Terrain, SurfaceWatch™, or other miscellaneous alerting functions. These settings are accessed through the **Quick Actions** Tab in the 'Apps' window. (Refer to *Hazard Avoidance* for more information)

SYSTEM UNITS

NOTE

Pilot configuration of these system units is optional. If a unit of measure can not be changed using this technique, contact Garmin® support or your local Garmin dealer.

Units in which various quantities are displayed throughout the system are able to be changed by accessing **Units & Time** in the 'Apps' window. The following system units may be available to change:

• Time Mode (UTC, Local, or Manual) • Air Temperature (Fahrenheit or Celsius) • Fuel Economy (Kilometers per Liter, Statute Miles per Gallon, Nautical Miles per Gallon, or Nautical Miles per Imperial Gallon) • Weight (Kilograms or Pounds)	• Barometric Pressure (Inches of Mercury, Hectopascals, or Millibars) • Location Format (LAT/LON, MGRS, or UTM) • NAV Angle (Auto Magnetic Variation, True, or User Magnetic Variation)

CHANGING A SYSTEM UNIT SETTING:

1. Navigate to the 'Apps' window by pressing the **MENU** Softkey two times.

   Or:

   Touch the **Applications** Icon on the Applications Bar.
2. Touch the **Settings & Tools** Tab.
3. Touch **Units & Time**.
4. Touch a unit of measurement selection button to be changed.
5. This will open a menu of various unit measurements. Select the desired option by touching the corresponding unit to change the system unit setting. The selected unit of measurement will be displayed in cyan on the selection button on the 'Units and Time' Window.

SYSTEM TIME

NOTE

The value entered for manually adjusting the time for UTC Offset will be rounded to the nearest 15 minutes.

The system obtains the current Universal Coordinated Time (UTC) date and time directly from the GPS satellite signals. System time (displayed in the below the HSI on the PFD) can be displayed in three formats: UTC, Local, or Manual. Local and Manual time modes are able to be displayed in either 12 hour or 24 hour format. Manual time is set by adding/subtracting an offset (hours:minutes) to/from UTC.

CONFIGURING THE SYSTEM TIME:

1 Navigate to the 'Apps' window by pressing the **MENU** Softkey two times.

Or:

Touch the **Applications** Icon on the Applications Bar.

2 Touch the **Settings & Tools** Tab.

3 Touch **Units & Time > Time Mode** Selection Button.

4 Touch the **UTC** Button, **Local** Button, or **Manual** Button.

5 If the **Local** Button is selected:

a) The pilot can touch the **24 Hour Format** Annunciation Button to enable or disable the 24 hour time format.

6 If the **Manual** Button is selected:

a) The pilot can touch the **24 Hour Format** Annunciation Button to enable or disable the 24 hour time format.

b) Touch the **Time Offset** Datafield Button.

c) Use the numerical keypad to enter the amount of UTC offset desired.

Or:

Touch the **Airport** Button and use the alphanumeric keyboard to enter an offset time of a specific airport and touch the **Enter** Button.

The amount of offset will be displayed in the 'UTC Offset' Window

d) Touch the **Enter** Button to accept the amount of offset from UTC.

DISPLAY BACK LIGHTING AND HIGH CONTRAST

The PFD and MFD back lighting is set to automatically adjust with ambient light sources using built in photocells. The pilot has the option to adjust the back lighting manually.

High contrast mode is a setting that enables a border for all aspects of the display that are available for interaction.

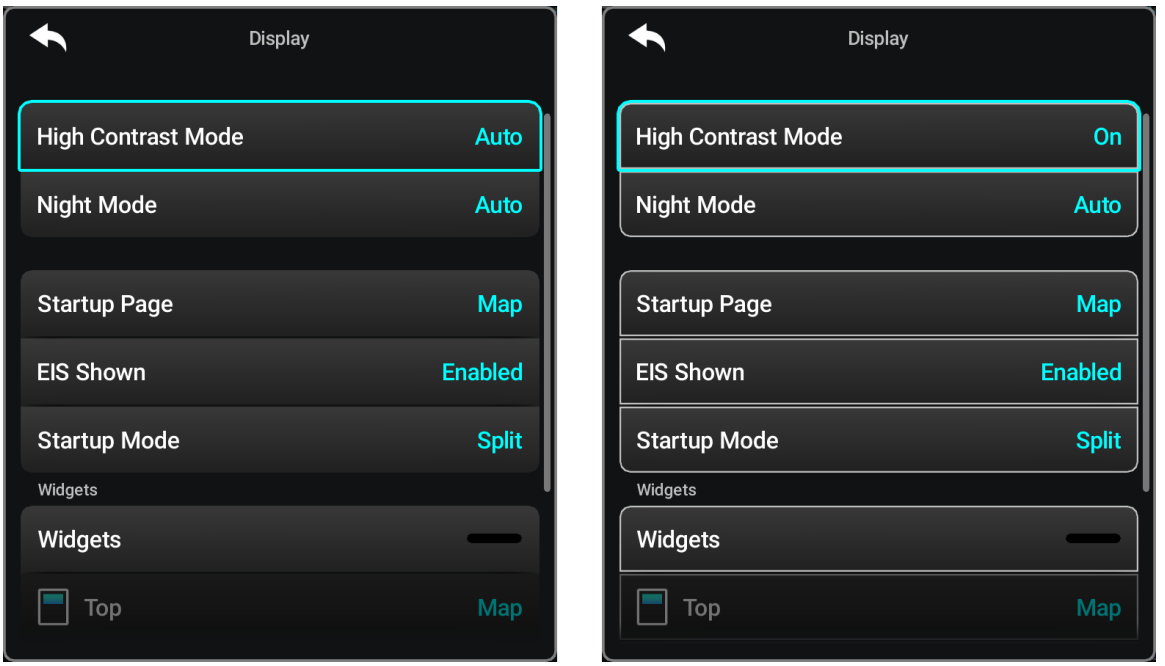


Figure 46: High Contrast Mode "On" and "Auto"

ENABLING/DISABLING HIGH CONTRAST MODE:

1 Navigate to the 'Apps' window by pressing the **MENU** Softkey two times.

Or:

Touch the **Applications** Icon on the Applications Bar.

2 Touch the **Settings & Tools** Tab.

3 Touch the **Display** Button.

4 Touch the **High Contrast Mode** Selection Button.

5 Select the **Auto** or **On** Button.

ADJUSTING SCREEN BRIGHTNESS

1 Navigate to the 'Apps' window by pressing the **MENU** Softkey two times.

Or:

Touch the **Applications** Icon on the Applications Bar.

2 Touch the **Settings & Tools** Tab.

3 Touch the **Brightness** Button.

4 Touch the **Backlight Control** Selection Button to choose between **Auto**, **Lighting Bus**, or **Manual**.

5 Move the **Brightness** Horizontal Slider to increase or decrease the intensity of the backlighting.

SELECTING SYSTEM (NIGHT, DAY, OR AUTO) COLOR SCHEMES:

1 Navigate to the 'Apps' window by pressing the **MENU** Softkey two times.

Or:

Touch the **Applications** Icon on the Applications Bar.

2 Touch the **Settings & Tools** Tab.

3 Touch the **Display** Button.

4 Touch the **Night Mode** Selection Button.

5 Touch one of the **Day/Night/Auto** to change between the different system color schemes.

SECTION 2 FLIGHT INSTRUMENTS

2.1 OVERVIEW

NOTE

Refer to 7 Automatic Flight Control System (AFCS) for Autopilot information.

Increased situational awareness is provided by replacing the traditional instruments on the panel with an easy-to-scan Primary Flight Window (PFW) that features an attitude indicator with attitude director indicator (ADI) functionality, airspeed indicator, barometric altimeter, vertical speed indicator (VSI), vertical deviation indicator (VDI), and a horizontal situation indicator (HSI) that includes the heading indicator and course deviation information.

Additionally, the system has various touch-screen features. For example, some indicators on the PFW also serve as buttons that, when touched, open that indicator's menu or a selection menu to configure that indicator. The customization of the HSI, for example, can be accessed from the 'PFW Menu', which can traditionally be opened using the **MENU** Softkey on the PFW side of the display, or alternatively, by touching the space inside the HSI on the PFW.

PFW's also display various alerts and annunciations.

FLIGHT INSTRUMENT SCREEN OVERVIEW

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

Figure 47: Flight Instruments Screen Overview

1	Engine Indication Strip (EIS)	9	Vertical Speed Indicator (VSI)
2	Left Dual Concentric Knob (DCK) Control	10	Right Dual Concentric Knob (DCK) Control

3	Airspeed Indicator	11	Widget Displays
4	Wind Data Window	12	Full and Split Screen Button
5	Horizontal Situation Indicator (HSI)	13	Audio and CNS bar (#2 side)
6	Supplemental Information Strip	14	Data Bar
7	Attitude Direction Indicator (ADI)	15	Audio and CNS bar (#1 side)
8	Altimeter	16	Emergency Button

ATTITUDE DIRECTION INDICATOR

Attitude information is displayed over a virtual blue sky and brown ground with a white horizon line. The Attitude Indicator displays the pitch (indicated by the symbolic aircraft on the pitch scale), roll, and slip/skid information.

The horizon line is part of the pitch scale. Major pitch markings and numerical labels occur every 10˚ up to 90˚. Medium pitch markings and numerical labels are displayed in between every major tick mark for intervening 5˚. Minor pitch markings occur at 2.5˚ intervals between all pitch ranges.

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.

Slip/skid is indicated by the location of the (configurable) ball or bar.

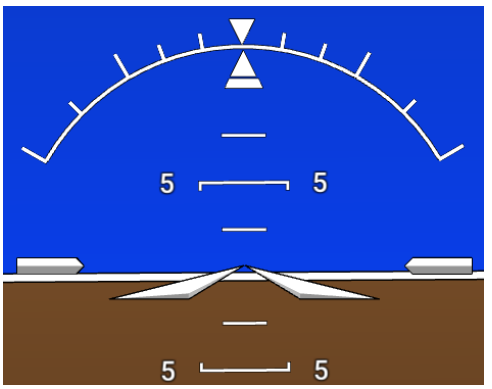


Figure 48: Attitude Indicator

The aircraft symbol that indicates the attitude of the aircraft is linked to the flight director indication. The two options for the aircraft symbol are Single Cue and Dual Cue. For more information on the selection of the aircraft symbol and the correlated flight director format, refer to the *Flight Director Format Selection* section in the AFCS chapter.

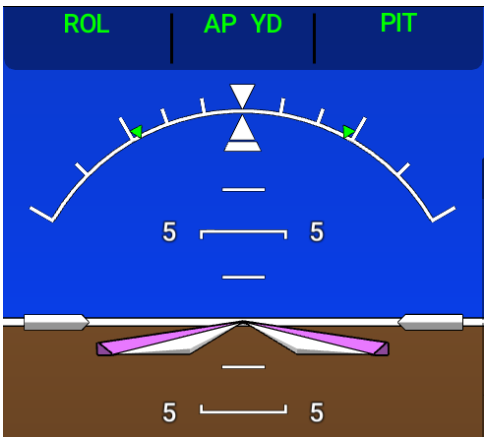


Figure 49: ADI with AFCS

MODIFYING THE SLIP/SKID INDICATION:

1 Access the 'PFW Settings' on the PFD:
   a) Press the **MENU** Softkey (on the PFW side of the bezel while in split screen mode) to open the 'PFW Menu'.

   Or:

   a) Touch anywhere within the HSI to open the 'PFW Menu'
   b) Touch the **PFW Settings** Button.
2 To access the 'PFW Menu' on the MFD:
   a) Display the PFW on the MFD by touching the **Applications** Icon **> Primary** Tab **> PFW**.
   b) Complete steps 1a / b.
3 Scroll if necessary and touch the **Slip/Skid Indication** Selection Button.
4 Touch **Bar** to display the slip/skid indicator below the roll pointer on the roll scale.

   Or:

   Touch **Ball** to display the more traditional ball type slip/skid indicator above the lateral deviation indicator and below the attitude indicator.

AIRSPEED INDICATOR

NOTE

The AXIS™ flight display Vspeed Reference values and Flaps Tick Mark values depend upon the aircraft specific system configuration and may vary from the examples discussed in this section.

The Airspeed Indicator displays airspeed on a rolling number gauge using a moving tape. The true airspeed (TAS) and ground speed (GS) is indicated in knots below the Airspeed Indicator. The standard configuration of the airspeed tape has major tick marks with numeric labels every ten Knots Indicated Airspeed (KIAS). Minor tick marks are displayed at intervals of five KIAS between the major tick marks. 60 knots of airspeed is viewable on the tape at a time with the indication of airspeed beginning at 20 knots. The indicated airspeed of the aircraft

is displayed inside the black pointer. The pointer remains black until reaching velocity never exceed speed (V_{NE}), at which point it turns red.

A color-coded (red, white, green, yellow, and red/white 'barber pole') speed range strip is available to be configured on the moving tape. The colors denote flaps operating range, normal operating range, caution range, and never-exceed speed (V_{NE}). A red range may also be present for low speed awareness. To configure these airspeed settings refer to the installation manual or contact a Garmin® dealer.

The Airspeed Trend Vector is a vertical, magenta line, extending up or down on the airspeed scale, emerging from the tip of the black airspeed indication. The end of the trend vector corresponds to the predicted airspeed in 6 seconds if the current rate of acceleration is maintained. If the trend vector crosses V_{NE}, the text of the actual airspeed readout changes to amber and the aural alert "OVERSPEED OVERSPEED" is triggered. The trend vector is absent if the speed remains constant or if any data needed to calculate airspeed is not available due to a system failure.

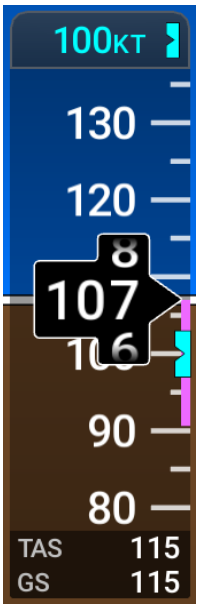


Figure 50: Airspeed Indicator

V_{NE} ADJUSTED FOR TRUE AIRSPEED (OPTIONAL)

The airspeed indicator can optionally be configured to display V_{ne} adjusted for true airspeed and allow the pilot of the aircraft to maintain situational awareness of the TAS V_{ne}. This is useful in aircraft where true airspeed (instead of indicated airspeed) must be kept below V_{ne}. When accounting for altitude and temperature, the TAS of the aircraft may be greater than the indicated airspeed. If configured, the AXIS™ flight displays can calculate and display this reduction in V_{ne}. As TAS increases with the altitude and temperature calculations, a solid red band is displayed between the TAS adjusted V_{ne} and the actual indicated value for V_{ne}.

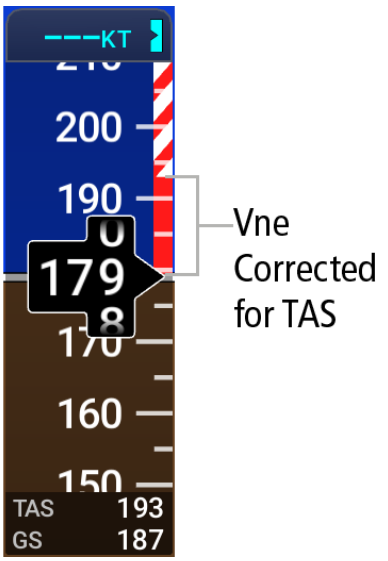


Figure 51: V_{ne} Adjusted for True Airspeed

VSPEED REFERENCE

The following Vspeed references that may be configured to display on the airspeed indicator include the following:

Vspeed Indication	Description
V_{ne}	Never Exceed Indicated Airspeed
V_{ne}	Never Exceed True Airspeed
V_{no}	Never Operate Airspeed
V_{s0}	Landing Configuration Stall Speed
V_{s1}	Specific Configuration Stall Speed
V_{fe}	Flaps Extended Maximum Airspeed
V_a	Maximum Maneuvering Airspeed
V_x	Best Angle of Climb Airspeed
V_y	Best Rate of Climb Airspeed
V_{yse}	Best Single Engine Climb Airspeed
V_r	Rotate Airspeed
V_g	Best Glide Airspeed
V_{mc}	Minimum Control Airspeed
V_{mo}	Maximum Operating Airspeed

Up to four custom Vspeeds may also be configured from the Aircraft Configuration Page, refer to the AXIS™ Flight Display Installation Manual for more information.

When an airspeed is actively displayed, the Vspeeds configured are also displayed at their respective locations to the right of the airspeed scale. While below the active airspeed range the Vspeeds are displayed in a list at the bottom of the airspeed indicator.

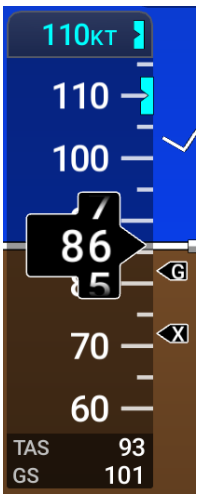


Figure 52: Vspeed References (with airspeed)

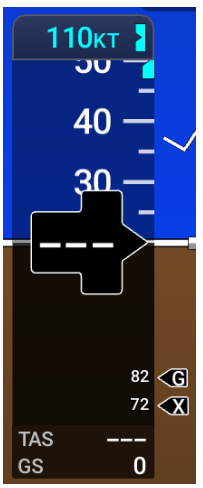


Figure 53: Vspeed References (without airspeed)

ALTIMETER

NOTE

The AXIS™ Flight Display(s) are highly configurable and display of the altimeter may vary from the examples discussed in the section.

The altimeter uses the pitot-static system to sense atmospheric pressure to display the barometric altitude in feet (by default) on a rolling number gauge. This moving tape is located to the right of the attitude indicator. Major and Minor tick marks are displayed on the altimeter to indicate intervals of barometric altitude. Major tick marks are accompanied with numeric values while the minor tick marks are smaller and are displayed evenly between the major tick marks. The current altitude is displayed in the black pointer with intervals of 20 feet. The pilot has the option to enable a meters or feet overlay feature on the altimeter depending on system configuration.

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 corresponding edge of the tape.

Below the altimeter is the datum pressure setting in a Kollsman window. The datum pressure (barometric pressure setting) is adjusted so the altimeter displays the altitude in Mean Sea Level (MSL) accounting for the local atmospheric effects.

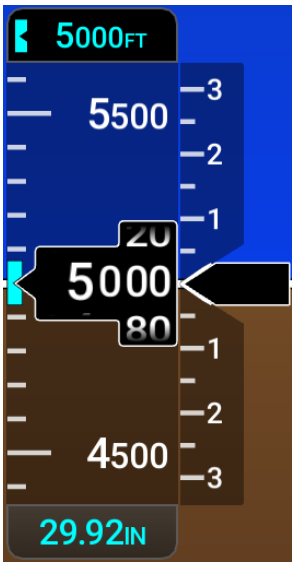


Figure 54: Altimeter

DATUM PRESSURE (BARO PRESSURE SETTING)

The datum pressure is displayed below the Altimeter in inches of mercury (in Hg), hectopascals (hPa), or millibars inside a Kollsman window. Using the **DCK** on the display bezel is the standard method to control the datum pressure setting but is configurable by the pilot (see *Knob Operation* in the System Overview chapter for more information on configuring the **DCK**s). In the case the **DCK** is configured to control other features, touching the Kollsman window on the PFW opens a numeric keypad to adjust the setting.

The system will alert the pilot when the standard altimeter setting is required after climbing or descending through a specific altitude. The standard barometric transition altitude is 18,000ft (FL180) but is adjustable to a different altitude if needed (Refer to the *Enabling/Disabling the 'Baro Transition' Alert* procedure for more information on adjusting this altitude alert setting). While the aircraft is transitioning through this transition altitude the Kollsman window will flash cyan until the pilot has taken action to change the barometric setting. The standard setting feature allows pilots to quickly adjust the altimeter setting to and from the standard barometric setting. While the standard barometric setting is selected, **STD** is displayed in place of the barometric pressure setting. While the standard setting is being used, a standby barometric altimeter setting may be selected for a quick adjustment back to the local barometric setting.

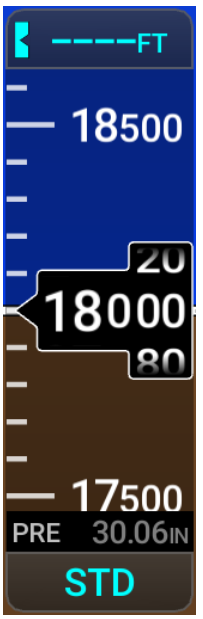


Figure 55: Standard Baro Pressure with Baro Preset

SELECTING THE ALTIMETER BAROMETRIC PRESSURE SETTING:

1 Touch the Barometric Altimeter Datafield Button (Kollsman window).

2 Enter the barometric setting on the numeric keypad, and then touch the **Enter** Button.

Or:

If the **DCK** is configured to adjust the barometric setting, turn the Outer **DCK** to select the desired setting.

SELECTING STANDARD BAROMETRIC PRESSURE:

1 Touch the Barometric Altimeter Datafield Button (Kollsman window).

2 Touch the **STD BARO** Button. 'STD' will be displayed in the barometric setting window, indicating that the standard barometric setting is active.

Or:

If the **DCK** is configured to adjust the barometric setting, push the **DCK** to toggle the standard barometric setting between 'STD' and the previously set (or preset) altimeter setting.

DISABLING STANDARD BAROMETRIC SETTING:

1 Touch the Barometric Altimeter Datafield Button (Kollsman window).

2 Enter the barometric setting using the numeric keypad and touch the **Enter** Button.

Or:

If the **DCK** is configured to adjust the barometric setting, push the **DCK** to toggle the standard barometric setting between 'STD' and the previously set (or preset) altimeter setting.

SETTING THE BAROMETRIC ALTIMETER PRESET WHILE IN STD SETTING:

1 While the standard barometric setting is active and the **DCK** is configured to adjust the barometric setting, turn the Outer **DCK** to create a preset altimeter setting that will be entered the next time the 'STD' setting is disabled.

Or:

a) While the standard barometric setting is active touch the Barometric Altimeter Datafield Button (Kollsman window).

b) Enter the desired preset altimeter setting using the numeric keypad and then touch the **Preset** Button. (Note: the preset value will be displayed at the bottom of the altimeter, just above the Barometric Altimeter Datafield Button.)

2 To load the preset pressure as the active setting:

a) Push the **DCK** to deactivate the 'STD' pressure setting.

Or:

a) Touch the Barometric Altimeter Datafield Button.

b) Touch the **Enter** Button on the keypad.

ENABLING/DISABLING THE 'BARO TRANSITION' ALERT:

1 Press the **MENU** Softkey two times to open the 'Apps' window.

Or:

Touch the **Applications** Icon on the MFW App Bar to open the 'Apps' window.

2 Touch the **Settings & Tools** Tab **> Alerts**.

3 Scroll (if necessary) to the 'Baro Transition' section and touch the **Baro Climb** Annunciation Button and/or **Baro Descend** Annunciation Button to enable or disable the 'Baro Transition' alert.

ADJUSTING THE TRANSITION ALTITUDE/LEVEL FOR THE 'BARO TRANSITION' ALERT:

1 Navigate to the 'Alerts' window:

a) Press the **MENU** Softkey two times to open the 'Apps' window.

Or:

Touch the **Applications** Icon on the MFW App Bar to open the 'Apps' window.

b) Touch the **Settings & Tools** Tab **> Alerts**.

Or:

2 Navigate to the 'Primary Flight Window' settings:

a) Press the **MENU** Softkey (on the PFW side of the bezel while in split screen mode) to open the 'PFW Menu'.

Or:

a) Touch anywhere within the HSI to open the 'PFW Menu'

b) Touch the **PFW Settings** Button.

3 Touch the **Transition Altitude** (Baro Climb) or **Transition Level** (Baro Descend) Datafield Buttons.

4 Using the numerical keypad, enter the altitude at which the alert will trigger.

5 Touch the **Enter** Button.

ALTITUDE ALERTING

The Altitude Alerting function provides the pilot with visual and aural alerts when approaching the Selected Altitude. Whenever the Selected Altitude is changed, the Altitude Alerter is reset. For more information see *Minimum Altitude Alerting* in this section. The following will occur when approaching the Selected Altitude:

- Passing within 1000 feet of the Selected Altitude, the Selected Altitude (shown above the Altimeter) changes to a cyan background with black text, flashes for 5 seconds, and an aural tone is generated.
- When the aircraft passes within 200 ft of the Selected Altitude, the Selected Altitude changes to a black background with cyan text, flashes for 5 seconds, and an aural tone is generated to indicate that the aircraft is approaching the selected altitude.
- After reaching the Selected Altitude, if the pilot flies outside the deviation band (±200 Feet of the Selected Altitude), the Selected Altitude changes to a black background with yellow text, flashes for 5 seconds, and an aural tone is generated.

Figure 56: Altitude Alerting Visual Annunciation

SETTING THE SELECTED ALTITUDE:

1 Touch the Selected Altitude Datafield Button above the altimeter.

2 Using the keypad, enter a value between -1000 and 60000 and touch .

Or:

Using the configured **DCK**, set the Selected Altitude in 100-ft increments then push the **DCK** to enter the selection.

SYNCING TO THE CURRENT ALTITUDE:

1 Touch the Selected Altitude Datafield Button above the altimeter.

2 Touch the **Set To Current** Button.

ACTIVATING / DEACTIVATING THE ALTITUDE ALERT TONE:

1 Press the **MENU** Softkey two times to open the 'Apps' window.

Or:

Touch the **Applications** Icon on the MFW App Bar to open the 'Apps' window.

2 Touch the **Settings & Tools** Tab **> Alerts**.

3 Scroll (if necessary) to the 'Aural Alerts' section and touch the **Altitude Preselect** Annunciation Button (green annunciator indicates that the alert is enabled).

BAROMETRIC MINIMUM ALERT

For altitude awareness, a barometric Minimum Descent Altitude (MDA), Decision Height (DH), or Decision Altitude (DA) can be set by the user and is reset when the power is cycled. Once the user-defined altitude is within the range of the tape, a cyan bug appears at the reference altitude on the Altimeter. The bug on the tape and the number set in the 'BARO MIN' Datafield Button will turn white when within 200 feet of reaching the barometric minimum alert. When the altitude of the aircraft reaches the minimum, the bug and text turn amber and the aural alert, “Minimums Minimums”, is heard.

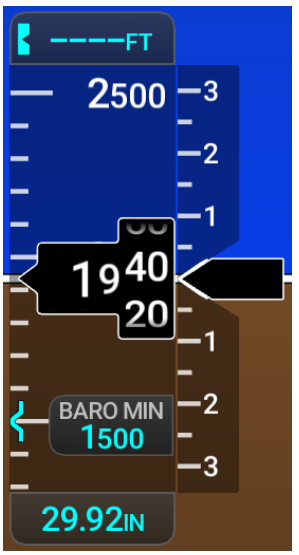


Figure 57: Barometric Minimum Visual Annunciation

SETTING THE BAROMETRIC MINIMUM ALERT BUG:

1 Access the 'PFW Menu' by:
   a) Touching anywhere inside the HSI on the PFW

      Or:

      Press the **MENU** Softkey on the PFW side of the display.
2 Touch the **Minimums** Datafield button on the 'PFW Menu' window opening the 'Minimums' numeric keypad window.
3 Using the keypad, set the desired alert altitude and touch the **Enter** Button.

After a barometric Minimum Alert has been set, a 'BARO MIN' Datafield Button will be displayed on the altimeter. This datafield button may be touched to quickly access the 'Minimums' numeric keypad window for quick barometric minimum alert adjustments.

CANCELING THE BAROMETRIC MINIMUM ALERT BUG:

1 Access the 'PFW Menu' by:
   a) Touching anywhere inside the HSI on the PFW

      Or:

      Press the **MENU** Softkey on the PFW side of the display.

2 Touch the **Minimums** Datafield button on the 'PFW Menu' window.

Or:

From the PFW, touch the 'BARO MIN' Datafield Button on the altimeter opening the 'Minimums' numeric keypad window.

3 Touch the **Delete MINS** Button.

4 Touch the **Enter** Button.

RADIO ALTIMETER (RA)/RADIO AGL (RAGL)

⚠ CAUTION

A Garmin Height Above Ground Sensor (GHA) will also provide the indications mentioned in this section but is NOT considered a radio altimeter.

NOTE

The GHA only provides a radio AGL from 0 to 500 feet.

NOTE

Radio altimeter functionality is optional. A radio altimeter must be installed and configured for this section to apply.

When the RA/RAGL height (aircraft altitude above ground level detected by the RA/RAGL) is between zero and 2500 feet, the current AGL value is displayed below the altimeter. Display of RA/RAGL height becomes more sensitive as the height above ground decreases.

Radio Height Range	Shown to Nearest
0 to 50 feet	1 foot
50 to 200 feet	5 feet
200 to 1500 feet	10 feet
1500 to 2500 feet	50 feet

Table 8: Radio Altimeter Sensitivity

When the RA/RAGL is selected as the altitude source for the minimum altitude alerting function, the color scheme of the minimums window is the same as the other barometric minimum alerts.

A ground line with diagonal stripes below it appears on the Altimeter to show the aircraft's height above the ground. If the RA/RAGL data becomes invalid, the message 'RA FAIL' is displayed in amber in place of the current AGL height. If a GHA is installed and data becomes invalid, the message 'RAGL FAIL' is displayed in amber in place of the current RAGL height.

Figure 58: Altimeter Displaying the Ground Line (Radio Alt)

Figure 59: GHA Installed with Invalid Data

ENABLING THE METERS OVERLAY ON THE ALTIMETER:

1 Access the 'PFW Settings' on the PFD:
   a) Press the **MENU** Softkey (on the PFW side of the bezel while in split screen mode) to open the 'PFW Menu'.

      Or:

   a) Touch anywhere within the HSI to open the 'PFW Menu'
   b) Touch the **PFW Settings** Button.
2 Scroll (if necessary) to and touch the **Meters Overlay** Indicator Button enabling the meters overlay on the altimeter.
3 Touch the **Meters Overlay** Indicator Button again to disable the meters overlay.

VERTICAL SPEED INDICATOR

NOTE

The AXIS™ Flight Display(s) are highly configurable and display of the vertical speed indicator (VSI) may vary from the examples discussed in the section.

The Vertical Speed Indicator (VSI) displays the aircraft vertical speed using a non-moving tape labeled with major and minor tick marks. The major tick marks are abbreviated with the first numerical position being displayed (e.g. 1000, 2000, and 3000 would be displayed as 1, 2, and 3). The minor tick marks are displayed in even intervals between the major tick

marks. In full screen mode, the current vertical speed is displayed as a numerical value inside a black arrow. In split-screen mode the VSI is abbreviated as a white triangular arrow with no numerical value displayed.

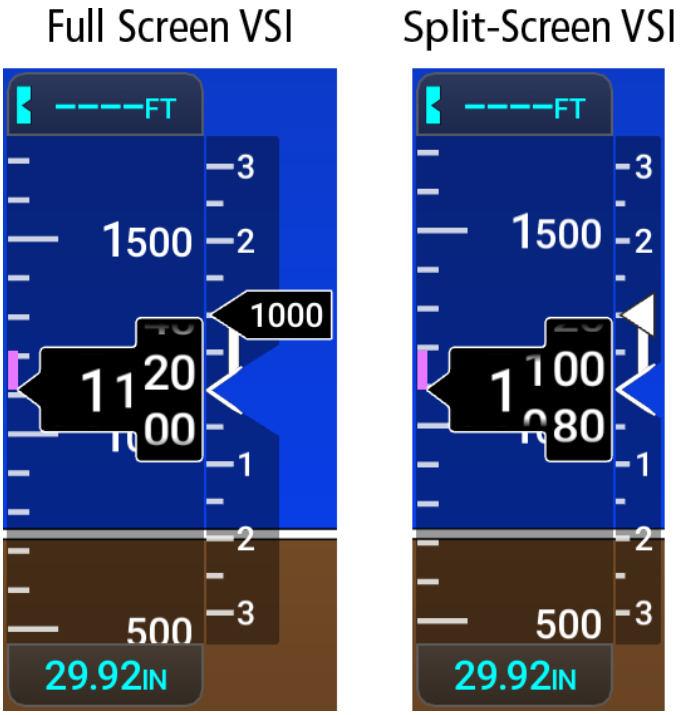


Figure 60: Vertical Speed Indicator

VERTICAL DEVIATION INDICATOR

NOTE

For the AXIS™ 116B an external navigator (i.e., SL30 Nav/Comm Transceiver and/or the GTN or GNS Series Units) must be configured to receive glideslope and/or glidepath vertical deviation indications.

GLIDESLOPE - ILS SOURCE

Prior to glideslope indications appearing for an approach, the vertical navigation will provide a glideslope preview of the approaching glideslope with a gray diamond. This is displayed while flying the initial or intermediate segment of an approach, before the active waypoint is the FAF waypoint. The gray preview diamond changes to a solid green diamond to indicate the Glideslope Indicator (ILS/LOC) is active. If the approach type downgrades past the FAF, 'NO GS' is displayed in place of the diamond.

The Glideslope Vertical Deviation Indicator (VDI) appears to the left of the Altimeter whenever an ILS frequency is tuned in the active NAV, the frequency is within range, and the aircraft heading and selected course are within 107˚. Like a glideslope needle on a conventional indicator, a green diamond acts as the Glideslope VDI. The green diamond is displayed as the VDI for ground navigation approach frequencies (ILS and LOC), and replaces the conventional

glideslope needle indicator. If a localizer frequency is tuned and there is no glideslope signal, “NO GS” is annunciated.

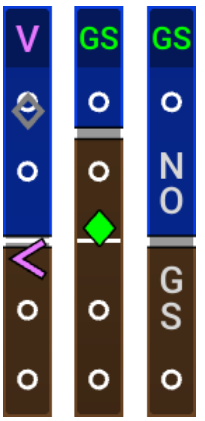


Figure 61: Vertical Deviation Indicator (Glideslope- ILS Source)

GLIDEPATH - GPS SOURCE

Prior to glidepath indications appearing for an approach, the vertical navigation will provide a glidepath preview of the approaching glidepath with a gray diamond. This is displayed while flying the initial or intermediate segment of an approach, before the active waypoint is the FAF waypoint. The preview is also displayed when the AFCS is coupled to the Vertical Navigation mode (VNAV) while inbound to the FAF waypoint, until the AFCS captures the glidepath (refer to the AFCS Section for more information about Vertical Navigation mode). The gray preview diamond changes to a solid magenta diamond to indicate the Glidepath Indicator is active. If the approach type downgrades past the FAF, ‘NO GP’ is displayed in place of the diamond.

The Glidepath Indicator is a vertical deviation scale for GPS approach service levels supporting SBAS vertical guidance or advisory vertical guidance. Full-scale deflection (two dots), is angular with upper and lower limits. The upper limit is ±492 feet (150 meters) and the lower limit depends on the approach service level.

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

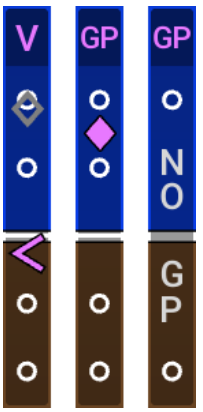


Figure 62: Vertical Deviation Indicator (Glidepath-GPS Source)

ENROUTE VERTICAL NAVIGATION INDICATIONS

An external navigation source is not required to receive Vertical Navigation (VNAV) indications. When the VNAV profile is defined, the pilot is informed of the progress by message alerts below the HSI. The Vertical Deviation Indicator (VDI) appears to the left of the Altimeter and is displayed with a magenta ‘V’ at the top of the scale accompanied by a magenta chevron indicating the VNAV vertical deviation. A Required Vertical Speed Indicator (RVSI) is displayed as a magenta chevron on the VSI indicating the required vertical speed to reach the target altitude, which is displayed above the altitude bug datafield button. The VDI and RVSI appear in conjunction with the 'TOD within 1 minute'. The VDI and RVSI are removed from the display if vertical deviation becomes invalid.

Vertical navigation indications will transition to approach indications if the approach is activated in the flight plan. If no approach is loaded, the vertical navigation will terminate at the Final Approach Fix.

⚠ CAUTION

Do not use approach guidance using the GDU™ 116B unless paired with an IFR navigator. The internal GPS navigation is only compliant with VFR navigation and should be used only as reference past the FAF.

See the *Flight Management Section* for details on VNAV features.

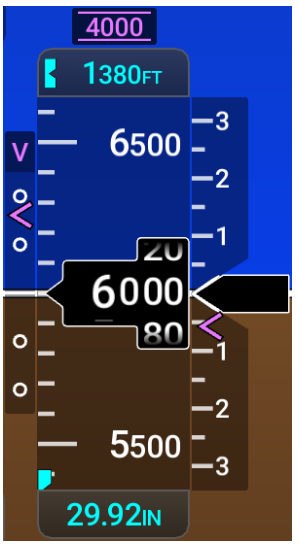


Figure 63: VNAV Indicator

HORIZONTAL SITUATION INDICATOR

The Horizontal Situation Indicator (HSI) displays a rotating compass card in a heading-up orientation at the bottom of the PFW. 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 three formats (Basic, HSI Map, and Traffic). The Selected Heading is displayed as a datafield button to the top left of the HSI. The cyan bug on the compass rose corresponds to the Selected Heading and if it is beyond the visible portion of the compass rose, the Selected Heading Bug will appear at the edge of the HSI. The Desired Track (DTK) is shown in magenta to the upper right of the HSI when the selected navigation source is FMS. The Selected Course (CRS) is shown to the upper right of the HSI in cyan when the selected navigation source is VOR or LOC.

Figure 64: Horizontal Situation Indicator

The 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 (FMS, VOR1, and LOC1) or a double line arrow (VOR2 and LOC2) which points in the direction of the set course. The To/From Indicator rotates with the Course Pointer and is displayed when the active NAVAID is received. Above the HSI a sliding deviation indicator incorporating a deviation scale and a To/From indication is displayed. If a navigation aid fails and the system enters dead reckoning mode "DR" will be annunciated inside the HSI. If the aircraft deviates from course a distance greater than the RNP value (full scale CDI deflection), a cross track error (XTK) will be annunciated at the bottom of the HSI displaying the current distance from the flight plan/VOR/LOC course.

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

Navigation angles (track, heading, course, bearing) are corrected automatically to the computed magnetic variation (Mag Var), or referenced to true north (T), or User (U). The 'User' Navigation Angle allows the pilot to enter a custom magnetic variance. 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 65: User Magnetic Variation and True Magnetic Variation

ADJUSTING THE SELECTED HEADING:

NOTE

If the heading bug is set to a direction outside of the visible compass rose, the bug will partially be visible on the corresponding edge of the compass.

1. On the PFW, touch the **HDG** Datafield Button.
2. Using the 'Selected Heading' keypad, type the desired heading bug value and touch the **Enter** Button.

   Or:

   Touch the **Set To Current** Button to sync the heading bug to the current heading.

If the **DCK** is configured to control heading and altitude, turn the Inner **DCK** to adjust the heading bug and push the **DCK** to sync the heading bug with the current heading.

CHANGING THE NAVIGATION ANGLE SETTING:

1. Navigate to the 'Apps' window by pressing the **MENU** Softkey two times.

   Or:

   Touch the **Applications** Icon on the Applications Bar.
2. Touch the **Settings & Tools** Tab.
3. Touch **Units & Time**.
4. Touch the **Nav Angle** Selection Button to select the desired magnetic variation. If the **Auto Mag. Variation** Button or **True** Button is selected the procedure is complete. If the **User Mag. Variation** Button is selected, proceed to the next step.
5. After touching the **User Mag. Variation** Button a **Magnetic Variation** Datafield Button will appear below the **Nav Angle** Selection Button. To adjust the user magnetic vaiation, touch the **Magnetic Variation** Datafield Button.
6. A 'Magnetic Variation' keypad will open with the option to select an **East** Selection Button or **West** Selection Button (the currently selected hemisphere is highlighted in blue). Enter the desired magnetic variation and touch the **Enter** Button.

HSI STYLE

The HSI can be set to 'Basic', 'Map', or 'Traffic' as desired. 'Basic' is the default option for the HSI and displays the traditional compass rose with the aircraft, CDI, and aircraft icon. The 'Map' option allows for most information normally found on the MFW Map page to be inlaid into the HSI with all of the traditional compass components of the HSI still visible. The 'Traffic' option allows for most information found on the MFW Traffic page to be inlaid into the HSI with all of the traditional compass components of the HSI still visible.

If the HSI Style is set to display the map inlay, the course deviation indications, topographical, traffic, weather, and terrain information are all available to be toggled on or off in the 'Primary Flight Window' Settings Menu.

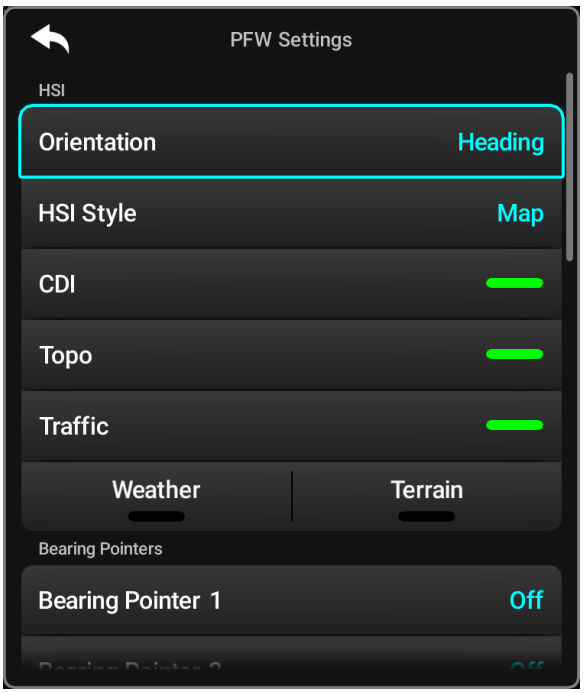


Figure 66: 'Primary Flight Window' Settings Menu

SELECTING THE HSI STYLE:

1 Access the 'PFW Settings' on the PFD:
   a) Press the **MENU** Softkey (on the PFW side of the bezel while in split screen mode) to open the 'PFW Menu'.
      Or:
   a) Touch anywhere within the HSI to open the 'PFW Menu'
   b) Touch the **PFW Settings** Button.
2 Touch the **HSI Style** Selection Button.
3 Touch the desired HSI Style Button (**Basic**, **Map**, or **Traffic**)

If the **Map** HSI Style is selected, five annunciator buttons appear in the 'Primary Flight Window' settings menu that may be toggled on or off to display specific content inside the HSI (CDI, Topo, Traffic, Weather, and Terrain). A green indication signifies that the content is enabled.

HSI MAP

When the pilot enables the HSI Map, the HSI is formatted to show a navigation map on the rotating compass card. The current map range is displayed in nautical miles to the upper left side of the HSI. 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 at any time, and remains until the active waypoint changes, a terrain or traffic alert occurs, the aircraft takes off, or the manual override times out. To adjust the map range touch two fingers anywhere within the HSI and move them apart to decrease range or pinch using two fingers to increase range, or use a single finger to swipe up or down to increase or decrease HSI range. ‘Autozoom’ can be

enabled and disabled and the ‘Minimum Zoom’ and ‘Maximum Zoom’ can be adjusted in the ‘Map Settings’ Menu for the display.

The pilot also has the option to toggle CDI, Terrain, Traffic, Weather, or Topographical (Topo) displays on or off on the ‘Primary Flight Window’ Settings. The basemap is the map layer that makes up the background of the HSI Map. The ‘Topo Basemap’ option gives the pilot a topographical map option. All symbology on the HSI map reflects the settings set in the 'Map Settings', accessed using the **MENU** Softkey while the 'Map' Application Page is open on the MFW.

If at any point the TAWS system reports an obstacle caution or warning, the HSI will automatically transfer to the HSI Map setting to present the obstacle or terrain in question. This switch in display will be accompanied by an alert below the HSI. Refer to *Terrain Avoidance and Warning System* in the Hazard Avoidance Section for more details.

Figure 67: HSI Map

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 6 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 (the two outside tick marks), 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 68: Turn Rate Indicator and Trend Vector

HSI TRACK

If the system is unable to find the aircraft heading, but GPS-based track information is available, the HSI displays the ground track instead of heading using HSI Track Mode. In this mode, a magenta 'TRK' annunciation and track display appear on the HSI.

Figure 69: Heading/Track Mode on HSI

When in track mode, the diamond representing the current GPS track replaces the black triangle (lubber line) representing the current heading, and the magenta diamond representing GPS track remains fixed near the top of the HSI.

BEARING POINTERS AND INFORMATION WINDOWS

Two bearing pointers and associated information can be displayed on the HSI. When enabled, bearing pointers display the direction of flight required to the selected navigation source. The bearing pointers are light blue and are single-line (Bearing Pointer 1) or double-line (Bearing Pointer 2). The navigation sources available are Flight Plan, VOR (or LOC depending on the radio frequency input), Best Airport (when configured), or Nearest Airport. When the bearing pointer is enabled, an information window with a pointer symbol (1 or 2) appears to indicate the navigation source and is displayed below the HSI containing information about each bearing source. The bearing pointers never override the CDI and are visually separated from the Course Deviation Indicator (CDI) by a white ring (shown when the bearing pointers are selected but not necessarily visible due to data unavailability).

When a bearing pointer is set to indicate Flight Plan information, it will point to the next waypoint in the active flight plan. If no flight plan is active, and the bearing pointer is set to FMS, no bearing pointer will appear on the HSI. If the HSI bearing pointer is set to a radio navigation frequency (e.g., VOR or LOC) it will point in the direction of the source of the signal as long as the station is within range. If the bearing pointer is set to Best, the system will continuously use the configured data (airport length, surface, and distance) as well as the information supplied by the ADAHRS to provide directional information to the best airport to use for an emergency situation. If the bearing pointer is set to Nearest, it will point to the nearest airport to the aircraft. In some circumstances the nearest and best airports are the same location.

When a bearing pointer is displayed, its associated information window is also displayed. The Bearing Information Windows are displayed at the lower sides of the HSI. The following information may be displayed in the Bearing Information Windows:

- Bearing source (NAV, FMS):
  - Flight Plan (FMS)
  - VOR
  - LOC

  - Best (BEST)
  - Nearest (NRST)
- Pointer icon (single lined or double lined)
- Station / waypoint identifier (NAV, FMS)
  - VOR/LOC identifier in green
  - VOR direct-to course TO the station
  - FMS identifier in magenta
- GPS-derived great circle distance to bearing source

If a bearing pointer is activated and no NAV or FMS source is available, the information window will only display the Bearing Source (VOR, LOC, or FMS) and dashed lines for the identifier and distance portions of the information window.

Figure 70: Bearing Pointers

ENABLING/DISABLING BEARING POINTERS:

1 Access the 'PFW Settings' on the PFD:

a) Press the **MENU** Softkey (on the PFW side of the bezel while in split screen mode) to open the 'PFW Menu'.

Or:

a) Touch anywhere within the HSI to open the 'PFW Menu'

b) Touch the **PFW Settings** Button.

2 To access the 'PFW Menu' on the MFD:

a) Display the PFW on the MFD by touching the **Applications** Icon **> Primary** Tab **> PFW**.

b) Complete steps 1a / b.

3 Touch **Bearing Pointer 1** or **Bearing Pointer 2**.

4 A 'Bearing Pointer' Window will appear. Select the desired option to display on the HSI:

- **OFF**
- **Flight Plan**
- **VOR**

- **Best**
- **Nearest**

COURSE DEVIATION INDICATOR (CDI)

The 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 (FMS1, GPS1, VOR1, and LOC1) or a double line arrow (FMS2, GPS2, VOR2, and LOC2) which points in the direction of the set course or VOR radial. The To/From arrow rotates with the course pointer and is displayed when the active NAVAID is received.

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.

The CDI is located in the center of the standard HSI compass card, and is duplicated using a standalone CDI bar above the HSI.

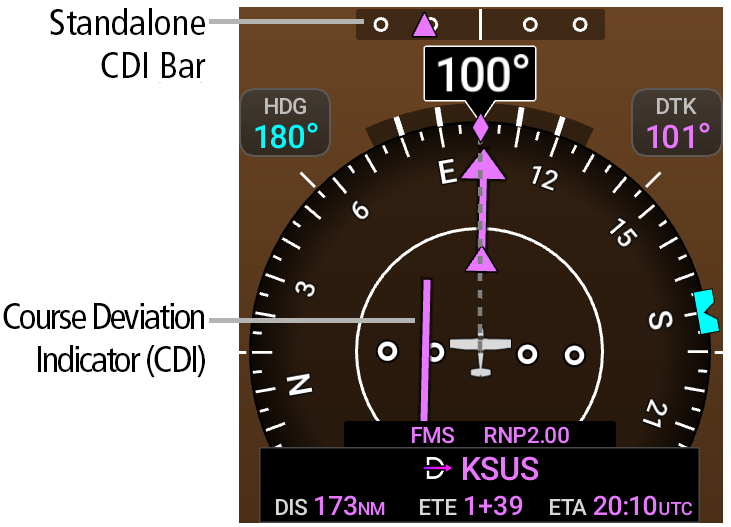


Figure 71: Lateral Deviation Scale

NOTE

The Standalone CDI bar will flip to the opposite side to accurately reflect the direction of deflection on the HSI CDI. While the track angle error is increasing, the indication will move to the opposite side of the Standalone CDI bar when the current aircraft heading is more than 103° from the course. While the track angle error is decreasing, the indication will move to the opposite side of the Standalone CDI bar when the current aircraft heading is more than 107° from the course.

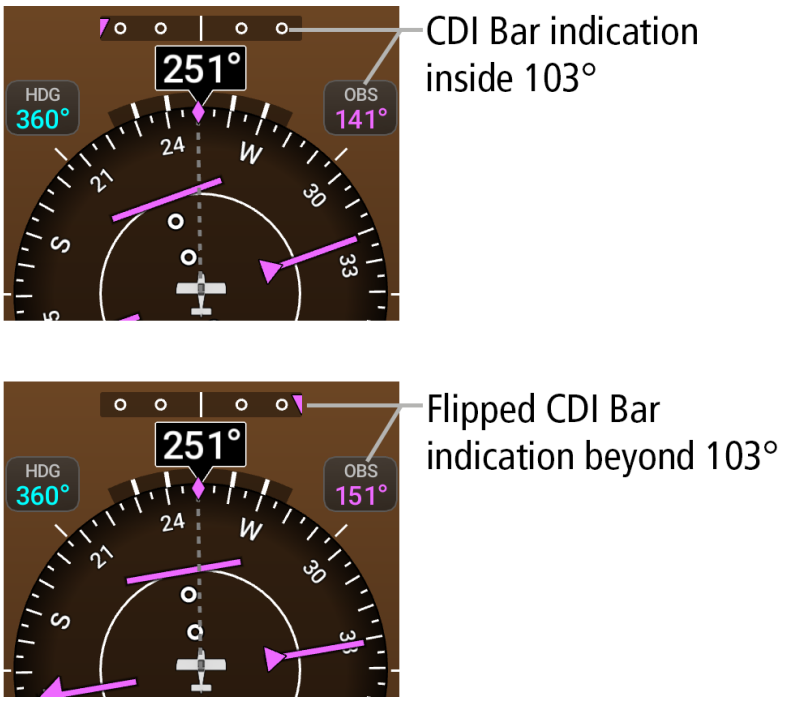


Figure 72: Changing Sides of the CDI Bar Deviation Scale

The CDI is capable of displaying two different sources of navigation: GPS/FMS or NAV (VOR, localizer) depending on the navigator(s) configured (refer to the AXIS™ installation manual for more information). The CDI color indicates the current navigation source: magenta (for GPS) or green (for VOR and LOC). The full-scale limits for the CDI are defined by a GPS-derived distance when coupled to GPS. When coupled to a VOR or localizer (LOC), the CDI has the same angular limits as a mechanical CDI. If the CDI exceeds the maximum deviation on the scale (two dots) while coupled to GPS, the crosstrack error (XTK) is displayed below the white aircraft symbol.

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

Figure 73: VOR / LOC Course Preview

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

Some VOR and NDB approaches are approved for use of GPS as a substitute means of navigation, meaning it is not necessary to tune or monitor the radio navigation source associated with the approach. These are referred to as “overlay approaches” and are indicated on the approach selection screen by the presence of ‘GPS’ after the VOR or VOR/DME prefix and LNAV or LNAV+V for NDB approaches. LNAV approaches provide lateral GPS-based guidance to legs defined by the navigation database.

The navigation source can change automatically from a GPS to ILS/LOC navigation source while transitioning to an approach depending flight plan information loaded into the Flight Management System (FMS). Refer to the FMS chapter for more information.

FMS/GPS/VFR NAVIGATION SYSTEMS

NOTE

The AXIS™ Pilot's Guide is written to explain the features of building a flight plan using the AXIS flight display. Flight plans using Serial GPS Navigator LRU's refer to the appropriate manuals provided for that system.

NOTE

If more than one GPS navigators are installed and one of the two GPS navigators is an HSDB navigator, the VFR CDI selection will not be used because the AXIS display’s internal flight plan is shared with the identified GPS navigator.

AXIS Flight Display Systems maintain an internal flight plan at all times. Depending on the system configuration, this flight plan may be used only for VFR navigation, for IFR navigation, or it may be shared with certified IFR navigators. There are three GPS CDI selection groups

that may be present in the AXIS Flight Display System (FMS, GPS, or VFR). If more than one GPS is connected to the system each one will be identified with a numerical value (GPS1, GPS2, etc.).

The active CDI source indicates both the navigation source and the available flight plan management functions. If flight plan editing is unavailable on AXIS, the active navigator is maintaining its own flight plan and all changes must be made on that navigator.

The data transfer of flight plans are different depending on the type of navigation LRU installed in the system. When the information is shared between the GPS NAV LRU and the AXIS flight displays (using HSDB connection) "FMS" will be the displayed source of navigation information. This indicates that flight plan modification may be performed from any AXIS display or connected IFR navigator, and will be reflected throughout the system.

When the information is transferred to the AXIS flight display (using Serial connection) "GPS" will be the displayed source of navigation information. This indicates that navigation guidance is being provided by an IFR GPS navigator that maintains its own flight plan. When a flight plan is provided by a serially connected navigator, AXIS displays the navigator's flight plan but cannot modify it ("Read Only"). All flight plan changes must be made on the navigator.

When the navigation source is only from the AXIS Display and the display is not qualified for IFR GPS operation, the system’s mode of operation is VFR. The VFR CDI indicates that the CDI selection is only intended for use in Visual Meteorological Conditions. The VFR CDI will not be available in systems where the internal flight plan is shared with an external flight plan or there is an IFR capable AXIS GDU.

Refer to *Failure of the External GPS Navigation Source* in the Flight instruments Section for more information.

COURSE DEVIATION INDICATOR (CDI) SCALING

NOTE

When an external GPS navigator is in use, the pilot cannot change the CDI scale.

When a flight plan is active, the flight plan legs and CDI are sequenced automatically based upon the current phase of flight. The CDI scale is set to automatically adjust the Required Navigation Performance (RNP) for each phase of flight. A cross track annunciation will appear below the aircraft symbol on the HSI when the CDI exceeds the current RNP value.

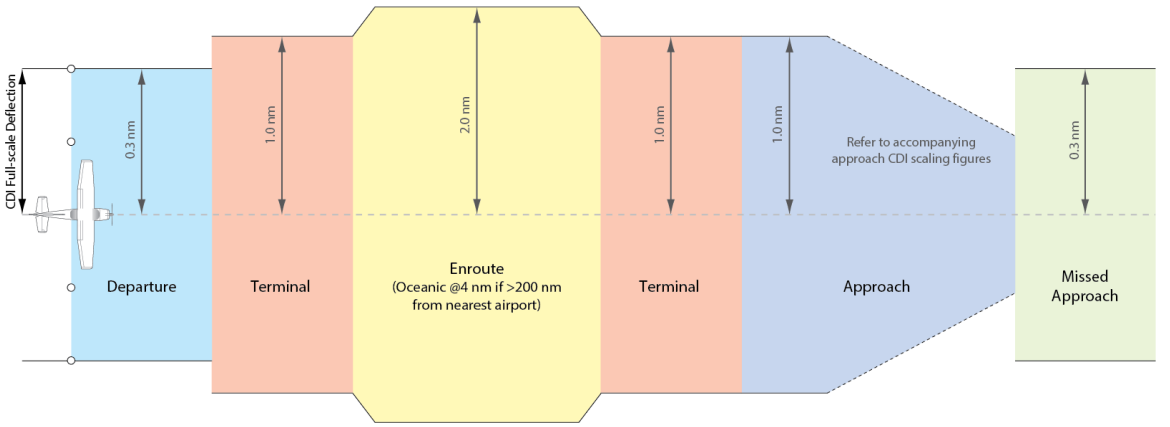


Figure 74: Automatic CDI Scaling

- Once a departure procedure is activated, the CDI is scaled for departure (0.3 NM).
- The system switches from departure to terminal CDI scaling (1.0 NM) under the following conditions:
  - The next leg in the departure procedure is not aligned with the departure runway.
  - The next leg in the departure procedure is not a CA, CD, CF, CI, CR, DF, FA, FC, FD, FM, IF, or TF (see *Aviation Terms and Acronyms* in Appendix C 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, except under the following conditions:
  - When navigating with an active departure procedure, the flight phase and CDI scale does not change until the aircraft arrives at the last departure waypoint (if more than 30 NM from the departure airport) or the leg after the last departure waypoint has been activated or a direct-to waypoint is activated.
- If after completing the departure procedure the nearest airport is more than 200 NM away from the aircraft and the approach procedure has not yet commenced, the CDI is scaled for oceanic flight (4.0 NM).
- Within 31 NM of the destination airport (terminal area), the CDI scale gradually ramps down from 2.0 NM to 1.0 NM over a distance of 1.0 NM; except under the following conditions:
  - Upon reaching the first waypoint of an arrival route that is more than 31 NM from the destination airport, the flight phase changes to terminal and the CDI scale begins to transition down from 2.0 NM to 1.0 NM over a distance of 1.0 NM.
- During approach, the CDI scale ramps down even further. This transition normally occurs within 2.0 NM of the final approach fix (FAF). The CDI switches to approach scaling automatically once the approach procedure is activated or if Vectors-To-Final (VTF) are selected.
- If the active waypoint is the FAF, the ground track and the bearing to the FAF must be within 45° of the final approach segment course.

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

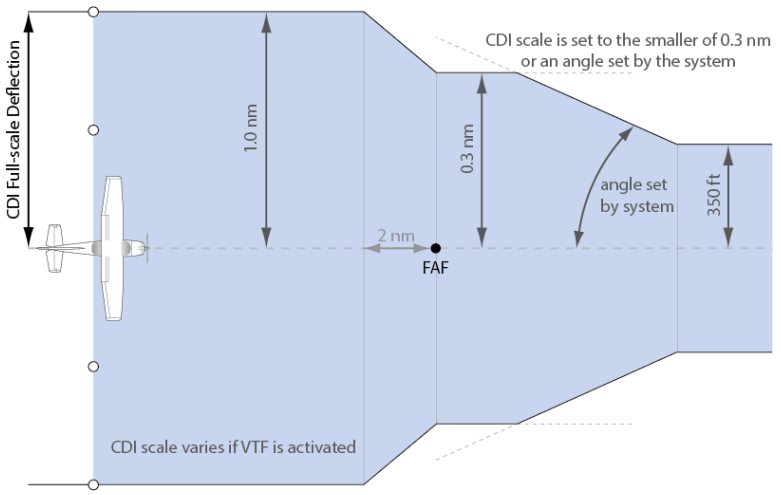


Figure 75: Typical LNAV, LNAV+V, and Visual Approach Service Level CDI Scaling

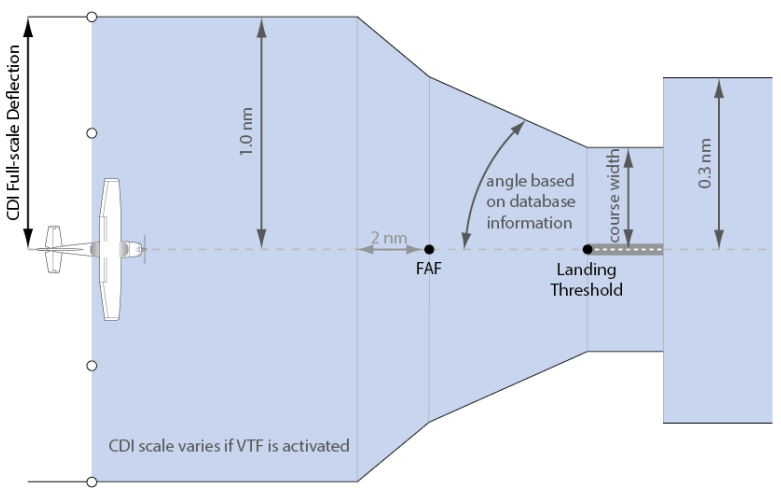


Figure 76: Typical LNAV/VNAV, LP, LP+V, and LPV Approach Service Level CDI Scaling

- 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.

CHANGING THE CDI SOURCE:

1 Open the 'PFW Menu' by touching anywhere inside the HSI.

Or:

Press the **MENU** Softkey on the PFD (if in split screen mode, touch the PFW side **MENU** Softkey.

2 Touch the **CDI** Selection Button to open the available CDI source selections (including external GPS sources if installed).

3 Touch the desired CDI source.

REQUIRED NAVIGATION PERFORMANCE (RNP)

NOTE

RNP requires GPS for integrity monitoring. Therefore, the following discussion is only applicable to navigators with FMS/GPS capability .

Required Navigation Performance (RNP) is a series of navigation specifications which permit operation of aircraft along a precise flight path with a high level of accuracy. RNP is specifically used to monitor navigation deviation during stringent procedures and airspace blocks.

GPS is the only type of navigation sensor available to the system that can stand up to the rigorous analysis to show compliance with integrity requirements. Thus, RNP integrity is completely dependent on GPS and any loss of integrity of GPS. The ‘UNABLE RNP’ annunciation and the RNP value changing to amber are the primary indications that RNP capability has been lost.

The system measures the RNP against Estimated Position Error (EPE), and an ‘UNABLE RNP’ cautionary annunciation will be displayed on the PFW if the error (EPE) is greater than the requirement (RNP). EPE can be monitored by the Sensor Status window on the MFW, refer to the procedure *Viewing GPS Receiver Information* in System Overview for access to this information on the flight display.

If the active leg/procedure of the flight plan has a published RNP procedure, the FMS will automatically populate the Current RNP Indicator with that value. If no FMS-set value is active, and no manual RNP entry has been defined, the system will determine a default RNP based on flight phase.

The Current RNP Indicator value will normally be displayed in magenta. The color will change to amber for LNAV+V, L/NAV, LP, or LPV when the Final Approach Fix (FAF) is the active waypoint and the GPS integrity is insufficient for the procedure. The indicator will also be shown in amber if the ‘Unable RNP’ position sensor status indication is displayed on the PFW. For waypoints other than the FAF, if the upcoming waypoint requires a lower RNP value, the system will switch to the lower RNP value 1 NM before the waypoint.

The pilot may set more stringent RNP values by accessing the 'Sensors FMS Position' window. The system will only accept manual RNP entries higher (less stringent) than FMS-set values if the current leg/phase-of-flight has a published RNP value. After inputting a manual RNP entry the 'Mode' will switch to "Manual RNP" below the ‘Required Navigation Performance’ field in the 'Sensors FMS Position' window. Canceling a manual RNP can be done by accessing the ‘Auto’ Button. The system will revert the value to an FMS-set value, or a system-defined value dependent on phase-of-flight.

Figure 77: RNP Indication on PFD

MANUALLY SETTING THE CURRENT RNP VALUE (INTERNAL GPS ONLY):

1 Navigate to the 'Apps' window by pressing the **MENU** Softkey two times.

Or:

Touch the **Applications** Icon on the Applications Bar.

2 Touch the **Settings & Tools** Tab.

3 Touch **Sensors**.

4 Touch the **RNP** Datafield Button.

5 Using the numeric keypad enter a value between 0.30 and 10.00 nautical miles. (The system will only allow entries more stringent than the current phase of flight.)

6 Touch the **Enter** Button to accept the new RNP value.

VIEWING ESTIMATED POSITION ERROR (EPE):

1 Navigate to the 'Apps' window by pressing the **MENU** Softkey two times.

Or:

Touch the **Applications** Icon on the Applications Bar.

2 Touch the **Settings & Tools** Tab.

3 Touch **Sensors**.

4 The EPE is viewed under the Required Navigation Performance section of the Sensors FMS Position window.

AUTO-SLEWING

NOTE

When the flight plans are controlled with a GTN/GNS navigator auto-slewing on the AXIS™ will not be available.

When the AXIS system has direct control of the flight plan the LOC course pointer will automatically slew to the correct final approach course when an ILS, LOC, BC, LDA, or SDF approach is loaded into the active flight plan.

When flying a localizer back course approach, verify that the selected course matches the published front course. A 'Check Course' message below the HSI will appear if the course selection is not within 10° of either the front or back course for the selected approach.

SETTING THE LOC COURSE:

1 Touch the **CRS** Indicator Button on the PFW, opening the 'Course' numeric keypad.

2 Using the keypad enter the desired course and touch the **Enter** Button.

Or:

Touch the **Direct** Button to automatically select the flight management systems database course.

OBS MODE

NOTE

If configured, the selected external GPS navigator (i.e., GTN or GNS Series Units) is used to set the OBS Mode.

Enabling Omni-bearing Selector (OBS) Mode suspends the automatic sequencing of waypoints in a GPS flight plan, but retains the current "active-to" waypoint as the navigation reference even after passing the waypoint. 'OBS XXX°' is annunciated in the FMS status box below the HSI 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. After releasing OBS Mode, the GPS 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.

ENABLING/DISABLING OBS MODE:

1 OBS mode can be enabled two different ways:

a) Touching the **CRS** Indicator Button will open a prompt to "Set OBS and hold?" Touch **OK** (skip step two).

Or:

a) Open the 'PFW Menu' by touching the HSI or pressing the **MENU** Softkey then touching the **OBS** Button.

2 If the second option in step one is chosen touch the **OBS** Datafield Button on the PFW.

3 Once the 'Select OBS Course' keypad is open:

a) Type the desired course and touch the **Enter** Button.

Or:

a) Touch the **Sync Course** Button to sync the FMS course and the OBS course.

4 To disable OBS Mode, open the 'Select OBS Course' keypad and touch the **Release OBS Hold** Button.

SUSP MODE

During an approach or while in a holding pattern using the FMS, the flight plan will be suspended. "SUSP" will be annunciated on the HSI while in suspend mode. If on an approach the SUSP Mode is activated after the missed approach point (MAP), this allows the pilot to take controls of the aircraft and land. If no action is taken by the pilot, the aircraft will continue to fly the last heading provided by the FMS until suspend mode is deactivated. While in a holding pattern the system will enter SUSP Mode and continue to fly the holding pattern until the pilot takes action. Refer to the Flight management section for more information on FMS *holding patterns* and *approaches*.

After suspend mode is deactivated the flight plan will automatically sequence to the next waypoint in the flight plan. If in a holding pattern and suspend mode is deactivated, the flight plan will continue the hold until the holding fix has been reached with the option to reactivate the suspend mode. Once the flight plan has continued to the next waypoint, the option to enter OBS mode replaces the suspend mode option.

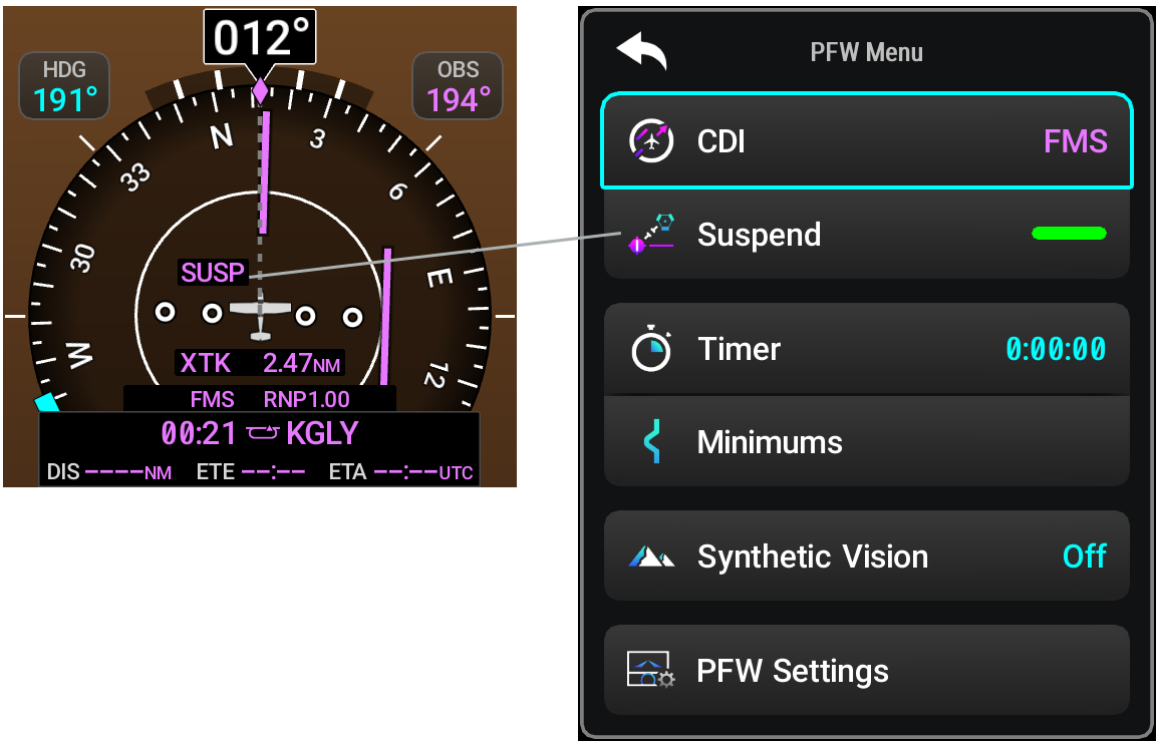


Figure 78: Suspend Mode Indications

DEACTIVATING SUSP MODE:

1 Access the 'PFW Menu' window by:

a) Touching the HSI on the PFW.

Or:

a) Press the **MENU** Softkey on the PFD (if in split screen mode press the **MENU** Softkey on the PFW side of the bezel).

2 Touch the **Suspend** Button to disable SUSP Mode (green annunciator indicates that SUSP Mode is activated).

HSI ORIENTATION

The HSI may be configured to provide directional information in either 'Heading' or 'Track/Heading' modes. Selecting Heading Mode orients the HSI to display aircraft heading in a conventional manner with heading shown at the top of the compass card as indicated by the lubber line. In 'Track/Heading' mode, the aircraft symbol and lubber line move to indicate heading and wind correction while ground track is shown at the top of the compass card. While in 'Track/Headaing' mode, the HSI will remain heading-based when the aircraft is on the ground or when the autopilot is in HDG mode. Refer to the AXIS™ installation manual for more information on configuring the HSI Orientation.

NOTE

If a GI 275 is integrated to interface with the AXIS, the HSI orientation will cross fill between the two LRU's.

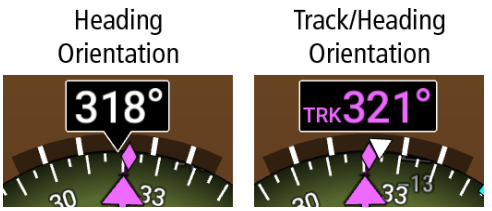


Figure 79: HSI Heading Mode

CHANGING HSI ORIENTATION:

1 Access the 'PFW Menu' window by:

a) Touch the HSI on the PFW.

Or:

a) Press the **MENU** Softkey on the PFD (if in split screen mode press the **MENU** Softkey on the PFW side of the bezel).

2 Touching the **Orientation** Selection Button.

3 Touch the **Heading** or **Track/Heading** Button button as desired.

2.2 SUPPLEMENTAL FLIGHT INSTRUMENTS

In addition to the flight instruments, the PFW or PFW Page also displays various supplemental information, including the Outside Air Temperature (OAT), wind data, and Angle of Attack (AoA) indications.

G-METER

Whenever the G load on the airplane goes above or below the configured settings, the HSI is temporally replaced with a large graphical G-meter. The G-meter can be deactivated in 'PFW Settings.' Regardless of the current G load, the HSI can be replaced with a G-meter by changing the ‘G Meter’ setting in 'PFW Settings.' If set to 'On', the G-meter will be displayed until the setting is changed to "Auto', 'Off', or power is cycled. The G-Meter is also an option to be displayed on the PFD as a widget. For more information on how to set up widgets refer to the *Enabling and Configuring Widgets on the PFD* procedure of the System Overview chapter.

Small white triangles are used to indicate the minimum and maximum recorded G loads. When in the auto display mode, the G-meter will automatically be displayed when an unusual attitude is sensed (i.e., greater than +/- 65° roll or +30°/-20° pitch). Refer to the AXIS™ installation manual for more information on configuring the G-meter.

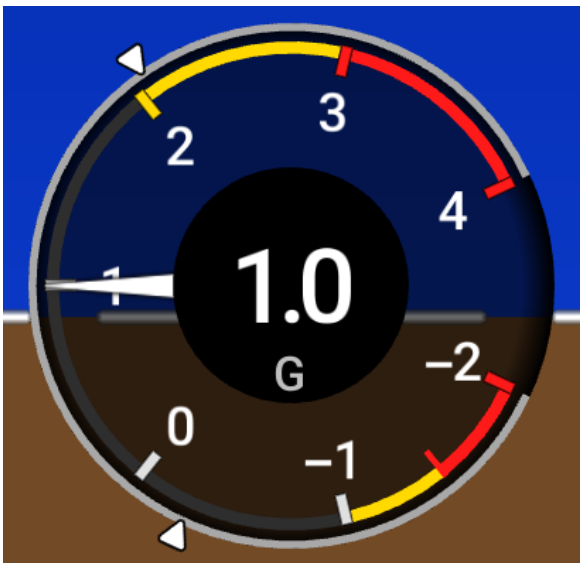


Figure 80: Automatic G-Meter Display

DISPLAYING / REMOVING THE G-METER ON THE HSI:

1 Access the 'PFW Menu' window by:
   a) Touch the HSI on the PFW.
   Or:
   a) Press the **MENU** Softkey on the PFD (if in split screen mode press the **MENU** Softkey on the PFW side of the bezel).
2 Touch the **PFW Settings** Button.
3 Scroll down to the 'G Meter' section and touch the **Display** Selection Button.
4 Touch the button for the desired setting ('On', 'Auto', 'Off').

RESETTING THE G-METER MINIMUM AND MAXIMUM MARKERS:

1 Access the 'PFW Menu' window by:

a) Touch the HSI on the PFW.

Or:

a) Press the **MENU** Softkey on the PFD (if in split screen mode press the **MENU** Softkey on the PFW side of the bezel).

2 Touch the **PFW Settings** Button.

3 Scroll down to the 'G Meter' section and touch the **Reset** Button (The **Reset** Button is accessible on the G Meter Widget if enabled on the PFD).

4 A confirmation window ('Reset G Meter') will open, touch the **Yes** Button to confirm or the **No** Button to cancel the reset.

Or:

If using the G Meter Widget reset option the buttons displayed for confirmation are **OK** and **Cancel**.

TRIM AND FLAP POSITION INDICATORS (OPTIONAL)

Elevator Trim, Aileron Trim, Rudder Trim, and Flap Position indicators are displayed to the left of the HSI and below the wind data on the PFW. These indicators can be configured from the Engine/Airframe Input Configuration Page in Configuration Mode. Refer to the AXIS™ installation manual for more information.

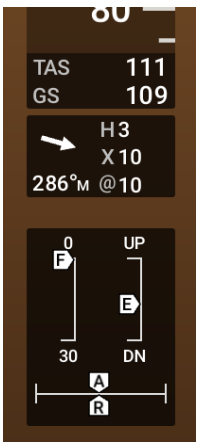


Figure 81: Trim and Flap Position Indicators

OUTSIDE AIR TEMPERATURE (OAT)

The Outside Air Temperature (OAT) is displayed in degrees Fahrenheit (°F) or degrees Celsius (°C) in the bottom portion of the PFW.

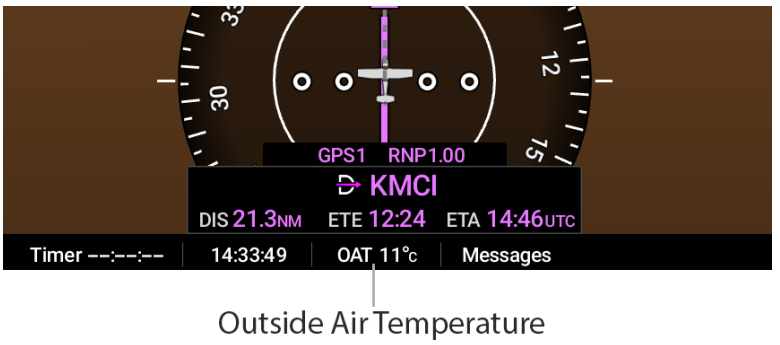


Figure 82: Outside Air Temperature on the PFW

CHANGING THE TEMPERATURE SCALE:

1. Navigate to the 'Apps' window by pressing the **MENU** Softkey two times.

   Or:

   Touch the **Applications** Icon on the Applications Bar.
2. Touch the **Settings & Tools** Tab.
3. Touch **Units & Time**.
4. Touch the **Air Temperature** Selection Button.
5. Touch the desired temperature measurement for the system (**Celsius** or **Fahrenheit**).

WIND DATA

Wind direction/speed or headwind/crosswind information is displayed in a window below the Airspeed Indicator. The left side of the wind data box displays an arrow indicating the estimated wind direction and the heading from which the wind originates. The right side of the wind data box displays headwind ("H") or tailwind ("T") factor, the crosswind ("X") factor, and total wind speed ("@") in knots. If the measured wind speed is less than four knots "Calm Wind" is displayed in the window. When wind information is invalid or unavailable, the window displays "No Wind Data".

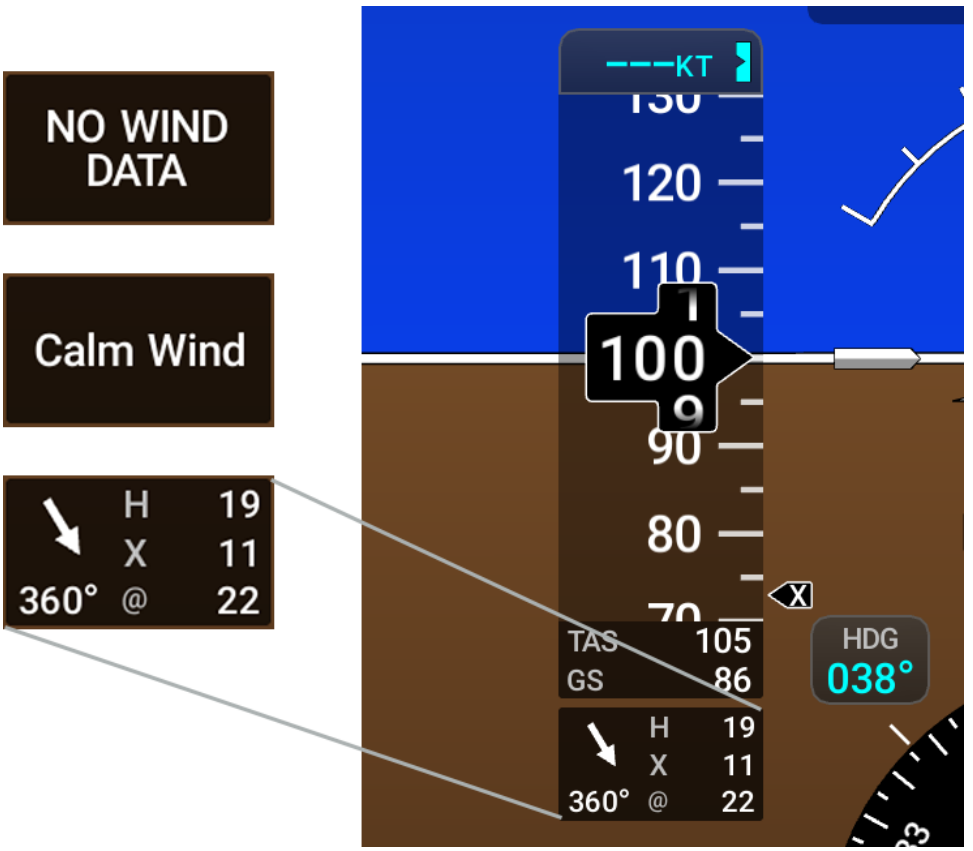


Figure 83: Wind Data

ANGLE OF ATTACK (AOA)

NOTE

After muting the AOA audible tone, the audio will remain muted for at least 15 seconds until the maximum illuminated bar has been lit for more than five seconds.

AXIS™ installations that include a GAP 26 and a GSU 25, Angle of Attack information can be displayed on the PFD. During Angle of Attack Calibration the Stall Warning AOA, Caution Alert AOA, Minimum Visible AOA, and Approach Target AOA are defined. The 'Approach Target' calibration can not be completed until the first three are complete. Once calibration of the AOA speeds is complete, the pilot may choose the airspeed at which the AOA is enabled above (while the aircraft is in the air) and disabled below (while the aircraft is on the ground). Refer to the AXIS installation manual for information regarding AOA calibration.

As the aircraft reaches the minimum visible angle the bottom green lines will begin to appear on the AOA gauge that is displayed to the left of the airspeed indicator. As the AOA continues to increase more lines become visible. If the approach speed has been calibrated, the top visible green line also has an approach target (circle) in the middle of it, this is to signify the appropriate approach or glide angle for the airframe. Amber lines and chevrons on the AOA indicator signal the caution alert. A persistent aural beeping will begin at the first red chevron and will become progressively faster as the AOA is increased. A constant tone will be heard at

the second red chevron indicating a stall condition. To mute the audible tone, press the **Mute** Button.

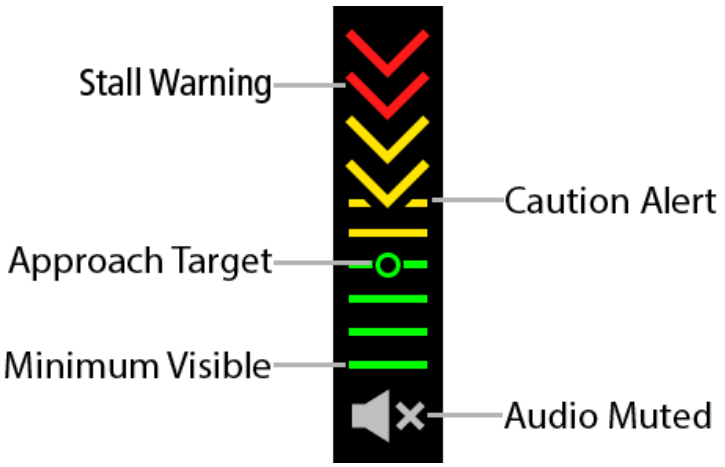


Figure 84: Angle of Attack on PFW

2.3 SYNTHETIC VISION TECHNOLOGY

⚠ 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.

NOTE

Terrain data is not displayed when the aircraft is outside of the installed terrain database coverage area.

NOTE

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

NOTE

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

Synthetic Vision Technology (Garmin SVT™) is a visual enhancement to the AXIS™ flight display. Garmin SVT depicts a forward-looking attitude display of the topography immediately in front of the aircraft. Garmin SVT information is shown on the Primary Flight Window (PFW). The depicted imagery is derived from the aircraft attitude, heading, GPS three-dimensional position, and databases of terrain, obstacles, and other relevant features. Loss of any of the required data, including temporary loss of the GPS signal, will cause Garmin SVT to be disabled until the required data is restored.

The Garmin 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 MFW 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.

Terrain is integrated within Garmin 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 PFW.

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 Synthetic Vision.

The following Garmin SVT enhancements appear on the PFW:

- Pathways
- Flight Path Marker
- Airport Signs / Airport Locator
- Runway Display / Runway Locator
- Traffic Display
- Terrain Alerting
- WireAware™
- Zero-Pitch Line
- Terrain and Obstacle Alerting

Figure 85: Synthetic Vision Imagery

ENABLING / DISABLING SYNTHETIC VISION:

1 Access the 'PFW Menu' window by:
   a) Touch the HSI on the PFW.
   Or:
   a) Press the **MENU** Softkey on the PFD (if in split screen mode press the **MENU** Softkey on the PFW side of the bezel).
2 Touch the **Synthetic Vision** Selection Button on the 'PFD Menu'.
3 From the pop-up window select **Auto**, **Flight**, or **Off** as desired.

PATHWAYS

NOTE

Pathways and terrain features are not a substitute for standard course and altitude deviation information provided by the CDI, VSI, and VDI.

NOTE

Pathways boxes may not be displayed for holding patterns, procedure turns and certain portions of the flight plan being received from an external GPS navigator.

Pathways provide a three-dimensional perspective view of the selected route of flight shown as colored rectangular boxes representing the horizontal and vertical flight path of the active flight plan. The box size represents 700 feet wide by 200 feet tall during enroute, oceanic, and terminal flight phases. During an approach, the box width is 700 feet or one half full scale deviation on the HSI, whichever is less. Other than a programmed descents and the descending portion of an ILS or WAAS GPS approach (starting from the leg leading into the FAF), pathways boxes are shown at the level of the altitude bug.

DEPARTURE AND EN ROUTE

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

Pathways are displayed along the flight plan route at the selected altitude for the leg. Climb profiles cannot be displayed due to the variables associated with aircraft performance. Flight plan legs requiring a climb are indicated by pathways displayed at a level above the aircraft at the altitude selected.

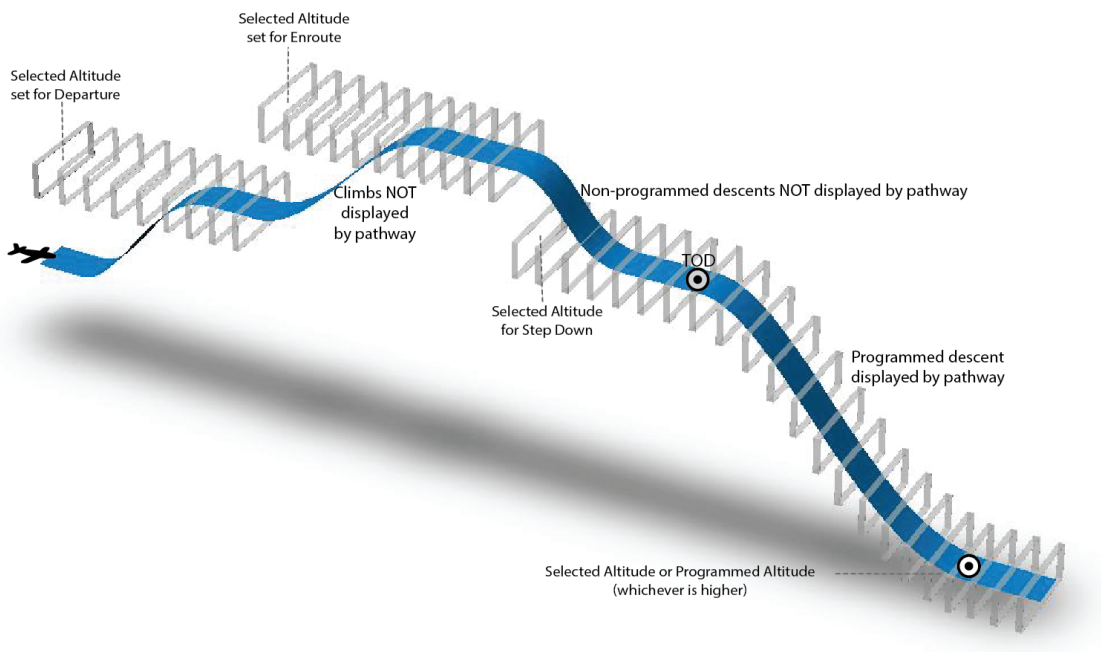


Figure 86: SVT Pathways, En Route and Descent

DESCENT AND APPROACH

NOTE

During the final segment of an ILS or WAAS GPS approach, the pathways boxes automatically adjust to correspond with the localizer/glideslope (ILS) or horizontal/vertical (GPS) deviation signals received from the external navigator.

Magenta pathways are shown (descending-only) for programmed descents. When the flight plan includes programmed descent segments, pathways are displayed along the descent path, provided that the selected altitude is lower than the programmed altitude. For more information on programmed descents refer to *VNAV Direct-To* in the Flight Management Section.

When an approach providing vertical guidance is activated, Pathways are shown level at the selected altitude. Pathways are shown level at the selected altitude up to the point along the final approach course where the altitude intercepts the extended vertical descent path or glideslope. From the vertical path descent or glideslope intercept point, the pathways are shown inbound to the Missed Approach Point (MAP) along the published lateral and vertical descent path.

During an ILS approach, the initial approach segment is displayed in magenta at the segment altitudes if GPS is selected as the navigation source on the CDI. When switching to the localizer inbound with LOC selected as the navigation source on the CDI, pathways are displayed in green along the localizer and glideslope.

If GPS is the selected navigation source on the HSI, the pathways boxes are magenta. If LOC is the selected navigation source on the HSI, the pathways boxes are green for the ILS. Pathways boxes are not displayed for segments such as heading legs or VOR radials.

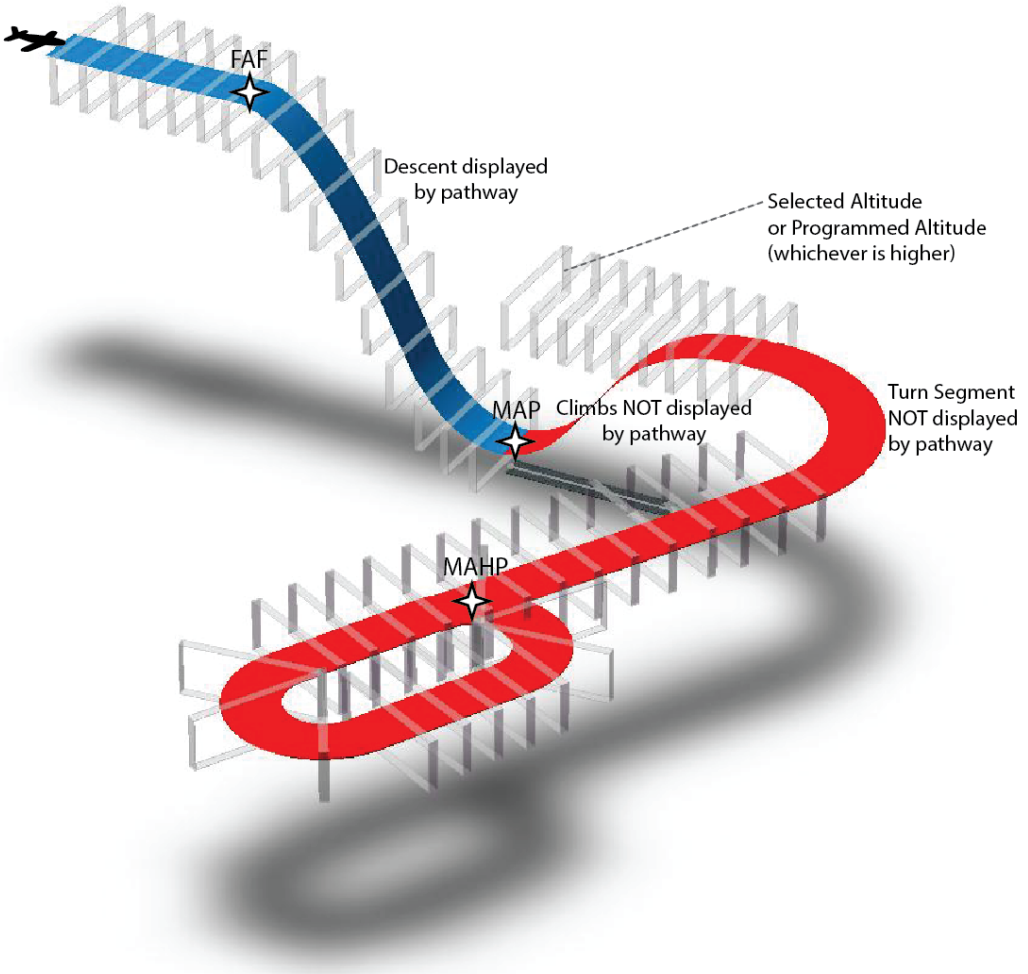


Figure 87: SVT Pathways, Approach, Missed Approach, and Holding

MISSED APPROACH

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

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

ENABLING/DISABLING PATHWAYS:

1 Access the 'PFW Menu' window by:
   a) Touch the HSI on the PFW.
   Or:
   a) Press the **MENU** Softkey on the PFD (if in split screen mode press the **MENU** Softkey on the PFW side of the bezel).
2 Touch the **PFW Settings** Button.
3 Scroll down and touch the **Pathways** Indicator Button so the green line appears on the button to enable the feature, or is removed to disable the feature.

FLIGHT PATH MARKER

The Flight Path Marker (FPM), also known as a Velocity Vector, is displayed on the PFW once the aircraft is above 30 knots. The FPM can be enabled and disabled when the synthetic terrain feature (SVT) is enabled, and is not available when synthetic terrain is not enabled. The FPM is track-based rather than heading-based and depicts the approximate projected climb or decent path of the aircraft. Certain operations, steep approaches or high rates of climb scenarios, can cause the FPM to deviate significantly from the trajectory of the aircraft, in which case the FPM will move to a section beyond the limits of the display. For more information on the FPM and AFCS modes, refer to the AFCS chapter.

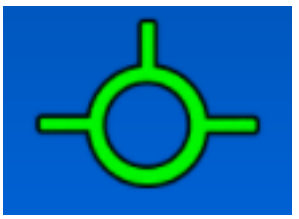


Figure 88: Example FPM

ENABLING / DISABLING FLIGHT PATH MARKER:

1 Access the 'PFW Menu' window by:
   a) Touch the HSI on the PFW.
   Or:
   a) Press the **MENU** Softkey on the PFD (if in split screen mode press the **MENU** Softkey on the PFW side of the bezel).
2 Touch the **PFW Settings** Button.
3 Scroll down and touch the **Flight Path Marker** Indicator Button so the green line appears on the button to enable the feature, or is removed to disable the feature.

AIRPORT SIGNS

Airport Signs provide a visual representation of airport location and identification on the synthetic vision display. Airport Signs appear on the display when the aircraft is approximately

15 NM from and airport and disappear at approximately 4.5 NM. Airport signs are shown without the identifier until the aircraft is approximately eight nautical miles from the airport. Airport Signs are not shown behind the airspeed or altitude display.

AIRPORT LOCATOR

Airport Locators provide advanced situational awareness by providing a visual representation of the Origin and Destination airports in the active FMS flight plan. They are represented as bold airport signs on the flight display. Origin airports are depicted in bold white with a black outline around the sign and the Destination airport is depicted in bold cyan.

When Airport Signs are activated and a flight plan is active, Airport Locators appear on the display at approximately 20 NM from an airport and disappear at approximately 4.5 NM. Airport Locators are shown without the identifier until the aircraft is approximately 8.5 NM from the airport. Airport Locators are not shown behind the airspeed or altitude display.

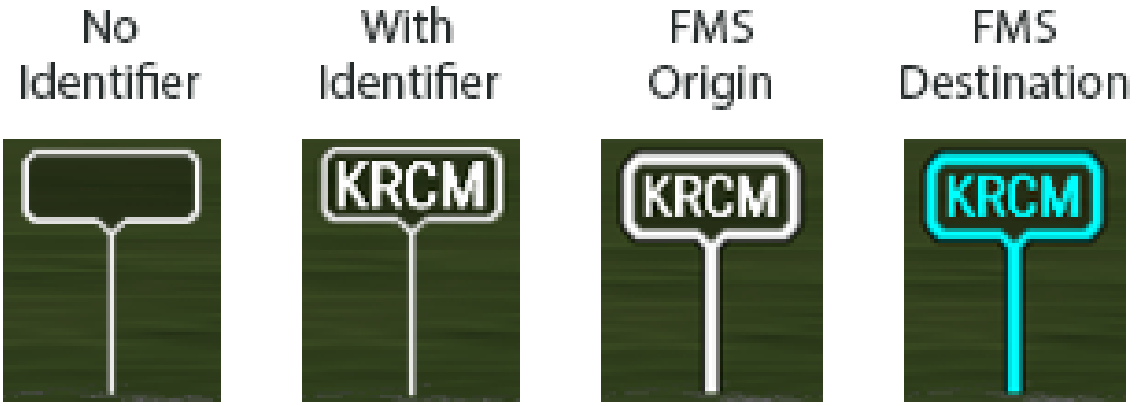


Figure 89: Airport Signs

ENABLING / DISABLING AIRPORT SIGNS:

1 Access the 'PFW Menu' window by:
   a) Touch the HSI on the PFW.
   Or:
   a) Press the **MENU** Softkey on the PFD (if in split screen mode press the **MENU** Softkey on the PFW side of the bezel).
2 Touch the **PFW Settings** Button.
3 Scroll down and touch the **Airport Signs** Indicator Button so the green line appears on the button to enable the feature, or is removed to disable the feature.

RUNWAYS

⚠ WARNING

Do not use Synthetic Vision runway depictions 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 outlined in white. Other runways (those NOT aligned with the aircraft heading) are outlined in gray. When an approach for a specific runway is active, that runway appears brighter and is outlined with a white box, regardless of the runway orientation as related to aircraft heading. The white outline of a flight plan runway will appear on the display larger the further the aircraft is from the runway and scale down slowly as the aircraft approaches the specified runway until it conforms to the actual size of that runway. As the aircraft gets closer to all runways, more detail such as runway numbers and centerlines are displayed.

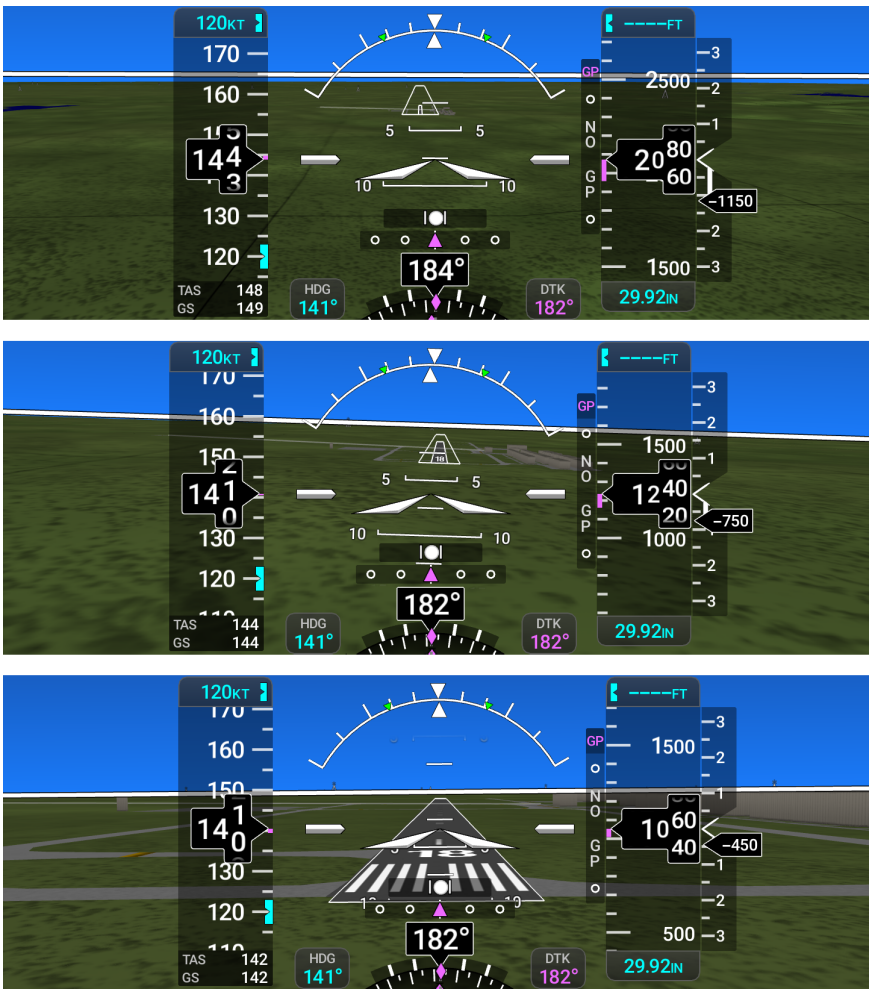


Figure 90: Airport Runways

RUNWAY LOCATOR

When an approach for a specific runway is active in the FMS flight plan and 'Runway Locator' is enabled the system will provide a series of cyan chevrons leading to the selected runway at the destination airport. The Runway Locator chevrons will fade into view when the aircraft is within a 25 NM radius from the destination airport. Chevrons will initially show 4 NM intervals. As the Aircraft gets closer to the airport chevrons will appear at 2 NM intervals and then 1 NM intervals. The chevrons will extend from the selected runway centerline to a distance of no greater than 10 NM.

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

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

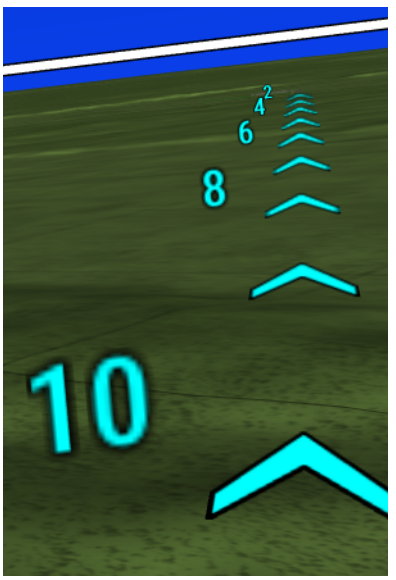


Figure 91: Runway Locator

ENABLING/DISABLING RUNWAY LOCATOR:

1 Access the 'PFW Menu' window by:
   a) Touch the HSI on the PFW.
   Or:
   a) Press the **MENU** Softkey on the PFD (if in split screen mode press the **MENU** Softkey on the PFW side of the bezel).
2 Touch the **PFW Settings** Button.
3 Scroll down and touch the **Runway Locator** Indicator Button so the green line appears on the button to enable the feature, or is removed to disable the feature.

TRAFFIC SYMBOLS

⚠ WARNING

Intruder aircraft at or below 500 ft. AGL may not appear on the Synthetic Vision display or may appear as a partial symbol.

Traffic symbols are displayed in their approximate locations. Traffic symbols are displayed in three dimensions, appearing larger as they are getting closer, and smaller when they are further away. Traffic within 250 feet laterally of the aircraft will not be displayed on the Synthetic Vision display. Traffic symbols and coloring are consistent with that used for traffic displayed on the Widget Map or Map Page. If the traffic altitude is unknown, the traffic will not be displayed on the Synthetic Vision display. For more details refer to the *Traffic Avoidance* discussion in the Hazard Avoidance section. Arrows are depicted on the traffic message if traffic is outside the Synthetic Vision field of view.

Figure 92: SVT Traffic

ENABLING / DISABLING TRAFFIC SYMBOLS:

1 Access the 'PFW Menu' window by:
   a) Touch the HSI on the PFW.
   Or:
   a) Press the **MENU** Softkey on the PFD (if in split screen mode press the **MENU** Softkey on the PFW side of the bezel).
2 Touch the **PFW Settings** Button.
3 Scroll down and touch the **Traffic Symbols** Indicator Button so the green line appears on the button to enable the feature, or is removed to disable the feature.

SVT TERRAIN AND OBSTACLE DATA

Terrain alerting on the synthetic vision display corresponds to the red and yellow symbols on the Widget Map, HSI Map, and Navigation Map. For more detailed information regarding Synthetic Vision Terrain and Obstacle Data, refer to the *Terrain Avoidance and Warning System (TAWS)* section in Hazard Avoidance.

Figure 93: Synthetic Vision Terrain Alerts

Obstacles are represented on the synthetic vision display by standard two dimensional tower symbols found on the Widget Map and Navigation Map. Obstacle symbols appear in the perspective view with relative height above terrain and distance from the aircraft. Unlike the Widget Map and Navigation Map display, obstacles on the synthetic vision display do not change colors to warn of potential conflict with the aircraft's flight path until the obstacle is associated with an actual terrain alert. Obstacles greater than 1000 feet below the aircraft altitude are not shown. Obstacles are shown behind the airspeed and altitude displays.

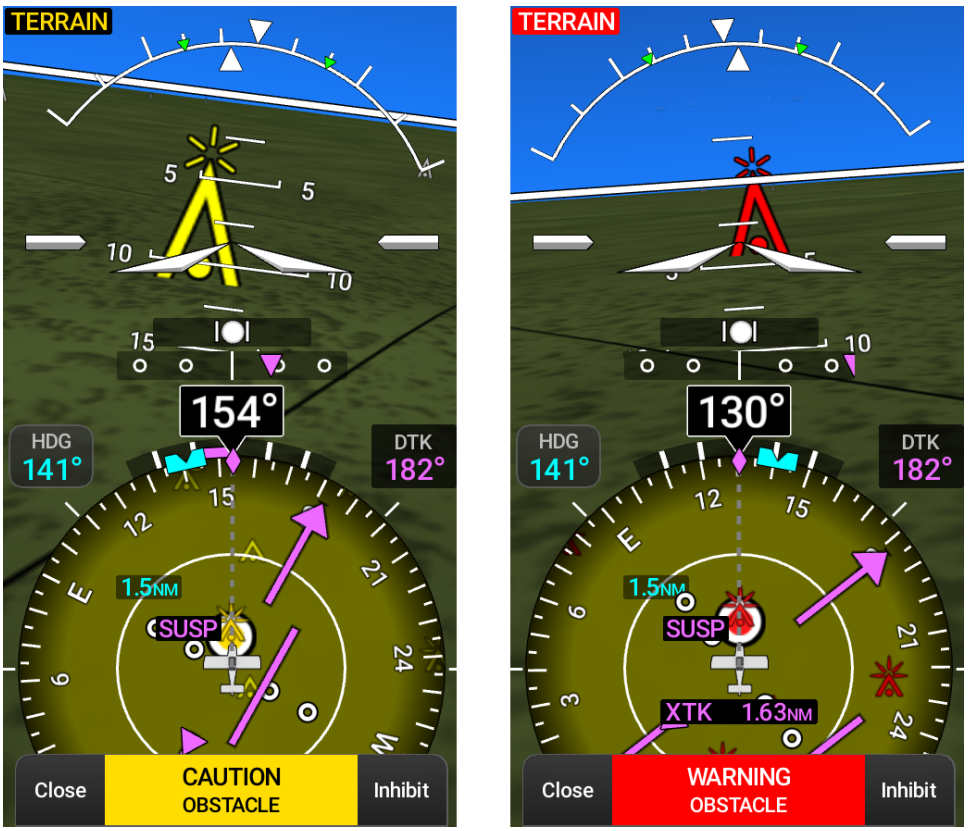


Figure 94: Synthetic Vision Obstacle Alerts

WIREAWARE

NOTE

The WireAware™ obstacle database does not contain all known power lines. Obstacle avoidance is the sole responsibility of the flight crew.

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

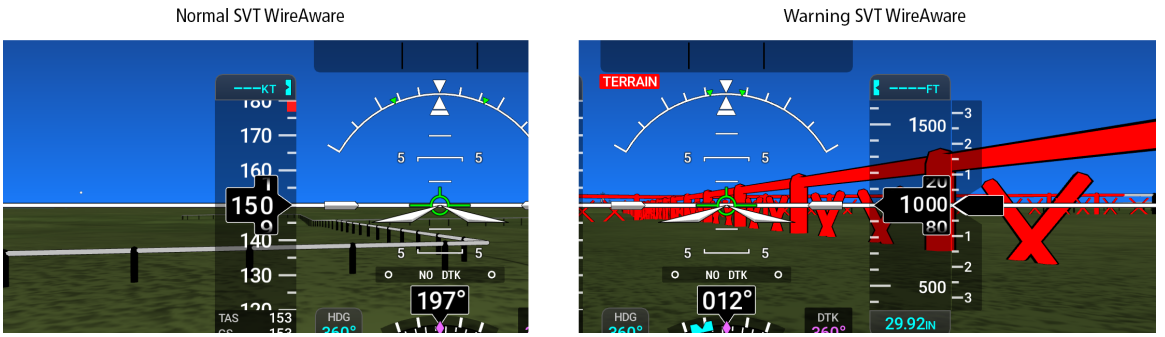


Figure 95: SVT with WireAware Obstacles

ZERO PITCH LINE

The Zero Pitch Line is drawn completely across the display and represents the aircraft attitude with respect to the horizon. With synthetic vision enabled, 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 marks are able to be enabled or disabled by the pilot on the Zero Pitch Line to aid in situational awareness. Major tick marks are displayed with numerical values (in degrees) every 30°. Minor tick marks are displayed with no numerical indications on the Zero Pitch line every 10°.

2.4 PFD ANNUNCIATIONS AND ALERTING FUNCTIONS

The following annunciations and alerting functions are displayed on the PFD. Refer to *Appendix A* for more information on alerts and annunciations.

MARKER BEACON ANNUNCIATIONS

Marker beacon annunciations are displayed on the PFW to the left of the Selected Altitude. Outer marker reception is indicated in cyan, middle in amber, and inner in white. Refer to the *Marker Beacon Receiver* section in the Audio & CNS chapter for more information on marker beacon annunciations.

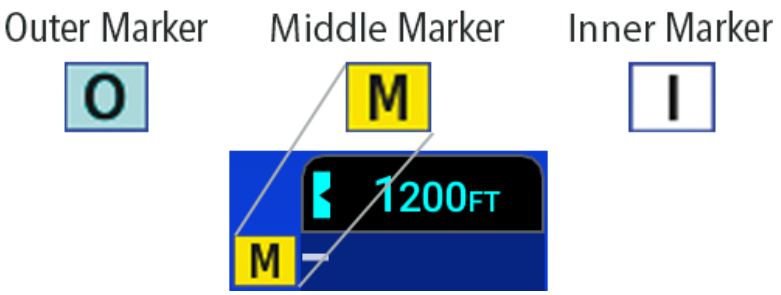


Figure 96: Marker Beacon Annunciations

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 an 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 in the top of the altimeter accompanied by the altitude constraint above the altimeter changing to amber. The 'LOW ALT' flashes for several seconds, and both indications remains displayed until the condition is resolved.

Figure 97: Low Altitude Annunciation on the PFW

MINIMUM ALTITUDE ALERTING

For altitude awareness, a Minimum Altitude Alert based on barometric ('BARO MIN'), temperature compensated ('TEMP MIN'), or radio (radar) altitude ('RA MIN') (optional) can be set at any time during a flight. When active, the altitude setting is displayed as an indicator button on the bottom portion of the Altimeter with a bug at the corresponding altitude on the Altimeter (once the altitude is within the visible range of the tape). While loading procedures into the Flight Management System (FMS), the option to set a Minimum Altitude Alert is also available.

When the alert has been set the bug that appears on the altimeter will appear in cyan. When the aircraft descends within 100 feet of the set alert the bug on the altimeter and the data in the minimums datafield button will turn white. Once the aircraft reaches the alert altitude, the bug and text turn amber and the voice alert, "Minimums Minimums" is heard.

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

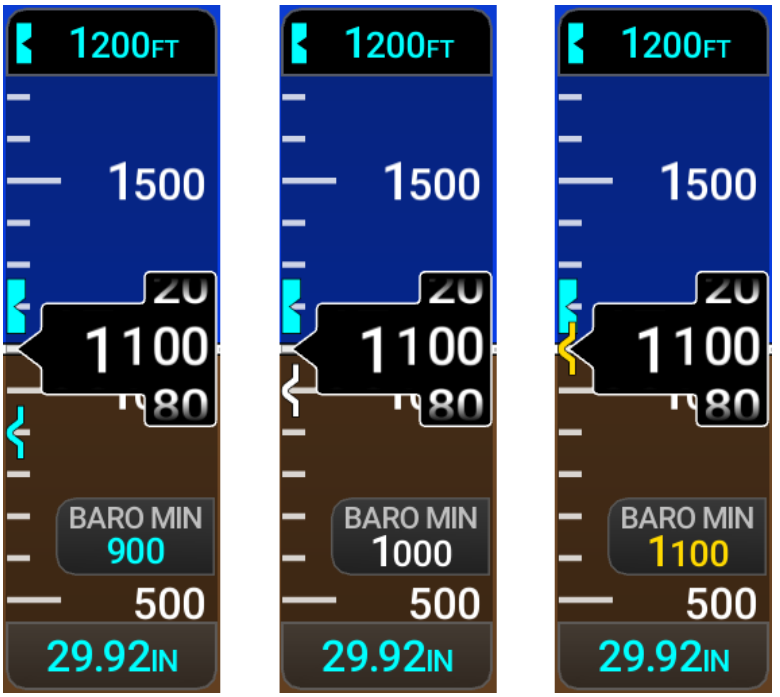


Figure 98: Minimum Altitude Alert Settings and Indicators

SETTING THE BARO/TEMP COMP/RADIO ALT MINIMUM ALTITUDE ALERT AND BUG:

NOTE

The Minimum Altitude Alert setting function will default to a barometric setting if a radar altimeter is installed.

1 Access the 'PFW Menu' window by:
   a) Touch the HSI on the PFW.

   Or:

   a) Press the **MENU** Softkey on the PFD (if in split screen mode press the **MENU** Softkey on the PFW side of the bezel).
2 Touch the **Minimums** Datafield Button.
3 Use the Minimums numeric keypad to enter a barometric altitude.
4 If temperature compensation is required:
   a) Touch the **TEMP COMP** Annunciation Button.
   b) Touch the **TEMP** Datafield Button.
   c) Using the Temperature numeric keypad, enter the desired temperature compensation.

d) Touch the **Enter** Button on the Temperature numeric keypad.

5 Touch the **Enter** Button on the Minimums numeric keypad.

REMOVING AN EXISTING MINIMUM ALTITUDE ALERT:

1 Access the Minimums numeric keypad by touching the **BARO MIN** Indicator Button.

Or:

a) If a temperature compensation has been entered, touch the **COMP MIN** Indicator Button.

Or:

a) If a radio altimeter altitude has been entered, touch the **RA MIN** Indicator Button.

Or:

a) Touch the **Minimums** Datafield Button in the PFW Menu window.

2 Touch the **Delete MINS** Button to remove the existing minimum altitude alert.

2.5 ABNORMAL OPERATIONS

ABNORMAL GPS CONDITIONS

The annunciations listed in the following table can appear on the HSI when abnormal GPS conditions occur. FMS navigation will resume automatically once a valid GPS solution is restored (and GPS sensors have not been inhibited). Refer to the Flight Management *Abnormal GPS Conditions* Section for more information on abnormal GPS conditions and *Appendix A* for abnormal GPS condition annunciations.

Annunciation	Location on HSI	Description
LOI	Upper left quadrant of HSI	Loss of Integrity Monitoring — GPS integrity is insufficient for the current phase of flight.
	Below HSI	Integrity OK — GPS integrity has been restored to within normal limits (annunciation displayed for 5 seconds).
DR	Lower right quadrant of HSI	Dead Reckoning — System is using projected position rather than GPS position to compute navigation data and sequence active flight plan waypoints.

Table 9: Abnormal GPS Conditions Annunciated on HSI

In Dead Reckoning (DR) mode, when FMS is the selected navigation source, the CDI Deviation Bar turns amber. The following items on the PFW are also shown in amber:

- Current Track Indicator
- Wind Data (calculated based on GPS information)

- Distances in the Bearing Information Windows
- Ground Speed
- GPS Bearing Pointers
- Active Flight Plan Distances, Bearings, and ETE Values

Figure 99: GPS Failure Dead Reckoning Indications

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. Refer to the *Dead Reckoning Mode* section in Flight Management for more information about DR mode.

FAILURE OF THE EXTERNAL GPS NAVIGATION SOURCE

Different banner messages may appear depending on the operational pedigree of the reverted CDI. The AXIS™ Flight display will maintain the upcoming waypoints in the flight plan at the time of failure. This helps preserve situational awareness in a failure.

If the external GPS source is Serial, the failure will revert to the internal GPS source. If the internal GPS source is not shared (there are only Serial navigators), the system will revert to the VFR CDI source and a "Flight Plan Reversion: Current CDI selection Limited to VFR" banner message will post below the HSI.

In some systems, it is possible the flight plan will revert to an IFR capable navigator. If the system fails from one external IFR GPS navigation source to another IFR source (Internal IFR or Shared external HSDB source), a "Flight Plan Reversion: Check Flight Plan" banner message will post below the HSI.

AHRS ALERTS

Multiple ADAHRS units may be installed to provide redundancy for critical flight data. If the PFW ADAHRS source selection is set to Auto, and attitude or air data from the default ADAHRS source becomes unavailable, the PFW will automatically switch to using attitude and air data from another valid ADAHRS source. The selected ADAHRS source can also be manually changed by the pilot. In either case, a message appears on the PFW to indicate that an alternate source of attitude and air data is being used (e.g. ‘ON AHRS2’ and 'ON ADC2').

If a standby flight display (SFD) is present, and all installed ADAHRS sources are unavailable, the messages ‘ON AHRS SFD’ and ‘ON ADC SFD’ will appear. These messages indicate that the PFW has reverted to using attitude and air data from the standby flight display instead of a dedicated ADAHRS unit.

If redundant sensors are installed they will be continuously monitored and compared. If the difference between the outputs of two or more sensors exceeds a specified amount, a message appears on the PFW and the discrepancy is annunciated as a ‘MISCOMP’ (miscompare) in amber. The comparison monitoring will be provided for attitude, heading, airspeed, and altitude. If an AFCS is installed and configured, it will disconnect when a miscompare event occurs. If not enough sensor data is available to make a comparison, it will be annunciated as a ‘NO COMP’ (no compare) displayed in white.

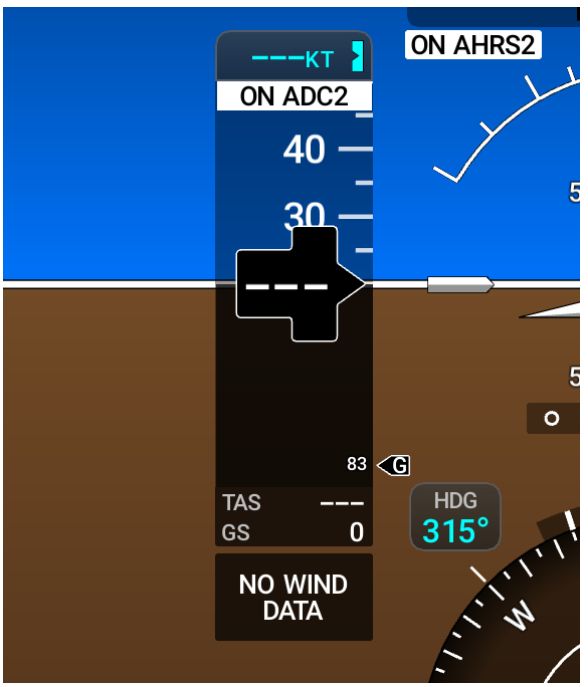


Figure 100: Reversionary Sensor Annunciation

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 101: Pitch Attitude Warning

If pitch exceeds +30°/-20° or bank exceeds 65°, some information displayed on the PFW is removed. While in an unusual attitude, the display will continue to provide a persistent indication of the ground (brown band or synthetic vision) in a nose down attitude, or sky (blue band) in a nose up attitude. The Altimeter, Airspeed, Attitude, Vertical Speed, and System Alert Window remain on the display and the Horizontal Situation indicator will be replaced by the G-meter (if G-meter is set to auto). The following information is removed from the PFW when the aircraft experiences unusual attitudes:

- Navigation Information Window (below the HSI)
- Traffic Annunciations
- AFCS Annunciations
- True Airspeed
- ISA Temperature Deviation
- Wind Data
- Selected Heading Indication
- Selected Course Indication
- PFD Settings Windows Displayed on the PFD (MFW split-screen will remain)
- Altimeter Barometric Setting
- Minimum Altitude Alert Setting
- Vertical Deviation, Glideslope, and Glidepath Indicators
- Selected Altitude
- VNAV Target Altitude

SVT UNUSUAL ATTITUDES

During extreme pitch attitudes, the display shows either a brown or blue colored bar at the top or bottom of the screen to represent the ground or the sky. The blue colored bar is also

displayed when terrain gradient is great enough to completely fill the display. This is intended to prevent losing sight of the horizon during extreme pitch attitudes.

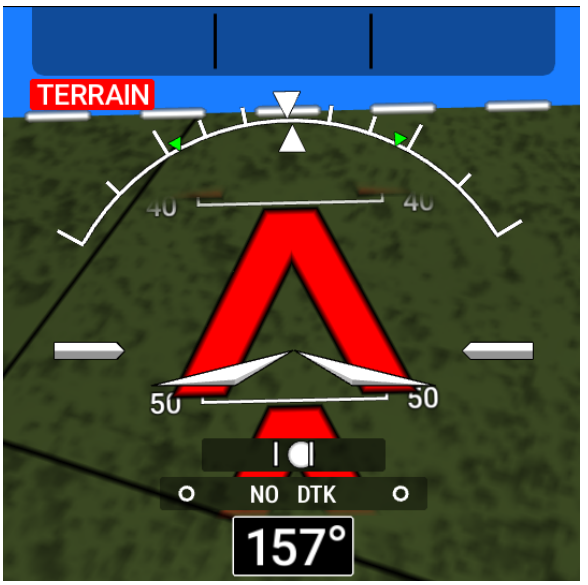


Figure 102: Blue Sky Bar with Terrain and Unusual Attitude Chevrons

SECTION 3 ENGINE INDICATION SYSTEM

3.1 OVERVIEW

NOTE

The display of the AXIS™ Engine Indication System depends upon the current configuration and may vary from the examples discussed in this section.

NOTE

A GEA 110 requires at least one GDU 116C/NC to be installed for proper display of engine systems.

The AXIS EIS displays engine, electrical, and other system parameters. Additional Engine information can be viewed by touching the **Engine** Icon on the MFW App Bar, selecting **Engine** icon from the **Primary** Tab in the 'Apps' Window, or tapping anywhere in the EIS Strip. The EIS strip can be configured to be displayed on the PFD or the MFD.

The AXIS EIS displays support a wide variety of engines and are able to provide indications for single and multi-engine aircraft. The following indications, if configured, may be shown:

- Tachometer
- Manifold Pressure (if required)
- Oil Pressure
- Oil Temperature
- Cylinder Head Temperature (CHT)
- Exhaust Gas Temperature (EGT)
- Fuel Flow
- Fuel Pressure
- Electrical Gauges (AMPS and/or VOLTS)
- Main and Auxiliary Fuel Quantity (up to four tanks)
- Carburetor Air Temperature (CAT)
- Turbine Inlet Temperature (TIT)
- Engine Percent Power (only use as a supplementary gauge, do not use as primary gauge)
- Primary EGT
- Inlet Air Temperature (IAT)
- Compressor Discharge Temperature (CDT)
- Other custom configured indications

Additional functions provided by the EIS system include a fuel computer and hour meters.

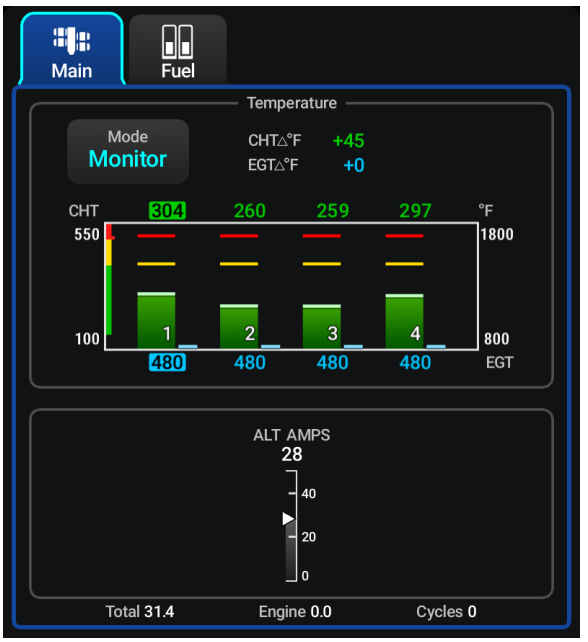


Figure 103: Example Engine Indication System

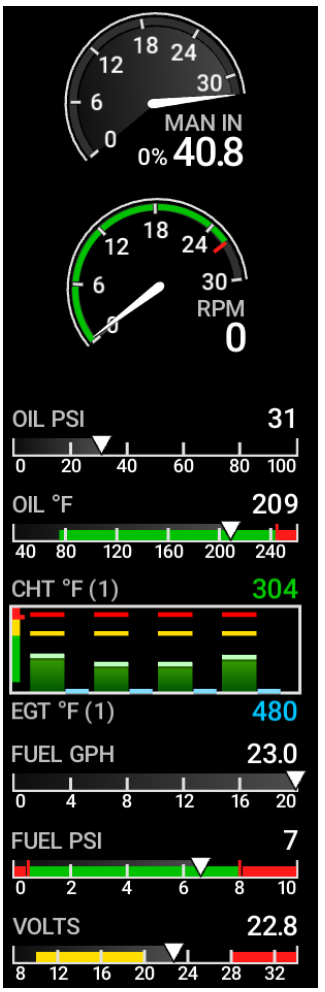


Figure 104: Example Engine Indication Strip Window (optional)

If configured to display normal, caution, and warning indication ranges (ie., bands or arcs), green ranges on the instruments indicate normal ranges of operation; yellow and red ranges indicate caution and warning, respectively. All gauges will highlight the digital readout in yellow or red when entering a non-safe range and cause the colorized CAUTION or WARNING annunciation to flash on the System Alert Window (SAW). If sensor data to an instrument becomes invalid or unavailable, a red or yellow "X" is displayed across the instrument.

NOTE

The highlighted digital readout for warning ranges on the EIS will flash until acknowledged, and the cautions will appear as a steady non-flashing indication (unless configured to flash in configuration mode).

CHT & EGT

NOTE

If gasket-style CHT probes are installed, CHT can read 50-100 degrees F higher than the bayonet-style probes used by most aircraft and engine manufacturers.

Cylinder Head Temperature (CHT) and Exhaust Gas Temperature (EGT) are displayed on a graph within the 'Temperature' Section of the Main Tab in the EIS Application. The CHT/EGT may also be configured to display on the EIS strip. Each cylinder will numerically display its respective CHT above the indicated bar, and respective EGT below the indicated bar. The selected or hottest CHT/EGT is displayed above the graph. The hottest CHT/EGT and TIT (Turbine Inlet Temperature) (if installed) values are in reverse video for easy reference. The CHT/EGT graphs will show the temperature bars of the graph at the bottom, even when temperatures are below the minimum indicating range.

If a Primary EGT is installed or a TIT is installed, a bar gauge on the right side of the CHT/EGT graph will be displayed with the respective value displayed above. If a single EGT/CHT is configured, these features are unavailable.

CHT SHOCK COOLING (OPTIONAL)

NOTE

Refer to the AXIS™ Installation Manual for more information on configuration of the CHT Shock Cooling feature.

The system will provide indications when the temperature of the fastest changing cylinder declines at a specific rate. One blue arrow pointing down will indicate a CHT shock cooling rate of ≥50°F per minute. Two blue arrows pointing down will indicate a CHT shock cooling rate of ≥100°F per minute. This is to provide the pilot with situational awareness of engine parameters that may cause excess damage to any specific cylinder.

3.2 NORMALIZATION MODE

In Normalize Mode, the CHT/EGT Page displays the Cylinder Head Temperatures, Exhaust Gas Temperatures, and any TIT or Primary EGT temperatures relative to a normalized value. The bars of the graph and the digital values display the temperature difference from the normalized value.

Normalized values can be activated by selecting the Normalize Mode page. To reset the normalization touch the **Reset** Button.

In Normalization Mode, yellow and red line markings are not shown but the gauge will change color to alert the user if the threshold is exceeded.

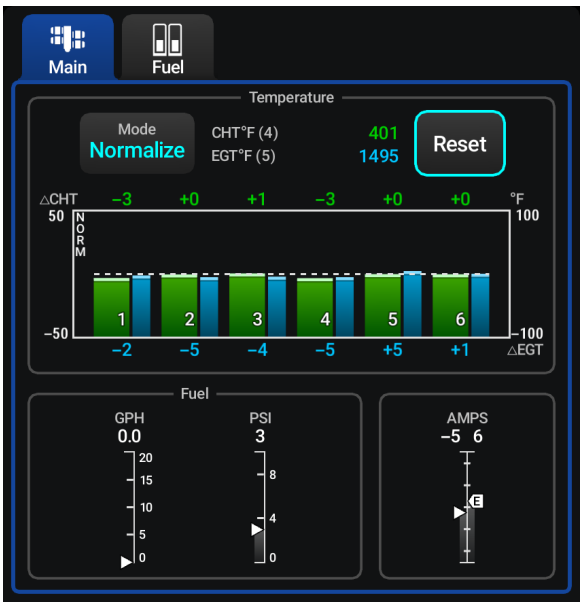


Figure 105: Normalization Mode on the Engine Application Page

3.3 LEAN ASSIST MODE

⚠ CAUTION

During the leaning procedure, the engine is not leaned beyond the engine or aircraft limitations and that the engine continues to operate smoothly after setting the mixture. Should any engine roughness occur during leaning, consult the aircraft POH or AFM for appropriate leaning of the engine.

NOTE

The Lean Assist functions are calculated using the relationship between fuel flow and EGTs (or TIT). If a false EGT peak is observed and does not automatically reset, disable the Lean Assist function, reset throttle and mixture controls, and reattempt.

NOTE

It is recommended to set the aircraft power settings for cruise flight and to let the engine temperatures settle prior to beginning the lean find process.

NOTE

The pilot should follow the engine manufacturer's recommended leaning procedures as described in the Pilot's Operating Handbook (POH).

When interfaced with a fuel flow sensor, the AXIS™ EIS provides two different lean assist methods, rich of peak or lean of peak.

Lean assist mode is initiated by navigating to the 'Engine' Application on the MFW and accessing the 'EIS Menu' using the **MENU** Softkey and then turning the inner knob to activate Lean mode. As the mixture is leaned, Lean mode automatically detects the first and last EGT (or TIT if installed and configured) peak and indicates peak by using a bar above the EGT indicator for the cylinder.

If fuel flow indication is not installed, then the system will only provide "Rich of Peak".

- **Rich of Peak** (ROP) — Detects and indicates the first engine cylinder to peak during the leaning process. Once the first peak in EGT (or TIT) is detected, the temperature differential from the recorded maximum EGT (or TIT) of the first cylinder to peak is displayed and the pilot can enrich the mixture to reach the proper operating temperature from peak using that value.
- **Lean of Peak** (LOP) — Detects and indicates the last engine cylinder to peak during the leaning process. Once the last cylinder peak EGT (or TIT) is detected, the system will display the temperature differential from the recorded maximum EGT (or TIT) of the last cylinder to peak and the pilot can continue to lean the mixture to reach the proper operating temperature from peak using that value.

Figure 106: Lean Assist

A dual-pointer gauge is displayed when exactly two cylinders of EGT are configured and appears on the Engine Application the same way the TIT configured image appears below. Each cylinder has its own peak temperature triangle.

The following gauge is displayed when TIT is configured instead of EGT.

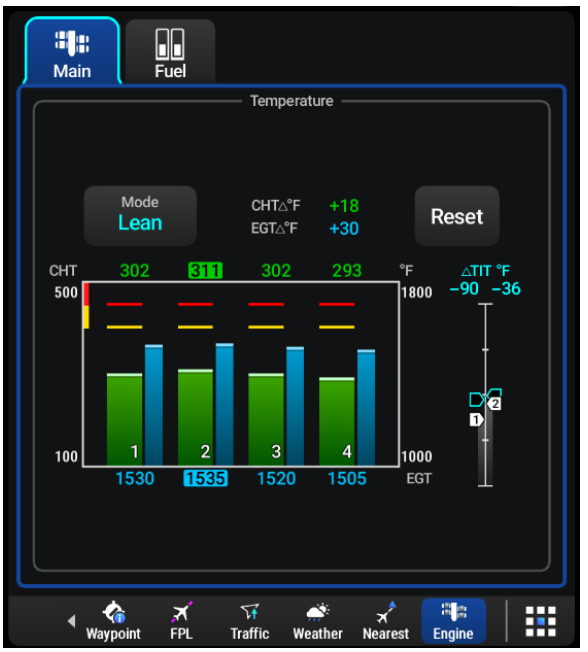


Figure 107: Lean Assist (TIT Configured)

NOTE

A '+' (ΔEGT) value indicates the current temperature is greater than the previously detected peak.

If a fuel flow sensor is configured, the fuel flow value detected as the first cylinder peaks is saved. The fuel flow corresponding to peak EGT (or TIT) is drawn on the fuel flow gauge as a hollow cyan pointer. This can be used to determine if you are on the rich side of peak (ROP) or the lean side of peak (LOP). Rich of Peak (ROP) if the fuel flow pointer is greater than the hollow cyan triangle, or Lean of Peak (LOP) if the fuel flow pointer is less than the hollow cyan triangle.

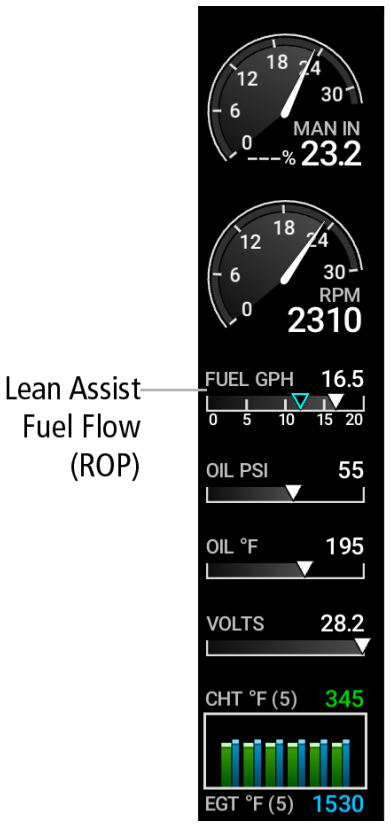


Figure 108: Fuel Flow Gauge - Lean Assist (Fuel Flow Sensor Configured)

The EIS displays the cylinder whose temperature is currently closest to its own peak value (when Lean Assist Mode is active) as a white pointer with the cylinder number. The peak temperature is depicted by a hollow cyan pointer, and the temperature deviation from peak (ΔEGT or ΔTIT) is displayed in place of the normal temperature number in cyan text.

LEAN ASSIST ALERTS

Lean alert settings may be adjusted, enabled or disabled. Depending on the sensors available, the alerts will either provide a change in temperature alert or a Rich of Peak (ROP)/Lean of Peak (LOP) alert. When the alert is triggered the “Peak D“ status value will be highlighted.

The change in temperature alert will occur when the first engine cylinder to peak’s Exhaust Gas Temperature has changed from its peak temperature by the specified temperature.

The Rich of Peak (ROP) alert will occur when the first engine cylinder to peak’s Exhaust Gas Temperature has changed from its peak temperature by the specified temperature and the Fuel Flow is above its peak fuel flow (rich of peak).

The Lean of Peak (LOP) alert will occur when the last engine cylinder to peak’s Exhaust Gas Temperature has changed from its peak temperature by the specified temperature and the Fuel Flow is below its peak fuel flow (lean of peak).

USING LEAN ASSIST MODE:

1 On the MFW:

a) Touch the **Engine** icon on the **App Bar**.

Or:

a) Touch the **Applications** Icon **>** **Primary** Tab **>** **Engine**.

Or:

a) Use the Outer **DCK** (on the MFW side of the PFD while in split screen mode) to select the **Engine** application.

2 Touch the **Mode** Button and select **Lean**.

3 Before starting the procedure or after the **Reset** Button has been pressed the ΔEGT (or ΔTIT if configured) will indicate a "**- - -**". Begin leaning the fuel mixture. As the fuel mixture is leaned, the EGT will begin to rise. After the system detects the EGT peak the ΔEGT will be displayed below each cylinder. (If ΔTIT is configured, the delta will be displayed as a hollow pentagram for each engine.)

4 Using the last cylinder to peak, continue to lean the fuel mixture until the proper operating temperature from peak is achieved.

Or:

Using the first engine cylinder to peak, enrich the fuel mixture until the proper operating temperature from peak is achieved.

ADJUSTING LEAN ALERT SETTINGS:

1 On the MFW:

a) Touch the **Engine** icon on the **App Bar**.

Or:

a) Touch the **Applications** Icon **>** **Primary** Tab **>** **Engine**.

Or:

a) Use the Outer **DCK** (on the MFW side of the PFD while in split screen mode) to select the **Engine** application.

2 Ensure the **Main** Tab is selected.

3 Press the **MENU** Softkey (on the MFW side of the bezel while in split screen mode).

4 Touch the **Lean Assist Alert** Annunciation Button (green annunciation indicates the alert is enabled).

ADJUSTING LEAN ALERT SETTINGS:

1 On the MFW:

a) Touch the **Engine** icon on the **App Bar**.

Or:

a) Touch the **Applications** Icon **>** **Primary** Tab **>** **Engine**.

Or:

a) Use the Outer **DCK** (on the MFW side of the PFD while in split screen mode) to select the **Engine** application.

2 Ensure the **Main** Tab is selected.
3 Press the **MENU** Softkey (on the MFW side of the bezel while in split screen mode).
4 If necessary, touch the **Alert Type** Selection Button (LOP/ROP) to choose between Lean of Peak or Rich of Peak.
5 Touch the **Degrees** Datafield Button.
6 Using the 'Lean Assist Alert Temperature' numeric keypad, enter a temperature between 0-99 degrees Fahrenheit (or 0-55 degrees Celsius), then touch the **Enter** Button.

3.4 MONITOR MODE

When in Monitor Mode, the application will display the current CHT/EGT temperatures, any TIT or Primary EGT temperatures, the current fuel information, and battery information.

Measured CHT is displayed in green above each bar, and the hottest cylinder is automatically detected and shown in black on a green background.

Measured EGT is displayed in cyan below each bar, and the hottest cylinder is automatically detected and shown in black text on a cyan background.

The CHT/EGT or TIT delta will be displayed at the top of the application window.

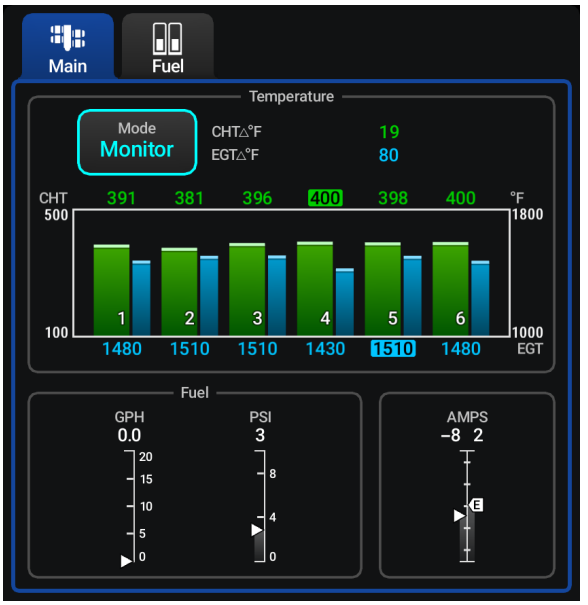


Figure 109: Monitor Mode on the Engine Application Page

3.5 FUEL QUANTITY DISPLAY

⚠ WARNING

Do not use the unverified fuel quantity indication provided by AXIS™ flight display(s) as the sole means of complying with the requirements of CFR 14 91.103, 91.151, or 91.167.

Usable fuel may be displayed on the EIS display. Main fuel quantities and aux/trip fuel quantities are grouped together at the bottom of the display.

Refer to the *Fuel Range Ring* section in Flight Management for information on displaying fuel range rings on the Navigation Map.

FUEL COMPUTER

⚠ WARNING

The AXIS™ Fuel Calculator and/or Fuel Range Rings are NOT intended to be relied upon as the primary fuel indicator(s), and does not relieve the pilot from the responsibility of proper flight planning. AXIS fuel calculations do not use the aircraft fuel quantity indicators and are calculated from the last time the fuel was reset.

⚠ CAUTION

The fuel computer functions must not be used as the primary means of determining the quantity of fuel in the tanks. The aircraft fuel quantity gauge(s) or visual inspection of the fuel tanks are the primary means of determining fuel quantity

⚠ CAUTION

Fuel flow values may be in error by as much as 15% if the K factor calibration is improperly set.

⚠ CAUTION

The pilot must ensure that the initial estimated fuel quantity value is accurate. The fuel computer calculates the remaining fuel based on the initial fuel value entered by the pilot. The estimated fuel remaining is derived by the fuel computer by subtracting the measured fuel flow from the initial fuel entry. Fuel quantity indications shown on the fuel gauges may not provide the accuracy required for determination of estimated fuel remaining values. ***Fuel Est*** *and* ***Act Used*** *buttons are available to aid the pilot in entering the initial estimated fuel.*

A Fuel Computer/Totalizer is provided under the **Fuel** Tab. The fuel computer function provides computation and display of estimated fuel remaining, endurance, and fuel used. When interfaced with a GPS source, the fuel computer also provides range and efficiency. The fuel computer calculates these values using the engine fuel flow sensor, ground speed, flight plan, and estimated fuel remaining. Estimated fuel remaining is independent of the measured fuel quantity shown on the fuel quantity gauges.

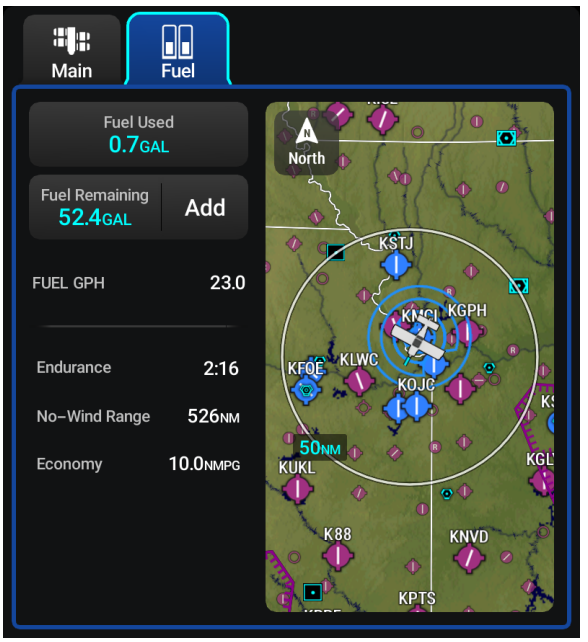


Figure 110: Example of Computer/Totalizer

FUEL FLOW CALIBRATION

The K-Factor represents the number of electrical pulses output by the fuel flow sensor per gallon of fuel. Aspects unique to each installation will affect the accuracy of the initial K-Factor, and as a result, the K-Factor must generally be adjusted up or down to increase the accuracy of the fuel flow calibration.

If the fuel usage reported by the AXIS™ flight display differs from the actual fuel usage (as measured at the fuel pump or other trusted method of measurement), the K-Factor can be adjusted either in Configuration Mode (as described in the AXIS EAB Installation Manual) or by using the Fuel Flow Calibration Menu in Normal Mode.

NOTE

Do not adjust the Actual Fuel Used unless at least 10 gallons of fuel has been used. The more fuel used, the more accurate the fuel flow calibration adjustment will be.

Once an 'Actual - Fuel Used' value is entered, the corresponding 'Adjustment - Fuel Flow' percentage is displayed. It is also possible to adjust the fuel flow using the 'Adjustment - Fuel Flow' field directly. Entering an adjustment percentage will adjust the 'Actual - Fuel Used' value accordingly. However, this is not the method used to adjust the K-Factor to increase the accuracy of the fuel flow calibration.

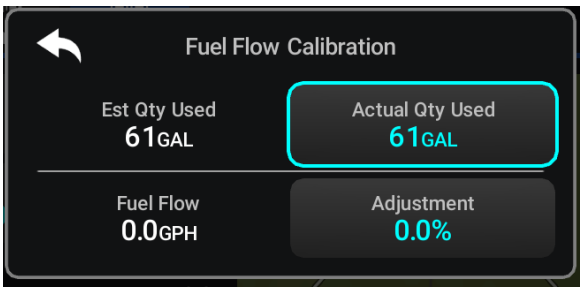


Figure 111: Fuel Flow Calibration

CALIBRATING THE FUEL FLOW:

1 On the MFW:
   a) Touch the **Engine** icon on the **App Bar**.
      Or:
   b) Touch the **Applications** Icon **>** **Primary** Tab **>** **Engine**.
      Or:
   c) Use the Outer **DCK** (on the MFW side of the PFD while in split screen mode) to select the **Engine** application.
2 With the "Engine" Page selected on the MFW, press the **MENU** Softkey (on the MFW side of the PFD while in split screen mode) to open the 'EIS Menu' Window.
3 Touch the **Fuel Flow Calibration** Button.
4 The **Actual Qty Used** Selection Button is used when the known amount of fuel has been calculated.
   a) Touch the **Actual Qty Used** Selection Button and enter an amount on the numeric keypad that opens.
   b) Touch the **Enter** Button to accept the actual amount of fuel used.
5 The **Adjustment** Selection Button is used when the difference of fuel flow is known.
   a) Touch the **Adjustment** Selection Button and enter a percentage that represents the difference in fuel flow (between -10.0 and +10.0 percent).
   b) Touch the **Enter** Button to accept the percentage of fuel flow difference.

> When entering a fuel flow adjustment percentage the **Fuel Used** Datafield Button will adjust accordingly to the updated fuel flow.

ADJUSTING THE FUEL USED QUANTITY:

1 On the MFW:
   a) Touch the **Engine** icon on the **App Bar**.
      Or:
   b) Touch the **Applications** Icon **>** **Primary** Tab **>** **Engine**.
      Or:

c) Use the Outer **DCK** (on the MFW side of the PFD while in split screen mode) to select the **Engine** application.

2 If necessary touch the **Fuel** Tab.

3 Touch the **Fuel Used** Datafield Button and use the 'Fuel Used' numeric keypad to adjust the amount of fuel used.

Or:

Touch the **Set to Zero** Button to reset the fuel used amount to zero.

4 Touch the **Enter** Button.

ADJUSTING THE FUEL FLOW CALIBRATION

1 On the MFW:

a) Touch the **Engine** icon on the **App Bar**.

Or:

b) Touch the **Applications** Icon **> Primary** Tab **> Engine**.

Or:

c) Use the Outer **DCK** (on the MFW side of the PFD while in split screen mode) to select the **Engine** application.

2 If necessary touch the **Fuel** Tab.

3 Adjust the fuel quantity displayed using the following methods:

a) Touch the **Add** Button.

b) Use the numeric keypad to enter a value of fuel to be added to the quantity already displayed.

Or:

a) Touch the **Fuel Remaining** Datafield Button.

b) Use the numeric keypad to adjust the total fuel remaining.

Or:

Touch the **Sync to Fuel on Board** Button (this sets the fuel to what the fuel tank sensors are detecting as the total amount of fuel remaining).

Or:

Touch the **Set to Full** Button (this sets the fuel to the configured full fuel amount).

Or:

Touch the **10.0GAL** Button or **20.0GAL** Button to quickly adjust the fuel remaining to 10 or 20 gallons.

4 Touch the **Enter** Button to accept the adjustment of fuel remaining.

3.6 SYSTEM ALERT MESSAGES

NOTE

A standalone MFD does not support system alert messages.

Formerly known as CAS or Crew Alerting System the system alert messages displayed depend upon the current configuration, and will vary from the examples listed below. Refer to the AXIS™ installation manual for more information on configuring system alert messages (if applicable) and refer to *Appendix A* for more information on system alert messages.

System alert messages are grouped by criticality (warning, caution, advisory). The color of the message is based on its urgency and on required action:

- WARNING (red): Requires immediate attention.
- CAUTION (yellow): Requires pilot awareness and possible future corrective action.
- ADVISORY (white): Provides general information.

Warning annunciation text is shown in red in the system alert messages window on the PFW. The system alert window is located to the right of the HSI on the PFW. If a caution or warning system alert message is populated on the PFW the system alert message and the 'Messages' icon will flash inverse color scheme until acknowledged. Depending on the type of alert the 'Messages' Button may be replaced with 'Caution', 'Warning', or 'System'.

When more system alert messages are present than can be displayed in the available window space, a down arrow will appear in the system alert window.

Figure 112: System Alert Window Warning Example

VIEWING AND ACKNOWLEDGING SYSTEM ALERT MESSAGES:

1. To acknowledge an actively flashing system alert message touch the system alert window one time on the PFW.
2. To view the system alert messages touch the system alert window a second time on the PFW.

   Or:

   a) Touch the **System** Button at the bottom of the display.
   b) Then touch the **Alerts** Tab in the 'Messages' Window.

NOTE

The substeps of step 2 above can be completed to acknowledge system alert messages. However, it is not the recommended method.

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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 audio interface, communication radios, navigation radios, and Mode S transponder. These functions can be accessed from the Main Menu and from the boxes that make up the CNS Data Bar located at the top of the PFD and/or MFD.

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

- COM Operation
- NAV Operation
- VOR/LOC
- Marker Beacon Receiver
- Mode S Transponder
- Flight ID
- Mono/Stereo Headsets
- Intercom
- Speaker
- Passenger Address
- Clearance Recorder and Player
- 3D Audio
- Simultaneous COM Operation
- Garmin Pilot™ App Volume Control
- Entertainment Inputs
- COM Freq Changed Tone
- Abnormal Operation

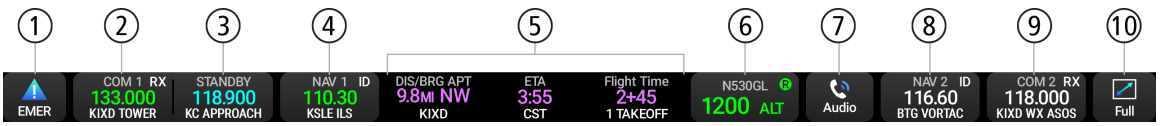


Figure 113: CNS Data Bar

1	**EMER** Button	Opens the Emergency Application to reduce pilot workload in the event of an emergency.
2	**COM1** Button	Transfers the standby and active frequencies for the number one radio.
3	**Standby** Button	Displays a number pad for the corresponding NAV or COM radio to change the standby frequency.
4	**NAV1** Button	If no standby button is present, the NAV button will open the NAV 'Standby' window to change and transfer frequencies.

⑤	(Configurable) Data Bar	See the *Data Bar* section in System Overview for more information.
⑥	Transponder	Displays aircraft ID, transponder code and mode, and whether receiving or transmitting. If touched it will open the 'Transponder Control' window.
⑦	**Audio** Button	If an internal audio panel is configured, this button will open the 'Audio' window.
⑧	**NAV2** Button	If no standby button is present, the NAV button will open the NAV 'Standby' window to change and transfer frequencies.
⑨	**COM2** Button	If no standby button is present, the COM button will open the COM 'Standby' window to change and transfer frequencies.
⑩	**Split** or **Full** Button	Toggles the display between full and split screen.

4.2 COM OPERATION

NOTE

The COM Operation section does not apply to any GDU 116B installations.

NOTE

SL30 and SL40 radios are not compatible for full integration with the AXIS™ flight display. Standby frequencies from these units can be tuned to the system, while active cannot.

Communication radio operations are controlled through the internal audio panel of the AXIS flight display and the integrated Garmin audio panels. Integration between third party communication radios encompasses the ability to control the following aspects of the radio:

- Radio Monitoring
- Radio Squelch
- Active Radio Display
- Standby Radio Receiving
- Frequency Swap
- Volume Control

COM Radio	Display Active & Standby COM Freq.	Tune Standby COM Freq.	Swap COM Freq.	Change COM Volume	Toggle COM Squelch	Toggle MON Mode
GDU 116C	X	X	X	X	X	X
GDU 116NC	X	X	X	X	X	X
SL30/SL40	X	X				
GTR 20	X	X	X	X	X	X
GTR 200B	X	X	X	X	X	X
GNC 355	X	X	X	X	X	X

COM Radio	Display Active & Standby COM Freq.	Tune Standby COM Freq.	Swap COM Freq.	Change COM Volume	Toggle COM Squelch	Toggle MON Mode
GTR 205x	X	X	X	X	X	X
GTR 205xR[1]	X	X	X	X	X	X
GNC 215	X	X	X	X	X	X
GTR 225/ GNC 255[2]	X	X	X	X	X	X
GTN 635/ GTN 650/ GTN 750[3]	X	X	X	X	X	X
GTN 635 Xi/ GTN 650 Xi/ GTN 750 Xi	X	X	X	X	X	X
GNS 4XXW/ GNS 5XXW						

Refer to the AXIS Flight Display Installation Manual Table 5-5 for more information on COM radio supported functions.

[1]Applies to all software versions except v2.2x.

[2]Applies to software version 2.10 or later.

[3]Applies to software version 6.11 or later.

Table 10: COM Radio Supported Interface Functions

In the event of a communication radio failure, an amber 'X' will be displayed over the failed radios display. If there is an external communication radio installed and the internal radio fails, the MIC and MON will be forced to the external radio. If there is a PFD failure, the external communication radio will automatically tune to the emergency frequency (121.5 mHz).

COM TRANSCEIVER SELECTION AND ACTIVATION

NOTE

The system retains the last frequencies used and the active COM transceiver state through power cycles.

COM frequencies are displayed on the CNS Bar at the top of the PFD and MFD. COM monitoring and selection can be controlled using both the PFD and MFD.

Active COM frequencies selected with the **MIC** Button are displayed in green. A green arrow also points toward the active radio being used and monitored with the radio number inside of it. Primary frequencies not selected with the **MIC** Button are displayed in white. The

standby frequencies are displayed in cyan. When a standby frequency is selected for tuning on the CNS Bar the entire **Standby** Button is highlighted in blue.

SELECTING A COM RADIO FOR TRANSMISSION:

1 Access the Audio Panel:
   a) Touch the **Applications** Icon on the MFW App Bar.
   b) Touch the **Quick Actions** Tab.
   c) Touch the **Audio** Button.

      Or:

      For quicker access touch the **Audio** Button on the CNS Data Bar.

2 Touch the **MIC1** Button or the **MIC2** Button to transmit on the desired radio.

   Or:

   For quicker transfer between COM1 and COM2, touch the **MIC** Button on the CNS Data Bar.

TRANSFERRING STANDBY TO ACTIVE:

1 Touch the COM1 or COM2 **Standby** Button to open the COM standby frequency numeric keypad.

2 Touch the **Transfer** Button.

   Or:

   Push and hold the **DCK** titled "Hold XFER".

   Or:

   For quicker commincation frequency transfers, touch the Active **COM1** Button or **COM2** Button to transfer the desired radio frequency from standby to active.

ENTERING A COM1 OR COM2 FREQUENCY USING THE CNS BAR:

1 Touch the COM1 or COM2 **Standby** Button to select the desired radio for tuning.

2 Use the keypad to select the frequency.

3 Touch the **Enter** Button to accept the new frequency and place it in the standby frequency position.

   Or:

   Touch the **Transfer** Button to accept the new frequency and place it in the active frequency position.

ENTERING A COM1 OR COM2 FREQUENCY USING THE FMS KNOBS:

NOTE

The FMS Knobs must be configured in the PFW Settings to adjust the COM radio frequencies on the main PFW/MFW. Refer to the Knob Operation Section in System Overview for more information on how to configure the FMS Knobs.

1 Push the **DCK** to select the standby radio frequency that needs to be tuned (The text above the **DCK** will change between COM1 and COM2 when the knob is pushed).

2 Turn the Outer **DCK** to adjust the MHz (left of the decimal).
3 Turn the Inner **DCK** to adjust the kHz (right if the decimal).
4 Touch the **COM1** Button or **COM2** Button on the CNS Bar when ready to transfer the standby frequency to the active position.

ENTERING A COM1 OR COM2 FREQUENCY FROM THE CNS BAR USING THE FIND FUNCTION:

1 Touch the COM1 or COM2 **Standby** Button to select the desired radio for tuning, opening the 'COM Standby' numeric keypad.
2 Touch the **Find** Button.

Or:

a) Touch the **Menu** Button

Or:

Touch the **MENU** Softkey (on the side of the bezel with the 'COM Standby' numeric keypad open).

b) Touch the **Find** Button.

3 Touch the tab for the desired type of frequency (**Nearest**, **Flight Plan**, or **Presets**).

a) If multiple frequencies are available while using the Find Function, "Multiple" will appear in the button on the list. If required touch the location to choose from the Frequencies list for that location.

4 Touch the desired frequency.
5 Touch the **Enter** Button to accept the new frequency and place it in the standby frequency position

Or:

Touch the **Transfer** Button to accept the new frequency and place it in the active frequency position.

ENTERING A COM1 OR COM2 FREQUENCY USING THE NEAREST PAGE ON THE MFW:

1 Touch the **Nearest** Button on the MFW App bar.

Or:

Use the **DCK** to navigate to the **Nearest** Page.

2 Touch the **Type** Button to open the 'Select Nearest Type' window.
3 For COM frequencies select the Airport, VOR, NDB, ARTCC, FSS, or Weather Broadcast from the 'Select Nearest Type' list.

a) If selecting from the Airport Type option scroll through the list of nearest airports and touch the Airport button with the identifier.

Or:

In the frequency column the system will provide a CTAF or Tower frequency to quickly load into the active or standby radio frequency (skip to step 6).

b) In the 'Airport Options' Window touch the **Waypoint Info** Button.

4 Touch the **Frequency** Button or **Frequency** Tab depending on the type of frequency being entered.

5 Select the desired Frequency.

6 Touch the **Active** Button or **Standby** Button to load the frequency into COM1 or COM2.

ENTERING A COM1 OR COM2 FREQUENCY USING THE WAYPOINT PAGE ON THE MFW:

1 Touch the **Waypoint** Button on the MFW App bar.

Or:

Use the **DCK** to navigate to the **Waypoint** Page.

2 After entering a desired waypoint into the **Waypoint** Selection Button, touch the **Frequency** Tab.

3 Choose a frequency from the provided list by touching it.

Or:

Use the Inner **DCK** to scroll through the options and push the **DCK** to select the frequency.

4 The next window will allow the pilot to load the frequency into any available radios by touching the **Active** Button or **Standby** Button.

ENTERING A COM1 OR COM2 FREQUENCY FROM THE FLIGHT PLAN PAGE ON THE MFW:

1 Touch the **Flight Plan** Button in the MFW App bar.

Or:

Use the **DCK** to navigate to the **Flight Plan** Page.

2 Select a waypoint or airport from the flight plan that has been entered by touching it or using the **DCK**.

3 Select the **Waypoint Info** Button by touching it or use the **DCK** to scroll to, and select it.

4 **If Multiple Frequencies are Available:**

a) With the "Airport Info" window open, touch the **Frequency** Tab.

b) Select the desired frequency by touching it, or using the **DCK**.

c) The next available window will allow the pilot to load the frequency into any available radios by touching the **Active** Button or **Standby** Button.

5 **Only One Frequency Available:**

a) With the information page open touch the **Frequency** Datafield Button displayed on the information map.

b) The next available window will allow the pilot to load the frequency into any available radios by touching the **Active** Button or **Standby** Button.

ENTERING A COM1 OR COM2 FREQUENCY USING THE RADIAL MENU ON THE MAP PAGE:

1. With the Map Page displayed on the MFW touch anywhere on the Map to display the **Radial** Menu.
2. With the **Radial** Menu displayed touch on the icon specific to changing a frequency (Airport, FSS, ARTCC, or Weather Broadcast).
3. Touch the **Frequency** Tab.
4. Select the desired Frequency.
5. The next window will allow the pilot to load the frequency into any available radios by touching the **Active** Button or **Standby** Button.

ADJUSTING COM VOLUME USING THE CNS BAR:

1. Touch the COM1 or COM2 **Standby** Button to select the desired radio for tuning.
2. Touch the **Volume** Button.
3. On the 'Radio Volume' window drag the slider to the desired volume level for the radio.
4. Touch the **Back Arrow** or **BACK** Softkey two times to return to the main window.

ADJUSTING THE COM VOLUME USING THE FMS KNOBS:

NOTE

The FMS Knobs must be configured by the pilot to adjust the COM radio frequencies in the settings for the PFD/MFD. Refer to the Knob Operation Section in System Overview for more information on how to configure the FMS Knobs.

1. To select the radio's volume to be adjusted push the **DCK** titled "Push: Switch to COM_".
2. Turn the Outer **DCK** titled "COM_ Volume" to adjust volume of the selected radio (counterclockwise to decrease and clockwise to increase the volume).

MONITORING THE STANDBY COM:

1. Touch the COM1 or COM2 **Standby** Button to select the desired radio for monitoring.
2. On the COM 'Standby' window touch the **Monitor** Annunciation Button (green annunciator indicates the radio is being monitored).

   Or:

   To transfer between the monitored radios quicker, touch the **MON** Button on the CNS Data Bar until the green numbered indication shows the desired radio to be monitored.

TRANSMIT AND RECEIVE INDICATIONS

When receiving a transmission, 'RX' is displayed on the COM button. 'TX' is also displayed on the COM button while transmitting.

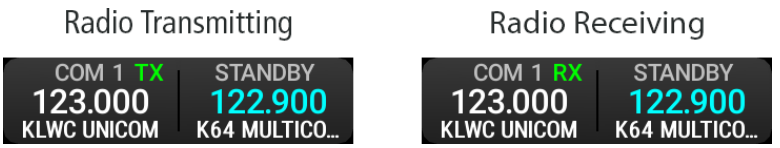


Figure 114: COM Annunciations (TX/RX)

'SQ' is displayed on the COM button when automatic squelch is overridden and the frequency monitoring function allows the pilot to listen to the Standby frequency while using the Active frequency.

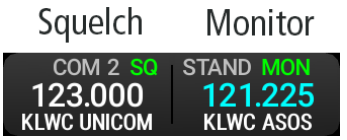


Figure 115: COM Annunciations (SQ/MON)

FREQUENCY SPACING (OPTIONAL)

Some communication radios have the ability to 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.

NOTE

The image below shows a configuration that has a radio installed that can be configured in both the 25-kHz and 8.33-kHz channel spacing. If no radios are installed that have this feature, the option will not exist to change the channel spacing. If two radios are installed and only one has this feature, the channel spacing option will only be available on the specific radio that has the feature.

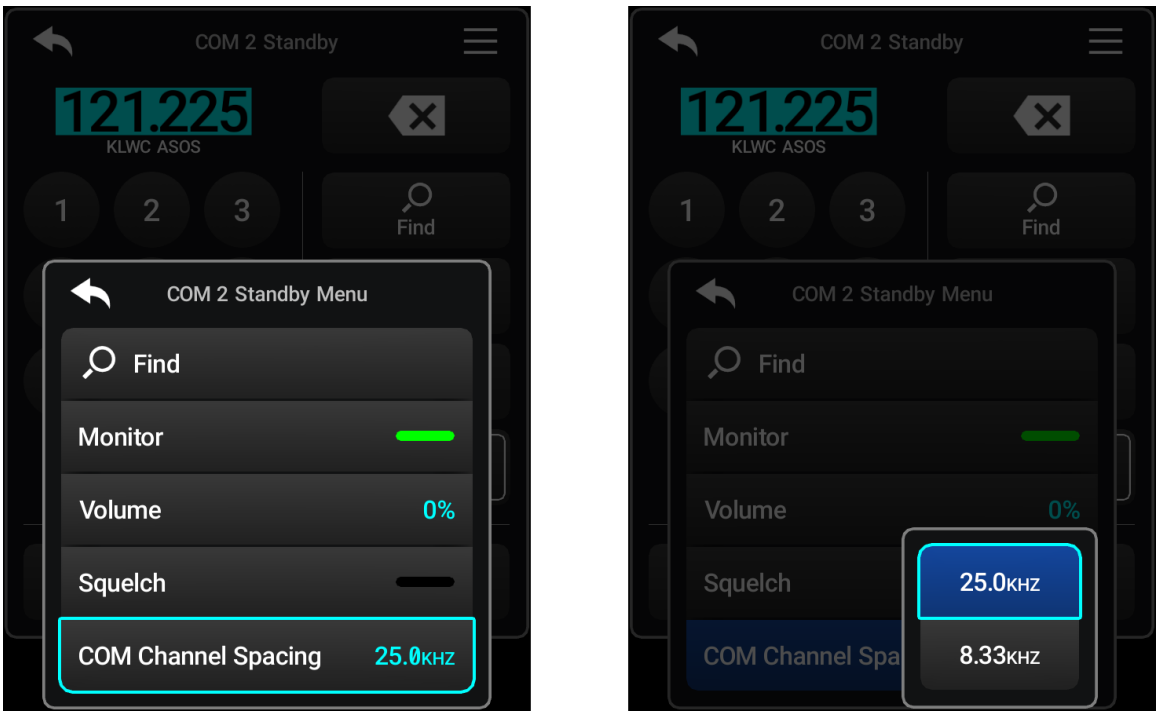


Figure 116: COM Channel Spacing

CHANGING THE COM FREQUENCY CHANNEL SPACING:

Each radio can be exclusively changed between 25 kHz and 8.33 kHz. It is required to complete this procedure for all radios interfaced with the system if the channel spacing is is required to be the same.

1. Touch the COM1 or COM2 **Standby** Button to select the desired radio for tuning, opening the 'COM Standby' numeric keypad.
2. Touch the **Menu** Button

   Or:

   Touch the **MENU** Softkey (on the side of the bezel with the 'COM Standby' numeric keypad open).
3. Touch the **COM Channel Spacing** Datafield Button.
4. Touch the **25.0KHZ** or **8.33KHZ** Button.

AUTOMATIC COM RADIO SQUELCH

Automatic Squelch quiets unwanted static noise when no audio signal is received, while still providing good sensitivity to weak COM signals. When Automatic Squelch is disabled, COM audio reception is always on. Continuous static noise may be heard over the headsets and speaker, if selected. When Automatic Squelch is disabled, the COM frequency and the Squelch on the COM tuning page is highlighted green.

Figure 117: COM Radio Automatic Squelch Disable/Enable

OVER-RIDING AUTOMATIC SQUELCH:

1 Touch any COM **Standby** Button.

2 Touch the **Squelch** Button to disable automatic squelch (when the green annunciator is on the auto-squelch has been over-ridden).

Or:

a) Touch the **Menu** Button

Or:

Touch the **MENU** Softkey (on the side of the bezel with the 'COM Standby' numeric keypad open).

b) Touch the **Squelch** Button to disable automatic squelch (when the green annunciator is on the auto-squelch has been over-ridden).

COM ERROR MESSAGES

Figure 118: COM Error Message on CNS Bar

The following COM error messages may be displayed by the system if a COM fault exists:

Message	Description	Action
PILOT PTT STUCK	The Pilot Push To Talk key has been in the pressed position for at least 35 seconds. This key will now be ignored.	Verify Push To Talk key is not stuck. Refer to the installation manual for installation wiring tests. Contact Garmin for service if this message persists.
COPILOT PTT STUCK	The Copilot Push To Talk key has been in the pressed position for at least 35 seconds. This key will now be ignored.	Verify Push To Talk key is not stuck. Refer to the installation manual for installation wiring tests. Contact Garmin for service if this message persists.
BOTH PTT STUCK	Both Push To Talk keys have been in the pressed position for at least 35 seconds. This key will now be ignored.	Verify Push To Talk keys are not stuck. Refer to the installation manual for installation wiring tests. Contact Garmin for service if this message persists.
TX HARDWARE FAULT	An internal hardware problem is preventing COM transmission.	Contact Garmin for service if this message persists.
TEMP TOO HIGH	Internal temperature is too high.	Wait for unit to cool. Add supplemental cooling if problem persists.
SUPPLY VOLTAGE LOW	Supply voltage is too low.	Verify supply voltage meets minimum requirement identified in installation manual. Contact Garmin for service if message persists.

COM FREQUENCY PRESETS

Frequency presets can be set by the user to allow for quicker radio frequency navigation. The preset frequencies can be loaded into the standby or active frequency using the COM radio Find Function.

ADDING A COM FREQUENCY TO PRESETS:

1. Touch any COM **Standby** Button.
2. Touch the **Find** Button.
3. Touch the **Presets** Tab.
4. Touch the **Create Preset** Button.
5. Use the alphanumeric keypad to enter the preset name (maximum of 11 characters) then press the **Enter** Button.
6. Use the numeric keypad to enter the frequency then touch the **Enter** Button.
7. A 'Preset Entry' window will open to review the name and frequency entries, touch the **Create Preset** Button to finish adding the preset, or touch **Cancel** to exit COM frequency preset setup.

EDITING A COM FREQUENCY PRESET:

1. Touch any COM **Standby** Button.
2. Touch the **Find** Button.
3. Touch the **Presets** Tab.

4 Touch the **Edit** Button to the right of the preset to be deleted.
5 Edit the name using the alphanumeric keypad window by touching the **Preset Name** Button and/or edit the frequency using the numeric keypad by using the **Preset Frequency** Button.
6 Touch the **Save Preset** Button to finish editing the preset.

REORDERING A COM FREQUENCY PRESET:

1 Touch any COM **Standby** Button.
2 Touch the **Find** Button.
3 Touch the **Presets** Tab.
4 Touch the **Reorder** Button.
5 Touch the UP arrows to the left of the preset to move the preset higher in the ordering.

Or:

Touch the DOWN arrows to the right of the preset to move the preset lower in the ordering.

REMOVING A COM FREQUENCY PRESET:

1 Touch any COM **Standby** Button.
2 Touch the **Find** Button.
3 Touch the **Presets** Tab.
4 Touch the **Edit** Button to the right of the preset to be deleted.
5 Touch the **Delete Preset** Button.

4.3 NAV OPERATION

NOTE

Due to the complexity and multiple configuration options of the AXIS™ flight display(s), this section will not mirror every configuration available.

NOTE

The SL30 and GNS 4xx/5xx are limited in there functional integration with the AXIS flight displays and will only display basic functions of the navigation information. The GTN, GTN Xi, GNC 255, GNC 215, and the AXIS 116N/NC versions have the ability for integration with navigation radio features.

NAV RADIO SELECTION AND ACTIVATION

NOTE

*If an installed external NAV LRU is capable of providing GPS and VOR/LOC navigation, the **CDI** Selection Button will indicate both sources of navigation with the currently selected navigation source highlighted with its appropriate color (green for radio navigation and magenta for FMS/GPS navigation)*

The active and standby NAV frequencies are display on the CNS Bar at the top of the PFD/MFD.

The three selectable navigation modes are:

- VOR1 (or LOC1) - If VOR1 (or LOC1) is selected, a green single line CDI is displayed on the HSI with the corresponding identifier displayed inside the navigation indicator button.
- VOR2 (or LOC2) - If VOR2 (or LOC2) is selected, a green double line CDI is displayed on the HSI with the corresponding identifier displayed inside the navigation indicator button.
- FMS (or GPS) - If FMS (or GPS) is selected, a magenta single line CDI is displayed on the HSI with the current Route Navigation Performance (RNP) distance displayed inside the navigation indicator button.

NOTE

For more information on Course Deviation Indicators and DME/Bearing Information windows refer to the HSI discussion in the Flight Instruments section. For more information on system navigation refer to the Flight Management Section.

Navigation radios are selected for listening through the NAV 'Standby' Window after touching the **ID** Annunciation Button and can be heard over the headset and the speaker if selected.

ENTERING A NAV1 OR NAV2 FREQUENCY USING THE CNS BAR:

1. Touch the NAV1 or NAV2 Frequency Buttons or their corresponding **Standby** Button to select the desired radio for tuning.
2. Use the keypad to select the frequency.
3. Touch the **Enter** Button to accept the new frequency and place it in the standby frequency position.

   Or:

   Touch the **Transfer** Button to accept the new frequency and place it in the active frequency position.

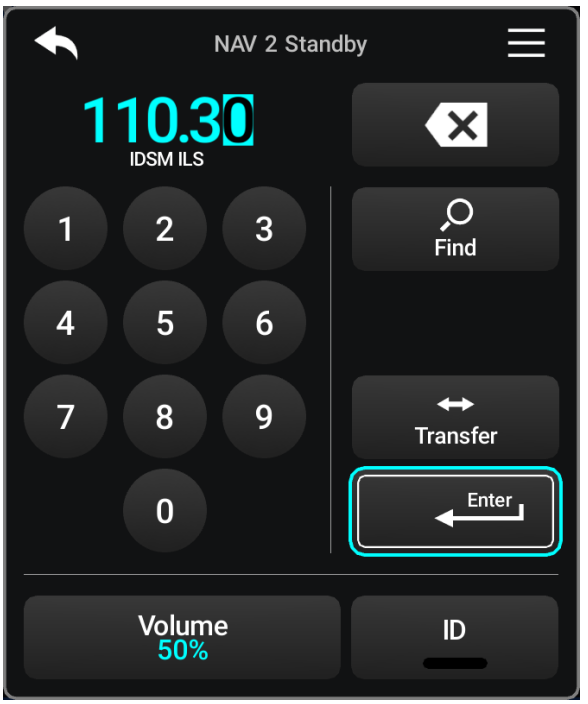


Figure 119: NAV Frequency Tuning

ENTERING A NAV1 OR NAV2 FREQUENCY FROM THE CNS BAR USING THE FIND FUNCTION:

1. Touch the NAV1 or NAV2 Frequency Buttons or their corresponding **Standby** Button to select the desired radio for tuning.
2. Touch the **Menu** Button on the 'NAV Standby' window.

   Or:

   Touch the **MENU** Softkey on the 'NAV Standby' window side of the display.
3. Touch the **Find** Button.
4. Touch the tab for the desired type of frequency (**Recent**, **Nearest**, **Destination**, **Flight Plan**, or **Presets**).
5. Touch the desired frequency.
6. Touch the **Enter** Button to accept the new frequency and place it in the standby frequency position

   Or:

   Touch the **Transfer** Button to accept the new frequency and place it in the active frequency position.

ENTERING A NAV1 OR NAV2 FREQUENCY USING THE RADIAL MENU ON THE MAP PAGE:

1. With the Map Page displayed on the MFW touch anywhere on the Map to display the **Radial** Menu.

2 With the **Radial** Menu displayed touch on the icon specific to changing a frequency (Airport, VOR, VORTAC, LOC, or ILS).
3 Touch the **Frequency** Button or **Frequency** Tab depending on the type of frequency being entered.
4 Select the desired Frequency.
5 Touch the **Enter** Buttonto accept the new frequency and place it in the standby frequency position

Or:

Touch the **Transfer** Button to accept the new frequency and place it in the active frequency position.

ENTERING A NAV1 OR NAV2 FREQUENCY USING THE NEAREST PAGE ON THE MFW:

1 Touch the **Nearest** Button on the MFW App bar.

Or:

Use the **DCK** to navigate to the **Nearest** Page.

2 Touch the **Type** Button to open the 'Type' window.
3 For NAV frequencies select the Airport, VOR, or NDB from the 'Select Nearest Type' list.
   a) If selecting from the Airport option scroll through the list of nearest airports and touch the button with the identifier in the Airport column.
   b) In the 'Airport Options' Window touch the **Waypoint Info** Button.
4 Touch the **Frequency** Button (displayed on the nearest page).

Or:

Touch the **Frequency** Tab (if using the **Waypoint Info** Button from step 3).

   a) Select the desired Navigation Frequency.
5 Touch the **Active** Button or **Standby** Button to load the frequency into NAV1 or NAV2.

TRANSFERRING NAV STANDBY FREQUENCY TO ACTIVE NAV FREQUENCY:

1 Touch the **NAV1** Button or **NAV2** Button to open the NAV Standby window.
2 Touch the **Transfer** Button. **NOTE:** when a frequency is entered into the NAV Standby window and then the window is closed, the frequency will remain for quick transfer the next time the window is opened.

Or:

   a) If the Audio & CNS bar has a navigation radio standby button:

      Touch the **NAV1** Button or **NAV2** Button on the data bar to transfer the desired navigation frequency from standby to active.

SELECTING/DESELECTING A NAVIGATION RADIO FOR MONITORING:

1 Open the 'Audio' Application Page.
   a) Touch the **Applications** Icon **> Quick Actions** Tab **> Audio** Button.
      Or:
   a) Touch the **Audio** Button on the CNS Bar.
2 Touch the **Radios** Button.
3 Touch the **NAV** Annunciation Button to enable the ability to monitor the navigation frequency.
4 To hear the monitored frequency, open the NAV window by touching the **NAV1** Button or **NAV2** Button (if installed) on the CNS Bar.
   Or:
   a) Touch the **Applications** Icon **> Quick Actions** Tab **> Radios** Button
   b) Touch the **NAV1** Button or **NAV2** Button (if installed).
5 Touch the **ID** Annunciation Button.

ADJUSTING NAV VOLUME USING THE CNS BAR:

The selected NAV radio volume level can be adjusted from 0 to 100% by sliding your finger on the NAV Volume Slider. Sliding to the right increases volume, sliding to the left decreases volume.

1 Touch the NAV1 or NAV2 **Standby** Button to select the desired radio.
2 Touch the **Volume** Button.
3 On the 'NAV Volume' window drag the slider to the desired volume level for the radio.
4 Touch the **Back Arrow** or **BACK** Softkey two times to return to the main window.

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 PFW. The **Radios** Button on the audio panel opens a list of annunciator buttons for the different navigation radios being monitored. The **MKR** Annunciation Button enables or disables the audio function of the marker beacon. The button annunciation 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 PFW 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** Annunciation Button in the audio panel menu switches between high and low marker beacon receiver sensitivity. The High Sense function (annunciation illuminated) is used to provide an earlier indication when nearing a marker during an approach. The Low Sense function (annunciation extinguished) results in a narrower marker dwell while over a station.

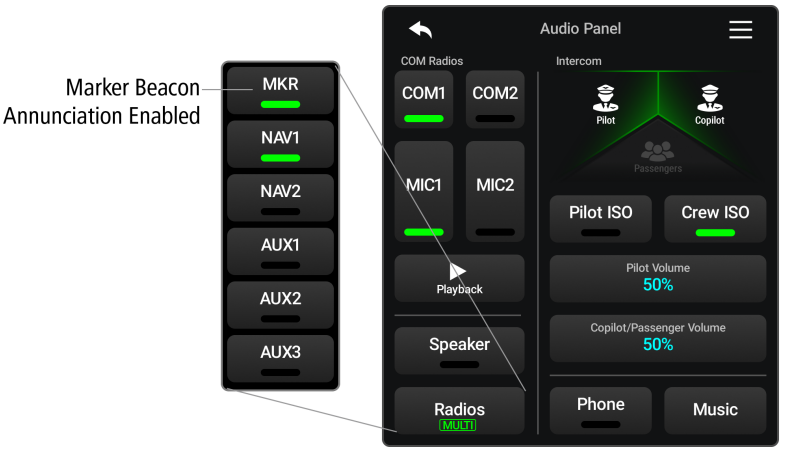


Figure 120: Marker Beacon Audio Operation

ENABLING HIGH SENSE MARKER BEACON:

1 Open the audio panel.
2 Touch the **Menu** Button or **MENU** Softkey to open the 'Audio Panel Menu'.
3 Touch the **High Sense** Annunciation Button (green annunciator indicates the marker beacon is operating with high sensitivity).

VOR/LOC IDENTIFICATION

From the CNS **Audio** Button, **Radios** Button, selecting the **NAV1** Button or **NAV2** Button will enable that nav station's audio. It will be heard on the pilot headset and the pilot speaker, if the speaker is on. The volume can be adjusted to hear the Morse code identifier.

If enabled, and the Copilot Audio Button is selected from the copilot position, selecting the **NAV1** Button or **NAV2** Button will enable that nav station's audio from the copilot's headset/speaker. The volume can be adjusted to hear the Morse code identifier.

The pilot can enable the system to identify the station automatically by using the **ID** Annunciation Button in the NAV 'Standby' Window. Touching the **ID** Annunciation Button decodes the Morse code signal. Touching the **ID** Annunciation Button allows station identification without listening to the Morse code. A white 'ID' is displayed in the NAV radio button on the CNS Bar and the identifier of the nav signal will be displayed in green after the system identifies the stations signal. Touching the **ID** Annunciation Button again deactivates the Morse code decoding feature.

ENABLING/DISABLING MORSE CODE IDENTIFICATION:

1 Touch the NAV1 or NAV2 **Standby** Button on the CNS Bar.

2 Touch the **ID** Annunciation Button to identify the station identifier (green indication represents decoding is activated).

3 Touch the **ID** Annunciation Button again to disable this feature.

AUTO-ACTIVATION OF APPROACH NAV FREQUENCIES

NOTE

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

NOTE

When an ILS/LOC approach has been activated in FMS Mode, the system switches to NAV Mode as the final approach course is intercepted (within 15 nm of the FAF). Refer to the Approaches discussion in the Flight Management Section for more details.

NOTE

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

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

	If the Current CDI NAV Source is NAV1 or NAV2	If the Current NAV Source is FMS
Approach LOADED	Approach frequency is transferred to the standby frequency field of the current CDI NAV source and to the active frequency field of the non-selected CDI Nav source.	The approach frequency is transferred to the NAV1 and NAV2 active frequency fields and the previously active frequencies are transferred to standby. If the approach frequency was already in the NAV1 or NAV2 standby frequency field, the standby frequency is transferred to active.
Approach ACTIVATED	Approach frequency is transferred to the active frequency field on both NAV1 and NAV2 and the previously active frequencies are transferred to standby.	

Table 11: Approach Frequency Auto-Tuning

NAV RADIO PRESETS

Frequency presets can be set by the user to allow for quicker radio frequency navigation. The preset frequencies can be loaded into the standby or active frequency using the NAV radio Find Function.

ADDING A NAV FREQUENCY TO PRESETS:

1 Touch any NAV **Standby** Button.

2 Touch the **Find** Button.
3 Touch the **Presets** Tab.
4 Touch the **Create Preset** Button.
5 Use the keypad to enter the preset name (maximum of 11 characters) then press the **Enter** Button.
6 Use the keypad to enter the frequency then touch the **Enter** Button.
7 A 'Preset Entry' window will open to review the name and frequency entries, touch the **Create Preset** Button to finish adding the preset, or touch **Cancel** to exit NAV frequency preset setup.

EDITING A NAV FREQUENCY PRESET:

1 Touch any NAV **Standby** Button.
2 Touch the **Find** Button.
3 Touch the **Presets** Tab.
4 Touch the **Edit** Button to the right of the preset to be deleted.
5 Edit the name using the keypad window by touching the **Preset Name** Button and/or edit the frequency using the number keypad by using the **Preset Frequency** Button.
6 Touch the **Save Preset** Button to finish editing the preset.

REORDERING A NAV FREQUENCY PRESET:

1 Touch any NAV **Standby** Button.
2 Touch the **Find** Button.
3 Touch the **Presets** Tab.
4 Touch the **Reorder** Button.
5 Touch the arrows to the right of the preset to shift the order of the presets.

REMOVING A NAV FREQUENCY PRESET:

1 Touch any NAV **Standby** Button.
2 Touch the **Find** Button.
3 Touch the **Presets** Tab.
4 Touch the **Edit** Button to the right of the preset to be deleted.
5 Touch the **Delete Preset** Button.

4.4 MODE S TRANSPONDER

The AXIS™ is capable of interfacing with several remote transponders providing Mode S interrogation and reply capabilities. Selective addressing or Mode Select (Mode S) capability includes the following features:

- Level-2 reply data link capability (used to exchange information between aircraft and ATC facilities)
- Surveillance identifier capability

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

The *Traffic Avoidance* portion of the Hazard Avoidance section provides more details on traffic avoidance systems.

TRANSPONDER CONTROLS

Transponder mode selection, code entry, and IDENT activation are controlled using the transponder control window, accessed by touching the transponder datafield button. When in standby, the transponder IDENT function will become inoperative. While in the ON or ALT state the transponder code will appear white while on the ground and green when in the air.

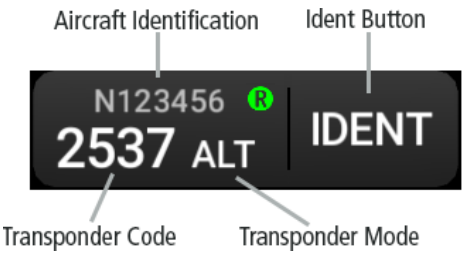


Figure 121: Transponder Datafield Button

ENTERING A TRANSPONDER CODE:

1. Touch the transponder datafield button.
2. Use the number pad to input the transponder code.

   Or:

   Touch the **VFR 1200** Selection Button.
3. Touch the **Enter** Button to activate the transponder code.

The VFR code can be entered either manually or by touching the **VFR 1200** Selection Button. When the **VFR 1200** Selection Button is selected, the pre-programmed VFR code (1200) is automatically displayed in the Transponder Code Button.

SELECTING TRANSPONDER MODE:

1 Touch the transponder datafield button.
2 Touch the **XPDR Mode** Selection Button.
3 Touch the desired transponder mode button.

REPLY STATUS

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

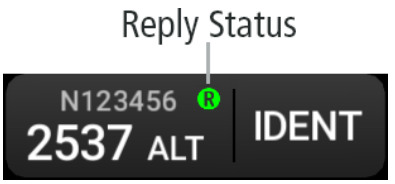


Figure 122: Transponder Reply Indication

IDENT FUNCTION

NOTE

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

Touching the Transponder **IDENT** Button 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 active, the word IDENT appears in white on the Active Transponder Frequency Button and pulsates.

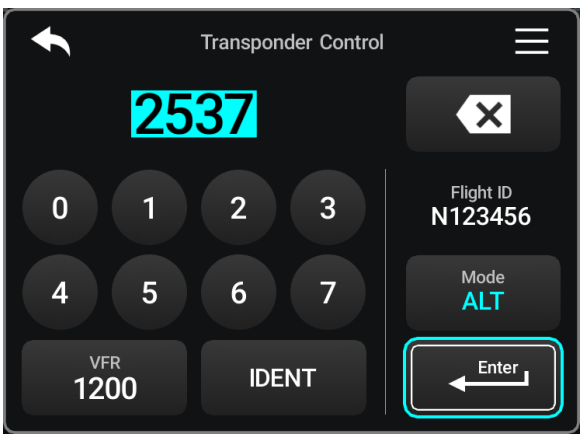


Figure 123: 'Transponder Control' Window

ENTERING A FLIGHT ID (OPTIONAL):

NOTE

Not all configurations of the AXIS™ flight display system allows for the pilot to enter a flight ID.

The following methods are available for entry of the Flight ID (tail number), before flight operation. The Flight ID field can hold up to eight characters.

1 Touch the **Transponder** Datafield Button, opening the 'Tranponder Control' window.
2 Touch the **Flight ID** Button.
3 Use the Flight ID alphanumeric keypad to enter up to eight digits for a Flight ID.
4 Touch the **Enter** Button.

TRANSPONDER MODES

NOTE

The XPDR/TCAS Mode on the 'Transponder' Screen always shows the default or pilot selected mode and does not necessarily correspond with the traffic system if it is in a lower mode due to other constraints.

NOTE

Refer to the Traffic Avoidance section in Hazard Avoidance for more information about TAS/TCAS alerts.

The following table describes the transponder and traffic system operating modes for each of the XPDR/TCAS Mode selection:

XPDR/TCAS Mode Selection	Indication (XPDR Mode Button)	Transponder Mode	Available TCAS Mode
Altitude Reporting	ALT	Altitude Reporting	Standby
On	ON	On	Standby
Standby	STBY	Standby	Standby

Table 12: Transponder Modes

ALTITUDE REPORTING MODE

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

Figure 124: Altitude Reporting Mode

TRANSPONDER 'ON' MODE

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

Figure 125: On Mode Indications

TRANSPONDER 'STANDBY' MODE

NOTE

In Standby Mode, the IDENT function is inoperative.

Standby Mode can be selected at any time by touching 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, the transponder code and STBY indication are displayed in white on the Transponder Code/Mode Button and a black on amber system alert message on the PFW.

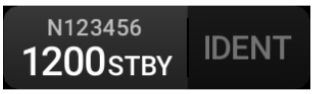


Figure 126: Transponder Standby Mode Indications

4.5 ADDITIONAL AUDIO FUNCTIONS

NOTE

The ICS functions of the AXIS™ flight displays are only available when the internal audio panel is configured.

NOTE

Due to the configurablility of radio specifications, the images in this section are for reference only and may not appear the same in all system configurations.

The AXIS flight display(s) offer varying levels of integrated audio panel and intercom support depending on the installed equipment. The following sections describe the integrated display functionality for each of the following installation types.

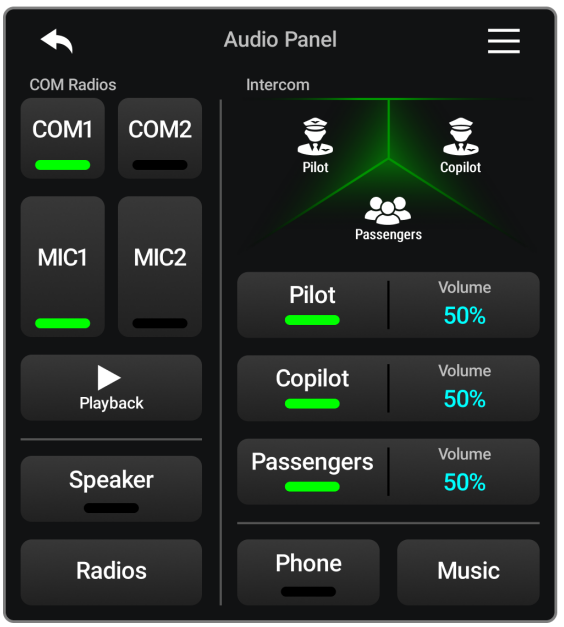
INTERNAL AUDIO PANEL

INTERCOM SYSTEM (ICS)

The intercom system (ICS) connects the pilot, copilot, and passengers. The intercom allows for quick isolation of audio from other positions by touching the corresponding **Isolate** Button (Pilot, Copilot, Passengers, Pilot Isolate, Crew Isolate, Pilot ISO, Crew ISO, etc.). The selected intercom volume level can be adjusted from 0 to 100% by touching the **Volume** Button then sliding your finger right or left on the slider. Sliding to the right increases volume, sliding to the left decreases volume.

AXIS™ flight displays internal audio panel ICS operates with a “opt in” methodology. This means that to be part of the ICS a user must “opt in” by activating the position’s (Pilot, Co-pilot, or Passenger when configured) button. Once a position is selected (a green indication on the button indicates that position is opted in) the position will be highlighted with a glowing green outline in the ICS summary image on the audio panel page. When users are not opted in to the audio panel, they will be considered “isolated” and will not be able to talk to other members of the aircraft over the ICS.

Audio Panel (Internal Example)



Audio Panel (GMA 245R Example)

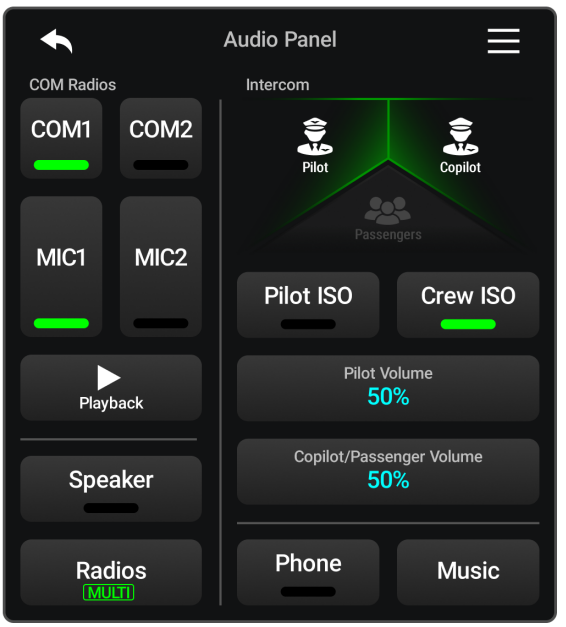


Figure 127: Intercom Controls

SPEAKER

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

CLEARANCE RECORDER

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

After opening the audio panel touch the **Playback** Button to listen to the latest recorded memory block. The **Stop** Button and **Back** Button are displayed while the audio is playing. When the present memory block has finished playing, the Recorder (**Playback** Button) is displayed again.

Touching the Recorder (**Stop** Button) during play of a memory block pauses play. If a COM input signal is detected during play of a recorded memory block, play is halted.

Removing power from the system clears all recorded blocks.

ENABLING THE CLEARANCE RECORDER:

1 Access the Audio Panel by touching the **Audio** Button on the CNS Bar at the top of the display.

   Or:

   a) Touch the **Applications** Icon **> Quick Actions** Tab **> Audio**.

2 Touch the **Menu** Button.

   Or:

   Press the **MENU** Softkey (on the 'Audio Panel' window side of the bezel).

3 Scroll to the **Recorder Enabled** Annunciation Button and touch it to enable the recorder (green annunciator on).

CLEARANCE RECORDING PLAYBACK:

1 Access the Audio Panel by touching the **Audio** Button on the CNS Bar at the top of the display.

   Or:

   a) Touch the **Applications** Icon **> Quick Actions** Tab **> Audio**.

2 Touch the **Playback** Button to begin listening to the previous transmission.

   a) While the audio panel is playing the recording, the pilot can touch the **Back** Button to rewind the recording.

      Or:

      Touch the **Stop** Button to pause the recording.

ACTIVE AND STANDBY COM RADIO MONITORING

Refer to *COM Operation* earlier in this section for more information on interacting with the COM buttons within the Audio Panel App.

NAV RADIO AND NON-MUSIC AUX MONITORING

AXIS™ flight display's internal audio panel, in addition to monitoring two COM radios, supports 4 additional aux inputs that are preset to the following inputs:

- External NAV radio
- Stereo Music (L)
- Stereo Music (R)
- Alerts

When Using a 116NC, the RADIO button will host up to three options (NAV 1, NAV2, and Alerts)

See *NAV Operation* for more information on monitoring NAV radios.

3D AUDIO

3D Audio is useful when multiple audio sources are present while using COM1 or COM2. By using different responses in each ear, 3D audio processing creates spatial separation from each audio source, aiding in the distinction of which audio source the pilot is hearing.

Because this feature uses different signals for left and right channels, it requires wiring for stereo intercom and stereo headsets. If an aircraft is not wired to support stereo headsets, or the crew does not use stereo headsets, then COMs audio will be distributed to both ears regardless of the 3D audio functionality selection.

With a single COM selected and 3D Audio enabled, the listener hears the audio source at the 12 o'clock position. If both COMs are selected, the listener hears COM1 at 11 o'clock and COM2 at the 1 o'clock position.

The scope of 3D Audio is limited to COM audio and Intercom audio for pilot and copilot stations. All other audio (alerts, sidetones, etc.) will be distributed equally to both ears.

COM and Intercom 3D audio can be enabled or disabled individually.

ENABLING/DISABLING 3D AUDIO:

1. Open the Audio Panel.
2. Touch the **Menu** Button or **MENU** Softkey to open the 'Audio Panel Menu'.
3. Touch the **COM 3D Audio** Annunciation Button to enable the COM radio 3D audio function (green annunciator indicates 3D audio is on).

   Or:

   Touch the **Intercom 3D Audio** Annunciation Button to enable the intercom 3D audio function (green annunciator indicates 3D audio is on).

SIMULTANEOUS COM OPERATION

The pilot and the copilot are able to transmit and receive simultaneously over separate COM radios if the 'Split COM' function is enabled in the Audio Panel Menu. The selected COM MIC Annunciation flashes when either pilot's microphone PTT is pressed.

For single pilot aircraft the 'Split COM' function will remove aural alerts from the passenger and co-pilot headsets. In dual pilot aircraft the 'Split COM' function will isolate all aural alerts to only be heard on the pilot headsets.

ENABLING/DISABLING THE SPLIT COM FUNCTION:

1 Open the audio panel.
2 Touch the **Menu** Button or **MENU** Softkey to open the 'Audio Panel Menu'.
3 Touch the **Split COM** Annunciation Button (green annunciator indicates the COM radios are split).

ENTERTAINMENT INPUTS

The AXIS™ flight display internal audio panel allows for phone call management as well as the support of a wide range of advanced music and entertainment functionality as it applies to the internal audio panel.

STANDARD MUSIC DISTRIBUTION

Standard music distribution offers a simplified music experience where all aircraft positions (Pilot, Co-Pilot, Passengers) would be listening to the same music source with the same volume settings. With standard music distribution, the user can select either the wired aux music source or BT music and adjust the audio volume from 0 to 100% using the volume button.

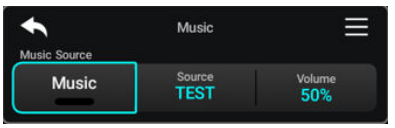


Figure 128: Music Source Example

ACCESSING THE MUSIC WINDOW:

1 Access the Audio Panel by touching the **Audio** Button on the CNS Bar at the top of the display.
   Or:
   a) Touch the **Applications** Icon **> Quick Actions** Tab **> Audio**.
2 Touch the **Music** Button.

ADVANCED MUSIC DISTRIBUTION

Advanced music distribution offers all of the same functionality of standard music distribution, but allows users to manage the volume, source, and presence of music at each individual position (Pilot, Co-Pilot, Passengers).

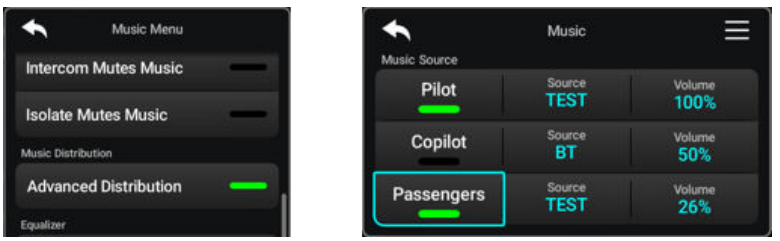


Figure 129: Advanced Music Distribution Example

ENABLING ADVANCED MUSIC DISTRIBUTION:

1 Access the Audio Panel by touching the **Audio** Button on the CNS Bar at the top of the display.

Or:

a) Touch the **Applications** Icon **> Quick Actions** Tab **> Audio**.

2 Touch the **Menu** Button.

Or:

Press the **MENU** Softkey (on the 'Audio Panel' window side of the bezel).

3 Scroll to the **Advanced Distribution** Annunciation Button and touch it to enable the advanced music distribution (green annunciator on).

SOURCE SELECTION

AXIS™ flight displays allow for users to select between a wired stereo Aux music source and BT music source whenever an aux source is configured and a BT device capable of playing music is connected to the internal audio panel.

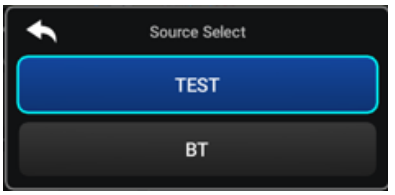


Figure 130: Source Selection Example

SELECTING THE MUSIC SOURCE:

1 Access the Audio Panel by touching the **Audio** Button on the CNS Bar at the top of the display.

Or:

a) Touch the **Applications** Icon **> Quick Actions** Tab **> Audio**.

2 Touch the **Music** Button.

3 Under 'Mode Source' touch the **Source** Datafield Button.

4 Touch an available source from the displayed list.

BLUETOOTH CONNECTIVITY

The AXIS™ architecture is capable of distributing entertainment audio on headsets for pilot, copilot, and passengers using a Bluetooth link for streaming audio from a third-party. Portable Electronic Device (PED). The audio panel retains information for up to ten PED devices. To connect devices to AXIS (when auto reconnect is not yet set up) users can either navigate to the connectivity app in the settings and tools tab, or by connections setting button in the music app menu. Once connected users can distribute music throughout the aircraft with the AXIS audio panel and their PED.

ACCESSING THE MUSIC MENU WINDOW

1 Access the Audio Panel by touching the **Audio** Button on the CNS Bar at the top of the display.

Or:

a) Touch the **Applications** Icon **> Quick Actions** Tab **> Audio**.

2 Touch the **Music** Button.

3 Touch the **MENU** Softkey on the side of the bezel the window is displayed.

Or:

Touch the **Menu** Button on the 'Music' window.

ADVANCED MUSIC SETTINGS

Within the Music App menu, there are several advanced settings that are used to enhance the user's music experience in the aircraft. The various mute settings enable the system to automatically mute music in situations where a pilot may not want the added distraction of music in their headset. These settings include the following:

- Equalizer customization – **None**, **Rock**, **Pop**, **Classical**
- Bass boost customization – **None**, **Medium**, **High**
- Mute options:
  - **Radio Mutes Music**: Whenever a selected COM receives a transmission, the music is soft muted.
  - **Alert Mutes Music**: Alerting audio soft mutes music
  - **Intercom Mutes Music**: Whenever someone talks on the ICS, music is soft muted
  - **Isolate Mutes Music**: Users isolated from the ICS will have their music totally muted.

ACCESSING ADVANCED MUSIC SETTINGS:

1 Access the Audio Panel by touching the **Audio** Button on the CNS Bar at the top of the display.

Or:

a) Touch the **Applications** Icon **> Quick Actions** Tab **> Audio**.

2 Touch the **Music** Button.

3 Touch the **MENU** Softkey on the side of the bezel the window is displayed.

Or:

Touch the **Menu** Button on the 'Music' window.

4 Touch the **Advanced Settings** Button.

GMA 245/245R

INTERCOM SYSTEM (ICS)

The intercom system (ICS) connects the pilot, copilot, and passengers. The intercom allows for quick isolation of audio from other positions by touching the corresponding **Isolate** Button (Pilot, Copilot, Passengers, Pilot Isolate, Crew Isolate, Pilot ISO, Crew ISO, etc.). The selected intercom volume level can be adjusted from 0 to 100% by touching the **Volume** Button then sliding your finger right or left on the slider. Sliding to the right increases volume, sliding to the left decreases volume.

The GMA 245's ICS operates in a "opt out" methodology. This means that by default all users are in the ICS, and users can Isolate themselves using one of two preset ICS isolation settings "Pilot Iso" and "Crew Iso". Once an "Iso" option has been selected, the positions

actively in the ICS will be highlighted with a glowing green line in the ICS summary image on the audio panel page.

Figure 131: GMA 245/245R Audio Panel Example

SPEAKER

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

CLEARANCE RECORDER

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

After opening the audio panel touch the **Playback** Button to listen to the latest recorded memory block. The **Stop** Button and **Back** Button are displayed while the audio is playing. When the present memory block has finished playing, the Recorder (**Playback** Button) is displayed again.

Touching the Recorder (**Stop** Button) during play of a memory block pauses play. If a COM input signal is detected during play of a recorded memory block, play is halted.

Removing power from the system clears all recorded blocks.

ENABLING THE CLEARANCE RECORDER:

1 Access the Audio Panel by touching the **Audio** Button on the CNS Bar at the top of the display.

Or:

a) Touch the **Applications** Icon **> Quick Actions** Tab **> Audio**.

2 Touch the **Menu** Button.

Or:

Press the **MENU** Softkey (on the 'Audio Panel' window side of the bezel).

3 Scroll to the **Recorder Enabled** Annunciation Button and touch it to enable the recorder (green annunciator on).

CLEARANCE RECORDING PLAYBACK:

1 Access the Audio Panel by touching the **Audio** Button on the CNS Bar at the top of the display.

Or:

a) Touch the **Applications** Icon **> Quick Actions** Tab **> Audio**.

2 Touch the **Playback** Button to begin listening to the previous transmission.

a) While the audio panel is playing the recording, the pilot can touch the **Back** Button to rewind the recording.

Or:

Touch the **Stop** Button to pause the recording.

ACTIVE AND STANDBY COM RADIO MONITORING

Refer to *COM Operation* earlier in this section for more information on interacting with the COM buttons within the Audio Panel App.

NAV RADIO AND NON-MUSIC AUX MONITORING

The GMA 245 supports 3 customizable non-music AUX inputs for monitoring within the "radios" button on the Audio Panel App. The titles of these AUX inputs are customizable in config mode.

See *NAV Operation* for more information on monitoring NAV radios.

3D AUDIO

3D Audio is useful when multiple audio sources are present while using COM1 or COM2. By using different responses in each ear, 3D audio processing creates spatial separation from each audio source, aiding in the distinction of which audio source the pilot is hearing.

Because this feature uses different signals for left and right channels, it requires wiring for stereo intercom and stereo headsets. If an aircraft is not wired to support stereo headsets, or the crew does not use stereo headsets, then COMs audio will be distributed to both ears regardless of the 3D audio functionality selection.

With a single COM selected and 3D Audio enabled, the listener hears the audio source at the 12 o'clock position. If both COMs are selected, the listener hears COM1 at 11 o'clock and COM2 at the 1 o'clock position.

The scope of 3D Audio is limited to COM audio and Intercom audio for pilot and copilot stations. All other audio (alerts, sidetones, etc.) will be distributed equally to both ears.

COM and Intercom 3D audio can be enabled or disabled individually.

ENABLING/DISABLING 3D AUDIO:

1 Open the Audio Panel.

2 Touch the **Menu** Button or **MENU** Softkey to open the 'Audio Panel Menu'.

3 Touch the **COM 3D Audio** Annunciation Button to enable the COM radio 3D audio function (green annunciator indicates 3D audio is on).

Or:

Touch the **Intercom 3D Audio** Annunciation Button to enable the intercom 3D audio function (green annunciator indicates 3D audio is on).

SIMULTANEOUS COM OPERATION

The pilot and the copilot are able to transmit and receive simultaneously over separate COM radios if the 'Split COM' function is enabled in the Audio Panel Menu. The selected COM MIC Annunciation flashes when either pilot's microphone PTT is pressed.

For single pilot aircraft the 'Split COM' function will remove aural alerts from the passenger and co-pilot headsets. In dual pilot aircraft the 'Split COM' function will isolate all aural alerts to only be heard on the pilot headsets.

ENABLING/DISABLING THE SPLIT COM FUNCTION:

1. Open the audio panel.
2. Touch the **Menu** Button or **MENU** Softkey to open the 'Audio Panel Menu'.
3. Touch the **Split COM** Annunciation Button (green annunciator indicates the COM radios are split).

ENTERTAINMENT INPUTS

The AXIS™ flight display allows for phone call management as well as the support of a wide range of advanced music and entertainment functionality as it applies to the GMA 245/245R.

STANDARD MUSIC DISTRIBUTION

Standard music distribution offers a simplified music experience where all aircraft positions (Pilot, Co-Pilot, Passengers) would be listening to the same music source with the same volume settings. With standard music distribution, the user can select either the wired aux music source or BT music source. With a GMA 245, users control volume via knobs on the GMA 245. With a GMA 245R, volume control is done using the AXIS flight display.

ACCESSING THE MUSIC WINDOW:

1. Access the Audio Panel by touching the **Audio** Button on the CNS Bar at the top of the display.

   Or:

   a) Touch the **Applications** Icon **> Quick Actions** Tab **> Audio**.
2. Touch the **Music** Button.

ADVANCED MUSIC DISTRIBUTION

Advanced music distribution offers all of the same functionality of standard music distribution, but allows users to manage the volume, source, and presence of music at each individual position (Pilot, Co-Pilot, Passengers).

NOTE

When using a GMA 245 music volume is controlled using the audio panel knobs for pilot and co-pilot, and the passenger's volume can be controlled using a volume slider on the advanced distribution page.

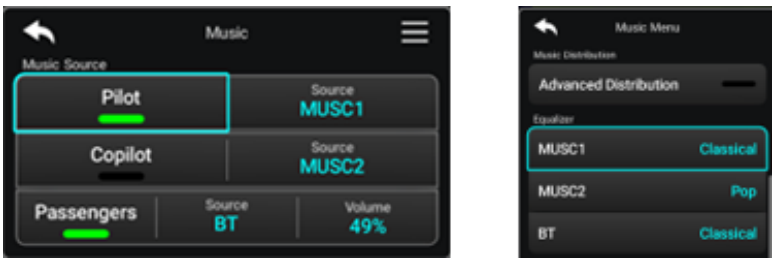


Figure 132: Advanced Music Distribution Example

ENABLING ADVANCED MUSIC DISTRIBUTION:

1 Access the Audio Panel by touching the **Audio** Button on the CNS Bar at the top of the display.

Or:

a) Touch the **Applications** Icon **> Quick Actions** Tab **> Audio**.

2 Touch the **Menu** Button.

Or:

Press the **MENU** Softkey (on the 'Audio Panel' window side of the bezel).

3 Scroll to the **Advanced Distribution** Annunciation Button and touch it to enable the advanced music distribution (green annunciator on).

SOURCE SELECTION

AXIS™ flight displays allow for users to select between a wired stereo Aux music source and BT music source whenever an aux source is configured and a BT device capable of playing music is connected to the internal audio panel.

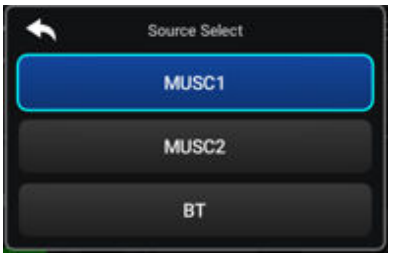


Figure 133: Source Selection Example

SELECTING THE MUSIC SOURCE:

1 Access the Audio Panel by touching the **Audio** Button on the CNS Bar at the top of the display.

Or:

a) Touch the **Applications** Icon **> Quick Actions** Tab **> Audio**.

2 Touch the **Music** Button.

3 Under 'Mode Source' touch the **Source** Datafield Button.

4 Touch an available source from the displayed list.

BLUETOOTH CONNECTIVITY

The GMA 245 is capable of connecting to one PED at a time. GMA 245's can be put into pairing mode via its own softkeys or by pressing the **Pair New Device** Button within the music menu. When using a GMA 245R, the device must be placed in pairing mode using the AXIS flight display.

Figure 134: Pairing a New Device

PLACING DEVICE IN PAIRING MODE:

1 Access the Audio Panel:
   a) Touch the **Audio** Button on the CNS Bar at the top of the display.
      Or:
      Touch the **Applications** Icon **> Quick Actions** Tab **> Audio**.
2 Touch the **Music** Button on the audio panel window.
3 Press the **MENU** Softkey on the side of the bezel the window is displayed.
   Or:
   Touch the **Menu** Icon in the top right of the window.
4 Touch the **Pair New Device** Button.
5 Using the PED, pair to the GMA.

ADVANCED MUSIC SETTINGS

Within the Music App menu, there are several advanced settings that are used to enhance the user's music experience in the aircraft. The various mute settings enable the system to automatically mute music in situations where a pilot may not want the added distraction of music in their headset. These settings include the following:

- Equalizer customization – **None**, **Rock**, **Pop**, **Classical**
- Bass boost customization – **None**, **Medium**, **High**
- Mute options:
  - **Radio Mutes Music**: Whenever a selected COM receives a transmission, the music is soft muted.
  - **Intercom Mutes Music**: Whenever someone talks on the ICS, music is soft muted

With a GMA 245, users can adjust the equalizer and bass boost settings individually for each auxiliary music input as well as the BT music.

ACCESSING ADVANCED MUSIC SETTINGS:

1 Access the Audio Panel by touching the **Audio** Button on the CNS Bar at the top of the display.

Or:

a) Touch the **Applications** Icon **> Quick Actions** Tab **> Audio**.

2 Touch the **Music** Button.

3 Touch the **MENU** Softkey on the side of the bezel the window is displayed.

Or:

Touch the **Menu** Button on the 'Music' window.

4 Touch the **Advanced Settings** Button.

GTR 205R INTERCOM SYSTEM ONLY (ICS)

The intercom system (ICS) connects the pilot and copilot. The intercom allows for quick isolation of audio from other positions by touching the corresponding **Isolate** Button (Pilot Isolate). The selected intercom volume level can be adjusted from 0 to 100% by touching the **Volume** Button then sliding your finger right or left on the slider. Sliding to the right increases volume, sliding to the left decreases volume.

The GTR 205R ICS operates in a “opt out” methodology. This means that by default all users are in the ICS, and users can isolate themselves using "Pilot Iso" setting. Once an "Iso" option has been selected, the positions actively in the ICS will be highlighted with a glowing green line in the ICS summary image on the audio panel page.

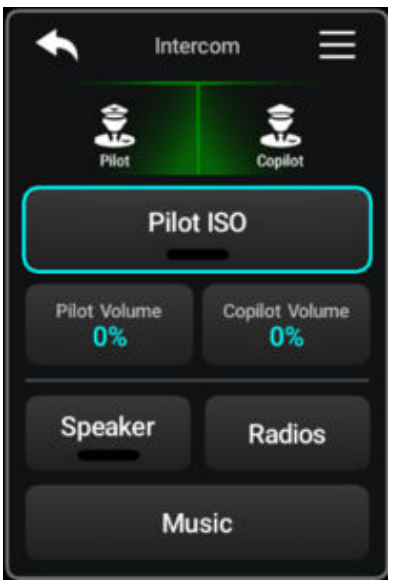


Figure 135: GTR 205R Audio Panel Example

SPEAKER

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

NAV RADIO AND NON-MUSIC AUX MONITORING

The GTR 205R supports 2 customizable non-music AUX inputs for monitoring within the "radios" button on the Audio Panel App. The titles of these AUX inputs are customizable in config mode.

See *NAV Operation* for more information on monitoring NAV radios.

3D AUDIO

3D Audio is useful when multiple audio sources are present while using COM1 or COM2. By using different responses in each ear, 3D audio processing creates spatial separation from each audio source, aiding in the distinction of which audio source the pilot is hearing.

Because this feature uses different signals for left and right channels, it requires wiring for stereo intercom and stereo headsets. If an aircraft is not wired to support stereo headsets, or the crew does not use stereo headsets, then COMs audio will be distributed to both ears regardless of the 3D audio functionality selection.

With a single COM selected and 3D Audio enabled, the listener hears the audio source at the 12 o'clock position. If both COMs are selected, the listener hears COM1 at 11 o'clock and COM2 at the 1 o'clock position.

The scope of 3D Audio is limited to COM audio and Intercom audio for pilot and copilot stations. All other audio (alerts, sidetones, etc.) will be distributed equally to both ears.

COM and Intercom 3D audio can be enabled or disabled individually.

ENABLING/DISABLING 3D AUDIO:

1. Open the Audio Panel.
2. Touch the **Menu** Button or **MENU** Softkey to open the 'Audio Panel Menu'.
3. Touch the **COM 3D Audio** Annunciation Button to enable the COM radio 3D audio function (green annunciator indicates 3D audio is on).

   Or:

   Touch the **Intercom 3D Audio** Annunciation Button to enable the intercom 3D audio function (green annunciator indicates 3D audio is on).

ENTERTAINMENT INPUTS

The AXIS™ flight display supports of a wide range of advanced music and entertainment functionality.

STANDARD MUSIC DISTRIBUTION

Standard music distribution offers a simplified music experience where all aircraft positions (Pilot and Co-Pilot) would be listening to the same music source with the same volume settings. Volume control is done using the AXIS™ flight display.

NOTE

If no music aux connection is configured, the music button on the intercom app will not be displayed.

ADVANCED MUSIC SETTINGS

Within the Music App menu, there are several advanced settings that are used to enhance the user's music experience in the aircraft. The various mute settings enable the system to automatically mute music in situations where a pilot may not want the added distraction of music in their headset. These settings include the following:

- Equalizer customization – **None**, **Rock**, **Pop**, **Classical**
- Bass boost customization – **None**, **Medium**, **High**
- Mute options:
  - **Radio Mutes Music**: Whenever a selected COM receives a transmission, the music is soft muted.
  - **Intercom Mutes Music**: Whenever someone talks on the ICS, music is soft muted.

ACCESSING ADVANCED MUSIC SETTINGS:

1. Access the Audio Panel by touching the **Audio** Button on the CNS Bar at the top of the display.

   Or:

   a) Touch the **Applications** Icon **> Quick Actions** Tab **> Audio**.
2. Touch the **Music** Button.
3. Touch the **MENU** Softkey on the side of the bezel the window is displayed.

   Or:

   Touch the **Menu** Button on the 'Music' window.
4. Touch the **Options** Button.

GTR 205/GTR 200/GTR 20 INTERCOM SYSTEM ONLY (ICS)

The intercom system (ICS) connects the pilot and copilot. The intercom allows for quick isolation of audio from other positions by touching the corresponding **Isolate** Button (Pilot Isolate). The selected intercom volume level can be adjusted from 0 to 100% by touching the **Volume** Button then sliding your finger right or left on the slider. Sliding to the right increases volume, sliding to the left decreases volume.

The ICS operates in a "opt out" methodology. This means that by default all users are in the ICS, and users can Isolate themselves using the "Pilot Iso" setting. Once an "Iso" option has been selected, the positions actively in the ICS will be highlighted with a glowing green line in the ICS summary image on the audio panel page.

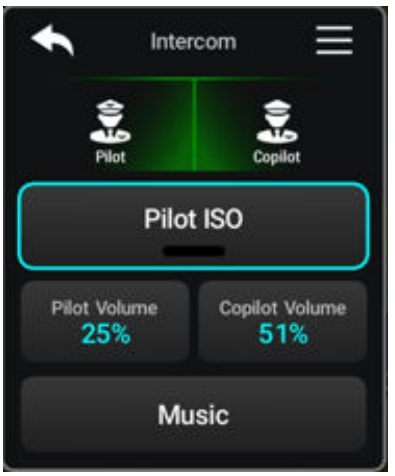


Figure 136: GTR 205/GTR 200/GTR 20 Audio Panel Example

SPEAKER

Speaker control for the GTR 205, GTR 200, GTR 200B, and GTR 20 must be controlled via the panel mounted GTR device.

NAV RADIO AND NON-MUSIC AUX MONITORING

NAV/AUX monitoring for the GTR 205, GTR 200, GTR 200B, and GTR 20 must be controlled via the panel mounted GTR device.

3D AUDIO

3D Audio is useful when multiple audio sources are present while using COM1 or COM2. By using different responses in each ear, 3D audio processing creates spatial separation from each audio source, aiding in the distinction of which audio source the pilot is hearing.

Because this feature uses different signals for left and right channels, it requires wiring for stereo intercom and stereo headsets. If an aircraft is not wired to support stereo headsets, or the crew does not use stereo headsets, then COMs audio will be distributed to both ears regardless of the 3D audio functionality selection.

With a single COM selected and 3D Audio enabled, the listener hears the audio source at the 12 o’clock position. If both COMs are selected, the listener hears COM1 at 11 o’clock and COM2 at the 1 o’clock position.

The scope of 3D Audio is limited to COM audio and Intercom audio for pilot and copilot stations. All other audio (alerts, sidetones, etc.) will be distributed equally to both ears.

COM and Intercom 3D audio can be enabled or disabled individually.

ENABLING/DISABLING 3D AUDIO:

1. Open the Audio Panel.
2. Touch the **Menu** Button or **MENU** Softkey to open the 'Audio Panel Menu'.
3. Touch the **COM 3D Audio** Annunciation Button to enable the COM radio 3D audio function (green annunciator indicates 3D audio is on).

Or:

Touch the **Intercom 3D Audio** Annunciation Button to enable the intercom 3D audio function (green annunciator indicates 3D audio is on).

ENTERTAINMENT INPUTS

The AXIS™ flight display supports of a wide range of advanced music and entertainment functionality.

STANDARD MUSIC DISTRIBUTION

Standard music distribution offers a simplified music experience where all aircraft positions (Pilot and Co-Pilot) would be listening to the same music source with the same volume settings. Volume control is done using the AXIS™ flight display.

NOTE

If no music aux connection is configured, the music button on the intercom app will not be displayed.

ADVANCED MUSIC SETTINGS

NOTE

These settings are only available on the GTR 205.

Within the Music App menu, there are several advanced settings that are used to enhance the user's music experience in the aircraft. The various mute settings enable the system to automatically mute music in situations where a pilot may not want the added distraction of music in their headset. These settings include the following:

- Equalizer customization – **None**, **Rock**, **Pop**, **Classical**
- Bass boost customization – **None**, **Medium**, **High**
- Mute options:
  - **Radio Mutes Music**: Whenever a selected COM receives a transmission, the music is soft muted.
  - **Intercom Mutes Music**: Whenever someone talks on the ICS, music is soft muted.

ACCESSING ADVANCED MUSIC SETTINGS:

1. Access the Audio Panel by touching the **Audio** Button on the CNS Bar at the top of the display.

   Or:

   a) Touch the **Applications** Icon **> Quick Actions** Tab **> Audio**.
2. Touch the **Music** Button.
3. Touch the **MENU** Softkey on the side of the bezel the window is displayed.

   Or:

   Touch the **Menu** Button on the 'Music' window.
4. Touch the **Options** Button.

MONO/STEREO HEADSETS

Stereo headsets are recommended for use with this system. 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.

PAIRING A BLUETOOTH DEVICE:

NOTE

All devices will have the option to "Auto Reconnect' when the power is cycled.

1 Access the 'Bluetooth Settings' Window:
   a) Access the Audio Panel by touching the **Audio** Button on the CNS Bar at the top of the display.

      Or:

      Touch the **Applications** Icon **> Quick Actions** Tab **> Audio**. ('Bluetooth Settings' may also be accessed through the 'Music' Window by touching the **MENU** Softkey.)
   b) Press the **MENU** Softkey on the side of the bezel the window is displayed.
   c) Touch the **Connection Settings** Button.

   Or:

   a) Access the 'Apps' Window by touching the **Applications** Icon.
   b) If necessary, touch the **Settings & Tools** Tab.
   c) Touch the **Connectivity** Button.
   d) If necessary, touch the **Bluetooth** Tab.
   e) Touch the **Settings** Button in the Datalink Bluetooth section of the window.
2 Touch the **Pair Device** Button.
3 A 'Pair Devices' window will open. The system may take several minutes to find available devices nearby.
4 If necessary, scroll though the available devices to find and select the device you are trying to pair.
5 The flight display will present a six digit code for verification with the device. Touch the **OK** Button to begin pairing the device. An "Enable Autoreconnect for [name of device]" will appear.
   a) Touch the **Yes** Button to connect to the device.

      Or:

      Touch the **No** Button to cancel the pairing process.

ENABLING THE BLUETOOTH AUTO RECONNECT FUNCTION:

1 Access the 'Bluetooth Settings' Window:
   a) Access the Audio Panel by touching the **Audio** Button on the CNS Bar at the top of the display.

Or:

Touch the **Applications** Icon **> Quick Actions** Tab **> Audio**. ('Bluetooth Settings' may also be accessed through the 'Music' Window by touching the **MENU** Softkey.

b) Touch the **MENU** Softkey on the side of the bezel the window is displayed.

c) Touch the **Connection Settings** Button.

Or:

a) Access the 'Apps' Window by touching the **Applications** Icon.

b) If necessary, touch the **Settings & Tools** Tab.

c) Touch the **Connectivity** Button.

d) If necessary, touch the **Bluetooth** Tab.

2 Touch the button for the connected device, opening a 'Device Options' window.

3 Touch the **Auto Reconnect** Annunciation Button (the indication will be green when auto reconnect is enabled).

DISCONNECTING A BLUETOOTH DEVICE:

1 Access the 'Bluetooth Settings' Window:

a) Access the Audio Panel by touching the **Audio** Button on the CNS Bar at the top of the display.

Or:

Touch the **Applications** Icon **> Quick Actions** Tab **> Audio**. ('Bluetooth Settings' may also be accessed through the 'Music' Window by touching the **MENU** Softkey.

b) Touch the **MENU** Softkey on the side of the bezel the window is displayed.

c) Touch the **Connection Settings** Button.

Or:

a) Access the 'Apps' Window by touching the **Applications** Icon.

b) If necessary, touch the **Settings & Tools** Tab.

c) Touch the **Connectivity** Button.

d) If necessary, touch the **Bluetooth** Tab.

2 Touch the button for the connected device, opening a 'Device Options' window.

3 Touch the **Disconnect** Button.

UNPAIRING (FORGETTING) A BLUETOOTH DEVICE:

1 Access the 'Bluetooth Settings' Window:

a) Access the Audio Panel by touching the **Audio** Button on the CNS Bar at the top of the display.

Or:

Touch the **Applications** Icon **> Quick Actions** Tab **> Audio**. ('Bluetooth Settings' may also be accessed through the 'Music' Window by touching the **MENU** Softkey.

b) Touch the **MENU** Softkey on the side of the bezel the window is displayed.

c) Touch the **Connection Settings** Button.

Or:

a) Access the 'Apps' Window by touching the **Applications** Icon.
b) If necessary, touch the **Settings & Tools** Tab.
c) Touch the **Connectivity** Button.
d) If necessary, touch the **Bluetooth** Tab.

2 Touch the button for the connected device, opening a 'Device Options' window.

3 Touch the **Unpair** Button.

SELECTING AUXILIARY AUDIO SOURCE:

1 Access the Audio Panel by touching the **Audio** Button on the CNS Bar at the top of the display.

Or:

a) Touch the **Applications** Icon **> Quick Actions** Tab **> Audio**.

2 Touch the **Music** Button.

3 Under 'Mode Source' touch the **Source** Datafield Button.

4 Touch an available source from the displayed list.

CONFIGURING AUXILIARY AUDIO MUTE SETTINGS:

1 Access the Audio Panel by touching the **Audio** Button on the CNS Bar at the top of the display.

Or:

a) Touch the **Applications** Icon **> Quick Actions** Tab **> Audio**.

2 Touch the **Music** Button.

3 Touch the **MENU** Softkey on the side of the bezel the window is displayed.

Or:

Touch the **Menu** Button on the 'Music' window.

4 Under 'Muting Options' touch the desired mute setting annunciation button to enable the system to mute the auxiliary audio for the specific circumstances.

4.6 ABNORMAL OPERATION

Abnormal operation of the system include equipment failures of the system components and failure of associated equipment, including switches and external devices.

STUCK MICROPHONE

If a push-to-talk (PTT) Key becomes stuck, the COM transmitter stops transmitting after 35 seconds of continuous operation. A banner message will appear below the HSI on the PFW to advise of a stuck microphone for either the pilot or co-pilot microphone.

Figure 137: Pilot PTT Stuck Indications

COM TUNING FAILURE

In case of a COM system tuning failure, the radio will remain tuned to the active frequency unless COM Lockout Mode has been entered automatically. See the *Lockout Mode* description for more information.

Depending on the failure mode, an amber X may appear on the frequency display.

AUDIO CONTROLLER FAILSAFE OPERATION

If there is a failure with the internal audio panel a system message will appear in the messages window, "Audio Controls Fault: Remote Control Unavailable". The fail safe mechanism is to switch to the external COM.

For more information on communication radio failure, refer to *Lockout Mode* for more information.

LOCKOUT MODE

NOTE

Lockout Mode will not effect the GTR 205 if one is installed and configured in the AXIS™ flight display software.

Communication radio Lockout Mode is a feature designed to quickly transfer the communication radio to 121.5 in the event of any LRU failure. This feature also protects the system if a stuck transfer key is detected on the internal or external radio.

Lockout Mode can manually be activated by holding the transfer key for approximately two seconds. After Lockout Mode has been activated (for longer than two seconds), it can be exited by holding the transfer key for two seconds again. Once Lockout Mode is exited, most controls are restored to their initial values. The banner message below the HSI will read, "Audio Controls Locked: Hold Freq Swap to Unlock" while Lockout Mode is active. Indications on the COM radio buttons while in Lockout Mode can be reviewed in the figure below.

In single communication radio installations Lockout Mode impacts the following radio features:

- The active radio frequency is tuned to the emergency frequency.
- The COM volume will automatically be set to a level that is specified in the configuration of the AXIS flight display.

- COM Squelch is disabled.
- Monitoring of the standby frequency is disabled.
- All COM radio remote transfer and standby monitor inputs are ignored (or locked out).

In installations that have one internal COM and one external COM, Lockout Mode impacts the following radio features:

- The COM MIC selection is set to the external radio that is specified in the configuration of the AXIS flight display.
- Monitoring of the internal COM radio is disabled.
- All intercom positions are enabled.
- All other radios and music are disabled (NAV and switchable AUX radios and both wired and Bluetooth music).
- COM MIC swap inputs are disabled.

Figure 138: Communication Radio Lockout Mode

SECTION 5 FLIGHT MANAGEMENT SYSTEM

5.1 OVERVIEW

The system is an integrated flight, engine, communication, navigation and surveillance system. This section of the Pilot's Guide provides information on the following:

- The system applications relevant to the Flight Management System (FMS)
- Managing various map displays and map display items
- Map display integration with the FMS
- FMS functionality as it relates to the flight plan, including: general navigation functions, route modifications, waypoint creation, and waypoint management
- Creating, viewing, modifying, and managing flight plans
- Initiating, editing, and viewing Departure, Arrival, and Approach procedures
-
- Trip Statistics and logging of trip data
- Viewing position sensor and position fixing information
- Information on degradation of the FMS and Dead Reckoning Mode

'MAP' AND OTHER MAP DISPLAYS

The MFW 'Map' Window serves as the primary map viewer for the system. The 'Map' Window displays relevant flight data in a manner that maximizes situational awareness for the flight crew by defaulting to a view fixed on the aircraft's present position.

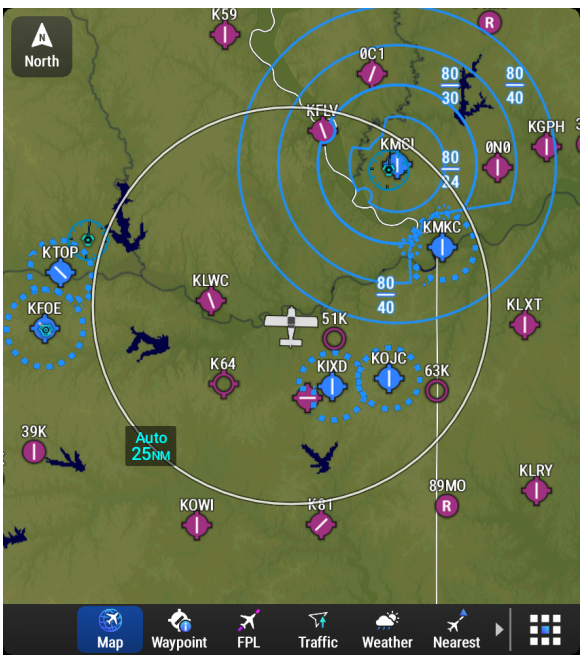


Figure 139: MFW 'Map' Window

An aircraft icon is placed on the map display at the location corresponding to the calculated present position. The aircraft position and the flight plan legs are accurately based on GPS calculations as they correspond to system database values. The basemap layer upon which

these are placed are from a source with less resolution, therefore the relative position of the aircraft to map items may not be exact. Hereafter, references to 'Map' imply the 'Map' Page on the MFW, while "map display(s)" implies 'Map' and all other maps capable of displaying aviation or flight plan data.

Map data displayed on the various map displays is highly customizable, giving the flight crew options to tailor the map to show or hide map features for desired focus on relevant map data, as well as decluttering and other situational awareness considerations.

Map features can generally be divided into four categories:

- **Aviation Data** — airports, VOR's, airways, airspaces
- **Terrain Data** — map shading indicating elevation
- **Geographical Data** — cities, lakes, highways, political borders, etc.
- **Hazard Data** — traffic, hazardous terrain, weather, obstacles, etc.

The amount of displayed data can be adjusted based on the selected map settings, detail level, and range. 'Map' can be oriented three different ways: North Up, Track Up, and Heading (HDG) Up.

Some FMS Apps can display an inset or preview of its related map (e.g., Active Flight Plan Map, Departure Preview Map). Aviation data and flight plan data may also be viewed on the MFW elsewhere, such as 'Terrain' or 'Weather'.

A smaller version of 'Map' may be displayed on the PFW as the HSI Map and will display flight management information, supplementing the information on the MFW Map. Refer to the *HSI Map* section in Flight Instruments for more information.

FLIGHT MANAGEMENT SYSTEM APPLICATIONS

The following are the applications most commonly used as part of the Flight Management system and where they may be found within the system.

- Direct-To Application
  - **Direct-To** Softkey
  - **Applications** Icon > **Quick Actions** Tab > **Direct-To** Button
  - Radial Menu > **Direct-To** Button
- Procedures Applications
  - **Applications** Icon > **Quick Actions** Tab > **PROC** Button
  - **FPL** (MFW App Bar) > **Airport Waypoint Identifier** Button > **Load Procedure** Button
  - **Waypoint** (MFW App Bar) > **Chart Selection** Button > **Approach/Arrival/Departure** Tabs
- Nearest and Waypoint Applications
  - Both can be accessed using the MFW App Bar or **Applications** Icon > **Primary** Tab > **Nearest** Button or **Waypoint** Button

Familiarization with these apps and their related functions serve to help the pilot effectively navigate and manage the FMS.

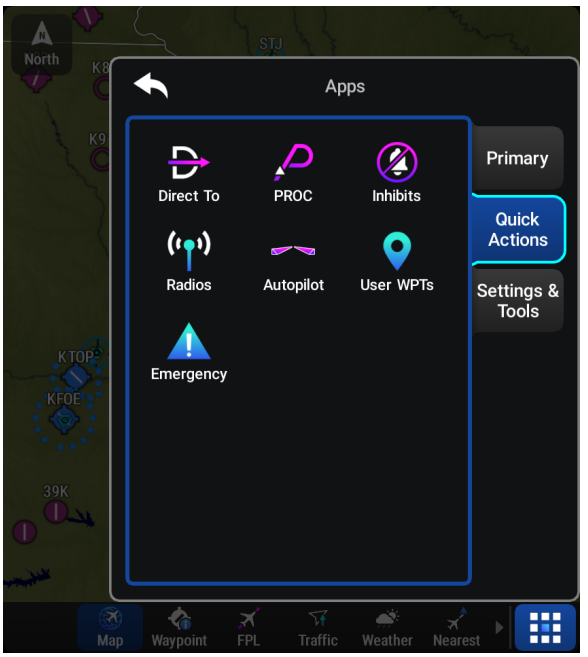


Figure 140: Quick Actions Tab in 'Apps'

Figure 141: MFW App Bar

5.2 MAP SETTINGS AND CONTROLS FOR FLIGHT

'Map' and other function related map displays are used to provide situational awareness in flight. Most map displays can show the following information:

- Airports, NAVAIDs, airspaces, airways, land data (highways, cities, lakes, rivers, borders, etc.) with names
- Map range
- Map orientation
- Icons for enabled map items
- 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
- Topographic terrain

- Fixes

MAP MENU

The 'Map Menu' contains the majority of map settings. This menu's settings applies to the GDU the settings are being adjusted on (Traffic, VSD, Basemap, etc.). This 'Map Menu' also has a 'Map Settings' that applies custom settings to all AXIS™ flight displays connected in the system.

OPENING THE MFW MAP MENU TO VIEW SETTINGS (FROM MFW MAP):

1. On the MFW App Bar, touch the Map Button to view the 'Map Page'.
2. Touch the **MENU** Softkey on the MFW map side of the display (if in split screen mode). 'Map Menu' is opened allowing access to the following overlay and basemap settings.
   - **Overlay**: Off, Weather, and Terrain overlays are available to be viewed on the map through this button.
   - **Traffic**: An indicator button that toggles traffic display on and off for the map.
   - **VSD**: An indicator button that toggles the Vertical Situation Display (VSD) on and off for the 'Map Page' on the MFW.
   - **Basemap**: Off, Topo, VFR, IFR Low, and IFR High are available to be used as the basemap on the MFW 'Map Page'.
   - **Map Orientation**: North Up, Track Up, and HDG Up are selectable map orientations for the MFW 'Map Page'.
   - **Map Legend** and **Overlay Details**: A map key identifying different indications and icons that may be displayed on the MFW 'Map Page'.
3. Touch the **Map Settings** Button to access more settings.

MAP ORIENTATION

Three different orientation options are available for system map displays. This allows flexibility in determining aircraft position relative to other items on the map (North Up) or for determining where map items are relative to where the aircraft is going (Track Up or Heading Up). The map orientation is shown in the upper left corner of the map display pane.

- North up ('North Up') aligns the top edge of the map display to north.
- Track up ('TRK Up') aligns the top edge of the map display to the current ground track.
- Heading up ('HDG Up') aligns the top edge of the map display to the current aircraft heading.

The map application allows users to select their preferred map orientation for the 'Map' Application and 'Weather' Application in the 'Map' Application settings. The map will return to this preferred orientation when:

- North up on ground or north up above conditions are no longer met.
- The map application is initialized by either opening the app for the first time or by re-selecting the map application while the map application is open.

The preferred display orientation will not be updated when cycling through map views using the **Map Orientation** Selection Button in the upper left corner of the map.

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

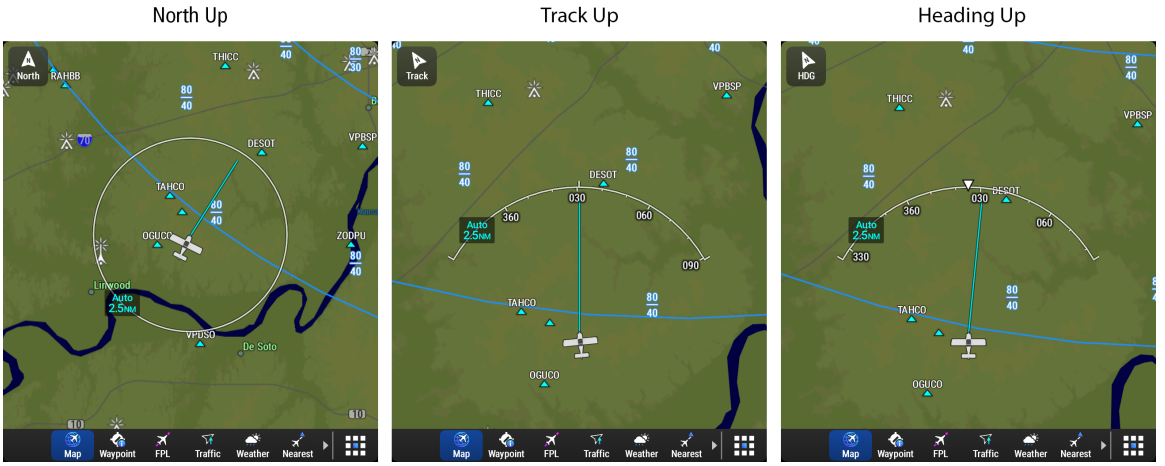


Figure 142: Map Orientation

TOGGLING BETWEEN MFW MAP/WEATHER ORIENTATIONS:

With the 'Map' or 'Weather' Application displayed on the MFW, touch the **Map Orientation** Selection Button in the upper corner of the map to toggle between North Up and Heading Up or Track Up.

EDITING MAP ORIENTATION PREFERENCE:

The map can be configured to switch automatically to a north up, track up, or heading up orientation when the map range reaches a designated range or when the aircraft is on the ground.

1. With the 'Map' Application displayed on the MFW, touch the **MENU** Softkey.
2. Touch the **Map Settings** Button.
3. Touch the **Preference** Selection Button.
4. Choose between **North Up**, **Track Up**, or **HDG Up** to select the desired map orientation preference (this will updaate the map orientation preference described in the Map Orientation Section).

MAP RANGE

Map range can be adjusted from 250 feet up to 1500 NM. 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.

Figure 143: Map Range

MAP RANGE AUTOZOOM

Autozoom allows the system to change the range to the smallest range clearly showing the active waypoint. Autozoom can be overridden by manually adjusting the range. The setting remains until the active waypoint changes, a terrain or traffic alert occurs, the aircraft takes off, or the manual override times out. Autozoom is suspended while the Pan Mode is active.

Figure 144: Autozoom

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

The autozoom function can be turned on or off. Control of the ranges at which the autozoom occurs is done by setting the Minimum and Maximum Zoom distances 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 Zoom setting to a value that limits the autozoom 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 Zoom to a value that limits the autozoom 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, autozoom can be disabled or the Maximum/Minimum Zoom distances can be adjusted.

ENABLING / DISABLING MFW MAP AUTOZOOM:

1. Navigate to the 'Map' Page on the MFW.
2. Press the **MENU** Softkey.
3. Touch **Map Settings**.
4. Touch the **General** Tab.
5. Touch the **Autozoom** Indicator Button to enable or disable the autozoom function. (Green annunciation indicates that it is enabled)

SETTING AUTOZOOM MIN/MAX ZOOM DISTANCES FOR AN MFW MAP DISPLAY:

1. Navigate to the 'Map' Page on the MFW.
2. Press the **MENU** Softkey.
3. Touch **Map Settings**.
4. Touch the **General** Tab.
5. To set the minimum autozoom distance touch the **Min** Datafield Button and touch the desired distance to be set as the minimum.

   Or:

   To set the maximum autozoom distance touch the **Max** Datafield Button and touch the desired distance to be set as the maximum.

ADJUSTING THE MFW MAP RANGE:

1. Zoom out by touching the map using two fingers and perform a pinch gesture (bringing your fingers closer together).

   Or:

Turn the Inner **DCK** (on the MFW Map Application side of the bezel if in split-screen mode) counter-clockwise.

2 Zoom in by touching the map using two fingers and perform a zoom gesture (bringing your fingers closer together).

Or:

Turn the Inner **DCK** (on the MFW Map Application side of the bezel if in split-screen mode) clockwise.

ADJUSTING THE HSI MAP AND WIDGET MAP RANGE:

NOTE

The touch feedback for increasing and decreasing the range on the HSI Map and Widget Map is not limited to the space inside the HSI or Widget. Maintaining the finger to the screen will continue to zoom in and out until released.

Touch one finger to the HSI Map or Widget Map.

a) Slide your finger up to decrease the range (zoom in).

Or:

a) Slide your finger down to increase the range (zoom out).

MAP PANNING

Pan Mode is selected by direct touch on all MFW map displays. Map motion stops when Pan Mode is active. A crosshair is placed in the center of the window while panning the map. Panning the map and adjusting the map range can be done simultaneously, meaning that while panning the user can zoom in and out to a specific location by beginning the zoom over a specific location. Map Panning functionality is not available for traffic maps.

Pan Mode allows the pilot to:

- View parts of the map outside the displayed range without adjusting the map range by panning the map
- Select any item on the map to display the Radial Menu and view the item name, elevation, and distance from present position

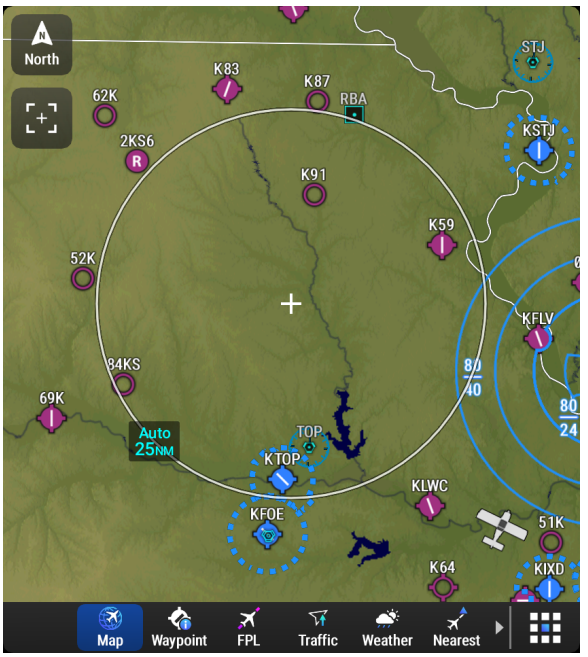


Figure 145: Pan Mode

To pan the map touch and drag any portion of the map display to enter Pan Mode. If necessary, use a Pinch or Zoom gesture to adjust the range while panning. At any time the while panning the map, the icon in the top left corner of the map will recenter the map on the current aircraft location and end panning.

RADIAL MENU

The Radial Menu provides quick and easy access to review and interact with map items that lie within the inner radius. The Radial Menu also provides a ready means of selecting a direct-to waypoint, creating user waypoints, and inserting a selected point into the flight plan. The Radial Menu can also be used to activate Graphical Edit Mode, which is discussed later in the Flight Planning portion of this Flight Management Section.

The following discussion will provide an overview of the Radial Menu. For supplemental information on this topic refer to the *Radial Menu* discussion in the System Overview Section. Map items, viewing waypoint information and finding nearest waypoints, using direct-to navigation, viewing the VSD, and flight plan operations are all discussed in more detail later in this section.

The Radial Menu consists of the following elements:

- **Dynamic Buttons:** There can be one to four dynamic buttons on the right side of the Radial Menu at any given time based on the available map items that lie within the inner radius.
- **Button**: The top, left static button shall be the Button. The Button is always displayed with the Radial menu, but it will be subdued when there are no waypoint elements within the inner radius.

- **Create User Waypoint Button :** The middle static button shall be the Create User Waypoint Button.
- **Insert in Flight Plan Button :** The bottom, left static button shall be the Insert in Flight Plan Button if the inner radius contains a waypoint that is not in the Active Flight Plan. If no waypoints lie within the inner radius , the Insert in Flight Plan Button will be displayed with the Radial Menu, but is will be subdued.
- **Graphical Reroute Button :** The Graphical Reroute Button shall be displayed instead of the Insert in Flight Plan Button if the inner radius contains a waypoint that is part of the Active Flight Plan. If the inner radius contains a waypoint that is part of the Active Flight Plan as well as waypoint(s) that are not a part of the Active Flight Plan, touching this button will display a 'Select From Multiple' Window so the intended waypoint and resulting functionality (Insert in Flight Plan or activate Graphical Edit Mode) can be selected.
- **Info Ring:** The Info Ring displays bearing and distance from present position, and elevation relative to what lies within the inner radius.

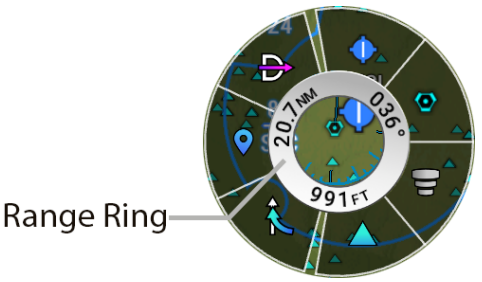


Figure 146: Radial Menu Example, Four Dynamic Buttons and Insert in Flight Plan Button Shown

ACCESSING AND REPOSITIONING THE RADIAL MENU:

1. Touch anywhere on the MFW map display to access the Radial Menu.
2. Once the Radial Menu appears, touch any part of it and drag it to a new location on the map. The Radial Menu becomes semi-transparent as it is being moved to allow visibility of the information behind it.
3. When finished, touch anywhere (on the map display) outside of the Radial Menu to remove it.

VIEWING INFORMATION ABOUT MAP ITEMS USING THE RADIAL MENU:

1. Touch any item on the MFW map display to access the Radial Menu. One or more Dynamic Buttons will be displayed on the right hand side of the Radial Menu, depending on what map items lies within the inner radius.
2. Touch the dynamic button for the desired type of map item. Information concerning that item is displayed in a pop out window.

   Or:

If multiple items of the same type lies within the inner radius, touch the Dynamic Button for the desired type of map item. Then, touch the button for which item to display more information about. Information concerning that item is displayed in a pop out window.

3 Touch the Back Arrow Button to return to the Radial Menu on the map display.

4 If more than one type of map items lies within the inner radius, touch each different Dynamic Button, as desired.

5 Repeat Steps 3 and 4 until all desired map items have been viewed.

6 If necessary, touch any part of the Radial Menu and drag it to a new location on the map.

7 Repeat Steps 2 through 6 as desired.

8 When finished, touch anywhere (on the map display) outside of the Radial Menu to remove it.

SELECTING ANY WAYPOINT AS A DIRECT-TO DESTINATION USING THE RADIAL MENU:

1 Touch the desired direct-to destination on the MFW map display to access the Radial Menu.

2 Touch the Button.

3 If multiple waypoints lie within the inner radius, the 'Select From Multiple' Window is displayed. Touch the button for the desired direct-to waypoint.

4 Touch the **Load** Button.

ADDING WAYPOINTS TO THE ACTIVE FLIGHT PLAN USING THE RADIAL MENU:

1 Touch the desired waypoint on the MFW map display to access the Radial Menu.

2 Touch the Insert in Flight Plan Button ( ). (See procedures for Graphical Flight Plan Modifications for using the Graphical Reroute Button instead.)

3 If multiple waypoints lie within the inner radius, the 'Select From Multiple' Window is displayed. Touch the button for the desired waypoint.

4 The 'Insert <Waypoint> Before' Window is displayed. Touch a Waypoint Selection Button to select where to insert the new waypoint. The waypoint will be inserted into the flight plan before the selected waypoint.

MEASURING BEARING AND DISTANCE

Distance and bearing can be measured on some map displays. Measurement can be from the aircraft's present position to any point by using the Radial Menu, as shown in the following figure:

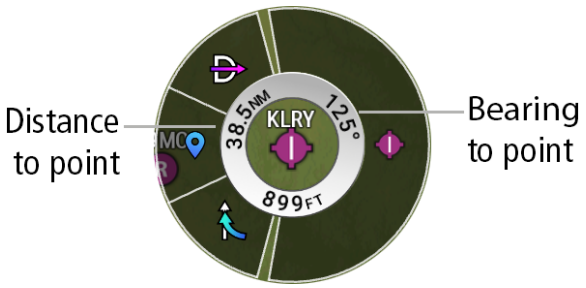


Figure 147: Measuring Bearing/Distance from Present Position

A Measurement Line can also be created between any two points on the map. The bearing and distance tool displays a white Measurement Line and a cyan Measure Pointer to aid in graphically identifying the points to measure. Distance measured is displayed above the Measurement Line; bearing is displayed below, and adjacent to, the Measure Point.

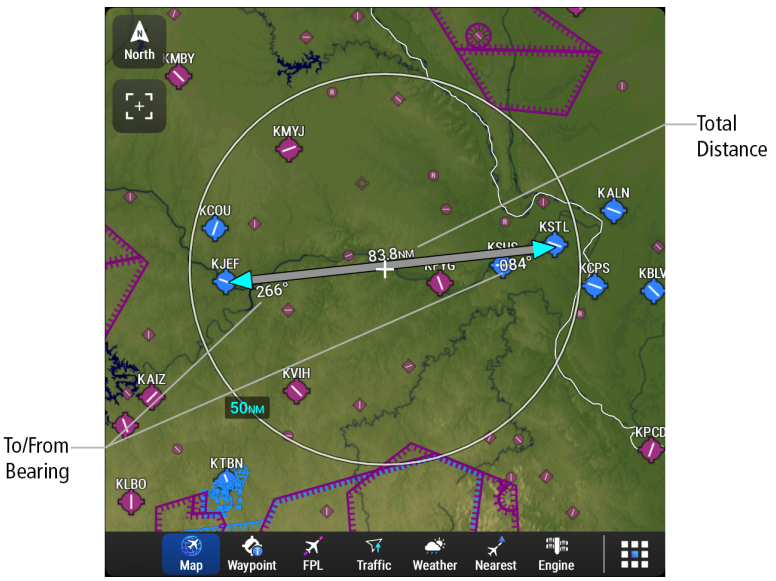


Figure 148: Measuring Bearing/Distance between Two Points

If the range is adjusted and/or Pan Mode is activated while measuring bearing and distance the following will occur:

- The end points of the measurement shall remain located at the lat/lon at which they were before adjusting the range or activating Pan Mode.
- The Measurement Line and Measure Pointer(s) shall be removed from map if the range is adjusted too far or under its display location.

MEASURING BEARING AND DISTANCE BETWEEN THE AIRCRAFT PRESENT POSITION AND ANY OTHER POINT:

Touch and hold one finger on the desired location of the map display. The Radial Menu is displayed. The distance and bearing from the aircraft present position to the inner radius is displayed on the Info Ring.

MEASURING BEARING AND DISTANCE BETWEEN ANY TWO POINTS:

1 Touch and hold two fingers anywhere on the MFW map display. A gray Measurement Line is drawn where the map was touched, with cyan Measure Pointers on each end of the line.
2 Touch and drag either cyan Measure Pointer to the desired location.
3 Repeat Step 2 as desired to move either pointer again and measure any other point.
4 When finished, touch anywhere on the map display to remove the measurement indications.

BASEMAP, TOPOGRAPHICAL SETTINGS

Map displays can show various shades of absolute terrain colors representing land elevation; similar to aviation sectional charts. Absolute terrain data ('Topo') can be displayed or removed as described in the following procedures. Absolute terrain is not displayed on weather and traffic maps.

Relative terrain discussion can be referenced in the *Relative Terrain Symbology* section in Hazard Avoidance.

Optionally, other basemap settings may be available through a subscription when IFR/VFR charts are enabled. More information on IFR/VFR Charts is discussed in the Charts portion of the Additional Features section.

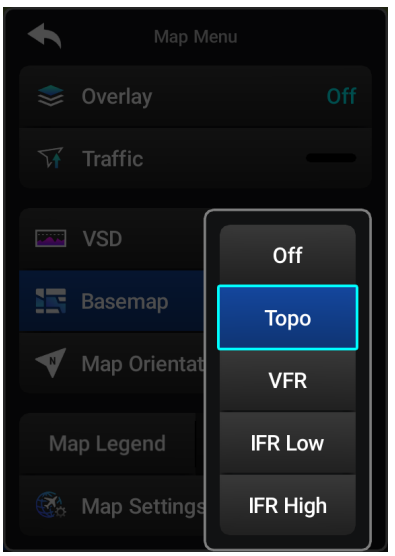


Figure 149: Basemap Settings

DISPLAYING / REMOVING MFW MAP BASEMAP DATA:

1 With the 'Map' Page on the MFW, press the **MENU** Softkey to open the 'Map Menu'.
2 Touch the **Basemap** Selection Button.
3 Select the basemap to be displayed on the MFW 'Map' Page (Off, Topo, VFR, IFR Low, or IFR High).

DISPLAYING/REMOVING HSI MAP TOPOGRAPHICAL DATA:

1 Access the 'PFW Menu' window by:
   a) Touch the HSI on the PFW.
   Or:
   a) Press the **MENU** Softkey on the PFD (if in split screen mode press the **MENU** Softkey on the PFW side of the bezel).
2 Touch the **PFW Settings** Button.
3 Ensure the **HSI Style** Indicator Button is set to display the 'Map'.
   a) Touch the **HSI Style** Indicator Button.
   b) Touch the **Map** Button.
4 Touch the **Topo** Indicator Button to display or remove the topographical data on the HSI. (Green indication indicates the Topo feature is enabled.)

VIEWING THE ABSOLUTE TERRAIN ('TOPO') SCALE:

1 With the 'Map' Page on the MFW, press the **MENU** Softkey to open the 'Map Menu'.
2 Touch the **Map Legend** Button to view the Topo Scale as well as other map legend icons.

MAP SYMBOLS

This section discusses the types of land and aviation symbols that can be displayed. Placement and range for which to display each enabled symbol is variable, in order to provide the best representation and minimal clutter.

AVIATION SYMBOLS

The following table describes the aviation symbols shown on the MFW Map page.

Aviation Symbol	Symbol
Low Altitude Airways (V and T Routes)	
High Altitude Airways (J and Q Routes)	
Airports	
VORs	

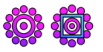
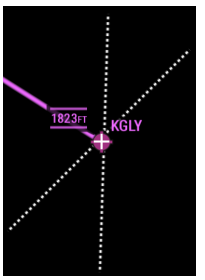
Aviation Symbol	Symbol
VOR Compass Rose	
Intersections	
NDBs	
VRPs	
SafeTaxi®	See Additional Features
Runway Extensions	
Missed Approach Preview	See Flight Planning
Alternate Flight Plan Preview	See Flight Planning

Table 13: MFW Map Symbols

AIRSPACE SYMBOLS

The following table describes the aviation symbols shown on the MFW Map page.

Airspace Symbols	Symbol
Altitude Labels:	
Class B Airspace Altitude Label (ceiling/floor)	
Class C Airspace Altitude Label (ceiling/floor)	
Class D Airspace Altitude Label (ceiling)	

Airspace Symbols	Symbol
CL B/TMA/AWY:	
Class B (CL B) and Terminal Maneuvering Area (TMA)[1]	
Airway (AWY)[1]	
CL C/CTA:	
Class C Airspace (CL C)	
Control Area (CTA)[1]	
CL A/D:	
Terminal Radar Service Area (TRSA), Controlled Traffic Region (CTR), and Class A (CL a)[1]	
Class D	
Aerodrome Traffic Zone (ATZ)[1]	
Traffic Information Zone (TIZ)[1]	
Restricted and Prohibited Areas (Restricted)	
Military Operations Areas (MOA)	
Other:	
ADIZ	
Alert	
Class E[1]	
Class G[1]	
Temporary[1]	
Danger, Warning, Unknown, Special Rules[1], and Training[1]	
TFRs	
[1] Not located in the United States	

Table 14: MFW Map Airspace Symbols

LAND SYMBOLS

The following table presents the map symbols seen on the MFW Map page. Refer to the *Hazard Avoidance* Section for more information on Obstacles.

Land Symbols	Symbol
Point Obstacles / Wire Obstacles	See *Hazard Avoidance*
Roads	
Interstate Highway (Freeway)	
International Highway (Freeway)	
Railroads	
Cities	
Political Boundaries	
Rivers and Lakes	
LAT/LON Lines	See *Latitude/Longitude Lines*

Table 15: MFW Map Land Symbols

MISCELLANEOUS MAP SYMBOLS

Map displays can show some additional items. Some items can be displayed through the use of the nearest frequency, map panning, and map measuring functions. The icons in the following table will be displayed when specific map functions are conducted or the heading or FMS solution is invalid:

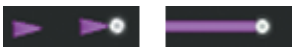
Symbol Name	Description	Symbol
Map Pointer	Displayed when panning	
Measuring Pointer	Displayed when measuring bearing and distance	
Dead reckoning aircraft icon	'DR' text displayed over the aircraft icon when the FMS solution is invalid	DR

Table 16: Miscellaneous Map Symbols

FLIGHT PLAN SYMBOLS

The following table lists the flight plan route and waypoint symbols which can be displayed on the map.

Symbol Name	Description	Symbol
Course Leg	Thick solid line between two waypoints in a flight plan	
Heading Leg	Widely spaced arrows directionally indicating the heading of flight plan leg	

Symbol Name	Description	Symbol
Roll Steering Path[1]	Closely spaced arrows indicating a turning path	
Missed Approach Leg	Thin gray line used to indicate Missed Approach course.	
All Other Legs	Thin dotted line indicating future paths	
Turn Anticipation Arc	Curved thick line, used to indicate course leg transition through a fly-by waypoint	
Fly-Over Waypoint	Cyan target at waypoint	
Along Track Waypoint	Orange square at along track waypoint	
Flight Path Fix	Widely spaced arrows leading to a fix, used to indicate a fix that terminates at a manual or specified location	
Bottom of Climb/Descent (BOC/BOD)	TOD and BOD, used to indicate vertical transition location	
Parallel Offset Waypoint	Waypoint identifier followed by "-p"	

[1] Roll Steering Path transitions between two disconnected legs (i.e. holding), some procedure turn segments, parallel offset segments, or after some fly-over waypoints.

Table 17: Flight Plan Symbols

MAP SETTINGS (FMS)

Map settings are accessible from 'Map Menu'. Settings for displaying weather radar, traffic, and the VSD on the map may also be accessed from 'Map Menu'. Weather radar and traffic is discussed in the *Hazard Avoidance Section*. *VSD* is discussed later in this section.

Figure 150: Viewing Map Settings for the MFW Map

TRACK VECTOR

Map displays can show a track vector that is useful in minimizing track angle error. The track vector is a solid cyan line segment extended to a predicted location. The track vector look-ahead time is selectable (30 sec, 60 sec (default), 2 min, 5 min) 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, and 5 min settings.

Figure 151: Track Vector

ENABLING/DISABLING THE MAP APP TRACK VECTOR:

1 Access the 'Map' Application Page:
   a) Touch the **Map** Button on the MFW App Bar.

   Or:

   a) Touch the **Applications** Icon on the MFW App Bar.
   b) Touch the **Map** Button.

   Or:

   a) Use the Outer **DCK** (on the MFW side of the PFD while in split screen mode) to scroll to the 'Map' Application Page.

2 With the 'Map' Application Page displayed on the MFW, press the **MENU** Softkey (on the MFW side of the PFD while in split screen mode) to open the 'Map Menu' Window.

3 Scroll down and touch the **Map Settings** Button.

4 Touch the **General** Tab.

5 Scroll down to the 'Miscellaneous' Section and touch the **Track Vector** Indicator Button. (The green annunciation indicates the feature is enabled.)

ADJUSTING THE MAP APP TRACK VECTOR DURATION:

1 Access the 'Map' Application Page:
   a) Touch the **Map** Button on the MFW App Bar.
      Or:
   a) Touch the **Applications** Icon on the MFW App Bar.
   b) Touch the **Map** Button.
      Or:
   a) Use the Outer **DCK** (on the MFW side of the PFD while in split screen mode) to scroll to the 'Map' Application Page.
2 With the 'Map' Application Page displayed on the MFW, press the **MENU** Softkey (on the MFW side of the PFD while in split screen mode) to open the 'Map Menu' Window.
3 Scroll down and touch the **Map Settings** Button.
4 Touch the **General** Tab.
5 Scroll down to the 'Miscellaneous' Section and touch the **Duration** Selection Button.
6 Touch the desired track vector duration for the Map Application page.

FUEL RANGE RING

Map displays can show a fuel range ring which shows an estimate of the remaining flight distance. A dashed green circle indicates the selected range to fuel reserves. A solid green circle indicates the total endurance range. If only fuel reserves remain, the range is indicated by a solid amber circle. The range ring circle will appear offset from center based on calculations of the current fuel flow, ground speed, and the winds the aircraft are currently experiencing.

Figure 152: Fuel Range Ring

ENABLING/DISABLING FUEL RANGE RINGS

1 Access the 'Map' Application Page:
   a) Touch the **Map** Button on the MFW App Bar.

      Or:

   a) Touch the **Applications** Icon on the MFW App Bar.
   b) Touch the **Map** Button.

      Or:

   a) Use the Outer **DCK** (on the MFW side of the PFD while in split screen mode) to scroll to the 'Map' Application Page.
2 With the 'Map' Application Page displayed on the MFW, press the **MENU** Softkey (on the MFW side of the PFD while in split screen mode) to open the 'Map Menu' Window.
3 Scroll down and touch the **Map Settings** Button.
4 Touch the **General** Tab.
5 Scroll down to the 'Map Rings' Section and touch the **Fuel Range** Indicator Button. (The green annunciation indicates the feature is enabled.)

MODIFY THE RESERVE TIME RANGE RING

1 Access the 'Map' Application Page:
   a) Touch the **Map** Button on the MFW App Bar.

      Or:

   a) Touch the **Applications** Icon on the MFW App Bar.
   b) Touch the **Map** Button.

      Or:

   a) Use the Outer **DCK** (on the MFW side of the PFD while in split screen mode) to scroll to the 'Map' Application Page.
2 With the 'Map' Application Page displayed on the MFW, press the **MENU** Softkey (on the MFW side of the PFD while in split screen mode) to open the 'Map Menu' Window.
3 Scroll down and touch the **Map Settings** Button.
4 Touch the **General** Tab.
5 Scroll down to the 'Map Rings' Section and touch the **Reserve Time** Selection Button.
6 Touch the desired reserve time to be displayed as a range ring on the Map Application page.

SELECTED ALTITUDE RANGE ARC

The map will display the location along the current track where the aircraft will intercept the selected altitude if one is set. The location will be shown as a cyan arc when the aircraft is actively climbing or descending in the direction of the selected altitude bug.

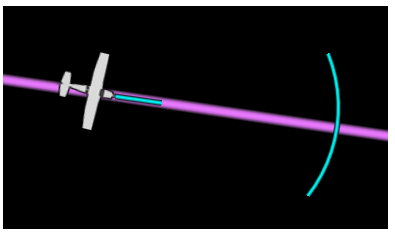


Figure 153: Selected Altitude Range Arc

LATITUDE/LONGITUDE LINES

The Map Application page can display latitudinal and longitudinal lines to provide more situational awareness of the aircraft position. They are shown as blue dashed lines. These Lat/Lon lines automatically adjust based on the zoom level of the map.

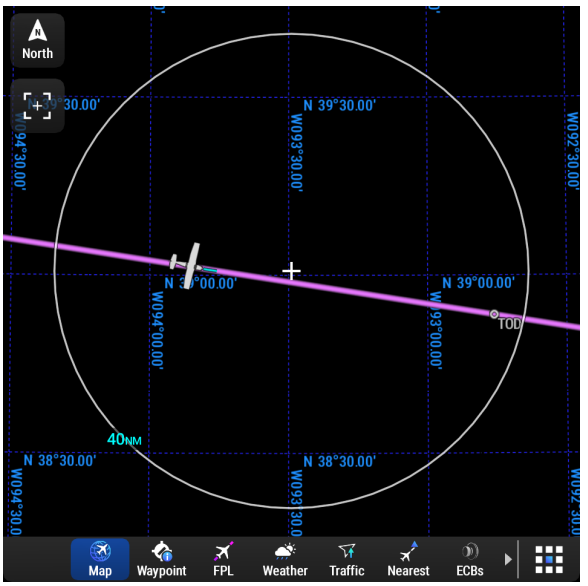


Figure 154: Latitude/Longitude Lines

ENABLING/DISABLING LAT/LON LINES ON THE MAP APPLICATION PAGE:

1 Access the 'Map' Application Page:

a) Touch the **Map** Button on the MFW App Bar.

Or:

a) Touch the **Applications** Icon on the MFW App Bar.

b) Touch the **Map** Button.

Or:

a) Use the Outer **DCK** (on the MFW side of the PFD while in split screen mode) to scroll to the 'Map' Application Page.

2 With the 'Map' Application Page displayed on the MFW, press the **MENU** Softkey (on the MFW side of the PFD while in split screen mode) to open the 'Map Menu' Window.

3 Scroll down and touch the **Map Settings** Button.

4 Touch the **Land** Tab.

5 Scroll if necessary and touch the **LAT/LON Lines** Indicator Button. (The green annunciation indicates the feature is enabled.)

GLIDE RANGE RING AND BEARING TO A GLIDE RANGE AIRPORT

The following section describes the map overlay setting for a glide range ring and bearing to a glide range airport. Displaying the glide range ring and bearing to a glide range airport may be done independent of or in conjunction with activating Smart Glide™.

A glide range ring and bearing to a glide range airport can be displayed on the map. When the Glide Range is enabled in the map settings, and the aircraft is at or above 1000' AGL, both the glide range ring and the system-selected glide range airport bearing information can be displayed.

NOTE

Always consider enabling the glide range airport display (cyan chevrons) and ensure the map settings for airports and airport map range are sufficiently set in order to promptly identify the system-selected glide range airport on the map display.

The glide range ring appears as an irregularly shaped cyan polygon around the aircraft and represents how far the aircraft can glide before reaching 1000' AGL under an optimal aircraft glide configuration. Altitude, winds, turning factors, and terrain will change the size and shape of the ring. When the glide range ring is not using datalink forecast winds in its calculation, it will be annunciated on each map. Refer to the Hazard Avoidance Section for information on forecast winds.

NOTE

The system will utilize the optimal glide range indicated airspeed at a zero flap setting as one factor in glide range calculations. Reference the current pertinent flight manual for the aircraft glide airspeed.

NOTE

The aircraft will always be displayed inside the Glide Range Ring, regardless of extreme winds higher than the aircraft's optimal glide range airspeed.

Bearing information will be provided on the map display toward a suitable, system-selected airport when Glide Range is enabled and 'Ring & Glide' is selected in the map settings. Bearing information will appear as a cyan dashed line of chevrons from the aircraft ownship icon to the system-selected glide range airport. For discussion on nearest glide range airports, refer to the Airports discussion later in this section.

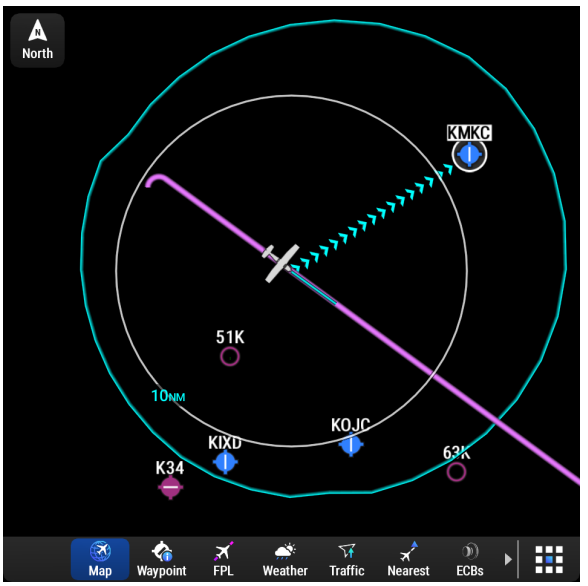


Figure 155: Range Ring and Bearing to a Sytem-selected Glide Range Airport

Additionally, the system-selected glide range airport is a selectable option for the HSI bearing pointer by selecting the 'Best' option under 'Bearing Pointers' in the 'PFD Settings' menu. This option is always available when Smart Glide is configured, regardless of the glide range map settings. For more information on HSI bearing pointers, see the *Flight Instruments Section*. For more information on Smart Glide, refer to *Smart Glide Emergency Operations*. For more information about navigation to a nearby airport, see the *Direct-To Navigation* or *Flight Planning* portions, later in this section.

SELECTING ADVANCED MAP SETTINGS (GENERAL, AVIATION, AIRSPACE, LAND) FOR AN MFW MAP DISPLAY:

1 Access the 'Map' Application Page:

a) Touch the **Map** Button on the MFW App Bar.

Or:

a) Touch the **Applications** Icon on the MFW App Bar.

b) Touch the **Map** Button.

Or:

a) Use the Outer **DCK** (on the MFW side of the PFD while in split screen mode) to scroll to the 'Map' Application Page.

2 With the 'Map' Application Page displayed on the MFW, press the **MENU** Softkey (on the MFW side of the PFD while in split screen mode) to open the 'Map Menu' Window.

3 Scroll down and touch the **Map Settings** Button.

4 Select the desired tab:

Touch the General Tab to display settings for synchronization, North Up Above, Autozoom, track vector, and various range rings.

Or:

Touch the Aviation Tab to display settings for Runway Extensions and map details (private airports, heliports, low airways, high airways, VORs, Intersections, NDBs, VRPs, and user waypoints).

Or:

Touch the Airspace Tab to display settings for TFRs, CL B/TMA/AWY, CL C/CTA, CL A/D, restricted, MOA (Military), or 'Other'.

Or:

Touch the Land Tab to display settings for obstacles, wires, roads, railroads, cities, political boundaries, rivers & lakes, LAT/LON lines.

5 Scroll as required and touch the desired button to display/remove map items.

6 If a pop up window or drop down list of settings relating to the selected map feature is displayed, touch the button for the desired setting.

MAP LEGEND AND OVERLAY DETAILS

All map symbols and overlay details can be reviewed in Map Legend and Overlay Details, which is accessible through the 'Map Menu'. Items displayed on the Map Legend and Overlay Details are dependent on which basemap and overlay is selected (for example, if the 'Topo' basemap layer is disabled, the Topo Scale will not be displayed on the Map Legend).

The Topo Scale serves as a legend for the various shades of colors representing land elevation. It may be viewed by opening the Map Legend.

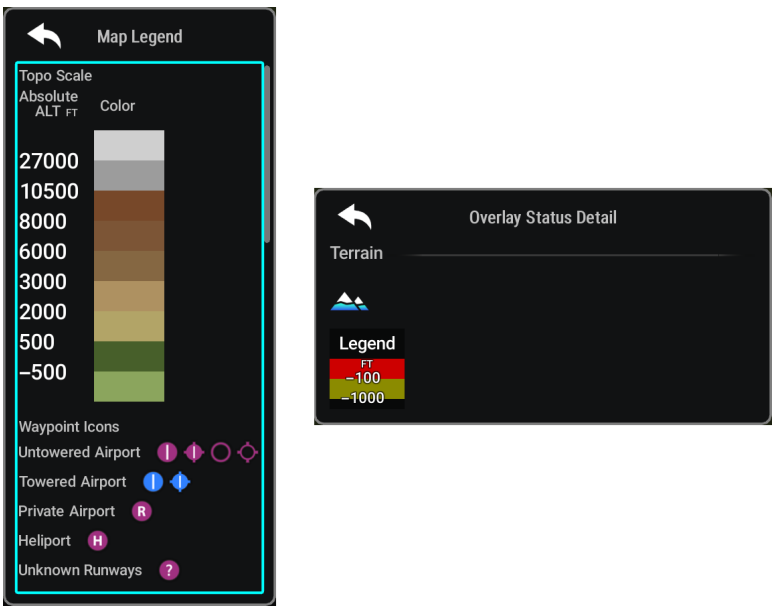


Figure 156: Map Legend and Overlay Details

VIEWING THE MAP LEGEND:

1 On the MFW:

a) Touch the **Map** icon on the **App Bar**.

Or:

b) Touch the **Applications** Icon **> Map**.

Or:

c) Use the Outer **DCK** (on the MFW side of the PFD while in split screen mode) to select the **Map** page.

2 With the "Map" Page selected on the MFW, press the **MENU** Softkey (on the MFW side of the PFD while in split screen mode) to open the 'Map Menu' Window.

3 Scroll down and touch the **Map Legend** Button. Items displayed in 'Map Legend' depend on which basemap is selected.

5.3 AIRSPACES

The system can display many types of airspaces. See the *Airspace Symbols* portion (earlier in this section) for a complete listing of all airspaces, and their associated symbols. Airspace information on 'Map' can be viewed by using the Radial Menu, while Nearest Airspace information used by accessing the 'Nearest' app. Displaying airspaces on the *VSD* is discussed later in this section. *Temporary Flight Restrictions (TFRs)* are discussed in the Hazard Avoidance Section.

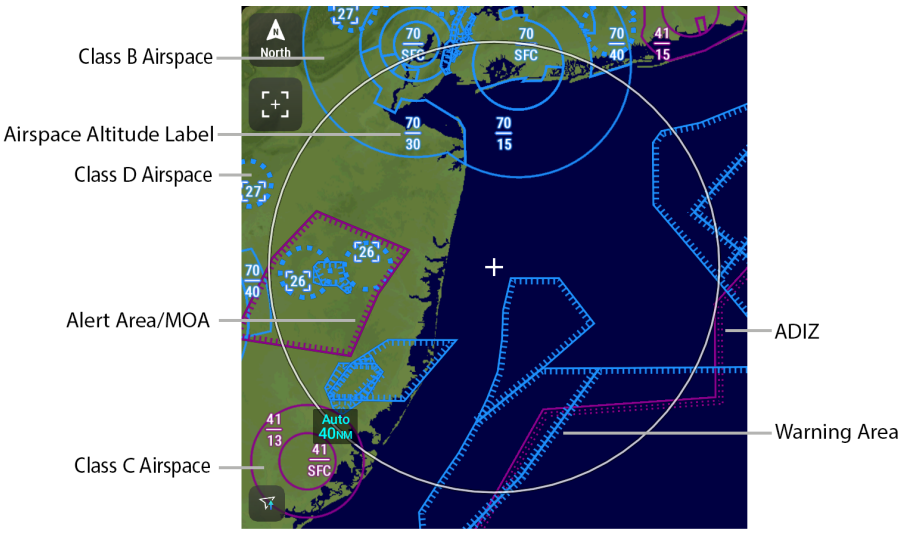


Figure 157: Airspaces

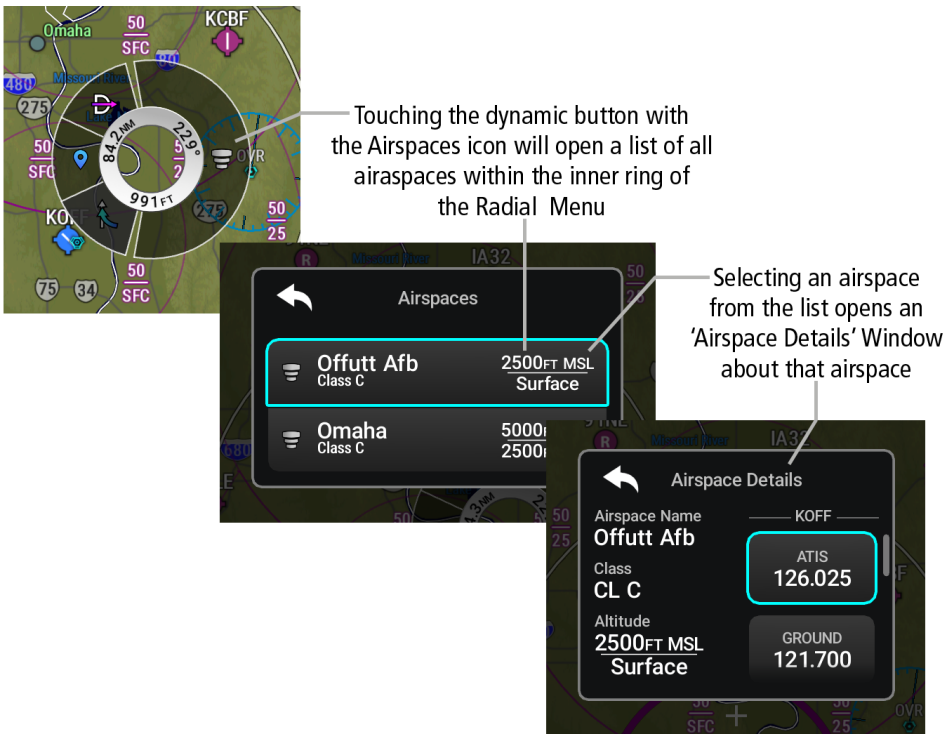


Figure 158: Accessing Airspace Information from 'Map'

NEAREST AIRSPACES

NOTE

The nearest airspace screen will display "None within 200 NM" if no nearest airspaces are found after the first 60 seconds upon power-up.

NOTE

The default "2NM" will be shown as "4km" if the units are set to metric.

The system provides a means to inform the flight crew about airspaces in close proximity to the aircraft present position. The aircraft positional status relative to a list of nearest airspaces, as well as the altitude ranges for those airspaces can be viewed on the 'Nearest' Screen.

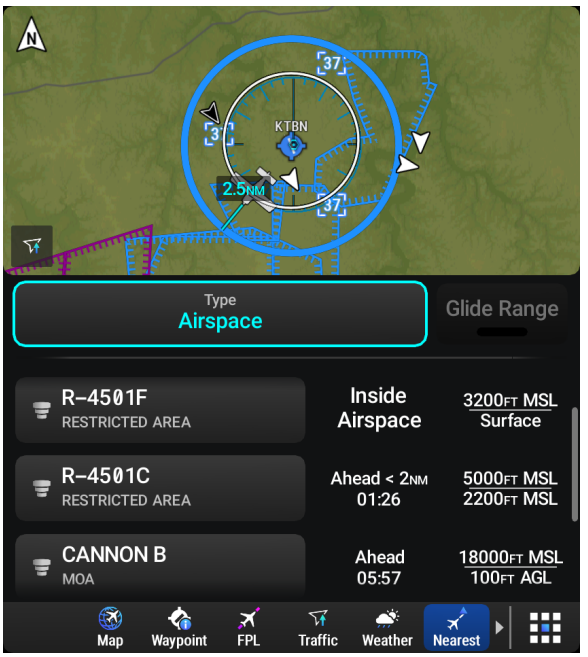


Figure 159: Viewing Nearest Airspaces

The 'Nearest' Airspaces will display a list up to 25 nearest airspaces and shows airspaces within which the aircraft is currently located or those that the aircraft will either enter or pass within defined vertical or horizontal proximity limits of the airspace boundaries in the near future if the current track is maintained. The proximity status of "Ahead" (less than 10 minutes), "Ahead < 2nm", "Within 2nm", or "Inside Airspace" is displayed when the current path of the aircraft is near, within, or just ahead of intercepting an airspace. The time until the current path of the aircraft intercepts the airspace is displayed below the proximity status text when the status is "Ahead" or "Ahead <".

VIEWING NEAREST AIRSPACE INFORMATION

After accessing the 'Nearest' Screen, a list of nearest airspaces is displayed, ordered from closest to furthest. The Selected Airspace is indicated by a blue overlay for the airspace, which can be changed by touching another airspace in the list. More information, including information regarding communication frequencies for the Selected Airspace, are shown in the 'Airspace Details' Window. 'Airspace Details' is accessed by touching an airspace button on the list.

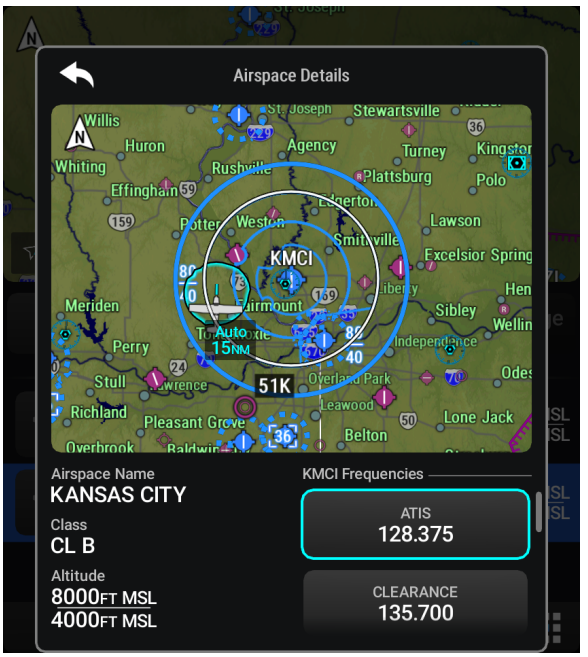


Figure 160: 'Airspace Details' Window

A spatial depiction of aircraft proximity to the selected airspace and surrounding airspaces is shown above the list of nearest airspaces. This window also contains information displaying the airspace name, class, and altitude range for the Selected Airspace.

VIEWING INFORMATION FOR THE NEAREST AIRSPACE:

1 Navigate to the 'Nearest' Applications Window by touching the **Applications** Icon and touching the **Nearest** Button.

   Or:

   Touch the **Nearest** Button on the MFW App Bar.

   Or:

   Use the **DCK** to scroll to the **Nearest** Application.

2 Touch the **Type** Button.

3 Touch the **Airspace** Button. A list of airspace is displayed, prioritized closest to furthest.

4 To open the 'Airspace Details' window, touch any of the airspace listed on the 'Nearest' Application Page.

SETTING AIRSPACE ALERTS

Alerts for controlled/special-use airspace can be turned on or off. This does not affect the airspaces listed on 'Nearest' or the airspace boundaries depicted on map displays, it simply turns on/off the alert provided when the aircraft is approaching or near an airspace.

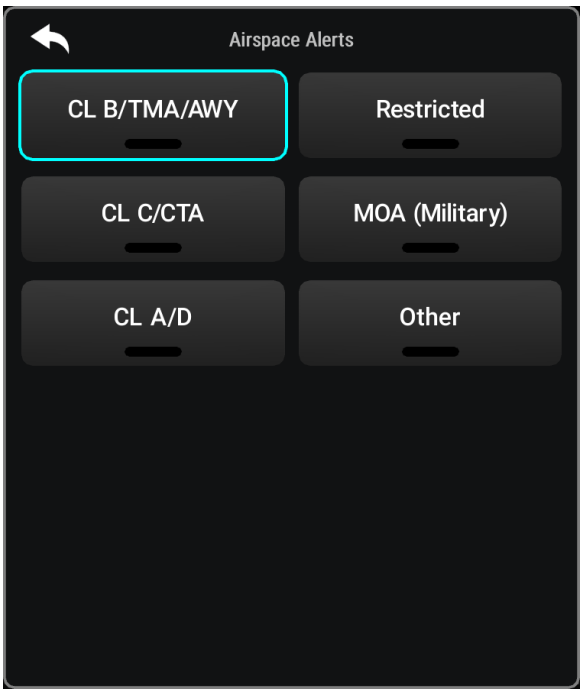


Figure 161: Airspace Alerts Menu

Alerting for an altitude buffer, which "expands" the vertical range above or below an airspace, can also be set. For example, if the Alert Altitude Buffer is set at 500 feet, and the aircraft altitude reaches 500 ft above/ below the airspace floor/ceiling, the flight crew is notified with an alert message.

Additionally, alerting for airspaces will become available for viewing when the aircraft is projected to enter or is already inside of airspace.

Status	Comments
Inside Airspace	The aircraft is inside the airspace.
Ahead	Special use airspace is ahead of aircraft. The aircraft current ground track penetrates the airspace within 10 minutes.
Ahead < 2 NM	Special use airspace is ahead of aircraft. The aircraft current ground track penetrates the airspace in less than 2 NM.
Within 2 NM	Special use airspace is within 2 NM of the aircraft position.

Table 18: Airspace Alert Messages

SETTING THE ALTITUDE BUFFER DISTANCE:

1 Navigate to the 'Apps' window by pressing the **MENU** Softkey two times.

Or:

Touch the **Applications** Icon on the Applications Bar.

2 Touch the **Settings & Tools** Tab.

3 Touch the **Alerts** Button.

4 Touch the **Alert Altitude Buffer** Button.
5 Using the numeric keypad enter a value between 0 and 32808 feet.
6 Touch the **Enter** Button.

ENABLING/DISABLING AN AIRSPACE ALERT:

1 Navigate to the 'Apps' window by pressing the **MENU** Softkey two times.

Or:

Touch the **Applications** Icon on the Applications Bar.

2 Touch the **Settings & Tools** Tab.
3 Touch the **Alerts** Button.
4 Touch the **Airspace Alerts** Button.
5 Select any of the airspace options displayed on the 'Airspace Alerts' Window (green annunciation indicates the airspace alert is activated).
6 Touch the back arrow to return to the previous page.

SMART AIRSPACE

The Smart Airspace™ function de-emphasizes airspaces above or below the current aircraft altitude to minimize irrelevant visual clutter on the MFW Map. 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 beyond 1500 feet of the vertical boundaries of the airspace, the airspace boundary is shown subdued.

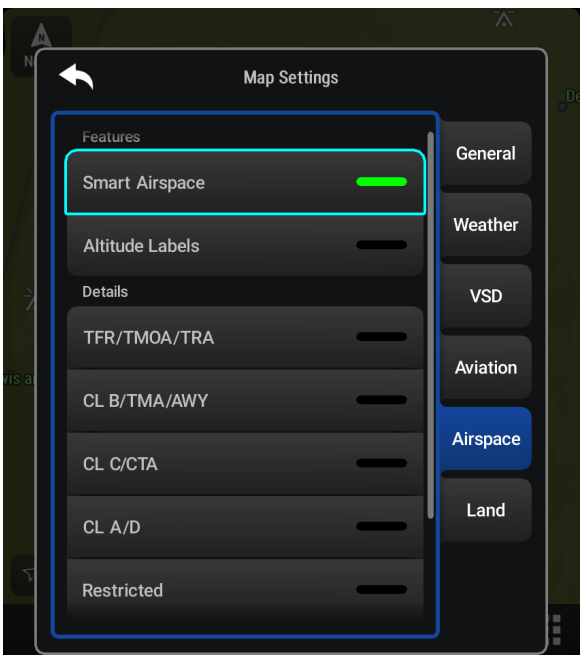


Figure 162: Smart Airspace

ENABLING/DISABLING THE SMART AIRSPACE FUNCTION:

1 On the MFW:
   a) Touch the **Map** icon on the **App Bar**.
      Or:
   b) Touch the **Applications** Icon **> Map**.
      Or:
   c) Use the Outer **DCK** (on the MFW side of the PFD while in split screen mode) to select the **Map** page.
2 With the "Map" Page selected on the MFW, press the **MENU** Softkey (on the MFW side of the PFD while in split screen mode) to open the 'Map Menu' Window.
3 Scroll down and touch the **Map Settings** Button.
4 Touch the **Airspace** Tab.
5 Touch the **Smart Airspace** Indicator Button to enable/disable the Smart Airspace function.

5.4 WAYPOINTS

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

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

This portion of the guide shall discuss accessing waypoint information, viewing nearest waypoints, creating user waypoints, and creating fixes. There are six different waypoint types configured in the system:

- Airport
- VOR
- NDB
- Intersection
- VRP
- User Created Waypoint

Waypoints can be selected by entering the ICAO identifier, entering the name of the facility, or by entering the city name. As a waypoint identifier, facility name, or location is entered, the system scrolls through the database, displaying those waypoints matching the characters which have been entered to that point.

If there is not a waypoint in the database matching the exact characters entered, the FastFind function will analyze the entered characters and use predictive logic based on current GPS location to suggest airports and waypoints. See the *Controls* portion of the System Overview section for detailed instructions on entering data in the system.

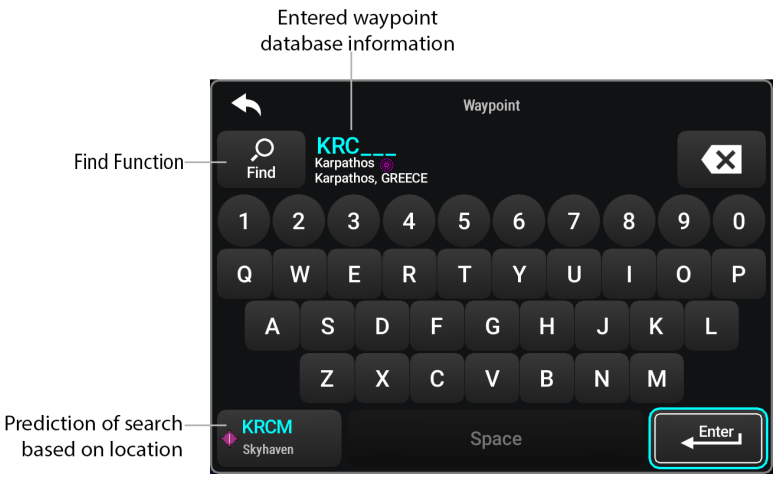


Figure 163: Entering and Selecting a Waypoint

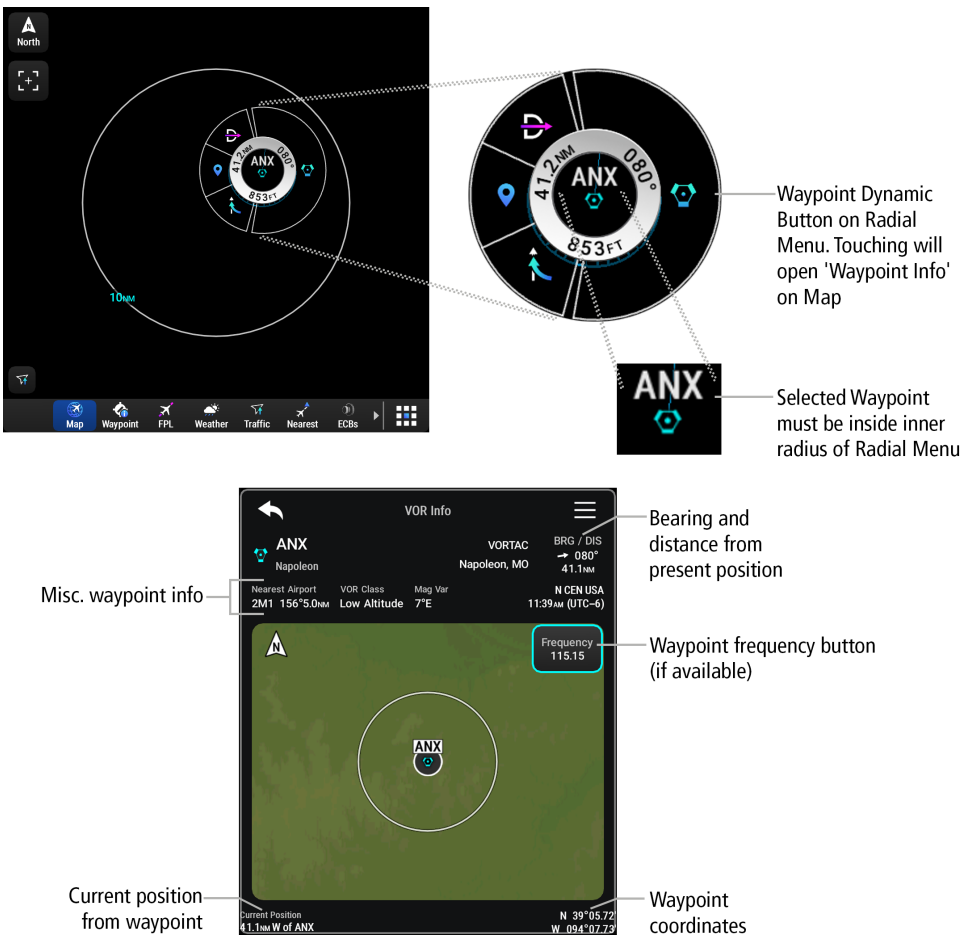


Figure 164: Accessing 'Waypoint Info' on Map using the Radial Menu

If duplicate entries exist for an identifier, the **Select Duplicate** Button shall be used to choose the desired waypoint if the desired waypoint is not already displayed under the entry field.

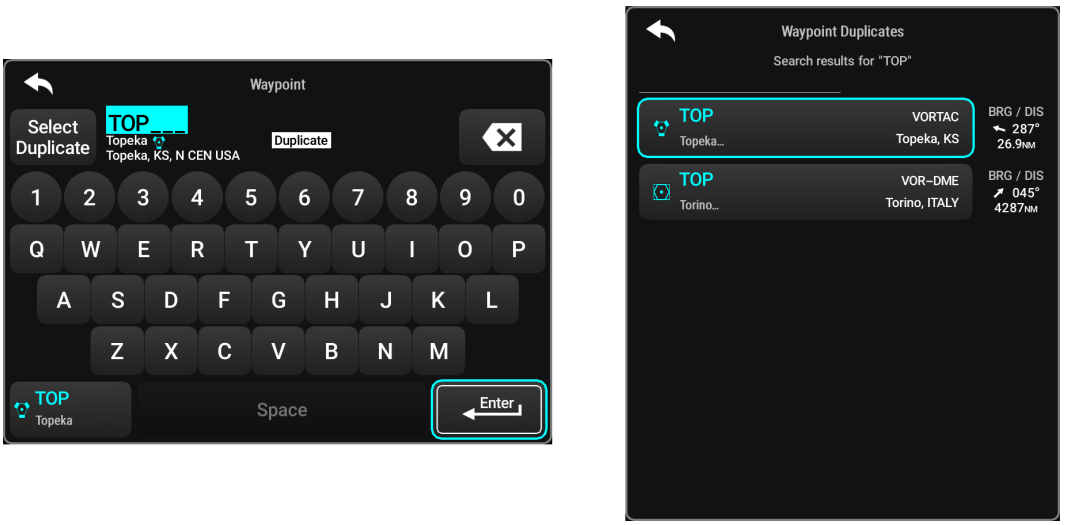


Figure 165: Waypoint Duplicates

WAYPOINT FIND FUNCTION

The Waypoint Find Function may be accessed from any keypad used for waypoint entry. Instead of using the keypad to enter an identifier, the Find Function is used to search for an airport or waypoint by facility name, city name, or by choosing from a list of recent, nearest, favorites, or flight plan waypoints.

Figure 166: Find Function

USING THE WAYPOINT FIND FUNCTION TO SEARCH BY FACILITY NAME OR CITY NAME:

1. From any keypad used for waypoint entry, touch the **Find** Button.
2. Touch the **Search** Tab.
3. Touch the **Search Term** Datafield Button to display the keypad.
4. Use the keypad to enter the name.
5. Touch the **Enter** Button to accept the entry and display the search results.

6 Touch the button for the desired airport or waypoint to select it.

USING THE WAYPOINT FIND FUNCTION TO SEARCH BY CATEGORY (RECENT, NEAREST, FLIGHT PLAN, OR FAVORITES):

1 From any keypad used for waypoint entry, touch the **Find** Button.
2 Touch the **Recent** Tab, **Nearest** Tab, **Flight Plan** Tab, or **Favorites** Tab.
3 Touch the button for the desired airport or waypoint to select it.
4 If necessary, change the waypoint 'Type' filter:
   a) Touch the **Type** Button (**Nearest** Tab and **Favorites** Tab only) to display a drop down list.
   b) Touch the button for the desired filter to refine the search results for that category.

      Or:

      Touch the left and right arrows adjacent to the **Type** Button to change the type filter.

ADDING AN AIRPORT OR WAYPOINT TO THE LIST OF FAVORITES IN THE FIND FUNCTION:

1 From any keypad used for waypoint entry, touch the **Find** Button.
2 Touch the **Favorites** Tab to display a list of airports and waypoints.
3 Touch the **Add Favorite** Button.
4 Use the keypad to enter the name.
5 Touch the **Enter** Button. The airport or waypoint is added to the list.
6 To remove the airport or waypoint from Favorites:
   a) Touch the '**X**' to the right of the airport or waypoint.
   b) The prompt "Remove [Waypoint] from Favorite List?" is displayed. Touch the **OK** button to remove.

      Or:

      Touch the **Cancel** Button to abort removing the waypoint.

WAYPOINTS, ACCESSING 'WAYPOINT INFO'

NOTE

When viewing information for an airport, if the map is selected, North Up orientation on 'Waypoint Info Map' cannot be changed; the pilot needs to be aware of proper orientation if the map display orientation is different from 'Map'.

NOTE

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

The 'Waypoint Info' App is the primary means by which the pilot can select a waypoint to view information about its location and frequencies. Procedures, runways, and charts may also be available for a selected airport. Once entered, the system automatically recognizes the waypoint type (Airport, VOR, NDB, Intersection, VRP, or User Waypoint) and displays

information available for the selected waypoint. See the *NAV Operation* portion of the Audio and CNS section for more information on finding and tuning frequencies. See the Charts portion of the Additional Features section for more information on instrument procedure charts.

The waypoint info map features are dependent on the enabled and disabled map settings. For example, if road details are enabled, roads will appear on the waypoint info map.

Figure 167: Navigating the 'Waypoint Info' Screen

ACCESSING 'WAYPOINT INFO' FROM THE 'WAYPOINT (WPT) APPLICATION':

1 Navigate to the Waypoint Application by touching the **WPT** Icon.

Or:

Touch the **Applications** Icon **>** **Waypoint** Button.

2 Touch the Waypoint Datafield Button to open the keypad.

3 Use the keypad and the **Enter** Button, or the Find function, to enter the waypoint identifier. The system automatically recognizes what waypoint type is entered and displays information available for the selected waypoint.

ACCESSING 'WAYPOINT INFO' USING THE RADIAL MENU TO SELECT A WAYPOINT:

1 Touch the desired waypoint on the map display to access the Radial Menu.

2 Touch the Dynamic Button for the desired waypoint type (Airport, VOR, NDB, Intersection, VRP, or User Waypoint). (If multiple waypoints of that category lie within the inner radius, touch

the Dynamic Button. Then, touch the button for which waypoint to display more information about.) Information concerning the waypoint is displayed in a pop out window.

ACCESSING 'WAYPOINT INFO' BY SELECTING A WAYPOINT IN A FLIGHT PLAN:

1 Access a flight plan:
   a) On a MFW, touch the **Applications** Icon **> Flight Plan** Button.
      Or:
   b) Touch the **FPL** Button on the MFW App Bar.
2 Touch the desired Waypoint Selection Button.
3 Touch the **Waypoint Info** Button. The system displays information available for the selected waypoint.

WAYPOINTS, VIEWING ADDITIONAL AIRPORT INFORMATION

The system shall display additional information, buttons, and tabs on 'Waypoint Info' if the selected waypoint is an airport. Loading procedures from 'Waypoint Info' is discussed later in the Procedures portion of the Flight Management Section.

VIEWING ALL AIRPORT INFORMATION ON 'WAYPOINT INFO':

1 Select an airport to view on 'Waypoint Info'.
2 Touch the **Info** Tab to review location and services of the airport.

   Or:

   Touch the **Frequency** Tab to review frequencies associated with the airport.

   Or:

   Touch the **Weather** Tab to review reported weather data for the airport.

   Or:

   Touch the **Runway** Tab to review runways available at the airport.

   Or:

   Touch the **Directory** Tab to review all miscellaneous information about the airport (hours of operation, type of fuel, phone numbers for services, etc.).

   Or:

   Touch the **Charts** Tab to review all charts associated with that airport.

NEAREST, VIEWING NEAREST WAYPOINTS

The pilot can quickly view nearest waypoints and select one to view information about its location, initiate a Direct-To to that waypoint, or insert the waypoint into the Active Flight Plan. The 'Nearest' Screen gives the flight crew the ability to filter nearest waypoints based on waypoint type by touching the **Type** Button and selecting the desired filtering criteria.

While the 'Nearest' App defaults to finding and listing waypoints of the desired type according to proximity to the aircraft present position, if 'Airport' is the selected waypoint

type, the flight crew can also filter the list of nearest airports according to the estimated glide range of the current aircraft's position. Regardless of whether the **Glide Range** Indicator Button is enabled or disabled, the list of airports provided by the 'Nearest' App will display a green "Glide" in the airport button indicating that the airport is within glide range.

Other waypoint types the Nearest Function can find and filter include: Intersection, VOR, NDB, User Waypoint, Visual Reporting Point(VRP), Airspace, Air Traffic Control Centers (ARTCC), Flight Service Stations (FSS), and Weather Broadcasts. Waypoint types that have associated frequencies for navigation and communication (VOR, NDB, Airport, ARTCC, FSS, and Weather Broadcast) have Frequency Buttons for that purpose. See the *NAV Operation* and *COM Operation* portions of the Audio and CNS Section for more information on finding and tuning frequencies.

Airspace information is discussed previously in this Flight Management Section. ARTCC and FSS frequency selection is discussed in the Audio and CNS Section. More information on weather broadcasts is discussed in the Hazard Avoidance Section.

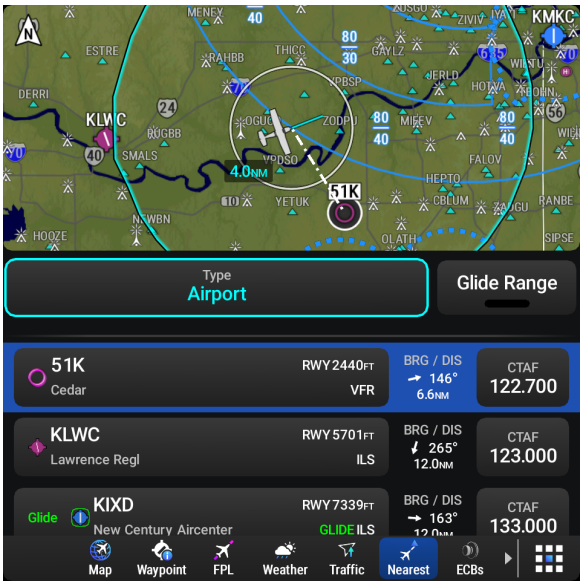


Figure 168: 'Nearest' Application

VIEWING NEAREST WAYPOINTS (AIRPORTS, INTERSECTIONS, VORS, NDBS, USER WAYPOINTS, VRPS):

1 Navigate to the Nearest Application by touching the **Nearest** Icon on the MFW App Bar.

   Or:

   Touch the **Applications** Icon and then the **Nearest** Button.

2 Touch the **Type** Button to display a drop down menu.

3 Touch the button for the desired waypoint type.

4 To see more information about a nearest waypoint, touch the desired Waypoint Selection Button to display an options menu.

5 Touch the **Waypoint Info** Button to display information about the selected waypoint.

USER WAYPOINT, CREATE AND EDIT

User Waypoints can be created and used for flight planning and for identifying a specific location on the map. User Waypoints can be created as Route or Airport waypoints using the **Type** Button. Once a waypoint has been created, it can be modified, deleted, or moved. Saved user waypoints are stored for future use. A user waypoint cannot be modified or deleted if it is part of the Active Flight Plan.

Any one of the following parameters may be used for defining the location of a user waypoint: Radial/ Distance, Radial/Radial, LAT/LON Coordinates, or Present Position.

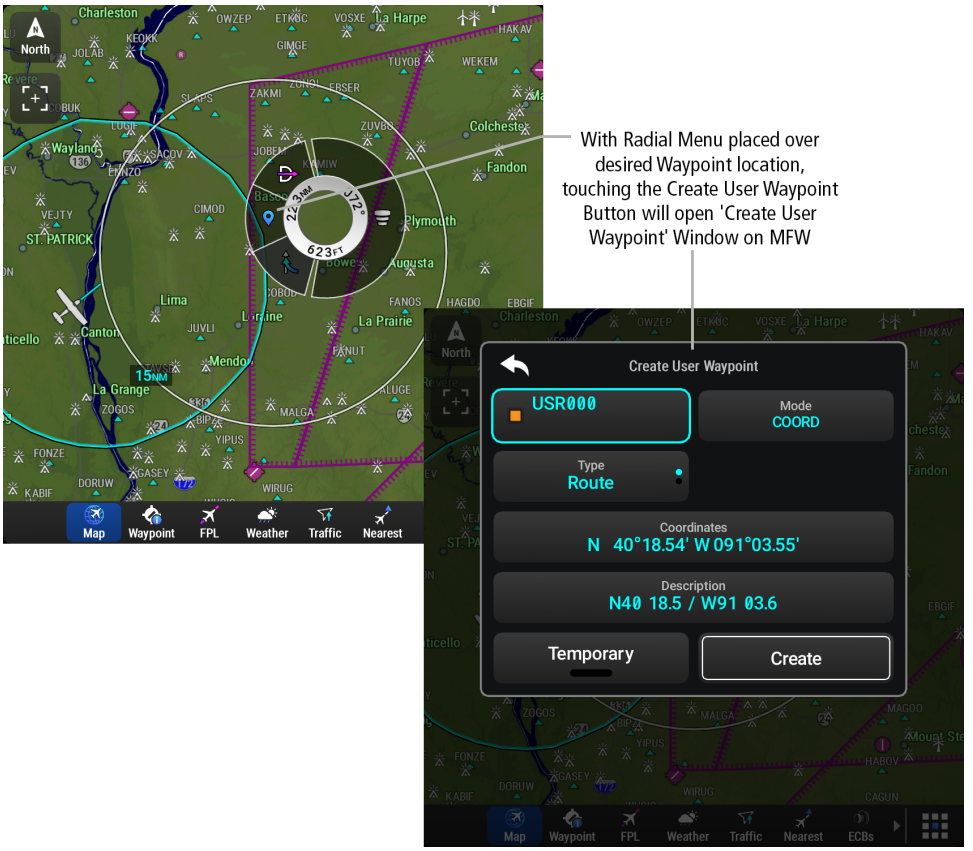


Figure 169: Creating User Waypoints using the Radial Menu

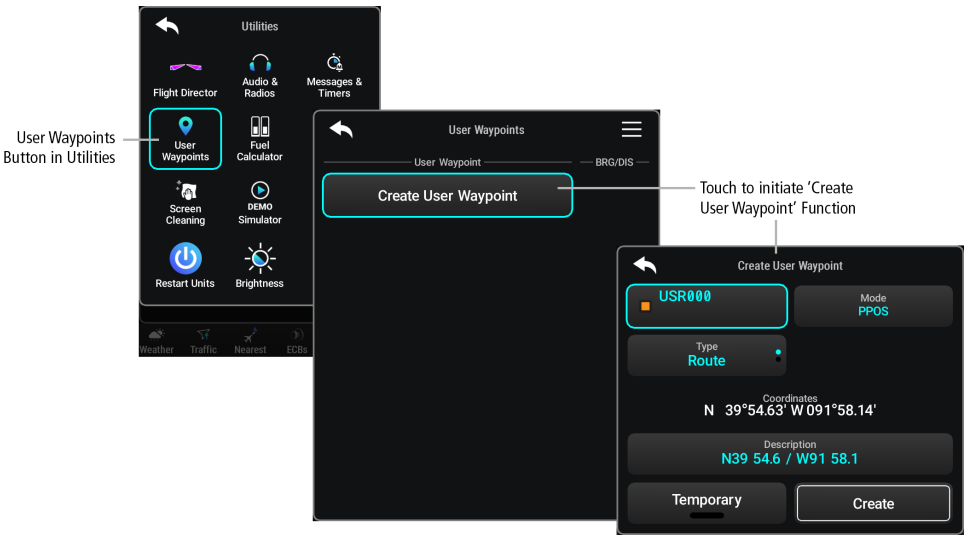


Figure 170: Initiating the 'Create User Waypoint' Function on the MFW

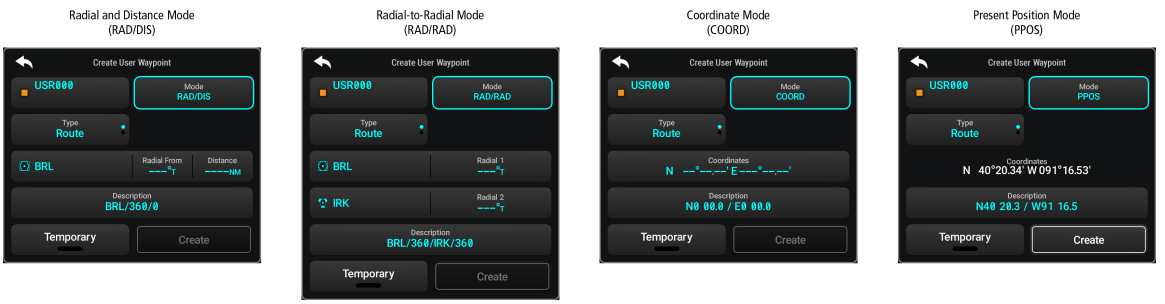


Figure 171: 'Create User Waypoint' Mode Options

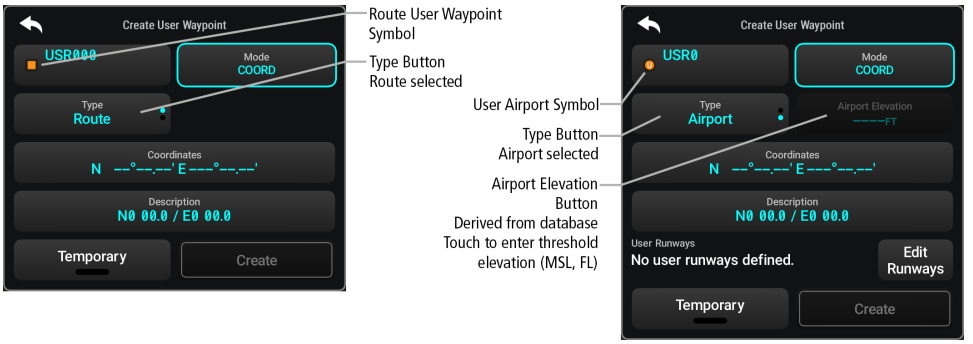


Figure 172: 'Create User Waypoint' Type Options

CREATING A USER WAYPOINT:

1 From any map display on an MFW, touch the map at the location of the new user waypoint to access the Radial Menu (if necessary, touch and drag the map display to pan to the desired location).

Or:

a) Navigate to the 'Apps' window by pressing the **MENU** Softkey two times.

Or:

Touch the **Applications** Icon on the Applications Bar.

b) Touch the **Quick Actions** Tab.

c) Touch **User WPTs**.

d) Touch the **Create User Waypoint** Icon.

2 Touch the **Waypoint Name** Button to display the keypad.

a) Use the keypad and the **Enter** Button to input the User Waypoint Name.

3 If the desired mode is not already selected, touch the **Mode** Button. Then, touch the button for the desired mode used to define the user waypoint location.

4 To change the type of user waypoint which is being created, touch the **Type** Selection Button to change the setting from **Route** to **Airport**.

5 If **Airport** is the selected Type, the ground level elevation of that location is automatically selected. To change the elevation, touch the **Airport Elevation** Button.

a) The pilot is prompted with, "Overwrite terrain database elevation of XXXX?" Touch the **OK** Button to overwrite the elevation.

b) Use the keypad and **Enter** Button to manually enter the elevation.

6 If **Airport** is the selected Type, add User Runways (see next procedure).

7 If not already selected, define the user waypoint location:

a) Touch a Location Parameter Button (Reference, Radial, Distance, or Coordinates) to display the keypad for that parameter. The Location Parameter Buttons depend on the Mode setting from Step 4.

b) **If a radial is being entered:**

c) Touch the **Reference** Button to select a reference for the **Radial From** Button and **Distance** Button to be set.

d) Touch the **Radial From** Button and enter a course or radial with the number pad. Select the **Course** Button or the **Radial** Button to change the mode of entry for the keypad. Touch the **Enter** Button.

e) Touch the **Distance** Button and enter a distance from the reference and touch the **Enter** Button.

f) **If a coordinate is being entered:**

g) Touch the **Units** Datafield Button to change the type of coordinate unit.

- **DM**: Degrees and Minutes
- **DEG**: Degrees only
- **DMS**: Degrees, Minutes, and Seconds

h) Select the hemisphere to enter the coordinates by touching the appropriate hemispheric letter.

i) Use the keypad to enter the desired coordinates and touch the **Enter** Button.

8 If desired, change the waypoint description:

a) Touch the **Description** Button and enter a short description for the user waypoint (up to 25 characters).

b) Touch the **Enter** Button.

9 If desired touch the **Temporary** Button. All temporary waypoints will be erased after the next power cycle.

10 Touch the **Create** Button to create the new user waypoint.

ADDING/EDITING USER RUNWAYS:

1 From any map display on an MFW, touch the map at the location of the new user waypoint to access the Radial Menu (if necessary, touch and drag the map display to pan to the desired location).

Or:

a) Navigate to the 'Apps' window by pressing the **MENU** Softkey two times.

Or:

Touch the **Applications** Icon on the Applications Bar.

b) Touch the **Quick Actions** Tab.

c) Touch **User WPTs**.

2 Touch the **Create User Waypoint** Icon.

3 Touch the **Waypoint Name** Button to display the keypad.

4 Use the keypad and the **Enter** Button to input the User Waypoint Name.

5 If the desired mode is not already selected, touch the **Mode** Button. Then, touch the button for the desired mode used to define the user waypoint location.

6 To change the type of user waypoint which is being created, touch **Type** Button to change the setting from 'Route' to 'Airport'.

7 If the system auto populated the airport elevation, and no modifications are desired, proceed to Step 8. To change the elevation, touch the **Airport Elevation** Button.

a) The pilot is prompted with, "Overwrite terrain database elevation of XXXX?" Touch the **OK** Button to overwrite the elevation.

b) Use the keypad and **Enter** Button to manually enter the elevation.

8 Touch the **Edit Runways** Button.

a) If no runways exist for the waypoint, "No User Runways Available" prompts the pilots. Touch the **Create Runway** Button.

b) If runways exist, touch the desired runway button to edit and then touch the **Edit** or **Delete** buttons.

9 Touch the **Runway Heading** Datafield Button.

10 Use the keypad and the **Enter** Button to enter the runway heading.

11 If desired, define a parallel runway:

a) Touch the **Parallel** Button.

b) Touch the button for the desired parallel runway designator (L,C,or R for Left, Center, or Right).

12 Enter the Threshold Coordinates:

a) If the system auto populated the coordinates on the Threshold Coordinates Button, and no modifications are desired, proceed to Step 13.
b) Touch the **Runway Threshold** Button.
c) Touch the **Units** Datafield Button to change the type of coordinate unit.
   - **DM**: Degrees and Minutes
   - **DEG**: Degrees only
   - **DMS**: Degrees, Minutes, and Seconds
d) Select the hemisphere to enter the coordinates by touching the appropriate hemispheric letter.
e) Use the keypad to enter the desired coordinates and touch the **Enter** Button.

13 Enter the Threshold Elevation:
a) If the system auto populated the elevation on the Threshold Elevation Button, and no modifications are desired, proceed to Step 14.
b) Touch the **Threshold Elevation** Button.
c) Use the keypad and the **Enter** Button to enter the threshold elevation.

14 Enter the Threshold Crossing Height:
a) If the system auto populated the height on the **TCH** Datafield Button, and no modifications are desired, proceed to Step 15.
b) Touch the **TCH** Datafield Button.
c) Use the keypad and the **Enter** Button to enter the threshold crossing height.

15 Touch the **Create Runway** Button if creating a new runway. A confirmation window will be displayed.

Or:

Touch the **Edit Runway** Button if editing an already existing runway.

16 Touch the **OK** Button.

17 Repeat Steps 8a through 17 until all User Runways are entered.

18 Touch the **BACK** Softkey or **Back** Icon to return to the previous screen where all newly created runways can be reviewed.

19 To finish creating the user airport, complete steps 10 through 12 of the previous procedure.

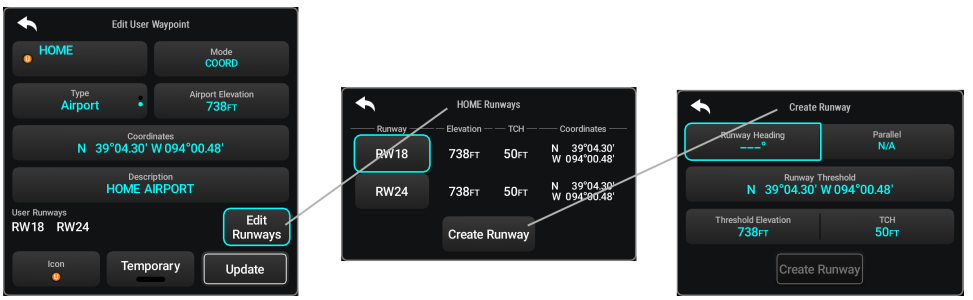


Figure 173: Create User Waypoint - Adding User Runways

UTILIZING USER WAYPOINT OPTIONS:

1 Navigate to the 'Apps' window by pressing the **MENU** Softkey two times.

Or:

Touch the **Applications** Icon on the Applications Bar.

2 Touch the **Quick Actions** Tab.

3 Touch **User WPTs**.

4 Touch the desired waypoint to access the user waypoint options.

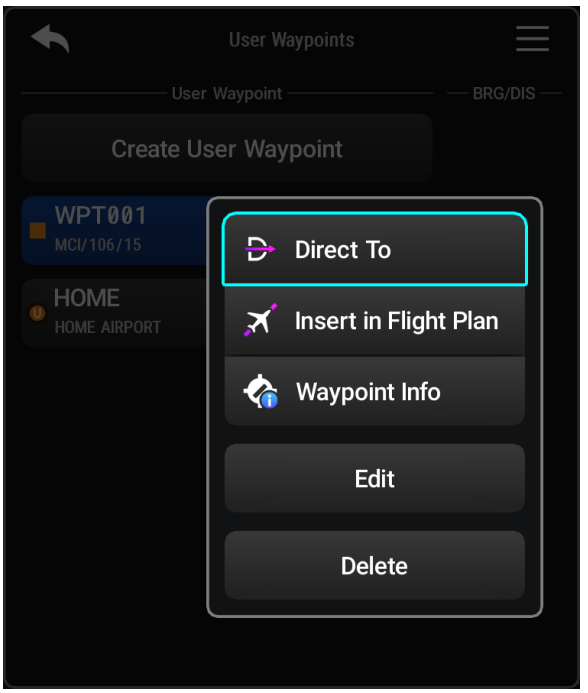


Figure 174: User Waypoint Options

EDITING A USER WAYPOINT:

1 Navigate to the 'Apps' window by pressing the **MENU** Softkey two times.

Or:

Touch the **Applications** Icon on the Applications Bar.

2 Touch the **Quick Actions** Tab.

3 Touch **User WPTs**.

4 Touch the desired waypoint to access the user waypoint options.

5 Touch the **Edit** Button to make changes to the selected waypoint.

6 After making the edits, touch the **Update** Button to save the changes.

7 If at any point the edit window is dismissed without touching the **Update** Button the pilot will be prompted to discard the changes. Touch the **Cancel** Button to return to the edit window.

Or:

Touch the **OK** Button to discard all changes and return to the previous screen.

DELETING A USER WAYPOINT:

1 Navigate to the 'Apps' window by pressing the **MENU** Softkey two times.

Or:

Touch the **Applications** Icon on the Applications Bar.

2 Touch the **Quick Actions** Tab.

3 Touch **User WPTs**.

4 Touch the desired waypoint to access the user waypoint options.

5 Touch the **Delete** Button. The pilot will be prompted to delete the selected waypoint.

6 Touch the **OK** Button to delete the user waypoint.

Or:

Touch the **Cancel** Button to disregard the deletion and return to the previous window.

DELETING A USER RUNWAY:

1 Navigate to the 'Apps' window by pressing the **MENU** Softkey two times.

Or:

Touch the **Applications** Icon on the Applications Bar.

2 Touch the **Quick Actions** Tab.

3 Touch **User WPTs**.

4 Touch the desired user airport to access the user waypoint options.

5 Touch the **Edit** Button to make changes to the selected waypoint.

6 Touch the **Edit Runways** Button.

7 Touch the desired runway to be deleted.

8 Touch the **Delete** Button. The pilot will be prompted to delete the selected runway.

9 Touch the **OK** Button to delete the user runway.

Or:

Touch the **Cancel** Button to disregard the deletion and return to the previous window.

DELETING ALL USER WAYPOINTS:

1 Navigate to the 'Apps' window by pressing the **MENU** Softkey two times.

Or:

Touch the **Applications** Icon on the Applications Bar.

2 Touch the **Quick Actions** Tab.

3 Touch **User WPTs**.

4 Touch the **Menu** Button to access the 'User Waypoints Menu'.

Or:

Push the **MENU** Softkey.

5 Touch the **Delete All User Waypoints** Button.
6 Touch the **OK** Button.

IMPORTING USER WAYPOINTS:

1 Navigate to the 'Apps' window by pressing the **MENU** Softkey two times.
   Or:
   Touch the **Applications** Icon on the Applications Bar.
2 Touch the **Quick Actions** Tab.
3 Touch **User WPTs**.
4 Touch the **Menu** Button to access the 'User Waypoints Menu'.
   Or:
   Push the **MENU** Softkey.
5 Touch the **Import** Button to import user waypoints.
6 Touch the **OK** Button.

EXPORTING USER WAYPOINTS:

1 Navigate to the 'Apps' window by pressing the **MENU** Softkey two times.
   Or:
   Touch the **Applications** Icon on the Applications Bar.
2 Touch the **Quick Actions** Tab.
3 Touch **User WPTs**.
4 Touch the **Menu** Button to access the 'User Waypoints Menu'.
   Or:
   Push the **MENU** Softkey.
5 Touch the **Export** Button to export user waypoints.
6 Touch the **OK** Button.

VIEWING THE MAP ASSOCIATED WITH A SELECTED USER WAYPOINT:

1 Navigate to the 'Apps' window by pressing the **MENU** Softkey two times.
   Or:
   Touch the **Applications** Icon on the Applications Bar.
2 Touch the **Quick Actions** Tab.
3 Touch **User WPTs**.
4 Touch the desired waypoint to access the user waypoint options.
5 Touch the **Waypoint Info** Button.

5.5 DIRECT-TO NAVIGATION

The direct-to method of navigation allows quick selection of a waypoint and provides guidance to the selected point. Initiate a direct-to by touching the Softkey.

Direct-to navigation may be provided to any waypoint. Once a direct-to is activated, the system establishes a course from the present position to the selected direct-to waypoint, with initial turn as needed. When activating a direct-to with only a single waypoint in the flight plan, the direct-to waypoint will be inserted into the active flight plan. This adds the navigation waypoint into flight plan instead of creating an off-route direct-to. Course guidance is provided until the direct-to is canceled, replaced with a new direct-to, or a new flight plan leg or sequence is activated.

The direct-to course to a waypoint can be manually selected. Otherwise, the course defaults to a direct leg from the aircraft present position to the direct-to waypoint.

The Direct-To Function can be accessed from any waypoint information screen (Airport Information, Intersection Information, VOR Information, NDB Information, VRP Information, or User Waypoint Information), and from some of the nearest waypoint screens (Nearest Airport, Nearest Intersection, Nearest VOR, Nearest NDB, Nearest VRP, Nearest User, or Nearest Weather). Direct-to requests on waypoint information screens or nearest waypoint screens default to the displayed waypoint.

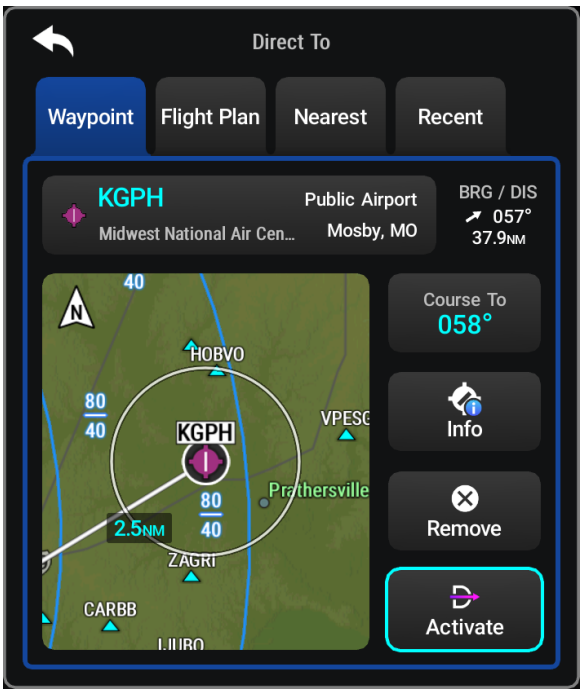


Figure 175: Initiating a Direct-To

LOADING DIRECT-TO NAVIGATION

Once the direct-to waypoint is selected, use the default course to navigate directly from the aircraft present position to the waypoint, or input a manual course.

REMOVING DIRECT-TO

Direct-to navigation can be canceled at anytime. The flight plan will resume the flight plan to the next sequenced waypoint in the flight plan after removing the Direct-To waypoint.

Figure 176: Removing Direct-To

DIRECT-TO PROCEDURES

INITIATING THE DIRECT-TO FUNCTION:

1 Open the Direct-To Window:
   a) Touch the Softkey.
      Or:
   b) Touch a desired location to go Direct-To on the MFW Map Page to open the Radial Menu.
   c) Touch the Direct-To Icon on the Radial Menu
2 Select the desired waypoint from any of the tabs.
3 Use the keypad and the **Enter** Button, or the Find function, to enter the waypoint identifier.
4 Touch the **Activate** Button.
   Or:
   Press the **Direct-To** Softkey.

INITIATING THE DIRECT-TO FUNCTION BY SELECTING A WAYPOINT IN A FLIGHT PLAN:

1 Navigate to the Flight Plan Application Page:
   a) Touch the **Applications** Icon.
   b) Touch the **Flight Plan** Button.
      Or:

Touch the **FPL** Icon on the MFW App Bar.

2 Touch the desired Waypoint Selection Button.
3 Touch the **Direct-To** Button.
4 Touch the **Activate** Button.

Or:

Press the **Direct-To** Softkey.

INITIATING THE DIRECT-TO FUNCTION BY SELECTING A WAYPOINT FROM 'NEAREST':

1 Navigate to the Nearest Application Page:
   a) Touch the **Applications** Icon.
   b) Touch the **Nearest** Button.

   Or:

   Touch the **Nearest** Icon on the MFW App Bar.
2 Touch the **Type** Button to display a drop down menu.
3 Touch the button for the desired waypoint type.
4 Touch the desired Waypoint Selection Button to display an options menu.
5 Touch the **Direct-To** Button.
6 Touch the **Activate** Button.

LOADING DIRECT-TO NAVIGATION FOR A SELECTED WAYPOINT:

1 From the MFW Map page, touch the desired waypoint to open the Radial Menu.
2 On the radial menu, touch the waypoint icon.
3 Touch the **Menu** Button or press the **MENU** Softkey.
4 Touch the **Direct-To** Button.
5 Touch the **Activate** Button.

RE-SELECTING THE DIRECT COURSE FROM THE CURRENT POSITION:

1 Access the Flight Plan window on the MFW.
2 Touch the Direct-To waypoint at the top of the flight plan list.

   Or:

   Press the **Direct-To** Softkey.
3 The course is loaded automatically as direct from the present position. Touch the **Activate** Button.

CANCELING DIRECT-TO NAVIGATION AND REMOVING THE DIRECT-TO LEG:

1 Press the **Direct-To** Softkey.

2 Touch the **Remove** Button.

Or:

3 Navigate to the Flight Plan Page:

a) Touch the **Applications** Icon.

b) Touch the **Flight Plan** Button.

Or:

c) Touch the **FPL** Button on the MFW App Bar.

4 Touch the active Direct-To Button to open the waypoint information window.

5 Touch the **Remove** Button.

5.6 FLIGHT PLANNING

Flight planning consists of building a flight plan by entering waypoints one at a time, adding waypoints along airways, and adding fixes, departures, airways, arrivals, or approaches as needed. The 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.

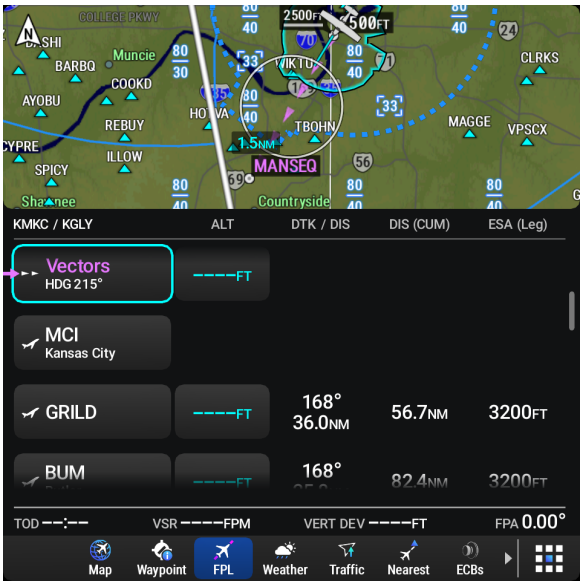


Figure 177: Flight Plan Button on MFW App Bar

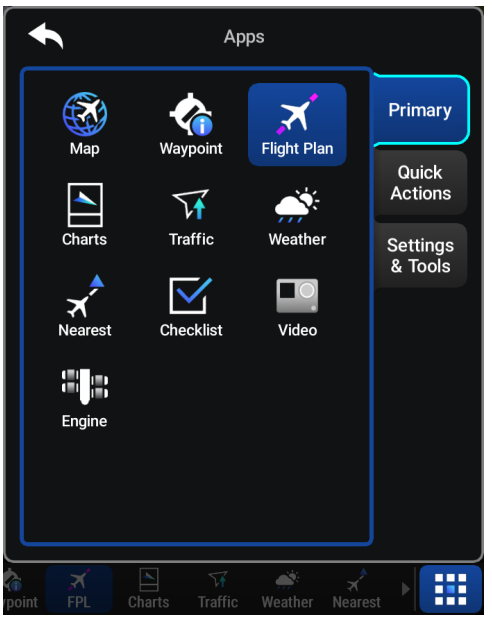


Figure 178: Flight Plan Button in Applications Window

FLIGHT PLAN CREATION

The Active Flight Plan is the flight plan to which the system is currently providing guidance, and is shown on the map displays. One flight plan can be activated at a time and becomes the Active Flight Plan. The Active Flight Plan is overwritten when another flight plan is activated. Once an active flight plan is created, it may also be stored.

Auto-designation will find the most likely airport of origin and auto-populate the Active Flight Plan. Once determined, the airfield identifier automatically appears in the Active Flight Plan. Auto-designation occurs between 15 and 60 seconds after applying power to the system under the following conditions:

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

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

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

The flight crew can insert waypoints using the **Add Waypoint** Button in the Active Flight Plan. Once an initial enroute waypoint has been entered, subsequent waypoints can also be entered using the **Add Waypoint** Button, or by accessing the 'Waypoint Options' Window and touching the **Insert Before** Button or **Insert After** Button.

If using the keypad through the Add Waypoint or Route Button, the FastFind function will suggest airports and waypoints based on the existing waypoints in the flight plan which

are before and after the selected insertion point. Flight plans are limited to 100 waypoints (including waypoints within airways and procedures). If the number of waypoints in the flight plan exceeds 100, the message “Flight plan is full. Remove unnecessary waypoints.” will appear and the new waypoint(s) will not be added to the flight plan.

The 'Waypoint Options' can be accessed from any waypoint, and provides the means for the flight crew to modify the flight plan using that waypoint as a reference. Different options are available based on the type of waypoint selected. Reference the following figure and table for standard actions within the 'Waypoint Options'. Many of these actions and functions are discussed in more detail later in this section.

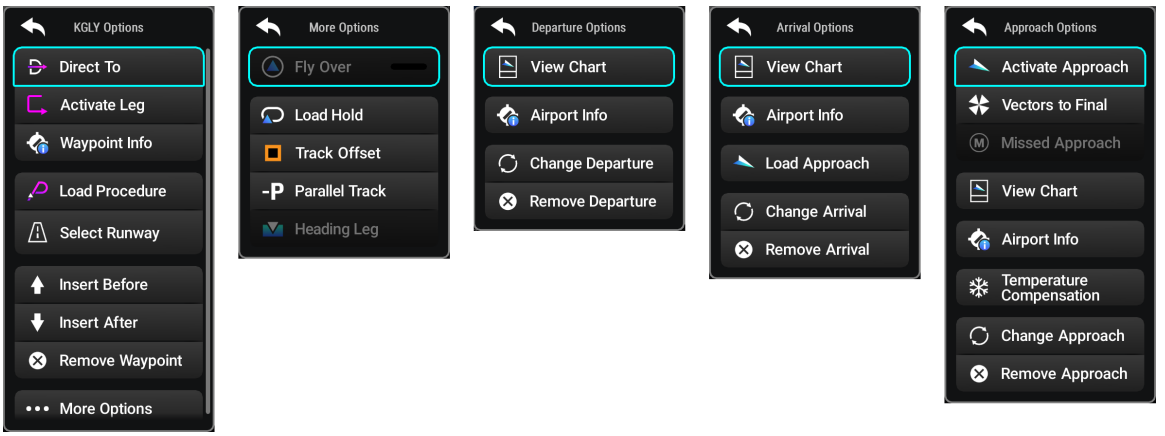


Figure 179: Waypoint Options

Waypoint/Airport Options:

- **Direct-To** — Forego all previously established sequencing up to the Selected Waypoint and initiate navigation directly to the Selected Waypoint.
- **Activate Leg** — Activate navigation sequencing from prior waypoint to the Selected Waypoint.
- **Waypoint Info** — Displays the information page for the selected waypoint or airport.
- **Load Airway** — Load a designated airway into the flight plan.
- **Load Procedure** — Allows the pilot to load a departure, arrival, or approach procedure.
- **Select Runway** — Select the desired runway to be added to the flight plan.
- **Insert Before** — Insert a waypoint before the selected flight plan waypoint.
- **Insert After** — Insert a waypoint after the selected flight plan waypoint.
- **Remove Waypoint** — Remove the selected waypoint from the flight plan.
- **More Options** — Opens a window of more options for the selected waypoint.

More Options:

- **Fly Over** — If enabled, the system will dictate the waypoint be flown over (the system defaults to a 'fly-by' method for establishing paths between two concurrent legs (depending on the angle of the two legs)).
- **Load Hold** — Establish a Hold at the Selected Waypoint. Touching the button opens a window to define the parameters of the Hold.

- **Track Offset** — Establish a waypoint on the path to or from the Selected Waypoint at a determined radial and distance before or after the Selected Waypoint.
- **Parallel Track** — Touching the button opens a window from which the flight crew can establish a flight path parallel to the current flight path.
- **Heading Leg** — Establish a heading leg from the Selected Waypoint.

Departure Options:

- **View Chart** — Opens the departure procedure chart view.
- **Airport Info** — Opens the waypoint info page for the airport.
- **Change Departure** — Allows the pilot to edit the departure procedure.
- **Remove Departure** — Removes the departure from the flight plan.

Arrival Options:

- **View Chart** — Opens the arrival procedure chart view.
- **Airport Info** — Opens the waypoint info page for the airport.
- **Load Approach** — Allows the pilot to load an approach into the flight plan.
- **Change Arrival** — Allows the pilot to edit the arrival procedure.
- **Remove Arrival** — Removes the arrival from the flight plan.

Approach Options:

- **Activate Approach** — Activates the appraoch in the flight plan.
- **Vectors to Final** — Suspends the flight plan and selects the FAF in the approach as the next active waypoint in the flight plan.
- **Missed Approach** — Activates the missed approach hold point as the next active waypoint in the flight plan.
- **View Chart** — Opens the approach chart view.
- **Airport Info** — Opens the waypoint info page for the airport.
- **Temperature Compensation** — Allows the pilot to adjust the temperature compensation for the approach procedure.
- **Change Approach** — Allows the pilot to edit the approach procedure.
- **Remove Approach** —Removes the approach procedure from the flight plan.

Certain actions within the 'Waypoint Options' Window may be subdued and unavailable for selection, depending on the context of that waypoint within the flight plan.

The following procedures are intended to provide an example that best captures a basic flight plan. It will create a flight plan from the origin runway to the destination runway — to include enroute waypoints for which lateral navigation will be provided. Information on airways, waypoint constraints, and vertical constraints is discussed later in this section.

CREATING A FLIGHT PLAN:

1 Navigate to the Flight Plan Page:

a) Touch the **FPL** Icon on the MFW App Bar.

Or:

b) Touch the **Applications** Icon.

c) Touch the **Flight Plan** Button.

2 Touch the **Add Waypoint** Button.

3 Use the Keypad to enter the waypoint identifier.

Or:

Use the Find Function and associated tabs (Recent, Nearest, Flight Plan, Favorites, and Search Tabs) to find a waypoint.

4 Repeat steps 2 and 3 until the flight plan is completed.

INVERTING THE ACTIVE FLIGHT PLAN:

NOTE

All procedures and SAR patterns will be removed from the flight plan.

Any flight plan may be inverted (reversed) for navigation back to the original origin point. See the *Stored Flight Plan* discussion later in this section for steps on how to invert and activate a stored flight plan.

1 Navigate to the flight plan page on the MFW.

2 Press the **MENU** Softkey (if in split screen mode press the **MENU** Softkey on the MFW side of the bezel) to open the Flight Plan Menu.

3 Touch the **Invert Flight Plan** Button. The prompt "Invert flight plan? All procedures and SAR patterns will be removed."

4 Touch the **Cancel** Button to cancel inverting the flight plan.

Or:

Touch the **OK** Button to invert the flight plan.

DELETING WAYPOINTS FROM THE ACTIVE FLIGHT PLAN:

1 With the active flight plan open touch the waypoint button of the desired waypoint to be deleted.

2 Touch the **Remove Waypoint** Button if the desired point is a waypoint.

3 A confirmation window will appear. Touch the **OK** Button to remove the waypoint.

Or:

Touch the **Delete Multiple** Button to select multiple points for deletion.

When multiple waypoints are selected for deletion, the system deletes the originally selected waypoint and all subsequent waypoints up to the last selected waypoint.

4 Select the last waypoint in succession to be deleted.

5 A confirmation window will appear. Touch the **OK** Button to remove the waypoints.

DELETING AN ACTIVE FLIGHT PLAN:

1 Navigate to the flight plan page on the MFW.

2 Press the **MENU** Softkey to open the Flight plan menu.

3 Touch the **Delete Flight Plan** Button. The pilot will be prompted to confirm the removal of all waypoints from the flight plan.

4 Touch the **OK** Button to confirm and delete the active flight plan.

FLIGHT PLAN DATA

Flight plan waypoints and leg data can be reviewed in the flight plan, on most map displays, and on the VSD. The flight plan shall contain the sequential list of flight plan waypoints (and any necessary leg identifiers) consisting of five columns. The first column shall contain a Waypoint Selection Button (or a Leg Type Button), and the other four data columns can be chosen using the **MENU** Softkey. The first column is frozen and the remaining columns may be scrolled left or right. The sequence of the flight plan may be reviewed by scrolling up or down.

Figure 180: Flight Plan Window and Corresponding Data Field Options

In addition to the waypoint (or leg type) identifier, each Waypoint Selection Button (or Leg Type Button) displays an icon for distinguishing waypoint and leg types. Furthermore, there may be additional information above (supertext) and below (subtext) the waypoint name on the Waypoint Selection Button to further emphasize characteristics of the waypoint or leg.

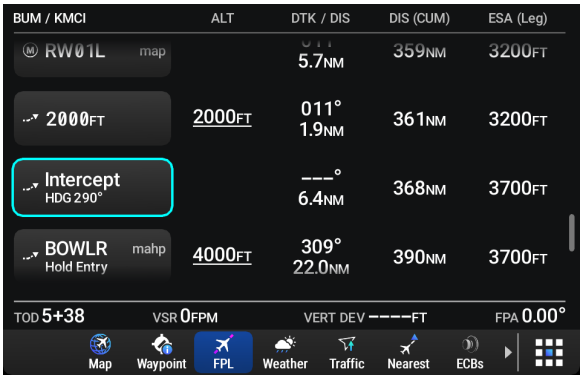


Figure 181: Example Flight Plan and Waypoint Selection Button

The following tables display possible waypoint icons, waypoint supertext, and waypoint subtext elements that may be displayed on the Waypoint Selection Button:

Flight Plan Waypoint Button	Icon	Flight Plan Waypoint Button	Icon
Airport Symbol		Missed Approach Waypoint	
Airway Icon		Runway	
Along Track Waypoint		Non-Fly Over VOR/DME Waypoint	
Departure		Parallel Offset	
Arrival		FAF Symbol	
Approach		Procedure Turn	
Intersection Waypoint		User Waypoint	
Heading Leg		Fly over VOR/DME Waypoint	
Hold Icon (right)		Missed Approach Point	
Hold Icon (left)		User Airport	
Decision Altitude			

Table 19: Flight Plan Waypoint Button Icons

Supertext Type	Display Format	Leg Types
DME Arc Leg	<ARC radius length> ARC <DME identifier>	DME Arc to a Fix Leg (AF)
Course Leg	<turn direction> CRS <course>	Course to Altitude Leg (CA), Course to a DME distance Leg (CD), Course to a Fix Leg (CF), Course to an Intercept Leg (CI), Course to a VOR Radial Leg (CR), Track from a Fix to an Altitude Leg (FA), Track from a Fix to a Changeover Point Distance Leg (FC), Track from a Fix to a DME Distance Leg (FD), Track from a fix to a Manual Termination Leg (FM)
Active Leg Direct-To	<course> <distance>	Direct-to a Fix Leg (DF) that is the active leg
Non-Active Leg Direct-To	<turn direction> Direct-To	Direct-to a Fix Leg (DF) that is not the active leg
Hold Leg	HOLD <course> <hold time or distance>	Holding to an Altitude Leg (HA), Holding to a Fix Leg (HF), Holding to a Manual Termination Leg (HM)
Procedure Turn	<turn direction>	Procedure Turn to an Intercept Leg (PI)
TF Leg with Turn Direction	<turn direction> CRS <course>	Track to Fix Leg (TF) with turn direction
TF Leg without Turn Direction	<course> <distance>	Track to Fix Leg (TF) without turn direction
None	N/A	Return to Target Procedure Leg (RTT) and Discontinuity Leg (DISCON)

Table 20: Flight Plan Waypoint Button Supertext

Sub-Text Type	Display Format	Leg Types
Holding Leg to an Altitude	<holding altitude>	Holding to an Altitude Leg (HA)
Manual Termination	'Manual Sequence'	Track from a fix to a Manual Termination Leg (FM), Holding to a Manual Termination Leg (HM), Vector to a Manual Termination Leg (VM)

Sub-Text Type	Display Format	Leg Types
Along Track Offset Leg	<reference waypoint identifier>/<bearing from reference waypoint identifier>/<distance from reference waypoint identifier>	Along Track Offset
Beginning Parallel Track Leg	'Start P-Offset'	Parallel Offset
Middle Parallel Track Leg	'P-Offset'	Parallel Offset
End Parallel Track Leg	'End P-Offset'	Parallel Offset
None	N/A	Course to Altitude Leg (CA), Course to a DME distance Leg (CD), Course to an Intercept Leg (CI), Course to a VOR Radial Leg (CR), Track from a Fix to an Altitude Leg (FA), Track from a Fix to a Changeover Point Distance Leg (FC), Track from a Fix to a DME Distance Leg (FD), Procedure Turn to an Intercept Leg (PI), Vector to an Altitude Leg (VA), Vector to a DME Distance Leg (VD), Vector to an Intercept Leg (VI), Vector to a VOR Radial (VR) Leg, Return to Target Procedure Leg (RTT), Discontinuity Leg (DISCON)

Table 21: Flight Plan Waypoint Subtext

Header rows for the origin or departure procedure, airways, arrival procedure, destination or approach procedure, and alternate arrival/approach procedure will be included as these elements are added to the flight plan. A discontinuity row may also be listed in the flight plan. Procedures and discontinuities in the flight plan are discussed later in this Flight Management Section.

VIEWING LEG INFORMATION IN THE FLIGHT PLAN:

1 Select the desired flight plan (see the *Managing Flight Plans* section for more information).
2 Touch and drag the Scroll Bar to scroll left/right, or up/down as needed to see all information.

COLLAPSING AND EXPANDING FLIGHT PLAN SEGMENTS

The system logically categorizes segments of the flight plan, and separates those segments by using appropriately-named headers. As an example, if a string of waypoints and legs in the flight plan consist of waypoints along the same airway, an 'Airway' header appears above the

segment. This allows the flight crew to visually distinguish that airway segment from other segments (departure, arrival, other airway segments, etc.).

The system allows header rows to be displayed as collapsed or expanded within a flight plan. When headers are collapsed, leg-to-leg computed values such as DIS or ETE shown for the last waypoint of that segment reflect the total of all the legs in that segment that have been hidden in the collapsed display.

The flight plan always keeps the following waypoints visible if the header is collapsed: “From” waypoint, “To” waypoint, the “Next” waypoint, and the "Exit" waypoint.

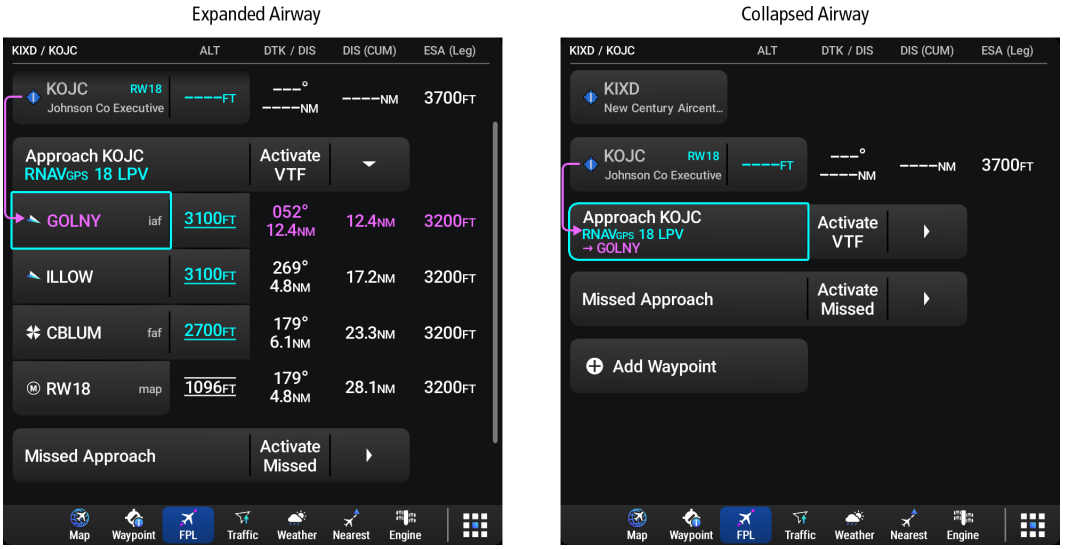


Figure 182: Header Rows Expanded/Collapsed in Flight Plan

COLLAPSING/EXPANDING THE HEADER ROWS IN THE FLIGHT PLAN:

1 Select the desired flight plan (see the *Managing Flight Plans* section for more information).

2 Touch the **MENU** Softkey.

3 Touch the **Expand Airways** Button or the **Collapse Airways** Button to expand or collapse all airway segments.

Or:

With the flight plan application open, scroll to the segment that is to be expanded or collapsed and touch the white arrow in the header row.

FLIGHT PLAN MODIFICATIONS

Active and stored flight plans can be edited at any time. Modifications to flight planned departures, arrivals, approaches, and missed approaches are discussed later in the Procedures portion of Flight Management.

WAYPOINTS

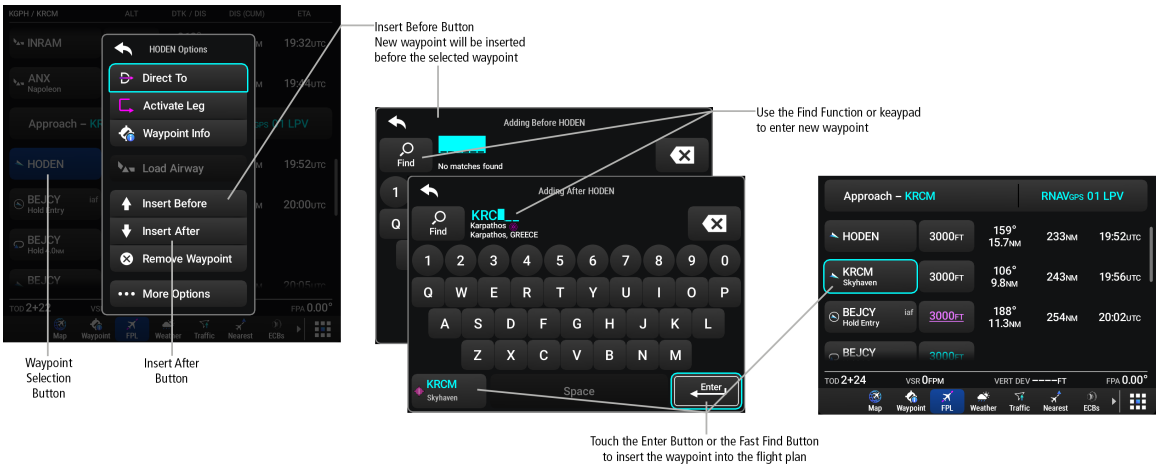


Figure 183: Inserting a Waypoint from the Active Flight Plan

FLY-OVER WAYPOINTS

Waypoints entered in the en route segment may be treated as either fly-by waypoints or fly-over waypoints. For both types of waypoints, the system will transition using a precisely calculated turn on course to the next waypoint.

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

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

ENABLING / DISABLING A FLY-OVER WAYPOINT:

1. Select the desired flight plan.
2. Touch a Waypoint Selection Button to display 'Waypoint Options'.
3. Touch the **More Options** Button.
4. Touch the **Fly-Over** Button to enable/disable the waypoint as a fly-over waypoint.

ADDING A WAYPOINT TO A FLIGHT PLAN:

1. Select the desired flight plan.
2. Enter waypoints in the flight plan by touching the **Add Waypoint** Button to display the keypad.
3. Use the keypad, or the Find Function to select the new waypoint; or use the keypad to create a route entry.
4. Touch the **Enter** Button or **Fast Find** Button to accept the waypoint or route and place it in the flight plan.

ADDING A WAYPOINT TO THE ACTIVE FLIGHT PLAN FROM 'WAYPOINT INFO':

1 With a the Waypoint application open, or a 'Waypoint Info' Window open for a specified waypoint, touch the **Menu** Button.

Or:

Press the **MENU** Softkey (if in split screen mode, press the **MENU** Softkey on the side of the display the window is open).

2 Touch the **Insert in Flight Plan** Button.

3 Scroll through the "Insert [Waypoint] Before" window and select where the waypoint should be added. Scroll to the bottom of the flight plan to add it to the end of the flight plan.

ADDING A WAYPOINT INTO THE ACTIVE FLIGHT PLAN USING THE NEAREST BUTTON:

1 Access the Nearest Application on the MFW.

2 Touch the **Type** Button to select from the list of waypoint types.

3 Scroll the list of nearest waypoint options and touch the desired waypoint to be added to the flight plan.

4 Touch the **Insert in Flight Plan** Button.

5 Scroll through the "Insert [Waypoint] Before" window and select where the waypoint should be added. Scroll to the bottom of the flight plan to add it to the end of the flight plan.

ADDING A WAYPOINT TO THE ACTIVE FLIGHT PLAN USING THE MAP RADIAL MENU:

1 With the map opened on the MFW touch the desired location to insert into the flight plan.

2 Touch the dynamic button that identifies the waypoint to be added. This opens the waypoint info for that waypoint.

3 With a the Waypoint application open, or a 'Waypoint Info' Window open for a specified waypoint, touch the **Menu** Button.

Or:

Press the **MENU** Softkey (if in split screen mode, press the **MENU** Softkey on the side of the display the window is open).

4 Touch the **Insert in Flight Plan** Button.

5 Scroll through the "Insert [Waypoint] Before" window and select where the waypoint should be added. Scroll to the bottom of the flight plan to add it to the end of the flight plan.

REMOVING WAYPOINTS FROM A FLIGHT PLAN:

Individual waypoints 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.

1 With the active flight plan open touch the waypoint or procedure button of the desired waypoint or procedure to be deleted.

2 Scroll the list, if necessary, and touch a Waypoint Selection Button to display the 'Waypoint Options' Window. Then, touch the **Remove Waypoint** Button.

3 The pilot will be prompted to verify the deletion of the waypoint. Touch the **OK** Button to delete the waypoint from the flight plan.

Or:

If muultiple waypoints are needing to be deleted, touch the **Delete Multiple** Button.

4 The original waypoint selected for deletion is subdued in the following list, select the waypoint though which all waypoints between the two selections will be deleted.

5 A verification window will appear that allows the pilot to go back and change the waypoints to be deleted, cancel the process, or accept by touching the **OK** Button.

CONSTRAINTS

NOTE

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

Altitude, speed, and FPA constraints in the flight plan can be used by the Flight Director (FD) for vertical navigation. These constraints are, depending on the specific instance, manually entered or retrieved from the published altitudes in the navigation database. Manually entered/modified constraints shall be indicated by the cyan pencil icon. A constraint in the flight plan shall be colored amber when the vertical profile is unattainable due to current aircraft performance. If the system is unable to calculate a logical vertical profile due to a constraint conflict or condition, the invalid constraint shall be crossed out.

Advisory constraints in the flight plan (white text) are not factored into the vertical profile and are not used by the FD for vertical navigation.

Constraints shall be colored magenta when supplying guidance for the active FD mode, cyan when armed for upcoming guidance, or white when neither active or armed for navigation. Flight plan navigation and VNAV direct-to is discussed in more detail later in this section. Lateral and vertical FD modes are discussed in the AFCS Section. See the following figure for an example of how different constraints are displayed in the Active Flight Plan.

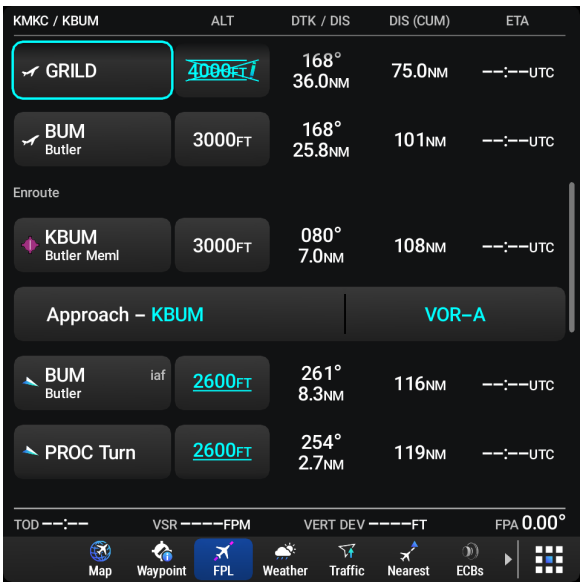


Figure 184: Constraints in the Active Flight Plan

ALTITUDE CONSTRAINTS

NOTE

If necessary, the FAF altitude constraint may be modified and set above or below the published FAF altitude.

NOTE

After an approach procedure has been loaded into the flight plan, any altitude constraint programmed at the airport reference point (on the flight plan just ahead of the approach procedure) will be removed if the approach procedure is changed or removed.

An altitude constraint may be displayed as a flight level (FL), height above mean sea level (MSL), or height above ground level (AGL). AGL format is only available for airport and runway waypoints when the radio altimeter is installed.

The type of altitude constraint shall be identified by the presence of constraint bars above and/or below the altitude. The vertical profile shall consider altitude constraints which must be crossed at the specified altitude, as well as complex altitude constraints (At or Above / Between / At or Below). Except during VNAV direct-to operations, the vertical profile considers all altitude constraints and creates an optimized profile descent from the TOD at the cruise altitude to the last descent constraint in the flight plan.

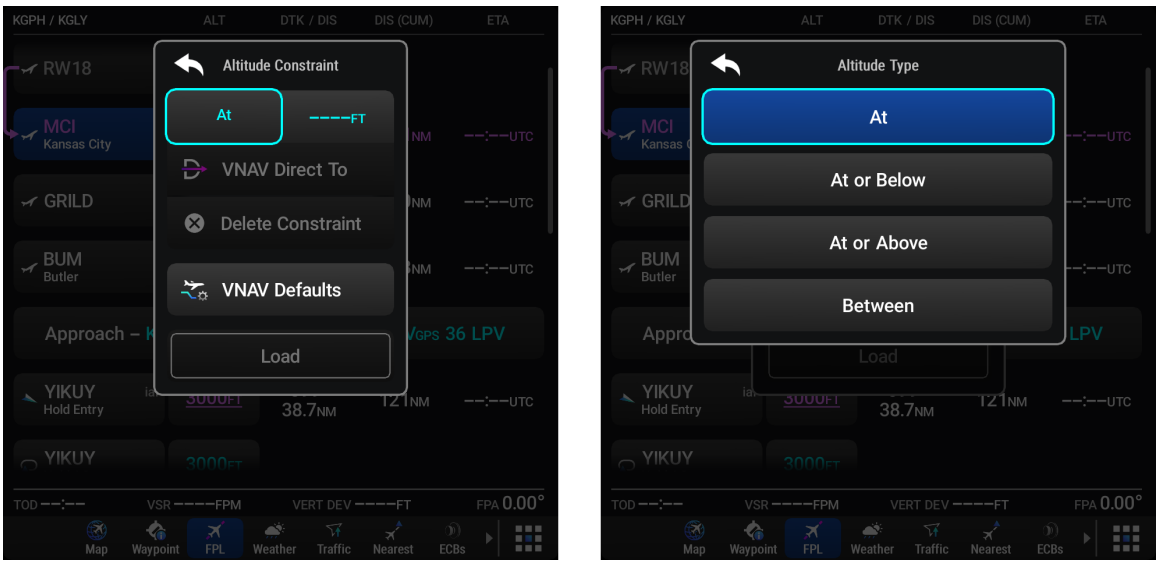


Figure 185: Altitude Constraint, Selecting the Constraint Type

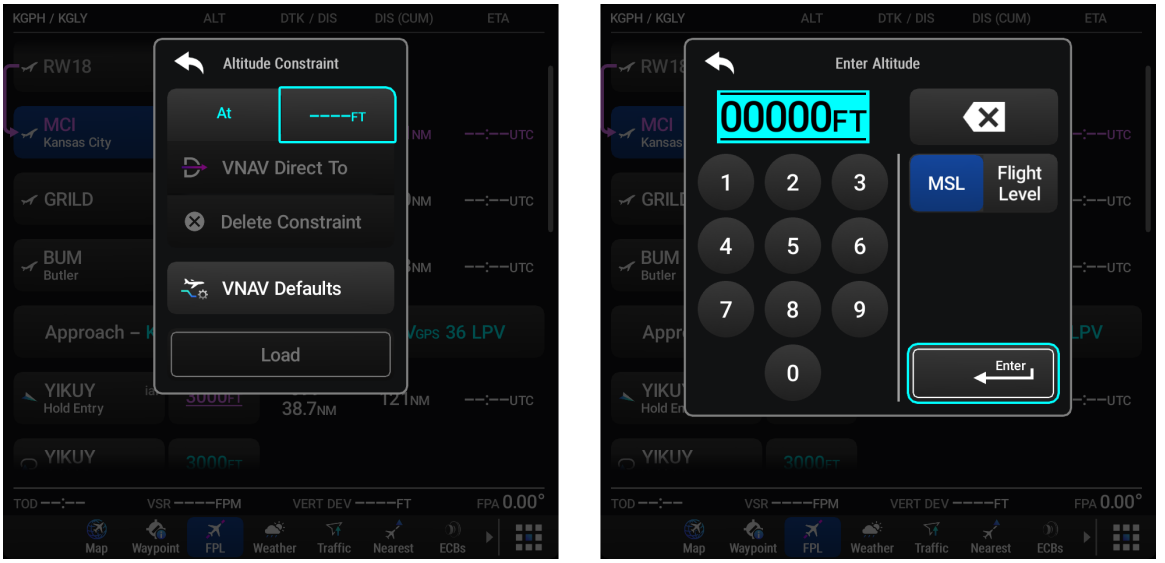


Figure 186: Altitude Constraint, Modifying the Altitude and Loading into Flight Plan

NOTE

When creating an altitude constraint, the Phase Button will default to Climb or Descent based upon the location in the flight plan of the waypoint being modified. If the waypoint is before the last climb constraint, the phase will default to Climb. If the waypoint is after a descent constraint, the phase will default to Descent. If the waypoint is located between the last climb constraint and the first descent constraint, the default will be determined based on the aircraft altitude, length of the flight plan, and existing constraints.

ENTERING OR MODIFYING AN ALTITUDE CONSTRAINT IN THE FLIGHT PLAN:

1 Navigate to the Flight Plan application on the MFW.

2 The "ALT" column displays altitude constraints that are published altitudes from the navigation database. Touch the desired ALT button to enter a new altitude constrain or modify an existing constraint.
3 Touch the complex constraint button (**At**, **At or Below**, **At or Above**, or **Between**).
4 Touch the Altitude button to open the "Enter Altitude" number pad.
5 Touch the **Mode** Button.
6 Select the desired mode of altitude for the constraint (**MSL**, **Flight Level**, or **AGL**).
7 Using the number pad, enter the desired altitude for the constraint and touch the **Enter** Button.

DELETING AN ALTITUDE CONSTRAINT:

Altitude constraints can be modified or deleted after having been added to the flight plan. If an altitude constraint is deleted and the navigation database contains an altitude restriction for the lateral waypoint, the system will display that altitude restriction in white text. The system also provides a way to revert a published altitude constraint that has been modified.

1 Navigate to the Flight Plan application on the MFW.
2 The "ALT" column displays altitude constraints that are published altitudes from the navigation database. Touch the desired ALT button to delete the constraint.
3 Touch the **Delete Constraint** Button. A "Delete Altitude Constraint?" window will appear, prompting the pilot to verify the deletion of the constraint.
4 Touch the **OK** Button to confirm.

   Or:

   Touch the **Cancel** Button to return to the previous window.

REVERTING A MODIFIED ALTITUDE CONSTRAINT BACK TO THE NAVIGATION DATABASE VALUE:

1 After a database altitude constrain has been deleted, it will be displayed in white on the "ALT" column button. Touch that altitude constraint ti open the "Altitude Constraint" window.
2 Touch the **Revert Constraint** Button to reload the previousely deleted altitude constraint. A "Revert Altitude Constraint?" window will appear, prompting the pilot to verify the reversion of the constraint.
3 Touch the **OK** Button to confirm.

   Or:

   Touch the **Cancel** Button to return to the previous window.

FLIGHT PATH ANGLE CONSTRAINTS

NOTE

Manually specifying an FPA to the FAF inhibits the Transition to Approach (TTA) function.

The system can use descending Flight Path Angle (FPA) constraints associated with flight plan waypoints to calculate a descent path in the vertical profile. The system calculated Flight Path Angle (FPA) will be displayed in flight plan. The crew may optionally define a specific Flight Path Angle (FPA) constraint for a waypoint in the flight plan.

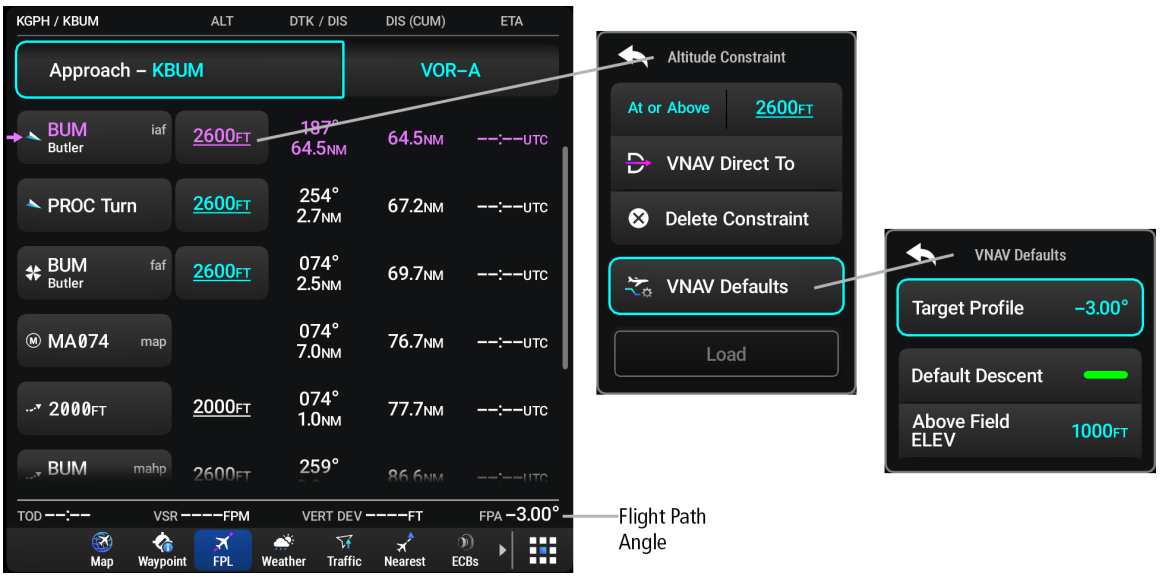


Figure 187: Entering a Flight Plan Waypoint FPA Constraint

ENTERING OR MODIFYING A FLIGHT PATH ANGLE CONSTRAINT:

1 Navigate to the flight plan application window on the MFD.
2 Touch the altitude constraint button in the ALT column.
3 Touch the **VNAV Defaults** Button.
4 Touch the **Target Profile** Datafield Button.
5 On the 'VNAV Target Profile' numeric keypad ensure "FPA" is selected (The button that is selected is highlighted in blue).
6 Enter a value between -6.00 and -1.00 degrees and touch the **Enter** Button.

REVERTING A FLIGHT PATH ANGLE CONSTRAINT BACK TO THE NAVIGATION DATABASE VALUE:

FPA constraints can be modified after having been added to the flight plan. The system also provides a way to revert a modified FPA constraint back to the system calculated FPA. These modifications will redefine the calculated vertical path and may result in movement of the Top of Descent (TOD).

1 Navigate to the flight plan application window on the MFD.
2 Touch the altitude constraint button in the ALT column.
3 Touch the **VNAV Defaults** Button.
4 Touch the **Default Descent** Indicator Button.

HEADING LEGS

Heading legs can be added and removed from the Active Flight Plan.

When adding a heading leg, it will be placed after the selected waypoint, and it can only be added when the following four conditions are met:

- The leg is not the first or last in the flight plan.

- The leg is not after a CI, PI, RF, FI, VM, or holding leg.
- The leg is not before an AF, RF, PI, VM or holding leg.
- The leg is inserting into the enroute portion of the flight plan, second departure leg, or the first approach leg for a Vectors-to-Final approach, or both the arrival procedure's final leg and its' navigation waypoint is the destination airport or runway.

After a heading leg has been entered into the flight plan, the waypoint identifier "MANSEQ" (Manual Sequence) will be the "fly-to" point until the heading leg is deleted, or the next waypoint is activated as the direct-to. While the waypoint on the 'Map' page is identified as "MANSEQ", the waypoint is identified on the 'Flight Plan' page as "Vectors".

ADDING A HEADING LEG AFTER A WAYPOINT IN THE ACTIVE FLIGHT PLAN:

1. Navigate to the Flight Plan page on the MFW.
2. Touch the waypoint that the heading leg will be entered after.
3. Touch the **More Options** Button.
4. Touch the **Heading Leg** Button. A numeric 'Heading' keypad will open.
5. Enter the desired heading of the heading leg and touch the **Enter** Button.

EDITING A HEADING AFTER A WAYPOINT IN THE ACTIVE FLIGHT PLAN:

1. Navigate to the Flight Plan page on the MFW.
2. Touch the **Vectors** Button.
3. Touch the **More Options** Button.
4. Touch the **Heading Leg** Button. A numeric 'Heading' keypad will open.
5. Enter the desired heading of the heading leg and touch the **Enter** Button.

REMOVING A HEADING FROM THE ACTIVE FLIGHT PLAN:

1. Navigate to the Flight Plan page on the MFW.
2. Touch the **Vectors** Button.
3. Touch the **Remove Waypoint** Button.
4. A "Remove manseq?" window will open.
   a) Touch the **Cancel** Button to return to the previous window.
   b) If multiple heading legs are in the flight plan and all of them are wanting to be deleted, touch the **Delete Multiple** Button.
   c) Touch the **OK** Button to delete the selected heading leg.

   If the heading leg is deleted while it is active in the flight plan, the next waypoint will become the new active leg.

AIRWAYS

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

When the database is updated, stored flight plan airways may need to be reloaded also. Each airway segment is reloaded from the database given the entry waypoint, the airway identifier and the exit waypoint. This reloads the sequence of waypoints between the entry and exit waypoints (the sequence may change when the database is updated). The update of a flight

plan airway can fail during this process. If that happens, the airway waypoints are changed to regular (non-airway) flight plan waypoints, and an alert is displayed (see messages in the Appendices).

The following could cause the airway update to fail:

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

ADDING AND REMOVING AIRWAYS

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

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

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

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

In the US, airways that are “one-way” for specified hours of operation are common. These airways are always bidirectional in the system database.

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

ADDING AN INDIVIDUAL AIRWAY TO A FLIGHT PLAN:

1. On the flight plan page, select a waypoint that is on an airway.
2. In the 'Waypoint Options' menu touch the **Load Airway** Button. An 'Airway Selection' window will appear displaying the entry point with the identifier.
3. Touch the **Airway** Button to display the 'Select Airway' window.
4. If necessary scroll through the displayed list and select the desired airway by touching the airway button. A 'Select Exit' window will appear. The default view is listed sequentially, but can be changed to list the waypoints alphabetically by touching the **Alphabetical** Button.
5. Select the desired airway exit waypoint by scrolling through the displayed list and touching the exit waypoint. Review the 'Airway Selection' window.
6. To modify the airway repeat steps three through five. If desired, modify the exit waypoint by touching the **Exit** Button and repeating step five.
7. If no modifications are required, touch the **Load** Button to load the airway into the flight plan.

MODIFYING AN INDIVIDUAL AIRWAY IN A FLIGHT PLAN:

1 On the flight plan page touch the Airway heading bar to open the 'Airway Options' menu.
2 Touch the **Change Airway** Button to open the 'Airway Selection' window.
3 Touch the **Airway** Button to display the 'Select Airway' window.
4 If necessary scroll through the displayed list and select the desired airway by touching the airway button. A 'Select Exit' window will appear. The default view is listed sequentially, but can be changed to list the waypoints alphabetically by touching the **Alphabetical** Button.
5 Select the desired airway exit waypoint by scrolling through the displayed list and touching the exit waypoint. Review the 'Airway Selection' window.
6 If desired, modify the exit waypoint by touching the **Exit** Button and repeating step five.

REMOVING AN ENTIRE AIRWAY FROM THE FLIGHT PLAN:

1 On the flight plan page touch the Airway heading bar to open the 'Airway Options' menu.
2 Touch the **Remove Airway** Button.
3 A confirmation "Remove airway?" window will open. Touch the **OK** Button to remove the airway, or touch the **Cancel** Button to return to the previous menu.

ALONG TRACK OFFSETS

NOTE

Initiating a Direct-to may remove the along track offset waypoint symbol from the map display if the along track offset waypoint is before the end of the direct-to segment. However, the along track offset waypoint will still remain in the flight plan. If it's desired to have the along track offset waypoint redisplayed on the map, recreate the along track offset waypoint.

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

Offset distance is calculated as a radial distance from the reference waypoint rather than a direct distance. The system will place the offset waypoint in the flight plan leg for which the radial distance intersects, regardless of distance between preceding flight plan legs.

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

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

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

Altitude constraints can also be entered for the along track offset waypoint within the flight plan or as part of a VNAV Direct-to. An along track offset waypoint can also be used for lateral navigation, such as the creation of a direct-to destination (discussed previously), or as a part of a user-defined hold (discussed later).

INSERTING AN ALONG TRACK OFFSET WAYPOINT INTO THE FLIGHT PLAN:

1. Navigate to the flight plan application on the MFW, if required create a flight plan.
2. Touch the waypoint identifier button to open the 'Waypoint Options' window.
3. Touch the **More Options** Button.
4. Touch the **Track Offset** Button.
5. On the 'Along Track Waypoint Offset' numeric keypad select a direction (**Before (-)** or **After (+)**).
6. Enter a number between 1 and 999. If the track btween the waypoints is less than 999 the distance entered is restricted to the total distance between the two waypoints.
7. Touch the **Enter** Button.

REMOVING AN ALONG TRACK OFFSET WAYPOINT FROM THE FLIGHT PLAN:

1. Navigate to the flight plan application on the MFW, if required create a flight plan.
2. Touch the track offset waypoint identifier button to open the 'Waypoint Options' window.
3. Touch the **Remove Waypoint** Button.
4. Touch the **OK** Button.

   Or:

   Touch the **Cancel** Button to go back to the previous window.

   Or:

   Touch the **Delete Multiple** Button to choose multiple waypoints to delete at one time.

PARALLEL OFFSET

The Parallel Offset feature allows creation of FMS-generated waypoints that parallel the course from 1 to 50 NM left or right of the current flight plan. When Parallel Offset is activated, the course line drawn on the map shows the parallel course, and waypoint names have a lower case “-p” placed after the identifier.

While flying a parallel offset:

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

Parallel Offset is also canceled if a course change occurs greater than 120° or the parallel offsets overlap as a result of the course change. Deleting a portion of the Active Flight Plan may also cancel a parallel track.

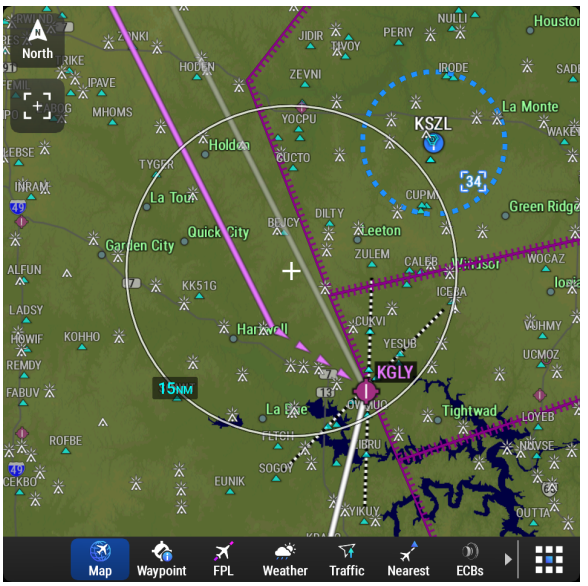


Figure 188: Parallel Offset on the MFW

ACTIVATING PARALLEL OFFSET FOR THE ACTIVE FLIGHT PLAN:

1. Navigate to the Flight Plan application on the MFW and if necessary load a flight plan.
2. Touch a waypoint identifier to open the 'Waypoint Options' window.
3. Touch the **More Options** Button.
4. Touch the **Parallel Track** Button.
5. Touch the **Start At** Datafield Button.
   a) Select **P.POS** to begin the parallel track at the present position of the aircraft.

      Or:

      Touch the waypoint identifier for the parallel track to begin.
6. Touch the **Distance** Datafield Button to change the distance from the course the parallel track will be.
   a) On the 'Offset Distance' keypad enter the distance desired and touch the **Enter** Button. A distance of 0.1 to 99.9 NM must be entered.
7. Touch the **Direction** Selection Button to change between **Left** and **Right** of the flight plan course.
8. Touch the **Intercept** Datafield Button.
   a) Using the 'Intercept Angle' keypad, enter an intercept angle between 10 and 50 degrees and touch the **Enter** Button.
9. Touch the **End Before** Datafield Button and select an endpoint for the offset from the provided list of valid endpoints.
10. Touch the **Load** Button to activate the parallel offset into the flight plan. A "-p" will appear to the right of all waypoints indicating the parallel offset is active for those waypoints in the flight plan. The waypoint identifier button where the offset begins will display the distance

and direction (L or R) of the offset and the waypoint identifier button that the offset ends will display "End P-Offset", indicating the end point for the parellel offset.

CANCELING PARALLEL OFFSET IN THE ACTIVE FLIGHT PLAN:

1 Navigate to the Flight Plan application on the MFW and if necessary load a flight plan.
2 Touch any waypoint identifier to open the 'Waypoint Options' window.
3 Touch the **More Options** Button.
4 Touch the **Parallel Track** Button.
5 Touch the **Cancel Offset** Button. The offset will be canceled and the flight plan will resume its normal route.

ACTIVATING A FLIGHT PLAN LEG

The system allows selection of a highlighted leg as the "active leg" (the flight plan leg which is currently used for navigation guidance). If necessary, the FMS will immediately provide a 45 degree intercept vector from the aircraft to the centerline.

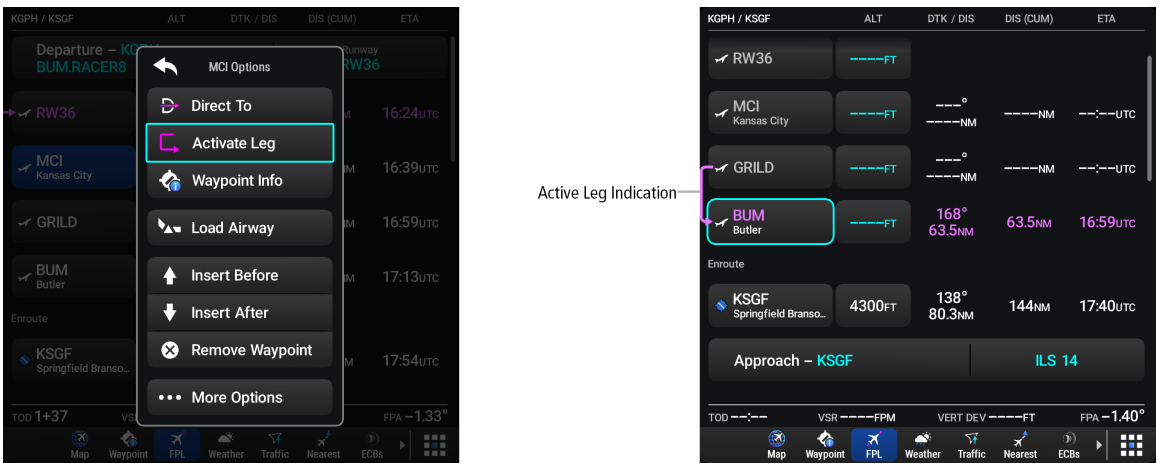


Figure 189: Activating a Flight Plan Leg

ACTIVATING A FLIGHT PLAN LEG (ACTIVE FLIGHT PLAN):

1 Navigate to the Flight Plan application on the MFW.
2 Touch the waypoint identifier button that the intended leg will end with. For example, in a flight plan with a leg from BUM to ANX, touch the ANX button to open the 'ANX Options' window.
3 Touch the **Activate Leg** Button. The FMS will immediately begin providing guidance for the newly activated leg.

HOLDING PATTERNS IN THE FLIGHT PLAN

NOTE

If a hold is required to be inserted on a waypoint in the Approach that is also included in the Missed Approach Procedure with a HOLD associated to it in the Missed Approach, then the system

will always default to the Missed Approach HOLD. A HOLD can be inserted in the approach section of the procedure by using the Pilot Defined Hold and not the Published Hold option.

NOTE

Holding pattern geometry is calculated using current ground speed. If the aircraft is above the future hold altitude, the calculated holding pattern may be larger than required. Performance management calculations for ETE and Fuel Remaining at the hold exit point will be affected, resulting in longer than expected ETE and less predicted fuel remaining.

A pilot-defined holding pattern can be created at any flight plan waypoint, at the aircraft present position, or at a direct-to waypoint. A published holding pattern can be entered into the flight plan if a published hold is available for the selected flight plan waypoint. Settings for the hold will be automatically selected based on the parameters of the published hold. If the pilot chooses to change any settings for the published hold, a pilot-defined holding pattern shall be entered instead. Holding patterns inserted at a flight plan waypoint are retained as part of the flight plan when storing an active or standby flight plan.

A hold-timer is displayed in the "Active-To" banner beneath the HSI when the aircraft is in a pilot-defined or published timed hold (a distance-based hold will not display this timer). This timer counts up from zero once the aircraft is established on the inbound path. When the To/From indication flips to "To" (the aircraft is abeam the holding waypoint) and the outbound leg begins, the timer will begin to count up again from zero. This count up timer is intended to decrease workload and increase situational awareness while holding.

When the selected waypoint is intersected by an airway, the quadrant (N, NE, NW, S, SE, etc) and airway shall be entered when loading the hold. When the selected waypoint is a part of a published hold, the setting shall be presented as '[Quadrant] as published'. Otherwise, the type of hold will be pilot-defined.

The system automatically enters SUSP Mode and suspends waypoint sequencing of a flight plan when crossing the HOLD waypoint. Once the hold is active, the system will remain in SUSP Mode until the pilot disables SUSP Mode, or uses the Exit Hold function, at which point guidance along the hold to the inbound course is provided and automatic waypoint sequencing is resumed. Refer to the *SUSP Mode* portion of the Flight Management section for more information.

Published holds that are part of an instrument procedure (departure, arrival, approach) shall be inserted in the flight plan when loading the procedure. See the *Procedures* portion later in this Flight Management Section for more information on loading procedures.

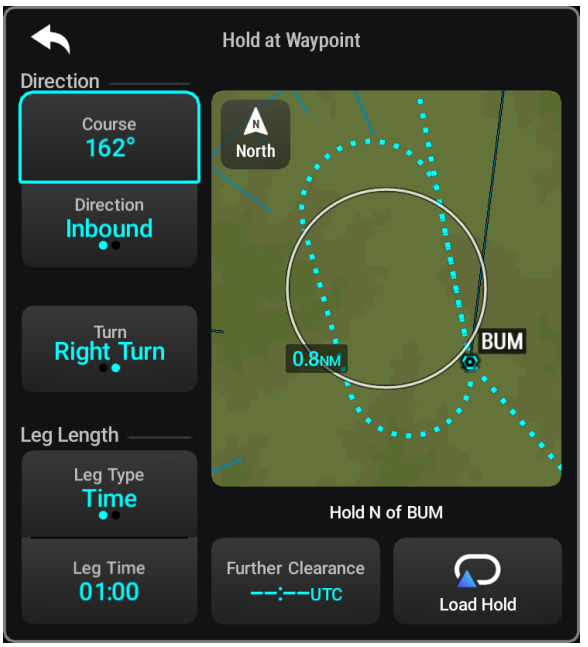


Figure 190: Creating a Hold Along an Intersecting Airway at a Waypoint

CREATING OR EDITING A HOLD AT A FLIGHT PLAN WAYPOINT:

NOTE

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

1. Navigate to the Flight Plan application on the MFW and load at least one flight plan waypoint into the flight plan.
2. Touch the desired waypoint identifier button to load the hold at.
3. Touch the **More Options** Button.
4. Touch the **Load Hold** Button.
5. Touch the **Course** Datafield Button.
   a) Using the 'Course' keypad, enter the inbound or outbound course desired and touch the **Enter** Button.
6. Touch the **Direction** Selection Button to switch between **Inbound** or **Outbound**.
7. Touch the **Turn** Selection Button to switch between **Right Turn** or **Left Turn**.
8. Touch the **Leg Type** Selection Button to switch between **Time** or **Distance**.
9. Touch the **Leg Time/Distance** Datafield Button.
   a) If entering a timed leg, use the 'Leg Time' keypad to enter a value between 00:30 and 09:59 minutes and touch the **Enter** Button.

      Or:

      If entering a distance leg, use the 'Leg Distance' keypad to enter a value between 1 and 99.9 NM and touch the **Enter** Button.
10. Touch the **Further Clearance** Datafield Button.

a) Using the 'Expect Further Clearance' keypad enter a value between 00:00 and 23:59 minutes and touch the **Enter** Button.
b) After entering an EFC the pilot may delete the EFC by touching the **Delete EFC** Button in the 'Expect Further Clearance' keypad window.

11 Touch the **Load Hold** Button to finish creating the hold in the flight plan.

CREATING A PILOT-DEFINED HOLD AT THE AIRCRAFT PRESENT POSITION:

NOTE

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

1 Navigate to the flight plan application on the MFW.

2 Press the **MENU** Softkey (on the flight plan application window side of the display bezel when in split screen mode).

3 Scroll if necessary and touch the **Hold at Present Position** Button.

4 Touch the **Course** Datafield Button.

a) Using the 'Course' keypad, enter the inbound or outbound course desired and touch the **Enter** Button.

5 Touch the **Direction** Selection Button to switch between **Inbound** or **Outbound**.

6 Touch the **Turn** Selection Button to switch between **Right Turn** or **Left Turn**.

7 Touch the **Leg Type** Selection Button to switch between **Time** or **Distance**.

8 Touch the **Leg Time/Distance** Datafield Button.

a) If entering a timed leg, use the 'Leg Time' keypad to enter a value between 00:30 and 09:59 minutes and touch the **Enter** Button.

Or:

If entering a distance leg, use the 'Leg Distance' keypad to enter a value between 1 and 99.9 NM and touch the **Enter** Button.

9 Touch the **Further Clearance** Datafield Button.

a) Using the 'Expect Further Clearance' keypad enter a value between 00:00 and 23:59 minutes and touch the **Enter** Button.
b) After entering an EFC the pilot may delete the EFC by touching the **Delete EFC** Button in the 'Expect Further Clearance' keypad window.

10 Touch the **Load Hold** Button to finish creating the hold in the flight plan.

ACTIVATING DIRECT-TO THE HOLD:

NOTE

Deleting the hold from an Active Flight Plan waypoint will remove the holding pattern from the flight plan, provide guidance to the active leg, and resume automatic waypoint sequencing.

1 After entering a hold into the flight plan touch the waypoint identifier indicating the hold point.

2 Touch the **Activate Hold** Button.

3 A confirmation window will open prompting the pilot, "Activate Leg?"

4 Touch the **OK** Button to confirm the activation. The FMS will immediately begin navigation guidance direct to the holding point waypoint.

Or:

Touch the **Cancel** Button to return to the 'Hold Options' window.

DELETING A HOLD FROM THE FLIGHT PLAN (HOLD NOT ACTIVE):

1 After entering a hold into the flight plan touch the waypoint identifier indicating the hold point.
2 Touch the **Remove Hold** Button.
3 A confirmation window will open prompting the pilot, "Delete hold at XXXX?"
4 Touch the **OK** Button to confirm the action.

Or:

Touch the **Cancel** Button to return to the 'Hold Options' window.

EXITING A HOLD AFTER THE HOLD IS ACTIVE:

1 Navigate to the Flight Plan application window on the MFW.
2 Touch the next waypoint identifier button after the hold in the flight plan to open the 'Waypoint Options' menu. Touch the **Direct-To** Button **> Activate** Button.

Or:

a) Touch the Hold waypoint identifier button to open the 'Hold Options' window.
b) Touch the **Exit Hold** Button. The pilot will be prompted with, "Exit hold at XXXX?"
c) Touch the **OK** Button to confirm the exit. The FMS will fly to the next waypoint in the flight plan on the next inbound leg.

Or:

Touch the **Cancel** Button to return to the 'Hold Options' window.

GRAPHICAL FLIGHT PLAN MODIFICATIONS

NOTE

When performing a graphical flight plan update, only execute the flight plan modification on the LRU where the flight plan modification was performed.

Graphical Edit Mode is activated by using the Graphical Reroute Button on the Radial Menu or holding a waypoint or flight plan leg on the 'Map' and Weather' Application pages. Once Graphical Edit Mode is active, the Modification Button Bar is displayed and waypoints or locations on the map may be touched to reroute a new leg in the Active Flight Plan.

Figure 191: Graphically Adding a Waypoint to the End of the En Route Section of the Active Flight Plan

When rubber banding a leg or waypoint, the Search Radius surrounding the grab point is displayed inside a white circle. When editing the flight plan on the 'Map' Application page the Map Data Box is displayed above the circle. Displayed in the Map Data Box is the perpendicular distance from the original grab point and course angle offset from the original leg to the center of the search radius.

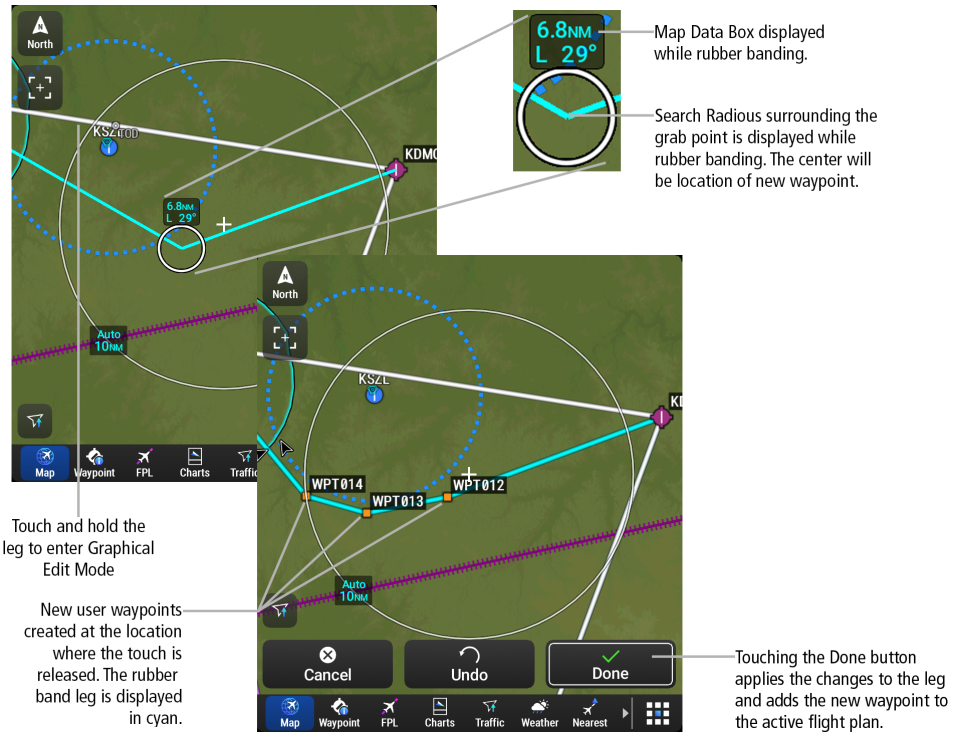


Figure 192: Graphically Editing a Flight Plan, Rubber Banding a Leg

ACTIVATING GRAPHICAL FLIGHT PLAN EDIT MODE:

NOTE

Users must become familiar with the following procedures before flight to ensure adequate understanding of the Graphical Flight Plan Edit Mode.

With a flight plan active, navigate to the 'Map' or 'Weather' Application Page on the MFW.

a) Touch the desired flight plan waypoint on the map, opening the Radial Menu. (The reroute will begin after the selected waypoint.)

b) To activate Graphical Edit Mode, touch the Graphical Reroute Button on the Radial Menu.

Or:

a) To adjust the flight plan by rubber banding, touch and hold a flight plan waypoint or route until the white Search Radius circle appears.

b) Continue to touch and hold while dragging the grab point (rubber banding) to a new location on the map.

Once this initial modification has been made, additional modifications may also be made before accepting any changes.

Once Graphical Flight Plan Mode is activated, the flight plan can be modified using either the rubber band method or by tapping the map to insert waypoints. The following procedures describe each method individually; however, they can be used together.

GRAPHICALLY ADDING WAYPOINTS USING THE GRAPHICAL REROUTE BUTTON:

1 Open the Radial Menu from which the flight plan is to be edited.

2 Touch the Graphical Reroute Button on the Radial Menu.

3 Tap the desired locations for waypoints to be added between the initially selected waypoint and the subsequent waypoint. If no location is within the white Search Radius circle, a temporary user waypoint is created. If multiple waypoints are in the white Search Radius circle a "Nearest Item" window will appear.

a) Scroll if necessary through the "Nearest Items" window to find the waypoint desired and touch it to add that waypoint to the flight plan.

4 The new route will be highlighted in cyan.

5 If necessary, touch the **Undo** Button to undo the most recent change made before continuing in Graphical Edit Mode.

6 If adding multiple waypoints, repeat Step 3 until all desired changes are complete.

7 Touch the **Done** Button to apply all changes to the active flight plan and exit Graphical Edit Mode.

Or:

Touch the **Cancel** Button then touch the **OK** Button to remove all changes and exit Graphical Edit Mode.

GRAPHICALLY ADD WAYPOINTS TO THE END OF THE EN ROUTE SECTION OF THE ACTIVE FLIGHT PLAN:

1. Open the Radial Menu over the last waypoint in the flight plan on the 'Map' Application page or 'Weather' Application page.
2. Touch the Graphical Reroute Button on the Radial Menu.
3. Touch anywhere on the map to add a new waypoint to the end of the flight plan. If no waypoints are located inside the white Search Radius circle, a temporary user waypoint is created. If multiple waypoints are in the white Search Radius circle a "Nearest Item" window will appear.
   a) Scroll if necessary through the "Nearest Items" window to find the waypoint desired and touch it to add that waypoint to the end of the flight plan.
4. After selecting the desired point the new route to it is highlighted in cyan.
5. Additional waypoints may be added at the end of the flight plan by selecting new point on the map.
6. If necessary, touch the **Undo** Button to undo the most recent change made before continuing in Graphical Edit Mode.
7. If adding multiple waypoints, repeat Step 3 until all desired changes are complete.
8. Touch the **Done** Button to apply all changes to the active flight plan and exit Graphical Edit Mode.

   Or:

   Touch the **Cancel** Button then touch the **OK** Button to remove all changes and exit Graphical Edit Mode.

GRAPHICALLY ADDING WAYPOINTS USING THE RUBBER BAND METHOD:

1. Activate Graphical Flight Plan Edit Mode.
2. Touch and hold an existing waypoint or flight plan leg on the map until the white Search Radius appears.
3. Continue to hold, and drag the point to a new location on the map. If no waypoints are located inside the white Search Radius circle, a temporary user waypoint is created. If multiple waypoints are in the white Search Radius circle a "Nearest Item" window will appear.
   a) Scroll if necessary through the "Nearest Items" window to find the waypoint desired and touch it to add that waypoint to the flight plan.
4. After releasing the selected waypoint, the new route to it and from it will be highlighted in cyan.
5. If necessary, touch the **Undo** Button to undo the most recent change made before continuing in Graphical Edit Mode.
6. If adding multiple waypoints, repeat Steps 2 and 3 until all desired changes are complete.
7. Touch the **Done** Button to apply all changes to the active flight plan and exit Graphical Edit Mode.

   Or:

Touch the **Cancel** Button then touch the **OK** Button to remove all changes and exit Graphical Edit Mode.

GRAPHICALLY REMOVING WAYPOINTS USING THE GRAPHICAL REROUTE BUTTON:

1. Open the Radial Menu over the waypoint from which the modification will begin.
2. Touch the Graphical Reroute Button on the Radial Menu.
3. Touch the waypoint where the modification should end on the map. A cyan route will appear between the two waypoints displaying the modification. All waypoints between the two selected will be deleted.
4. If necessary, touch the **Undo** Button to undo the most recent change made before continuing in Graphical Edit Mode.
5. Touch the **Done** Button to apply all changes to the active flight plan and exit Graphical Edit Mode.

   Or:

   Touch the **Cancel** Button then touch the **OK** Button to remove all changes and exit Graphical Edit Mode.

GRAPHICALLY REMOVING WAYPOINTS USING THE RUBBER BAND METHOD:

1. Activate Graphical Flight Plan Edit Mode.
2. Touch and hold the waypoint you want to delete until the white Search Radius appears.
3. Drag that waypoint to the preceding or subsequent waypoint in the flight plan. The selected waypoint between the two waypoints is deleted from the route.
4. If necessary, touch the **Undo** Button to undo the most recent change made before continuing in Graphical Edit Mode.
5. If removing multiple waypoints, repeat Step 3 until all desired changes are complete.
6. Touch the **Done** Button to apply all changes to the active flight plan and exit Graphical Edit Mode.

   Or:

   Touch the **Cancel** Button then touch the **OK** Button to remove all changes and exit Graphical Edit Mode.

VIEW LATERAL AND VERTICAL NAVIGATION FOR THE FLIGHT PLAN

NOTE

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

NOTE

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

NOTE

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

FLIGHT PLAN NAVIGATION INDICATIONS

Lateral navigation along the Active Flight Plan shall be displayed and can be supplied to the Flight Director (FD). Active and upcoming flight plan legs are displayed on maps and in the Active Flight Plan. The system displays a calculated turn anticipation arc, and can display 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. If the active FD mode is sourcing the FMS for use, the FD will follow the displayed guidance.

Components in the flight plan shall be displayed in magenta when part of the active leg or active VNAV waypoint, cyan when designated for upcoming guidance, or white when considered advisory (not used for active guidance and not designated for upcoming guidance). See the AFCS Section for information regarding lateral and vertical FD Modes for active and upcoming guidance.

The system shall also calculate a vertical profile considering all waypoints/legs and constraints in the flight plan, and current aircraft conditions to calculated a vertical profile. Vertical navigation (VNAV) complying with constraints in the Active Flight Plan as well as VNAV direct-to navigation can be supplied to the FD. VNAV guidance is based on barometric altitudes, not on GPS altitude.

Amber text in the flight plan indicates a constraint in the vertical profile is unattainable due to current aircraft performance. A constraint that is crossed in the flight plan indicates the system has determined this constraint to be invalid based on aircraft limitations or logical sequencing of the constraint within the flight plan. Constraint validity is continuously monitored and may be adjusted by the system as the flight progresses.

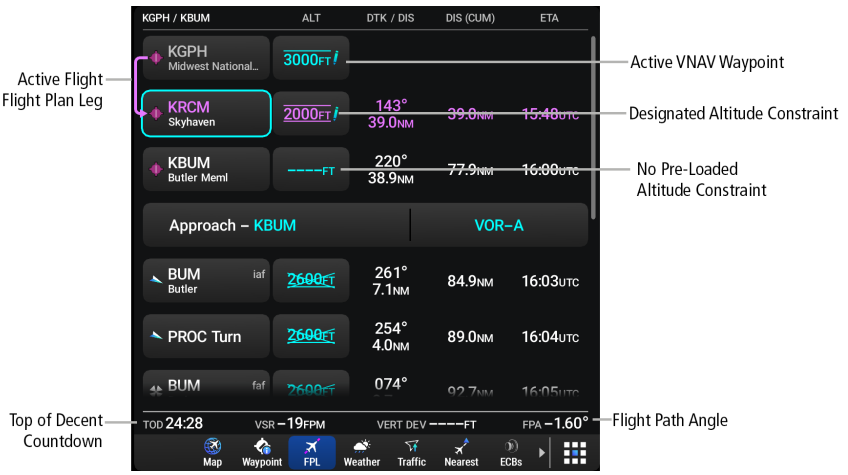


Figure 193: Flight Plan Navigation Status

VNAV guidance may include the active VNAV waypoint identifier, Target Altitude, VS Required, Top of Descent (TOD), Bottom of Descent (BOD), and descent vertical deviation. The VNAV guidance to be displayed depends upon VNAV profile parameters (such as FPA), and aircraft location relative to the VNAV profile. The VNAV guidance will also provide a Vertical Track Tone when the aircraft is within one minute of reaching a BOD or TOD perimeter.

PFW NAVIGATION STATUS

Navigation status for the active leg is displayed on the PFW. This status shall include the Navigation Mode, RNP Level or Approach Service Level, as well as distance and ETE to the next waypoint. Navigation prompts may also be displayed to inform of upcoming route/VNAV changes. Navigation Mode indicates which navigation source is providing the course data (e.g., FMS, VOR), the RNP level, and approach service level (LNAV, LNAV+V, L/VNAV, LP, LP+V, LPV, VISUAL).

Figure 194: FMS Navigation Information on the PFW

The following symbols may be displayed on the PFW to indicate navigation status:

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

Table 22: PFW Navigation Status Box Symbols

ARRIVAL ALERT SETTINGS

An arrival alert can be set to notify the pilot with a message upon reaching a user-specified distance or time from the final destination (the direct-to waypoint or the last waypoint in a flight plan).

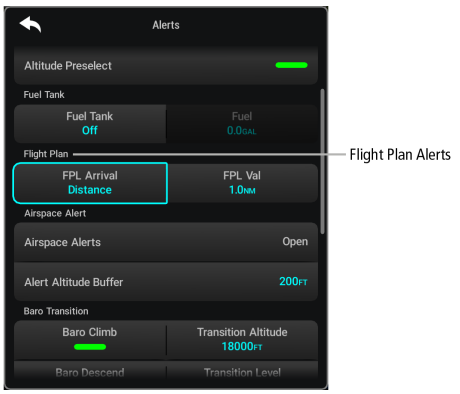


Figure 195: Enabling Arrival Alerts

MODIFYING THE ARRIVAL ALERT SETTINGS:

1 Navigate to the 'Apps' window by pressing the **MENU** Softkey two times.

Or:

Touch the **Applications** Icon on the Applications Bar.

2 Touch the **Settings & Tools** Tab.

3 Touch the **Alerts** Button.

4 Scroll if necessary to the 'Flight Plan' section of the 'Alerts' Settings Window and touch the **FPL Arrival** Selection Button.

a) Choose from **Off**, **Distance**, or **Time**.

5 If **Time** is selected touch the **FPL Time** Datafield Button.

a) Use the 'FPL Time' keypad to enter a value in hours and minutes (X+XX).

6 If **Distance** is selected touch the **FPL Val** Datafield Button.

a) Use the 'FPL Val' keypad to enter a value in nautical miles (XXX.X).

7 To turn the alert off select the **Off** option.

PFW/MFW DATA BAR

The Data Bar is always displayed at the top of the PFW/MFW. If desired, the pilot can change which fields are displayed. For more information refer to the *Data Bar* section in System Overview.

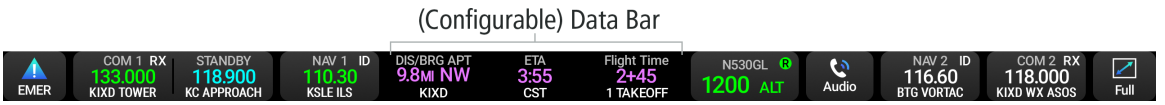


Figure 196: (Configurable) Data Bar

NOTE

The MSA altitude displayed will equal the highest grid MORA (Minimum Off Route Altitude) within a 10 mile square, surrounding the aircraft. The square is aligned to the cardinal directions and

provides 1,000 ft separation (2,000 ft in designated mountainous terrain within the U.S.). Grid MORA data (or its equivalent) must be present in the database to provide an MSA value.

VERTICAL SITUATION DISPLAY

NOTE

Certain leg types (e.g., holds, heading legs) do not support VNV PATH descents as the lateral distance of those legs is unknown. The VSD will not show a VNV profile for legs with no vertical path guidance.

The Vertical Situation Display (VSD) represents a vertical view of the map display. The VSD horizontal range is equal to the map range when the VSD is in Track mode. When the VSD is in Flight Plan mode, the horizontal range is the lower of: twice the indicated range; or the lowest range that displays all of the remaining Active Flight Plan. The VSD altitude range automatically changes when the map range is changed to keep a ratio of altitude range to horizontal range (until display limits are met). At ranges above the maximum, the altitude range remains constant at the maximum. VSD range may also be adjusted independently from the map display. See the following tables for information on VSD Modes and the Width of Swath.

The following components for flight management may be displayed on the VSD:

- Airspace Boundaries
- Vertical Track Vector
- Climb/Cruise/Descent VNAV
- Modified Flight Plan
- Flight Plan Waypoints and Constraints
- Holding Pattern Depiction
- Advisory Descent
- Approach and Missed Approach
- Runway Symbols

Figure 197: VSD Inset on MFW 'Map' Application Page

VSD range can be adjusted independently from the map display. Pan Mode is available while Flight Plan Mode (including Modified Flight Plan Mode) is selected.

VSD Mode Button	Displayed Mode	FPL Criteria	Items available on VSD
AUTO TRK Button	AUTO FPL	Available active FPL & aircraft within FPL swath	Terrain/obstacles along the Active Flight Plan route, vertical track vector, selected altitude, and Active Flight Plan information [1]
	AUTO TRK	(1) Active FPL available & aircraft not within FPL swath, or (2) Active FPL not available	Terrain/obstacles along the current track, vertical track vector, and selected altitude
FPL Button	FPL	Active FPL available	Terrain/obstacles along the Active Flight Plan route, vertical track vector, selected altitude, and Active Flight Plan information [1]
		Active FPL not available	Only shows message 'Flight Plan Not Available'

VSD Mode Button	Displayed Mode	FPL Criteria	Items available on VSD
TRK Button	TRK	N/A	Terrain/obstacles along the current track, vertical track vector, and selected altitude
[1] Active flight plan information consists of waypoints, associated altitude constraints, current VNV profile, TOD/BOD, and destination runway.			

Table 23: VSD Mode Description

The terrain depicted on the VSD is the highest point within the width of the swath determined by the phase of flight. In some instances when the width of the swath changes dramatically the terrain depiction on the VSD may display an abrupt vertical discrepancy. The scenario that this may be noticed the most is while flying an approach that is loaded into the flight plan where the swath jumps from a 0.6 NM swath to a 2.0 NM swath at the missed approach point.

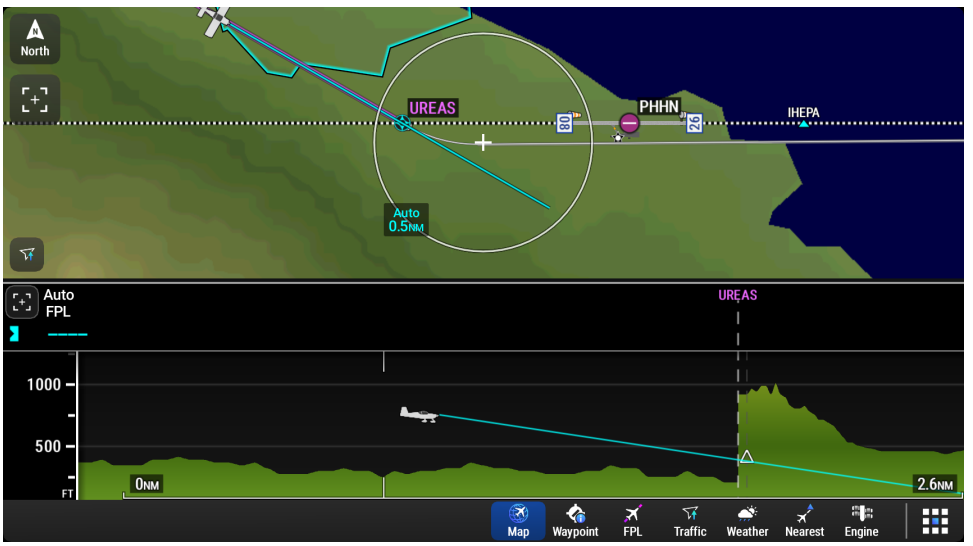


Figure 198: Swath Width Terrain Discrepancy on the VSD

Flight Phase	Swath Width (NM)
Departure	2.0
En Route	4.0
Arrival	2.0
Approach (before FAF waypoint)	2.0
Approach (after FAF waypoint)	0.6
Missed Approach	2.0

Table 24: Swath Width

VSD AIRSPACE BOUNDARIES

Airspace boundaries as defined in the Navigation Database can be shown on the VSD. Airspace symbols on the VSD reflect what is shown on other map displays in a vertical form. If the aircraft is within an airspace boundary, the airspace is displayed in semi-transparent shading. The VSD defaults to drawing airspaces as defined in 'Map Settings', with the additional ability for the pilot to enable/disable airspace viewing specifically on the VSD.

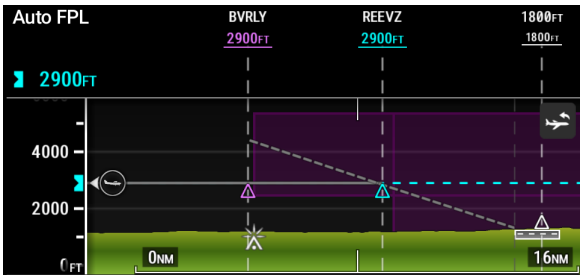


Figure 199: Airspaces on the VSD

VSD VERTICAL TRACK DISPLAY

The aircraft's vertical track vector is displayed in cyan. The length of the vector is equal to the distance the aircraft will travel, relative to the swath's centerline at the current position, at the current ground speed and vertical speed. The slope of the vector is relative to the aircraft's current climb or descent gradient (altitude change per horizontal distance traveled). The track vector look-ahead time is selectable (30 sec, 60 sec (default), 2 min, 5 min) and determines the length of the track vector.

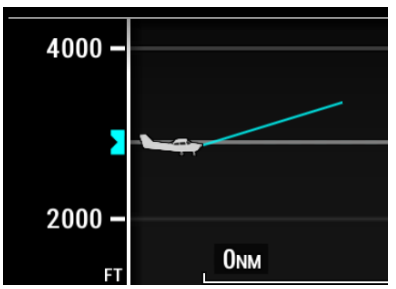


Figure 200: Vertical Track Vector on the VSD

VSD CLIMB/CRUISE/DESCENT VNAV

The position of the aircraft symbol on the vertical scale of the VSD is at the bottom for climb-out, in the middle while enroute (cruise) or if the phase is unknown, and close to the top during a descent.

Climb legs beginning from a waypoint ahead of the aircraft or from the aircraft position shall be shown as a horizontal line at the altitude of the next altitude constraint or at the cruise altitude when the aircraft is past the last climb altitude constraint in the flight plan.

The VSD will display the cruise altitude (shown as a horizontal line) as the highest of the departure airport elevation, current altitude, highest planned performance cruise altitude,

highest valid constraint in the flight plan, selected altitude, or destination airport elevation. If the aircraft climbs above the planned performance cruise altitude or the selected altitude is set above the entered cruise altitude, the performance cruise altitude and VSD horizontal line will follow the altitude upward.

While enroute and flying to the first descent point, the VSD will display the horizontal line that intercepts the descent at the TOD. Normally, the aircraft will be displayed at the same altitude as the horizontal line and descend at the TOD.

If the aircraft descends before the TOD, the horizontal line may or may not change at that time. If the aircraft is more than 50 NM from the TOD, and the aircraft descends, then the TOD may be removed, and the system will display the horizontal line as the aircraft altitude, highest valid constraint in the flight plan, pilot entered performance cruise altitude (only if the aircraft never reached this cruise altitude), or selected altitude, whichever is highest. If the aircraft is 10 to 50 NMs from the TOD, and the aircraft descends, then the TOD may be removed, and the system will display the horizontal line as the aircraft current altitude, highest valid constraint in the flight plan, or selected altitude, whichever is highest. Updating the cruise altitude and selected altitude to the current or lower expected altitude will likely re-display the TOD. As previously described, the TOD will always appear once 10 NM from the computed descent path. During the descent phase, the flight plan vertical profile shall match VNAV guidance.

The following climb and descent symbols can be displayed on the VSD:

Condition	Climb/Descend Icon
If the active leg's flight plan line is above the highest altitude shown on the VSD, a climb icon will be displayed to the right of the ownship symbol. [1]	
If the active leg's flight plan line is below the lowest altitude shown on the VSD, a descend icon will be displayed to the right of the ownship symbol. [1]	
[1]This symbol will be displayed in magenta when it is supplying guidance for the active Flight Director (FD) mode, cyan when it will be used for the armed FD mode, green when it is part of the active flight plan leg but not being used for the active FD mode, and white when it is part of the preceding leg or a future leg in the flight plan.	

Table 25: VSD Climb/Descent Icons

VSD FLIGHT PLAN WAYPOINTS

Waypoint constraint values are displayed below the waypoint label, using the same color and format as the Active Flight Plan. Refer to *Altitude Constraints* in this section for more information.

If two waypoints are close together, and their labels or constraint values overlap enough to obscure any text, one waypoint label/constraint value is removed and the vertical dashed line for that waypoint is displayed as darker gray. The priority for which waypoint remains

displayed is: (1) the current active-to waypoint, (2) waypoint with an altitude constraint, and (3) waypoint closer to the aircraft.

Additionally, a constraint icon is displayed on the VSD along the vertical profile path for each flight plan waypoint altitude constraint. The tip of each constraint icon represents the AT portion of an AT-or-ABOVE / AT-or-BELOW constraint type, pointing up / down, respectively. Two opposing icons pointing to the same barometric altitude represent an AT constraint type. Two opposing icons pointing at different barometric altitudes represent a BETWEEN constraint type.

VSD HOLDING PATTERN DEPICTION

Each hold leg is displayed one or more times on the VSD. When the hold is to be terminated at a specific altitude or other manual input by the pilot, the VSD will show one additional hold so the following path and terrain after the hold are shown before reaching the hold waypoint.

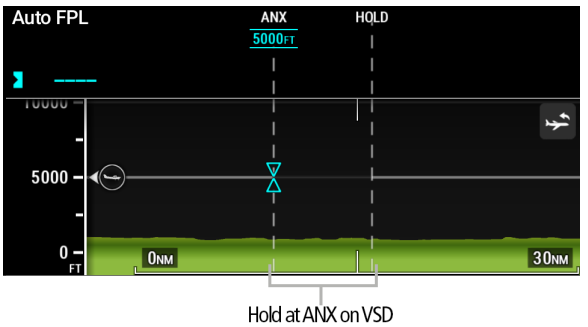


Figure 201: Holding Pattern on the VSD

VSD APPROACH AND MISSED APPROACH

Approach and Missed Approach waypoints shall be displayed on the VSD. The glideslope or glidepath will be displayed as a dashed gray line when inactive. The glideslope shall be displayed in magenta when it is active, and the glidepath shall be displayed in magenta when it is active.

If a Vectors-to Final approach has been loaded but not activated, a discontinuity may be displayed on the VSD between the last enroute or arrival waypoint to the final approach course.

If MAP vertical guidance is specified, the profile of the missed approach shall be displayed on the VSD. It shall be displayed in gray until it becomes the active leg, at which point is displayed in magenta. As the width of the swath for the terrain expands at the MAP, the terrain height may appear as an abrupt vertical discrepancy on the VSD. For more information on the swath width see the information in *Vertical Situation Display*.

The position of the aircraft symbol on the vertical scale shall be depicted on the bottom of the VSD for climb-out on the missed approach. Once the selected altitude is reached, the aircraft symbol shall be depicted in the middle of the VSD (as if in the cruise phase).

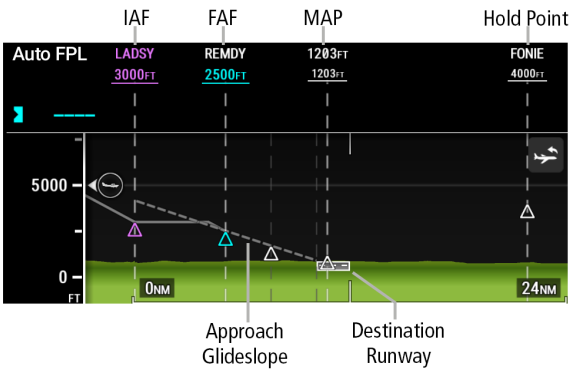


Figure 202: Approach on the VSD

VSD BAROMETRIC AND TEMPERATURE COMPENSATED MINIMUMS

If temperature compensation has been applied, a snowflake symbol will also be displayed for all waypoints encompassing the approach. See the *Temperature Compensation* discussion later in this section for information on setting approach barometric and temperature compensated minimums.

METAR information can also be used to display a ceiling/visibility on the VSD. See the *Hazard Avoidance* Section for more information.

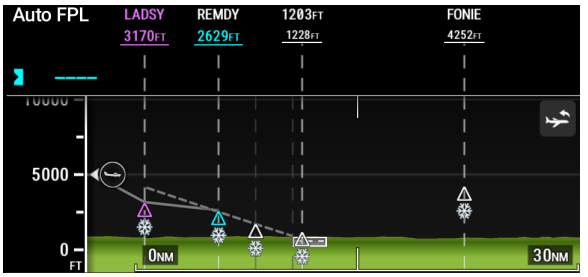


Figure 203: Temperature Compensated Minimums on the VSD

VSD RUNWAY SYMBOLS

The approach runway can be displayed on the VSD.

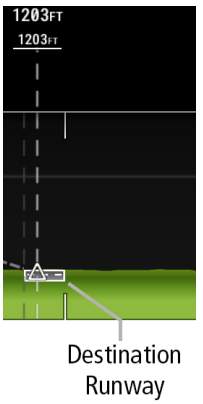


Figure 204: Runway on the VSD

VSD MESSAGES

Under certain conditions, some messages may appear in conjunction with others:

Message	Description
'Loading…'	VSD is loading data due to a range change, full/half switch, or first being selected for display.
'Flight Plan Not Available'	Flight Plan mode is selected and there is not a flight plan loaded with at least one leg.
'Ownship Position Unknown'	Flight Plan mode is selected and the ownship's position is unknown or cannot be accurately placed on the VSD
'GPS Altitude Fail'	Track mode is selected and GPS altitude has been lost.
'VSD Not Available'	At least one of the following is true: ● Valid terrain database not available ● Current barometric altitude not available ● Current heading is not available ● GPS position not available ● An invalid range error has occurred

Table 26: VSD Messages

VSD PROCEDURES

ENABLING/DISABLING THE VSD:

1 Open the MFW Map Menu

2 Touch the **VSD** Button (a green indicator will illuminate when enabled).

ADJUSTING THE RANGE ON THE VSD INDEPENDENT OF THE MAP RANGE:

Touch the VSD using a Pinch gesture to increase the range or a Zoom gesture to decrease the range.

PANNING THE VSD:

Touch and drag the VSD to pan. When finished, touch the Return to Center Button to exit panning mode on the VSD.

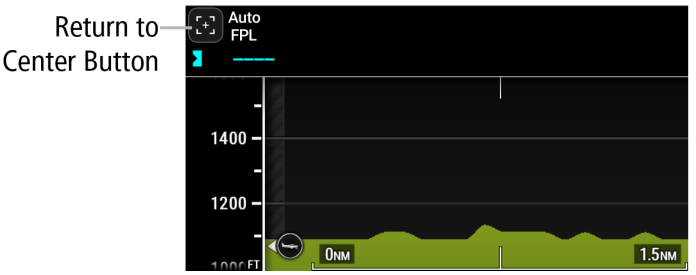


Figure 205: Return to center Button

ENABLING/DISABLING AIRSPACE VIEWING ON THE VSD:

1 Open the MFW Map Menu.
2 Scroll down and touch the **Map Settings** Button.
3 Touch the **Airspace** Tab.
4 Touch the airspace buttons to enable/disable airspace overlays on the VSD.

ENABLING/DISABLING THE VSD VERTICAL TRACK VECTOR:

1 Open the MFW Map Menu.
2 Scroll down and touch the **Map Settings** Button.
3 Touch the **General** Tab.
4 Touch the **Track Vector** Indicator Button (green annunciation indicates that it is enabled).

SELECTING THE VSD TRACK VECTOR SETTINGS LOOKAHEAD TIME:

1 Open the MFW Map Menu.
2 Scroll down and touch the **Map Settings** Button.
3 Touch the **General** Tab.
4 Touch the Track Vector **Duration** Button to display the 'Duration' Window.
5 Touch one of the options displayed to change the duration of the track vector.

VNAV DIRECT-TO

The system can calculate a VNAV direct-to path for any descent constraint in the Active Flight Plan. See the *Vertical Navigation Modes (VNAV)* portion of the AFCS section for information of using the FD to follow the VNAV direct-to path. The system is capable of performing VNAV Direct-to in the following ways:

- **Descent with complex active VNAV constraint:** VNAV Direct-to is selected for the active VNAV waypoint and the active VNAV waypoint is a complex altitude constraint. Initiating the VNAV direct-to shall create a vertical profile beginning in front of the aircraft at its present position. The complex altitude constraint of the active leg shall be maintained, and a vertical profile based on a flight path angle from the present position to the next AT

constraint shall be complied with. This behavior can be activated by touching the **VNAV Direct To** Button and then selecting the first option listed on the 'Select VNAV Direct To' Window (this option will display the complex altitude constraint).

- **Descent to a constraint at a waypoint (constraints before waypoint are removed):** VNAV Direct-to is selected for a descent altitude constraint in the flight plan. Initiating the VNAV direct-to shall create a vertical profile beginning in front of the aircraft at its present position. The selected altitude constraint is converted to an AT constraint. All altitude constraints before the selected constraint are removed from the flight plan to allow for a continuous descent profile to the waypoint of the selected altitude constraint.

The system allows a vertical navigation (VNAV) direct-to for any waypoint in the active flight plan with an altitude descent constraint designated (cyan text) for vertical guidance. Initiating the VNAV direct-to allows the flight plan to be flown, while vertical guidance based on the altitude constraint at the VNAV direct-to waypoint is provided. The altitude change begins on the current leg and is spread along the flight plan from current position to the vertical direct-to waypoint, not just along the leg for the direct-to waypoint. A TOD point is computed based on this altitude change; guidance for descent begins once the TOD is reached.

Once VNAV direct-to is activated, all VNAV altitude constraints before the VNAV direct-to waypoint are removed from the active flight plan. All VNAV altitude constraints following the VNAV direct-to waypoint are retained.

Figure 206: VNAV to an Altitude Constraint at a Waypoint Before Activation

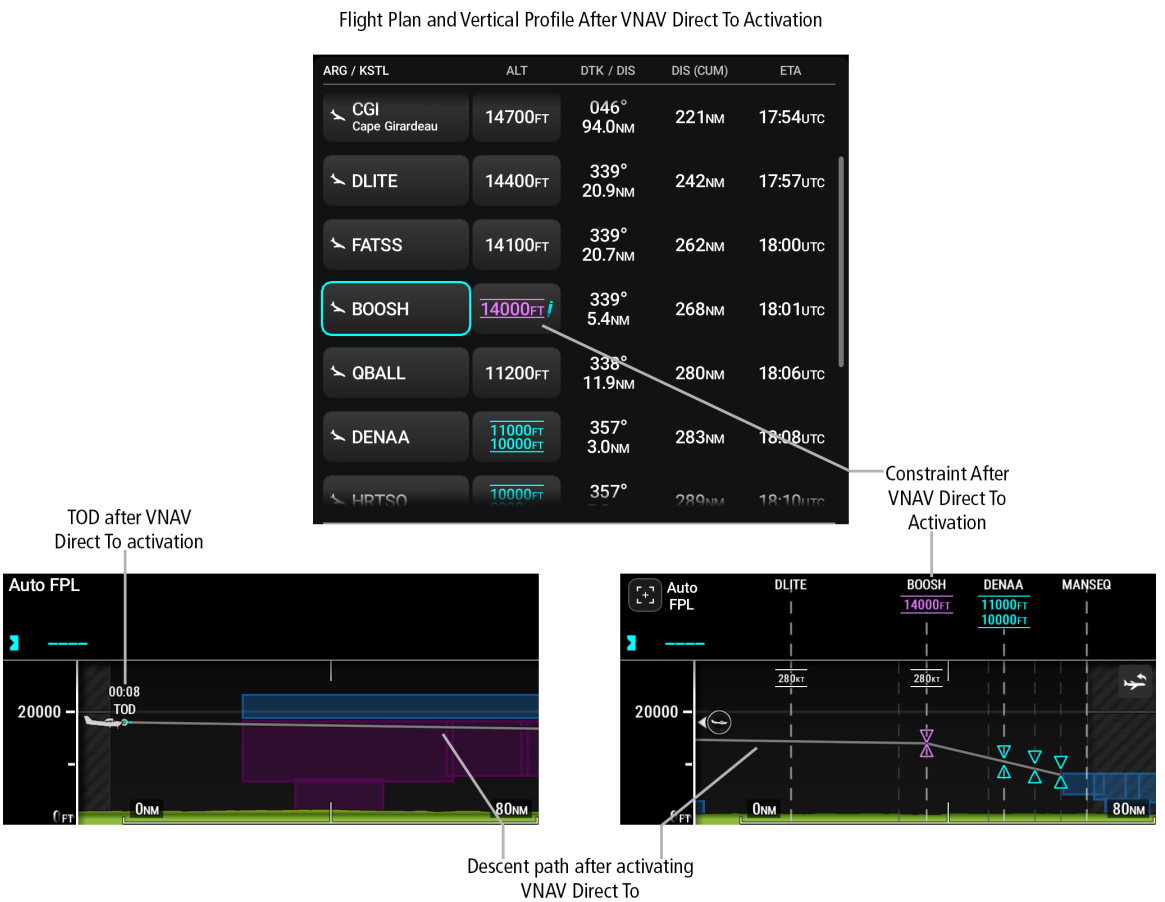


Figure 207: VNAV to an Altitude Constraint at a Waypoint After Activation

ACTIVATING A VERTICAL NAVIGATION DIRECT-TO TO AN ALTITUDE CONSTRAINT AT A WAYPOINT:

1 With a flight plan loaded into the system navigate to the Flight Plan Application Page.
2 Touch the Altitude Constraint button that is desired to be an Active VNAV Direct To.
3 Touch the **VNAV Direct To** Button.

Refer to the procedures in the *Altitude Constraints* section earlier in this chapter for information on deleting or reverting VNAV Altitude Constraints.

MANAGING FLIGHT PLANS

The pilot can manage flight plans by storing, copying, inverting, and deleting them. Flight plans may also be imported/exported using a USB device inserted in the USB port on the flight display, using Bluetooth functionality, or imported from the cloud if the GDL® 60 is installed. Also, the name of each flight plan can be changed to something that is useful for identification and sorting.

ACTIVE FLIGHT PLAN RETENTION

After applying power to the system, the previously Active Flight Plan is retained and automatically repopulated if the aircraft position is at the origin airport and the aircraft is on the ground. If, however, the aircraft is not at the origin, on the ground, or if more than 12 hours have passed since the last Active Flight Plan modification, the previously Active Flight Plan is not retained.

IMPORTING AND EXPORTING FLIGHT PLANS

NOTE

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

Flight plans may be imported from the cloud, or from a personal electronic device (PED) over Wi-Fi/ Bluetooth (from Garmin Pilot™), or from a USB. Flight plans may also be exported to a USB.

WIRELESS TRANSFER FROM PERSONAL ELECTRONIC DEVICE

If a Personal Electronic Device (PED) is paired to the system, the pilot can choose to allow a Garmin Pilot™ flight plan to be imported wirelessly from the PED. See the PED's Bluetooth pairing instructions and the connection instructions in the Garmin Pilot application. Once a PED with Garmin Pilot has been connected to the AXIS™ flight display, flight plans can be shared between the PED and the AXIS system.

Sending a flight plan to the Garmin Pilot application is done using the app on the PED. For instructions on how to send flight plans to the Garmin Pilot app, see the "Loading a flight plan from a display unit to Garmin Pilot" procedure in the applicable Garmin Pilot User's Guide.

ACTIVATING/SAVING/IGNORING A FLIGHT PLAN IMPORT FROM A PED (GARMIN PILOT):

1. After a flight plan has been sent using Garmin Pilot™, a window will prompt the pilot on the AXIS™ flight display.
2. Touch the **Activate** Button to activate the flight plan/

   Or:

   Touch the **Save** Button to save the flight plan to the Flight Plan Catalog.

   Or:

   Touch the **Ignore** Button to reject the flight plan from being imported to the display.

IMPORT FROM USB

Flight Plans may be imported or exported by using a USB flash drive. The flight plan files to be imported will have a .fpl extension and must be saved in the root level on the USB. Stored flight plans may be exported to a USB. If the name of the selected flight plan matches a flight plan already saved on the USB, a pop up message will be displayed to confirm overwriting the existing flight plan. If the export fails, a pop up message concerning the error is displayed.

NOTE

The exported flight plan will not contain any procedures or airways. The flight plan origin/destination airport will be exported, but as the first and last waypoint, not the origin and destination.

IMPORTING A FLIGHT PLAN FROM A USB:

1. Insert a USB into the flight display USB port.
2. Navigate to the Flight Plan Application Page on the MFW. (See the *Stored Flight Plan Functions* section for more information on creating, adding, and storing flight plans into the flight plan catalog.)
3. Press the **MENU** Softkey to open the Flight Plan Menu.
4. Touch the **Flight Plan Catalog** Button.
5. Touch the **Menu** Button in the upper right corner of the 'Flight Plan Catalog' window.

   Or:

   Press the **MENU** Softkey to open the 'Flight Plan Catalog Menu'.
6. Touch the **Import From USB** Button. A list of flight plans that are saved on the USB will appear on the 'Import Flight Plan' window with the File Name and the date/time stamp the flight plan was created.
7. Scroll if necessary to the desired flight plan to be imported and touch it.

   Or:

   Touch the **Import All** Button to transfer all flight plans from the USB to the flight display.
8. If flight plans exist in the AXIS™ Flight Display with the same name, a prompt will ask the pilot if the existing files should be overwritten.
   a) Touch the **Yes** Button to overwrite the existing flight plan file.

      Or:

   a) Touch the **No** Button in import the flight plan using the same naming convention.

      Or:

   a) Touch the **Cancel** Button to stop importing the flight plan.
9. A "Flight plan(s) successfully imported." message will prompt the pilot that there were no issues importing the flight plan(s).
   a) If the import failed or was partially successful, the applicable message will be displayed from the following list. For assistance contact the Garmin® Support Center.
      - "Flight plan import failed."
      - "Flight plan catalog limit reached. Import failed."
      - "File contained user waypoints only. User waypoints imported successfully. No stored flight plans were changed."
      - "File contained user waypoints only."
      - "Flight plan partially imported."
      - "Too many points. Flight plan truncated."
      - "Some waypoints not loaded. Waypoints locked."

- "User waypoint database full. Not all loaded."
- "Unable to load unsupported airway in flight plan."
- "Unable to load unsupported procedure in flight plan."
- "Unable to load unsupported element in flight plan."
- "One or more user waypoints renamed."

b) Touch the **OK** Button to dismiss the message.

EXPORTING A STORED FLIGHT PLAN TO A USB:

1 Insert a USB into the flight display USB port.

2 With a flight plan stored into the Flight Plan Catalog navigate to the Flight Plan Application Page on the MFW. (See the *Stored Flight Plan Functions* section for more information on creating, adding, and storing flight plans into the flight plan catalog.)

3 Press the **MENU** Softkey to open the Flight Plan Menu.

4 Touch the **Flight Plan Catalog** Button.

5 Touch a saved flight plan to be exported.

6 Touch the **Export** Button, opening the 'Export Flight Plan' window.

7 If desired, change the name of the route (which auto populates as the first and last waypoint in the flight plan):

a) Touch the **Route Comment** Datafield Button.

b) Using the keyboard enter a name for the route to be exported.

c) Touch the **Enter** Button.

8 If desired, change the name of the file (which auto populates as the first and last waypoint in the flight plan):

a) Touch the **File Name** Datafield Button.

b) Using the keyboard enter a file name for the route to be exported.

c) Touch the **Enter** Button.

9 Touch the **Export** Button.

10 A "Flight plan(s) successfully exported" message will prompt the pilot that there were no issues expoting the flight plan(s)

a) If the export failed or there were any issues exporting the flight plan(s), an "Unable to export flight plan(s)" message will appear. For assistance contact the Garmin® Support Center.

11 Touch the **OK** Button to dismiss the message.

After successfully exporting the flight plan, it will appear on the USB as a file with a ".fpl" extension.

STORED FLIGHT PLAN FUNCTIONS

Stored flight plans are saved in the system for future use. Up to 99 flight plans with up to 100 waypoints each can be created and stored in the flight plan catalog and are able to be activated at any time.

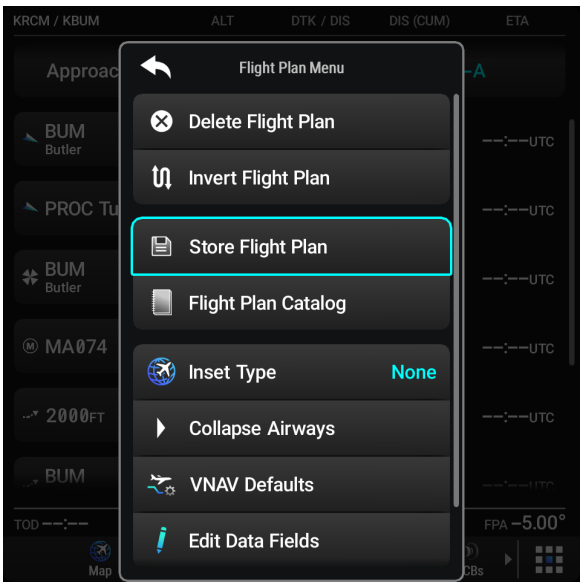


Figure 208: Storing the Active Flight Plan

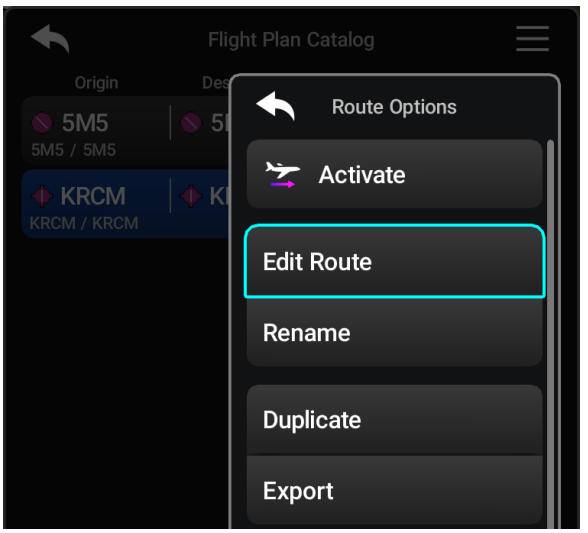


Figure 209: Editing a Stored Flight Plan

ADDING AN ACTIVE FLIGHT PLAN TO THE FLIGHT PLAN CATALOG:

1 With a flight plan added, navigate to the Flight Plan Application Page.
2 On the flight plan page press the **MENU** Softkey.
3 Touch the **Store Flight Plan** Button.
4 A confirmation window will open:
   a) Touch the **OK** Button to confirm and store the flight plan to the flight plan catalog.
   Or:
   a) Touch the **Cancel** Button to cancel storing the flight plan.

CREATING AND STORING A FLIGHT PLAN IN THE FLIGHT PLAN CATALOG:

1 Navigate to the Flight Plan Page:
   a) Touch the **FPL** Icon on the MFW App Bar.
      Or:
   b) Touch the **Applications** Icon.
   c) Touch the **Flight Plan** Button.
2 Press the **MENU** Softkey on the side of the display the flight plan page is being displayed. The Flight Plan Menu will open.
3 Touch the **Flight Plan Catalog** Button.
4 Touch the **Create New Catalog Route** Button
5 If desired touch the **Flight Plan Name** Button and use the keypad to enter a name for the flight plan to be stored. Touch the **Enter** Button to accept the name.
6 Touch the **Add Waypoint** Button.
7 Use the Keypad to enter the waypoint identifier.

   Or:

   Use the Find Function and associated tabs (Recent, Nearest, Flight Plan, Favorites, and Search Tabs) to find a waypoint.
8 Touch the **Enter** Button to accept the waypoint identifier.

   Or:

   Use the Find Function and associated tabs (Recent, Nearest, Flight Plan, Favorites, and Search Tabs) to find a waypoint.

   Or:

   Touch the predicted waypoint identifier in the lower left corner to immediately add it to the flight plan.
9 Repeat step 6 through 8 until the flight plan is completed.
10 Touch the **Back Arrow**, **Done** Button, or **BACK** Softkey to the flight plan catalog page.

EDITING A FLIGHT PLAN IN THE FLIGHT PLAN CATALOG:

1 Navigate to the Flight plan page.
2 Press the **MENU** Softkey to open the flight plan menu.
3 Touch the **Flight Plan Catalog** Button.
4 Touch the desired flight plan button to open the 'Route Options' Window.
5 Touch the **Edit Route** Button.
6 To edit the existing route, touch a Waypoint Selection Button to insert a new waypoint before or after the selected waypoint, edit or delete the waypoint, add an airway, along track offset, parallel offset, hold, or heading leg.
7 When all edits are complete, touch the **Back Arrow**, **Done** Button, or **BACK** Softkey to save changes and exit.

INVERTING A FLIGHT PLAN IN THE FLIGHT PLAN CATALOG:

1. Navigate to the Flight plan page.
2. Press the **MENU** Softkey to open the flight plan menu.
3. Touch the **Flight Plan Catalog** Button.
4. Touch the desired flight plan button to open the 'Route Options' Window.
5. Touch the **Edit Route** Button.
6. In the 'Edit Stored Flight Plan' window press the **MENU** Softkey.

   Or:

   Touch the **Menu** Button to open the flight plan menu
7. Touch the **Invert Flight Plan** Button, the pilot will be prompted to confirm inversion and that all procedures will be removed from the stored flight plan.
8. Touch the **OK** Button to invert the flight plan.

ACTIVATING A FLIGHT PLAN FROM THE FLIGHT PLAN CATALOG:

1. Navigate to the Flight Plan page.
2. Press the **MENU** Softkey to open the 'Flight Plan Menu'.
3. Touch the **Flight Plan Catalog** Button.
4. Touch the selector button of the desired flight plan to be activated opening a 'Route Options' Window.
5. Touch the **Activate** Button. A confirmation window will open.
6. Touch the **OK** Button to begin the selected flight plan.

COPYING A FLIGHT PLAN IN THE FLIGHT PLAN CATALOG TO ANOTHER FLIGHT PLAN MEMORY SLOT:

1. Navigate to the Flight plan page.
2. Press the **MENU** Softkey to open the flight plan menu.
3. Touch the **Flight Plan Catalog** Button.
4. Touch the desired flight plan button to open the 'Route Options' Window.
5. Touch the **Duplicate** Button.
6. A confirmation window is displayed. Touch the **OK** Button to duplicate the stored flight plan.

EDITING THE NAME OF A STORED FLIGHT PLAN:

The name of each flight plan can be changed to something that is useful for identification and sorting.

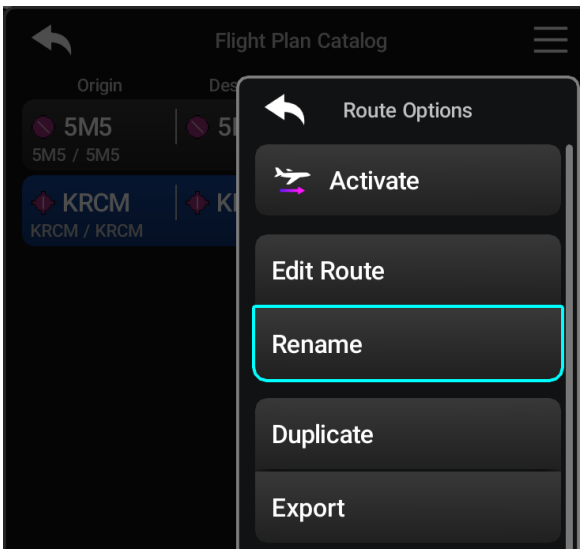


Figure 210: Renaming a Stored Flight Plan

1 Navigate to the Flight Plan page.
2 Press the **MENU** Softkey to open the 'Flight Plan Menu'.
3 Touch the **Flight Plan Catalog** Button.
4 Touch the selector button of the desired flight plan for the name to be changed, a 'Route Options' Window.
5 Touch the **Rename** Button.
6 Use the keypad to edit the name of the stored flight plan and touch the **Enter** Button to save the change and return to the flight plan catalog.

DELETING A FLIGHT PLAN FROM THE FLIGHT PLAN CATALOG:

1 Navigate to the Flight plan page.
2 Press the **MENU** Softkey to open the flight plan menu.
3 Touch the **Flight Plan Catalog** Button.
4 Touch the desired flight plan button to open the Route Options Menu.
5 Scroll to the bottom of the options window and touch the **Delete** Button.
6 The pilot is prompted to verify deleting the stored flight plan. Touch the **OK** Button to delete the stored flight plan.

5.7 PROCEDURES

⚠ WARNING

If a 116C/NC fails and navigation reverts to a 116B, do not use the approach information provided by the internal navigation of the GDU™ 116B (VFR only) as a means of navigating any instrument approach. The consumer GPS provided in the GDU 116B AXIS™ flight display does not provide IFR

qualified GPS data and is not suitable for IMC flight. These waypoints and associated course lines are made available for monitoring purposes only.

⚠ CAUTION

IFR external navigation may only be used if the CDI Source on the PFD is synced to the external navigation source.

NOTE

No approach vertical guidance will be provided for published instrument procedures when loaded into the GDU 116B AXIS flight display.

NOTE

If unsure whether or not your system uses an RS 232 connection for external GPS navigators contact your dealer or Garmin Product Support for clarification.

NOTE

The 116B GDU internal GPS flight plan is for VFR use only.

The system can access departures, arrivals, and approaches that are stored within the database. Procedures can be added to the active or stored flight plans.

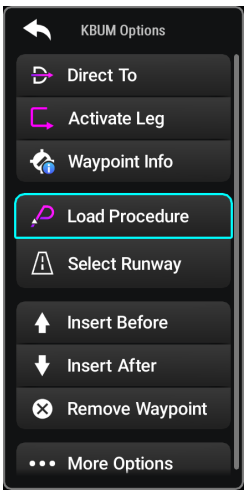


Figure 211: Load Procedures Button on the 'Waypoint Options' Window

Whenever an approach, departure, or arrival procedure is loaded into the Active Flight Plan, a set of approach, departure, or arrival waypoints are inserted into the flight plan along with a header row identifying the procedure the pilot selected. The original enroute portion of the flight plan remains active when the procedure is loaded.

The system adds procedures to the flight plan based on the leg types coded within that procedure in the navigation database. Over twenty types of legs are possible in terminal area procedures, such as DME Arc to a Fix, course to a VOR radial, hold in lieu of a procedure turn, vector (heading) to an altitude. The system offers lines of text on each waypoint button to help identify each leg type in the selected procedure. The text provided will vary depending on the leg type and other attributes that are specified as part of the leg.

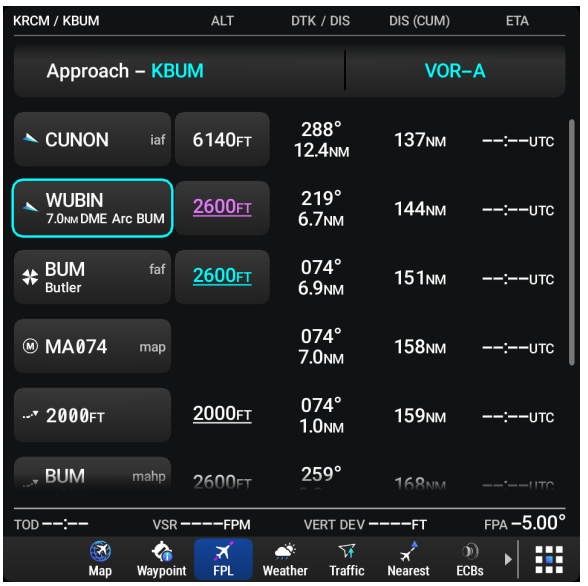


Figure 212: Attributes of Procedural Legs on Waypoint Button

INITIATING THE PROCEDURE LOADING FUNCTION

The system allows the Procedure Loading Function to be accessed from multiple starting points depending on the current operation or display. The following procedures provide instruction on how to select and initiate the load of any procedure, depending on the starting point. Following discussions in this section shall assume the pilot has initiated the Procedure Loading Function and is ready to select the required settings and load the procedure in the flight plan.

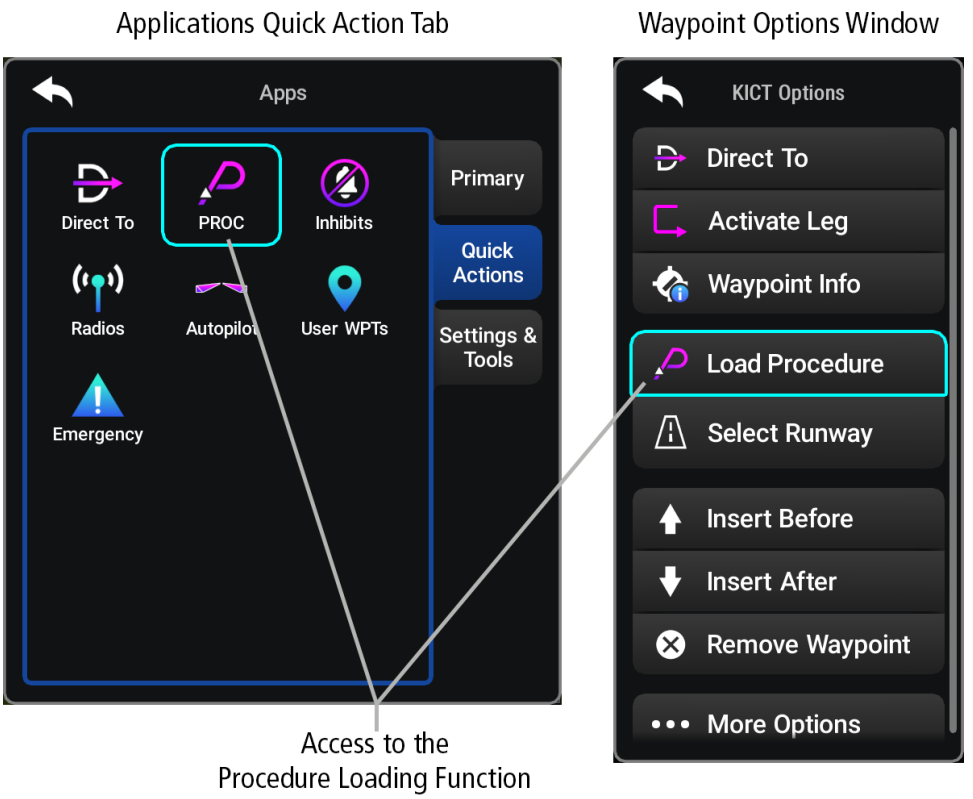


Figure 213: Initiating the Procedure Loading Function

INITIATING THE PROCEDURE LOADING FUNCTION AND SELECTING A PROCEDURE:

1 Navigate to the Applications **Quick Actions** Tab and touch the **PROC** Button.

Or:

Navigate to the Flight Plan Application on the MFW and touch the airport identifier for which a procedure is to be loaded. Then touch the **Load Procedure** Button.

2 Initiate the Procedure Loading Function:

a) Touch the **Departure** Button, **Arrival** Button, or the **Approach** Button to display the Procedure Loading Function for the selected type of procedure.

3 Select the procedure:

a) If necessary, touch the Airport Selection Button and use the keypad or the Find Function to enter or modify the airport identifier.

b) Touch the Procedure Selection Button to display a list of procedures available at the selected airport for the selected type of procedure.

c) Touch the button for the desired procedure to select it and return to the Procedure Loading Function.

The system will automatically run through the series of options for the selected procedure (i.e., Departure, Transition, and Runway). Select each desired option as they appear.

INITIATING THE PROCEDURE LOADING FUNCTION AND SELECTING A PROCEDURE FROM THE WAYPOINT PAGE ON THE MFW:

Figure 214: Initiating the Procedure Loading Function from 'Charts'

1 On the MFW App Bar, touch the **Waypoint** Button.

   Or:

   Touch the **Applications** Icon **>** **Waypoint** Button.

2 On the Waypoint Page, select the **Charts** Tab.

3 Touch the Chart Selection Button.

4 Select the type of procedure but touching the **Departure** Tab, **Arrival** Tab, or the **Approach** Tab.

5 If necessary, scroll through the list of charts and select the desired procedure by touching the Chart Selection Button.

6 Touch the **Load Procedure** Button.

7 The system will automatically load the procedure into the Procedure Loading Function. The Load <Procedure> Button will be subdued until all required information is input into the Procedure Loading Function (i.e., Departure, Transition, and Runway).

8 Touch the Load <Procedure> Button to add the procedure to the active flight plan for review.

   Or:

   Touch the **Load and Activate** Button to begin FMS navigation of the procedure.

DEPARTURES

A Departure can be loaded at any airport that has one available. When loaded, a departure procedure is placed at the origin airport in the flight plan. Only one departure can be loaded at a time in a flight plan. If a departure is loaded when another departure is already in the flight

plan, the new departure replaces the previous departure. The departure sequence is defined by selection of a departure, the runway, and transition waypoints.

LOADING A DEPARTURE PROCEDURE TO THE FLIGHT PLAN:

1. Initiate the Procedure Loading Function for departure (see procedures for *Initiating the Procedure Loading Function*).
2. If necessary, select or modify the departure airport:
   a) Touch the Airport Selection Button.
   b) Use the keypad, or the Find Function, to enter the departure airport.
   c) Touch the **Enter** Button.
3. If necessary, select or modify the departure runway:
   a) Touch the **Runway** Button to display a list of runways.
   b) Touch the button for the desired runway.
4. Touch the **Departure** Button to display a list of departure procedures.
5. Touch the button for the desired departure procedure to select it. Then, the 'Transitions' Window is automatically displayed.
6. Select or modify the departure transition waypoint:
   a) If the 'Transitions' Window is not already displayed, touch the Transition Procedure Button to display a list of transition waypoints.
7. Touch the **Load Departure** Button

UPDATING THE DEPARTURE RUNWAY

When a published departure is in any flight plan, the Runway Button in the Departure Header row will be displayed to simplify potential departure runway changes. Using this button to change runways will automatically update the flight plan with the new departure procedure waypoints associated with the runway change. Any previous modifications or additions to the flight plan waypoints in the departure, such as a user defined hold, shall be removed when the runway is changed and the new departure procedure is loaded.

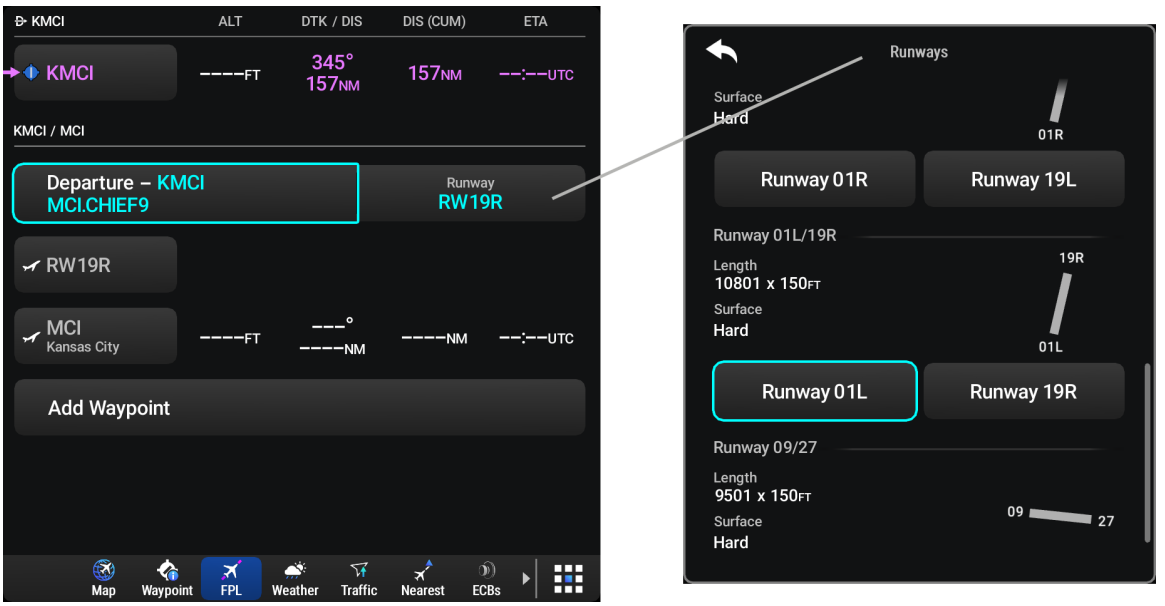


Figure 215: Update Departure Runway (Reloads New Departure)

CHANGING THE DEPARTURE RUNWAY FOR A PUBLISHED DEPARTURE PROCEDURE (RELOADS NEW DEPARTURE):

1 Navigate to the active flight plan.

Or:

Access a flight plan that is stored in the Flight Plan Catalog.

2 Touch the **Runway** Button in the Departure Header Row.

3 Touch the button for the desired runway.

4 Touch the **OK** Button to continue. The previous departure procedure and any waypoint or hold modifications made to the flight plan for that procedure are removed and the published departure procedure is reloaded with the new runway selection.

REMOVING A DEPARTURE FROM A FLIGHT PLAN:

1 Navigate to the active flight plan.

Or:

Access a flight plan that is stored in the Flight Plan Catalog.

2 Touch the Departure Button in the Departure Header Row, opening the Departure Options Window.

3 Touch the **Remove Departure** Button.

4 A confirmation window will appear. Touch the **OK** Buttonto remove the procedure.

ARRIVALS

A Standard Terminal Arrival can be loaded at any airport that has one available. When loaded, an arrival procedure is placed at the destination airport in the flight plan. Only one

arrival per destination is allowed. The arrival sequence is defined by selection of an arrival, the runway, and transition waypoints.

LOADING AN ARRIVAL PROCEDURE TO THE FLIGHT PLAN:

1 Initiate the Procedure Loading Function for departure (see procedures for *Initiating the Procedure Loading Function*).
2 If necessary, select or modify the departure airport:
   a) Touch the Airport Selection Button.
   b) Use the keypad, or the Find Function, to enter the departure airport.
   c) Touch the **Enter** Button.
3 Touch the **Arrival** Procedure Button.
4 Touch the **Arrival** Button.
5 If necessary touch the **Waypoint** Button.
   a) Use the Keypad to enter the desired waypoint.

      Or:

      Use the Find Function and associated tabs to search for a waypoint.
6 Touch the **Arrival** Procedure Button and select a procedure from the provided list.
7 Select an arrival transition:
   a) The transitions window will automatically open after selecting the arrival procedure. Touch the desired Transition Button to add the transition to the arrival procedure.

      Or:

      Touch the **Transition** Procedure Button to add or edit the transition for the arrival procedure.
8 The Runways window will automatically open after selecting the arrival transition. If necessary, select or modify the arrival runway:
   a) Touch the desired runway to add it to the arrival procedure.

      Or:

      Touch the **Runway** Procedure Button to add or edit the runway for the arrival procedure.
9 Touch the **Load Arrival** Button

UPDATING THE ARRIVAL RUNWAY

When a published arrival is in any flight plan, the **Runway** Button will be displayed in the Arrival Header row to simplify potential arrival runway changes. Using this button to change runways will automatically update the flight plan with the new arrival procedure waypoints associated with the runway change. Any previous modifications or additions to the flight plan waypoints in the arrival, such as a user defined hold, shall be removed when the runway is changed and the new arrival procedure is loaded.

CHANGING THE ARRIVAL RUNWAY FOR A PUBLISHED ARRIVAL PROCEDURE:

1 Navigate to the active flight plan.

   Or:

Access a flight plan that is stored in the Flight Plan Catalog.

2 Touch the **Runway** Button in the Arrival Header Row.
3 Touch the button for the desired runway.
4 Touch the **OK** Button to continue. The previous arrival procedure and any waypoint or hold modifications made to the flight plan for that procedure are removed and the published arrival procedure is reloaded with the new runway selection.

REMOVING AN ARRIVAL FROM A FLIGHT PLAN:

1 Select the desired flight plan.
2 Touch the Arrival Button in the Arrival Header Row, opening the Arrival Options Window.
3 Touch the **Remove Arrival** Button.
4 A confirmation window will appear. Touch the **OK** Button to remove the procedure.

APPROACHES

The system can provide navigation guidance for GPS and NAVAID instrument approach procedures. Visual Approach guidance is also available. This section will discuss loading, activating, and removing approaches designated for navigation. See the Flight Instruments section for information on *Changing The Navigation Source* of the CDI, and for information on the *Vertical Deviation Indicator* on the PFW. Refer to *NAV Receiver Tuning* in the Audio and CNS Section for information on selecting and tuning a NAV receiver. See the AFCS Section for information on *Lateral Modes* and *Vertical Modes* used for approach guidance.

INSTRUMENT APPROACHES

NOTE

If certain GPS parameters (SBAS, RAIM, etc.) are not available, some published approach procedures for the desired airport may not be displayed in the list of available approaches.

NOTE

If flying Direct-to the Final Approach Fix (FAF), and an instrument approach has been loaded, the system will suspend (SUSP) leg sequencing if the approach intercept angle exceeds 45 degrees.

AXIS™ Flight Displays will automatically switch the CDI from GPS to VLOC when an ILS approach is loaded once the aircraft is 1 NM from the FAF and has a fix on the approach frequency. This feature works when axis is installed with any non-serial Garmin® navigator.

The system provides guidance for non-precision and precision approaches to airports with published instrument approach procedures. Only one approach per destination can be loaded at a time in a flight plan. The route is defined by selection of an approach, runway, and the transition waypoints.

LOCALIZER OR VOR-BASED APPROACHES

The AXIS™ automatically switches the external CDI output from GPS to VLOC as you intercept the final approach course. When the ILS approach activates and the correct ILS frequency activates in the VLOC window, the AXIS automatically switches to VLOC within

1.2 NM left or right of the final approach course. This switch can take place anywhere from 2.0 to 15.0 NM from the FAF.

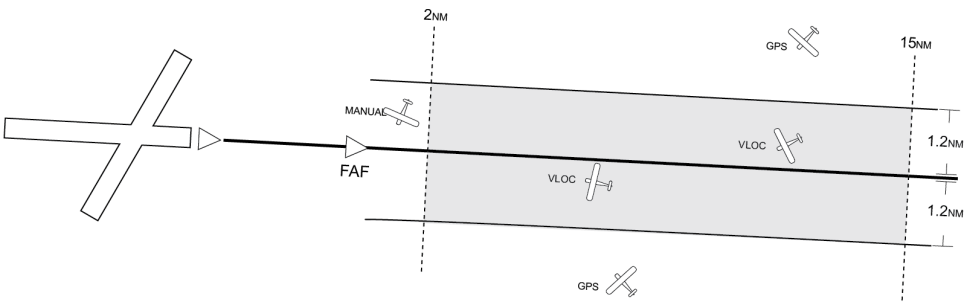


Figure 216: Automatic CDI Switching Locations

USING GPS FOR APPROACHES (RNAV AND +V)

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.

NOTE

The system requires 30 seconds of valid SBAS integrity monitoring before selecting an approach that requires SBAS vertical guidance.

NOTE

To ensure the system does not abort the GPS approach, both GPS receivers should have a VFOM less than 106 feet before loading a GPS approach.

RNAV/GPS approach procedures require GPS and can be selected for use. When the display shows ‘gps’ after a NAVAID prefix (such as `VORGPS 17L’), this indicates the procedure is an Overlay Approach. The procedure may be flown either as a conventional, ground-based approach procedure or may be flown using GPS.

Just as the system supports navigating an airway using GPS, and using GPS instead of DME, the system also supports using GPS as an alternate means of navigation for NAVAID exclusive approaches (not including localizer based approaches). The pilot has the option to fly a NAVAID exclusive approach with either GPS/FMS or the NAVAID as the selected CDI source. Refer to the current, pertinent flight manual and regulations for information on alternatively using GPS navigation for NAVAID exclusive approaches.

When the display shows an approach with ‘+V’, this indicates the system will provide advisory vertical guidance when using GPS to fly the approach. Procedure briefing and execution of the approach must be made in accordance with the published approach and applicable landing minimums for this aircraft; +V does not circumvent step down fix restrictions or descent beyond the Minimum Descent Altitude (MDA) without establishing the necessary visual references.

The system will allow the applicable level of service for the chosen approach using GPS navigation; selection of ‘+V’ means advisory vertical guidance will be displayed for that

particular level of service. See the following table for levels of service allowed by the system, and the accompanying approach mode indication on the HSI:

Level of Service	Selected Approach Mode	Description	Example on HSI
LNAV	LNAV or LNAV+V	Approach to the published MDA Advisory vertical guidance to the MDA available when 'LNAV+V' or 'LP+V' is selected	 Approach Service Level – LNAV, LNAV+V, L/VNAV, LP, LP+V, LPV
LP	LP or LP+V		
L/VNAV	L/VNAV	Approach with approved vertical guidance to the published DA	
LPV	LPV		

Table 27: Approach Level of Service

The system GPS receivers will use Satellite Based Augmentation (SBAS) when available. Some approach modes require the use of SBAS for lateral and/or vertical GPS navigation. For information on how lateral and vertical guidance is depicted on the PFD, see the Flight Instruments Section.

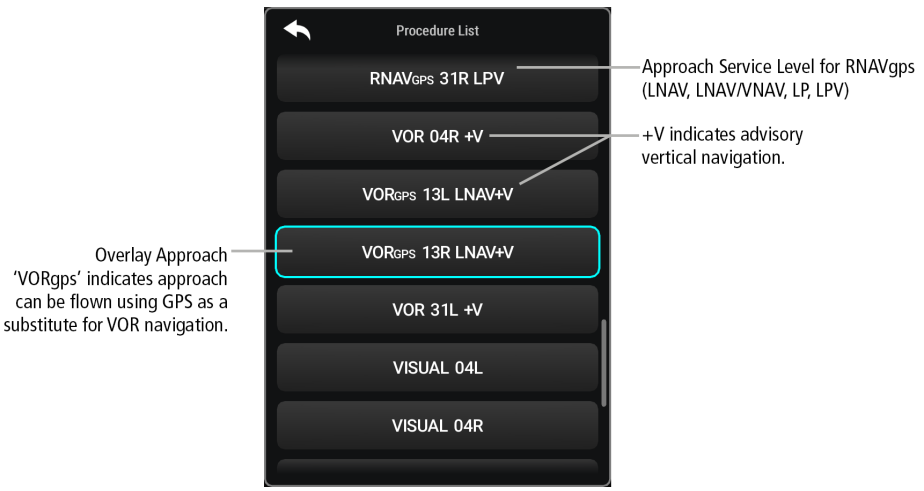


Figure 217: Procedures List of Available Approaches

Approach Service Level	Lateral Navigation Source	Vertical Navigation Source
LNAV	GPS	N/A
LNAV+V	GPS	GPS (advisory only)
LNAV/VNAV	GPS[1]	GPS[1]
LP	GPS[1]	N/A

Approach Service Level	Lateral Navigation Source	Vertical Navigation Source
LP+V	GPS[1]	GPS[1] (advisory only)
LPV	GPS[1]	GPS[1]
[1] SBAS required		

Table 28: Source of Lateral and Vertical Navigation per Approach Service Level

LOSS OF SBAS

NOTE

Refer to the current, pertinent flight manual for additional information regarding crew responses for loss of SBAS and approach downgrade procedures

Due to the high level of precision required by some approach service levels, losing SBAS may require the pilot to acknowledge a downgrade of approach service level, or to abort the approach. See the following table for approach degradation behavior:

Approach	SBAS Becomes Unavailable	Description	Action Required	Downgrade
LNAV	Approach phase not specified	SBAS not required. The approach is continued.	None	N/A
LNAV+V				
LNAV/VNAV	Before the FAF	HSI displays approach service level in amber; VDI displays 'NO GP'.[2]	Acknowledge message to redisplay CDI with LNAV [1]	LNAV[1]
	At/After the FAF	HSI displays downgraded approach service level in magenta; VDI displays 'NO GP'.	None	LNAV[1]
LP	More than one minute to the FAF	HSI displays approach service level in amber;	None	N/A
	Within one minute to the FAF	HSI displays downgraded approach service level in magenta CDI is removed.[2]	Acknowledge message to redisplay CDI with LNAV [1]	LNAV [1]
	At/After the FAF	CDI is removed.[2]	Acknowledge ABORT APR message to redisplay CDI	N/A

Approach	SBAS Becomes Unavailable	Description	Action Required	Downgrade
LP+V	More than one minute to the FAF	HSI displays approach service level in amber; VDI displays 'NO GP'.	None	N/A
	Within one minute to the FAF	HSI displays downgraded approach service level in amber; CDI is removed. VDI displays 'NO GP'. [2]	Acknowledge message to redisplay CDI with LNAV+V [1] Glidepath	LNAV+V [1]
	At/After the FAF	CDI is removed. VDI displays 'NO GP'. [2]	Acknowledge ABORT APR message to redisplay CDI	N/A
LPV	More than one minute to the FAF	HSI displays downgraded approach service level in amber;	None	N/A
	Within one minute to the FAF	HSI displays downgraded approach service level in amber VDI displays 'NO GP'. [2]	None	LNAV/VNAV[1]
	At/After the FAF	HSI displays downgraded approach service level in magenta; VDI displays 'NO GP'.	None	LNAV[1]
[1] Some approaches may not publish minimums for the downgrade given as an example in this table. The system will select the appropriate downgrade, if available, for each published approach as it is derived from the database. If an appropriate downgrade is not available, the approach should be aborted.				
[2] System message is generated.				

Table 29: Approach Degradation Behavior

LOSS OF INTEGRITY

The system uses RAIM to assess the integrity of GPS signals. The 'UNABLE RNP' annunciation will be displayed on the PFW if either the system Estimated Position Error (EPE) is greater than the required RNP, or if GPS integrity is insufficient while the aircraft is inbound to the FAF. The RNP level is displayed in amber whenever the 'UNABLE RNP' annunciation is displayed. If the FAF waypoint is sequenced while this condition persists, a system message to abort the approach will be generated.

LOSS OF GPS ON A PUBLISHED GPS APPROACH

When GPS sensors are no longer being utilized for position fixing while on the final segment of a GPS approach, the approach service level on the HSI will turn amber and the annunciation 'GPS NOT USED' will be displayed on the PFW. If the aircraft is at or beyond the FAF when the condition occurs, a system message to abort the approach will be generated. The CDI deviation bar is also removed from the HSI. Once the pilot acknowledges the abort message, the CDI deviation bar will reappear.

LOSS OF GPS FROM EXTERNAL NAVIGATOR

NOTE

Do not use the approach information provided by the internal navigation of the GDU™ 116B (VFR only) as a means of navigating any instrument approach. The consumer GPS provided in the GDU 116B AXIS™ flight display is limited to a VFR navigation database the presents only the waypoints for the final approach leg of a published procedure. These waypoints and associated course lines are made available for monitoring purposed only.

When an external navigator is being used and the GPS sensor fails the system will automatically revert to the internal GPS sensor. An indication will appear below the HSI notifying the pilot of this change. If the display is a GDU 116B the GPS will not be capable of providing approach information at and beyond the FAF of an instrument approach.

VISUAL APPROACHES

The system provides a visual approach feature. Unlike instrument approaches, visual approaches are not defined in the navigation database. Instead, the system calculates the lateral and vertical path for the chosen runway and creates visual approach waypoints based on runway position and course as specified in the navigation database. Visual approaches may be loaded for either a published airport or a User Airport. For visual approaches, the pilot is responsible for avoiding terrain, obstacles and traffic.

NOTE

The charts database may contain Charted Visual Flight Procedures (CVFPs) for certain airports. CVFPs follow a precise prescribed path and are classified as Instrument Approach Procedures (IAPs). See the Charts section in Additional Features for more information on Charts.

The system allows for Straight-In Visual Approaches, where the system will place a final approach fix (FAF). The FAF will automatically be generated one mile from the runway. The pilot may alter the distance, if desired, so long as the disatnce falls within the allowable limits for that distance.

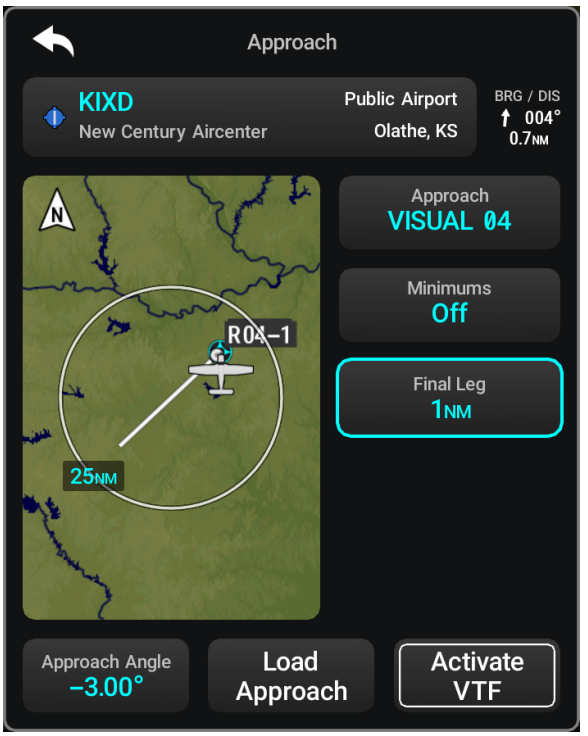


Figure 218: Visual Approach Loading

USER APPROACH MODE

When loading a GPS approach the system will allow modification to the Active Flight Plan GPS approach service level without disabling SBAS. For example, a crew could choose to execute an approach marked LPV as though it were an LNAV+V approach. The **Service Level** Button is accessed through the menu button on the approach window. The service levels and vertical sources available in this selection are limited to those applicable to the approach, and invalid combinations (such as executing an LPV with Baro vertical guidance) are prevented. The Approach Mode default setting is 'Auto', for which the optimal service level and vertical source will be displayed, as determined by the system for the selected published approach.

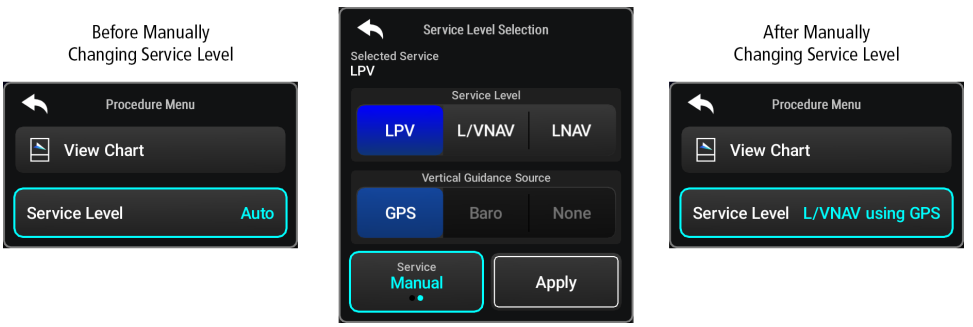


Figure 219: User Service Level Selection

TRANSITION TO APPROACH

When utilizing VNAV to descend to the FAF on an approach, the system utilizes the Transition to Approach (TTA) function to calculate and adjust the descent path between the FAF and the waypoint preceding the FAF so that a seamless capture and transition to the approach vertical guidance occurs. The time and location of the Bottom of Descent (BOD) may change once any TTA adjustments are made.

LOADING AN APPROACH

Loading an instrument procedure into the flight plan, selecting approach minimums, and changing the approach service level is covered in the following procedure. If minimums must be modified after already loading the approach, the pilot may edit the minimums by touching the **BARO MIN** Indicator Button on the altimeter. Adjusting the minimums may also be accessed by touching the **Runway** Button in the Approach Header Row on the 'Flight Plan' Application Page to access the Procedure Loading Function, then touch the **Minimums** Button. A separate procedure for loading a visual approach into the flight plan is also provided.

NOTE

If there is no arrival procedure in the Active Flight Plan, loading an approach to a flight plan in which the destination airport has already been entered, will result in the previously entered destination airport becoming a fly-over waypoint before the newly loaded approach.

NOTE

If the desired IAF is also an entry waypoint to a hold in lieu of procedure turn, and the option to load the course reversal is accepted, the altitude constraint for this IAF may not be loaded.

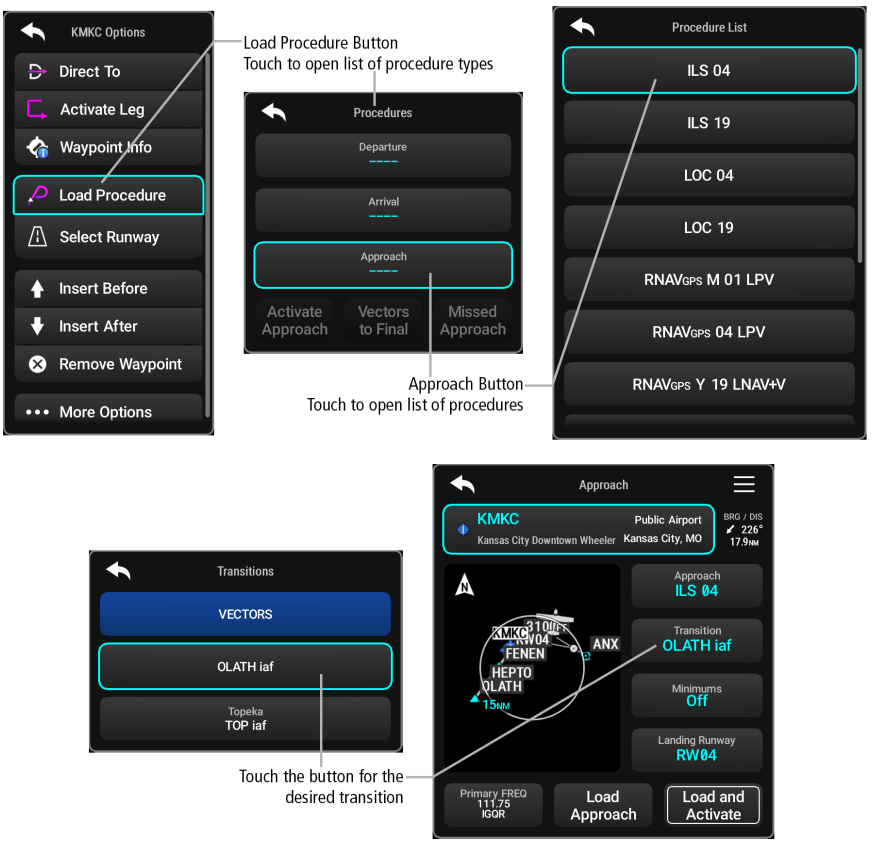


Figure 220: Loading an Instrument Approach Procedure

LOADING AN INSTRUMENT APPROACH INTO THE FLIGHT PLAN:

1. Initiate the Procedure Loading Function for approach (see procedures for *Initiating the Procedure Loading Function*).
2. If necessary, select or modify the approach airport:
   a) Touch the Airport Selection Button.
   b) Use the keypad, or the Find Function, to enter the approach airport.
   c) Touch the **Enter** Button.
3. Touch the **Approach** Procedure Button to display a list of approach procedures.
4. Touch the button for the desired instrument approach procedure to select it. Then, the 'Transitions' Window is automatically displayed.
5. Select or modify the approach transition waypoint:
   a) If the 'Transitions' Window is not already displayed, touch the **Transition** Procedure Button to display a list of transition waypoints.
   b) Touch the button for the desired transition waypoint or touch the **VECTORS** Button for vectors to final.
   c) If prompted to fly the course reversal, select the **Yes** Button or **No** Button. The system automatically loads the course reversal into the flight plan if the aircraft is outside 180° of the inbound course.

6 If necessary, select or modify the landing runway:
   a) Touch the **Landing Runway** Procedure Button to display a list of runways.
   b) Touch the button for the desired landing runway.
7 Enter or modify minimums (only selectable for the Active Flight Plan):
   a) Touch the **Minimums** Button.
   b) Use the keypad to enter the minimums altitude.
   c) If necessary, apply temperature compensation to approach minimums (only available for BARO Mode):

      Touch the **TEMP COMP** Annunciation Buttonto enable the setting. Then, touch the **TEMP** Datafield Button, and use the keypad and **Enter** Button to enter the destination temperature.
   d) Touch the **Enter** Button to add minimums to the Procedure Loading Function.
8 If necessary, select a different Approach Mode (Service Level):
   a) Touch the Approach **Menu** Button.
   b) Touch the **Service Level** Button.
   c) Touch the **Service** Button to toggle the selection to 'Manual'.
   d) Touch each button for the desired Service Level and Vertical Guidance Source settings.
   e) Touch the **Apply** Button.
   f) Touch the **Back Arrow** to exit the procedure menu.
9 Touch the **Load and Activate** Button to activate the approach.

   Or:

   Touch the **Load** Button.

LOADING A VISUAL APPROACH INTO THE FLIGHT PLAN:

1 With a destination loaded into the flight plan, navigate to the 'Flight Plan' Application Page.
2 Touch the desired Airport Identifier Waypoint Button to load the approach, opening the '[Waypoint] Options' Menu.
3 Touch the **Load Procedure** Button.
4 Touch the **Approach** Procedure Button to display a list of approach procedures.
5 Scroll to the bottom of the list and touch the button for the desired visual approach to select it.
6 The final leg distance is auto selected as 1 NM. If desired, change the straight in leg distance of the final approach:
   a) Touch the **Final Leg** Datafield Button.
   b) Use the numeric keypad to enter a final leg distance between one and 25 NMs.
   c) Touch the **Enter** Button to accept the final leg distance.
7 If desired, enter or modify minimums:
   a) Touch the **Minimums** Button.
   b) Use the keypad to enter the minimums altitude.

c) If necessary, apply temperature compensation to approach minimums (only available for BARO Mode):

Touch the **TEMP COMP** Annunciation Button to enable the setting. Then, touch the **TEMP** Datafield Button, and use the keypad and **Enter** Button to enter the destination temperature.

d) Touch the **Enter** Button to add minimums to the Procedure Loading Function.

8 If desired, enter or modify the Approach angle:

a) Touch the **Approach Angle** Datafield Button.

b) Use the numeric keypad to enter a value btween -4.50° and -2.50°.

c) Touch the **Enter** Button to accept the modified glidepath angle.

9 Touch the **Activate VTF** Button to activate the approach.

Or:

Touch the **Load Approach** Button.

After an approach has been loaded it can be activated by touching the **Activate VTF** Button that is adjacent to the Approach Button on the FPL Application page, or navigating to the Approach Options Window and touching the **Vectors to Final** Button.

REMOVING AN APPROACH FROM THE FLIGHT PLAN:

1 Navigate to a flight plan in the Flight Plan Catalog.

Or:

Navigate to the active flight plan.

2 Touch the Approach button on the Approach Header Row.

3 Touch the **Remove Approach** Button.

4 The pilot will be prompted to verify deleting the approach. Touch the **OK** Button.

ACTIVATING AN APPROACH

The system automatically activates the approach when the IAF or any other waypoint in the approach procedure becomes the active waypoint in the flight plan. If an approach frequency is available, it is automatically loaded when the approach is activated. It is also possible for the pilot to activate the approach manually, at any time. See the following table for approach activation information:

Selection Method	Changes to the Flight Plan
None (Automatic)	**IAF (or first approach waypoint) becomes the active waypoint.** Automatic waypoint sequencing from the enroute or arrival segments to the approach segment occurs, and the approach is automatically activated.
Flight Plan > Approach > Activate Approach	**Direct-to the IAF (or first approach waypoint) becomes active.** Direct-to leg from aircraft current position to the first approach waypoint is activated (previously active leg or approach guidance is terminated).
Flight Plan > Approach > Activate Vectors to Final	**Inbound course to the FAF waypoint becomes the active leg.** Approach waypoints before the FAF and aligned with the final approach course are included in the flight plan list, but waypoint sequencing will not occur until the inbound course is intercepted.

Table 30: Activating an Approach

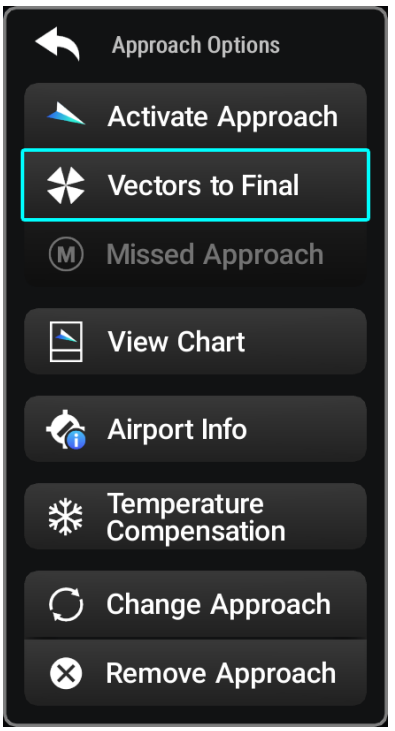


Figure 221: Activating Vectors to Final

MANUALLY ACTIVATING AN APPROACH:

1 Touch the **Approach** Button in the Approach Header Row to open the Approach Options Window.

2 Touch the **Activate Approach** Button.

MISSED APPROACH

NOTE

When changing the destination while navigating on a missed approach, delete the arrival (if loaded) or the approach before changing the destination in order to preserve the missed approach guidance.

The system is capable of providing guidance for the approach as well as the missed approach. Once the missed approach is activated, RNP 0.3 will be displayed on the HSI next to the CDI. If the missed approach is activated before the Missed Approach Point (MAP), waypoint sequencing will continue along the approach to the missed approach. If the missed approach is not activated before the MAP, the system will enter SUSP Mode once the aircraft crosses the MAP until the missed approach is activated or SUSP Mode is disabled. See the Flight Instruments Section for more information on *SUSP Mode*.

See the *Missed Approach Preview* for information on displaying the missed approach preview on map displays.

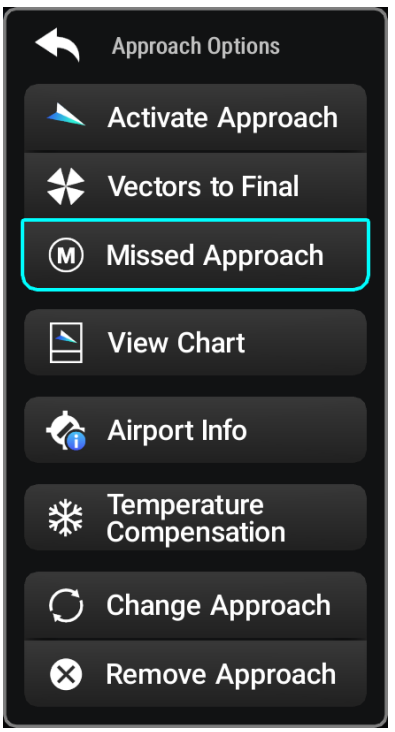


Figure 222: Activating the Missed Approach

In the missed approach procedure shown in the following figure, the altitude immediately following the MAP may or may not be part of the published procedure. Regardless, it represents a Course to Altitude (CA) leg along the runway centerline. The altitude shown must be achieved before turning safely toward the Missed Approach Holding Point (MAHP). If the aircraft altitude is below the specified altitude after crossing the MAP, a direct-to is established to provide a course on runway heading until the altitude is reached. After reaching the altitude, a direct-to is established to the next published waypoint. If the aircraft altitude is

above the specified altitude after crossing the MAP, a direct-to is established to the published fix to begin the missed approach procedure.

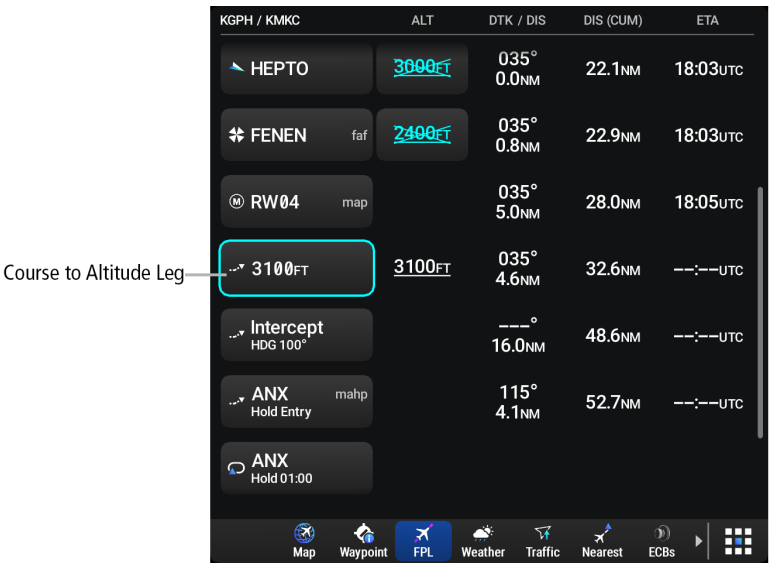


Figure 223: Course to Altitude

MISSED APPROACH PREVIEW

Map displays can show a preview of Missed Approach procedures. The Missed Approach Preview course legs appear thinner than those of the Active Flight Plan until the Missed Approach is activated.

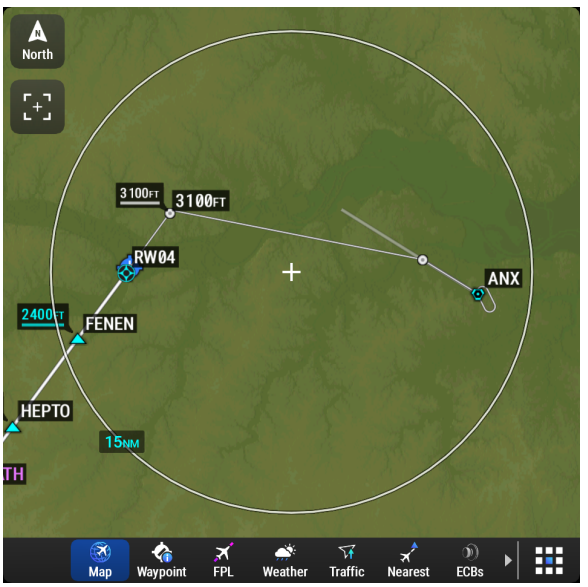


Figure 224: Missed Approach Preview

ACTIVATING A MISSED APPROACH IN THE ACTIVE FLIGHT PLAN:

1 Touch the **Approach** Button in the Approach Header Row to open the Approach Options Window.

2 Touch the **Missed Approach** Button.

TEMPERATURE COMPENSATION

If desired, the system can calculate temperature compensation for waypoint crossing altitudes loaded as part of an approach procedure. The pilot must manually enable temperature compensation and then enter the destination airport temperature.

The system adjusts the altitudes accordingly, and the snowflake icon is displayed next to those altitudes. By default, these altitudes are displayed in MSL values. When a temperature compensated approach altitude (shown in MSL) is higher than the Transition Level but is not shown in FL, a system message is generated.

Temperature compensation shall also be applied to approach waypoint altitudes. Temperature compensated minimums are displayed on the PFW. The destination temperature setting will be the same for both temperature compensated minimums and approach waypoint altitudes.

Temperature compensation of approach waypoint altitudes and approach minimums is coupled. If approach minimums have already been entered, and 'BARO' is the selected mode, enabling temperature compensation for approach waypoint altitudes will automatically apply temperature compensation to the approach minimums. Enabling temperature compensation for approach minimums will automatically apply temperature compensation to the approach waypoint altitudes.

NOTE

The use of temperature compensated altitudes outside the final approach segment must be coordinated with ATC.

ENABLING/DISABLING TEMPERATURE COMPENSATION FOR APPROACH WAYPOINT ALTITUDES:

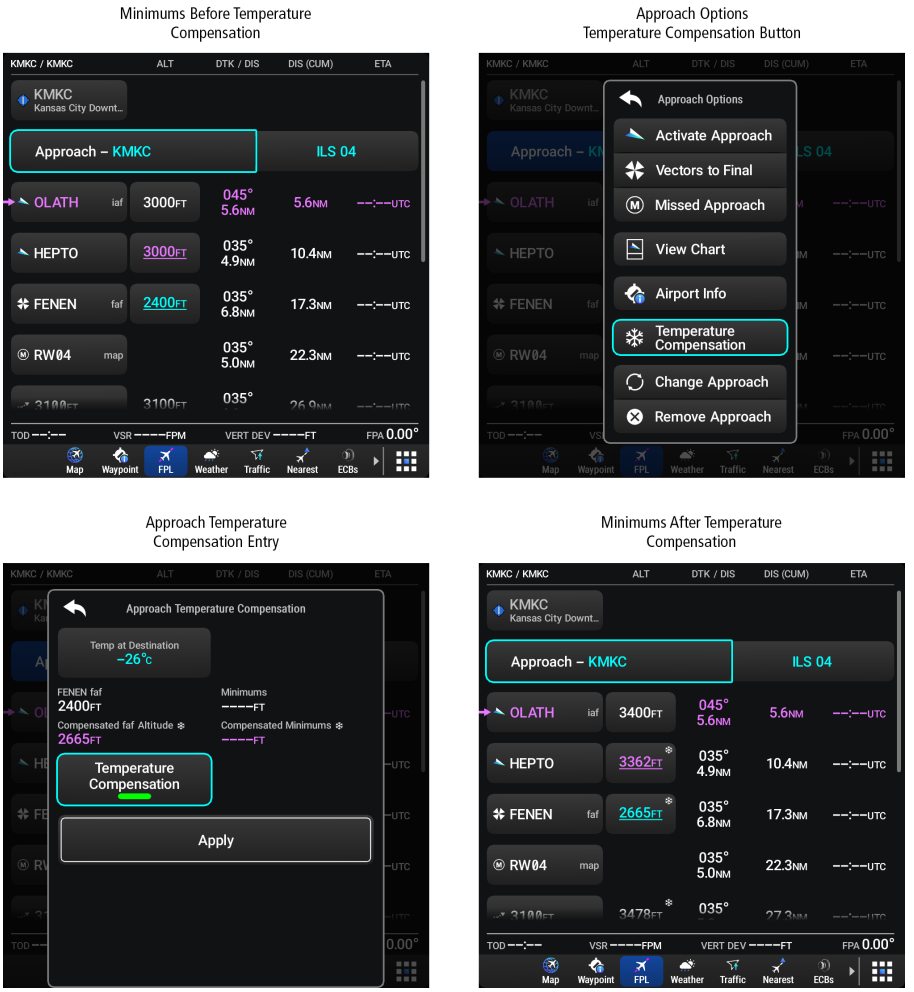


Figure 225: Enabling Temperature Compensation for Approach Waypoint Altitudes

1. Navigate to the Flight Plan Application Page.
2. Touch the **Approach** Button in the Approach Header Row to open the Approach Options Window.
3. Touch the **Temperature Compensation** Button.
4. Touch the **Temp at Destination** Datafield Button.
5. Using the keypad enter the temperature at the destination airport and touch the **Enter** Button.
6. Touch the **Temperature Compensation** Annunciation Button to review the compensated altitude(s).
7. Touch the **Apply** Button to activate the temperature compensation and return to the flight plan page.

ENTERING TEMPERATURE COMPENSATED MINIMUMS FOR AN APPROACH:

Figure 226: Enabling and Setting Temperature Compensation for Approach Minimums

1 Navigate to the PFD Menu:
   Touch the HSI.
   Or:
   Press the **MENU** Softkey (the PFW side of the bezel when in split screen mode).
2 Touch the **Minimums** Button.
3 On the Minimums keypad window, touch the **TEMP COMP** Annunciation Button.
4 Touch the **TEMP** Datafield Button.
5 On the Destination Temp keypad, enter the temperature and touch the **Enter** Button.
6 On the Minimums keypad enter the height desired for the minimums bug on the altimeter.
7 Touch the **Enter** Button.

5.8 FMS POSITIONING SENSORS AND MODES

POSITIONING SENSORS

The system accommodates aircraft positioning using the GPS sensors. When power is applied to the system, each sensor is enabled. Each sensor is continuously monitored and compared by the system, ensuring the most accurate source is in use. When a sensor is in use, 'Used' will be its displayed status. See the *GPS Receiver Operation* in the System Overview Section for details on SBAS, sensor receiver information, and RAIM prediction.

FMS Sensor	Description
GPS 1	Garmin GPS Sensors
GPS 2	

Table 31: FMS Sensors

Sensors may be manually inhibited and re-enabled at any time. The annunciation bar on each sensor button will be displayed as green when the sensor is enabled, and gray when inhibited. Information on sensor failure and FMS degradation is discussed later in this section. Approach downgrade information is discussed previously in the Procedures portion of this section.

NOTE

A sensor will not be monitored or used by the system once inhibited. Manually inhibiting sensors will affect the availability of position fixing modes.

MANUALLY INHIBITING/ENABLING GPS SENSORS:

1 Navigate to the 'Apps' window by pressing the **MENU** Softkey two times.

Or:

Touch the **Applications** Icon on the Applications Bar.

2 Touch the **Settings & Tools** Tab.

3 Touch **Sensors**.

4 If necessary srcoll to the position sensor that is required to inhibit or enable.

5 Touch the **GPS** or **SBAS** Indicator Button (the green bar indicates the sensor is enabled).

POSITION FIXING

The system can calculate position using GPS sensors. The system shall indicate how the current position fix is being determined and displays the current Lat/Lon position.

NOTE

If GPS position fixing are unavailable, the 'UNABLE RNP' annunciation will be show on the PFW.

NOTE

Some system functions require GPS position fixing to operate. If the system is no longer using GPS to find the aircraft position, annunciations may appear, indicating what functionality has been affected.

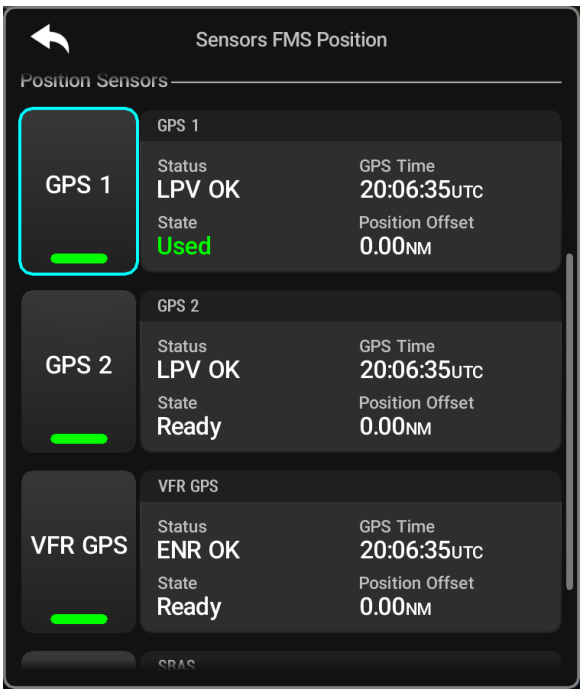


Figure 227: Position Fixing Sensors on the 'Position Sensors' Screen

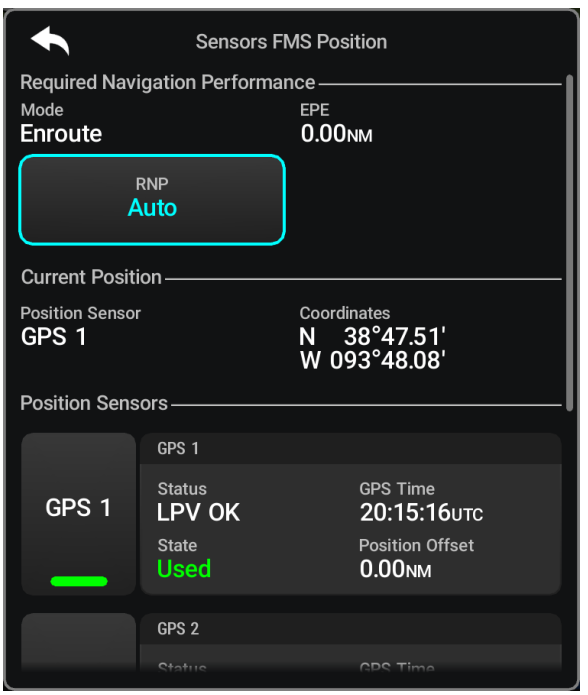


Figure 228: Current Position and Sensor in Use

GPS

GPS position fixing will be available if at least one GPS sensor is available and is enabled. If more than one GPS sensor is available, the system will prioritize which sensor to use based

on RAIM, integrity, and SBAS services. Additionally, each PFD will prioritize the on-side GPS sensor.

DEAD RECKONING

If there is no sensor data available to find position, the system reverts to Dead Reckoning Mode. *Dead Reckoning Mode* is discussed later in the Abnormal Operations portion of this section.

5.9 ABNORMAL OPERATIONS

FMS DEGRADATION

NOTE

Once inhibited, sensors will not be monitored or used by the system, and the system will not re-enable those sensors in the event of a failure. The system will revert to Dead Reckoning or no position until an available sensor with a valid position is available.

This portion of the guide discusses enroute and terminal Flight Management System (FMS) degradation and Dead Reckoning (DR). For information on final approach degradation behavior, see the *Approaches* portion in Procedures given earlier in this section.

The FMS will operate in either the GPS or the DR position fixing mode, depending on the available sensors. If enabled and available for use, GPS 1/GPS 2 will have priority, and SBAS will be used if available. If one GPS sensor fails, the system will automatically transition to the other GPS sensor.

If GPS is lost and the system is unable to recover a signal, or if both GPS sensors fail, the "GPS LOI" (Loss of Integrity) annunciation is displayed in amber on the PFW. Also, a system message concerning the loss of GPS will be generated.

ABNORMAL GPS CONDITIONS

See the Warning, Caution, and Advisory sections in *Appendix A* for abnormal GPS condition annunciations. GPS navigation will resume automatically once a valid GPS solution is restored.

Up to two external GPS sources may be configured, along with the internal VFR GPS. Each GPS must be configured and operational during the last on-ground start to be available for use. The following table provides information on what GPS source will be used in the event of one or more GPS failure.

Available GPS Sources			GPS Source(s) Used
External GPS #1	External GPS #2	External GPS #3	
Yes	No	Yes	External GPS #1
No	Yes	Yes	External GPS #2

Available GPS Sources			GPS Source(s) Used
External GPS #1	External GPS #2	External GPS #3	
No	No	Yes	Internal VFR GPS
No	No	No	None

Table 32: GPS Failure Downgrade

EXTERNAL GPS FAILURE

If configured, the external GPS shall be considered the Primary GPS, and the internal VFR GPS may be utilized as a Backup GPS. The VFR GPS is continuously being monitored and compared to the Primary GPS, so that a seamless and automatic transition to the VFR GPS will be made if the Primary GPS fails.

If all configured external GPS sources fail, and configured to do so, the AXIS™ flight display will revert to using the internal VFR GPS for emergency Direct-To navigation guidance and position data on the moving map. In this case, a system message is generated and Direct-To navigation using the internal VFR GPS becomes available. Direct-to navigation is discussed previously in this section. TAWS/terrain features are not available with the internal VFR GPS.

GPS JAMMING AND GPS SPOOFING

GPS jamming and spoofing are two distinct events that adversely affect an aircraft's ability to maintain accurate GPS information.

- GPS jamming can result in degraded GPS accuracy or a complete loss of GPS positioning.
- GPS spoofing can have a variety of impacts depending on the type and sophistication of the spoofer. In cases where a spoofer only partially captures the GPS receiver, the effects will appear much like GPS jamming. Full capture of the GPS receiver without detection can result in misleading navigation guidance for as long as the false signals are present.

SUSPECTED JAMMING

GPS jamming is radio frequency interference that disrupts the ability of a receiver to track the GPS signal and provide an accurate position solution. GPS jamming can be either intentional or accidental. Jamming can overwhelm the GPS receiver and prevent it from determining a position. Jamming can also partially degrade the signal so that only a few satellites are available for the receiver to compute a position with reduced accuracy.

A strong jamming signal could cause loss of GPS positioning, resulting in FMS degradation, ADS-B Out failure, and the loss of SVT and forward looking terrain alerting functions. Upon a loss of GPS positioning due to jamming, ADAHRS will revert to the No-GPS Mode and will continue to provide attitude and heading information with no noticeable adverse effects on accuracy.

The flight director mode will transition to a reversionary state if the loss occurs while FMS is in use for a GPS based approach; otherwise, the flight director mode can remain coupled to the FMS for lateral and vertical modes.

When GPS is lost due to jamming, the pilot should use alternate navigation methods such as VOR, LOC/ILS, or an ATC-assigned heading, if possible, instead. See the previous discussion on *FMS Positioning Sensors* in this section for more information.

SUSPECTED SPOOFING

GPS spoofing is different from jamming in that spoofing signal mimics the true GPS signal and can be received and processed by the GPS receiver. If the GPS receiver is partially spoofed, only a portion of the tracked signals are affected. The receiver may be unable to track some or all GPS signals and may have ranging errors on other signals. If the GPS receiver is completely spoofed, all tracked signals being used by the receiver are affected by the spoofer. Spoofing may be suspected if any of the following occur:

- FMS Degradation (see previous section on degradation indications when GPS is lost).
- Sudden, erratic, or unexplained changes of aircraft location on the moving map.
- Unexpected autopilot commands or oscillations during straight and level flight.
- Unexpected SVT and forward looking terrain alerts.
- Ground track angle, track vector, or ground speed indication inconsistent with actual aircraft heading and true airspeed, accounting for expected winds.
- ADAHRS reverting to No-GPS Mode.
- Incorrect computed wind speed or direction.
- System messages “GPS[1/2] CHECK POSITION” may be displayed.
- Incorrect automatic system date or time update, or incorrect indication of date/time on GPS status pages.

If the aircraft is not within range of a suitable NAVAID, or if the only NAVAIDS within range have been excluded ('Disabled NAVAIDS' listed under NOTAM NAVAIDS), the pilot should use alternate navigation methods such as VOR, LOC/ILS, or an ATC-assigned heading, if possible, instead.

The pilot may also choose to disable SVT, and inhibit nuisance terrain alerts, if desired. SVT is discussed in the Flight Instruments Section. Traffic and Terrain alerting and discussed in the Hazard Avoidance Section.

DEAD RECKONING MODE

The system will revert to Dead Reckoning (DR) Mode if the system is no longer fully using any GPS sensor or DME / DME for position fixing, even if airspeed and heading data are unavailable. In DR Mode, the system will use its last-known position combined with continuously updated airspeed and heading data (when available) to calculate and display the aircraft’s current estimated position. It is important to note that estimated navigation data supplied by the system in DR mode will become increasingly unreliable and must not be used as a sole means of navigation.

DR mode is inherently less accurate due to the lack of measurements otherwise provided by GPS or DME/ DME. Changes in wind speed and/or wind direction compound the relative inaccuracy of DR mode. Because of this degraded accuracy, other navigation equipment must be relied upon for position awareness until GPS or DME/DME position data is restored.

DR mode will be indicated on the system by the appearance of the letters “DR” displayed in amber on the HSI. The CDI deviation bar will be displayed in amber. The autopilot can be coupled in DR mode, as long as the lateral deviation guidance is available.

NOTE

FMS derived information may not be displayed amber on the Flight Plan Progress Window when operating in Dead Reckoning mode. However, this information shall still be considered as degraded navigation source information.

As a result of operating in DR mode, all data that is dependent upon FMS position data is displayed as amber text to denote degraded navigation information. Airspace alerts continue to function, but with degraded accuracy. Also, while the system is in DR mode, SVT and forward looking terrain alerting functions are disabled.

Figure 229: Dead Reckoning Mode on the PFD

SECTION 6 HAZARD AVOIDANCE

6.1 OVERVIEW

Hazard Avoidance features available for the AXIS™ flight displays 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**
  - Flight Information Services-Broadcast (FIS-B) (Standard)
  - GDL® 5x Garmin Connext® Weather (Subscription Optional)
  - WX-500 Stormscope Lightning Detection System (Optional)
  - GDL 69A SXM SiriusXM Weather (Subscription Optional)
- **Terrain Avoidance**
  - Terrain Awareness and Warning System (Adaptive Terrain) (Standard)
  - Terrain Awareness and Warning System Class-B (TAWS-B) (Optional)
- **Traffic**
  - Flight Information Services-Broadcast (FIS-B) (Standard)
  - Garmin GTS™ 8xx TAS/TCAS
  - Automatic Dependent Surveillance-Broadcast (ADS-B) Traffic (Optional)
  - Traffic Information System (TIS-A)

6.2 DATALINK WEATHER

⚠ WARNING

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

⚠ WARNING

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

NOTE

Do not rely on datalink weather information to discern precise values for any weather-related measurements. Datalink 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 FIS-B Weather service, available when equipped with a capable transponder or data link receiver which can receive 978 MHz Universal Access Transceiver (UAT) data, delivers subscription-free weather information periodically and automatically to the aircraft. FIS-B uses a network of FAA-operated Ground-Based Transceivers (GBTs) to transmit the information to the aircraft's receiver. Reception is limited to line-of-sight, and is available below 24,000 feet MSL

in the United States. FIS-B broadcasts provide weather data in a repeating cycle which may take approximately ten minutes to transmit all available weather data. Therefore, not all weather data may be present immediately upon initial FIS-B signal acquisition. FIS-B is a component of the Automatic Dependent Surveillance (ADS-B) system, which offers both weather and traffic data; refer to the *ADS-B Traffic* discussion later in this section for a more detailed discussion of the ADS-B system and its capabilities.

The Garmin Connext® Weather service, available when equipped with the optional Garmin GSR 56 Iridium Transceiver and an active service subscription, provides data link weather information to the aircraft after the pilot defines a geographic area and subsequently selects a manual or automatically recurring Connext Data Request. The transceiver then contacts the Garmin Connext Weather service using the Iridium Satellite telephone system and retrieves the weather data for the specified area. The Garmin Connext Weather service offers worldwide weather coverage, but the availability of individual weather products, such as radar precipitation, varies by region.

NOTE

To check the availability of Garmin Connext weather products offered in a particular region, visit flyGarmin.com®.

WEATHER PRODUCT AGE

Unlike real-time weather information collected directly from weather sensors on-board an aircraft, such as an airborne lightning detection system, data link weather by contrast relies on service providers to collect, process, and transmit weather information to the aircraft. This information can come from a variety of sources such as government agencies. Due to the time it takes to collect, process, and distribute data link weather information, it is imperative for pilots to understand that data link weather information is not real-time information and may not accurately depict the current conditions.

For each data link weather product which can be displayed as a map overlay, such as METARs, the system can also show a weather product age. This age represents the elapsed time, in minutes, since the weather service provider compiled the weather product and the current time. It does not represent the age of the information contained within the weather product itself. For example, a single mosaic of radar precipitation is comprised data from multiple radar sites providing data at differing scan rates or intervals. The weather service provider periodically compiles this data to create a single composite image, and assigns one time to this image which becomes the basis of the product age. The service provider then makes this weather product available for data link transmission at the next scheduled update time. The actual age of the weather data contained within the mosaic is therefore older than its weather product age and should never be considered current.

Each data link weather product age has an expiration time. The weather product age is shown in white if it is less than half of this expiration time, otherwise it is shown in amber until reaching its expiration time. After a weather product has expired, the system removes the expired weather product from the displays, and shows white dashes instead of the age. If the data link receiver has not yet received a weather product ‘N/A’ appears instead of the age to show the product is currently not available for display. This may occur, for example, after

powering on the system but before the data link receiver has received a complete weather data transmission. It could also indicate a possible outage of a weather product.

The weather product age is shown automatically for weather products displayed on MFW maps. For PFW maps, the pilot can manually enable/disable the age information.

The following tables show the weather product symbols, the expiration times and the broadcast rates where applicable. The data link weather service providers and their respective weather data vendors define and control the data update intervals, which are subject to change. These update intervals represents the interval at which the service provider transmits new signals that may or may not contain updated weather product information. It does not represent the rate at which the weather information is updated or when the Datalink Receiver receives new data.

FIS-B Products	Product Symbol	Expiration Time (Minutes)	FIS-B Products	Product Symbol	Expiration Time (Minutes)
NEXRAD Composite		30	Graphical AIRMETs		60
Turbulence		120	SIGMETs		60
Icing		30	Center Weather Advisories (CWAs)		60
METARs		90	Temporary Flight Restriction (TFR)		60
Pilot Weather Report (PIREP)		90	Temporary Military Operation Area (TMOA)	MOA	60
Lightning		30	Temporary Reserved Area (TRA)	RA	60
Winds Aloft		90[1]	Terminal Aerodrome Forecast (TAF)	No product image	60
Cloud Tops		120	No Radar Coverage	No product image	30

[1] The Winds Aloft product no longer issues an expiration time. It uses the best applicable model data for the time given, if one is available, to set an expiration time.

Table 33: FIS-B Weather Product Symbols and Data Timing

NOTE

The composite precipitation image is updated every 5 minutes, but individual radar sites may take between 3 and 10 minutes to provide new data.

NOTE

Canadian radar precipitation data provided by Environment Canada.

NOTE

Australian radar precipitation data provided by the Australia Bureau of Meteorology.

Weather legend icons may be displayed in four states depending on the whether the data is current or old, downloading, or if there is a fault with the data. In the table below, the icon used is for example purposes only.

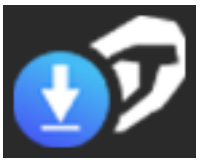
Example Icon (NEXRAD)	Description
	When the data is current the normal icon is displayed.
	When the data is still current but old the icon is displayed to all white with a white outline.
	When new data is being downloaded a blue downloading symbol is displayed over the icon.
	If there is any current fault with the data, an exclamation point will be displayed over the icon.

Table 34: Weather Legend Icon Status

DATALINK WEATHER

'Weather' map application page on the MFW provides the capability for displaying the most data link weather products of any map on the system. 'Datalink Weather' also provides system-wide controls for selecting the data link weather source, if more than one source has been installed.

NAVIGATE TO THE WEATHER MAP:

On the MFW, touch the **Weather** Button on the MFW App Bar.

Or:

Turn the Outer **DCK** on the MFW side of the bezel until the Weather Application is open on the MFW.

Or:

Touch the **Applications** Icon **>** **Primary** Tab **>** **Weather**.

ENABLING WEATHER INFORMATION ON THE 'MAP' APPLICATION PAGE:

1 Navigate to the MFW 'Map' Application Page.
2 Press the **MENU** Softkey.
3 Touch the **Overlay** Selection Button.
4 Touch **Weather**.

ENABLING/DISABLING WEATHER INFORMATION ON THE HSI MAP:

1 Navigate to the PFW Settings:
   a) Press the **MENU** Softkey (On the PFW side of the bezel if in split screen mode).
      Or:
      Touch the HSI to open the 'PFW Menu.
   b) Touch **PFW Settings**.
2 Ensure **Map** is the selected overlay using the **HSI Style** Selector Button.
3 Touch the **Weather** Annunciation Button (green annunciation indicates the feature is enabled).

ADDITIONAL WEATHER DISPLAY INFORMATION

Figure 230: Radial Menu Showing Datalink Weather Information

Datalink Weather Product	HSI Map	MFW Map Page	Datalink Weather Page	PFD Widget
NEXRAD/Radar Precipitation	+	+	+	
Datalink Lightning	+	+	+	
SIGMETs/AIRMETs			+	
Graphical AIRMETs			+	
METARs	+	+	+	
Winds Aloft		+[1]	+	+
Icing			+	+

Datalink Weather Product	HSI Map	MFW Map Page	Datalink Weather Page	PFD Widget
PIREPs			+	
Temperatures Aloft			+	
Turbulence			+	+
No Radar Coverage	+	+	+	
TFRs	+	+	+	
TAFs			+	
Center Weather Advisories			+	
[1] Winds Aloft data is available inside the VSD when VSD is enabled on the 'Map'.				

Table 35: Weather Product Display Maps

The 'Weather Menu' controls the enabling/disabling of weather products for 'Datalink Weather'. The 'Map Menu' controls the enabling/disabling of weather products for the 'Map'.

NOTE

When viewing the 'Map' with a data link weather overlay information enabled, displaying a different map and returning to the original map will ensure the most current weather overlay information is displayed.

The system displays additional information about the following weather products by touching the product on the map.

- SIGMETs
- AIRMETs
- METARs
- Center Weather Advisories
- Graphical AIRMETs
- TFRs
- PIREPs
- AIREPs
- Infrared (IR) Satellite (Connext)

The system provides the ability to select a map orientation for 'Weather' on the selected MFW. In addition to the Heading Up, Track Up, and North Up display options, the system can also synchronize 'Weather' orientation to the 'Map' orientation.

The weather product age and availability information appears automatically when a weather product is shown on 'Weather'. The pilot can manually enable/disable the display of this information on the HSI Map.

DISPLAYING ADDITIONAL WEATHER INFORMATION:

Weather options may contain additional information which can be accessed through the Radial Menu.

1 Touch the relevant weather icon or select the icon to display the Radial Menu.
2 Touch the Dynamic Button with the desired weather icon to bring up additional information.

NEXRAD

⚠ WARNING

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

NOTE

The NEXRAD weather product cannot be displayed at the same time as relative terrain.

NOTE

Pilots are encouraged to check additional NOTAM sources to supplement FIS-B NOTAMs. NOTAMs older than 30 minutes will not be displayed by FIS-B. For additional information refer to InFO 18008 and AC 00-63.

NOTE

The ceiling for FIS-B is 24,000ft (FL240), however it is expected that users can receive the FIS-B service above that altitude. Some FIS-B products will only include data up to or near FL240, however Winds and Temps Aloft will extend up to FL390.

The National Weather Service (NWS) operates the WSR-88D, or NEXRAD (NEXt-generation RADar) system, an extensive network of 156 high-resolution Doppler radar systems. The NEXRAD network provides centralized meteorological information for the continental United States (CONUS) and selected overseas locations. The maximum range of a single NEXRAD site is 250 NM.

Individual NEXRAD sites supply the network with radar images, and the images from each radar site may arrive at the network at different rates and times. Periodically, the weather data provider to FIS-B compiles the available individual site images from the network to form a composite image, and assigns a single time to indicate when it created the image. This image becomes the NEXRAD weather product. Individual images--gathered from each NEXRAD site--differ in age, and are always older than the displayed NEXRAD weather product age. The data provider then sends the NEXRAD data to the FIS-B GBTs, which transmit this information during the next designated broadcast time for the NEXRAD weather product.

Because of the time required to detect, assemble, and distribute the NEXRAD weather product, the displayed weather information contained within the product may be older than the current radar synopsis and may not depict the current weather conditions. NEXRAD information should never be used as a basis for maneuvering in, near, or around areas of hazardous weather regardless of the information it contains.

NOTE

The Map Application page on the MFW will only display CONUS NEXRAD Weather. Regional NEXRAD Weather information must be viewed using the Weather Application page on the MFW.

The FIS-B NEXRAD weather product may be displayed for a region around the GBT (higher resolution, updated more frequently) or for across the continental United States (lower resolution, updated less frequently). A combined version of both weather products is also available for display on the Weather Application page. When the combined NEXRAD is selected, regional NEXRAD takes display precedence where data is available, and continental US NEXRAD is displayed outside of the regional NEXRAD coverage area.

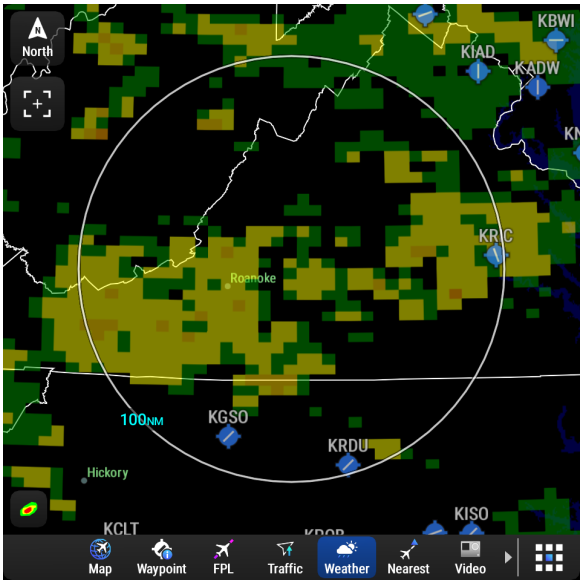


Figure 231: CONUS NEXRAD Weather Product on the 'Weather' Page

The Regional NEXRAD weather product coverage area varies, as it is determined by the data received from ground-based sources. When the Regional NEXRAD weather product is enabled, a white hatched boundary encloses this area to indicate the geographic limits of the Regional NEXRAD coverage being displayed. The system shows composite radar data from all available NEXRAD sites inside of this boundary area.

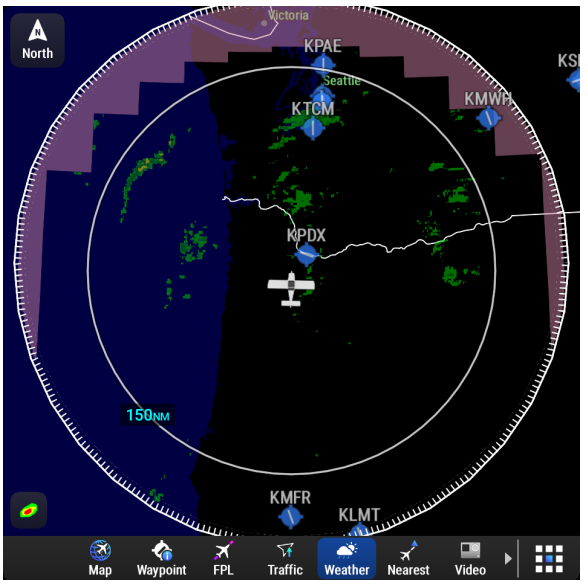


Figure 232: Regional NEXRAD Weather Product on the 'Weather' Page

This data is composed of the maximum reflectivity from the individual radar sweeps. The display of the information is color-coded to indicate the weather severity level.

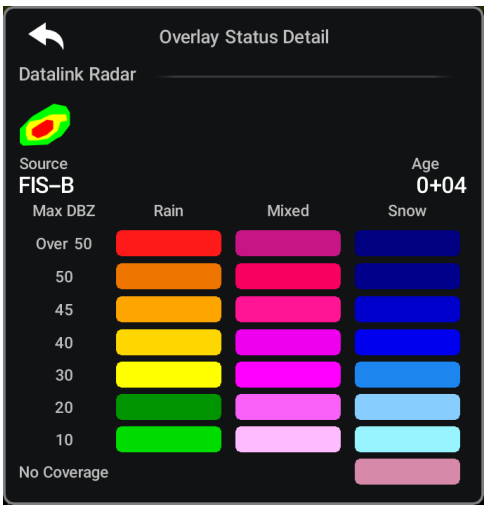


Figure 233: FIS-B NEXRAD Weather Legend

When NEXRAD is enabled, areas where radar data is not currently available, has not yet been received, or is not being collected are indicated in a gray shade of purple.

NOTE

If the system has not received all available NEXRAD weather data (such as during initial FIS-B signal acquisition or in areas of marginal or poor signal reception), the system may display areas of no radar coverage which are subsequently removed as radar data is received. It may take up to approximately ten minutes to receive all FIS-B data, when adequate reception is available.

NEXRAD REFLECTIVITY

Reflectivity is the amount of transmitted power returned to the radar receiver. Colors on the NEXRAD display are directly correlative to the level of detected reflectivity. Reflectivity as it relates to hazardous weather can be very complex.

The role of radar is essentially to detect moisture in the atmosphere. Simply put, certain types of weather reflect radar better than others. The intensity of a radar reflection is not necessarily an indication of the weather hazard level. For instance, wet hail returns a strong radar reflection, while dry hail does not. Both wet and dry hail can be extremely hazardous.

The different NEXRAD echo intensities are measured in decibels (dB) relative to reflectivity (Z). NEXRAD measures the radar reflectivity ratio, or the energy reflected back to the radar receiver (designated by the letter Z). The value of Z increases as the returned signal strength increases.

NEXRAD LIMITATIONS

NEXRAD radar images may have certain limitations:

- At a map range of 30 NM or less, individual blocks of NEXRAD weather data are viewable. For the regional version of the NEXRAD weather product, each block is 1.5 NM wide by 1 NM tall. For the continental United States version of the NEXRAD weather product, each block is 7.5 NM wide by 5 NM wide.
- The continental US version of the NEXRAD weather product is not available above 60º of latitude.

The following may cause abnormalities in displayed NEXRAD radar images:

- Ground clutter.
- Spurious radar data.
- Sun strobes (when the radar antenna points directly at the sun).
- Interference from buildings or mountains, which may cause shadows.
- Metallic dust (chaff) from military aircraft, which can cause alterations in radar scans.

ENABLING/DISABLING WEATHER INFORMATION ON THE 'WEATHER' APPLICATION PAGE:

1 Navigate to the 'Weather' Application Page on the MFW:
   a) Touch the **Weather** Button on the MFW App Bar.
      Or:
   a) Use the Outer **DCK** on the MFW side (of the PFD) while in split screen mode to scroll through the applications to navigate to the 'Weather' Application Page.
      Or:
   a) Touch the **Applications** Icon **> Primary** Tab **> Weather**.
2 Press the **MENU** Softkey.

3 Scroll as necessary through the Weather Menu and touch the desired weather feature annunciator buttons to toggle them on and off. The green annunciation indicates the feature is enabled.

DISPLAYING THE NEXRAD WEATHER PRODUCT ON THE 'DATALINK WEATHER' (CONUS, REGIONAL, OR ALL):

1 Navigate to the 'Weather' Application Page on the MFW:
   a) Touch the **Weather** Button on the MFW App Bar.
      Or:
   a) Use the Outer **DCK** on the MFW side (of the PFD) while in split screen mode to scroll through the applications to navigate to the 'Weather' Application Page.
      Or:
   a) Touch the **Applications** Icon **>** **Primary** Tab **>** **Weather**.
2 Press the **MENU** Softkey.
3 Scroll to the bottom of the menu and touch the **Weather Settings** Button.
4 Touch the **Radar Type** Selection Button.
5 Touch the type of NEXRAD Weather to be displayed on the Weather Application Page (CONUS, Regional, or All).

DISPLAYING NEXRAD WEATHER INFORMATION ON THE 'MAP':

NOTE

The Map Application page on the MFW will only display CONUS NEXRAD Weather. Regional NEXRAD Weather information must be viewed using the Weather Application page on the MFW.

1 On the 'Map' Application Page of the MFW, press the **MENU** Softkey.
2 Touch the **Overlay** Selection Button.
3 Touch the **Weather** option to display the weather on the MFW 'Map' Page.
4 Touch the **Map Settings** Button.
5 Touch the **Weather** Tab.
6 Touch the desired weather feature annunciator buttons to toggle them on and off. The green annunciation indicates the feature is enabled.

CLOUD TOPS

NOTE

When the Cloud Tops weather product is enabled on the 'Weather' Application Page the system disables the Echo Tops weather product.

The Cloud Tops weather product depicts cloud top altitudes as determined from satellite imagery. When the Cloud Tops weather product is enabled, the system removes the Echo Tops weather product. Using the dynamic button on the Radial Menu the pilot can view the hieght of the cloud tops at a specific point on the 'Weather' Map.

The FIS-B Cloud Tops weather product is not available in Alaska, Hawaii, Guam, or Puerto Rico.

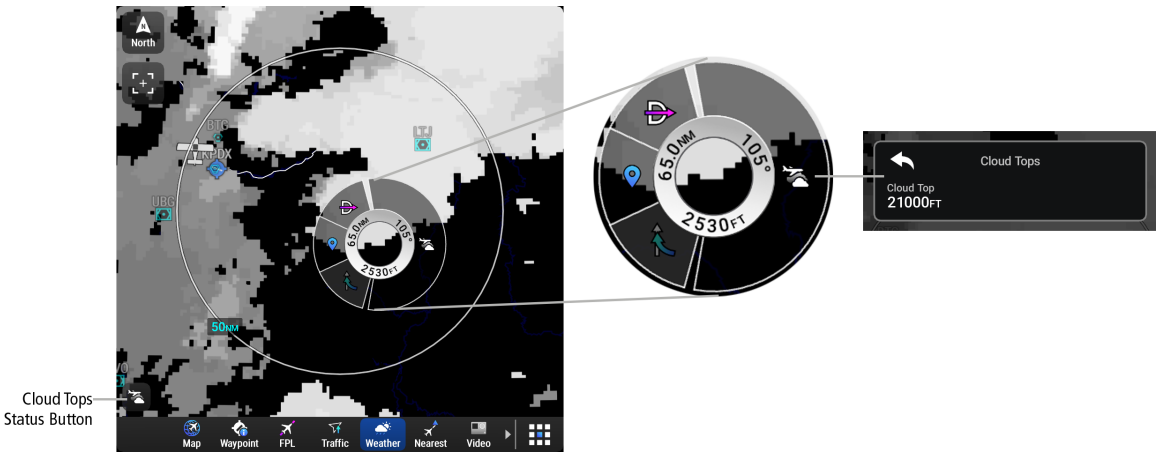


Figure 234: Cloud Tops Weather Product

Touch the Status Button on the 'Weather' Page to display the 'Overlay Status Detail' legend when 'Cloud Tops' weather product is enabled.

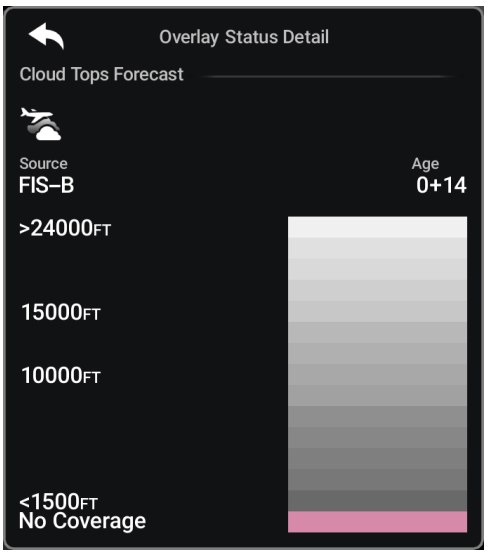


Figure 235: Cloud Tops Legend

ENABLING/DISABLING CLOUD TOPS INFORMATION ON THE 'WEATHER' PAGE:

1 Navigate to the 'Weather' Application Page on the MFW:
   a) Touch the **Weather** Button on the MFW App Bar.

      Or:

   a) Use the Outer **DCK** on the MFW side (of the PFD) while in split screen mode to scroll through the applications to navigate to the 'Weather' Application Page.

Or:

a) Touch the **Applications** Icon **>** **Primary** Tab **>** **Weather**.

2 Press the **MENU** Softkey.

3 Scroll as necessary and touch the **Cloud Tops** Annunciation Button to toggle on and off. The green annunciation indicates the feature is enabled.

MEATARS AND TAFS

METARs typically contain information about the temperature, dewpoint, wind, precipitation, cloud cover, cloud base heights, visibility, and barometric pressure at an airport or observation station. They can also contain information on precipitation amounts, lightning, and other critical data. METARs reflect hourly observations; non-routine updates include the code "SPECI" in the report. METARs are shown as colored flags at airports which have a requested METAR available.

TAFs (Terminal Aerodrome Forecasts) are weather predictions for specific airports within a 24-hour period, and may span up to 36 hours. TAFs typically include forecast wind, visibility, weather phenomena, and sky conditions using METAR codes.

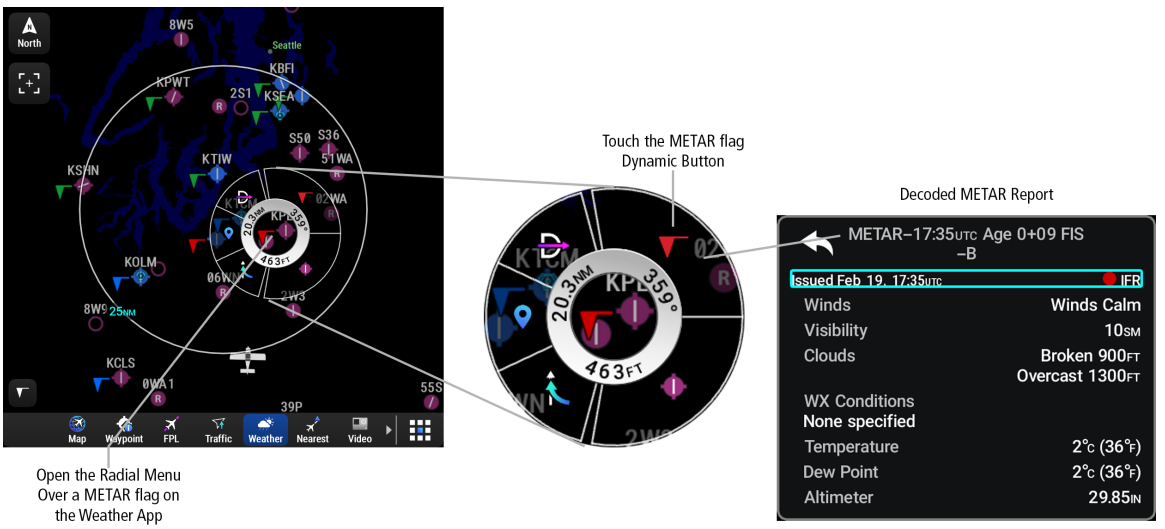


Figure 236: Displaying METAR Data

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 Datalink Weather service was unable to categorize the METAR.

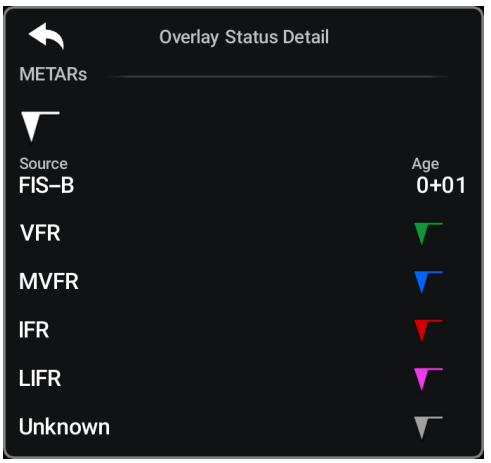


Figure 237: METAR Legend

Textual METAR/TAF information is available on the 'Waypoint Info' on the 'Map,' 'Datalink Weather,' or PFW Navigation or Datalink Weather 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 FIS-B or Garmin Connext), if more than one source is installed. In this case, the system automatically displays the newest available METAR. If the METAR age is identical from all available data link sources, the system selects one METAR to display in the following order of source priority: FIS-B, then Garmin Connext.

The textual display of METAR information on the 'Waypoint Info' shows the decoded 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 decoded METAR text.

Figure 238: METAR Waypoint Info

SHOWING METAR TEXT ON THE 'WEATHER' APPLICATION PAGE:

1 Navigate to the 'Weather' Application Page.
   a) Touch the **Weather** Button on the MFW App Bar.

      Or:

   a) Use the Outer **DCK** (on the MFW side of the bezel in split screen mode) to scroll to the 'Weather' Application Page.

      Or:

   a) Touch the **Applications** Icon **> Primary** Tab **> Weather**.
2 Ensure METARs is enabled on the 'Weather' Application Page.
   a) Press the **MENU** Softkey on the MFW/Weather App side of the bezel in split screen mode.
   b) Enable METARs by ensuring the **METARs** Annunciation Button is green (touch the **METARs** Annunciation Button if it is subdued to enable it).
   c) Touch the **Back Arrow**

      Or:

      Press the **BACK** Softkey (on the MFW/Weather App side of the bezel in split screen mode) to return to the 'Weather' Application Page on the MFW.
3 Touch the area of the Weather Map that has a METAR icon to open the Radial Menu over the desired METAR to be viewed.
4 Touch the METAR Dynamic Button on the Radial Menu to view the METAR information.

SHOWING METAR INFORMATION ON THE 'MAP':

1 Navigate to the 'Map' Application Page.
   a) Touch the **Map** Button on the MFW App Bar.

      Or:

   a) Use the Outer **DCK** (on the MFW side of the bezel in split screen mode) to scroll to the 'Map' Application Page.

      Or:

   a) Touch the **Applications** Icon **> Primary** Tab **> Map**.
2 Press the **MENU** Softkey to open the 'Map Menu'.
3 Touch the **Overlay** Selection Button and ensure **Weather** is the selected overlay option.
4 Touch the **Map Settings** Button.
5 Touch the **Weather** Tab.
6 Touch the **METARs** Annunciation Button. The green annunciation indicates the feature is enabled.
7 Touch the area of the 'Map' that has a METAR icon to open the Radial Menu over the desired METAR to be viewed.
8 Touch the METAR Dynamic Button on the Radial Menu to view the METAR information.

VIEWING TEXTUAL METAR/TAF INFORMATION ON THE 'WAYPOINT' APPLICATION PAGE:

1 Navigate to the 'Waypoint' Application Page.
   a) Touch the **Waypoint** Button on the MFW App Bar.
      Or:
   a) Use the Outer **DCK** (on the MFW side of the bezel in split screen mode) to scroll to the 'Waypoint' Application Page.
      Or:
   a) Touch the **Applications** Icon **>** **Primary** Tab **>** **Waypoint**.
2 If required, change the airport using the **Waypoint Identifier** Datafield Button at the top of the page.
   a) Touch the **Waypoint Identifier** Datafield Button.
   b) Use the keyboard to type a waypoint identifier and touch the **Enter** Button.
      Or:
      Use the find function by touching the **Find** Button at the top of the keyboard.
3 Touch the **Weather** Tab.
4 Scroll if necessary to view all decoded METAR and TAF information. If no information is available, "No Data Available" will appear below the METAR and/or TAF sections.
5 If viewing raw data is desired for either the METAR or TAF, touch the **View Raw** Button at the bottom of their respective sections. A window will open with the raw data for the METAR or TAF.
6 Touch the **Back Arrow**
   Or:
   Press the **BACK** Softkey (on the MFW/Waypoint App side of the bezel in split screen mode) to return to the 'Waypoint' Application Page on the MFW.

DISPLAYING METAR CEILING AND VISIBILITY ON THE VSD:

1 Navigate to the 'Weather' Application page.
2 Press the **MENU** Softkey.
3 Scroll if necessary, and touch the **VSD** Annunciation Button.
4 Ensure the proper weather features are enabled in the 'Weather Menu'.

DATALINK LIGHTNING

The Lightning weather product shows the approximate location of cloud-to-ground lightning strikes. A strike icon represents a strike has occurred within a two-kilometer region. The exact location of the lightning strike is not displayed.

The FIS-B Lightning weather product is not available in Alaska, Hawaii, Guam, or Puerto Rico.

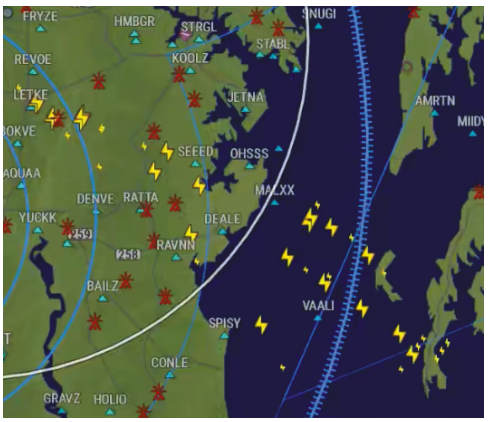


Figure 239: Lightning Weather Product

Touch the Status Button on 'Datalink Weather' to display weather legend(s) for enabled weather product(s). Scroll as necessary to view the information, then touch the Back Button.

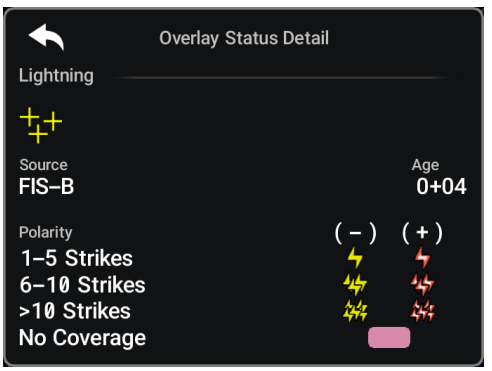


Figure 240: FIS-B Datalink Lightning Overlay Status

ENABLING/DISABLING DATALINK LIGHTNING INFORMATION ('WEATHER' APP):

1 Navigate to the 'Weather' Application Page.
   a) Touch the **Weather** Button on the MFW App Bar.
      Or:
   a) Use the Outer **DCK** (on the MFW side of the bezel in split screen mode) to scroll to the 'Weather' Application Page.
      Or:
   a) Touch the **Applications** Icon **> Primary** Tab **> Weather**.
2 Press the **MENU** Softkey on the MFW/Weather App side of the bezel in split screen mode.
3 Touch the **Lightning** Annunciation Button. The green annunciation indicates the feature is enabled.
4 Touch the **Back Arrow**
   Or:

Press the **BACK** Softkey (on the MFW/Weather App side of the bezel in split screen mode) to return to the 'Weather' Application Page on the MFW.

DISPLAYING DATALINK LIGHTNING INFORMATION ON THE 'MAP':

1 Navigate to the 'Map' Application Page.
   a) Touch the **Map** Button on the MFW App Bar.
      Or:
   a) Use the Outer **DCK** (on the MFW side of the bezel in split screen mode) to scroll to the 'Map' Application Page.
      Or:
   a) Touch the **Applications** Icon **>** **Primary** Tab **>** **Map**.
2 Press the **MENU** Softkey to open the 'Map Menu'.
3 Touch the **Overlay** Selection Button and ensure **Weather** is the selected overlay option.
4 Touch the **Map Settings** Button.
5 Touch the **Weather** Tab.
6 Touch the **Lightning** Annunciation Button. The green annunciation indicates the feature is enabled.

WINDS ALOFT

The Winds Aloft weather product shows the predicted wind speed and direction at the surface and at selected altitudes.Connext Winds Aloft data can be displayed in 3,000-foot increments from the surface up to 42,000 feet MSL. FIS-B Winds Aloft data can be displayed in 3000-foot increments beginning at the 3000 feet up to 53,000 feet MSL. FIS-B Weather additionally allows flight crews to select winds aloft data at lower altitudes in 500- foot increments beginning at 1000 feet through 2000 feet MSL.

Figure 241: Winds Aloft Data

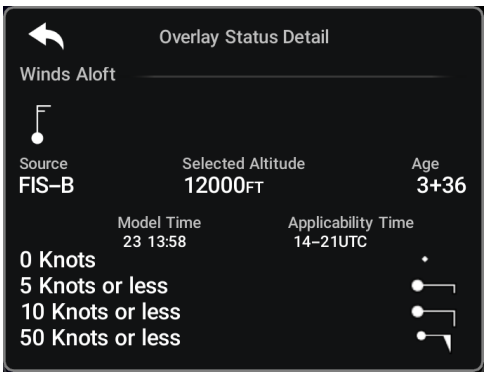


Figure 242: Winds Aloft Legend

Headwind and tailwind components aloft are available inside the Vertical Situation Display (VSD) Inset Window on the 'Map.' 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.

NOTE

Winds Aloft information will not be available on the VSD Inset Window if FIS-B is the active data link weather source.

Arrows pointing to the left indicate headwind components; tailwind component arrows point to the right, as shown in the following table.

DISPLAYING WINDS ALOFT DATA:

1 Navigate to the 'Weather' Application Page.
   a) Touch the **Weather** Button on the MFW App Bar.
      Or:
   a) Use the Outer **DCK** (on the MFW side of the bezel in split screen mode) to scroll to the 'Weather' Application Page.
      Or:
   a) Touch the **Applications** Icon **>** **Primary** Tab **>** **Weather**.
2 Press the **MENU** Softkey on the MFW/Weather App side of the bezel in split screen mode.
3 Touch the **Winds Aloft** Annunciation Button. The green annunciation indicates the feature is enabled.
4 When the **Winds Aloft** Annunciation Button is enabled, the **Altitude** Datafield Button becomes available on the 'Weather Menu' and the 'Weather' Application Page.
5 Touch the **Back Arrow**
   Or:
   Press the **BACK** Softkey (on the MFW/Weather App side of the bezel in split screen mode) to return to the 'Weather' Application Page on the MFW.

6 Touch the **Altitude** Datafield Button, scroll if necessary, and touch the desired altitude for the system to display the winds aloft at the specified altitude. The **DCK** is able to scroll and select the desired altitude.

Or:

On the 'Weather' Application Page touch the Increase **Altitude** Arrow or Decrease **Altitude** Arrow to quickly view the next lowest or highest winds aloft readings.

TURBULENCE (FIS-B)

NOTE

The Turbulence weather product cannot be displayed at the same time as NEXRAD weather product.

The FIS-B Turbulence weather product displays forecast turbulence every 2,000 feet starting 2000 feet MSL to 24,000 feet MSL. Turbulence data is intended to supplement AIRMETs and SIGMETs.

The FIS-B Turbulence weather product is not available in Alaska, Hawaii, Guam, or Puerto Rico.

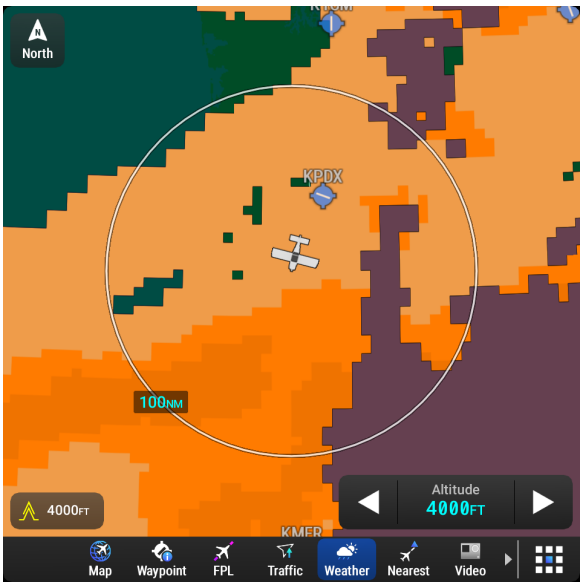


Figure 243: Turbulance Weather Product

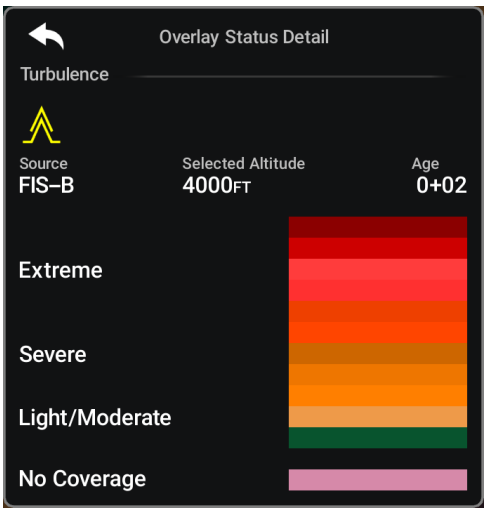


Figure 244: Turbulance Legend

DISPLAYING TURBULENCE DATA ON THE 'WEATHER' APPLICATION PAGE:

1 Navigate to the 'Weather' Application Page.
   a) Touch the **Weather** Button on the MFW App Bar.
      Or:
   a) Use the Outer **DCK** (on the MFW side of the bezel in split screen mode) to scroll to the 'Weather' Application Page.
      Or:
   a) Touch the **Applications** Icon **>** **Primary** Tab **>** **Weather**.
2 Press the **MENU** Softkey on the MFW/Weather App side of the bezel in split screen mode.
3 Touch the **Turbulence** Annunciation Button. The green annunciation indicates the feature is enabled.
4 When the **Turbulence** Annunciation Button is enabled, the **Altitude** Datafield Button becomes available on the 'Weather Menu' and the 'Weather' Application Page.
5 Touch the **Back Arrow**

   Or:

   Press the **BACK** Softkey (on the MFW/Weather App side of the bezel in split screen mode) to return to the 'Weather' Application Page on the MFW.
6 Touch the **Altitude** Datafield Button, scroll if necessary, and touch the desired altitude for the system to display the winds aloft at the specified altitude. The **DCK** is able to scroll and select the desired altitude.

   Or:

   On the 'Weather' Application Page touch the Increase **Altitude** Arrow or Decrease **Altitude** Arrow to quickly view the next lowest or highest winds aloft readings.

ICING (FIS-B)

NOTE

Icing data cannot be displayed at the same time as NEXRAD data.

The Icing Forecast (FIS-B) weather product displays a graphical view of the icing probability forecast. Icing Forecast data is supplied by the National Weather Service (NWS) utilizing the Forecast Icing Potential model. The FIS-B Icing Forecast is available from 2,000 feet MSL to 24,000 feet MSL at 2,000 feet intervals. Additionally, the FIS-B Icing Forecast weather product is only available in the continental United States.

Supercooled Large Droplet (SLD) icing conditions are characterized by the presence of relatively large, super cooled water droplets indicative of freezing drizzle and freezing rain aloft. SLD threat areas are depicted as magenta dots over the CIP colors.

The FIS-B Icing Forecast weather product is not available in Alaska, Hawaii, Guam, or Puerto Rico.

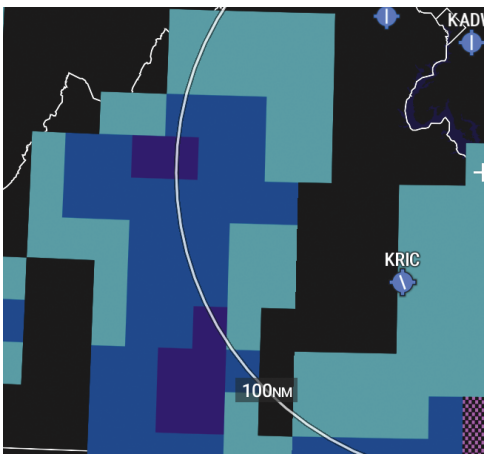


Figure 245: Icing Weather Product (FIS-B)

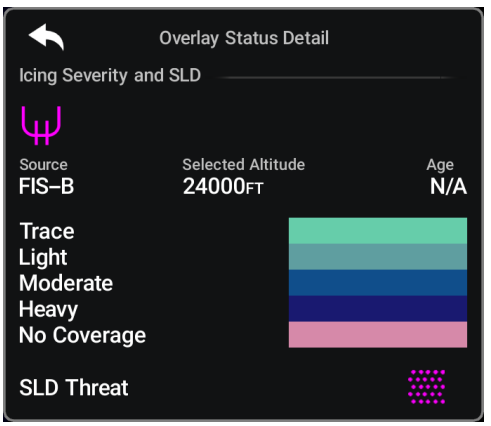


Figure 246: Icing Forecast Legend

DISPLAYING ICING DATA:

1 Navigate to the 'Weather' Application Page.
   a) Touch the **Weather** Button on the MFW App Bar.
      Or:
   a) Use the Outer **DCK** (on the MFW side of the bezel in split screen mode) to scroll to the 'Weather' Application Page.
      Or:
   a) Touch the **Applications** Icon **> Primary** Tab **> Weather**.
2 Press the **MENU** Softkey on the MFW/Weather App side of the bezel in split screen mode.
3 Touch the **Icing** Annunciation Button. The green annunciation indicates the feature is enabled.
4 When the **Icing** Annunciation Button is enabled, the **Altitude** Datafield Button becomes available on the 'Weather Menu' and the 'Weather' Application Page.
5 Touch the **Back Arrow**

   Or:

   Press the **BACK** Softkey (on the MFW/Weather App side of the bezel in split screen mode) to return to the 'Weather' Application Page on the MFW.
6 Touch the **Altitude** Datafield Button, scroll if necessary, and touch the desired altitude for the system to display the winds aloft at the specified altitude. The **DCK** is able to scroll and select the desired altitude.

   Or:

   On the 'Weather' Application Page touch the Increase **Altitude** Arrow or Decrease **Altitude** Arrow to quickly view the next lowest or highest winds aloft readings.

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.

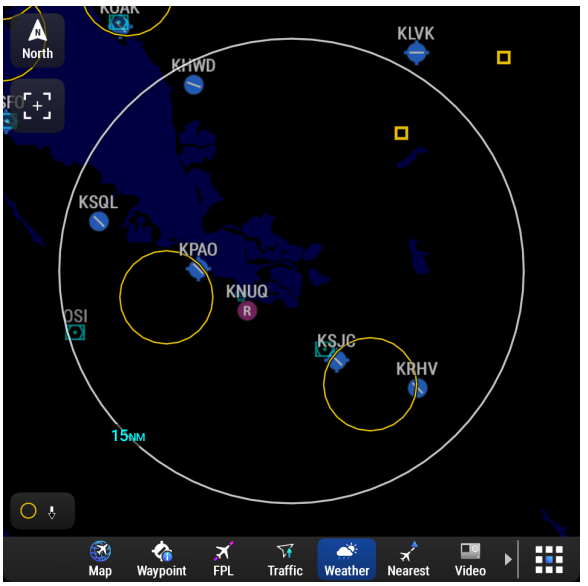


Figure 247: TFR Data on MFW

ENABLING/DISABLING TFR INFORMATION ON THE 'WEATHER' APPLICATION PAGE:

1 Navigate to the 'Weather' Application Page.
   a) Touch the **Weather** Button on the MFW App Bar.

      Or:

   a) Use the Outer **DCK** (on the MFW side of the bezel in split screen mode) to scroll to the 'Weather' Application Page.

      Or:

   a) Touch the **Applications** Icon **>** **Primary** Tab **>** **Weather**.
2 Press the **MENU** Softkey on the MFW/Weather App side of the bezel in split screen mode.
3 Touch the **NOTAM — TFRs** Annunciation Button. The green annunciation indicates the feature is enabled.
4 Touch the **Back Arrow**

   Or:

   Press the **BACK** Softkey (on the MFW/Weather App side of the bezel in split screen mode) to return to the 'Weather' Application Page on the MFW.

ENABLING/DISABLING TFR INFORMATION ON THE 'MAP':

1 Navigate to the 'Map' Application Page.
   a) Touch the **Map** Button on the MFW App Bar.

      Or:

   a) Use the Outer **DCK** (on the MFW side of the bezel in split screen mode) to scroll to the 'Map' Application Page.

Or:

a) Touch the **Applications** Icon **> Primary** Tab **> Map**.

2 Press the **MENU** Softkey to open the 'Map Menu'.

3 Touch the **Map Settings** Button.

4 Touch the **Airspace** Tab.

5 Touch the **TFR/TMOA/TRA** Annunciation Button. The green annunciation indicates the feature is enabled.

VIEWING TFR INFORMATION ON THE 'MAP' OR 'WEATHER' PAGE:

1 Navigate to the 'Map' or 'Weather' Application Page.

a) Touch the **Map** Button or **Weather** Button on the MFW App Bar.

Or:

a) Use the Outer **DCK** (on the MFW side of the bezel in split screen mode) to scroll to the 'Map' or 'Weather' Application Page.

Or:

a) Touch the **Applications** Icon **> Primary** Tab **> Map** or **Weather**.

2 Ensure TFRs are enabled on the 'Map' or 'Weather' Page.

a) On the 'Map' page, press the **MENU** Softkey to open the 'Map Menu'.

b) Touch the **Overlay** Selection Button and ensure **Weather** is the selected overlay option.

c) Touch the **Map Settings** Button.

d) Touch the **Airspace** Tab.

e) Touch the **TFR/TMOA/TRA** Annunciation Button. The green annunciation indicates the feature is enabled.

f) Touch the **Back Arrow**

Or:

Press the **BACK** Softkey (on the MFW/Weather App side of the bezel in split screen mode) to return to the 'Map' Application Page on the MFW.

Or:

a) On the 'Weather' Page, press the **MENU** Softkey to open the 'Weather Menu'.

b) Scroll if necessary and touch the **NOTAM — TFRs** Annunciation Button. The green annunciation indicates the feature is enabled.

c) Touch the **Back Arrow**

Or:

Press the **BACK** Softkey (on the MFW/Weather App side of the bezel in split screen mode) to return to the 'Weather' Application Page on the MFW.

3 Touch the area of the 'Weather' or 'Map' page that has a TFR icon to open the Radial Menu over the desired TFR to be viewed.

4 Touch the TFR Dynamic Button on the Radial Menu to view the TFR information.

PIREPS AND AIREPS

Pilot Weather Reports (PIREPs) provide weather observations collected from pilots. When significant weather conditions are reported or forecast, Air Traffic Control (ATC) facilities are required to solicit PIREPs. A PIREP may contain adverse weather conditions, such as low in-flight visibility, icing conditions, windshear, and turbulence. PIREPs are issued as either Routine (UA) or Urgent (UUA), the color is determined by the type.

Another type of PIREP is an Air Report (AIREP). Commercial airlines typically generate AIREPs.

PIREPs and AIREPs are displayed on the 'Map' and 'Weather' Application Page's and will also display the flight level at which the report was given on the VSD.

Figure 248: PIREPs and AIREPs on the MFW

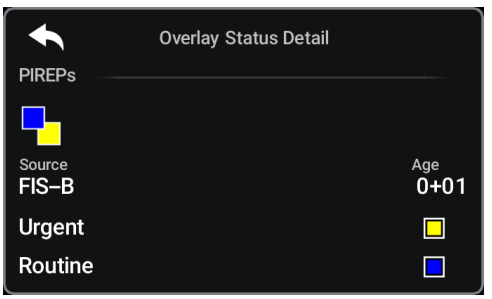


Figure 249: PIREPs and AIREPs Overlay Status

DISPLAYING PIREP OR AIREP INFORMATION ON THE 'WEATHER' APPLICATION PAGE:

1 Navigate to the 'Weather' Application Page.

a) Touch the **Weather** Button on the MFW App Bar.

Or:

a) Use the Outer **DCK** (on the MFW side of the bezel in split screen mode) to scroll to the 'Weather' Application Page.

Or:

a) Touch the **Applications** Icon **> Primary** Tab **> Weather**.

2 Ensure PIREPs is enabled on the 'Weather' Application Page.

a) Press the **MENU** Softkey on the MFW/Weather App side of the bezel in split screen mode.

b) Enable PIREPs by ensuring the **PIREPs** Annunciation Button is green (touch the **PIREPs** Annunciation Button if it is subdued to enable it).

c) Touch the **Back Arrow**

Or:

Press the **BACK** Softkey (on the MFW/Weather App side of the bezel in split screen mode) to return to the 'Weather' Application Page on the MFW.

3 Touch the area of the Weather Map that has a PIREP icon to open the Radial Menu over the desired PIREP to be viewed.

4 Touch the PIREP Dynamic Button on the Radial Menu to view the PIREP information.

DISPLAYING PIREP OR AIREP INFORMATION ON THE 'MAP':

1 Navigate to the 'Map' Application Page.

a) Touch the **Map** Button on the MFW App Bar.

Or:

a) Use the Outer **DCK** (on the MFW side of the bezel in split screen mode) to scroll to the 'Map' Application Page.

Or:

a) Touch the **Applications** Icon **> Primary** Tab **> Map**.

2 Press the **MENU** Softkey to open the 'Map Menu'.

3 Touch the **Overlay** Selection Button and ensure **Weather** is the selected overlay option.

4 Touch the **Map Settings** Button.

5 Touch the **Weather** Tab.

6 Touch the **PIREPs** Annunciation Button. The green annunciation indicates the feature is enabled.

7 Touch the area of the 'Map' that has a PIREP icon to open the Radial Menu over the desired PIREP to be viewed.

8 Touch the PIREP Dynamic Button on the Radial Menu to view the PIREP information.

GRAPHICAL AIRMETS (FIS-B)

The National Weather Service issues SIGMETs (SIGnificant METeorological Information) and AIRMETs (AIRmen's METeorological Information) for potentially hazardous weather. Convective SIGMETs are issued for hazardous convective weather.

SIGMETs and AIRMETs are represented on 'Datalink Weather' by dashed lines when they are issued for a wide geographic area, or a diamond shape when conditions are confined to a localized area. The color of the line or diamond correlates to the conditions shown in the SIGMET or AIRMET legend, as applicable.

NOTE

If a GDL 69A SXM receiver is installed, then the SIGMET and AIRMET weather products are not available unless at least one SIGMET or AIRMET has been received. The weather product age indicates 'N/A' when no SIGMET or AIRMET is available.

AIRMETS (FIS-B)

The FIS-B AIRMET weather product, when enabled, displays a graphical depiction of meteorological weather information for conditions that may be hazardous to aircraft. The AIRMETs are issued by the Aviation Weather Center at 0245, 0845, 1445, and 2045 UTC.

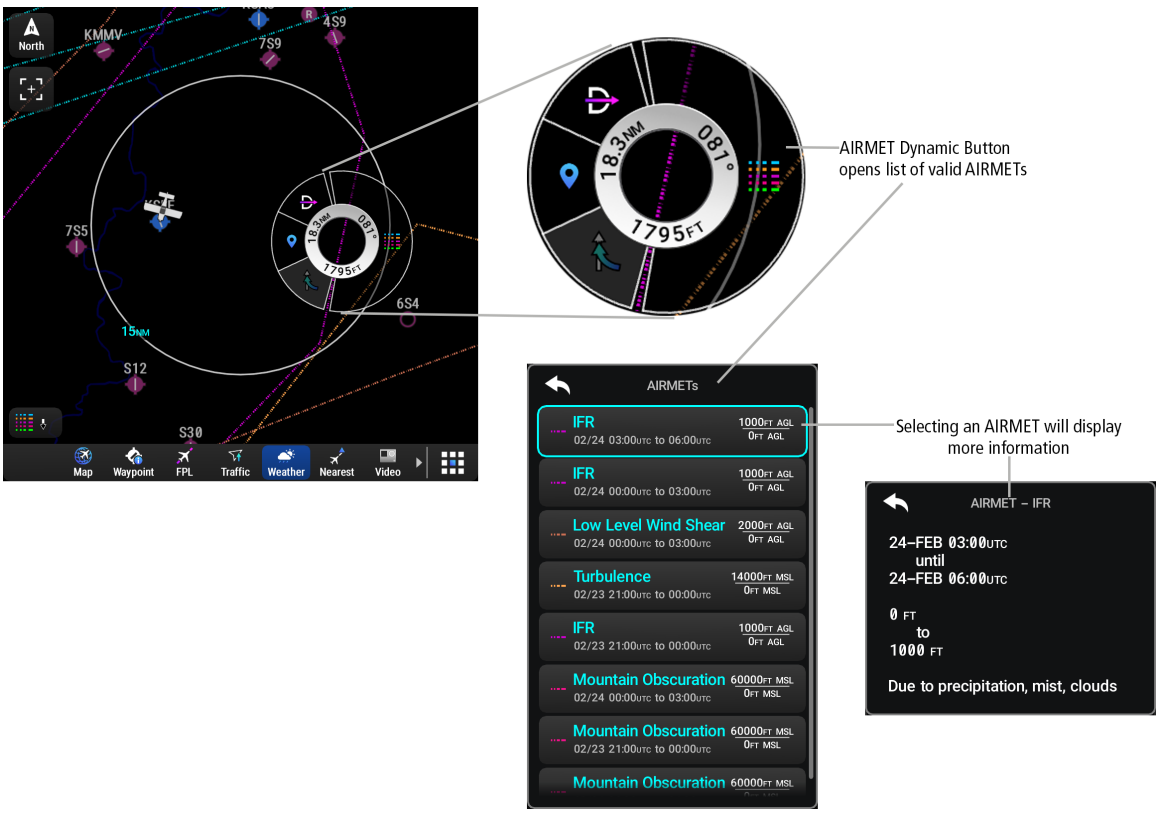


Figure 250: Graphical AIRMET Weather Product

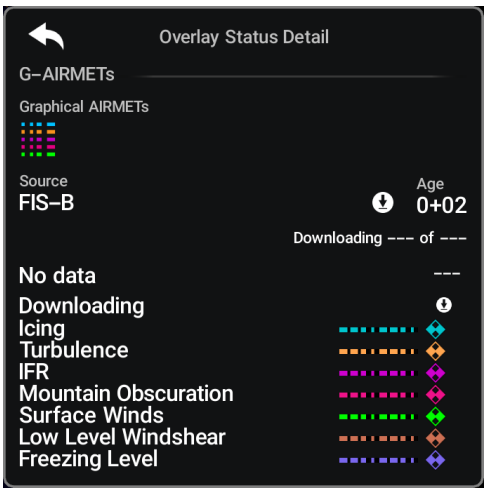


Figure 251: Graphical AIRMET Legend

DISPLAYING AIRMET INFORMATION ON THE 'WEATHER' APPLICATION PAGE:

1 Navigate to the 'Weather' Application Page.
   a) Touch the **Weather** Button on the MFW App Bar.

      Or:

   a) Use the Outer **DCK** (on the MFW side of the bezel in split screen mode) to scroll to the 'Weather' Application Page.

      Or:

   a) Touch the **Applications** Icon **>** **Primary** Tab **>** **Weather**.
2 Ensure AIRMETs is enabled on the 'Weather' Application Page.
   a) Press the **MENU** Softkey on the MFW/Weather App side of the bezel in split screen mode.
   b) Enable PIREPs by ensuring the **AIRMETs** Annunciation Button is green (touch the **AIRMETs** Annunciation Button if it is subdued to enable it).
   c) Touch the **Back Arrow**

      Or:

      Press the **BACK** Softkey (on the MFW/Weather App side of the bezel in split screen mode) to return to the 'Weather' Application Page on the MFW.
3 Touch the area of the Weather Map that has an AIRMET indication to open the Radial Menu over the desired AIRMET to be viewed.
4 Touch the AIRMET Dynamic Button on the Radial Menu to view the AIRMET information.

DISPLAYING AIRMET INFORMATION ON THE 'MAP' APPLICATION PAGE:

1 Navigate to the 'Map' Application Page.
   a) Touch the **Map** Button on the MFW App Bar.

Or:

a) Use the Outer **DCK** (on the MFW side of the bezel in split screen mode) to scroll to the 'Map' Application Page.

Or:

a) Touch the **Applications** Icon **> Primary** Tab **> Map**.

2 Press the **MENU** Softkey to open the 'Map Menu'.

3 Touch the **Overlay** Selection Button and ensure **Weather** is the selected overlay option.

4 Touch the **Map Settings** Button.

5 Touch the **Weather** Tab.

6 Touch the **AIRMETs** Annunciation Button. The green annunciation indicates the feature is enabled.

7 Touch the area of the 'Map' that has an AIRMET indication to open the Radial Menu over the desired AIRMET to be viewed.

8 Touch the AIRMET Dynamic Button on the Radial Menu to view the AIRMET information.

CENTER WEATHER ADVISORIES (CWAS) (FIS-B)

The National Weather Service issues Center Weather Advisories (CWA) when conditions exists meeting or approaching the national in-flight advisory (AIRMET, SIGMET, or Convective SIGMET) criteria. CWAs are unscheduled weather advisories which are valid for up to 2 hours and may include forecast conditions that are expected to begin within 2 hours of the issuance. If meteorological conditions are expected to continue beyond the advisories valid period a statement to this effect will be included in the advisory.

The CWA will describe the location of the phenomenon using ARTCC relevant points of reference, such as VORs, and will include the height, extent, intensity, and movement of the phenomenon. Each CWA will have a phenomenon number.

The format of the CWA communications header is: (ARTCC designator)(phenomenon number) CWA (date/time issued in UTC)/(ARTCC designator) CWA (issuance number) VALID UNTIL (date/time in UTC)/ (FROM) (affected area)/(text).

CWAs can be issued for any of the following meteorological events:

- Conditions meeting convective SIGMET criteria.
- Conditions at or approaching Low IFR.
- Freezing precipitation.
- Heavy precipitation.
- Icing - moderate or greater.
- Low Level Windshear (surface - 2,000 feet).
- Surface winds/gusts >30 knots.
- Turbulence - moderate or greater.
- Volcanic ash, dust storms, or sandstorms.

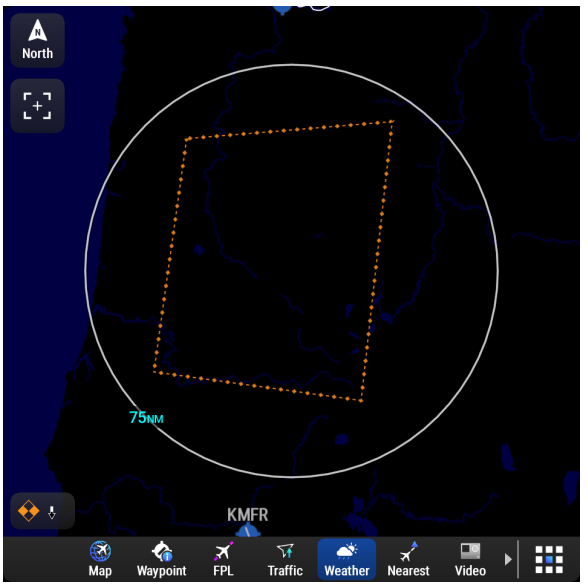
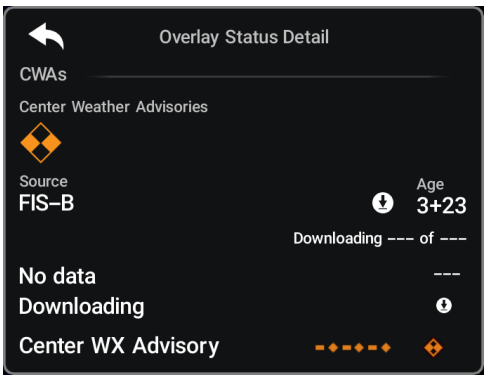


Figure 252: Center Weather Advisories on the MFW

Figure 253: Center Weather Advisories Overlay Status



VIEWING CENTER WEATHER ADVISORY INFORMATION:

1 Navigate to the 'Weather' Application Page.
   a) Touch the **Weather** Button on the MFW App Bar.
      Or:
   a) Use the Outer **DCK** (on the MFW side of the bezel in split screen mode) to scroll to the 'Weather' Application Page.
      Or:
   a) Touch the **Applications** Icon **>** **Primary** Tab **>** **Weather**.
2 Press the **MENU** Softkey on the MFW/Weather App side of the bezel in split screen mode.
3 Touch the **CWAs** Annunciation Button. The green annunciation indicates the feature is enabled.
4 Touch the **Back Arrow**

Or:

Press the **BACK** Softkey (on the MFW/Weather App side of the bezel in split screen mode) to return to the 'Weather' Application Page on the MFW.

5 Touch the area of the 'Weather' page that has a CWA icon to open the Radial Menu over the desired CWA to be viewed.

6 Touch the CWA Dynamic Button on the Radial Menu to view the CWA information.

ABNORMAL OPERATIONS (FIS-B)

Additional information about the status of FIS-B Weather is available by touching the **FIS-B Info** Button on the 'FIS-B Weather Menu'. The status of all FIS-B products is listed as either "Waiting for Data" in white or "Data Active" in green. No graphical information will be displayed if the Product Status is in white and will need to be reviewed in further detail to troubleshoot the issue.

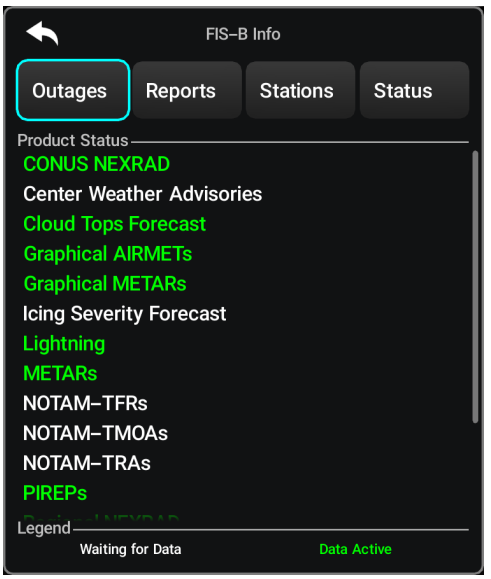


Figure 254: FIS-B Weather Product Status

6.3 TERRAIN AVOIDANCE AND WARNING SYSTEM

⚠ WARNING

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

NOTE

Terrain data is not displayed when the aircraft is outside the installed terrain database coverage area.

NOTE

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

NOTE

Terrain and obstacle alerting requires Adaptive Terrain or TAWS-B.

The 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.

For AXIS™ Flight Display(s) installations that require TAWS-B the configuration will satisfy TSO-C151d Class B requirements for certification. For installations that do not require TAWS-B, Adaptive Terrain will be the standard configuration. The rest of this section will be describing TAWS-B functionality and any mention of pilot configurable options will be in reference to only Adaptive Terrain configuration of the system.

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-C151d. However, the displayed information should never be understood as being all-inclusive and data may still contain inaccuracies.

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 find the 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.

- 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

The terrain system uses colors and symbols to represent terrain and point obstacles (with heights greater than 200 feet above ground level, AGL) present in the databases relative to aircraft altitude. The system dynamically adjusts these colors as the aircraft altitude changes, and after takeoff and landing.

While the aircraft is on the ground, the system displays relative terrain 400 feet or more above the aircraft altitude using red, and terrain at less than 400 feet above aircraft altitude using black, as shown on the On- Ground Legend. When the aircraft is in the air, the system displays relative terrain information using red, yellow, green, and black, as shown on the In-Air Legend. As the aircraft transitions from on-ground to in-air, or from in-air to on-ground, the display of relative terrain momentarily fades into the corresponding colors. If an alert occurs, the relative terrain colors transition to the In-Air Legend if the On-Ground Legend was shown in order to provide the pilot with the most information possible.

Figure 255: Relative Terrain Legends

The following figure shows relative terrain coloring for TAWS. Warnings, depicted in red, indicate the aircrafts height above the obstacle is within 100 feet. Cautions, depicted in yellow, indicate the aircrafts height above the obstacle is within 1000 feet (305 meters). White obstacles indicate the aircraft is more than 1000 feet above the obstacle.

NOTE

With Adaptive Terrain enabled, the caution alerts and indications can be configured to announce at or below 500, 750, or 1000 feet.

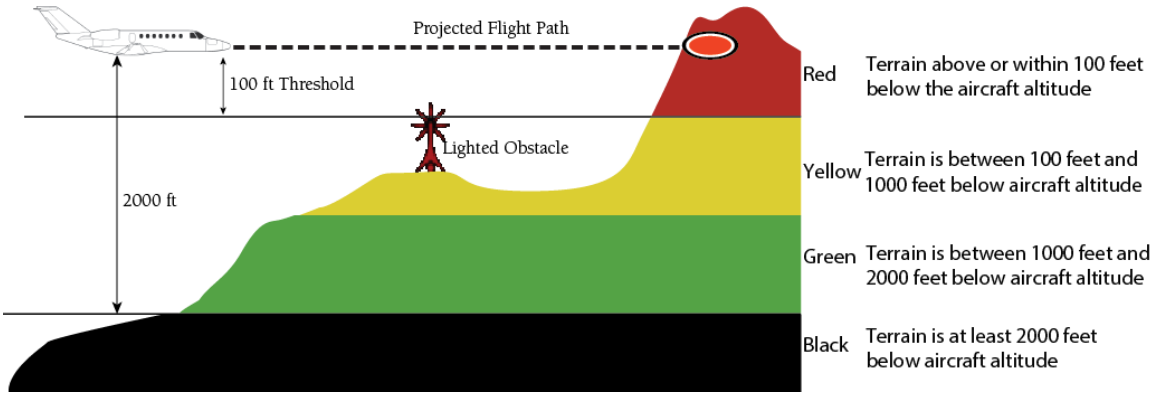


Figure 256: Terrain Altitude/Color Correlation for TAWS-B Systems

The AXIS™ flight display automatically removes obstacle symbols from the map when the difference between the top of the obstacle and the aircraft is greater than 2000 feet (fixed wing) or 500 feet (rotorcraft).

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.[1]
				White obstacle is more than 1000 ft below aircraft altitude.
[1] With Adaptive Terrain enabled, the caution alerts and indications can be configured to announce at or below 500, 750, or 1000 feet.				

Table 36: Relative Point Obstacle Symbols and Colors

Wire Obstacle	Wire Obstacle Location
	Red wire obstacle is at or above the aircraft altitude.
	Yellow obstacle is between 100 ft and 250 ft below the aircraft altitude.
	White wire obstacle is more than 250 ft below the aircraft altitude.

Table 37: Relative Wire Obstacles and Colors

Unlighted Wind Turbine Obstacle	Lighted Wind Turbine Obstacle	Wind Turbine Obstacle Location
		Red obstacle is above or within 100 ft below the aircraft altitude.
		Yellow obstacle is between 100 ft and 1000 ft below the aircraft altitude.[1]
		White obstacle is more than 1000 ft below aircraft altitude.
[1] With Adaptive Terrain enabled, the caution alerts and indications can be configured to announce at or below 500, 750, or 1000 feet.		

Table 38: Wind Turbine Obstacles and Colors

TAWS will show potential impacts areas for terrain and obstacles as shown in the following table.

Potential Impact Area Example			Alert Type	Example Annunciation
	or		Warning	PULL UP
	or		Caution	TERRAIN

Table 39: TAWS Potential Impact Area with Annunciations

TERRAIN

The Map Page on the MFW is the principal page for viewing terrain information. Aviation data (airports, VORs, and other NAVAIDs) can be disabled to reference only terrain data.

The Map Page also shows potential impact areas. If terrain or obstacles (optionally including wire obstacles) and the projected flight path of the aircraft intersect, the display automatically adjusts to a map range if necessary to emphasize the display of the potential impact area.

Map range is adjustable by pinching in or out with two fingers from 400 feet to 1500 NM, which is indicated on the map range arc.

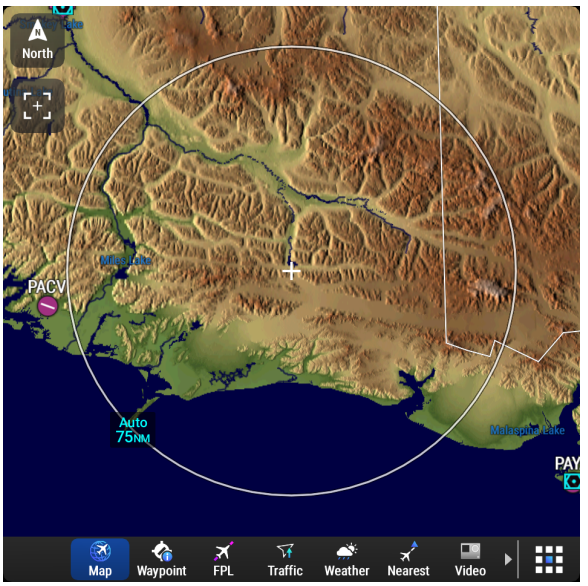


Figure 257: Terrain on the MFW Map Page

RELATIVE TERRAIN MAP OVERLAYS

The ‘Map’ is the principal MFD for viewing terrain information. Relative terrain information is also available for display on the ‘Map.’

When relative terrain information is enabled on the MFW Map Page, a relative terrain legend is viewable in the ‘Overlay Status Detail’ Page by touching the ‘Status’ Box. A relative terrain overlay enabled icon also appears in the ‘Status’ Box on the ‘Map’.

The ‘Map Menu’ window provides a means for enabling/disabling the display of relative terrain while the point obstacles (such as towers), and wire obstacles (such as power lines) are enabled/disabled from the ‘Advanced Settings’ window found by scrolling down in the ‘Map Menu’ Page.

The pilot can display relative terrain information independently of point or wire obstacle information; however, obstacles for which TAWS warnings are issued are shown when terrain is selected for display and the map range is within the setting limit.

On the MFW Map, the pilot can view an obstacle height in AGL and MSL by touching the obstacle on the page. The Radial Menu will show an obstacle symbol on the Dynamic Button. Touching the Obstacle Dynamic Button will pull up a page with information of the obstacle, including the AGL and MSL height.

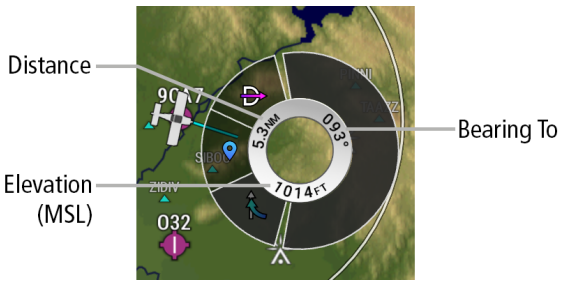


Figure 258: Selected Obstacle Radial Menu View

ENABLING RELATIVE TERRAIN INFORMATION ON THE MFW 'MAP' APPLICATION PAGE:

1 Navigate to the 'Map' Application Page.
   a) Touch the **Map** Button on the MFW App Bar.
      Or:
   a) Use the Outer **DCK** (on the MFW side of the bezel in split screen mode) to scroll to the 'Map' Application Page.
      Or:
   a) Touch the **Applications** Icon **>** **Primary** Tab **>** **Map**.
2 Press the **MENU** Softkey to open the 'Map Menu'.
3 Touch the **Basemap** Selection Button.
4 Touch **Topo**.
5 Touch the **Back Arrow**
   Or:
   Press the **BACK** Softkey (on the MFW side of the bezel in split screen mode) to return to the 'Map' Application Page on the MFW.

ENABLING RELATIVE TERRAIN INFORMATION ON THE HSI MAP:

1 Navigate to the PFW Settings Window.
   a) Touch the HSI to open the 'PFW Menu'.
      Or:
      Press the **MENU** Softkey (on the PFW side of the bezel if in split screen mode).
   b) Touch the **PFW Settings** Button.
2 Touch the **HSI Style** Selector Button.
3 Touch the **Map** Button.

CUSTOMIZING TERRAIN AND OBSTACLE DISPLAY ON THE 'MAP':

1 Navigate to the 'Map' Application Page.
   a) Touch the **Map** Button on the MFW App Bar.
      Or:

a) Use the Outer **DCK** (on the MFW side of the bezel in split screen mode) to scroll to the 'Map' Application Page.

Or:

a) Touch the **Applications** Icon **> Primary** Tab **> Map**.

2 Press the **MENU** Softkey to open the 'Map Menu'.

3 Touch the **Map Settings** Button.

4 Touch the **Land** Tab.

5 Scroll through the and enable the desired land features by touching the ones to be enabled or disabled. (The green annunciation indicates the feature is enabled.)

WIRE OBSTACLE INFORMATION AND ALERTING (OPTIONAL)

For additional safety, the terrain system incorporates Garmin's WireAware™ wire obstacle information. For wire obstacles such as power lines present in the obstacle database, the system shows these on the maps as well as the Synthetic Vision display; see the *WireAware* portion of the Flight Instruments section for more information about Synthetic Vision displays of power lines. TAWS can also issue warnings for potential impact with wire obstacles.

WireAware database information mainly includes Hazardous Obstacle Transmission (HOT) power lines which are typically high voltage transmission lines depicted on VFR Sectional charts, and are considered of special interest to fixed-wing pilots. These include power lines which may span rivers, valleys, canyons, or be in close proximity to airports/heliports.

It is important to note the obstacle database does not contain all power lines. In fact, WireAware database coverage is mostly limited to HOT power lines, such as the especially tall transmission lines and their associated support structures. It does not typically have information for the more prevalent smaller utility poles or lines, such as those found in residential areas. Furthermore, WireAware obstacle database coverage exists mainly in the United States; with limited coverage in portions of Canada and Mexico. In addition, the height of the wire obstacles is commonly estimated and should not be relied upon for maneuvering decisions.

TAWS VISUAL ANNUNCIATIONS AND VOICE ALERTS

The system issues alerts when flight conditions meet parameters that are set within TAWS software algorithms. The system issues terrain/obstacle alerts as a caution or warning severity level. Alerts include visual annunciations and voice alerts.

When the system issues an alert, annunciations appear on the PFW and the map. The PFW shows the annunciation to the right of the airspeed tape and displays the alert in a Terrain Alert window below the HSI. The potential impact areas are displayed on the MFW 'Map'.

Voice Alerts (or Voice Call Outs (VCOs)) will be heard from 500 feet down to 50 feet and if a radio altimeter is installed and configured VCOs will continue below 50 feet down to one foot.

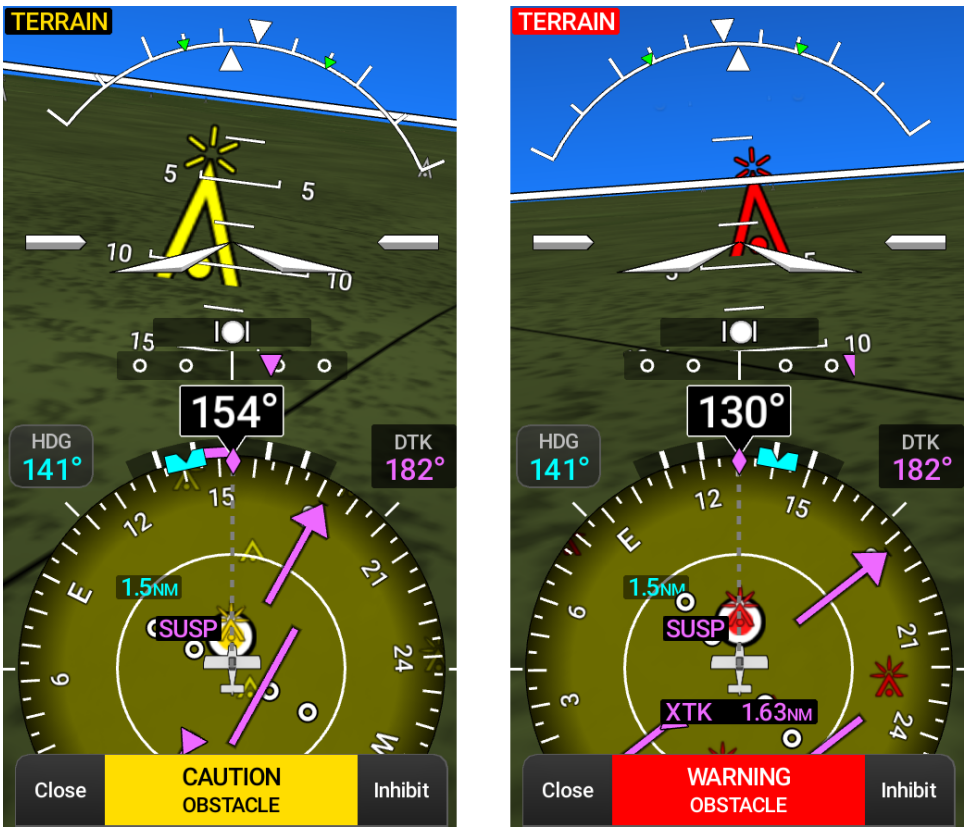


Figure 259: Potential Impact Area on HSI Map and SVT

Alert Type	TAWS-B Visual Annunciation	Adaptive Terrain Visual Annunciation	Voice Alert
Reduced Required Terrain Clearance (RTC) Warning	TERRAIN PULL UP	TERRAIN	"Terrain Terrain - Pull Up Pull Up"
Imminent Terrain Impact (ITI) Warning	PULL UP	TERRAIN	"Terrain Ahead - Pull Up"
Reduced Required Obstacle Clearance (ROC) Warning	WARNING OBSTACLE	TERRAIN	"Obstacle - Pull Up"
Imminent Obstacle Impact (IOI) Warning	WARNING OBSTACLE	TERRAIN	"Warning - Obstacle Obstacle"
Required Line Clearance (RLC) Warning	WIRE PULL UP	TERRAIN	"Wire Wire - Pull Up Pull Up"
Imminent Line Impact (ILI) Warning	WARNING WIRE	TERRAIN	"Warning - Wire Wire"

Alert Type	TAWS-B Visual Annunciation	Adaptive Terrain Visual Annunciation	Voice Alert
Reduced Required Terrain Clearance (RTC) Caution	TOO LOW TERRAIN	TERRAIN	"Too Low - Terrain"
Imminent Terrain Impact (ITI) Caution	CAUTION TERRAIN	TERRAIN	"Caution Terrain - Caution Terrain"
Reduced Required Obstacle Clearance (ROC) Caution	CAUTION OBSTACLE	TERRAIN	"Caution - Obstacle Obstacle"
Imminent Obstacle Impact (IOI) Caution	CAUTION OBSTACLE	TERRAIN	"Obstacle Ahead"
Required Line Clearance (RLC) Caution	CAUTION WIRE	TERRAIN	"Caution - Wire"
Imminent Line Impact (ILI) Caution	CAUTION WIRE	TERRAIN	"Wire Ahead"

Table 40: TAWS Alert Summary

FORWARD LOOKING TERRAIN AVOIDANCE

The Forward Looking Terrain Avoidance (FLTA) feature of TAWS compares the projected flight path as derived from GPS data with terrain features and obstacles from the terrain and obstacle databases. The system issues FLTA alerts when the projected flight path conflicts with terrain or obstacles.

The projected flight path is a calculated area ahead of, to the sides, and below the aircraft. The size of the projected flight path varies based on factors including ground speed (the path ahead is larger when the ground speed is higher), whether the aircraft is level, turning, or descending, and the proximity to the nearest usable runway along the current track. As the aircraft approaches the runway, the projected flight path becomes narrower until the system automatically disables FLTA alerts or the flight crew manually inhibits them.

NOTE

The nearest usable runway is identified based on the shorter of the nearest runway length configuration, or the emergency runway length configuration.

There are two types of FLTA alerts, Reduced Required Terrain/Obstacle Clearance (RTC or ROC respectively) and Imminent Terrain/Obstacle Impact (ITI or IOI respectively).

The system issues Reduced Required Terrain Clearance (RTC) and Reduced Required Obstacle Clearance (ROC) alerts when the aircraft flight path is above terrain, yet is projected to come within the minimum clearance values in the following figure. When an RTC alert is issued, the system displays a potential impact area on the ‘Map’ and the PFD.

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 the 'Map' and the PFD. The alert occurs when the projected vertical flight path is calculated to come within minimum clearance altitudes in the following figure.

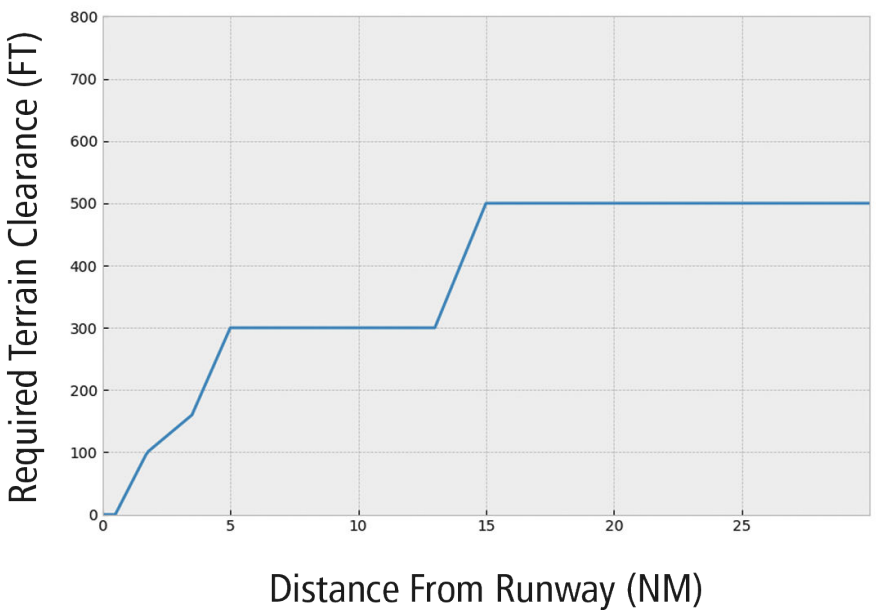


Figure 260: FLTA Alert Minimum Terrain and Obstacle Clearance Values

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.

FLTA ALERT SUPPRESSION

⚠ WARNING

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

⚠ WARNING

Do not rely solely on FLTA Alerts for terrain and obstacle clearance. Use FLTA Alerts only as a supplemental aid to terrain and obstacle awareness. FLTA Alerts are automatically suppressed within specified proximity to the airport environment.

The terrain system provides alerts for Forward Looking Terrain Avoidance (FLTA), Premature Descent Alert (PDA), as well as basic Ground Proximity Warning System (GPWS) modes. FLTA alerts are comprised of Reduced Terrain Clearance (RTC), Reduced Obstacle Clearance (ROC), Reduced Line Clearance (RLC), Imminent Terrain Impact (ITI), Imminent Obstacle Impact (IOI), and Imminent Line Impact (ILI) alerts. These FLTA Alerts are automatically suppressed within specific proximity to the airport environment to prevent

potential nuisance alerts. Both FLTA and PDA alerts can also manually be inhibited by the pilot using the TAWS Inhibit function discussed in a later section.

SUPPRESSION NEAR APPROACH PATHS

All FLTA alerts are suppressed when the aircraft is within the Approach Path Suppression Area. The Approach Path Suppression Areas prevent potential nuisance alerts when the aircraft is on a published ILS, LPV, LNAV/VNAV, or LNAV+V approach procedure. An instrument approach does not have to be loaded into the FMS for FLTA Alerts to be suppressed per the criteria below.

The Approach Path Suppression Areas are defined as follows:

- ILS — The lateral area of alert suppression extends from the approach's localizer emitter out toward its FAF and is based on the approach procedure's localizer beam and glide slope angle. This area is represented by the green cones in the following figure.
- LPV — The alert suppression area is based on the lateral and vertical approach path on the final approach segment. This area is represented by the magenta cones in the following figure.
- LNAV/VNAV or LNAV+V — The lateral area of alert suppression is based on a default angular width extending from the MAP position toward its FAF and the vertical area of alert suppression is based on the procedure's vertical angle at the MAP. This area is also represented by the magenta cones in the following figure.

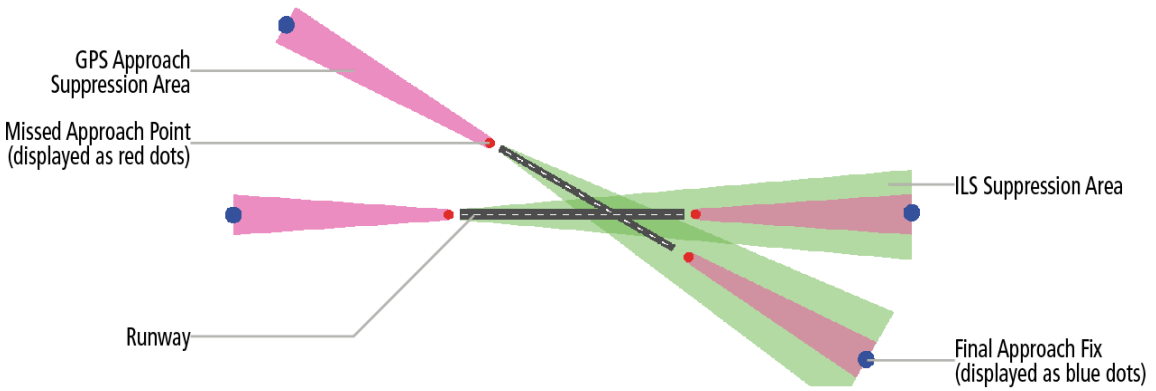


Figure 261: Areas of Suppression Near Approaches

SUPPRESSION NEAR RUNWAYS

Alerts for terrain, obstacle, and power lines are suppressed when the aircraft is within 5 NM of an airport and the projected position of the aircraft falls within the Runway Suppression Area surrounding a published runway. These Runway Suppression Areas prevent potential nuisance alerts when the aircraft is descending near an airport. The suppressed area extends 1 NM from the runway thresholds and 0.75 NM from the sides of the runway, i.e., the suppressed area is the runway length plus 2 NM and the runway width plus 1.5 NM.

NOTE

FLTA IOI and ILI alerts are not suppressed in these runway suppression areas.

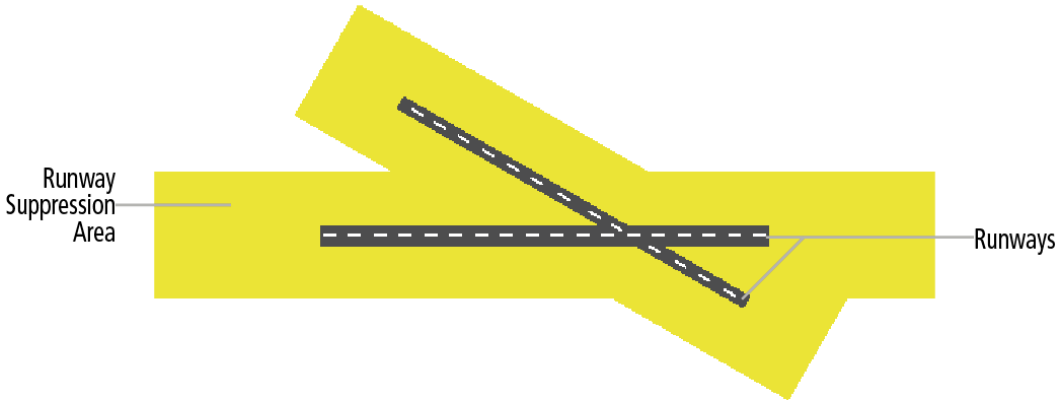


Figure 262: Suppression Near Runways

SUPPRESSION NEAR AIRPORTS

All FLTA Alerts are suppressed when the aircraft's current position is in the Airport Suppression Area. The ceiling of the Airport Suppression Area is 125 feet above the airport elevation. The Airport Suppression Area is the length of the runway and the half the length of the runway to the left and right of centerline.

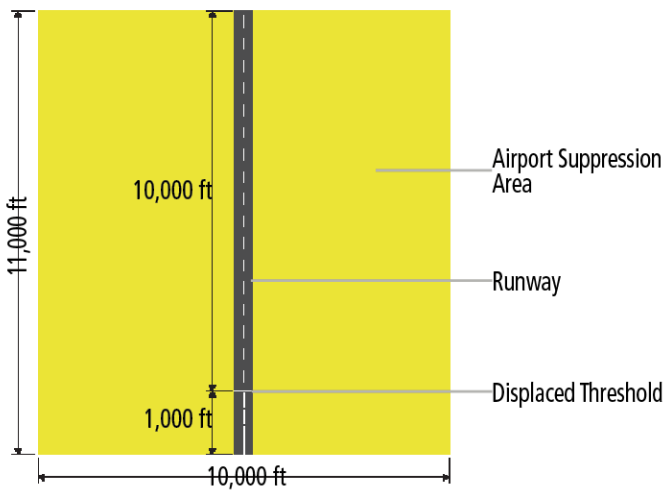


Figure 263: Airport Suppression Area

ADDITIONAL SUPPRESSION

FLTA alerts are suppressed when any of the following conditions are met:

- The aircraft altitude is within 200 ft of the airport elevation and the distance to the airport is less than 0.5 NM, the aircraft is flying towards the airport.
- The aircraft altitude is within 125 ft of the airport elevation, the distance to the airport is less than 1 NM and the aircraft is flying towards the airport.

The above is applicable to user created airports.

NOTE

TAWS FLTA suppression can occur when on or near approaches, runways, and airports. Specific boundaries are noted above. It is the pilot's responsibility to maintain obstacle and terrain clearance.

SUMMARY OF FLTA ALERT SUPPRESSION

FLTA alerts are suppressed when:

- The aircraft is flying on or through an ILS, LPV, LNAV/VNAV, or LNAV+V approach. An approach does not have to be loaded into the FMS for suppression to occur.
- The aircraft is within 5 NM and descending toward an airport.
- The aircraft is less than 125 feet above the airport, between the runways ends, and no more than half the runway length from centerline.

LOOK AHEAD TIME CUSTOMIZATION

The pilot may adjust the computed "Look-Ahead Time" of the system to reduce the amount if nuisance alerts that may populate while flying low or near obstacles. The look-ahead time determines the maximum time when an alert annunciation occurs. For example, if 60 seconds is selected, AXIS™ flight display provides an alert up to 60 seconds before you reach the terrain or obstacle. The user can select 30s or 60s, if normal mode editing is configured on.

ADJUSTING THE ADAPTIVE TERRAIN LOOK-AHEAD TIME:

1. Touch the **Applications** Icon on the MFW App Bar.

   Or:

   Press the **MENU** Softkey two times to open the 'Apps' Window.
2. If necessary, touch the **Settings & Tools** Tab.
3. Touch **Alerts**.
4. Scroll to the 'Terrain' Section.
5. Touch the **Look-Ahead Time** Selection Button to open the selection window.
6. Select the desired look-ahead time (**30s** or **60s** (default)).

TERRAIN AND OBSTACLE SENSITIVITY (ADAPTIVE TERRAIN)

Terrain and Obstacle Alert Sensitivity determines what level of alerts are annunciated. AXIS™ flight display defaults to 'High" sensitivity, which annunciates all read and yellow alerts at the time set in Look Ahead Time. 'Medium' sensitivity annunciates all of the red and highest priority yellow alerts. 'Low' only annunciates red alerts.

ADJUSTING THE TERRAIN/OBSTACLE ADAPTIVE TERRAIN SENSITIVITY:

1. Touch the **Applications** Icon on the MFW App Bar.

   Or:

   Press the **MENU** Softkey two times to open the 'Apps' Window.
2. If necessary, touch the **Settings & Tools** Tab.
3. Touch **Alerts**.

4 Scroll to the 'Terrain' Section.

5 Touch the **Terrain Sensitivity** Selection Button or **Obstacle Sensitivity** Selection Button to open the selection window.

6 Touch the desired sensitivity (**Low**, **Medium**, or **High** deffault)).

PREMATURE DESCENT ALERTING

A Premature Descent Alert (PDA) occurs when the system detects the aircraft is significantly below the normal approach path to a runway.

PDA alerting begins when the aircraft is below 500 feet AGL within 15 NM of the destination airport and ends when the aircraft is 0.5 NM from the runway threshold.

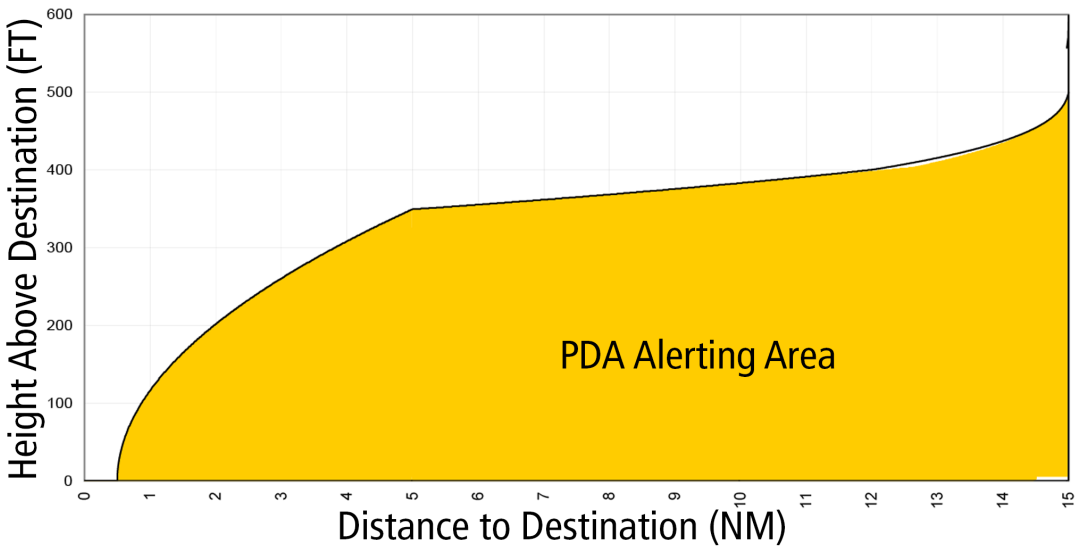


Figure 264: PDA Alerting Threshold

EXCESSIVE DESCENT RATE ALERT

The Excessive Descent Rate (EDR) alert occurs when the system determines the aircraft is closing (descending) upon terrain at an excessive speed. The following figure shows the parameters for the alert as defined by TSO-C151d.

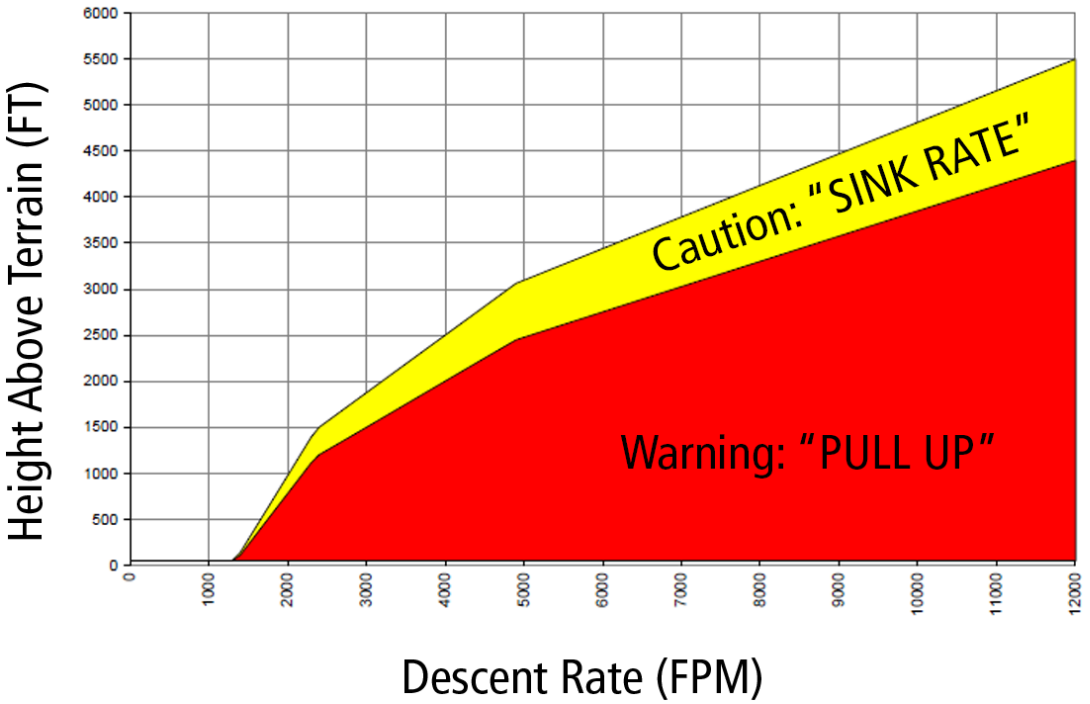


Figure 265: Excessive Descent Rate Alert Criteria

INHIBITING FLTA ALERTS

The flight crew can manually inhibit FLTA visual annunciations and voice alerts. Discretion should be used when inhibiting alerts and the system should be enabled when appropriate. When PDA and FLTA alerts are inhibited, the system status annunciation 'TER/OBST INHIB' appears in the system alert window.

Figure 266: TAWS Inhibit Annunciation

While Terrain alerting is manually inhibited (or the TAWS system is not available or has failed), the system may display a 'LOW ALT' annunciation on the PFD next to the altitude tape if the following conditions are met:

- The aircraft is on an SBAS approach.
- The Final Approach Fix is the active waypoint.
- The aircraft is at least 164 feet below the prescribed altitude at the Final Approach Fix.

See the *Low Altitude Annunciation* portion of the Flight Instruments section for more details about the 'LOW ALT' annunciation.

INHIBITING/ENABLING ADAPTIVE TERRAIN FLTA AND PDA ALERTING:

1 Touch the **Applications** Icon.

2 Touch the **Quick Actions** Tab.

3 Touch the **Inhibits** Button.

4 Touch the **Inhibit/Normal** Selection Button for the alerts to be inhibited or enabled. The blue indication displays which option has been selected.

INHIBITING TERRAIN ALERTING WHILE AN ALERT IS OCCURRING:

After a Visual Annunciation appears below the HSI touch the **Inhibit** Annunciation Button.

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 or sink rate.

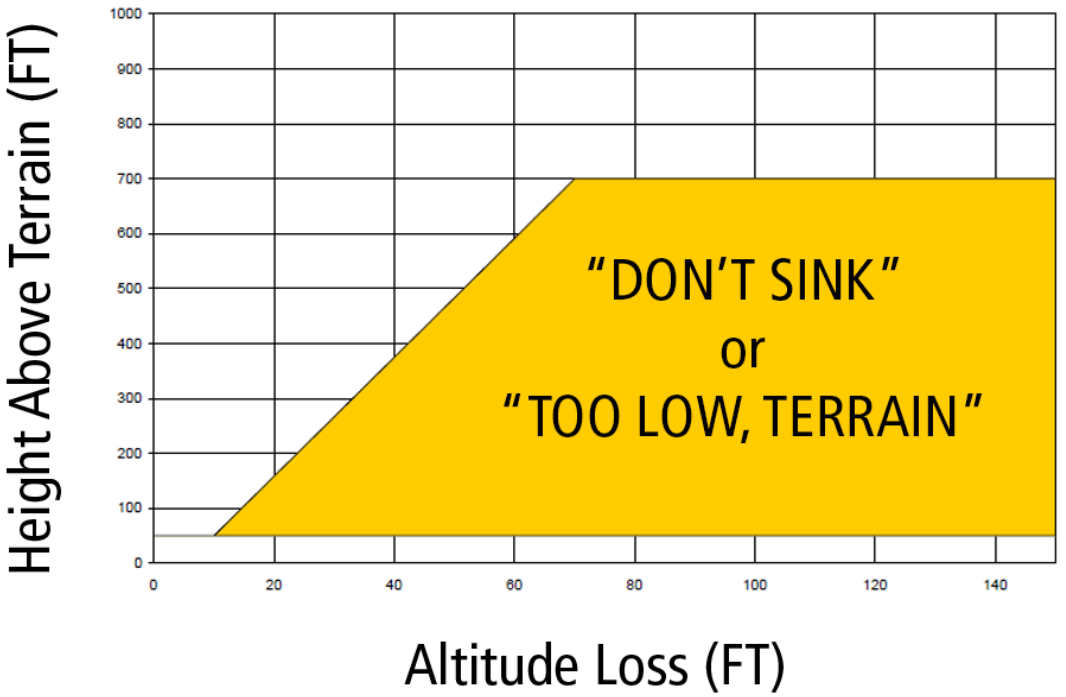


Figure 267: Negative Climb Rate (NCR) Altitude Loss

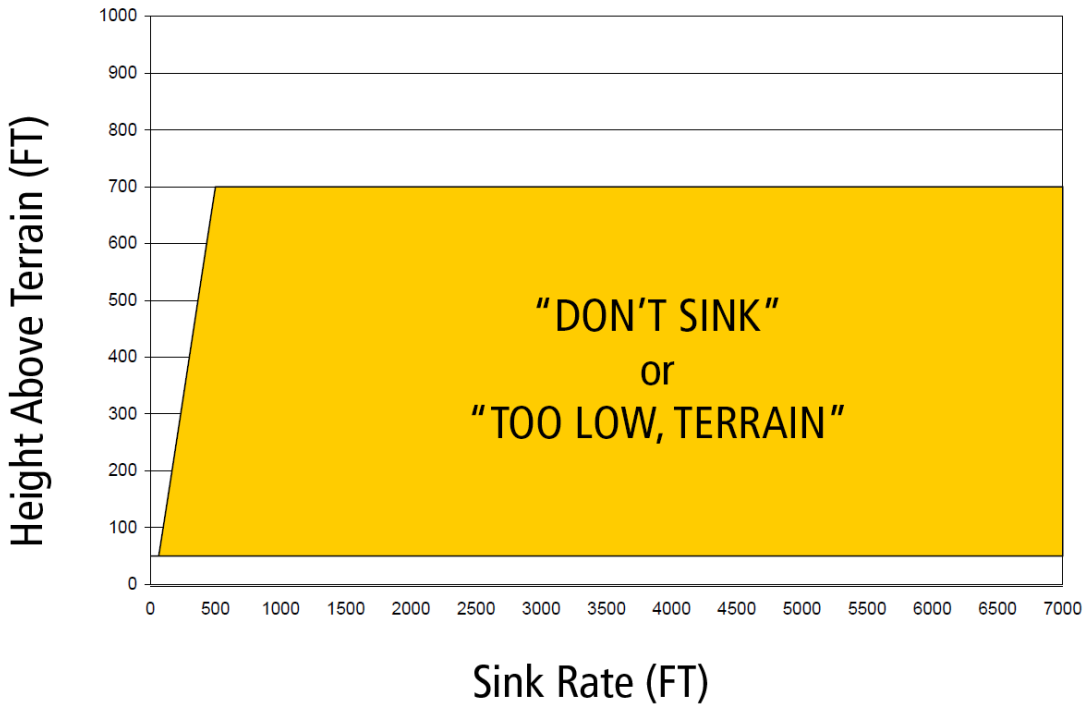


Figure 268: Negative Climb Rate (NCR) Sink Rate

ALTITUDE VOICE CALLOUTS (VCO)

Voice callouts are an aural annunciation issued to the pilot when the aircraft reaches a specific altitude during a decent. If TAWS-B is the active system, the system will issue the aural alert beginning at 500 feet. Otherwise, the altitude height limits can be configured from 500 feet down to 100 feet in 50 foot increments. If a radio altimeter (RA) is installed, voice callout aural annunciations can be configured from 50 feet to 1 foot. Voice callouts are triggered by either the height above the runway threshold or height above the terrain immediately below the aircraft.

When the aircraft is within 5 NM of the airport threshold, the GPS altitude above the threshold is used to initiate the alert. When the aircraft is greater than 5 NM from the runway threshold, voice callouts are initiated using the aircrafts height above the terrain. When the system is using height above the terrain data is derived from the optional radio altimeter. However, if a RA is not installed or has failed, the height above the terrain is derived from the GPS altitude and terrain database.

With the RA installed, regardless of distance from the nearest runway threshold, voice callouts are produced starting at 50 feet and continue down to 1 foot.

ENABLING/DISABLING/EDITING ALTITUDE VOICE CALLOUTS:

1. Touch the **Applications** Icon on the MFW.
2. Touch the **Settings & Tools** Tab.
3. Touch the **Alerts** Button.

4 To enable altitude voice callouts, scroll if necessary to the 'Height Advisory' section of the 'Alerts' Window, and touch the **Touchdown Callouts** Annunciation Button to enable or disable the altitude voice callouts. A green indication signifies the feature is enabled.
5 To edit altitude voice callouts ensure callouts are enabled by following steps 1 through 4.
6 Then touch the **Edit Enabled Callouts** Button.
7 A 'Touchdown Callouts' Window will open with all of the heights call outs may be given. Touch the **Touchdown Callouts** Altitude Annunciation Button(s) desired to enable or disable each individual altitude.

6.4 TRAFFIC AVOIDANCE

⚠ WARNING

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

⚠ WARNING

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

NOTE

Pilots should be aware of traffic system limitations. Traffic systems require transponders of other aircraft to respond to system interrogations. If the transponders do not respond to interrogations due to phenomena such as antenna shading or marginal transponder performance, traffic may be displayed intermittently, or not at all. Aircraft without altitude reporting capability are shown without altitude separation data or climb descent indication. Pilots should remain vigilant for traffic at all times.

NOTE

Refer to the Automatic Dependent Surveillance-Broadcast (ADS-B) Traffic discussion for more information about ADS-B traffic displays.

The two traffic avoidance systems, Traffic Advisory System (TAS) or Traffic Alert and Collision Avoidance System I (TCAS I), are optional with the installation of a 800 series GTS. TIS-A traffic is also available with a Mode S transponder. These traffic systems enhance flight crew situational awareness by monitoring the airspace for transponder-equipped aircraft. They also provide visual annunciations and voice alerts to assist the flight crew with the visual acquisition of traffic.

TAS/TCAS I are capable of tracking up to 75 intruding aircraft equipped with transponders. They can display a maximum of 30 aircraft with the highest threat potential simultaneously. The system provides no surveillance information for aircraft without operating transponders.

TAS/TCAS I THEORY OF OPERATION

When the traffic system is in Operating Mode, the system interrogates the transponders of other aircraft while monitoring for transponder replies. The system uses this information to derive the distance, relative bearing, and if reported, the altitude and vertical trend for each aircraft within its surveillance range.

The system then calculates a closure rate to each intruder based on the projected Closest Point of Approach (CPA). If the closure rate meets the threat criteria for a Traffic Advisory (TA), the system provides visual and voice alerting.

TRAFFIC SURVEILLANCE VOLUME

The TAS/TCAS I system monitors the airspace within ±10,000 feet of own altitude, and up to 40 NM in the forward direction. Traffic system range is somewhat reduced to the sides and aft of own aircraft due to the directional interrogation signal patterns. In areas of greater transponder traffic density, the on-board traffic system automatically reduces its interrogation transmitter power (and therefore range) in order to limit potential interference from other signals.

NOTE

Do not confuse this functionality with full ADS-B capability, which can provide traffic information from ADS-B Ground-Based Transceivers (GBTs) and ADS-B traffic outside of the TAS/TCAS I surveillance volume.

When the traffic system is paired with a system compatible GTX transponder (optional), the traffic system also uses Automatic Dependent Surveillance - Broadcast (ADS-B) position reports from participating aircraft to enhance the positional accuracy of traffic displayed within the TAS/TCAS I surveillance range, in addition to broadcasts from traffic outside of the TAS/TCAS I surveillance range. It also receives information from ADS-B Ground Based Transceivers (GBTs). This includes the Traffic Information Service-Broadcast (TIS-B) service and Automatic Dependent Surveillance-Rebroadcast (ADS-R) service; refer to the *Automatic Dependent Surveillance-Broadcast (ADS-B) Traffic* section for more information about these features.

NOTE

The Garmin traffic system does not display traffic determined to be on the ground, including Mode C transponder equipped aircraft operating below 300' AGL that is not climbing. However, if own aircraft has ADS-B In capability, and is receiving traffic information from an ADS-B source (including ADS-R, ADS-B, TIS-B), the system does display this traffic while operating in SURF Mode. Refer to the Automatic Dependent Surveillance-Broadcast (ADS-B) Traffic Section for more information.

TAS/TCAS I SYMBOLOGY

The system displays traffic using the symbols shown in the following tables depending on the type of equipment installed.

Traffic Symbol	Description
	Non-Threat Traffic
	Proximity Advisory (PA)
	Traffic Advisory (TA)
	Traffic Advisory Off Scale

Table 41: TAS/TCAS I Traffic Symbology

TRAFFIC SYMBOLOGY WITH OPTIONAL GTX

The system displays traffic using the symbols shown in the following table if an optional GTX transponder with ADS-B capability is installed on the aircraft.

Traffic 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 with directional information. Displayed at outer range ring at proper bearing.
	Traffic Advisory out of the selected display range without directional information. 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.
	Other Non-Threat traffic with directional information. Points in the direction of the intruder aircraft track.
	Other 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 with ADS-B directional information. Pointed end indicates direction of travel. Ground traffic is only displayed when ADS-B is in Surface (SURF) Mode or own aircraft is on the ground.
	Non-aircraft ground traffic without ADS-B directional information. Ground traffic is only displayed when ADS-B is in Surface (SURF) Mode or own aircraft is on the ground.

Table 42: ADS-B Traffic Symbology (GTX Transponder Installed)

A Traffic Advisory (TA), displayed as an amber circle or amber circle with an enclosed triangle, alerts the crew to a potentially hazardous intruding aircraft, if the closing rate, distance, and vertical separation meet TA criteria. A Traffic Advisory that is beyond the selected display range (off scale) is indicated by a half TA symbol at the edge of the page at the relative bearing of the intruder.

A Proximity Advisory (PA), displayed as a solid white diamond or triangle, indicates the intruding aircraft is within ±1200 feet and is within a six nautical mile range, but is still not considered a TA threat.

Other Non-Threat traffic, shown as a hollow white diamond or triangle, is displayed for traffic beyond a six nautical mile range that is neither a TA or PA.

Absolute altitude, when available, is displayed above or below the corresponding intruder symbol. The altitude of the intruder aircraft will show the altitude in MSL (based on the ownship baro-corrected MSL altitude).

Relative altitude, when available, is displayed above or below the corresponding intruder symbol in hundreds of feet. When this altitude is above own aircraft, it is preceded by a '+' symbol; a minus sign '-' indicates traffic is below own aircraft.

The system displays the altitude vertical trend as an up/down arrow (for vertical speeds greater than 500 FPM in either direction) to the right of the intruder symbol. If the intruding aircraft is providing ADS-B track information, a motion vector line extending beyond the traffic symbol in the direction of the track may also be displayed when either absolute or relative motion vectors are enabled.

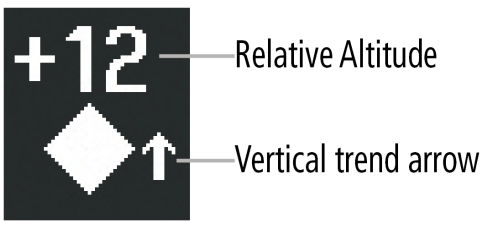


Figure 269: Intruder Aircraft with ADS-B Directional Information

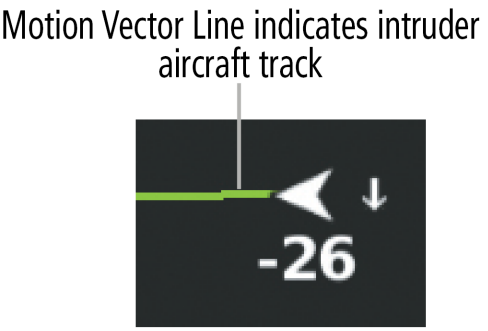


Figure 270: Intruder Altitude and Vertical Trend Arrow

The traffic system automatically suppresses the display of other altitude-reporting aircraft on the ground under either of the following conditions:

- On-ground aircraft is equipped with a Mode S transponder.

- On-ground aircraft is equipped with a Mode C transponder, and own aircraft's radar altimeter (if installed) is displaying 1700' AGL or less.

TA ALERTING CONDITIONS

The traffic system automatically adjusts its TA sensitivity level to reduce the likelihood of nuisance TA alerting during flight phases likely to be near airports. The system uses Level A (less) sensitivity when the height above terrain is at or below 2,000' AGL. If the height above terrain is unavailable, Level A sensitivity applies when the ground speed is less than 120 knots. In all other conditions, Level B (higher) sensitivity applies.

Sensitivity Level	Intruder Altitude Available	TA Alerting Conditions
A	Yes	Intruder closing rate provides less than 20 seconds of vertical and horizontal separation. **Or:** Intruder closing rate provides less than 20 seconds of horizontal separation and vertical separation is within 600 feet. **Or:** Intruder range is within 0.2 NM and vertical separation is within 600 feet.
A	No	Intruder closing rate provides less than 15 seconds of separation. **Or:** Intruder range is within 0.2 NM.
B	Yes	Intruder closing rate provides less than 30 seconds of vertical and horizontal separation. **Or:** Intruder closing rate provides less than 30 seconds of horizontal separation and vertical separation is within 800 feet. **Or:** Intruder range is within 0.55 NM and vertical separation is within 800 feet.
B	No	Intruder closing rate provides less than 20 seconds of separation. **Or:** Intruder range is within 0.55 NM.

Table 43: TA Sensitivity Level and TA Alerting Criteria

SYSTEM STATUS

The traffic system mode appears in the upper right corner of the MFW 'Traffic' Page.

Traffic System Mode	Traffic Map Mode Annunciation	Traffic Overlay Status Icon
Operating	OPERATE	
Standby	STANDBY	
Failed	FAILED	

Table 44: TAS/TCAS I Modes

If the traffic unit fails, the system shows a 'FAIL' annunciation on the 'Traffic' page. During a failure condition, the Operating Mode is not available.

The 'Map' application page will automatically zoom out to view a traffic alert if the scale of the map is not wide enough to view the traffic in question.

TRAFFIC ALERTS

When the traffic system detects a new TA, the following occur:

- The system issues a single **"Traffic!"** voice alert, followed by additional voice information about the bearing, relative altitude, and approximate distance from the intruder that caused the TA. The voice alert **"Traffic! 12 o'clock, high, four miles"**, would indicate the traffic is in front of own aircraft, above own altitude, and approximately four nautical miles away.
- A 'TRAFFIC' Annunciation appears to the left of the Attitude Indicator on the PFW, flashes for five seconds and remains displayed until no TAs are detected in the area.
- If the bearing of TA traffic cannot be determined, an amber text banner will be displayed in the center of the Traffic Map and in at the bottom of the HSI map instead of a TA symbol. The text will indicate 'TA' followed by the distance, relative altitude, and vertical trend arrow for the TA traffic, if known.

The system displays a TA traffic symbol and traffic annunciation for at least eight seconds, even if the alerting condition(s) that initially triggered the TA are no longer present.

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" **Or:** "One Mile" through "Ten Miles" **Or:** "More than ten miles"

Table 45: TA Descriptive Voice Alert

NOTE

If a GTX 345R transponder is installed, the system mutes TAS-derived voice alerts below 400' AGL, and mutes ADS-B-derived voice alerts below 400' or 500' AGL (depending on software configuration) or when landing gear is extended. In rotorcraft installations the system mutes alerts below 200' AGL.

NOTE

If a TAS is installed without a GTX 345R transponder, the system mutes TA voice alerts below 400' AGL or when landing gear is extended.

'TRAFFIC' OPERATION

The 'Traffic' page shows surrounding traffic data in relation to the aircraft's current position and altitude, without basemap clutter. It is the principal MFW application for viewing traffic information. Aircraft orientation is always heading up unless there is no valid heading. Range rings indicate map ranges. Touch the screen with two fingers and pinch out to decrease range and pinch in to increase range. Alternatively touch the screen with a single finger and scroll up to decrease range or scroll down to increase range.

The traffic operating mode appears in the information bar at the top of the 'Traffic' Application Page and the altitude range appears in the lower left of the range ring.

Figure 271: Traffic Annunciation

ACCESSING THE 'TRAFFIC' PAGE ON THE MFW:

Use the Outer **DCK** (on the MFW side of the bezel when in spit screen mode) to scroll to the 'Traffic' Application Page on the MFW.

Or:

Touch the **Applications** Icon **>** **Primary** Tab **>** **Traffic**.

CHANGING THE 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.

1 Navigate to the 'Traffic' Application Page on the MFW.

Use the Outer **DCK** (on the MFW side of the bezel when in spit screen mode) to scroll to the 'Traffic' Application Page on the MFW.

Or:

Touch the **Applications** Icon **> Primary** Tab **> Traffic**.

2 Press the **MENU** Softkey (on the 'Traffic' side of the bezel when in split screen mode).

3 Touch the **Altitude Range** Selection Button.

4 Select **Normal**, **Above**, **Below**, or **Unrestricted**.

ADDITIONAL TRAFFIC DISPLAYS

The system can overlay traffic information on the 'Map' page. Traffic information is also available on the PFW when the Synthetic Vision Technology (SVT™) terrain display is enabled. Refer to *SVT traffic* in the Flight Instruments section for details about .

When the display of traffic is enabled on the 'Map,' the system shows a traffic status icon and altitude mode in the lower left corner of the map. When touched, the icon will open the 'Overlay Status Detail' Window which will give more information about the traffic information being displayed on the 'Map' Page.

The system provides controls to customize the display of traffic information on the 'Map.' 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.

The HSI can also present a version of the Traffic Map. Traffic operating mode information is not present on this map. Refer to the *HSI Style* portion of the Flight Instruments section for more information about displaying maps on the HSI.

ENABLING/DISABLING TRAFFIC ON THE 'MAP' APPLICATION PAGE:

1 Navigate to the 'Map' Application Page.

a) Touch the **Map** Button on the MFW App Bar.

Or:

a) Use the Outer **DCK** (on the MFW side of the bezel in split screen mode) to scroll to the 'Map' Application Page.

Or:

a) Touch the **Applications** Icon **> Primary** Tab **> Map**.

2 Press the **MENU** Softkey to open the 'Map Menu'.

3 Touch the **Traffic** Annunciation Button to enable or disable the traffic displayed on the 'Map' Page. The green annunciation indicates the feature is enabled.

CUSTOMIZING TRAFFIC DISPLAY INFORMATION ON THE 'MAP' APPLICATION PAGE:

1 Navigate to the 'Map' Application Page.

a) Touch the **Map** Button on the MFW App Bar.

Or:

a) Use the Outer **DCK** (on the MFW side of the bezel in split screen mode) to scroll to the 'Map' Application Page.

Or:

a) Touch the **Applications** Icon **>** **Primary** Tab **>** **Map**.

2 Press the **MENU** Softkey to open the 'Map Menu'.

3 Touch the **Map Settings** Button.

4 If necessary, touch the **General** Tab.

5 Scroll if necessary to the 'Traffic' Section of the 'Map Settings'.

6 Touch the **Labels** Annunciation Button to enable the traffic icons on the 'Map' to display altitude and tail number information.

7 Touch the **Motion Vectors** Selection Button to enable the traffic icons on the 'Map' to display **Absolute** or **Relative** motion vectors.

SHOWING THE HSI TRAFFIC MAP:

1 Navigate to the PFW Settings:

a) Press the **MENU** Softkey (On the PFW side of the bezel if in split screen mode).

Or:

Touch the HSI to open the 'PFW Menu.

b) Touch **PFW Settings**.

2 Touch the **HSI Style** Selector Button.

3 Select **Traffic** to enable the traffic map on the HSI.

INHIBIT/ENABLE TRAFFIC ALERTS:

After a Visual Annunciation appears below the HSI touch the **Inhibit** Annunciation Button.

Or:

a) Touch the **Applications** Icon.

b) Touch the **Quick Actions** Tab.

c) Touch the **Inhibits** Button.

d) Touch the **Inhibit/Normal** Selection Button for the Traffic alerts to be inhibited or enabled. The blue indication displays which option has been selected.

ADS-B TRAFFIC

⚠ WARNING

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

⚠ WARNING

Do not rely solely upon the display of traffic information to accurately depict all of the traffic information within range of the aircraft. Due to lack of equipment, poor signal reception, and/or

inaccurate information from other aircraft, traffic may be present but not represented on the display.

ADS-B SYSTEM OVERVIEW

Automatic Dependent Surveillance-Broadcast (ADS-B) is a core technology in the FAA NextGen air traffic control system. It offers improved surveillance services, both air-to-air and air-to-ground, especially in areas where radar coverage is ineffective due to terrain, or where it is impractical or cost prohibitive. ADS-B is comprised of three segments for the purposes of providing traffic information: ADS-B (Broadcast), ADS-R (Rebroadcast), and Traffic Information Service-Broadcast (TIS-B).

ADS-B includes the automatic broadcast of position reports by aircraft, surface vehicles, and transmitters on fixed objects. These broadcasts contain information such as GPS position, identity (Flight ID, Call Sign, Tail Number, ICAO registration number, etc.), ground track, ground speed, pressure altitude, and emergency status.

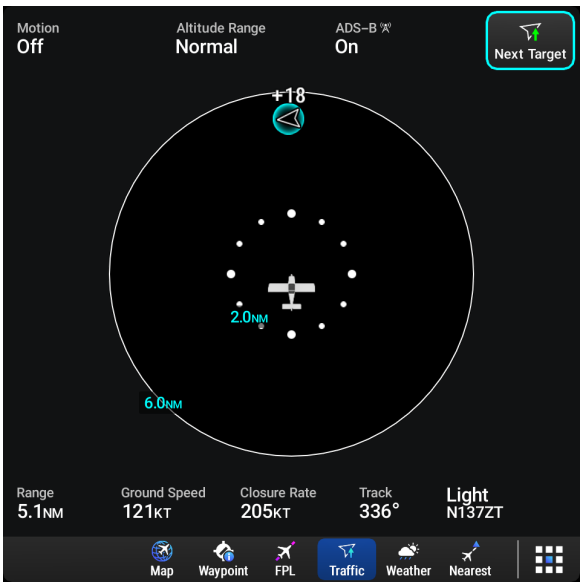


Figure 272: ADS-B System

For the purpose of distinguishing between levels of ADS-B service, there are three classifications of aircraft or system capability: ADS-B In, ADS-B Out, and ADS-B participating. ADS-B In refers to the capability to receive ADS-B information. ADS-B Out refers to the capability to transmit ADS-B information. ADS-B participating refers to the capability to both send and receive ADS-B information. Aircraft lacking either ADS-In, ADS-B Out, or both ADS-B capabilities may also be referred to as ADS-B nonparticipating aircraft.

The ADS-B system operates on two frequencies: 1090 MHz and 978 MHz. Both frequencies provide the same traffic information. An aircraft may be ADS-B In, Out, or participating on one or both frequencies, depending on the installed equipment. The 1090 MHz frequency portion of ADS-B is known as 1090 Extended Squitter (1090 ES). The 978 MHz portion of ADS-B is known as Universal Access Transceiver (UAT).

AUTOMATIC DEPENDENT SURVEILLANCE-REBROADCAST (ADS-R)

Because it is not required that ADS-B In capable aircraft be able to receive ADS-B data on both the 1090 MHz and 978 MHz data links, a method exists to get data from one data link to the other. ADS-R is the rebroadcast of ADS-B data by FAA ground stations, which provide this service by taking traffic data from one link and rebroadcasting it on the other. For example, if two aircraft are in the service volume for a ground station, and one is transmitting on the 1090 MHz frequency and the other is transmitting on the 978 MHz frequency, the ground station retransmits the data from each aircraft on the other link to ensure the two aircraft can "see" each other as traffic.

If another aircraft can only receive 978 MHz UAT information, it cannot directly 'see' another aircraft sending only 1090 ES information aircraft unless an ADS-R ground station in the vicinity rebroadcasts the 1090 ES data over the 978 MHz UAT frequency. This is also true for an aircraft which can only receive 1090 ES data; it would need an ADS-R ground station to 'see' another aircraft operating on the UAT frequency.

TRAFFIC INFORMATION SERVICE-BROADCAST (TIS-B)

NOTE

ADS-B Traffic on the ground may not be displayed for targets between 0° and -90° longitude (west of the prime meridian).

TIS-B provides a link between the secondary surveillance radar (SSR)-based system ATC uses and the ADSB- based system. When an ADS-B In or Out capable aircraft is within the service volume of an FAA ADS-B ground station, the ground station broadcasts a portion of the ATC radar data to the aircraft. This aircraft is then included in the list of aircraft being provided TIS-B service and is then considered a "TIS-B participant." TIS-B coverage is available when the aircraft is within ground station and SSR coverage, and the other aircraft is also in SSR coverage, and is transmitting its altitude.

The ground station provides ATC radar information for other aircraft within ±3,500 feet and 15 NM of the participant, to include altitude, position, ground speed, and ground track. TIS-B broadcasts occur once every three to thirteen seconds, depending on the characteristics of the ground station providing the TIS-B service.

ADS-B TRAFFIC ADVISORY SYSTEM (ATAS)

NOTE

The system mutes TA voice alerts from ADS-B sources when own aircraft is below 400 feet AGL.

ADS-B Traffic Advisory System (ATAS) is an alerting algorithm which provides ADS-B traffic alerts to the flight crew which are similar in nature to the TAS Traffic system discussed previously.

When a TA occurs, the system displays an amber 'TRAFFIC' annunciation on the PFDs and provides a voice alert.

Sensitivity Level	Height Above Airport Reference Point (Feet)	Radar Altitude (Feet)	Height Above Terrain (HAT)	Own Altitude (Feet)	Look-Ahead Time (Seconds)	Vertical Threshold for Alert (Feet)	Protected Volume (NM)
4	≤ 1500 and within 5 NM of airport reference point	Any	Any	Any	30	400	0.20
4	Unavailable	≤ 1500	Any	Any	30	400	0.20
4	Unavailable	Unavailable	≤ 1500	Any	30	400	0.20
5	Unavailable or > 1500	Unavailable or > 1500	Unavailable or > 1500	≤ 5000	35	700	0.35
6	Unavailable or > 1500	Unavailable or > 1500	Unavailable or > 1500	> 5000 ≤ 10,000	40	100	0.55
7	Unavailable or > 1500	Unavailable or > 1500	Unavailable or > 1500	> 10,000 ≤ 20,000	45	100	0.80
8	Unavailable or > 1500	Unavailable or > 1500	Unavailable or > 1500	>20,000	48	700	1.10

Table 46: ATAS Alerting Thresholds for ADS-B Traffic

AIRBORNE AND SURFACE APPLICATIONS

NOTE

Do not rely solely on the traffic display to ascertain the alignment of traffic to the runway, especially when runways are in close proximity to each other.

NOTE

Refer to the TAS Traffic section for a table of ADS-B and TAS traffic symbols the system can display.

ADS-B traffic can help the pilot visually acquire traffic both in the air and on-the-ground. There are two ADS-B applications or modes: Airborne Situational Awareness (AIRB) and Surface Situational Awareness (SURF). The system automatically selects the appropriate application based on conditions.

The AIRB application is on when the aircraft is more than five NM and 1,500 feet above the nearest airport. When the AIRB application is active, the system only displays traffic which is airborne.

The SURF application is on when the aircraft is within five NM and less than 1,500 feet above field elevation. When the SURF applications is on, the system displays airborne and on the ground traffic. At a ‘Traffic’ range of one NM or less, the airport environment (including taxiways and runways) appears in addition to traffic. The airport displays are derived from the

SafeTaxi® database. Refer to the *SafeTaxi* section in Additional Features for more information about SafeTaxi displays.

Figure 273: 'Traffic' with SURF Mode On

ADS-B TRAFFIC OPERATION

The Traffic Map shows surrounding traffic data in relation to the aircraft's current position and altitude, without basemap clutter. Aircraft orientation is always heading up unless there is no valid heading. Map range is adjustable with the knob, or by touch and is indicated by the map range rings.

The traffic mode and altitude display range are annunciated in the upper corners of the MFW.

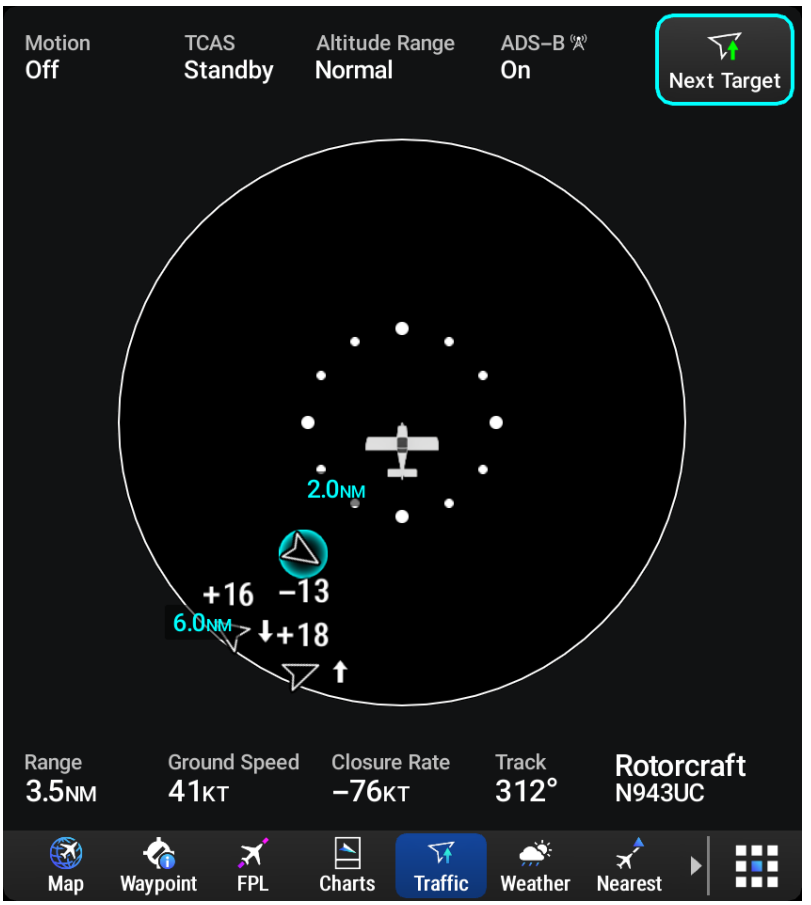


Figure 274: 'Traffic' with ADS-B Traffic Enabled

ENABLING/DISABLING THE DISPLAY OF ADS-B TRAFFIC:

NOTE

*The **ADS-B In** Annunciation Button will be disabled when there is an ADS-B failure.*

1 Navigate to the 'Traffic' Application Page on the MFW:
   a) Use the Outer **DCK** on the MFW to scroll to the application.
      Or:
   a) Touch the **Traffic** Button on the MFW 'App' Bar.
      Or:
   a) Touch the **Applications** Icon on the MFW 'App' Bar.
   b) If necessary, touch the **Primary** Tab.
   c) Touch the **Traffic** Button.
2 Press the **MENU** Softkey on the 'Traffic' application side of the bezel.
3 If necessary, scroll to the 'System' portion of the 'Traffic Menu'.
4 Touch the **TCAS Mode** Selection Button to switch the mode from 'Standby' to 'Operate'.
5 Touch the **ADS-B In** Annunciation Button (the green indication represents the feature is enabled).

DISPLAYING MOTION VECTORS

When Absolute Motion Vectors are selected, the vectors extending from the traffic symbols depict the traffic's reported track and speed over the ground. When Relative Motion Vectors are selected, the vectors extending from the traffic symbols display how the traffic is moving relative to own aircraft. These vectors are calculated using the traffic's track and ground speed and own aircraft's track and ground speed. These two values are combined to depict where the traffic is moving purely with respect to own aircraft, and provide a forecast of where the traffic will be, relative to own aircraft, in the near future. If the system does not have sufficient information to calculate motion vectors, they are not shown.

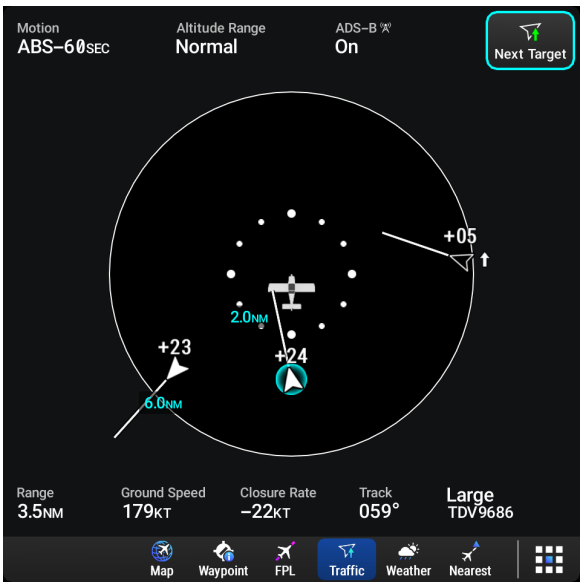


Figure 275: Traffic' with Motion Vectors Enabled

ENABLING/DISABLING MOTION VECTORS:

1 Navigate to the 'Traffic' Application Page on the MFW:
   a) Use the Outer **DCK** on the MFW to scroll to the application.
      Or:
   a) Touch the **Traffic** Button on the MFW 'App' Bar.
      Or:
   a) Touch the **Applications** Icon on the MFW 'App' Bar.
   b) If necessary, touch the **Primary** Tab.
   c) Touch the **Traffic** Button.
2 Press the **MENU** Softkey on the 'Traffic' application side of the bezel.
3 Touch the **Motion Vectors** Selection Button.
4 Touch the desired type of motion vector to be displayed (**Absolute** or **Relative**) to enable them on the traffic application.
   Or:

Touch the **Off** button to disable motion vectors.

ADDITIONAL TRAFFIC INFORMATION

The 'Traffic' Application Page 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.)

⚠ CAUTION

*Specific traffic information may be skipped by the system if a "bearing to" traffic has changed enough in the time that other traffic information has been viewed. The pilot should be pay special attention to the next traffic that should be viewed when using the **Next Target** Button.*

When interrogating traffic for more detailed information, the **Next Target** Button will cycle to the next source of traffic data using the 'bearing to' the target in a clockwise fashion.

DISPLAYING ADDITIONAL TRAFFIC INFORMATION ON THE 'TRAFFIC' APPLICATION PAGE:

Touch the **Next Target** Button on the 'Traffic' Page to cycle through all the traffic being interrogated by the system.

Or:

Push the **DCK** on the 'Traffic' side of the bezel to cycle through all the traffic being interrogated by the system.

Or:

Using one finger touch the desired traffic symbol on the 'Traffic' Page to open the information bar at the bottom of the application.

'TRAFFIC' DISPLAY RANGE

The pilot can adjust the range of traffic displayed on the MFW ‘Traffic’ page. Range indications appear on rings shown on the MFW. The minimum map range is 750 feet. A maximum map range of 40 nautical miles is available.

SELECTING ‘TRAFFIC’ DISPLAY RANGE:

On the MFW 'Traffic' page, touch the screen with two fingers and pinch in to increase the range and pinch out to decrease the range.

Or:

Use one finger to slide up and down on the 'Traffic' Page to zoom in and out (sliding up zooms in and sliding down zooms out.

Or:

Turn the Inner **DCK** clockwise to zoom in and counter-clockwise to zoom out.

ADS-B SYSTEM STATUS

The traffic mode is annunciated on the top of the MFW 'Traffic' Page.

ADS-B Mode	Traffic Mode Annunciation (Traffic)	Traffic Display Status Icon (Other Maps)
ADS-B System Test Initiated	ADS–B: TEST	
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 Traffic Not Available	ADS–B: N/A	
ADS-B Failed[1]	ADS–B: FAIL	
[1] See next tables for additional failure annunciations.		

Table 47: ADS-B Modes

The MFW 'Traffic' page displays a white antenna icon to indicate the successful reception of ADS-B traffic services from a ground station. For systems with an installed and operating TAS/TCAS I system, a white-X over this icon indicates the status of the TIS-B/ADS-R coverage is irrelevant and not required.

Ground Station Status	Reception Icon
Receiving ADS-B traffic services from a ground station/TCAS Operating.	
Not receiving ADS-B traffic services from a ground station/TCAS in Standby Mode.	

Table 48: ADS-B Ground Station Reception Status

If the traffic unit fails, an annunciation as to the cause of the failure is shown in the center of the 'Traffic' page. During a failure condition, the Operating Mode cannot be selected.

ADS-B Status Page Item	Status Message	Description
Airborne (AIRB), Surface (SURF), Airborne Alerts (ATAS)	On	Traffic application is currently on. Required input data is available, and it meets performance requirements.
	Available to Run	Traffic application is not currently active, but application is ready to run when condition(s) detect 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 49: ADS-B Status Page Messages for ADS-B Traffic

VIEWING ADS-B TRAFFIC STATUS:

1. Navigate to the 'Traffic' Application Page on the MFW.
2. Press the **MENU** Softkey (on the 'Traffic' side of the bezel when in split screen mode).
3. Scroll if necessary, then touch the **ADS-B Status** Button.

Figure 276: MFW Traffic Status Window

RUNWAY OCCUPANCY AWARENESS (ROA)

⚠ WARNING

Traffic information shown on system displays is provided as an aid in visually acquiring traffic. Not all runways will provide ROA alerting. ROA alerts are dependent on ADS-B data from participating traffic.

Runway Occupancy Awareness (ROA) requires a GTX X45 family transponder. GNX 375 cannot currently support ROA.

The ROA function is an extension of the ADS-B traffic function and will be active when ADS-B IN is enabled and Surface Indications and Alerts (SURF IA) is not inhibited in the system. The ROA function is available when ownship is on or near a runway with a hard surface and served by a precision instrument approach. The ownship can be considered near a runway when located on the surface within 1500 ft of a runway or airborne within 3 NM of the runway threshold and below 1000 ft above field elevation. The ROA function uses the Navigation and SafeTaxi® databases for airport and runway data.

ROA INDICATIONS AND ALERTS

The system generates three types of ROA indications and alerts as follows:

- **Traffic Indication (TI)** — There is no immediate collision hazard between traffic and ownship, however, a high-speed traffic collision hazard could develop on the runway.
- **Runway Status Indication (RSI)** — A high-speed traffic collision hazard would result if the ownship enters a runway, attempts to takeoff on a runway, or attempts to land on a runway.

- **Runway Caution Indication** — An yellow Caution Level Alert on the PFW and the traffic map when a runway collision hazard exists.

The system will provide an yellow Caution Level Alert on the PFW and the traffic map when a runway collision hazard exists where traffic and ownship are converging at high speed and immediate flight crew awareness of the conflict is required. The aural voice alert “Traffic Runway” will include the specific runway number (ex.“Traffic Runway 01”). Caution alerts are provided when either ownship taxi speed is above 30 KIAS or other participating traffic taxi speed is above 40 KIAS and a collision risk is expected to occur on a runway within 35 seconds. ROA Alerts are suppressed during takeoff when ownship has reached a ground speed greater than 60 KIAS or GPS ground speed (whichever is higher).

For runways where Land and Hold Short Operations (LAHSO) are in effect, the system will not indicate a caution alert as the result of a LAHSO operation where ownship or crossing traffic has not crossed the LAHSO hold line. The system will activate LAHSO suppression automatically when a LAHSO hold line has been located on ownship’s runway or a runway that intersects with ownship’s runway. A LAHSO annunciation will appear on the traffic map showing “on” or “off”, see the following figure for an example.

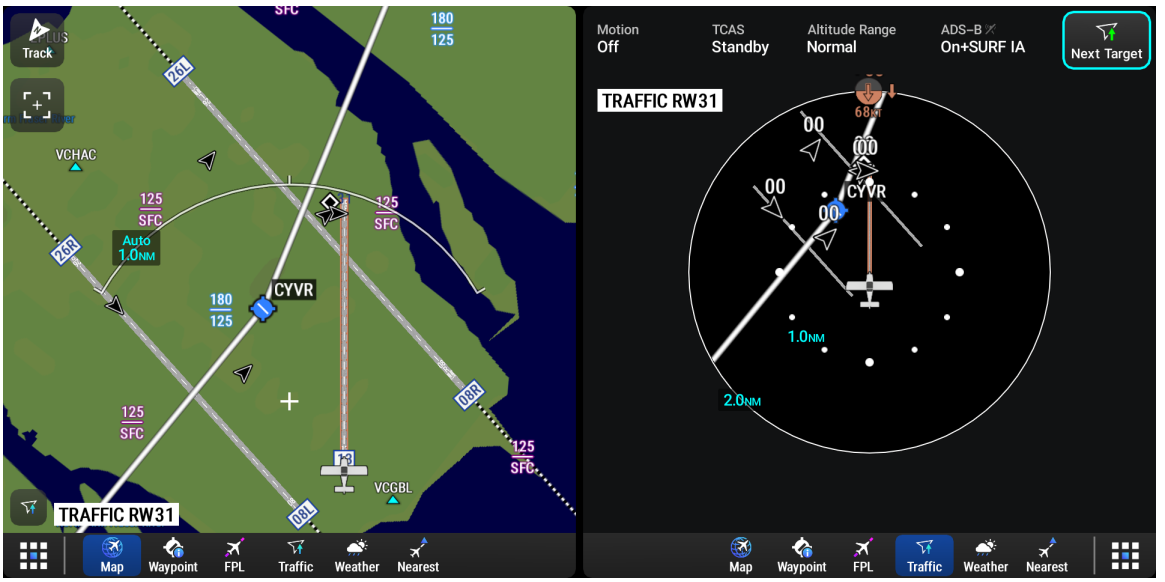


Figure 277: ROA Indications on 'Map' and 'Traffic' Applications

ROA Occupied Runway Highlight Navigation Maps	Description	ROA Occupied Runway Highlight (SVT)
	Runway Status Indication (RSI)	Not Shown on SVT
	Runway Caution Alert	
	Runway Warning Alert	

Table 50: ROA Occupied Runway Highlight

PFW ROA Alert Annunciation	Description	SURF IA Aural Voice Alert
TRAFFIC RW36	Runway Advisory Alert	None
TRAFFIC RW36	Runway Caution Alert	"Traffic Runway ##"
TRAFFIC RW36	Runway Warning Alert	"Traffic Runway ##"

Table 51: PFW SURF IA Alert Annunciations

The ROA function can be manually inhibited on the 'Inhibits' Window using the **Quick Actions** Tab in the 'Apps' Window.

When a ROA Indication or Alert (IA) is generated, the system will display a symbol on the MFW 'Traffic' Map or SafeTaxi® Diagram. The flight ID and ground speed will be displayed with the TI or RSI traffic ROA symbol. Traffic symbol examples are shown in the following table.

Symbol	Description
	Traffic Indication (TI) with directional information.
	Traffic Indication (TI) without directional information.
	Aircraft or Non-Aircraft Traffic Indication (TI) off-scale with directional information.
	Aircraft or Non-Aircraft Traffic Indication (TI) off-scale without directional information.
	Runway Status Indication (RSI) with direction information.
	Runway Status Indication (RSI) without directional information.
	Aircraft or Non-Aircraft Runway Status Indication (RSI) and directional information off-scale.
	Aircraft or Non-Aircraft Runway Status Indication (RSI) without directional information off-scale
	Traffic Caution Alert with directional information.
	Traffic Caution Alert without directional information.
	Aircraft or Non-Aircraft Traffic Caution Alert off-Scale with directional information.
	Aircraft or Non-Aircraft Traffic Caution Alert off-Scale without directional information.
	Non-aircraft Traffic Indication (TI) with directional information.
	Non-aircraft Traffic Indication (TI) without directional information.
	Non-aircraft Runway Status Indication (RSI) with directional information.

Symbol	Description
	Non-aircraft Runway Status Indication (RSI) without directional information.
	Non-aircraft Traffic Caution Alert with directional information.
	Non-aircraft Traffic Caution Alert without directional information.
	Non-aircraft Runway Status Indication (RSI) with directional information.
	Non-aircraft Runway Status Indication (RSI) without directional information.
	Non-aircraft Traffic Caution Alert with directional information.
	Non-aircraft Traffic Caution Alert without directional information.
	Non-aircraft Traffic Warning Alert with directional information.
	Non-aircraft Traffic Warning Alert without directional information.

Table 52: ROA Traffic Symbols

INHIBITING ROA ALERTS:

After a Visual Annunciation appears below the HSI touch the **Inhibit** Annunciation Button.

Or:

a) Touch the **Applications** Icon.
b) Touch the **Quick Actions** Tab.
c) Touch the **Inhibits** Button.
d) Touch the **Inhibit/Normal** Selection Button for the SURF alerts to be inhibited or enabled. The blue indication displays which option has been selected.

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SECTION 7 AUTOMATIC FLIGHT CONTROL SYSTEM (AFCS)

7.1 OVERVIEW

⚠ CAUTION

Standby flight instrumentation is suggested for IFR flight. The G5 and GI 275 are compatible with the AXIS™ flight displays, however, the GI 275 is not capable of communicating with the GFC 500X using the AXIS flight displays and must be configured to interface with a third party autopilot.

NOTE

This section describes capabilities and functions of the optional Garmin GFC 507 autopilot system unless otherwise noted.

NOTE

The approved Pilot's Operating Handbook (POH) always supersedes the information in this Pilot's Guide.

NOTE

Refer to the approved Pilot's Operating Handbook (POH) for emergency procedures.

NOTE

VOR, LOC, and GS modes are all GPS-aided. You must have a GPS position to use VOR, LOC, or GS modes.

An Automatic Flight Control System (AFCS) is typically comprised of two major components: A Flight Director (FD) and Autopilot servos. The Flight Director provides pitch and roll commands to the autopilot servos. These pitch and roll commands are displayed on the PFW as Command Bars. When the Flight Director is active the pitch and roll commands can be hand-flown by the pilot or when coupled with the flight director, the autopilot servos drive the flight controls to follow the commands issued by the Flight Director. The Flight Director operates independently of the autopilot servos, but in most cases the autopilot servos can not operate independent of the Flight Director. On installations that do not have a separate and independent Flight Director, the Flight Director is always coupled to the autopilot. The autopilot and optional yaw damper operate the flight control surface servos to provide automatic flight control.

The Garmin Automatic Flight Control System (AFCS) is fully integrated within the system avionics architecture. The System Overview section provides a block diagram to support this system description. Garmin AFCS functionality is distributed across the following Line Replaceable Unit's (LRU's):

- GDU™ 116 Flight Display
- GMC AFCS Controller (Internal)
  - GMC 305 (optional)
  - GMC 307 (optional)
  - GMC 507 (optional)
- GSA 28 Pitch, Roll, Yaw, and Trim Servos

- 3rd Party Trim Servos

The AFCS is separated into these main operating functions:

- **Flight Director (FD)** — Flight director computations are accomplished by the GDU which is a mixture between the GDU and the GMC 507. Flight director commands are displayed on the PFD. The flight director provides:
  - Command Bars showing pitch/roll guidance
  - Vertical/Lateral mode selection and processing
  - Autopilot communication
- **Autopilot (AP)** — Autopilot operation occurs within the pitch, roll, and yaw servos. It also provides servo monitoring and automatic flight control in response to flight director steering commands, Air Data and Attitude and Heading Reference System (ADAHRS) attitude, rate information, and airspeed.
- **Yaw Damper (YD)** — The yaw servo (optional), is self-monitoring and provides Dutch roll damping and turn coordination in response to yaw rate, roll angle, lateral acceleration, and airspeed. If installed the YD comes on when the autopilot is engaged. Depending on configuration/installation options, the YD stays on after disengaging the autopilot.
- **Manual Electric Pitch Trim (MEPT)** — Manual electric trim provides trim capability for the pitch axis when the autopilot is not engaged.
- **Manual Electric Roll Trim (MERT)** — The roll trim actuator provides manual electric roll trim capability when the autopilot is not engaged.
- **Manual Electric Yaw Trim (MEYT)** — The yaw trim adapter provides manual electric yaw trim capability while the autopilot is not engaged.

7.2 AFCS CONTROLS

AFCS CONTROLLER

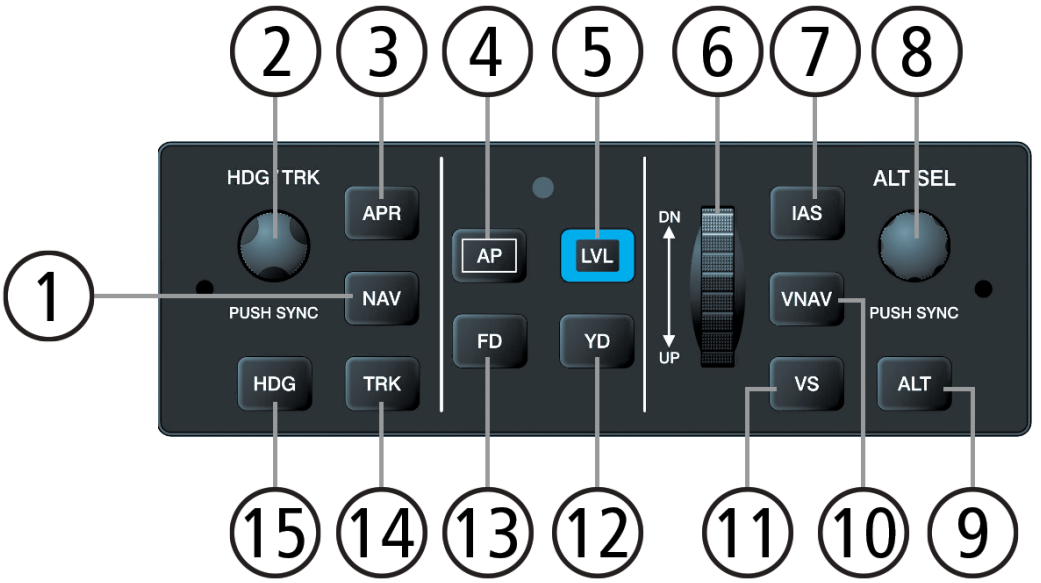


Figure 278: GMC 507 AFCS Controller

The AFCS Controller has the following dedicated AFCS controls:

1	**NAV** Key	Selects/deselects Navigation Mode. Cancels GS Mode if LOC Mode is either active or armed. Cancels GP Mode if GPS Mode is either active or armed. Cancels LOC Mode if GPS Mode is active and LOC Mode is armed.
2	**HDG/TRK** Knob	Selects the desired Heading/Track
3	**APR** Key	Selects/deselects Approach Mode
4	**AP** Key	Engages/disengages the autopilot
5	**LVL** Key	Engages the autopilot (if the autopilot is disengaged) in level vertical and lateral modes
6	Nose **UP/DN** Wheel	Adjusts the vertical mode reference in Pitch Hold, Vertical Speed, Indicated Airspeed, and Altitude Hold modes
7	**IAS** Key	Selects/deselects Indicated Airspeed Mode
8	**ALT SEL** Knob	Selects the desired Altitude setting
9	**ALT** Key	Selects/deselects Altitude Hold Mode
10	**VNAV** Key	Selects/deselects Vertical Path Tracking Mode for Vertical Navigation flight control
11	**VS** Key	Selects/deselects Vertical Speed Mode

⑫	**YD** Key	Engages/disengages the yaw damper
⑬	**FD** Key	Activates/deactivates the flight director only Pressing once turns on the 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.
⑭	**TRK** Key	Selects/deselects Track (TRK) Mode
⑮	**HDG** Key	Selects/deselects Heading Select Mode

DISPLAY UNIT AUTOPILOT INTERFACE

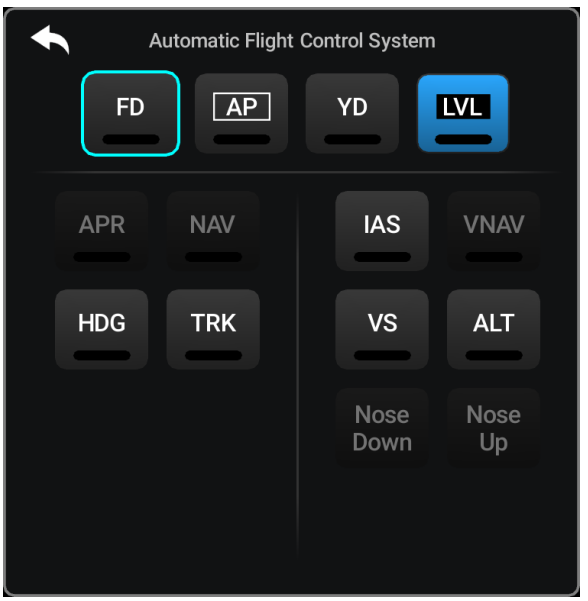


Figure 279: AFCS Controls

- **FD** Button — Activates/deactivates the flight director only.
- **AP** Button — Engages/disengages the autopilot.
- **YD** Button — Engages/disengages the yaw damper.
- **LVL** Button — Engages the autopilot (if the autopilot is disengaged) in level vertical and lateral modes.
- **APR** Button — Selects/deselects approach mode.
- **NAV** Button — Selects/deselects navigation mode. Cancels GS Mode if LOC Mode is either active or armed. Cancels GP Mode if GPS Mode is either active or armed. Cancels LOC Mode if GPS Mode is active and LOC Mode is armed.
- **HDG** Button — Selects/deselects heading mode.
- **TRK** Button — Selects/deselects track mode.
- **IAS** Button — Selects/deselects Indicated Airspeed Mode.
  - **Slower/Faster** Button — Adjusts the vertical mode reference in Indicated Airspeed Hold Mode.

- **VNAV** Button — Selects/deselects vertical navigation.
- **VS** Button — Selects/deselects Vertical Speed Mode.
  - **Nose Up / Nose Down** Buttons — Adjusts the vertical mode reference in Vertical Speed Mode.
- **ALT** Button — Selects/deselects Altitude Hold Mode.
  - **Lower Alt/Higher Alt** Buttons — Adjusts the vertical mode reference in Altitude Hold Mode.

ACCESSING THE AFCS INTERFACE ON THE AXIS FLIGHT DISPLAY:

Touch the AFCS Status Box located above the attitude indicator.

Or:

a) Navigate to the 'Apps' Window by pressing the **MENU** Softkey two times.

Or:

Touch the **Applications** Icon on the MFW App Bar.

b) Touch the **Quick Actions** Tab.

c) Touch the **Autopilot** Button.

AFCS PRE-FLIGHT CHECKLIST — GARMIN GFC 500X:

To ensure the Automatic Flight Control System (AFCS) is operating properly prior to flight, perform the following Garmin recommended pre-flight checks.

1. Autopilot — ENGAGE (using **AP** Button, or **AP** Key on mode controller).
2. Autopilot — DISENGAGE (using **AP** Button, or **AP** Key on mode controller) verify autopilot disengages and audio alert is heard.
3. Verify yaw damper — OFF (if installed) (verify yaw damper disengages and audio alert is heard).
4. Flight director — SET FOR TAKEOFF (select VS mode or push **FD** Key to turn off the Flight Director).
5. Flight controls — CHECK (verify autopilot servos are disengaged from pitch, roll, and yaw controls, and all controls move freely).
6. Elevator/roll/yaw trim control (if equipped) — SET FOR TAKEOFF.

BASIC AUTOPILOT OPERATION

This section provides an overview for engagement and disengagement of the autopilot. A more detailed description follows in the Autopilot, Yaw Damper, and Trim Operation section.

- **Autopilot Engagement** — The autopilot may be engaged by pressing the **AP** Key on the mode controller or **AP** Button on the AXIS™ Flight Display Autopilot Interface. Annunciations regarding engagement are indicated on the PFW(s). Engaging the autopilot also engages the yaw damper.

- **Autopilot Engagement with Flight Director Off** — Upon engagement, the autopilot will be set to hold the current airplane attitude if the flight director was not previously activated. In this case, 'ROL' and 'PIT' will be annunciated.
- **Autopilot Engagement with Flight Director On** — If the flight director has already been activated, the autopilot will smoothly pitch and roll the airplane to capture the flight director guidance. The prior flight director modes remain unchanged.

- **Autopilot Disengagement** — The most common way to disengage the autopilot is to press and release the **AP DISC** Button on the control stick / yoke. Autopilot disengagement is indicated visually by PFD annunciation and aurally by an autopilot disconnect tone (pressing the **AP DISC** Button again or touching the AFCS Status Window on the PFW will acknowledge/silence the tone/alert). Other ways to disengage the autopilot include:
  - Pressing the **AP** Key on the AFCS Mode Controller or the **AP** Button on the AFCS window.
  - Pulling the Autopilot or AFCS Servos circuit breakers.

In the event of unexpected autopilot behavior, pressing and holding the **AP DISC** Button on the pilot's control stick / yoke will disengage the autopilot and remove all power to the servos.

7.3 FLIGHT DIRECTOR OPERATION

The flight director function provides pitch and roll commands to the pilot and autopilot, which are displayed on the PFW. With the flight director active, the aircraft can be hand-flown to follow the path shown by the Command Bars. The Flight Director has the following maximum commands: pitch (-15°, +20°) and roll (30°) angles.

ACTIVATING THE FLIGHT DIRECTOR

An initial press of a key listed in the table below (when the flight director is not active) activates the flight director in the listed modes. The flight director may be turned off and the Command Bars removed from the display by pressing the **FD** Key again. The **FD** Key is disabled when the autopilot is engaged.

Control Pressed	Lateral Modes Activated		Vertical Modes Activated	
FD Key	Roll Hold (default)	ROL	Pitch Hold (default)	PIT
AP Key	Roll Hold (default)	ROL	Pitch Hold (default)	PIT
TO/GA Button	Takeoff (on ground) Go Around (in air)	TO GA	Takeoff (on ground) Go Around (in air)	TO GA
ALT Key	Roll Hold (default)	ROL	Altitude Hold	ALT
VS Key	Roll Hold (default)	ROL	Vertical Speed	VS
VNAV Key	Roll Hold (default)	ROL	Vertical Navigation[1]	VNAV
IAS Key	Roll Hold (default)	ROL	Indicated Airspeed	IAS

Control Pressed	Lateral Modes Activated		Vertical Modes Activated	
APR Key	Approach[2]	GPS VOR LOC	Pitch Hold (default)	PIT
NAV Key	Navigation[2]	GPS VOR LOC BC	Pitch Hold (default)	PIT
HDG Key	Heading Select	HDG	Pitch Hold (default)	PIT
TRK Key	Track Select	TRK	Pitch Hold (default)	PIT
LVL Key	Level Hold	LVL	Level Hold	LVL
[1] Valid VNAV flight plan must be entered before VNAV Key press activates flight director.				
[2] The selected navigation receiver must have a valid VOR or LOC signal or active GPS course before NAV or APR Key press activates flight director.				

Table 53: Flight Director Activation (GMC 507)

AFCS STATUS BOX

The AFCS status box displays Autopilot (AP), Optional Yaw Damper (YD), Flight Director (FD) mode annunciations on the PFD, and Autopilot Preflight Test (PFT).

Autopilot (AP) status is displayed on the far left of the AXIS™ flight display Autopilot Status Box. Lateral modes are displayed in the center, and vertical modes are displayed on the right. Armed modes are displayed in white and active in green.

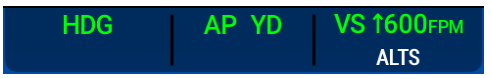


Figure 280: Autopilot Status Box

FLIGHT DIRECTOR MODES

Flight director modes are normally selected independently for the pitch and roll axes. In the absence of specific mode selections, the flight director activates into the default pitch and/or roll mode(s). Unless otherwise specified, all FD mode selection keys on the AFCS Controller are alternate action (i.e., press on, press off). These mode keys are also accompanied by annunciator lights which illuminate when their respective modes are active on the AXIS™ Flight Display Autopilot Interface.

Armed modes are annunciated in white and active in green in the AFCS Status Box. Automatic mode transition from armed to active is indicated by the armed mode annunciation moving to the active mode field and displaying in inverse green and black for ten seconds (as demonstrated in the following figure).

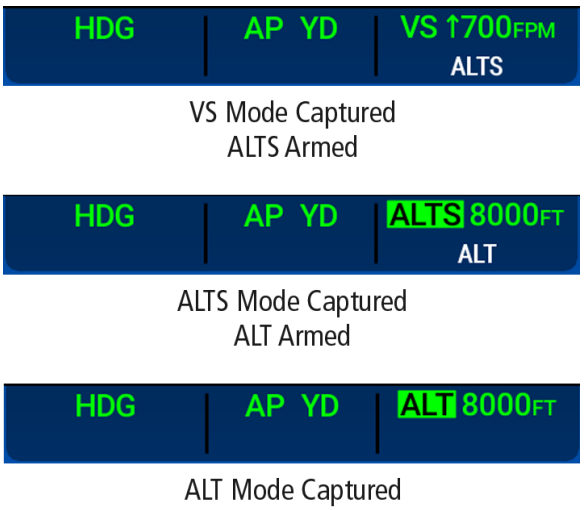


Figure 281: Armed Modes and Active Modes in the AFCS Status Box

If the information required to compute a FD mode becomes invalid or unavailable, the FD automatically reverts to the default mode for that axis. A flashing amber mode annunciation indicate loss of sensor (ADC) or navigation data (e.g., VOR, LOC, or GPS) required to compute commands. When such a loss occurs, the system automatically reverts to Roll Hold and/or either Pitch Hold or Flight Path Angle Mode, depending on the affected axis(es) (refer to the corresponding FD mode sections for explanation of FD behavior in each mode). The flashing annunciation stops when the affected mode key is pressed or another mode for the axis is selected. If after 10 seconds no action has been taken, the flashing annunciation stops.

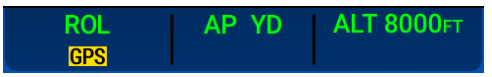


Figure 282: Loss of GPS Signal Annunciation

FLIGHT DIRECTOR FORMAT SELECTION

When activated, the flight director can be displayed in two different modes/formats: single-cue command bars and dual-cue command bars. The aircraft symbol (in white) will change to accommodate the FD format.

SINGLE CUE

Upon activation of the flight director, Command Bars are displayed in magenta on the PFD. If the aircraft is being flown by hand, the command bars are displayed hollow. The Command Bars do not override the Aircraft Symbol. The Command Bars move together vertically to indicate pitch commands and bank left or right to indicate roll commands.

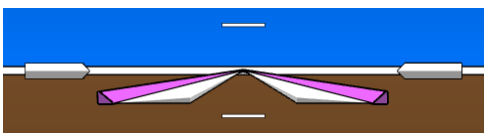


Figure 283: Command Bars (Single Cue)

DUAL CUE

Command bars displayed as a dual cue move independently to indicate pitch (horizontal bar) and roll (vertical bar) commands. When the pilot (or autopilot) maneuvers the aircraft so the aircraft symbol wings align with the horizontal pitch bar and the aircraft symbol center dot is aligned with the vertical roll bar then the aircraft has achieved the appropriate attitude to follow the programmed guidance.

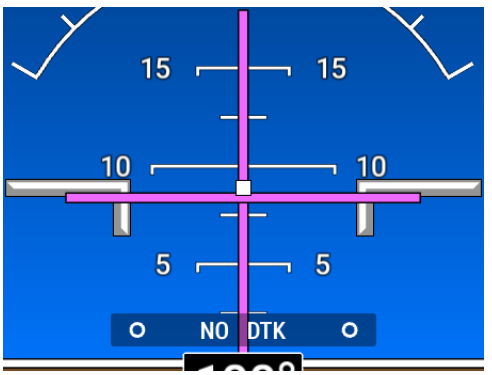


Figure 284: Command Bars (Dual Cue)

FLIGHT PATH MARKER (FPM)

The Flight Path Marker (FPM) is a symbolic representation of the aircraft trajectory. It reflects the flight path of the aircraft with respect to an earth-fixed 3D coordinate system. In addition to pitch, roll, and yaw the FPM accounts for wind, vertical and lateral G loading, airspeed changes, PCL changes, etc. While the FD is activated, the FPM will be displayed (refer to *Flight Instruments* for other conditions that will activate the FPM).

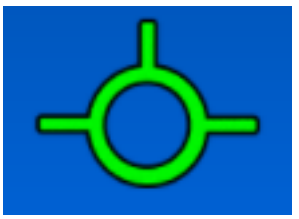


Figure 285: Example FPM

CHANGING THE SELECTED FLIGHT DIRECTOR STYLE:

1 Access the 'PFW Menu' window by:
   a) Touch the HSI on the PFW.
   Or:
   a) Press the **MENU** Softkey on the PFD (if in split screen mode press the **MENU** Softkey on the PFW side of the bezel).
2 Touch the **PFW Settings** Button.
3 Scroll if necessary, and touch the **Flight Director Style** Selection Button.
4 Select the desired flight director style by touching the **Single Cue** Button or **Dual Cue** Button.

7.4 AFCS MODES

The AFCS is capable of operating in a variety of independent FD lateral modes and vertical modes, and in combination modes of both.

LATERAL MODES

The following table lists the lateral modes and respective control(s) and annunciation. Refer to the *Takeoff and Go Around Modes* section in this chapter for information regarding takeoff and go around modes.

Lateral Mode	Description	Control	Annunciation
Roll Hold	Holds the current aircraft roll attitude or rolls the wings level, depending on the commanded bank angle.	(default)	ROL
Heading Select	Captures and tracks the Selected Heading	**HDG** Key	HDG
Track	Captures and tracks the Selected Ground Track	**TRK** Key	TRK
Navigation, GPS	Captures and tracks the selected navigation source (GPS, VOR, LOC)	**NAV** Key	GPS
Navigation, VOR Enroute Capture/Track			VOR
Navigation, LOC Capture/Track (no glide-slope)			LOC
Navigation, Backcourse Capture/Track	Captures and tracks a localizer signal for back-course approaches		BC
Approach, GPS	Captures and tracks the selected navigation source (GPS and LOC)	**APR** Key	GPS
Approach, LOC Capture/Track (Glideslope Mode automatically armed)			LOC
Takeoff	Commands a constant pitch angle and wings level on ground in preparation for takeoff	**TO/GA** Button	TO
Go Around	Commands a constant pitch angle and wings level in the air		GA

Table 54: Flight Director Lateral Modes

ROLL HOLD MODE (ROL)

NOTE

If Roll Hold Mode is activated as a result of a mode reversion, the flight director rolls the wings level.

When the flight director is activated or switched, Roll Hold Mode is selected by default. This mode is annunciated as 'ROL' in the Autopilot Status Box. The current aircraft bank angle is held, subject to the bank angle condition.

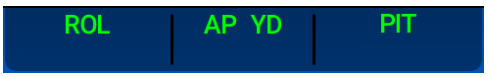


Figure 286: Roll Mode Annunciation

Bank Angle	Flight Director Response
< 6°	Rolls wings level
6 to 30°	Maintains current aircraft roll attitude
> 30°	Limits bank angle to 30°

Table 55: Roll Hold Mode Responses

CHANGING THE ROLL REFERENCE

When operating in Roll Hold Mode, the roll reference can be adjusted by holding the CWS Button on the pilot's control stick / yoke, adjusting the bank angle, then releasing the CWS Button to complete the adjustment.

HEADING SELECT MODE (HDG)

Heading Select Mode acquires and maintains the Selected Heading. The Selected Heading is displayed as a cyan bug on the HSI and shown in a box to the upper left of the HSI in cyan.

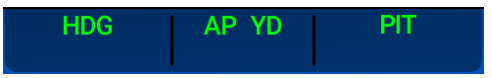


Figure 287: Heading Mode Annunciation

When HDG Mode is active and the **HDG/TRK** Knob is turned, the FD commands turns 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, changes of more than 330° at a time result in a turn reversal.

If HDG Mode is active and the aircraft is banking/turning to a Selected Heading when the Selected Heading is synced to the current heading, the Selected Heading and bug sync to the current heading but the aircraft continues to adjust/move as it rolls past the synced heading. In other words, the resulting Selected Heading will roll past the heading when the sync was initiated, overshooting the desired heading. The AFCS will roll back in the opposite direction to capture the desired heading.

HEADING SYNC MODE

Heading Sync Mode is activated when the AP/FD is laterally coupled to a Navigation or Approach Mode and the pilot pushes the **HDG/TRK** Knob. When activated, 'SYNC' will be displayed in the **HDG** Indicator Button on the PFW.

In Heading Sync Mode the Selected Heading Bug will remain continuously synchronized to aircraft heading as it changes due to winds or course changes, eliminating the need to sync the

bug any time a turn is completed. Should the flight director lateral mode uncouple due to a fault or user change, the bug will already be set to continue along the current heading, if desired (i.e., by pressing the **HDG** Key to select HDG Mode).

If Heading Sync Mode is active and the NAV source changes, the system will remain in Heading Sync Mode. Heading Sync Mode is canceled if any of the following occur:

- A Navigation or Approach Mode is no longer the active lateral mode.
- A different heading is selected by turning the **HDG/TRK** Knob.
- The **HDG/TRK** Knob is pushed again.

ENABLING HEADING SELECT MODE:

1 Touch the AFCS Status Box located above the attitude indicator.

Or:

a) Navigate to the 'Apps' Window by pressing the **MENU** Softkey two times.

Or:

Touch the **Applications** Icon on the MFW App Bar.

b) Touch the **Quick Actions** Tab.

c) Touch the **Autopilot** Button.

2 Touch the **HDG** Button.

Or:

Press the **HDG** Key on the AFCS Mode Controller.

CHANGING THE SELECTED HEADING:

The Selected Heading can be changed through the **HDG/TRK** Knob or the PFW:

a) Turning the **HDG/TRK** Knob will change the Selected Heading in one degree increments.

b) Pushing the **HDG/TRK** Knob will sync the Selected Heading to the current heading.

Or:

c) Touching the **HDG** Indicator Button on the PFW will display the 'Selected Heading' Window.

d) Touching the keypad numbers and then touching the **Enter** Button will set the Selected Heading.

e) Touching the **Set To Current** Button will sync the selected heading to the current heading.

TRACK SELECT MODE (TRK)

Track Select Mode acquires and maintains a pilot-selected track along the ground, correcting for winds. This Selected Track is displayed as a magenta bug on the HSI and shown in a box to the upper left of the HSI in magenta.

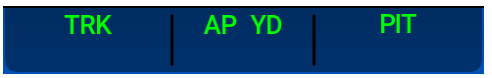


Figure 288: Track Mode Annunciation

When TRK Mode is active and the **HDG/TRK** Knob is turned, the FD commands turns in the same direction as Selected Track Bug movement, even if the bug is turned more than 180°

from the present track (e.g., a 270° turn to the right). However, changes of more than 330° at a time result in a turn reversal.

If TRK Mode is active and the aircraft is banking/turning to a Selected Track when the Selected Track is synced to the current Track, the Selected Track and bug sync to the current track but the aircraft continues to adjust/move as it rolls past the synced track. In other words, the resulting Selected Track will roll past the track when the sync was initiated, overshooting the desired track. The AFCS will roll back in the opposite direction to capture the desired track.

TRACK SYNC MODE

Track Sync Mode is activated when the AP/FD is laterally coupled to a Navigation or Approach Mode and the pilot pushes the **HDG/TRK** Knob. When activated, 'SYNC' will be displayed in the **TRK** Indicator Button on the PFW.

In Track Sync Mode the Selected Track Bug will remain continuously synchronized to aircraft track as it changes due to winds or course changes, eliminating the need to sync the bug any time a turn is completed. Should the flight director lateral mode uncouple due to a fault or user change, the bug will already be set to continue along the current track, if desired (i.e., by pressing the **TRK** Key to select TRK Mode).

If Track Sync Mode is active and the NAV source changes, the system will remain in Track Sync Mode. Track Sync Mode is canceled if any of the following occur:

- A Navigation or Approach Mode is no longer the active lateral mode.
- A different heading is selected by turning the **HDG/TRK** Knob.
- The **HDG/TRK** Knob is pushed again.

ENABLING TRACK SELECT MODE:

1 Touch the AFCS Status Box located above the attitude indicator.

Or:

a) Navigate to the 'Apps' Window by pressing the **MENU** Softkey two times.

Or:

Touch the **Applications** Icon on the MFW App Bar.

b) Touch the **Quick Actions** Tab.

c) Touch the **Autopilot** Button.

2 Touch the **TRK** Button.

Or:

Press the **TRK** Key on the AFCS Mode Controller.

CHANGING THE SELECTED TRACK USING THE PFW:

1 Touching the **TRK** Indicator Button on the PFW will display the 'Selected Track' Window.

2 Use the keypad to enter the desired track (001-360). touch the Touching the keypad numbers and then touching the will set the Selected Track.

3 Touch the **Enter** Button to establish the desired track.

Or:

Touching the **Set To Current** Button will sync the selected track to the current track.

CHANGING THE SELECTED TRACK USING THE HDG/TRK KNOB:

Turning the **HDG/TRK** Knob will change the Selected Track in one degree increments.

Or:

Pushing the **HDG/TRK** Knob will sync the Selected Track to the current track.

NAVIGATION MODES (GPS, VOR, LOC, BC)

NOTE

When making a VOR or LOC approach, a valid GPS position is required.

NOTE

The selected navigation receiver must have a valid VOR or LOC signal or active GPS course for the flight director to enter Navigation Mode.

NOTE

When intercepting a flight plan leg, the flight director gives commands to capture the active leg at approximately a 45° angle to the track between the waypoints defining the active leg. The flight director does not give commands fly to the starting waypoint of the active leg.

NOTE

When making a backcourse approach, set the Selected Course to the localizer front course.

Pressing the **NAV** Key selects Navigation Mode. Navigation Mode acquires and tracks the selected navigation source (GPS, VOR, or LOC). The flight director follows FMS roll steering commands when GPS is the selected navigation source. When the navigation source is VOR or LOC, the flight director creates roll steering commands from the Selected Course and deviation. Navigation Mode can also be used (instead of using Approach Mode) to fly non-precision RNAV (GPS) and Localizer approaches where glidepath/glideslope capture is either not required or desired. Navigation Mode can also be used to fly LOC Backcourse approaches (as described later in this section).

Pressing the **NAV** Key arms or activates the Navigation Mode corresponding to the CDI navigation source selected. An armed Navigation Mode annunciation appears in white below the active lateral FD mode.

Figure 289: FMS Navigation Mode Armed

Navigation Mode will engage/activate when avionics activation criteria are met. Navigation Mode activation is dependent on factors such as airspeed, intercept angle, and closure rate. If activation criteria are met upon **NAV** Key press, then navigation mode will activate immediately.

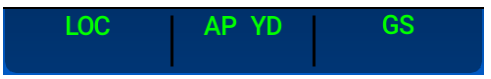


Figure 290: FMS Navigation Mode Active

When the selected navigation source is LOC and the **NAV** Key is pressed, either Localizer Navigation or Backcourse Navigation Mode (annunciated as 'BC') may be selected. Which mode is selected, though, depends on aircraft heading. While heading is within 105° of a tuned localizer front course, LOC Mode will be armed (and subsequently activated upon localizer intercept). Conversely, while aircraft heading exceeds 105° of the localizer front course (i.e., heading is within 75° of the localizer back course), BC Mode will be armed (and subsequently activated upon localizer backcourse intercept).

Figure 291: Back Course Mode Armed

Armed LOC Mode may switch to armed BC Mode (and vice versa) as the aircraft maneuvers toward the final approach course (e.g., while being vectored to final by ATC). Once either mode becomes activated (i.e., the LOC front- or backcourse is captured), the FD lateral mode will no longer switch based on aircraft heading.

If a Navigation Mode is active and any of the following occur, the FD lateral mode reverts to ROL Mode (wings rolled level):

- A different VOR or LOC is tuned while in VOR or LOC Navigation Mode (VOR/LOC Mode reverts to armed).
- The navigation source is manually switched.
- During a LOC/ILS approach, the FAF is crossed after the automatic navigation source switch from FMS to LOC but while FMS Navigation Mode is still active.

CHANGING THE SELECTED COURSE WHILE IN A NAVIGATION MODE:

When the navigation source is VOR or localizer, or OBS Mode has been enabled when using FMS, the Selected Course can be changed by the pilot.

If the FMS knob is configured to adjust the Course, use the Inner **DCK** to adjust the course.

Or:

a) Touch the **CRS** Indicator Button on the PFW to display the 'Course' numeric keypad.
b) Touching the keypad numbers and then touching the **Enter** Button will set the Selected Course.

Or:

Touching the **Direct** Button will sync the Selected Course to the course that runs directly from the aircraft to the NAVAID or OBS Mode fix.

Or:

With the 'Course' numeric keypad open, use the Inner **DCK** or Outer **DCK** to adjust the course clockwise and counter-clockwise.

VERTICAL MODES

The following table lists the independent vertical FD modes with their corresponding controls and annunciations.

Vertical Mode	Description	Control	Annunciation		Reference Change Increment
Pitch Hold	Holds the current aircraft pitch attitude; may be used to climb/descend to the Selected Altitude	(default)	PIT		0.5°
Selected Altitude Capture	Captures the Selected Altitude	[1]	ALTS		10 ft
Altitude Hold	Holds the current Altitude	**ALT** Key or Button	ALT	nnnnn FT	
Vertical Speed	Maintains the current aircraft vertical speed; may be used to climb/descend to the Selected Altitude	**VS** Key or Button	VS	nnnn FPM	100 fpm
Indicated Airspeed	Maintains the current aircraft vertical speed; may be used to climb/descend to the Selected Altitude	**IAS** Key or Button	IAS	nnn KT	1 kt
[1] ALTS armed automatically when PIT, VS, IAS, or GA active, and under VNAV when Selected Altitude is to be captured instead of VNV Target Altitude					

Table 56: Flight Director Vertical Modes

PITCH HOLD MODE

While the FD format is set to either single or dual cue, upon FD activation (e.g., the FD Key is pressed; refer to *Activating the Flight Director* in this chapter for more information), Pitch Hold Mode is selected by default. This mode is annunciated as 'PIT' in the AFCS Status Box.

In PIT Mode, the flight director maintains a constant pitch attitude, called the Pitch Reference. The Pitch Reference is set to the aircraft pitch attitude at the moment of mode selection. If the aircraft pitch attitude exceeds the flight director pitch command limitations, the flight director commands a pitch angle equal to the nose-up/down limit.

Figure 292: Pitch Hold Mode Active, Selected Altitude Capture Mode Armed

PIT Mode may be used to climb or descend to the Selected Altitude (shown above the Altimeter). Selected Altitude Capture Mode (ALTS) is automatically armed when PIT Mode is activated, provided the pilot has set a Selected Altitude.

When PIT Mode is used in conjunction with Vertical Navigation, VNAV Target Altitude Capture Mode (ALTV) is also enabled (refer to *Vertical Navigation Modes* later in the Combination Modes section for more information).

CHANGING THE PITCH REFERENCE

When operating in PIT Mode, the Pitch Reference can be adjusted by:

- Using the **UP/DN** Wheel on the AFCS Mode Controller.
- Touching the **Nose Up** Button or **Nose Down** Button in the AFCS Control Window.

SELECTED ALTITUDE CAPTURE MODE (ALTS)

Selected Altitude Capture Mode is automatically armed (provided the pilot has set a Selected Altitude) with activation of the following modes:

- Pitch Hold
- Vertical Speed
- Indicated Airspeed
- Takeoff / Go Around (if 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. Touch the AFCS Status Box on the PFW and touch the **ALT** Button or use the AFCS Mode Controller and touch the **ALT** Key. Use the Outer **DCK** associated with the PFW and adjust the Selected Altitude until the 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. This automatic transition is indicated by the green 'ALTS' annunciation flashing for up to 10 seconds and the appearance of the white 'ALTS' annunciation. The Selected Altitude is shown as the Altitude Reference beside the 'ALTS' annunciation.

At 50 feet from the Selected Altitude, the flight director automatically transitions from Selected Altitude Capture to Altitude Hold Mode and holds the reference altitude. As Altitude Hold Mode becomes active, the white 'ALTS' annunciation moves to the active vertical mode field and flashes green for 10 seconds to indicate the automatic transition.

Changing the Selected Altitude while Selected Altitude Capture Mode is active causes the autopilot to revert to Pitch Hold Mode with Selected Altitude Capture Mode armed for the new Selected Altitude.

CHANGING THE SELECTED ALTITUDE ON THE PFW:

Use the Altitude **DCK** (if configured) to increase or decrease the selected altitude.

Or:

a) Touch the **Selected Altitude** Indicator Button.
b) On the keypad enter the desired altitude and touch the **Enter** Button.

Or:

Use the **DCK** associated with the 'Selected Altitude' numeric keypad to increase or decrease the selected altitude.

CHANGING THE SELECTED ALTITUDE ON THE AFCS MODE CONTROLLER:

Turn the **ALT SEL** Knob to change the desired altitude.

ALTITUDE HOLD MODE (ALT)

Altitude Hold Mode can be activated by touching the AFCS Status Box and touching the **ALT** Button or on the AFCS Mode Controller press the **ALT** Key; the AFCS maintains the current aircraft altitude (to the nearest 10 feet) as the Altitude Reference. The Altitude Reference, shown in the AFCS Status Box, is independent of the Selected Altitude, displayed above the Altimeter. Altitude Hold Mode active is indicated by a green 'ALT' annunciation in the AFCS Status Box.

Altitude Hold Mode is automatically armed when in Selected Altitude Capture Mode. Selected Altitude Capture Mode automatically transitions to Altitude Hold Mode when within 50 feet of the Selected Altitude. In this case, the Selected Altitude becomes the Altitude Reference.

CHANGING THE ALTITUDE REFERENCE

When operating in Altitude Hold Mode, the Altitude Reference can be adjusted in the following ways:

- The altitude reference can be adjusted in 10 feet increments using the **Higher Alt** Button or **Lower Alt** Button in the AFCS window.
- Use the **UP/DN** Wheel on the AFCS Mode Controller. Using this method, up to 200 feet of altitude change can be commanded.

To change the Altitude Reference by more the 200 feet, climb/descend using another vertical mode (PIT, VS) to capture the desired Selected Altitude.

VERTICAL SPEED MODE

In Vertical Speed Mode, the flight director acquires and maintains a Vertical Speed Reference. Current aircraft vertical speed (to the nearest 100 fpm) becomes the Vertical Speed Reference at the moment of Vertical Speed Mode activation. This mode may be used for climb or descent to the Selected Altitude (shown above the Altimeter) since Selected Altitude Capture Mode is automatically armed when Vertical Speed Mode is selected.

When Vertical Speed Mode is activated by pressing the **VS** Key on the AFCS Mode Controller or accessing the AFCS Control window on the PFW and touching the **VS** Button, 'VS' is annunciated in green in the AFCS Status Box along with the Vertical Speed Reference. A Vertical Speed Reference Bug corresponding to the Vertical Speed Reference is shown on the indicator.

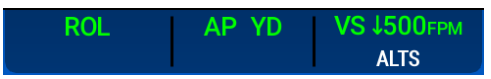


Figure 293: Vertical Speed Mode Capture

CHANGING THE VERTICAL SPEED MODE

The Vertical Speed Reference may be adjusted in the following ways:

- Touch the AFCS status box to open the AFCS Control window, touch the **VS** Button and then the **Nose Up** Button/**Nose Down** Button to adjust the vertical speed.
- Use the **UP/DN** Wheel on the AFCS Mode Controller.

The vertical speed reference can only be adjusted in increments of 100 fpm. The current Vertical Speed Reference is displayed in the AFCS Status Box for 10 seconds after a change is made and as a reference bug on the Vertical Speed Indicator.

INDICATED AIRSPEED MODE (IAS)

NOTE

If IAS Mode is selected while aircraft is stopped on ground, airspeed is set to V_y.

Indicated Airspeed Mode acquires and maintains the Airspeed Reference (IAS) while climbing or descending. When Indicated Airspeed 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. Indicated Airspeed Mode is indicated by a green 'IAS' annunciation beside the Airspeed Reference in the Autopilot Status Box. The Airspeed Reference is also displayed as a cyan bug corresponding to the Airspeed Reference along the airspeed 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.

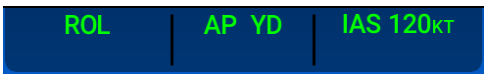


Figure 294: Indicated Airspeed Mode Capture

CHANGING THE AIRSPEED REFERENCE

The Airspeed Reference may be adjusted in the following ways:

- Use the **UP/DN** Wheel on the AFCS Mode Controller.
- Touch the **Nose Up** Button/**Nose Down** Button in the AFCS Control Window.

COMBINATION MODES

The following table lists the modes that operate through combined lateral and vertical FD modes, with their corresponding controls and annunciations.

Mode	Description	Control	Annunciation
Vertical Navigation	Captures and tracks descent legs of an active vertical profile	**VNAV** Key on GMC 507 or **VNAV** Button on PFW.	VNAV
VNAV Target Altitude Capture	Captures the Vertical Navigation (VNAV) Target Altitude	1	ALTV

Mode	Description	Control	Annunciation
VOR	Captures and tracks a VOR navigation source	**APR** Key on GMC 507 or **APR** Button on PFW.	VAPP
Glidepath	Captures and tracks the glidepath on approach		GP
ILS/LOC	Captures and tracks a localizer navigation source		LOC
Glideslope	Captures and tracks the ILS glideslope on approach		GS
Takeoff	Commands a constant pitch angle and wings level on ground in preparation for takeoff	**TO/GA** Button	TO
Go Around	Commands a constant pitch angle and wings level in the air		GA
[1] ALTV armed automatically under VNAV when VNAV Target Altitude is to be captured instead of Selected Altitude.			

Table 57: Flight Director Combination Modes

LEVEL MODE

Level Mode is coupled in pitch and roll modes and is annunciated as both the vertical and lateral modes when active. Pressing the **LVL** Key engages the autopilot in Level vertical and lateral modes. Level Mode does not track altitude or heading. When the **LVL** Key is pressed all armed and active modes are canceled and the autopilot and flight director revert to LVL mode for pitch and roll. While in level mode, all other modes are available by pressing the corresponding button.

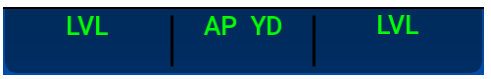


Figure 295: Level Mode Capture

VERTICAL NAVIGATION MODES (VNAV)

NOTE

If another vertical mode is touched while VNAV Mode is selected, VNAV Mode reverts to armed.

NOTE

VNAV mode will not capture a descending profile unless the selected altitude is valid and at least 75 feet below the current aircraft altitude

Vertical Navigation (VNAV) Mode is available for enroute/terminal cruise and descent operations any time that VNAV flight planning is available.

Activating Vertical Navigation Mode:

- When a flight plan is active, VNAV data is valid, and the **VNAV** Key is selected on the GMC 507 or **VNAV** Button on the AFCS Control Window, VNAV mode is armed in preparation for descent path capture. 'VNAV' is annunciated in white in the AFCS Status Box. If applicable, the appropriate altitude capture mode is armed for capture of the VNAV Target Altitude (ALTV) or the Selected Altitude (ALTS), whichever is greater.
- When a descent leg is captured (i.e., vertical deviation becomes valid), VNAV Mode is activated and tracks the descent profile. An altitude capture mode (ALTS or ALTV) is armed as appropriate.
- When approaching the VNAV Target Altitude (or Selected Altitude) the system automatically transitions to ALTS or ALTV Mode with ALT Mode armed.

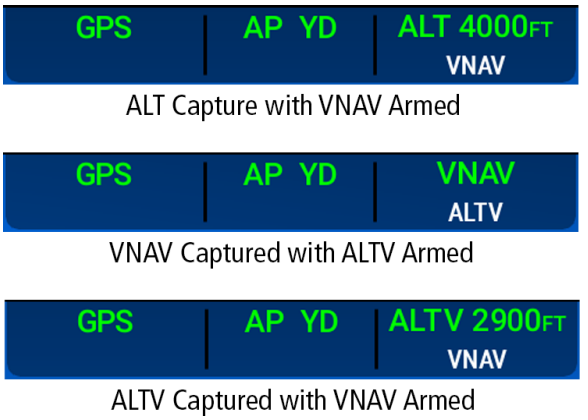


Figure 296: Vertical Navigation Modes in the AFCS Status Box

If the altimeter's barometric setting is adjusted while VNAV mode is active, the autopilot increases/decreases the descent rate by up to 500 fpm to re-establish the aircraft on the descent path (without commanding a climb). For large changes, it may take several minutes for the aircraft to reestablish on the descent path. If the change is made while nearing the VNAV waypoint, the aircraft may not reestablish on the descent path in time to level off at the VNAV Target Altitude. In this case, the autopilot will revert to Pitch Hold mode upon passing the VNAV waypoint, and Selected Altitude Capture (ALTV) mode will be automatically armed.

SYSTEM MESSAGES

The following VNAV system messages that may be displayed in the messages window at the bottom of the display.

VNAV System Message	Comments
UNABLE VNAV Excessive cross-track error.	The current cross-track exceeds the limit, causing VNAV to be temporarily unavailable.
UNABLE VNAV Excessive track angle error.	The current track angle error exceeds the limit, causing VNAV to be temporarily unavailable.
UNABLE VNAV Parallel course selected.	VNAV is not available while a parallel course is active.

VNAV System Message	Comments
UNABLE VNAV Reverted to PIT.	This message is displayed when PATH has reverted to Pitch Hold Mode. This would happen because of an overspeed condition, a vertical discontinuity, or invalid vertical deviation.
ARM VNAV DESCENT Reset altitude preselect to arm descent.	The flight plan calls for a descent, but the Selected Altitude needs to be reset. No change in altitude can be made unless allowed by the Selected Altitude.
ARM VNAV CLIMB Reset altitude preselect to arm climb.	The flight plan calls for a climb, but the Selected Altitude needs to be reset. No change in altitude can be made unless allowed by the Selected Altitude.
DISABLE GS TO ARM CLIMB Press NAV button to enable VNAV track change.	While the GS (glideslope) vertical mode is armed, the flight director will not arm a climb mode. GS must be removed before VNAV can arm a climb mode.
DISABLE GP TO ARM CLIMB Press NAV button to enable VNAV track change.	While the GP (glidepath) vertical mode is armed, the flight director will not arm a climb mode. GP must be removed before VNAV can arm a climb mode.
UNABLE VNAV ALTITUDE Cannot meet VNAV altitude constraint.	Based on the current rate of climb or descent, the next flight plan altitude constraint will be exceeded (VNAV Mode remains active).

Table 58: VNAV System Messages

AUTOMATIC REVERSION TO PITCH HOLD MODE

Several situations can occur while VNAV Mode is active which cause the AFCS to revert to Pitch Hold Mode:

- Vertical deviation exceeds 200 feet during an overspeed condition.
- Vertical deviation becomes invalid (the Deviation Indicator is removed from the PFD).

Following a reversion to Pitch Hold Mode, VNAV Mode and the appropriate altitude capture mode become armed to allow for possible profile recapture.

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 **VNAV** Key is pressed on the AFCS Mode Controller or the **VNAV** Button it touched in the AFCS Control window on the PFW, if the VNAV Target Altitude is

to be intercepted before the Selected Altitude. The annunciation 'ALTV' indicates the VNAV Target Altitude is to be captured.

As the aircraft nears the VNAV Target Altitude, AFCS 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.

At 50 feet from the VNAV Target Altitude, the AFCS automatically transitions from VNAV Target Altitude Capture to Altitude Hold Mode and selects the VNAV target altitude as the new Autopilot Altitude Reference. As Altitude Hold Mode becomes active, the white 'ALT' annunciation moves to the active vertical mode field and flashes green for 10 seconds to indicate the automatic transition.

A VNAV Target Altitude can be specified in several different ways, which result in different system behavior depending on whether the airplane is climbing or descending (as shown in the following table).

VNAV Target Altitude Type	VNAV Target Altitude Indication	Climb Behavior	Descent Behavior
At	5000	Arms ALTV	Arms ALTV
At-or-Below	4500	Arms ALTV	Does not arm ALTV[1, 2]
At-or-Above	5000	Does not arm ALTV[1]	Arms ALTV
Between	6000 4000	Arms ALTV using the upper altitude	Arms ALTV using the lower altitude
[1] Even if ALTV Mode is not armed, the 'UNABLE VNAV ALTITUDE' system message will be shown if the airplane's vertical speed is not sufficient to meet the targeted altitude before crossing the waypoint.			
[2] Normally, AT-or-BELOW altitudes are not used to define a BOD. However, if an AT-or-BELOW altitude is used in this way, it will be treated as an AT altitude (arming ALTV Mode). Intermediate AT-or-BELOW altitudes in the descent do not arm ALTV.			

Table 59: VNAV Target Altitude Behavior

CHANGING THE VNAV TARGET ALTITUDE

VNAV target altitudes can be changed while editing the active flight plan (see the *Altitude Constraints* portion of the Flight Management Section for details). However, changing the current VNAV Target Altitude while ALTV Mode is active causes the flight director to revert to PIT Mode. The appropriate altitude capture mode will be armed in preparation to capture the new VNAV Target Altitude or the Selected Altitude, depending on which altitude is to be intercepted first.

APPROACH MODES

⚠ WARNING

Do not rely on the autopilot to level the aircraft at the MDA/DH when flying a coupled approach with GP or GS Mode active. The autopilot will not level the aircraft at the MDA/DH even if the MDA/DH is set in the altitude preselect.

NOTE

The selected navigation receiver must have a valid LOC signal or active GPS course for the flight director to enter Approach Mode.

Pressing the **APR** Key (GMC) or **APR** Button (PFW) arms the selected Approach Mode. An armed Approach Mode annunciation appears in white in the AFCS Status Box. Approach Mode will engage/activate when avionics activation criteria are met, dependent on factors such as airspeed, intercept angle, and closure rate. If activation criteria are met upon **APR** Key (GMC) or **APR** Button (PFW) press, then Approach Mode will activate immediately.

If any of the following occur, the flight director will revert to Roll Hold Mode (wings rolled level):

- Approach Mode is active and a Vectors-To-Final is activated.
- Approach Mode is active and the navigation source is manually switched.
- A different VOR/LOC is tuned while in LOC Approach Mode (VOR/LOC Mode reverts to armed).
- During a LOC/ILS approach, the FAF is crossed after the automatic navigation source switch from GPS to LOC but while GPS navigation is still active.

INTERCEPTING AND FLYING A DME ARC

The AFCS will intercept and track a DME arc that is part of the active flight plan provided that GPS Navigation Mode is engaged, GPS is the active navigation source on the CDI, and the DME arc segment is the active flight plan leg. It is important to note that automatic navigation of DME arcs is based on GPS. Thus, even if the **APR** Key is pressed and LOC Approach Mode is armed before reaching the Initial Approach Fix (IAF), Approach Mode will not activate until the arc segment is completed.

If the pilot decides to intercept the arc at a location other than the published IAF (e.g., ATC provides vectors to intercept the arc) and subsequently selects HDG Mode or ROL Mode, the AFCS will not automatically intercept or track the arc unless the pilot activates the arc leg of the flight plan and arms GPS Navigation Mode. The AFCS will not intercept and fly a DME arc before reaching an IAF that defines the beginning of the arc segment. Likewise, if at any point while established on the DME arc the pilot deselects GPS Navigation Mode, the AFCS will no longer track the arc.

LOCALIZER APPROACH MODE

Localizer Approach Mode can be utilized to fly a LOC Approach (i.e., without a glideslope) or an ILS Approach (i.e., with a glideslope). When LOC Approach Mode is armed, Glideslope Mode will also annunciate as armed, regardless of whether or not a glideslope is available.

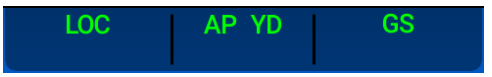


Figure 297: LOC Approach Mode Armed (Glideslope Mode Arms Automatically)

Once LOC becomes the active navigation source the localizer can be captured, provided the following conditions are met:

- Aircraft heading is within 105° of the localizer course.
- The aircraft is within 15 NM of the Final Approach Fix (FAF) but not past it, and tracking inbound.
- The active waypoint is the FAF.
- Localizer deviation is valid.

For LOC-only approaches (i.e., no glideslope provided/available), another vertical mode may be selected (e.g., VS or ALTV) for the autopilot to fly a stabilized approach. For ILS Approaches, if the pilot wants to fly the non-precision LOC Approach without capturing the glideslope, pressing the **NAV** Key instead of the **APR** Key will prevent glideslope capture. Again, another vertical mode may be selected to fly a stabilized approach.

SELECTING LOCALIZER APPROACH MODE:

1. Ensure a valid localizer frequency is tuned.
2. Ensure that LOC is the selected navigation source.
   a) Touch the HSI on the PFW to open the 'PFW Menu'

      Or:

      Press the **MENU** Softkey (on the PFW side of the bezel while in split screen mode).

   b) Touch the **CDI** Selection Button **> LOC**.
3. Press the **APR** Key on the AFCS Mode Controller or touch the **APR** Button in the AFCS Control Window.

CHANGING THE SELECTED COURSE WHILE IN AN APPROACH MODE:

When the navigation source for the approach is VOR or localizer, the Selected Course can be changed by the pilot.

If the FMS knob is configured to adjust the Course, use the Inner **DCK** to adjust the course.

Or:

a) Touch the **CRS** Indicator Button on the PFW to display the 'Course' numeric keypad.
b) Touching the keypad numbers and then touching the **Enter** Button will set the Selected Course.

   Or:

   Touching the **Direct** Button will sync the Selected Course to the course that runs directly from the aircraft to the NAVAID or OBS Mode fix.

   Or:

   With the 'Course' numeric keypad open, use the Inner **DCK** or Outer **DCK** to adjust the course clockwise and counter-clockwise.

USING A LOCALIZER APPROACH USING THE FMS AS THE NAVIGATION SOURCE:

1 Ensure that FMS is the selected navigation source.
2 Ensure a localizer-based approach (i.e., LOC, ILS, LDA, SDF) is loaded into the active flight plan.
3 Ensure the corresponding LOC frequency is tuned.
4 Press the **APR** Key on the AFCS Mode Controller or touch the **APR** Button in the AFCS Control Window.

BACKCOURSE APPROACH

NOTE

When making a backcourse approach, set the Selected Course to the localizer front course.

NOTE

If the aircraft heading is within 75° of the localizer backcourse then BC Mode will be armed. If the aircraft heading is within 105° of the localizer front course, LOC Mode will be armed.

Backcourse Mode captures and tracks a localizer signal in the backcourse direction. Backcourse is indicated by 'BC' in the AFCS status box.

If GS and LOC Mode are armed, the flight director can only capture the localizer front course, indicated by 'LOC' in the AFCS status box. If only LOC Mode is armed (not GS Mode), the flight director will capture either the front course or the backcourse based on the angle at which the aircraft intercepts the localizer.

SELECTING BC MODE:

1 Ensure a valid localizer frequency is tuned.
2 Ensure that LOC is the selected navigation source.
   a) Touch the HSI on the PFW to open the 'PFW Menu'

      Or:

      Press the **MENU** Softkey (on the PFW side of the bezel while in split screen mode).
   b) Touch the **CDI** Selection Button **> LOC**.
3 Press the **NAV** Key on the AFCS Mode Controller or touch the **NAV** Button in the AFCS Control Window.

CHANGING THE SELECTED COURSE WHILE IN AN APPROACH MODE:

When the navigation source for the approach is VOR or localizer, the Selected Course can be changed by the pilot.

If the FMS knob is configured to adjust the Course, use the Inner **DCK** to adjust the course.

Or:

a) Touch the **CRS** Indicator Button on the PFW to display the 'Course' numeric keypad.
b) Touching the keypad numbers and then touching the **Enter** Button will set the Selected Course.

Or:

Touching the **Direct** Button will sync the Selected Course to the course that runs directly from the aircraft to the NAVAID or OBS Mode fix.

Or:

With the 'Course' numeric keypad open, use the Inner **DCK** or Outer **DCK** to adjust the course clockwise and counter-clockwise.

GLIDESLOPE MODE (GS)

NOTE

Glideslope Mode requires a valid GPS position.

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.

Once LOC becomes the active navigation source the localizer can be captured, provided the following conditions are met:

- A valid ILS frequency is tuned on the NAV radio.
- A glideslope signal is being received.
- The active waypoint is the FAF or a subsequent waypoint.
- 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).

For LOC-only approaches (i.e., no glideslope provided/available), another vertical mode may be selected (e.g., VS or ALTV) for the autopilot to fly a stabilized approach. For ILS Approaches, if the pilot wants to fly the non-precision LOC Approach without capturing the glideslope, pressing the **NAV** Key instead of the **APR** Key will prevent glideslope capture. Again, another vertical mode may be selected to fly a stabilized approach.

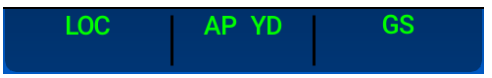


Figure 298: LOC Approach and Glideslope Modes Active

SELECTING LOCALIZER APPROACH WITH GLIDESLOPE MODE:

1. Ensure a valid localizer frequency is tuned.
2. Ensure that LOC is the selected navigation source.
   a) Touch the HSI on the PFW to open the 'PFW Menu'

      Or:

      Press the **MENU** Softkey (on the PFW side of the bezel while in split screen mode).

   b) Touch the **CDI** Selection Button **> LOC**.
3. Press the **APR** Key on the AFCS Mode Controller or touch the **APR** Button in the AFCS Control Window.

CHANGING THE SELECTED COURSE WHILE IN AN APPROACH MODE:

When the navigation source for the approach is VOR or localizer, the Selected Course can be changed by the pilot.

If the FMS knob is configured to adjust the Course, use the Inner **DCK** to adjust the course.

Or:

a) Touch the **CRS** Indicator Button on the PFW to display the 'Course' numeric keypad.

b) Touching the keypad numbers and then touching the **Enter** Button will set the Selected Course.

Or:

Touching the **Direct** Button will sync the Selected Course to the course that runs directly from the aircraft to the NAVAID or OBS Mode fix.

Or:

With the 'Course' numeric keypad open, use the Inner **DCK** or Outer **DCK** to adjust the course clockwise and counter-clockwise.

USING A LOCALIZER APPROACH WITH GLIDESLOPE MODE USING GPS AS THE NAVIGATION SOURCE:

1 Ensure an ILS approach is loaded into the active flight plan.

2 Ensure that GPS is the selected navigation source.

a) Touch the HSI on the PFW to open the 'PFW Menu'

Or:

Press the **MENU** Softkey (on the PFW side of the bezel while in split screen mode).

b) Touch the **CDI** Selection Button **> GPS**.

3 Ensure the corresponding LOC frequency is tuned.

4 Press the **APR** Key on the AFCS Mode Controller or touch the **APR** Button in the AFCS Control Window.

VNAV GUIDANCE FOR NON-PRECISION APPROACHES

Advisory vertical navigation guidance is provided for legacy non-precision, non-RNAV/GPS approaches (e.g., VOR, NDB) when a published advisory glide path angle is resident in the navigation databases. These approaches will include '+V' in the selection title, as shown in the following figure, to indicate when advisory vertical guidance is available (though this guidance it is not required to complete the approach).

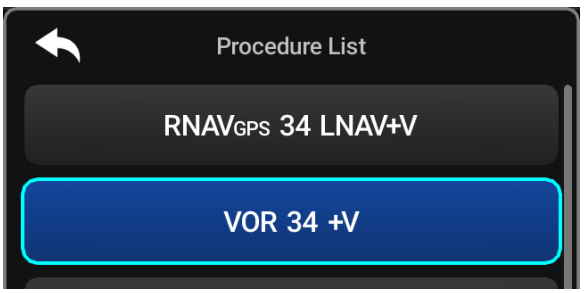


Figure 299: Legacy Non-Precision Approach with Advisory VNAV Guidance Available

If selected, these approaches will be flown in GPS Approach and Glidepath Mode, using FMS lateral and vertical guidance (unless the crew selects otherwise, e.g., by selecting VOR Approach Mode). Refer to the *Approaches* section in Flight Management for more information on approach selection.

To satisfy the requirement to monitor the NAVAID for VOR or NDB approaches, a preview is displayed on the CDI. For VOR approaches, information about the preview (NAVAID tuned, NAVAID frequency, and selected approach course) will be automatically displayed, similar to ILS approaches. The CDI will automatically display the deviation from the VOR final approach course, as shown in the following figure.

Figure 300: VOR+V Approach CDI Preview

For NDB approaches, the crew will need to manually set up the NDB bearing pointer on the HSI to monitor NDB bearing deviation.

GPS APPROACH MODE

GPS Approach Mode provides more precise tracking of lateral approach guidance than GPS Navigation Mode. GPS Approach Mode can be utilized to fly RNAV (GPS) approaches with or without vertical guidance. When GPS Approach Mode is armed, Glidepath Mode will also annunciate as armed, regardless of whether or not a glidepath is available.

Figure 301: GPS Approach Mode Armed (Glidepath Mode Arms Automatically)

For those RNAV (GPS) approaches without a glidepath, another vertical mode may be selected for the autopilot to fly a stabilized approach. If a glidepath is available but the pilot wants to fly the approach without capturing the vertical guidance, pressing the **NAV** Key or **NAV** Button instead of the **APR** Button or **APR** Key will prevent glidepath capture. Again, another vertical mode (e.g., VS or FLC) may be selected to fly a stabilized approach.

SELECTING FMS APPROACH MODE:

1 Ensure an RNAV (GPS) approach is loaded into the active flight plan. The active waypoint must be part of the flight plan (cannot be a direct-to a waypoint not in the flight plan).

2 Ensure that GPS is the selected navigation source.

a) Touch the HSI on the PFW to open the 'PFW Menu'

Or:

Press the **MENU** Softkey (on the PFW side of the bezel while in split screen mode).

b) Touch the **CDI** Selection Button **> GPS**.

3 Touch the **APR** Button in the AFCS Control Window.

Or:

Press the **APR** Key on the AFCS Mode Controller.

GLIDEPATH MODE

⚠ WARNING

Do not relay on the AFCS to level the aircraft at the MDA/DH when flying a coupled approach with GP or GS Mode active. The AFCS will not level the aircraft at the MDA/DH even if the MDA/DH is set in the altitude preselect.

NOTE

Some RNAV (GPS) approaches provide advisory vertical guidance as an aid in flying a stabilized approach. These approaches are NOT considered Approaches with Vertical Guidance (APV). Approaches that are annunciated on the HSI as 'LNAV+V' or 'LP+V' should be flown in compliance with any stepdown altitude constraints and to an MDA, until visual reference with the landing environment is established, even though vertical glidepath (GP) information may be provided.

NOTE

When flying an autopilot-coupled 'LNAV+V' or 'LP+V' approach with GP Mode active, the aircraft will not level off at the MDA even if the MDA is set in the altitude preselect. A different vertical mode (e.g., VS or FLC) must be selected prior to MDA (as altitude preselect) to arm ALTS Mode.

Glidepath Mode is used to track the glidepath when executing an RNAV (GPS) Approach. When GPS Approach Mode is armed, Glidepath Mode is also automatically armed.

Upon reaching the glidepath, the flight director transitions to Glidepath Mode and begins to capture and track the glidepath, provided the following conditions have been met:

- An RNAV approach providing vertical guidance is loaded into the active flight plan.
- The active waypoint is the final approach fix (FAF) or a subsequent waypoint.
- 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).

SELECTING GPS APPROACH WITH GLIDEPATH MODE:

1 Ensure an RNAV (GPS) approach providing vertical guidance is loaded into the active flight plan. The active waypoint must be part of the flight plan (cannot be a direct-to a waypoint not in the flight plan).

2 Ensure that GPS is the selected navigation source.

a) Touch the HSI on the PFW to open the 'PFW Menu'

Or:

Press the **MENU** Softkey (on the PFW side of the bezel while in split screen mode).

b) Touch the **CDI** Selection Button **> GPS**.

3 Touch the **APR** Button in the AFCS Control Window.

Or:

Press the **APR** Key on the AFCS Mode Controller.

TAKEOFF AND GO AROUND MODES

Takeoff and Go Around modes are coupled pitch and roll modes and are annunciated as both the vertical and lateral modes when active. In these modes, the flight director commands a constant set pitch attitude and keeps the wings level. The GA Switch is used to activate both modes. The mode entered by the flight director depends on whether the aircraft is on the ground or in the air.

TAKEOFF MODE

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** Button. The flight director Command Bars assume a wings-level, pitch-up attitude.

GO AROUND MODE

NOTE

GO Arounds do not disconnect the AP, so long as Airspeed ESP is configured and a minimum airspeed limit is entered.

Pressing the **TO/GA** Button while the aircraft is airborne activates GA Mode. In GA Mode the flight director commands a pitch-up attitude, allowing the execution of a missed approach or go around. If there is a valid flight plan loaded in the system with GPS lateral guidance, GPS Mode becomes the active lateral mode in preparation for proceeding to the Missed Approach Hold Point. Selecting GA Mode does not disengage the autopilot. If no approach has been loaded, or if there is no FMS lateral guidance, the flight director commands wings level.

7.5 AUTOPILOT, YAW DAMPER, AND AUTOMATIC TRIM OPERATION

NOTE

Refer to the current, approved version of the pertinent flight manual for specific instructions regarding emergency procedures.

The autopilot (AP) and yaw damper (YD) are designed to operate the flight control surface servos to provide automatic flight control. When engaged, the autopilot controls aircraft pitch and roll through the elevator and aileron servos, following commands received from the flight director. The yaw damper is also automatically engaged with autopilot engagement. Autopilot operation does not require the yaw damper; however, it is highly suggested to utilize the yaw damper while auto pilot is engaged.

The yaw damper reduces Dutch Roll tendencies and coordinates turns through the rudder servo. The yaw damper can operate independently of the autopilot and may be used during normal hand-flight maneuvers. Yaw rate commands are limited by the yaw damper.

The Automatic Trim system provides automatic pitch and yaw trim when the autopilot and yaw damper (respectively) are engaged. Autotrim provides commands to the trim adapters to relieve/offload any sustained effort required in those control axes. In the event of runaway trim, the AFCS will disengage automatic (and manual) trim commands being sent to the trim adapters.

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. Servo mounts and gearboxes are equipped with slip-clutches set to certain values, allowing the servos to be overridden in case of an emergency.

PITCH AXIS AND TRIM

The autopilot pitch axis uses pitch rate to stabilize the aircraft pitch attitude during upsets and flight director maneuvers. Flight director pitch commands are rate- and attitude-limited, combined with pitch damper control, and sent to the pitch servo motor. The pitch servo measures the output effort (torque) and provides this signal to the pitch trim adapter. The pitch trim adapter runs to reduce the torque held by the pitch servo.

ROLL AXIS

The autopilot roll axis uses roll rate to stabilize aircraft roll attitude during upsets and flight director maneuvers. The flight director roll commands are rate- and attitude-limited, combined with roll damper control, and sent to the roll servo motor.

YAW AXIS AND TRIM

The yaw damper uses yaw rate and roll attitude to dampen the aircraft's natural Dutch Roll response. It also uses lateral acceleration to coordinate turns. Yaw damper operation is independent of autopilot operation. The loss of manual or automatic yaw trim function does not inhibit or disconnect the yaw damper.

AUTOPILOT AND YAW DAMPER ENGAGEMENT

After pressing the **AP** Key on the AFCS Mode Controller or touching the **AP** Button in the AFCS Control Window, the autopilot, yaw damper, and flight director (if not already active) are activated. When initially activated, the flight director engages in Roll Hold Mode and Pitch

Hold Mode. Autopilot and yaw damper status are displayed in the center of the AFCS Status Box. Engagement is indicated by green ‘AP’ and ‘YD’ annunciations, respectively.

CONTROL WHEEL STEERING (CWS) (OPTIONAL)

During autopilot operation, the aircraft may be hand-flown without disengaging the autopilot. Pressing and holding the **AP DISC** Button for five seconds on the control stick / yoke 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 'CW' in white for the duration of CWS maneuvers.

Figure 302: Control Wheel Steering Active Annunciation

MANUAL AUTOPILOT AND YAW DAMPER DISENGAGEMENT

The autopilot and yaw damper can be manually disengaged by pressing the **AP** Key and/or the **YD** Key on the AFCS Mode Controller or the **AP** Button and/or the **YD** Button in the AFCS Control Window. Manual disengagement is indicated by a three-second flashing amber 'AP' and/or 'YD' annunciation (with subsequent annunciation removal) and an Autopilot disconnect tone.

AUTOMATIC AUTOPILOT AND YAW DAMPER DISENGAGEMENT

Automatic autopilot/yaw damper disengagement is indicated by a flashing red and white 'AP'/'YD' annunciation and by an Autopilot disconnect tone. The automatic disengagement indications will continue until acknowledged by the pilot which is accomplished by touching the AFCS Status Box on the PFW. 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).

If automatic autopilot disengagement is caused by failure in a parameter also affecting the yaw damper then the yaw damper may also automatically disengage. Otherwise, the yaw damper can remain operational in some cases where the autopilot automatically disengages.

Automatic yaw damper disengagement is indicated by a five-second flashing amber ‘YD’ annunciation. A localized failure in the yaw damper system or invalid sensor data can cause automatic yaw damper disengagement.

7.6 AFCS ANNUNCIATIONS AND ALERTS

TRIM ALERTS

If the commanded operation cannot be achieved due to the limitations configured, the following messages can be displayed over the pitch scale. The annunciation is removed once the condition is resolved.

Alert Condition	Annunciation	Description
Up-elevator Trim Required	TRIM UP	The autopilot does not have the required elevator authority to reach the desired flight condition.
Down-elevator Trim Required	TRIM DOWN	

Table 60: Status Alerts

OVERSPEED PROTECTION

While the flight director is on, it monitors airspeed and provides overspeed protection. This overspeed protection limits the flight director's pitch commands in situations where the flight director cannot acquire and maintain the mode reference for the selected vertical mode without exceeding a certified maximum airspeed.

If an overspeed condition develops, a flashing amber 'MAXSPD' annunciation appears above the Airspeed Indicator. The flashing annunciation lasts several seconds before becoming solid black text on an amber background. The annunciation disappears when the overspeed condition is remedied.

UNDERSPEED PROTECTION

Underspeed Protection is available when the autopilot system is engaged. It is designed to discourage aircraft operation below minimum established air speeds.

When the aircraft reaches a predetermined airspeed (see pertinent flight manual for air speeds which are dependent upon flap setting, and anti-ice system on-board), a flashing amber 'MINSPD' annunciation will appear above the airspeed indicator.

When the airspeed trend vector reaches the predetermined airspeed, a single aural "Airspeed" will sound, alerting the pilot to the impending underspeed condition. If the aircraft continues to decelerate, an "Airspeed" voice alert will begin to sound every five seconds. The autopilot will provide input causing the aircraft to pitch down to increase airspeed and the wings to level. The pitch down force will continue until the aircraft reaches a pitch attitude at which airspeed equals the airspeed at which stall warning turns off, plus two knots. Previously-coupled flight director modes will change from armed back to active, allowing the aircraft to pitch up to recapture the mode references.

SPEED ALERTS

If the remote autopilot unit supports speed alerts and the airspeed limitations configured have been reached, the following messages can be displayed next to the airspeed tape. The annunciation is removed once the condition is resolved

Alert Condition	Annunciation	Description
High Speed Protection	**MAXSPD**	Autopilot unit will raise the nose to limit the aircraft's speed.
Low Speed Protection	**MINSPD**	Autopilot unit will lower the nose to prevent the aircraft's speed from decreasing.

Table 61: Speed Alerts

AFCS MESSAGES AND ANNUNCIATIONS

The annunciations and alerts in the following table (listed in order of increasing priority) can appear on the PFD below the leftmost portion of the AFCS Status Box. Only one annunciation may occur at a time, and messages are prioritized by criticality.

Autopilot Annunciations	
AFCS Controller Key Stuck	The system has sensed a key input on the external AFCS mode controller for 30 seconds or longer.
AFCS Controller Audio Database Missing	The audio database for the external AFCS mode controller is missing. No aural voice alerts will be heard.
Servo Clutch Fault	One or more autopilot servos has a stuck clutch. The servo needs service.
Servo Trim Input Fault	The inputs to the trim system are invalid. The trim system needs service.
AFCS	Autopilot has failed. Autopilot and trim are inoperative and the flight director is not available.
AP	Autopilot normal disconnect.
AP	Autopilot abnormal disconnect.
AP	Autopilot has failed. The autopilot is inoperative. FD modes may still be available.
PFT	Autopilot preflight test is in progress.
PTRIM	Pitch Trim Fail — Manual Electric Pitch Trim is inoperative.

AFCS AURAL ALERTS

The aural alerts in the following table relate to AFCS. Voice alerts are listed with quotation marks. For additional information on aural alerts, refer to *Aural Alerts* in Appendix A.

Aural Alert	Description
Autopilot disconnect tone	Auto pilot has disengaged ● Single alert for manual AP disengagement ● Continuous alert for automatic AP disengagement
"Overspeed Overspeed"	Aircraft is in an overspeed condition

Table 62: AFCS Aural Alerts

7.7 ABNORMAL OPERATION

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 causing the trim to hit the stop if the action is prolonged. In this case, larger than anticipated control forces are required after the autopilot is disengaged.

CHECKING AUTOPILOT SERVOS DURING THE PREFLIGHT CHECK:

While not necessary before every flight, the following procedure should be performed periodically by the pilot.

1. Engage all servos to check for proper operation.
2. After engaging each axis of autopilot servo, ensure that the servo can be overpowered using the flight controls.

MITIGATING SUSPECTED AUTOPILOT FAILURE OR TRIM FAILURE:

NOTE

Consult the aircraft documentation for the location of circuit breakers as well as specifics that may supplement or amplify this procedure.

1. Firmly grasp the control wheel.
2. Press and hold the **AP** Key on the AFCS Mode Controller. The autopilot will disengage and power is removed from the trim motor. Power is also removed from all primary servo motors and engaged solenoids. Observe there is a visual and aural alert indicating autopilot disengagement.
3. Retrim the aircraft as needed. Substantial trim adjustment may be required.
4. Pull the appropriate circuit breaker(s) to electrically isolate the servo and solenoid components.
5. Release the **AP** Key.

SECTION 8 ADDITIONAL FEATURES

8.1 OVERVIEW

NOTE

With the availability of SafeTaxi®, FliteCharts®, and ChartView™ in electronic form, it is still advisable to carry another source of charts on board the aircraft.

Additional features of the system include the following:

- SafeTaxi diagrams
- SurfaceWatch™ feature (optional)
- Electronic Charts
  - ChartView charts (optional)
  - FliteCharts electronic procedure charts
  - IFR/VFR Charts
- Electronic Checklists
- Electronic Documents
- Connext® connected cockpit (optional)
- Data Logging
- Auxiliary Video
- Emergency Autoglide
- Database Management

SafeTaxi diagrams provide detailed taxiway, runway, and ramp information at more than 2,500 airports in North America, South America, and Europe. By decreasing range on an airport that has a SafeTaxi diagram available, a close up view of the airport layout can be seen.

The SurfaceWatch feature provides voice and visual annunciations to aid in maintaining situational awareness and avoid potential runway incursions during ground and air operations in the airport environment.

ChartView (optional) provides on-board electronic terminal procedures charts. FliteCharts provide onboard electronic terminal procedures charts. Electronic charts offer the convenience of rapid access to essential information. IFR/VFR Charts provide electronic low altitude IFR charts, high altitude IFR charts, and VFR charts for navigation.

The optional Connext feature allows for a Bluetooth connection between the system and a mobile device running the Garmin Pilot™ application. It also allows for integration of internal Wi-Fi for large data transfers. External Wi-Fi allows for the transmission of aircraft data as well as weather information while the aircraft is on the ground over wireless connections.

The Central Maintenance Computer (CMC) Data Logging (optional) automatically stores avionics data, events/faults, exceedances, and aircraft logs internally on the AXIS™ flight display. Exporting the Flight Data Log (FDL) can be done using an external USB-C device or internal Wi-Fi.

The Electronic Checklists feature helps to quickly find the proper checklist procedure on the ground or during flight. CAS Linked Checklists automatically nominate checklists based on activation of a Crew Alerting Message.

The Electronic Documents feature allows viewing of electronic documents on the AXIS flight display(s).

The database management feature provides a comprehensive means to view and manage all databases installed on the system.

8.2 SAFETAXI

⚠ WARNING

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

⚠ WARNING

Do not use SafeTaxi® information as the primary method of navigation during ground operations

NOTE

When obstacles are displayed on the Topographic Basemap in the vicinity of an airport being viewed with SafeTaxi, the obstacle symbols may be obscured by SafeTaxi feature labels.

SafeTaxi is an enhanced feature that gives greater map detail when viewing airports at close range on the MFW 'Map' Page or the Map Widget on the PFW. The maximum map ranges for enhanced detail are pilot configurable. When viewing at ranges close enough to show the airport detail, the map reveals taxiways with identifying letters, numbers, airport Hot Spots, and airport landmarks including ramps, buildings, control towers, and other prominent features. Resolution is greater at lower map ranges. When the aircraft's current position is within the SafeTaxi view, the airplane symbol on the airport provides enhanced position awareness.

Figure 303: SafeTaxi Depiction on the Map Page

SAFETAXI OPERATION

Any map display that shows the Topographic Map can also show the airport layout within the maximum configured range. The following is a list of displays where the SafeTaxi® diagram can be seen:

- 'Map' Page
- HSI Map
- Flight Plan Map Window
- Direct-to Preview Window
- Waypoints Info Map Windows
- 'User Waypoints Map' Window

During ground operations, the aircraft's position is displayed in reference to taxiways, runways, and airport features.

HOT SPOTS

Designated Hot Spots are recognized at airports with many intersecting taxiways and runways, or complex ramp areas. Airport Hot Spots are outlined to caution pilots of areas on an airport surface where positional awareness must increase and confusion or runway incursions happen most often. Hot Spots are defined with a magenta circle or outline around the region of possible confusion.

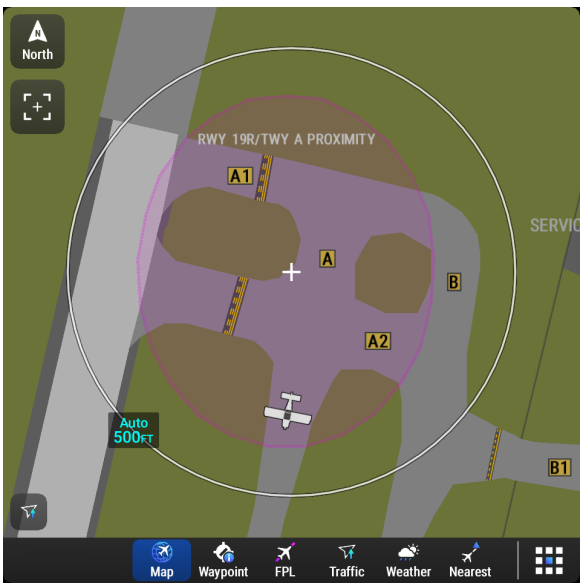


Figure 304: SafeTaxi Hot Spot Depiction

8.3 SURFACEWATCH (OPTIONAL)

⚠ WARNING

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

NOTE

Due to known database irregularities, it is possible to receive erroneous SurfaceWatch annunciations. When operating at airports that generate these nuisance alerts, it is recommended to disable SurfaceWatch if visual confirmation of correct runway lineup is assured.

The SurfaceWatch feature provides aural and visual annunciations to help the pilot maintain situational awareness and avoid potential runway incursions during ground and air operations in the airport environment. This feature is an additional "paid for enablement". The full SurfaceWatch feature is not available in Reversionary Mode. The SurfaceWatch feature is comprised of the following key components:

- Alert Annunciations
  - Taxiway Takeoff
  - Runway too short (during takeoff or landing)
  - Check Runway (during takeoff or landing)
  - Taxiway landing
- Provides the pilot with voice alerts at key transition points and runway distance remaining callouts.
- Provides information on the Primary Flight Window (PFW) that contains runway and taxiway information that changes as the aircraft moves through the airport environment.

Figure 305: SurfaceWatch Information on PFW

INFORMATION DISPLAY

The SurfaceWatch™ Information Box is displayed on the PFW to the right of the HSI. It contains runway and taxiway information that dynamically changes as the aircraft moves

through the airport environment. The information that is displayed in the Information Box is the aircraft's relative position to nearby aprons, taxiways, and runways.

There are three components to the SurfaceWatch Information Box as shown in the following figure. These components are Currently Occupied, Approaching, and Crossing.

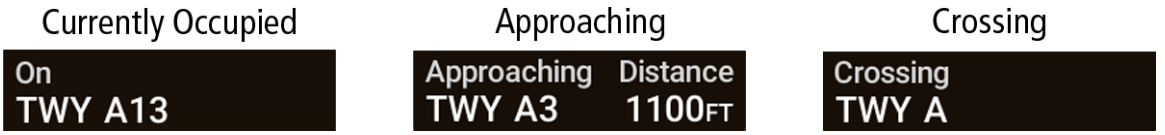


Figure 306: Information Types Displayed in the Information Box

CURRENTLY OCCUPIED

This component indicates the aircraft is 'On' the indicated apron, taxiway, or runway. In the previous figure, the aircraft is currently 'On' TWY A13. 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. If the specific runway is designated in the flight plan, 'Approaching' and 'Distance' will also be displayed with the corresponding distance and runway.

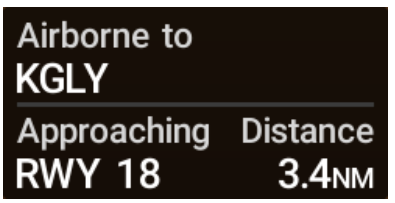


Figure 307: SurfaceWatch 'Approaching' Indication

APPROACHING COMPONENT

This component indicates the aircraft is 'Approaching' the indicated apron, taxiway, or runway. In the previous figure, the aircraft is currently 'Approaching' RWY 18. The distance to the runway threshold is also shown.

NOTE

When approaching a runway from a taxiway, 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 COMPONENT

This component displays the runways or taxiways that the aircraft is crossing, as seen in the following figure. Runways or taxiways behind the aircraft are not depicted.

The Crossing component is shown in conjunction with the Currently Occupied component of the Information Box.

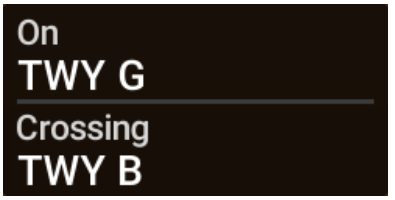


Figure 308: SurfaceWatch 'Crossing' Component

SCENARIOS

Additionally, different scenarios are presented to convey how the Information Box is depicted under different circumstances.

ON APRON

When the aircraft is situated on a labeled apron (i.e., any non-maneuvering area not controlled by ATC Tower that is identified in the SafeTaxi Database), the apron label name will be shown in the “Currently Occupied” component of the Information Box. Additionally, the “Approaching” component may show the object name and distance to the nearest edge of the object.

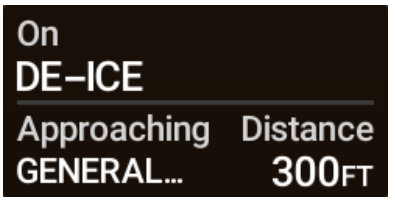


Figure 309: "On Apron" Scenario Examples

ON TAXIWAY

When the aircraft is situated on a taxiway, the taxiway name will be shown in the ‘Currently Occupied’ component of the SurfaceWatch Information Box. If the aircraft heading is such that another geometric object (e.g., taxiway, runway, labeled apron) is encountered, the 'Approaching' component will show the object name and distance to the nearest edge of the object. When approaching an intersection of multiple taxiways, the taxiways will be listed in order of proximity in the 'Approaching' component. If the aircraft is within the intersection of multiple taxiways, the 'Crossing Taxiways/Runways' component title will display 'Crossing' and the taxiway being crossed will be displayed with no distance shown.

ALERTS

The SurfaceWatch™ alert annunciations are displayed in the central portion of the PFD. The alert annunciations are accompanied by a corresponding voice alert. Other associated information is presented in the SurfaceWatch Information Box.

The following is a descriptive list of the SurfaceWatch alerts.

Alert Annunciation	Associated Voice Alert	Description
TWY TAKEOFF TWY LANDING	"Taxiway" "Not a Runway"	Issued when the aircraft is taking off from or landing on a non-runway (e.g., a taxiway).
	"Runway too short"	Issued when the aircraft is taking off from or landing on a runway with a length less than needed as calculated by the TOLD function or by pilot entry.[1]
CHECK RUNWAY	"Check Runway"	Issued when the aircraft is taking off from or landing on a runway different than that entered in the flight plan.
[1] For this alert to be operational, a required runway length must be specified in TOLD, by pilot entry, or the aircraft must be taking off or landing on a one-way runway.		

Table 63: SurfaceWatch Alert Annunciations

TAKEOFF ALERTS

The takeoff phase-of-flight, as determined by the system, must be valid in order for the system to issue Takeoff Alerts. Takeoff Alerts will be issued when the thrust levers (throttle) are advanced to near the TO position. Nominally, the aircraft will be in the SurfaceWatch 'Takeoff Phase-of-Flight' when the aircraft starts its takeoff maneuver (e.g., the throttles are pushed forward).

TAXIWAY TAKEOFF

The Taxiway Takeoff Alert is issued when the aircraft attempts to takeoff from a non-runway (e.g., a taxiway). The system determines this when the takeoff phase-of-flight is valid, the thrust levers are advanced, and the aircraft is not aligned with the runway.

In addition to the visual and voice alert, the Information Box contains a textual description of the currently occupied taxiway (or other maneuvering area) and potentially the next area (apron or maneuvering area) to be occupied (based on aircraft heading and the airport geometry) and the distance to that area.

RUNWAY TOO SHORT

The Runway Too Short (during takeoff) alert is issued when the aircraft attempts to takeoff from a runway and the remaining runway length is less than the required length. The system determines this when the takeoff phase-of-flight is valid, the thrust levers are advanced while the aircraft is aligned with a runway and the remaining runway length is less than the required takeoff distance calculated by TOLD.

In addition to the visual and voice alert, the Information Box will contain a textual description of the currently occupied runway and the remaining runway length.

CHECK RUNWAY

The Check Runway alert is issued when the aircraft attempts to takeoff from a runway that does not match the active flight plan. The system determines this when the Takeoff phase-of-flight is valid and the thrust levers are advanced while the aircraft is aligned with a runway that is not the departure runway entered in the active flight plan. Because it is somewhat common for ATC to redirect an aircraft to a different runway, this alert is a caution (amber) alert level as opposed to a warning (red) alert level.

In addition to the visual and voice alert, the Information Box contains a textual description of the currently occupied runway.

LANDING ALERTS

The On-Final phase-of-flight, as determined by the system, must be valid in order for the system to issue Landing Alerts. The system will issue Landing Alerts when the aircraft is below 250 feet AGL and within one nautical mile of the runway threshold. Nominally, the aircraft will be in the SurfaceWatch 'On-Final Phase-of- Flight' when the aircraft is on approach and nearing the airport to land (generally within a couple of nautical miles of the runway threshold).

TAXIWAY LANDING

The Taxiway Landing alert is issued when the aircraft attempts to land on a non-runway (e.g., a taxiway). The system determines this when the On-Final phase-of-flight is valid, the aircraft is below 250 feet AGL, within one nautical mile of the runway threshold, and the aircraft is not aligned with a runway.

In addition to the visual and voice alert, the Information Box will display the destination airport identifier and the text 'Approaching TWY' to indicate a non-runway landing is being attempted.

RUNWAY TOO SHORT

The Runway Too Short alert is issued when the aircraft attempts to land on a runway where the remaining runway length is less than the required landing runway length as calculated by the TOLD function. The system determines this when the On-Final phase-of-flight is valid and the aircraft is aligned with a runway the system TOLD function has calculated to be too short.

In addition to the visual and voice alert, the Information Box will display the destination airport identifier and the text “APPROACHING” above the runway designation and the text “RMNG” above the indicated remaining runway length.

CHECK RUNWAY

The Check Runway alert is issued when the aircraft attempts to land on a runway that does not match the arrival runway specified in the active flight plan. The system determines this when the On-Final phase-of flight is valid, the aircraft is below 250 feet AGL, within one nautical mile of the runway threshold, and the aircraft is aligned with a runway that is not the landing runway entered in the active flight plan. Because it is somewhat common for ATC to redirect an aircraft to a parallel runway, this alert is a caution (amber) alert level as opposed to a warning (red) alert level.

Additionally, the Information Box will display the destination airport identifier, the runway with which the aircraft is aligned, and the distance to the runway.

DISTANCE REMAINING CALLOUTS

NOTE

SurfaceWatch™ aural/visual indications may not be aligned with physical runway distance remaining markers.

NOTE

Per AC 150/5340-18F Paragraph 22.a, the runway distance remaining sign placement may be adjusted to account for excess length beyond whole number multiples of 1000 feet and for placement conflicts with other airport elements (such as runway/taxiway intersections). Thus, distance remaining callouts issued by SurfaceWatch may occur at a location other than the associated distance remaining sign.

Distance remaining is calculated based on the current aircraft position relative to the opposite runway endpoint along the runway centerline based on the runway position information contained in the Navigation Database.

With rejected takeoff or during landing rollout, distance remaining voice callouts are issued for the remaining runway distances of 5,000’, 4,000’, 3,000’, 2,000’, 1,000’, and 500’. Distance remaining callouts will be issued during rejected-takeoff and landing-rollout phases of flight.

SURFACEWATCH SETUP

Origin/destination airport, runway, and distance data entered integrates with SurfaceWatch™ technology to alert the flight crew of runway distance remaining, or to advise of a potential taxiway takeoff/landing. The runway selected in SurfaceWatch Setup appears on the airport diagram in cyan and appears outlined in cyan on the synthetic vision representation of the runway on the PFW.

ENABLING/DISABLING SURFACEWATCH™ ALERTS (WHEN ENABLED):

1. Navigate to the 'Apps' Window:
   a) Press the **MENU** Softkey two times.
   Or:
   a) Touch the **Applications** Icon on the MFW App Bar.
2. Touch the **Quick Actions** Tab.
3. Touch the **Inhibits** Button.
4. Touch the **Inhibit/Normal** Selection Button for the SurfaceWatch alerts to be enabled (normal) or inhibited (inhibit). The blue indication displays which option has been selected.

ENTERING ORIGIN/DESTINATION AIRPORT WHEN NO FLIGHT PLAN HAS BEEN ENTERED:

If the first waypoint in the flight plan is an airport, it will automatically be designated as the origin. If the last waypoint in the flight plan is an airport, the system will automatically designate it as the destination. If an approach procedure has been added to the flight plan, the missed approach procedures will not affect the destination designation of the final airport in the flight plan.

1 Navigate to the Flight Plan Page:
   a) Touch the **FPL** Icon on the MFW App Bar.
      Or:
   b) Touch the **Applications** Icon.
   c) Touch the **Flight Plan** Button.
2 Touch the **Add Waypoint** Button.
3 Use the Keypad to enter the waypoint identifier.
   Or:
   Use the Find Function and associated tabs (Recent, Nearest, Flight Plan, Favorites, and Search Tabs) to find a waypoint.
4 Repeat steps 2 and 3 until the flight plan is completed.

SELECTING ORIGIN/DESTINATION RUNWAY:

1 With the flight plan loaded, navigate to the flight plan application page on the MFW.
2 Touch the Airport **Waypoint Identifier** Datafield Button (first or last airport in the flight plan).
3 On the 'Waypoint Options' Window touch the **Select Runway** Button.
4 Scroll if necessary, and touch the desired **Runway** Button.

EDITING DISTANCE REMAINING CALLOUTS

1 Navigate to the 'Apps' Window:
   a) Press the **MENU** Softkey two times.
      Or:
   a) Touch the **Applications** Icon on the MFW App Bar.
2 Touch the **Settings & Tools** Tab.
3 Scroll if necessary, and touch the **Distance Remaining Callouts** Button.
4 Select the distances to be enabled or disabled by touching the appropriate **Distance** Annunciation Button(s). (The green annunciation indicates the callout is enabled.)

OPERATIONAL STATES

NOTE

While a missing or invalid SafeTaxi® Database will reduce functionality, SurfaceWatch™ will remain operational. All SurfaceWatch alerting is based on the Navigation Database. The SurfaceWatch

Information Box will show only 'On' or 'Approaching' runway information if the SafeTaxi Database is missing or invalid or if the airport does not have SafeTaxi diagrams.

SurfaceWatch has four distance operational states: Normal, Fail, Inhibited, and Disabled.

Alert	Description
SFCWTC FAIL (One or more inputs invalid)	The GPS or WAAS position could be invalid, or is insufficient due to RAIM position warning, loss of integrity, or the GPS horizontal protection level exceeds the LNAV/VNAV horizontal alert limit (556.0 meters). Heading Input could be invalid.
SFCWTC INHIB (SurfaceWatch inhibited)	SurfaceWatch has been inhibited by the pilot. Aural and visual alerts are inhibited. Functionality will automatically reset on a system restart.
SurfaceWatch Disabled: Too far north/south	Issued when the aircraft is positioned north of N 87° latitude or south of S 87° latitude.
Runway Data Not Available: Inhibit SurfaceWatch	Not enough information is available for the active runway, SurfaceWatch will issue nuisance alerts if not inhibited. See *Enabling/Disabling SurfaceWatch Alerts (When Enabled)*:. Some airports within the Navigation database do not have surveyed runway position data for all runways at the airport (e.g., soft surface runways, turf, gravel, etc.). In these cases, SurfaceWatch may either issue alerts, or may not provide alerts, or may not be able to display complete Information Box data at that airport.

Table 64: SurfaceWatch Alerts

The following image displays the 'Messages' Window. The previously discussed annunciations will populate the 'Messages' Window as applicable. In the below image, 'SFCWTC INHIB' is annunciated.

Figure 310: SurfaceWatch Inhibit Annunciation

8.4 ELECTRONIC CHARTS

⚠ WARNING

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

⚠ WARNING

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

NOTE

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

NOTE

The Electronic Charts do not replace the published paper copies of charts.

NOTE

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

NOTE

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

Electronic charts resemble the paper version aviation charts and are displayed on the MFW. AeroNav Services (FliteCharts®) and Jeppesen (ChartView) terminal procedure charts can be displayed on the MFW.

SELECTING THE PREFERRED CHARTS SOURCE:

When the databases for both chart types are purchased and loaded in the system, the desired charts brand, or source, can be selected for viewing. The active chart source for a particular procedure is shown on the 'Charts Options' Screen under Preferred Source.

1 Navigate to the 'Charts' Application Page on the MFW:
   a) Touch the **Charts** Button on the MFW App Bar.
      Or:
   a) Use the Outer **DCK** (on the MFW side of the bezel while in split screen mode) to scroll to the 'Charts' Application Page.
      Or:
   a) Touch the **Applications** Icon **>** **Primary** Tab **>** **Charts**.
2 Press the **MENU** Softkey (on the MFW/'Charts' App side of the bezel while in split screen mode) to open the 'Chart Menu'.
3 Scroll if necessary, touch the **Chart Settings** Button.
4 Touch the **Chart Source** Selection Button.
5 Touch the desired source for the charts to be displayed.

LOADING CHARTS INTO THE 'CHARTS' APPLICATION PAGE:

1 Navigate to the 'Charts' Application Page on the MFW:
   a) Touch the **Charts** Button on the MFW App Bar.
      Or:
   a) Use the Outer **DCK** (on the MFW side of the bezel while in split screen mode) to scroll to the 'Charts' Application Page.
      Or:
   a) Touch the **Applications** Icon **>** **Primary** Tab **>** **Charts**.
2 Press the **MENU** Softkey (on the MFW/'Charts' App side of the bezel while in split screen mode) to open the 'Chart Menu'.

3 Touch the **Select Chart** Button.
4 Touch the **Waypoint Identifier** Datafield Button and use the keypad or **Fast Find** Button to enter an airport identifier.
5 Navigate through the tabs on the 'Chart Selection' Window and select the desired charts to be accessed quickly on the 'Charts' Application Page.

FLITECHARTS

FliteCharts® are electronic charts that resemble the paper version of AeroNav Services Terminal Procedures Charts. The charts are displayed with high-resolution and in color for applicable charts. The display pane depiction shows the aircraft position on the moving map and on airport diagrams.

The geo-referenced aircraft position is indicated by an aircraft symbol displayed on the chart when the current position is within the boundaries of the chart. When the aircraft is not within the chart boundaries, the ‘Aircraft Not Shown’ Icon is displayed in the lower right corner of the MFW.

Off-scale areas are indicated by the gray shading. Note, the gray shading is for illustrative purposes only and will not appear on the published chart or display pane. These off-scale areas appear on the chart to convey supplemental information. However, the depicted geographical position of this information, as it relates to the chart plan view, is not the actual geographic position. Therefore, when the aircraft symbol appears within one of these areas, the aircraft position indicated is relative to the chart plan view, not to the off-scale area.

NOTE

Do not maneuver the aircraft based solely upon the geo-referenced aircraft symbol.

FliteCharts database subscription is available from Garmin. Available data includes:

- Arrivals (STAR)
- Departure Procedures (DP)
- Approaches
- Airport Diagrams
- Takeoff Minimums
- Alternate Minimums

CHARTVIEW (OPTIONAL)

ChartView™ Electronic Charts resemble the paper version of Jeppesen Terminal Procedures Charts and can be viewed on the MFW. The charts are displayed in full color with high-resolution. The display pane depiction shows the aircraft position on the moving map in the plan view of approach charts and on airport diagrams.

The geo-referenced aircraft position is indicated by an aircraft symbol displayed on the chart when the current position is within the boundaries of the chart. Inset boxes are not considered within the chart boundaries. Therefore, when the aircraft symbol reaches a chart boundary line, or inset box, the aircraft symbol is removed from the display.

The following figure shows examples of off-scale areas, indicated by the gray shading. Note, the gray shading is for illustrative purposes only and will not appear on the published chart or display pane. These off-scale areas appear on the chart to convey supplemental information. However, the depicted geographical position of this information, as it relates to the chart plan view, is not the actual geographic position. Therefore, when the aircraft symbol appears within one of these areas, the aircraft position indicated is relative to the chart plan view, not to the off-scale area.

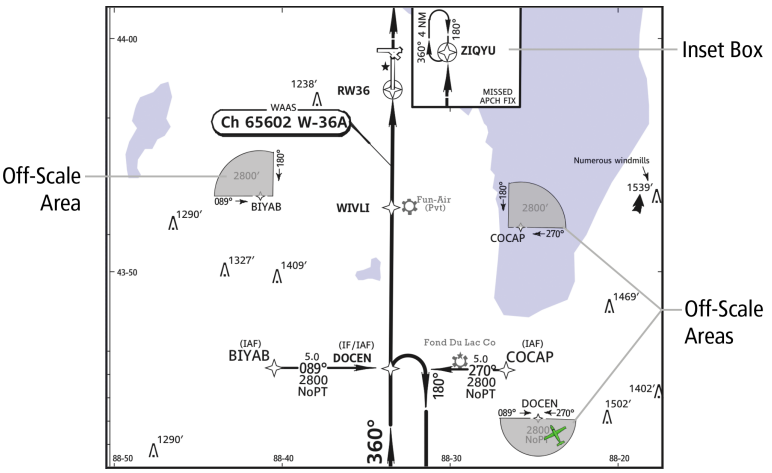


Figure 311: Sample Chart Indicating Off-Scale Areas

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
- Approaches

CHART SELECTION

When a flight plan is active, or when flying direct-to a destination, the initial set of charts made available pertain to the departure airport. After departing the airport environment, the initial chart set made available pertains to the destination airport. When no flight plan is active, or when not flying to a direct-to destination, the initial chart set is made available for the nearest airport. If the charts pane is displayed when landing, the chart will automatically change to the airport diagram upon landing.

The aircraft symbol is shown on the chart only if the chart is to scale and the aircraft position is within the boundaries of the chart.

When no terminal procedure chart is available for the nearest airport or the selected airport, the banner 'No Available Charts' appears on the screen. The 'No Available Charts' banner does

not refer to the Jeppesen or AeroNav Services Terminal Procedures Charts subscription, but rather the availability of a particular airport chart selection or procedure for a selected airport.

If there is a problem in rendering the data (e.g., a data error or a failure of an individual chart), the banner 'Unable To Display Chart' is then displayed.

VIEWING CHARTS USING THE WAYPOINT APPLICATION:

1 Navigate to the Waypoint Application Page by:
   a) Touching the **Waypoint** Button on the MFW application bar.

   Or:

   a) Use the **DCK** to scroll through the applications on the MFW until the Waypoint application is selected.

   Or:

   a) Touch the **Applications** Icon.
   b) Touch the **Waypoint** Button.
2 If required use the waypoint selection button to enter the desired waypoint.
3 Touch the **Charts** Tab.
4 Touch the chart selection button to open the options for a chart to be displayed. These charts are subdivided into informational, departure, arrival, and approach charts and can be selected by touching the specified tab in the waypoint chart selection window.

SELECTING A CHART USING THE 'CHARTS' APPLICATION PAGE:

With the 'Charts' Application Page open on the MFW, touch the left and right arrows at the top left corner of the application to cycle through the loaded charts.

Or:

Use a horizontal swiping gesture left or right to cycle through the loaded charts.

NOTE

*If more than one page exists in the database for a specific chart, a **Page** Selection Button appears in the top right corner of the application page that can be touched to cycle through the pages of the selected chart.*

ZOOMING-IN, ZOOMING-OUT, ROTATING, AND PANNING THE DISPLAYED CHART:

1 On an MFW displaying a chart, pinch and spread to zoom in and out to adjust the chart zoom.

   Or:

   Use the Inner **DCK** to zoom in and out.
2 Touch and drag the screen to pan the displayed chart.
3 Touch the Rotate Icon in the top left corner of the displayed chart to rotate clockwise.

VIEWING AIRPORT DIAGRAMS FROM THE 'NEAREST' APPLICATION PAGE:

1 Navigate to the 'Nearest' Application Page
   a) Touch the **Nearest** Button on the MFW App Bar.
      Or:
   a) Use the Outer **DCK** (on the MFW side of the bezel while in split screen mode) to scroll to the 'Nearest' Application Page.
      Or:
   a) Touch the **Applications** Icon **>** **Primary** Tab **>** **Nearest**.
2 If necessary select Airport using the **Type** Button.
3 Scroll if necessary, touch the desired **Airport** Button to open the 'Airport Options' Window.
4 Touch the **Waypoint Info** Button.
5 The 'Airport Info' Window will open to the **Info** Tab, displaying the map location of the selected airport with an inset of the airport diagram. Touch the airport diagram inset to swap between the map and diagram view.
6 With the airport diagram open the ability to pan and zoom are available.

IFR/VFR CHARTS

The IFR Charts include both IFR High (designed for navigation at or above 18,000 ft) and IFR Low (designed for navigation below 18,000 ft). The VFR Charts are digital representations of the Sectional Aeronautical Charts, World Aeronautical Charts, and Terminal Area Charts. The system can display flight plan information, terrain, traffic, and weather information.

When VFR charts are displayed, the system automatically selects the appropriate chart for display (Sectional, World Aeronautical Chart, or Terminal Aeronautical Chart) based on zoom range.

SELECTING A CHART TO DISPLAY:

1 Navigate to the 'Map' Application Page.
   a) Touch the **Map** Button on the MFW App Bar.
      Or:
   a) Use the Outer **DCK** (on the MFW side of the bezel in split screen mode) to scroll to the 'Map' Application Page.
      Or:
   a) Touch the **Applications** Icon **>** **Primary** Tab **>** **Map**.
2 Press the **MENU** Softkey (on the MFW/'Map' App side of the bezel while in split screen mode) to open the 'Map Menu'.
3 Touch the **Basemap** Selection Button.
4 Select **VFR**, **IFR Low**, or **IFR High** to display the preferred chart on the 'Map' Page.

TRAFFIC AND WEATHER MAP OVERLAYS

Traffic symbols and labels as well as weather can be configured and overlaid onto IFR/VFR charts. See the following procedures in the Hazard Avoidance Section for 'Map' overlay details:

- *Enabling/Disabling Display of Traffic Information on the 'Map'*
- *Customizing Traffic Displays on the 'Map'*
- *Enabling Datalink Weather on the 'Map'*

CONFIGURING WEATHER OVERLAY SETTINGS:

1 Navigate to the 'Map' Application Page.
   a) Touch the **Map** Button on the MFW App Bar.
      Or:
   a) Use the Outer **DCK** (on the MFW side of the bezel in split screen mode) to scroll to the 'Map' Application Page.
      Or:
   a) Touch the **Applications** Icon **>** **Primary** Tab **>** **Map**.
2 Press the **MENU** Softkey to open the 'Map Menu'.
3 Touch the **Overlay** Selection Button and ensure **Weather** is the selected overlay option.
4 Touch the **Map Settings** Button.
5 Touch the **Weather** Tab.
6 Touch the desired weather information to be overlaid on the 'Map' Application Page. The green annunciation indicates the feature is enabled.

8.5 ELECTRONIC CHECKLISTS

NOTE

The checklists shown in the following figures are examples only.

The Electronic Checklists feature allows the pilot to view and interact with aircraft checklists on the ground and during each phase of flight. Checklist contents are displayed on the MFW. The checklist file can be uploaded to the system by using a USB type C dongle and inserting it into the USB-C port on the display bezel. Once the checklist file is synced across the system, the USB-C dongle with the checklist file is no longer required.

The following colors are used for checklists items:

- **Cyan** — Used for checklist titles and links to other checklists
- **White** — Item not checked
- **Green** — Item has been checked
- **Gray** — General notes
- **Amber** — Caution item
- **Red** — Warning item

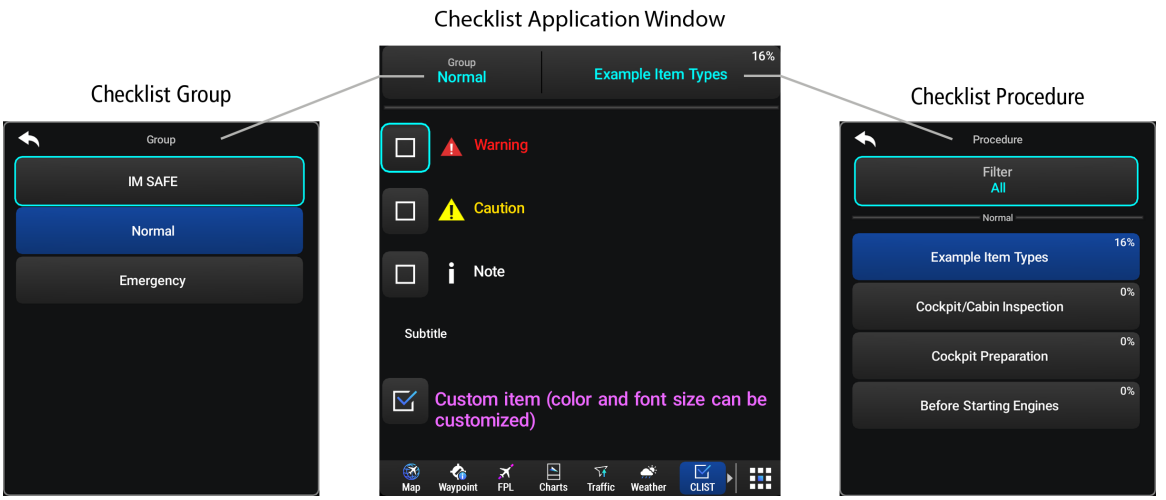


Figure 312: Checklist Overview

In the system, checklists are organized into Groups with each group comprised of a series of checklists that apply to that group. After selecting a group a 'Procedure' window will open allowing the pilot to filter the procedures in the group. Filter categories are set by the OEM who built the checklist or using the Checkset tool.

Once a 'Procedure' is selected the checklist application will open that specific checklist. As items are checked off the bottom of the list will display the number of items remaining. After the last item has been checked, the bottom of the checklist will display "Procedure Complete" in green and a **Next Procedure** Button will be displayed. Touching the **Next Procedure** Button will cycle the checklist application to the next procedure in the Group.

(EXPERIMENTAL) CHECKSET TOOL

NOTE

Garmin does not provide a checklist file required for flight operation. The file could be authored by the aircraft operator.

NOTE

It is the operator's responsibility to gain the necessary operational approvals following guidance of AC 20-176D and AC 120-64.

A checklist file can be created or edited by the pilot without involvement from Garmin. Garmin provides a CheckSet Tool which is used to generate and edit enhanced electronic checklist files. These files are saved in the .GCL3 format. Previous files in the .JSON, .ACE, or .GCL format should be converted to .GCL3 using the CheckSet Tool. Visit flyGarmin.com to download the CheckSet Tool.

ELECTRONIC CHECKLIST FEATURES

The following are features available while using the electronic checklist feature:

- **Checklist Images** — Checklists can display an image as a part of the checklist.

- **Branch questioning** — Branched questioning allows the checklist to provide two or more options.

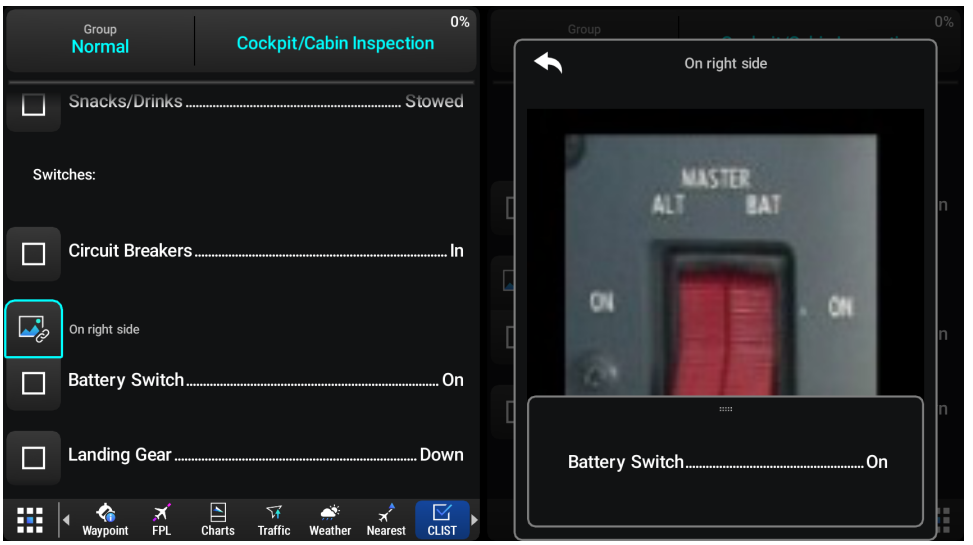


Figure 313: Linked Checklist Image

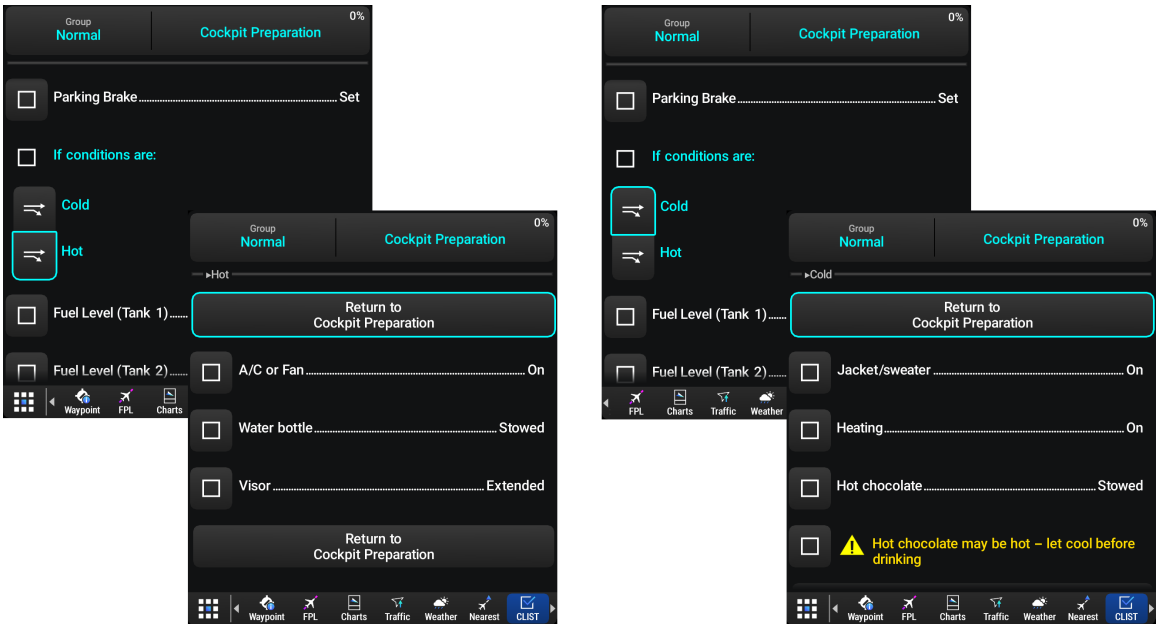


Figure 314: Branch Questioning

CHECKLIST IMAGES

Checklists can display an image as a part of the checklist. The image can be setup as a challenge item with an associated check box or as a reference item without a check box. The images are included in the checklist file uploaded to the system.

BRANCH QUESTIONING

Many checklists involve a decision-making process that depends on operational conditions. Branched questioning allows the checklist to provide two or more options. Each option can have a sub checklist associated with it. The pilot can pick the appropriate option and complete the associated checklist. Only one of the sub checklists needs to be filled out in order to satisfy the "Checklist Complete" criteria.

At any time the pilot can return to the main checklist by touching the "Return to [CHECKLIST]" at the top or bottom of the branched checklist.

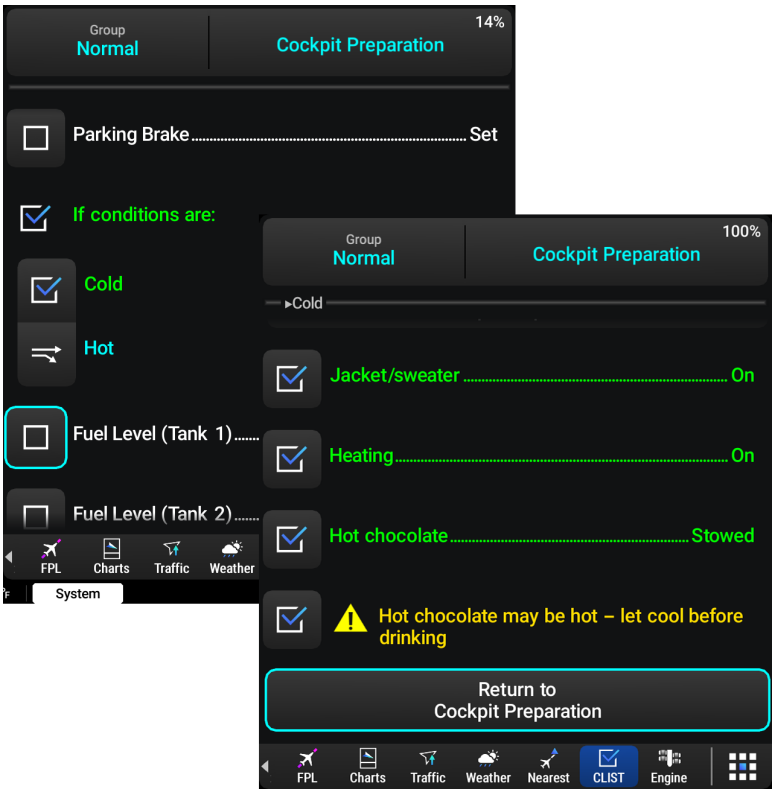


Figure 315: Completed Branch Checklist

ACCESSING AND NAVIGATING CHECKLISTS:

1 Navigate to the 'Checklist' Application Page on the MFW:
   a) Touch the **CLIST** Button on the MFW App Bar.
      Or:
   a) Use the Outer **DCK** (on the MFW side of the bezel while in split screen mode) to scroll to the 'Checklist' Application Page.
      Or:
   a) Touch the **Applications** Icon **> Primary** Tab **> Checklist**.
2 Touch the **Group** Selection Button, then select the desired checklist group.

3 After selecting the Group, the 'Procedure' window will open. Touch the desired checklist to open.

Or:

At any point select a new checklist in the group by touching the **Procedure** Selection Button and touch the desired checklist.

4 Once a checklist is open, scroll as necessary and touch the **Check Box** as the individual tasks are completed.

5 Once a checklist is complete, scroll to the bottom of the window and touch the **Next Procedure** Button to open the next procedure in the group.

6 At any time touch the **MENU** Softkey (on the MFW side of the display while in split screen mode) to open a list of the following checklist menu options.

- **Incomplete Procedures** Button
- **Check All Items** Button
- **Reset All Items** Button
- **Reset All Procedures in Group** Button
- **Checklist Info** Button

RESETTING A SPECIFIC CHECKLIST:

1 Navigate to the 'Checklist' Application Page on the MFW:

a) Touch the **CLIST** Button on the MFW App Bar.

Or:

a) Use the Outer **DCK** (on the MFW side of the bezel while in split screen mode) to scroll to the 'Checklist' Application Page.

Or:

a) Touch the **Applications** Icon **> Primary** Tab **> Checklist**.

2 Touch the **MENU** Softkey.

3 Touch the **Reset All Items** Button to reset all the steps in the checklist.

RESETTING ALL CHECKLISTS IN GROUP:

1 Navigate to the 'Checklist' Application Page on the MFW:

a) Touch the **CLIST** Button on the MFW App Bar.

Or:

a) Use the Outer **DCK** (on the MFW side of the bezel while in split screen mode) to scroll to the 'Checklist' Application Page.

Or:

a) Touch the **Applications** Icon **> Primary** Tab **> Checklist**.

2 Touch the **MENU** Softkey.

3 Touch the **Reset All Procedures in Group** Button to reset all the procedures in the selected group.

8.6 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 Controlled Documents and User Documents.

When viewing documents using the 'Documents' window the AXIS™ flight display allows for users to navigate documents loaded into the system by page or by a keyword search. To navigate the document with navigation source set to 'Page', swipe left and right. Setting the navigate function to 'Search' allows the user to type in a keyword, searching the document for any word or phrase up to 39 characters. The user can then cycle through eh search results using the left and right arrows. The 'Table of Contents' for the document may also be used to quickly navigate to a title header within the document.

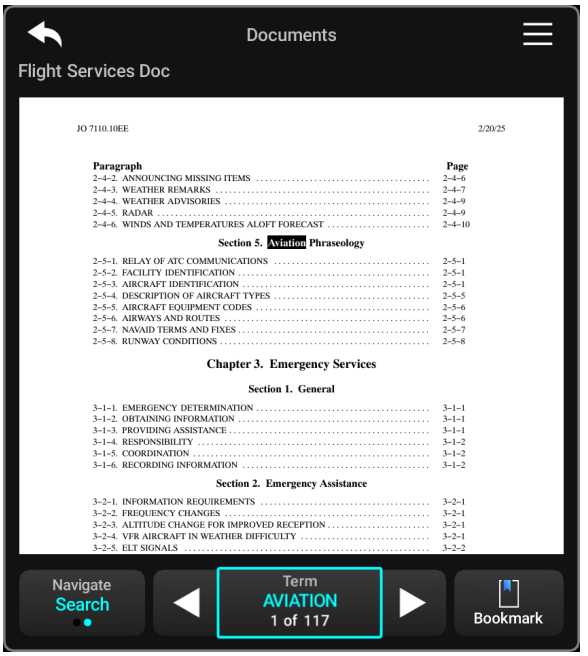


Figure 316: Search Function of System Documents

Bookmarks may also be created for quickly navigating to a saved location within the document.

CONTROLLED DOCUMENTS

‘Controlled’ Documents are typically provided by the aircraft manufacturer. These documents are stored on the supplied USB-C dongle, and pertain to the aircraft the Axis flight display is installed.

USER DOCUMENTS

User Documents are those loaded by the crew. User Documents must be in .pdf format and reside on a USB in a folder titled "documents" (this is not case sensitive). The list of available User Documents is limited to 100 documents and are shown in alphabetical order based on filename. The maximum document file size is 1.5GB. The maximum number of pages per

document is limited to 9,999. For documents containing more than 9,999 pages, only the first 9,999 pages will be displayed. Pages that contain large and/or numerous images may exceed RAM memory limits and therefore may not be displayed correctly or may not be displayed at all. The name of the file is limited to 63 characters (59 characters and ".pdf"). If this length is exceeded, the file may not be able to be viewed. The file name must comply with the following valid characters; A-Z, a-z, 0-9, [space], and the following special characters: ! # $ % & ( ) + , ; = @ [ ] ^ ` { } ~. The period in ".pdf" is allowed, but no other periods can appear in the file naming convention.

SUPPORTED PDF FEATURES

User Documents must be in .pdf format. The following .pdf features are not supported. If a file contains any of these features, the system will ignore the feature and display the document.

- Embedded files (attachments)
- Alternate images (using a different image for display and printing)
- Page labels (alternate page numbers; e.g., i, ii, iii, iv for Table of Contents)
- Additional annotations, including file attachment annotation, sound annotation, movie annotation, widget annotation, and trap network annotation
- Digital signatures
- JavaScript
- Logical structure (structuring documents into chapters, paragraphs, headings, footnotes)
- Web capture information (annotations for search engines)
- Prepress support (annotations for newspapers, etc.)

IMPORTING DOCUMENTS

1 Navigate to the Application window by touching the **Applications** Icon.

Or:

Press the **MENU** Softkey two times.

2 Touch the **Settings & Tools** Tab.

3 Touch the **Documents** Button. The most recent document opened will be the document opened after touching this button.

a) If no documents are on the display, touch the **Import Documents** Button displayed on the window.

Or:

If documents are already present on the device:

a) Touch the **MENU** Softkey.

Or:

Touch the **Menu** Icon.

b) Touch the **Import Documents** Button.

4 A list of all available documents on the USB will be displayed. Touch the **Select All** Button.

Or:

Scroll the list and select the individual documents desired to be imported to the flight display.

5 Touch the **Import** Button.

6 The pilot will be prompted with an "Import cannot be stopped once started. This may take several minutes." message. Touch **OK** to accept, or touch **Cancel** to go back.

A window will open showing the progress of the documents being uploaded.

7 The pilot will be notified when the document has successfully be uploaded. Touch the **OK** Button to close the prompt.

VIEWING ELECTRONIC DOCUMENTS:

1 Navigate to the Application window by touching the **Applications** Icon.

Or:

Press the **MENU** Softkey two times.

2 Touch the **Settings & Tools** Tab.

3 Touch the **Documents** Button. The most recent document opened will be the document opened after touching this button.

4 To select a different document to view, touch the **MENU** Softkey (on the MFW side of the bezel when in split screen mode).

Or:

Touch the **Menu** Icon in the corner of the window.

5 Touch the **Select Document** Button.

6 Touch the **Controlled** Tab or **User** Tab to choose from the imported documents on the device.

CHANGING DOCUMENT DISPLAY CONTROLS:

1 With a document open, open the 'Documents Menu':

a) Touch the **MENU** Softkey.

Or:

a) Touch the **Menu** Icon.

2 Touch the **Display Controls** Indicator Button.

CREATING BOOKMARKS IN THE DOCUMENT:

1 With a document open, ensure the **Display Controls** Indicator Button is enabled in the 'Documents Menu'.

2 Touch the **Bookmark** Button.

3 Using the alphanumeric keypad, enter a name for the bookmarked page, then touch the **Enter** Button.

DELETING DOCUMENT BOOKMARKS:

1. With a document open, ensure the **Display Controls** Indicator Button is enabled in the 'Documents Menu'.
2. Touch the **Bookmark** Button.
3. Touch the **View All** Button.
4. Scroll if necessary and touch the bookmark to be deleted, opening the document to that bookmarked page.
5. Touch the **Bookmark** Button.
6. Touch the **Remove Bookmark** Button.
7. Confirm the deletion by touching the **OK** Button.

8.7 CONNEXT

Connext® seamlessly brings together people, flight information, and hardware to create a connected environment. This section will discuss the functionality of Connext and how to setup a mobile device running the Garmin Pilot™ application. Data shared is dependent upon the hardware installed on your aircraft and whether you are operating Garmin Pilot on an iOS System or an Android System.

The following section will be presented from the flight deck point of view. See the Garmin Pilot for iOS Manual or the Garmin Pilot for Android Manual for discussion in detail on how to use the below features from the Garmin Pilot Application point of view.

The AXIS™ flight displays are capable of providing an internal Wi-Fi network which allows for higher bandwidth for moving databases and aircraft/flight data between the avionics and connected devices.

Upon successful connection, the Garmin Pilot application and the wireless transceiver enable an array of features:

- **Database Concierge:** enables wireless transfer of databases to select avionics
- **Flight Plan Transfer:** supports two-way flight plan transmission
- **Bluetooth Interface:** supports basic phone and volume controls on the AXIS display
- **Flight Deck Data Streaming to Mobile Device:**
  - Attitude & Heading Reference System (AHRS): displays attitude information including roll, pitch, and yaw
  - Traffic: displays traffic targets
  - GPS Information: shares position, velocity, and time with Garmin Pilot
  - Flight Data Logging: streamed in real time to Garmin Pilot and saved as a log for each flight in Garmin Pilot on your portable electronic device
  - Garmin® Aviation Smartwatch Connectivity: Compatible Garmin Aviation Smartwatches offer further connectivity in flight by providing global navigational capability in a wearable package.

The mobile device must be ‘paired’ with the system in order to use the various functions. Pairing is accomplished by first placing the system in pairing mode by enabling ‘Pairing Mode’ in the Connections Screen. The system is ‘discoverable’ whenever pairing mode is enabled. The pairing operation is completed from the mobile device and the Garmin Pilot application. See the device Bluetooth pairing instructions and the connection instructions in the Garmin Pilot application.

ENABLING DATALINK BLUETOOTH:

1 Access the 'Bluetooth Settings' Window:
   a) Access the Audio Panel by touching the **Audio** Button on the CNS Bar at the top of the display.

      Or:

      Touch the **Applications** Icon **> Quick Actions** Tab **> Audio**. ('Bluetooth Settings' may also be accessed through the 'Music' Window by touching the **MENU** Softkey.)
   b) Touch the **MENU** Softkey on the side of the bezel the window is displayed.
   c) Touch the **Connection Settings** Button.

   Or:

   a) Access the 'Apps' Window by touching the **Applications** Icon.
   b) If necessary, touch the **Settings & Tools** Tab.
   c) Touch the **Connectivity** Button.
   d) If necessary, touch the **Bluetooth** Tab.
   e) Touch the **Settings** Button in the Datalink Bluetooth section of the window.
2 Touch the **Bluetooth** Annunciation Button (the green annunciation indicates the feature is enabled).

PAIRING A BLUETOOTH DEVICE:

NOTE

All devices will have the option to "Auto Reconnect' when the power is cycled.

1 Access the 'Bluetooth Settings' Window:
   a) Access the Audio Panel by touching the **Audio** Button on the CNS Bar at the top of the display.

      Or:

      Touch the **Applications** Icon **> Quick Actions** Tab **> Audio**. ('Bluetooth Settings' may also be accessed through the 'Music' Window by touching the **MENU** Softkey.)
   b) Press the **MENU** Softkey on the side of the bezel the window is displayed.
   c) Touch the **Connection Settings** Button.

   Or:

   a) Access the 'Apps' Window by touching the **Applications** Icon.
   b) If necessary, touch the **Settings & Tools** Tab.
   c) Touch the **Connectivity** Button.

d) If necessary, touch the **Bluetooth** Tab.
e) Touch the **Settings** Button in the Datalink Bluetooth section of the window.

2 Touch the **Pair Device** Button.
3 A 'Pair Devices' window will open. The system may take several minutes to find available devices nearby.
4 If necessary, scroll though the available devices to find and select the device you are trying to pair.
5 The flight display will present a six digit code for verification with the device. Touch the **OK** Button to begin pairing the device. An "Enable Autoreconnect for [name of device]" will appear.
   a) Touch the **Yes** Button to connect to the device.

      Or:

      Touch the **No** Button to cancel the pairing process.

CHANGING A BLUETOOTH DEVICE NAME:

1 Access the 'Apps' Window by touching the **Applications** Icon.
2 If necessary, touch the **Settings & Tools** Tab.
3 Touch the **Connectivity** Button.
4 If necessary, touch the **Bluetooth** Tab.
5 Touch the **Settings** Button for the desired device to complete the name change.
6 Touch the **Bluetooth Device Name** Datafield Button.
7 Use the alpha-numeric keypad to change the device name.
8 Touch the **Enter** Button to accept the change.

   Or:

   Touch the **Back Arrow** to discard the changes.

UNPAIRING (FORGETTING) A BLUETOOTH DEVICE:

1 Access the 'Bluetooth Settings' Window:
   a) Access the Audio Panel by touching the **Audio** Button on the CNS Bar at the top of the display.

      Or:

      Touch the **Applications** Icon **> Quick Actions** Tab **> Audio**. ('Bluetooth Settings' may also be accessed through the 'Music' Window by touching the **MENU** Softkey.
   b) Touch the **MENU** Softkey on the side of the bezel the window is displayed.
   c) Touch the **Connection Settings** Button.

   Or:

   a) Access the 'Apps' Window by touching the **Applications** Icon.
   b) If necessary, touch the **Settings & Tools** Tab.
   c) Touch the **Connectivity** Button.

d) If necessary, touch the **Bluetooth** Tab.

2 Touch the button for the connected device, opening a 'Device Options' window.

3 Touch the **Unpair** Button.

VIEWING THE 'DATALINK BLUETOOTH STATUS' SCREEN:

1 Access the 'Apps' Window by touching the **Applications** Icon.

2 If necessary, touch the **Settings & Tools** Tab.

3 Touch the **Connectivity** Button.

4 If necessary, touch the **Bluetooth** Tab to view all Datalink Bluetooth connections..

SELECTING CREW POSITION FOR GARMIN PILOT APP CONTROL OF CONNEXT BLUETOOTH VOLUME:

1 Touch the **Applications** Icon on the MFW App Bar.

Or:

Press the **MENU** Softkey (on the MFW side of the bezel if in split screen mode).

2 **Settings & Tools** Tab on the 'Apps' Window.

3 Touch the **Connectivity** Button.

4 Touch the **Bluetooth** Tab to view all Datalink Bluetooth connections.

5 Touch the desired device to select a crew position.

6 Scroll if necessary and touch the **Garmin Pilot App Volume Control** Selection Button.

7 Select **Pilot**, **Copilot**, or **None** for the desired crew position for Garmin Pilot control of Connext Bluetooth Volume.

ENABLING/DISABLING FLIGHT PLAN IMPORTING FROM GARMIN PILOT:

1 Navigate to the 'Flight Plan' Application Page.

2 Press the **MENU** Softkey to open the 'Flight Plan Menu'.

3 Touch the **Flight Plan Catalog** Button.

4 Press the **MENU** Softkey.

Or:

Touch the **Menu** Icon at the top right corner of the 'Flight Plan Catalog' Window.

5 Touch the **Allow PED FPL Transfer** Annunciation Button to enable/disable flight plan importing from Garmin Pilot. (A green annunciation indicates the feature is enabled.)

ADJUSTING BLUETOOTH VOLUME:

1 Access the Audio Panel by touching the **Audio** Button on the CNS Bar at the top of the display.

Or:

Touch the **Applications** Icon **> Quick Actions** Tab **> Audio**.

2 Touch the **Music** Button.
3 Ensure the source is set to Bluetooth, and touch the **Volume** Datafield Button.
4 Increase the volume by sliding the adjuster right and decrease the volume by sliding the adjuster left.

Or:

Use the appropriate **DCK**, turning it clockwise to increase volume, or counter-clockwise to decrease the volume.

5 Touch the **Back Arrow** when the adjustment is complete.

RECORDING MODE

Recording Mode will allow monitored audio to be recorded on a device capable of recording audio over Bluetooth (e.g., Garmin VIRB). The GMA will send audio from the flight crew headset to a device connected to the AXIS™ or corresponding GMA for recording. Any Garmin recording device will be enabled by default upon successful pairing.

ENABLING A BLUETOOTH DEVICE AS A RECORDING DEVICE:

1 Touch the **Applications** Icon on the MFW Button Bar.

Or:

Press the **MENU** Softkey (on the MFW side of the bezel if in split screen mode).

2 **Settings & Tools** Tab on the 'Apps' Window.
3 Touch the **Connectivity** Button.
4 Touch the **Bluetooth** Tab to view all Datalink Bluetooth connections.
5 Touch the desired Bluetooth device to set as a recording device.
6 Touch the **MENU** Softkey on the side of the bezel the window is displayed.

Or:

Touch the **Menu** Button in the top right corner.

7 Touch the **Recording Device** Annunciation Button to enable that device as a recording device. (A green annunciation indicates the recording device is enabled.)

8.8 WIRELESS CONNECTIONS

NOTE

If a paired device is lost or stolen, is the victim of malware, or if the Wi-Fi password is exposed or leaked outside of a trusted group, the flight crew or operator shall immediately delete the device from the paired device list and change the Wi-Fi password.

The Wi-Fi Datalink also provides internal Wi-Fi Networks for the aircraft. These network names (SSIDs) and passwords can be modified by the aircrew.

For more information about the Bluetooth connection capabilities, refer to the *Connext* chapter of this section.

CYBERSECURITY

Operators have specific responsibilities around maintaining the cybersecurity of the aircraft and its systems. Regulations require that operators pay close attention to the following items:

- When pairing a Portable Electronic Device (PED) to the system using Bluetooth, the flight crew should always reject a Bluetooth pairing request if the PINs on the PED and Garmin display are not identical or the request originates from any unknown or suspicious device.
- Before activating a flight plan that has been transferred or uploaded from outside of the avionics system, the flight crew should always validate the flight plan is correct.
- If a paired device is lost or stolen, is the victim of malware, or if the Wi-Fi password is exposed or leaked outside of a trusted group, the flight crew or operator should immediately delete the device from the paired device list and change the Wi-Fi password.

ENABLING INTERNAL WI-FI:

1. Access the 'Apps' Window by touching the **Applications** Icon.
2. If necessary, touch the **Settings & Tools** Tab.
3. Touch the **Connectivity** Button.
4. If necessary, touch the **WiFi** Tab.
5. Under the 'Garmin Pilot WiFi' section, touch the **Settings** Button.
6. Touch the **Garmin Pilot WiFi** Annunciation Button (the green indication indicates the feature is enabled).

CHANGING THE WI-FI SSID

1. Access the 'Apps' Window by touching the **Applications** Icon.
2. If necessary, touch the **Settings & Tools** Tab.
3. Touch the **Connectivity** Button.
4. If necessary, touch the **WiFi** Tab.
5. Touch the **Settings** Button.
6. Touch the **WiFi SSID** Datafield Button.
7. Use the alphanumeric keyboard to change the WiFi SSID, then touch the **Enter** Button.

CHANGING THE WI-FI PASSWORD

1. Access the 'Apps' Window by touching the **Applications** Icon.
2. If necessary, touch the **Settings & Tools** Tab.
3. Touch the **Connectivity** Button.
4. If necessary, touch the **WiFi** Tab.
5. Touch the **Settings** Button.
6. Touch the **WiFi Password** Datafield Button.
7. Use the alphanumeric keyboard to change the WiFi Password, then touch the **Enter** Button.

CONNECTING TO INTERNAL WI-FI:

With the **Garmin Pilot WiFi** Annunciation Button enabled, use the PED to connect to the internal WiFi.

8.9 DATA LOGGING

This System supports continual, event-based, life cycle, and exceedance-triggered data logging of flight and aircraft data.

FLIGHT DATA LOGGING

NOTE

Some aircraft installations may not provide all aircraft/engine data capable of being logged by the system.

NOTE

Past flights cannot be viewed directly on Garmin Pilot and need to be pushed to flyGarmin.com® *to access them.*

The Flight Data Logging feature automatically stores critical flight and engine data which includes a default list (approximately 60 parameters). Approximately 25 flight hours are stored to a CMC folder in internal memory.

The logged data is written to the logging folder once each second while the GDU™ is powered on. When the allocated space is fully utilized, the oldest data will be overwritten. This data can then be manually exported when desired to a USB storage device using the USB port on the bezel of the AXIS™ flight display or it can be uploaded to a PED using internal Wi-Fi or bluetooth. Once the data has been transferred to Garmin Pilot, the application can transfer the flight log to the pilot's flyGarmin.com® account for archiving and analysis once the mobile device connects to the Internet.

A number of third party tools are currently available for viewing/graphing these flight data logging files. For example, one tool is capable of directly importing these files into an aircraft specific flight log book. Any flight file in the logbook can be selected for viewing with the engine and flight data superimposed over 2D and 3D earth maps. Flights can be re-flown in 3D using the detailed data available. The data recorded by the Flight Data Logging feature is separate from data recorded by the Central Maintenance Computer (CMC).

All flight data logged on a specific date is stored in a file named in a format which includes the date, time, and nearest airport identifier. The file is created automatically each time the system is powered on. 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:

• Date (YYYY-MM-DD) • Time (Local) • UTC Offset (HH:MM) • Active Waypoint Identifier • Latitude (deg) • Longitude (deg) • Indicated Baro-altitude (feet) • Selected Baro-pressure setting (in/HG) • GPS altitude (MSL) • OAT (degrees C) • Indicated airspeed (kts) • Ground Speed (kts) • Vertical speed (fpm) • Attitude Pitch Angle (deg) • Attitude Roll Angle (deg) • Lateral and Vertical G Force (g) • Heading (degrees) • Aircraft Weight (lbs)	• Track (degrees) • Fuel Qty L/C/R (lbs) • Fuel Flow eng. 1/2 (PPH) • Manifold Pressure eng. 1/2 (in/HG) • RPM eng. 1/2 • Torque eng. 1/2 (ft-lbs) • RPM % Generator Turbine eng. 1/2 • ITT eng. 1/2 (deg. C) • GPS altitude (WGS84) • True Airspeed (kts) • HSI source (NAV1/NAV2/GPS) • Selected course (deg) • Nav1/Nav2 frequency (MHz) • Com1/Com2 frequency (MHz) • Horizontal/Vertical CDI • Wind Speed (kts) • Wind Direction (deg)	• Distance to next waypoint (NM) • Bearing to next waypoint (deg) • Magnetic variation (deg) • Autopilot On/Off • Autopilot roll/pitch mode • Autopilot roll/pitch command • GPS vertical speed (fpm) • GPS fix • GPS horizontal alert limit • GPS vertical alert limit • WAAS GPS horizontal protection level (1/2) • WAAS GPS vertical protection level (1/2) • GPS horizontal protection level (1/2) • GPS vertical protection level (1/2) • Position Fix Mode

The file containing the recorded data will appear in the format shown in the following figure. This file can be imported into most computer spreadsheet applications.

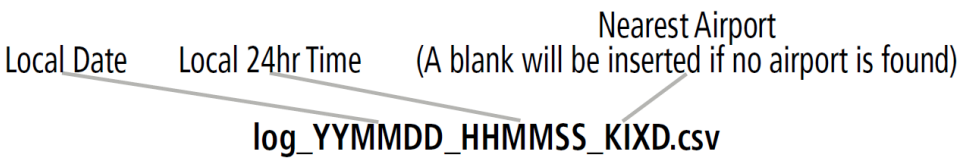


Figure 317: Flight Data Log File Format

CENTRAL MAINTENANCE COMPUTER DATA LOGGING

Central Maintenance Computer (CMC) Data Logging automatically stores avionics data, events/faults, exceedances, and aircraft logs. Each designated GDU allocates 8 GB of non-volatile internal memory dedicated for CMC data log storage. This feature is useful for system integration, maintenance diagnostics, maintenance scheduling, return to service, and in-flight reporting of failure status.

All CMC data logged on a specific date is stored in a file named in a format which includes the aircraft bureau number, engine serial numbers, flight date, and time. The file is created automatically each time the system is powered on. The .csv file may be viewed with Microsoft Excel or other spreadsheet applications.

The file containing CMC recorded data will appear in the format shown in the following figure. This file can be imported into most computer spreadsheet applications.

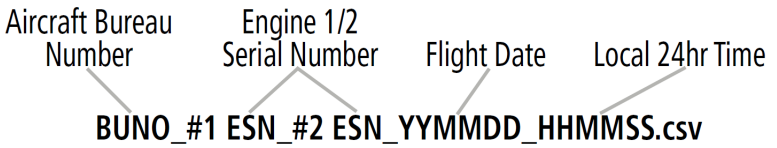


Figure 318: CMC Data Log File Format

The following image is an example of how the file could be named.

761551_228039_226729_200329_151208.csv

Figure 319: CMC Data Log File Name Example

EXPORTING FILES AND DATA STREAMING TO A PED

The system can use the internal Wi-Fi to export files to a Personal Electronic Device (PED) running the Garmin Pilot app (or approved partner app) when on ground or in flight. When streaming is enabled, the internal Wi-Fi can also stream flight log entries to the Garmin Pilot app. The AXIS™ flight display exports files to the PED and then the files are delivered in .CSV format once the PED establishes an internet connection with the flyGarmin server.

FLIGHT DATA LOG MANAGEMENT

The system retains historical snapshots of the Aircraft Log data for up to 1,000 flights. The snapshot log files are stored in a circular buffer similar to CMC data log storage. Therefore, upon reaching the configured maximum number of logs, the snapshot from the latest flight will replace the oldest snapshot file. An aircraft log can be deleted similar to the CMC log.

VIEWING SYSTEM LOGS

1. Navigate to the 'Apps' Window:

   Touch the **Applications** Icon on the MFW.

   Or:

   Press the **MENU** Softkey two times.
2. Touch the **Settings & Tools** Tab.
3. Touch the **Flight Data** Button.
4. Touch the **View All** Button.
5. Scroll to view all the system logs. If filtering is desired, continue to the next steps.
6. Touch the **Log Filters** Selection Button.
7. Filter the content by touching any or all of the following:
   - **Airport** Annunciation Button
   - **Size** Annunciation Button
   - **Status** Annunciation Button
   - **Date Range** Annunciation Button

8 Touch the associated **Filter** Selection Button for the four annunciation buttons to enter more detailed criteria narrow the search results.

9 Press the **BACK** Softkey (on the Data Log side of the bezel if in split screen mode) or touch the **Back Arrow** to view the filtered data logs.

EXPORTING LOGS

1 Navigate to the 'Apps' Window:

Touch the **Applications** Icon on the MFW.

Or:

Press the **MENU** Softkey two times.

2 Touch the **Settings & Tools** Tab.

3 Touch the **Flight Data** Button.

4 If desired, change the export path by touching the **Manual Export Path** Selection Button and select the desired path for export.

Touch the **Export All** Button to begin the export process of all data logs in the system.

Or:

Touch the **Export Unexported** Button to only export the data logs that have not yet been exported.

Or:

a) Touch the **View All** Button to view all data logs.
b) Scroll the list of data logs as necessary and touch the data log that is to be exported.
c) If desired, change the export path by touching the **Manual Export Path** Selection Button and select the desired path for export.
d) Touch the **Export** Button.

5 A confirmation window will open verifying the export should take place. Touch the **OK** Button to continue the export.

Or:

Touch the **Cancel** Button to cancel the export.

6 After the export has begun, touch the **Cancel Export** Button to cancel all exports of the data logs.

8.10 AUXILIARY VIDEO

The display of auxiliary video information enhances situational awareness, provides entertainment, and if applicable, allows for visual monitoring of the inside or outside of the airplane. The display of auxiliary video is crew-selectable. AXIS™ display units are compatible with one external HDMI video source. If multiple displays are installed, the pilot is able to view auxiliary video of one source on any of the displays. Video has the ability to be viewed in Full screen, Split Screen, or in an inset window on the display.

AUX VIDEO LAYOUT

The system has four options to change the layout of the video picture to adjust screen fitting and aspect ratio:

- **Fit** — As the default selection, this layout sizes the image to be as large as possible while fitting the entire image within the layout area and maintaining its aspect ratio.
- **Fill** — This layout sizes the image to be as small as possible while filling the entire layout area and maintaining its aspect ratio.
- **Match Height** — This layout sizes the video to stretch the image to fill the height of the display while maintaining its aspect ratio.
- **Match Width** — This layout sizes the video to stretch the image to fill the width of the display while maintaining its aspect ratio.

If applying Fill, Match Height, or Match Width, some of the image may be cut off from view in the display area.

ACCESSING THE AUXILIARY VIDEO PAGE:

Use the Outer **DCK** (on the MFW side of the bezel if in split screen mode) to scroll to the 'Video' Application Page.

Or:

a) Touch the **Applications** Icon.
b) Touch the **MENU** Softkey two times in succession.
c) If necessary, touch the **Primary** Tab.
d) Touch the **Video** Button to open the 'Video' Application Page.

CHANGING THE VIDEO LAYOUT:

1 Navigate to the 'Video' Application.
2 Press the **MENU** Softkey (on the MFW side of the bezel if in split-screen mode).
3 Touch the **Layout Scheme** Selection Button.
4 Touch **None**, **Fit**, **Fill**, **Match Height**, or **Match Width**.

ADJUSTING VIDEO COLOR CORRECTION PARAMETERS:

1 Navigate to the 'Video' Application.
2 Press the **MENU** Softkey (on the MFW side of the bezel if in split-screen mode).
3 Use the **Brightness** Horizontal Slider to adjust the Brightness.

Or:

4 Use the **Contrast** Horizontal Slider to adjust the Contrast.

Or:

5 Use the **Saturation** Horizontal Slider to adjust the Saturation.

Use the **DCK** to adjust the setting by using the following steps.

a) Push the **DCK** on the MFW side of the bezel if in split-screen mode.

b) While the cyan outline is flashing, turn the Inner **DCK** clockwise to increase the setting and counter-clockwise to decrease the setting.
c) Push the **DCK** again on the MFW side of the bezel if in split-screen mode to accept the change to the display setting.

8.11 EMERGENCY PAGE OPERATIONS

The 'Emergency' Page is a feature intended to assist the pilot in an emergency with the process of Aviate, Navigate, Communicate. If one or more emergency checklists are present, the emergency page will also provide quick access to those checklists for assistance in resolving the emergency. The 'Emergency' Page is accessed by pressing the **EMER** Softkey, or if enabled, touching the **EMER** Button on the Audio & CNS Bar at the top of the display.

The 'Emergency' Page consists of the following features:

- A **Smart Glide** Button which is discussed in more detail later in this section and is only available if a glide speed is configured.
- An Emergency Descent Button
- An AFCS must be installed and configured for the following features to function:
  - An **Activate 180° Turn** Button which will activate the AFCS lateral Heading Mode, and the Vertical Speed Mode to zero. When activated a short-term banner will appear below the HSI, "Emergency 180° Turn in Progress".
  - A **Level Mode** Button which activates the AFCS Level Mode (refer to the *Level Mode* discussion in the AFCS Section for more details).
- A 'Nearest Airport' or 'Best Airport' identifier is displayed with distance/bearing information to that airport. The following criteria dictate the best airport or nearest indications:
  - 'Best Airport' — (Only available when Smart Glide™ is enabled) Displayed when a glide speed is configured and an airport is within glide range.
  - 'Nearest Airport' — Is displayed whether glide speed has been configured or not, and shows the distance and direction to the closest airport. When glide speed is configured, the nearest airport might not always be within glide range.
- A **Change Airport** Button that only allows the pilot to change the airport when Smart Glide is active, and there are multiple airports within glide range that are suitable to land at (meet configured landing criteria). When pressed opens a 'Smart Glide Alternate Airport' Window that lists all available airports with runway dimensions and bearing/distance information to each one.
- A map is displayed that automatically zooms out far enough to view the entire glide range ring. If glide speed is not configured the map will zoom to a distance to show the nearest airports.
- The aircraft 'Current Position' is displayed below the map. This is displayed as distance and direction from the neareast airport accompanied by the altitude above ground level (AGL).
- Two communication radio frequencies buttons and a transponder emergency button is displayed at the bottom of the 'Emergency' Page. If no COM or XPDR is configured to

interface with the AXIS™, these fields are displayed as data fields only for situational awareness.

- Two COM Buttons — One will display the emergency frequency, the other will display the tower or CTAF frequency for the best/nearest airport. When pressed a window prompts the pilot to load the frequency into the active or standby frequency of the radio(s).
- Transponder Button — Displaying the emergency transponder frequency, it will prompt the pilot to set the transponder to that frequency when pressed.

- If emergency checklists are loaded into the system, the 'Emergency' Page will provide a button that quickly accesses the Checklists application. If accessed through the 'Emergency' Page, the "back" operation will reopen the 'Emergency' Page.

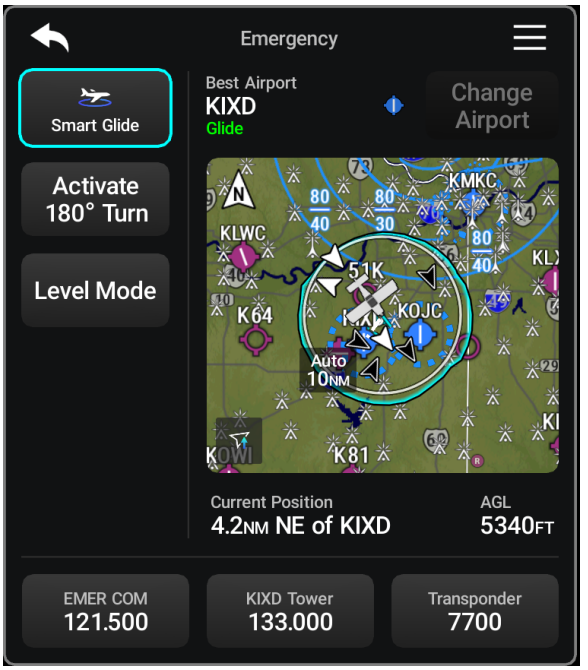


Figure 320: 'Emergency' Page Overview

ENABLING/DISABLING THE EMERGENCY PAGE BUTTON ON THE DATA BAR

1. Access the 'Apps' Window by touching the **Applications** Icon on the MFW App Bar.

   Or:

   Press the **MENU** Softkey two times.
2. Touch the **Settings & Tools** Tab.
3. Touch the **Display** Button.
4. Touch the **Data Bar** Button.
5. Touch the **Emergency Button** Selection Button.
6. Select **Enabled** or **Disabled** for the desired preference of the Emergency Page Button to be displayed on the Data Bar.

SMART GLIDE EMERGENCY OPERATIONS

⚠ WARNING

Smart Glide™ is NOT Emergency Auto Land. The pilot of the aircraft must manually manipulate the controls and make configuration changes (gear, flaps, etc.) to safely land the aircraft.

⚠ CAUTION

*Smart Glide is armed, meaning it is available for activation, after passing through 1,000 feet above ground level (AGL) after takeoff. Up until that point Smart Glide cannot be activated. Smart Glide remains armed and available for use throughout the remainder of the flight until the aircraft descends below 200 feet AGL. The **Smart Glide** Button on the 'Emergency' Window is subdued when Smart Glide is not armed.*

⚠ CAUTION

During an emergency glide while coupled to the AFCS, up to 30 degrees of bank may be reached when initiating a turn to get on course.

NOTE

*The transponder emergency frequency will not be automatically set and the pilot will need to activate the emergency code manually or with the Emergency **Transponder** Button on the 'Emergency' Page.*

NOTE

When a CTAF or Tower frequency cannot be identified for the selected airport, the standby frequency is automatically tuned to 121.500.

NOTE

If desired, the pilot may adjust the airspeed using the pitch wheel.

Smart Glide is designed to assist the pilot by enhancing situational awareness and providing helpful automation during an emergency inoperative engine event. To activate Smart Glide press the optionally installed cockpit mounted SMART GLIDE Button or press and hold the **Direct-To** or **EMER** Softkeys until Smart Glide is activated. Smart Glide can also be activated in the 'Emergency' Page using the **Smart Glide** Button. When Smart Glide is active, the **EMER** Button on the Data Bar is replaced with a Glide Button and the **Smart Glide** Button on the 'Emergency' Page is replaced with a **Cancel Glide** Button.

When Smart Glide is activated the aural alert, "Smart Glide Active, Engaging Autopilot, Airport [XX] O'clock, [XX] Miles" is heard ("Engaging Autopilot" is only heard if an AFCS is installed and configured). If no airport is within glide range the annunciation "No airports within glide range" is played. The 'Emergency' Window is opened and if more than one AXIS™ flight display is installed the 'Map' Application Page will open with the VSD inset displayed. The active COM standby frequency will be loaded with the CTAF/Tower frequency of the nearest airport, if more than one radio is operational the inactive COM standby frequency will be loaded with the emergency frequency (121.5 MHz).

Once initiated, Smart Glide performs an airport selection algorithm to determine the most suitable landing location within the aircraft's glide range. The algorithm is an optimization scheme that considers several factors including runway attributes, distance, and wind. The routing algorithm determines a path to the chosen airport that avoids terrain and obstacles. The flight director and Automatic Flight Control System (AFCS) is automatically activated to provide lateral and speed guidance along the route. If no airport is within glide range, the AFCS will couple ROL and IAS Modes.

The AXIS flight display monitors the performance of the descent throughout the glide to the airport environment. If the destination airport falls out of the glide range, the aural alert 'Airport Out of Range' is played. The AXIS will attempt to establish a new destination airport, if a suitable airport can be located.

When the system determines there is not a suitable airport within glide range, the alert message 'No Airport - Find Alternate Landing Area' is displayed on the Emergency Page and the aural alert "No Airports Within Glide Range" is played. When the AFCS is enabled, the flight director modes are ROL with a wings level roll attitude and IAS with a configured best glide speed reference. The autopilot automatically engages and follows the Smart Glide flight director guidance.

When determining if an airport is within range, the system uses the configured Sink Rate at V_G value. When under partial power, range will be greater than expected by the system. The system monitors for suitable runways that may come into glide range; if an airport comes into glide range, the AXIS flight display provides that airport as a Smart Glide option in the 'Alternate Airports' List for selection by the pilot. The flight director and autopilot remain engaged until pilot action is taken.

Smart Glide assists the pilot with three critical components for a safe recovery from an engine failure:

- Vertical and lateral guidance is provided by setting the airspeed bug to the best glide speed
- Setting the altitude bug to the field elevation of the nearest airport (if no airport is within glide range the altitude bug will be removed)
- Provides GPS guidance to the nearest airport. If an AFCS is installed the following vertical and lateral guidance is automatically armed:
  - IAS Mode with configured Best Glide airspeed reference.
  - GPS Mode with guidance to suitable landing surface (if one is available) or ROL Mode if no suitable landing area is within glide range.
- Provides quick access to relevant communication channels and emergency checklists

If the aircraft arrives to the airport environment with too much altitude to make a landing, Smart Glide will calculate and provide guidance for a series of descending spirals that can be flown coupled to the AFCS to reduce the excess altitude. This function is intended to provide the pilot sufficient excess energy to hand fly and align the aircraft with the desired runway for landing. Only one spiral is added to the end of the guidance at a time, each successive spiral is added when nearing the end of the current spiral to ensure there is enough altitude to maintain flight.

When the automatic route guidance is nearing its end, the system will provide the following audio and visual alerting to prepare the pilot to begin preparation for landing:

NOTE

The AFCS (when installed) will not automatically disengage.

- Audio Annunciations
  - "Approaching Airport" — Announced when the aircraft is inside 4NM of the airport.
  - "Maneuver and Land, Airport [xx] O'clock, Two Miles" — Announced when two miles from the airport.
  - "Disconnect Autopilot" — If an AFCS is installed and configured this will be announced immediately following the "Maneuver and Land" aural annunciation.
  - If no airport is within glide range, the callouts for 2000ft and 1000ft will be announced.
- Visual Annunciations:
  - Attitude indicator — Maneuver and Land
  - 'Map' Application — Smart Glide: Maneuver and Land
  - Emergency Page — Maneuver and Land

SMART GLIDE OPERATIONAL BEHAVIOR FOR MAP OVERLAYS

When the Map Overlay is set to **Off** before Smart Glide activation, Smart Glide automatically changes the Map Overlay to **Terrain**. During Smart Glide operation, the pilot may change the Map Overlay selection as desired. If or when Smart Glide is deactivated, the Map Overlay is restored to the **Off** setting as it was before Smart Glide was activated.

Smart Glide does not change the Map Overlay setting if **Terrain** or **Weather** is selected before activation. The selected overlay remains enabled during Smart Glide operation, and the pilot can continue to modify the Map Overlay selection as needed. If or when Smart Glide is deactivated, the system keeps the Map Overlay most recently selected by the pilot and does not return to the overlay setting that was active prior to Smart Glide activation.

For other settings that have a Smart Glide default value, Smart Glide activation temporarily applies the associated default setting during operation. The pilot may modify the setting while Smart Glide is active. If or when Smart Glide is deactivated, the system restores the setting to the value selected before Smart Glide activation. This behavior is consistent with overlay behavior when the Map Overlay is initially set to **Off**.

For settings that do not have a Smart Glide default value, Smart Glide does not modify the setting during operation. The pilot may continue to adjust the setting as desired while Smart Glide is active, and the system preserves the last pilot-selected value if or when Smart Glide is deactivated. This behavior is consistent with overlay behavior when the Map Overlay is initially set to **Terrain** or **Weather**.

GLIDE RANGE INDICATIONS

⚠ CAUTION

If any aircraft configuration changes are made (e.g., flaps, gear), it may take up to 30 seconds for the system to determine the new glide ratio.

The Glide Range provides two types of indications on the moving map, a Range Ring and Best Glide Airport indication. These indications are enabled individually or concurrently in the Map Settings. The Range Ring is displayed in cyan and is based on the configured glide ratio, terrain, obstacles, and winds (Datalink winds aloft are the primary source for computing glide range, when not available, the secondary source for glide range effected by wind is the FMS). The Range Ring also takes into account the increased descent rate in a turn. When Smart Glide is enabled the cyan ring is replaced with an amber ring, the system begins to measure the actual real-time glide ratio and updates the Range Ring accordingly. This is indicated by a change in the Range Ring shape and size.

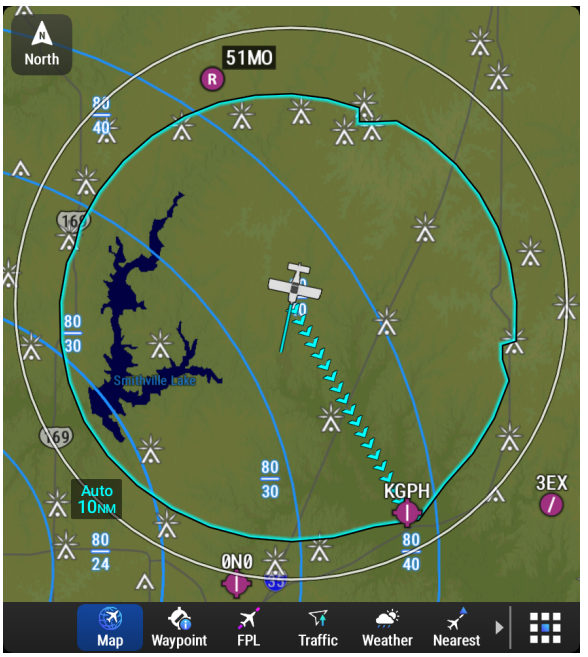


Figure 321: Glide Range Ring with Glide Chevrons

The Best Glide Airport indication provides situational awareness on the 'Map' Application page with chevrons connecting the aircraft's location to the nearest appropriate airport within the Range Ring. A bearing pointer can also be set to indicate the direction to the Best Glide Airport (for more information on bearing pointers refer to the discussion in Flight instruments on *Bearing Pointers*. The 'Nearest' Application page will provide a cyan box around the airport symbol specifying if an airport is within glide range. The system identified Best Glide Airport has a cyan "Best Glide" annunciation on the airport information button as seen in the figure below.

Figure 322: Best Glide Airport Indications on 'Nearest' Application Page

ENABLING GLIDE RANGE RING ON THE 'MAP' APPLICATION PAGE

1. With the 'Map' Application Page on the MFW, press the **MENU** Softkey (on the 'Map' side of the bezel if in split screen mode).
2. Touch the **Map Settings** Button.
3. If necessary, touch the **General** Tab.
4. Touch the **Glide Range Ring** Annunciation Button to enable or disable the Glide Range Ring. The green annunciation indicates the feature is enabled.
5. To change the Glide range type:
   a) Touch the **Glide Range Type** Selection Button.
   b) Touch the type of range ring to be displayed on the map (**Ring Only/Glide Only/Ring and Glide**.

VSD DISPLAY WITH SMART GLIDE ACTIVE

The vertical situation display provides a visual indication of the margin available to get to the landing location. If the airplane symbol is higher than the depicted "Too Low" zone, the airplane is higher than necessary to get to the landing zone. If the airplane symbol is lower than the top of the "Too Low" zone, the aircraft may not be high enough to get to the selected landing location (the pilot should be looking for an off-airport landing).

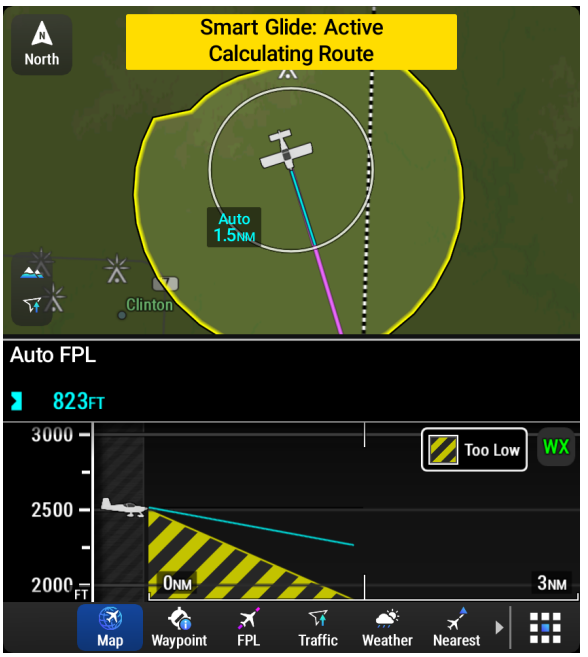


Figure 323: Smart Glide VSD Too Low Display

ENABLING/DISABLING SMART GLIDE:

1 Press the **EMER** Softkey.

Or:

Touch the **EMER** Button on the Data Bar at the top of the display (if enabled in display settings).

2 Press the **MENU** Softkey (on the MFW/'Emergency' Window side of the bezel if in split screen mode).

Or:

Touch the **Menu** Icon in the top right corner of the 'Emergency' Window.

3 In the 'Emergency Menu' touch the **Smart Glide Enabled** Annunciation Button. The green annunciation indicates the feature is enabled.

ACTIVATING SMART GLIDE (PREFERRED METHODS):

There are multiple ways to activate Smart Glide™. The following procedures are listed in order of precedence based on the quickest way to activate Smart Glide.

Press the optionally installed cockpit mounted SMART GLIDE Button.

Or:

Hold the **EMER** Softkey for approximately four seconds.

Or:

Hold the **Direct-To** Softkey for approximately four seconds.

ACTIVATING SMART GLIDE (SECONDARY METHODS):

1 Using the 'Emergency' Page:
   a) Press the **EMER** Softkey.

      Or:

      Touch the **EMER** Button on the Data Bar at the top of the display (if enabled in display settings).
   b) Touch the **Smart Glide** Button.
2 Using the Applications Icon Window:
   a) On the MFW App Bar, touch the **Applications** Icon.
   b) Touch the **Quick Actions** Tab.
   c) Touch the **Emergency** Button.
   d) Touch the **Smart Glide** Button.

AUTOPILOT OPERATION WITH ACTIVE SMART GLIDE

The autopilot engages servos when the aircraft is more than 2 NM from the destination airport. Coupling will not occur if less than 2 NM; however, the autopilot will remain coupled if servos are already engaged. Flight director modes activate as follows:

- Airport within Smart Glide range ring:
  - Lateral Mode — AFCS couples GPS mode and begins flying route towards nearest suitable airport.
  - Vertical Mode — AFCS couples IAS mode and pitch the aircraft to the best glide speed.
- If no Airport is with Smart Glide range ring:
  - Lateral Mode — AFCS couples ROL mode and maintains wings level.
  - Vertical Mode — AFCS couples IAS mode and pitch the aircraft to the best glide speed.

SMART GLIDE CANCELLATION

In the event engine power is restored at any point, the pilot may cancel the emergency glide by touching the **Cancel Glide** Button in the 'Emergency' Window. The flight director will remain engaged in the previously selected lateral and vertical modes. If in GPS mode, the lateral mode will revert to ROL. The AFCS will remain engaged.

CANCELING SMART GLIDE

1 With the 'Emergency' Window open and Smart Glide™ active, touch the **Cancel Glide** Button.
2 The prompt "Exit Smart Glide?" will open. Touch the **Yes** Button to confirm cancellation.

   Or:

   Touch the **No** Button to continue in Smart Glide.

8.12 ABNORMAL OPERATIONS

DATALINK TROUBLESHOOTING

For troubleshooting purposes, check the LRU Information Box on the ‘Avionics Status’ Page for the LRU in question status, serial number, and software version number. If a failure has been detected, the LRU status is marked with a red ‘X’.

QUICK TROUBLESHOOTING

Some quick troubleshooting steps listed below can be performed to find the possible cause of a failure.

- Ensure the installed hardware has an active subscription or account.
- Perform a quick check of the circuit breakers to ensure that power is applied to the applicable hardware.

SECTION 9 APPENDICES

9.1 APPENDIX A (SYSTEM MESSAGING)

NOTE

The current version of the pertinent flight manual supersedes information found in this document. Refer to the current version of the pertinent flight manual for recommended pilot actions.

NOTE

This section provides information regarding system messages that may be displayed by the system. Knowledge of the aircraft, systems, flight conditions, and other existing operational priorities must be considered when responding to a message. Always use sound pilot judgment. The current version of the pertinent flight manual takes precedence over any conflicting guidance found in this section.

The flight display will provide multiple forms of messages and alerts for the pilot or crew to make sound aeronautical decision making. These messages and alerts include the following:

- System Alert Window — A dedicated section of the display to announce Warnings, Cautions, and Advisories.
- PFW/MFW Indications — Alerts providing situational awareness to the pilot or crew and have dedicated locations around the display.
  - Red or Yellow X Indications — Replaces a display field on the PFW when it is no longer receiving data, or the data is invalid.
  - Red or Yellow EIS Indications —Indicates the engine parameter has exceeded a warning or caution threshold and the appropriate action must be taken to correct the condition causing the parameter exceedance.
- CNS Bar Indications — Indications to the pilot or crew of a situation with the communication and transponder systems.
- AFCS Box Annunciations — Used to display functional operations of the AFCS. (See the *AFCS Status Box* portion of the AFCS section for more information)
- System Messages — Accessed by navigating to the System Messages window, this is where all messages are stored for the pilot or crew to refer back to while the aircraft is in the air.
  - Banner Messages — An informational System Message displayed on the lower banner of the display related to system faults, FMS and navigation information, and other pertinent information.
- Maintenance Messages — Primarily accessed through the System Messages window, these messages will trigger the Banner Messages Button at bottom of the display to flash only when the aircraft is on the ground.
- Pop Up Messages — Similar to PFW/MFW indications, these messages alert the crew to unexpected situations (e.g., Traffic, Terrain, or Missed Approach).
- HSI Indications — These indications appear inside the HSI on the PFW and alert the crew to navigation discrepancies.

SYSTEM ALERT MESSAGES

The System Alert Window display shows warning (red), caution (amber), and advisory (white) messages to alert the crew to system malfunctions. Warning and caution messages display a flashing inverse video until acknowledged. Warning messages appear at the top of the display area, followed by the caution messages, followed by advisories. Warning messages are accompanied by a triple chime and caution messages are accompanied by a single chime aural alert. Some messages include voice alerts. A maximum of seven messages can be displayed in the System Alert Window. When the number of active messages exceeds seven, the seventh message is replaced with "WARN", "CAUT", or "ADVSRY" with the number of messages accompanied by a down arrow is displayed next to it. To view the full list of System Alert Messages touch the System Alert Window Indicator Button on the PFW to open the 'Messages' Window.

Figure 324: System Aleert Window on PFW

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

Any System Alert Window messages that come up when the system is first powered on are considered already acknowledged. All messages are displayed until the issue has been corrected.

A System Alert Window message does not appear more than once at a given time (unless the System Alert Window is being tested). If signals are received that justify multiple priorities for a certain message, the message is displayed for the higher priority condition. When graduating to a higher priority, requires new acknowledgment. When degrading to a lower priority condition, the message moves to the top of the appropriate grouping, but does not require new acknowledgment.

WARNING MESSAGES

See the current version of the pertinent flight manual for recommended pilot actions. Warning Messages are accompanied by a triple chime alert and may have an aural alert.

Severity Level	Alert Text	Description
Warning	STALL	The aircraft is approaching a stall.
Warning	ECB FAIL	VP-X Installations Only. The VP-X Electronic Circuit Breaker System has failed.
Warning	ECS FAIL	The system cannot establish communication with an expected GAD 27 ECS module.
Warning	SPEED BRAKE	Left or Right speed brake is not closed while above speed brake airspeed or speed brake engine power.
Warning	CANOPY OPEN	The aircraft canopy is not closed and, the aircraft is in air or the engine power is above a given threshold.
Warning	DOOR OPEN	The aircraft door is not closed and the aircraft is in air.
Warning	CHECK GEAR	The landing gear is in the wrong configuration.
Warning	GEAR UNSAFE	The landing gear is in an unsafe configuration.
Warning	VP-X AMPS	VP-X Installations Only. The VP-X Electronic Circuit Breaker System has exceed its total current limit (48 A for Caution and 60 A for Warning).
Warning	EGT TEMP	Exhaust Gas Temperature is within the configured warning range.
Warning	CHT TEMP	Cylinder Head Temperature is within the configured warning range.
Warning	OIL TEMP	Oil Temperature is within the configured warning range.
Warning	CARB TEMP	Carburetor Temperature is within the configured warning range.
Warning	TIT	Turbine Inlet Temperature is within the configured warning range.
Warning	FUEL LVL 1-6	Fuel Level is within the configured warning range of the specified fuel cell.
Warning	FUEL PRESS	Detected Fuel Pressure is within the configured warning range.
Warning	OIL PRESS	Detected Oil Pressure is within the configured warning range.
Warning	RPM	Engine RPMs are within the configured warning range. (A number will specify which system when two are configured.)
Warning	RPM1/2	
Warning	MAN PRESS	Manifold Pressure is within the configured warning range.

Severity Level	Alert Text	Description
Warning	VOLTS1/2	System Voltage is within the configured warning range.
Warning	FUEL FLOW	Fuel Flow is within the configured warning range.
Warning	AMPS1/2	System Amperage is within the configured warning range. (A number will specify which system when two are configured.)
Warning	AMPS	
Warning	AMPS M	Main Bus Amperage is within the configured warning range.
Warning	AMPS E	Essential Bus Amperage is within the configured warning range.
Warning	BATT AMPS	Battery Amperage is within the configured warning range.
Warning	ALT AMPS	Alternator Amperage is within the configured warning range. (A number will specify which system when two are configured.)
Warning	ALT AMPS 1/2	
Warning	ELEV TRIM	Elevator trim is not in take-off position.
Warning	AILERON TRIM	Aileron trim is not in take-off position.
Warning	COOLANT TEMP	A Coolant Temperature tolerance has been exceeded
Warning	RUDDER TRIM	Rudder trim is not in take-off position.
Warning	COOLANT PRESS	A configured coolant pressure tolerance has been exceeded.
Warning	FLAP POS	Dependent on system configuration. The flaps in their current position, given the speed of flight, could cause structural damage to the airframe.
Warning	GP PRESS	General Purpose Pressure Warning: A user defined pressure limitation has reached the configured warning range.
Warning	TORQUE	A configured torque tolerance has been exceeded.
Warning	ECS VOLTS 1/2	The GAD 27 voltage is within a caution or warning range.
Warning	ECS AMPS 1/2	The GAD 27 current is within a caution or warning range.
Warning	THROTTLE	The FADEC engine throttle is within a warning range.
Warning	CDT TEMP	Engine compressor discharge temperature is within a warning range.
Warning	IAT TEMP	Engine intake air temperature is within a warning range.
Warning	CDT-IAT TEMP	Engine CDT-IAT differential is within a warning range.
Warning	ENGINE ECU	The FADEC system is reporting a warning alert.
Warning	ENG1/2 ECU	The FADEC system is reporting a warning alert for the specified engine.
Warning	SPO2 LEVEL	Finger detected and pulse oximeter readings are NOT within the acceptable range.
Warning	CHECK SPO2	The pulse oximeter has read a oxygen concentration value that isn't acceptable AND a finger is no longer detected in the sensor.

CAUTION MESSAGES

See the current version of the pertinent flight manual for recommended pilot actions.

Severity Level	Alert Text	Description
Caution	TER FAIL	Terrain alerting is inoperative.
Caution	TER N/A	Terrain alerting is not available. This can be caused by a temporary inability of the system to support terrain alerting , such as insufficient GPS position integrity or being outside of terrain data coverage.
Caution	TAWS FAIL	TAWS is inoperative.
Caution	TAWS N/A	TAWS alerting is not available. This can be caused by a temporary inability of the system to support TAWS operation, such as insufficient GPS position integrity or being outside of terrain data coverage.
Caution	TRAFFIC FAIL	Traffic system is inoperative.
Caution	TAS FAIL	TAS system is inoperative.
Caution	TCAS FAIL	TCAS system is inoperative.
Caution	USING GPS1/2	The system has reverted to using only one GPS.
Caution	GPS1/2 FAIL	Indicates a failure of the GPS.
Caution	VLOC1/2 FAIL	A failure exists in the VOR radio system.
Caution	GPS1/2 NO POS	The specified GPS position data is unavailable.
Caution	VGPS NO POSN	VFR GPS position data is unavailable.
Caution	UNABLE RNP	The estimated position error exceeds the current RNP level or a loss of integrity occurs and an approach is active prior to the FAF.
Caution	GDU FPL SYNC	A GDU has stopped communicating over HSDB and the flight plan may be out of sync between GDUs.
Caution	CO FAIL	The configured carbon monoxide detector has either failed, or lost communication with the system.
Caution	CO FAULT	The carbon monoxide detector is faulted.
Caution	CO/O2 FAULT	The carbon monoxide detector and pulse oximeter are faulted.
Caution	SPO2 FAULT	The pulse oximeter within the carbon monoxide detector is faulted.
Caution	CHECK SPO2	The reminder has been triggered to check your oxygen concentration levels, but no finger is detected or there is some fault in the pulse oximeter.
Caution	CO LEVEL	Carbon monoxide levels have exceeded the allowable limits based on concentration and time.
Caution	RAGL MISCOMP	Radio derived AGL from a GHA 15, and GPS AGL height differ by more than 1000 feet for more than 5 seconds. Cross reference with other instruments.
Caution	AHRS[1/2/3] ALIGN	The specified AHRS is aligning or in a degraded state.

Severity Level	Alert Text	Description
Caution	AOA FAIL	The AOA unit has failed. Angle of attack data from this unit is unavailable.
Caution	ADAHRS[1/2/3] FAIL	AHRS, ADC and AOA functions on the specified unit have failed.
Caution	ADC[1/2/3] FAIL	The specified ADC unit has failed. Air data from this unit is unavailable.
Caution	AHRS[1/2/3] FAIL	The specified AHRS unit has failed. Attitude data from this unit is unavailable.
Caution	RAGL FAIL	A configured GHA 15 has failed. Radio derived AGL data is unavailable.
Caution	EIS 1/2 FAIL	The specified EIS unit has failed. Engine information from this unit is unavailable.
Caution	CANOPY OPEN	The aircraft canopy is not closed.
Caution	DOOR OPEN	The aircraft door is not closed.
Caution	CHECK GEAR	The gear position cannot be determined.
Caution	GEAR FAULT	A landing gear fault is detected.
Caution	PITOT TEMP	Pitot heat is enabled and is cold.
Caution	FLAPS DOWN	Aircraft flaps are down.
Caution	VP-X ERROR	VP-X Installations Only. There was an error with the VP-X Electronic Circuit Breaker System self-test.
Caution	VP-X AMPS	VP-X Installations Only. The VP-X Electronic Circuit Breaker System has exceed its total current limit (48 A for Caution and 60 A for Warning).
Caution	VP-X FAULT	VP-X Installations Only. The VP-X Electronic Circuit Breaker System is reporting a device fault.
Caution	TRIM FAULT	VP-X Installations Only. Trim control via the VP-X Electronic Circuit Breaker System has faulted.
Caution	FLAP FAULT	VP-X Installations Only. Flap control via the VP-X Electronic Circuit Breaker System has faulted.
Caution	FLAP SPEED	The aircraft has exceed the max flap speed.
Caution	ALT FAULT	VP-X Installations Only. The alternator connected to the VP-X Electronic Circuit Breaker System has faulted.

Severity Level	Alert Text	Description
Caution	ALT1 FAULT	VP-X Installations Only. The primary alternator connected to the VP-X Electronic Circuit Breaker System has faulted.
Caution	ALT2 FAULT	VP-X Installations Only. The auxiliary alternator connected to the VP-X Electronic Circuit Breaker System has faulted.
Caution	ENGINE ECU	The FADEC system is reporting a caution alert.
Caution	ENG1/2 ECU	The FADEC system is reporting a caution alert for the specified engine.
Caution	XPDR FAIL	A failure condition exist with the transponder.
Caution	XPDR STBY	The transponder is in standby mode.
Caution	PFD1/2/3 FAIL	The specified display is expected in the system, and is not seen on the common network.
Caution	MFD1/2/3 FAIL	The specified display is expected in the system, and is not seen on the common network.
Caution	ALERT AUD FAIL	The audio alert function of the system has failed. Audio alerts may not be heard while this condition exists.
Caution	EGT TEMP	Exhaust Gas Temperature is within the configured caution range.
Caution	CHT TEMP	Cylinder Head Temperature is within the configured caution range.
Caution	OIL TEMP	Oil Temperature is within the configured caution range.
Caution	CARB TEMP	Carburetor Temperature is within the configured caution range.
Caution	TIT	Turbine Inlet Temperature is within the configured caution range.
Caution	FUEL LVL 1/2/3/4/5/6	Fuel Level is within the configured caution range of the specified fuel cell.
Caution	FUEL PRESS	Detected Fuel Pressure is within the configured caution range.
Caution	OIL PRESS	Detected Oil Pressure is within the configured caution range.
Caution	RPM	Engine RPM's are within the configured caution range. (A number will specify which system when two are configured.)
Caution	RPM1/2	
Caution	MAN PRESS	Manifold Pressure is within the configured caution range.
Caution	VOLTS1/2	System Voltage is within the configured caution range.
Caution	FUEL FLOW	Fuel Flow is within the configured caution range.
Caution	AMPS1/2	System Amperage is within the configured caution range. (A number will specify which system when two are configured.)
Caution	AMPS	

Severity Level	Alert Text	Description
Caution	AMPS M	Main Bus Amperage is within the configured caution range.
Caution	AMPS E	Essential Bus Amperage is within the configured caution range.
Caution	BATT AMPS	Battery Amperage is within the configured caution range.
Caution	ALT AMPS	Alternator Amperage is within the configured caution range. (A number will specify which system when two are configured.)
Caution	ALT AMPS 1/2	
Caution	GP TEMP 1/2/3/4/5/6	General Purpose Temperature Caution: A user defined temperature limitation has reached the configured caution range. (A number will specify which user defined system when more than one is configured.)
Caution	ELEV TRIM	Elevator trim is near or at its control range limit.
Caution	AILERON TRIM	Aileron trim is near or at its control range limit.
Caution	COOLANT TEMP	A Coolant Temperature tolerance has been exceeded
Caution	RUDDER TRIM	Rudder trim is near or at its control range limit.
Caution	COOLANT PRESS	A configured coolant pressure tolerance has been exceeded.
Caution	FLAP POS	Dependent on system configuration. The flaps in their current position, given the speed of flight, could cause structural damage to the airframe.
Caution	GP ANALOG 1/2/3/4/5/6/7	General Purpose Analog Caution: A fault in the user defined input has been detected. (A number will specify which user defined system when more than one is configured.)
Caution	GP PRESS	General Purpose Pressure Caution: A user defined pressure limitation has reached the configured caution range.
Caution	TORQUE	A configured torque caution tolerance has been exceeded.
Caution	GP DISCRETE 1-16	General Purpose Discrete Caution: A fault in the user defined discrete input has been detected. (A number will specify which user defined system when more than one is configured.)
Caution	GP ECS DISCRETE 1-9	General Purpose Discrete Caution: A user defined Environmental Control System discrete input fault has been detected. (A number will specify which user defined system when more than one is configured.)
Caution	PFD1 DISCRETE 1-10	A user defined Primary Flight Display Discrete input fault has been detected. (A number will specify which user defined system when more than one is configured.)
Caution	PFD2 DISCRETE 1-10	
Caution	PFD3 DISCRETE 1-10	
Caution	MFD1 DISCRETE 1-10	A user defined Multifunction Display Discrete input fault has been detected. (A number will specify which user defined system when more than one is configured.)
Caution	MFD2 DISCRETE 1-10	
Caution	MFD3 DISCRETE 1-10	

Severity Level	Alert Text	Description
Caution	ECS FAIL	The system cannot establish communication with an expected GAD 27 ECS module.
Caution	ECS VOLTS 1/2	A configured Environmental Control System Volts tolerance has been exceeded. (A number will specify which user defined system when more than one is configured.)
Caution	ECS AMPS 1/2	A configured Environmental Control System Amperage tolerance has been exceeded. (A number will specify which user defined system when more than one is configured.)
Caution	THROTTLE	The FADEC engine throttle is within a caution range.
Caution	CDT TEMP	Engine compressor discharge temperature is within a caution range.
Caution	IAT TEMP	Engine intake air temperature is within a caution range.
Caution	CDT-IAT TEMP	Engine CDT-IAT differential is within a caution range.
Caution	ATT MISCOMP	Critical values generated by redundant ADAHRS sensors are continuously monitored and compared. The difference between the calculated attitude of two or more sensors has exceeded a specified amount.
Caution	ALT MISCOMP	Critical values generated by redundant ADAHRS sensors are continuously monitored and compared. The difference between calculated altitude of two or more sensors has exceeded a specified amount.
Caution	IAS MISCOMP	Critical values generated by redundant ADAHRS sensors are continuously monitored and compared. The difference between calculated IAS of two or more sensors has exceeded a specified amount.
Caution	HDG MISCOMP	Critical values generated by redundant ADAHRS sensors are continuously monitored and compared. The difference between the calculated heading of two or more sensors has exceeded a specified amount.

ADVISORY MESSAGES

See the current version of the pertinent flight manual for recommended pilot actions.

Severity Level	Alert Text	Description
Advisory	SFCWTCH INHIB	SurfaceWatch™ Alerting has been inhibited by the user.
Advisory	SURF INHIB	SURF IA (Runway Occupancy Awareness) Alerting has been inhibited by the user.
Advisory	TER INHIB	Terrain Alerting has been inhibited by the user.
Advisory	TER TEST	Terrain Test is active, TAWS alerting is not available.
Advisory	TAWS INHIB	TAWS alerting has been inhibited by the user.
Advisory	TAWS TEST	TAWS Test is active, TAWS alerting is not available.

Severity Level	Alert Text	Description
Advisory	OBST INHIB	Obstacle Alerting has been inhibited by the user.
Advisory	TER/OBST INHIB	Terrain and Obstacle Alerting has been inhibited by the user.
Advisory	STEEP APR	Steep Approach mode activated by the user.
Advisory	TRFC INHIB	Traffic system has been inhibited by the user.
Advisory	ESP INHIB	Electronic Stability Protection has been inhibited by the user.
Advisory	ESP OFF	GFC 500X Electronic Stability & Protection has been disarmed by the user.
Advisory	NO IAS ESP	Indicated airspeed electronic stability protection is unavailable.
Advisory	SET BARO	There is a barometric altitude and field elevation mismatch.
Advisory	RP MODE	The TAWS system is operating in reduced protection mode.
Advisory	GPS1/2 CHK POS	Current position differs from the specified GPS by a defined threshold.
Advisory	VGPS CHK POS	Current position differs from the VFR GPS by a defined threshold.
Advisory	SPO2 LEVEL	Finger detected and pulse oximeter readings are within the acceptable range.
Advisory	PULSE RATE	A finger is detected and the sensor reports the pulse.
Advisory	USER CO LEVEL	User-defined carbon monoxide levels have been exceeded.
Advisory	SMRTGLD DSBL	Smart Glide has been disabled. If needed, re-enable via the Inhibits page or the Emergency page menu.
Advisory	AOA CAL ERR	AOA calibration has been completed but is invalid.
Advisory	NO AOA CAL	AOA calibration has not yet been completed, AOA indications will not be displayed.
Advisory	NO SFD[1/2/3/4] DATA	The AXIS system is not receiving data from the specified standby flight display (GI 275 or G5).
Advisory	HDG SNSR1/2/3 FAIL	The system is not receiving data from the specified magnetometer. Magnetic heading data may be unavailable.
Advisory	SPEED BRAKE	Left or Right speed brake is not closed (Warning if above speed brake airspeed or speed brake engine power, otherwise Advisory).
Advisory	AOA NO FLAPS	Flap position sensor information is not available to the system, due to a system fault or otherwise. The system has reverted to referencing the Flaps Up Calibration curve.
Advisory	AOA INHIB	The Angle of Attack system has been inhibited by the user.
Advisory	EIS INPUT FAIL	Partial failure of the EIS input has failed. Some of the engine information may not be displayed.
Advisory	STARTER	VP-X Installations Only. The engine starter is engaged.
Advisory	ENGINE ECU	The FADEC system is reporting an advisory alert.

Severity Level	Alert Text	Description
Advisory	ENG1/2 ECU	The FADEC system is reporting an advisory alert for the specified engine.
Advisory	NO ADS-B TX	The transponder is not transmitting ADS-B information.
Advisory	NO MODE S TX	The transponder is not transmitting Mode S information.
Advisory	GP DISCRETE 1-16	General Purpose Discrete Advisory: The user defined advisory discrete input has been detected. (A number will specify which user defined system when more than one is configured.)
Advisory	GP ECS DISCRETE 1-9	General Purpose Discrete Advisory: A user defined Environmental Control System advisory discrete input has been detected. (A number will specify which user defined system when more than one is configured.)
Advisory	PFD1 DISCRETE 1-10	A user defined Primary Flight Display Discrete input advisory has been detected. (A number will specify which user defined system when more than one is configured.)
Advisory	PFD2 DISCRETE 1-10	
Advisory	PFD3 DISCRETE 1-10	
Advisory	MFD1 DISCRETE 1-10	A user defined Multifunction Display Discrete input advisory has been detected. (A number will specify which user defined system when more than one is configured.)
Advisory	MFD2 DISCRETE 1-10	
Advisory	MFD3 DISCRETE 1-10	
Advisory	SOFTWARE FAULT	A fault exists in the software of the AXIS™ flight display(s).
Advisory	ATT NO COMP	Critical values generated by redundant ADAHRS sensors are continuously monitored and compared. Not enough attitude sensor data is available to make a comparison.
Advisory	HDG NO COMP	Critical values generated by redundant ADAHRS sensors are continuously monitored and compared. Not enough heading sensor data is available to make a comparison.
Advisory	IAS NO COMP	Critical values generated by redundant ADAHRS sensors are continuously monitored and compared. Not enough IAS sensor data is available to make a comparison.
Advisory	ALT NO COMP	Critical values generated by redundant ADAHRS sensors are continuously monitored and compared. Not enough altitude sensor data is available to make a comparison.
Advisory	ADAHRS NO COMP	Critical values generated by redundant ADAHRS sensors are continuously monitored and compared. Not enough sensor data is available to make a comparison for all 4 functions, IAS, ALT, ATT and HDG.

SYSTEM MESSAGES

Messages are presented to the pilot through the **System** Messages Button at the bottom of the display. When pressed the "Messages" Window is opened. When a message is present, the button will flash white (for advisory), flash "Caution" in yellow (for cautions) and flash "Warning" in red (for warnings). System messages include system alerts, maintenance messages, and other system messages that pertain to the airframe and its systems including long-term banner messages.

System Message Alert Text	Description
Inside [Identifier, Class] Airspace: N/A	The aircraft is inside the airspace.
[Identifier, Class] Airspace Ahead: Entry within 10 minutes	Special use airspace is ahead of aircraft. The aircraft current ground track penetrates the airspace within 10 minutes.
[Airspace Class} Airspace Ahead: [Identifier] within 2 NM on Current Course	Special use airspace is near and ahead of the aircraft position.
Within 2NM of [Identifier, Class] airspace: N/A	Special use airspace is within 2 NM of the aircraft position.
SVT Outside Available Terrain Region: Outside of area supported by the terrain database	SVT™ will not be displayed on the PFW until the aircraft enters an area supported by the terrain database.
Magnetic Database Out of Date : Update Navigation Database to resolve this issue	Magnetic variation databases are updated once every 10 years. When this message is displayed, update the Magnetic Variation Database.
Database Fault : See Database Status Page	View details of the database fault: **Applications** Icon **> Settings & Tools** Tab **> Databases**.
Database Change : Verify User Modified Procedures	Displayed when one or more stored flight plans have procedures built into them and a database update has occurred.
Audio Device Conflict: Intercom enabled on more than one unit	Displayed until the conflict is resolved by disabling the appropriate audio intercom.
Database Change : Verify Stored Airways	Displayed when one or more stored flight plans have airways built into them and a database update has occurred.
Database Sync in Progress : See Database Status Page for more information	View details of the database sync: **Applications** Icon **> Settings & Tools** Tab **> Databases**.
EXTERNAL GPS SIMULATOR : External GPS simulated. Do not use for navigation	GPS position is being simulated and MUST not be used for navigation purposes.
Simulator: Sim mode is active. Do not use for navigation.	AXIS is in demo mode, do not use for normal operating procedures.
SurfaceWatch Fail : One or more inputs invalid	SurfaceWatch™ features may be unavailable until the failure is resolved.

System Message Alert Text	Description
Transponder not receiving pressure altitude : Altitude Reporting may be impacted	An integrated transponder is not receiving pressure altitude. Mode C transmissions will not include altitude information.
Transponder has lost communication with GPS source: Position Data not available for ADS-B	ADS-B out transmissions of GPS data will not be transmitted until GPS position is restored.
Traffic Fault: Traffic Picture May not be Complete	1090 or 978 receiver has failed, but not both. Some traffic targets may be unavailable.
ADS-B In Failed: Weather and Traffic Unavailable	No weather or traffic information will be displayed or announced until the ADS-B failure has been resolved.
AHRS 1/2/3 Redundancy Reduced: Heading Data Unavailable	AHRS units use multiple sources of data to assist in determining attitude and heading. AHRS units are designed to continue operation in the absence of an aiding input. The failure of one or more inputs lowers the threshold to a complete loss of data from the unit.
AHRS 1/2/3 Redundancy Reduced: Air Data Unavailable	AHRS units use multiple sources of data to assist in determining attitude and heading. AHRS units are designed to continue operation in the absence of an aiding input. The failure of one or more inputs lowers the threshold to a complete loss of data from the unit.
AHRS 1/2/3 Redundancy Reduced: GPS Data Unavailable	AHRS units use multiple sources of data to assist in determining attitude and heading. AHRS units are designed to continue operation in the absence of an aiding input. The failure of one or more inputs lowers the threshold to a complete loss of data from the unit.
Non WGS84 Waypoint: No GPS Navigation to [waypoint]	The active waypoint does not reference the WGS84 datum. No action necessary. For more information, read “Points About Non-WGS84 Waypoints” in this section.
Large Magnetic Variance: Cross-check mag angles and use with caution	The system position is in a region with large magnetic variance, and the magnetic angles should be cross-checked and used with caution.
VNAV Unavailable: Reset altitude preselect to arm descent	Reset altitude preselect to arm VNAV descent.
VNAV Unavailable: Unsupported Leg Type in Active Flight Plan	The lateral flight plan contains an unsupported leg type prior to the active vertical waypoint. This prevents PATH guidance to the active vertical waypoint.
VNAV Unavailable: Excessive Track Angle Error	Track angle error exceeds limit, causing vertical path guidance to become invalid. Navigate within 70º of active flight plan course.
VNAV Unavailable: Excessive XTK Deviation Error	Crosstrack exceeds limit, causing vertical path guidance to become invalid. Navigate within 10 NM of flight plan centerline, or edit flight plan to allow for vertical navigation.

System Message Alert Text	Description
VNAV Unavailable: Reverted to Pitch	The system was previously in PATH flight director mode but has reverted to PIT (pitch hold). This would happen as a result of an over-speed condition, a vertical discontinuity, or invalid vertical deviation.
VNAV Unavailable: Cannot meet VNAV altitude constraint	Based on the current rate of climb or descent, the next flight plan altitude constraint will not be met.
Vertical Discontinuity Ahead: Discontinuity after @0@	A vertical gap in the computed descent path exists between two waypoints ahead of the aircraft in the flight plan.
Audio Controls Fault: Remote Control Unavailable	This alert is displayed any time the CNI bar audio panel controls are inoperative.
COM 1/2 Transmit Power Reduced: Temperature High	The specified COM has exceeded its operating temperature range. Transmit power is reduced which may result in reduced transmission range.
COM 1/2 Transmit Power Reduced: Supply Voltage Low	The specified COM has exceeded its operating voltage range. Transmit power is reduced which may result in reduced transmission range.
COM1/2 Transmit Hardware Fault: COM Transmissions May be Impacted	A hardware issue has been detected by the system.
NAV 1/2 Stuck Key: VLOC Remote Xfer Disabled	The specified key has been in the pressed position for at least 35 seconds, and the input has been disabled. Function still available by other available means.
COM1/2 Stuck Key: Pilot Push-To-Talk Disabled	The specified key has been in the pressed position for at least 35 seconds, and the input has been disabled. Function still available by other available means.
COM1/2 Stuck Key: Co-Pilot Push-To-Talk Disabled	The specified key has been in the pressed position for at least 35 seconds, and the input has been disabled. Function still available by other available means.
COM1/2 Stuck Key: Both Push-To-Talk Disabled	The specified key has been in the pressed position for at least 35 seconds, and the input has been disabled. Function still available by other available means.
COM1/2 Stuck Key: Push-To-Talk Disabled	The specified key has been in the pressed position for at least 35 seconds, and the input has been disabled. Function still available by other available means.
COM1/2 Stuck Key: COM Monitor Key Disabled	The specified key has been in the pressed position for at least 35 seconds, and the input has been disabled. Function still available by other available means.
COM1/2 Stuck Key: COM Remote Xfer Key Disabled	The specified key has been in the pressed position for at least 35 seconds, and the input has been disabled. Function still available by other available means.
COM1/2 Stuck Key: COM Interlock Disabled	The specified key has been in the pressed position for at least 35 seconds, and the input has been disabled. Function still available by other available means.

System Message Alert Text	Description
COM1/2 Stuck Key: COM Mic Swap Disabled	The specified key has been in the pressed position for at least 35 seconds, and the input has been disabled. Function still available by other available means.
Stuck Key: Pilot Push to Talk Disabled	Push to talk functions are not available through other means.
Stuck Key: Audio Panel Button Disabled	The Audio Panel button has been disabled and functions must be completed using other means.
Audio Stuck Key: COM Playback Key Disabled	The COM Playback Key has been disabled and functions must be completed using other means.
Pilot Headset Short: Headset Audio May Be Degraded	A wiring fault has been detected for the Pilot headset. Audio functionality may be impacted.
Copilot Headset Short: Headset Audio May Be Degraded	A wiring fault has been detected for the Co-Pilot headset. Audio functionality may be impacted.
Passenger Headset Short: Headset Audio May Be Degraded	A wiring fault has been detected for the Passenger headset. Audio functionality may be impacted.
Transponder Transmit Disabled: Temperature High	The transponder has exceeded its operating range and is no longer transmitting.
Transponder Transmit Disabled: Temperature Low	The transponder has exceeded its operating range and is no longer transmitting.
SurfaceWatch Disabled: Too far north/south	The aircraft is North of 87°N or South of 87°S latitude and will re-enable itself when the aircraft is no longer in these areas.

BANNER MESSAGES

Banner messages are presented to the pilot on the bottom of the flight display, centered below the HSI. If more than one banner message is active they are prioritized by precedence with the higher priority messages being displayed over the lower priority messages. When the highest priority message is acknowledged the next higher priority message will be displayed.

There are two types of banner messages; long-term banner messages and short-term banner messages. Long-term banner messages are higher priority messages that will remain on the banner until acknowledged by the pilot. These long-term banner messages, with few exceptions, are also available to be viewed under the system messages tab in the messages window for as long as the condition persists. Short-term banner messages are a lower priority and will remain active in the banner for 15 seconds, or until acknowledged (whichever comes first).

Banner Message Alert Text	Description
[Display ID] Touchscreen Fault: Use Buttons and Knobs	The system has detected a touchscreen module fault. Use knobs and buttons to operate the system.
Glideslope 1/2 inoperative: Use Alternate Navigation Source	Glide slope functionality on NAV1/2 is not available. ILS approach operations and AFCS GS coupling are unavailable.

Banner Message Alert Text	Description
VOR1/2 Approach: NAVAID deviation not available	This message appears when GPS is used as an alternate means of navigation for a VOR approach while monitoring VOR1. It indicates that VOR1 is flagged. A VOR-based approach may not be continued using GPS as an alternate means of navigation if VOR deviation is not available.
Abort Approach: Loss of GPS navigation	Displayed when GPS integrity has been lost while on an approach at or beyond the FAF.
Unable <SBAS APR>: SBAS not available for approach	SBAS not available for approach.
RAIM Unavailable: RAIM not available from FAF to MAP waypoints	This message has no user impact unless the aircraft installation supports a third party GPS device that requires automatic approach RAIM prediction. In those very installation specific cases the crew must refer to the appropriate aircraft documentation for user impact. The check that would result in this message is not performed for installations that do not have the relevant equipment installed.
Flight Plan Advisory: VFR GPS Active, advisory only	For VNAV approached the VFR GPS must only be used for advisory purposes only.
Approach ID Mismatch: <CHECK LOC IDENT>	The LOC ident received by the NAV radio does not match that which is expected based on the loaded approach. The crew should verify that the correct LOC transmitter is being received and that the correct approach procedure is loaded in the FMS.
GPS1/2 Data not Scaled for IFR : Vertical Guidance Unavailable	Due to a data path failure, vertical GPS guidance is unavailable. Lateral guidance is still present, but is not properly scaled for IFR.
Approach Inactive: N/A	The system notifies the pilot that the loaded approach is not active. Activate approach when required.
Select appropriate frequency for approach: N/A	The active NAV frequency is not correct for the approach procedure. Enter the correct frequency into the active NAV frequency window.
CDI Source: Select CDI source for approach	The active CDI source must be switched to the appropriate source for the approach in the flight plan.
Check Course: Database course for LOC 1 / <LOC1 Course>	This will not cause a loss of approach capability, but indicates to the user that the selected CDI course does not match the course expected by the database for the loaded approach. The user should check current and approved approach information to determine the correct course.
Check Course: Database course for LOC 2 / <LOC2 Course>	This will not cause a loss of approach capability, but indicates to the user that the selected CDI course does not match the course expected by the database for the loaded approach. The user should check current and approved approach information to determine the correct course.
Change Magnetic Reference: Select alternate NAV angle display units	A TRUE or GRID referenced approach procedure is active, but the system is currently operating in magnetic angle units.

Banner Message Alert Text	Description
Change Magnetic Reference: Select magnetic NAV angle display units	A magnetic based approach procedure is active, but the system is currently operating in non-magnetic (TRUE or USER) angle units.
Temperature Compensation: ALT Constraint above Transition LVL	A temperature compensated approach altitude constraint is in violation of the transition level.
Fuel Reminder: Switch Tanks	The user Fuel alarm interval has been met.
Runway Data Not Available: Inhibit SurfaceWatch	The next runway in the active flight plan does not support SurfaceWatch™ or the next airport in the active flight plan has a runway(s) that does not support SurfaceWatch. To avoid potential nuisance alerts, SurfaceWatch should be inhibited.
GAD 27 Fault: Flap/Trim Movement May be Impacted	If the GAD 27 ECS module is installed to control flap and/or trim movement, a fault in this unit may lead to loss of control of those control surfaces. This condition must be corrected by an installer qualified for maintenance of the aircraft.
<Display ID> Temperature High: Display Backlight Reduced	The specified GDU has exceeded normal operating temperature range. Increase cooling to the unit if possible.
<Display ID> Hardware Fault: Fan Failure Detected	The specified GDU has reported a fan fault, this may result in the unit exceeding its operating temperature range.
AXIS Display Identity Error: GDU Variant mismatch	An AXIS™ GDU assigned display variant disagrees with the hardware variant that is detected. Use the Devices Application in configuration mode to resolve.
Select Runway: Arrival was loaded without a runway	Arrival was loaded without a runway.

Table 65: Banner Messages (Long-term)

Banner Message Alert Text	Description
VNAV: Top of Descent in 1 minute	Aircraft will reach top of descent in 1 minute.
VNAV: Bottom of Descent in 1 minute	Aircraft will reach bottom of descent in 1 minute.
Flight Plan Catalog: Last plan in catalog was overwritten by an import	The last catalog flight plan was overwritten by a flight plan import. This can occur when the flight plan catalog is full and a flight plan import has resulted in the last catalog flight plan being overwritten.
GPS Integrity Restored: N/A	All GPS functions should resume functionality.
Database Sync Complete!: N/A	A database sync cycle has completed.
Emergency: 180 Turn In Progress	The Smart Glide™ **Activate 180° Turn** Button has been activated.

Banner Message Alert Text	Description
Audio Controls Locked: Hold Freq Swap to Unlock	Audio panel controls have been locked by the user and will not be functional until the frequency swap button has been held to unlock them.
Hold Expired: N/A	The 'Expect Further Clearance' time has expired for the 'Hold at Waypoint' function in the Flight Plan Application.

Table 66: Banner Messages (Short-term)

ACKNOWLEDGING BANNER MESSAGES:

Press the **BACK** Softkey (on the PFW side of the bezel while in split screen mode).

Or:

Touch the banner message.

MAINTENANCE MESSAGES

Maintenance messages are triggered when there is a major system issue (e.g., mismatched software). The **System** Messages Button will flash (white and black inverse video) when a maintenance message persists while the aircraft is on the ground only. While in flight these messages provide supplemental information that provide a reference to a condition that is already alerted somewhere else in the system.

To navigate to the maintenance messages touch the **System** Messages Button > **Maintenance** Tab. A numerical visual indication on the **Maintenance** Tab will indicate the amount of maintenance messages present for the system.

Maintenance Message Alert Text	Description
AHRS 1/2/3 Software Mismatch: Use Software Update Tool to Resolve	Software reported by the specified LRU does not match the version expected by the system. This must be corrected by an installer qualified for maintenance of the aircraft. Use software update tool in configuration mode to update the unit to the appropriate version.
OAT Module Software Mismatch: Use Software Update Tool to Resolve	Software reported by the specified LRU does not match the version expected by the system. This must be corrected by an installer qualified for maintenance of the aircraft. Use software update tool in configuration mode to update the unit to the appropriate version.
SFD 1/2 Software Mismatch: Use Software Update Tool to Resolve	Software reported by the specified LRU does not match the version expected by the system. This must be corrected by an installer qualified for maintenance of the aircraft. Use software update tool in configuration mode to update the unit to the appropriate version.

Maintenance Message Alert Text	Description
AOA Indicator Software Mismatch: Use Software Update Tool to Resolve	Software reported by the specified LRU does not match the version expected by the system. This must be corrected by an installer qualified for maintenance of the aircraft. Use software update tool in configuration mode to update the unit to the appropriate version.
GAD 27 Software Mismatch: Use Software Update Tool to Resolve	Software reported by the specified LRU does not match the version expected by the system. This must be corrected by an installer qualified for maintenance of the aircraft. Use software update tool in configuration mode to update the unit to the appropriate version.
Radio AGL Software Mismatch: Use Software Update Tool to Resolve	Software reported by the specified LRU does not match the version expected by the system. This must be corrected by an installer qualified for maintenance of the aircraft. Use software update tool in configuration mode to update the unit to the appropriate version.
Pitch Servo Software Mismatch: Use Software Update Tool to Resolve	Software reported by the specified LRU does not match the version expected by the system. This must be corrected by an installer qualified for maintenance of the aircraft. Use software update tool in configuration mode to update the unit to the appropriate version.
Roll Servo Software Mismatch: Use Software Update Tool to Resolve	Software reported by the specified LRU does not match the version expected by the system. This must be corrected by an installer qualified for maintenance of the aircraft. Use software update tool in configuration mode to update the unit to the appropriate version.
Yaw Servo Software Mismatch: Use Software Update Tool to Resolve	Software reported by the specified LRU does not match the version expected by the system. This must be corrected by an installer qualified for maintenance of the aircraft. Use software update tool in configuration mode to update the unit to the appropriate version.
Pitch Trim Software Mismatch: Use Software Update Tool to Resolve	Software reported by the specified LRU does not match the version expected by the system. This must be corrected by an installer qualified for maintenance of the aircraft. Use software update tool in configuration mode to update the unit to the appropriate version.
Roll Trim Software Mismatch: Use Software Update Tool to Resolve	Software reported by the specified LRU does not match the version expected by the system. This must be corrected by an installer qualified for maintenance of the aircraft. Use software update tool in configuration mode to update the unit to the appropriate version.

Maintenance Message Alert Text	Description
Autopilot Controller 1/2 Software Mismatch: Use Software Update Tool to Resolve	Software reported by the specified LRU does not match the version expected by the system. This must be corrected by an installer qualified for maintenance of the aircraft. Use software update tool in configuration mode to update the unit to the appropriate version.
Remote GPS Receiver Software Mismatch: Use Software Update Tool to Resolve	Software reported by the specified LRU does not match the version expected by the system. This must be corrected by an installer qualified for maintenance of the aircraft. Use software update tool in configuration mode to update the unit to the appropriate version.
Audio Panel Software Mismatch: Use Software Update Tool to Resolve	Software reported by the specified LRU does not match the version expected by the system. This must be corrected by an installer qualified for maintenance of the aircraft. Use software update tool in configuration mode to update the unit to the appropriate version.
Magnetometer 1/2/3 Software Mismatch: Use Software Update Tool to Resolve	Software reported by the specified LRU does not match the version expected by the system. This must be corrected by an installer qualified for maintenance of the aircraft. Use software update tool in configuration mode to update the unit to the appropriate version.
Engine Instrumentation 1/2 Software Mismatch: Use Software Update Tool to Resolve	Software reported by the specified LRU does not match the version expected by the system. This must be corrected by an installer qualified for maintenance of the aircraft. Use software update tool in configuration mode to update the unit to the appropriate version.
COM 1/2 Software Mismatch: Use Software Update Tool to Resolve	Software reported by the specified LRU does not match the version expected by the system. This must be corrected by an installer qualified for maintenance of the aircraft. Use software update tool in configuration mode to update the unit to the appropriate version.
<Display ID> Software Mismatch: Use Software Update Tool to Resolve	Software reported by the specified LRU does not match the version expected by the system. This must be corrected by an installer qualified for maintenance of the aircraft. Use software update tool in configuration mode to update the unit to the appropriate version.
GAD 29 Software Mismatch: Use Software Update Tool to Resolve	Software reported by the specified LRU does not match the version expected by the system. This must be corrected by an installer qualified for maintenance of the aircraft. Use software update tool in configuration mode to update the unit to the appropriate version.

Maintenance Message Alert Text	Description
GDL 50 Software Mismatch: Use Software Update Tool to Resolve	Software reported by the specified LRU does not match the version expected by the system. This must be corrected by an installer qualified for maintenance of the aircraft. Use software update tool in configuration mode to update the unit to the appropriate version.
GDL 51 Software Mismatch: Use Software Update Tool to Resolve	Software reported by the specified LRU does not match the version expected by the system. This must be corrected by an installer qualified for maintenance of the aircraft. Use software update tool in configuration mode to update the unit to the appropriate version.
GDL 52 Software Mismatch: Use Software Update Tool to Resolve	Software reported by the specified LRU does not match the version expected by the system. This must be corrected by an installer qualified for maintenance of the aircraft. Use software update tool in configuration mode to update the unit to the appropriate version.
GDL 50 Software Mismatch: Use Garmin Pilot to update GDL software	Software reported by the specified LRU does not match the version expected by the system. Use software update tool in configuration mode to update the unit to the appropriate version.
GDL 51 Software Mismatch: Use Garmin Pilot to update GDL software	Software reported by the specified LRU does not match the version expected by the system. Use software update tool in configuration mode to update the unit to the appropriate version.
GDL 52 Software Mismatch: Use Garmin Pilot to update GDL software	Software reported by the specified LRU does not match the version expected by the system. Use software update tool in configuration mode to update the unit to the appropriate version.
GAD 29 Fault: Remote A429 Interface Failed	The ARINC 429 interface for the system is reporting a fault. This may result in lost data transfer to and from an external navigator. Primary navigation indications provide more specific information to the pilot relating to the availability of each navigation source.
AHRS1/2/3 Fault: See Device Application for further information	The specified LRU is reporting a unit fault. Use the Devices Application in configuration mode for more information. Contact Garmin Aviation support if necessary to troubleshoot this error.
OAT Module Fault: See Device Application for further information	The specified LRU is reporting a unit fault. Use the Devices Application in configuration mode for more information. Contact Garmin Aviation support if necessary to troubleshoot this error.
Autopilot Controller 1/2 Fault: See Device Application for further information	The specified LRU is reporting a unit fault. Use the Devices Application in configuration mode for more information. Contact Garmin Aviation support if necessary to troubleshoot this error.
Pitch Servo Fault: See Device Application for further information	The specified LRU is reporting a unit fault. Use the Devices Application in configuration mode for more information. Contact Garmin Aviation support if necessary to troubleshoot this error.
Roll Servo Fault: See Device Application for further information	The specified LRU is reporting a unit fault. Use the Devices Application in configuration mode for more information. Contact Garmin Aviation support if necessary to troubleshoot this error.

Maintenance Message Alert Text	Description
Yaw Servo Fault: See Device Application for further information	The specified LRU is reporting a unit fault. Use the Devices Application in configuration mode for more information. Contact Garmin Aviation support if necessary to troubleshoot this error.
Pitch Trim Servo Fault: See Device Application for further information	The specified LRU is reporting a unit fault. Use the Devices Application in configuration mode for more information. Contact Garmin Aviation support if necessary to troubleshoot this error.
Roll Trim Servo Fault: See Device Application for further information	The specified LRU is reporting a unit fault. Use the Devices Application in configuration mode for more information. Contact Garmin Aviation support if necessary to troubleshoot this error.
Remote GPS Receiver Fault: See Device Application for further information	The specified LRU is reporting a unit fault. Use the Devices Application in configuration mode for more information. Contact Garmin Aviation support if necessary to troubleshoot this error.
Audio Panel Hardware Fault: See Device Application for further information	The specified LRU is reporting a unit fault. Use the Devices Application in configuration mode for more information. Contact Garmin Aviation support if necessary to troubleshoot this error.
Magnetometer 1/2/3 Fault: See Device Application for further information	The specified LRU is reporting a unit fault. Use the Devices Application in configuration mode for more information. Contact Garmin Aviation support if necessary to troubleshoot this error.
EIS 1/2 Fault: See Device Application for further information	The specified LRU is reporting a unit fault. Use the Devices Application in configuration mode for more information. Contact Garmin Aviation support if necessary to troubleshoot this error.
COM 1/2 Fault: See Device Application for further information	The specified LRU is reporting a unit fault. Use the Devices Application in configuration mode for more information. Contact Garmin Aviation support if necessary to troubleshoot this error.
[Display ID] Configuration Module Fault: See Device Application for further information	The specified display cannot communicate with its associated configuration module.
Transponder Fault Detected: See Device Application for further information	The specified LRU is reporting a unit fault. Use the Devices Application in configuration mode for more information. Contact Garmin Aviation support if necessary to troubleshoot this error.
Transponder Configuration Error: See Device Application for further information	The specified LRU is reporting a software configuration error. Use the Devices Application in configuration mode for more information. Contact Garmin Aviation support if necessary to troubleshoot this error.
Pitch Trim Fault: Trim output overcurrent	GSA 28 servos are capable of driving electric trim motors. The electric trim motor can draw up to 1A of current. This message is displayed if the electric trim motor is drawing more than 1 A of current from the GSA 28.
Roll Trim Fault: Trim output overcurrent	
Yaw Trim Fault: Trim output overcurrent	

Maintenance Message Alert Text	Description
Roll Servo Fault: Temperature Out Of Range	The specified unit has exceeded its operating temperature range. Do not rely on unit for flight.
Pitch Servo Fault: Temperature Out Of Range	
Yaw Servo Fault: Temperature Out Of Range	
Pitch Trim Servo Fault: Temperature Out Of Range	
Roll Trim Servo Fault: Temperature Out Of Range	
EIS 1/2 Temperature Fault: Temperature Out Of Range	A Temperature Fault has been detected in the specified EIS unit. This is specific to the EIS controller, and not specifically a temperature sensor connected to the EIS unit.
AHRS 1/2/3 Fault: Temperature Out Of Range	A Temperature Fault has been detected in the specified AHRS unit. While continued operation may be possible, the unit is operating beyond its intended temperature range, which may lead to a loss of function.
Remote GPS Receiver Battery Low: GPS May be slow to acquire Signal	The internal battery for a connected GPS 20A GPS 20A remote GPS receiver is low. GPS acquisition times may be extended.
GPS Receiver Battery Low: GPS May be slow to acquire Signal	The internal battery for a AXIS™ display is depleted, which will result in slow GPS acquisition times.
USB-C drive is invalid or failed: Use FAT32 format or try another unit	Cannot establish normal communication with a connected USB-C drive.
[Display ID] Needs Service: N/A	The AXIS Display hardware needs serviced. Contact Garmin Aviation support for troubleshooting.
[Display ID] GPS Receiver Needs Service: N/A	The GPS Receiver hardware of the AXIS Display needs serviced. Contact Garmin Aviation support for troubleshooting.
[Display ID] GPS Antenna Shorted to ground: Use alternate navigation method	The GPS Antenna is shorted. Inspect GPS antenna wiring and connections.
[Display ID] GPS Antenna Not Connected: Use alternate navigation method	No GPS data is being received. Inspect GPS antenna wiring and connections.
Wireless Module Fault: Bluetooth Not Available	A fault condition exists in the wireless module of the AXIS display. Wireless connectivity function may be impacted.
VNAV Configuration Error: Vertical Navigation not available	VNAV configuration parameters are misconfigured. Verify the configuration settings.
Audio Alert Fail: Audio Database Missing or Invalid	Reload databases to the system. If problem persist, contact Garmin for additional troubleshooting.

Maintenance Message Alert Text	Description
Manifest Fault Detected: Restart System into config mode for more info	The system has failed to load critical software version information. Rebooting the system into configuration mode resolves this issue.
<Display ID> External LRU Power Output Failed: Excessive Current Draw	An external LRU has an excessive current draw. To troubleshoot, 1) power cycle the system. 2) check configuration settings of the LRU against the STC IM. 3) verify wiring of the unit. 4) if condition persists, replace unit.
TAWS INHIB: TAWS Discrete Input Active	TAWS INHIBIT is active, the system will not display TAWS alerts. To enable TAWS alerts, press or switch the TAWS INHIB switch or pushbutton.
[APP NAME] App Failed: Use alternate source	[APP NAME] App has failed. Power cycle the unit. If the condition persists, contact Garmin Aviation support to troubleshoot this error.
Magnetic Anomaly Detected: Magnetic Interference Present in Vicinity of GMU	The magnetometer has detected a magnetic field that is not consistent with that generated by the natural earth magnetic field. This is the result of interference in the area of the magnetometer. While continued operation may be possible, the unit should be serviced by an installer qualified for maintenance on the aircraft prior to continued reliance on this unit for operations.
ADAHRS1/2/3 OAT Input Missing: Outside air temperature may be unavailable	The ADAHRS source (GSU) is not receiving OAT data. OAT may be unavailable. Inspect OAT probe wiring and connector. Check OAT status on the ADAHRS LRU device page. If condition persists, replace OAT probe.
CO Monitor: Expired	GCO 14 has exceeded expiration date
CO Monitor: Expiring Soon	GCO 14 is within 30 days of its expiration date.
Audio Device Conflict: Intercom enabled on more than one unit	Intercom is enabled on more than 1 GTR radio in the system. Only 1 intercom can exist in the system. Use the Devices application to resolve this conflict.
Databus Fault: AHRS 1/2/3 Using Backup Datapath	GSU 25 ADAHRS units can be connected to the system via 2 independent data paths to ensure critical flight data is available if one of the paths fail. The primary path has failed, and the system is using the backup data path.
Redundancy Reduced: AHRS 1/2/3 Backup Datapath Failed	GSU 25 ADAHRS units can be connected to the system via 2 independent data paths to ensure critical flight data is available if one of the paths fail. If the backup data path has failed, the system has no means to route GSU 25 data in the event of a primary databus failure.
Databus Fault: EIS 1/2 Using Backup Datapath	GEA 24 units can be connected to the system via 2 independent data paths to ensure critical engine data is available if one of the paths fail. The primary path has failed, and the system is using the backup data path.

Maintenance Message Alert Text	Description
Redundancy Reduced: EIS 1/2 Backup Datapath Failed	GEA 24 units can be connected to the system via 2 independent data paths to ensure critical engine data is available if one of the paths fail. If the backup data path has failed, the system has no means to route GEA 24 data in the event of a primary databus failure.
Power Fault: EIS 1/2 Primary Power Fail	The primary power input has failed on the specified EIS unit. The unit is operating on the secondary backup power input.
EIS 1/2 Configuration Fault: Use Configuration Mode to Resolve	The specified LRU is reporting a configuration fault. Troubleshoot using the following steps: 1) Power cycle the unit. 2) check configuration settings of the reporting LRU. 3) Reload configuration file. 4) If condition perists, return unit.
EIS 1/2 Calibration Fault: See Device Application for further information	The specified LRU is reporting a calibration fault. Use the Devices Application in configuration mode for more information. Power cycle the unit. If condition persists, return unit.
EIS 1/2 Fault: Unit Reset	The GEA has detected a fault. The unit should power cycle by itself to correct the issue. If the condition persists, power cycle manually. Contact Garmin Aviation support to further troubleshoot.
Glideslope 1/2 needs service.: Return unit for repair.	Cycle power to the unit. If problem persists, replace unit.
Transponder in Test Mode: Do not use for flight or ground operations	An integrated transponder is reporting it is operating in Test mode.
Transponder in Demo Mode: Do not use for flight or ground operations	An integrated transponder is reporting it is operating in Demo mode.
Transponder in Ground Test Mode: Do not use for flight or ground operations	An integrated transponder is reporting it is operating in Ground Test mode.
ADS-B Weather Receiver Failed: Use Alternate Source	Use alternate weather data source if available. Inspect wiring of weather receiver to troubleshoot this error.
XPDR Config Sync Error: Restart to configuration mode to restore	Restart the XPDR or GDU into config mode.
Not Receiving Data from GDL 5X Receiver: ADS-B In data Unavailable	The system is not receiving data from a connected GDL 50, 51 or 52. Associated weather and/or traffic data is not available.
Not Receiving Data from SXM Receiver: SXM Data Unavailable	The system is not receiving data from a connected GDL 69. Associated Sirius XM data is not available.
AFCS Preflight Test Failed: Autopilot Unavailable	AFCS preflight test has failed. Ensure autopilot components are powered. If condition persists, this must be addressed by qualified maintenance personnel.

Maintenance Message Alert Text	Description
GPS1/2 Config Error: Receiving GPS1/2 data from <>	The system is receiving GPS data from an unexpected source. Verify GPS Configuration settings. If condition persists, inspect GPS source wiring to the GDU.
Timer Expired: [Dynamic Text]	A set timer has reached its set limit, the dynamic text will display the elapsed time since expiration.
SurfaceWatch Fail: Invalid configurable alerts	The SurfaceWatch™ system has failed due to invalid configurable alerts.
SurfaceWatch Fail: Invalid Audio Configuration	The SurfaceWatch system has failed due to an invalid audio configuration.
Display Redundancy Reduced: Communication Fault	AXIS Display units communicate via CAN and HSDB. This message represents a condition in which the CAN path has failed between displays, resulting in a reduced capacity to share information across the display units. Verify CAN wiring and configuration.
Audio Board Configuration Error: Use configuration mode to resolve	Verify audio configuration settings.
Remote Configuration Mismatch: Loading configuration to [LRU]	Software reported by the specified LRU does not match the version expected by the system. Use software update tool in configuration mode to update the unit to the appropriate version.

AURAL ALERTS

The following audio alerts are announced by the system. If the optional Terrain Awareness and Warning System or Terrain Collision Avoidance System (TCAS) is installed, voice alerts are also generated (refer to the *Hazard Avoidance* section).

Voice Alert	Description
"Minimums Minimums"	Aircraft has reached the user-defined MDA/DH.
"Canopy"	A canopy closed input is not active.
"Door Open"	A door closed input is not active.
"Flaps"	Dependent on system configuration. The flaps in their current position, given the speed of flight, could cause structural damage to the airframe.
"Trim"	Trim not is take-off position.
Vertical Track tone	Aircraft is within one minute of reaching a Bottom of Descent (BOD) or Top of Descent (TOD) point

Aural Alert	Description
Autopilot disconnect tone	Auto pilot has disengaged ● Single alert for manual AP disengagement ● Continuous alert for automatic AP disengagement
"Speed"	Aircraft is in an overspeed condition

Aural Alert	Description
"Stall"	Stall alert
"Trim Runaway"	Pitch or yaw trim in a runaway condition

Table 67: AFCS Aural Alerts

Voice Alert	Description
"Engine Speed"	A configured RPM tolerance has been exceeded.
"Engine Power"	A configured torque or manifold pressure tolerance has been exceeded.
"Engine Temperature"	A configured Cylinder Head Temperature or Exhaust Gas Temperature tolerance has been exceeded.
"Oil Temperature"	A configured oil temperature tolerance has been exceeded.
"Oil Pressure"	A configured oil pressure tolerance has been exceeded.
"Fuel Pressure"	A configured fuel pressure tolerance has been exceeded.
"Fuel"	A configured fuel quantity tolerance has been exceeded.
"Voltage"	A configured voltage tolerance has been exceeded.

Table 68: EIS Spoken Alerts

9.2 APPENDIX B (DATABASE INFORMATION)

UPLOADING DATABASES

The options available for updating databases are:

- Garmin Pilot™ in combination with a Portable Electronic Device (PED) which transfers databases using the Wi-Fi Datalink
- A 32 GB (minimum), solid state USB stick used to perform database updates through the USB Data Loader.

Database information is obtained from third party sources. Inaccuracies in the data may be discovered from time to time. Garmin communicates this information by issuing a Database Alert. These notifications are available on flyGarmin.com®.

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

NOTE

Loading a database in the system prior to its effective date will result in the expiration date on the Power-on Display and the effective date on the 'Database Summary' Screen being displayed in amber.

NOTE

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

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

NOTE

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

NOTE

If the pilot/operator wants or needs to adjust the database, contact Garmin Product Support to coordinate the revised DQRs.

UPDATING DATABASES WHEN THE SYSTEM IS POWERED ON

The following instructions cover updating databases after system power-on for using a USB Stick or Wi-Fi Datalink. (For instructions to update databases after system power-on using Garmin Pilot and a PED, see 'Updating Databases Using Garmin Pilot' later in this Appendix). Databases will begin to update automatically when the system is powered-on with a USB stick inserted into the display with current database updates. If the Wi-Fi Datalink is established and any databases are available to update, the process will begin as soon as power is applied to the system.

NOTE

If a USB Stick is inserted in the USB Data Loader of the display after power-on, the databases on the stick will take priority over any matching databases on the Wi-Fi Datalink. Any Wi-Fi Datalink databases matching those on the USB Stick will be in 'USB Lockout' and not available until the USB Stick is removed.

UPDATING DATABASES USING AN USB STICK:

1. Download and install the databases on the USB Stick.
2. Insert the USB Stick in the USB Data Loader on the bezel of the AXIS™ flight display.
3. Touch the **Applications** Icon on the MFW App Bar.

Or:

Press the **MENU** Softkey two times to open the 'Apps' Window.

4 If necessary, touch the **Settings & Tools** Tab.

5 Touch the **Databases** Button.

6 Monitor the Sync Status on the 'Database Status' Screen. Each database sync is complete when 'Sync Complete' displays on the button for the individual database. This 'Sync Complete' message will appear for about five seconds before showing the database information on the button.

USB STICK REQUIREMENTS

A 32 GB (minimum), solid state USB stick can be used to perform database updates through the USB Data Loader located on the front of the AXIS™ flight display bezel. Database updates can be obtained by following the instructions detailed in the 'Aviation Databases' section of the Garmin website (flyGarmin.com®). When database files are loaded to the USB stick, any previously loaded database files of the same type residing on the card will be overwritten. This includes loading a database of a different coverage area or data cycle than the currently residing on the USB stick.

UPDATING DATABASES WITH GARMIN PILOT AND THE WI-FI DATALINK

Databases can be updated using a PED with Garmin Pilot™ in combination with the Wi-Fi Datalink. A PED with Garmin Pilot must be paired with the Wi-Fi Datalink over Bluetooth.

The PED with Garmin Pilot must be connected to the Wi-Fi network of the Wi-Fi Datalink. The database updates may be initiated through Garmin Pilot interface. The system will then determine whether to transfer the databases based on databases present in the avionics. (Refer to the Garmin Pilot for Android or Garmin Pilot for iOS User's Guides.)

STANDBY DATABASE CATALOG

The AXIS™ supports storage of multiple regions for the same database, allowing the crew to quickly change regions while on the ground. A system power cycle is required to change database regions. The system can store standby and active databases using the internally stored display (AXIS flight display) databases, USB Stick databases, and databases from a connected PED. Databases in the 'Available Cycle' can be active databases from a region that are not currently selected, or standby databases stored until reaching the activation date. When an USB Stick is inserted in the USB Data Loader of the display, it will take priority over any other databases recognized by the system, putting all other forms of databases in 'USB Lockout'.

To view the available databases touch any 'Available Cycle' datafield buttons then touch the **View All Available** Button. The 'Available Cycle' datafield button is visible in the right-most column on the 'Database Status' Window with the active and standby databases. Download status is indicated by a down arrow, with only the currently downloading database displaying a solid arrow to indicate which database is currently downloading. The 'Available Cycle' column will only show the selected region. If no database is selected, the Catalog entry will have a star indicating user input is needed.

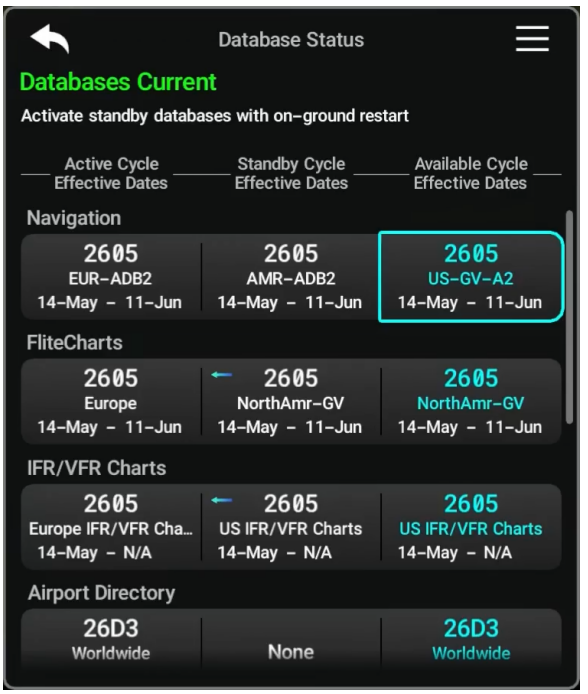


Figure 325: Database Catalog on 'Database Status' Window

Pressing on one of the catalog entries brings up the available regions for selection. This will show the source of the database which can be from a USB Stick or the PED Garmin Pilot App. Selecting one of the regions brings up the catalog details. The **Load to Standby** Button will trigger the database to sync to the standby column. The region loaded will be remembered for future updates.

The top-level ‘Database Summary’ will show the sync status and progress. Completed syncs will have an arrow at the top. Selecting one of the standby databases will give the option to view the details of the DB such as part number, version, file size, and copyright info, as well as the Unit DB Summary which shows what each display unit has installed on that column. The Marked for Delete Button will mark databases for deletion on the next on-ground power cycle.

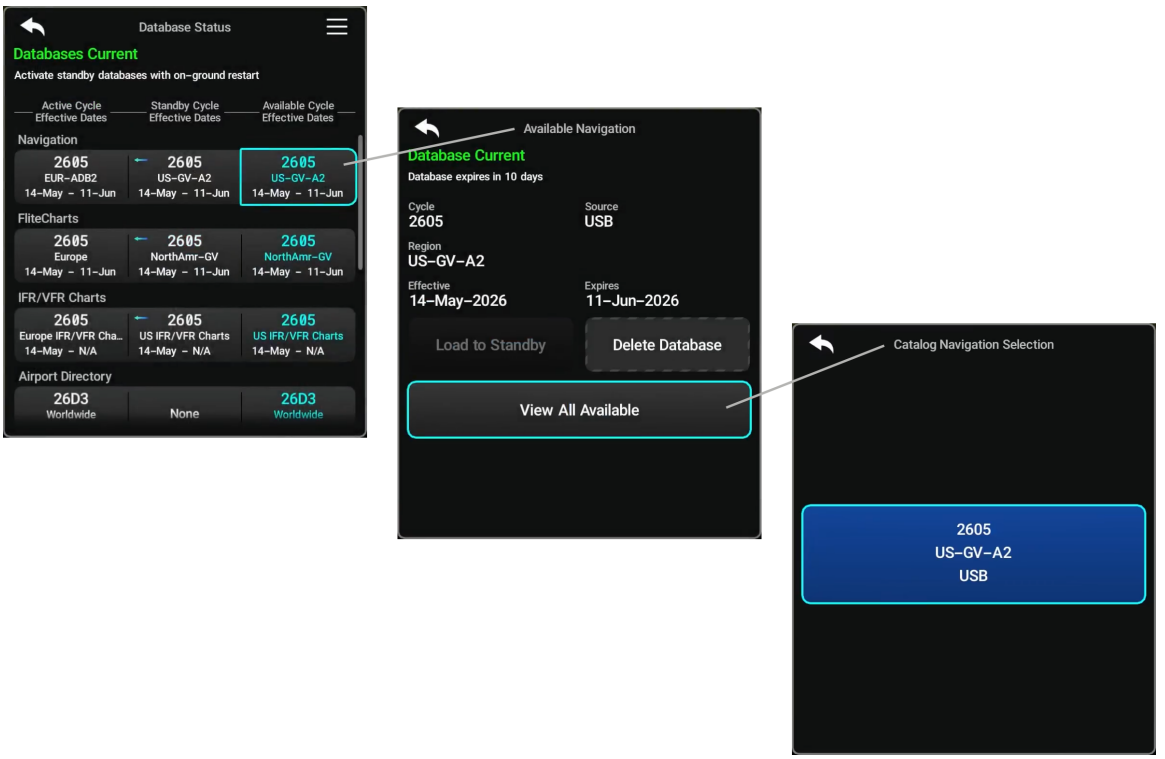


Figure 326: Standby Database Catalog Database Selection

ACTIVATE STANDBY DATABASES:

1 Touch the **Applications** Icon on the MFW App Bar.

Or:

Press the **MENU** Softkey two times to open the 'Apps' Window.

2 If necessary, touch the **Settings & Tools** Tab.

3 Touch the **Databases** Button.

a) Select the standby database to be activated.

b) Touch the **Marked For Activation** Annunciation Button.

Or:

a) Press the **MENU** Softkey (on the 'Database Status' Window side of the bezel if in split screen mode).

Or:

Touch the **Menu** Icon in the top right corner of the 'Database Status' Window.

b) Touch the **All Newer Marked For Activation** Annunciation Button.

c) A confirmation window will appear, "This will activate all standby databases on a newer database cycle than the active databases." Touch the **OK** Button to activate on the next system power cycle.

Or:

Touch the **Cancel** Button to return to the previous window.

4 To initiate a power cycle:

a) With the 'Database Status' Window open, and a database marked for deletion, touch the **Menu** Icon at the top right corner of the window.

Or:

Press the **MENU** Softkey (on the 'Database Status' Window side of the bezel if in split screen mode).

b) Touch the **Restart Avionics** Button (this button will be subdued if the aircraft is not on the ground).

c) The prompt, "Restart Avionics? XX Database(s) will be Deleted" will open.

Touch the **OK** Button to initiate the power cycle of the avionics unit.

Or:

Touch the **Cancel** Button to cancel the process and return to the 'Database Status' Window.

DISABLING AUTOMATIC STANDBY DATABASE ACTIVATION:

1 Touch the **Applications** Icon on the MFW App Bar.

Or:

Press the **MENU** Softkey two times to open the 'Apps' Window.

2 If necessary, touch the **Settings & Tools** Tab.

3 Touch the **Databases** Button.

4 Press the **MENU** Softkey (on the 'Database Status' Window side of the bezel if in split screen mode).

Or:

Touch the **Menu** Icon in the top right corner of the 'Database Status' Window.

5 Touch the **AUTO Standby Activation** Annunciation Button. (The green annunciation indicates standby databases will automatically be activated.)

CHANGING THE DATABASE REGION:

1 Touch the **Applications** Icon on the MFW App Bar.

Or:

Press the **MENU** Softkey two times to open the 'Apps' Window.

2 If necessary, touch the **Settings & Tools** Tab.

3 Touch the **Databases** Button.

4 Touch the Available Cycle datafield button to be loaded to the standby cycle.

5 Touch the **Load to Standby** Button.

SEAMLESS DATABASE ACTIVATION

When new databases have been downloaded to the system using a USB stick, the Seamless Database Activation process allows any new Navigation, Obstacle, Airport Directory, and SafeTaxi® databases to be synchronized and activated across the avionics system at power-on. FliteCharts®, ChartView™, and IFR/VFR Charts databases will be synchronized and

activated in the background after power-on. All aforementioned databases will be activated and displayed in the 'Active' Column of the 'Database Summary' Screen; no restart of system is required. However, when new Basemap and Terrain databases are available, a restart of the system will be required for those databases to be activated.

DELETING DATABASES

NOTE

Avoid using the Delete All databases function unless it is recommended by Garmin Aviation Support. Deleting all the databases will greatly increase the download time of the next system update.

If databases are not properly loading or functioning, it may be necessary to delete the databases from the system. Databases can also be deleted from an inserted USB Stick. All databases may be deleted at once, or individual databases may be selected for deletion. Databases marked for deletion will display a white 'X' until avionics power is cycled.

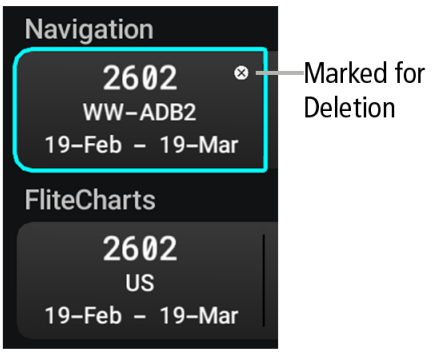


Figure 327: Databases Marked for Deletion

DELETING DATABASES:

NOTE

It is not necessary to cycle system power when deleting GDL60 databases.

1 Touch the **Applications** Icon on the MFW App Bar.

Or:

Press the **MENU** Softkey two times to open the 'Apps' Window.

2 If necessary, touch the **Settings & Tools** Tab.

3 Touch the **Databases** Button.

a) Select the database to be deleted (Active, Standby, or Catalog).

b) Touch the **Marked for Deletion** Annunciation Button (Active and Standby). Touch the **Delete Database** Button if attempting to delete a Catalog Database.

Or:

a) Press the **MENU** Softkey (on the 'Database Status' Window side of the bezel if in split screen mode).

Or:

Touch the **Menu** Icon in the top right corner of the 'Database Status' Window.

b) Touch the **All Active Marked for Deletion** Annunciation Button to delete all active databases on the next system power cycle.

Or:

Touch the **All Standby Marked for Deletion** Annunciation Button to delete all standby databases on the next system power cycle.

4 To initiate a power cycle:

a) With the 'Database Status' Window open, and a database marked for deletion, touch the **Menu** Icon at the top right corner of the window.

Or:

Press the **MENU** Softkey (on the 'Database Status' Window side of the bezel if in split screen mode).

b) Touch the **Restart Avionics** Button (this button will be subdued if the aircraft is not on the ground).

c) The prompt, "Restart Avionics? XX Database(s) will be Deleted" will open.

Touch the **OK** Button to initiate the power cycle of the avionics unit.

Or:

Touch the **Cancel** Button to cancel the process and return to the 'Database Status' Window.

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 ADAHRS. When applying power, the system compares the MV DB within the navigation database to that presently residing in each ADAHRS. When a new navigation database is loaded, the system may ascertain the newly loaded MV DB within the navigation database is newer than that residing in each ADAHRS. In this case, the system will prompt for an update with the system message 'Magnetic Database Out of Date: Update Navigation Database to resolve this issue' on the 'Messages' Window.

DATABASE MANAGEMENT

⚠ CAUTION

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

NOTE

To improve database security, the following databases are digitally signed and must pass digital signature verification before the system will accept an upload through a USB drive: Airport Directories, Basemap, Navigation, Obstacles, SafeTaxi, Terrain, ChartView™, FliteCharts®, and IFR/VFR.

NOTE

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

NOTE

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

NOTE

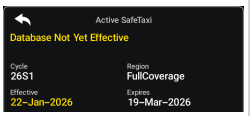
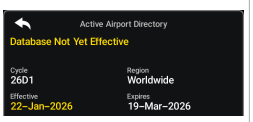
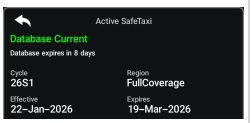
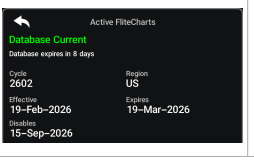
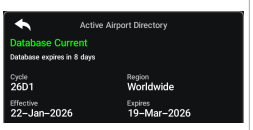
The pilot/operator must review and be familiar with Garmin's database exclusion list as discussed in SAIB CE-14-04 to determine what data may be incomplete. The database exclusion list can be viewed at flyGarmin.com® *by selecting 'Database Exclusions List.'*

Databases that may be available include Terrain, Obstacle, Navigation, Basemap, SafeTaxi®, Airport Directory, IFR/VFR Charts, ChartView, and FliteCharts. Data is revised and expiration dates vary. The 'Database Summary' Page displays the current status of the databases. As an example, see the table below for the various displays and the definition of each. The expiration date and disables date varies for each database.

The Effective Date is the beginning date for this database cycle. The Effective Date appears in amber when the current date is before the effective date. The 'Expires' date is the revision date for the next database cycle. The 'Expires' date appears in amber when expired. 'Database Missing' indicates the database is not installed.

An expired SafeTaxi and Airport Directory database is not disabled and will continue to function indefinitely. Charts are still viewable during a period that extends from the cycle expiration date to the "Disables" date. ChartView is disabled 70 days after the expiration date and is no longer available for viewing.

Additionally, if standby databases are available to activate that are more current than the active databases in the system the option to activate all standby databases is available in the 'Databases Menu'.

Database Condition	SafeTaxi	FliteCharts	Airport Directory
Current date is before effective date		Not Applicable	
Database is current			

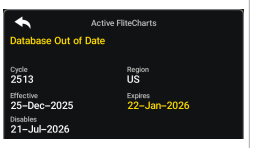
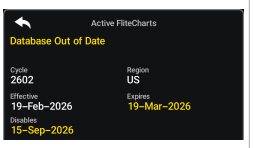
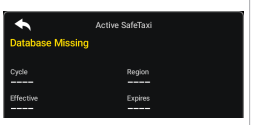
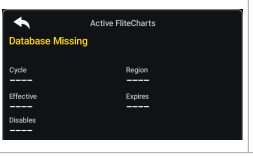
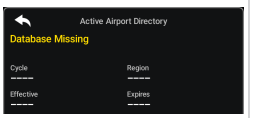
Database Condition	SafeTaxi	FliteCharts	Airport Directory
Database has expired			
Database is disabled	Not Applicable		Not Applicable
Database is not installed			

Table 69: Database Conditions

Database cycle numbers are in a format such as YYXI or YYII, which are deciphered as follows:

- **YYXI**
  - YY — Indicates the last two digits of the year (e.g., 25 represents 2025)
  - X — Indicates the database type (e.g., 'S' is for SafeTaxi, 'D' is for Airport Directory, etc., as seen in the following table)
  - I — Indicates the numerical issue of the database for the year (e.g., 05 is the fifth issue of the year
- **YYII**
  - YY — Indicates the last two digits of the year (e.g., 25 represents 2025)
  - II — Indicates the numerical issue of the database for the year (e.g., 05 is the fifth issue of the year

Database	Database Cycle Number Format	Revision Cycle
Navigation	YYII	28 days
Basemap	YYMI	N/A
Terrain	YYTI	N/A
Obstacle	YYBI	56 days
SafeTaxi	YYSI	56 days
Airport Directory	YYDI	56 days
ChartView	YYII	14 days
FliteCharts	YYII	28 days
IFR/VFR Charts	YYII	28 days

Table 70: Database Cycle Number Format and Revision Cycle

VIEWING DATABASE INFORMATION:

1 Touch the **Applications** Icon on the MFW App Bar.

Or:

Press the **MENU** Softkey two times to open the 'Apps' Window.

2 If necessary, touch the **Settings & Tools** Tab.

3 Touch the **Databases** Button.

4 Scroll through the list of databases to view the brief description of each database information.

5 To view more information, each database has three datafield buttons that can be touched for more details (Active, Standby, and Available Cycle Effective Dates). If no database is present in any of the categories "None" appears in the datafield button.

6 After touching the Active Cycle datafield button, more details may be viewed by touching the **Unit DB Summary** Button or the **Details** Button and the database may be marked for deletion by touching the **Marked for Deletion** Annunciation Button.

7 After touching the Standby Cycle datafield button, more details may be viewed by touching the **Unit DB Summary** Button or the **Details** Button and the database may be marked for deletion by touching the **Marked for Deletion** Annunciation Button. The database may also be selected for activation by touching the **Marked For Activation** Annunciation Button.

8 After touching the Available Cycle datafield button, the options to load the database to standby or to delete the database are available.

a) To view all databases, touch the **View All Available** Button.

DATABASES AND CYCLES

The cycles, dates, and regions for standby, active, and available databases are displayed on the ‘Database Status’ Screen. Any active databases with expiration dates in the past will be highlighted with amber text.

The navigation database contains the aeronautical data used by the system for the flight management and flight planning functions. Included is detailed data for waypoints, procedures (arrivals, departures, approaches), and airways. The navigation database is updated every 28 days. Navigation databases are available for multiple regions. Refer to flyGarmin.com® for a list of navigation databases available.

The basemap database contains data for the topography and land features, such as rivers, lakes, and towns. It is updated only periodically, with no set schedule. There is no expiration date. The basemap database is only available in a ‘Worldwide’ version.

The terrain database contains the terrain mapping data. These databases are updated periodically and have no expiration date. The terrain database is only available in a ‘Worldwide’ version.

The obstacle database contains data for obstacles, such as towers, that pose a potential hazard to aircraft. Obstacles 200 feet and higher are included in the obstacle database. It is very important to note that not all obstacles are necessarily charted and therefore may not be

contained in the obstacle database. This database is updated on a 56-day cycle. The obstacle database is only available in a 'US/Canada/Europe' version.

NOTE

The data contained in the terrain and obstacle databases comes from government agencies. Garmin accurately processes and cross-validates the data, but cannot guarantee the accuracy and completeness of the data.

The AOPA or AC-U-KWIK Airport Directory provides data on airports and heliports throughout the U.S. or worldwide, respectively. The AOPA Directory offers detailed information for over 5,300 U. S. airports, along with the names and phone numbers of thousands of FBOs. These databases are updated every 56 days. The AC-U-KWIK Directory offers detailed information for more than 8,000 airports with runways longer than 3,000 feet worldwide. A 'Worldwide' Airport Directory database is available as well as Airport Directory databases for multiple regions. Refer to flyGarmin.com® for a list of Airport Directory databases available.

The SafeTaxi® database contains detailed airport diagrams for selected airports. These diagrams aid in following ground control instructions by accurately displaying the aircraft position on the map in relation to taxiways, ramps, runways, terminals, and services. This database is updated on a 56-day cycle. A 'Full Coverage' SafeTaxi database is available as well as SafeTaxi databases for multiple regions. Refer to flyGarmin.com® for a list of SafeTaxi databases available.

The FliteCharts® database contains procedure charts. This database is updated on a 28-day cycle. If not updated within 180 days of the expiration date, FliteCharts will no longer function.

The ChartView™ database is updated on a 14-day cycle. If the ChartView database is not updated within 70 days of the expiration date, ChartView will no longer function. The ChartView database must be purchased directly from Jeppesen but can be updated at jeppesen.com or flyGarmin.com®. The ChartView database is available for multiple regions. Refer to jeppesen.com for a list of ChartView databases available.

The IFR/VFR charts database contains VFR and IFR raster charts. The VFR Charts are digital representations of the Sectional Aeronautical Charts and Terminal Area Charts. The IFR Charts include both IFR High (designed for navigation at or above 18,000 ft) and IFR Low (designed for navigation below 18,000 ft). IFR/VFR Charts are updated every 28 days except for Canadian IFR/VFR Charts which are updated every 56 days. The IFR/VFR charts database is available for multiple regions. Refer to flyGarmin.com® for a list of IFR/VFR charts databases available.

9.3 APPENDIX C (GLOSSARY)

AVIATION TERMS, ABBREVIATIONS, AND ACRONYMS

A Amps, Amperes

ABN Abnormal

AC Advisory Circular, Alternating Current

ACARS Aircraft Communications Addressing and Reporting System
ACC Accuracy
ACFT Aircraft
ACK Acknowledge
ACT, **ACTV** Active, Activate, Altitude Compensated Tilt
ADAHRS Air Data, Attitude and Heading Reference System
ADC Air Data Computer
ADF Automatic Direction Finder
ADI Attitude Direction Indicator
ADIZ Air Defense Identification Zone
ADM Administrative Domain
ADS-B Automatic Dependent Surveillance-Broadcast
ADS-C Automatic Dependent Surveillance-Contract
ADS-R Automatic Dependent Surveillance-Rebroadcast
AEA Aircraft Electronic Association
AF Arc to Fix Leg
AFCS Automatic Flight Control System
AFM Airplane Flight Manual
AFMS Airplane Flight Manual Supplement
AFN ATS Facilities Notification
AFRM Airframe
AFTN Aeronautical Fixed Telecommunication Network
A/G Air-to-Ground
AGL Above Ground Level
AHRS Attitude and Heading Reference System
AIM Aeronautical Information Manual
AIRB Airborne
AIRMET, **AIRM** Airman's Meteorological Information
AIRREP Air Reports
ALRT Alert, Alerting
ALT Altitude
ALT, **ALTN** Alternator, Alternate
ALTM Altimeter
ALTS Altitude Select, Selected Altitude Capture Mode
ALTV VNAV Altitude Capture Mode
AM Amplitude Modulation
AMP Amplifier, Ampere

AMPS Amperes
ANN/ANNUNC Annunciation/Annunciator
ANSP Air Navigation Service Provider
ANT Antenna
AOA Angle of Attack, ACARS Over AVLC
AOC Aeronautical Operational Control
AOG Aircraft On Ground
AOPA Aircraft Owners and Pilots Association
AP Autopilot
AP DISC Autopilot Disconnect
APPR, **APR** Approach, Approach Control
APT Airport, Aerodrome, Automatic Pitch Trim
APTSIGNS Airport Signs
APU Auxiliary Power Unit
APV Approaches with Vertical Guidance
ARINC Aeronautical Radio Incorporated
ARM Arm, Armed
ARR, **ARV** Arrival
ARSPC Airspace
ARTCC Air Route Traffic Control Center
AS Airspeed
ASB Aviation Support Branch
ASDA Accelerate-Stop Distance Available
ASI Airspeed Indicator
ASOS Automated Surface Observing System
AT Auto Throttle
ATAS ADS-B Traffic Advisory System
ATC Air Traffic Control
ATCRBS ATC Radar Beacon System
ATD Along-Track Distance
ATE Along-Track Error, Automatic Test Equipment
ATIS Automatic Terminal Information Service
ATK Along Track
ATN Aeronautical Telecommunications Network
ATS Air Traffic Services
ATT Attitude
ATZ Aerodrome Traffic Zone

AUD Audio
AUTO Automatic
AUTOSEQ Automatic Sequence
AUX Auxiliary
AVAIL Available
AVG Average
AVLC Aviation VHF Link Control
AWOS Automated Weather Observing System
AWY Airway
AZ Azimuth
B Both Runways
B ALT Barometric Altitude
BC, **B/C** Back Course
BARO Barometer, Barometric Setting
BATT Battery
Bearing The compass direction from the present position to a destination waypoint.
BFO Beat Frequency Oscillator
BKLT Backlight
BKSP Backspace
BKUP Backup
BLKHD Bulkhead
Bluetooth Wireless standard for data exchange over short distances
BOC Bottom of Climb
BOD Bottom of Descent
BRG see also Bearing
BRK Brake
BTM Bottom
°C Degrees Celsius
C Center Runway
CA Course to Altitude Leg
CAL Calibrated, Calibration
CALC Calculator
Calibrated Airspeed Indicated airspeed corrected for installation and instrument errors.
CAS Crew Alerting System
CAT Clear Air Turbulence
CAVS CDTI Assisted Visual Separation
CLB Climb

CB Circuit Breaker
CCG Current Climb Gradient
CD Course to DME Distance Leg
CDA Current Data Authority
CDI Course Deviation Indicator
CDU Control Display Unit
CDTI Cockpit Display of Traffic Information
CF Course to Fix Leg
CFG Configuration
CFIT Controlled Flight into Terrain
CG Center of Gravity
CH, **CHNL** Channel
CHK Check
CHKLIST Checklist
CHRG Charge
CHT Cylinder Head Temperature
CI Course to Intercept Leg
CIP Current Icing Potential
CL Class, Centerline
CLB Climb
CLD Cloud
CLG Ceiling
CLR Clear
CLS Close
CLTR Clutter
CM Centimeter, Context Management, Configuration Module
CMC Central Maintenance Computer
CMPRTR Comparator
CN Canada
CNCL Cancel
CNFM Confirm
CNI Communication, Navigation, & Identification
CNS Communication, Navigation, & Surveillance
CNXT Connext®
CO Carbon Monoxide
COM Communication Radio
COMP Compensated, Compensation

CONFIG Configuration

CONUS Continental United States

COOL Coolant

COPLT Copilot

CORR Correct, Corrected, Correction

Course The line between two points to be followed by the aircraft.

Course to Steer The recommended direction to steer in order to reduce course error or stay on course. Provides the most efficient heading to get back to the desired course and proceed along the flight plan.

CP Copilot, Control Panel

CPDLC Controller Pilot Datalink Communications

CPL Couple

CR Course to Radial Leg

CRC Cyclic Redundancy Check

CRG Cockpit Reference Guide

CRNT Current

Crosstrack Error The distance the aircraft is off a desired course in either direction, left or right.

CRS see also Course, Course to Steer

CRSR Cursor

CRU, **CRZ** Cruise

CSA Conflict Situational Awareness

CSC Current Speed Control

CSTR Constraint

CTA Control Area

CTAF Common Traffic Advisory Frequency

CTR Center, Controlled Traffic Region

CTRL Control

Cumulative, **CUM** The total of all legs in a flight plan.

CVDR Cockpit Voice Data Recorder

CVFP Charted Visual Flight Procedure

CVR Cockpit Voice Recorder

CVRG Coverage

CVS Combined Vision System

CWS Control Wheel Steering

CYC CTR Cyclic Centering

CYL Cylinder

CZ Control Zone

D->, Direct-To

D/A Digital to Analog Converter

D ALT Density Altitude

D-ATIS Digital Automatic Terminal Info Service

DA Decision Altitude, Drift Angle

DB, **DBASE** Database

DBZ Decibels 'Z' (Radar Return)

DCL Departure Clearance

DCLTR, **DECLTR** Declutter

DEC Declination

DEC FUEL Decrease Fuel

DEG Degree

DEIC, **DEICE** De-icing

DEL Delete

DEP Departure, Departure Control

DESC Descent

Desired Track The desired course between the active "from" and "to" waypoints.

DEST, **DES** Destination, Destination Airport Identifier

DET Detect, Detected, Detection, Detector

DEV Deviation

DF Direction Finder, Direct-to Fix Leg

DFLT Default

DG Directional Gyro

DGPS Differential GPS

DGRD Degrade

DH Decision Height

DIFF Differential

DIG Digital

Dilution of Precision A measure of GPS satellite geometry quality on a scale of one to ten (lower numbers equal better geometry, where higher numbers equal poorer geometry).

DIR Direction

DIS Distance

DISC Disconnect

DISENG Disengage

DISP, **DSPL** Display

Distance The 'great circle' distance from the present position to a destination waypoint.

DIV Divert, Diversion
DL LTNG Datalink Lightning
DLS Data Link System
DME Distance Measuring Equipment
DN Down
DNALT Density Altitude
DNGR Danger
DNLK Downlink
DOD Department of Defense
DOP see also Dilution of Precision
DOPP Doppler
DP Departure Procedure, Differential Pressure
DPRT Departure
DQR Data Quality Requirements
DR Dead Reckoning
DSBL Disabled
DSP Display, Datalink Service Provider, Digital Signal Processor
DTG Distance To Go, Remaining distance to last active FPL waypoint
DTK see also Desired Track
DWNGRADE Downgrade
E Empty, East
EAS Engine and Airframe Systems
EC Error Correction
ECC Error Correcting Code
ECL Electronic Checklist
ECR Excessive Closure Rate
ECS Environmental Control System, or Electrical Control System
ECU Engine Control Unit
EDM Emergency Descent Mode
EDR Excessive Descent Rate
EEP Expanded Envelope Protection
EFB Electronic Flight Bag
EFC Expected Further Clearance
EFVS Enhanced Flight Vision System
EGNOS European Geostationary Navigation Overlay Service
EGT Exhaust Gas Temperature
EHS Enhanced Surveillance

EICAS Engine Indication and Crew Alerting System

EIS Engine Indication System

ELEC Electrical

ELEV Elevation, Elevator

ELT Emergency Locator Transmitter

EMER, **EMERG**, **EMERGCY** Emergency

EMI Electromagnetic Interference

END, **ENDUR** Endurance

Endurance Flight endurance, or total possible flight time based on available fuel on board.

ENG Engine

ENGA Engage

ENGD Engaged

ENR Enroute; ETE to Final Destination

Enroute Safe Altitude (ESA) Uses Grid MORAs to find a safe altitude within ten miles left or right of the desired course on an active flight plan or direct-to.

ENT Enter

EP Envelope Protection

EPE see also Estimated Position Error

EPU Estimated Position Uncertainty

ERR Error

ES Extended Squitter

ESA Emergency Safe Altitude, see also Enroute Safe Altitude

ESOSP Electronic Stability Overspeed Protection

Garmin ESP™ Electronic Stability and Protection

Estimated Position Error (EPE) A measure of horizontal GPS position error derived by satellite geometry conditions and other factors.

Estimated Time Enroute (ETE) The estimated time it takes to reach the destination waypoint from the present position, based upon current groundspeed.

Estimated Time of Arrival (ETA) The estimated time at which the aircraft should reach the destination waypoint, based upon current speed and t rack.

ET Elapsed Time

ETA see also Estimated Time of Arrival

ETD Estimated Time of Departure

ETE see also Estimated Time Enroute

EVS Enhanced Vision Sensor

EXCIT Excitation

EXP Expand

EXPIRD Expired

EXT External
EXTD Extend, Extended
EXTING Extinguish, Extinguisher
EXTR Extract, Extraction
°F Degrees Fahrenheit
FA Course From Fix to Altitude Leg
FAA Federal Aviation Administration
FADEC Full Authority Digital Engine Control
FAF Final Approach Fix
FAIL Failure
FANS Future Air Navigation System
FAP Final Approach Point
FAPP Final Approach
FAR Federal Aviation Regulations
FBO Fixed Base Operator
F/C Flight Crew
FC Course From Fix to Distance Leg
FCC Federal Communication Commission
FCE Flight Control Equipment
FCST Forecast
FCTN Function
FD Flight Director, Course From Fix to DME Distance Leg
FDE Fault Detection and Exclusion
FDR Flight Data Recorder
FF, **FFLOW** see also Fuel Flow
FIS-B Flight Information Services-Broadcast
FISDL Flight Information Service Data Link
FIT Flight Into Terrain
FL Flight Level
FLC, **FLCH** Flight Level Change
FLT Flight, Flight Timer
FLTA Forward Looking Terrain Avoidance
FLW Follow, Following
FM Course From Fix to Manual Termination Leg
FMS Flight Management System
FOB see also Fuel On Board
FOD see also Fuel Over Destination

FPA Flight Path Angle

FPBFD Flight Path Based Flight Director

FPL Flight Plan

FPM Feet Per Minute, Flight Path Marker

FR From

FREQ Frequency

FRMT Format

FRT Front

FRZ Freezing

FS Flight Stream

FSD Full-Scale Deflection

FSM Flight System Messages

FSS Flight Service Station

FT Foot/Feet

Fuel Flow The fuel flow rate, expressed in units of fuel per hour.

Fuel On Board The total amount of usable fuel on board the aircraft.

Fuel Over Destination The estimated fuel remaining when the aircraft reaches the destination waypoint, based upon current fuel flow.

FWD Forward

G/A Ground to Air

G/S Glideslope

GA Go-Around

GAGAN GPS Aided GEO Augmented Navigation

GAGL GPS AGL Altitude

GAL, **GL** Gallon(s)

GBAS Ground Based Augmentation System

GBOX Gearbox

GBT Ground Based Transceiver

GCS Ground Clutter Suppression

GCSS Garmin Connext Satellite Services

GCU Garmin Control Unit

GDC Garmin Air Data Computer

GDL Garmin Satellite Data Link

GDM Garmin Distance Measuring Equipment

GDR Garmin Data Radio

GDU Garmin Display Unit

GEA™ Garmin Engine/Airframe Unit

GEAR Landing Gear

GEN Generator

GEO Geographic

GFC Garmin Flight Control

GHD™ Garmin Head Up Display

GHZ Gigahertz

GIA Garmin Integrated Avionics Unit

GIFD Garmin Integrated Flight Deck

GLONASS Global Orbiting Navigation Satellite Landing System

GLS Global Navigation Satellite Landing System

GMA™ Garmin Audio Panel System

GMC Garmin Mode Controller

GMT Greenwich Mean Time

GMU Garmin Magnetometer Unit

GND Ground

GNSS Global Navigation Satellite System

GOLD Global Operational Data Link

GP Glidepath

GPH Gallons per Hour

GPN Garmin Part Number

GPS Global Positioning System

GPWS Ground Proximity Warning System

GRA™ Garmin Radar Altimeter

GRC Garmin Remote Control

Grid MORA (Minimum Off-Route Altitude) One degree latitude by one degree longitude in size and clears the highest elevation reference point in the grid by: a) 1,000 feet where the highest elevation is <5001MSL or b) 2,000 feet where the highest elevation is >5000MSL

Ground Track See Track Groundspeed The velocity the aircraft is traveling relative to a ground position.

GRP Geographic/Ground Reference Point

GRS Garmin Reference System

GRT Garmin Radio Transceiver

GS Ground Speed, Glideslope

GSA Garmin Servo Adapter

GSB™ Garmin USB Ports

GSD Glideslope/Glidepath Deviation, Garmin Data Concentrator

GSL Geometric/Geodetic Sea Level

GSR Garmin Satellite Radio

GSU Garmin Sensor Unit

GTC Garmin Touchscreen Controller

GTS™ Garmin Traffic System

GTX™ Garmin Transponder

GW Gross Weight

GWX™ Garmin Weather Radar

H Hours

H+MM Hours and Minutes

HA Hold Terminating at Altitude Leg

HAL Horizontal Alert Limit

HAT Height Above Threshold

HDD Head Down Display

HDG see also Heading

HDOP Horizontal Dilution of Precision

Heading The direction an aircraft is pointed, based upon indications from a magnetic compass or a properly set directional gyro.

HF High Frequency, Hold Terminating at Fix Leg

HFOM see also Horizontal Figure of Merit

HG Mercury

HI High

HI SENS High Sensitivity

HLD Hold, Holding, Holding Pattern

HM Hold with Manual Termination Leg

HNS Hybrid Navigation Sensor

Horizontal Figure of Merit A measure of the uncertainty in the aircraft's horizontal position.

HOV Hover

HOV-P Hover Prediction

HP High Pressure, Horsepower

HPA Hectopascal

HPI Hover Power Indicator

HPL Horizontal Protection Level

HR Hour

HRZN HDG Horizon Heading

HSC High Speed Cruise

HSDB High-Speed Data Bus

HSI Horizontal Situation Indicator
HT Heat, Height
HTR Heater
HUD Head Up Display
HUL Horizontal Uncertainty Level
HWND Headwind
HYD Hydraulic
HZ Hertz (cycles per second)
HZN Horizon
I Inner Marker
IAF Initial Approach Fix
IAP Instrument Approach Procedure
IAS Indicated Air Speed
IAT Indicated Air Temperature
IATA International Air Transport Association
IAU Integrated Avionics Unit
IBD, **INBD** Inboard
ICAO International Civil Aviation Organization
ICE Icing
ICS Intercom System
ID Identification/Morse Code Identifier
IDENT, **IDNT** Identification
IEEE Institute of Electrical & Electronics Engineers
IF Initial Fix
IFR Instrument Flight Rules
IG Imperial Gallon
IGE In Ground Effect
IGRF International Geomagnetic Reference Field
IGW Increased Gross Weight
ILI Imminent Line Impact
ILS Instrument Landing System
IM Inner Marker
IMC Instrument Meteorological Conditions
IN Inch
IN HG, "HG Inches of Mercury
INACTV Inactive
INBD Inboard

INBND Inbound

INC FUEL Increase Fuel

IND Indicator, Indicated

Indicated Information provided by properly calibrated and set instrumentation on the aircraft panel.

INDX Index

INFO Information

INH, **INHIB** Inhibit

INIT Initialization

INOP Inoperative

INS Inertial Navigation System

INSTR Instrument

INT Intersection(s), Internal

INTEG Integrity (RAIM unavailable)

INTERN, **INTRL** Internal

INV Invalid

IOI Imminent Obstacle Impact

IR Infrared

IrDA, **IRDA** Infrared Data Association

IRST Infrared Surveillance and Tracking

ISA International Standard Atmosphere; ISA Relative Temperature

ISO International Standards Organization

ISOL Isolation

ITI Imminent Terrain Impact

ITT Inter-Turbine Temperature, Interstage Turbine Temperature

KEYSTK Key Stuck

KG Kilogram

KHZ Kilohertz

KIAS Knots Indicated Airspeed

KM Kilometer

KT Knot

L Left, Left Runway

LAHSO Land And Hold Short Operations

LAT Latitude, Lateral

LB Pound

LBL Label

LCD Liquid Crystal Display

LCL Local
LDA Landing Distance Available, Localizer Type Directional Aid
LDG Landing, ETA at Final Destination
LED Light Emitting Diode
Leg The portion of a flight plan between two waypoints.
LEN Length
LGND Legend
LIFR Low Instrument Flight Rules
LI-ION Lithium Ion
LIM Limit
LMM Locator Middle Marker
LNAV Lateral Navigation
LO Low
LOA Letter of Authorization
LOC Localizer
LOI Loss of Integrity (GPS)
LOM Locator Outer Marker
LON, **LONG** Longitude, Longitudinal
LP Localizer Performance, Low Pressure
LPV Localizer Performance with Vertical Guidance
LRC, **LRCR** Long Range Cruise
LRG Large
LRU Line Replaceable Unit
LSB V Lower Sideband Voice
LT Left, Light
LTNG Lightning
LVL Level
M Meter, Middle Marker, Mach
Mach Number the ratio of the true airspeed to the speed of sound.
MAG Magnetic
MAG VAR Magnetic Variation
MAHP Missed Approach Hold Point
MAINT Maintain
MAL Malfunction
MAN Manual
MAN IN Manifold Pressure (inches Hg)
MAN SQ Manual Squelch

MANSEQ Manual Sequence
MAP Missed Approach Point
MAPROC Missed Approach Procedure
MASQ Master Avionics Squelch
MAX Maximum
MAXSPD Maximum Speed (overspeed)
MB Marker Beacon, Millibar(s)
MCDU Multifunction Control and Display Unit
MCLB Maximum Climb Thrust
MCP Maximum Continuous Power
MCRZ Maximum Cruise Thrust
MCT Maximum Continuous Thrust
MDA Barometric Minimum Descent Altitude
MEA Minimum Enroute Altitude
MEM Memory
MEPT Manual Electric Pitch Trim
MERT Manual Electric Roll Trim
MET Manual Electric Trim
METAR Aviation Routine Weather Report
METRO Metropolitan
MEYT Manual Electric Yaw Trim
MFI Multi-Function Instrument
MFD Multi Function Display
MFW Multi Function Window
MGRS Military Grid Reference System
MGT Measured Gas Temperature
MHz Megahertz
MIC Microphone
MID Middle
MIN Minimum, Minute
MKR Marker Beacon
MM Middle Marker
M_{MO} (V_{MO}) Maximum Speed
MOA Military Operations Area
MOD Modification, Modify
MON Monitor, Monitored, Monitoring
MORA Minimum Off-Route Altitude

MOV Movement

MPEL Maximum Permissible Exposure Level

MPM Meters per Minute

MSA Minimum Safe Altitude

MSAS Multi-functional Satellite Augmentation System

MSG Message

MSL Mean Sea Level

MT, **M** Meter

MTG Mounting

MTN Mountain

MTOGW Maximum Takeoff Gross Weight

MTOW Maximum Takeoff Weight

MV Millivolt(s)

MVFR Marginal Visual Flight Rules

MXCR Maximum Cruise

N North

NATS North Atlantic Tracks System

NAV Navigation

NAVAID Navigation Aid

NCR Negative Climb Rate

NDA Next Data Authority

NDB Non-Directional Beacon

NEG Negative

NEXRAD Next Generation Radar

NG Gas Producer Rotation Speed

NM Nautical Mile(s)

NMPG Nautical Miles per Gallon

NoPT No Procedure Turn Required (procedure shall not be executed without ATC clearance)

NORM Normal

NOTAM Notice To Air Missions

NP Power Turbine Speed

NPA Non-Precision Approach

NR Rotor Speed

NRST Nearest

NWHL Nosewheel

NWS National Weather Service, Nosewheel Steering

O Outer Marker
OAT Outside Air Temperature
OBD, **OUTBD** Outboard
OBS Omni Bearing Selector, Observation, Observe, Observed
OBSCR Obscuration
OCL Oceanic Clearance
OEM Original Equipment Manufacturer
OFST Offset
OGE Out of Ground Effect
OM Outer Marker
OOOI Out of the gate, Off the ground, On the ground, and In the gate
OROCA Off Route Obstacle Clearance Altitude
OSP Overspeed Protection
OUTBD Outboard
OUTBND Outbound
OVBD Overboard
OVFL Overflow
OVFLY Overfly, Overflying
OVHD Overhead
OVHT Overheat
OVLIM Overlimit
OVLD Overload
OVPR Overpressure
OVR, **OVRD** Override
OVRN Overrun
OVSPD Overspeed
OVTMP Overtemperature
OXY Oxygen
P ALT Pressure Altitude
P-ATT Pitch Attitude
PA Precision Approach, Passenger Address, Proximity Advisory
PB Push Button
PASS, **PAX** Passenger(s)
PC Personal Computer
PCL Pilot Controlled Lighting
PDA Premature Descent Alerting
PDC Pre-Departure Clearance

PED Portable Electronic Device
PERF Performance
PFD Primary Flight Display
PFT Preflight Test
PFW Primary Flight Window
PG Pilot's Guide
PI Procedure Turn to Course Intercept Leg
PIREP Pilot Report
PIT, **PTCH** Pitch
PLT Pilot
PNR Prior Notice Required
POA Plain Old ACARS
POB Persons (Souls) on Board
POF Phase of Flight
POH Pilot's Operating Handbook
POHS Pilot's Operating Handbook Supplement
POS, **POSN** Position
POSS Possible
PPH Pounds per Hour
PPM Parts per Million
PPOS, **P. POS** Present Position
PREFLT Preflight
PRES, **PRESS**, **P** Pressure
PREV Previous
PRI, **PRIM** Primary
PRL Parallel
PRN Pseudo Random Noise
PROC Procedure(s), Procedure Turn
PROP Propeller
PROX Proximity
PSI Pounds per Square Inch, Power Situation Indicator
PT Procedure Turn, Part Time
PTK Parallel Track
PTT Push-to-Talk
PWR Power
Q Engine Torque
QFE Field Elevation Pressure

QNE Pressure Altitude
QNH Sea Level Pressure
QTY Quantity
R Right, Right Runway
RA Resolution Advisory, Radio Altimeter, Radar Altimeter
RAD Radial
RAD ALT Radio Altimeter, Radar Altimeter
RAIM Receiver Autonomous Integrity Monitoring
RAM Random Access Memory
RAT Ram Air Temperature
RCR Recommended Cruise
RCVR Receiver
R/D Radial/Distance
RDR Radar
REC Record, Recorder
RECIRC Recirculate/Recirculating
REF Reference
REGL Regulator
REM Remaining (fuel remaining), Reminder, Removed, Remote
REQ Request
REQD, **REQ'D** Required
RES Reserve (fuel reserve entered by pilot)
REST Restricted, Restriction
RET Return
RETD Retard
REV Reverse, Revision, Revise
RF Radio Frequency, Constant Radius Turn to Fix Leg
RFM Rotorcraft Flight Manual
RLC Required Line Clearance
RMI Radio Magnetic Indicator
RMT Remote
RNAV Area Navigation
RNG Range
RNP Required Navigation Performance
RNWY, **RWY** Runway
ROA Runway Occupancy Awareness
ROAAS Runway Overrun Awareness and Alerting System

ROC Required Obstacle Clearance, Rate of Climb
ROD Rate of Descent
ROL Roll
ROM Read Only Memory
ROT Rotary
RPM Revolutions Per Minute
RQRD Required
RST FUEL Reset Fuel
RSV Reserve (fuel reserve entered by pilot)
RT Right
RTC Required Terrain Clearance
RTE Route
RTR Router
RUDICS Router-Based Unrestricted Digital Interworking Connectivity Solution
RVRSNRY Reversionary
RVSI Required Vertical Speed Indicator
RVSM Reduced Vertical Separation Minimums
RX Receive
S South
SA Selective Availability
SAIB Special Airworthiness Information Bulletin
SAR Search and Rescue
SAT Static Air Temperature
SATCOM Satellite Communication
SBAS Satellite-Based Augmentation System
S-CLB Step Climb
SC Short Circuit
SCIT Storm Cell Identification and Tracking
S-DES Step Descent
SD Secure Digital
SDF Simplified Directional Facility
SEC Second(s), Secondary
SECT Section
SEG Segment
SEL, **SLCT** Select
SELCAL Selective Calling
SENS Sense, Sensitivity, Sensor

SEQ Sequence, Sequencing
SERL Serial
SERV Service, Servicing, Served
SET Setup
SFC Surface
SFD Standby Flight Display
SHT Short
SIAP Standard Instrument Approach Procedures
SID Standard Instrument Departure
SIG Signal
SIG/AIR SIGMET/AIRMET
SIGM SIGMET
SIGMET Significant Meteorological Information
SIM Simulator
SITA Societe Internationale de Telecommunications
SLD Supercooled Large Droplet
SLP/SKD Slip/Skid
SLW Slow
SM Statute Mile
SMBL Symbol
SMK Smoke
SMS Short Message System
SNGL Single
SOB Souls on Board
SPBK Speed Brake
SPC Space
SPD Speed
SPI Special Position Identification
SPKR Speaker
SQ, **SQL** Squelch
SRVC, **SVC** Service
SSEC Static Source Error Correction
SSID Wireless Service Set Identifier
SSR Secondary Surveillance Radar
STAB Stabilization
STAL Stall
STAR Standard Terminal Arrival Route

STAT Status
STATS Statistics
STBY Standby
STC Sensitivity Time Constant, Supplemental Type Certificate
STD Standard
STN Station
STR Strip
STRMSCP Stormscope
SUA Special Use Airspace
SUB Substitute
SUPPRESS Suppression
SURF Surface
SUSP Suspend
SVBL Serviceable
SVO Servo
SVT™™ Synthetic Vision Technology
SW Software
SWPS Stall Warning Protection System
SYN TERR Synthetic Terrain
SYN VIS Synthetic Vision
SYNC Synchronize
SYNTH Synthesizer
SYS System
T True
T HDG True Heading
T/R Thrust Reverser
TA Traffic Advisory, Transition Altitude
TAC Tactical, Terminal Area Chart
TACAN, **TCN** Tactical Air Navigation System
TAF Terminal Aerodrome Forecast
TAS True Airspeed, Traffic Advisory System
TAT Total Air Temperature
TAWS Terrain Awareness and Warning System
TC Table of Contents
TCA Terminal Control Area
TCAS Traffic Alert Collision Avoidance System
TCH Threshold Crossing Height

TCS Touch Control Steering
TD Touchdown
TEL Telephone
TEMP, **TMP** Temperature
TERM Terminal
TERR Terrain
T/F To/From
TF Track Between Two Fixes Leg
TFR Temporary Flight Restriction
TGT Target
TH True Heading
THLD Threshold
THR Thrust
TIS Traffic Information Service
TIS-B Traffic Information Service-Broadcast
TIT Turbine Inlet Temperature
TIZ Traffic Information Zone
TKE see also Track Angle Error
TL Transition Level
TLA Throttle Lever Angle, Thrust Lever Angle
TMA Terminal Maneuvering Area
TMR/REF Timer/Reference
TNK Tank
TO To, Takeoff
TOC Top of Climb, Table of Contents
TOD Top of Descent, Time to TOD
TOGA, **TO/GA** Take-Off, Go-Around
TOLA Takeoff and Landing Assistant
TOLD Takeoff and Landing Data
TOPO Topographic
TORA Takeoff Run Available
TOT Total
TPA Traffic Pattern Altitude
Track Direction of aircraft movement relative to a ground position; also 'Ground Track'.
Track Angle Error The angle difference between the desired track and the current track.
TRFC Traffic
TRK see also Track

TRM Trim
TRN Terrain
TRSA Terminal Radar Service Area
TRUNC Truncated
TSO Technical Standard Order
TST Test
TTA Time-to-Alert
TTK True Track
TTL Total
TTS Text to Speech
TUR Turbine
TURB Turbulence
TURN Procedure Turn
TWND Tailwind
TWIP Terminal Weather Information for Pilots
TWR Tower
TWY Taxiway
TX Transmit
UA Routine PIREP
UAT Universal Access Transceiver
UAV Unmanned Airborne Vehicle
UHF Ultra-High Frequency
UNABL Unable
UNAVAIL Unavailable
UNLIM Unlimited
UPLK Uplink
US United States
USB V Upper Sideband Voice
USP Underspeed Protection
USR User
UTC Coordinated Universal Time
UTM/UPS Universal Transverse Mercator/ Universal Polar Stereographic Grid
UUA Urgent PIREP
V Volts, Vertical
V DEV Vertical Deviation
V, **Vspeed** Velocity (airspeed)
$\mathbf{V_1}$ Takeoff Decision Speed

V_2 Takeoff Safety Speed

V_A Maneuvering Speed

VA Heading Vector to Altitude Leg

VAC Volts Alternating Current

VAL Vertical Alert Limit

V_{APP} VOR Approach Mode

V_{APP} , V_{AC} Approach Climb Speed

VAR Variable, Variation

VCO Voice Call Out

VD Heading Vector to DME Distance Leg

VDC Volts Direct Current

VDI Vertical Deviation Indicator

VDL VHF Datalink

V_E, V_{ENR} Enroute Climb Speed

VECT Vector

VERT Vertical

Vertical Figure of Merit A measure of the uncertainty in the aircraft's vertical position.

Vertical Speed Required The vertical speed necessary to descend/ climb from a current position and altitude to a defined target position and altitude, based upon current groundspeed.

V_{FE} Maximum Flap Extended Speed

VFOM see also Vertical Figure of Merit

VFR Visual Flight Rules

VHF Very High Frequency

VI Heading Vector to Intercept Leg

VIB Vibration

V_{LE} Maximum Landing Gear Extended Speed

V_{LNDx} Approach Speed (Flaps at x°)

V_{LO} Maximum Landing Gear Operating Speed

VLD Valid

VLOC, **VOR/L** VOR/Localizer Receiver

VM Heading Vector to Manual Termination Leg

V_{MC} Minimum Control Speed

VMC Visual Meteorological Conditions

V_{MO} (MMO) Maximum Operating Speed

VNAV, VNV Vertical Navigation

V_{NE} Never-Exceed Speed

VOL Volume
VOLT Voltage
VOR VHF Omnidirectional Range
VOR/D VOR/DME
VOR/I VOR/ILS
VORTAC VHF Omnidirectional Range Station and Tactical Air Navigation
VPATH, **VPTH** Vertical Path
VPL Vertical Protection Level
VPROF VNAV Profile, Vertical Profile
V_R Takeoff Rotate Speed
VR Heading Vector to Radial Leg
V_{REF} Landing Approach Speed, Reference Landing Speed
VRP Visual Reporting Point
VS Vertical Speed
V_{SB} Maximum Speedbrake Speed
VSD Vertical Situation Display
VSI Vertical Speed Indicator
VSM Vertical Separation Minima
V_{SR} Stall Speed
VSR, **VS REQ** see also Vertical Speed Required
V_T Takeoff Flap Retraction Speed
VTE Vertical Track Error
VTF Vector to Final
VTK Vertical Track
V_{TIRE} Maximum Tire Speed
V_X Best Angle of Climb Speed
V_Y Best Rate of Climb Speed
V_{YSE} Best Single-Engine Rate of Climb Speed
W Watt(s), West
WAAS Wide Area Augmentation System
WARN Warning
WATCH® Weather Attenuated Color Highlight
WB Weight & Balance
WDIR Wind Direction
WEP Wired Equivalent Privacy
WSPD Wind Speed

WGS-84 World Geodetic System - 1984
WI-FI, **WIFI** Wireless Local Area Network based on IEEE 802.11
WILCO Will Comply
WNDSHR, **WSHEAR** Windshear
WL Wings Level
WOG Weight on Gear
WOW Weight on Wheels
WPA Wi-Fi Protected Access
WPT Waypoint(s)
WT Weight
WUXGA Widescreen Ultra Extended Graphics Array
W/V Wind Velocity
WW World Wide
WX Weather
WXR Weather Radar
XFD Crossfeed
XFER, **XFR** Transfer
XFLOW Crossflow
XM LTNG SiriusXM Lightning
XMIT Transmit
XMSN Transmission
XPDR Transponder
XTALK Cross-Talk
XTE Crosstrack Error
XTK Cross-Track, Crosstrack Error
YD Yaw Damper
Z Reflectivity Factor
ZPL Zero Pitch Line

9.4 APPENDIX D (PRE-FLIGHT CHECKS)

⚠ CAUTION

Do not fly the aircraft if a required AXIS™ flight display presents any persistent warning, caution, or advisory indications relating to equipment requiring service, internal faults, or failures.

NOTE

Appendix D of this Pilot's Guide applies to the AXIS Flight Display(s) only. For more information on pre-flight inspections and procedures, refer to the applicable flight manual (e.g., POH, other LRU manual/guide, etc.).

GLOVE QUALIFICATION CONSIDERATIONS

The touchscreen uses capacitive touch technology to sense the proximity of skin to the display. A glove creates a barrier between the skin and the display glass, potentially reducing the ability of the display to detect touches.

Due to differences in finger size and glove size, the qualification considerations are specific to the pilot/glove and aircraft display configuration. If multiple display unit models are installed on the airframe, units must be evaluated individually.

GLOVE SELECTION CONSIDERATIONS

- Thinner gloves perform better than thicker gloves.
- Leather gloves, and gloves designed specifically for use with capacitive touchscreen devices, are often found to be acceptable.
- To improve touchscreen sensitivity while wearing gloves, use the pad of your finger instead of the tip during touch interactions.

AUTOMATIC FLIGHT CONTROL SYSTEM PRE-FLIGHT

For more information pertaining to the AFCS, refer to the *AFCS Section*.

AFCS PRE-FLIGHT CHECKLIST — GARMIN GFC 500X:

To ensure the Automatic Flight Control System (AFCS) is operating properly prior to flight, perform the following Garmin recommended pre-flight checks.

1. Autopilot — ENGAGE (using **AP** Button, or **AP** Key on mode controller).
2. Autopilot — DISENGAGE (using **AP** Button, or **AP** Key on mode controller) verify autopilot disengages and audio alert is heard.
3. Verify yaw damper — OFF (if installed) (verify yaw damper disengages and audio alert is heard).
4. Flight director — SET FOR TAKEOFF (select VS mode or push **FD** Key to turn off the Flight Director).
5. Flight controls — CHECK (verify autopilot servos are disengaged from pitch, roll, and yaw controls, and all controls move freely).
6. Elevator/roll/yaw trim control (if equipped) — SET FOR TAKEOFF.

CHECKING AUTOPILOT SERVOS DURING THE PREFLIGHT CHECK:

While not necessary before every flight, the following procedure should be performed periodically by the pilot.

1. Engage all servos to check for proper operation.

2 After engaging each axis of autopilot servo, ensure that the servo can be overpowered using the flight controls.

9.5 APPENDIX E (FAQ)

FREQUENTLY ASKED QUESTIONS

Garmin® is dedicated to supporting its products and customers. If a particular aspect of system operational capability is not addressed by these commonly asked questions, contact Garmin or a Garmin-authorized dealer.

WHAT IS SBAS?

The Satellite Based Augmentation System (SBAS) uses a system of ground stations to correct any GPS signal errors. These ground stations correct for errors caused by ionospheric disturbances, timing, and satellite orbit errors. It also provides vital integrity information regarding the health of each GPS satellite. The signal correction is then broadcast through geostationary satellites. This correction information can then be received by any SBAS-enabled GPS receiver.

SBAS is designed to provide the additional accuracy, availability, and integrity necessary to enable users to rely on GPS for all phases of flight.

There are several SBAS systems serving different parts of the world. The Wide Area Augmentation System (WAAS) is currently available in the United States, including Alaska and Hawaii. The European Geostationary Navigation Overlay Service (EGNOS) offers coverage of Europe, parts of the middle east and northern Africa. The Multi-functional Satellite Augmentation System (MSAS) covers mainly Japan. The GPS aided GEO augmented navigation (GAGAN) offers covers mainly India.

HOW DOES SBAS AFFECT APPROACH OPERATIONS?

Both LNAV/VNAV and LPV approaches use the accuracy of SBAS to include vertical (glide path) guidance capability. The additional accuracy and vertical guidance capability allows improved instrument approaches to an expanded number of airports throughout the U.S.

The implementation of LPV approaches further improves precision approach capabilities. LPV approaches are designed to make full use of the improved GPS signal from the SBAS. This approach combines the LNAV/ VNAV vertical accuracy with lateral guidance similar to the typical Instrument Landing System (ILS). LPV approaches allow lower approach minimums.

WHAT IS RAIM AND HOW DOES IT AFFECT APPROACH OPERATIONS?

RAIM is an acronym for Receiver Autonomous Integrity Monitoring. RAIM is a GPS receiver function that performs the following functions:

- Monitors and verifies integrity and geometry of tracked GPS satellites

- Notifies the pilot when satellite conditions do not provide the necessary coverage to support a certain phase of flight
- Ascertains whether the number of available satellites is sufficient to satisfy requirements at a destination

For RAIM to work correctly, the GPS receiver must track at least five satellites. A minimum of six satellites is required to allow RAIM to eliminate a single corrupt satellite from the navigation solution.

RAIM ensures that satellite geometry allows for a navigation solution calculation within a specified protection limit (2.0 NM for oceanic and en route, 1.0 NM for terminal, and 0.3 NM for non-precision approaches). Without RAIM, GPS position accuracy cannot be monitored. If RAIM is not available when crossing the FAF, the pilot must fly the missed approach procedure.

WHAT IS GSL ALTITUDE?

GSL (Geodetic Sea Level) altitude is the height above Mean Sea Level (MSL), as calculated geometrically, generally using a global positioning system (GPS) as the primary data source. The calculated result may or may not include a barometric component, but the primary source is geometric.

WHAT HAPPENS WHEN AN APPROACH IS SELECTED? CAN A FLIGHT PLAN WITH AN APPROACH, A DEPARTURE, OR AN ARRIVAL BE STORED?

When an approach, departure, or arrival is loaded into the active flight plan, a set of approach, departure, or arrival waypoints is inserted into the flight plan, along with a header line showing the title of the selected instrument procedure. The original en route portion of the flight plan remains active, unless the instrument procedure is activated. This may be done either when the procedure is loaded or at a later time.

Flight plans can also be stored with an approach, a departure, or an arrival. Note 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.

WHAT DOES OBS MODE DO?

The OBS 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 before 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.

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 course change on HSI not possible • Always navigates 'TO' the active waypoint • Must be in this mode for final approach course	• Manual sequencing - 'holds' on selected waypoint • Manually select course to waypoint from HSI • Indicates 'TO' or 'FROM' waypoint • Cannot be set for final approach course or published holding patterns

WHY MIGHT THE SYSTEM NOT AUTOMATICALLY SEQUENCE TO THE NEXT WAYPOINT?

The system only sequences flight plan waypoints when automatic sequencing is enabled (i.e., no 'OBS' or 'SUSP' annunciation on the HSI). For automatic sequencing to occur, the aircraft must also cross the bisector of the turn being navigated. The bisector is a line passing through the waypoint common to two flight plan legs at an equal angle from each leg.

HOW CAN A WAYPOINT BE SKIPPED IN AN APPROACH, A DEPARTURE, OR AN ARRIVAL?

The system allows the pilot to manually select any approach, departure, or arrival leg as the active leg of the flight plan. This procedure is performed from the displays 'Active Flight Plan' Screen by touching the desired waypoint button, followed by the Activate Leg 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 23° bank angle (with the ability to roll up to 27°) and provides three pilot cues for turn anticipation:

- A waypoint alert ('Next HDG ###° in # seconds') appears on the PFDs 10 seconds before the turn point and flashes as it counts down to zero.
- A flashing turn advisory ('Turn [right/left] to ###° in # seconds') appears on the PFD 10 seconds before the turn and flashes as it counts down to zero. 'Turn [right/left] to ###° now' or 'Next [DTK/HDG] to ###° now' is displayed when the pilot is to begin the turn and the HSI (GPS mode) automatically sequences to the next DTK or HDG value.
- The To/From indicator on the HSI flips momentarily to indicate the midpoint of the turn has been crossed.

WHEN DOES THE CDI SCALE CHANGE?

Once a departure is activated, the system Course Deviation Indicator (CDI) full scale deflection is set to 0.3 NM. The CDI scale changes to 1.0 NM (terminal mode) then ramps up to 2.0 NM (enroute mode) at 30 NM from the departure airport. When 31 NM from the active

waypoint, the CDI scale smoothly transition from 2.0 NM back to 1.0 NM (terminal mode). At 2.0 NM before the FAF during an active approach, the CDI scale transitions down further based on the service level of approach activated (LNAV, LNAV/VNAV, LP, LPV). When a missed approach is activated, the CDI is set to 0.3 NM. See the *Course Deviation Indicator (CDI) Scaling* in the Flight Instruments section for more details on CDI scaling.

WHY DOES THE HSI NOT RESPOND LIKE A VOR WHEN OBS MODE IS ACTIVE?

Unlike a VOR, the CDI scale used on GPS equipment is based on the crosstrack distance to the desired course, not on the angular relationship to the active waypoint. Therefore, the CDI deflection on the GPS is constant regardless of the distance to the active waypoint and does not become less sensitive when further away from the active waypoint.

WHAT IS THE CORRECT MISSED APPROACH PROCEDURE? HOW IS THE MISSED APPROACH HOLDING POINT SELECTED?

To comply with TSO specifications, the system does not automatically sequence past the MAP. The first waypoint in the missed approach procedure becomes the active waypoint when the SUSP Button or TOGA Button on the control stick/yoke is pressed after crossing the MAP. All published missed approach procedures must be followed, as indicated on the approach plate.

Execute missed approach procedures per the current version of the pertinent flight manual.

AFTER A MISSED APPROACH, HOW CAN THE SAME APPROACH BE RE-SELECTED? HOW CAN A NEW APPROACH BE ACTIVATED?

NOTE

Do not attempt to reactivate the current approach before crossing the missed approach point (MAP). The system directs the pilot back to the transition waypoint and does not take into consideration any missed approach procedures, if the current approach is reactivated.

After flying the missed approach procedure, the pilot may reactivate the same approach for another attempt by touching the PROC Button, followed by the Approach or 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 Approach [Airport Identifier] button in the flight plan to open the 'Approach Options', then touch the **Change Approach** Button to open the 'Approach' Window and begin selecting a new approach. Then touch the **Approach** Button. The display shows a list of approaches as buttons. Scroll as needed and touch the desired approach button, then touch a transition button. The display returns to the ‘Approach Selection’. To activate the selected approach, touch the **Load Approach** Button or **Activate VTF** 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. Touch the Enter Button to accept the selected airport, then follow the steps in the preceding paragraph to select an approach for the new airport.