GARMIN®

G1000® NXi

Pilot's Guide

Socata TBM 910

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This manual reflects the operation of System Software version 2883.00 or later for the G1000 NXi Socata TBM 910. Some differences in operation may be observed when comparing the information in this manual to earlier or later software versions.

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

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

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

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

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

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

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

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

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

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

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

WARNING: *When using the autopilot to fly an approach with vertical guidance, the autopilot will not level the aircraft at the MDA/DH even if the MDA/DH is set in the altitude preselect.*

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

WARNING: *Because of variation in the earth's magnetic field, do not rely on the accuracy of attitude and heading indications in the following geographic areas: North of 72° North latitude at all longitudes; South of 70° South latitude at all longitudes; North of 65° North latitude between longitude 75° W and 120° W. (Northern Canada); North of 70° North latitude between longitude 70° W and 128° W. (Northern Canada); North of 70° North latitude between longitude 85° E and 114° E. (Northern Russia); South of 55° South latitude between longitude 120° E and 165° E. (Region south of Australia and New Zealand).*

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

NOTE: *The pilot/operator must have access to Garmin and Jeppesen database alerts and consider their impact on the intended aircraft operation. The database alerts can be viewed at www.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: *The system supports approval of AC 120-76C Hardware Class 3, Software Type B Electronic Flight Bag (EFB) electronic aeronautical chart applications. Possible additional requirements may make a secondary source (traditional paper or additional electronic display) necessary onboard the aircraft. If the secondary source is a Portable Electronic Device (PED), its use must be consistent with guidance in AC 120-76C.*

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

NOTE: *Operate G1000 NXi system power through at least one cycle in a period of four days of continuous operation to avoid an autonomous system reboot.*

Record of Revisions				
Part Number	**Revision**	**Date**	**Page Range**	**Description**
190-02218-00	A	3/27/17	i – I-6	Initial Release for GDU 20.51
	B	4/10/17	i – I-6	Revision Added support for Split Screen Mode Updated CAS Messages Added Voice Message Alerts Updated ESP Information Added support for Electronic Checklists

SECTION 1 SYSTEM OVERVIEW

1.1 System Description 1
Line Replaceable Units (LRU) 1
1.2 System Controls 4
PFD Controls 4
Controls Associated With the MFD 6
Secure Digital Cards 8
1.3 System Operation 9
System Power-up 9
Normal Operation 10
Reversionary Mode 11
System Annunciations 12
System Status 14
AHRS Operation 15
GPS Receiver Operation 16
1.4 Accessing System Functionality 21
Softkey Function 21
Menus 27
MFD Page Groups 28
Split Screen Functionality 31
System Settings 32
System Utilities 41
1.5 Display Backlighting 46

SECTION 2 FLIGHT INSTRUMENTS

2.1 Flight Instruments 50
Airspeed Indicator 50
Attitude Indicator 53
Altimeter 54
Vertical Speed Indicator (VSI) 57
Vertical Deviation 57
Horizontal Situation Indicator (HSI) 60
Course Deviation Indicator (CDI) 64
Angle of Attack (AOA) Indicator 72
Radar Altimeter 73
2.2 Supplemental Flight Data 75
Temperature Displays 75
Wind Data 76
Vertical Navigation (VNV) Indications 77
2.3 PFD Annunciations and Alerting Functions 78
Marker Beacon Annunciations 78
Altitude Alerting 78
Low Altitude Annunciation 79
Minimum Descent Altitude/Decision Height Alerting 79
2.4 Garmin SVT (Synthetic Vision Technology) 81
SVT Operation 82
SVT Features 84
Field of View 93
2.5 Abnormal Operations 94
Abnormal GPS Conditions 94
Comparator Annunciations 95
Reversionary Sensor Annunciations 96
Unusual Attitudes 97

SECTION 3 ENGINE INDICATION SYSTEM

3.1 Engine Display 100
3.2 Landing Field Elevation 103
3.3 Synoptics 104
Electrical (ELEC) 104
Fuel (FUEL) 107
General System (GEN) 108
3.4 EIS Display (Reversionary Mode) 110

SECTION 4 AUDIO PANEL AND CNS

4.1 Overview 111
Audio Panel Volume Control 111
PFD Controls and Frequency Display 112
Audio Panel Controls 114
4.2 COM Operation 116
COM Transceiver Manual Tuning 117
Auto-Tuning the COM Frequency 117
Frequency Spacing 120
4.3 NAV Operation 121
NAV Tuning Boxes 121
NAV Radio Selection and Activation 122
NAV Receiver Manual Tuning 122
Auto-Tuning a NAV Frequency from the MFD 123
Marker Beacon Receiver 125
ADF/DME Tuning 126
4.4 Mode S Transponders 129
Transponder Controls 129
Transponder Mode Selection 130
Entering a Transponder Code 132
IDENT Function 133

4.5 Additional Audio Panel Functions 134
Power-Up 134
Mono/Stereo Headsets 134
Speaker 134
Intercom 134
Passenger Address (PA) System 135
Simultaneous COM Operation 135
Clearance Recorder and Player 135
Entertainment Inputs 136
4.6 Audio Panels Preflight Procedure 137
4.7 Abnormal Operation 139
Stuck Microphone 139
COM Tuning Failure 139
PFD Failure, Dual System 139
Audio Panel Fail-Safe Operation 140
Reversionary Mode 140

SECTION 5 FLIGHT MANAGEMENT

5.1 Introduction 141
Navigation Status Box and Data Bar 143
5.2 Using Map Displays 145
Map Orientation 146
Map Range 148
Map Panning 150
Measuring Bearing and Distance 153
Topography 154
Map Symbols 157
Airways 162
Additional Navigation Map Items 164
IFR/VFR Charts 167
5.3 Waypoints 170
Airports 171
Intersections 178
NDBs 180
VORs 182
VRPs 184
User Waypoints 186
5.4 Airspaces 192
5.5 Direct-to-Navigation 196
5.6 Flight Planning 201
Flight Plan Creation 202
Flight Plan Import/Export 205
Adding Waypoints to an Existing Flight Plan 210
Adding Airways to a Flight Plan 214
Adding Procedures to a Stored Flight Plan 216
Flight Plan Storage 222
Flight Plan Editing 224
Along Track Offsets 228
Parallel Track 229
Activating a Flight Plan Leg 231
Inverting a Flight Plan 231
Flight Plan Views 232
Closest Point of FPL 236
Collapsing Airways 236
User-Defined Holding Patterns 237
5.7 Vertical Navigation 241
Altitude Constraints 243
5.8 Procedures 249
Departures 251
Arrivals 253
Approaches 255
5.9 Weight Planning 262
Weight Caution And Warning Conditions 264
5.10 Trip Planning 265
Trip Planning 265
5.11 Abnormal Operation 269

SECTION 6 HAZARD AVOIDANCE

6.1 Data Link Weather 272
Activating Data Link Weather Services 273
Weather Product Age 276
Displaying Data Link Weather Products 281
Connext Data Requests 290
Weather Product Overview 294
FIS-B Weather Status 329
Abnormal Operations for Garmin Connext Weather 331
6.2 Stormscope Lightning Detection System 333
Using the Stormscope Page 333
Setting Up Stormscope on the Navigation Map 335
6.3 Airborne Color Weather Radar 339
System Description 339
Principles of Pulsed Airborne Weather Radar 339
Safe Operating Distance 343
Basic Antenna Tilt Setup 344
Practical Application Using the Basic Tilt Setup 344
Weather Mapping and Interpretation 346

Ground Mapping and Interpretation 357
Additional Weather Radar Displays 357
System Status 360
6.4 Terrain Displays 361
Relative Terrain Symbology 362
Terrain Page 365
Vertical Situation Display (VSD) Terrain 366
Terrain-SVT and TAWS-B Alerting Displays 369
Forward Looking Terrain Avoidance 373
Additional TAWS-B Alerting 375
System Status 376
6.5 Traffic Information Service (TIS) 379
Displaying Traffic Data 380
Traffic Map Page 381
TIS Alerts 382
System Status 384
6.6 TAS Traffic 386
TAS Theory of Operation 386
TAS Alerts 390
System Test 391
Operation 392
6.7 ADS-B Traffic 399
ADS-B System Overview 399
Conflict Situational Awareness & Alerting (CSA) 401
Airborne and Surface Applications 402
Traffic Description 403
Operation 404
ADS-B System Status 410

SECTION 7 AUTOMATIC FLIGHT CONTROL SYSTEM

7.1 AFCS Overview 413
Additional AFCS Controls 415
Basic Autopilot Operation 416
7.2 Flight Director Operation 417
Activating the Flight Director 417
AFCS Status Box 418
Flight Director Modes 419
Switching Flight Directors 419
Command Bars 420
7.3 AFCS Modes 421
Vertical Modes 421
Lateral Modes 428
Combination modes (VNV, APR, NAV, BC, GA) 433
7.4 Autopilot and Yaw Damper Operation 444
Flight Control 444
Engagement 445
Control Wheel Steering 445
Disengagement 446
7.5 AFCS Annunciations and Alerts 447
Overspeed Protection 448
Underspeed Protection 448
Level Mode 450
Emergency Descent Mode 451
7.6 Abnormal Operation 452
Suspected Autopilot malfunction 452
Overpowering Autopilot Servos 452

SECTION 8 ADDITIONAL FEATURES

8.1 SafeTaxi 454
8.2 Charts 457
Split view 458
ChartView 459
FliteCharts 468
IFR/VFR Charts 473
Airport Directory 474
8.3 Database Cycle number and revisions 475
Cycle Number and Revision 475
8.4 SiriusXM Radio Entertainment 477
Activating SiriusXM Satellite Radio Services 477
Using SiriusXM Radio 478
8.5 Flight Data Logging 481
8.6 Satellite Telephone and sms messaging 483
Registering with Garmin Connext® 483
Disable/Enable Iridium Transceiver 483
Telephone Communication 484
Text Messaging (SMS) 491
8.7 Connext Setup 503
8.8 Maintenance Logs 505
8.9 Electronic Stability and Protection (ESP™) 506
Roll Engagement 507
Pitch Engagement 508
Angle of Attack Protection 510
High Airspeed Protection 510
8.10 Electronic Checklists 511
8.11 Abnormal Operation 513
SiriusXM Data Link Receiver Troubleshooting 513

APPENDICES

Annunciations and Alerts 515
CAS Message Prioritization 516
CAS Messages 518
Audio Alerts 520
System Message Advisories 521
Database Management 535
Loading Updated Databases 535
Magnetic Field Variation Database Update 542
Garmin Aviation Glossary 545
Frequently Asked Questions 555
Map Symbols 559

INDEX

Index I-1

SECTION 1 SYSTEM OVERVIEW

1.1 SYSTEM DESCRIPTION

This section provides an overview of the G1000 NXi Integrated Avionics System as installed in the Socata TBM 910. The system is an integrated avionics system that presents flight instrumentation, position, navigation, communication, and identification information to the pilot through large-format displays.

The system is comprised of several Line Replaceable Units along with an optional Flight Stream 510 device. The Flight Stream 510 provides a Bluetooth® connection between the system and a mobile device. GPS, AHRS, ADS-B, traffic, SiriusXM audio, and weather data can then be shared with the mobile device, and flight plans can be transferred to or from the mobile device. Also, database updates may be performed using the Flight Stream 510 WiFi link.

LINE REPLACEABLE UNITS (LRU)

- **GDU 1050A** (2) – Each unit is configured as a PFD that features a 10.5-inch LCD display. The unit installed on the left/pilot side is designated as PFD1, and the one installed on the right/copilot side is designated as PFD2. These units communicate with each other, the MFD, and with the on-side GIA 63W Integrated Avionics Unit through a High-Speed Data Bus (HSDB) connection.
- **GDU 1550** (1) – This unit features a 15-inch LCD display and is configured as an MFD. This unit is linked to both PFDs via HSDB connection.
- **GIA 63W** (2) – Functions as the main communication hub, linking all LRUs with the PFD and MFD. Each GIA 63W contains a GPS SBAS receiver, VHF COM/NAV/GS receivers, a flight director (FD) and system integration microprocessors. Each GIA 63W is paired with the PFD and MFD via High Speed Database connection. The GIA 63Ws are not paired together and do not communicate with each other directly.
- **GDC 72B** (2) – Processes data from the pitot/static system as well as the OAT probe. This unit provides pressure altitude, airspeed, vertical speed and OAT information to the system, and it communicates with the GIA 63Ws, the displays, and the GRS 79, using an ARINC 429 digital interface. The GDC 72B is designed to operate in Reduced Vertical Separation Minimum (RVSM) airspace.
- **GRS 79** (2) – Provides aircraft attitude and heading information via ARINC 429 to both displays and both GIA 63Ws. The GRS 79 contains advanced sensors (including accelerometers and rate sensors) and interfaces with the GMU 44 to obtain magnetic field information, with the GDC 72B to obtain air data, and with both GIA 63Ws to obtain GPS information. AHRS modes of operation are discussed later in this document.
- **GMU 44** (2) – Measures local magnetic field. Data is sent to the GRS 79 unit for processing to determine aircraft magnetic heading. The GMU 44 receives power directly from the GRS unit, and communicates with the GRS 79 unit using an RS-485 digital interface.
- **GMA 1347D** (2) – Integrates NAV/COM digital audio, intercom system and marker beacon controls, and is installed in dual configuration on the outboard side of PFD1 and PFD2. This unit also enables the manual control of the display reversionary mode (red **DISPLAY BACKUP** button) and communicates with the on-side GIA 63W, using an RS-232 digital interface.
- **GMC 710** (1) – Provides the controls for the Garmin AFCS through an RS-232 digital interface allowing communication with both PFDs.

- **GCU 475** – Provides the Flight Management System (FMS) controls for the MFD through an RS-232 digital interface.
- **GTX 33D ES** (1), or the **GTX 345R** (optional) (1 or 2) – Solid state transponders that provide Mode A, C, S capability. The standard GTX 33D includes Mode S with diversity and Extended Squitter Automatic Dependent Surveillance (ADS-B out) transmission, and is indicated as 'XPDR1'. The optional GTX 345R provides ADS-B In/Out. The optional GTX 345R may be installed in addition to the GTX 33D, in which case, it is indicated as 'XPDR2'. The system may instead accommodate an optional dual set of GTX 345R transponders as well, occupying 'XPDR1' and 'XPDR2'. Only one transponder can be active at a time. Each transponder communicates with the on-side GIA 63W through an RS-232 digital interface. If installed, the (#1) GTX 345R communicates with the PFD via High Speed Database connection.
- **GEA 71** (2) – Receives and processes signals from the engine and airframe sensors. This unit communicates with both GIA 63Ws using an RS-485 digital interface.
- **GSA 81** (4), and **GSM 86** (1) – The GSA 81 servos are used for the automatic control of roll, yaw, pitch, and pitch trim. These units interface with each GIA 63W.

  The GSM 86 servo gearbox is responsible for transferring the output torque of the GSA 81 servo actuator to the mechanical flight-control surface linkage.
- **GTA 82** – The GTA 82 Trim Adapter is a remote mounted device that is used to allow the AFCS to drive the yaw trim actuator.
- **GDL 69A SXM** (1) (Optional) – A satellite radio receiver that provides data link weather information to the MFD (and, indirectly, to the inset map of the PFD) as well as digital audio entertainment. The GDL 69A SXM communicates with the MFD via HSDB connection. Subscriptions to the SiriusXM Weather or SiriusXM Satellite Radio services are required to enable the GDL 69A SXM capability.
- **GTS 820** (Optional) – The GTS 820 Traffic Advisory System (TAS) uses active interrogations of Mode S and Mode C transponders to provide traffic information to the pilot independent of the air traffic control system.
- **GWX 70** (1) (Optional) – Provides airborne weather and ground mapped radar data to the MFD via HSDB connection.
- **GRA 55** (1) (Optional) – The optional Radar Altimeter provides altitude above the ground information and rate of change of radar altitude information.
- **GSR 56** (1) (Optional) - The Iridium Transceiver provides voice communications by means of a telephone handset in the cabin and pilot and copilot headsets in the cockpit. The transceiver can also send and receive short message service (SMS) text messages. The GSR 56 also receives data link weather products from the Garmin Connext weather service through the Iridium satellite network.

Figure 1-1 shows interactions between the LRUs. Additional/optional equipment are also shown in Figure 1-1. The system is capable of interfacing with the following optional equipment:

- **GDL 69A SXM** Data Link Receiver
- **GTS 820** Traffic Advisory System
- **FS 510** Flight Stream (SD Card)
- **GRA 55** Radio Altimeter
- **GSR 56** Iridium Transceiver
- WX 500 Stormscope Lightning Sensor
- KN 63 DME
- Becker ADF 3502

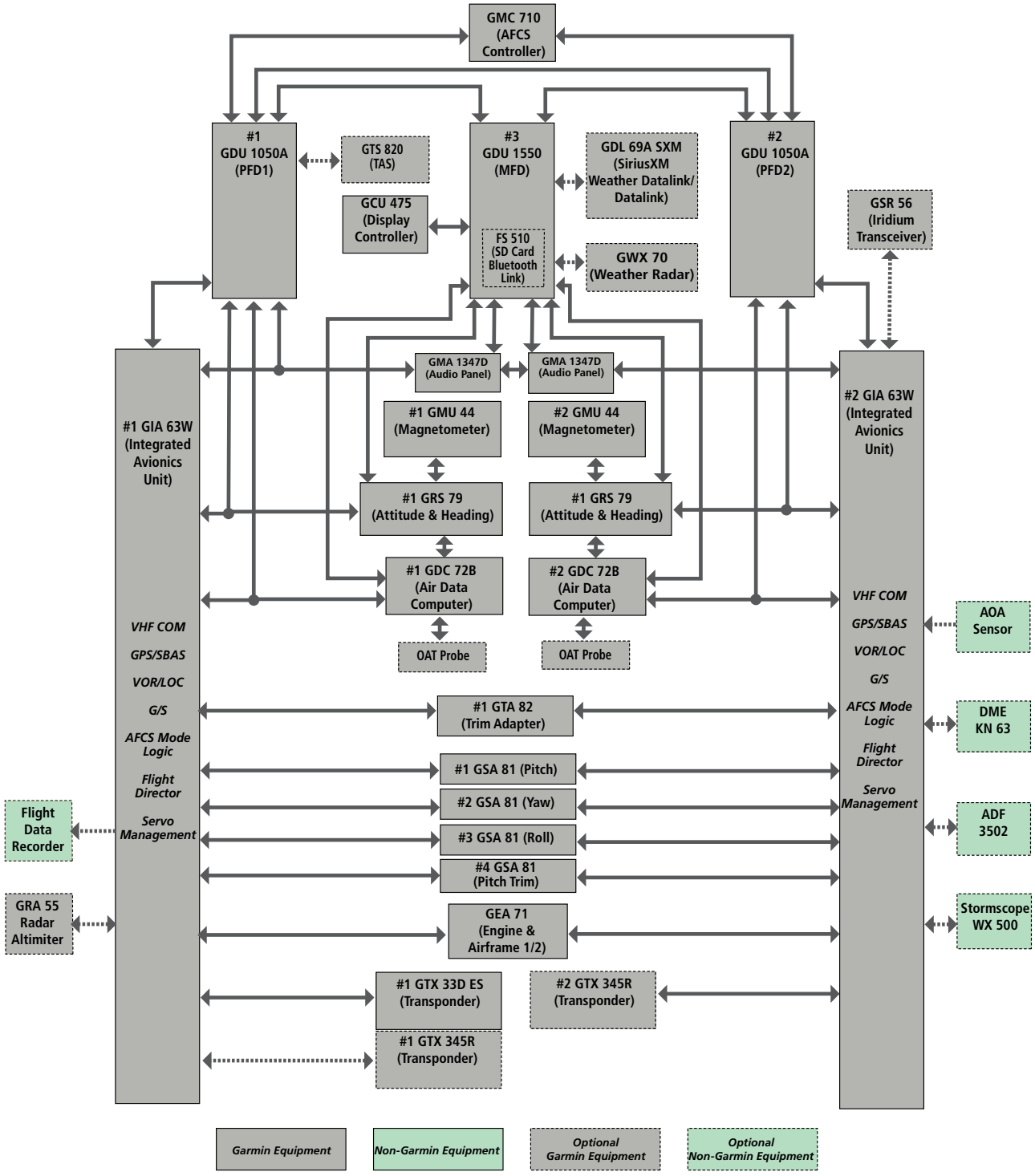


Figure 1-1 System (LRU Configuration)

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

1.2 SYSTEM CONTROLS

NOTE: *The Audio Panel (GMA 1347D Cabin) and AFCS controls (GMC 710) are described in the Audio & CNS and AFCS sections respectively.*

The system controls are located on the PFD and MFD bezels, MFD Control Unit, AFCS Control Unit and audio panel. The controls for the PFD and MFD are discussed within the following pages of this section.

PFD CONTROLS

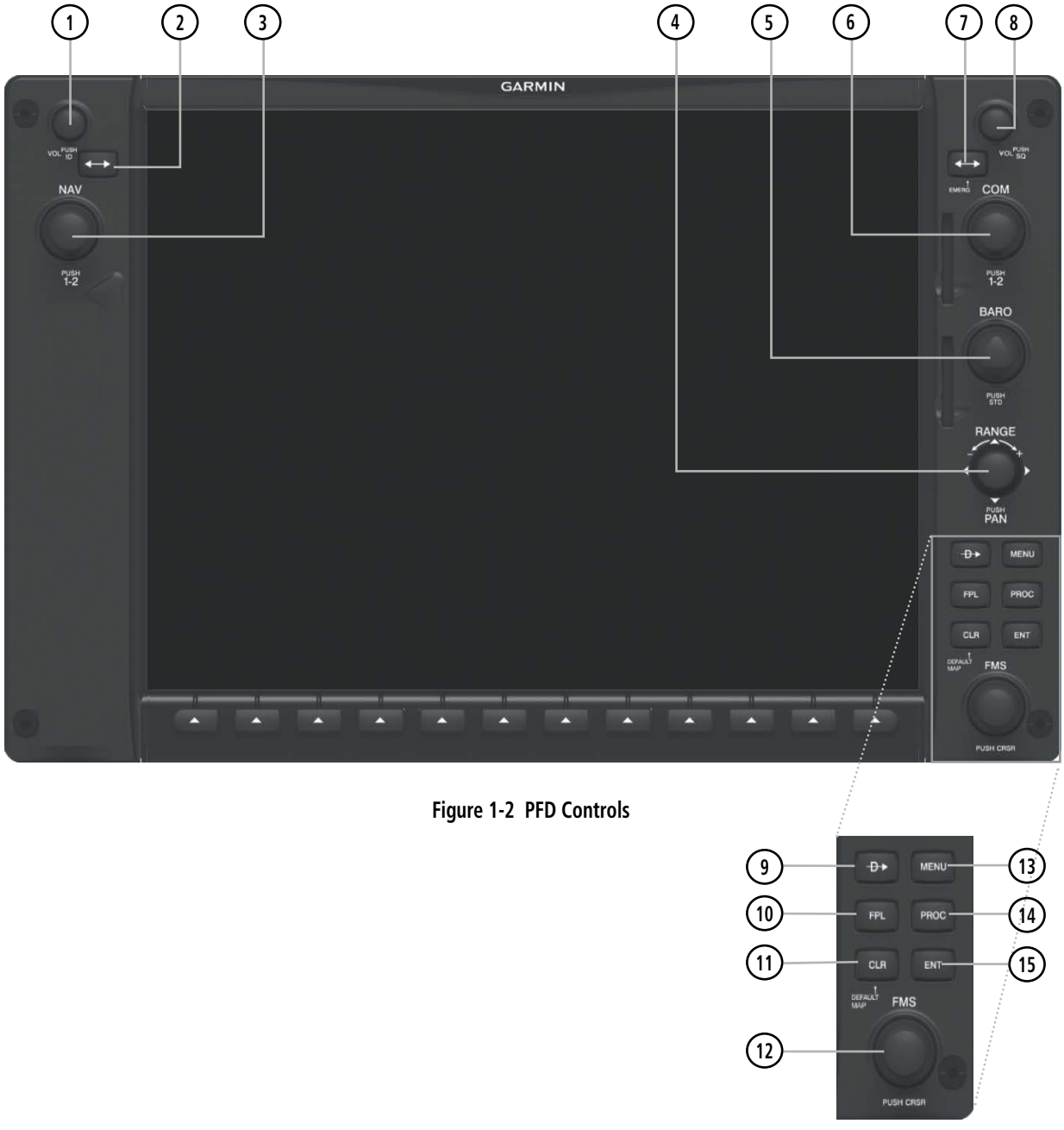


Figure 1-2 PFD Controls

The following list provides an overview of the controls located on the PFD bezel (see Figure 1-2).

1. **NAV VOL/ID Knob –** Controls NAV audio volume level. Press to toggle the Morse code identifier audio ON and OFF. Volume level is shown in the NAV frequency field as a percentage.
2. **NAV Frequency Transfer Key –** Toggles the standby and active NAV frequencies.
3. **Dual NAV Knob –** Tunes the standby frequencies for the NAV receiver (large knob for MHz; small knob for kHz). Press to switch the tuning box (cyan box) between NAV1 and NAV2.
4. **Joystick –** Changes the map range when rotated. Activates the map pointer when pressed.
5. **BARO Knob –** Sets the altimeter barometric pressure. Press to enter standard pressure (29.92).
6. **Dual COM Knob –** Tunes the standby frequencies for the COM transceiver (large knob for MHz; small knob for kHz). Press to switch the tuning box (cyan box) between COM1 and COM2.
7. **COM Frequency Transfer Key –** Toggles the standby and active COM frequencies. Press and hold this key for two seconds to tune the emergency frequency (121.5 MHz) automatically into the active frequency field.
8. **COM VOL/SQ Knob –** Controls COM audio volume level. Volume level is shown in the COM frequency field as a percentage. Press to turn the COM automatic squelch ON and OFF.
9. **Direct-to Key (D▸) –** Allows the user to enter a destination waypoint and establish a direct course to the selected destination (the destination is either specified by the identifier, chosen from the active route, or taken from the map pointer position).
10. **FPL Key –** Displays the active Flight Plan Page for creating and editing the active flight plan.
11. **CLR Key –** Erases information, cancels entries, or removes page menus.
12. **Dual FMS Knob –** Flight Management System Knob. Press the **FMS** Knob to turn the selection cursor ON and OFF. When the cursor is ON, data may be entered in the applicable window by turning the small and large knobs. The large knob moves the cursor on the page, while the small knob selects individual characters for the highlighted cursor location.
13. **MENU Key –** Displays a context-sensitive list of options. This list allows the user to access additional features or make setting changes that relate to particular pages.
14. **PROC Key –** Gives access to IFR departure procedures (DPs), arrival procedures (STARs) and approach procedures (IAPs) for a flight plan. If a flight plan is used, available procedures for the departure and/or arrival airport are automatically suggested. These procedures can then be loaded into the active flight plan. If a flight plan is not used, both the desired airport and the desired procedure may be selected.
15. **ENT Key –** Validates or confirms a menu selection or data entry.

CONTROLS ASSOCIATED WITH THE MFD

The controls for the MFD (GDU 1550) are located on both the MFD bezel and the MFD Control Unit (GCU 475). The bottom portion of the MFD bezel features 12 softkeys that are designed to perform various functions depending upon the control display mode and the specific page being displayed. These softkeys are discussed throughout this documentation.

The following list provides an overview of the controls located on the MFD Control Unit:

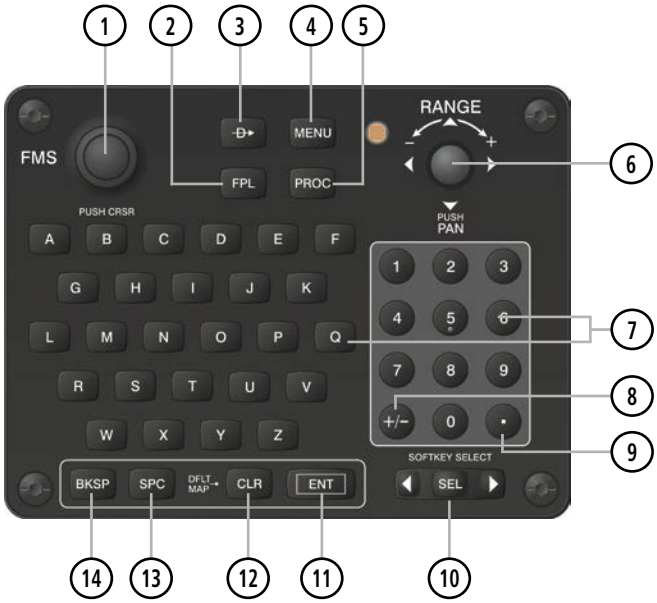


Figure 1-3 MFD Control Unit (GCU 475)

(1) **Dual FMS Knob –** Flight Management System Knob. This knob selects the MFD page to be viewed; the large knob selects a page group (MAP, WPT, Aux, RPL, Sys, NRST), while the small knob selects a specific page within the page group. Pressing the **FMS** Knob turns the selection cursor ON and OFF. When the cursor is ON, data may be entered in the applicable window by turning the small and large knobs. In this case, the large knob moves the cursor on the page, while the small knob selects individual characters for the highlighted cursor location.

(2) **FPL Key** – Displays the active Flight Plan Page for creating and editing the active flight plan, or for accessing stored flight plans.

(3) **Direct-to Key (D▸) –** Allows the user to enter a destination waypoint and establish a direct course to the selected destination (the destination is either specified by the identifier, chosen from the active route, or taken from the map pointer position).

(4) **MENU Key –** Displays a context-sensitive list of options. This list allows the user to access additional features or make setting changes that relate to particular pages.

(5) **PROC Key –** Gives access to IFR departure procedures (DPs), arrival procedures (STARs) and approach procedures (IAPs) for a flight plan. If a flight plan is used, available procedures for the departure and/or arrival airport are automatically suggested. Theses procedures can then be loaded into the active flight plan. If a flight plan is not used, both the desired airport and the desired procedure may be selected.

(6) **Joystick –** Changes the map range when rotated. Activates the map pointer when pressed.

(7) **Alphanumeric Keys –** Allow the user to enter data quickly, without having to select individual characters with the **FMS** Knob.

(8) **Plus (+) Minus (-) Key –** Switches between a (+) or (-) character.

(9) **Decimal Key –** Enters a decimal point.

(10) **SEL Key –** The center of this key activates the selected softkey, while the right and left arrows move the softkey selection box to the right and left, respectively.

(11) **ENT Key –** Validates or confirms a menu selection or data entry.

(12) **CLR Key –** Erases information, cancels entries, or removes page menus. Pressing and holding this key displays the Navigation Map Page automatically.

(13) **SPC Key –** Adds a space character.

(14) **BKSP Key –** Moves the cursor back one character space.

SECURE DIGITAL CARDS

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

NOTE: *Ensure that the system is powered off before inserting the SD card.*

The GDU 1050A/1550 data card slots use Secure Digital (SD) cards and are located on the top right portion of the display bezels. Each display bezel is equipped with two SD card slots. SD cards are used optionally for aviation database and system software updates; terrain database storage; and flight plan import and export from an SD card in the MFD. For information on updating databases, via SD card or Flight Stream 510, see Appendix B. For more information on importing and exporting a flight plan, see the Flight Management Section.

Inserting and Removing an SD card

Insert the SD card in the SD card slot, pushing the card in until the spring latch engages. The front of the card should remain flush with the face of the display bezel. To remove, gently press on the SD card to release the spring latch and eject the card.

Figure 1-4 PFD/MFD Display Bezel SD Card Slots

1.3 SYSTEM OPERATION

This section discusses powering up the system, normal and reversionary display operation, system status, AHRS modes of operation, and GPS receiver operation.

SYSTEM POWER-UP

NOTE: *See the Appendices for additional information regarding system-specific annunciations and alerts.*

NOTE: *See the Pilot's Operating Handbook (POH) for specific procedures concerning avionics power application and emergency power supply operation.*

The system is integrated with the aircraft electrical system and receives power directly from electrical busses. The PFD, MFD, and supporting sub-systems include both power-on and continuous built-in test features that exercise the processor, RAM, ROM, external inputs and outputs to provide safe operation.

When powering up the system, test annunciations are displayed and key annunciator lights also become momentarily illuminated on the audio panel and the display bezels. On the PFD, the AHRS begins to initialize and displays 'AHRS/DG ALIGN: Remain Stationary'. All system annunciations should disappear typically within one minute of power-up.

When the MFD powers up, the MFD Power-up Page displays the following information:

- System version
- Land database name and version
- Safe Taxi database name and effective dates
- Terrain database name and version
- Obstacle database name and effective dates
- Navigation database name and effective dates
- Airport Directory name and effective dates
- FliteCharts/ChartView database information
- IFR/VFR charts database information
- Crew Profile
- Copyright

Current database information includes the valid operating dates, cycle number and database type. When this information has been reviewed for currency (to ensure that no databases have expired), the pilot is prompted to continue. Pressing the **ENT** Key acknowledges this information and displays the Auxiliary (Aux) Weight Planning Page.

NORMAL OPERATION

NOTE: *In normal operating mode, backlighting can only be adjusted from the PFD (see Section 1.5). In reversionary mode, it can be adjusted from the remaining display.*

In normal operating mode, the PFD presents graphical flight instrumentation (attitude, heading, airspeed, altitude, vertical speed), replacing the traditional flight instrument cluster (see the Flight Instruments Section for more information). The MFD normally displays a full-color moving map with navigation information (see the Flight Management Section), while the left portion of the MFD is dedicated to the Engine Indication System (see the EIS Section). Both displays offer control for COM and NAV frequency selection.

PFD1 MFD PFD2

Figure 1-5 Normal Operation

REVERSIONARY MODE

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

Reversionary mode is a mode of operation in which all important flight information is presented identically on at least one of the remaining displays. Transition to reversionary mode should be straightforward for the pilot, for flight parameters are presented in the same format as in normal mode.

Figure 1-6 Reversionary Mode

Reversionary mode can be activated manually by pressing the dedicated **DISPLAY BACKUP** button at the bottom of the audio panel (refer to the Audio Panel section for further details). Pressing this button again deactivates reversionary mode.

*Pressing the **DISPLAY BACKUP** button activates/deactivates reversionary mode for both the on-side PFD and the MFD.*

Figure 1-7 DISPLAY BACKUP Button

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

- **PFD1** – By pressing the **DISPLAY BACKUP** button on the left audio panel.
- **MFD** – By pressing the **DISPLAY BACKUP** button on the left or the right audio panel.
- **PFD2** – By pressing the **DISPLAY BACKUP** button on the right audio panel.

Should the connection between a PFD and the on-side GIA 63W become inoperative, the on-side GIA 63W can no longer communicate with the remaining PFD (refer to Figure 1-1). As a result, the NAV and COM functions provided to the failed PFD by the on-side GIA 63W are flagged as invalid (red "X") on the remaining PFD.

Figure 1-8 Inoperative Input (NAV1 Shown)

SYSTEM ANNUNCIATIONS

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

When an LRU or an LRU function fails, a large red 'X' is typically displayed on windows associated with the failed data (refer to Table 1-1 for all possible flags and the responsible LRUs). Refer to the Pilot's Operating Handbook (POH) for additional information regarding pilot responses to these annunciations.

The status of detected LRUs can be checked on the Aux - System Status Page. Active LRUs are indicated by green check marks; failed LRUs are indicated by red 'X's. Failed LRUs should be noted and a service center or Garmin-authorized dealer informed.

Viewing LRU information:

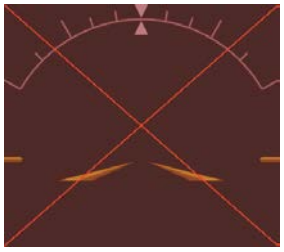
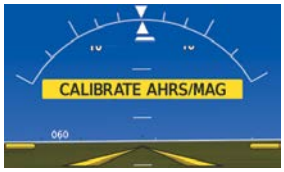
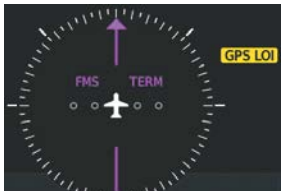
1) Use the **FMS** Knob to select the 'Aux - System Status' Page.
2) To place the cursor in the 'LRU Information' Box,

   Select the **LRU** Softkey.

   Or:

   a) Press the **MENU** Key.
   b) With 'Select LRU Window' highlighted, press the **ENT** Key.
3) Use the **FMS** Knob to scroll through the box to view LRU status information.

NOTE: *Refer to the POH for additional information regarding pilot responses to these annunciations.*

System Annunciation	Comment
	Air Data, Attitude and Heading Reference System is aligning.
	Display system is not receiving attitude information from the AHRS.
	AHRS calibration incomplete or configuration module failure.
	GPS information is either not present or is invalid for navigation use. Note that AHRS utilizes GPS inputs during normal operation. AHRS operation may be degraded if GPS signals are not present (see POH).
	Display system is not receiving airspeed input from the air data computer.

System Annunciation	Comment
	Display system is not receiving vertical speed input from the air data computer.
	Display system is not receiving valid heading input from the AHRS or magnetometer.
	Display system is not receiving altitude input from the air data computer.
	Display system is not receiving valid ISA information from the air data computer.
	Display system is not receiving valid OAT information from the air data computer.
	Display system is not receiving valid transponder information.
Other Various Red X Indications	A red 'X' through any other display field (such as engine instrumentation fields) indicates that the field is not receiving valid data.

Table 1-1 System Annunciations

SYSTEM STATUS

The System Status Page displays the status and software version numbers for all detected system LRUs. Pertinent information on all system databases is also displayed. Active LRUs are indicated by green check marks and failed LRUs are indicated by red "X"s. Failed LRUs should be noted and a service center or Garmin dealer informed.

Figure 1-9 Example System Status Page

The **LRU** and **ARFRM** Softkeys on the System Status Page select the applicable list (LRU Information or Airframe window) through which the **FMS** Knob can be used to scroll information within the selected window.

Selecting the **MFD1 DB** Softkey (label annunciator turns green indicting the softkey is selected) places the cursor in the database window. Use the **FMS** Knob to scroll through database information for the MFD. Selecting the softkey again will change the softkey label to **PFD1 DB**. PFD 1 database information is now displayed in the database window. Selecting the softkey a third time will change the softkey label to **PFD2 DB**. PFD 2 database information is now displayed in the database window.

The **ANN Test** Softkey, when selected, causes an annunciation test tone to be played.

The **RA Test** Softkey, when selected, initiates the Radar Altimeter test mode. For more information, see the Flight Instruments section.

AHRS OPERATION

NOTE: *Refer to the Appendices for specific AHRS alert information.*

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

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

The AHRS corrects for shifts and variations in the Earth's magnetic field by applying the Magnetic Field Variation Database. The Magnetic Field Variation Database is derived from the International Geomagnetic Reference Field (IGRF). The IGRF is a mathematical model that describes the Earth's main magnetic field and its annual rate of change. The database is updated approximately every 5 years. See the Appendices for information on updating the Magnetic Field Variation Database. The system will prompt you on startup when an update is available. Failure to update this database could lead to erroneous heading information being displayed to the pilot.

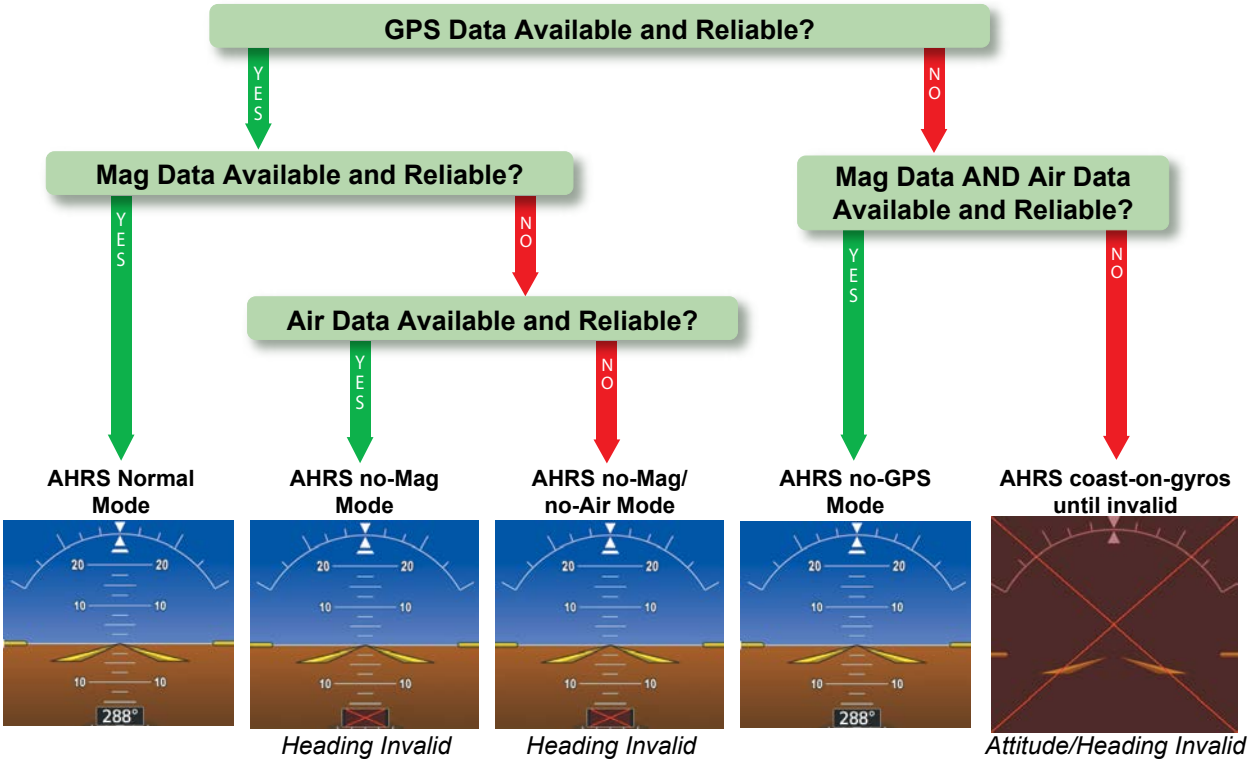


Figure 1-10 AHRS Operation

GPS INPUT FAILURE

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

The system provides two sources of GPS information. If a single GPS receiver fails, or if the information provided from one of the GPS receivers is unreliable, the AHRS seamlessly transitions to using the other GPS receiver. An alert message informs the pilot of the use of the backup GPS path. If both GPS inputs fail, the AHRS continues to operate in reversionary No-GPS mode so long as the air data and magnetometer inputs are available and valid.

AIR DATA INPUT FAILURE

A failure of the air data input has no effect on AHRS output while AHRS is operating in normal mode. A failure of the air data input while the AHRS is operating in reversionary No-GPS mode results in invalid attitude and heading information on the PFD (as indicated by red "X" flags).

MAGNETOMETER FAILURE

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

GPS RECEIVER OPERATION

Each GIA 63W Integrated Avionics Unit (IAU) contains a GPS receiver. Information collected by the specified receiver (GPS1 for the #1 IAU or GPS2 for the #2 IAU) may be viewed on the Aux - GPS Status Page.

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

If the sensor annunciation persists, check for a system failure message in the Messages Window on the PFD. If no failure message exists, check the GPS Status Page and compare the information for GPS1 and GPS2. Discrepancies may indicate a problem.

The GPS Status Page provides the following information:

- Constellation

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

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

- Satellite Status

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

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

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

- RAIM (Receiver Autonomous Integrity Monitoring) Prediction (**RAIM** Softkey is selected)

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

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

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

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

- GPS Status

  The GPS solution type (ACQUIRING, 2D NAV, 2D DIFF NAV, 3D NAV, 3D DIFF NAV) for the active GPS receiver (GPS1 or GPS2) is shown in the upper right of the GPS Status Page. When the receiver is in the process of acquiring enough satellite signals for navigation, the receiver uses satellite orbital data (collected continuously from the satellites) and last known position to determine the satellites that should be in view. 'Acquiring' is indicated as the solution until a sufficient number of satellites have been acquired for computing a solution.

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

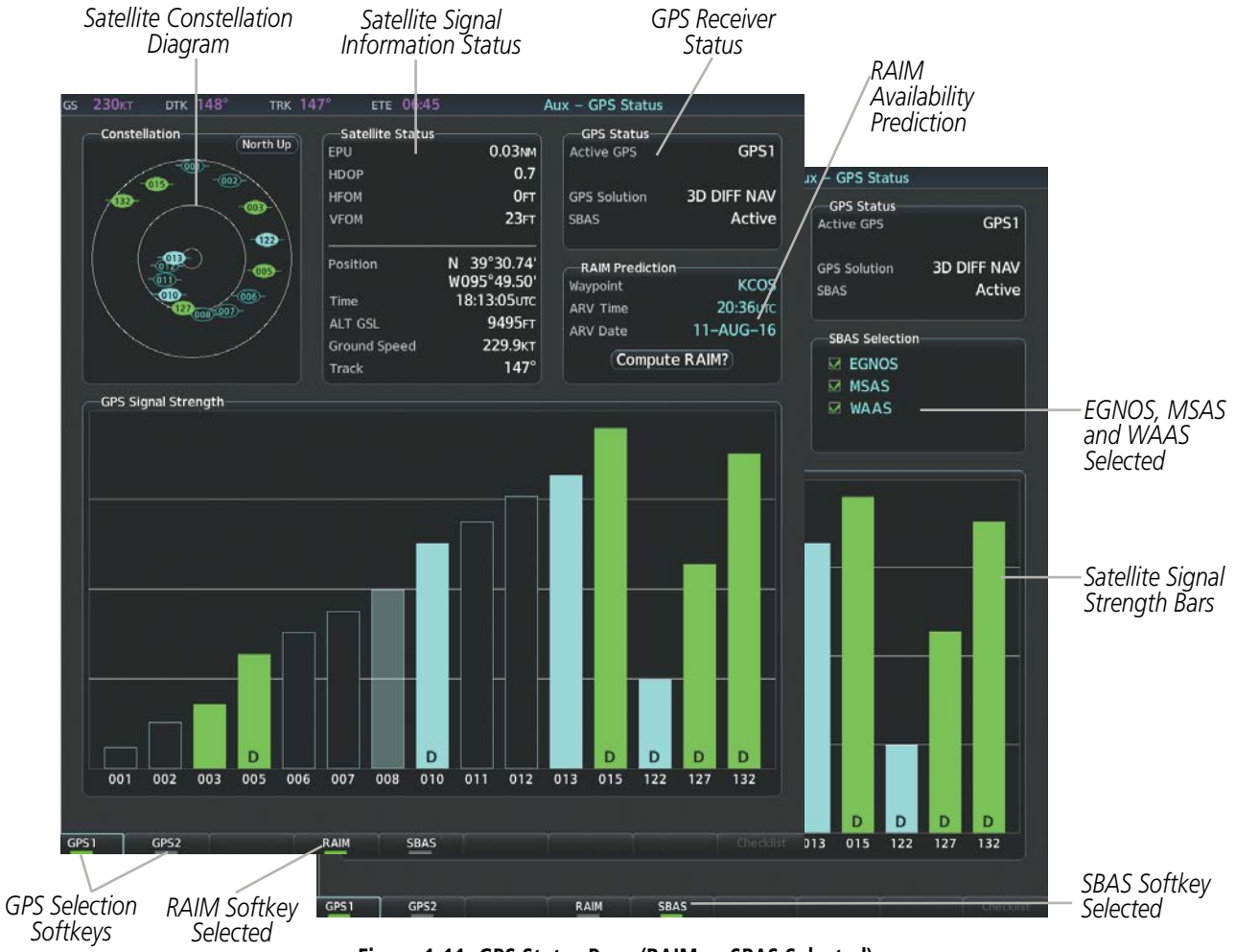


Figure 1-11 GPS Status Page (RAIM or SBAS Selected)

Viewing GPS receiver status information

1) Use the large **FMS** Knob to select the Auxiliary Page Group ('Aux') (see Section 1.4 for information on navigating MFD page groups).
2) Use the small **FMS** Knob to select 'Aux - GPS Status' Page.

Selecting the GPS receiver for which data may be reviewed

1) Use the **FMS** Knob to select the 'Aux - GPS Status' Page.
2) To change the selected GPS receiver:

   Press the desired **GPS** Softkey.

   Or:

   a) Press the **MENU** Key.
   b) Use the **FMS** Knob to highlight the receiver which is not selected and press the **ENT** Key.

Predicting RAIM availability at a selected waypoint

1) Select the 'Aux - GPS Status' Page.
2) If necessary, press the **RAIM** Softkey.

3) Press the **FMS** Knob. The 'Waypoint' Field is highlighted.

4) Turn the small **FMS** Knob to display the 'Waypoint Information' Window.

5) Enter the desired waypoint:

   Use the **FMS** Knob to enter the desired waypoint by identifier, facility, or city name and press the **ENT** Key.

   Or:

   a) Turn the small **FMS** Knob counter-clockwise to display a list of flight plan waypoints (the FPL list is populated only when navigating a flight plan).

   b) Turn the small **FMS** Knob clockwise to display the Flight Plan, Nearest, Recent, or User waypoints, if required.

   c) Turn the large **FMS** Knob clockwise to select the desired waypoint. The system automatically fills in the identifier, facility, and city fields with the information for the selected waypoint.

   d) Press the **ENT** Key to accept the waypoint entry.

6) Use the **FMS** Knob to enter an arrival time and press the **ENT** Key.

7) Use the **FMS** Knob to enter an arrival date and press the **ENT** Key.

8) With the cursor highlighting 'Compute RAIM?', press the **ENT** Key. Once RAIM availability is computed, one of the following is displayed:

   • 'Compute RAIM?'—RAIM has not been computed for the current waypoint, time, and date combination

   • 'Computing Availability'—RAIM calculation in progress

   • 'RAIM Available'—RAIM is predicted to be available for the specified waypoint, time, and date

   • 'RAIM not Available'—RAIM is predicted to be unavailable for the specified waypoint, time, and date

Predicting RAIM availability at present position

1) Select the 'Aux - GPS Status' Page.

2) If necessary, press the **RAIM** Softkey.

3) Press the **FMS** Knob. The 'Waypoint' Field is highlighted.

4) Press the **MENU** Key.

5) With 'Set WPT to Present Position' highlighted, press the **ENT** Key.

6) Press the **ENT** Key to accept the waypoint entry.

7) Use the **FMS** Knob to enter an arrival time and press the **ENT** Key.

8) Use the **FMS** Knob to enter an arrival date and press the **ENT** Key.

9) With the cursor highlighting 'Compute RAIM?', press the **ENT** Key. Once RAIM availability is computed, one of the following is displayed:

   • 'Compute RAIM?'—RAIM has not been computed for the current waypoint, time, and date combination

   • 'Computing Availability'—RAIM calculation in progress

   • 'RAIM Available'—RAIM is predicted to be available for the specified waypoint, time, and date

   • 'RAIM not Available'—RAIM is predicted to be unavailable for the specified waypoint, time, and date

SBAS Selection (SBAS Softkey is selected)

In certain situations, such as when the aircraft is outside or on the fringe of the SBAS coverage area, it may be desirable to disable EGNOS, WAAS or MSAS (although it is not recommended). When disabled, the SBAS field in the GPS Status box indicates Disabled. There may be a small delay for the GPS Status box to be updated upon WAAS and MSAS enabling/disabling.

Disabling SBAS

1) Select the 'Aux - GPS Status' Page.
2) If necessary, press the **SBAS** Softkey.
3) Press the **FMS** Knob, and turn the large **FMS** Knob to highlight 'EGNOS', 'MSAS' or 'WAAS'.
4) Press the **ENT** Key to uncheck the box.
5) Press the **FMS** Knob to remove the cursor.

- GPS Satellite Signal Strengths

The GPS 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 120-138 for WAAS) below each bar. The progress of satellite acquisition is shown in three stages, as indicated by signal bar appearance:

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

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

1.4 ACCESSING SYSTEM FUNCTIONALITY

SOFTKEY FUNCTION

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

Figure 1-12 Softkeys (First-Level PFD Configuration)

PFD SOFTKEYS

The PFD softkeys provide control over the PFD display and some flight management functions, including GPS, NAV, terrain, traffic, and weather (optional). Each softkey sublevel has a **Back** Softkey which can be pressed to return to the previous level. If messages remain after acknowledgement, the **Alerts** Softkey is black on white. The **Alerts** Softkey is visible in all softkey levels. For the top level softkeys and the transponder (XPDR) levels, the **Ident** Softkey remains visible.

The following table describes PFD Softkey functions. Softkeys which display another set of softkeys are indicated in the table by showing the given set as an increased level. For example, the Map/HSI softkey is shown in the Level 1 collum. When pressed, the **Map/HSI** softkey will display another set of softkeys and these softkeys are explained in the Level 2 column. If a softkey on Level 2 provides yet another set of softkey functions, those new available softkeys are then explained in the Level 3 column, etc.

Level 1	Level 2	Level 3	Level 4	Description
Map/HSI				Displays the PFD Map display settings softkeys.
	Layout			Displays the PFD Map selection softkeys.
		Map Off		Removes the PFD map from display (Inset or Traffic).
		Inset Map		Displays the Inset Map.
		HSI Map		Displays the HSI Map.
		Inset Trfc		Replaces the Inset Map with a dedicated traffic display.
		HSI Trfc		Replaces the HSI Map with a dedicated traffic display.

Level 1	Level 2	Level 3	Level 4	Description
	Detail			Selects desired amount of map detail: **All** (No Declutter): All map features visible **Detail 3**: Declutters land data **Detail 2**: Declutters land and SUA data **Detail 1**: Removes everything except for the active flight plan
	Traffic			Displays traffic information on PFD Map.
	TER			Displays terrain on the PFD map; cycles through the following: **Off**: No terrain information shown on PFD Map. **Topo**: Displays topographical data (e.g., coastlines, terrain, rivers, lakes). **REL**: Displays relative terrain information on the PFD Map.
	WX LGND			Displays/removes the name of the selected data link weather provider (SiriusXM) and the weather product icon and age box (for enabled weather products).
	PRECIP **or** **NEXRAD**			Displays Connext weather and coverage on PFD Map. Displays XM NEXRAD weather and coverage on PFD Map (subscription optional).
	METAR			Displays METAR information on Inset Map (subscription optional).
	Lightning			Adds/removes the display of SiriusXM lightning information on PFD Map.
		LTNG Off		Disables lightning function on PFD Map. The softkey annunciator is green when the lightning function is off.
		Datalink		Selects the data link weather source for the PFD Map.
		STRMSCP		Adds or removes the display of Stormscope information on the PFD Map. The softkey annunciator is green when the function is on. When the function is off, the annunciator is gray (optional).
	Wx Radar			When enabled, displays the airborne weather radar overlay on HSI Map (GWX 70 only).
	RDR Opt			Displays softkeys for airborne weather radar options (GWX 70 only).
		Mode SEL		Displays softkeys for weather radar mode selection (GWX 70 only).
			Standby	Selects Standby weather radar mode (GWX 70 only).
			Weather	Activates Weather radar mode (GWX 70 only).
			Ground	Activates Ground Map weather radar mode (GWX 70 only).
		Gain -		Decreases weather radar gain setting (GWX 70 only).
		Gain +		Increases weather radar gain setting (GWX 70 only).
		WX ALRT		When enables, displays weather alerts as system messages. (GWX 70 only)
		STAB		Activates antenna stabilization feature (GWX 70 only).
		ACT		Activates Altitude Compensated Tilt feature (GWX 70 only).
TFC Map				Replaces the PFD Map with a dedicated traffic display.

Level 1	Level 2	Level 3	Level 4	Description
PFD Opt				Displays second-level softkeys for additional PFD options.
	SVT			Displays additional SVT overlay softkeys.
		Pathways		Displays Pathway Boxes on the Synthetic Vision Display.
		Terrain		Enables synthetic terrain depiction.
		HDG LBL		Displays compass heading along the Zero-Pitch line.
		APT Sign		Displays position markers for airports within approximately 15 nm of the current aircraft position. Airport identifiers are displayed when the airport is within approximately 9 nm.
	AOA			Selects the display mode for the Angle of Attack (AOA) indicator on the PFD: **Auto**: Displays AOA indicator on the PFD. **Off**: Removes AOA indicator from the PFD.
	Wind			Displays the wind option softkeys.
		Off		Wind information not displayed.
		Option 1		Headwind/Tailwind and crosswind components.
		Option 2		Wind direction arrow and speed.
		Option 3		Wind direction arrow with direction and speed.
	DME			Displays DME Information Window (optional).
	Bearing 1			Cycles the Bearing 1 Information Window through NAV1, NAV2, GPS/waypoint identifier and GPS-derived distance information, ADF/frequency, and Off.
	Sensors			Displays the sensor selection softkeys.
		ADC		Displays ADC selection softkeys.
			ADC 1	Selects the #1 ADC.
			ADC 2	Selects the #2 ADC.
		AHRS		Displays the AHRS selection softkeys.
			AHRS 1	Selects the #1 AHRS.
			AHRS 2	Selects the #2 AHRS.
	Bearing 2			Cycles the Bearing 2 Information Window through NAV1, NAV2, GPS/waypoint identifier and GPS-derived distance information, ADF/frequency, and Off.
	ALT Units			Displays softkeys to select altitude unit parameters.
		Meters		When enabled, displays altimeter in meters.
		IN		Press to display the BARO setting as inches of mercury.
		HPA		Press to display the BARO setting as hectopascals.
	STD Baro			Sets barometric pressure to 29.92 in Hg (1013 hPa if metric units are selected).
OBS				Selects OBS mode on the CDI when navigating by GPS (only available with active leg). When OBS is on, the softkey annunciator is green.
CDI				Cycles through FMS, NAV1, and NAV2 navigation modes on the CDI.

Level 1	Level 2	Level 3	Level 4	Description
ADF/DME				Displays the ADF/DME Tuning Window, allowing tuning and selection of the ADF/DME (optional).
XPDR				Displays the transponder selection softkeys.
	XPDR 1			Selects the #1 transponder as active.
	XPDR 2			Selects the #2 transponder as active.
	Standby			Selects transponder Standby Mode (transponder does not reply to any interrogations).
	On			Activates transponder (transponder replies to identification interrogations).
	ALT			Altitude Reporting Mode (transponder replies to identification and altitude interrogations).
	VFR			Automatically enters the VFR code (1200 in the U.S.A. only).
	Code			Displays transponder code selection softkeys 0-7.
		0 - 7		Use numbers to enter code.
		Ident		Activates the Special Position Identification (SPI) pulse for 18 seconds, identifying the transponder return on the ATC screen.
		BKSP		Removes numbers entered, one at a time.
	Ident			Activates the Special Position Identification (SPI) pulse for 18 seconds, identifying the transponder return on the ATC screen.
Ident				Activates the Special Position Identification (SPI) pulse for 18 seconds, identifying the transponder return on the ATC screen.
Tmr/Ref				Displays Timer/References Window.
Nearest				Displays Nearest Airports Window.
Alerts or Message				Displays the Alerts Window when pressed. System generated messages cause the Alerts Softkey label to change to a flashing 'Message' label. Pressing the Message Softkey opens the Alerts Window, acknowledges the message, and the softkey reverts to the 'Alerts' label.

Table 1-2 PFD Softkeys

MFD SOFTKEYS

The MFD softkeys provide control over flight management functions, including GPS, NAV, terrain, traffic, and weather (optional). There are many softkey functions available on the MFD depending on the page group and screen selected.

The following table provides an example of the MFD Softkey functions accessed from the Navigation Map screen. Further information concerning softkeys providing more navigation and flight planning functions may be found in the Flight Management Section. Terrain, traffic, and weather softkey descriptions may be found in the Hazard Avoidance section. Further description of optional equipment and corresponding softkey functions may be found in the Additional Features Section.

Level 1	Level 2	Level 3	Description
System			Accesses the Synoptics page softkeys and the Landing Field Elevation softkeys.
CAS	**Cas ↑ and CAS ↓**		Scroll up or down (displayed only when a sufficient number of items are displayed in the Crew Alerting System display to warrant scrolling).
	LFE MAN		Displays the manual landing field elevation softkeys.
		+ 250 FT	Adds 250 feet to the previously selected or default LFE value.
		- 250 FT	Subtracts 250 feet to the previously selected or default LFE value.
		+ 25 FT	Adds 25 feet to the previously selected or default LFE value.
		- 25 FT	Subtracts 25 feet to the previously selected or default LFE value.
		Accept	Press to accept the adjustments to the LFE value.
	FMS LFE		Sets the landing field elevation to the destination airport elevation.
	ELEC		Displays the electrical synoptics page.
	FUEL		Displays the fuel synoptics page.
	GEN		Displays the general synoptics page for the anti-ice system and doors.
Map Opt			Displays system oil pressure and temperature, fuel calculations, and electrical system information.
	Traffic		Displays traffic information on Navigation Map Page.
	Inset		Displays inset window second level softkeys.
		Off	Removes VSD inset from Navigation Map Page.
		VSD	Displays VSD profile information of terrain/obstacles along the current track, vertical track vector, and selected altitude. **Auto**: Automatically displays either VSD profile information for active flight plan information or along current track with no active flight plan. **FPL**: Displays VSD profile information for active flight plan. **TRK**: Displays VSD profile information along current track.

Level 1	Level 2	Level 3	Description
	TER		Displays terrain on the map; cycles through the following: **Off**: No terrain information shown on MFD Map. **Topo**: Displays topographical data (e.g., coastlines, terrain, rivers, lakes) and elevation scale on MFD Map. **REL**: Displays relative terrain information on the MFD Map.
	AWY		Displays airways on the map; cycles through the following: **Off**: No airways are displayed. **On**: All airways are displayed. **LO**: Only low altitude airways are displayed. **HI**: Only high altitude airways are displayed.
	STRMSCP		Displays Stormscope information on Navigation Map (optional).
	NEXRAD		Displays XM NEXRAD weather and coverage on Navigation Map Page (optional).
	XM LTNG		Displays XM lightning information on Navigation Map Page (optional).
	METAR		Displays METAR information on Inset Map (subscription optional).
	Legend		Displays legends for the displayed XM Weather products (optional).
	Wx Radar		Displays weather information.
Detail			Selects desired amount of map detail; cycles through the following levels: **Detail All**: All map features visible. **Detail-3**: Declutters land data. **Detail-2**: Declutters land and SUA data. **Detail-1**: Removes everything except for the active flight plan.
Charts			When available, displays optional airport and terminal procedure charts.
	CHRT Opt		Displays chart display settings softkeys (if available).
	AUTO		Displays the most pertinent chart based on the phase of flight and loaded procedures in the active flight plan.
	Info		Pressing the **Info 1** or **Info 2** Softkey returns to the airport diagram when the view is on a different chart.
	DP		Displays departure procedure chart.
	STAR		Displays standard terminal arrival procedure chart.
	APR		Displays approach procedure chart.
	NOTAM		Displays NOTAM information for selected airport, when available.
Checklist			When available, displays optional checklists

Table 1-3 MFD Navigation Map Page Softkeys

MENUS

The system has a **MENU** Key that, when pressed, displays a context-sensitive list of options. This options list allows the user to access additional features or make settings changes which specifically relate to the currently displayed window/page. There is no all-encompassing menu. Some menus provide access to additional submenus that are used to view, edit, select, and review options. Menus display 'No Options' when there are no options for the window/page selected. The main controls used in association with all window/page group operations are described in Section 1.2. Softkey selection does not display menus or submenus.

Navigating the Page Menu Window

1) Press the **MENU** Key to display the 'Page Menu' Window.
2) Turn the **FMS** Knob to scroll through a list of available options (a scroll bar appears to the right of the window when the option list is longer than the window).
3) Press the **ENT** Key to select the desired option.
4) The **CLR** Key may be pressed to remove the menu and cancel the operation. Pressing the **FMS** Knob also removes the displayed menu.

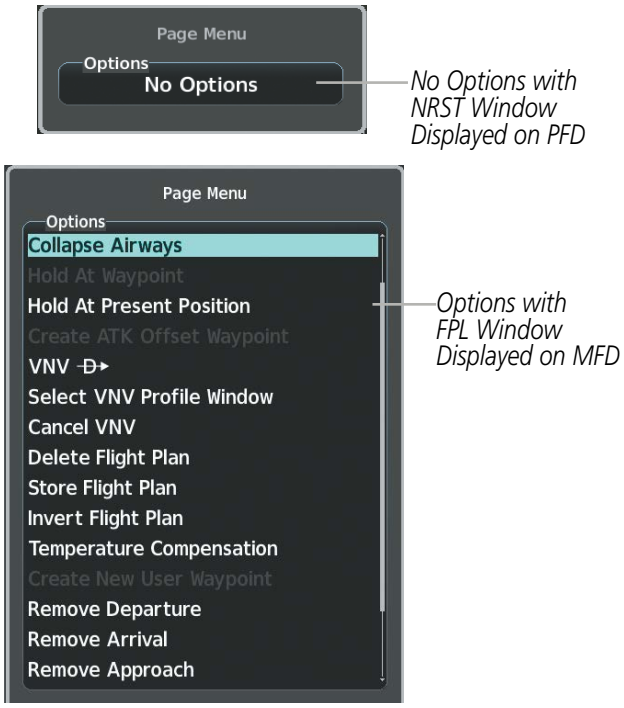


Figure 1-13 Page Menu Examples

MFD PAGE GROUPS

NOTE: *Refer to other supporting sections in this Pilot's Guide for details on specific pages.*

Information on the MFD is presented on pages grouped according to function. The page group and active page title are displayed in the upper center of the screen, below the Navigation Status Box. In the bottom right corner of the screen, a page group window is displayed by turning either **FMS** Knob. The page group tabs are displayed along the bottom of the window. The page titles are displayed in a list above the page group tabs. The current page group and current page within the group are shown in cyan. For some of these pages (Airport/Procedures/Weather Information, XM, Procedure Loading), the active title of the page changes while the page name in the list remains the same.

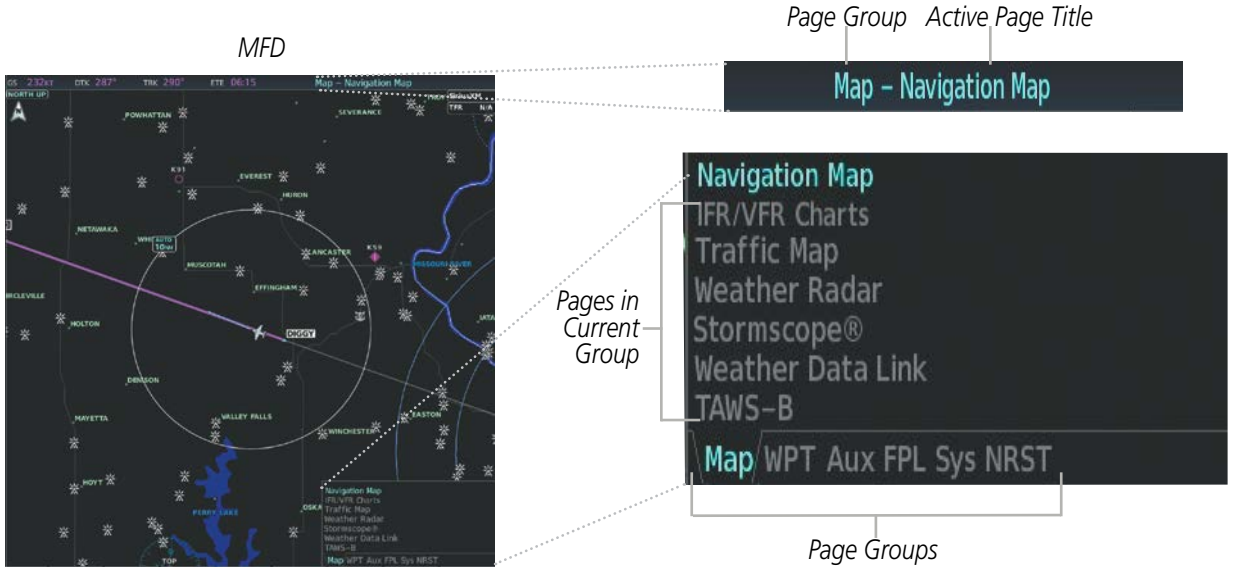


Figure 1-14 Page Title and Page Groups

The main page groups are navigated using the **FMS** Knob; specific pages within each group can vary depending on the configuration of optional equipment.

Selecting a page using the FMS Knob:

1) Turn the large **FMS** Knob to display the list of page groups; continue turning the large **FMS** Knob until the desired page group is selected
2) Turn the small **FMS** Knob to display the desired page within a specific page group.

There are also several pages (Airport Information/Procedures/Weather Information and XM pages) selected first from within a main page group with the **FMS** Knob, then with the appropriate softkey at the bottom of the page (or from the page menu). In this case, the page remains set to the selected page until a different page softkey is pressed, even if a different page group is selected.

Page Group	Pages within Page Group
MAP (Map Page Group)	• Navigation Map • IFR/VFR Charts • Traffic Map • Weather Radar • Stormscope • Weather Data Link (*service optional*) • Terrain/ TAWS-B
WPT (Waypoint Page Group)	• Airport/Procedures/Weather Information Pages - Airport Information (Info **1** Softkey) - Airport Directory Information (Info **2** Softkey) - Departure Information (**DP** Softkey) - Arrival Information (**STAR** Softkey) - Approach Information (**APR** Softkey) - Weather Information (*optional*) (**WX** Softkey) • Intersection Information • NDB Information • VOR Information • VRP Information • User Waypoint Information

Page Group	Pages within Page Group
Aux (Auxiliary Page Group)	• Weight Planning • Trip Planning • Utility • GPS Status • System Setup 1/2 • XM Radio Pages - XM Information (**Info** Softkey) - XM Radio (**Radio** Softkey) • Satellite Phone pages - Telephone (**Phone** Softkey) - Text Messaging (**SMS** Softkey) • Maintenance Logs • System Status • ADS-B Status • Connext Setup • Databases
FPL (Flight Plan Page Group)	• Active Flight Plan - Wide View, Narrow View (**View** Softkey) • Flight Plan Catalog - Stored Flight Plan (via **New** Softkey)
Sys (Synoptics Page Group)	• Electrical • Fuel • General
NRST (Nearest Page Group)	• Nearest Airports • Nearest Intersections • Nearest NDB • Nearest VOR • Nearest VRP • Nearest User WPTS • Nearest Frequencies • Nearest Airspaces

Table 1-4 Page Group and Pages

PROCEDURE PAGES (PROC)

The Procedure Pages may be accessed at any time on the MFD by pressing the **PROC** Key. A menu is initialized, and when a departure, approach, or arrival is selected, the appropriate Procedure Loading Page is opened. Turning the **FMS** Knob does not scroll through the Procedure pages

- Departure Loading
- Arrival Loading
- Approach Loading

SPLIT SCREEN FUNCTIONALITY

Chart pages may be viewed in split screen mode with the Navigation Map Page and the Active Flight Plan Page. When the system is powered-up on the ground, following acknowledgement of the MFD Power-up Display, the Navigation Map Page and Active Flight Plan Page will be displayed in normal page view. To activate the split screen functionality, press the **Charts** Softkey. Two display panes are displayed on the MFD. If split screen is activated from the Navigation Map Page, the page title will show 'Map - Chart + Navigation Map'. If split screen is activated from the Active Flight Plan Page, the page title will change to show 'FPL - Chart + Active Flight Plan'.

MFD in Split Screen Mode

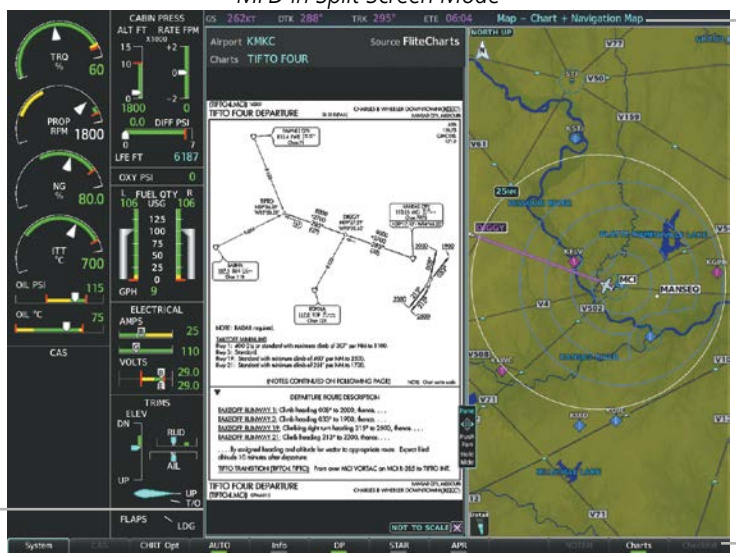


Figure 1-15 Split Screen Mode

Enabling/disabling split screen mode:

1) From the 'Map - Navigation Map' Page or the 'FPL - Active Flight Plan' Page press the **Charts** Softkey, or press the **MENU** Key and select 'Chart Mode On'.
2) To disable the split screen mode, press the **Charts** Softkey again or press the **MENU** Key and select 'Chart Mode Off'. The display returns to the base page, either the Navigation Map Page or the Active Flight Plan Page.

See the Additional Features section for more information on Charts, and how to enable Charts Full Screen.

CONTROLLING DISPLAY PANES

In split screen mode, the active display pane is outlined by a cyan box called the pane selector. Softkeys and menu options will automatically change depending on which display pane is active. Display panes may be displayed vertically in Narrow View, or horizontally in Wide View. In Narrow View, move the **Joystick** left or right to move the pane selector. In Wide View, move the **Joystick** up and down to move the pane selector. To change between Wide View and Narrow View, push and hold the **Joystick**.

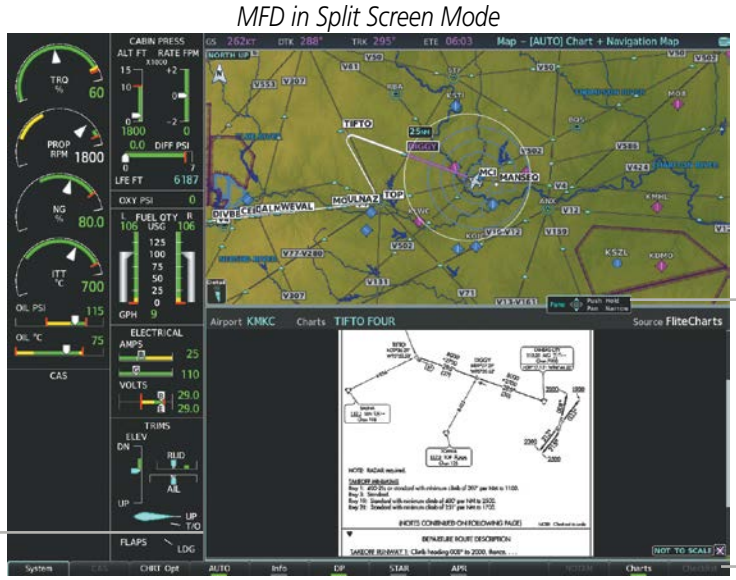


Figure 1-16 Split Screen in Wide View

For information on viewing Charts and the Active Flight Plan Page with the Flight Plan map, see the Flight Management Section.

SYSTEM SETTINGS

System settings are managed from the System Setup Pages. The System Setup pages allow management of the crew profiles. Also, fields shown in cyan text may be edited for following system parameters:

- Time display format (local or UTC)
- Displayed measurement units
- Barometric Transition Alert
  (see the Flight Instruments Section)
- Airspace alerts
  (see the Flight Management Section)
- Arrival alert
- Flight Director Format
  (Single Cue Only - can not edit)
  (see the Flight Instruments Section)
- MFD Data Bar (Navigation Status Box) fields
  (see the Flight Management Section)
- GPS Course Deviation Indicator (CDI) range
  (see the Flight Instruments Section)
- COM transceiver channel spacing
  (see the Audio Panel and CNS Section)
- Displayed nearest airports
  (see the Flight Management Section)
- Electronic Stability and Protection
  (see the Additional Features Section)
- Audio Voice Format
- Chart selection for Auto Taxi Chart

Restoring system setup defaults:

1) Select the 'Aux - System Setup' 1 or 2 Page.

2) Press the **Defaults** Softkey; or press the **MENU** Key, highlight 'Restore Page Defaults', and press the **ENT** Key. The message 'Restore Setup X Page Defaults?' is displayed.

3) With 'OK' highlighted, press the **ENT** Key.

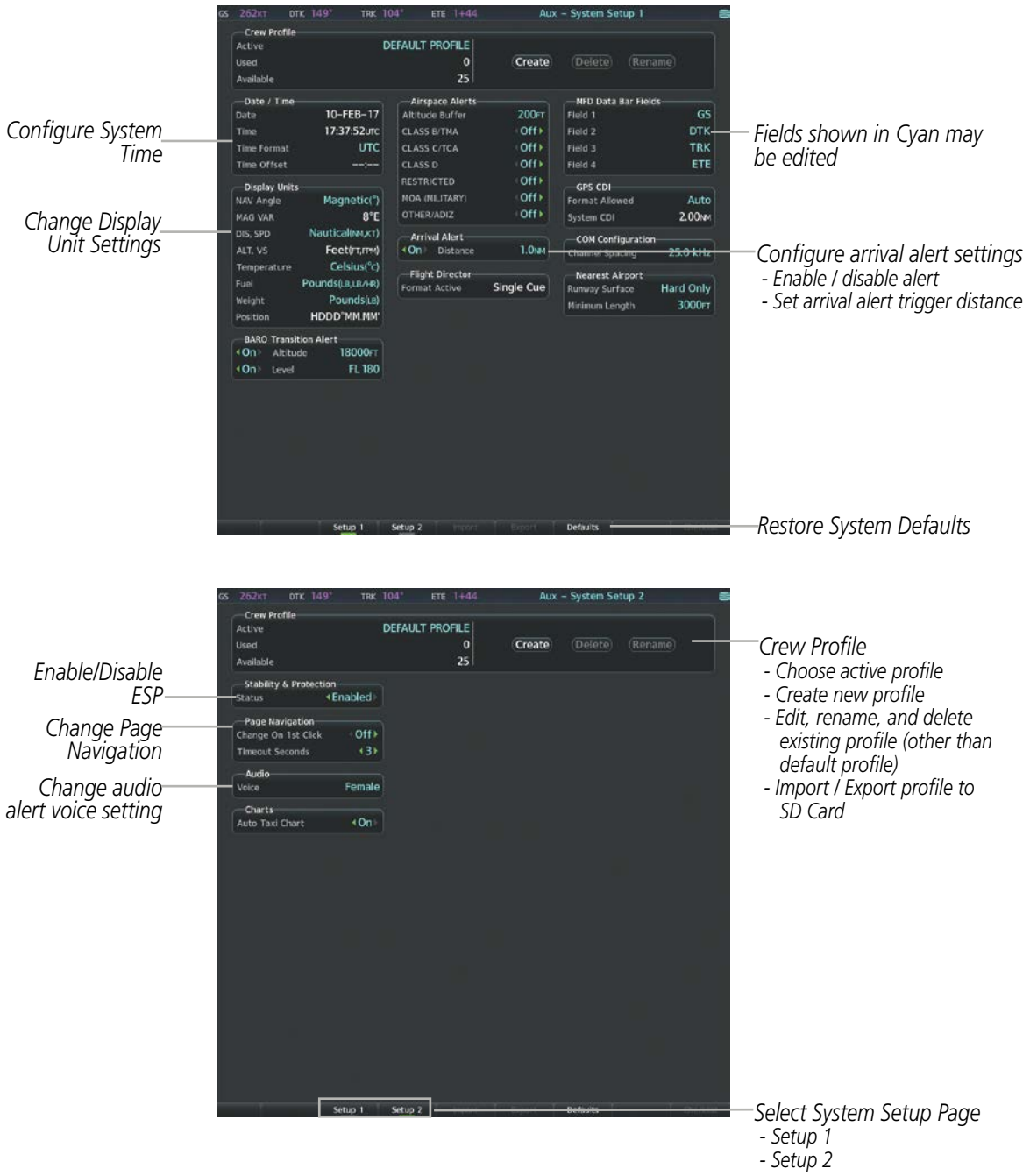


Figure 1-17 System Setup 1/2 Pages

DATE/TIME

The system obtains the current Universal Coordinated Time (UTC) date and time directly from the GPS satellite signals (shown on the Aux - GPS Status Page). System time (displayed in the lower right corner of the PFD) can be displayed in three formats: local 12-hr, local 24-hr, or UTC. Local time is set by adding/subtracting an offset (hours:minutes) to/from UTC.

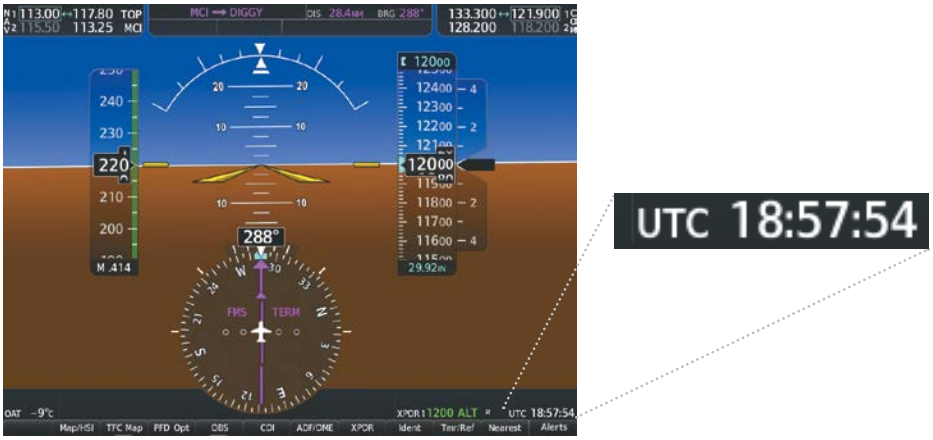


Figure 1-18 System Time (UTC Format)

Configuring the system time:

1) Select the 'Aux - System Setup 1' Page.
2) Press the **FMS** Knob to activate the cursor.
3) Turn the large **FMS** Knob to highlight the 'Time Format' Field.
4) Turn the small **FMS** Knob to select the desired format and press the **ENT** Key to confirm selection. If local time format is selected, the 'Time Offset' Field is highlighted.
5) If necessary, use the **FMS** Knob to enter the desired time offset (±HH:MM) and press the **ENT** Key to confirm selection.

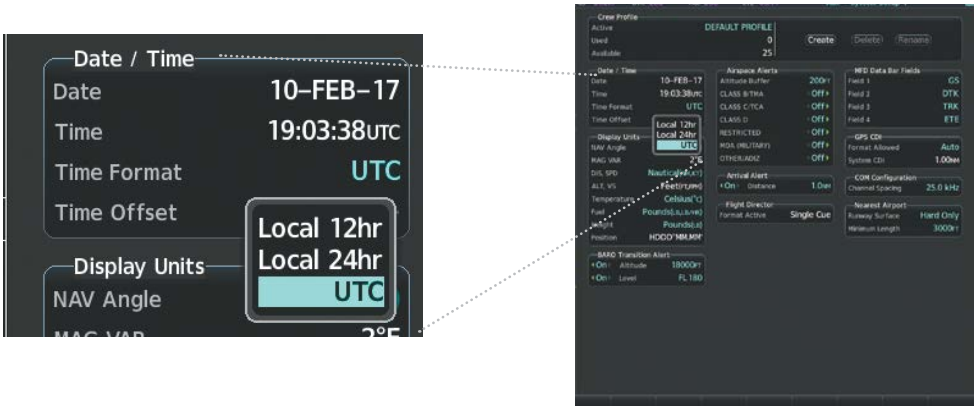


Figure 1-19 Date/Time Settings (System Setup 1 Page)

CREW PROFILES

System settings may be saved under a crew profile. When the system is powered on, the last selected crew profile is shown on the MFD Power-up Splash Screen (Figure 1-8). The system can store up to 25 profiles; the currently active profile, the amount of memory used, and the amount of memory available are shown at the top of the System Setup Page in the box labeled 'Crew Profile'. From here, crew profiles may be created, selected, renamed, or deleted. Crew profiles may also be exported from the system to an SD card, or imported from an SD card into the system.

Creating a profile:

1) Select the 'Aux - System Setup (X)' Page.

2) Press the **FMS** Knob momentarily to activate the flashing cursor.

3) Turn the large **FMS** Knob to highlight 'Create' in the Crew Profile Box.

4) Press the **ENT** Key. A 'Create Profile' Window is displayed.

5) Use the **FMS** Knob to enter a profile name up to 16 characters long and press the **ENT** Key. Crew profile names cannot begin with a blank as the first letter.

6) In the next field, use the small **FMS** Knob to select the desired settings upon which to base the new profile. Profiles can be created based on Garmin factory defaults, default profile settings (initially based on Garmin factory defaults unless edited by the pilot), or other previously created profile settings.

7) Press the **ENT** Key.

8) With 'Create' highlighted, press the **ENT** Key to create the profile

Or:

Use the large **FMS** Knob to select 'Create & Activate' and press the **ENT** Key to activate the new profile.

9) To cancel the process, select 'Cancel' with the large FMS Knob and press the **ENT** Key.

Selecting an active profile:

1) Select the 'Aux - System Setup (X)' Page.

2) Press the **FMS** Knob momentarily to activate the flashing cursor.

3) Turn the large **FMS** Knob to highlight the active profile field in the 'Crew Profile' Box.

4) Turn the small **FMS** Knob to display the crew profile list and highlight the desired profile.

5) Press the **ENT** Key. The system loads and displays the system settings for the selected profile.

Renaming a profile:

1) Select the 'Aux - System Setup (X)' Page.
2) Press the **FMS** Knob momentarily to activate the flashing cursor.
3) Turn the large **FMS** Knob to highlight 'Rename' in the 'Crew Profile' Box.
4) Press the **ENT** Key.
5) In the 'Rename Profile' Window, turn the **FMS** Knob to select the profile to rename.
6) Press the **ENT** Key.
7) Use the **FMS** Knob to enter a new profile name up to 16 characters long and press the **ENT** Key.
8) With 'Rename' highlighted, press the **ENT** Key.
9) To cancel the process, use the large **FMS** Knob to select 'Cancel' and press the ENT Key.

Deleting a profile:

1) Select the 'Aux - System Setup (X)' Page.
2) Press the **FMS** Knob momentarily to activate the flashing cursor.
3) Turn the large **FMS** Knob to highlight 'Delete' in the 'Crew Profile' Box.
4) Press the **ENT** Key.
5) In the 'Delete Profile' Window, turn the **FMS** Knob to select the profile to delete.
6) Press the **ENT** Key.
7) With 'Delete' highlighted, press the **ENT** Key.
8) To cancel the process, use the large **FMS** Knob to select 'Cancel' and press the **ENT** Key.

Importing a profile from an SD card:

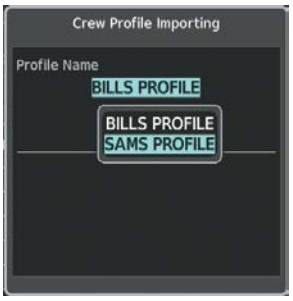
1) Insert an SD card containing the crew profile(s) into the top card slot on the MFD.
2) Turn the **FMS** Knob to select the 'Aux - System Setup (X)' Page.
3) Press the **Import** Softkey.

   Or:

   a) Press the **MENU** Key.

   b) Turn the **FMS** Knob to highlight 'Import Crew Profile' and press the **ENT** Key.
4) The system displays the 'Crew Profile Importing' Window with 'Import' highlighted. Turn the large **FMS** Knob to highlight the 'Profile Name' Field, then scroll to the desired profile name with the large and small FMS Knobs, then press the **ENT** Key. Then press the **ENT** Key with 'Import' highlighted.
5) If the imported profile name is the same as an existing profile on the system, the system displays an 'Overwrite existing profile? OK or Cancel' prompt. Press the **ENT** Key to replace profile on the system with the profile imported from the SD card, or turn the **FMS** Knob to highlight 'Cancel' and press the **ENT** Key to return to the 'Crew Profile Importing' Window.
6) If successful, the system displays 'Crew profile import succeeded.' in the window below. With 'OK' highlighted, press the **ENT** or **CLR** Keys or press the **FMS** Knob to return to the 'Aux - System Setup (X)' Page. The imported profile becomes the active profile.

Crew Profile Importing and Import Results Window



Crew Profiles Available for Import from SD Card

Import Successful

Figure 1-20 Pilot Profile Import (Aux - System Setup Page)

Exporting a profile to an SD card:

1) Insert the SD card for storing the Crew Profile into the top card slot on the MFD.

2) Turn the **FMS** Knob to select the 'Aux - System Setup (X)' Page.

3) Press the **Export** Softkey. The system displays the 'Crew Profile Exporting' Window.

Or:

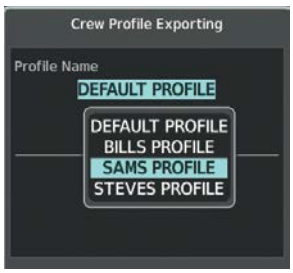
a) Press the **MENU** Key.

b) Turn the **FMS** Knob to highlight 'Export Crew Profile' and press the **ENT** Key.

4) To export the crew profile using the current selected profile, press the **ENT** Key with 'Export' highlighted. To change the selected profile, turn the large **FMS** Knob to highlight the 'Profile Name' ield, then scroll to the desired profile name with the large and small FMS Knobs, then press the **ENT** Key. Then press the **ENT** Key with 'Export' highlighted.

5) If the selected profile to be exported is the same as an existing profile file name on the SD card, the system displays an 'Overwrite existing profile? OK or Cancel' prompt. Press the **ENT** Key to replace the profile on the SD card with the profile to be exported, or turn the FMS Knob to highlight 'Cancel' and press the **ENT** Key to return to the 'Pilot Profile Exporting' Window without exporting the profile.

6) If successful, the window displays 'Crew profile export succeeded.' With 'OK' highlighted, press the **ENT** or **CLR** Keys, or press the **FMS** Knob to return to the 'Aux - System Setup (X)' Page.



Crew Profile Exporting Window, Enter a Name to Use for Exported Profile

Export Successful

Figure 1-21 Pilot Profile Export on the Aux - System Setup Page

DISPLAY UNITS

Units in which various quantities are displayed on the system screens are listed on the System Setup Page. Units can be changed if the Category text is cyan as with Navigation Angle, Distance/Speed, Temperature, Fuel/Fuel Flow, and Weight.

Category	Settings	Affected Quantities	Exceptions
Navigation Angle	Magnetic (North)* True (North)	Heading Course Bearing Track Desired Track Wind direction (Trip Planning Page)	
Magnetic Variance	Degrees (East/ West)	Heading Course Bearing Track Desired Track Wind direction (Trip Planning Page)	
Distance and Speed	Metric Nautical*	Crosstrack error (HSI) Bearing distances (information windows) DME distance (information window) Flight plan distances Map ranges DIS, GS, TAS, XTK fields (Navigation Status Box) All distances on MFD Altitude buffer distance (System Setup) Arrival Alert trigger distance (System Setup) All speeds on MFD	Airspeed Indicator True Airspeed (PFD) Wind speed vector Map range (Traffic Page, Terrain Proximity/TAWS Page) CDI scaling (System Setup) Fuel range calculation (EIS)
Altitude and Vertical Speed	Feet	All altitudes on MFD All elevations on MFD	Altimeter Vertical Speed Indicator VNV altitudes (Active Flight Plan)
Temperature	Celsius* Fahrenheit	All temperatures on PFD Total Air Temperature (Trip Planning Page)	Engine Indication System (EIS)
Fuel and Fuel Flow	Gallons IMP GALS Kilograms Liters Pounds*	Fuel parameters (Trip Planning Page)	Engine Indication System (EIS)
Weight	Pounds* Kilograms	N/A	N/A
Position	HDDD°MM.MM′	All positions	N/A

* *Default setting*

Table 1-5 Display Units Settings (System Setup Page)

Changing a display unit setting

1) While on the 'Aux - System Setup 1' Page, press the **FMS** Knob momentarily to activate the flashing cursor.
2) Turn the large **FMS** Knob to highlight the desired field in the Display Units Box.
3) Turn the small **FMS** Knob to select the desired units.
4) Press the **ENT** Key. Press the **CLR** Key to cancel the action without changing the units.

ARRIVAL ALERTS

The Arrival Alert Box on the System Setup 1 Page allows the Alerts Window arrival alerts to be turned 'On/Off' and the alert trigger distance (up to 99.9 units) set for alerts in the Alerts Window and the PFD Navigation Status Box. An arrival alert can be set to notify the pilot with a message upon reaching a user-specified distance from the final destination (the direct-to waypoint or the last waypoint in a flight plan). When Arrival Alerts is set to 'On', and the set distance is reached, an "Arrival at waypoint" message is displayed in the PFD Navigation Status Box, and a "WPT ARRIVAL - Arriving at waypoint - [xxxx]" is displayed in the Alerts Window. When Arrival Alerts is set to 'Off', only the PFD Navigation Status Box message "Arriving at waypoint" is displayed, and it is displayed when the time to the final destination is approximately ten seconds.

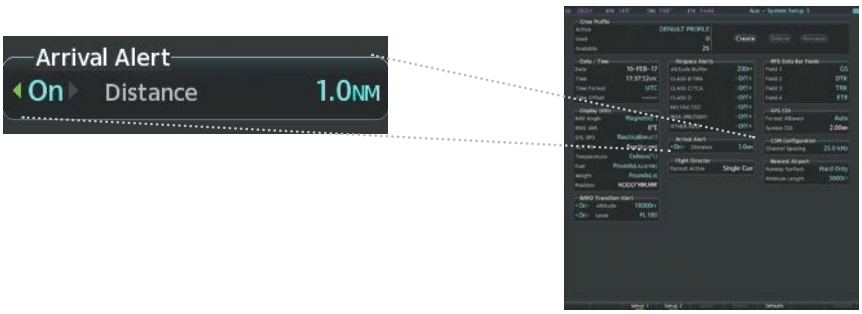


Figure 1-22 Arrival Alert Settings (System Setup 1 Page)

Enabling/disabling the Alerts Window arrival alert:

1) Use the **FMS** Knob to select the 'Aux - System Setup 1' Page.
2) Press the **FMS** Knob momentarily to activate the flashing cursor.
3) Turn the large **FMS** Knob to select the 'On/Off' field in the Arrival Alert Box.
4) Turn the small **FMS** Knob clockwise to turn the airspace alert On or counterclockwise to turn the alert Off.

Changing the arrival alert trigger distance:

1) Use the **FMS** Knob to select the 'Aux - System Setup 1' Page.
2) Press the **FMS** Knob momentarily to activate the flashing cursor.
3) Turn the large **FMS** Knob to highlight the distance field in the Arrival Alert Box.
4) Use the **FMS** Knob to enter a trigger distance and press the **ENT** Key.

ELECTRONIC STABILITY AND PROTECTION

Garmin Electronic Stability and Protection (ESP™) is an optional feature intended to discourage the exceedance of attitude, airspeed, and angle of attack (AOA) parameters. This feature will only operate when the aircraft is above 200 feet AGL and the autopilot is not engaged. The pilot can enable/disable ESP on the System Setup Pages on the MFD.

Enabling/disabling ESP:

1) While on the 'Aux - System Setup 2' Page, press the **FMS** Knob momentarily to activate the flashing cursor.
2) Turn the large **FMS** Knob to place the cursor in the status field of the 'Stability & Protection' Box.
3) Turn the small **FMS** Knob to select 'Enabled' or 'Disabled' and press the **ENT** Key when the desired selection is highlighted.

PAGE NAVIGATION

The large **FMS** Knob displays the Page Group Tabs and navigates through the tabs. The small **FMS** Knob navigates through the pages listed within a specific group. The number of clicks it takes to display the Page Group Tabs and change to the next tab can be controlled from the Page Navigation box on the Aux - System **Setup 2** Page.

Off – Displays the Page Group Window with one click of either **FMS** Knob.

On – Displays the Page Group Window and navigates to the next page group with one click of either **FMS** Knob.

The pilot can select, from the Aux - System **Setup 2** Page, the amount of time the Page Group Window is displayed (in the lower right corner of the MFD). The timeout can range from two to ten seconds.

Selecting page navigation settings:

1) Use the **FMS** Knob to select the Aux - System **Setup 2** Page.
2) Press the **FMS** Knob momentarily to activate the flashing cursor.
3) Turn the large **FMS** Knob to highlight the 'Change On 1st Click' field in the Page Navigation Box.
4) Turn the small **FMS** Knob to select 'Off' or 'On'.
5) Turn the large **FMS** Knob to highlight the 'Timeout Seconds' field in the Page Navigation Box.
6) Turn the small **FMS** Knob to select the desired number of seconds
7) Press the **FMS** Knob momentarily to remove the flashing cursor.

AUDIO ALERTS

The Audio Box on the 'Aux - System Setup 2' Page allows the audio alert voice setting (male or female).

Changing the audio alert voice:

1) Use the **FMS** Knob to select the 'Aux - System Setup 2' Page.
2) Press the **FMS** Knob momentarily to activate the flashing cursor.
3) Turn the large **FMS** Knob to highlight the voice field in the 'Audio' Box.
4) Use the **FMS** Knob to select the desired voice setting and press the **ENT** Key.

SYSTEM UTILITIES

For flight planning purposes, timers, trip statistics, and a scheduler feature are provided on the 'Aux - Utility' Page. The timers available include a stopwatch-like generic timer, a total time in flight timer, and a record of the time of departure. Trip statistics—odometer, trip odometer, and average trip and maximum groundspeeds—are displayed from the time of the last reset.

Figure 1-23 Utility Page

TIMERS

The system timers available on the 'Aux - Utility' Page include:

- Stopwatch-like generic timers
- Total-time-in-flight timer
- Time since departure

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

Setting the generic timer

1) Use the **FMS** Knob to select the 'Aux - Utility' Page.
2) Press the **FMS** Knob momentarily to activate the flashing cursor.
3) Turn the small **FMS** Knob to select the timer counting direction (Up/Dn) and press the **ENT** Key.
4) If a desired starting time is desired:
   a) Use the large **FMS** Knob to highlight the HH:MM:SS field.
   b) Use the **FMS** Knob to enter the desired time and press the **ENT** Key.
5) Turn the large **FMS** Knob to highlight 'Start?' and press the **ENT** Key to start the timer. The field changes to 'Stop?'.
6) To stop the timer, press the **ENT** Key with 'Stop?' highlighted. The field changes to 'Reset?'.
7) To reset the timer, press the **ENT** Key with 'Reset?' highlighted. The field changes back to 'Start?' and the digits are reset.

The flight timer can be set to count up from zero starting at system power-up or from the time that the aircraft lifts off; the timer can also be reset to zero at any time.

Setting the flight timer starting criterion

1) Use the **FMS** Knob to select the 'Aux - Utility' Page.
2) Press the **FMS** Knob momentarily to activate the flashing cursor.
3) Turn the large **FMS** Knob to highlight the field next to the flight timer.
4) Turn the small **FMS** Knob to select the starting criterion (Pwr-On or In-Air) and press the **ENT** Key.

Resetting the flight timer

1) Use the **FMS** Knob to select the 'Aux - Utility' Page.
2) Press the **MENU** Key.
3) With 'Reset Flight Timer' highlighted, press the **ENT** Key.

The system records the time at which departure occurs, depending on whether the pilot prefers the time to be recorded from system power-up or from aircraft lift off. The displayed departure time can also be reset to display the current time at the point of reset. The format in which the time is displayed is controlled from the System Setup Page.

Setting the departure timer starting criterion

1) Use the **FMS** Knob to select the 'Aux - Utility' Page.
2) Press the **FMS** Knob momentarily to activate the flashing cursor.
3) Turn the large **FMS** Knob to highlight the field next to the departure time.
4) Turn the small **FMS** Knob to select the starting criterion (Pwr-On or In-Air) and press the **ENT** Key.

Resetting the departure time

1) Use the **FMS** Knob to select the 'Aux - Utility' Page.
2) Press the **MENU** Key.
3) Use the **FMS** Knob to highlight 'Reset Departure Time' and press the **ENT** Key.

TRIP STATISTICS

The odometer and trip odometer record the total mileage traveled from the last reset; these odometers can be reset independently. Resetting the trip odometer also resets the average trip groundspeed. Maximum groundspeed for the period of time since the last reset is also displayed.

Resetting trip statistics readouts

1) Use the **FMS** Knob to select the 'Aux - Utility' Page.
2) Press the **MENU** Key. The following reset options for trip statistics are displayed:
   - Reset Trip ODOM/AVG GS—Resets trip average ground speed readout and odometer
   - Reset Odometer—Resets odometer readout only
   - Reset Maximum Speed—Resets maximum speed readout only
   - Reset All—Resets flight timer, departure timer, odometers, and groundspeed readouts
3) Use the **FMS** Knob to highlight the desired reset option and press the **ENT** Key. The selected parameters are reset to zero and begin to display data from the point of reset.

SCHEDULER

The system's Scheduler feature can be used to enter and display reminder messages (e.g., "Change oil", "Switch fuel tanks", "Overhaul") in the Alerts Window on the PFD. Messages can be set to display based on a specific date and time (event), once the message timer reaches zero (one-time; default setting), or recurrently whenever the message timer reaches zero (periodic). Message timers set to periodic alerting automatically reset to the original timer value once the message is displayed. When power is cycled, messages are retained until deleted, and message timer countdown is restarted.

Entering a scheduler message:

1) Select the 'Aux - Utility' Page.

2) Press the **FMS** Knob momentarily to activate the flashing cursor.

3) Turn the large **FMS** Knob to highlight the first empty scheduler message naming field.

4) Use the **FMS** Knob to enter the message text to be displayed in the PFD Alerts Window and press the **ENT** Key.

5) Press the **ENT** Key again or use the large **FMS** Knob to move the cursor to the field next to 'Type'.

6) Turn the small **FMS** Knob to select set the message alert type:

- Event—Message issued at the specified date/time
- One-time—Message issued when the message timer reaches zero (default setting)
- Periodic—Message issued each time the message timer reaches zero

7) Press the **ENT** Key again or use the large **FMS** Knob to move the cursor to the next field.

8) For periodic and one-time message, use the **FMS** Knob to enter the timer value (HHH:MM:SS) from which to countdown and press the **ENT** Key.

9) For event-based messages:

a) Use the **FMS** Knob to enter the desired date (DD-MM-YYYY) and press the **ENT** Key.

b) Press the **ENT** Key again or use the large **FMS** Knob to move the cursor to the next field.

c) Use the **FMS** Knob to enter the desired time (HH:MM) and press the **ENT** Key.

10) Press the **ENT** Key again or use the large **FMS** Knob to move the cursor to enter the next message.

Deleting a scheduler message:

1) Select the 'Aux - Utility' Page.
2) Press the **FMS** Knob momentarily to activate the flashing cursor.
3) Turn the large **FMS** Knob to highlight the name field of the scheduler message to be deleted.
4) Press the **CLR** Key to clear the message text. If the **CLR** Key is pressed again, the message is restored.
5) Press the **ENT** Key to confirm message deletion.

Scheduler messages appear in the Alerts Window on the PFD and cause the **Alerts** Softkey label to change to a flashing 'Message' label. Pressing the **Message** Softkey opens the Alerts Window and acknowledges the scheduler message. The softkey reverts to the 'Alerts' label. Pressing the **Alerts** Softkey again removes the Alerts Window from the display and the scheduler message is deleted from the message queue.

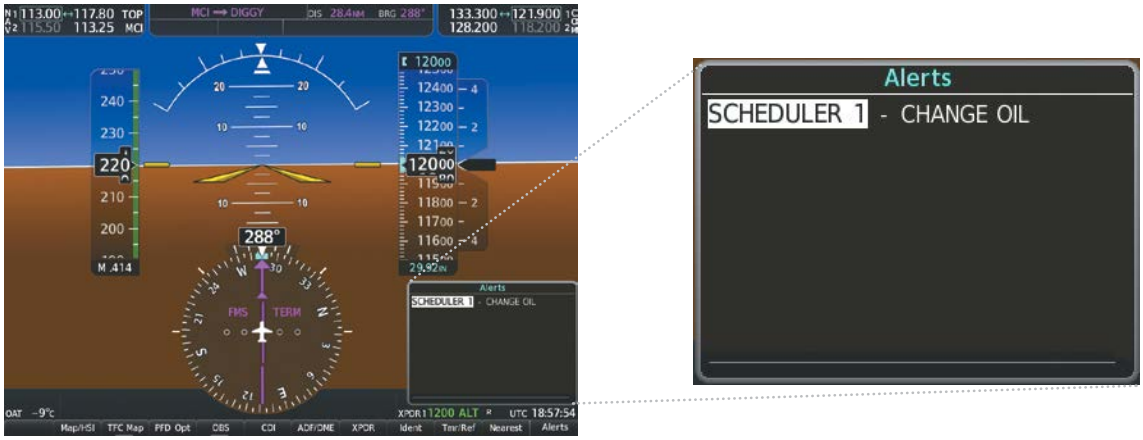


Figure 1-24 PFD Alerts Window

1.5 DISPLAY BACKLIGHTING

The PFD and MFD display backlighting, the PFD and MFD bezel, and the Audio Panel keys can be adjusted manually in one of two ways:

- Using the individual dimmer bus control for the desired display, or
- Using the PFD Setup Menu and the following procedures. In normal operating mode, backlighting can only be adjusted from the PFDs. In reversionary mode, adjustments can be made from any remaining displays.

NOTE: *Backlighting may be manually adjusted as low as 0.01%. Manually adjusting the backlighting to a low setting may result in an illegible (too dim) display.*

Adjusting display backlighting:

1) Press either PFD **MENU** Key to display the 'PFD Setup Menu' Window. 'Auto' is now highlighted next to 'PFD1 Display'. If desired, turn the large **FMS** Knob to select 'Auto' next to 'MFD Display' or 'PFD2 Display'.
2) Turn the small **FMS** Knob to select 'Manual' and press the **ENT** Key. The intensity value is now highlighted.
3) Use the **FMS** Knob to enter the desired backlighting then press the **ENT** Key.
4) To remove the menu, press the **CLR** or **MENU** Key.

Adjusting key backlighting:

1) Press either PFD **MENU** Key to display the PFD Setup Menu. 'Auto' is now highlighted next to 'PFD1 Display'.
2) Turn the large **FMS** Knob to highlight 'PFD1 Display', 'MFD Display', or 'PFD2 Display', as desired.
3) Turn the small **FMS** Knob in the direction of the green arrowhead to display 'PFD1 Key', 'MFD Key', or 'PFD2 Key'.
4) Turn the large **FMS** Knob to highlight 'Auto'.
5) Turn the small **FMS** Knob to select 'Manual' and press the **ENT** Key. The intensity value is now highlighted.
6) Use the **FMS** Knob to enter the desired backlighting and press the **ENT** Key.
7) To remove the menu, press the **CLR** or **MENU** Key.

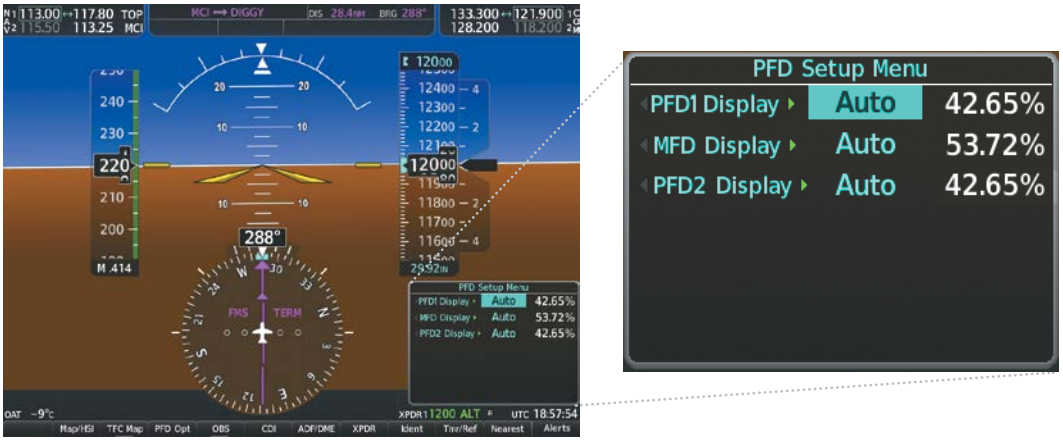


Figure 1-25 PFD Setup Menu

SECTION 2 FLIGHT INSTRUMENTS

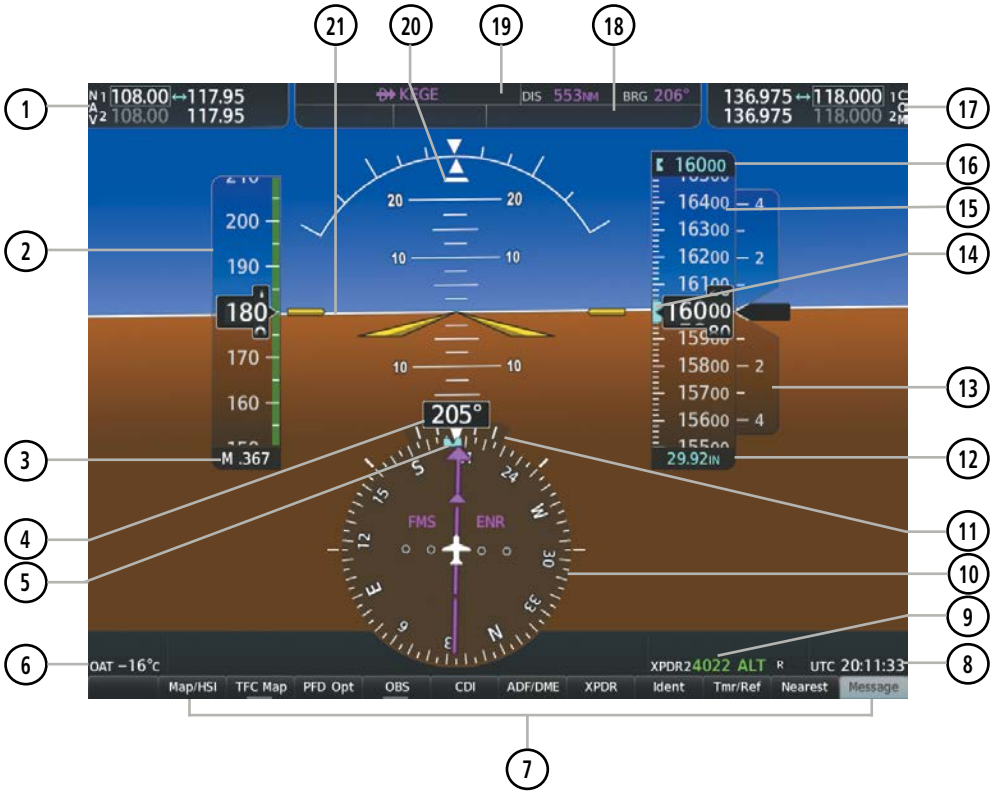
NOTE: *The Automatic Flight Control System (AFCS) provides additional readouts and bugs on selected flight instruments. Refer to the AFCS Section for details on these bugs and readouts, as they appear on the display during certain AFCS modes.*

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

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

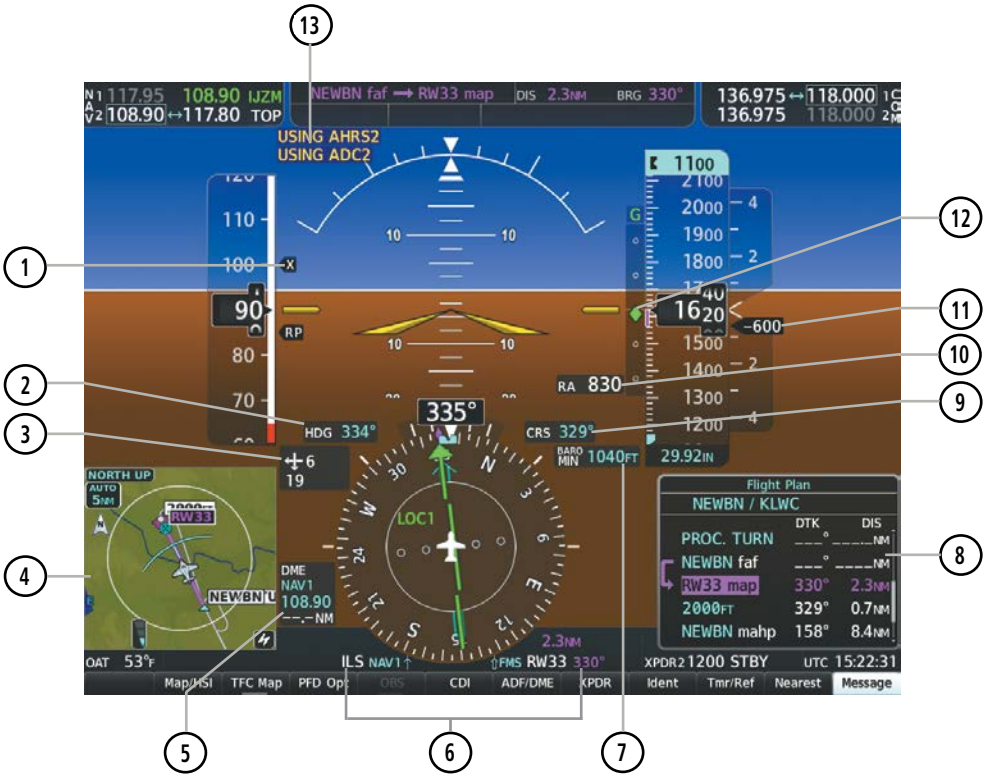
- Airspeed Indicator, showing
  - Indicated Airspeed
  - Airspeed awareness ranges
  - Mach number
  - Vspeed Reference Bugs
- Attitude Indicator with slip/skid indication
- Altimeter, showing
  - Indicated Altitude
  - Trend vector
  - Barometric setting
  - Selected Altitude
- Vertical Deviation, Glideslope, and Glidepath Indicators
- Vertical Speed Indicator (VSI)
- Horizontal Situation Indicator, showing
  - Turn Rate Indicator
  - Bearing pointers and information windows
  - DME Information Window (optional)
  - Course Deviation Indicator (CDI)
- DME Tuning Window
- Outside Air Temperature (OAT)
- System time
- Wind data
- Vertical Navigation indications
- Radar altimeter (optional)
- Angle of Attack (AOA) Indicator

The PFDs also display various alerts and annunciations discussed throughout this Pilot's Guide.



1. *NAV Frequency Box*
2. *Airspeed Indicator*
3. *Mach Number*
4. *Current Heading*
5. *Selected Heading Bug*
6. *Outside Air Temperature (OAT)*
7. *Softkeys*
8. *System Time*
9. *Transponder Data Box*
10. *Horizontal Situation Indicator (HSI)*
11. *Turn Rate Indicator*
12. *Altimeter Barometric Setting*
13. *Vertical Speed Indicator (VSI)*
14. *Selected Altitude Bug*
15. *Altimeter*
16. *Selected Altitude*
17. *COM Frequency Box*
18. *AFCS Status Box*
19. *Navigation Status Box*
20. *Slip/Skid Indicator*
21. *Attitude Indicator*

Figure 2-1 Primary Flight Display (Default)



1. *Vspeed Reference Bug*
2. *Selected Heading*
3. *Wind Data*
4. *Inset Map*
5. *DME Information Window (optional)*
6. *Bearing Information*
7. *Minimum Descent Altitude/Decision Height*
8. *Flight Plan Window*
9. *Selected Course*
10. *Radar Altimeter (optional)*
11. *Current Vertical Speed*
12. *Glideslope Indicator*
13. *Reversionary Sensor Annunciations*

Figure 2-2 Additional PFD Information

2.1 FLIGHT INSTRUMENTS

AIRSPEED INDICATOR

NOTE: *Refer to the Pilot's Operating Handbook (POH) for speed criteria and Vspeed values.*

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

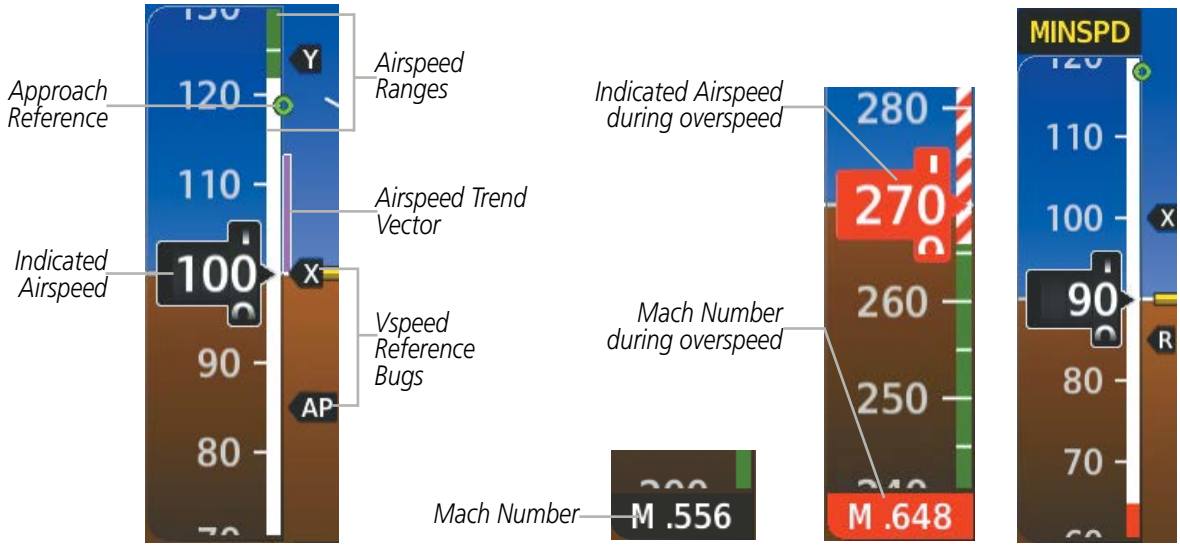


Figure 2-3 Airspeed Indicator

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

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

The Airspeed Trend Vector is a vertical magenta line that appears to the right of the color-coded speed range strip when airspeed is either accelerating or decelerating. One end of the magenta line is anchored to the tip of the airspeed pointer while the other end moves continuously up or down corresponding to the rate of

acceleration or deceleration. For any constant rate of acceleration or deceleration, the moving end of the line shows approximately what the indicated airspeed value will be in six seconds. If the trend vector crosses V_{MO}/M_{MO}, the text of the actual airspeed readout changes to amber while the pointer remains black. 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.

Vspeeds can be changed and their bugs enabled/disabled from the References Window. When enabled (on), the Vspeeds are displayed at their respective locations to the right of the airspeed scale. On the next avionics power cycle, all Vspeed Reference Bugs are in a disabled state with their default values.

Below 20 knots, Vspeed Reference Bugs and their numeric values appear toward the bottom of the airspeed tape arranged from highest to lowest values.

	Vspeed	Bug
Takeoff	V_R	R
	V_X	X
	V_Y	Y
Landing	V_{APP}	AP

Table 2-1 Vspeed Bug Labels

Enabling/disabling individual Vspeed Reference Bugs:

1) Press the **Tmr/Ref** Softkey.
2) Turn the large **FMS** Knob to highlight the field of the desired Vspeed to be changed.
3) Use the small **FMS** Knob to change the Vspeed in 1-kt increments. When a speed is changed from a default value, an asterisk appears next to the speed.
4) Press the **ENT** Key or turn the large **FMS** Knob to highlight the 'On/Off' field
5) Turn the small **FMS** Knob to 'On' to enable or counterclockwise to 'Off' to disable selected Vspeed bug.
6) To remove the window, press the **CLR** Key or the **Tmr/Ref** Softkey.

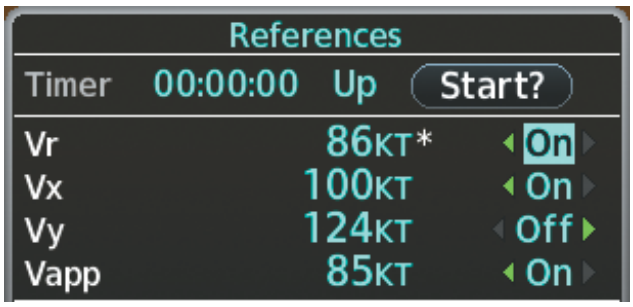


Figure 2-4 Vspeed Reference Bugs Settings on the References Window

The pilot can also enable/disable all Vspeed Reference Bugs as a group.

Enabling/disabling all Vspeed Reference Bugs as a group:

1) Press the **Tmr/Ref** Softkey.
2) Press the **MENU** Key.
3) To activate all Vspeed bugs, press the **ENT** Key with 'All References On' highlighted.
4) To remove all Vspeed bugs, turn the **FMS** Knob to highlight 'All References Off' and press the **ENT** Key.
5) To remove the References Window, press the **CLR** Key or the **Tmr/Ref** Softkey.

Restoring all Vspeeds defaults:

1) Press the **Tmr/Ref** Softkey.
2) Press the **MENU** Key.
3) Turn the large **FMS** Knob to highlight 'Restore Defaults' and press the **ENT** Key.

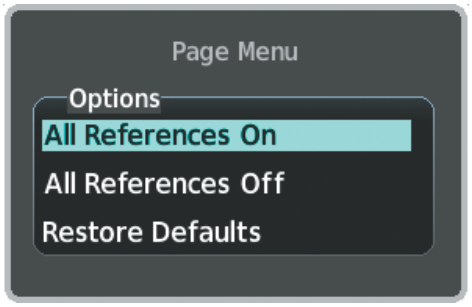


Figure 2-5 Page Menu for the References Window

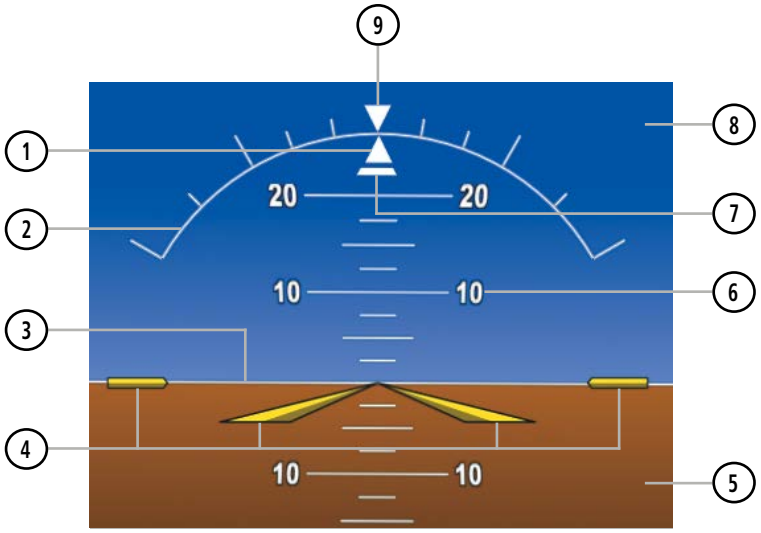
GENERIC TIMER

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

1) Press the **Tmr/Ref** Softkey.
2) Turn the large **FMS** Knob to select the Timer field (HH:MM:SS).
3) Use the **FMS** Knob to enter the desired time.
4) Press the **ENT** Key. The Up/Dn field is now highlighted.
5) Turn the small **FMS** Knob to display the Up/Dn Window.
6) Turn the small **FMS** Knob to select 'Up' or 'Dn'.
7) Press the **ENT** Key. 'Start?' is now highlighted.
8) Press the **ENT** Key to start the timer. The field changes to 'Stop?'. If the timer is counting down, it will start counting up after reaching zero.
9) To stop the timer, press the **ENT** Key with 'Stop?' highlighted. The field changes to 'Reset?'.
10) To reset the timer, press the **ENT** Key with 'Reset?' highlighted. The field changes back to 'Start?' and the digits are reset.
11) To remove the window, press the **CLR** Key or the **Tmr/Ref** Softkey.

ATTITUDE INDICATOR

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



1. *Roll Pointer*
2. *Roll Scale*
3. *Horizon Line*
4. *Aircraft Symbol*
5. *Land Representation*
6. *Pitch Scale*
7. *Slip/Skid Indicator*
8. *Sky Representation*
9. *Roll Scale Zero*

Figure 2-6 Attitude Indicator

The horizon line is part of the pitch scale. Above and below the horizon line, major pitch marks and numeric labels are shown for every 10°, up to 90°. Minor pitch marks are shown for intervening 5° increments, up to 25° below and 45° above the horizon line. Between 20° below to 20° above the horizon line, minor pitch marks occur every 2.5°. When Synthetic Vision Technology (Garmin SVT™) is activated, the pitch scale is reduced to 10° up and 7.5° down; refer to the SVT discussion later in this section for more information about SVT.

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

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

Figure 2-7 Slip/Skid Indication

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

ALTIMETER

The Altimeter displays barometric altitude values on a moving tape rolling number gauge

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

The Indicated Altitude is displayed in the black pointer.

The pilot can choose to display overlays for the indicated altitude and Selected Altitude using alternate display units. For example, if the Altimeter is displaying feet, the system can show a metric overlay for the indicated and selected altitudes without changing the scale or display units of the Altimeter.

Enabling altitude units overlays:

1) Press the **PFD Opt** Softkey to display the second-level softkeys.
2) Press the **ALT Units** Softkey.
3) Press the **Meters or Feet** Softkey to enable/disable the altitude overlays .
4) Press the **Back** Softkey twice to return to the top-level softkeys.

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

Setting the Selected Altitude:

Turn the **ALT SEL** Knob to set the Selected Altitude.

If the Altimeter display units are set to feet, the Selected Altitude increments are 100 feet.

When the altitude units overlays are enabled, the increments alternate between a rounded value of feet or meters while turning the **ALT SEL** Knob.

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

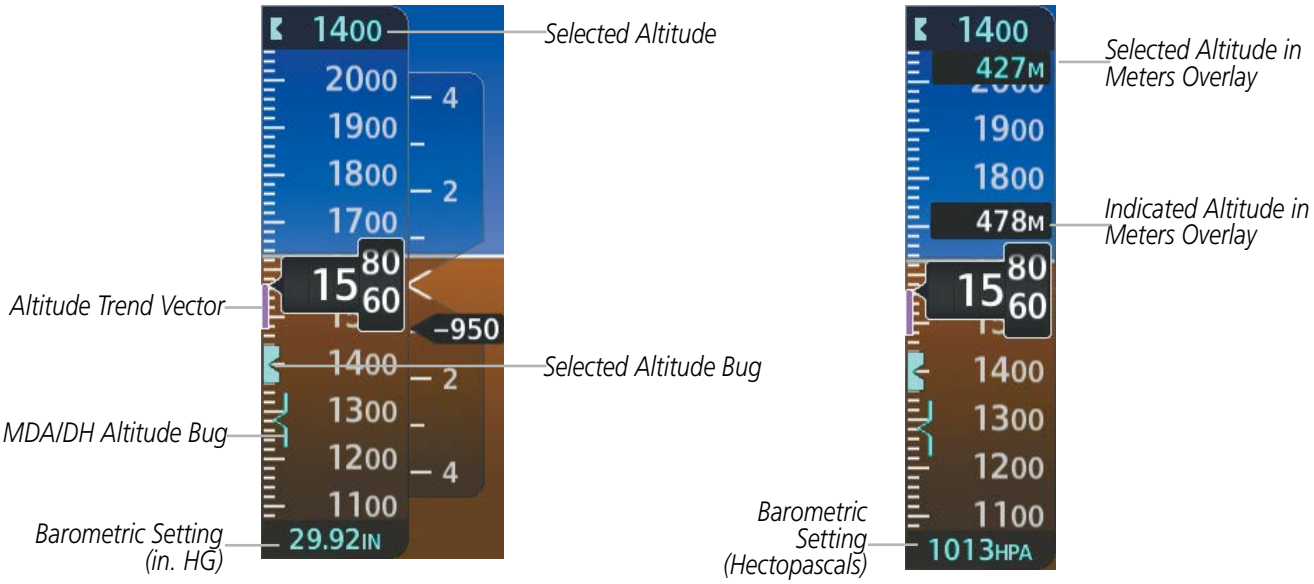


Figure 2-8 Altimeter (Standard and Metric)

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

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

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

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

Selecting the altimeter barometric pressure setting:

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

Selecting standard barometric pressure:

Press the **BARO** Knob to select standard pressure; 'STD BARO' appears in the barometric setting box.

Or:

1) Press the **PFD Opt** Softkey to display the second-level softkeys.
2) Press the **STD Baro** Softkey; STD BARO is displayed in barometric setting box.

Figure 2-9 Standard Barometric Altimeter Setting

Changing altimeter barometric pressure setting units:

1) Press the **PFD Opt** Softkey to display the second-level softkeys.
2) Press the **ALT Units** Softkey.
3) Press the **IN** Softkey to display the barometric pressure setting in inches of mercury (in Hg).

   Or, press the **HPA** Softkey to display the barometric pressure setting in hectopascals (hPa;)
4) Press the **Back** Softkey twice to return to the top-level softkeys.

If the barometric altimeter settings differ between PFDs by more than 0.02 Hg, the readouts become amber (Figure 2-10). The settings can be synchronized from the Aux - System Setup 1 Page on the MFD. Once the settings are synchronized, the readouts change from amber to cyan.

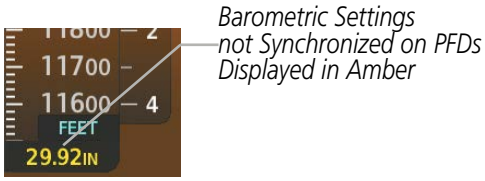


Figure 2-10 Barometric Setting on PFDs not Synchronized

Synchronizing the altimeter barometric pressure settings:

1) Turn the large **FMS** Knob to select the 'Aux - System Setup 1' Page on the MFD.
2) If necessary, press the **Setup 1** Softkey to display the 'Aux - System Setup 1' Page.
3) Press the **FMS** Knob to activate the cursor.
4) Turn the large **FMS** Knob to highlight 'BARO' in the 'Synchronization' box.
5) Turn the small **FMS** Knob clockwise to 'On' or counterclockwise to 'Off'.
6) Press the **ENT** Key.
7) Turn the small **FMS** Knob to change the altitude.
8) Press the **ENT** Key.
9) To cancel the selection, press the **FMS** Knob.

BAROMETRIC TRANSITION ALTITUDE ALERTS

The Baro Transition Alerts flash the barometric pressure setting to remind the pilot to change the barometric pressure setting to or from standard. Two alerts are available. The altitude Baro Transition Alert occurs when climbing through the transition altitude beginning at 200 feet below this altitude. The flight level Baro Transition Alert occurs when descending through the transition flight level beginning at 200 feet above this flight level. The barometric pressure setting stops flashing after the pilot changes the barometric pressure setting. The pilot can enable/disable either Baro Transition Alerts, and choose the altitude or flight level used to trigger the alerts.

Setting the Baro Transition Alerts:

1) Use the **FMS** Knob to select the 'Aux - System Setup 1' Page on the MFD.
2) Press the **FMS** Knob to activate the cursor.
3) To enable/disable the Baro Transition Alert based on altitude, turn the large **FMS** Knob to highlight the 'On' or 'Off' field for the BARO Transition Alert Altitude in the 'BARO Transition Alert' Box.
4) If desired, turn the small **FMS** Knob to set the BARO Transition Alert Altitude 'On' or 'Off'.
5) Turn the large **FMS** Knob to highlight the Altitude field.
6) Use the **FMS** Knobs to change the altitude and press the **ENT** Key to accept or press the **CLR** Key to return to the previous altitude selection.
7) Turn the large **FMS** Knob to highlight the 'On' or 'Off' field for the BARO Transition Alert Level.
8) If desired, turn the small **FMS** Knob to set the BARO Transition Alert Flight Level 'On' or 'Off'.

9) Turn the large **FMS** Knob to highlight the Flight Level field.

10) Use the **FMS** Knobs to change the Flight Level for the alert and press the **ENT** Key to accept or press the **CLR** Key to return to the previous altitude selection.

11) Push the **FMS** Knob to deactivate the cursor.

VERTICAL SPEED INDICATOR (VSI)

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

The Vertical Speed Indicator (VSI) displays the aircraft vertical speed using a non-moving tape. The current vertical speed is displayed in the pointer along the tape.

The VSI is displayed in feet, numeric labels with major tick marks appear at 2000 and 4000 feet per minute. Minor tick marks appear for every 1000 fpm. If the current vertical speed is greater than 100 fpm, digits appear in the pointer. If the rate of ascent/descent exceeds 4000 fpm, the pointer appears at the corresponding edge of the tape while displaying the current vertical speed numerically.

A magenta chevron bug is displayed as the Required Vertical Speed Indication (RVSI) for reaching a VNV Target Altitude once the "TOD [Top of Descent] within 1 minute" alert has been generated. See the Flight Management Section for details on VNV features, and refer to Section 2.2, Supplemental Flight Data, for more information about VNV indications on the PFD.

VERTICAL DEVIATION

The Vertical Deviation Indicator (VDI; Figure 2-11) uses a magenta chevron to indicate the baro-VNV vertical deviation when Vertical Navigation (VNV) is being used; the VDI appears in conjunction with the "TOD within 1 minute" alert. Full-scale deflection (two dots) is 1000 feet (305 meters). The VDI is removed from the display if vertical deviation becomes invalid. See the Flight Management and AFCS sections for details on VNV features, and refer to Section 2.3, Supplemental Flight Data, for more information about VNV indications on the PFD.

The Glideslope Indicator (Figure 2-12) appears to the left of the Altimeter whenever an ILS frequency is tuned in the active NAV field and the aircraft heading and selected course are within 107°. A green diamond acts as the Glideslope Indicator, like a glideslope needle on a conventional indicator. If a localizer frequency is tuned and there is no glideslope, "NO GS" is displayed in place of the diamond.

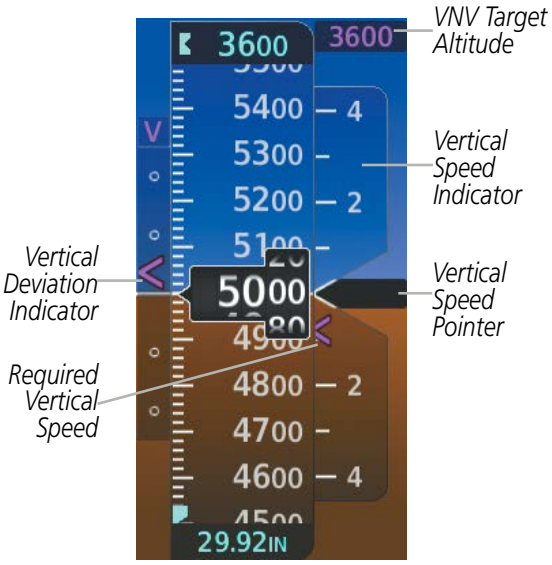


Figure 2-11 Vertical Speed and Deviation Indicator (VSI and VDI)

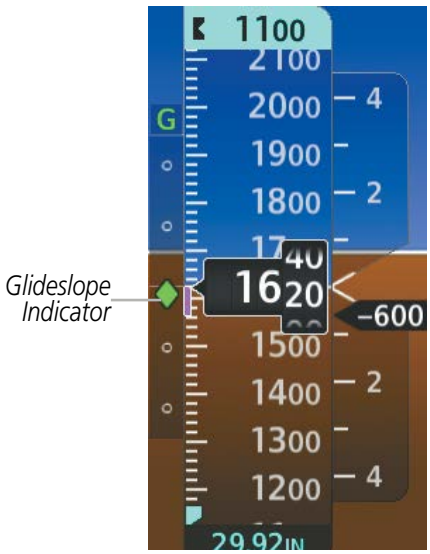


Figure 2-12 Glideslope Indicator

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

The Glidepath Indicator is a vertical deviation scale for GPS approach service levels supporting SBAS vertical guidance (LNAV+V, L/VNAV, LPV, LP+V) or advisory vertical guidance (LNAV+V, LP+V, Visual). The Glidepath Indicator, a magenta diamond (Figure 2-13) appears on the display as soon as the Final Approach Fix (FAF) becomes the active waypoint, and FMS is the selected navigation source. Full-scale deflection (two dots), is angular with upper and lower limits. The upper limit is +/-492 feet (150 meters) and lower limits depend on approach service level.

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

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

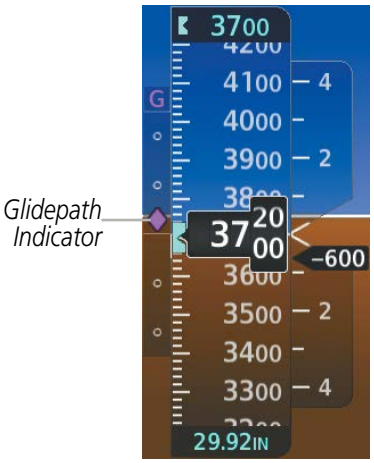


Figure 2-13 Glidepath Indicator

While executing an LNAV/VNAV approach, and between the FAF and MAP, the Vertical Deviation Limit Indicators appear as vertical white lines (Figure 2-14) indicating the area where deviation exceeds allowable limits for the glidepath. The Vertical Deviation Limit Indicator provides a scaled representation of +/- 75 feet of the calculated glidepath. The "window" between the lines represents the area of acceptable deviation. The length of the lines will change while progressing through the final approach. When the Glidepath Indicator enters an excessive deviation area, the Glidepath and Vertical Deviation Limit Indicators are amber (Figure 2-15).

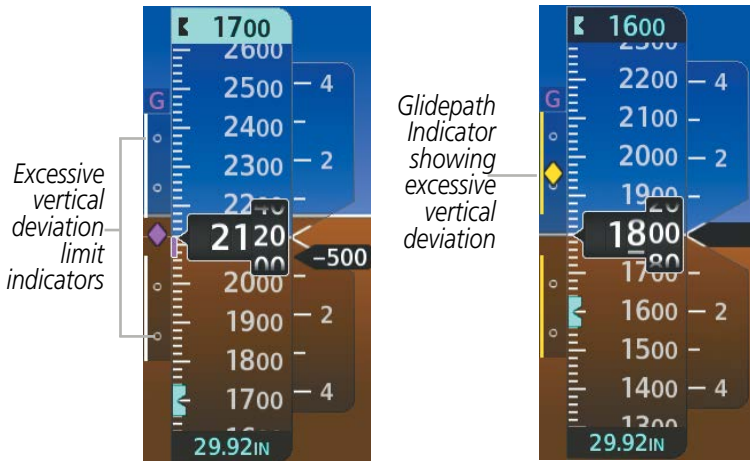
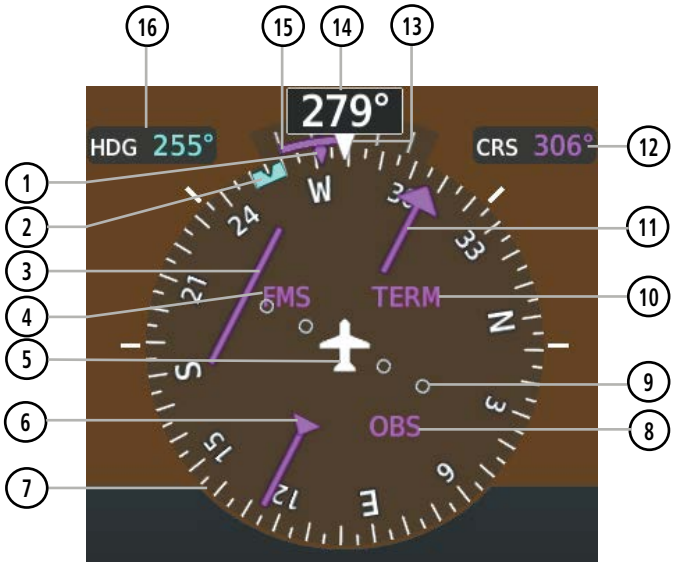


Figure 2-14 Glidepath Indicator (LNAV/VNAV) and Vertical Deviation Limit Indicators

HORIZONTAL SITUATION INDICATOR (HSI)

The Horizontal Situation Indicator (HSI) displays a rotating compass card in a heading-up orientation. Letters indicate the cardinal points with numeric labels every 30˚. Major tick marks are at 10˚ intervals and minor tick marks are 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. The HSI also presents turn rate, course deviation, bearing, and navigation source information.

The HSI with the HSI Map disabled contains a Course Deviation Indicator (CDI), with a Course Pointer, To/From Indicator, and a sliding deviation bar and scale. The course pointer is a single line arrow (FMS, VOR1, and LOC1) or a double line arrow (VOR2 and LOC2) which points in the direction of the set course. The To/From arrow rotates with the course pointer and is displayed when the active NAVAID is received.



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

Figure 2-15 Horizontal Situation Indicator

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

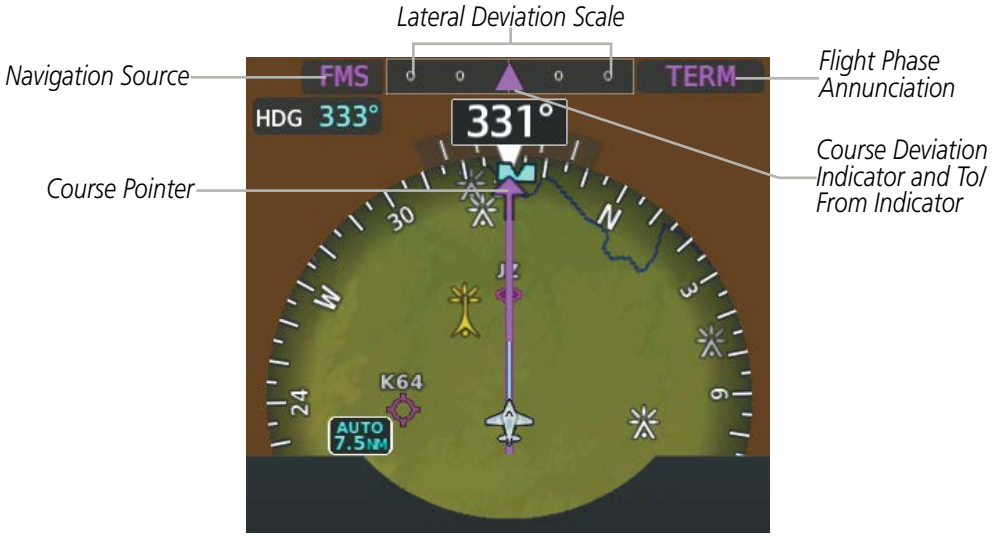


Figure 2-16 HSI Map

A digital reading of the current heading appears above the rotating compass card. A magenta diamond on the HSI represents the current track over the ground the aircraft is flying. To the upper left of the HSI, the Selected Heading is shown in cyan for three seconds after it is adjusted, which corresponds to the cyan heading bug on the compass rose. The Desired Track (DTK) is shown in magenta to the upper right of the HSI when the selected navigation source is FMS and OBS Mode is not active. The Selected Course (CRS) is shown to the upper right of the HSI when the selected navigation source is VOR or LOC and in magenta when the selected navigation source is FMS with OBS Mode active. Upon station passage, the To/From Indicator flips and points to the tail of the aircraft, just like a conventional To/From flag. Depending on the navigation source, the CDI on the can appear in two different ways: an arrowhead (FMS, VOR, OBS) or a diamond (LOC).

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

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

Enabling/disabling the HSI Map:

1) Press the **Map/HSI** Softkey.
2) Press the **Layout** Softkey.
3) Press the **HSI Map** Softkey to display the HSI Map.

   Or:

   Press the **Map Off** Softkey to disable the HSI Map.
4) Press the **Back** Softkey twice to return to the top-level softkeys.

Upon station passage, the To/From Indicator flips and points to the tail of the aircraft, just like a conventional To/From flag. Depending on the navigation source, the CDI on the can appear in two different ways: an arrowhead (FMS, VOR, OBS) or a diamond (LOC).

The Selected Heading is shown to the upper left of the HSI for three seconds after being adjusted The cyan bug on the compass rose corresponds to the Selected Heading.

Adjusting the Selected Heading:

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

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

The Selected Course is shown to the upper right of the HSI for three seconds after being adjusted.

Adjusting the Selected Course:

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

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

Figure 2-17 Heading and Course Indications

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

Navigation angles (track, heading, course, bearing) are corrected to the computed magnetic variation ('Mag Var') or referenced to true north (denoted 'T'), set on the Aux - System Setup 1 Page. When an approach referenced to true north has been loaded into the flight plan, the system generates a message to change the navigation angle setting to 'True' at the appropriate time.

Figure 2-18 Heading and Course Indications (True)

Changing the navigation angle setting:

1) Use the **FMS** Knob to select the Aux - System Setup 1 Page on the MFD.
2) Press the **FMS** Knob to activate the cursor.
3) Turn the large **FMS** Knob to highlight NAV Angle setting in the Display Units box.
4) Turn the small **FMS** Knob to highlight the desired setting and press the **ENT** Key.
   - Magnetic - Angles corrected to the computed magnetic variation (Mag Var)
   - True - References angles to true north (T)

TURN RATE INDICATOR

The Turn Rate Indicator is located directly above the rotating compass card. Tick marks to the left and right of the lubber line denote half-standard and standard turn rates. A magenta Turn Rate Trend Vector shows the current turn rate. The end of the trend vector gives the heading predicted in six seconds, based on the present turn rate. A standard-rate turn is shown on the indicator by the trend vector stopping at the standard turn rate tick mark, corresponding to a predicted heading of 18° from the current heading. At rates greater than four deg/sec, an arrowhead appears at the end of the magenta trend vector and the prediction is no longer valid.

Figure 2-19 Turn Rate Indicator and Trend Vector

BEARING POINTERS AND INFORMATION WINDOWS

Two bearing pointers and associated information can be displayed on the HSI for NAV and FMS sources. The pointers are cyan and are single- (BRG1) or double-lined (BRG2); an icon is shown in the respective information window to indicate the pointer type. The bearing pointers never override the CDI and are visually separated from the CDI by a white ring (shown when bearing pointers are selected but not necessarily visible due to data unavailability).

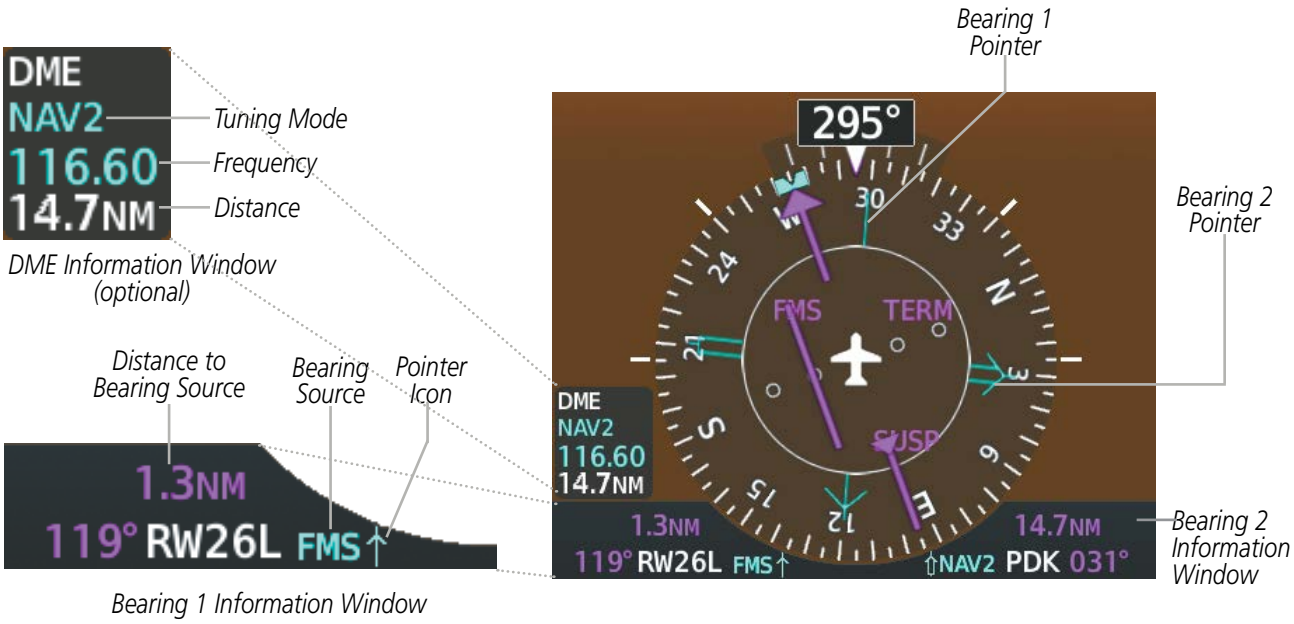


Figure 2-20 HSI with Bearing and DME Information

When a bearing pointer is displayed, its associated information window is also displayed. The Bearing Information windows are displayed to the lower sides of the HSI and show the following information:

- Bearing source (NAV, FMS, ADF)
- Pointer icon (BRG1 = single line, BRG2 = double line)
- Frequency (NAV)
- Station/waypoint identifier (NAV, FMS)
- FMS-derived great circle distance to bearing source

If the NAV radio is the bearing source and is tuned to an ILS frequency (refer to the Audio Panel and CNS Section for information on tuning the radios), the bearing pointer is removed from the HSI and the frequency is replaced with "ILS". When NAV1 or NAV2 is the selected bearing source, the frequency is replaced by the station identifier when the station is within range. If FMS is the bearing source, the active waypoint identifier is displayed in lieu of a frequency.

The bearing pointer is removed from the HSI and "NO DATA" is displayed in the information window if:

- The NAV radio is not receiving the tuned VOR station
- FMS is the bearing source and an active waypoint is not selected

Selecting bearing display and changing sources:

1) Press the **PFD Opt** Softkey.
2) Press either **Bearing 1** or **Bearing 2** Softkey to display the desired bearing pointer and information window with a NAV source.
3) Press either **Bearing 1** or **Bearing 2** Softkey again to change the bearing source to FMS.
4) Press either **Bearing 1** or **Bearing 2** Softkey a third time to change the bearing source to ADF (note: ADF radio installation is optional).
5) To remove the bearing pointer and information window, press either **Bearing 1** or **Bearing 2** Softkey again.

DME INFORMATION WINDOW

NOTE: *DME radio installation is optional.*

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

Displaying the DME Information Window:

1) Press the **PFD Opt** Softkey.
2) Press the **DME** Softkey to display the DME Information Window above the BRG1 Information Window.
3) To remove the DME Information Window, press the **DME** Softkey again.

COURSE DEVIATION INDICATOR (CDI)

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

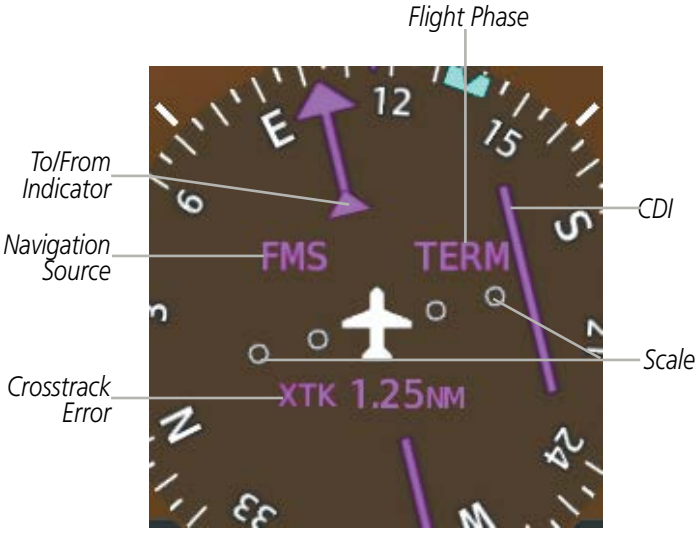


Figure 2-21 Course Deviation Indicator

The CDI can display two sources of navigation: FMS or NAV (VOR, localizer). Color indicates the current navigation source: magenta (for FMS) or green (for VOR and LOC); the Selected Course readout also follows these color indications. When coupled to FMS, the full scale limits for the CDI are defined by a GPS-derived distance. 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 FMS, the crosstrack error (XTK) is displayed below the white aircraft symbol.

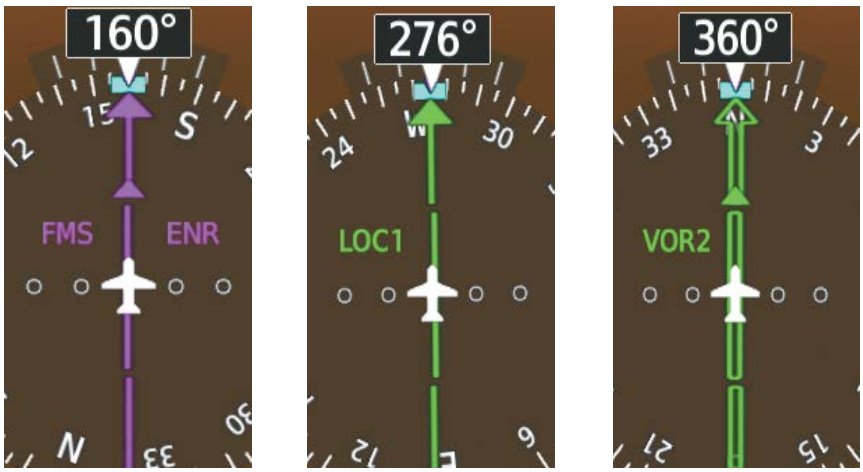


Figure 2-22 Navigation Sources

Changing navigation sources:

1) Press the **CDI** Softkey to change from FMS to VOR1 or LOC1. This places the cyan tuning box over the NAV1 standby frequency in the upper left corner of the PFD.
2) Press the **CDI** Softkey again to change from VOR1 or LOC1 to VOR2 or LOC2. This places the cyan tuning box over the NAV2 standby frequency.
3) Press the CDI Softkey a third time to return to FMS.

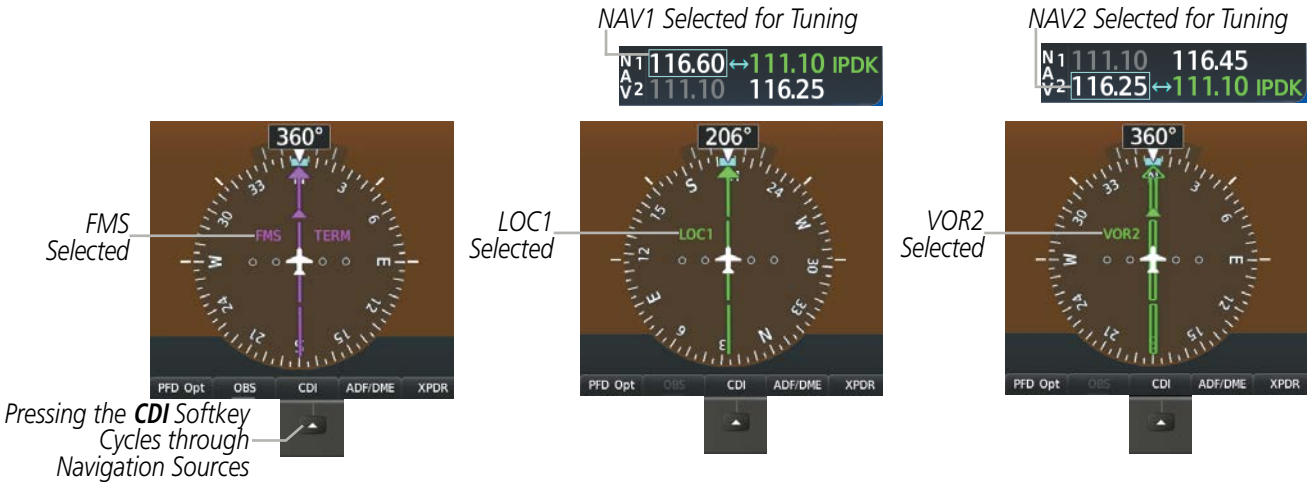


Figure 2-23 Selecting a Navigation Source

If the same VOR/LOC navigation source is selected on both PFDs, the navigation source annunciation turns amber on both displays (unless synchronized). Once the CDIs are synchronized (CDI SYNC turned on), they remain synchronized until the setting is turned off.

Synchronizing the CDIs:

1) Select the 'Aux - System Setup 1' Page.
2) Press the **FMS** Knob to activate the cursor.
3) Turn the large **FMS** Knob to highlight the CDI On/Off datafield in the 'Synchronization' box.
4) Turn the small **FMS** Knob clockwise to 'On' or counterclockwise to 'Off'.

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

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

FMS steering guidance is still provided after the CDI automatically switches to LOC until LOC capture, up to the Final Approach Fix (FAF) for an ILS approach, or until FMS information becomes invalid. Activating a Vector-to-Final (VTF; see the Flight Management Section) also causes the CDI to switch to LOC navigation source; FMS steering guidance is not provided after this switch.

On some ILS approaches where the glideslope intercept point is at or in close proximity to the fix prior to the FAF (see Figure 2-24), it is possible to be above the glideslope when the navigation source automatically switches from FMS to LOC. The probability of this occurring varies based on air temperature.

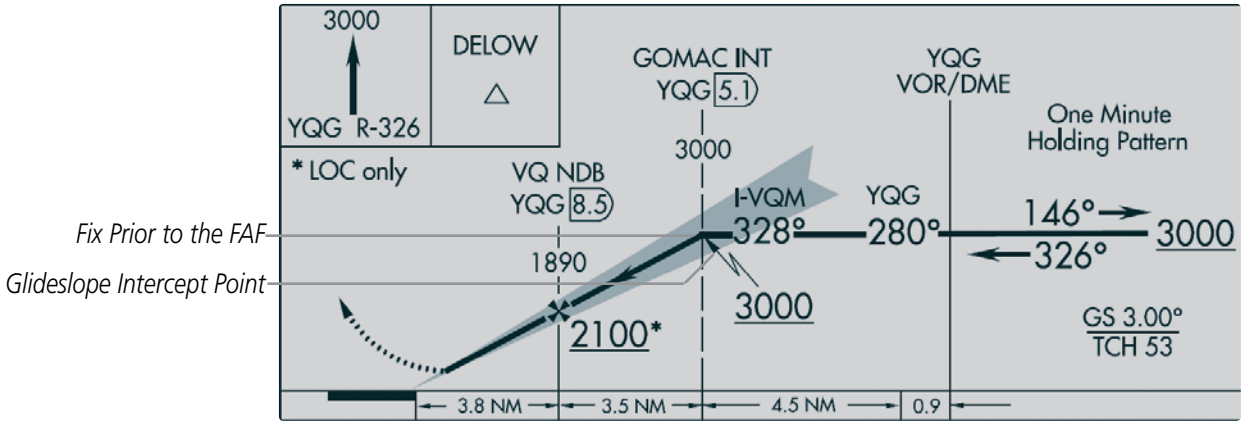


Figure 2-24 ILS Approach with Glideslope Intercept Point at Fix Prior to the FAF

FMS CDI SCALING

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

The current FMS CDI scale setting is displayed as 'System CDI' on the Aux - System Setup 1 Page and the full-scale deflection setting may also be changed (2.0 nm, 1.0 nm, 0.3 nm, or Auto) from this page. If the selected scaling is smaller than the automatic setting for enroute and terminal phases, the CDI is scaled accordingly and the selected setting is be displayed rather than the flight phase annunciation.

Changing the selected GPS CDI setting:

1) Select the 'Aux - System Setup 1' Page.
2) Press the **FMS** Knob to activate the cursor.
3) Turn the large **FMS** Knob to highlight 'Format Allowed' in the 'GPS CDI' box.
4) Turn the small **FMS** Knob to highlight the desired setting and press the **ENT** Key.
5) To cancel the selection, press the **FMS** Knob or the **CLR** Key.

When set to 'Auto' (default), the FMS CDI scale automatically adjusts to the desired limits based upon the current phase of flight (Figure 2-25, 2-26, 2-27, Table 2-2).

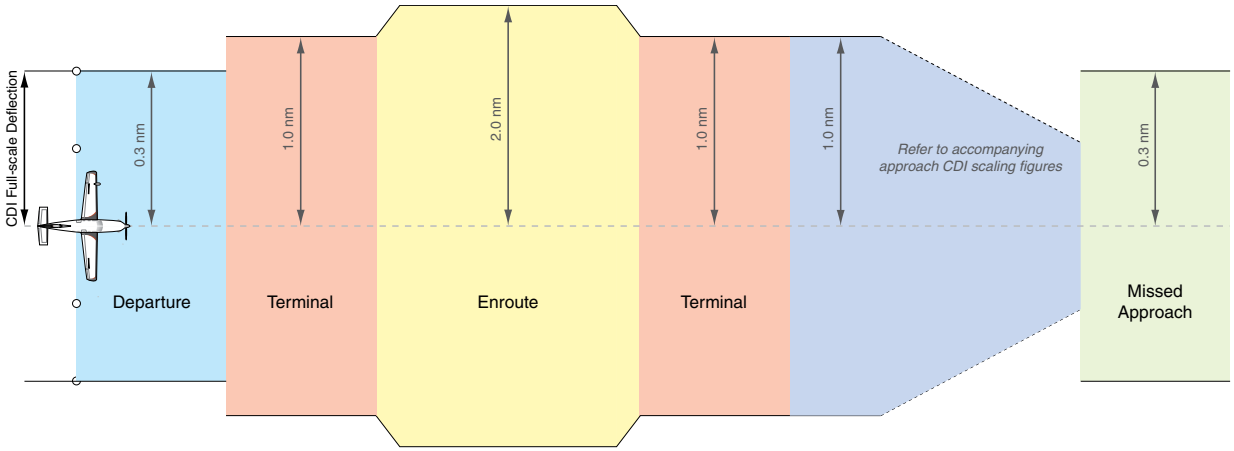


Figure 2-25 Automatic CDI Scaling

- Once a departure procedure is active, the CDI is scaled for ***departure*** (0.3 nm).
- The system switches from departure to ***terminal*** CDI scaling (1.0 nm) under the following conditions:
  - The next leg in the procedure is not aligned with the departure runway
  - The next leg in the departure procedure is not CA, CD, CF, CI, CR, DF, FA, FC, FD, FM, IF, or TF (see Glossary for leg type definitions)
  - After any leg in the departure procedure that is not CA or FA
- At 30 nm from the departure airport the ***enroute*** phase of flight is automatically entered and CDI scaling changes to 2.0 nm over a distance of 1.0 nm, except under the following conditions:
  - When navigating with an active departure procedure, the flight phase and CDI scale does not change until the aircraft arrives at the last departure waypoint (if more than 30 nm from the departure airport) or the leg after the last departure waypoint has been activated or a direct-to waypoint is activated.
- If after completing the departure procedure the nearest airport is more than 200 nm away from the aircraft and the approach procedure has not yet commenced, the CDI is scaled for ***oceanic*** flight (4.0 nm).
- Within 31 nm of the destination airport (***terminal*** area), the CDI scale gradually ramps down from 2.0 nm to 1.0 nm over a distance of 1.0 nm; except under the following conditions:
  - Upon reaching the first waypoint of an arrival route that is more than 31 nm from the destination airport, the flight phase changes to terminal and the CDI scale begins to transition down from 2.0 nm to 1.0 nm over a distance of 1.0 nm.
- During ***approach***, the CDI scale ramps down even further (see Figures 2-26 and 2-27). This transition normally occurs within 2.0 nm of the final approach fix (FAF). The CDI switches to approach scaling automatically once the approach procedure is activated or if Vector-to-Final (VTF) is selected.
  - If the active waypoint is the FAF, the ground track and the bearing to the FAF must be within 45° of the final approach segment course.
  - If the active waypoint is part of the missed approach procedure, the active leg and preceding missed approach legs must be aligned with the final approach segment course and the aircraft must not have passed the turn initiation point.

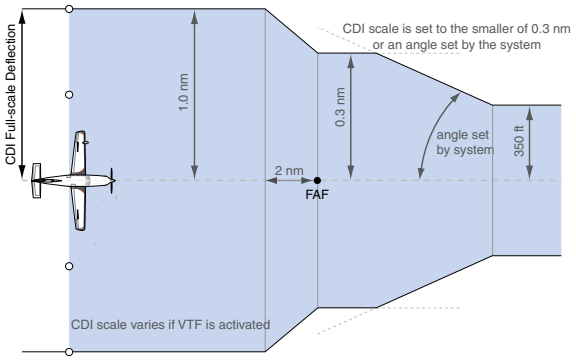


Figure 2-26 Typical LNAV and LNAV+V Approach CDI Scaling

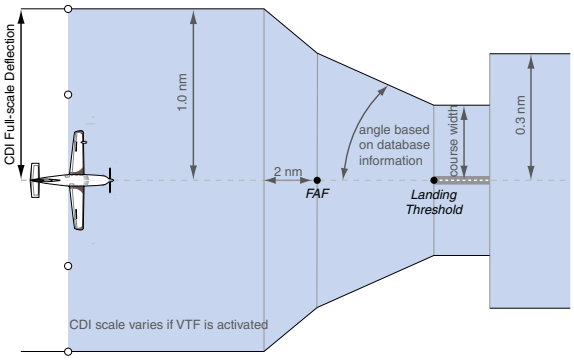


Figure 2-27 Typical LNAV/VNAV, LP, and LPV Approach CDI Scaling

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

Flight Phase	Annunciation	Automatic CDI Full-scale Deflection
Departure	DPRT	0.3 nm
Terminal	TERM	1.0 nm
Enroute	ENR	2.0 nm
Oceanic	OCN	4.0 nm
Approach (Non-precision)	LNAV	1.0 nm decreasing to 350 feet depending on variables (see Figure 2-27)
Approach (Non-precision with Advisory Vertical Guidance)	LNAV + V	
Approach (Non-precision with Advisory Vertical Guidance)	VISUAL	
Approach (LNAV/VNAV)	L/VNAV	1.0 nm decreasing to a specified course width, then 0.3 nm, depending on variables (see Figure 2-28)
Approach (LP)	LP	
Approach (Non-precision with Advisory Vertical Guidance))	LP+V	
Approach (LPV)	LPV	
Missed Approach	MAPR	0.3 nm

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

Table 2-2 Automatic FMS CDI Scaling

OBS MODE

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

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

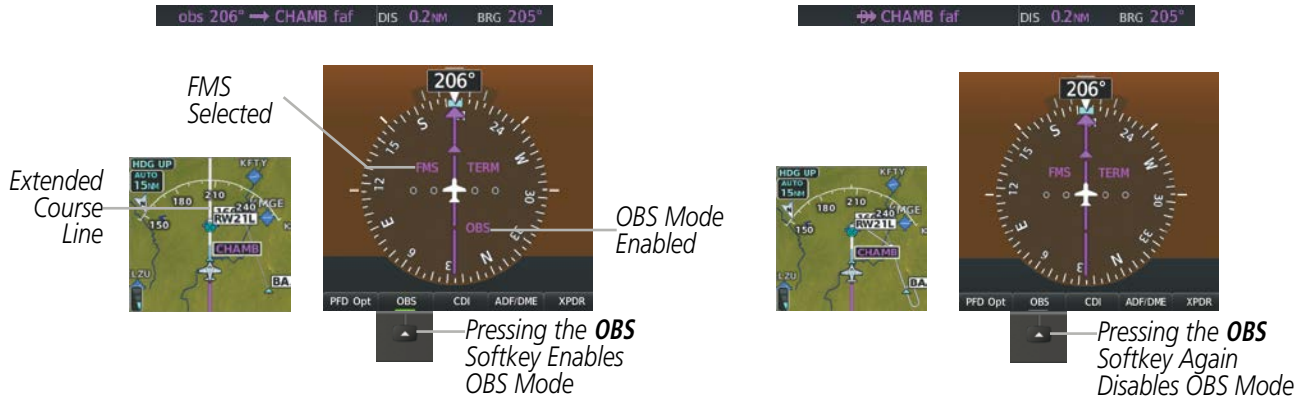


Figure 2-28 Omni-bearing Selector (OBS) Mode

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

NOTE: *When OBS mode is active to a VOR waypoint, the course pointer and current track indicator are relative to the published magnetic variation of the VOR which can be outdated with respect to the current magnetic variation. Consequently, in OBS mode a slight offset may exist between indicated heading and selected course and track indicator even when there is no crosswind.*

Enabling/disabling OBS Mode while navigating an FMS flight plan:

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

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

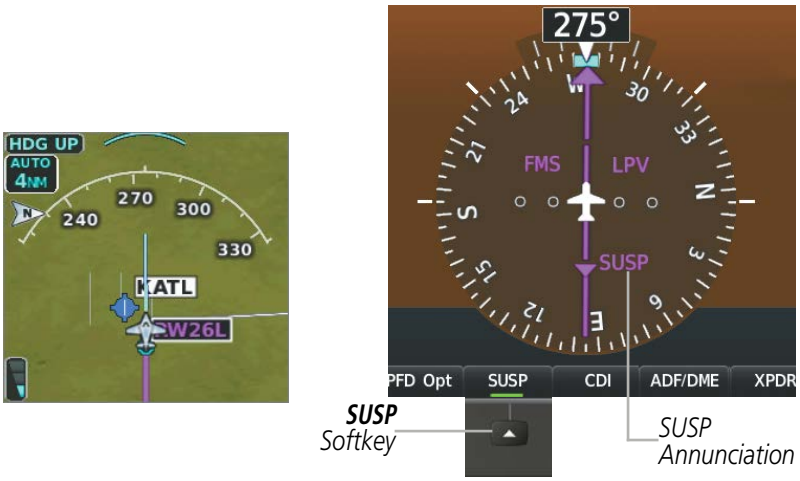


Figure 2-29 Suspending Automatic Waypoint Sequencing

ANGLE OF ATTACK (AOA) INDICATOR

The Angle of Attack (AOA) Indicator (Figure 2-30) appears on the PFD below the airspeed indicator and displays the normalized angle of attack. White and red arc indicate AOA ranges. The pointer color matches the color of the arc associated with the current AOA value.

The pilot can enable/disable the display of the AOA Indicator on the PFD, or select the auto mode. In auto mode, the AOA Indicator appears automatically on the PFD's and is removed from the pilot's view whenever one or both PFD's enter Reversionary mode.

Figure 2-30 Angle of Attack (AOA) Indicator

Selecting the AOA Indicator display mode:

1) Press the PFD Opt Softkey.
2) The **AOA** Softkey displays the currently selected mode in cyan. Press the **AOA** Softkey to choose either Off or Auto Mode.

NOTE: *If the Garmin ESP option is installed, refer to the Additional Features section for information about Angle of Attack Protection and indications.*

When certain Angle of Attack conditions are met, a Pitch Limit Indicator will appear on the Attitude Indicator ,and is removed when these conditions no longer exist. Refer to the Additional Features Section for more information about Garmin ESP.

RADAR ALTIMETER

When the radar height (the aircraft altitude above ground level detected by the radar altimeter) is between zero and 2500 feet, the current value is displayed in white to the right of the current aircraft heading (Figure 2-31). Display of radar height becomes more sensitive as the height above ground decreases (Table 2-3).

Figure 2-31 Current Radar Height

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

Table 2-3 Radar Altimeter Sensitivity

When the radar altimeter is selected as the altitude source for the minimum descent altitude alerting function (Figure 2-32), the color of the radar height changes to amber upon reaching at or below the MDA/DH (Figure 2-33).

Figure 2-32 RAD ALT Setting(Timer/References Window)

Figure 2-33 RA as Altitude Source for MDA/DH

A ground line is shown on the Altimeter to display the aircraft's height relative to the ground. If the data becomes invalid, the message "RA FAIL" is displayed in amber in the RA box. The Radar Altimeter test is done on the MFD but is displayed on the PFDs to the right of the current heading.

Figure 2-34 Altimeter Displaying the Ground Line (RAD ALT)

Figure 2-35 Radar Altimeter with Invalid Data

Testing the Radar Altimeter:

1) Turn the **FMS** Knobs to select the 'Aux - System Status' Page.
2) Press the **RA Test** Softkey to enable or disable the test.

   Or:

   a) Press the **MENU** Key.

   b) Turn the **FMS** Knob to highlight 'Enable RA Test Mode' or 'Disable RA Test Mode'.

   c) Press the **ENT** Key.

When test mode is active, 'RA TEST' is annunciated above the RA box and 40 feet will be displayed in the RA box. To cancel the test, press the **RA TEST** Softkey again, or turn the **FMS** Knob to exit the Aux - System Status Page.

Figure 2-36 Radar Altimeter with Test Annunciation

2.2 SUPPLEMENTAL FLIGHT DATA

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

TEMPERATURE DISPLAYS

The Outside Air Temperature display (OAT) appears in the lower left corner of the PFD under normal display conditions and in reversionary mode

Figure 2-37 Outside Air Temperature

The pilot can choose to display the temperature in degrees Celsius or Fahrenheit.

Changing temperature display units:

1) Select the 'Aux - System Setup 1' Page on the MFD using the **FMS** Knob.
2) Press the **FMS** Knob to activate the cursor.
3) Turn the large **FMS** Knob to highlight the 'Temperature' datafield in the 'Display Units' box.
4) Turn the small **FMS** Knob to highlight either 'Celsius' or 'Fahrenheit' and press the **ENT** Key to confirm the selection.
5) To cancel the selection, press the **FMS** Knob or the **CLR** Key.

WIND DATA

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

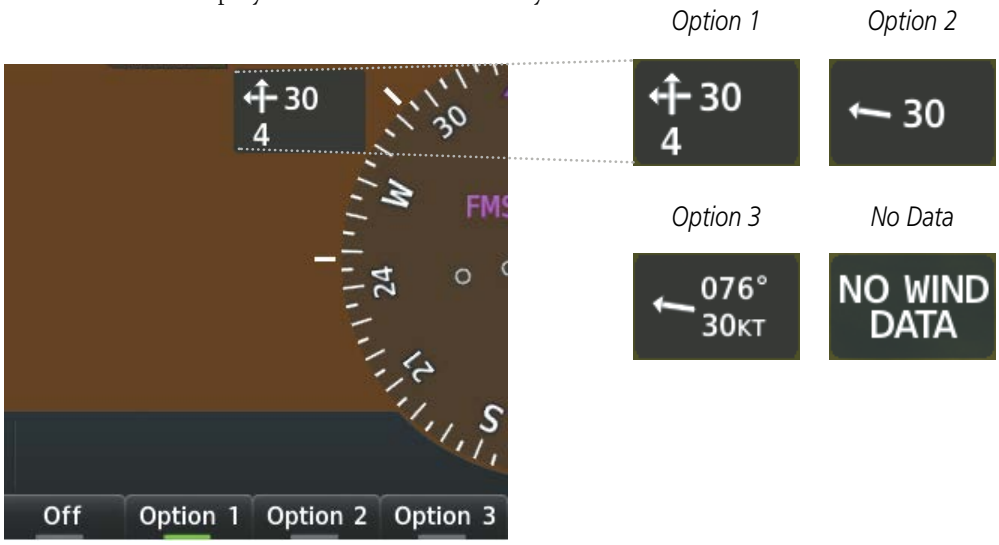


Figure 2-38 Wind Data

Displaying wind data:

1) Press the **PFD Opt** Softkey.
2) Press the **Wind** Softkey to display wind data below the Selected Heading.
3) Press one of the **Option** softkeys to change how wind data is displayed:
   - **Option 1**: Wind direction arrows with numeric headwind/tailwind and crosswind components
   - **Option 2**: Wind direction arrow with numeric speed
   - **Option 3**: Wind direction arrow with numeric direction and speed
4) To remove the window, press the **Off** Softkey.

VERTICAL NAVIGATION (VNV) INDICATIONS

When a VNV flight plan has been activated, VNV indications (VNV Target Altitude, RVSI, VDI) appear on the PFD in conjunction with the "TOD within 1 minute" message and "Vertical track" voice alert. See the Flight Management and AFCS sections for details on VNV features and additional indications. VNV indications are removed from the PFD according to the criteria listed in Table 2-4.

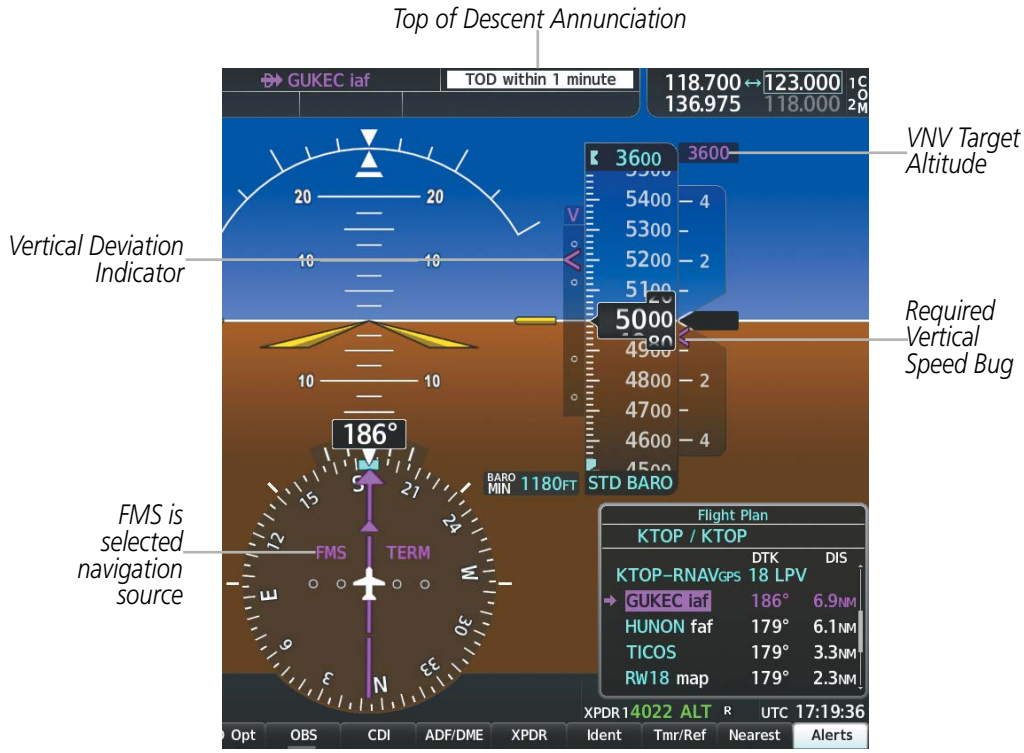


Figure 2-39 Vertical Navigation Indications (PFD)

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

Table 2-4 VNV Indication Removal Criteria

2.3 PFD ANNUNCIATIONS AND ALERTING FUNCTIONS

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

MARKER BEACON ANNUNCIATIONS

Marker Beacon Annunciations are displayed on the PFD to the left of the Selected Altitude. Outer marker reception is indicated in cyan, middle in amber, and inner in white. Refer to the Audio Panel and CNS Section for more information on Marker Beacon Annunciations.

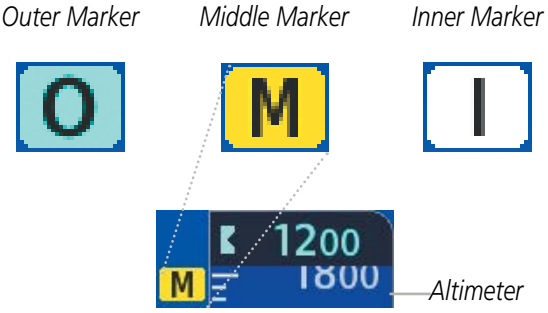


Figure 2-40 Marker Beacon Annunciations

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. The Altitude Alerter is independent of the Garmin AFCS, but aural and visual alerts are generated only when the Garmin AFCS is installed. The following occur when approaching the Selected Altitude:

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

Figure 2-41 Altitude Alerting Visual Annunciations

LOW ALTITUDE ANNUNCIATION

NOTE: *A Low Altitude Annunciation is available only when SBAS is available. This annunciation is only available when TAWS-B alerting has been inhibited.*

When the Final Approach Fix (FAF) is the active waypoint in a GPS SBAS approach using vertical guidance, a Low Altitude Annunciation may appear if the current aircraft altitude is at least 164 feet below the prescribed altitude at the FAF. A black-on-amber LOW ALT annunciation appears to the left of the Altimeter, flashes for several seconds, then remains displayed until the condition is resolved.

Figure 2-42 Low Altitude Annunciation on PFD

MINIMUM DESCENT ALTITUDE/DECISION HEIGHT ALERTING

For altitude awareness, a barometric, radar altimeter, or temperature compensated Minimum Descent Altitude (MDA) or Decision Height (DH) can be set in the Timer/References Window and is reset when the power is cycled. When active, the altitude setting is displayed to the bottom left of the Altimeter. Once the altitude is within the range of the tape, a bug appears at the reference altitude on the Altimeter. The following visual annunciations occur when approaching the MDA/DH:

- When the aircraft altitude descends to within 2500 feet of the MDA/DH setting, the BARO MIN, RA MIN, or COMP MIN box appears with the altitude in cyan (or magenta for COMP MIN) text. The bug appears on the altitude tape in cyan (or magenta for COMP MIN) once in range.
- When the aircraft passes through 100 feet of the MDA/DH, the bug and text turn white.
- Once the aircraft reaches MDA/DH, the bug and text turn amber and the aural alert, "Minimums. Minimums", is heard. When the radar altimeter is selected as the altitude source for the Minimum Descent Altitude alerting function, the color of the current radar height changes to amber.

Figure 2-43 Barometric MDA/DH Alerting Visual Annunciations

Alerting is inhibited while the aircraft is on the ground and until the aircraft reaches 150 feet above the MDA. If the aircraft proceeds to climb after having reached the MDA, once it reaches 50 feet above the MDA, alerting is disabled.

The MDA/DH may be set from either PFD and is synchronized on both PFDs. The function is reset when the power is cycled or a new approach is activated.

Setting the barometric Minimum Descent Altitude/Decision Height and bug:

1) Press the **Tmr/Ref** Softkey.
2) Turn the large **FMS** Knob to highlight the 'MINS' datafield.
3) Turn the small **FMS** Knob to select 'BARO', 'TEMP COMP', or 'RAD ALT' 'OFF' is selected by default. Press the **ENT** Key or turn the large **FMS** Knob to highlight the next field.
4) Use the small **FMS** Knob to enter the desired altitude (from zero to 16,000 feet when 'BARO' or 'TEMP COMP' is selected, or up to 2,500 feet when 'RAD ALT' is selected).
5) If 'TEMP COMP' was selected, press the **ENT** Key or turn the large **FMS** Knob to highlight the next field and then enter the temperature (-59°C to 59°C)
6) To remove the window, press the **CLR** Key or the **Tmr/Ref** Softkey.

Figure 2-44 BARO and TEMP COMP MDA/DH

NOTE: *For temperature compensated minimums to be displayed on the PFDs, the active flight plan must contain an airport.*

NOTE: *The temperature at the destination can be entered on the Minimums Screen on the Touchscreen Controller. There is only one compensation temperature for the system, therefore, changing the temperature will affect both the loaded approach altitudes and the minimums. Refer to the Flight Management section for information about applying temperature compensation to approach altitudes*

2.4 GARMIN SVT (SYNTHETIC VISION TECHNOLOGY)

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

NOTE: *Do not use the flight path marker as a flight director.*

NOTE: *Terrain 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.*

Garmin SVT™ (Synthetic Vision Technology) is an optional visual enhancement to the system. SVT depicts a forward-looking attitude display of the topography immediately in front of the aircraft. The field of view is 29 degrees to the left and 35.5 degrees to the right. In Reversionary Mode, the field of view is 21.5 degrees to the left and 35.5 degrees to the right. SVT information is shown on the Primary Flight Displays (PFDs), or on the Multifunction Display (MFD) in Reversionary Mode. The depicted imagery is derived from the aircraft attitude, heading, GPS three-dimensional position, and a 4.9 arc-second database of terrain, obstacles, and other relevant features. The terrain data resolution is 4.9 arc-seconds, meaning that the terrain elevation contours are stored in squares measuring 4.9 arc-seconds on each side, is required for the operation of SVT. Loss of any of the required data, including temporary loss of the GPS signal, will cause SVT to be disabled (although the softkeys will still appear functional) until the required data is restored.

The SVT terrain display shows land contours (colors are consistent with those of the topographical map display), large water features, towers, wind turbines, 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 navigation maps. The terrain display includes a north–south east–west grid with lines oriented with true north and spaced at one arc-minute intervals to assist in orientation relative to the terrain.

The optional Terrain Awareness and Warning System (TAWS-B) or standard Terrain-SVT 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 PFD.

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

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

The following SVT enhancements appear on the PFD:

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

Figure 2-45 Synthetic Vision Imagery

SVT OPERATION

SVT is activated from the PFD using the softkeys located along the bottom edge of the display. Pressing the softkeys turns the related function on or off. When SVT is enabled, the pitch attitude scale is reduced from 20 degrees up and down to 10 degrees up to 7.5 degrees down.

SVT functions are displayed on three levels of softkeys. The **PFD Opt** Softkey leads into the PFD function Softkeys, including synthetic vision. Pressing the **SVT** Softkey displays the SVT feature softkeys. The softkeys are labeled **Pathways**, **Terrain**, **HDG LBL**, and **APT Sign**. The **Back** Softkey returns to the previous level of softkeys. Synthetic Terrain must be active before any other SVT feature may be activated.

Pathways, **HDG LBL**, and **APT Sign** Softkeys are only available when the **Terrain** Softkey is activated (gray with black characters). After activating the **Terrain** Softkey, the **Pathways**, **HDG LBL**, and **APT Sign** softkeys may be activated in any combination to display desired features. On the next avionics power cycle, the system recalls the last selected state (on or off) of the **Pathways**, **Terrain**, **HDG LBL**, and **APT Sign** Softkeys.

- **Pathways** Softkey enables display of rectangular boxes that represent course guidance.
- **Terrain** Softkey enables synthetic terrain depiction.
- **HDG LBL** Softkey enables horizon heading marks and digits.
- **APT Sign** Softkey enables airport signposts.

Activating and deactivating SVT:

1) Press the **PFD Opt** Softkey.
2) Press the **SVT** Softkey.
3) Press the **Terrain** Softkey. The SVT display will cycle on or off with the **Terrain** Softkey.

Activating and deactivating Pathways:

1) Press the **PFD Opt** Softkey.
2) Press the **SVT** Softkey.
3) Press the **Terrain** Softkey.
4) Press the **Pathways** Softkey. The Pathway feature will cycle on or off with the **Pathways** Softkey.

Activating and deactivating Horizon Headings:

1) Press the **PFD Opt** Softkey.
2) Press the **SVT** Softkey.
3) Press the **Terrain** Softkey.
4) Press the **HDG LBL** Softkey. The horizon heading display will cycle on or off with the **HDG LBL** Softkey.

Activating and deactivating Airport Signs:

1) Press the **PFD Opt** Softkey.
2) Press the **SVT** Softkey.
3) Press the **Terrain** Softkey.
4) Press the **APT Sign** Softkey. Display of airport signs will cycle on or off with the **APT Sign** Softkey.

SVT FEATURES

Figure 2-46 SVT on the Primary Flight Display

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

PATHWAYS

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

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

Figure 2-47 Programmed and Selected Altitude

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

DEPARTURE AND ENROUTE

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

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

DESCENT AND APPROACH

Pathways are shown descending only for a programmed descent. 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.

When an approach providing vertical guidance is activated, 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, glidepath, or glideslope. From the vertical path descent, glidepath, or glideslope intercept point, the pathways are shown inbound to the Missed Approach Point (MAP) along the published lateral and vertical descent path, or at the selected altitude, whichever is lower.

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

VOR, LOC BC approach segments that are approved to be flown using FMS are displayed in magenta boxes. Segments that are flown using other than FMS or ILS, such as heading legs or VOR final approach courses are not displayed.

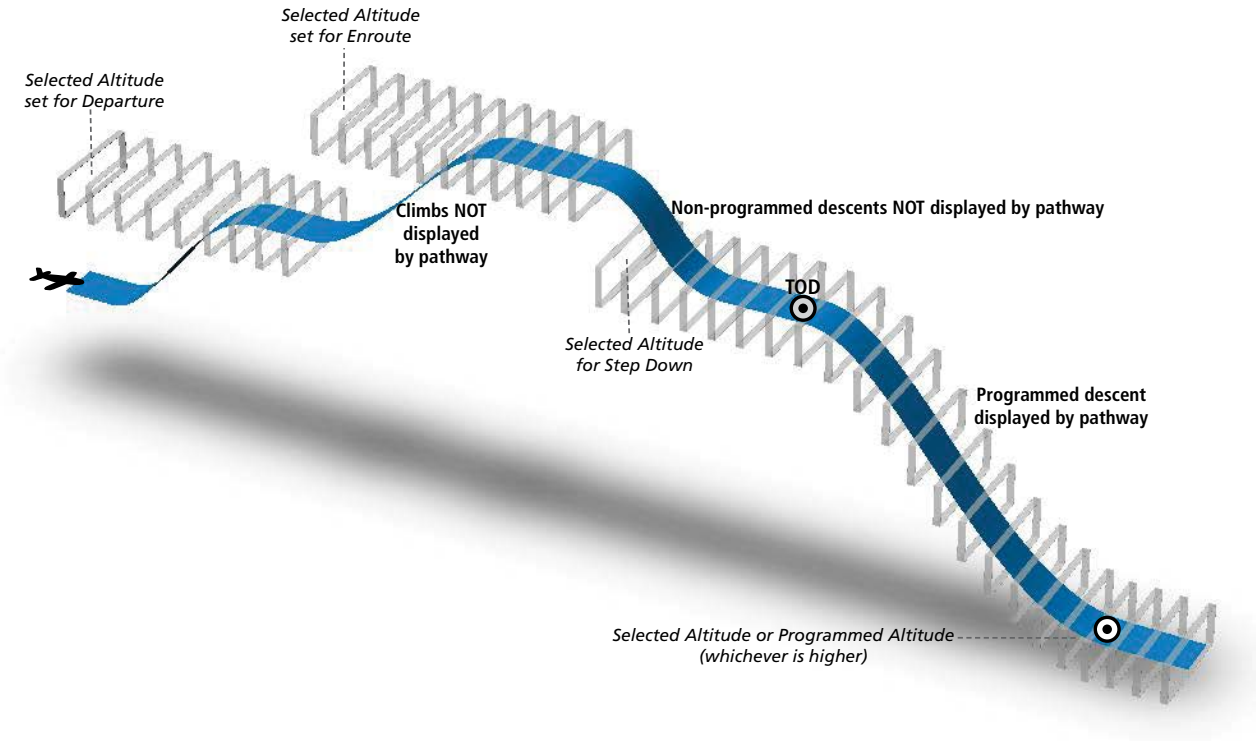


Figure 2-48 SVT Pathways, Enroute and Descent

MISSED APPROACH

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

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

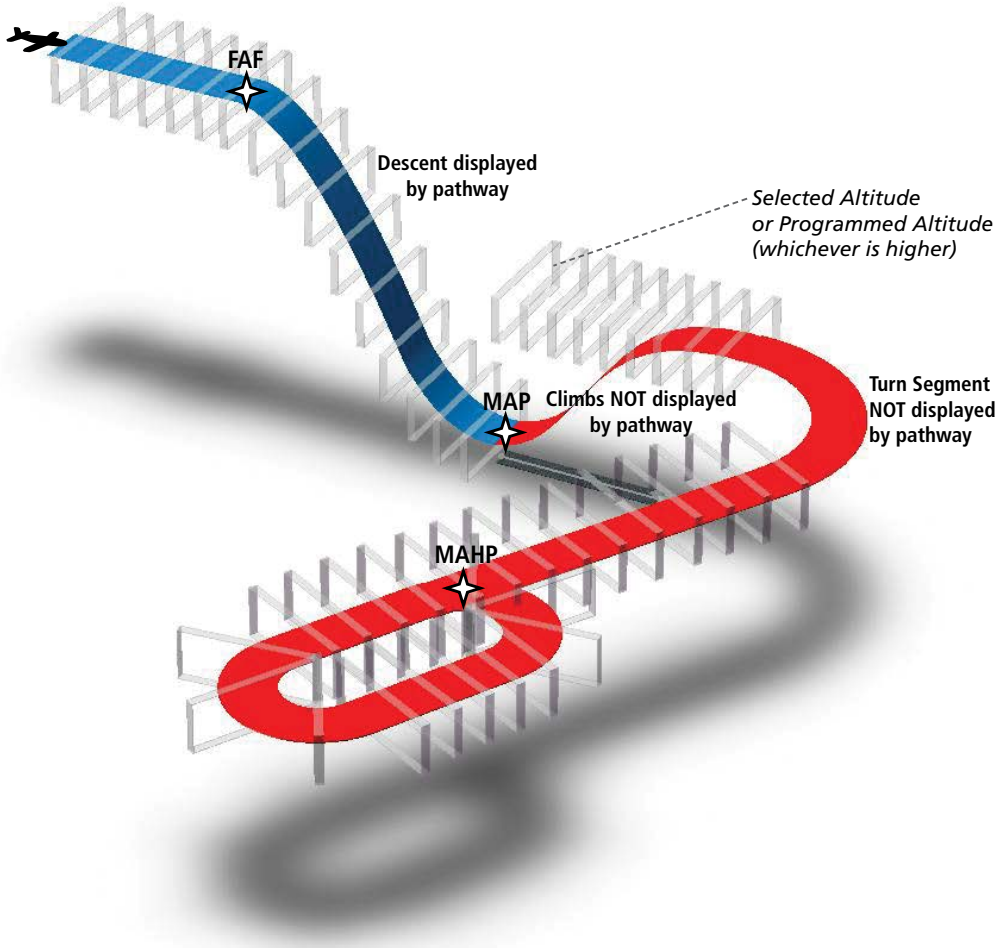


Figure 2-49 SVT Pathways, Approach, Missed Approach, and Holding

FLIGHT PATH MARKER

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

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

The FPM works in conjunction with the pathways feature to assist the pilot in maintaining desired altitudes and direction when navigating a flight plan. When on course and altitude the FPM is aligned inside the pathway boxes as shown.

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

Figure 2-50 Flight Path Marker and Pathways

ZERO PITCH LINE

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

HORIZON HEADING

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

TRAFFIC

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

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

AIRPORT SIGNS

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

Figure 2-51 Airport Signs

RUNWAYS

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

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

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

Figure 2-52 Airport Runways

TERRAIN ALERTING

Terrain alerting on the synthetic terrain display is triggered by Forward-looking Terrain Avoidance (FLTA) alerts, and corresponds to the yellow terrain shading for a caution alert and the red shading for a warning alert on the Inset Map and MFD Map displays. For more detailed information regarding Terrain-SVT and TAWS refer to the Hazard Avoidance Section.

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

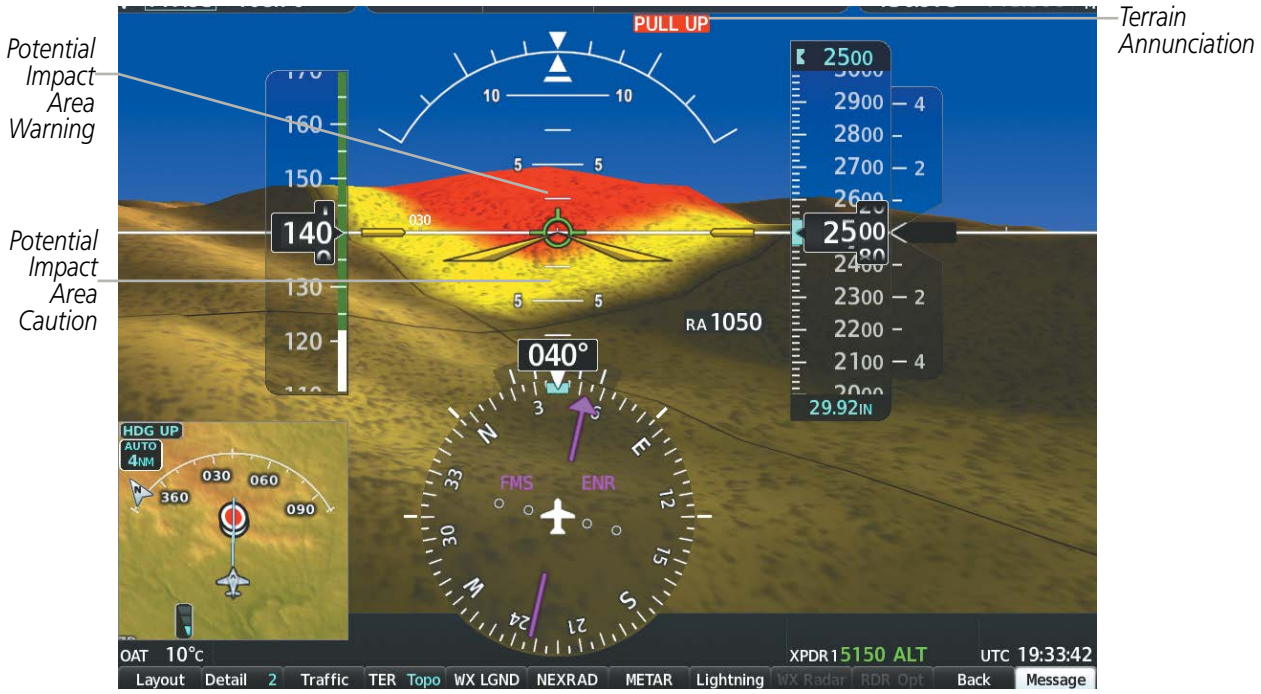


Figure 2-53 Terrain Alert

Obstacles are represented on the synthetic terrain display by standard two-dimensional tower symbols or wind turbine symbols found on the maps. Obstacle symbols appear in the perspective view with relative height above terrain and distance from the aircraft. When employing a TAWS system, unlike the Inset map and MFD moving map display, obstacles on the synthetic terrain display do not change colors to warn of potential conflict with the aircraft's flight path until the obstacle is associated with an actual FLTA alert. Obstacles greater than 1000 feet below the aircraft altitude are not shown. Obstacles are shown behind the airspeed and altitude displays.

Figure 2-54 SVT Obstacle Warning

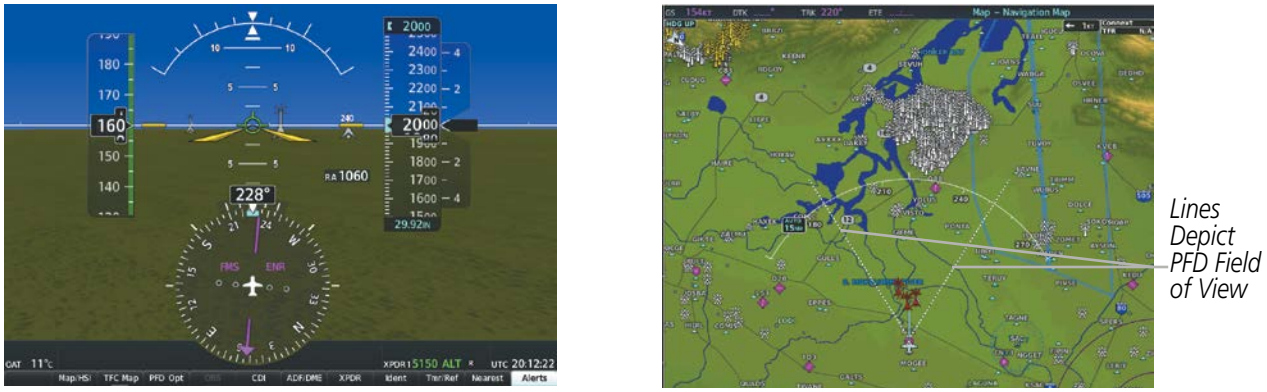
FIELD OF VIEW

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

Enabling/Disabling SVT Field of View on the Navigation Map:

1) While viewing the 'Map - Navigation Map' Page, press the **MENU** Key to display the 'Page Menu' Window.
2) Turn the large **FMS** Knob to highlight 'Map Settings' and press the **ENT** Key.
3) Turn the small **FMS** Knob to select the 'Map' Group and press the **ENT** Key.
4) Turn the large **FMS** Knob to scroll through the 'Map' Group options to 'Field of View'.
5) Turn the small **FMS** Knob to select 'On' or 'Off'.
6) Press the **FMS** Knob to return to the 'Map - Navigation Map' page.

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



SVT View on the PFD *Field of View on the MFD*

Figure 2-55 PFD and MFD Field of View Comparison

2.5 ABNORMAL OPERATIONS

ABNORMAL GPS CONDITIONS

The annunciations listed in Table 2-5 can appear on the HSI when abnormal GPS conditions occur; see Figure 2-56 for examples. Refer to the Flight Management Section for more information on Dead Reckoning (DR) Mode.

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

Table 2-5 Abnormal GPS Conditions Annunciated on HSI

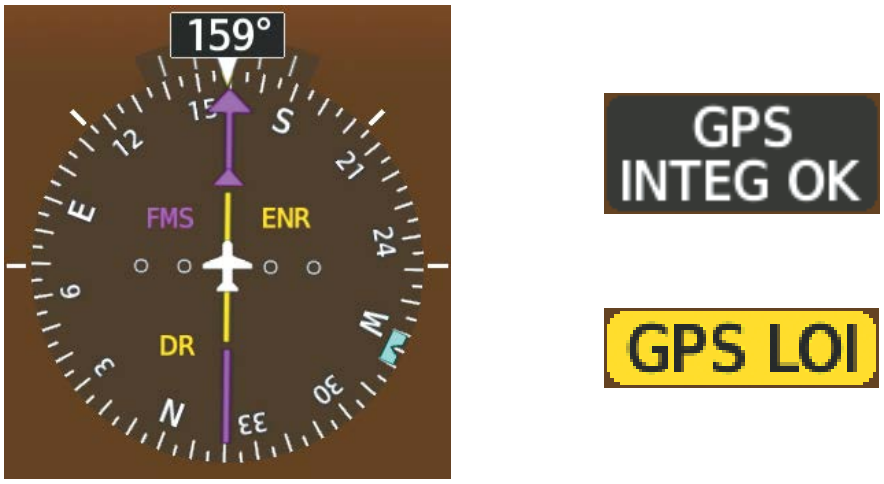


Figure 2-56 Example HSI Annunciations

DR Mode causes the following items on the PFD to be shown in amber:

- CDI (when FMS is the selected navigation source; removed after 20 minutes in DR mode operation)
- Current Track Indicator
- Wind data and pointers in the Wind Data Box on the PFD
- FMS bearing pointers
- Distances in the Bearing Information windows
- Active Flight Plan distances, bearings, and ETE values

The accuracy items should be verified when operating in DR Mode.

COMPARATOR ANNUNCIATIONS

The Comparator monitors critical values generated by redundant sensors. If differences in the sensors exceed a specified amount, a comparator annunciation is displayed in black text on an amber background. If one or both of the sensed values are unavailable, the comparator annunciation is black text on a white background. Refer to the Appendix A Section for more information about Comparator Annunciations.

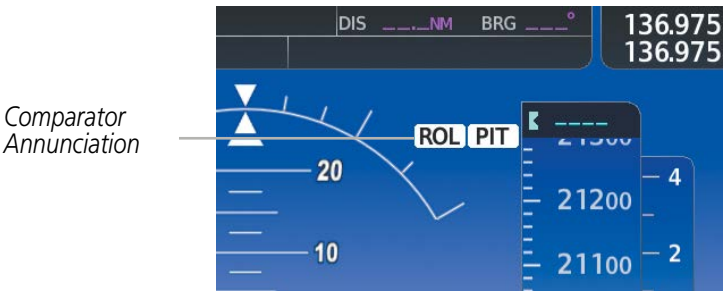


Figure 2-57 Sensor Comparator Annunciations on the PFD

The following is a list of the possible annunciations:

Comparator Annunciation	Comparator Type	Condition
ALT	**MISCOMPARE**	Difference in altitude sensors is ≥ 200 ft.
IAS	**MISCOMPARE**	If both airspeed sensors detect < 35 knots, this is inhibited.
		If either airspeed sensor detects ≥ 35 knots, and the difference in sensors is > 10 knots.
		If either airspeed sensor detects ≥ 80 knots, and the difference in sensors is > 7 knots.
HDG	**MISCOMPARE**	Difference in heading sensors is > 6 degrees.
PIT	**MISCOMPARE**	Difference in pitch sensors is > 5 degrees.
ROL	**MISCOMPARE**	Difference in roll sensors is > 6 degrees.
VDI	**MISCOMPARE**	Difference in temperature compensated altitudes is > 50 ft.
ALT	**NO COMP**	No data from one or both altitude sensors.
IAS	**NO COMP**	No data from one or both airspeed sensors.
HDG	**NO COMP**	No data from one or both heading sensors.
PIT	**NO COMP**	No data from one or both pitch sensors.
ROL	**NO COMP**	No data from one or both roll sensors.
VDI	**NO COMP**	No temperature compensated altitude data available.

Table 2-6 Comparator Annunciations

REVERSIONARY SENSOR ANNUNCIATIONS

Reversionary sensor selection is annunciated on the upper left center of the PFD. These annunciations reflect reversionary sensors selected on one or both PFDs. Pressing the **PFD Opt** Softkey accesses the **Sensors** Softkey. Pressing the **Sensors** Softkey accesses the **ADC** and **AHRS** softkeys These softkeys allow switching of the sensors being viewed on each PFD. With certain types of sensor failures, the system may make some sensor selections automatically. The FMS sensor cannot be switched manually.

Figure 2-58 Reversionary Sensor Annunciation

Reversionary Sensor Annunciation	Condition
BOTH ON ADC1	Both PFDs are displaying data from the number one Air Data Computer.
BOTH ON ADC2	Both PFDs are displaying data from the number two Air Data Computer.
BOTH ON AHRS1	Both PFDs are displaying data from the number one Attitude & Heading Reference System.
BOTH ON AHRS2	Both PFDs are displaying data from the number two Attitude & Heading Reference System.
BOTH ON GPS1	Both PFDs are displaying data from the number one GPS receiver.
BOTH ON GPS2	Both PFDs are displaying data from the number two GPS receiver.
USING ADC1	PFD2 is displaying data from the #1 Air Data Computer.
USING ADC2	PFD1 is displaying data from the #2 Air Data Computer.
USING AHRS1	PFD2 is displaying data from the #1 AHRS.
USING AHRS2	PFD1 is displaying data from the #2 AHRS.
USING GPS1	PFD2 is displaying data from the #1 GPS.
USING GPS2	PFD1 is displaying data from the #2 GPS.

Table 2-7 Reversionary Sensor Annunciations

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.

Nose High *Nose Low*

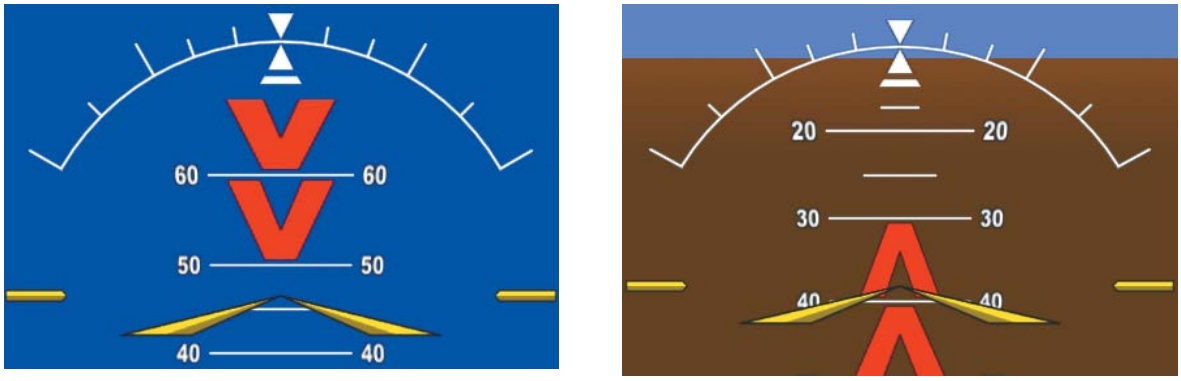


Figure 2-59 Pitch Attitude Warnings

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

- Traffic Annunciations
- AFCS Annunciations
- Flight Director Command Bars
- Inset Map
- Outside Air Temperature (OAT)
- International Standard Atmosphere Temperature (ISA)
- DME Information Window (optional)
- Wind data
- Transponder Status Box
- PFD Setup Menu
- Windows displayed in the lower right corner of the PFD:
  - Timer/References
  - Nearest Airports
  - Flight Plan
  - Alerts
  - Procedures
  - DME Tuning (optional)
- Minimum Descent Altitude/ Decision Height readout
- Vertical Deviation, Glideslope, and Glidepath Indicators
- Altimeter Barometric Setting
- Selected Altitude
- VNV Target Altitude
- System Time

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SECTION 3 ENGINE INDICATION SYSTEM

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

The system offers improved flight operations and reduces crew workload by automatically monitoring critical system parameters and providing system alerts during all phases of flight. The Engine Indication System (EIS) displays electrical, fuel, and engine information on the left side of the Multi Function Display (MFD).

Figure 3-1 MFD Normal Mode

Green bands on the instruments indicate normal ranges of operation; amber and red bands indicate caution and warning, respectively. White or uncolored bands indicate areas outside of normal operation not yet in the caution or warning ranges. When unsafe operating conditions occur, the corresponding displays flash to indicate cautions and warnings. If sensory data to an instrument becomes invalid or unavailable, a red "X" is displayed across the instrument.

3.1 ENGINE DISPLAY

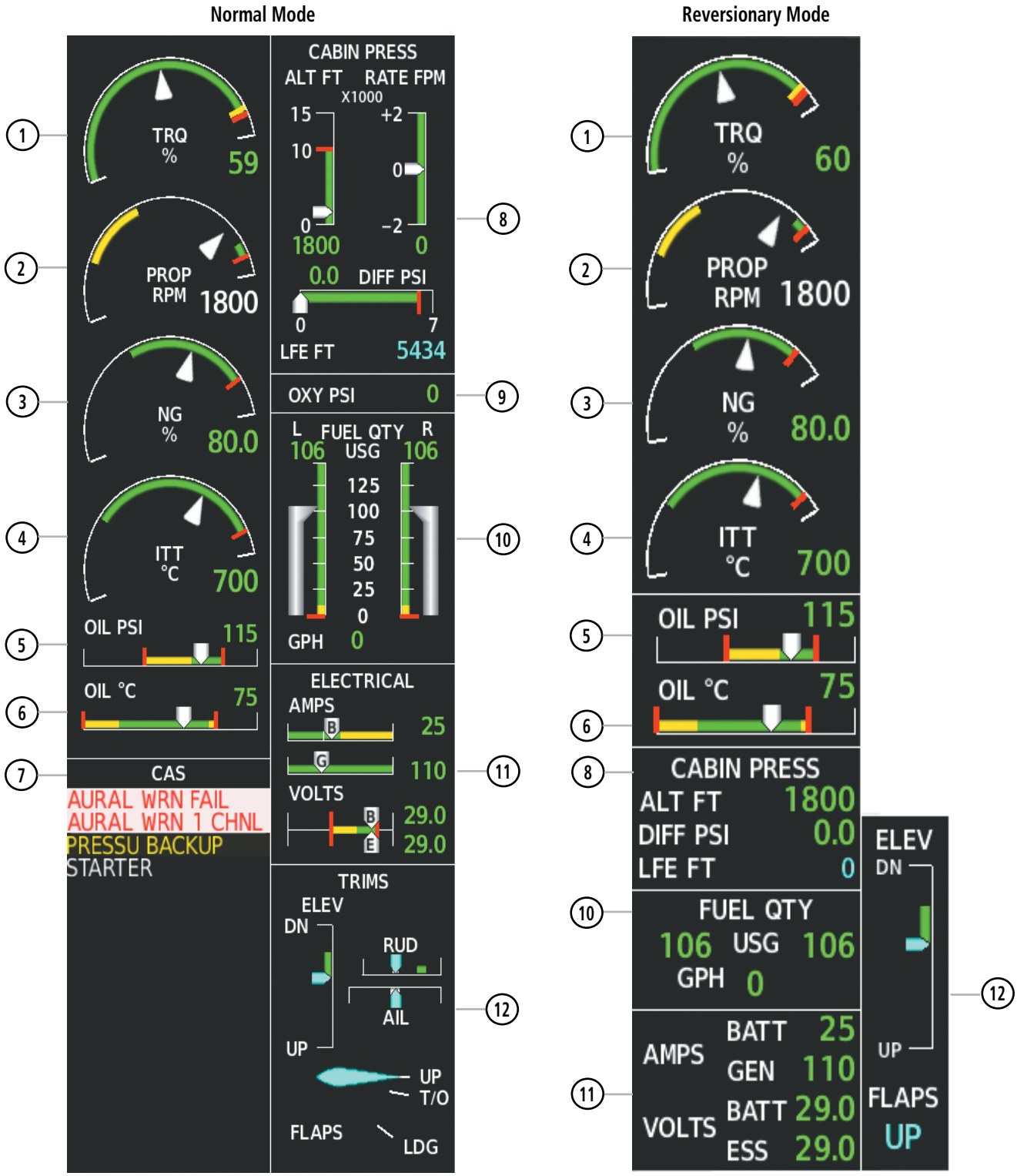


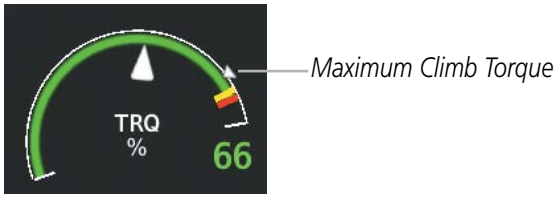
Figure 3-2 Engine Display

(1) Torque (TRQ)

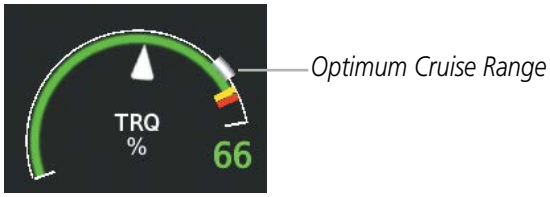
The Torque Gauge displays values from 0 to 130% of maximum safe torque.

If the torque remains above 100% for more than 5 seconds or exceeds the value indicated by the red tick mark, a warning condition occurs.

The maximum climb torque is displayed as a white triangle (bug).



The optimum cruise range is displayed as a white band.



When bleed pressure reaches its upper limit, 'BLEED HI' is annunciated above the Torque Gauge.

(2) Propeller Speed (PROP RPM)

Displays propeller speed in revolutions per minute (rpm) from zero to 2200.

If propeller speed slows so that the gauge pointer enters the amber range, a caution is issued.

If propeller speed exceeds the maximum safe operating speed, a warning is indicated.

(3) Generator Speed (NG)

Generator speed is displayed as a percentage of maximum safe operating speed (rpm), from 0 to 120%.

If generator speed exceeds 104% a warning condition occurs.

(4) Interturbine Temperature (ITT °C)

The Interturbine Temperature (ITT) Gauge ranges differ for engine off/start and running conditions. Engine starting temperature range: Between 200 and 1200 degrees Celsius (°C), and 'STRT' annunciation is shown above the ITT indication. Engine normal operating temperature range: Between 200 to 900 Celsius (°C) with no annunciation shown above the ITT indication.

When the engine is not running: 'OFF' annunciation above the ITT displayed.

Red tick marking along the ITT gauge, indicate ITT exceedance limits.

(5) Oil Pressure (OIL PSI)

Displays engine oil pressure in pounds per square inch (psi)

(6) Oil Temperature (OIL °C)

Displays oil temperature in degrees Celsius (°C)

(7) **Crew Alerting System (CAS)**	Displays CAS messages. (Refer to the Appendices section for information on the CAS display).
(8) **Cabin Pressure (ALT FT, RATE FPM, DIFF PSI, LFE FT)**	Cabin pressurization information (cabin altitude, rate of change, differential cabin pressure, and landing field elevation) is shown. Only displays for cabin altitude and pressure differential are shown during Reversionary Mode. Cabin altitude (ALT FT) is shown on a color-coded scale labeled 0, 10, and 15 in 1,000 of feet, with numerical digital values in feet displayed below. Cabin altitude change rate (RATE FPM) is displayed on a scale of 1,000-ft from plus (+) 2 to minus (-) 2 fpm with numerical digital values in feet displayed below. (Only displayed in normal mode). Cabin pressure differential (DIFF PSI), is displayed in pounds per square inch (psi) on a color-coded scale, with numerical digits in psi.
(9) **Oxygen Pressure (OXY PSI)**	Crew oxygen system is displayed in pounds per square inch (psi) in numerical digital readout. (Only displayed in normal mode).
(10) **Fuel Quantity (FUEL QTY, GPH)**	Fuel quantity is displayed in United States gallons (USG). In normal mode, fuel quantity for each tank is normally shown along a color-coded scale with numerical digits. In reversionary mode, it is only displayed in numerical digits. Fuel flow usage is listed in gallons per hour (gph) in numerical digits.
(11) **Electrical (AMPS, VOLTS)**	Electrical amps and volts are displayed with indications for battery and the electrical generating system. In normal mode, amps and volts are displayed along a color-coded scale, with numerical digits. In reversionary mode, only the numerical digits are displayed. AMPS displays the battery (pointers labeled “B”) and generators (pointer labeled “G” for primary generator, “S” for standby generator when primary generator is offline) (normal mode only) VOLTS displays the battery (pointers labeled “B”) and essential bus (pointer labeled “E”) (normal mode only).
(12) **Trims and Flaps Position (ELEV, RUD, FLAPS)**	Elevator (ELEV), rudder (RUD), and aileron (AIL) trim indications are shown along slide bar scales (normal mode). Rudder and aileron trim indications are not displayed in reversionary mode. Flap trim indication is displayed using a rotating pointer, with positions for takeoff, landing, and up (normal mode). Flap indications are only displayed as UP, T/O, and LDG in reversionary mode. The elevator display does not change in reversionary mode.

3.2 LANDING FIELD ELEVATION

Landing Field Elevation (LFE FT) is displayed in numerical digits in feet and is set two ways. The first is automatically, based on the destination in the active flight plan by selecting the **FMS LFE** Softkey. The other is set by selecting the **LFE MAN** Softkey on the MFD and selecting one of four softkeys: **+250 FT, -250 FT, +25 FT,** or **-25 FT**.

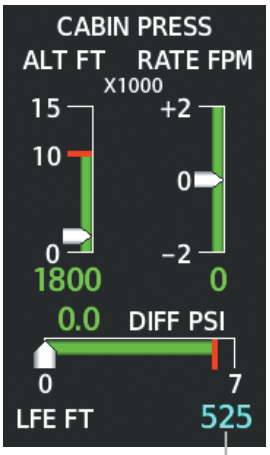


Figure 3-3 Manual LFE on the Cabin Pressure Display

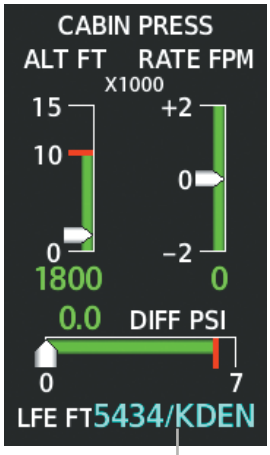


Figure 3-4 FMS LFE on the Cabin Pressure Display

Setting the displayed landing field elevation to the value for the destination airport:

1) Select the **System** Softkey.
2) Select the **FMS LFE** Softkey to set the LFE to the value for the destination airport in the current flight plan.

Manually adjusting the displayed landing field elevation:

1) Select the **System** Softkey.
2) Select the **LFE MAN** Softkey.
3) Use the **+250**, **-250**, **+25**, or **-25 FT** softkeys to set the desired elevation.
4) To confirm the new LFE value, select the **Accept** Softkey.

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

3.3 SYNOPTICS

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

- Electrical System
- Fuel System
- De-Ice System
- Status/Doors

LEVEL 1	LEVEL 2	DESCRIPTION
System		Accesses the Synoptics page softkey and LFE softkeys
	ELEC	Displays the Electrical Synoptics Page
	FUEL	Displays the Fuel Synoptics Page
	GEN	Displays the General Synoptics Page for the de-ice system and doors

ELECTRICAL (ELEC)

The Sys - Electrical synoptics page uses a diagram of the aircraft's electrical system to display the system status. The generators, ground power supply (GPU), batteries, and buses are shown in green to denote normal operation. Color of the units change depending on the condition. A red "X" over a component indicates invalid data or failed unit.

Accessing the Sys-Electrical synoptics status:

1) Select the **System** softkey.
2) Select the **ELEC** softkey.

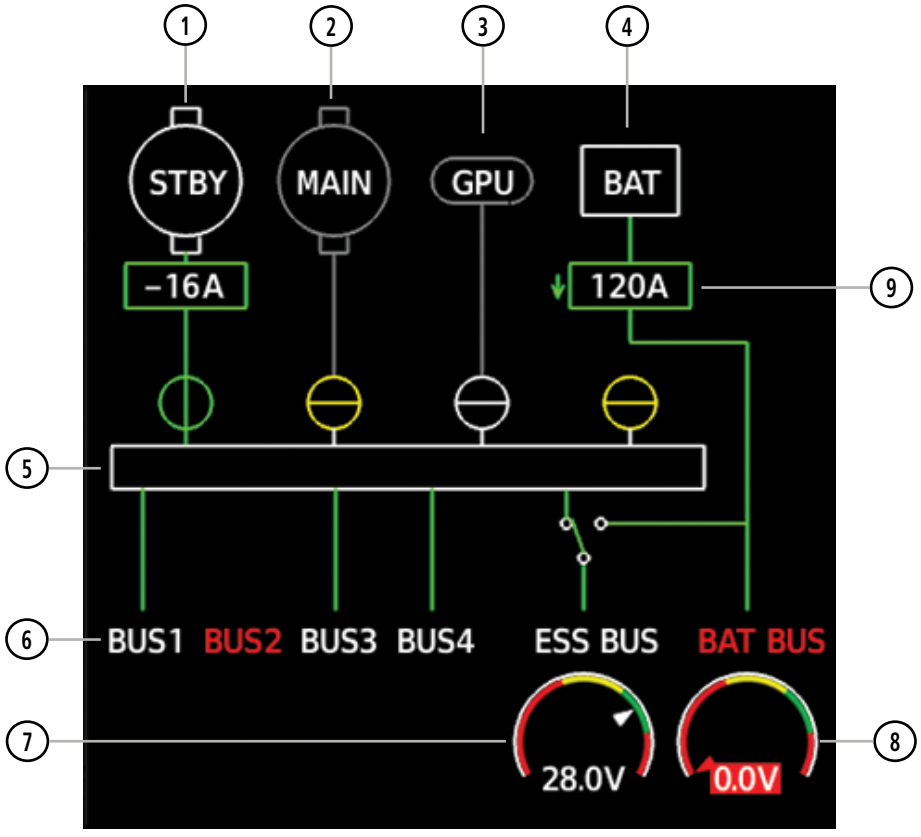
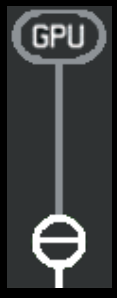


Figure 3-5 Sys - Electrical Page

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

Unit	Description				
Main Generator	Connected	Disconnected			
Standby Generator	Connected	Disconnected			
GPU	Door Open Selected	 Door Open Not Selected	Door Closed (No Indication)		

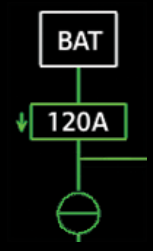
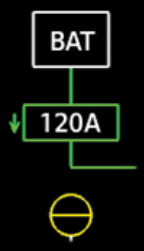
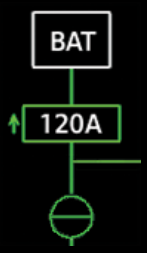
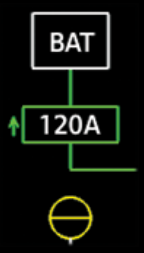
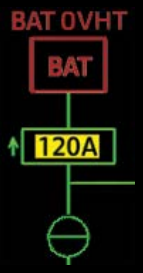
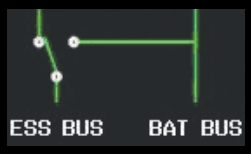
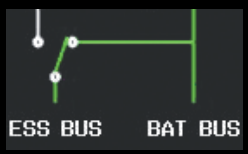
Unit	Description				
Battery	 Connected Current Flow from Battery	 Disconnected Current Flow from Battery	 Connected Current Flow to Battery	 Disconnected Current Flow to Battery	 Battery Overheat Condition
Ess Bus/Batt Bus	Normal	Caution - Low Voltage	Warning - Low Voltage	Warning - High Voltage	
DC Buses	Bus Energized	Bus not Energized			
Ess Bus Connections	 Switch Down - Essential Bus connected to Main Bus	 Switch Up - Essential Bus connected to Battery Bus			

Table 3-1 Electrical System Synoptics

FUEL (FUEL)

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

Accessing the Sys-Fuel synoptics status:

1) Select the **System** softkey.
2) Select the **FUEL** softkey.

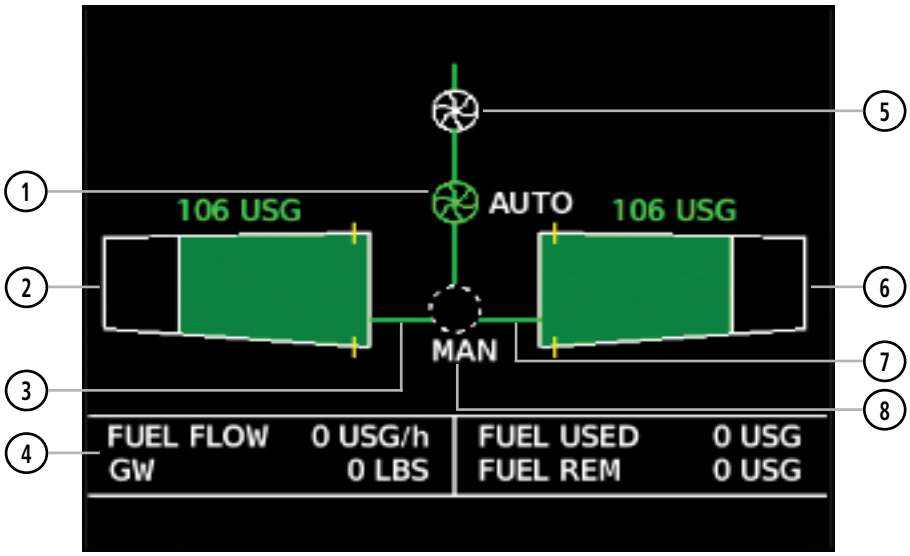


Figure 3-6 Sys - Fuel Page

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

Unit	Description				
Fuel Selector	Left Fuel Tank Selected	Switching Fuel Tank Selection	Right Fuel Tank Selected	Manual or Unknown Fuel Tank Selection	Fuel Selector Off
Auxiliary Boost Pump	On	Off (Auto)	Off (Manual)		

Table 3-2 Fuel System Synoptics

GENERAL SYSTEM (GEN)

The Sys - General synoptics page displays open doors in red (CAS messages also generated).

Statuses of stall sensor, propeller, pitot probes, and windshield heat are also indicated on the diagram:

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

Accessing the Sys-General synoptics status:

1) Select the **System** softkey.
2) Select the **GEN** softkey.

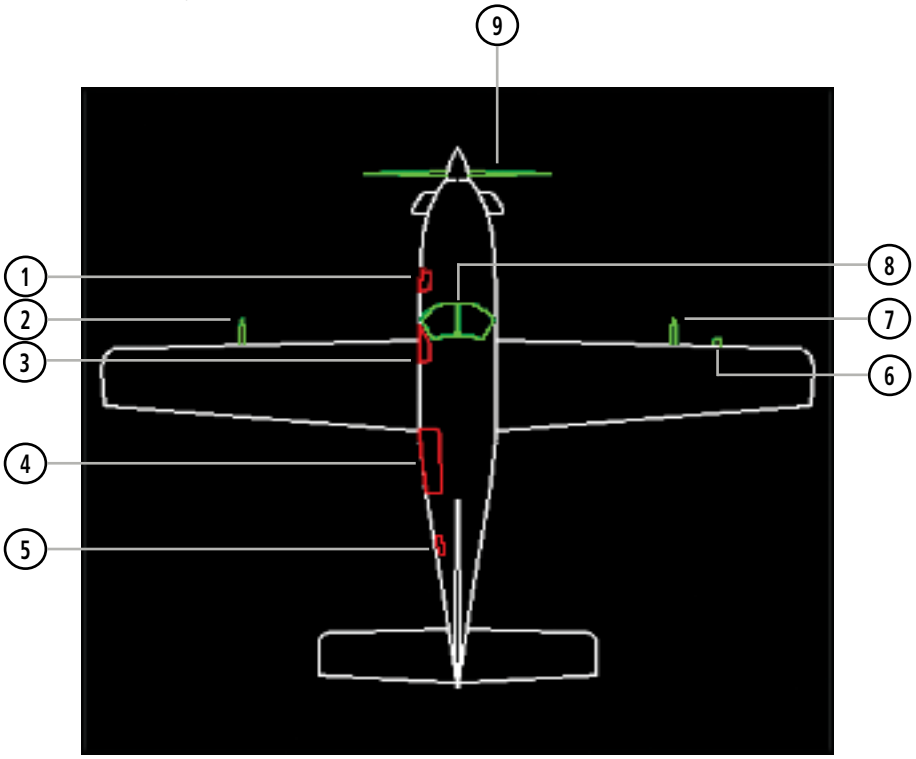


Figure 3-7 Sys - General Page

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

Unit	Description		
Windshield Heat	On	Off	Left Heat On, Right Heat Selected

Table 3-3 Windshield Heat Synoptics

3.4 EIS DISPLAY (REVERSIONARY MODE)

In the event of a PFD or MFD display failure, the display(s) operating in Reversionary Mode are configured to present PFD symbology together with the EIS Display (refer to the System Overview for information about display reversionary mode).

EIS Display

Figure 3-8 Reversionary Mode (EIS Shown)

SECTION 4 AUDIO PANEL AND CNS

4.1 OVERVIEW

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

CNS operation is performed by the following Line Replaceable Units (LRUs):

- Primary Flight Display (PFD) (2)
- Multi Function Display (MFD)
- Integrated Avionics Unit (2)
- Audio Panel (2)
- Mode S Transponder (2)
- Control Unit

The PFD and Control Unit controls are used to tune the communication transceivers and navigation radios.

The two Audio Panels provide the traditional audio selector functions of microphone and receiver audio selection. Each Audio Panel includes a two position intercom system (ICS) between the pilot and copilot, a marker beacon system, and a COM clearance recorder. Ambient noise from the aircraft radios is reduced by a feature called Master Avionics Squelch (MASQ). When no audio is detected, MASQ processing further reduces the amount of background noise from the radios.

The Mode S Transponders are controlled with softkeys and the **FMS** Knobs. The Transponder Data Box is located to the left of the System Time Box. The data box displays the selected transponder, the active four-digit code, mode, and a reply status.

AUDIO PANEL VOLUME CONTROL

Adjusting the master volume control affects all radio audio volume and airframe type warnings that are heard in the headsets (not the speaker) for the pilot or copilot side Audio Panel. Radio adjustments made on the PFD controls to compensate for the master volume change on the Audio Panel also affect the radio levels for the other pilot. Independent radio volume adjustments made using the Audio Panel Master Volume controls affect only the audio heard in the corresponding crew position headset.

Radio volume adjustments may be overridden by each crew position independently using the master volume control on the Audio Panel for the respective crew position. In addition, the master volume control for each Audio Panel affects all other system audio output to its designated crew position headset much like volume adjustments found on many aviation headsets.

PFD CONTROLS AND FREQUENCY DISPLAY

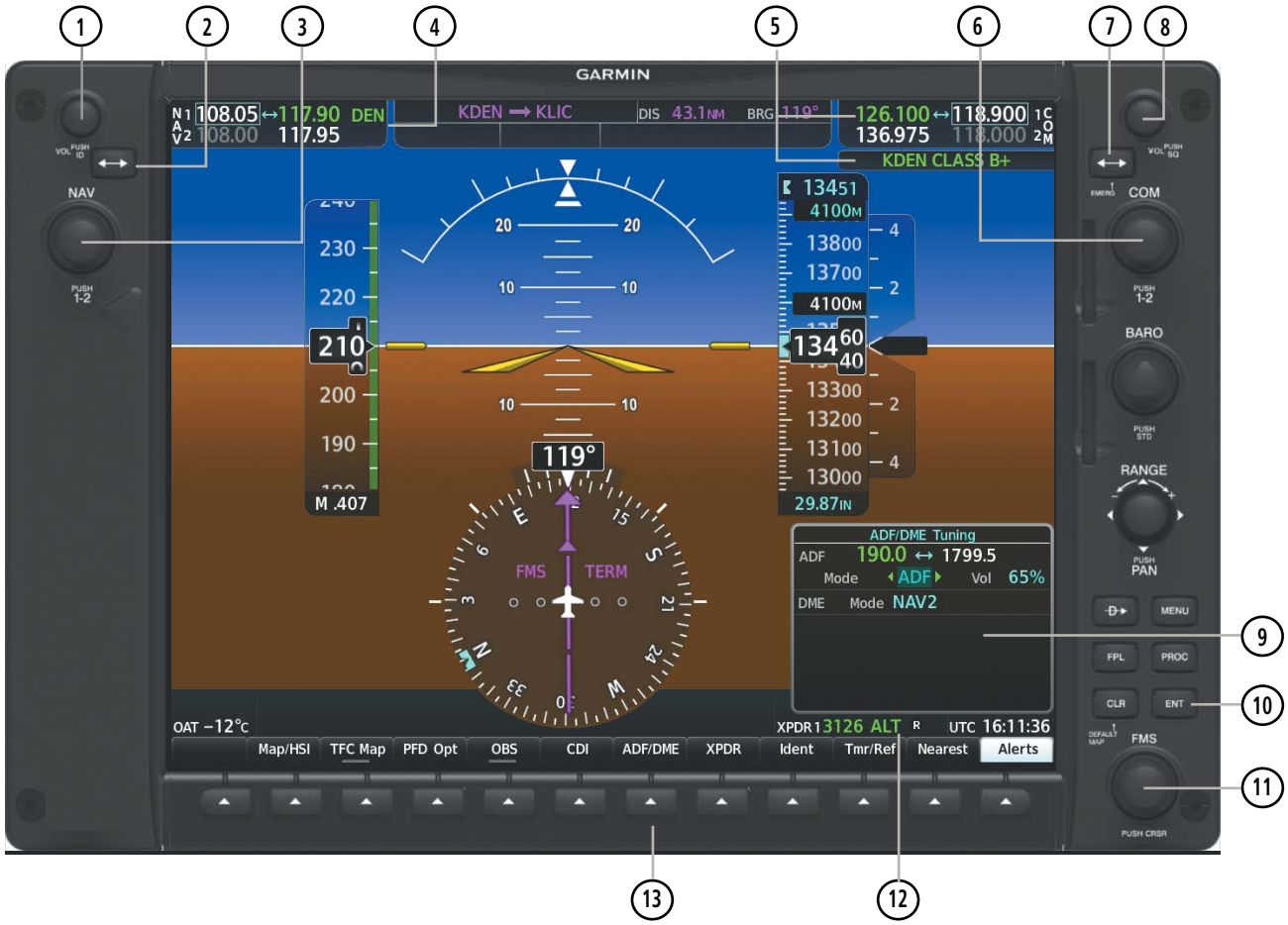


Figure 4-1 PFD Controls, NAV/COM Frequency Tuning Boxes, and DME Tuning Window

1. **NAV VOL/ID Knob –** Controls NAV audio volume level. Press to turn the Morse code identifier audio on and off. Volume level is shown in the NAV frequency field as a percentage.

2. **NAV Frequency Transfer Key –** Transfers the standby and active NAV frequencies.

3. **NAV Knob –** Tunes the standby frequencies for the NAV receiver (large knob for MHz; small knob for kHz). Press to move the frequency selected for tuning (cyan numbers) and the Frequency Transfer Arrow between NAV1 and NAV2.

4. **NAV Frequency Box –** Displays NAV standby and active frequency fields, volume, and station ID. The frequency of the NAV radio selected for navigation and the station ID are displayed in green.

5. **COM Frequency Box** and **Decoded COM Frequency Identifier –** Displays COM standby and active frequency fields and volume. The selected and decoded COM transceiver frequency is displayed in green.

6. **COM Knob –** Tunes the standby frequencies for the COM transceiver (large knob for MHz; small knob for kHz). Press to move the frequency selected for tuning (cyan numbers) and the Frequency Transfer Arrow between COM1 and COM2.

7. **COM Frequency Transfer Key –** Transfers the standby and active COM frequencies. Press and hold this key for two seconds to tune the emergency frequency (121.500 MHz) automatically into the active frequency field.

8. **COM VOL/SQ Knob –** Controls COM audio volume level. Press to turn the COM automatic squelch on and off. Volume level is shown in the COM frequency field as a percentage.

9. **ADF/DME Tuning Window –** Displays ADF frequencies, volume setting, and modes, and DME tuning selection. Display by pressing the **ADF/DME** Softkey.

10. **ENT Key –** Validates or confirms DME pairing mode and Auto-tune selection.

11. **FMS Knob –** Flight Management System Knob, used to enter transponder codes, select DME modes, and Auto-tune entries when DME Tuning Window or NRST Window is present. Press the **FMS** Knob to turn the selection cursor on and off. The large knob moves the cursor in the window. The small knob selects individual characters for the highlighted cursor location.

12. **Transponder Data Box –** Indicates the selected transponder code, operating mode, reply, and ident status for the applicable transponder.

13. **ADF/DME Softkey –** Displays the ADF/DME Tuning Window.

AUDIO PANEL CONTROLS

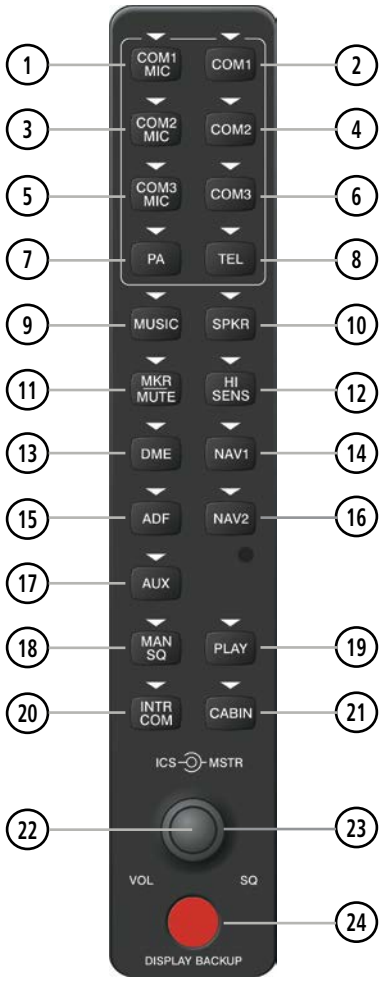



Figure 4-2 Audio Panel Controls

NOTE: *When a key is selected, a triangular annunciator above the key is illuminated.*

1. **COM1 MIC** – Selects the #1 transmitter for transmitting. COM1 receive is simultaneously selected when this key is pressed allowing received audio from the #1 COM receiver to be heard. COM2 receive can be added by pressing the **COM2** Key.
2. **COM1** – When selected, audio from the #1 COM receiver can be heard.
3. **COM2 MIC** – Selects the #2 transmitter for transmitting. COM2 receive is simultaneously selected when this key is pressed allowing received audio from the #2 COM receiver to be heard. COM1 receive can be added by pressing the **COM1** Key.
4. **COM2** – When selected, audio from the #2 COM receiver can be heard.
5. **COM3 MIC** – (Optional) When selected, audio from the #3 COM receiver can be heard.

6. **COM3 –** (Optional) Selects the HF transmitter for transmitting. COM3 receive is simultaneously selected when this key is pressed allowing received audio from the COM3 receiver to be heard.

7. **PA –** Selects the passenger address system. The selected COM transmitter is deselected when the **PA** Key is pressed. The message is heard by the other pilot on the headset only if the **INTR COM** Key is enabled. PA messages are one way from the flight deck to the passengers.

8. **TEL –** (Optional) Selects and deselects telephone audio.

9. **MUSIC –** Toggles the Music 1 input on or off. Pressing and holding toggles music muting on or off.

10. **SPKR –** Selects and deselects the on-side flight deck speaker. COM and NAV receiver audio can be heard on the speaker.

11. **MKR/MUTE –** Selects marker beacon receiver audio. Mutes the currently received marker beacon receiver audio. Unmutes automatically when new marker beacon audio is received.

12. **HI SENS –** Press to increase marker beacon receiver sensitivity. Press again to return to low sensitivity.

13. **DME –** Turns optional DME audio on or off.

14. **NAV1 –** When selected, audio from the #1 NAV receiver can be heard.

15. **ADF –** Turns optional ADF receiver audio on or off.

16. **NAV2 –** When selected, audio from the #2 NAV receiver can be heard.

17. **AUX –** Not used in the TBM 910.

18. **MAN SQ –** Enables manual squelch for the intercom. When the intercom is active, press the **ICS** Knob to illuminate SQ. Turn the **ICS** Knob to adjust squelch.

19. **PLAY –** Press once to play the last recorded COM audio. Press again to stop playing. Press twice within 0.5 second while audio is playing and the previous block of recorded audio is played. Each subsequent two presses within 0.5 second plays each previously recorded block.

20. **INTR COM –** Selects and deselects the pilot/copilot intercom on both Audio Panels.

21. **CABIN –** Initiates intercom communications with passengers in the cabin.

22. **ICS Knob –** Turn to adjust intercom volume or squelch. Press to switch between volume and squelch control as indicated by illumination of VOL or SQ. The **MAN SQ** Key must be selected to allow squelch adjustment.

23. **MSTR Knob –** The Master Volume Control adjusts volume for the blended NAV, COM, intercom audio, and alert warnings.

24. **DISPLAY BACKUP Button –** Manually selects Reversionary Mode.

4.2 COM OPERATION

Figure 4-3 COM Tuning Box Indications

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

1. **Active Fields** – The COM Frequency Box is composed of four fields; the two active frequencies are on the left. An active COM frequency is displayed in green and indicates that the COM transceiver is selected on the Audio Panel (**COM1 MIC** or **COM2 MIC** Key). Both active COM frequencies appearing in white indicate that no COM radio is selected for transmitting (**PA** Key is selected on the Audio Panel).

2. **Frequency Transfer Arrow** – Moves between the upper and lower radio frequency fields with the Frequency Tuning Box. Indicates which COM transciever is selected for frequency transfer between the Standby and Active fields.

3. **Standby Fields** – The COM Frequency Box is composed of four fields; the two standby frequencies are on the right. Frequencies in the standby field are displayed in either white or gray. The standby frequency in the tuning box is white. The other standby frequency is gray.

4. **Frequency Tuning Box** – Moves between the upper and lower radio frequency fields with the Frequency Transfer Arrow. Indicates which COM transceiver is to be tuned in the Standby Field.

5. **Automatic Squelch Indication** – Indicates that Automatic Squelch is disabled. 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 is heard over the headsets and speaker, if selected.

(6) **Transmit and Receive Indications** – During COM transmission, a white TX appears by the active COM frequency replacing the Frequency Transfer Arrow. During COM signal reception, a white RX appears by the active COM frequency replacing the Frequency Transfer Arrow.

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

(8) **COM Volume** – COM radio volume level can be adjusted from 0 to 100% using the **VOL/SQ** Knob. Turning the knob clockwise increases volume, turning the knob counterclockwise decreases volume. When adjusting volume, the level is displayed in place of the standby frequencies. Volume level indication remains for two seconds after the change.

COM TRANSCEIVER MANUAL TUNING

The COM frequency controls and frequency boxes are on the right side of each PFD.

Manually tuning a COM frequency:

1) Turn the **COM** Knob to tune the desired frequency (large knob for MHz; small knob for kHz).
2) Press the **Frequency Transfer** Key to transfer the frequency to the active field.
3) Adjust the volume level with the COM **VOL/SQ** Knob.
4) Press the COM **VOL/SQ** Knob to turn automatic squelch on and off.

AUTO-TUNING THE COM FREQUENCY

COM frequencies can be automatically tuned from the following:

- Nearest Airports Window (PFD)
- WPT – Airport Information Page
- NRST – Nearest Airports Page
- NRST – Nearest Frequencies Page (ARTCC, FSS, WX)
- NRST – Nearest Airspaces Page

AUTO-TUNING FROM THE PFD

COM frequencies for the nearest airports can be automatically tuned from the Nearest Airports Window on the PFD. When the desired frequency is entered, it becomes a standby frequency. Pressing the **Frequency Transfer** Key places this frequency into the COM Active Frequency Field.

Auto-tuning a COM frequency for a nearby airport from the PFD:

1) Select the **Nearest** Softkey on the PFD to open the Nearest Airports Window. A list of 25 nearest airport identifiers and COM frequencies is displayed.
2) Turn the **FMS** Knob to scroll through the list and highlight the desired COM frequency.
3) Press the **ENT** Key to load the COM frequency into the COM Standby Frequency Field.
4) Press the Frequency Transfer Key to transfer the frequency to the COM Active Frequency Field.

*Select the **Nearest** Softkey to Open the Nearest Airports Window*

Figure 4-4 Nearest Airports Window (PFD)

AUTO-TUNING FROM THE MFD

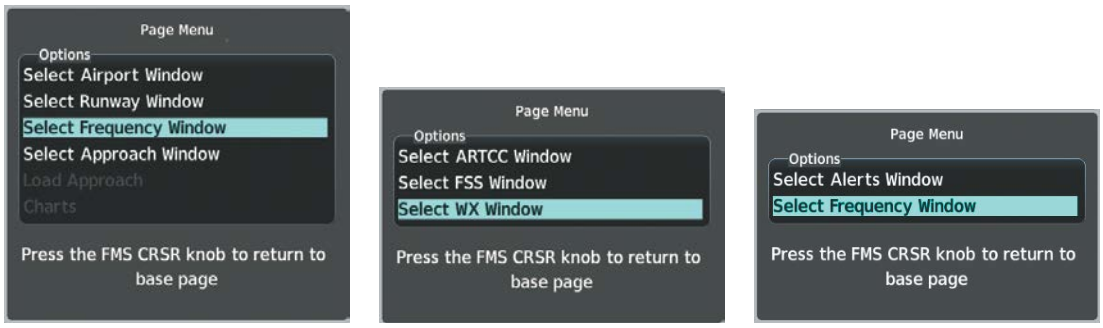
Frequencies can be automatically loaded into the COM Frequency Box from pages in the NRST or WPT page group by highlighting the frequency and pressing the **ENT** Key.

Auto-tuning a COM frequency from the WPT and NRST Pages:

1) From any page that the COM frequency can be auto-tuned, activate the cursor by pressing the **FMS** Knob or selecting the appropriate softkey.
2) Turn the **FMS** Knob to place the cursor on the desired COM frequency.
3) Press the **ENT** Key to display the Load Frequency options window.
4) Turn the **FMS** Knob to select the desired COM radio field in which to load the frequency.
5) Press the **ENT** Key to load the COM frequency into the selected COM radio field.

Or:

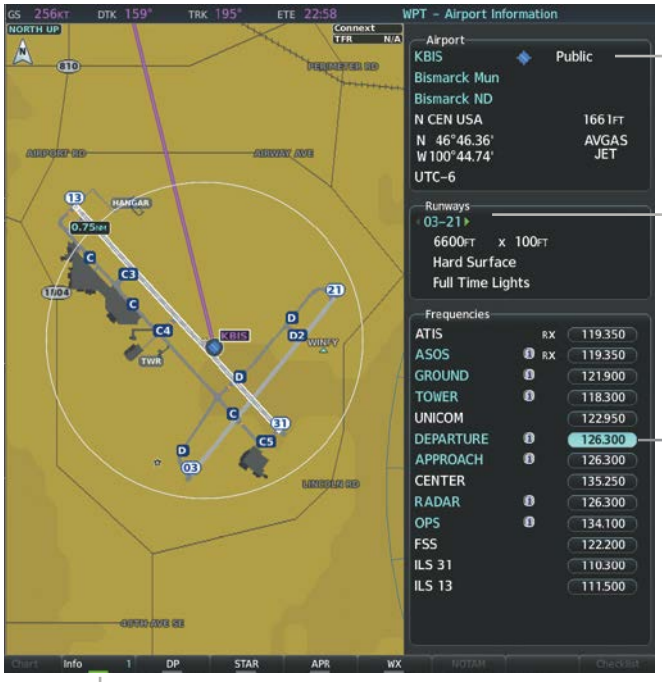
1) Press the **MENU** Key to display the page menu.
2) Turn the large **FMS** Knob to scroll through the menu options.
3) Press the **ENT** Key to place the cursor on the desired selection.
4) Scroll through the frequency selections with the **FMS** Knob or the **ENT** Key.
5) Press the **ENT** Key to load the COM frequency into the standby field of the selected COM radio.
6) Press the Frequency Transfer Key to transfer the frequency to the COM Active Frequency Field.



Nearest Airports Menu *Nearest Frequencies Menu* *Nearest Airspaces Menu*

Figure 4-5 Nearest Pages Menus

On the WPT - Airport Information Page, the cursor can be placed on the frequency field by pressing the **FMS** Knob and scrolling through the list. With the desired frequency highlighted, press the **ENT** Key to bring up the Load Frequency Options menu. Use the **FMS** Knobs to select the desired COM radio field and press the **ENT** Key to load it.



Selected Airport Identifier and Information

Runway Information

*Press **ENT** Key to bring up the 'Load Frequency' menu.*

*Select **INFO 1** Softkey for AIRPORT, RUNWAYS, and FREQUENCIES Windows*

Figure 4-6 WPT – Airport Information Page

COM frequencies can also be auto-tuned from the NRST – Nearest Airspaces, NRST – Nearest Frequencies, and NRST – Nearest Airports Pages on the MFD in a similar manner using the appropriate softkeys or **MENU** Key, the **FMS** Knobs, and the **ENT** Key.

FREQUENCY SPACING

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

COM channel spacing is set on the System Setup 1 Page of the AUX Page Group.

Changing COM frequency channel spacing:

1) Select the 'AUX – System Setup 1' Page.
2) Press the **FMS** Knob to activate the flashing cursor.
3) Turn the large **FMS** Knob to highlight the Channel Spacing Field in the COM Configuration Box.
4) Turn the small **FMS** Knob to select the desired channel spacing.
5) Press the **ENT** Key to complete the channel spacing selection.

While the COM CONFIG Window is selected, the softkeys are blank.

Figure 4-7 AUX – System Setup 1 Page

4.3 NAV OPERATION

NAV TUNING BOXES

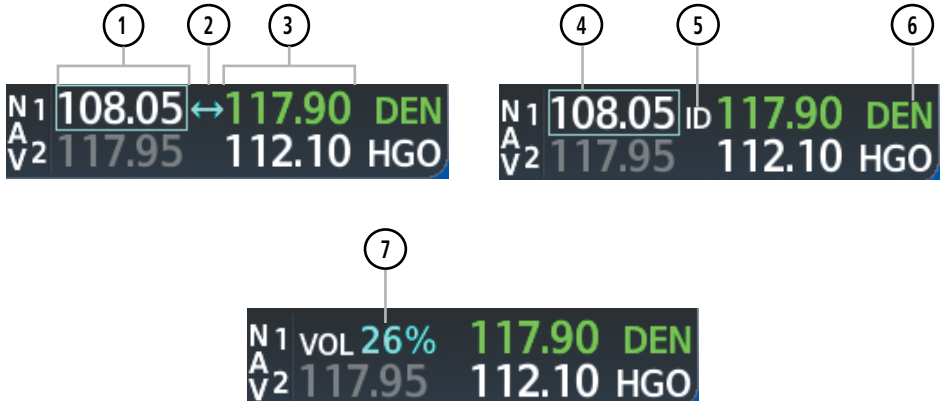


Figure 4-8 NAV Tuning Box Indications

1. **Standby Fields** – The NAV Frequency Box is composed of four fields; the two standby frequencies are on the left. Frequencies in the standby field are displayed in either white or gray. The standby frequency in the tuning box is white. The other standby frequency is gray.

2. **Frequency Transfer Arrow** – Moves between the upper and lower radio frequency fields with the Frequency Tuning Box. Indicates which NAV transciever is selected for frequency transfer between the Standby and Active fields.

3. **Active Fields** – The NAV Frequency Box is composed of four fields; the two active frequencies are on the right. An active NAV frequency is displayed in green. The active NAV radio is selected by pressing the **CDI** softkey on the PFD. Both active NAV frequencies appearing in white indicate that no NAV radio is selected.

4. **NAV Tuning Box** – Moves between the upper and lower radio standby frequency fields with the Frequency Transfer Arrow. Indicates which NAV transceiver is to be tuned in the Standby Field. Moving the Frequency Tuning Box is accomplished by pressing the **NAV** knob on the PFD.

5. **VOR/LOC Morse Code Audio Indication** – When the Morse code Identifier audio is on for a NAV radio, a white ID replaces the **Frequency Transfer Arrow** to the left of the active NAV frequency. In order to listen to either station identifier, press the **NAV1** or **NAV2** Key on the Audio Panel. Pressing the **VOL/ID** Knob turns on/off the Morse code audio only in the radio with the NAV Tuning Box. To turn on/off both NAV IDs, transfer the NAV Tuning Box between NAV1 and NAV2 by pressing the small **NAV** Knob and pressing the **VOL/ID** Knob again to turn the Morse code off in the other radio.

6. **Decoded Morse Code Station Identifier** – The NAV Frequency Box displays the decoded Morse Code station identifier that is received from the navigation source. Audio verification of the selected station identifier is still required, and can be accomplished by selecting the corresponding NAV radio on the audio panel and pressing the **NAV VOL/ID** Knob.

(7) **NAV VOLUME** – NAV radio volume level can be adjusted from 0 to 100% using the **VOL/ID** Knob. Turning the knob clockwise increases volume, turning the knob counterclockwise decreases volume. When adjusting volume, the level is displayed in place of the standby frequencies. Volume level indication remains for two seconds after the change.

NAV RADIO SELECTION AND ACTIVATION

The NAV Frequency Box is composed of four fields; two standby fields and two active fields. The active frequencies are on the right side and the standby frequencies are on the left.

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

While cycling through the **CDI** Softkey selections, the selected NAV standby frequency is selected for tuning, the Frequency Transfer Arrow is placed in the selected NAV Frequency Field, and the active NAV frequency color changes to green.

The three navigation modes that can be cycled through are:

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

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

The NAV Frequency Box displays the decoded Morse Code station identifier that is received from the navigation source. Audio verification of the selected station identifier is still required, and can be accomplished by selecting the corresponding NAV radio on the audio panel and pressing the **NAV VOL/ID** Knob.

NAV radios are selected for listening by pressing the corresponding keys on the Audio Panel. Pressing the **NAV1**, **NAV2**, **ADF**, or **DME** Key selects and deselects the navigation radio source. Selected audio can be heard over the headset and the speakers (if selected). All radios can be selected individually or simultaneously.

NAV RECEIVER MANUAL TUNING

The NAV frequency controls and frequency boxes are on the left side of the PFDs.

Manually tuning a NAV frequency:

1) Turn the **NAV** Knob to tune the desired frequency in the NAV Tuning Box.
2) Press the **Frequency Transfer** Key to transfer the frequency to the NAV Active Frequency Field.
3) Adjust the volume level with the COM **VOL/SQ** Knob.
4) Press the COM **VOL/SQ** Knob to turn automatic squelch on and off.

AUTO-TUNING A NAV FREQUENCY FROM THE MFD

NAV frequencies can be selected and loaded from the following MFD pages:

- WPT – Airport Information
- WPT – VOR Information
- NRST – Nearest Airports
- NRST – Nearest VOR
- NRST – Nearest Frequencies (FSS, WX)
- NRST – Nearest Airspaces

The MFD provides auto-tuning of NAV frequencies from waypoint and nearest pages. During enroute navigation, the NAV frequency is entered automatically into the NAV standby frequency field. During approach activation the NAV frequency is entered automatically into the NAV active frequency field.

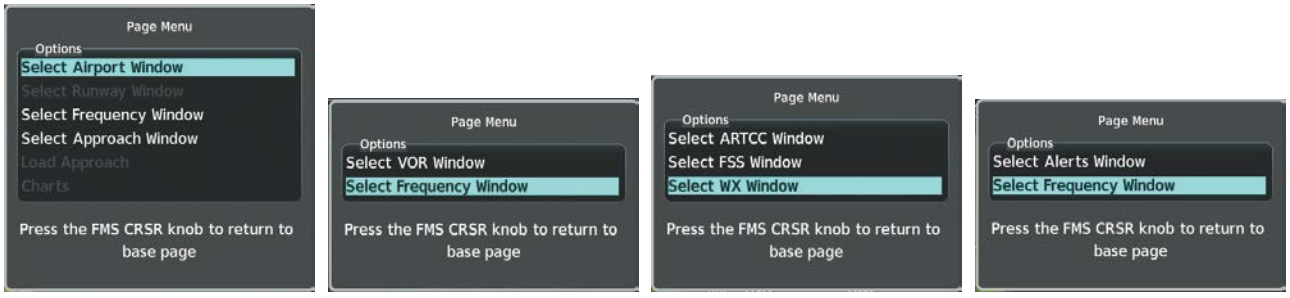
Frequencies can be automatically loaded into the NAV Frequency Box from pages in the NRST or WPT page group by highlighting the frequency and pressing the **ENT** Key.

Auto-tuning a NAV frequency from the WPT and NRST Pages:

1) From any page that the NAV frequency can be auto-tuned, activate the cursor by pressing the **FMS** Knob on the MFD control unit or selecting the appropriate softkey.
2) Turn the **FMS** Knob to place the cursor on the desired NAV identifier or NAV frequency.
3) On the Nearest VOR, Nearest Airspaces, and Nearest Airports pages, select the **FREQ** Softkey to place the cursor on the NAV frequency.
4) Turn the **FMS** Knob to select the desired NAV radio field in which to load the frequency.
5) Press the **ENT** Key to load the NAV frequency into the selected NAV radio field.

Or:

1) When on the NRST pages, press the **MENU** Key on the MFD control unit to display the page menu.
2) Turn the large **FMS** Knob to scroll through the menu options.
3) Press the **ENT** Key to place the cursor in the desired window.
4) Scroll through the frequency selections with the **FMS** Knob or the **ENT** Key.
5) Turn the **FMS** Knob to select the desired NAV radio field in which to load the frequency.
6) Press the **ENT** Key to load the NAV frequency into the selected NAV radio field.



Nearest Airports Menu *Nearest VOR Menu* *Nearest Frequencies Menu* *Nearest Airspaces Menu*

Figure 4-9 Nearest Pages Menus

In the example shown, the VOR list is selected with the **VOR** Softkey or from the page menu. The **FMS** Knob or **ENT** Key is used to scroll through the list. The cursor is placed on the frequency with the **FREQ** Softkey and loaded into the desired NAV Tuning Field with the **FMS** Knobs and the **ENT** Key.

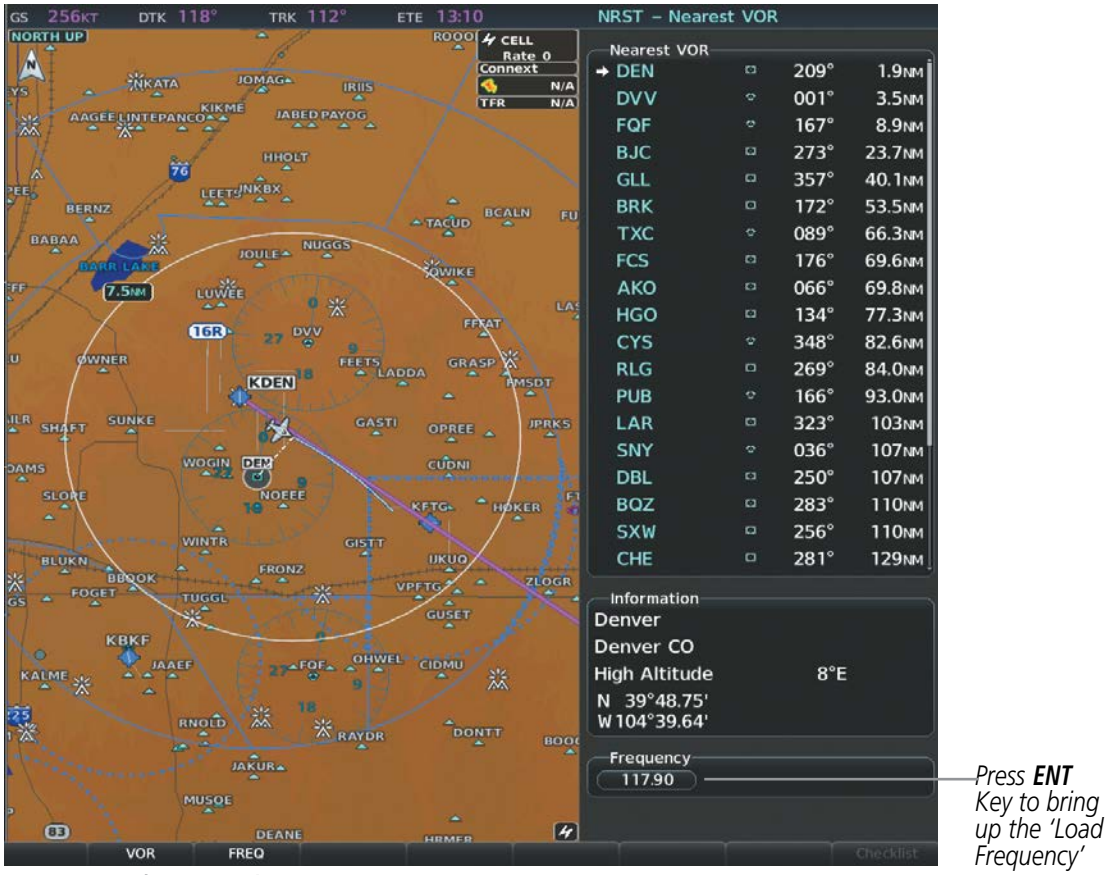


Figure 4-10 Loading the NAV Frequency from the NRST – Nearest VOR Page

While enroute, NAV frequencies can also be auto-tuned from the NRST – Nearest Airports, WPT – Airport Information, WPT – VOR Information, and NRST – Nearest Frequencies Pages on the MFD in a similar manner using the appropriate softkeys or **MENU** Key, the **FMS** Knob, and the **ENT** Key.

AUTO-TUNING NAV FREQUENCIES ON APPROACH ACTIVATION

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

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

NAV frequencies are automatically loaded into the NAV Frequency field on approach activation, on both PFD1 and PFD2.

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

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

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 an ILS. The marker beacon receiver is always on and detects any marker beacon signals within the reception range of the aircraft.

The receiver detects the three marker tones – outer, middle, and inner – and provides the marker beacon annunciations located to the left of the Altimeter on the PFD.

Figure 4-11 Marker Beacon Keys

The Audio Panels provide three different states of marker beacon operation; On, Muted, and Deselected. Pressing the **MKR/MUTE** Key selects and deselects marker beacon audio. The key annunciator indicates when marker beacon audio is selected.

During marker beacon audio reception, pressing the **MKR/MUTE** Key mutes the audio but does not affect the marker annunciations. The marker tone is silenced, then waits for the next marker tone. The **MKR/MUTE** Key Annunciator is illuminated, indicating audio muting. The audio returns when the next marker beacon signal is received. If the **MKR/MUTE** Key is pressed during signal reception (O, M, I indication) while marker beacon audio is muted, the audio is deselected and the **MKR/MUTE** Key Annunciator is extinguished.

Pressing the **HI SENS** Key switches between high and low marker beacon receiver sensitivity. The HI SENS function (annunciator illuminated) is used to provide an earlier indication when nearing a marker during an approach. The LO SENS function (annunciator extinguished) results in a narrower marker dwell while over a station.

ADF/DME TUNING

NOTE: *When another auxiliary window is turned on, the ADF/DME Tuning Window is replaced on the PFD.*

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

The G1000 system tunes the ADF receiver (optional) and DME transceiver (optional). The ADF is tuned by entering the frequency in the ADF standby frequency field of the ADF/DME Tuning Window. (The softkey may be labeled **ADF/DME**, **ADF**, or **DME**, depending on installed equipment.)

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

The following ADF/DME information is displayed in the ADF/DME Tuning Window:

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

When the ADF/DME Tuning Window is displayed, the selection cursor is placed over the standby ADF frequency field.

Turning the large **FMS** Knob moves the selection cursor through the various fields (standby ADF frequency, ADF receiver mode, ADF radio volume, and DME tuning mode). Pressing the **FMS** Knob activates/deactivates the selection cursor in the ADF/DME Tuning Window. The ADF frequency is entered using the **FMS** Knob and the **ENT** Key.

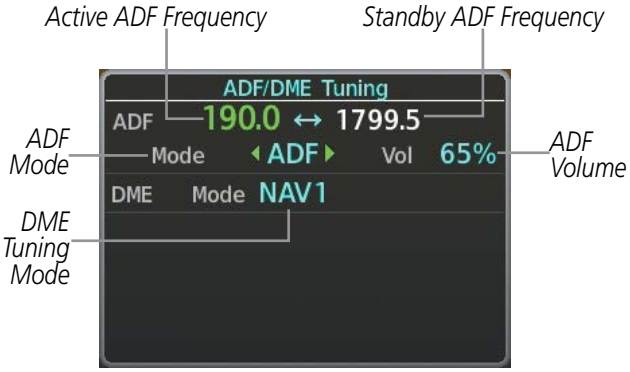


Figure 4-12 ADF/DME Tuning Window

ADF TUNING

ADF frequencies in the 190.0-kHz to 1799.5-kHz range are entered in the standby ADF frequency field of the ADF/DME Tuning Window. The System does not tune the ADF emergency frequency, 2182.0-kHz.

Tuning an ADF frequency:

1) Press the **ADF/DME** Softkey to display the 'ADF/DME Tuning' Window.
2) Turn the large **FMS** Knob to place the selection cursor over the standby ADF frequency field.
3) Turn the small **FMS** Knob to begin data entry and change each digit.
4) Turn the large **FMS** Knob to move the cursor to the next digit position.
5) Press the **ENT** Key to complete data entry for the standby frequency.

Pressing the **CLR** Key before completing frequency entry cancels the frequency change and reverts back to the previously entered frequency.

Pressing the **CLR** Key when the cursor is flashing, clears the frequency and replaces the standby field with '0000.0'.

Transferring the active and standby ADF frequencies:

1) Turn the large **FMS** Knob to place the selection cursor over the standby ADF frequency field.
2) Press the **ENT** Key to complete the frequency transfer.

SELECTING ADF RECEIVER MODE

The following modes can be selected: (In all modes NDB audio can be heard by pressing the **ADF** Key on the Audio Panel.)

- ANT (Antenna) – The ADF bearing pointer parks on the HSI at 90 degrees. Best mode for listening to NDB audio.
- ADF (Automatic Direction Finder) – The ADF pointer points to the relative bearing of the NDB station.
- ADF/BFO (ADF/Beat Frequency Oscillator) – The ADF pointer points to the relative bearing of the NDB station and an audible tone confirms signal reception. This mode allows identification of the interrupted carrier beacon stations used in various parts of the world.
- ANT/BFO (Antenna/Beat Frequency Oscillator) – The ADF bearing pointer parks on the HSI at 90 degrees while an audible tone is provided when a signal is received. This mode also allows identification of the interrupted carrier beacon stations and confirms signal reception.

Selecting an ADF receiver mode:

1) Turn the large **FMS** Knob to place the selection cursor over the ADF mode field.
2) Turn the small **FMS** Knob to select the desired ADF receiver mode.

ADF receiver volume level can be adjusted in the tuning window from 0 to 100%. The default volume level is set to 50%. The ADF volume level is the same for both Audio Panels.

Adjusting ADF receiver volume:

1) Turn the large **FMS** Knob to place the selection cursor over the ADF volume field.
2) Turn the small **FMS** Knob to adjust volume as desired.

DME TUNING

NOTE: *When turning on the system for use, it will remember the last frequency used for DME tuning and the NAV1, NAV2, or HOLD state prior to shutdown.*

The DME transceiver is tuned by selecting NAV1, NAV2, or HOLD in the ADF/DME Tuning Window.

Figure 4-13 ADF/DME Tuning Window, DME Modes

The following DME transceiver pairings can be selected:

- NAV1 – Pairs the DME frequency from the selected NAV1 frequency.
- NAV2 – Pairs the DME frequency from the selected NAV2 frequency.
- HOLD – When in the HOLD position, the DME frequency remains paired with the last selected NAV frequency.

Selecting DME transceiver pairing:

1) Press the **ADF/DME** Softkey to display the 'ADF/DME Tuning' Window.
2) Turn the small **FMS** Knob to select the DME tuning mode.
3) Press the **ENT** Key to complete the selection.

Pressing the **CLR** Key or **FMS** Knob while in the process of DME pairing cancels the data entry and reverts back to the previously selected DME tuning state. Pressing the **FMS** Knob activates/deactivates the cursor in the ADF/DME Tuning Window.

4.4 MODE S TRANSPONDERS

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

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

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

TRANSPONDER CONTROLS

Transponder function is displayed on three levels of softkeys on the PFD: Top-level, Mode Selection, and Code Selection. When the top-level **XPDR** Softkey is pressed, the Mode Selection softkeys appear: **XPDR1**, **XPDR2**, **Standby**, **On**, **ALT**, **VFR**, **Code**, **Ident**, **Back**.

When the **Code** Softkey is pressed, the number softkeys appear: **0**, **1**, **2**, **3**, **4**, **5**, **6**, **7**, **Ident**, **BKSP**, **Back**. The digits 8 and 9 are not used for code entry. Pressing the numbered softkeys in sequence enters the transponder code. If an error is made, pressing the **BKSP** Softkey moves the code selection cursor to the previous digit. Pressing the **BKSP** Softkey again moves the cursor to the next previous digit.

Pressing the **Back** Softkey during code selection reverts to the Mode Selection Softkeys. Pressing the **Back** Softkey during mode selection reverts to the top-level softkeys.

The code can also be entered with the **FMS** Knob on either PFD. Code entry must be completed with either the softkeys or the **FMS** Knob, but not a combination of both.

Pressing the **Ident** Softkey while in Mode or Code Selection initiates the ident function and reverts to the top-level softkeys.

After 45 seconds of transponder control inactivity, the system reverts back to the top-level softkeys.

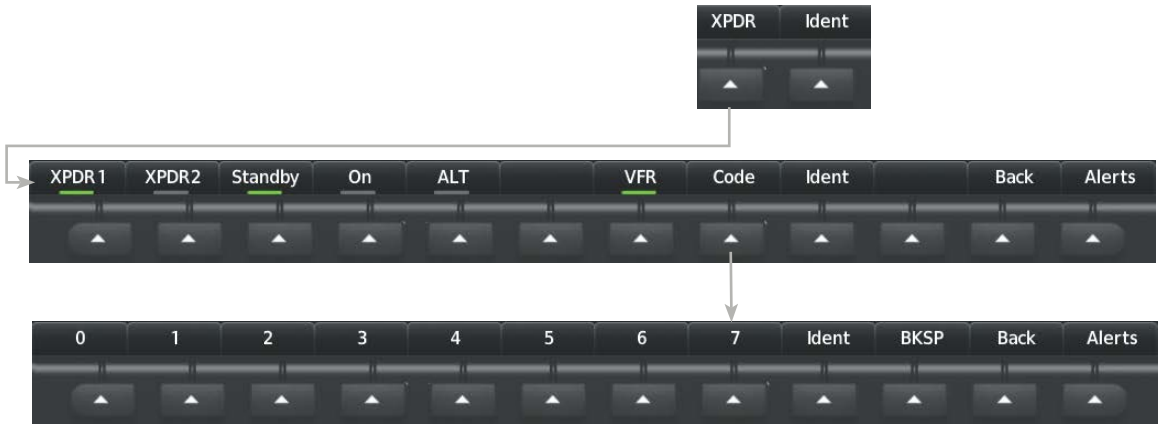


Figure 4-14 XPDR Softkeys (PFD)

Selecting and activating Transponder 1 or Transponder 2:

1) Press the **XPDR** Softkey to display the Transponder Mode Selection Softkeys.
2) Press the **XPDR1** or **XPDR2** Softkey to select and activate the desired transponder.

When turning on the system for use, the system activates Transponder 1 as the default unit, regardless of which transponder was active prior to shutdown. When switching between Transponder 1 and Transponder 2, the code and mode remain the same. If a new code is entered in the active transponder, switching transponders does not bring back the previous code.

TRANSPONDER MODE SELECTION

Mode selection can be automatic (Altitude Mode) or manual (Standby, ON, and Altitude Modes). The **Standby**, **ON**, and **ALT** Softkeys can be accessed by pressing the **XPDR** Softkey.

Selecting a transponder mode:

1) Press the **XPDR** Softkey to display the Transponder Mode Selection Softkeys.
2) Select the desired softkey to activate the transponder mode.

STANDBY MODE (MANUAL)

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

Standby Mode can be selected at any time by pressing the **Standby** Softkey. In Standby, the transponder is powered and new codes can be entered, but no replies or squitters are transmitted.. When Standby is selected, a white STBY indication and transponder code appear in the mode field of the Transponder Data Box.

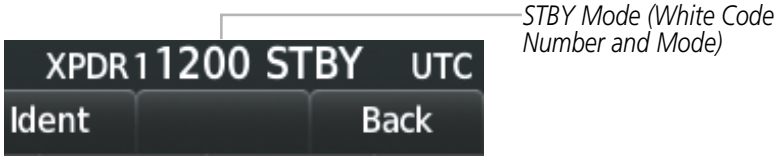


Figure 4-15 Standby Mode

MANUAL ON MODE

ON Mode can be selected at any time by pressing the **ON** Softkey. ON Mode generates Mode A and Mode S replies as well as transmission of acquisition and extended squitters, including ADS-B out. Mode S replies will not include altitude information. Mode C altitude reporting is inhibited.

The ON indication and transponder code in the Transponder Data Box will appear green while airborne and white while on the ground.

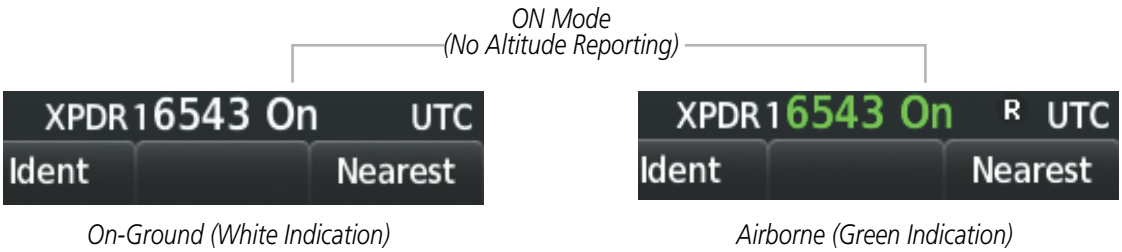


Figure 4-16 ON Mode

ALTITUDE MODE (AUTOMATIC OR MANUAL)

The white Altitude Reporting Mode is normally selected automatically when the aircraft is on the ground. White Altitude Mode may also be selected manually by pressing the **ALT** Softkey while on the ground. White Altitude Mode generates Mode S replies to discrete interrogations as well as transmission of acquisition and extended squitters, including ADS-B out. Mode A, Mode C, and Mode S all-call replies are inhibited.

If Altitude Mode is selected while on the ground, a white ALT indication and transponder code appear in the mode field of the Transponder Data Box.

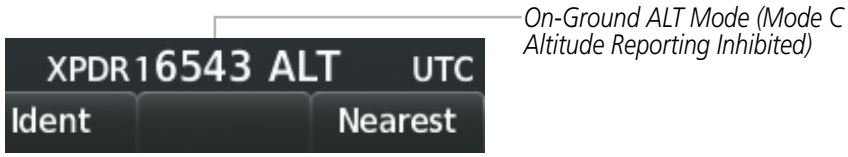


Figure 4-17 Altitude Mode

The green Altitude Mode is automatically selected when the aircraft becomes airborne. Green Altitude Mode may also be selected manually by pressing the **ALT** Softkey while airborne. Green Altitude Mode generates Mode A, Mode C, and Mode S replies as well as transmissions of acquisition and extended squitters including ADS-B out.

If Altitude Mode is selected while airborne, a green ALT indication and transponder code appear in the mode field of the Transponder Data Box, and all transponder replies requesting altitude information are provided with pressure altitude information.

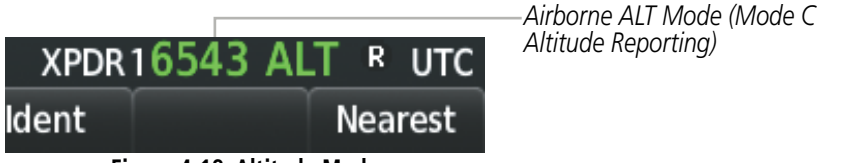


Figure 4-18 Altitude Mode

REPLY STATUS

When the transponder sends replies to interrogations, a white R indication appears momentarily in the reply status field of the Transponder Data Box.

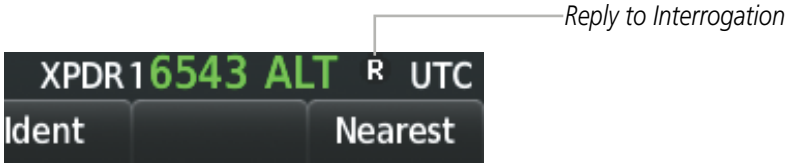


Figure 4-19 Reply Indication

ENTERING A TRANSPONDER CODE

Entering a transponder code with softkeys:

1) Press the **XPDR** Softkey to display the Transponder Mode Selection Softkeys.
2) Press the **Code** Softkey to display the Transponder Code Selection Softkeys, for digit entry.
3) Press the digit softkeys to enter the code in the code field. When entering the code, the next softkey in sequence must be selected within 10 seconds, or the entry is cancelled and restored to the previous code. Pressing the **BKSP** Softkey moves the code selection cursor to the previous digit. Five seconds after the fourth digit has been entered, the transponder code becomes active.

Entering a transponder code with the PFD FMS Knob:

1) Press the **XPDR** and the **Code** Softkeys as in the previous procedure to enable code entry.
2) Turn the small **FMS** Knob to enter the first two code digits.
3) Turn the large **FMS** Knob to move the cursor to the next code field.
4) Enter the last two code digits with the small **FMS** Knob.
5) Press the **ENT** Key to complete code digit entry.

Pressing the **CLR** Key or small **FMS** Knob before code entry is complete cancels code entry and restores the previous code. Waiting for 10 seconds after code entry is finished activates the code automatically.

VFR CODE

The VFR code can be entered either manually or by pressing the **XPDR** Softkey, then the **VFR** Softkey. When the **VFR** Softkey is pressed, the pre-programmed VFR code is automatically displayed in the code field of the Transponder Data Box. Pressing the **VFR** Softkey again restores the previous identification code.

The pre-programmed VFR Code is set at the factory to 1200. If a VFR code change is required, contact a Garmin-authorized service center for configuration.

IDENT FUNCTION

NOTE: *In Standby Mode, the* ***Ident*** *Softkey is inoperative.*

Pressing the **Ident** Softkey sends a distinct identity indication to Air Traffic Control (ATC). The indication distinguishes the identing transponder from all the others on the air traffic controller's screen. The **Ident** Softkey appears on all levels of transponder softkeys. When the **Ident** Softkey is pressed, a green Ident indication is displayed in the mode field of the Transponder Data Box for a duration of 18 seconds.

After the **Ident** Softkey is pressed while in Mode or Code Selection, the system reverts to the top-level softkeys.

4.5 ADDITIONAL AUDIO PANEL FUNCTIONS

POWER-UP

The Audio Panels perform a self-test during power-up. During the self-test all Audio Panel annunciator lights illuminate for approximately two seconds. Once the self-test is completed, most of the settings are restored to those in use before the unit was last turned off. The exceptions are the speaker and intercom, which are always selected during power up.

MONO/STEREO HEADSETS

Stereo headsets are recommended for use in this aircraft.

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

SPEAKER

Each Audio Panel controls a separate cabin speaker. Pressing the **SPKR** Key selects and deselects the on-side speaker.

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

The speaker volume is adjustable within a nominal range. Contact a Garmin-authorized service center for volume adjustment.

INTERCOM

Pressing the **INTR COM** Key on either Audio Panel selects and deselects the intercom on both Audio Panels. The annunciator is lit when the intercom is active. The intercom connects the pilot and copilot together. Either the pilot or copilot may select or deselect the intercom.

The **CABIN** Key initiates two way communication between the pilot or copilot and the passengers in the cabin. The annunciator is lit when the cabin intercom is active on either Audio Panel.

When the flight crew wants to communicate with the passengers, the pilot or copilot presses the **CABIN** Key to signal that communication is desired. The cabin signal must be acknowledged to begin intercom conversation.

The **MAN SQ** Key allows either automatic or manual control of the intercom squelch setting. Pressing the **MAN SQ** Key enables manual squelch control, indicated by the MAN SQ annunciator.

- When the MAN SQ Annunciator is extinguished (Automatic Squelch is on), the **ICS** Knob controls only the volume (pressing the **ICS** Knob has no effect on the VOL/SQ selection).
- When the MAN SQ Annunciator is illuminated (Manual Squelch), the **ICS** Knob controls either volume or squelch (selected by pressing the **ICS** Knob and indicated by the VOL or SQ annunciation).

PASSENGER ADDRESS (PA) SYSTEM

A passenger address system is provided by pressing the **PA** Key to deliver messages to the passengers. The message is heard by the other pilot on the headset only if the **INTR COM** Key is enabled. PA messages are one way from the flight deck to the passengers.

A Push-to-talk (PTT) must be pressed to deliver PA announcements to the passengers over their headphones.

When PA is selected on the Audio Panel, the annunciator flashes about once per second while pressing the PTT, the COM MIC annunciator is no longer lit, and the active COM frequency for that Audio Panel changes to white, indicating that there is no COM selected.

SIMULTANEOUS COM OPERATION

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

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

CLEARANCE RECORDER AND PLAYER

NOTE: *Pressing the play key on the pilot's Audio Panel plays recorded audio to the Pilot. Pressing the play key on the Copilot's Audio Panel plays recorded audio to the Copilot.*

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

The **PLAY** Key controls the play function. The PLAY annunciator remains lit to indicate when play is in progress. The PLAY annunciator turns off after playback is finished.

Pressing the **PLAY** Key once plays the latest recorded memory block and then returns to normal operation. Pressing the **PLAY** Key again during play of a memory block stops play. If a COM input signal is detected during play of a recorded memory block, play is halted.

Pressing the **PLAY** Key twice within one-half second while audio is playing plays the previous block of recorded audio. Each subsequent two presses of the **PLAY** Key within one-half second backtracks through the recorded memory blocks to reach and play any recorded block.

Powering off the unit automatically clears all recorded blocks.

ENTERTAINMENT INPUTS

NOTE: *MUSIC 1 inputs cannot be completely turned off. Audio level for MUSIC 1 can be adjusted by a Garmin-authorized service center.*

The Audio Panel provides a stereo auxiliary entertainment inputs: MUSIC 1. This input is compatible with popular portable entertainment devices such as cell phones and other tablet devices. Two 3.5-mm stereo phone jacks are installed in convenient locations for audio connection. The headphone outputs of the entertainment devices are plugged into the MUSIC 1 jack.

MUSIC 1

MUSIC 1 can be heard by the pilot and copilot when the **MUSIC** Key is selected.

MUSIC 1 Muting

MUSIC 1 muting occurs when aircraft radio or marker beacon activity is heard. MUSIC 1 is always soft muted when an interruption occurs from an aircraft radio. Soft muting is the gradual return of MUSIC 1 to its original volume level. The time required for MUSIC 1 volume to return to normal is between one-half and four seconds.

MUSIC 1 Muting Enable/Disable

Pressing and holding the **MUSIC** Key for three seconds switches MUSIC 1 muting on and off. When switching, either one or two beeps are heard; one beep indicates that music muting is enabled, two beeps indicate music muting is disabled.

MUSIC 1 muting is independent for each Audio Panel. Pressing the **MUSIC** Key on one Audio Panel does not enable/disable MUSIC 1 muting on the opposite side. MUSIC 1 muting is reset (enabled) during power up.

SIRIUSXM RADIO ENTERTAINMENT

SiriusXM Radio audio from the Data Link Receiver may be heard by the pilot and passengers simultaneously (optional: requires subscription to SiriusXM Radio Service). Refer to the Additional Features Section for more details on the Data Link Receiver.

Connecting a stereo input to the MUSIC 1 jack removes the SiriusXM Radio Audio from that input. For example, if passengers prefer their own music while the pilot listens to the SiriusXM Radio, the entertainment audio should be connected to the MUSIC 1 jack.

4.6 AUDIO PANELS PREFLIGHT PROCEDURE

NOTE: *If the flight crew is using headsets that have a high/low switch or volume control knob, verify that the switch is in the high position and the volume control on the headsets are at max volume setting. On single-pilot flights, verify that all other headsets are not connected to avoid excess noise in the audio system.*

NOTE: *Adjusting the PILOT volume control affects ICS audio that is heard in the headset for the flight crew member that is performing the adjustment. Keep in mind that the intercom volumes on the Audio Panels are independent of one another, but the radio volumes are not.*

NOTE: *When the **MAN SQ** Key is pressed, the flight crew is now able to set the ICS squelch manually. If manual squelch is set to full open (SQ annunciated and the small knob turned counterclockwise) background noise is heard in the ICS system as well as during COM transmissions.*

After powering up the system the following steps aid the flight crew in maximizing the use of the Audio Panels as well as prevent flight crew induced issues. These preflight procedures should be performed each time a flight crew boards the aircraft to ensure awareness of all audio levels in the Audio Panels and radios.

Figure 4-20 Audio Panel Controls

Independent radio volume adjustments made using the PFD controls affect only the audio output for each radio selected for adjustment. Radio volume adjustment affects both crew positions equally for each radio that is adjusted. Turning the master volume control located on either Audio Panel affects only the audio heard in the corresponding crew position headset. Thus, radio volume adjustments may be overridden by each crew position independently using the master volume control on the Audio Panel for the respective crew position. The master volume control for each Audio Panel affects all other system audio output for the pilot or copilot headset.

Setting the Audio Panels during preflight:

1) Verify that the **INTR COM** Key is selected.
2) Verify manual squelch is set to minimum.
3) Turn the **MSTR** Knob (Master Volume Control) on both Audio Panels clockwise two full turns. This sets the headset audio level to max volume (least amount of attenuation).
4) Adjust radio volume levels (COM, NAV, etc.) to a suitable level.
5) Adjust the **ICS** volume Knob on each Audio Panel to the desired intercom level.
6) Reset squelch to automatic, or adjust to the appropriate level manually.

Once this procedure has been completed, the master volume controls on both Audio Panels may now be adjusted. The flight crew can change settings, keeping in mind the notes above.

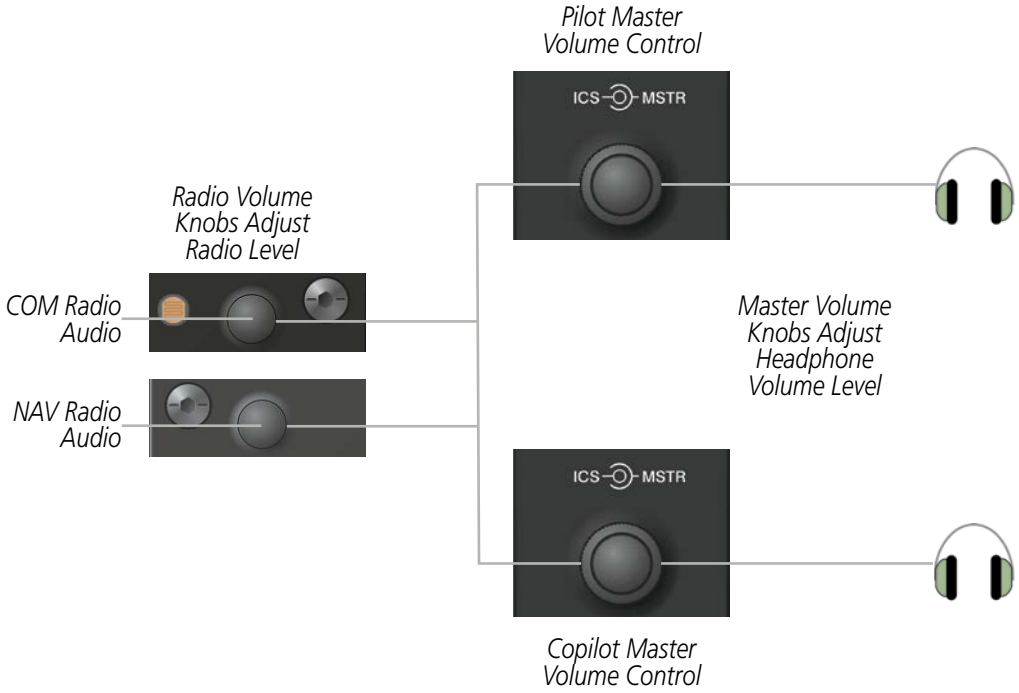


Figure 4-21 Radio and Headphone Volume Controls

4.7 ABNORMAL OPERATION

Abnormal operation includes equipment failures of system components and failure of associated equipment, including switches and external devices.

STUCK MICROPHONE

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

The **COM1 MIC** or **COM2 MIC** Key Annunciator on the Audio Panel flashes as long as the PTT Key remains stuck.

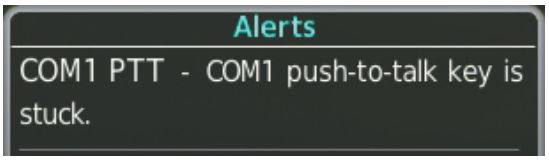


Figure 4-22 Stuck Microphone Alert

COM TUNING FAILURE

In case of a COM system tuning failure, the emergency frequency (121.500 MHz) is automatically tuned in the radio in which the tuning failure occurred.

Figure 4-23 COM Tuning Failure

PFD FAILURE, DUAL SYSTEM

If PFD1 fails, COM1 and NAV1 display a red X on both remaining displays. NAV1 is unavailable. COM1 automatically tunes 121.500 MHz, but the frequency is not shown. The COM1 emergency frequency is available to both the copilot and pilot.

Figure 4-24 Frequency Section of PFD2 Display after PFD1 Failure

If PFD2 fails, COM2 and NAV2 display a red X on the remaining PFD display. NAV2 is unavailable. COM2 tunes 121.500 MHz, but the frequency is not shown. The COM2 emergency frequency is available to both the copilot and pilot.

Figure 4-25 PFD1 Display after PFD2 Failure

AUDIO PANEL FAIL-SAFE OPERATION

If there is a failure of both Audio Panels, a fail-safe circuit connects the pilot's headset and microphone directly to the COM1 transceiver and the copilot's headset directly to the COM2 transceiver. Audio is not available on the speakers. If there is a failure of one Audio Panel, that side only has access to their respective on-side fail-safe COM.

If there is a failure of one Audio Panel, the remaining one does not have access to the others side's COM and NAV. For example, if the pilot side Audio Panel fails, the copilot side Audio Panel has access to all the radios except for COM1 and NAV1.

REVERSIONARY MODE

The red **DISPLAY BACKUP** Button selects the PFD/MFD Reversionary Mode. See the System Overview Section for more information on Reversionary Mode.

SECTION 5 FLIGHT MANAGEMENT

5.1 INTRODUCTION

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

The most prominent part of the system are the three full color displays: two Primary Flight Displays (PFDs) and one Multi Function Display (MFD). The information to successfully navigate the aircraft using the GPS sensors is displayed on the PFDs and the MFD. Detailed descriptions of GPS navigation functions are discussed later in this section.

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

Navigation mode indicates which sensor is providing the course data (e.g., GPS, VOR) and the flight plan phase (e.g., Departure (DPRT), Terminal (TERM), Enroute (ENR), Oceanic (OCN), RNAV Approach (LNAV, LNAV+V, L/VNAV, LP, LP+V, LPV), or Missed Approach (MAPR)). L/VNAV, LP, LP+V, and LPV approach service levels are only available with SBAS.

The Inset Map is a small version of the Navigation Map and can be displayed in the lower left corner of the PFD. When the system is in reversionary mode, the Inset Map is displayed in the lower right corner. The Inset Map is displayed by pressing the **Map/HSI** Softkey, pressing the **Layout** Softkey, then pressing the **Inset Map** Softkey. Pressing the **Map Off** Softkey removes the Inset Map. The HSI Map is also a small version of the Navigation Map and is displayed in the center of the HSI.

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

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

There are 28 different map ranges available, from 250 feet to 1000 nm. Range is indicated in the upper left quadrant of the range ring shown around the aircraft icon. This indicated range is the range from the aircraft icon to the range ring, and roughly half the range to the top edge of the displayed map. To change the map range on any map, turn the **Joystick** counter-clockwise to zoom in (-, decreasing), or clockwise to zoom out (+, increasing).

The Direct-to Window, the Flight Plan Window, the Procedures Window, and the Nearest Airports Window can be displayed in the lower right corner of the PFD. Details of these windows are discussed in detail later in the section.

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

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

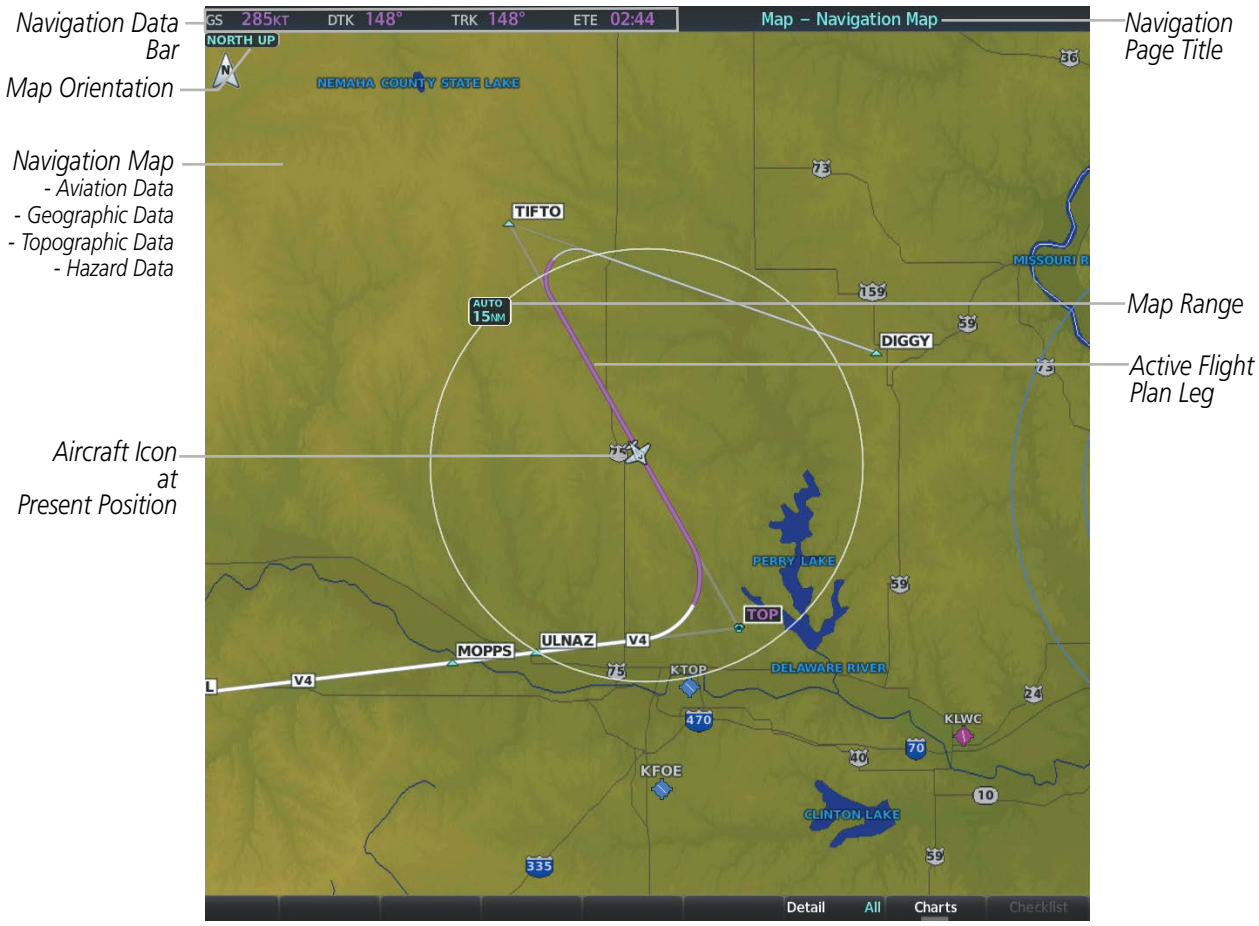


Figure 5-3 GPS Navigation Information on the MFD Navigation Page

NAVIGATION STATUS BOX AND DATA BAR

The Navigation Status Box located at the top of the PFD contains two fields displaying the following information:

Figure 5-4 PFD Navigation Status Box

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

The symbols used in the PFD status box are:

Symbol	Description	Symbol	Description
	Active Leg		Left Holding Pattern
	Direct-to		Vector to Final
	Right Procedure Turn		Right DME Arc/Radius to Fix Leg
	Left Procedure Turn		Left DME Arc/Radius to Fix Leg
	Right Holding Pattern		

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

BRG	Bearing		**FOB**	Fuel on Board
DEST	Destination Airport Identifier		**FOD**	Fuel over Destination
DIS	Distance		**GS**	Ground Speed
DTG	Distance to Go		**ISA**	Temperature at Standard Pressure
DTK	Desired Track		**LDG**	ETA at Final Destination
END	Endurance		**MSA**	Minimum Safe Altitude
ENR	ETE to Final Destination		**TAS**	True Airspeed
ESA	Enroute Safe Altitude		**TKE**	Track Angle Error
ETA	Estimated Time of Arrival		**TRK**	Track
ETE	Estimated Time Enroute		**VSR**	Vertical Speed Required
FLT	Flight Timer		**XTK**	Cross-Track Error

Figure 5-5 MFD Navigation Data Bar

The navigation information displayed in the four data fields can be selected on the MFD Data Bar Fields Box on the Aux-System **Setup 1** Page. The default selections (in order left to right) are GS, DTK, TRK, and ETE.

Changing a field in the MFD Navigation Data Bar:

1) Select the 'Aux - System Setup 1' Page.
2) Press the **FMS** Knob momentarily to activate the flashing cursor.
3) Turn the large **FMS** Knob to highlight the desired field number in the MFD Data Bar Fields Box.
4) Turn the small **FMS** Knob to display and scroll through the data options list to select the desired data.
5) Press the **ENT** Key. Pressing the **Defaults** Softkey returns all fields to the default setting.

5.2 USING MAP DISPLAYS

Map displays are used extensively in the system to provide situational awareness in flight. Most system maps can display the following information:

- Airports, NAVAIDs, airspaces, airways, land data (highways, cities, lakes, rivers, borders, etc.) with names
- Map range
- Wind direction and speed
- Map orientation
- Icons for enabled map features
- Aircraft icon (representing present position)
- Obstacle data (see Section 6: Hazard Avoidance)
- Topography scale
- Map Pointer information (distance and bearing to pointer, location of pointer, name, and other pertinent information)
- Fuel range ring
- Flight plan legs (see Section 5: Flight Management)
- User waypoints
- Track vector
- Terrain
- Topography data

The information in this section applies to the following maps unless otherwise noted:

All Map Group Pages (MAP)
All Waypoint Group Pages (WPT)
Aux - Trip Planning
All Nearest Group Pages (NRST)
Flight Plan Pages (FPL)
Direct-to Window
PFD Map
Procedure Loading Pages

MAP ORIENTATION

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

Figure 5-6 Map Orientation

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

NOTE: *When panning or reviewing active flight plan legs in a non-North Up orientation, the map does not show the map orientation nor the wind direction and speed.*

NOTE: *Map orientation can only be changed on the Navigation Map Page. Any other displays that show navigation data reflect the orientation selected for the Navigation Map Page.*

Changing the Navigation Map orientation:

1) With the Navigation Map Page displayed, press the **MENU** Key. The cursor flashes on the 'Map Settings' option.

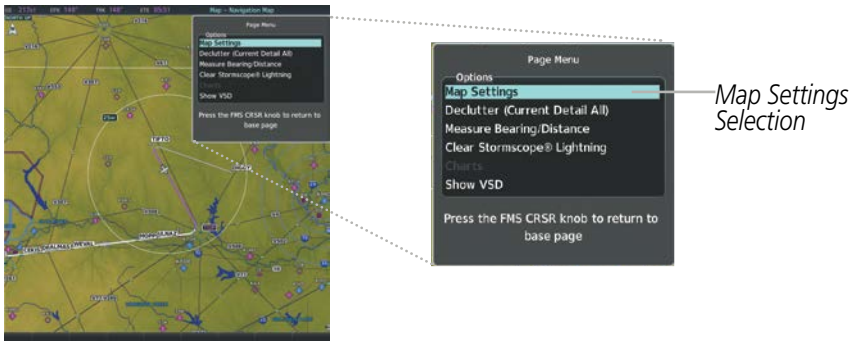


Figure 5-7 Navigation Map Page Menu Window

2) Press the **ENT** Key to display the 'Map Settings' Window.

3) Select the 'Map' group if necessary. Turn the large **FMS** Knob, or press the **ENT** Key once, to select the 'Orientation' field.

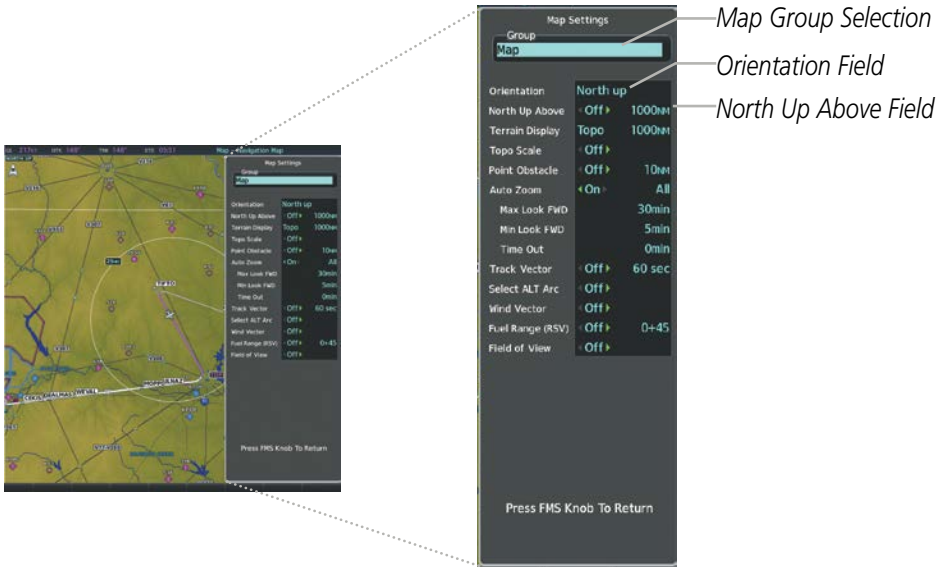


Figure 5-8 Map Settings Menu Window - Map Group

4) Turn the small **FMS** Knob to select the desired orientation.

5) Press the **ENT** Key to select the new orientation.

6) Press the **FMS** Knob to return to the base page.

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

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

1) Press the **MENU** Key with the 'Map - Navigation Map' Page displayed. The cursor flashes on the 'Map Settings' option.
2) Press the **ENT** Key. The 'Map Settings' Window is displayed.
3) Select the 'Map' group.
4) Press the **ENT** Key.
5) Highlight the 'North Up Above' field.
6) Select 'On' or 'Off' using the small **FMS** Knob.
7) Press the **ENT** Key to accept the selected option. The flashing cursor highlights the range field.
8) Use the small **FMS** Knob to select the desired range.
9) Press the **ENT** Key to accept the selected option.
10) Press the **FMS** Knob to return to the Navigation Map Page.

MAP RANGE

There are 28 different map ranges available, from 250 feet to 1000 nm. Range is indicated in the upper left quadrant of the range ring shown around the aircraft icon. This indicated range is the range from the aircraft icon to the range ring, and roughly half the range to the top edge of the displayed map. When the map range is decreased to a point that exceeds the capability of the system to accurately represent the map, a magnifying glass icon is shown to the left of the map range. To change the map range turn the **Joystick** counter-clockwise to decrease the range, or clockwise to increase the range.

Figure 5-9 Map Range

AUTO ZOOM

Auto zoom allows the system to change the map display range to the smallest range clearly showing the active waypoint. Auto zoom can be overridden by adjusting the range with the Joystick, and remains until the active waypoint changes, a terrain or traffic alert occurs, the aircraft takes off, or the manual override times out (timer set on Map Settings Window). Auto zoom is suspended while the map pointer is active.

If a terrain caution or warning occurs, all navigation maps automatically adjust to the smallest map range clearly showing the potential impact areas. If a new traffic advisory alert occurs, any map page 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 returns to the previous auto zoom range based on the active waypoint.

The auto zoom function can be turned on or off independently for the PFD and MFD. Control of the ranges at which the auto zoom occurs is done by setting the minimum and maximum 'look forward' times (set on the Map Settings Window for the Map Group). These settings determine the minimum and maximum distance to display based upon the aircraft's ground speed.

- Waypoints that are long distances apart cause the map range to increase to a point where many details on the map are decluttered. If this is not acceptable, lower the maximum look ahead time to a value that limits the auto zoom to an acceptable range.
- Waypoints that are very short distances apart cause the map range to decrease to a point where situational awareness may not be what is desired. Increase the minimum look ahead time to a value that limits the auto zoom to a minimum range that provides acceptable situational awareness.
- Flight plans that have a combination of long and short legs cause the range to increase and decrease as waypoints sequence. To avoid this, auto zoom can be disabled or the maximum/minimum times can be adjusted.
- The 'time out' time (configurable on the Map Settings Page for the Map Group) determines how long auto zoom is overridden by a manual adjustment of the range knob. At the expiration of this time, the auto zoom range is restored. Setting the 'time out' value to zero causes the manual override to never time out.
- When the maximum 'look forward' time is set to zero, the upper limit becomes the maximum range available (1000 nm).
- When the minimum 'look forward' time is set to zero, the lower limit becomes 1.5 nm.

Configuring automatic zoom:

1) Press the **MENU** Key with the 'Map - Navigation Map' Page displayed. The cursor flashes on the 'Map Settings' option.
2) Press the **ENT** Key. The 'Map Settings' Window is displayed.
3) Select the 'Map' group.
4) Press the **ENT** Key.
5) Highlight the 'Auto Zoom' on/off field, and select 'Off' or 'On' using the small **FMS** Knob.
6) Press the **ENT** Key to accept the selected option. The flashing cursor highlights the 'Auto Zoom' display selection field.
7) Select 'MFD', 'PFD', or 'All' using the small **FMS** Knob.
8) Press the **ENT** Key to accept the selected option. The flashing cursor highlights the 'Max Look FWD' field. Times are from zero to 999 minutes.
9) Use the **FMS** Knobs to set the time. Press the **ENT** Key.
10) Repeat step 9 for 'Min Look FWD' (zero to 99 minutes) and 'Time Out' (zero to 99 minutes).
11) Press the **FMS** Knob to return to the Navigation Map Page.

MAP PANNING

Map panning allows the pilot to:

- View parts of the map outside the displayed range without adjusting the map range
- Highlight and select locations on the map
- Review information for a selected airport, NAVAID or user waypoint
- Designate locations for use in flight planning
- View airspace and airway information

When the panning function is selected by pushing the **Joystick**, the Map Pointer flashes on the map display. A window also appears at the top of the map display showing the latitude/longitude position of the pointer, the bearing and distance to the pointer from the aircraft's present position, and the elevation of the land at the position of the pointer.

Panning the map:

1) With the desired map page displayed, push the **Joystick** to display the Map Pointer.
2) Move the **Joystick** to move the Map Pointer around the map.
3) Push the **Joystick** to remove the Map Pointer and recenter the map on the aircraft's current position.

NOTE: *The map is normally centered on the aircraft's position. If the map has been panned and there has been no pointer movement for about 60 seconds, the map reverts back to centered on the aircraft position and the flashing pointer is removed.*

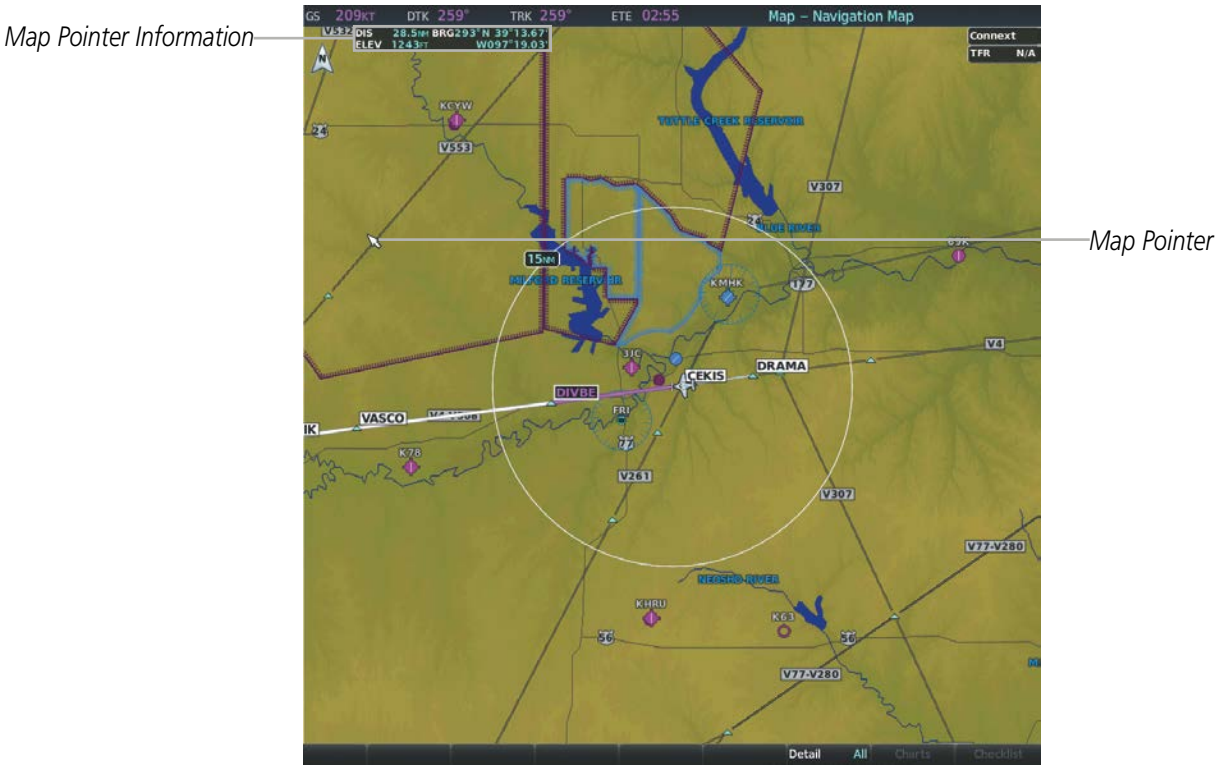


Figure 5-10 Navigation Map - Map Pointer Activated

When the Map Pointer is placed on an object, the name of the object is highlighted (even if the name was not originally displayed on the map). When any map feature or object is selected on the map display, pertinent information is displayed.

Figure 5-11 Navigation Map - Map Pointer on Point of Interest

When the Map Pointer crosses an airspace boundary, the boundary is highlighted and airspace information is shown. The information includes the name and class of airspace, the ceiling in feet above Mean Sea Level (MSL), and the floor in feet MSL.

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

1) With the desired map page displayed, push the **Joystick** to display the Map Pointer and place the Map Pointer on a waypoint.
2) Press the **ENT** Key to display the Waypoint Information Page for the selected waypoint.
3) Select the **Go Back** Softkey, the **CLR** Key, or the **ENT** Key to exit the Waypoint Information Page and return to the Navigation Map showing the selected waypoint.

When the Map Pointer crosses an airspace boundary, the boundary is highlighted and airspace information is shown. The information includes the name and class of airspace, the ceiling in feet above Mean Sea Level (MSL), and the floor in feet MSL.

Reviewing information for a special-use or controlled airspace:

1) With the desired map page displayed, push the **Joystick** to display the Map Pointer and place the Map Pointer on an open area within the boundaries of an airspace. (As the Map Pointer crosses the airspace boundary, the boundary is highlighted and airspace information is shown.)
2) Press the **ENT** Key to display an options menu.
3) 'Review Airspaces' should already be highlighted, if not select it. Press the **ENT** Key to display the 'Information' Window for the selected airspace.
4) Press the **FMS** Knob, the **CLR** Key, or the **ENT** Key to exit the 'Information' Window.

MEASURING BEARING AND DISTANCE

Distance and bearing from the aircraft's present position to any point on the viewable navigation map may be calculated using the 'Measure Bearing/Distance' selection from Navigation Map page menu. The bearing and distance tool displays a dashed Measurement Line and a Measure Pointer to aid in graphically identifying points with which to measure. Lat/Long, distance and elevation data for the Measure Pointer is provided in a window at the top of the navigation map.

Measuring bearing and distance between any two points:

1) Press the **MENU** Key (with the 'Map - Navigation Map' Page displayed).
2) Highlight the 'Measure Bearing/Distance' field.
3) Press the **ENT** Key. A Measure Pointer is displayed on the map at the aircraft's present position.
4) Move the **Joystick** to place the reference pointer at the desired location. The bearing and distance are displayed at the top of the map. Elevation at the current pointer position is also displayed. Pressing the **ENT** Key changes the starting point for measuring.
5) To exit the Measure Bearing/Distance option, push the **Joystick**; or select 'Stop Measuring' from the Page Menu and press the **ENT** Key.

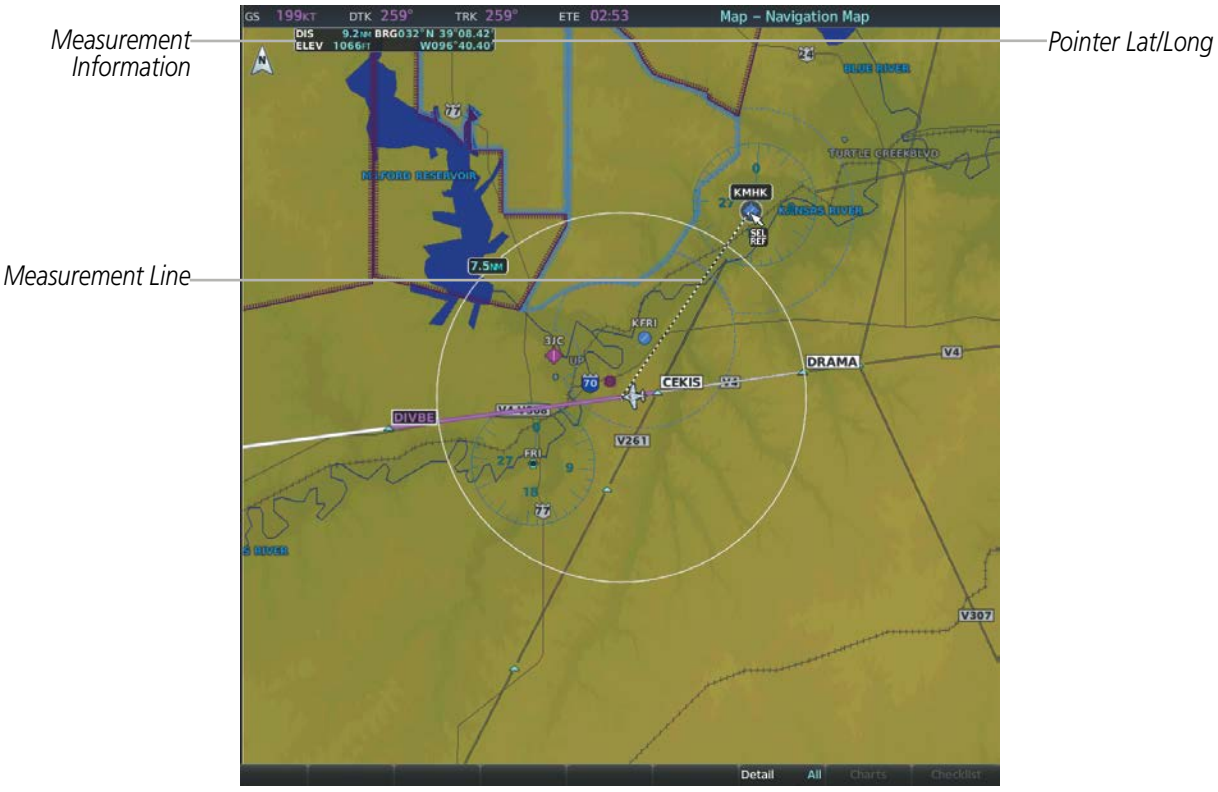


Figure 5-12 Navigation Map - Measuring Bearing and Distance

TOPOGRAPHY

All navigation maps can display various shades of topography colors representing land elevation, similar to aviation sectional charts. Topographic data can be displayed or removed as described in the following procedures. Topographic data can also be displayed on the selectable profile map at the bottom of the navigation map.

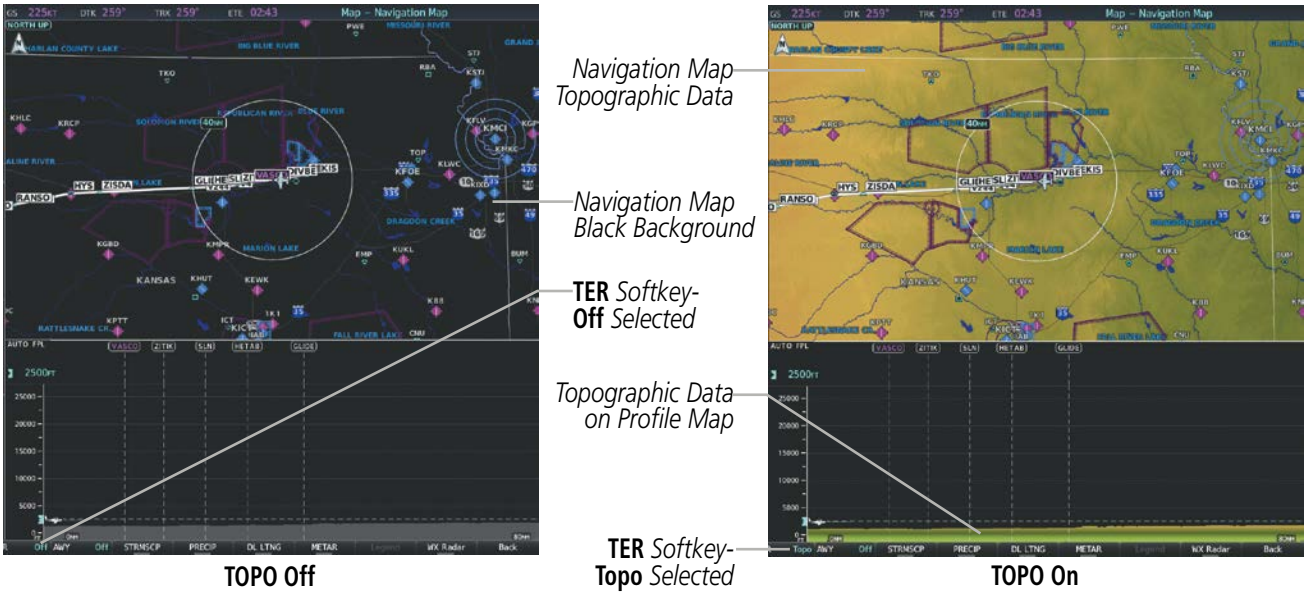


Figure 5-13 Navigation Map - Topographic Data

Displaying/removing topographic data on all MFD pages displaying navigation maps:

1) With the desired map page displayed, select the **Map Opt** Softkey.
2) Select the **TER** Softkey until 'Topo' is shown on the softkey to display topographic data.
3) Select the **TER** Softkey until 'Off' is shown on the softkey to remove topographic data from the navigation map. When topographic data is removed from the page, all navigation data is presented on a black background.

Displaying/removing topographic data on the PFD Map:

1) Select the **Map/HSI** Softkey on the PFD.
2) Select the **TER** Softkey until 'Topo' is shown on the softkey to display topographic data.
3) Select the **TER** Softkey until 'Off' is shown on the softkey to remove topographic data from the navigation map. When topographic data is removed from the page, all navigation data is presented on a black background.

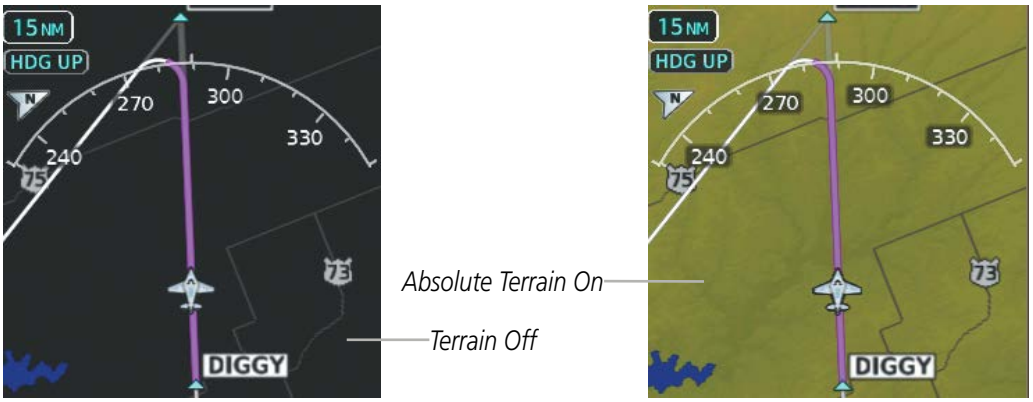


Figure 5-14 PFD Inset Map - Absolute Terrain Data

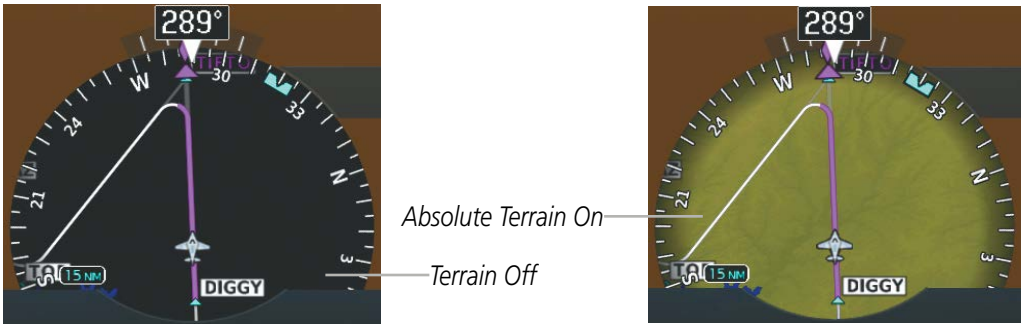


Figure 5-15 HSI Map - Absolute Terrain Data

Displaying/removing topographic data using the Navigation Map Page Menu:

1) Press the **MENU** Key with the 'Map - Navigation Map' Page displayed. The cursor flashes on the 'Map Settings' option.
2) Press the **ENT** Key. The 'Map Settings' Window is displayed.
3) Select the 'Map' group.
4) Press the **ENT** Key.
5) Highlight the 'Terrain Display' field.
6) Select 'Topo' or 'Off'.
7) Press the **FMS** Knob to return to the 'Map - Navigation Map' Page.

The topographic data range is the maximum map range on which topographic data is displayed.

NOTE: *Since the PFD Map is much smaller than the MFD navigation maps, items are removed on the PFD Map two range levels smaller than the range selected in the Map Settings pages (e.g., a setting of 100 nm removes the item at ranges above 100 nm on MFD navigation maps, while the PFD Map removes the same item at 50 nm).*

Selecting a topographical data range (Terrain Display):

1) Press the **MENU** Key with the 'Map - Navigation Map' Page displayed. The cursor flashes on the 'Map Settings' option.
2) Press the **ENT** Key. The 'Map Settings' Window is displayed.
3) Select the 'Map' group.
4) Press the **ENT** Key.
5) Highlight the 'Terrain Display' range field. Ranges are from 1 nm to 1000 nm.
6) To change the Terrain Display range setting, turn the small **FMS** Knob to display the range list.
7) Select the desired range using the small **FMS** Knob.
8) Press the **ENT** Key.
9) Press the **FMS** Knob to return to the 'Map - Navigation Map' Page.

In addition, the Navigation Map can display a topographic scale (located in the lower right hand side of the map) showing a scale of the terrain elevation and minimum/maximum displayed elevations.

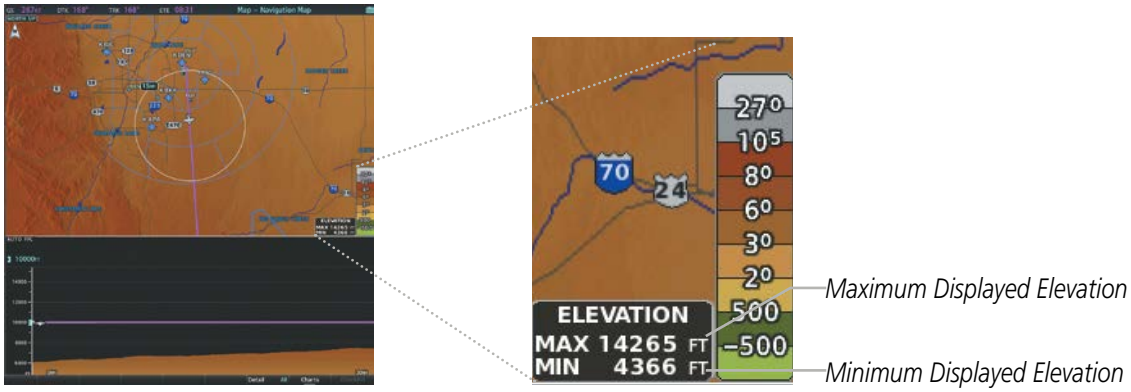


Figure 5-16 Navigation Map - TOPO SCALE

Displaying/removing the topographic scale (Topo Scale):

1) Press the **MENU** Key with the 'Map - Navigation Map' Page displayed. The cursor flashes on the 'Map Settings' option.
2) Press the **ENT** Key. The 'Map Settings' Window is displayed.
3) Select the 'Map' group and select the **ENT** Key.
4) Highlight the 'Topo Scale' field.
5) Select 'On' or 'Off'.
6) Press the **FMS** Knob to return to the Navigation Map Page.

MAP SYMBOLS

This section discusses the types of land and aviation symbols that can be displayed. Each listed type of symbol can be turned on or off, and the maximum range to display each symbol can be set. The decluttering of the symbols from the map using the **Detail** Softkey is also discussed.

LAND SYMBOLS

The following items are configured on the land menu:

Land Symbols	Symbol	Default Range (nm)	Maximum Range (nm)
User Waypoint		25	40
Highways and Roads			
Interstate Highway (Freeway)		50	400
International Highway (Freeway)		50	400
US Highway (National Highway)		15	150
State Highway (Local Highway)		2.5	100
Local Road (Local Road)	N/A	4	25
Railroads (RAILROAD)		7.5	25
Large City (> 200,000)		100	1000
Medium City (> 50,000)		50	400
Small City (> 5,000)		25	100
State/Province		400	1000
River/Lake		75	100
Latitude/Longitude (LAT/LON)		1	1000

Table 5-1 Land Symbol Information

AVIATION SYMBOLS

The following items are configured on the aviation menu:

Aviation Symbols	Symbol	Default Range (nm)	Maximum Range (nm)
Large Airport (Longest Runway ≥ 8100 ft)		100	1000
Medium Airport (8100 ft > Longest Runway ≥ 5000 ft)		50	400
Small Airport (Longest Runway < 5000 ft) (Medium Airport if it has a tower frequency)		25	150
Taxiways (SafeTaxi)	See Additional Features	1.5	5
Runway Extension		7.5	150
Missed Approach Preview On/Off (Missed APR)	N/A	N/A	N/A
Intersection (INT)		25	40
Non-directional Beacon (NDB)		25	50
VOR		50	250
VOR Compass Rose On/Off	N/A	N/A	N/A
Visual Reporting Point (VRP)		25	1000
Temporary Flight Restriction (TFR)		250	1000
VNAV Constraints		1000	1000

Table 5-2 Aviation Symbol Information

AIRSPACE SYMBOLS

The following items are configured on the airspace menu:

Airspace Symbols	Symbol	Default Range (nm)	Maximum Range (nm)
Smart Airspace On/Off	N/A	N/A	N/A
Airspace Altitude Labels (Airspace ALT LBL) On/Off	N/A	N/A	N/A
Class B Airspace Altitude Label (ceiling/floor)		N/A	N/A
Class C Airspace Altitude Label (ceiling/floor)		N/A	N/A
Class D Airspace Altitude Label (ceiling)		N/A	N/A
Class B Airspace/TMA (CLASS B/TMA)		50	150
Class C Airspace/TCA (CLASS C/TCA)		50	100
Class D Airspace (CLASS D)		10	100
Restricted Area (RESTRICTED)		50	100
Military Operations Area [MOA(MILITARY)]		50	250
Other/Air Defense Interdiction Zone (OTHER/ADIZ)		50	250

Table 5-3 Airspace Symbol Information

SYMBOL SETUP

All navigation maps can display land, aviation and airspace symbols. Symbol types (e.g. runway extensions, railroads) can be removed individually. The range sets the maximum range at which items appear on the display. For example, enabling "Runway Extension" displays a dashed line on the map extending from each runway of an airport in the flight plan when the range is set at or below the value of the map settings option.

Setting up the 'Land', 'Aviation' or 'Airspace' group items:

1) Press the **MENU** Key with the 'Map - Navigation Map' Page displayed. The cursor flashes on the 'Map Settings' option.
2) Press the **ENT** Key. The 'Map Settings' Window is displayed.
3) Turn the small **FMS** Knob to select the desired group.
4) Press the **ENT** Key. The cursor flashes on the first field.
5) Turn the large **FMS** Knob to select the desired option.
6) Turn the small **FMS** Knob to select the desired setting (e.g. On/Off or maximum range).
7) Press the **ENT** Key to accept the selected option and move the cursor to the next item.
8) Repeat steps 5-7 as necessary.
9) Press the **FMS** Knob to return to the 'Map - Navigation Map' Page.

MAP DECLUTTER

The declutter feature allows the pilot to progressively step through four levels of removing map information. The declutter level is displayed in the **Detail** Softkey and next to the Declutter Menu Option.

Decluttering the map:

Select the **Detail** Softkey with the 'Map - Navigation Map' Page displayed. The current declutter level is shown. With each softkey press, another level of map information is removed.

Or:

1) Press the **MENU** Key with the 'Map - Navigation Map' Page displayed.
2) Select 'Declutter'. The current declutter level is shown.
3) Press the **ENT** Key.

Decluttering the PFD Map:

1) Select the **Map/HSI** Softkey on the PFD.
2) Select the **Detail** Softkey. The current declutter level is shown. With each selection, another level of map information is removed.

Table 5-4 lists the items that are decluttered at each map detail level. The 'X' represents map items decluttered for each level of detail.

Item	Detail 3	Detail 2	Detail 1
Data Link Radar Precipitation			X
Data Link Lightning			X
Graphical METARs			X
Airports			X
Safe Taxi			X
Runway Labels			X
TFRs			X
Restricted			X
MOA (Military)			X
Intersections		X	X
NDBs		X	X
VORs		X	X
VRPs		X	X
User Waypoints		X	X
Latitude/Longitude Grid		X	X
NAVAIDs (does not declutter if used to define airway)		X	X
Intersections (does not declutter if used to define airway)		X	X
Class B Airspaces/TMA		X	X
Class C Airspaces/TCA		X	X
Class D Airspaces		X	X
Other Airspaces/ADIZ		X	X
Obstacles		X	X
Cities	X	X	X
Roads	X	X	X
Railroads	X	X	X
State/Province Boundaries	X	X	X

Table 5-4 Navigation Map Items Decluttered for each Detail Level

AIRWAYS

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

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

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

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

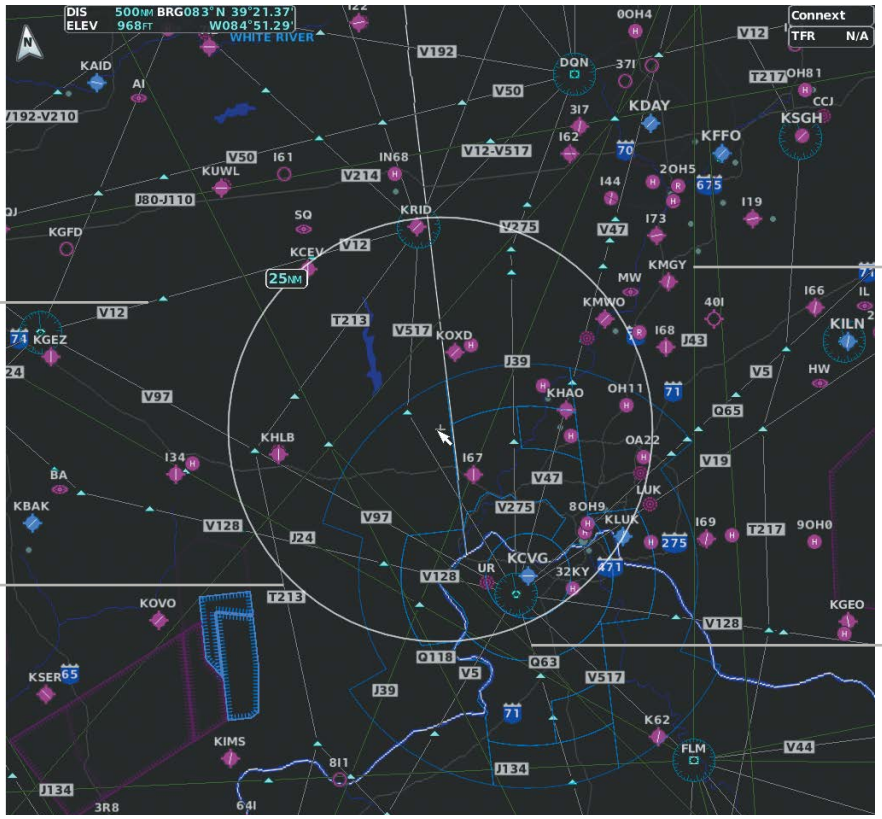


Figure 5-17 Airways on MFD Navigation Page

Airways may be displayed on the map at the pilot's discretion using either a combination of **AWY** Softkey presses, or menu selections using the **MENU** Key from the Navigation Map Page. The Airway range can also be programmed to only display Airways on the MFD when the map range is at or below a specific number.

Displaying/removing airways:

1) With the desired map page displayed, select the **Map Opt** Softkey.
2) Select the **AWY** Softkey. Both High and Low Altitude Airways are displayed (AWY On).
3) Select the softkey again to display Low Altitude Airways only (AWY LO).
4) Select the softkey again to display High Altitude Airways only (AWY HI).
5) Select the softkey again to remove High Altitude Airways. No airways are displayed (AWY Off).

Or:

1) Press the **MENU** Key with the 'Map - Navigation Map' Page displayed. The cursor flashes on the 'Map Settings' option.
2) Press the **ENT** Key. The 'Map Settings' Window is displayed.
3) Turn the small **FMS** Knob to select the 'Airways' group, and press the **ENT** Key.
4) Turn the large **FMS** Knob to highlight the desired ALT Airways 'On/Off' field.
5) Turn the **FMS** Knob to select 'Off' or 'On'.
6) Press the **FMS** Knob to return to the 'Map - Navigation Map' Page.

The airway range is the maximum map range on which airways are displayed.

Selecting an airway range (Low ALT Airways or High ALT Airways):

1) Press the **MENU** Key with the 'Map - Navigation Map' Page displayed. The cursor flashes on the 'Map Settings' option.
2) Press the **ENT** Key. The 'Map Settings' Window is displayed.
3) Turn the small **FMS** Knob to select the 'Airways' group, and press the **ENT** Key.
4) Highlight the 'Low ALT Airways' or 'High ALT Airways' range Field.
5) To change the range setting, turn the small **FMS** Knob to display the range list.
6) Select the desired range using the small **FMS** Knob.
7) Press the **ENT** Key.
8) Press the **FMS** Knob to return to the Navigation Map Page.

The following items are configured on the airways menu:

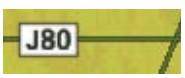
Airways Symbols	Symbol	Default Range (nm)	Maximum Range (nm)
Low Altitude Airways (V Routes and T Routes)		50	100
High Altitude Airways (J Routes and Q Routes)		50	100

Table 5-5 Airways Symbol Information

ADDITIONAL NAVIGATION MAP ITEMS

Navigation maps can display some additional items. These items (e.g. selected altitude intercept arc, track vector, wind vector, fuel range ring, and SVT field of view) can be displayed/removed individually.

Setting up additional 'Map' group items:

1) Press the **MENU** Key with the 'Map - Navigation Map' Page displayed. The cursor flashes on the 'Map Settings' option.
2) Press the **ENT** Key. The 'Map Settings' Window is displayed.
3) Turn the small **FMS** Knob to select the 'Map' group.
4) Press the **ENT** Key. The cursor flashes on the first field.
5) Turn the large **FMS** Knob to select the desired option.
6) Turn the small **FMS** Knob to select 'On' or 'Off'.

   Or:

   If it is a data field, use the **FMS** Knob to select the range or time value.
7) Press the **ENT** Key to accept the selected option and move the cursor to the next item.
8) Repeat steps 5-7 as necessary.
9) Press the **FMS** Knob to return to the 'Map - Navigation Map' Page.

SELECTED ALTITUDE INTERCEPT ARC

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

Figure 5-18 Navigation Map - Range to Altitude Arc

TRACK VECTOR

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

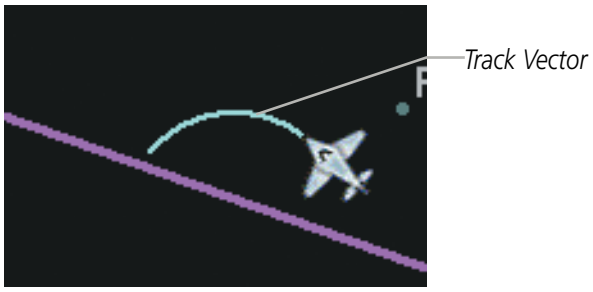


Figure 5-19 Navigation Map -Track Vector

WIND VECTOR

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

Figure 5-20 Navigation Map - Wind Vector

NOTE: *The wind vector is not displayed until the aircraft is moving. It is not displayed on the Waypoint Information pages.*

FUEL RANGE RING

The map can display a fuel range ring which shows the remaining flight distance. A dashed green circle indicates the selected range to reserve fuel. A solid green circle indicates the total endurance range. If only reserve fuel remains, the range is indicated by a solid amber circle.

Figure 5-21 Navigation Map - Fuel Range Ring

FIELD OF VIEW (SVT)

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

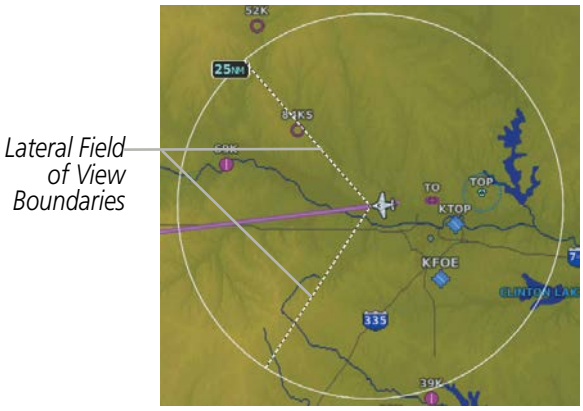


Figure 5-22 Navigation Map - Field of View

IFR/VFR CHARTS

The system can display GPS navigation information on a VFR chart, a low altitude IFR chart, or a high altitude IFR chart. The information overlaid on the IFR/VFR Charts is selected and setup on the Navigation Map, but the IFR/VFR charts will not display some of the selected items. Only the following items will be overlaid on the chart:

- Map Pointer (distance and bearing to pointer, location of pointer, name, and other pertinent information)
- Map Range (17 range choices from 1 nm to 150 nm)
- Map Orientation (always North Up for IFR/VFR Charts)
- Aircraft Icon (representing present position)
- Wind Direction and Speed
- Icons for enabled map features (Traffic only)
- Flight Plan Legs
- Track Vector
- Runway Extension
- Missed Approach Preview
- Intersections (only as part of active flight plan)
- Visual Reporting Points
- VNAV Constraints
- Selected Altitude Intercept Arc

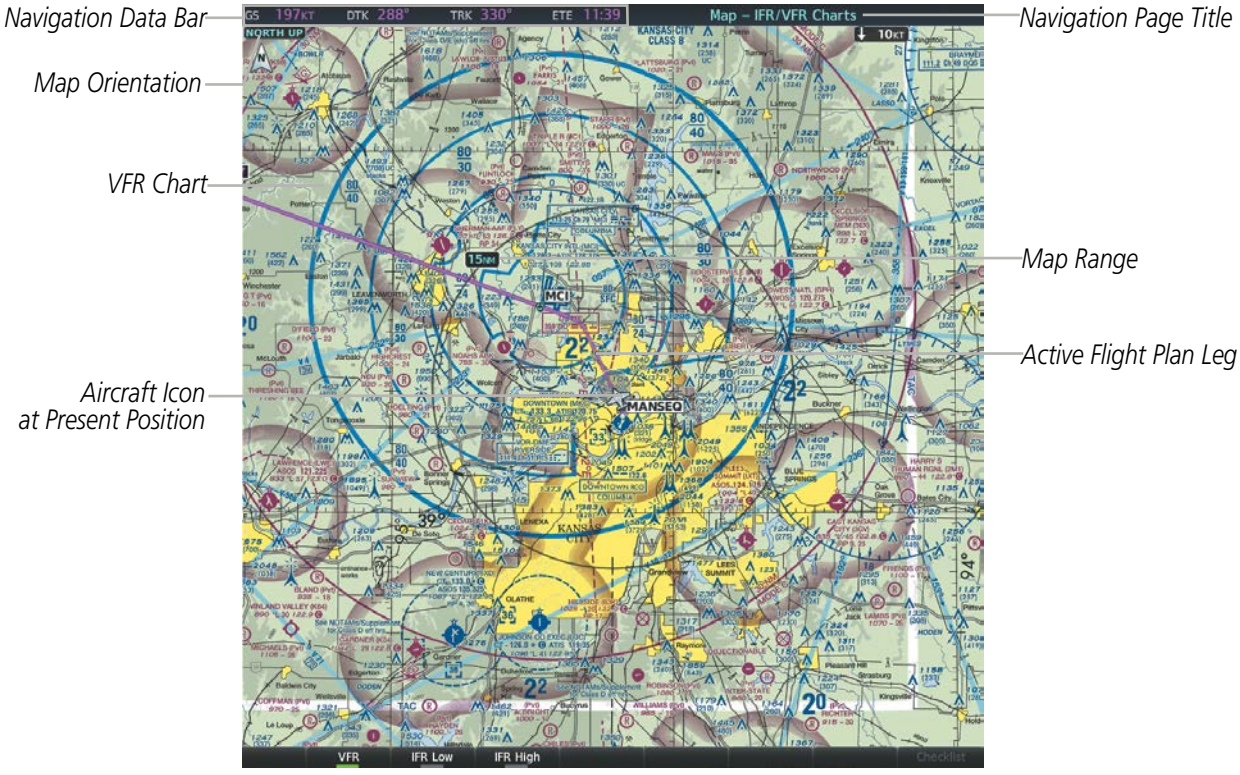


Figure 5-23 GPS Navigation Information on the VFR Chart

Figure 5-24 GPS Navigation Information on the IFR Low Altitude Chart

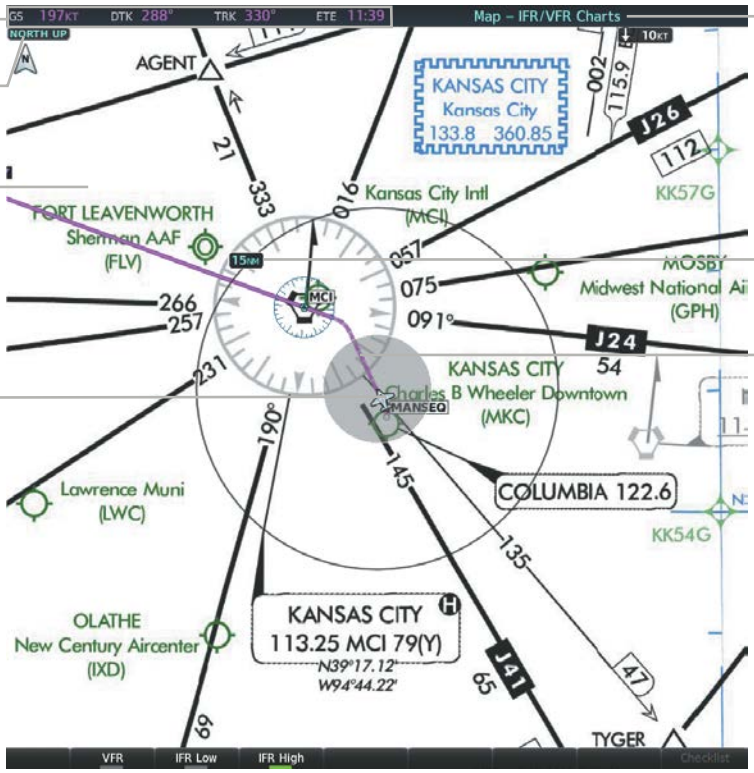


Figure 5-25 GPS Navigation Information on the IFR High Altitude Chart

Map panning on the IFR/VFR Charts works the same as on the Navigation Map. Map range selected on either the Navigation Map or the IFR/VFR Charts applies to both. However, if the range selected on the Navigation Map it is not a valid chart range, the chart is shown with a range of 7.5 nm.

Modifying the chart settings:

1) Press the **MENU** Key with the IFR Low / IFR High Chart displayed. The cursor flashes on the 'Settings' option.
2) Press the **ENT** Key. The cursor flashes on the 'Color Scheme' setting.
3) Turn the small **FMS** Knob to select 'Day', 'Auto', or 'Night'. The IFR Chart display changes to reflect the setting.
4) If 'Auto' was selected, turn the large **FMS** Knob to select the backlight threshold field (sets value for automatic day/night switching).

Selecting the chart to display:

1) Press the **MENU** Key with the 'Map - IFR/VFR Charts' Page displayed.
2) Turn the **FMS** Knob to highlight the 'Display VFR' Field, the 'Display IFR Low' Field, or the 'Display IFR High' Field.
3) Press the **ENT** Key. The selected chart is displayed.

5.3 WAYPOINTS

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

Communication and navigation frequencies can be tuned "automatically" from various Waypoint Information (WPT) pages, Nearest (NRST) pages, and the Nearest Airports Window (on PFD). This auto-tuning feature simplifies frequency entry over manual tuning. Refer to the Audio Panel and CNS section for details on auto-tuning.

Waypoints can be selected by entering the ICAO identifier, entering the name of the facility, or by entering the city name. See the System Overview section for detailed instructions on entering data in the system. As a waypoint identifier, facility name, or location is entered, the Spell'N'Find feature scrolls through the database, displaying those waypoints matching the characters which have been entered to that point. A direct-to navigation leg to the selected waypoint can be initiated by pressing the **Direct-to** Key on any of the waypoint pages.

Figure 5-26 Waypoint Information Window

If duplicate entries exist for the entered facility name or location, additional entries may be viewed by continuing to turn the small **FMS** Knob during the selection process. If duplicate entries exist for an identifier, a Duplicate Waypoints Window is displayed when the **ENT** Key is pressed.

Figure 5-27 Waypoint Information Window - Duplicate Identifier

AIRPORTS

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

The Airport Information Page is the first page in WPT group and allows the pilot to view airport information, load frequencies (COM, NAV, and lighting), review runways, and review instrument procedures that may be involved in the flight plan. See the Audio Panel and CNS Section for more information on loading frequencies (auto-tuning). After engine startup, the Airport Information Page defaults to the airport where the aircraft is located. After a flight plan has been loaded, it defaults to the destination airport. On a flight plan with multiple airports, it defaults to the airport which is the current active waypoint.

In addition to displaying a map of the currently selected airport and surrounding area, the Airport Information Page displays airport information in three boxes labeled 'Airport', 'Runways', and 'Frequencies'. For airports with multiple runways, information for each runway is available. This information is viewed on the Airport Information Page by pressing the **Info** softkey until 1 is displayed.

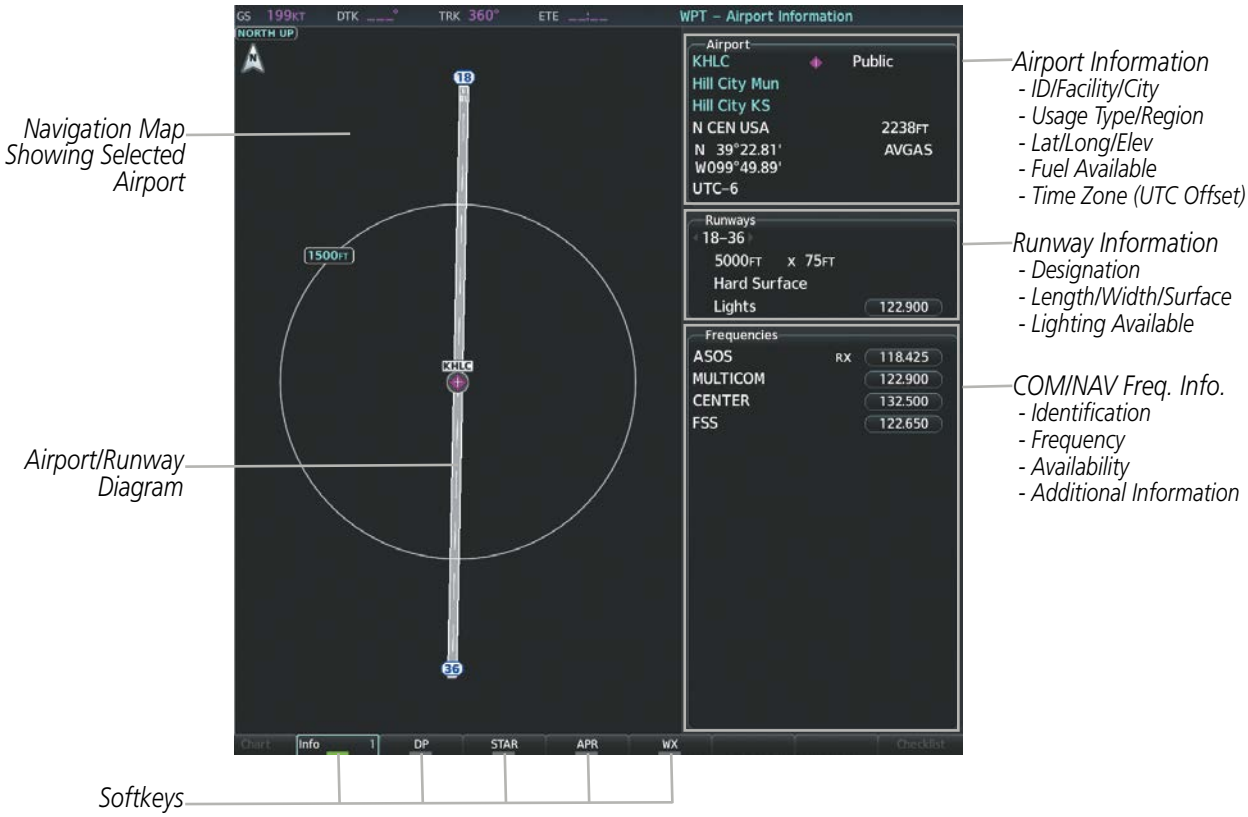


Figure 5-28 Airport Information Page

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

- Usage type: Public, Military, Private, or Heliport
- Runway surface type: Hard, Turf, Sealed, Gravel, Dirt, Soft, Unknown, or Water
- Runway lighting type: No Lights, Part Time, Full Time, Unknown, or PCL Freq (for pilot-controlled lighting)
- COM Availability: TX (transmit only), RX (receive only), PT (part time), i (additional information available)

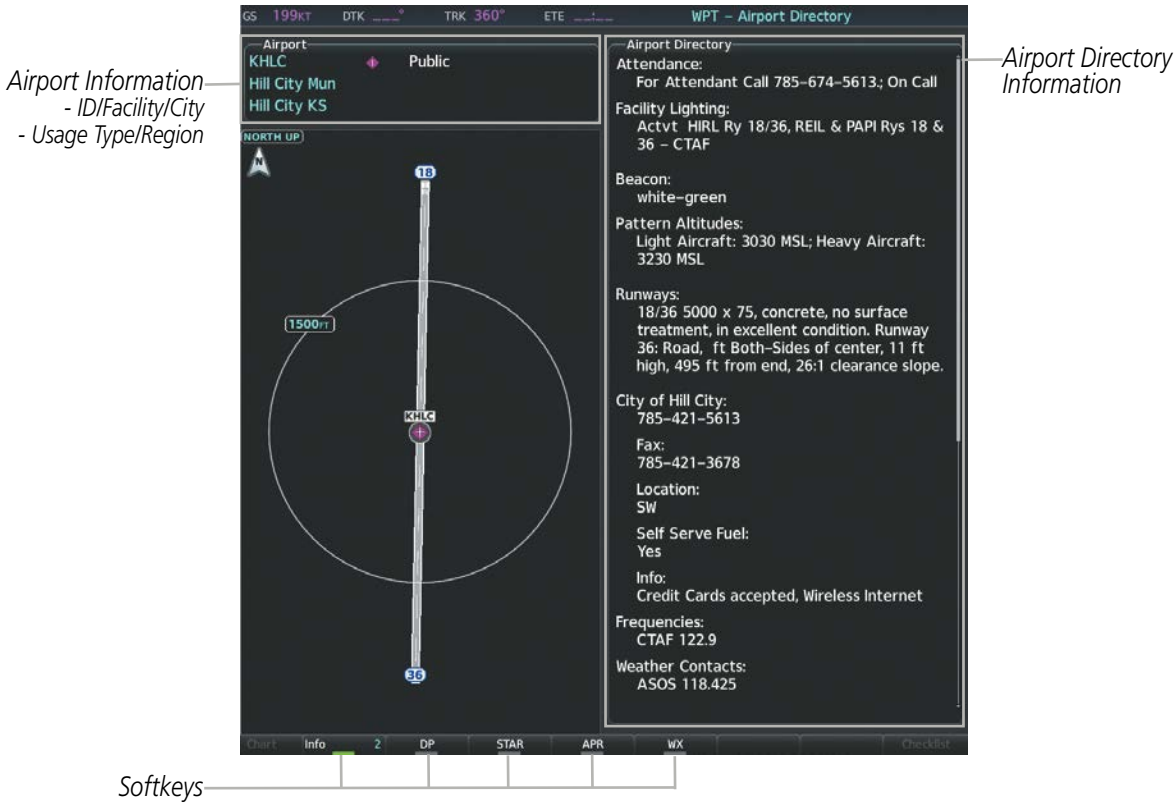


Figure 5-29 Airport Directory Page Example

The airport directory information is viewed on the Airport Directory Page by pressing the **Info** Softkey until 2 is displayed. The following are types of airport directory information shown (if available) on the Airport Directory Page:

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

Selecting an airport for review by identifier, facility name, or location:

1) From the 'WPT - Airport Information' Page, press the **FMS** Knob.
2) Use the **FMS** Knobs and enter an identifier, facility name, or location.
3) Press the **ENT** Key.
4) Press the **FMS** Knob to remove the cursor.

Selecting a runway:

1) With the 'WPT - Airport Information' Page 1 displayed, press the **FMS** Knob to activate the cursor.
2) Turn the large **FMS** Knob to place the cursor in the 'Runways' Box, on the runway designator.
3) Turn the small **FMS** Knob to display the desired runway (if more than one) for the selected airport.
4) To remove the flashing cursor, press the **FMS** Knob.

Viewing a destination airport:

From the 'WPT - Airport Information' Page press the **MENU** Key. Highlight 'View Destination Airport' and press the **ENT** Key. The Destination Airport is displayed.

The Airport Frequencies Box uses the descriptions and abbreviations listed in the following table:

Communication Frequencies			Navigation Frequencies
Approach *	Control	Pre-Taxi	ILS
Arrival *	CTA *	Radar	LOC
ASOS	Departure *	Ramp	
ATIS	Gate	Terminal *	
AWOS	Ground	TMA *	
Center	Helicopter	Tower	
Class B *	Multicom	TRSA *	
Class C *	Other	Unicom	
Clearance			
* May include Additional Information			

Table 5-6 Airport Frequency Abbreviations

A departure, arrival, or approach can be loaded using the softkeys on the Airport Information Page. See the Procedures section for details. METARs or TAFs applicable to the selected airport can be selected for display (see the Hazard Avoidance section for details about weather).

The system provides a **Nearest** Softkey on the PFD, which gives the pilot quick access to nearest airport information (very useful if an immediate landing is required). The Nearest Airports Window displays a list of up to 25 of the nearest airports (three entries can be displayed at one time). If there are more than three they are displayed in a scrollable list. If there are no nearest airports available, "None Within 200nm" is displayed.

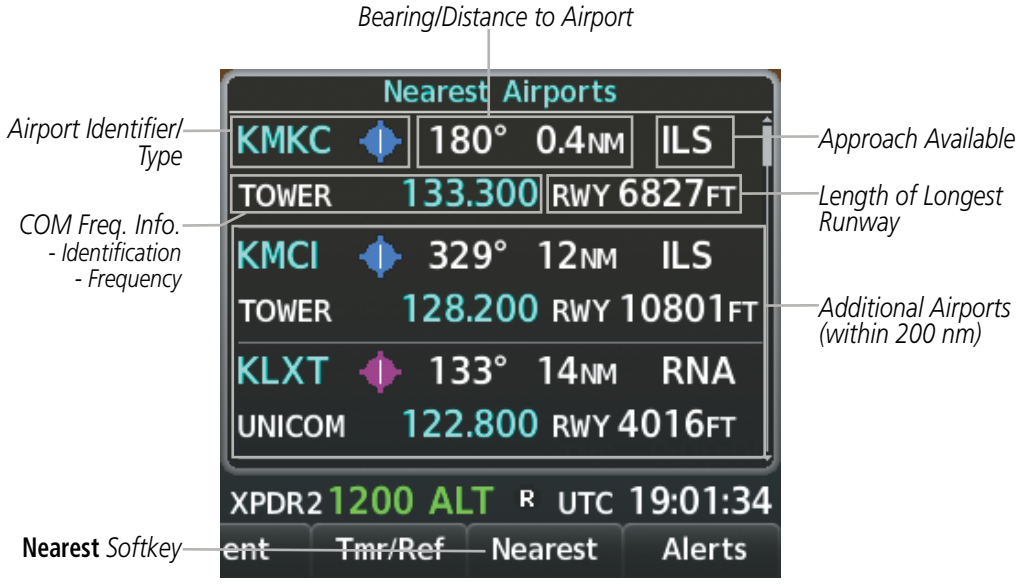


Figure 5-30 Nearest Airports Window on PFD

With the Nearest Airports Window displayed, pressing the **ENT** Key displays the PFD Airport Information Window for the highlighted airport. Pressing the **ENT** Key again returns to the Nearest Airports Window with the cursor on the next airport in the list. Continued presses of the **ENT** Key sequences through the information pages for all airports in the Nearest Airports list.

Figure 5-31 Airport Information Window on PFD

Viewing information for a nearest airport on the PFD:

1) Select the **Nearest** Softkey to display the 'Nearest Airports' Window.
2) Highlight the airport identifier with the **FMS** Knob and press the **ENT** Key to display the 'Airport Information' Window.
3) To return to the 'Nearest Airports' Window press the **ENT** Key (with the cursor on 'BACK') or press the **CLR** Key. The cursor is now on the next airport in the nearest airports list. (Repeatedly pressing the **ENT** Key moves through the airport list, alternating between the 'Nearest Airports' Window and the 'Airport Information' Window.)
4) Press the **CLR** Key or select the **Nearest** Softkey to close the PFD 'Nearest Airports' Window.

The Nearest Airports Page on the MFD is first in the group of NRST pages because of its potential use in the event of an in-flight emergency. In addition to displaying a map of the currently selected airport and surrounding area, the page displays nearest airport information in five boxes labeled 'Nearest Airports', 'Information', 'Runways', 'Frequencies', and 'Approaches'.

The selected airport is indicated by a white arrow, and a dashed white line is drawn on the navigation map from the aircraft position to the nearest airport. Up to five nearest airports, one runway, up to seven frequencies, and up to eight approaches are visible at one time. If there are more than can be shown, each list can be scrolled. If there are no items for display in a boxed area, text indicating that fact is displayed. The currently selected airport remains in the list until it is unselected.

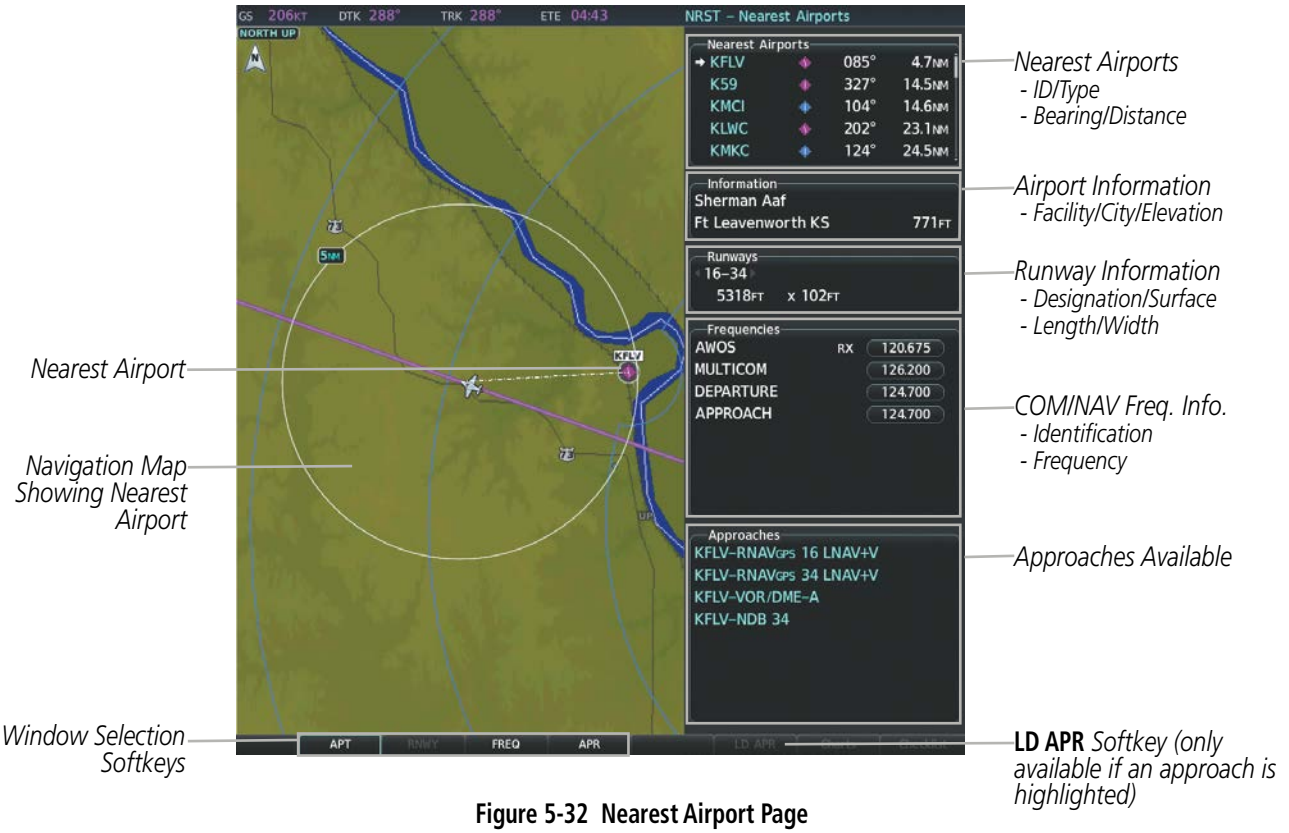


Figure 5-32 Nearest Airport Page

Viewing information for a nearest airport on the MFD:

1) Turn the large **FMS** Knob to select the NRST page group.
2) Turn the small **FMS** Knob to select the 'NRST - Nearest Airports' Page (it is the first page of the group, so it may already be selected). If there are no Nearest Airports available, 'None Within 200nm' is displayed.
3) Select the **APT** Softkey; or press the **FMS** Knob; or press the **MENU** Key, highlight 'Select Airport Window' and press the **ENT** Key. The cursor is placed in the 'Nearest Airports' Box. The first airport in the nearest airports list is highlighted.
4) Turn the **FMS** Knob to highlight the desired airport. (Pressing the **ENT** Key also moves to the next airport.)
5) Press the **FMS** Knob to remove the flashing cursor.

Viewing runway information for a specific airport:

1) With the 'NRST - Nearest Airports' Page displayed, select the **RNWY** Softkey; or press the **MENU** Key, highlight 'Select Runway' Window; and press the **ENT** Key. The cursor is placed in the 'Runways' Box.
2) Turn the small **FMS** Knob to select the desired runway.
3) Press the **FMS** Knob to remove the flashing cursor.

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

The Nearest Airports Box on the System Setup Page defines the minimum runway length and surface type used when determining the 25 nearest airports to display on the MFD Nearest Airports Page. A minimum runway length and/or surface type can be entered to prevent airports with small runways or runways that are not appropriately surfaced from being displayed. Default settings are 3000 feet (or meters) for runway length and 'Hard Only' for runway surface type.

Selecting nearest airport surface and minimum runway length matching criteria:

1) Use the **FMS** Knob to select the 'Aux - System **Setup 1**' Page.
2) Press the **FMS** Knob momentarily to activate the flashing cursor.
3) Turn the large **FMS** Knob to highlight the 'Runway Surface' Field in the 'Nearest Airport' Box.
4) Turn the small **FMS** Knob to select the desired runway option (Any, Hard Only, Hard/Soft, Water).
5) Press the **ENT** Key. The cursor moves to the 'Minimum Length' Field in the 'Nearest Airport' Box.
6) Use the **FMS** Knob to enter the minimum runway length (zero to 25,000 feet) and press the **ENT** Key.
7) Press the **FMS** Knob to remove the flashing cursor.

INTERSECTIONS

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

The Intersection Information Page is used to view information about intersections. In addition to displaying a map of the currently selected intersection and surrounding area, the Intersection Information Page displays intersection information in three boxes labeled 'Intersection', 'Information', and 'Nearest VOR'.

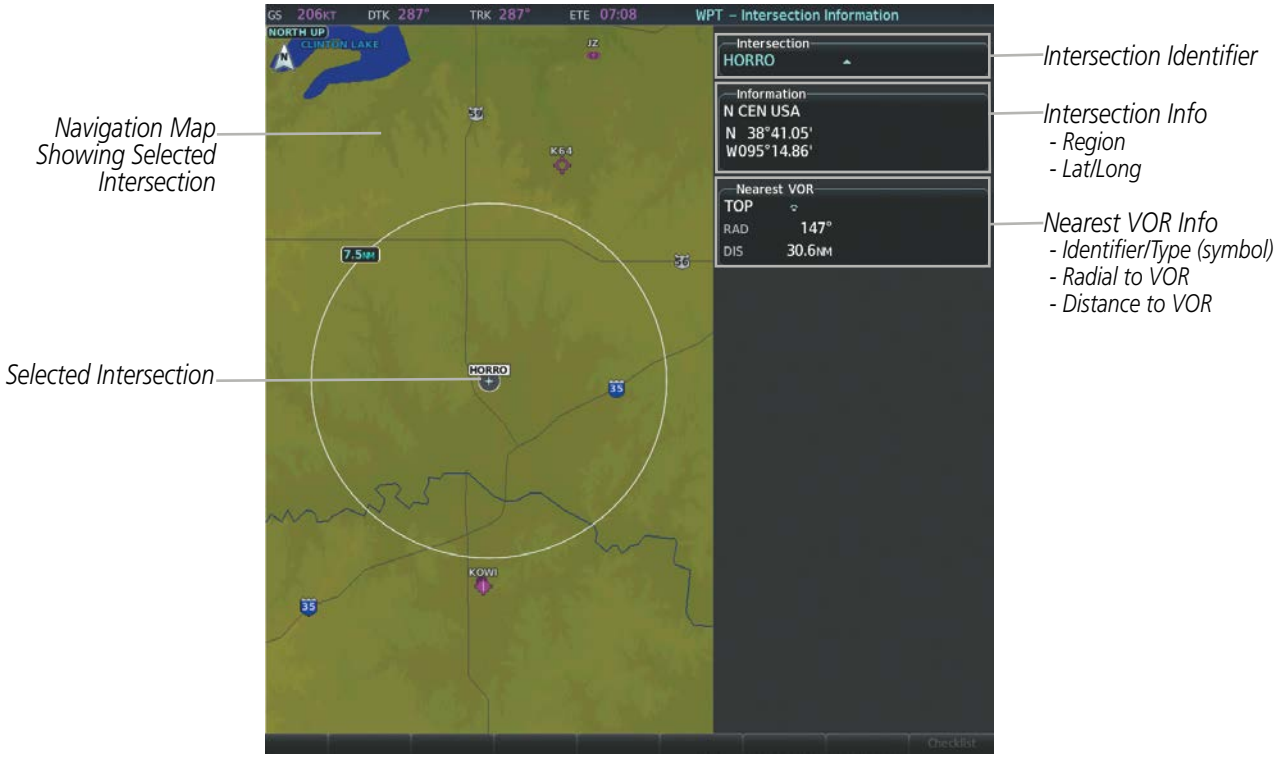


Figure 5-33 Intersection Information Page

Selecting an intersection:

1) With the 'WPT - Intersection Information' Page displayed, enter an identifier in the 'Intersection' Box.
2) Press the **ENT** Key.
3) Press the **FMS** Knob to remove the flashing cursor.

Or:

1) With the 'NRST - Nearest Intersections Page' displayed, press the **FMS** Knob.
2) Press the **ENT** Key or turn either **FMS** Knob to select an identifier in the 'Nearest Intersection' Box.
3) Press the **FMS** Knob to remove the flashing cursor.

The Nearest Intersections Page can be used to quickly find an intersection close to the flight path. In addition to displaying a map of the surrounding area, the page displays information for up to 25 nearest intersections in three boxes labeled 'Nearest INT', 'Information', and 'Reference VOR'.

The selected intersection is indicated by a white arrow. Up to 19 intersections are visible at a time. If there are more than can be shown, the list can be scrolled. If there are no items for display, text indicating that fact is displayed.

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

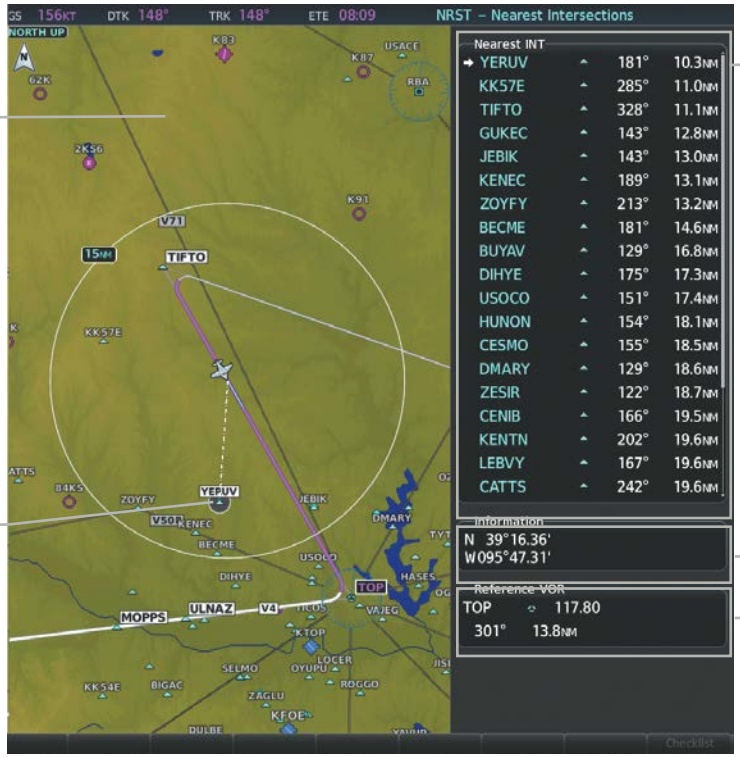


Figure 5-34 Nearest Intersections Page

NDBs

The NDB Information Page is used to view information about NDBs. In addition to displaying a map of the currently selected NDB and surrounding area, the page displays NDB information in four boxes labeled 'NDB', 'Information', 'Frequency', and 'Nearest Airport'.

Figure 5-35 NDB Information Page

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

Selecting an NDB:

1) With the 'WPT - NDB Information' Page displayed, enter an identifier, the name of the NDB, or the city in which it's located in the 'NDB' Box.
2) Press the **ENT** Key.
3) Press the **FMS** Knob to remove the flashing cursor.

Or:

1) With the 'NRST - Nearest NDB' Page displayed, press the **FMS** Knob.
2) Press the **ENT** Key or turn either **FMS** Knob to select an identifier in the 'Nearest NDB' Box.
3) Press the **FMS** Knob to remove the flashing cursor.

The Nearest NDB Page can be used to quickly find a NDB close to the flight path. In addition to displaying a map of the surrounding area, the page displays information for up to 25 nearest NDBs in three boxes labeled 'Nearest NDB', 'Information', and 'Frequency'.

A white arrow before the NDB identifier indicates the selected NDB. Up to 19 NDBs are visible at a time. If there are more than can be shown, each list can be scrolled. The list only includes waypoints that are within 200nm. If there are no NDBs in the list, text indicating that there are no nearest NDBs is displayed. If there are no nearest NDBs in the list, the information and frequency fields are dashed.

Figure 5-36 Nearest NDB Page

VORs

The VOR Information Page can be used to view information about VOR and ILS navigation signals, or to quickly auto-tune a VOR or ILS frequency. Localizer information cannot be viewed on the VOR Information Page. If a VOR station is combined with a TACAN station it is listed as a VORTAC on the VOR Information Page and if it includes only DME, it is displayed as VOR-DME.

In addition to displaying a map of the currently selected VOR and surrounding area, the VOR Information Page displays VOR information in four boxes labeled 'VOR', 'Information', 'Frequency', and 'Nearest Airport'.

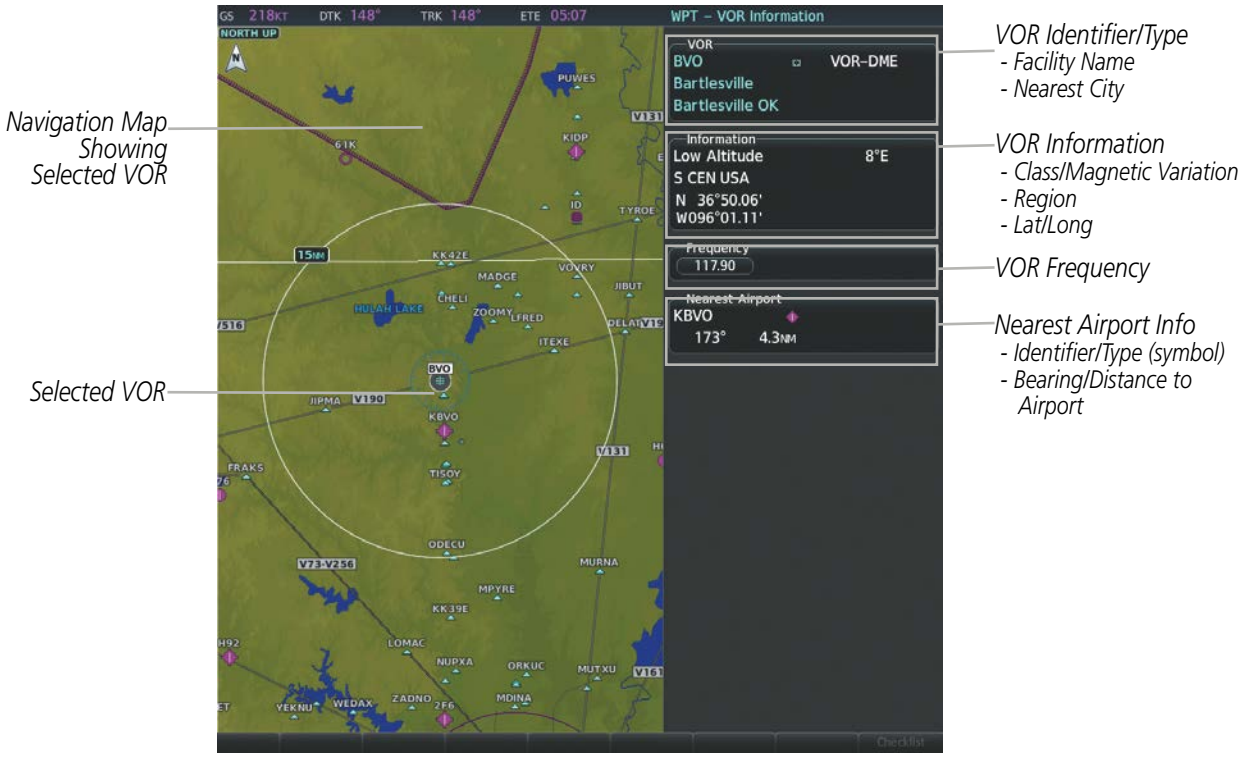


Figure 5-37 VOR Information Page

The VOR classes used in the VOR information box are: Low Altitude, High Altitude, and Terminal.

Selecting a VOR:

1) With the 'WPT - VOR Information' Page displayed, enter an identifier, the name of the VOR, or the city in which it's located in the 'VOR' Box.
2) Press the **ENT** Key.
3) Press the **FMS** Knob to remove the flashing cursor.

Or:

1) With the 'NRST - Nearest VOR' Page displayed, press the **FMS** Knob or press the **VOR** Softkey.
2) Press the **ENT** Key or turn either **FMS** Knob to select an identifier in the 'Nearest VOR' Box.
3) Press the **FMS** Knob to remove the flashing cursor.

Or:

1) With the 'NRST - Nearest VOR' Page displayed, press the **MENU** Key.
2) Highlight 'Select VOR Window', and press the **ENT** Key.
3) Press the **ENT** Key or turn either **FMS** Knob to select an identifier in the 'Nearest VOR' Box.
4) Press the **FMS** Knob to remove the flashing cursor.

The Nearest VOR Page can be used to quickly find a VOR station close to the aircraft. Also, a NAV frequency from a selected VOR station can be loaded from the Nearest VOR Page. In addition to displaying a map of the surrounding area, the Nearest VOR Page displays information for up to 25 nearest VOR stations in three boxes labeled 'Nearest VOR', 'Information', and 'Frequency'. The list only includes waypoints that are within 200 nm.

A white arrow before the VOR identifier indicates the selected VOR. Up to 19 VORs are visible at a time. If there are more than can be shown, each list can be scrolled. If there are no VORs in the list, text indicating that there are no nearest VORs is displayed. If there are no nearest VORs in the list, the information is dashed.

Figure 5-38 Nearest VOR Page

VRPs

The VRP Information Page is used to view information about visual reporting points (VRPs). In addition to displaying a map of the currently selected VRP and surrounding area, the VRP Information Page displays VRP information in two boxes labeled 'VRP' and 'Information".

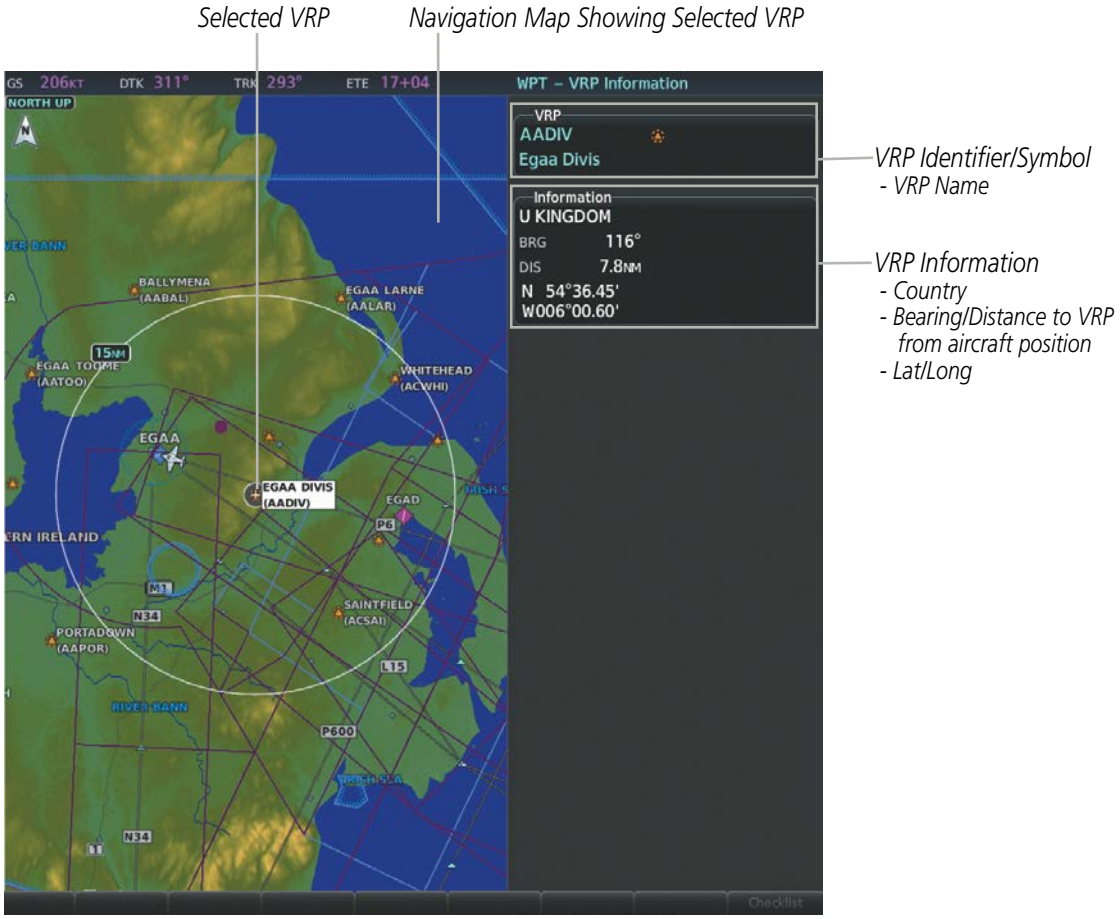


Figure 5-39 VRP Information Page

Selecting a VRP:

1) With the 'WPT - VRP Information' Page displayed, enter the identifier or the name of the VRP in the 'VRP' Box.
2) Press the **ENT** Key.
3) Press the **FMS** Knob to remove the flashing cursor.

Or:

1) With the 'NRST - Nearest VRP' Page displayed, press the **FMS** Knob.
2) Press the **ENT** Key or turn either **FMS** Knob to select an identifier in the 'Nearest VRP' Box.
3) Press the **FMS** Knob to remove the flashing cursor.

The Nearest VRP Page can be used to quickly find a VRP close to the aircraft. In addition to displaying a map of the surrounding area, the Nearest VRP Page displays information for up to 25 nearest VRPs in two boxes labeled 'Nearest VRP' and 'Information'. The list only includes VRPs that are within 200 nm.

A white arrow before the VRP identifier indicates the selected VRP. Up to 19 VRPs are visible at a time. If there are more than can be shown, the list can be scrolled. If there are no VRPs in the list, text indicating that there are no nearest VRPs is displayed. If there are no nearest VRPs in the list, the information is dashed.

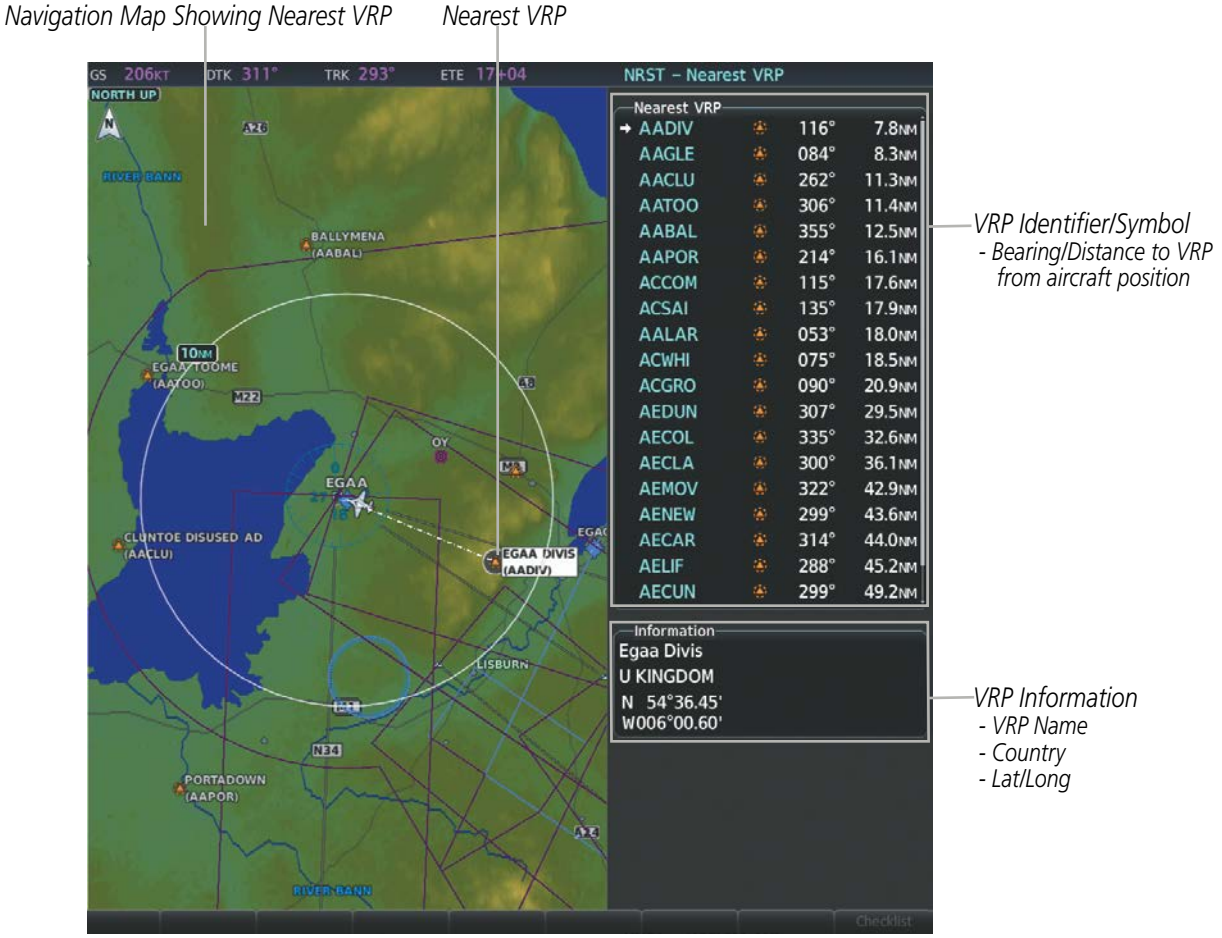


Figure 5-40 Nearest VRP Page

USER WAYPOINTS

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

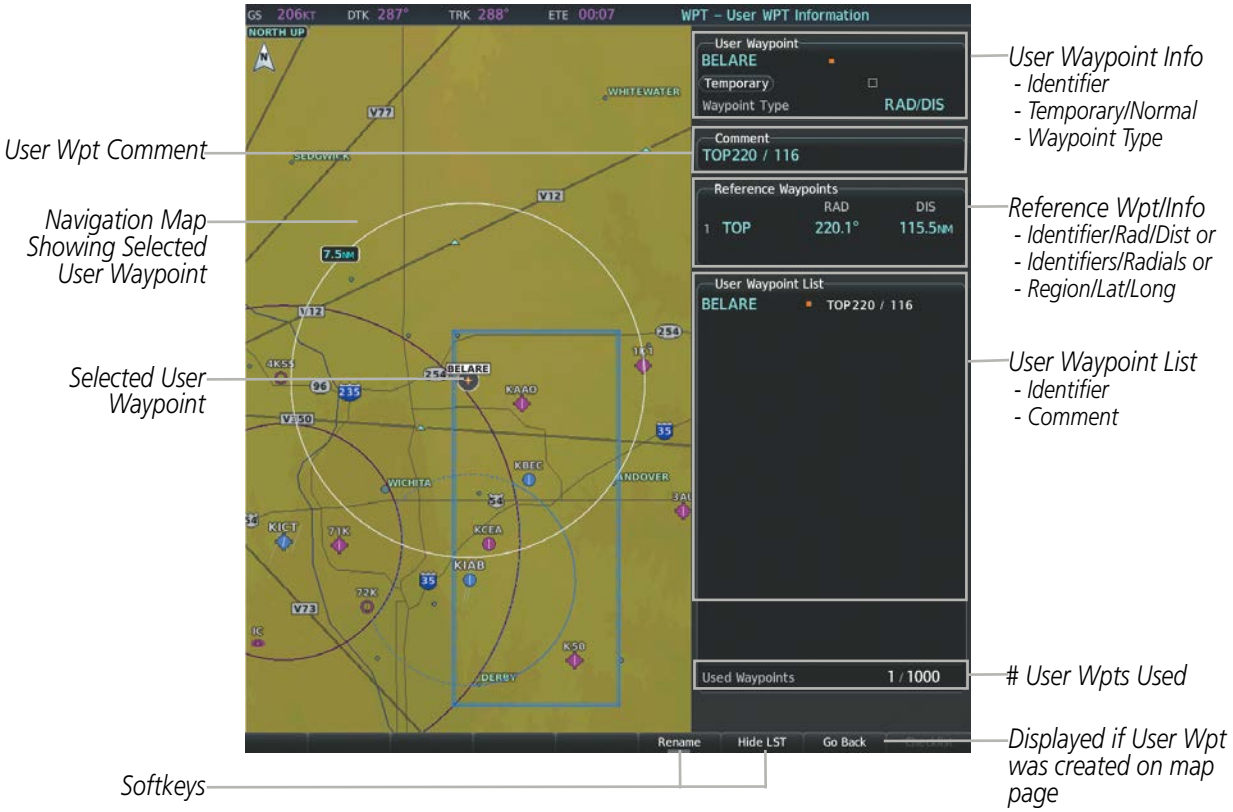


Figure 5-41 User Waypoint Information Page

Selecting a User Waypoint:

1) With the 'WPT - User WPT Information' Page displayed, enter the name of the User Waypoint, or scroll to the desired waypoint in the 'User Waypoint List' Box using the large **FMS** Knob.
2) Press the **ENT** Key.
3) Press the **FMS** Knob to remove the flashing cursor.

Or:

1) With the 'NRST - Nearest User WPTS' Page displayed, press the **FMS** Knob.
2) Press the **ENT** Key or turn either **FMS** Knob to select an identifier in the 'Nearest User' Box.
3) Press the **FMS** Knob to remove the flashing cursor.

Figure 5-42 Nearest User Waypoint Page

CREATING USER WAYPOINTS

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

Creating user waypoints from the 'WPT - User WPT Information' Page:

1) Select the **New** Softkey, or press the **MENU** Key and select 'Create New User Waypoint'.
2) Enter a user waypoint name (up to six characters).
3) Press the **ENT** Key. The current aircraft position is the default location of the new waypoint.
4) If desired, define the type and location of the waypoint in one of the following ways:

   Select 'RAD/RAD' using the small **FMS** Knob, press the **ENT** Key, and enter the two reference waypoint identifiers and radials into the 'Reference Waypoints' Box using the **FMS** Knobs.

   Or:

   Select 'RAD/DIS' using the small **FMS** Knob, press the **ENT** Key, and enter the reference waypoint identifier, the radial, and the distance into the 'Reference Waypoints' Box using the **FMS** Knobs.

   Or:

   Select 'LAT/LON' using the small **FMS** Knob, press the **ENT** Key, and enter the latitude and longitude into the 'Information' Box using the **FMS** Knobs.

5) Press the **ENT** Key to accept the new waypoint.

6) If desired, change the storage method of the waypoint to temporary by moving the cursor to 'Temporary' and selecting the **ENT** Key to check the box.

7) Press the **FMS** Knob to remove the flashing cursor.

Or:

1) Press the **FMS** Knob to activate the cursor.

2) Enter a user waypoint name (up to six characters).

3) Press the **ENT** Key. The message 'Are you sure you want to create the new User Waypoint AAAAAA?' is displayed.

4) With 'YES' highlighted, press the **ENT** Key.

5) If desired, define the type and location of the waypoint in one of the following ways:

   Select 'RAD/RAD' using the small **FMS** Knob, press the **ENT** Key, and enter the two reference waypoint identifiers and radials into the 'Reference Waypoints' Box using the **FMS** Knobs.

   Or:

   Select 'RAD/DIS' using the small **FMS** Knob, press the **ENT** Key, and enter the reference waypoint identifier, the radial, and the distance into the 'Reference Waypoints' Box using the **FMS** Knobs.

   Or:

   Select 'LAT/LON' using the small **FMS** Knob, press the **ENT** Key, and enter the latitude and longitude into the 'Information' Box using the **FMS** Knobs.

6) Press the **ENT** Key to accept the new waypoint.

7) If desired, change the storage method of the waypoint to temporary by moving the cursor to 'Temporary' and selecting the **ENT** Key to check the box.

8) Press the **FMS** Knob to remove the flashing cursor.

Creating user waypoints from map pages:

1) Push the **Joystick** to activate the panning function and pan to the map location of the desired user waypoint.

2) Press the **ENT** Key. The 'WPT - User WPT Information' Page is displayed with the captured position.

NOTE: *If the pointer has highlighted a map database feature, one of three things happens upon pressing the* **ENT** *Key: 1) information about the selected feature is displayed instead of initiating a new waypoint, 2) a menu pops up allowing a choice between 'Review Airspaces' or 'Create User Waypoint', or 3) a new waypoint is initiated with the default name being the selected map item.*

---

3) Enter a user waypoint name (up to six characters).

4) Press the **ENT** Key to accept the selected name. The first reference waypoint box is highlighted.

5) If desired, define the type and location of the waypoint in one of the following ways:

   Select 'RAD/RAD' using the small **FMS** Knob, press the **ENT** Key, and enter the two reference waypoint identifiers and radials into the 'Reference Waypoints' Box using the **FMS** Knobs.

Or:

Select 'RAD/DIS' using the small **FMS** Knob, press the **ENT** Key, and enter the reference waypoint identifier, the radial, and the distance into the 'Reference Waypoints' Box using the **FMS** Knobs.

Or:

Select 'LAT/LON' using the small **FMS** Knob, press the **ENT** Key, and enter the latitude and longitude into the 'Information' Box using the **FMS** Knobs.

6) Press the **ENT** Key to accept the new waypoint.
7) If desired, change the storage method of the waypoint to temporary by moving the cursor to 'Temporary' and selecting the **ENT** Key to check or uncheck the box.
8) Press the **FMS** Knob to remove the flashing cursor.
9) Press the **Go Back** Softkey to return to the map page.

EDITING USER WAYPOINTS

Editing a user waypoint comment or location:

1) With the 'WPT - User Waypoint Information' Page displayed, press the **FMS** Knob to activate the cursor.
2) Select a user waypoint in the 'User Waypoint List' Box, if required, and press the **ENT** Key.
3) Move the cursor to the desired field.
4) Turn the small **FMS** Knob to make any changes.
5) Press the **ENT** Key to accept the changes.
6) Press the **FMS** Knob to remove the flashing cursor.

Renaming user waypoints:

1) With the 'WPT - User WPT Information' Page displayed, press the **FMS** Knob to activate the cursor.
2) Highlight a user waypoint in the 'User Waypoint List' Box. Press the **Rename** Softkey, or press the **MENU** Key and select 'Rename User Waypoint'.
3) Enter a new name.
4) Press the **ENT** Key. The message 'Do you want to rename the user waypoint AAAAAA to BBBBBB?' is displayed.
5) With 'YES' highlighted, press the **ENT** Key.
6) Press the **FMS** Knob to remove the flashing cursor.

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

1) With the 'WPT - User WPT Information' Page displayed, press the **FMS** Knob to activate the cursor.
2) Enter a waypoint name or select the waypoint in the 'User Waypoint List' Box, then press the **ENT** Key.
3) Press the **MENU** Key.
4) Select 'Use Present Position'.
5) Press the **ENT** Key. The new waypoint's location is saved.
6) Press the **FMS** Knob to remove the flashing cursor.

A system generated comment for a user waypoint incorporates the reference waypoint identifier, bearing, and distance. If a system generated comment has been edited, a new comment can be generated.

Resetting the comment field to the system generated comment:

1) With the 'WPT - User WPT Information' Page displayed, press the **FMS** Knob to activate the cursor.
2) Enter a waypoint name or select the waypoint in the 'User Waypoint List' Box, then press the **ENT** Key.
3) Press the **MENU** Key.
4) Select 'Auto Comment'.
5) Press the **ENT** Key. The generated comment is based on the reference point used to define the waypoint.

The default type of user waypoint (normal or temporary) can be changed using the user waypoint information page menu. Temporary user waypoints are automatically deleted upon the next power cycle.

Changing the user waypoint storage duration default setting:

1) With the 'WPT - User WPT Information' Page displayed, press the **MENU** Key.
2) Move the cursor to highlight 'Waypoint Setup', and press the **ENT** Key.
3) Select 'Normal' or 'Temporary' as desired, and press the **ENT** Key.
4) Press the **FMS** Knob to remove the flashing cursor and return to the 'WPT - User WPT Information' Page.

DELETING USER WAYPOINTS

Deleting a single user waypoint:

1) With the 'WPT - User WPT Information' Page displayed, press the **FMS** Knob to activate the cursor.
2) Highlight a User Waypoint in the 'User Waypoint List' Box, or enter a waypoint in the 'User Waypoint' Box.
3) Select the **Delete** Softkey or press the **CLR** Key. 'Yes' is highlighted in the confirmation window.
4) Press the **ENT** Key.
5) Press the **FMS** Knob to remove the flashing cursor.

Or:

1) With the 'WPT - User WPT Information' Page displayed, press the **FMS** Knob to activate the cursor.
2) Highlight a User Waypoint in the 'User Waypoint List' Box, or enter a waypoint in the 'User Waypoint' Box.
3) Press the **MENU** Key.
4) Select 'Delete User Waypoint'.
5) Press the **ENT** Key twice to confirm the selection.
6) Press the **FMS** Knob to remove the flashing cursor.

NOTE: *The option to 'Delete All User Waypoints' is not available while the aircraft is in flight.*

Deleting all user waypoints:

1) With the 'WPT - User Waypoint Information' Page displayed, press the **FMS** Knob to activate the cursor.

2) Highlight a User Waypoint in the 'User Waypoint List' Box.

3) Press the **MENU** Key.

4) Select 'Delete All User Waypoints.'

5) Press the **ENT** Key twice to confirm the selection.

6) Press the **FMS** Knob to remove the flashing cursor.

5.4 AIRSPACES

The system can display the following types of airspaces: Class B/TMA, Class C/TCA, Class D, Restricted, MOA (Military), Other Airspace, Air Defense Identification Zone (ADIZ), and Temporary Flight Restriction (TFR).

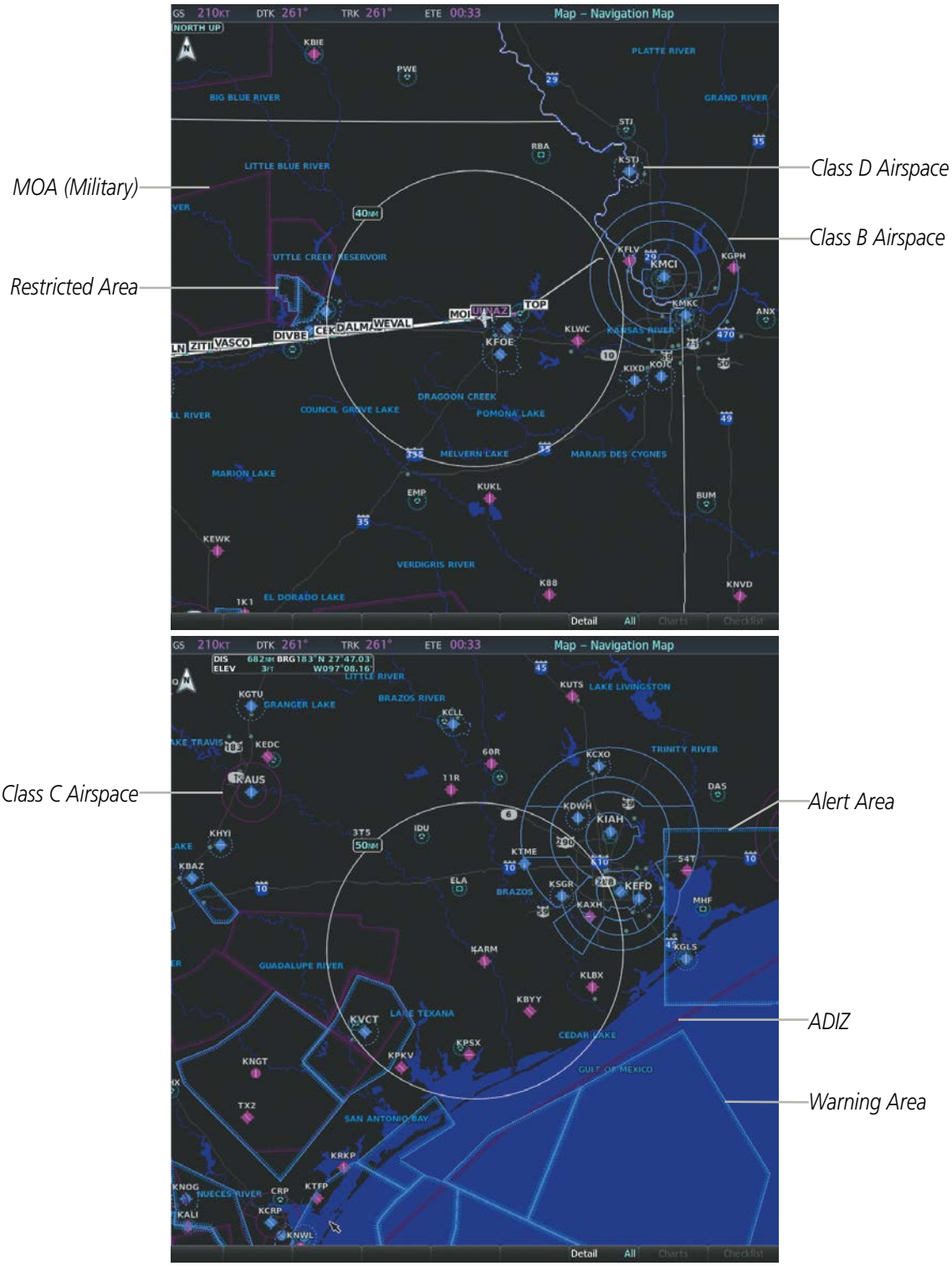


Figure 5-43 Airspaces

The Nearest Airspaces Page, Airspace Alerts Window, and Airspace Alerts on the PFD provide additional information about airspaces and the location of the aircraft in relationship to them.

The Airspace Alerts Box allows the pilot to turn the controlled/special-use airspace message alerts on or off. This does not affect the alerts listed on the Nearest Airspaces Page or the airspace boundaries depicted on the Navigation Map Page. It simply turns on/off the warning provided when the aircraft is approaching or near an airspace.

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

Changing the altitude buffer distance setting:

1) Use the **FMS** Knob to select the 'Aux - System Setup 1' Page.
2) Press the **FMS** Knob momentarily to activate the flashing cursor.
3) Turn the large **FMS** Knob to highlight the 'Altitude Buffer' Field in the 'Airspace Alerts' Box.
4) Use the **FMS** Knob to enter an altitude buffer value and press the **ENT** Key.
5) Press the **FMS** Knob to remove the flashing cursor.

Turning an airspace alert on or off:

1) Use the **FMS** Knob to select the 'Aux - System Setup 1' Page.
2) Press the **FMS** Knob momentarily to activate the flashing cursor.
3) Turn the large **FMS** Knob to highlight the desired field in the 'Airspace Alerts' Box.
4) Turn the small **FMS** Knob clockwise to turn the airspace alert on or counterclockwise to turn the alert off.
5) Press the **FMS** Knob to remove the flashing cursor.

Map ranges for the airspace boundaries are selected from the Airspace Group in the Map Settings Menu. See Table 5-3 for the default and maximum ranges for each type of airspace and the symbol used to define the airspace area.

The Nearest Airspaces Page can be used to quickly find airspaces close to the flight path. In addition, a selected frequency associated with the airspace can be loaded from the Nearest Airspaces Page. In addition to displaying a map of airspace boundaries and surrounding area, the Nearest Airspaces Page displays airspace information in four boxes labeled 'Airspace Alerts', 'Airspace Agency', 'Vertical Limits', and 'Frequencies'.

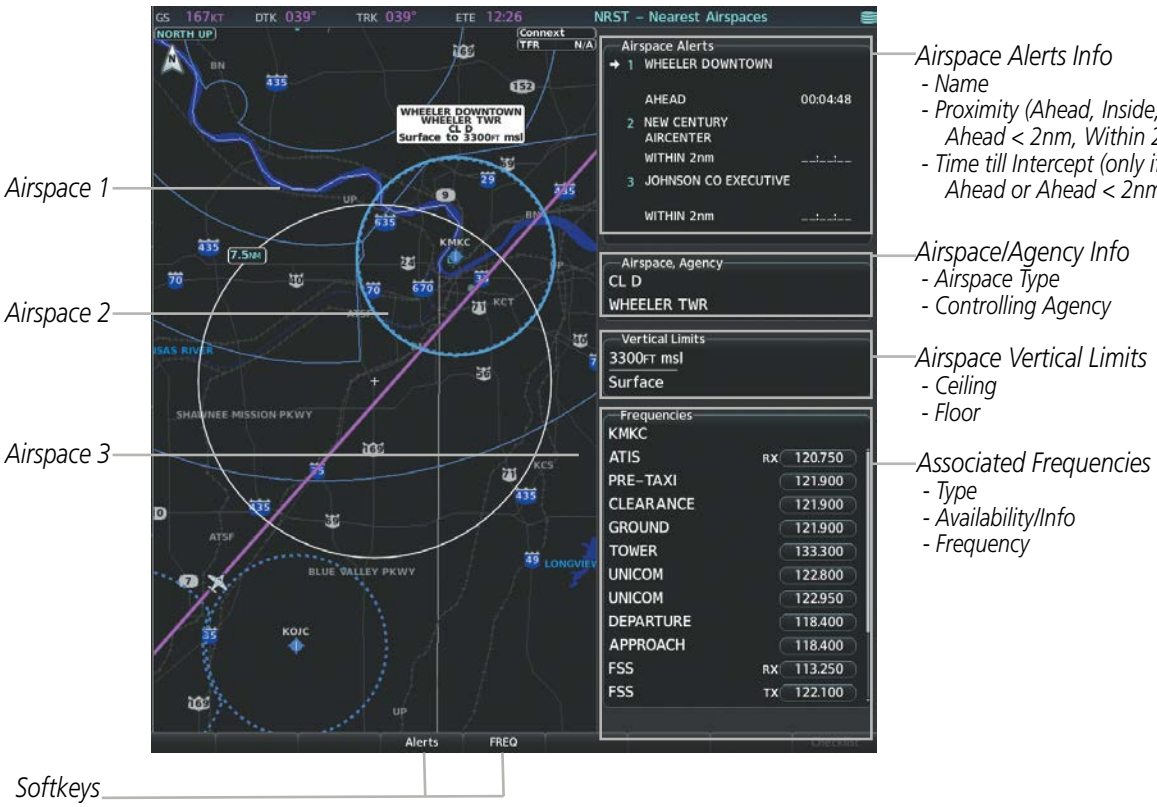


Figure 5-44 Nearest Airspaces Page

Airspace alerts and associated frequencies are shown in scrollable lists on the Nearest Airspaces Page. The **Alerts** and **FREQ** softkeys place the cursor in the respective list. The **FREQ** Softkey is enabled only if one or more frequencies exist for a selected airspace.

Selecting and viewing an airspace alert with its associated information:

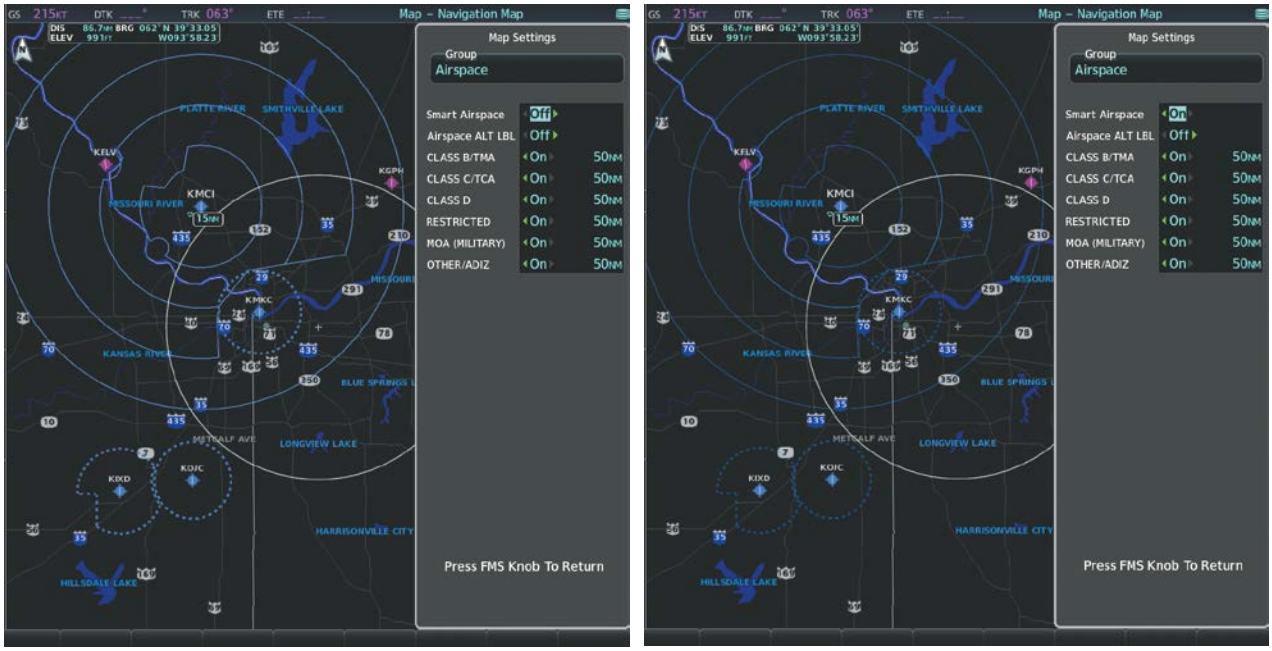
1) Select the 'NRST - Nearest Airspaces' Page.
2) Press the **Alerts** Softkey; or press the **FMS** Knob; or press the **MENU** Key, highlight 'Select Alerts Window', and press the **ENT** Key. The cursor is placed in the 'Airspace Alerts' Box.
3) Select the desired airspace.
4) Press the **FMS** Knob to remove the flashing cursor.

Pressing the PFD **Alerts** Softkey displays the Alerts window on the PFD. The following airspace alerts are displayed in the alerts window:

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

Table 5-7 PFD Airspace Alert Messages

The Smart Airspace function de-emphasizes airspaces above or below the current aircraft altitude. The function does not require the aircraft present position or flight path to enter the lateral boundaries of the airspace. If the current aircraft altitude is within 1100 feet of the vertical boundaries of the airspace, the airspace boundary is shown normally. If the current aircraft altitude is not within 1100 feet of the vertical boundaries of the airspace, the airspace boundary is shown subdued.



Smart Airspace Off **Smart Airspace On**

Figure 5-45 Smart Airspace

Turning smart airspace on or off:

1) Use the **FMS** Knob to select the 'Map - Navigation Map' Page.
2) Press the **MENU** Key, and press the **ENT** Key. The cursor is placed in the 'Group' Box.
3) Turn the small **FMS** Knob to highlight the 'Airspace' in the 'Group' Box and press the **ENT** Key.
4) Turn the large **FMS** Knob to highlight the 'Smart Airspace' Field in the 'Map Settings' Window.
5) Turn the small **FMS** Knob clockwise to turn Smart Airspace 'On' or counterclockwise to turn smart airspace 'Off'.
6) Press the **FMS** Knob to remove the flashing cursor.

5.5 DIRECT-TO-NAVIGATION

The Direct-to method of navigation, initiated by pressing the **Direct-to** Key on either the MFD Controller or the PFD, is quicker to use than a flight plan when the desire is to navigate to a single point such as a nearby airport.

Once a direct-to is activated, the system establishes a point-to-point course line from the present position to the selected direct-to destination. Course guidance is provided until the direct-to is replaced with a new direct-to or flight plan, or cancelled.

A vertical navigation (VNV) direct-to creates a descent path (and provides guidance to stay on the path) from the current altitude to a selected altitude at the direct-to waypoint. Vertical navigation is based on barometric altitudes, not on GPS altitude, and is used for cruise and descent phases of flight.

The Direct-to Window allows selection and activation of direct-to navigation. The Direct-to Window displays selected direct-to waypoint data on the PFD and the MFD.

Figure 5-46 Direct-to Window - PFD

Any waypoint can be entered as a direct-to destination from the Direct-to Window.

Entering a waypoint identifier, facility name, or city as a direct-to destination:

1) Press the **Direct-to** Key. The 'Direct To' Window is displayed (with the active flight plan waypoint as the default selection or a blank waypoint field if no flight plan is active).
2) Turn the small **FMS** Knob clockwise to begin entering a waypoint identifier (turning it counter-clockwise brings up the waypoint selection submenu - press the **CLR** Key to remove it), or turn the large **FMS** Knob to select the facility name, or city field and turn the small **FMS** Knob to begin entering a facility name or city. If duplicate entries exist for the entered facility or city name, additional entries can be viewed by turning the small **FMS** Knob during the selection process.
3) Press the **ENT** Key. The 'Activate?' Field is highlighted.
4) Press the **ENT** Key to activate the direct-to.

Any waypoint contained in the active flight plan can be selected as a direct-to waypoint from the Direct-to Window, the Active Flight Plan Page, or the Active Flight Plan Window.

Figure 5-47 Waypoint Submenu

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

1) While navigating an active flight plan, press the **Direct-to** Key. The 'Direct To' Window is displayed with the active flight plan waypoint as the default selection.
2) Turn the small **FMS** Knob counter-clockwise to display a list of flight plan waypoints (the FPL list is populated only when navigating a flight plan).
3) Select the desired waypoint.
4) Press the **ENT** Key. The cursor is now displayed on 'Activate?'.
5) Press the **ENT** Key again to activate the direct-to.

Or:

1) Select the 'FPL - Active Flight Plan' Page on the MFD, or the 'Flight Plan' Window on the PFD.
2) Select the desired waypoint.
3) Press the **Direct-to** Key.
4) Press the **ENT** Key. The cursor is now displayed on 'Activate?'.
5) Press the **ENT** Key again to activate the direct-to.

Any Nearest, Recent or User waypoint can be selected as a direct-to destination in the Direct-to Window.

Selecting a Nearest, Recent or User waypoint as a direct-to destination:

1) Press the **Direct-to** Key. The 'Direct To' Window is displayed (with the active flight plan destination as the default selection or a blank destination if no flight plan is active).
2) Turn the small **FMS** Knob counter-clockwise to display a list of flight plan waypoints (the FPL list is populated only when navigating a flight plan).
3) Turn the small **FMS** Knob clockwise to display the Nearest, Recent or User waypoints.
4) Turn the large **FMS** Knob clockwise to select the desired waypoint.
5) Press the **ENT** Key. The cursor is now displayed on 'Activate?'.
6) Press the **ENT** Key again to activate the direct-to.

The Direct-to Window can be displayed from any page and allows selection and activation of direct-to navigation. If the direct-to is initiated from any page except the WPT pages, the default waypoint is the active flight plan waypoint (if a flight plan is active) or a blank waypoint field. Direct-to requests on any WPT page defaults to the displayed waypoint.

Selecting any waypoint as a direct-to destination:

1) Select the page or window containing the desired waypoint type and select the desired waypoint.
2) Press the **Direct-to** Key to display the 'Direct To' Window with the selected waypoint as the direct-to destination.
3) Press the **ENT** Key. The cursor is now displayed on 'Activate?'.
4) Press **ENT** again to activate the direct-to.

Selecting a nearby airport as a direct-to destination:

1) Press the **Nearest** Softkey on the PFD; or turn the **FMS** Knob to display the 'NRST - Nearest Airports' Page and press the **FMS** Knob.
2) Select the desired airport (the nearest one is already selected).
3) Press the **Direct-to** Key.
4) Press the **ENT** Key. The cursor is now displayed on 'Activate?'.
5) Press the **ENT** Key again to activate the direct-to.

Direct-to destinations may also be selected by using the pointer on the navigation map pages. If no airport, NAVAID, or user waypoint exists at the desired location, a temporary waypoint named 'MAPWPT' is automatically created at the location of the map arrow.

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

1) From the desired map page, push the **Joystick** to display the pointer.
2) Move the **Joystick** to place the pointer at the desired destination location.

3) If the pointer is placed on an existing airport, NAVAID, or user waypoint, the waypoint name is highlighted.

4) Press the **Direct-to** Key to display the 'Direct To' Window with the selected point entered as the direct-to destination.

5) Press the **ENT** Key. The cursor is now displayed on 'Activate?'.

6) Press the **ENT** Key again to activate the direct-to.

Cancelling a Direct-to:

1) Press the **Direct-to** Key to display the 'Direct To' Window.

2) Press the **MENU** Key.

3) With 'Cancel Direct-To NAV' highlighted, press the **ENT** Key. If a flight plan is still active, the system resumes navigating the flight plan along the closest leg.

When navigating a direct-to, the system sets a direct great circle course to the selected destination. The course to a destination can also be manually selected using the course field ('Course') on the Direct-to Window.

Selecting a manual direct-to course:

1) Press the **Direct-to** Key. The 'Direct To' Window is displayed with the destination field highlighted.

2) Highlight the course field.

3) Enter the desired course.

4) Press the **ENT** Key. The cursor is now displayed on 'Activate?'.

5) Press the **ENT** Key again to activate the direct-to.

Reselecting the direct course from the current position:

1) Press the **Direct-to** Key. The 'Direct To' Window is displayed with the destination field highlighted.

2) Press the **ENT** Key. The cursor is now displayed on 'Activate?'.

3) Press the **ENT** Key again to activate the direct-to.

A direct-to with altitude constraints creates a descent path (and provides guidance to stay on the path) from the aircraft's current altitude to the altitude of the direct-to waypoint. The altitude is reached at the waypoint, or at the specified distance along the flight path if an offset distance has been entered. All VNV altitudes prior to the direct-to destination are removed from the active flight plan upon successful activation of a direct-to destination that is part of the active flight plan. All VNV altitudes following the direct-to waypoint are retained. See the section on Vertical Navigation for more information regarding the use and purpose of VNV altitudes and offset distances.

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

1) Press the **Direct-to** Key to display the 'Direct To' Window.

2) Turn the large **FMS** Knob to place the cursor over the 'VNV' altitude field ('ALT' field on the PFD).

3) Enter the desired altitude.

4) Press the **ENT** Key to accept the altitude constraint.

5) If the selected waypoint is an airport, an additional choice is displayed. Turn the small **FMS** Knob to choose 'MSL' or 'AGL'.

6) Press the **ENT** Key. The cursor is now flashing in the VNV offset distance ('Offset' Field).

7) Enter the desired along-track distance before the waypoint.

8) Press the **ENT** Key. The 'Activate?' Field is highlighted.

9) Press the **ENT** Key to activate.

Removing a VNV altitude constraint:

1) Press the **Direct-to** Key to display the 'Direct To' Window.

2) Press the **MENU** Key.

3) With 'Clear Vertical Constraints' highlighted, press the **ENT** Key.

5.6 FLIGHT PLANNING

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

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

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

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

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

Table 5-8 Flight Plan Leg Symbols

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

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

When the database is updated, the airways 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 an airway can fail during this process. If that happens, the airway waypoints are changed to regular (non-airway) flight plan waypoints, and an alert is displayed (see Miscellaneous Messages in Appendix A).

The following could cause the airway update to fail:

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

FLIGHT PLAN CREATION

There are three methods to create or modify a flight plan:

- Active Flight Plan Page on the MFD (create/modify the active flight plan)
- Flight Plan Window on the PFD (create/modify the active flight plan)
- Flight Plan Catalog Page on the MFD (create/modify a stored flight plan)

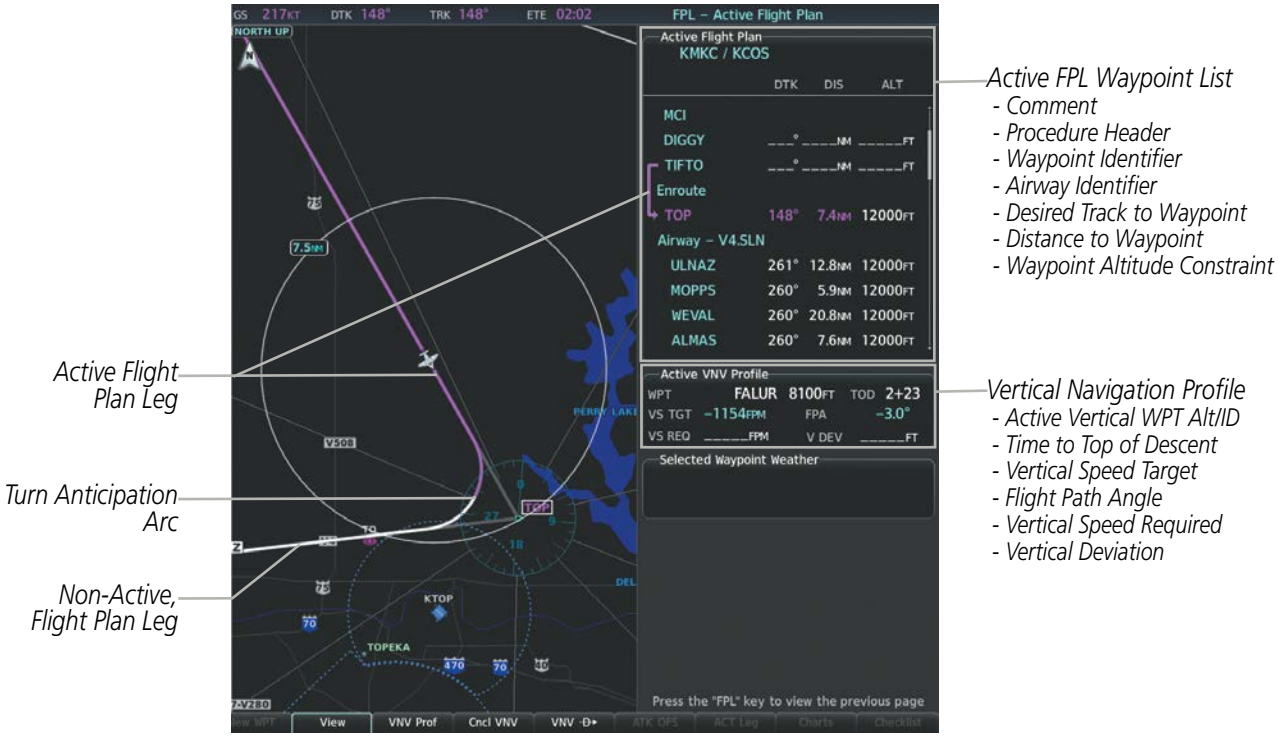


Figure 5-48 Active Flight Plan Page

Figure 5-49 Active Flight Plan Window on PFD

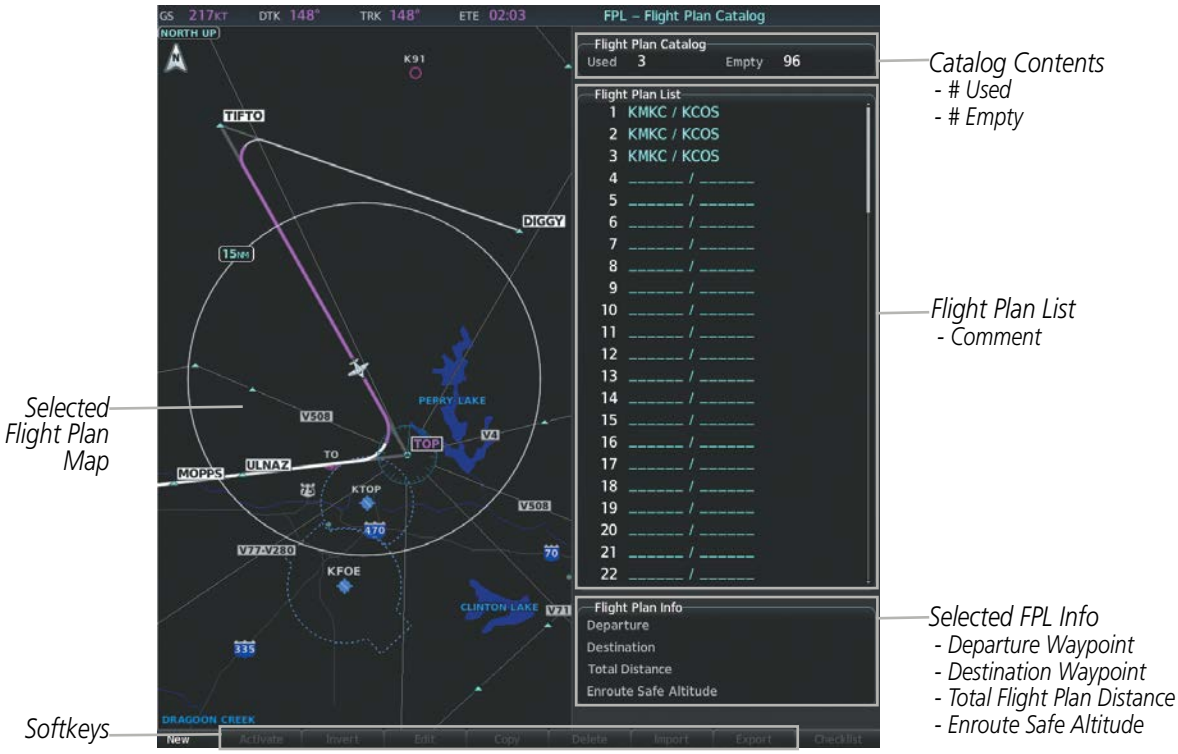


Figure 5-50 Flight Plan Catalog Page

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

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

Creating an active flight plan:

1) Press the **FPL** Key. Press the **FMS** Knob to activate the cursor (only on MFD).
2) Select the departure airport and runway.
   a) Highlight the departure airport identifier using the **FMS** Knob
   b) Use the **FMS** Knob or the waypoint submenu to enter the identifier, facility, or city name of the departure waypoint.
   c) Press the **ENT** Key. The 'Set Runway' Window is displayed with the 'Runway' field highlighted.
   d) Turn the small **FMS** Knob to select the runway, and press the **ENT** Key.
   e) Press the **ENT** Key again to add the departure airport/runway to the flight plan.
3) Repeat step number 2 for the destination airport and runway.
4) Select the enroute waypoints.
   a) Highlight the location to insert the waypoint using the **FMS** Knob (If the enroute header is selected, the new waypoint is placed following the header. If an enroute waypoint or the dashes are selected, the new waypoint will be placed before the selected item).
   b) Use the **FMS** Knob or the waypoint submenu to enter the identifier, facility, or city name of the waypoint. The active flight plan is modified as each waypoint is entered.
5) Repeat step number 4 to enter each additional enroute waypoint.
6) When all waypoints have been entered, press the **FMS** Knob to remove the cursor (if required).

Creating a stored flight plan:

1) From the MFD, press the **FPL** Key.
2) Turn the small **FMS** Knob clockwise to display the 'FPL - Flight Plan Catalog' Page.
3) Press the **New** Softkey; or press the **MENU** Key, highlight 'Create New Flight Plan', and press the **ENT** Key to display a blank flight plan for the first empty storage location.
4) Select the origin airport and runway.
   a) Highlight the origin airport identifier using the **FMS** Knob.
   b) Use the **FMS** Knob or the waypoint submenu to enter the identifier, facility, or city name of the origin waypoint.
   c) Press the **ENT** Key. The 'Set Runway' Window is displayed with the 'Runway' Field highlighted.
   d) Turn the small **FMS** Knob to select the runway, and press the **ENT** Key.
   e) Press the **ENT** Key again to add the origin airport/runway to the flight plan.
5) Repeat step number 4 for the destination airport and runway.

6) Select the enroute waypoints.
   a) Highlight the location to insert the waypoint using the **FMS** Knob (If the enroute header is selected, the new waypoint is placed following the header. If an enroute waypoint or the dashes are selected, the new waypoint will be placed ahead of the selected item.)
   b) Use the **FMS** Knob or the waypoint submenu to enter the identifier, facility, or city name of the waypoint.
   c) Press the **ENT** Key. The stored flight plan is modified as each waypoint is entered.
7) Repeat step number 6 to enter each additional enroute waypoint.
8) When all waypoints have been entered, press the **FMS** Knob to remove the cursor.

FLIGHT PLAN IMPORT/EXPORT

Flight plans can be imported from an SD Card or exported to an SD Card from the Stored Flight Plan Page.

Importing a Flight Plan from an SD Card:

1) Insert the SD card containing the flight plan in the top card slot on the MFD.
2) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page on the MFD.
3) Turn the small **FMS** Knob to select the 'FPL - Flight Plan Catalog' Page.
4) Press the **FMS** Knob to activate the cursor.
5) Turn either **FMS** Knob to highlight an empty or existing flight plan.
6) Press the **Import** Softkey; or press the **MENU** Key, select "Import Flight Plan", and press the **ENT** Key.

   If an empty slot is selected, a list of the available flight plans on the SD card will be displayed.

   Or:

   If an existing flight plan is selected, an "Overwrite existing flight plan? OK or CANCEL" prompt is displayed. Press the **ENT** Key to choose to overwrite the selected flight plan and see the list of available flight plans on the SD card. If overwriting the existing flight plan is not desired, select "CANCEL" using the **FMS** Knob, press the **ENT** Key, select another flight plan slot, and press the **Import** Softkey again.
7) Turn the small **FMS** Knob to highlight the desired flight plan for importing.
8) Press the **ENT** Key to initiate the import.
9) Press the **ENT** Key again to confirm the import.

NOTE: *If the imported flight plan contains a waypoint with a name that duplicates the name of a waypoint already stored on the system, the system compares the coordinates of the imported waypoint with those of the existing waypoint. If the coordinates are different, the imported waypoint is automatically renamed by adding characters to the end of the name.*

Exporting a Flight Plan to an SD Card:

1) Insert the SD card into the top card slot on the MFD.
2) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page on the MFD.
3) Turn the small **FMS** Knob to select the 'FPL - Flight Plan Catalog' Page.

4) Press the **FMS** Knob to activate the cursor.
5) Turn the large **FMS** Knob to highlight the flight plan to be exported.
6) Press the **Export** Softkey; or press the **MENU** Key, select "Export Flight Plan".
7) If desired, change the name for the exported file by turning the large **FMS** Knob to the left to highlight the name, then use the small and large **FMS** knobs to enter the new name, and press the **ENT** Key.
8) Press the **ENT** Key to initiate the export.
9) Press the **ENT** Key to confirm the export.

NOTE: *The exported flight plan will not contain any procedures or airways.*

FLIGHT PLAN IMPORT/EXPORT MESSAGES

Under certain conditions, some messages may appear in conjunction with others.

Flight Plan Import/Export Results	Description
'Flight plan successfully imported.'	A flight plan file stored on the SD card was successfully imported as a stored flight plan.
'File contained user waypoints only. User waypoints imported successfully. No stored flight plan data was modified.'	The file stored on the SD card did not contain a flight plan, only user waypoints. These waypoints have been saved to the system user waypoints. No flight plans stored in the system have been modified.
'No flight plan files found to import.'	The SD card contains no flight plan data.
'Flight plan import failed.'	Flight plan data was not successfully imported from the SD card.
'Flight plan partially imported.'	Some flight plan waypoints were successfully imported from the SD card, however others had errors and were not imported. A partial stored flight plan now exists in the system.
'File contained user waypoints only.'	The file stored on the SD card did not contain a flight plan, only user waypoints. One or more of these waypoints did not import successfully.
'Too many points. Flight plan truncated.'	The flight plan on the SD card contains more waypoints than the system can support. The flight plan was imported with as many waypoints as possible.
'Some waypoints not loaded. Waypoints locked.'	The flight plan on the SD card contains one or more waypoints that the system cannot find in the navigation database. The flight plan has been imported, but must be edited within the system before it can be activated for use.
'User waypoint database full. Not all loaded.'	The flight plan file on the SD card contains user waypoints. The quantity of stored user waypoints has exceeded system capacity, therefore not all the user waypoints on the SD card have been imported. Any flight plan user waypoints that were not imported are locked in the flight plan. The flight plan must be edited within the system before it can be activated for use.
'One or more user waypoints renamed.'	One or more imported user waypoints were renamed when imported due to naming conflicts with waypoints already existing in the system.
'Flight plan successfully exported.'	The stored flight plan was successfully exported to the SD card.
'Flight plan export failed.'	The stored flight plan was not successfully exported to the SD card. The SD card may not have sufficient available memory or the card may have been removed prematurely.

Table 5-9 Flight Plan Import/Export Messages

Flight plans can be transferred to or from a mobile device via the Flight Stream 510 Bluetooth wireless connection. Transfer of a flight plan to a mobile device is controlled by the mobile device.

Previewing a pending flight plan transfer from a wireless connection:

1) When a flight plan transfer has been initiated from a mobile device, a 'PENDING FLIGHT PLAN' pop-up alert appears in the lower right corner of the MFD, and an Connext annunciation appears to the right of the MFD page name.
2) Press the **ENT** Key to display the 'FPL - Preview Flight Plan' Page on the MFD.

   Or:

   Press the **Preview** Softkey to display the 'FPL - Preview Flight Plan' Page on the MFD.

   Or:

   a) Press the **MENU** Key,
   b) Turn the **FMS** Knob to highlight 'Preview Flight Plan'.
   c) Press the **ENT** Key to display the 'FPL - Preview Flight Plan' Page on the MFD.

Ignoring a pending flight plan transfer from a wireless connection:

1) When a flight plan transfer has been initiated from a mobile device, a 'PENDING FLIGHT PLAN' pop-up alert appears in the lower right corner of the MFD, and an Connext annunciation appears to the right of the MFD page name.
2) Press the **CLR** Key to remove the pop-up alert and ignore the pending flight plan. The pending flight plan will still be available on the 'FPL - Flight Plan Catalog' page.

   Or:

   Press the **Ignore** Softkey to remove the pop-up alert and ignore the pending flight plan. The pending flight plan will still be available on the 'FPL - Flight Plan Catalog' page.

Figure 5-51 Pending Flight Plan Transfer

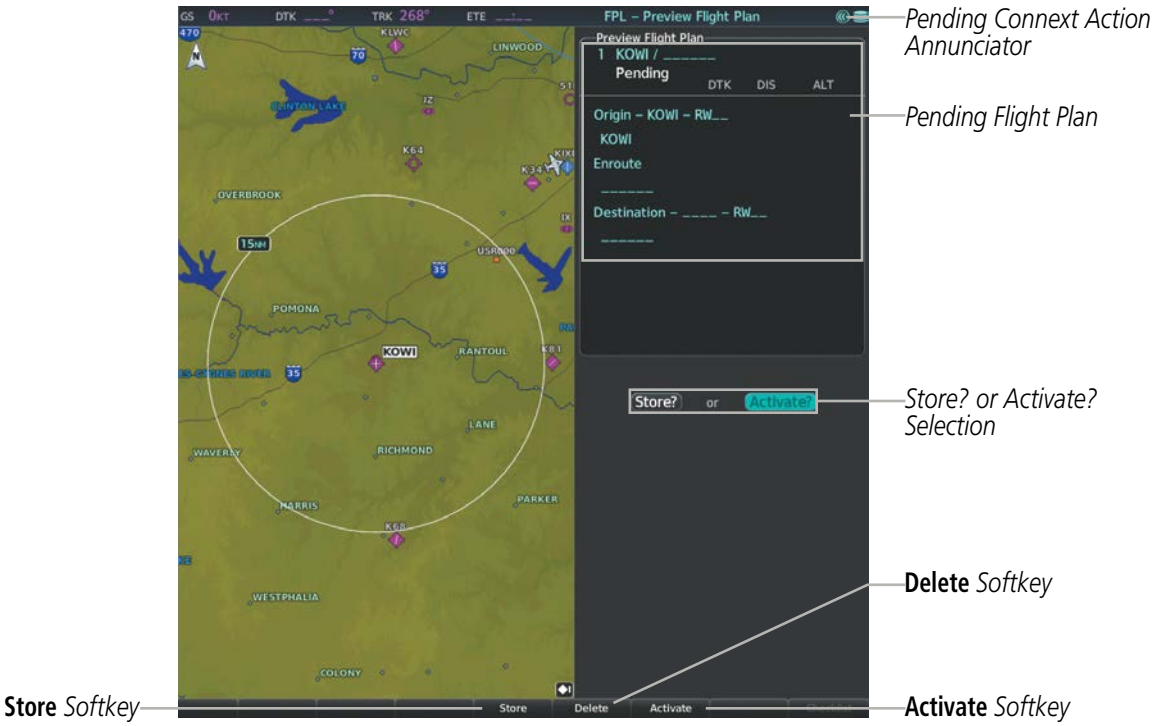


Figure 5-52 Preview Flight Plan Page

Storing a pending flight plan:

1) Press the **FPL** Key.
2) Turn the small **FMS** Knob to display the 'FPL - Flight Plan Catalog' Page.
3) Press the **FMS** Knob to activate the cursor, and
4) Turn the **FMS** Knob to highlight the pending flight plan.
5) Press the **ENT** Key to display the 'FPL - Preview Flight Plan' Page on the MFD.
6) Press the **Store** Softkey to store the flight plan. The pending flight plan is stored and the pending annunciation is removed.

   Or:

   a) Press the **FMS** Knob to activate the cursor.
   b) Turn the **FMS** Knob to highlight 'Store?'.
   c) Press the **ENT** Key to store the flight plan. The pending flight plan is stored and the pending annunciation is removed.

   Or:

   a) Press the **MENU** Key,
   b) Turn the **FMS** Knob to highlight 'Store Flight Plan'.
   c) Press the **ENT** Key to store the flight plan. The pending flight plan is stored and the pending annunciation is removed.

Activating a pending flight plan:

1) Press the **FPL** Key and turn the small **FMS** Knob to display the 'FPL - Flight Plan Catalog' Page.
2) Press the **FMS** Knob to activate the cursor, and turn the **FMS** Knob to highlight the pending flight plan.
3) Press the **ENT** Key to display the 'FPL - Preview Flight Plan' Page on the MFD.
4) Press the **Activate** Softkey. The 'Activate Flight Plan?' Window is displayed.

   Or:

   a) Press the **FMS** Knob to activate the cursor.
   b) Turn the **FMS** Knob to highlight 'Activate?'.
   c) Press the **ENT** Key. The 'Activate Flight Plan?' Window is displayed.

   Or:

   a) Press the **MENU** Key.
   b) Turn the **FMS** Knob to highlight 'Activate Flight Plan'.
   c) Press the **ENT** Key. The 'Activate Flight Plan?' Window is displayed.

5) With 'OK' highlighted, press the **ENT** Key to activate the pending flight plan. The pending flight plan becomes the active flight plan and is removed from the 'FPL - Flight Plan Catalog' Page. To cancel the request, press the **CLR** Key, or highlight 'Cancel' and press the **ENT** Key.

Deleting a pending flight plan:

1) Press the **FPL** Key.
2) Turn the small **FMS** Knob to display the 'FPL - Flight Plan Catalog' Page.
3) Press the **FMS** Knob to activate the cursor.
4) Turn the **FMS** Knob to highlight the desired pending flight plan.
5) Press the **Delete** Softkey. The 'Delete Flight Plan XX?' Window is displayed.

   Or:

   Press the **CLR** Key. The 'Delete Flight Plan XX?' Window is displayed.

   Or:

   a) Press the **MENU** Key.
   b) Turn the **FMS** Knob to highlight 'Delete Flight Plan'.
   c) Press the **ENT** Key. The 'Delete Flight Plan XX?' Window is displayed.

6) With 'OK' highlighted, press the **ENT** Key to delete the pending flight plan. The pending flight plan is removed from the 'FPL - Flight Plan Catalog' Page. To cancel the request, press the **CLR** Key, or highlight 'Cancel' and press the **ENT** Key.

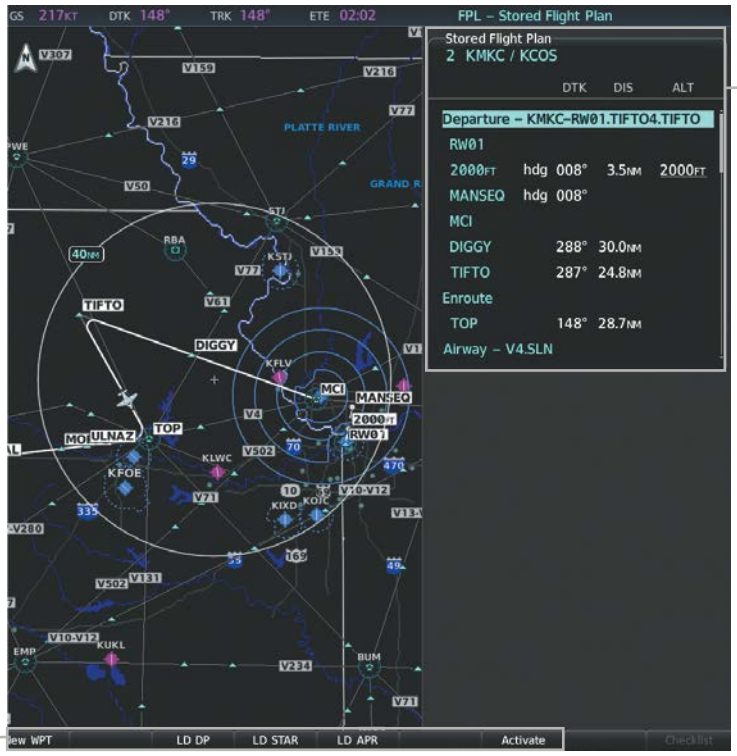
Deleting all pending flight plans:

1) Press the **FPL** Key.
2) Turn the small **FMS** Knob to display the 'FPL - Flight Plan Catalog' Page.
3) Press the **MENU** Key.
4) Turn the **FMS** Knob to highlight 'Delete All Pending'.
5) Press the **ENT** Key. A 'Delete all pending flight plans?' confirmation window is displayed.
6) With 'OK' highlighted, press the **ENT** Key to delete all pending flight plans. To cancel the request, press the **CLR** Key, or highlight 'Cancel' and press the **ENT** Key.

ADDING WAYPOINTS TO AN EXISTING FLIGHT PLAN

Waypoints can be added to the active flight plan or any stored flight plan. Choose the flight plan, select the desired point of insertion, enter the waypoint, and it is added to the flight plan. Flight plans are limited to 100 waypoints (including waypoints within airways and procedures). If the number of waypoints in the flight plan exceeds 100, the message "Flight plan is full. Remove unnecessary waypoints." appears and the new waypoint(s) are not added to the flight plan.

NOTE: *Manually adding waypoints to a flight plan after a MANSEQ leg creates a lateral gap in the flight plan. Time, fuel, and distance values for legs beyond the gap do not include the distance across the gap.*



Stored Flight Plan Selected
- *Memory Slot*
- *Comment*
- *Procedure Identifier*
- *Waypoint Identifier*
- *Airway Identifier*
- *Desired Track to Waypoint*
- *Distance to Waypoint*
- *Waypoint Altitude Constraint*

Softkeys

Figure 5-53 Stored Flight Plan Page

Adding a waypoint to a stored flight plan:

1) On the 'FPL - Flight Plan Catalog' Page, press the **FMS** Knob to activate the cursor.
2) Highlight the desired flight plan.
3) Press the **Edit** Softkey; or press the **ENT** Key, turn the large **FMS** Knob clockwise to select 'Edit' and press the **ENT** Key. The 'FPL - Stored Flight Plan' Page is displayed.
4) Highlight the location to insert the waypoint using the FMS Knob (If an enroute waypoint or the dashes are selected, the new waypoint will be placed before the selected item).
5) Turn the small **FMS** Knob to display the 'Waypoint Information' Window. (Turning it clockwise displays a blank 'Waypoint Information' Window, turning it counter-clockwise displays the 'Waypoint Information' Window with a waypoint selection submenu allowing selection of active flight plan, nearest, recent, user, or airway waypoints).
6) Enter the identifier, facility, or city name of the waypoint or select a waypoint from the submenu of waypoints and press the **ENT** Key. The new waypoint now exists in the flight plan.

NOTE: *If the identifier entered in the Waypoint Information Window has duplicates, a Duplicate Waypoint Window is displayed. Use the FMS Knob to select the correct waypoint.*

NOTE: *If the flight plan is successfully edited in the Flight Plan Window from PFD while the MFD Active Flight Plan Page is in the process of being edited, the 'Flight Plan Modified By Other User' Window will appear on the MFD. Press the **ENT** key to return to the Active Flight Plan Page with the accepted changes.*

Adding a waypoint to the active flight plan:

1) Press the **FPL** Key.
2) Press the **FMS** Knob to activate the cursor (not required on the PFD).
3) Highlight the location to insert the waypoint using the FMS Knob (If the enroute header is selected, the new waypoint is placed following the header. If an enroute waypoint or the dashes are selected, the new waypoint will be placed before the selected item).
4) Turn the small **FMS** Knob to display the 'Waypoint Information' Window. (Turning it clockwise displays a blank 'Waypoint Information' Window, turning it counter-clockwise displays the 'Waypoint Information' Window with a waypoint selection submenu allowing selection of active flight plan, nearest, recent, user, or airway waypoints).
5) Enter the identifier, facility, or city name of the waypoint or select a waypoint from the submenu of waypoints and press the **ENT** Key. The active flight plan is modified as each waypoint is entered.

Creating and adding user waypoints to the active flight plan:

1) Push the **Joystick** to activate the panning function on the 'FPL - Active Flight Plan' Page and pan to the map location of the desired user waypoint.
2) Press the **LD WPT** Softkey; or press the **MENU** Key, select 'Load Waypoint', and press the **ENT** Key. The user waypoint is created with a name of USRxxx (using the next available in sequence) and is added to the active flight plan.

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

Designating a fly-over waypoint:

1) For the active flight plan, press the **FPL** Key and press the FMS Knob to activate the cursor (not required on the PFD).

   Or:

   For a stored flight plan, highlight the desired flight plan on the 'FPL - Flight Plan Catalog Page' and press the **Edit** Softkey.

2) Highlight the desired waypoint.

3) Press the **MENU** Key, highlight 'Set Fly-Over Waypoint', and press the **ENT** Key. The 'Set <waypoint> to be a fly-over waypoint?' Window is displayed.

4) With 'OK' highlighted, press the **ENT** Key. To cancel the request, press the **CLR** Key, or highlight 'Cancel' and press the **ENT** Key.

5) To change the waypoint back to a fly-by waypoint, highlight the desired waypoint. Press the **MENU** Key, highlight 'Set Fly-By Waypoint', and press the **ENT** Key. The 'Set <waypoint> to be a fly-by waypoint?' Window is displayed. With 'OK' highlighted, press the **ENT** Key.

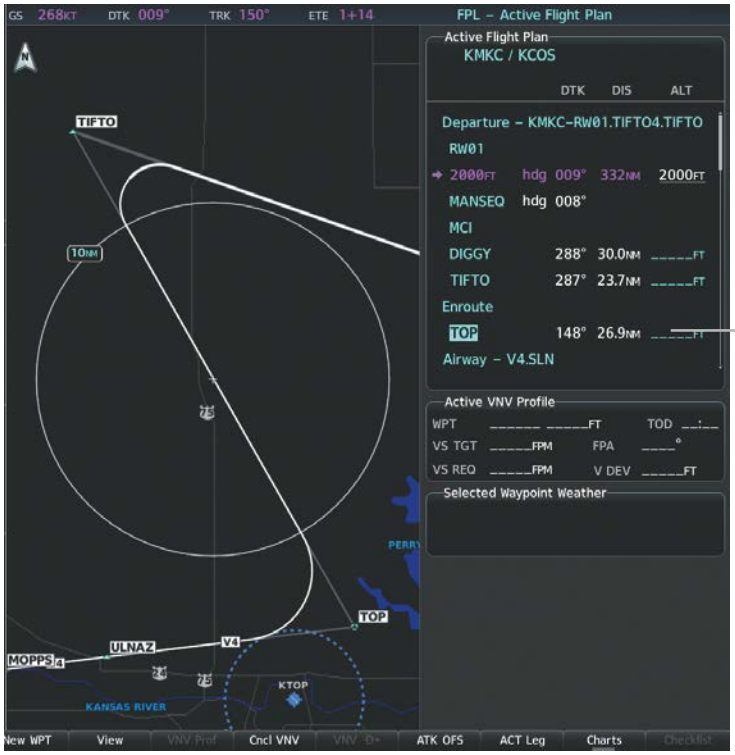


Figure 5-54 TOP Fly-By Waypoint

Figure 5-55 TOP Fly-Over Waypoint

ADDING AIRWAYS TO A FLIGHT PLAN

Airways can be added to the active flight plan or any stored flight plan. Choose a flight plan (add the desired airway entry point if not already in the flight plan), select the waypoint after the desired airway entry point, select the airway, and it is added in front of the selected waypoint. An airway can only be loaded if there is a waypoint in the flight plan that is part of the desired airway and is not part of an arrival or approach procedure. The system also anticipates the desired airway and exit point based on loaded flight plan waypoints.

Figure 5-56 Select Airway Page - Selecting Airway

Adding an airway to a flight plan:

1) Press the **FPL** Key.
2) Press the **FMS** Knob to activate the cursor (not required on the PFD).
3) Turn the large **FMS** Knob to highlight the waypoint after the desired airway entry point. If this waypoint is not a valid airway entry point, a valid entry point should be entered at this time.
4) Turn the small **FMS** Knob one click clockwise and press the **LD AIRWY** Softkey on the MFD, or press the **MENU** Key and select "Load Airway" on the PFD. The Select Airway Page is displayed. The **LD AIRWY** Softkey or the "Load Airway" menu item is available only when a valid airway entry waypoint has been chosen (the waypoint ahead of the cursor position).
5) Turn the **FMS** Knob to select the desired airway from the list, and press the **ENT** Key. Low altitude airways are shown first in the list, followed by "all" altitude airways, and then high altitude airways.

6) Turn the **FMS** Knob to select the desired airway exit point from the list, and press the **ENT** Key. 'Load?' is highlighted.

7) Press the **ENT** Key. The system returns to editing the flight plan with the new airway inserted.

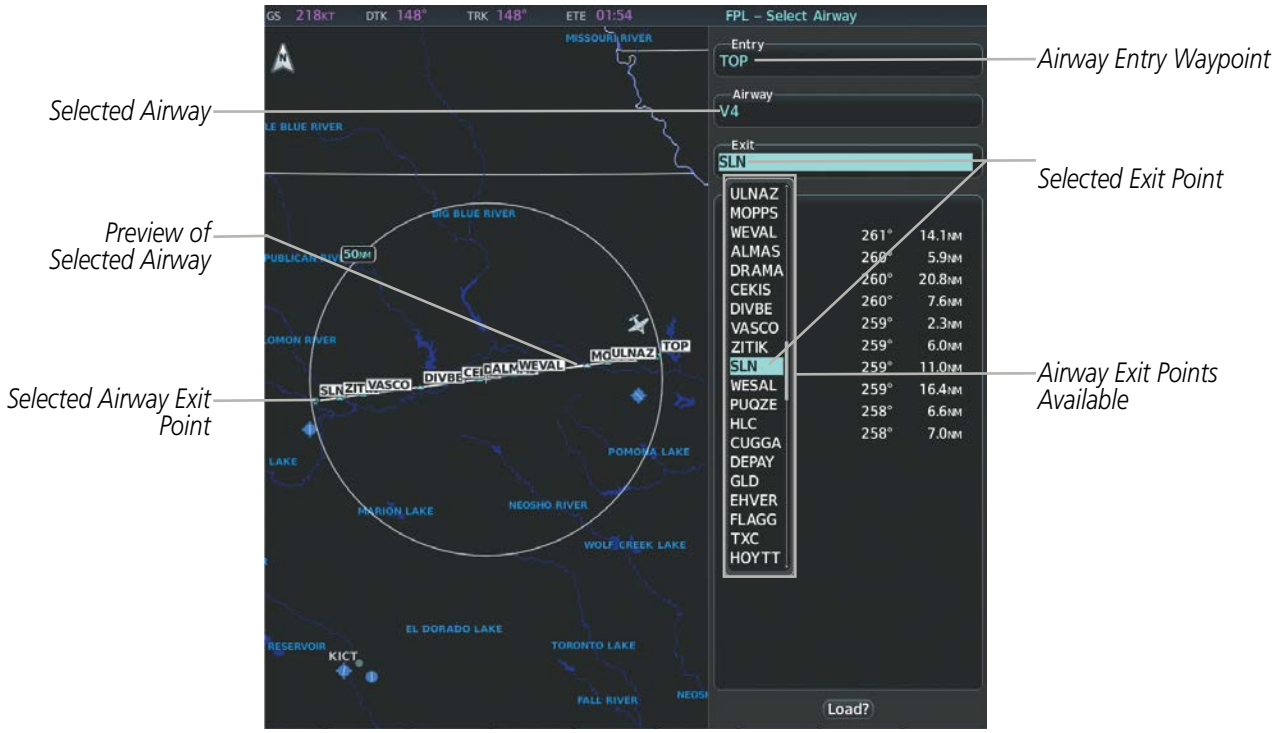


Figure 5-57 Select Airway Page - Selecting Exit Point

RESTRICTIONS ON ADDING AIRWAYS

Some airways have directional restrictions on all or part of the route. Airway "A2" in Europe has a directional restriction over the whole route such that it can be flown only one direction. Another example, airway "UR975" in North Africa, has more complicated directional restrictions within the list of airway waypoints. That is, each waypoint may have its own conditional route in relation to another waypoint.

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

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

ADDING PROCEDURES TO A STORED FLIGHT PLAN

The system allows the pilot to insert pre-defined instrument procedures from the navigation database into a flight plan. The procedures are designed to facilitate routing of traffic leaving an airport (departure), arriving at an airport (arrival), and landing at an airport (approach). See the procedures section for more details.

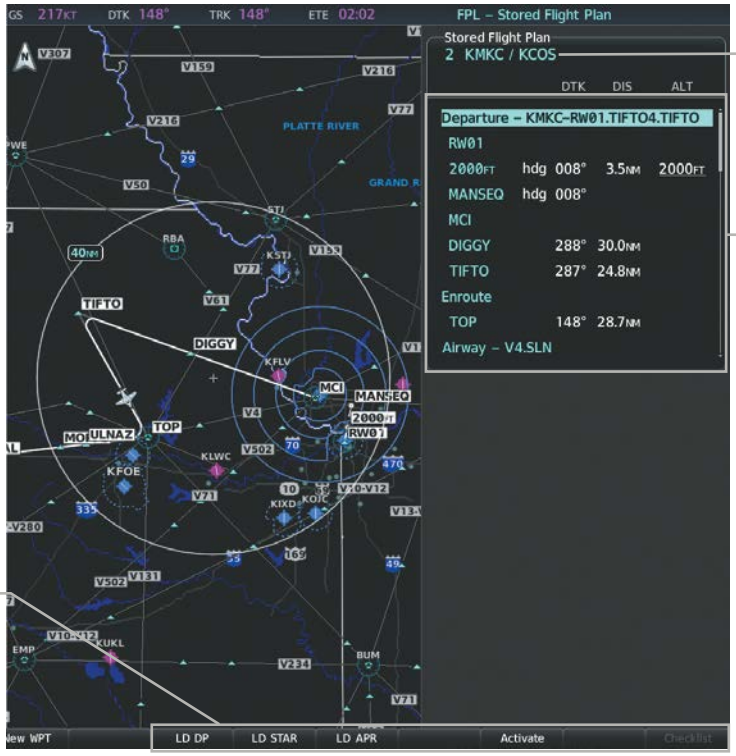


Figure 5-58 Stored Flight Plan Page

DEPARTURE

A Departure Procedure (DP) is loaded at the departure airport in the flight plan. Only one departure can be loaded at a time in a flight plan. The route is defined by selection of a departure, the transition waypoints, and a runway.

Loading a departure procedure into a stored flight plan:

1) Select a stored flight plan from the 'FPL - Flight Plan Catalog' Page.
2) Press the **Edit** Softkey; or press the **MENU** Key, select 'Edit Flight Plan', and press the **ENT** Key. The 'FPL - Stored Flight Plan' Page is displayed.
3) Press the **LD DP** Softkey; or press the **MENU** Key, select 'Load Departure', and press the **ENT** Key. The 'PROC - Departure Loading' Page is displayed.
4) Select a departure. Press the **ENT** Key.
5) Select a runway served by the selected departure, if required. Press the **ENT** Key.
6) Select a transition for the selected departure. Press the **ENT** Key.
7) Press the **ENT** Key to load the selected departure procedure.

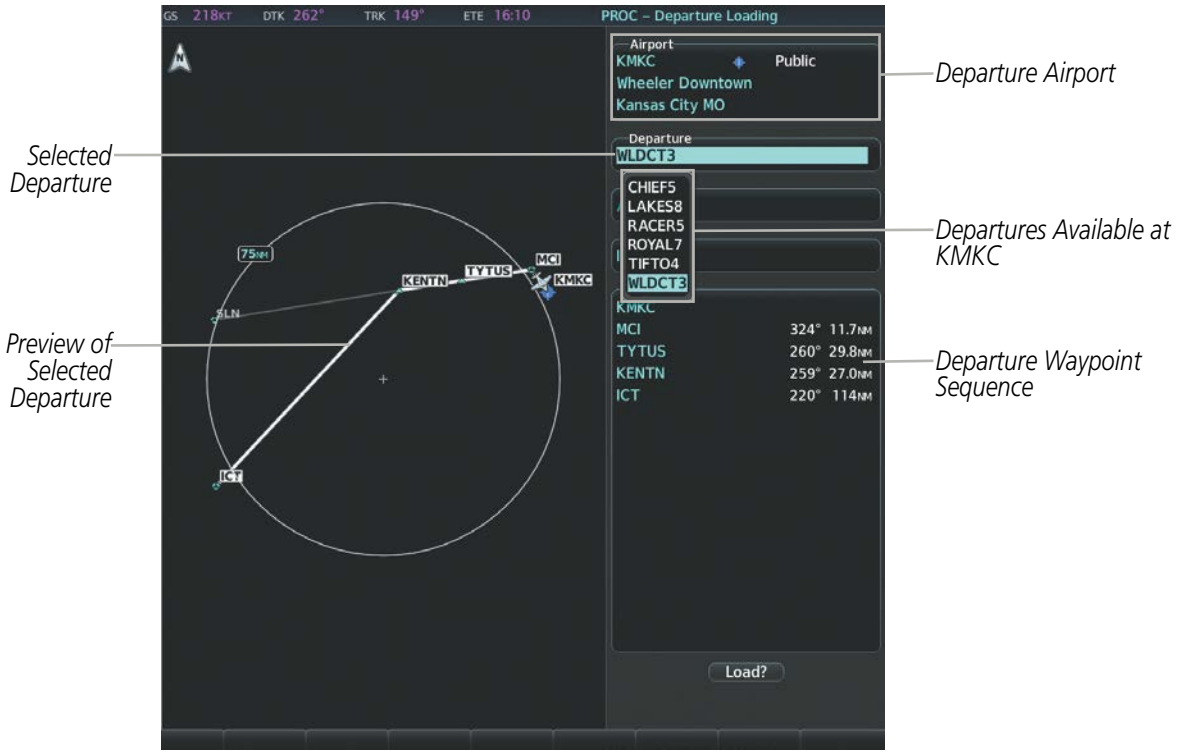


Figure 5-59 Departure Loading Page - Selecting the Departure

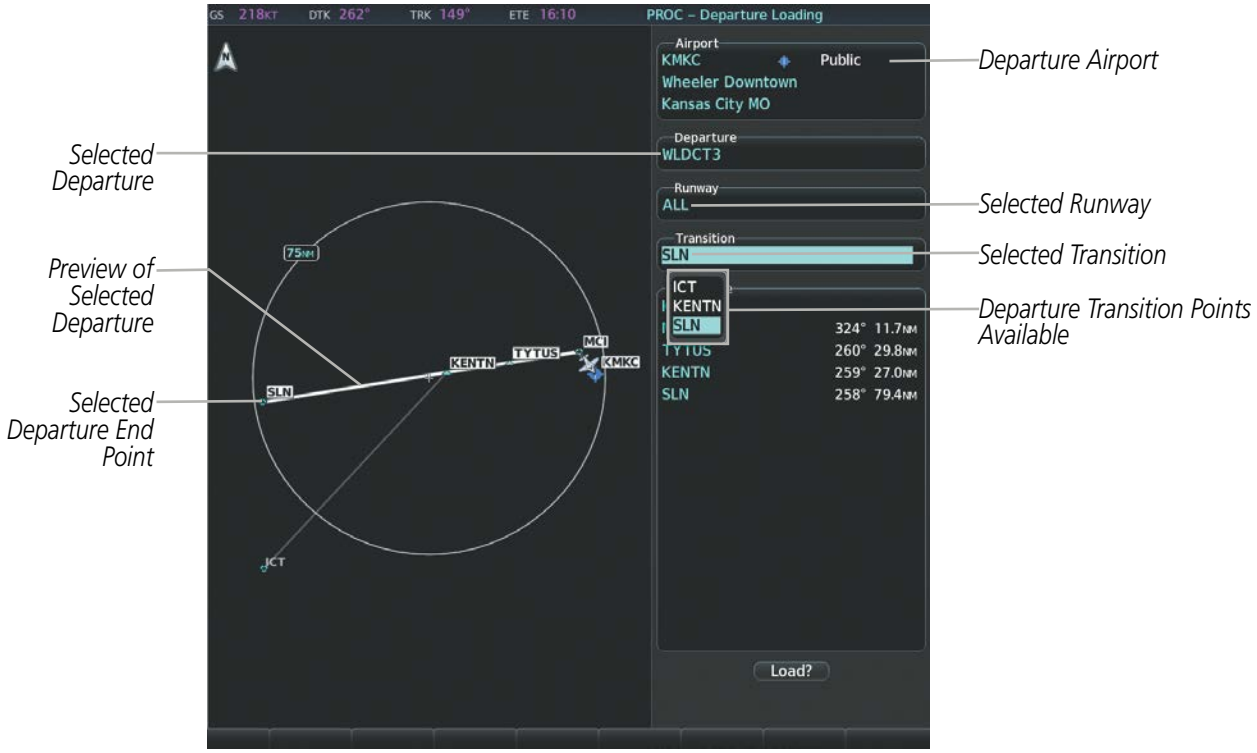


Figure 5-60 Departure Loading Page - Selecting Transition

ARRIVAL

A Standard Terminal Arrival (STAR) is loaded at the destination airport in the flight plan. Only one arrival can be loaded at a time in a flight plan. The route is defined by selection of an arrival, the transition waypoints, and a runway.

Loading an arrival procedure into a stored flight plan:

1) Select a stored flight plan from the 'FPL - Flight Plan Catalog' Page.
2) Press the **Edit** Softkey; or press the **MENU** Key, select 'Edit Flight Plan', and press the **ENT** Key. The 'FPL - Stored Flight Plan' Page is displayed.
3) Press the **LD STAR** Softkey; or press the **MENU** Key, select 'Load Arrival', and press the **ENT** Key. The 'PROC - Arrival Loading' Page is displayed.
4) Select an arrival. Press the **ENT** Key.
5) Select a transition for the selected arrival. Press the **ENT** Key.
6) Select a runway served by the selected arrival, if required. Press the **ENT** Key.
7) Press the **ENT** Key to load the selected arrival procedure.

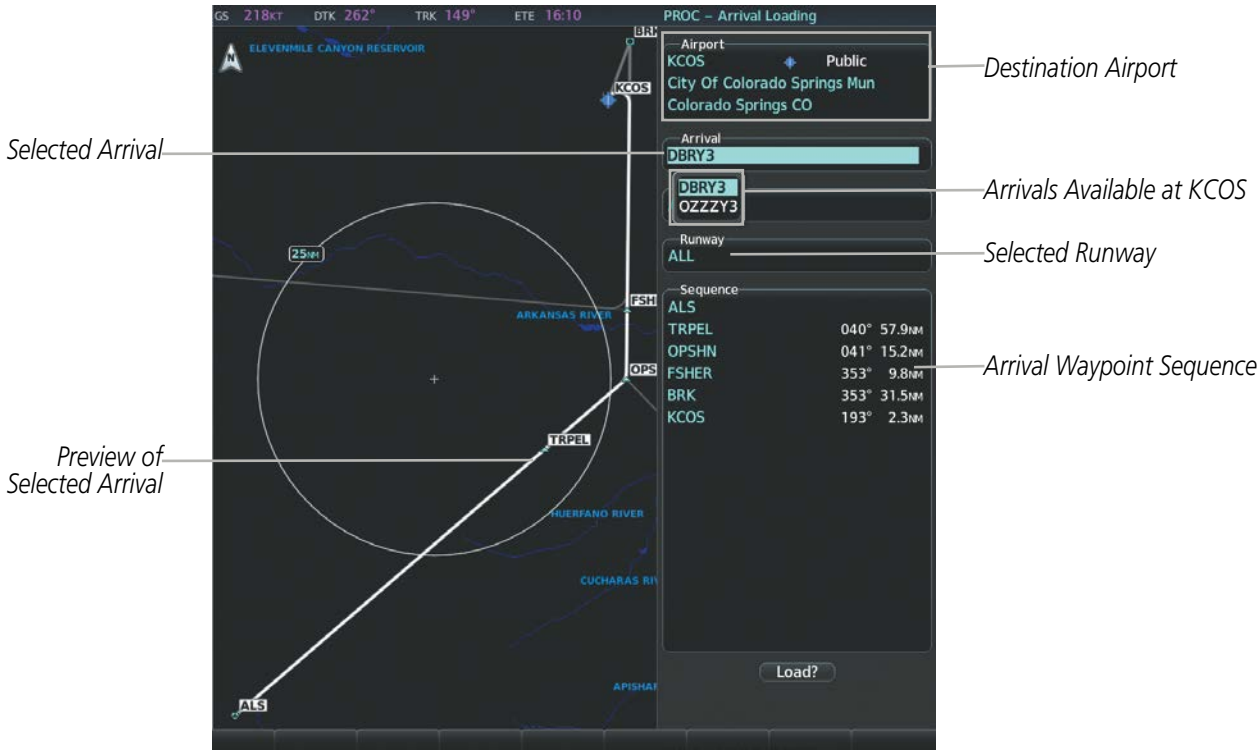


Figure 5-61 Arrival Loading Page - Selecting the Arrival

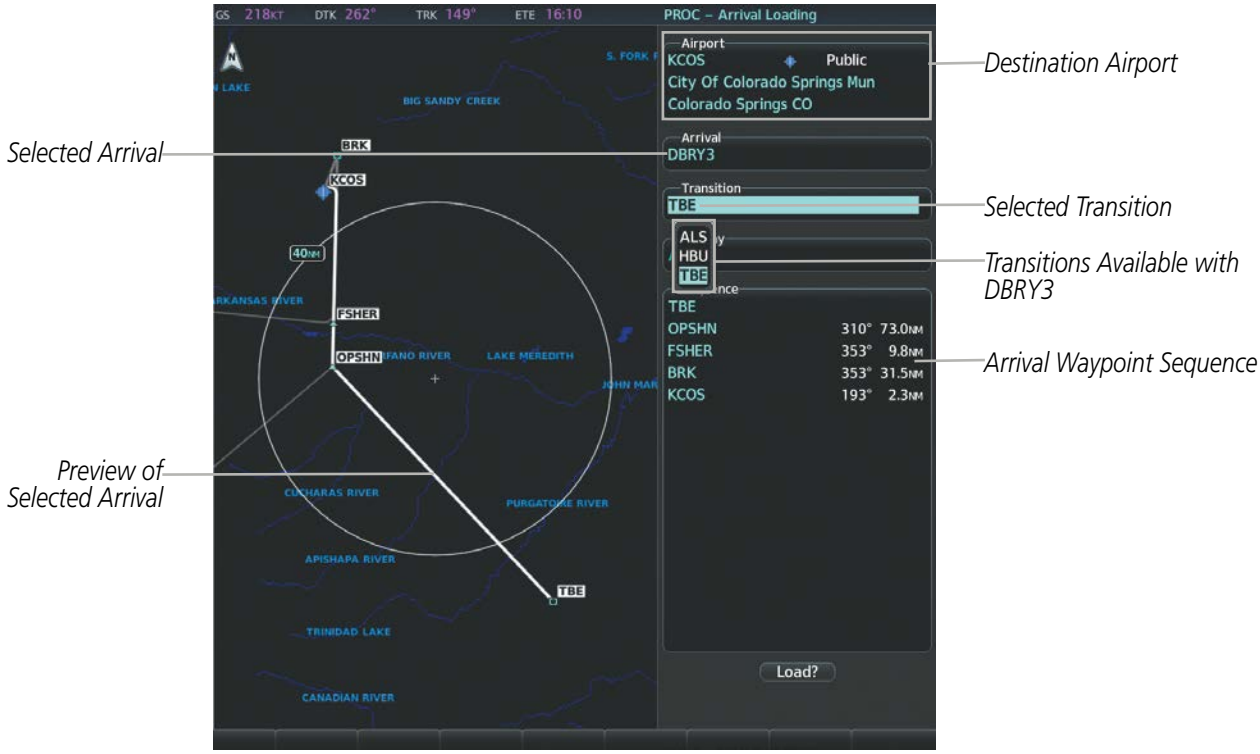


Figure 5-62 Arrival Loading Page - Selecting the Transition

APPROACH

An Approach Procedure (APR) can be loaded at any airport that has an approach available. Only one approach can be loaded at a time in a flight plan. The route for a selected approach is defined by designating transition waypoints.

Loading an approach procedure into a stored flight plan:

1) Select a stored flight plan from the 'FPL - Flight Plan Catalog' Page.
2) Press the **Edit** Softkey; or press the **MENU** Key, select 'Edit Flight Plan', and press the **ENT** Key. The 'PROC - Stored Flight Plan' Page is displayed.
3) Press the **LD APR** Softkey; or press the **MENU** Key, select 'Load Approach', and press the **ENT** Key. The 'PROC - Approach Loading' Page is displayed.
4) Select the airport and approach:
   a) Use the **FMS** Knob to select an airport and press the **ENT** Key.
   b) Select an approach from the list and press the **ENT** Key.

   Or:

   a) If necessary, push the **FMS** Knob to exit the approach list, and use the large **FMS** Knob to move the cursor to the 'Approach Channel' Field.
   b) Use the **FMS** Knob to enter the approach channel number, and press the **ENT** Key to accept the approach channel number. The airport and approach are selected.
5) Select a transition for the selected approach. Press the **ENT** Key.
6) Press the **ENT** Key to load the selected approach procedure.

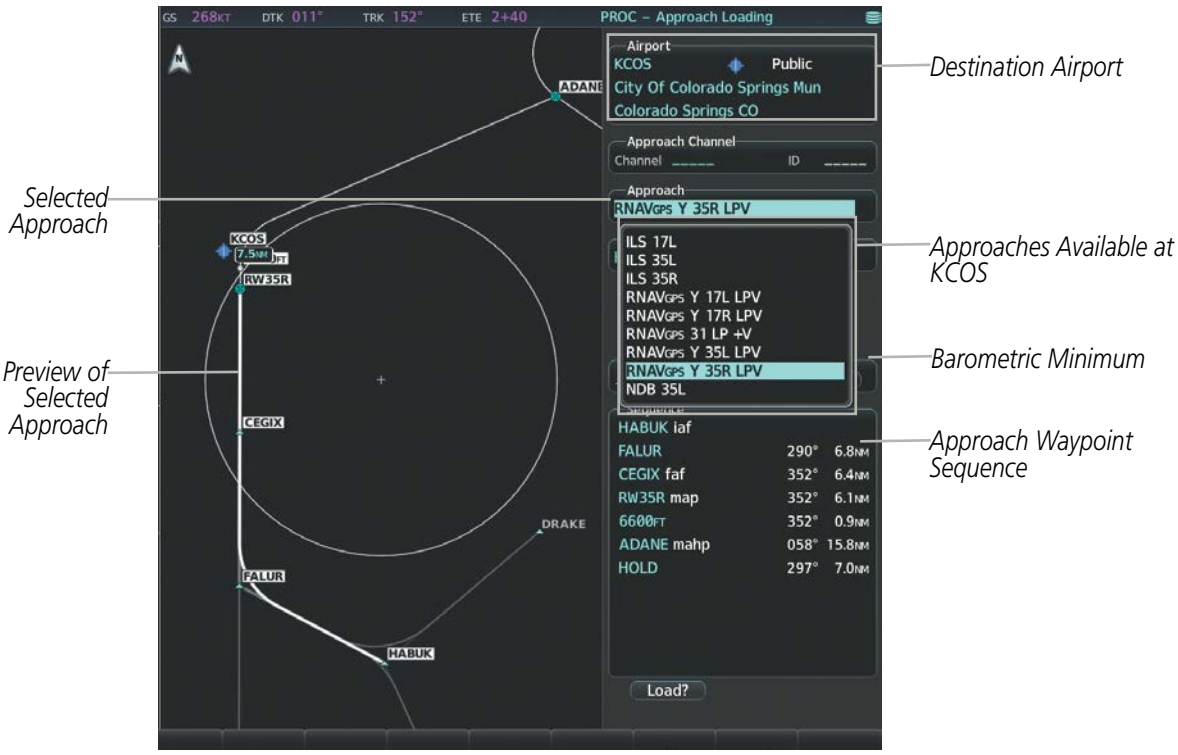


Figure 5-63 Approach Loading Page - Selecting the Approach

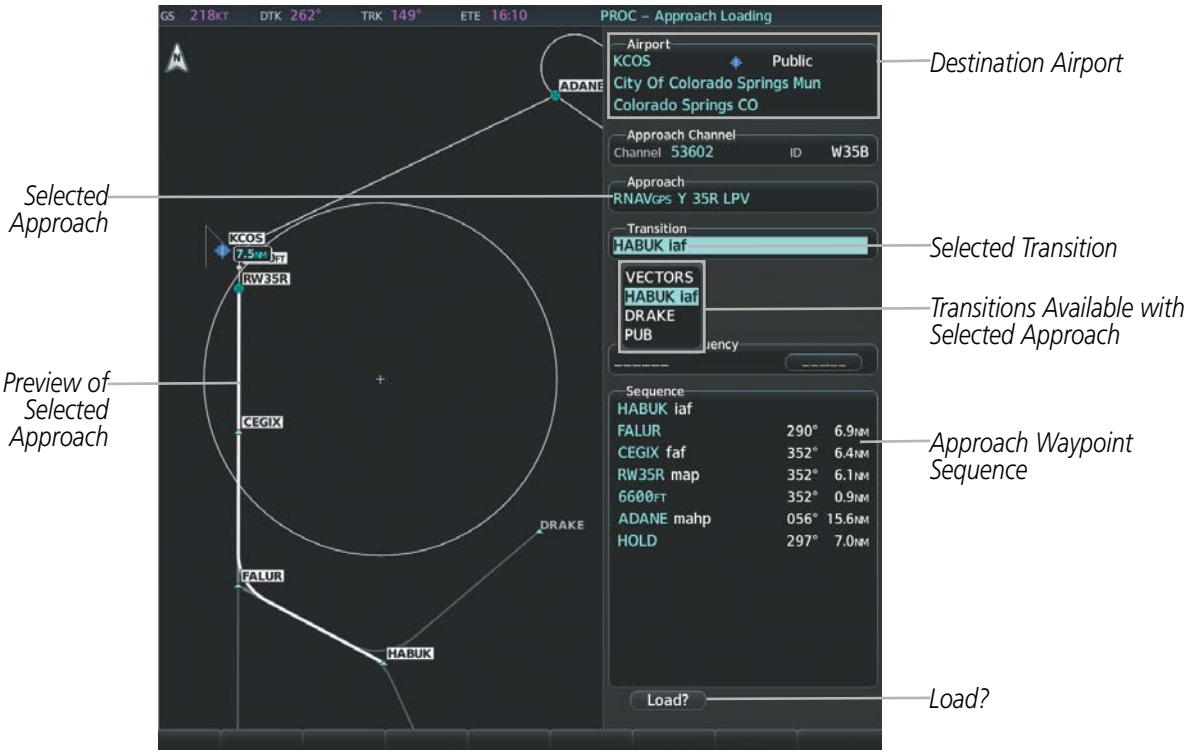


Figure 5-64 Approach Loading Page - Selecting the Transition

FLIGHT PLAN STORAGE

The system can store up to 99 flight plans, numbered 1 through 99. The active flight plan is erased when the system is powered off or when another flight plan is activated. Details about each stored flight plan can be viewed on the Flight Plan Catalog Page and on the Stored Flight Plan Page.

Viewing information about a stored flight plan:

1) Press the **FPL** Key on the MFD to display the 'FPL - Active Flight Plan' Page.
2) Turn the small **FMS** Knob clockwise one click to display the 'FPL - Flight Plan Catalog' Page.
3) Press the **FMS** Knob to activate the cursor and turn the **FMS** Knob to highlight the desired flight plan.
4) The 'Flight Plan Info' Box displays departure, destination, total distance, and enroute safe altitude information for the selected flight plan.
5) Press the **Edit** Softkey to open the 'FPL - Stored Flight Plan' Page and view the waypoints in the flight plan.
6) Press the **FMS** Knob to exit the 'FPL - Stored Flight Plan' Page.

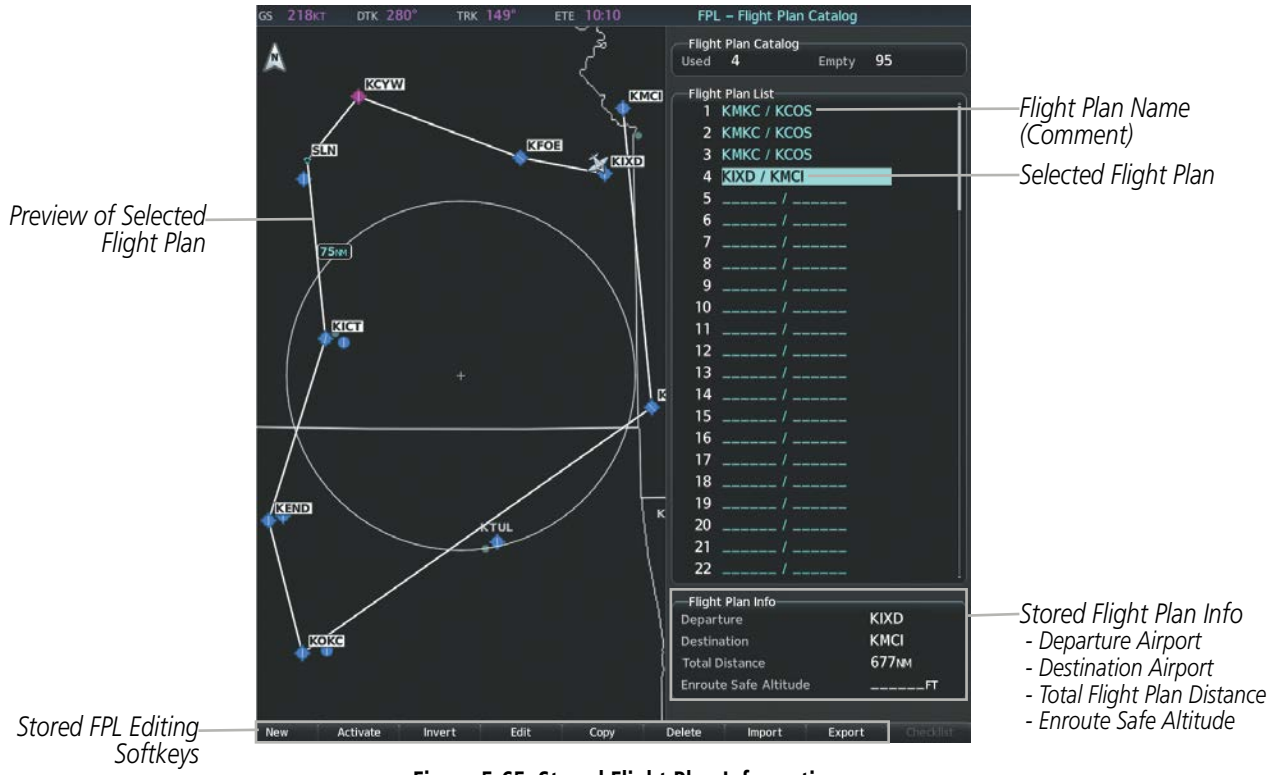


Figure 5-65 Stored Flight Plan Information

Storing an active flight plan from the 'FPL - Active Flight Plan' Page or the 'Flight Plan' Window:

1) Press the **MENU** Key.
2) Highlight 'Store Flight Plan'.
3) Press the **ENT** Key.
4) With 'OK' highlighted, press the **ENT** Key. The flight plan is stored in the next available position in the flight plan list on the 'FPL - Flight Plan Catalog' Page.

ACTIVATE A FLIGHT PLAN

Activating a stored flight plan erases the active flight plan and replaces it with the flight plan being activated. Inverting a stored flight plan reverses the waypoint order, erases the active flight plan, and replaces it with the flight plan being activated (the stored flight plan is not changed).

Activating a stored flight plan on the MFD:

1) Press the **FPL** Key and turn the small **FMS** Knob to display the 'FPL - Flight Plan Catalog' Page.
2) Press the **FMS** Knob to activate the cursor, and turn the **FMS** Knob to highlight the desired flight plan.
3) Press the **Activate** Softkey; or press the **ENT** Key twice; or press the **MENU** Key, highlight 'Activate Flight Plan', and press the **ENT** Key. The 'Activate stored flight plan?' Window is displayed.
4) With 'OK' highlighted, press the **ENT** Key. To cancel the request, press the **CLR** Key, or highlight 'Cancel' and press the **ENT** Key.

Inverting and activating a stored flight plan on the MFD:

1) Press the **FPL** Key and turn the small **FMS** Knob to display the 'FPL - Flight Plan Catalog' Page.
2) Press the **FMS** Knob to activate the cursor, and turn the **FMS** Knob to highlight the desired flight plan.
3) Press the **Invert** Softkey; or press the **MENU** Key, highlight 'Invert & Activate FPL?', and press the **ENT** Key. The 'Invert and activate stored flight plan?' Window is displayed.
4) With 'OK' highlighted, press the **ENT** Key. To cancel the request, press the **CLR** Key, or highlight 'Cancel' and press the **ENT** Key.

COPY A FLIGHT PLAN

The system allows copying a flight plan into a new flight plan memory slot, allowing editing, etc., without affecting the original flight plan. This can be used to duplicate an existing stored flight plan for use in creating a modified version of the original stored flight plan.

Copying a stored flight plan on the MFD:

1) Press the **FPL** Key and turn the small **FMS** Knob to display the 'FPL - Flight Plan Catalog' Page.
2) Press the **FMS** Knob to activate the cursor, and turn the **FMS** Knob to highlight the desired flight plan.
3) Press the **Copy** Softkey; or press the **MENU** Key, highlight 'Copy Flight Plan', and press the **ENT** Key. The 'Copy to flight plan XX?' Window is displayed.
4) With 'OK' highlighted, press the **ENT** Key to copy the flight plan. To cancel the request, press the **CLR** Key, or highlight 'Cancel' and press the **ENT** Key.

DELETE A STORED FLIGHT PLAN

Individual or all stored flight plans can be deleted from the system memory.

Deleting a stored flight plan:

1) Press the **FPL** Key and turn the small **FMS** Knob to display the 'FPL - Flight Plan Catalog' Page.
2) Press the **FMS** Knob to activate the cursor, and turn the **FMS** Knob to highlight the desired flight plan.
3) Press the **Delete** Softkey; press the **CLR** Key; or press the **MENU** Key, highlight 'Delete Flight Plan', and press the **ENT** Key. The 'Delete flight plan XX?' Window is displayed.
4) With 'OK' highlighted, press the **ENT** Key to delete the flight plan. To cancel the request, press the **CLR** Key, or highlight 'Cancel' and press the **ENT** Key.

NOTE: *The option to delete all stored flight plans is not available while the aircraft is in flight.*

Deleting all stored flight plans:

1) Press the **FPL** Key and turn the small **FMS** Knob to display the 'FPL - Flight Plan Catalog' Page.
2) Press the **MENU** Key.
3) Highlight 'Delete All' and press the **ENT** Key. A 'Delete all flight plans?' confirmation window is displayed.
4) With 'OK' highlighted, press the **ENT** Key to delete all flight plans. To cancel the request, press the **CLR** Key, or highlight 'Cancel' and press the **ENT** Key.

FLIGHT PLAN EDITING

The active flight plan or any stored flight plan can be edited. The edits made to the active flight plan affect navigation as soon as they are entered.

DELETING THE ACTIVE FLIGHT PLAN

The system allows deleting an active flight plan. Deleting the active flight plan suspends navigation by the system.

Deleting the active flight plan:

1) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page (MFD) or the 'Flight Plan' Window (PFD).
2) Press the **MENU** Key, highlight 'Delete Flight Plan', and press the **ENT** Key. The 'Delete all waypoints in flight plan?' Window is displayed.
3) With 'OK' highlighted, press the **ENT** Key to delete the active flight plan. To cancel the request, press the **CLR** Key, or highlight 'Cancel' and press the **ENT** Key.

DELETING FLIGHT PLAN ITEMS

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

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

Deleting an individual waypoint from the active flight plan:

1) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page (MFD) or the 'Flight Plan' Window (PFD).
2) Press the **FMS** Knob to activate the cursor (not required on the PFD) and turn the large **FMS** Knob to highlight the waypoint to be deleted.
3) Press the **CLR** Key. The 'Remove XXXXX?' Window is displayed.
4) With 'OK' highlighted, press the **ENT** Key. To cancel the request, press the **CLR** Key, or highlight 'Cancel' and press the **ENT** Key.
5) Press the **FMS** Knob to remove the flashing cursor.

Deleting an entire airway from the active flight plan:

1) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page (MFD) or the 'Flight Plan' Window (PFD).
2) Press the **FMS** Knob to activate the cursor (not required on the PFD) and turn the large **FMS** Knob to highlight the header of the airway to be deleted.
3) Press the **CLR** Key. The 'Remove <airway name> from flight plan?' Window is displayed.
4) With 'OK' highlighted, press the **ENT** Key. To cancel the request, press the **CLR** Key, or highlight 'Cancel' and press the **ENT** Key.
5) Press the **FMS** Knob to remove the flashing cursor.

Deleting an entire procedure from the active flight plan:

1) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page (MFD) or the 'Flight Plan' Window (PFD).
2) Press the **FMS** Knob to activate the cursor (not required on the PFD) and turn the large **FMS** Knob to highlight the header of the procedure to be deleted.
3) Press the **CLR** Key. The 'Remove <procedure name> from flight plan?' Window is displayed.
4) With 'OK' highlighted, press the **ENT** Key. To cancel the request, press the **CLR** Key, or highlight 'Cancel' and press the **ENT** Key.
5) Press the **FMS** Knob to remove the flashing cursor.

Or:

1) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page (MFD) or the 'Flight Plan' Window (PFD).
2) Press the **MENU** Key to display the 'Page Menu' Window and turn the **FMS** Knob to highlight 'Remove <procedure>'.
3) Press the **ENT** Key. The 'Remove <procedure name> from flight plan?' Window is displayed.
4) With 'OK' highlighted, press the **ENT** Key. To cancel the request, press the **CLR** Key, or highlight 'Cancel' and press the **ENT** Key.

Deleting an individual waypoint from a stored flight plan:

1) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page.
2) Turn the small **FMS** Knob clockwise one click to display the 'FPL - Flight Plan Catalog' Page.
3) Press the **FMS** Knob to activate the cursor and turn the **FMS** Knob to highlight the flight plan to be edited.
4) Press the **Edit** Softkey; or press the **MENU** Key, select 'Edit Flight Plan' and press the **ENT** Key. The 'FPL - Stored Flight Plan' Page is displayed.
5) Turn the large **FMS** Knob to highlight the waypoint to be deleted.
6) Press the **CLR** Key. The 'Remove XXXXX?' Window is displayed.
7) With 'OK' highlighted, press the **ENT** Key. To cancel the request, press the **CLR** Key, or highlight 'Cancel' and press the **ENT** Key.
8) Press the **FMS** Knob to remove the flashing cursor.

Deleting an entire airway from a stored flight plan:

1) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page.
2) Turn the small **FMS** Knob clockwise one click to display the 'FPL - Flight Plan Catalog' Page.
3) Press the **FMS** Knob to activate the cursor and turn the **FMS** Knob to highlight the flight plan to be edited.
4) Press the **Edit** Softkey; or press the **MENU** Key, select 'Edit Flight Plan' and press the **ENT** Key. The 'FPL - Stored Flight Plan' Page is displayed.
5) Turn the large **FMS** Knob to highlight the header of the airway to be deleted.
6) Press the **CLR** Key. The 'Remove <airway name> from flight plan?' Window is displayed.
7) With 'OK' highlighted, press the **ENT** Key. To cancel the request, press the **CLR** Key, or highlight 'Cancel' and press the **ENT** Key.
8) Press the **FMS** Knob to remove the flashing cursor.

Deleting an entire procedure from a stored flight plan:

1) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page.
2) Turn the small **FMS** Knob clockwise one click to display the 'FPL - Flight Plan Catalog' Page.
3) Press the **FMS** Knob to activate the cursor and turn the **FMS** Knob to highlight the flight plan to be edited.
4) Press the **EDIT** Softkey; or press the **MENU** Key, select 'Edit Flight Plan' and press the **ENT** Key. The 'FPL - Stored Flight Plan' Page is displayed.
5) Turn the large **FMS** Knob to highlight the header of the procedure to be deleted.
6) Press the **CLR** Key. The 'Remove <procedure name> from flight plan?' Window is displayed.
7) With 'OK' highlighted, press the **ENT** Key. To cancel the request, press the **CLR** Key, or highlight 'Cancel' and press the **ENT** Key.
8) Press the **FMS** Knob to remove the flashing cursor.

Or:

1) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page.
2) Turn the small **FMS** Knob clockwise one click to display the 'FPL - Flight Plan Catalog' Page.
3) Press the **FMS** Knob to activate the cursor and turn the **FMS** Knob to highlight the flight plan to be edited.
4) Press the **Edit** Softkey; or press the **MENU** Key, select 'Edit Flight Plan' and press the **ENT** Key. The 'FPL - Stored Flight Plan' Page is displayed.
5) Press the **MENU** Key to display the 'Page Menu' Window and turn the **FMS** Knob to highlight 'Remove <procedure>'.
6) Press the **ENT** Key. The 'Remove <procedure name> from flight plan?' Window is displayed.
7) With 'OK' highlighted, press the **ENT** Key. To cancel the request, press the **CLR** Key, or highlight 'Cancel' and press the **ENT** Key.
8) Press the **FMS** Knob to remove the flashing cursor.

CHANGING FLIGHT PLAN COMMENTS (NAMES)

The comment field (or name) of each flight plan can be changed to something that is useful for identification and sorting.

Changing the active flight plan comment:

1) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page.
2) Press the **FMS** Knob to activate the cursor and turn the large **FMS** Knob to highlight the comment field.
3) Use the **FMS** Knobs to edit the comment.
4) Press the **ENT** Key to accept the changes.
5) Press the **FMS** Knob to remove the flashing cursor.

Changing a stored flight plan comment:

1) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page.
2) Turn the small **FMS** Knob clockwise one click to display the 'FPL - Flight Plan Catalog' Page.
3) Press the **FMS** Knob to activate the cursor and turn the **FMS** Knob to highlight the flight plan to be edited.
4) Press the **Edit** Softkey; or press the **MENU** Key, select 'Edit Flight Plan' and press the **ENT** Key. The 'FPL - Stored Flight Plan' Page is displayed.
5) Turn the large **FMS** Knob to highlight the comment field.
6) Use the **FMS** Knobs to edit the comment.
7) Press the **ENT** Key to accept the changes.
8) Press the **FMS** Knob to remove the flashing cursor.

ALONG TRACK OFFSETS

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

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

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

Figure 5-66 Along Track Offset

Entering an along track offset distance:

1) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page (MFD) or the 'Flight Plan' Window (PFD).
2) Press the **FMS** Knob to activate the cursor (not required on the PFD) and turn the large **FMS** Knob to highlight the waypoint for the along track offset.
3) Press the **ATK OFS** Softkey (MFD only); or press the **MENU** Key, highlight 'Create ATK Offset WPT', and press the **ENT** Key.
4) Enter a positive or negative offset distance in the range of +/- 1 to 999 nm (limited by leg distances).
5) Press the **ENT** Key to create the offset waypoint.
6) Press the **FMS** Knob to remove the flashing cursor.

PARALLEL TRACK

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

While flying a parallel track:

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

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

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

Activating parallel track:

1) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page (MFD) or the 'Flight Plan' Window (PFD).
2) Press the **MENU** Key, highlight 'Parallel Track', and press the **ENT** Key. The 'Parallel Track' Window is displayed with the 'Direction' Field highlighted.
3) Turn the small **FMS** Knob to select 'LEFT' or 'RIGHT' and press the **ENT** Key. The 'Distance' field is highlighted.
4) Turn the small **FMS** Knob to enter a distance from 1- 99 nm and press the **ENT** Key. 'Activate Parallel Track?' is highlighted.
5) Press the **ENT** Key to activate parallel track. Press the **FMS** Knob or the **CLR** Key to cancel the parallel track activation.

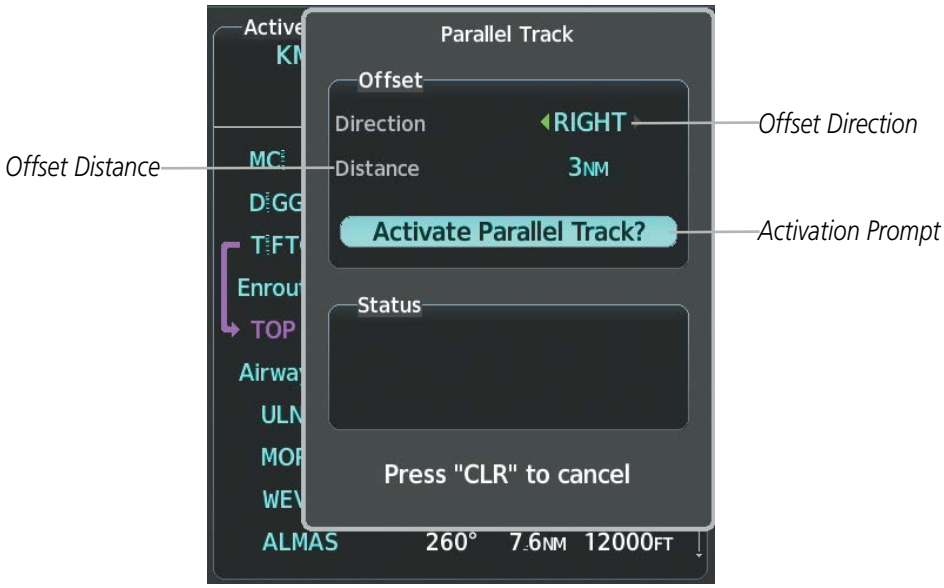


Figure 5-67 Parallel Track Window

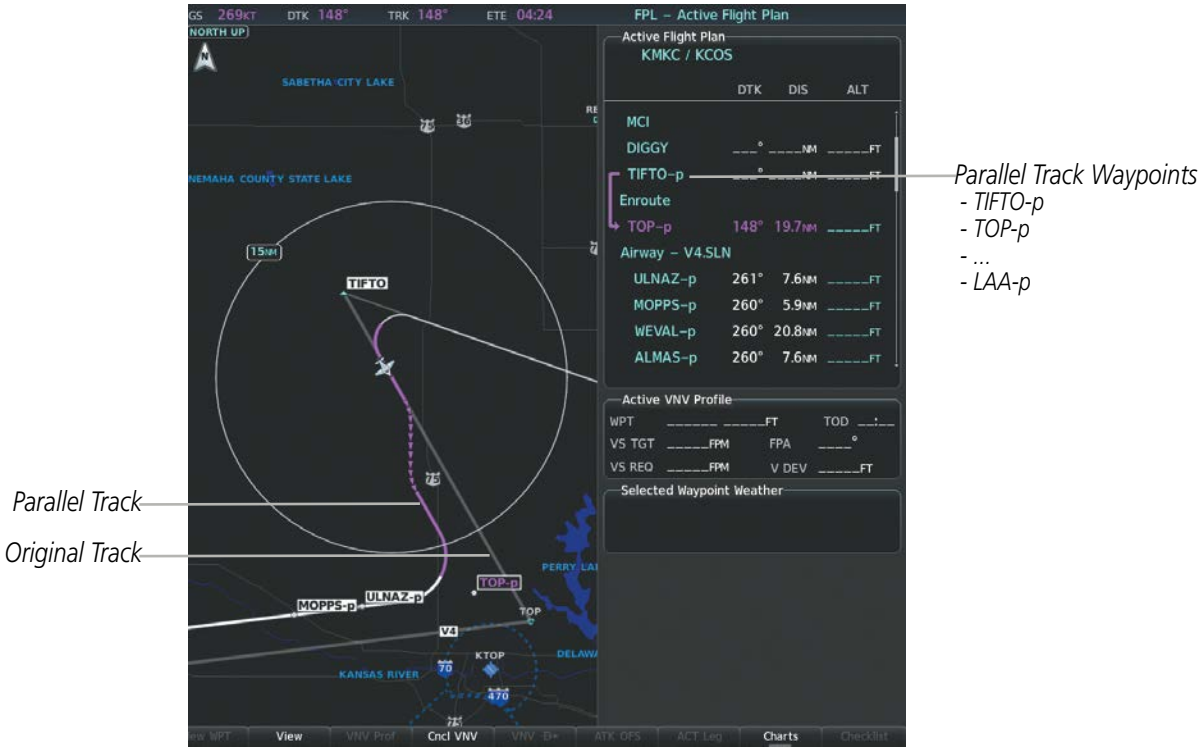


Figure 5-68 Parallel Track Active

If the parallel track proposed by the offset direction and distance is not allowed by the system, the activation prompt is displayed, but disabled. If an approach leg is active, the status indicates that the system is unable to activate the parallel track with the message 'Parallel Track Unavailable Approach Leg Active'. If the offset direction and distance results in an unreasonable route geometry (e.g., there is a sharp turn of more than 120 degrees), the status indicates that the system is unable to activate the parallel track because of invalid geometry ('Parallel Track Unavailable Invalid Route Geometry'). If the active leg is not a track between two fixes (TF) or a course to a fix (DF) leg, the status

indicates that the system is unable to activate the parallel track because parallel track is not available for the active leg type ('Parallel Track Unavailable Not Allowed for Active Leg'). Parallel track is also unavailable for a leg if there are no legs remaining in the flight plan after the given leg, or OBS mode is active. Parallel track will be cancelled if the active leg changes to a leg where one of the preceding is true.

Activation of parallel track will apply from the current position along the flight plan until a leg that does not meet the criteria for parallel track. Guidance will be computed to return to the original track at the beginning of that leg.

Cancelling parallel track:

1) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page (MFD) or the 'Flight Plan' Window (PFD).
2) Press the **MENU** Key, highlight 'Parallel Track', and press the **ENT** Key. The 'Parallel Track' Window is displayed with 'Cancel Parallel Track?' highlighted.
3) Press the **ENT** Key.

ACTIVATING A FLIGHT PLAN LEG

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

Activating a flight plan leg:

1) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page (MFD) or the 'Flight Plan' Window (PFD).
2) Press the **FMS** Knob to activate the cursor (not required on the PFD) and turn the large **FMS** Knob to highlight the destination waypoint for the desired leg.
3) Press the **ACT Leg** Softkey (MFD only); or press the **MENU** Key, highlight 'Activate Leg', and press the **ENT** Key. A confirmation window is displayed with 'Activate' highlighted.
4) Press the **ENT** Key to activate the flight plan leg. To cancel, press the **CLR** Key, or highlight 'Cancel' and press the **ENT** Key.
5) Press the **FMS** Knob to remove the flashing cursor.

INVERTING A FLIGHT PLAN

Any flight plan may be inverted (reversed) for navigation back to the original departure point.

Inverting the active flight plan:

1) Press the **FPL** Key to display the 'FPL - Active Flight Plan Page (MFD) or the 'Flight Plan' Window (PFD).
2) Press the **MENU** Key, highlight 'Invert Flight Plan', and press the **ENT** Key. An 'Invert active flight plan?' confirmation window is displayed.
3) Select 'OK'.
4) Press the **ENT** Key to invert and activate the active flight plan. To cancel, press the **CLR** Key, or highlight 'Cancel' and press the **ENT** Key.

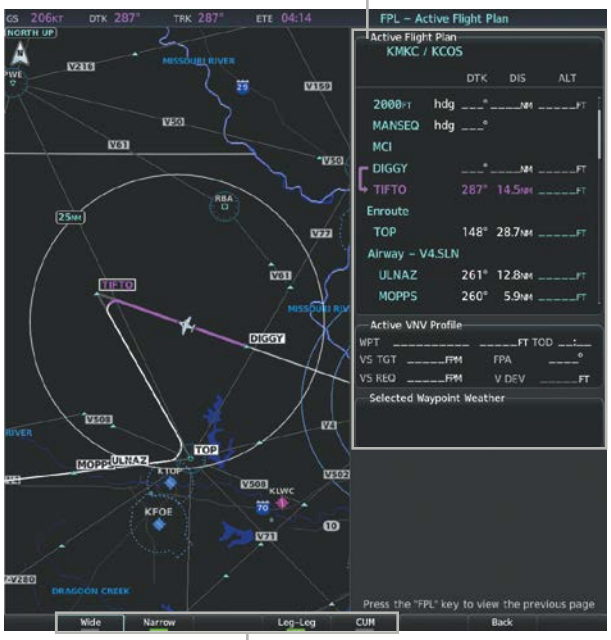
FLIGHT PLAN VIEWS

Information about flight plans can be viewed in more than one way. The active flight plan can be configured to show cumulative distance over the length of the flight plan or the distance for each leg of the flight plan; and the active flight plan can be viewed in a narrow or wide view. In the wide view, additional information is displayed: Fuel Remaining (FUEL REM), Estimated Time Enroute (ETE), Estimated Time of Arrival (ETA), and Bearing to the waypoint (BRG).

Changing the flight plan view:

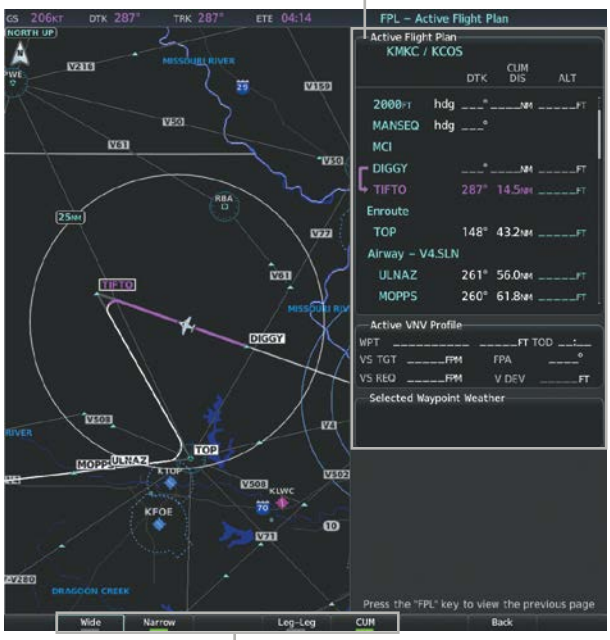
1) Press the **FPL** Key on the MFD to display the 'FPL - Active Flight Plan' Page.
2) Select the **View** Softkey to display the **Wide**, **Narrow**, **Leg-Leg**, and **CUM** Softkeys.
3) Select the **CUM** Softkey to view cumulative waypoint distance, or select the **Leg-Leg** Softkey to view leg-to-leg waypoint distance.
4) Select the **Wide** Softkey to display the wide view, or select the **Narrow** Softkey to display the narrow view.
5) Select the **Back** Softkey to return to the top level active flight plan softkeys.

Active Flight Plan Leg to Leg Distance



Wide *Softkey,* **Leg-Leg** *Softkey*

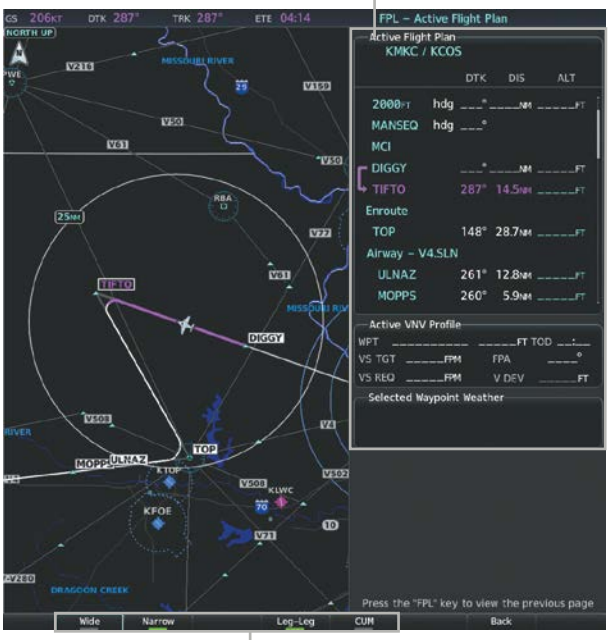
Active Flight Plan Cumulative Distance



Narrow *Softkey* **CUM** *Softkey*

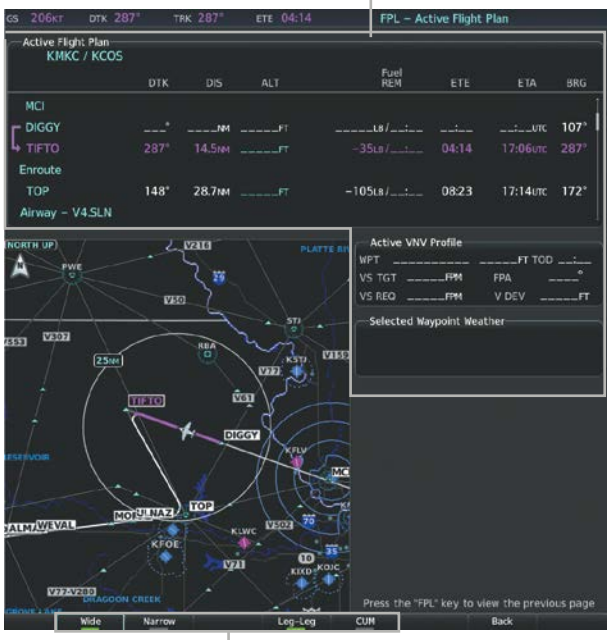
Figure 5-69 Active Flight Plan - Leg to Leg vs. Cumulative Distance

Active Flight Plan Narrow View



Wide *Softkey,* **Narrow** *Softkey,*

Active Flight Plan Wide View



Leg-Leg *Softkey,* **CUM** *Softkey*

Figure 5-70 Active Flight Plan - Wide vs. Narrow View

Charts may also be viewed alongside the active flight plan in split screen mode. With an active flight plan loaded into the system, the Charts page can be set to automatically display a chart depending on the active flight plan leg.

Viewing charts and active flight plan page in split screen mode:

1) Press the **FPL** Key on the MFD to display the 'FPL - Active Flight Plan' Page.
2) Press the **Charts** Softkey. Split screen mode is now enabled showing the Charts page alongside the Active Flight Plan Page, and Charts page is bordered by a cyan box indicating it is the active display pane.
3) To quickly view the chart corresponding to the active flight plan leg, press the **AUTO** Softkey.

For more information on Charts, see the Additional Features Section.

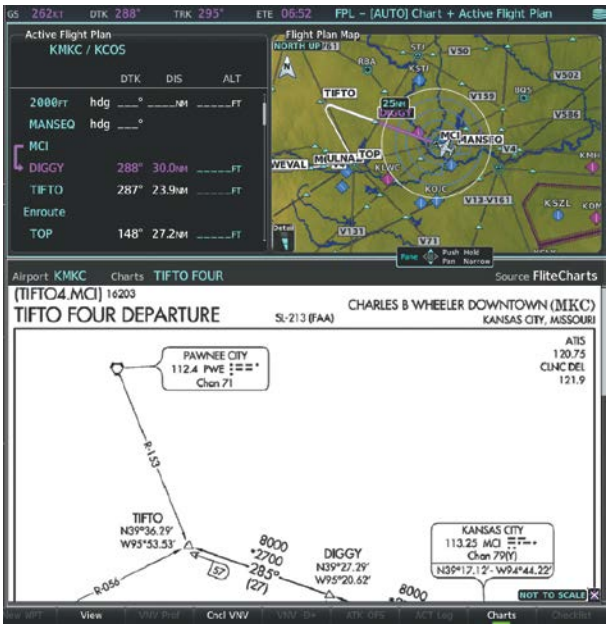
Activating split screen mode from the Active Flight Plan Page displays the Charts page which removes the Flight Plan Map. The Flight Plan Map can be re-displayed on the Active Flight Plan Page. However replacing the Flight Plan Map on the Active Flight Plan Page in split screen mode limits the flight plan content which can be displayed. For example, displaying the Flight Plan Map while in split screen narrow view removes the Active VNV Profile Box. See the following figures below depicting the different split screen displays with the Active Flight Plan.

Page Title shows Map - Chart + Navigation Map
- AUTO indicates the chart is corresponding to the phase of flight

Split Screen Narrow View *Split Screen Wide View*

Figure 5-71 Split Screen Narrow and Wide View

Split Screen Narrow View with Flight Plan Map



Split Screen Wide View with Flight Plan Map

Figure 5-72 Split Screen Mode with Flight Plan Map

Displaying the flight plan map on the active flight plan page in split mode:

1) Press the **FPL** Key on the MFD to display the 'FPL - Active Flight Plan' Page.

2) Press the **Charts** Softkey. Split screen mode is now enabled showing the Charts page alongside the Active Flight Plan Page, and Charts page is bordered by a cyan box indicating it is the active display pane.

3) Move the **Joystick** to select the Active Flight Plan page as the active display pane.

4) Press the **MENU** Key. 'Show Flight Plan Map' is highlighted. Press the **ENT** Key.

5) To removed the Flight Plan Map, press the **MENU** Key and select 'Hide Flight Plan Map'. Press the **ENT** Key.

CLOSEST POINT OF FPL

'Closest Point of FPL' calculates the bearing and closest distance at which a flight plan passes a reference waypoint, and creates a new user waypoint along the flight plan at the location closest to a chosen reference waypoint.

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

1) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page (MFD) or the 'Flight Plan' Window (PFD).
2) Press the **MENU** Key, highlight 'Closest Point Of FPL', and press the **ENT** Key. A window appears with the reference waypoint field highlighted.
3) Enter the identifier of the reference waypoint. The system displays the bearing (BRG) and distance (DIS) to the closest point along the flight plan to the selected reference waypoint and creates a user waypoint at this location. Press the **ENT** Key. The name for the new user waypoint is derived from the identifier of the reference waypoint.

COLLAPSING AIRWAYS

The system allows airways on the active flight plan to be collapsed or expanded from the Stored or Active Flight Plan Page/Window. When airways have been collapsed, it is indicated on the airway heading.

When airways are collapsed, leg-to-leg computed values such as DIS or ETE shown for the exit waypoint reflect the total of all the legs on the airway that have been hidden in the collapsed display. The DTK value is inhibited because it is not usable in this context.

The Active Flight Plan Page always keeps the following three waypoints visible: "From" waypoint, "To" waypoint, and "Next" waypoint. To prevent one or more of these waypoints from being hidden in a collapsed airway segment, the airway segment that contains either the "To" or the "Next" waypoint is automatically expanded. When an airway is loaded, airways are automatically expanded to facilitate flight plan review.

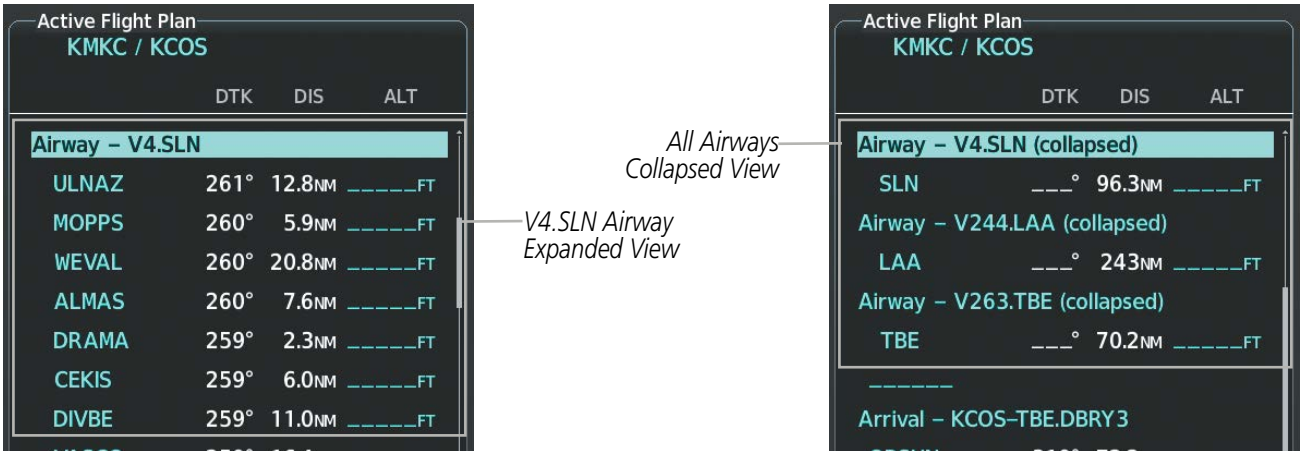


Figure 5-73 Expanded/Collapsed Airways

Collapsing/expanding the airways in the active flight plan:

1) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page (MFD) or the 'Flight Plan' Window (PFD).
2) Press the **MENU** Key, highlight 'Collapse Airways' or 'Expand Airways', and press the **ENT** Key. The airways are collapsed/expanded.

USER-DEFINED HOLDING PATTERNS

A holding pattern can be defined at the aircraft present position, at any active flight plan waypoint, or at a direct-to waypoint.

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

1) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page (MFD) or the 'Flight Plan' Window (PFD).
2) Press the **MENU** Key, highlight 'Hold At Present Position', and press the **ENT** Key. The 'Hold at' Window appears with the 'Course' field highlighted.
3) If desired, use the **FMS** Knobs to edit the course, and press the **ENT** Key.
4) Use the small **FMS** Knob to select 'Inbound' or 'Outbound' course direction, and press the **ENT** Key.
5) Use the small **FMS** Knob to select 'Time' or 'Distance' length mode, and press the **ENT** Key.
6) Use the **FMS** Knobs to edit the length, and press the **ENT** Key.
7) Use the small **FMS** Knob to select 'Right' or 'Left' turn direction, and press the **ENT** Key.
8) Use the **FMS** Knobs to edit the Expect Further Clearance Time (EFC Time), and press the **ENT** Key.
9) Press the **ENT** Key while 'Activate?' is highlighted to create an Offroute Direct-to hold waypoint at the aircraft present position and activate the hold.

Creating a user-defined hold at an active flight plan waypoint:

1) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page (MFD) or the 'Flight Plan' Window (PFD).
2) Press the **FMS** Knob to activate the cursor (not required on the PFD) and turn the large **FMS** Knob to highlight the waypoint for the hold.
3) Press the **MENU** Key, highlight 'Hold At Waypoint', and press the **ENT** Key. The 'Hold at' Window appears with the 'Course' Field highlighted.
4) Use the **FMS** Knobs to edit the course, and press the **ENT** Key.
5) Use the small **FMS** Knob to select 'Inbound' or 'Outbound' course direction, and press the **ENT** Key.
6) Use the small **FMS** Knob to select 'Time' or 'Distance' length mode, and press the **ENT** Key.
7) Use the **FMS** Knobs to edit the length, and press the **ENT** Key.
8) Use the small **FMS** Knob to select 'Right' or 'Left' turn direction, and press the **ENT** Key.
9) Use the **FMS** Knobs to edit the Expect Further Clearance Time (EFC Time), and press the **ENT** Key.
10) Press the **ENT** Key while 'Load?' is highlighted to insert the hold into the flight plan.

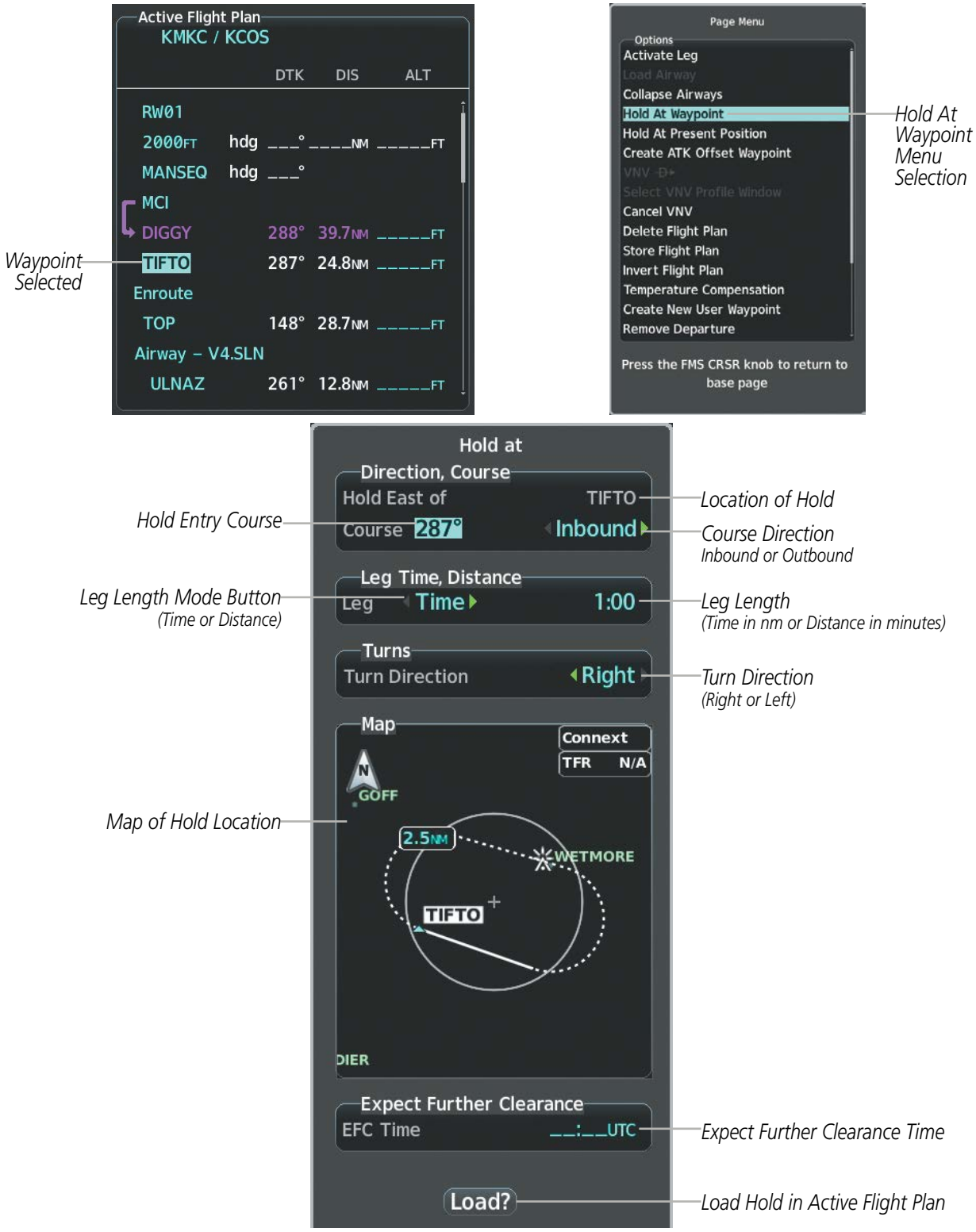


Figure 5-74 Creating a User Defined Holding Pattern at an Active Flight Plan Waypoint

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

1) Press a **Direct-to** Key and set up the direct-to waypoint as desired, but select 'Hold?' instead of 'Activate?' when finished (MFD or PFD).
2) Use the **FMS** Knobs to edit the course, and press the **ENT** Key.
3) Use the small **FMS** Knob to select 'Inbound' or 'Outbound' course direction, and press the **ENT** Key.
4) Use the small **FMS** Knob to select 'Time' or 'Distance' length mode, and press the **ENT** Key.
5) Use the **FMS** Knobs to edit the length, and press the **ENT** Key.
6) Use the small **FMS** Knob to select 'Right' or 'Left' turn direction, and press the **ENT** Key.
7) Use the **FMS** Knobs to edit the Expect Further Clearance Time (EFC TIME), and press the **ENT** Key.
8) Press the **ENT** Key while 'Activate?' is highlighted to activate the direct-to with the user-defined hold defined at the direct-to waypoint. (If the direct-to waypoint is part of the active flight plan, the HOLD is inserted into the active flight plan. If the direct-to waypoint is not part of the active flight plan, an off-route direct-to hold is created.)

Exiting a user-defined hold inserted into the active flight plan:

Select the **SUSP** Softkey. The system will provide guidance to follow the holding pattern to the inbound course and resume automatic waypoint sequencing.

Removing a user-defined hold inserted into the active flight plan:

1) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page (MFD) or the 'Flight Plan' Window (PFD).
2) Press the **FMS** Knob to activate the cursor (not required on the PFD) and turn the large **FMS** Knob to highlight the HOLD waypoint.
3) Press the **CLR** Key. A 'Remove Holding Pattern?' confirmation window is displayed.
4) Select 'OK' and press the **ENT** Key. The holding pattern is removed from the active flight plan. Select 'Cancel' and press the **ENT** Key to cancel the removal of the holding pattern.

Removing a user-defined hold at an off-route direct-to:

1) Press a **Direct To** Key to display the 'Direct To' Window (PFD or MFD).
2) Press the **MENU** Key to display the 'Page Menu' Window with the cursor on the 'Cancel Direct-To NAV' selection.
3) Press the **ENT** Key. The holding pattern is removed.

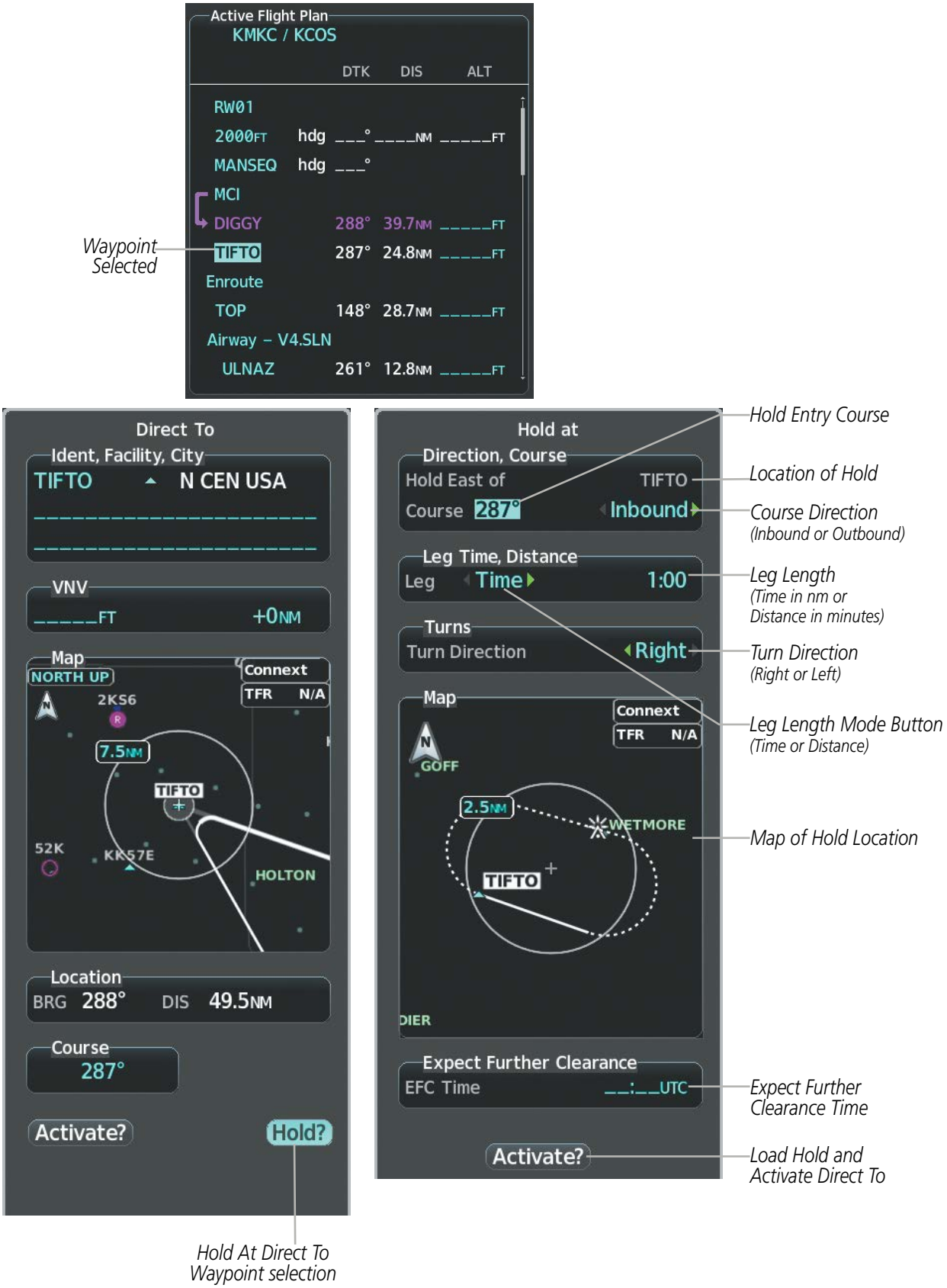


Figure 5-75 Creating a User Defined Holding Pattern at a Direct To Waypoint

5.7 VERTICAL NAVIGATION

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

The system Vertical Navigation (VNV) feature provides vertical profile guidance during the enroute and terminal phases of flight. Guidance based on specified altitudes at waypoints in the active flight plan or to a direct-to waypoint is provided. It includes vertical path guidance to a descending path, which is provided as a linear deviation from the desired path. The desired path is defined by a line joining two waypoints with specified altitudes or as a vertical angle from a specified waypoint/altitude. The vertical waypoints are integrated into the active flight plan. Both manual and autopilot-coupled guidance are supported.

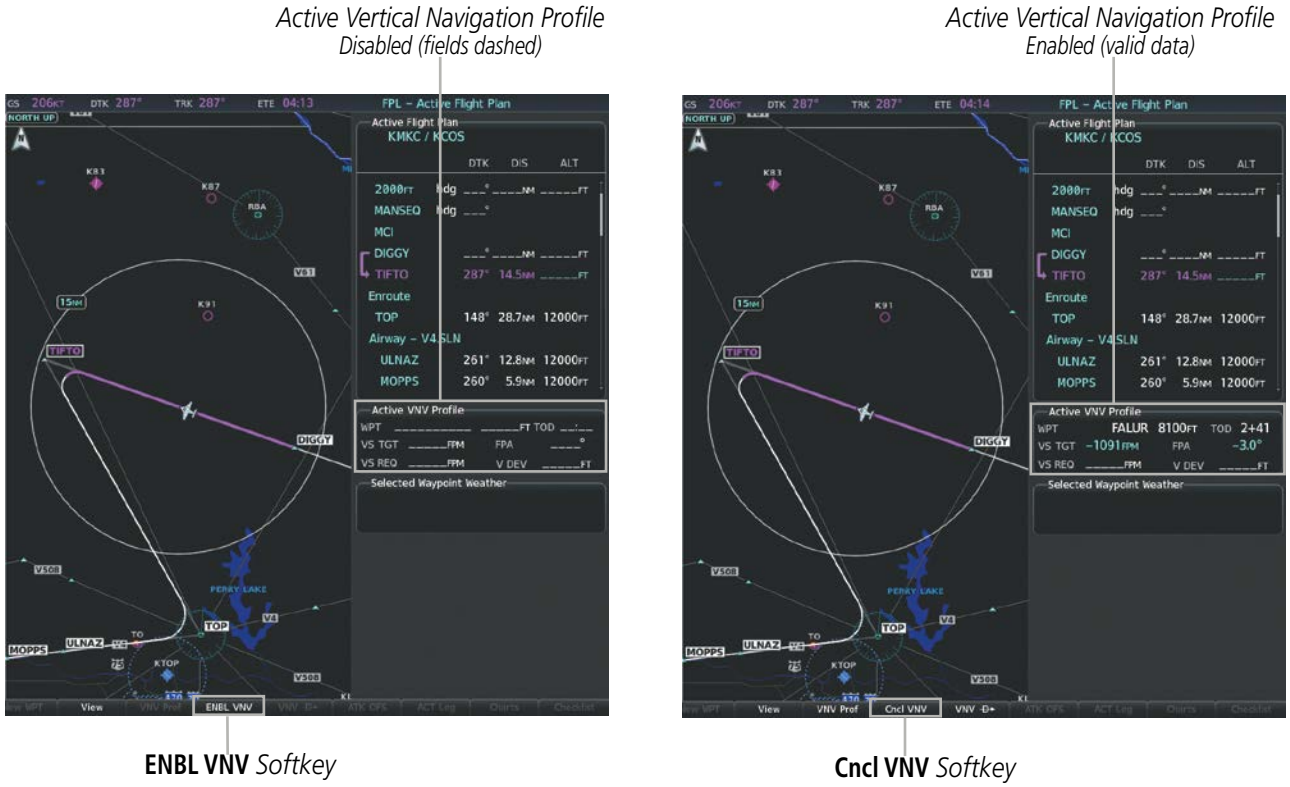


Figure 5-76 Enabling/Disabling Vertical Navigation

Enabling and Disabling VNV guidance:

1) Press the **FPL** Key on the MFD to display the 'FPL- Active Flight Plan' Page.
2) Select the **ENBL VNV** Softkey; or press the **MENU** Key, highlight 'Enable VNV', and press the **ENT** Key. Vertical navigation is enabled, and vertical guidance begins with the waypoint shown in the 'Active VNV Profile' Box (defaults first waypoint in the active flight plan with an altitude enabled for vertical navigation (e.g., FALUR)).
3) To disable VNV guidance, select the **Cncl VNV** Softkey; or press the **MENU** Key, highlight 'Cancel VNV', and press the **ENT** Key. Vertical navigation is disabled.

Canceling vertical navigation results in vertical deviation (V DEV), vertical speed required (VS REQ), and time to top of descent/bottom of descent (TOD/BOD) going invalid. The Vertical Deviation Indicator (VDI) and Required Vertical Speed Indicator (RVSI) on the PFD are removed, and the V DEV, VS REQ, and TOD items displayed in the Active VNV Profile box are dashed. VNV remains disabled until manually enabled. Vertical guidance in reversionary mode can only be enabled for a direct-to waypoint.

The system allows a vertical navigation direct-to for any waypoint in the active flight plan with an altitude constraint "designated" for vertical guidance. Pressing the **VNV Direct-to** Softkey on the Active Flight Plan Page allows the flight plan to be flown, while vertical guidance based on the altitude constraint at the VNV direct-to waypoint is provided. The altitude change begins immediately 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 direct-to with altitude constraint activated by pressing the **Direct-to** Key also provides vertical guidance, but would bypass flight plan waypoints between the current position in the flight plan and the direct-to waypoint. A top of descent (TOD) point is computed based on the default flight path angle; descent begins once the TOD is reached.

Activating a vertical navigation direct-to:

1) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page on the MFD.
2) Press the **FMS** Knob to activate the cursor and turn the **FMS** Knob to highlight the desired waypoint.

NOTE: *The selected waypoint must have a designated altitude constraint (cyan number) to be used. If not, the first waypoint in the flight plan with a designated altitude constraint is selected.*

3) Select the **VNV Direct-To** Softkey; or press the **MENU** Key, highlight 'VNV Direct-To', and press the **ENT** Key. An 'Activate vertical Direct-to to: NNNNNFT at XXXXXX?' confirmation window is displayed.
4) Press the **ENT** Key. Vertical guidance begins to the altitude constraint for the selected waypoint.
5) Press the **FMS** Knob to remove the flashing cursor.

The vertical navigation profile can be modified by directly entering a vertical speed target (VS TGT) and/or flight path angle (FPA) in the Active VNV Profile box.

Modifying the VS TGT and FPA:

1) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page on the MFD.
2) Select the **VNV Prof** Softkey; or press the **MENU** Key, highlight 'Select VNV Profile Window', and press the **ENT** Key. The cursor is now located in the 'Active VNV Profile' Box.
3) Turn the **FMS** Knobs as needed to edit the values.
4) Press the **FMS** Knob to remove the flashing cursor.

ALTITUDE CONSTRAINTS

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

Figure 5-77 Waypoint Altitude Constraints

White Text	Cyan Text
5000FT Altitude calculated by the system estimating the altitude of the aircraft as it passes over the navigation point. No white line above or below to indicate a potential constraint.	5000FT Altitude is designated for use in determining vertical guidance. A pencil icon indicates manual designation or manual data entry.
5000FT Altitude retrieved from the navigation database. White line above or below indicates the type of constraint, as shown in the preceding figure. These altitudes are provided as a reference, and are not designated to be used in determining vertical guidance.	5000FT The system cannot use this altitude in determining vertical guidance because of an invalid constraint condition.

Table 5-10 Altitude Constraint Color Coding

Altitudes associated with arrival and approach procedures are not "auto-designated". This means the system does not automatically provide descending vertical speed and deviation guidance to an altitude chosen by the system. Therefore, these altitudes are displayed as white text. However, all altitudes can be manually designated up to the FAF. The FAF can be manually designated if the selected approach provides no vertical guidance (i.e. glidepath). Manually designated altitudes are displayed as cyan text. For all designated altitudes, the system will automatically calculate altitude constraints prior to the designated altitude, which are displayed as white text.

NOTE: *All designated altitudes will be displayed without restriction bars regardless of what is shown on the published arrival or approach.*

Manually designating a waypoint altitude to be used for vertical guidance:

1) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page on the MFD.
2) Press the **FMS** Knob, and turn to highlight the desired waypoint altitude.
3) Turn the small **FMS** Knob to enter editing mode.
4) Press the **ENT** Key. The altitude is now shown in cyan, indicating it is usable for vertical guidance.

Manually designating a procedure waypoint altitude to be used for vertical guidance:

1) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page on the MFD.
2) Press the **FMS** Knob, and highlight the desired waypoint altitude. Turn the small **FMS** Knob to enter editing mode. .
3) Press the **ENT** Key. The altitude is now shown in cyan, indicating it is usable for vertical guidance.

Altitude constraints are displayed and entered in feet mean sea level (MSL) values to the nearest hundred. An altitude constraint in feet above ground level (AGL) format is supported for airports. When a database altitude restriction is displayed, the system allows entry of a different altitude when creating a waypoint, effectively overriding the database restriction (only before the FAF). When a database altitude restriction of type "AT or ABOVE" or "AT or BELOW" is activated, the system uses the "AT" portion of the restriction to define the vertical profile.

Altitudes that have been designated for use in vertical guidance can be "un-designated" using the **CLR** Key. The altitude is now displayed only as a reference (white text). It is not used to give vertical guidance. Other displayed altitudes may change due to re-calculations or be rendered invalid as a result of manually changing an altitude to a non-designated altitude.

An altitude constraint is invalid if:

- Meeting the constraint requires the aircraft to climb
- Meeting the constraint requires the maximum flight path angle or maximum vertical speed to be exceeded
- The altitude constraint results in a TOD behind the aircraft present position
- The constraint is within a leg type for which altitude constraints are not supported
- The altitude constraint is added to the FAF of an approach that provides vertical guidance (i.e., ILS or GPS SBAS approach)
- The altitude constraint is added to a waypoint past the FAF

Entering/modifying an altitude constraint:

1) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page on the MFD.
2) Press the **FMS** Knob, and turn to highlight the desired waypoint altitude constraint.
3) Enter an altitude constraint value using the **FMS** Knobs. To enter altitudes as a flight level, turn the small **FMS** Knob counter-clockwise past zero or clockwise past 9 on the first character, and the system automatically changes to show units of Flight Level. Turn the large **FMS** Knob clockwise to highlight the first zero and enter the three digit flight level.

4) Press the **ENT** Key to accept the altitude constraint; if the selected waypoint is an airport, an additional choice is displayed. Turn the small **FMS** Knob to choose 'MSL' or 'AGL', and press the **ENT** Key to accept the altitude.

Altitude constraints can be modified or deleted after having been added to the flight plan. In the event an altitude constraint is deleted and the navigation database contains an altitude restriction for the lateral waypoint, the system displays the altitude restriction from the database provided no predicted altitude can be provided. The system also provides a way to reinstate a published altitude constraint that has been edited.

Deleting an altitude constraint provided by the navigation database:

1) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page on the MFD.
2) Press the **FMS** Knob, and turn to highlight the desired waypoint altitude constraint.
3) Press the **CLR** Key. A 'Remove VNV altitude?' confirmation window is displayed.
4) Select 'OK' and press the **ENT** Key.

Deleting an altitude constraint that has been manually entered:

1) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page on the MFD.
2) Press the **FMS** Knob, and turn to highlight the desired waypoint altitude constraint.
3) Press the **CLR** Key. A 'Remove or Revert to published VNV altitude of nnnnnFT?' confirmation window is displayed.
4) Select 'Remove' and press the **ENT** Key. The manually entered altitude is deleted (it is replaced by a system calculated altitude, if available).

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

1) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page on the MFD.
2) Press the **FMS** Knob, and turn to highlight the desired waypoint altitude constraint.
3) Press the **CLR** Key. A 'Remove or Revert to published VNV altitude of nnnnnFT?' confirmation window is displayed.
4) Select 'Revert' and press the **ENT** Key. The altitude is changed to the navigation database value.
5) Press the **FMS** Knob to remove the flashing cursor.

Modifying a system calculated altitude constraint:

1) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page on the MFD.
2) Press the **FMS** Knob, and turn to highlight the desired waypoint altitude constraint.
3) Press the **CLR** Key. An 'Edit or Revert to published VNV altitude of nnnnnFT?' confirmation window is displayed.
4) Select 'Edit' and press the **ENT** Key.
5) Edit the value using the **FMS** Knobs, and press the **ENT** Key.
6) Press the **FMS** Knob to remove the flashing cursor.

A Vertical Situation Display (VSD) can be shown on the bottom of the Navigation Map Page. The terrain, obstacles, vertical track vector, selected altitude, and active flight plan information (active flight plan information consists of waypoints, associated altitude constraints, current VNAV profile, BOC/TOC, TOD/BOD, and destination runway) can be displayed on the VSD, depending on the selected mode. See the Hazard Avoidance section for information about winds aloft, obstacles, and relative terrain on the VSD.

NOTE: *Certain leg types (e.g. holds, heading legs) do not support VNAV PATH descents because the lateral distance of those legs in unknown. The VSD will not show a VNAV profile for any legs that have no vertical path guidance.*

The VSD horizontal range is equal to the navigation map indicated range when the VSD is in Track mode. When the VSD is in Flight Plan mode, the horizontal range is the lower of twice the navigation map indicated range or the lowest range the displays all of the remaining active flight plan. The VSD altitude range automatically changes when the navigation map range is changed to keep a constant ratio of altitude range to horizontal range, until both minimum and maximum display limits have been met. At ranges above the maximum, the altitude range remains constant at the maximum.

The aircraft symbol is displayed on the left side of the VSD. The position of the aircraft symbol on the vertical scale is close to the top for a descent phase, at the bottom for on-ground or a climb phase, and in the middle for a cruise phase or if the phase is unknown.

If two waypoints are close together, and their labels or constraint values overlap enough to obscure any text, one waypoint label/constraint value is removed and the vertical dashed line for that waypoint is displayed as darker gray. The priority for which waypoint remains displayed is: (1) the current TO waypoint, (2) waypoint with an altitude constraint, and (3) waypoint closer to the aircraft.

Enabling the Vertical Situation Display

1) Select the 'Map - Navigation Map' Page.
2) Select the **Map Opt** Softkey.
3) Select the **Inset** Softkey.
4) Select the **VSD** Softkey to enable the Vertical Situation Display.
5) Select the **VSD** mode softkey to choose between **Auto**, **FPL**, or **TRK**.

Or:

1) Select the 'Map - Navigation Map' Page.
2) Press the **MENU** Key.
3) Turn the FMS Knob to highlight 'Show VSD' and press the **ENT** Key.
4) Select the VSD mode softkey to choose between **Auto**, **FPL**, or **TRK**.

Disabling the Vertical Situation Display

1) Select the 'Map - Navigation Map' Page.
2) Select the **Map Opt** Softkey.
3) Select the **Off** Softkey.

Or:

1) Select the 'Map - Navigation Map' Page.
2) Press the **MENU** Key.
3) Turn the **FMS** Knob to highlight 'Hide VSD' and press the **ENT** Key.

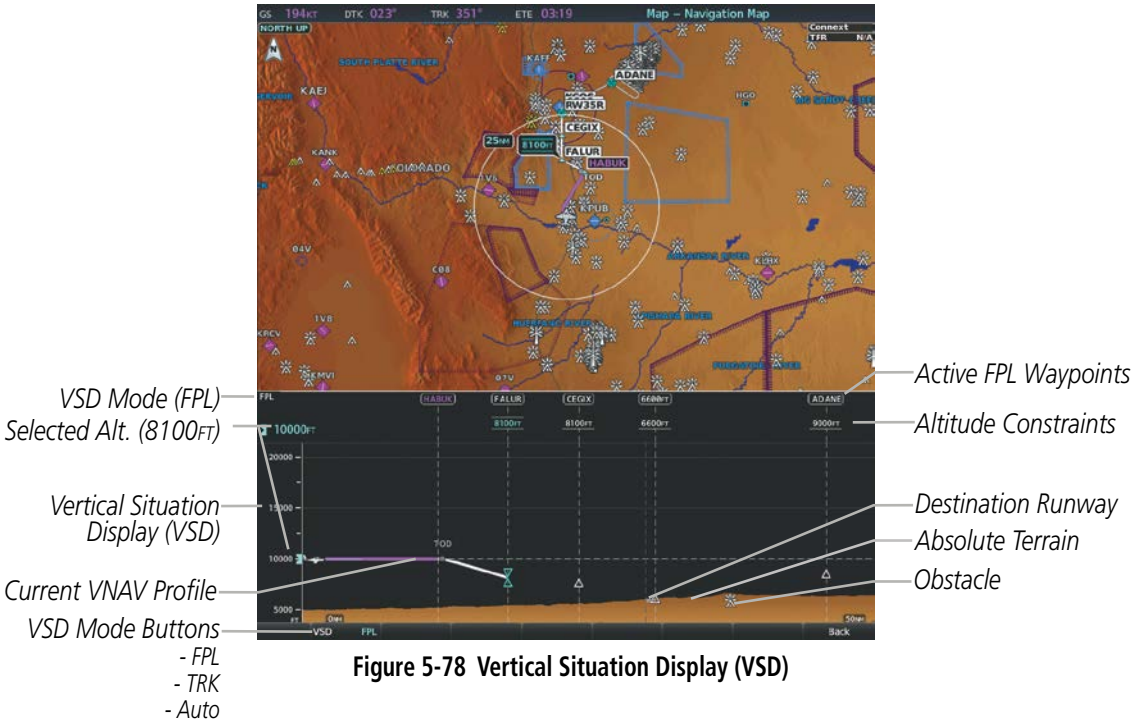


Figure 5-78 Vertical Situation Display (VSD)

VSD Mode Button	Displayed Mode	FPL Criteria	Items available on VSD
Auto	AUTO FPL	Available active FPL & aircraft within FPL swath	Terrain/obstacles along the active flight plan route, vertical track vector, selected altitude, and active flight plan information
	AUTO TRK	(1) Active FPL available & aircraft not within FPL swath, or (2) Active FPL not available	Terrain/obstacles along the current track, vertical track vector, and selected altitude
Flight Plan	FPL	Active FPL available	Terrain/obstacles along the active flight plan route, vertical track vector, selected altitude, and active flight plan information
		Active FPL not available	Only shows message 'Flight Plan Not Available'
Track	TRK	NA	Terrain/obstacles along the current track, vertical track vector, and selected altitude
Active flight plan information consists of waypoints, associated altitude constraints, current VNAV profile, BOC/TOC, TOD/BOD, and destination runway			

Table 5-11 VSD Modes

Terrain/obstacles are available on the VSD, and will be shown if the aircraft altitude is low enough for the terrain/obstacles to be in view (terrain will be shown in gray if the terrain is selected Off on the navigation map). The depicted terrain profile represents an approximate forward-looking contour of the terrain based upon the highest reported terrain elevations, measured at intervals defined by the terrain database resolution, within a predefined width along the active flight plan between the aircraft present position and the end of the map range or active flight plan. The predefined width is determined by the flight phase.

Flight Phase	Width of Swath
Approach, Departure	0.6 nm
Terminal	2.0 nm
En Route, Oceanic	4.0 nm

Table 5-12 VSD Swath Width by Flight Phase

5.8 PROCEDURES

The system can access the whole range of instrument procedures available. Departures (DPs), arrivals (STARs), and non-precision and precision approaches (APRs) are stored within the database and can be loaded using any Procedures **(PROC)** Key.

The selected procedure for the departure or arrival airport is added to the active flight plan. No waypoints are required to be in the active flight plan to load procedures; however, if the origin and destination airport are already loaded, the procedure loading window defaults to the appropriate airport, saving some time selecting the correct airport on the Procedure Loading Page. Whenever an approach is selected, the choice to either "load" or "activate" is given. "Loading" adds the approach to the end of the flight plan without immediately using it for navigation guidance. This allows continued navigation via the intermediate waypoints in the original flight plan, but keeps the procedure available on the Active Flight Plan Page for quick activation when needed. "Activating" also adds the procedure to the end of the flight plan but immediately begins to provide guidance to the first waypoint in the approach.

The system adds terminal procedures to the flight plan based on leg types coded within that procedure in the navigation database. If the terminal procedure in the flight plan contains an identifier like '6368FT', that indicates a leg that terminates when the specified altitude (6,368 feet) has been exceeded. A heading leg in the flight plan displays 'hdg' preceding the DTK (e.g. 'hdg 008°'). A flight plan leg requiring the pilot to manually initiate sequencing to the next leg displays 'MANSEQ' as the identifier.

Figure 5-79 Procedure Leg Identifiers

Viewing available procedures at an airport:

1) From the 'WPT - Airport Information' Page (first page in the WPT group):

Select the **DP** Softkey. The 'WPT - Departure Information' Page is displayed, defaulting to the airport displayed on the Airport information Page.

Or:

Select the **STAR** Softkey. The 'WPT - Arrival Information' Page is displayed, defaulting to the airport displayed on the Airport information Page.

Or:

Select the **APR** Softkey. The 'WPT - Approach Information' Page is displayed, defaulting to the airport displayed on the Airport information Page.

2) To select another airport, press the **FMS** Knob to activate the cursor, enter an identifier/facility name/city, and press the **ENT** Key.
3) Turn the large **FMS** Knob to highlight the procedure. The procedure is previewed on the map.
4) Turn the small **FMS** Knob to view the available procedures. Press the **ENT** Key to select the procedure. The cursor moves to the next box (runway or transition). The procedure is previewed on the map.
5) Turn the small **FMS** Knob to view the available runway or transition. Press the **ENT** Key to select the runway or transition. The cursor moves to the next box (if available). The procedure is previewed on the map.
6) Turn the small **FMS** Knob to view the available runway or transition. Press the **ENT** Key to select the runway or transition. The cursor moves to the 'Sequence' Box or the 'Minimums' Box. The procedure is previewed on the map.
7) Select the **Info** 1 Softkey or the **Info** 2 Softkey to return to the 'WPT - Airport Information' Page.

Loading a procedure into the active flight plan from the <Procedure> Information Page:

1) From the 'WPT- Airport Information' Page (first page in the WPT group):

   Select the **DP** Softkey. The 'WPT - Departure Information' Page is displayed, defaulting to the airport displayed on the Airport information Page.

   Or:

   Select the **STAR** Softkey. The 'WPT - Arrival Information' Page is displayed, defaulting to the airport displayed on the Airport information Page.

   Or:

   Select the **APR** Softkey. The 'WPT - Approach Information' Page is displayed, defaulting to the airport displayed on the Airport information Page.

2) To select another airport, press the **FMS** Knob to activate the cursor, enter an identifier/facility name/city, and press the **ENT** Key.
3) Select a different procedure, if desired.
   a) Turn the large **FMS** Knob to highlight the procedure. The procedure is previewed on the map.
   b) Turn the small **FMS** Knob to view the available procedures. Press the **ENT** Key to select the procedure. The cursor moves to the next box (runway or transition). The procedure is previewed on the map.
   c) Turn the small **FMS** Knob to view the available runway or transition. Press the **ENT** Key to select the runway or transition. The cursor moves to the next box (if available). The procedure is previewed on the map.
   d) Turn the small **FMS** Knob to view the available transitions. Press the **ENT** Key to select the transition. The cursor moves to the 'Sequence' Box or the 'Minimums' Box. The procedure is previewed on the map.
4) Press the **MENU** Key to display the <Procedure> Information Page Menu.
5) Turn the **FMS** Knob to highlight 'Load <procedure>'.
6) Press the **ENT** Key to load the procedure into the active flight plan.

DEPARTURES

A Departure Procedure (DP) is loaded at the departure 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 active flight plan, the new departure replaces the previous departure. The route is defined by selection of a departure, the transition waypoints, and a runway.

LOADING A DEPARTURE INTO THE ACTIVE FLIGHT PLAN

Loading a departure into the active flight plan using the PROC Key:

1) Press the **PROC** Key. The 'Procedures' Window is displayed.
2) Highlight 'Select Departure'.
3) Press the **ENT** Key. The 'PROC - Departure Loading' Page is displayed.
4) Use the **FMS** Knob to select an airport, if necessary, and press the **ENT** Key.
5) Select a departure from the list and press the **ENT** Key.
6) Select a runway (if required) and press the **ENT** Key.
7) Select a transition (if required) and press the **ENT** Key. 'Load?' is highlighted.
8) Press the **ENT** Key to load the departure procedure.

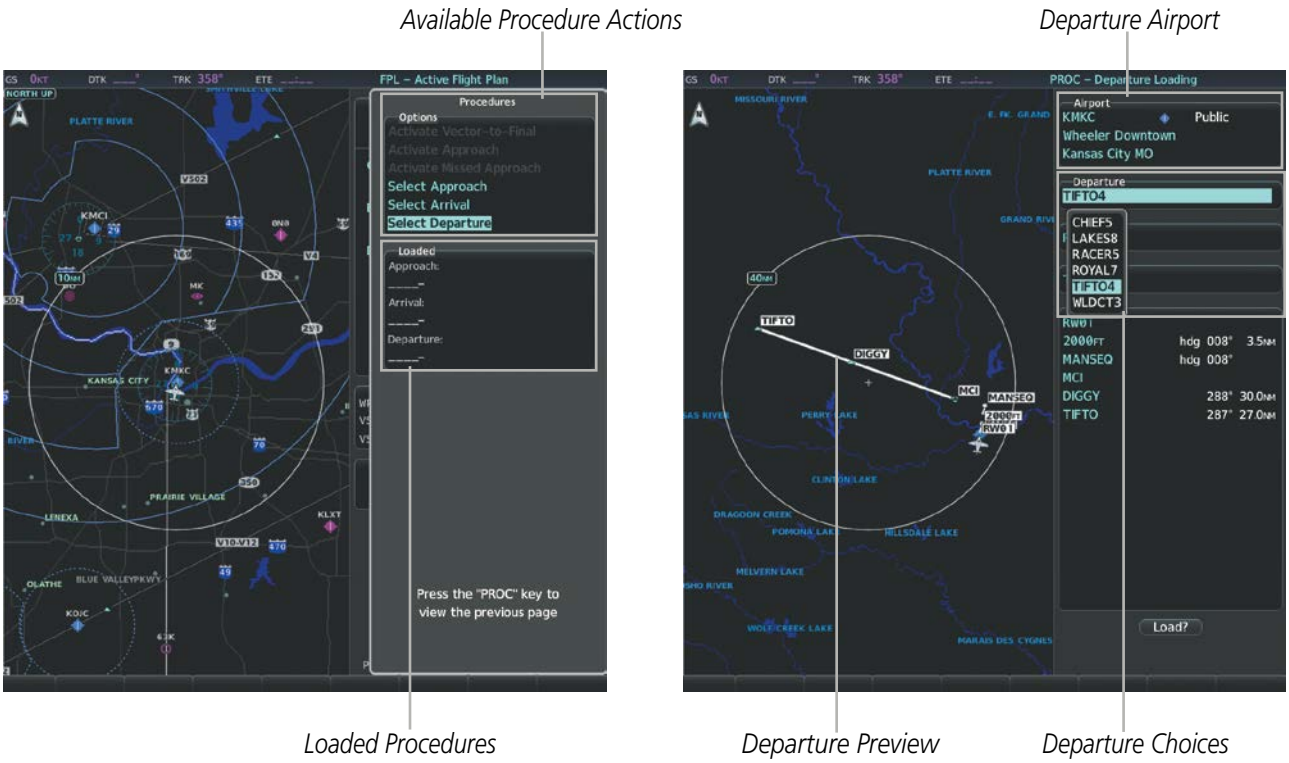


Figure 5-80 Departure Selection

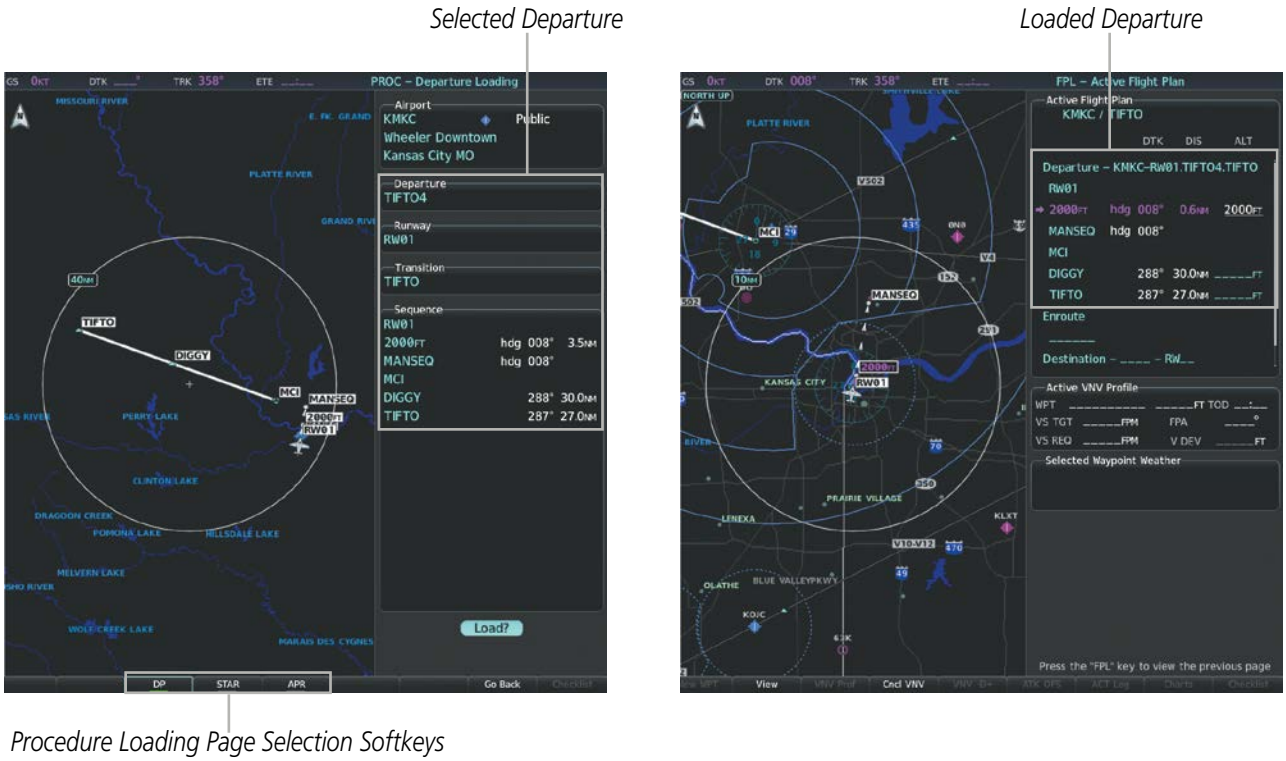


Figure 5-81 Departure Loading

REMOVING A DEPARTURE FROM THE ACTIVE FLIGHT PLAN

When plans change while flying IFR, departures can be easily removed from the Active Flight Plan.

Removing a departure procedure from the active flight plan:

1) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page (MFD) or the 'Flight Plan' Window (PFD).
2) Press the **MENU** Key, and highlight 'Remove Departure'.
3) Press the **ENT** Key. A confirmation window is displayed listing the departure procedure.
4) With 'OK' highlighted, press the **ENT** Key. To cancel the removal request, highlight 'Cancel' and press the **ENT** Key.

Or:

1) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page (MFD) or the 'Flight Plan' Window (PFD).
2) Press the **FMS** Knob, and turn to highlight the departure header in the active flight plan.
3) Press the **CLR** Key. A confirmation window is displayed listing the departure procedure.
4) With 'OK' highlighted, press the **ENT** Key. To cancel the removal request, highlight 'Cancel' and press the **ENT** Key.
5) Press the **FMS** Knob to remove the flashing cursor.

ARRIVALS

A Standard Terminal Arrival (STAR) can be loaded at any airport that has one available. Only one arrival can be loaded at a time in a flight plan. If an arrival is loaded when another arrival is already in the active flight plan, the new arrival replaces the previous arrival. The route is defined by selection of an arrival, the transition waypoints, and a runway.

LOADING AN ARRIVAL INTO THE ACTIVE FLIGHT PLAN

Loading an arrival into the active flight plan using the PROC Key:

1) Press the **PROC** Key. The 'Procedures' Window is displayed.
2) Highlight 'Select Arrival'.
3) Press the **ENT** Key. The 'PROC - Arrival Loading' Page is displayed.
4) Use the **FMS** Knob to select an airport, if necessary, and press the **ENT** Key.
5) Select an arrival from the list and press the **ENT** Key.
6) Select a transition (if required) and press the **ENT** Key.
7) Select a runway (if required) and press the **ENT** Key. 'Load?' is highlighted.
8) Press the **ENT** Key to load the arrival procedure.

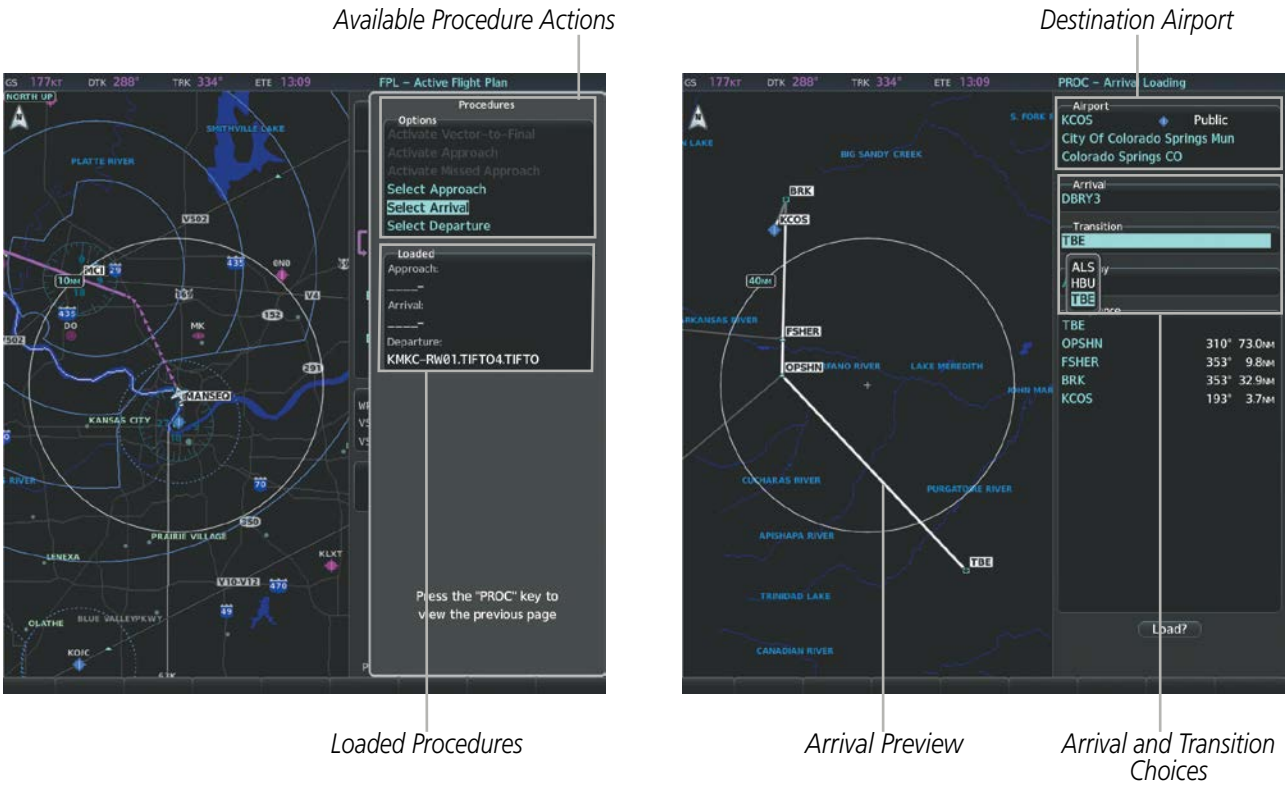


Figure 5-82 Arrival Selection

Figure 5-83 Arrival Loading

REMOVING AN ARRIVAL FROM THE ACTIVE FLIGHT PLAN

When plans change while flying IFR, arrivals can be easily removed from the Active Flight Plan.

Removing an arrival from the active flight plan:

1) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page (MFD) or the 'Flight Plan' Window (PFD).
2) Press the **MENU** Key, and highlight 'Remove Arrival'.
3) Press the **ENT** Key. A confirmation window is displayed listing the arrival procedure.
4) With 'OK' highlighted, press the **ENT** Key. To cancel the removal request, highlight 'Cancel' and press the **ENT** Key.

Or:

1) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page (MFD) or the 'Flight Plan' Window (PFD).
2) Press the **FMS** Knob, and turn to highlight the arrival header in the active flight plan.
3) Press the **CLR** Key. A confirmation window is displayed listing the arrival procedure.
4) With 'OK' highlighted, press the **ENT** Key. To cancel the removal request, highlight 'Cancel' and press the **ENT** Key.
5) Press the **FMS** Knob to remove the flashing cursor.

APPROACHES

NOTE: *If certain GPS parameters (SBAS, RAIM, etc.) are not available, some published approach procedures for the desired airport may not be displayed in the list of available approaches.*

An Approach Procedure (APR) can be loaded at any airport that has one available, and provides guidance for non-precision and precision approaches to airports with published instrument approach procedures. Only one approach can be loaded at a time in a flight plan. If an approach is loaded when another approach is already in the active flight plan, the new approach replaces the previous approach. The route is defined by selection of an approach and the transition waypoints.

Whenever an approach is selected, the choice to either "Load" or "Load and Activate" is given ("Load and Activate" is only available for the active flight plan). "Loading" adds the approach to the end of the flight plan without immediately using it for navigation guidance. This allows continued navigation via the intermediate waypoints in the original flight plan, but keeps the procedure available for quick activation when needed. "Activating" also adds the procedure to the end of the flight plan but immediately begins to provide guidance to the first waypoint in the approach.

When selecting an approach, a "GPS" designation to the right of the procedure name indicates the procedure can be flown using the GPS receiver. Some procedures do not have this designation, meaning the GPS receiver can be used for supplemental navigation guidance only. If the GPS receiver cannot be used for primary guidance, the appropriate navigation receiver must be used for the selected approach (e.g., VOR or ILS). The final course segment of ILS approaches, for example, must be flown by tuning the NAV receiver to the proper frequency and selecting that NAV receiver on the CDI.

The SBAS GPS allows for flying LNAV, LNAV+V, LNAV/VNAV, LP, LP+V, LPV, and RNP approach service levels according to the published chart. LNAV+V is an LNAV with advisory vertical guidance provided for assistance in maintaining a constant vertical glidepath similar to an ILS glideslope on approach. This guidance is displayed on the system PFD in the same location as the ILS glideslope using a magenta diamond. In all cases where LNAV+V is indicated by the system during an approach, LNAV minima are used. The active approach service level is annunciated on the HSI as shown in the following table:

HSI Annunciation	Description	Example on HSI
LNAV	RNAV GPS approach using published LNAV minima	**Approach Service Level** *- LNAV, LNAV+V, L/VNAV, LP, LP+V, LPV*
LNAV+V	RNAV GPS approach using published LNAV minima. Advisory vertical guidance is provided	
L/VNAV (available only if SBAS available)	RNAV GPS approach using published LNAV/VNAV minima (downgrades to LNAV if SBAS unavailable)	
LP (available only if SBAS available)	RNAV GPS approach using published LP minima (downgrades to LNAV if SBAS unavailable)	
LP+V (available only if SBAS available)	RNAV GPS approach using published LP minima Advisory vertical guidance is provided (downgrades to LNAV if SBAS unavailable)	
LPV (available only if SBAS available)	RNAV GPS approach using published LPV minima (downgrades to LNAV if SBAS unavailable)	

Table 5-13 Approach Service Levels

LOADING AN APPROACH INTO THE ACTIVE FLIGHT PLAN

Loading an approach into the active flight plan using the PROC Key:

1) Press the **PROC** Key. The 'Procedures' Window is displayed.
2) Highlight 'Select Approach', and press the **ENT** Key. The 'PROC - Approach Loading' Page is displayed.
3) Select the airport and approach:
   a) Use the **FMS** Knob to select an airport, if necessary, and press the **ENT** Key.
   b) Select an approach from the list and press the **ENT** Key.

   Or:

   a) If necessary, push the **FMS** Knob to exit the approach list, and use the large **FMS** Knob to move the cursor to the 'Approach Channel' Field.
   b) Use the **FMS** Knob to enter the approach channel number, and press the **ENT** Key to accept the approach channel number. The airport and approach are selected.
4) Select a transition (if required) and press the **ENT** Key.
5) Minimums
   a) To set 'Minimums', turn the small **FMS** Knob to select 'BARO', 'TEMP COMP' or 'RAD ALT', and press the **ENT** Key. Turn the small **FMS** Knob to select the altitude, and press the **ENT** Key.
   b) If 'TEMP COMP' was selected, the cursor moves to the temperature field. Turn the small **FMS** Knob to select the temperature, and press the **ENT** Key.

   Or:

   To skip setting minimums, press the **ENT** Key.
6) Press the **ENT** Key with 'Load?' highlighted to load the approach procedure; or turn the large **FMS** Knob to highlight 'Activate' and press the **ENT** Key to load and activate the approach procedure.

NOTE: *If there is no arrival procedure in the active flight plan, loading an approach after a destination airport has already been entered will result in a duplicate destination airport waypoint being added to the end of the enroute segment.*

NOTE: *When GPS is not approved for the selected final approach course, the message 'NOT APPROVED FOR GPS' is displayed. GPS provides guidance to the approach, but the CDI must to be switched to a NAV receiver to fly the final course of the approach.*

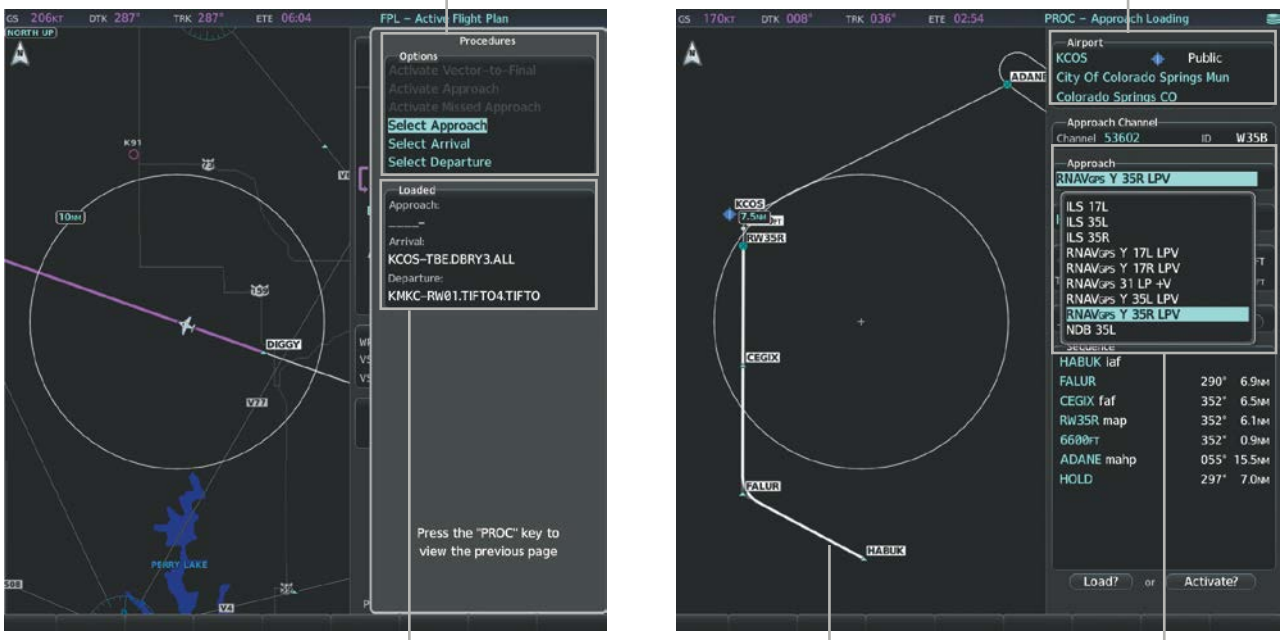


Figure 5-84 Approach Selection

Figure 5-85 Approach Loading

Loading an approach into the active flight plan from the 'NRST - Nearest Airports' Page:

1) Select the 'NRST - Nearest Airports' Page.
2) Press the **FMS** Knob, then turn the large **FMS** Knob to highlight the desired nearest airport. The airport is previewed on the map.
3) Select the **APR** Softkey; or press the **MENU** Key, highlight 'Select Approach Window', and press the **ENT** Key.
4) Turn the **FMS** Knob to highlight the desired approach.
5) Select the **LD APR** Softkey; or press the **MENU** Key, highlight 'Load Approach', and press the **ENT** Key. The 'PROC - Approach Loading' Page is displayed with the transitions field highlighted.
6) Turn the **FMS** Knob to highlight the desired transition, and press the **ENT** Key.
7) Minimums
   a) To set 'Minimums', turn the small **FMS** Knob to select 'BARO', 'TEMP COMP', or 'RAD ALT' and press the **ENT** Key. Turn the small **FMS** Knob to select the altitude, and press the **ENT** Key.
   b) If 'TEMP COMP' was selected, the cursor moves to the temperature field. Turn the small **FMS** Knob to select the temperature, and press the **ENT** Key.

      Or:

      To skip setting minimums, press the **ENT** Key. The 'LOAD?' Field is highlighted.
8) Press the **ENT** Key with 'LOAD?' highlighted to load the approach procedure; or turn the large **FMS** Knob to highlight 'ACTIVATE' and press the **ENT** Key to load and activate the approach procedure. The system continues navigating the current flight plan until the approach is activated. When GPS is not approved for the selected final approach course, the message 'NOT APPROVED FOR GPS' is displayed. GPS provides guidance to the approach, but the CDI must to be switched to a NAV receiver to fly the final course of the approach.

ACTIVATING AN APPROACH

A previously loaded approach can be activated from the Procedures Window.

Activating a previously loaded approach:

1) Press the **PROC** Key. The 'Procedures Window' is displayed with 'Activate Approach' highlighted.
2) Press the **ENT** Key to activate the approach.

In many cases, it may be easiest to "load" the full approach while still some distance away, enroute to the destination airport. Later, if vectored to final, use the steps below to select 'Activate Vector-To-Final' — which makes the inbound course to the FAF waypoint active.

Activating a previously loaded approach with vectors to final:

1) Press the **PROC** Key to display the 'Procedures' Window.
2) Highlight 'Activate Vector-to-Final' and press the **ENT** Key.

Loading and activating an approach using the MENU Key:

1) From the 'PROC - Approach Loading' Page, press the **MENU** Key. The 'Page Menu' Window is displayed with 'Load & Activate Approach' highlighted.
2) Press the **ENT** Key. When GPS is not approved for the selected final approach course, the message 'NOT APPROVED FOR GPS' is displayed. GPS provides guidance to the approach, but the CDI must to be switched to a NAV receiver to fly the final course of the approach.

REMOVING AN APPROACH FROM THE ACTIVE FLIGHT PLAN

When plans change while flying IFR, approaches can be easily removed from the Active Flight Plan.

Removing an approach from the active flight plan:

1) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page (MFD) or the 'Flight Plan' Window (PFD).
2) Press the **MENU** Key, and highlight 'Remove Approach'.
3) Press the **ENT** Key. A confirmation window is displayed listing the approach procedure.
4) With 'OK' highlighted, press the **ENT** Key. To cancel the removal, highlight 'Cancel' and press the **ENT** Key.

Or:

1) Press the **FPL** Key to display the 'FPL - Active Flight Plan' Page (MFD) or the 'Flight Plan' Window (PFD).
2) Press the **FMS** Knob, and turn to highlight the approach header in the active flight plan.
3) Press the **CLR** Key. A confirmation window is displayed listing the approach procedure.
4) With 'OK' highlighted, press the **ENT** Key. To cancel the removal, highlight 'Cancel' and press the **ENT** Key.
5) Press the **FMS** Knob to remove the flashing cursor.

MISSED APPROACH

Activating a missed approach in the active flight plan:

1) Press the **PROC** Key.
2) Turn the **FMS** Knob to highlight 'Activate Missed Approach'.
3) Press the **ENT** Key. The aircraft automatically sequences to the MAHP.

Or:

Fly past the MAP, and select the **SUSP** Softkey on the PFD.

Or:

Press the Go-Around Button.

In this missed approach procedure, the altitude immediately following the MAP (in this case '6600FT') is not part of the published procedure. It is simply a Course to Altitude (CA) leg which guides the aircraft along the runway centerline until the altitude required to safely make the first turn toward the MAHP is exceeded. This altitude is provided by the navigation database, and may be below, equal to, or above the published minimums for this approach. In this case, if the aircraft altitude is below the specified altitude (6,600 feet) after crossing the MAP, a direct-to is established to provide a course on runway heading until an altitude of 6,600 feet is reached. After reaching 6,600 feet, a direct-to is established to the published MAHP (in this case ADANE). If the aircraft altitude is above the specified altitude after crossing the MAP, a direct-to is established to the published fix (ADANE) to begin the missed approach procedure.

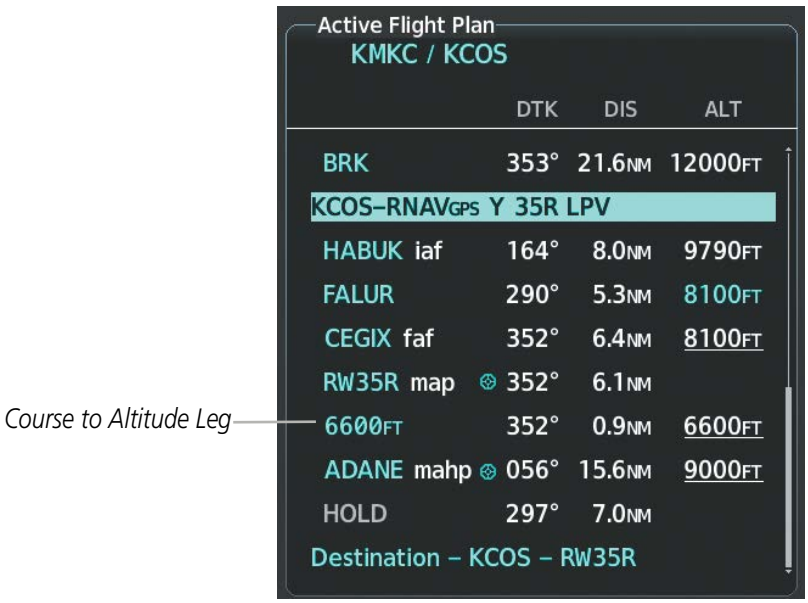


Figure 5-86 Course to Altitude

In some missed approach procedures this Course to Altitude leg may be part of the published procedure. For example, a procedure may dictate a climb to 5,500 feet, then turn left and proceed to the Missed Approach Hold Point (MAHP). In this case, the altitude would appear in the list of waypoints as '5500FT'. Again, if the aircraft altitude is lower than the prescribed altitude, a direct-to is established on a Course to Altitude leg when the missed approach procedure is activated.

TEMPERATURE COMPENSATED ALTITUDE

If desired, the system can compensate the loaded approach altitudes based on a pilot-supplied temperature at the destination. For example, if the pilot enters a destination temperature of -40° C, the system increases the approach altitudes accordingly. A temperature compensated altitude will have a snowflake icon next to it.

Activating temperature compensated altitude:

1) From the 'FPL - Active Flight Plan' Page, press the **MENU** Key. The 'Page Menu' Window is displayed.
2) Turn the **FMS** Knob to highlight 'Temperature Compensation'.
3) Press the **ENT** Key. The 'Temperature Compensation' Window is displayed.
4) Use the small **FMS** Knob to select the temperature at the <airport>. The compensated altitude is computed as the temperature is selected.

NOTE: *The temperature at the destination can be entered in the Temperature Compensation Window on the MFD, or in the References Window on the PFD. There is only one compensation temperature for the system, therefore, changing the temperature will affect both the loaded approach altitudes and the minimums. Refer to the Flight Instruments section for information about applying temperature compensation to the MDA/DH.*

5) Press the **ENT** Key. 'Activate Compensation?' is highlighted.
6) Press the **ENT** Key. The compensated altitudes for the approach are shown in the flight plan.

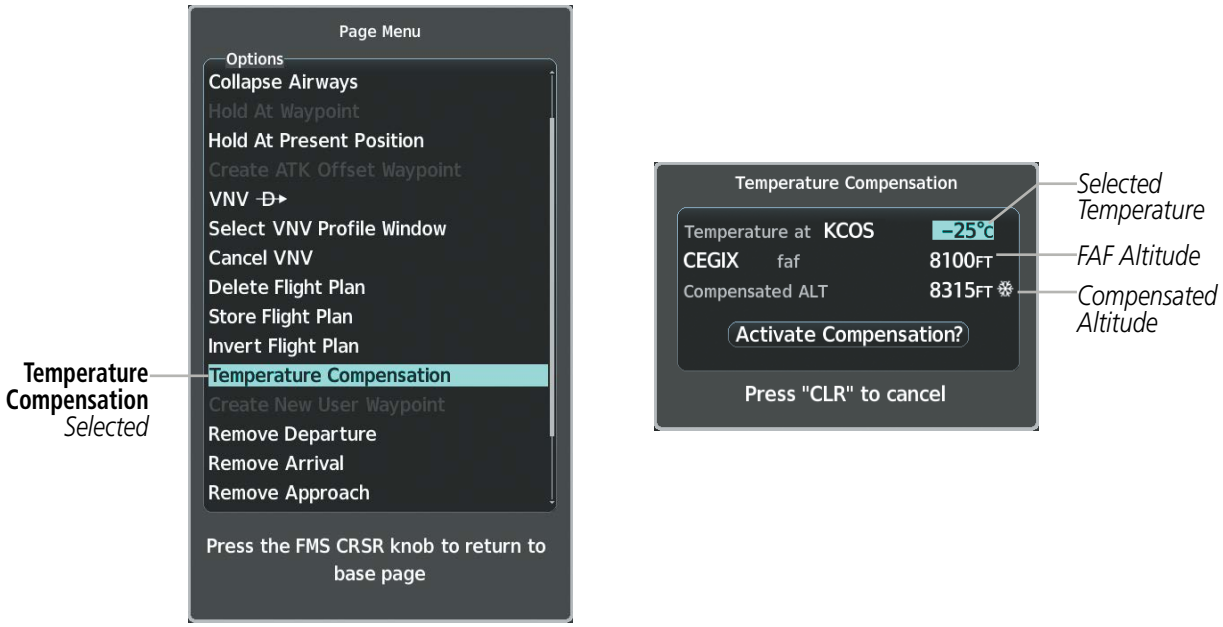


Figure 5-87 Temperature Compensation

Figure 5-88 Temperature Compensation in the Active Flight Plan

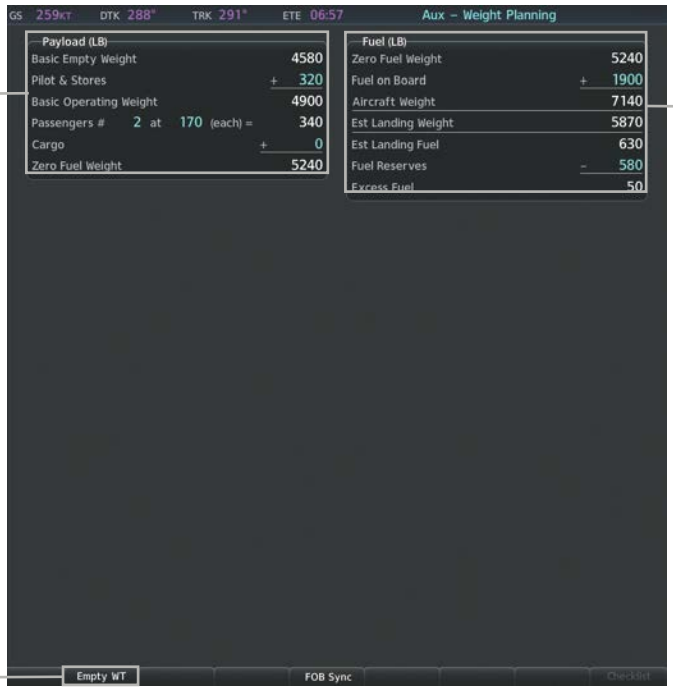
Cancelling temperature compensated altitude:

1) From the 'FPL - Active Flight Plan' Page, press the **MENU** Key. The 'Page Menu' Window is displayed.
2) Turn the **FMS** Knob to highlight 'Temperature Compensation'.
3) Press the **ENT** Key. The 'Temperature Compensation' Window is displayed.
4) Press the **ENT** Key. 'Cancel Compensation?' is highlighted.
5) Press the **ENT** Key. The temperature compensated altitude at the FAF is cancelled.

NOTE: *Activating/cancelling temperature compensation for the loaded approach altitudes does not select/deselect temperature compensated minimums (MDA/DH), nor does selecting/deselecting temperature compensated minimums activate/cancel temperature compensated approach altitudes.*

5.9 WEIGHT PLANNING

NOTE: *All weight planning page data fields display data rounded to the nearest 10 pounds or 5 kilograms.*



A/C Payload Calculator
Basic Empty Weight Entry -
Pilot and Stores Weight Entry -
Basic Operating Weight Calculation -
Passenger(s) Weight Entry -
Cargo Weight Entry -
Zero Fuel Weight Calculation -

Fuel Weight Calculator
- Zero Fuel Weight Calculation
- Fuel on Board Entry
- Aircraft Weight Calculation
- Estimated Landing Weight Calculation
- Estimated Landing Fuel Calculation
- Fuel Reserve Entry
- Excess Fuel Calculation

Empty Weight Softkey (selects Basic Empty Weight)

Figure 5-89 Weight Planning Page

Entering basic empty weight:

1) Select the **Empty WT** Softkey; or press the **MENU** Key, highlight 'Set Basic Empty Weight', and press the **ENT** Key to select the 'Basic Empty Weight' Field.
2) Turn the small **FMS** Knob to enter the basic empty weight.
3) Press the **ENT** Key to confirm the entry.
4) Press the **FMS** Knob to remove the flashing cursor.

Entering a pilot and stores weight:

1) Press the **FMS** Knob to activate the cursor and highlight the 'Pilot & Stores' Field.
2) Turn the small **FMS** Knob to enter the pilot and stores weight.
3) Press the **ENT** Key to confirm the entry.
4) Press the **FMS** Knob to remove the flashing cursor.

The basic operating weight is calculated by adding the basic empty weight and the pilot and stores weight.

Entering the number of passengers:

1) Press the **FMS** Knob to activate the cursor and highlight the 'Passengers #' Field.
2) Turn the small **FMS** Knob to enter the number of passengers.
3) Press the **ENT** Key to confirm the entry.
4) Press the **FMS** Knob to remove the flashing cursor.

Entering the average passenger weight:

1) Press the **FMS** Knob to activate the cursor and highlight the passenger weight ('at') field.
2) Turn the small **FMS** Knob to enter the average passenger weight.
3) Press the **ENT** Key to confirm the entry.
4) Press the **FMS** Knob to remove the flashing cursor.

The total weight of passengers is calculated by multiplying the number of passengers by the average passenger weight.

Entering the cargo weight:

1) Press the **FMS** Knob to activate the cursor and highlight the 'Cargo' Field.
2) Turn the small **FMS** Knob to enter the cargo weight.
3) Press the **ENT** Key to confirm the entry.
4) Press the **FMS** Knob to remove the flashing cursor.

The 'Zero Fuel Weight' is calculated by adding the basic empty, pilot and stores, passenger, and cargo weights.

Entering a fuel on board weight:

1) Press the **FMS** Knob to activate the cursor and highlight the 'Fuel on Board' Field.
2) Turn the small **FMS** Knob to enter the fuel on board.
3) Press the **ENT** Key to confirm the entry.
4) Press the **FMS** Knob to remove the flashing cursor.

Entering fuel reserve:

1) Press the **FMS** Knob to activate the cursor and highlight the 'Fuel Reserves' Field.
2) Turn the small **FMS** Knob to enter the fuel reserves amount.
3) Press the **ENT** Key to confirm the entry.
4) Press the **FMS** Knob to remove the flashing cursor

Synchronizing the fuel on board with the actual measured fuel on board:

Select the **FOB Sync** Softkey on the 'Aux - Weight Planning' Page; or press the **MENU** and highlight 'Synchronize Fuel on Board', and press the **ENT** Key. The actual measured fuel on board is displayed in the 'FUEL ON BOARD' Field.

When the aircraft is in the air and a destination waypoint has been entered, the fuel calculations can be completed.

- Estimated landing weight = zero fuel weight + estimated landing fuel weight.
- Estimated landing fuel weight = fuel on board weight - (fuel flow x ETE)
- Excess fuel weight = estimated landing fuel weight - fuel reserves weight

If the aircraft is on the ground or a destination waypoint has not been entered, the following fields display invalid values consisting of six dashes:

- Estimated landing weight
- Estimated landing fuel weight
- Excess fuel weight

WEIGHT CAUTION AND WARNING CONDITIONS

If the zero fuel weight is greater than the maximum allowable zero fuel weight, then the zero fuel weight is displayed in amber.

If the aircraft weight is greater than the maximum allowable takeoff weight, then the aircraft weight is displayed in amber.

If the estimated landing weight is greater than the maximum allowable landing weight, then the estimated landing weight is displayed in amber.

If the estimated landing fuel weight is positive, but less than or equal to the fuel reserves weight, the following values are displayed in amber:

- Estimated fuel at landing weight
- Excess fuel weight

If the estimated landing fuel weight is zero or negative, then the following values are displayed in amber:

- Estimated fuel at landing weight
- Excess fuel weight

5.10 TRIP PLANNING

The system allows the pilot to view trip planning information, fuel information, and other information for a specified flight plan or flight plan leg based on automatic data, or based on manually entered data. Weight planning is also available, based on manually entered fuel data and the active flight plan (to estimate remaining fuel).

TRIP PLANNING

All of the input of data needed for calculation and viewing of the statistics is done on the Trip Planning Page located in the Aux Page Group.

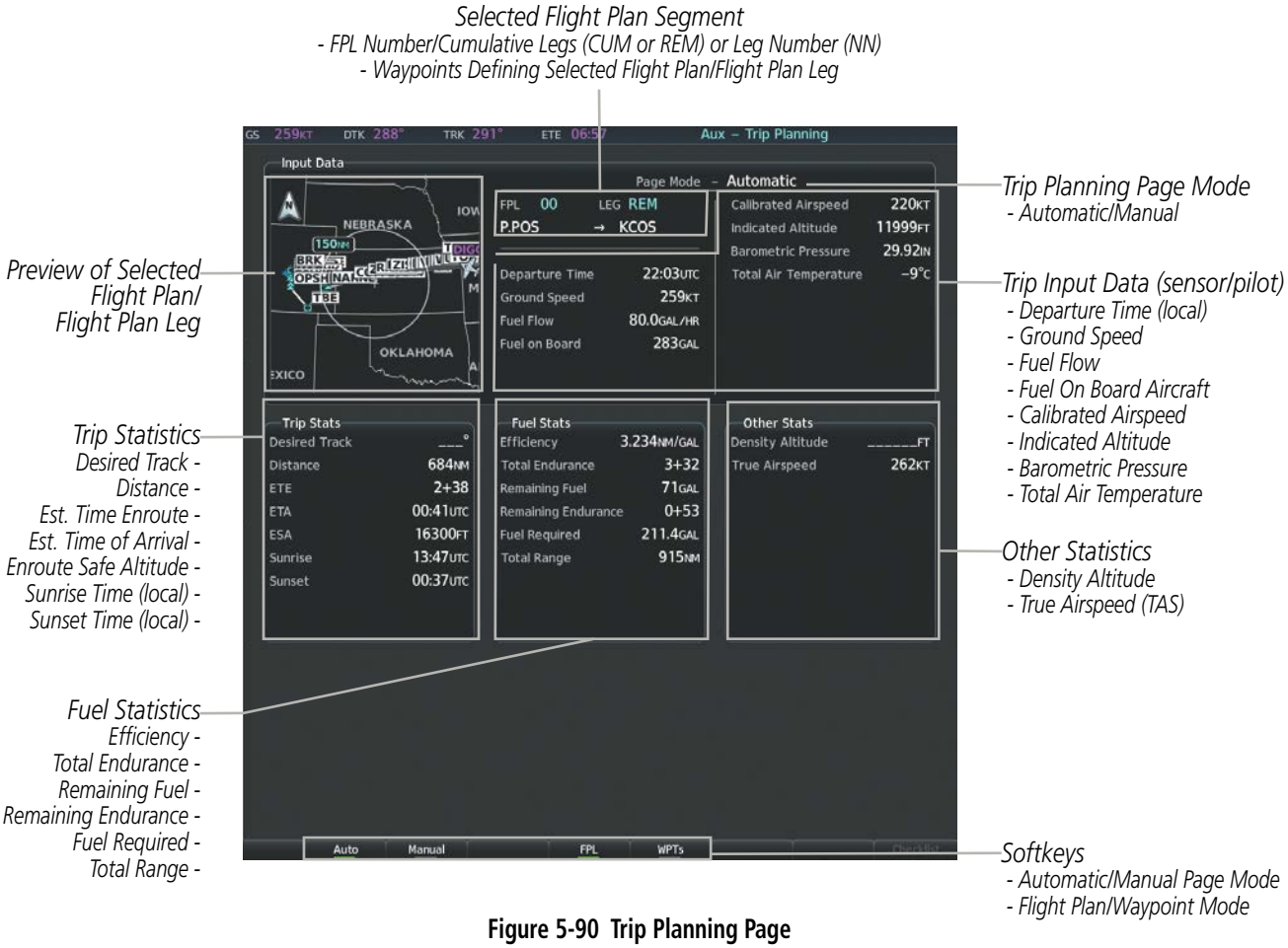


Figure 5-90 Trip Planning Page

The trip planning inputs are based on sensor inputs (automatic page mode) or on pilot inputs (manual page mode). Some additional explanation of the sources for some of the inputs is as follows:

- Departure Time - This defaults to the current time in automatic page mode. The computations are from the aircraft present position, so the aircraft is always just departing.
- Calibrated Airspeed - The primary source is from the air data system, and the secondary source of information is GPS ground speed.
- Indicated Altitude - The primary source is the barometric altitude, and the secondary source of information is GPS altitude.

TRIP STATISTICS

The trip statistics are calculated based on the selected starting and ending waypoints and the trip planning inputs.

In flight plan mode (FPL) with a stored flight plan selected (NN), and the entire flight plan (CUM) selected, the waypoints are the starting and ending waypoints of the selected flight plan.

In flight plan mode (FPL) with a stored flight plan selected (NN), and a specific leg (NN) selected, the waypoints are the endpoints of the selected leg.

In flight plan mode (FPL) with the active flight plan selected (00), and the remaining flight plan (REM) selected, the 'from' waypoint is the present position of the aircraft and the 'to' waypoint is the endpoint of the active flight plan.

In flight plan mode (FPL) with the active flight plan selected (00), and a specific leg (NN) selected, the 'from' waypoint is the current aircraft position and the 'to' waypoint is the endpoint of the selected leg.

In waypoint (WPTs) mode these are manually selected waypoints (if there is an active flight plan, these default to the endpoints of the active leg).

Some of the calculated trip statistics are dashed when the selected leg of the active flight plan has already been flown.

- Desired Track - Desired Track is shown as nnn° and is the desired track between the selected waypoints. It is dashed unless only a single leg is selected.
- Distance - The distance is shown in tenths of units up to 99.9, and in whole units up to 9999.
- Estimated time enroute (ETE) - ETE is shown as hours+minutes until less than an hour, then it is shown as minutes:seconds.
- Estimated time of arrival (ETA) - ETA is shown as hours:minutes and is the local time at the destination.
  - If in waypoint mode then the ETA is the ETE added to the departure time.
  - If a flight plan other than the active flight plan is selected it shows the ETA by adding to the departure time all of the ETEs of the legs up to and including the selected leg. If the entire flight plan is selected, then the ETA is calculated as if the last leg of the flight plan was selected.
  - If the active flight plan is selected, the ETA reflects the current position of the aircraft and the current leg being flown. The ETA is calculated by adding to the current time the ETEs of the current leg up to and including the selected leg. If the entire flight plan is selected, then the ETA is calculated as if the last leg of the flight plan was selected.
- Enroute safe altitude (ESA) - The ESA is shown as nnnnnFT
- Destination sunrise and sunset times (SUNRISE, SUNSET) - These times are shown as hours:minutes of the time at the destination.

FUEL STATISTICS

The fuel statistics are calculated based on the selected starting and ending waypoints and the trip planning inputs. Some of the calculated trip statistics are dashed when the selected leg of the active flight plan has already been flown.

- Fuel efficiency (Efficiency) - This value is calculated by dividing the current ground speed by the current fuel flow.
- Time of fuel endurance (Total Endurance) - This time is shown as hours+minutes. This value is obtained by dividing the amount of fuel on board by the current fuel flow.
- Fuel on board upon reaching end of selected leg (Remaining Fuel) - This value is calculated by taking the amount of fuel onboard and subtracting the fuel required to reach the end of the selected leg.
- Fuel endurance remaining at end of selected leg (Remaining Endurance) - This value is calculated by taking the time of fuel endurance and subtracting the estimated time enroute to the end of the selected leg.
- Fuel required for trip (Fuel Required) - This value is calculated by multiplying the time to go by the fuel flow.
- Total range at entered fuel flow (Total Range) - This value is calculated by multiplying the time of fuel endurance by the ground speed.

OTHER STATISTICS

These statistics are calculated based on the system sensor inputs or the manual trip planning inputs.

- Density Altitude
- True Airspeed

The pilot may select Automatic or Manual page mode, and flight plan (FPL) or waypoint (WPTs) mode. In automatic page mode, only the FPL, LEG, or waypoint IDs are editable (based on FPL/WPTs selection).

Figure 5-91 Trip Planning Page - Flight Plan Mode

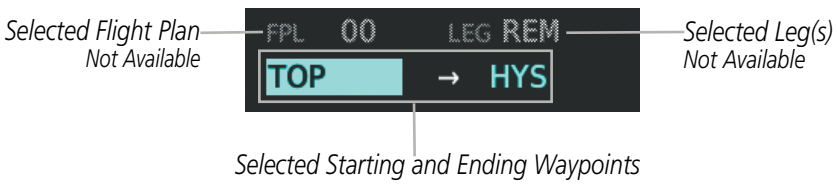


Figure 5-92 Trip Planning Page - Waypoint Mode

Selecting automatic or manual page mode:

From the 'Aux - Trip Planning' Page, press the **Auto** Softkey or the **Manual** Softkey; or press the **MENU** Key, highlight 'Auto Mode' or 'Manual Mode', and press the **ENT** Key.

Selecting flight plan or waypoint mode:

From the 'Aux - Trip Planning' Page, press the **FPL** Softkey or the **WPTs** Softkey; or press the **MENU** Key, highlight 'Flight Plan Mode' or 'Waypoints Mode', and press the **ENT** Key.

Selecting a flight plan and leg for trip statistics:

1) From the 'Aux - Trip Planning' Page, press the **FMS** Knob to activate the cursor in the 'FPL' Field.
2) Turn the small **FMS** Knob to select the desired flight plan number.
3) Turn the large **FMS** Knob to highlight 'CUM' or 'REM'. The statistics for each leg can be viewed by turning the small **FMS** Knob to select the desired leg. The Trip Planning map also displays the selected data.

Selecting waypoints for waypoint mode:

1) From the 'Aux - Trip Planning' Page, press the **WPTs** Softkey; or press the **MENU** Key, highlight 'Waypoints Mode', and press the **ENT** Key. The cursor is positioned in the waypoint field directly below the 'FPL' Field.
2) Turn the **FMS** knobs to select the desired waypoint (or press the **MENU** Key and highlight 'Set WPT to Present Position' if that is what is desired), and press the **ENT** Key. The cursor moves to the second waypoint field.
3) Turn the **FMS** knobs to select the desired waypoint, and press the **ENT** Key. The statistics for the selected leg are displayed.

In manual page mode, the other eight trip input data fields must be entered by the pilot, in addition to flight plan and leg selection.

Entering manual data for trip statistics calculations:

1) From the 'Aux - Trip Planning' Page, select the **Manual** Softkey or select 'Manual Mode' from the 'Page Menu' Window, and press the **ENT** Key. The cursor may now be positioned in any field in the top right two boxes.
2) Turn the **FMS** Knobs to move the cursor onto the 'Departure Time' Field and enter the desired value. Press the **ENT** Key. The statistics are calculated using the new value and the cursor moves to the next entry field. Repeat until all desired values have been entered.

5.11 ABNORMAL OPERATION

***NOTE:THE** Inset Map is removed from the PFD any time aircraft pitch is greater than +30° or less than –20°, or when a 65° bank angle is reached.*

This section discusses the Dead Reckoning mode of operation and the subsequent indications.

***NOTE:** Dead Reckoning Mode only functions in Enroute (ENR) or Oceanic (OCN) phase of flight. In all other phases, an invalid GPS solution produces a "NO GPS POSITION" annunciation on the map and the system stops using GPS.*

While in Enroute or Oceanic phase of flight, if the system detects an invalid GPS solution or is unable to calculate a GPS position, the system automatically reverts to Dead Reckoning (DR) Mode. In DR Mode, the system uses its last-known position combined with continuously updated airspeed and heading data (when available) to calculate and display the aircraft's current estimated position.

It is important to note that estimated navigation data supplied by the system in DR Mode may become increasingly unreliable and must not be used as a sole means of navigation. If while in DR Mode, airspeed and/or heading data is also lost or not available, the DR function may not be capable of accurately tracking estimated position and, consequently, the system may display a path that is different than the actual movement of the aircraft. Estimated position information displayed by the system through DR while there is no heading and/or airspeed data available should not be used for navigation.

DR Mode is inherently less accurate than the standard GPS/SBAS Mode due to the lack of satellite measurements needed to determine a position. Changes in wind speed and/or wind direction compound the relative inaccuracy of DR Mode. Because of this degraded accuracy, other navigation equipment must be relied upon for position awareness until GPS-derived position data is restored.

DR Mode is indicated on the system by the appearance of the letters 'DR' superimposed in amber over the 'own aircraft' symbol as shown in Figure 5-93. In addition, 'DR' is prominently displayed in amber on the HSI slightly below and to the left of the aircraft symbol on the CDI as shown in Figure 5-93. The CDI deviation bar remains, but is removed from the display after 20 minutes in DR Mode. The autopilot will remain coupled in DR mode as long as the deviation info is available (20 min.) Furthermore, a 'GPS NAV LOST' alert message appears on the PFD. Normal navigation using GPS/SBAS source data resumes automatically once a valid GPS solution is restored.

As a result of operating in DR Mode, all GPS-derived data is computed based upon an estimated position and is displayed as amber text on the display to denote degraded navigation source information as shown in Figure 5-93.

Also, while the system is in DR Mode, some terrain functions are not available. Additionally, the accuracy of all nearest information (airports, airspaces, and waypoints) is questionable. Finally, airspace alerts continue to function, but with degraded accuracy.

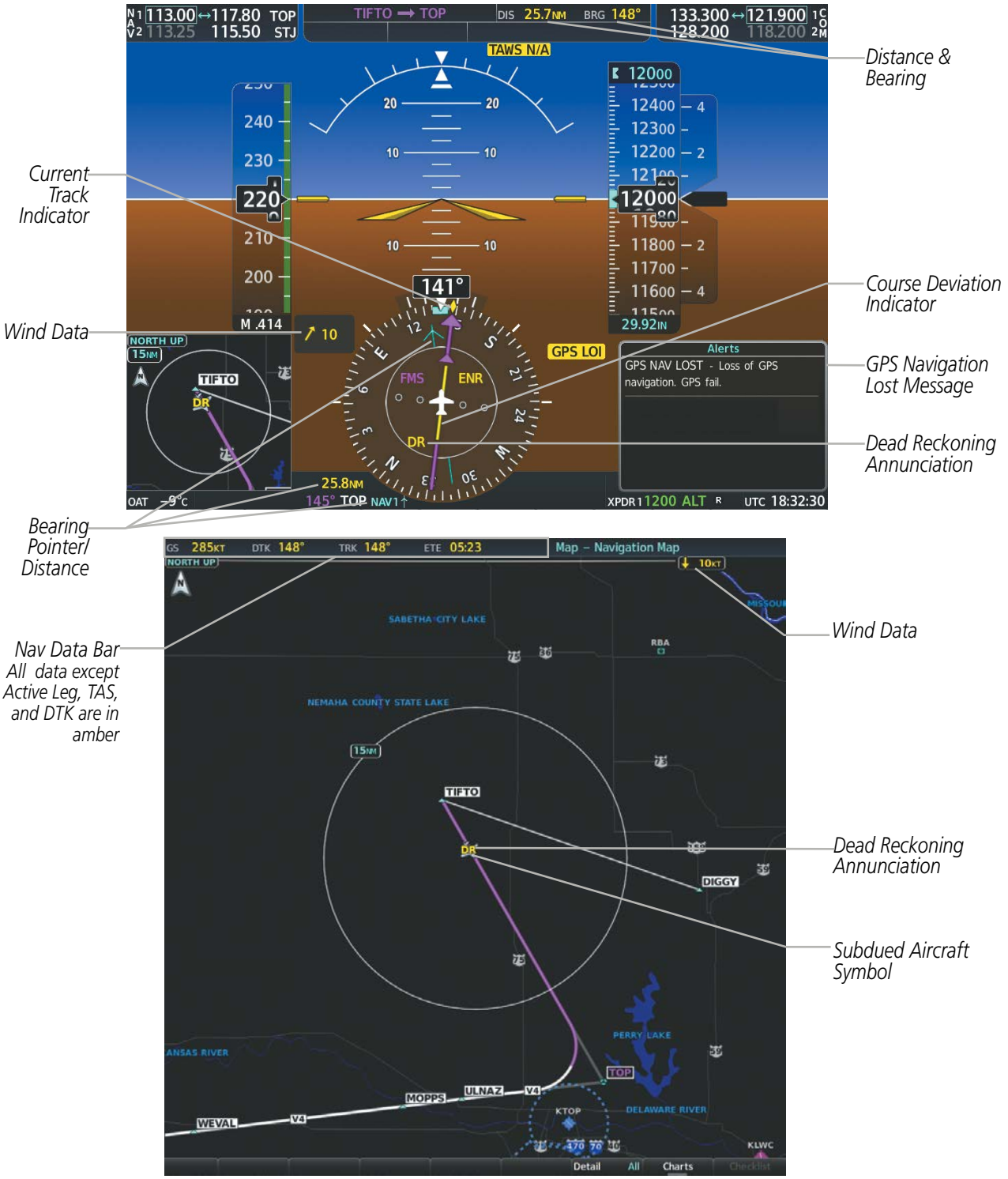


Figure 5-93 Dead Reckoning Mode - GPS Derived Data Shown in Amber

SECTION 6 HAZARD AVOIDANCE

Hazard avoidance features available for the G1000 NXi are designed to aid situational awareness and provide advisory information with regard to potential hazards to flight safety associated with weather, terrain, and air traffic.

Weather

- GDL 69/69A SXM SiriusXM Weather (Subscription Optional)
- GSR 56 Garmin Connext Weather (Optional)
- Flight Information Services-Broadcast (Optional)
- L-3 Stormscope® WX-500 Lightning Detection System (Optional)
- GWX 70 Airborne Color Weather Radar (Optional)

Terrain Avoidance

- Terrain Proximity
- Terrain-SVT (included with Garmin SVT option)
- Terrain Awareness and Warning System Class-B (TAWS-B) (Optional)

Traffic

- Traffic Information Service (TIS)
- Garmin GTS 820 Traffic Advisory System (TAS) (Optional)

6.1 DATA LINK WEATHER

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

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

The Data Link Weather feature enables the system to receive weather information from a variety of weather sources, depending on the equipment installed in the aircraft. These sources may include SiriusXM Weather, Garmin Connext Weather, and Flight Information Services-Broadcast (FIS-B). For each source, a ground-based system processes the weather information collected from a network of sensors and weather data providers.

The SiriusXM Weather service, available with the Garmin 69A SXM data link receiver and an active service subscription, updates its weather data periodically and automatically, and transmits this information to the aircraft's receiver via satellite on the S-Band frequency. This service provides continuous reception capabilities at any altitude throughout North America.

The FIS-B Weather service, available when equipped with a capable transponder or data link receiver which can receive 978 MHz Universal Access Transceiver (UAT) data, delivers subscription-free weather information periodically and automatically to the aircraft. FIS-B uses a network of FAA-operated Ground-Based Transceivers (GBTs) to transmit the information to the aircraft's receiver. Reception is limited to line-of-sight, and is available below 24,000 feet MSL in the United States. FIS-B broadcasts provide weather data in a repeating cycle which may take approximately ten minutes to transmit all available weather data. Therefore, not all weather data may be present immediately upon initial FIS-B signal acquisition. FIS-B is a component of the Automatic Dependent Surveillance (ADS-B) system, which offers both weather and traffic data; refer to the ADS-B Traffic discussion later in this section for a more detailed discussion of the ADS-B system and its capabilities.

The Garmin Connext Weather service, available when equipped with the Garmin GSR 56 Iridium Satellite Transceiver and an active service subscription, provides data link weather information to the aircraft after the pilot defines a geographic area and subsequently selects a manual or automatically recurring Connext Data Request. The transceiver then contacts the Garmin Connext Weather service using the Iridium Satellite telephone system and retrieves the weather data for the specified area. The Garmin Connext Weather service offers worldwide weather coverage, but the availability of individual weather products, such as radar precipitation, varies by region.

NOTE: *To check the availability of Garmin Connext weather products offered in a particular region, visit http://sites.garmin.com/connext.*

ACTIVATING DATA LINK WEATHER SERVICES

NOTE: *Service activation is not applicable to the FIS-B Weather service.*

ACTIVATING THE SIRIUSXM WEATHER SERVICE

Before SiriusXM Weather can be used, the service must be enabled by providing SiriusXM's customer service the coded ID(s) unique to the installed data link receiver. The Data Radio ID must be provided to activate the weather service. A separate Audio Radio ID, if present, enables the receiver to provide SiriusXM Radio entertainment. To view this information, refer to the following locations:

- The Aux - XM Information Page on the MFD
- The SiriusXM Activation Instructions included with the Data Link Receiver
- The label on the back of the Data Link Receiver

SiriusXM uses the coded IDs to send an activation signal that allows the system to display weather data and/or provide audio entertainment programming through the data link receiver.

Establishing an account for SiriusXM services:

1) Select the XM Radio Page in the Aux Page Group.
2) If necessary, press the **Info** Softkey to display the 'Aux - XM Information' Page.
3) Note the Data Radio ID (for SiriusXM Weather data) and/or the Audio Radio ID (for SiriusXM Satellite Radio).
4) Contact SiriusXM customer service through the phone number listed on its website, www.siriusxm.com.
5) Provide SiriusXM customer service the Data Radio ID and/or Audio Radio ID, in addition to payment information, and the desired weather product subscription package.

After SiriusXM has been contacted, it may take approximately 15 minutes until the activation occurs.

Verifying the SiriusXM Weather service activation:

1) Once a SiriusXM Weather account has been established, select the XM Radio Page in the Auxiliary Page Group.
2) If necessary, press the **Info** Softkey to display the 'Aux - XM Information' Page.
3) View the list of supported Weather Products. An empty box appears next to an unavailable weather product; a green filled box appears next to an available weather product. During activation, it may take several minutes for weather products in the selected subscription package to become available.

NOTE: *Not all weather products offered by SiriusXM are supported for display on this system. This pilot's guide only discusses supported weather products.*

Figure 6-1 XM Information Page

ACTIVATING GARMIN CONNEXT WEATHER

Garmin Connext weather requires an active Iridium satellite network account and an active subscription to the Garmin Connext Weather service.

A subscriber account must be established for the Iridium transceiver prior to using the Iridium Satellite System for telephone services. Before setting up an Iridium account, obtain the serial number of the Iridium Transceiver (GSR1) and the System ID by selecting the Aux - System Status Page. Then Contact Garmin at 1-866-739-5687 in the United States or 913-397-8200, wait for the operation, and request extension 1135.

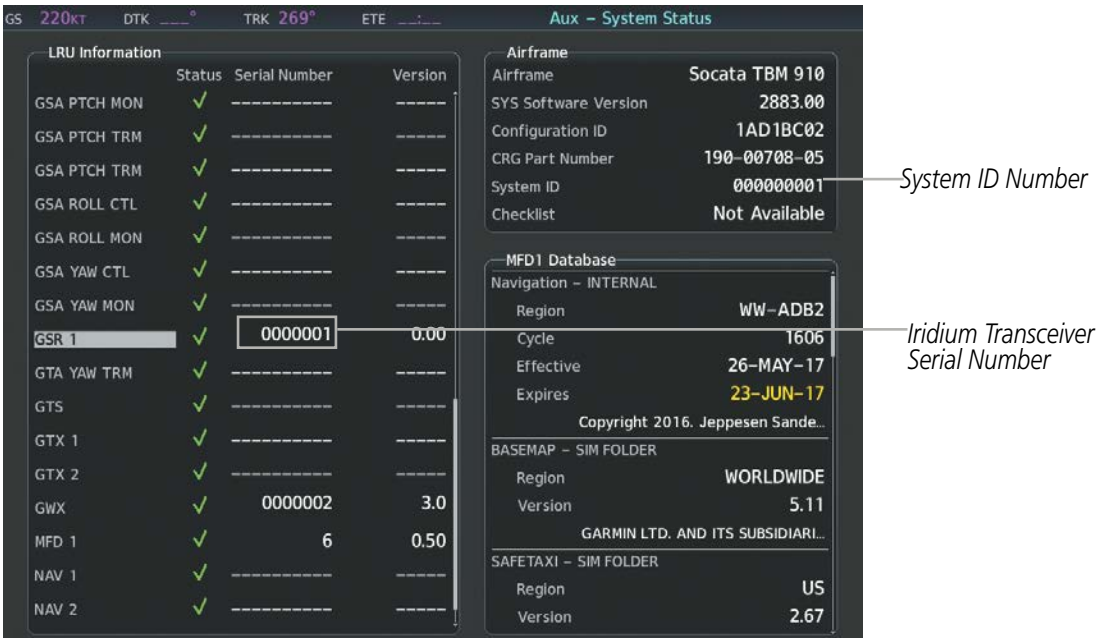


Figure 6-2 Identification Needed for Iridium Registration

When an account is established, Garmin provides an Access Code which must be entered on the system in order to complete the registration process.

Registering the system to receive Garmin Connext Weather:

1) With the aircraft outside and having a clear view of the sky, turn the large **FMS** Knob on the MFD to select the Map page group.
2) Turn the small **FMS** Knob to select the 'Map - Weather Data Link (CNXT)' Page. If another data link weather source such as 'XM' or 'FIS-B' is displayed in the page title, it will be necessary to change the data link weather source to CNXT before continuing. Refer to 'Viewing the Weather Data Link (CNXT) Page' procedure to change the data link source to prior to registration.
3) If the system displays the Connext Registration Window, proceed to step 6. Otherwise, press the **MENU** Key. The page menu window is now displayed.
4) Turn the large **FMS** Knob to select 'Register With Connext' in the menu list.
5) Press the **ENT** Key. The Connext Registration Window appears as shown in Figure 6-3.

Figure 6-3 Enter Access Code

6) Enter the access code provided by Garmin in the 'Access Code' field.

7) Press the **ENT** Key. 'Register' is highlighted as in Figure 6-3.

8) Press the **ENT** Key. The system contacts Garmin through the Iridium network. System registration is complete when the Current Registration Window displays the correct information for the Airframe, Tail Number, Airframe Serial Number, and Iridium Serial Number.

9) When finished, push the **FMS** Knob to remove the Connext Registration Window.

WEATHER PRODUCT AGE

Unlike real-time weather information collected directly from weather sensors on-board an aircraft, such as an airborne weather radar or a lightning detection system, data link weather in contrast relies on external 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 radar precipitation, the system can also show a weather product age. This age represents the elapsed time, in minutes, since the weather service provider compiled the weather product and the current time. It does not represent the age of the information contained within the weather product itself. For example, a single mosaic of radar precipitation is comprised data from multiple radar sites providing data at differing scan rates or intervals. The weather service provider periodically compiles this data to create a single composite image, and assigns one time to this image which becomes the basis of the product age. The service provider then makes this weather product available for data link transmission at the next scheduled update time. The actual age of the weather data contained within the mosaic is therefore older than its weather product age and should never be considered current.

SiriusXM and FIS-B weather products are broadcast automatically on a repeating cycle without pilot intervention. For the Garmin Connext service, the pilot schedules a one-time or repeating data request at regular intervals.

Each data link weather product age has an expiration time. The weather product age is shown in white if it is less than half of this expiration time, otherwise it is shown in amber until reaching its expiration time. After a weather product has expired, the system removes the expired weather product from the displays, and shows white dashes instead of the age. If the data link receiver has not yet received a weather product 'N/A' appears instead of the age to show the product is currently not available for display. This may occur, for example, after powering on the system but before the data link receiver has received a complete weather data transmission. It could also indicate a possible outage of a weather product.

The weather product age is shown automatically for weather products displayed on MFD maps. For PFD maps, the pilot can manually enable/disable the age information.

Enabling/disabling the weather product age for PFD Maps:

1) With the PFD Inset Map or HSI Map displayed, press the **Map/HSI** Softkey.
2) Press the **WX LGND** to show/remove the weather product age information for PFD maps.

Tables 6-1 and 6-2 show the weather product symbols, the expiration times and the broadcast rates for SiriusXM Weather and FIS-B Weather, respectively. The broadcast rate represents the interval at which the service provider transmits new signals that may or may not contain updated weather product information. It does not represent the rate at which the weather information is updated or when the Data Link Receiver receives new data. The service provider and its weather data suppliers define and control the data update intervals, which are subject to change.

SiriusXM Weather Product	Symbol	Expiration Time (Minutes)	Broadcast Rate (Minutes)
NEXRAD		30	5 (U.S.) 10 (Canada)
Cloud Top (CLD TOP)		60	15 (69/69A) 30 (69/69A SXM)
Echo Top (ECHO TOP)		30	7.5
SiriusXM Lightning (LTNG)		30	5
Cell Movement		30	1.25
SIGMETs/AIRMETs		60	12
METARs		90	12
City Forecast		90	12
Surface Analysis		60	12
Freezing Levels		120	12
Winds Aloft		90	12
County Warnings		60	5
Cyclone Warnings		60	12
Icing Potential (CIP and SLD)		90	22
Pilot Weather Report (PIREP)		90	12
Air Report(AIREP)		90	12
Turbulence		180	12
Radar Coverage Not Available	No product image	30	5
Temporary Flight Restriction (TFR)	No product image	60	12
Terminal Aerodrome Forecast (TAF)	No product image	60	12

Table 6-1 SiriusXM Weather Product Symbols and Data Timing

FIS-B Weather Product	Symbol	Expiration Time (Minutes)	Broadcast Rate (Minutes)
NEXRAD Composite (US)		30	15
NEXRAD Composite (Regional)		30	2.5
METARs		90	5
Pilot Weather Report (PIREP)		90	10
Winds Aloft		90	10
SIGMETs/AIRMETs		60	5
No Radar Coverage	no product image	30	2.5
Terminal Aerodrome Forecast (TAF)	no product image	60	10
Temporary Flight Restriction (TFR)	no product image		10

Table 6-2 FIS-B Weather Product Symbols and Data Timing

The following table shows the Garmin Connext Weather product symbols, the expiration times and the refresh rates. The refresh rate represents the interval at which Garmin Connext weather service makes available the most current known weather data. It does not necessarily represent the rate at which the service receives new data from various weather sources. The pilot chooses how often to contact the Garmin Connext weather service in order to retrieve weather data through the Connext Data Request.

Garmin Connext Weather Product	Symbol	Expiration Time (Minutes)	Refresh Rate (Minutes)
Radar Precipitation		30	U.S.: 3* Canada: 3*† Europe: 15 Australia: 15ˆ
Infrared Satellite		60	30
Datalink Lightning		30	Continuous
SIGMETs/AIRMETs		60	Continuous
METARs		90	Continuous
Winds Aloft		90	Continuous
Pilot Weather Report (PIREPs)		90	Continuous
Temporary Flight Restrictions (TFRs)	no product image	60	Continuous
Terminal Aerodrome Reports TAFs)	no product image	60	Continuous

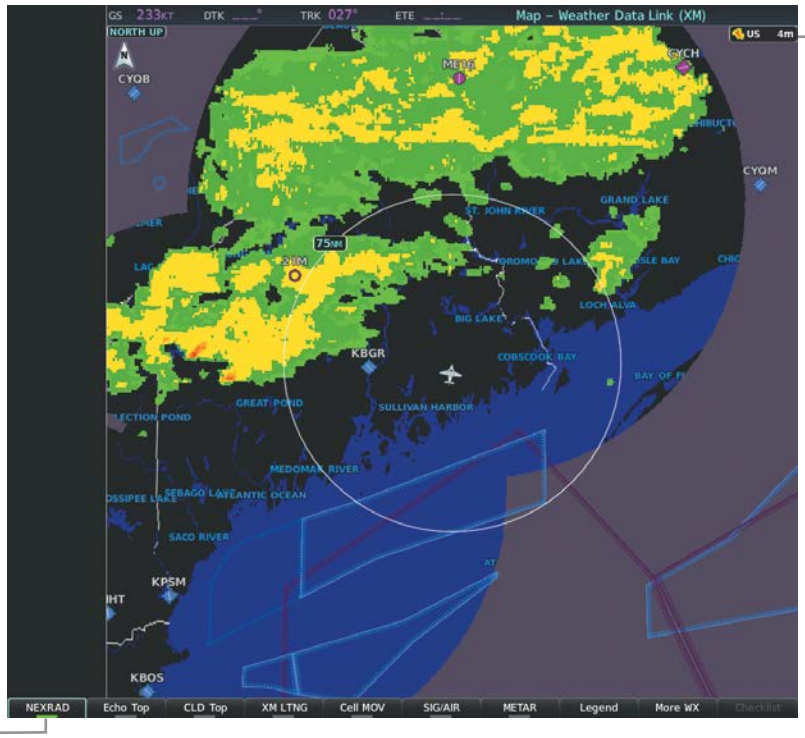
** The composite precipitation image is updated every 3 minutes, but individual radar sites may take between 3 and 10 minutes to provide new data.*
† Canadian radar precipitation data provided by Environment Canada.
ˆ Australian radar precipitation data provided by the Australian Bureau of Meteorology.

Table 6-3 Garmin Connext Weather Product Symbols and Data Timing

DISPLAYING DATA LINK WEATHER PRODUCTS

WEATHER DATA LINK PAGE

The Map - Weather Data Link (XM/FIS-B/CNXT) Page is the principal map page for viewing data link weather information. This page provides the capability for displaying the most data link weather products of any map on the system. The Weather Data Link Page also provides system-wide controls for selecting the data link weather source, if more than one source has been installed. The page title indicates the selected data link weather source (e.g., "XM", "FIS-B" or "CNXT").



NEXRAD Weather Product Icon and Age (U.S.)

NEXRAD Weather Product Selected for Display

Figure 6-4 Weather Data Link (XM) Page

Viewing the Weather Data Link Page and changing the data link weather source, if applicable:

1) Turn the large **FMS** Knob to select the Map Page Group.

2) Turn the small **FMS** Knob to select the Weather Data Link (XM or CNXT or FIS-B) Page. The currently selected data link weather source appears in the page title.

3) If the page title does not contain the desired weather source, press the **MENU** Key.

a) Turn the **FMS** Knob to highlight 'Display XM Weather', 'Display Connext Weather' or 'Display FIS-B Weather' (choices may vary depending on the installed equipment).

b) Press the **ENT** Key.

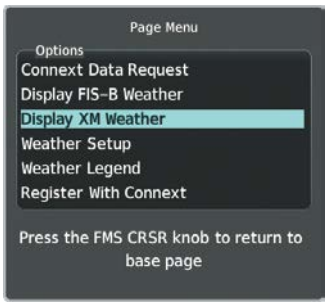


Figure 6-5 Changing the Data Link Weather Source

The system presents the softkeys for the selected source on the Weather Data Link Page, and for weather product map overlays used throughout the system. The following tables show the softkeys for the Weather Data Link Page based on the selected weather source.

WEATHER DATA LINK (XM) PAGE SOFTKEYS

NOTE: *Only softkeys pertaining to data link weather features are shown in the following tables.*

Level 1	Level 2	Level 3	Description
NEXRAD			Enables/disables the NEXRAD weather product overlay.
Echo Top			Enables/disables the Echo Tops weather product overlay.
CLD Top			Enables/disables the Cloud Tops weather product overlay.
XM LTNG			Enables/disables the SiriusXM Lightning weather product overlay.
Cell MOV			Enables/disables the Cell Movement weather product overlay.
SIG/AIR			Enables/disables the SIGMET/AIRMET weather product overlay.
METAR			Enables/disables the graphical METAR weather product overlay.
Legend			Enables/disables the SiriusXM Weather Legends Window. Softkey available for selection when at least one SiriusXM Weather product is enabled.
More WX			Displays second-level SiriusXM Weather product softkeys.
	Cyclone		Enables/disables the Cyclone weather product overlay.
	SFC		Displays third level softkey for enabling/disabling the Surface Analysis and City Forecast weather product and selecting a forecast period.
		Off	Disables the Surface Analysis and City Forecast weather product overlay.
		Current	Displays the Surface Analysis for the current time period overlay.
		12 HR, 24 HR, 36 HR, 48 HR	These softkeys display a Surface Analysis and City Forecast overlay for the selected future time period.
		Legend	Enables/disables the SiriusXM Weather Legends Window. Softkey available for selection when at least one SiriusXM Weather product is enabled.
		Back	Returns to the second-level softkeys.
	FRZ LVL		Enables/disables the Freezing Level weather product overlay.

Level 1	Level 2	Level 3	Description
	Wind		Displays third level softkeys for enabling/disabling the Winds Aloft weather product and selecting a winds aloft altitude.
		PREV	Shows the previous level of winds aloft altitude softkeys.
		Off	Disables the Winds Aloft weather product overlay.
		Softkeys available for selecting winds from the Surface to 42,0000 feet	Enables/disables the Winds Aloft weather product for the surface (SFC) through 15,000 feet. Softkeys available for 3,000 foot increments of altitude.
		Next	Shows the next level of winds aloft altitude softkeys.
		Legend	Enables/disables the SiriusXM Weather Legends Window. Softkey available for selection when at least one SiriusXM Weather product is enabled.
		Back	Returns to the second-level softkeys.
	ICNG		Displays altitude softkeys for the Icing weather product overlay.
		PREV	Shows the previous level of Icing altitude softkeys.
		Off	Disables the Icing weather product.
		Softkeys available for selecting winds from the Icing altitude from to 1,000 to 30,000 feet	Enables/disables the Icing weather product overlay from 1,000 feet to 30,000 feet. Softkeys available for 3,000 foot increments of altitude.
		Next	Shows the next level of Icing weather product softkeys.
		Legend	Enables/disables the SiriusXM Weather Legends Window. Softkey available for selection when at least one SiriusXM Weather product is enabled.
	TURB		Displays softkeys for enabling/disabling the Turbulence weather product overlay.
		PREV	Shows the previous level of Turbulence altitude softkeys.
		Off	Disables the Turbulence weather product overlay.
		Softkeys available for selecting Turbulence altitude from 21,000 feet to 45,000 feet	Enables/disables the Icing weather product overlay from 21,000 feet to 45,000 feet. Softkeys available for 3,000 foot increments of altitude.
		Next	Shows the next level of Icing weather product softkeys.
		Legend	Enables/disables the SiriusXM Weather Legends Window. Softkey available for selection when at least one SiriusXM Weather product is enabled.
		Back	Returns to the second-level softkeys.
	AIREPS		Enables/disables the AIREPs weather product overlay.
	PIREPS		Enables/disables the PIREPs weather product overlay.
	County		Enables/disables the County Warnings weather product overlay.
	Back		Returns to the first level softkeys.

WEATHER DATA LINK (CNXT) PAGE SOFTKEYS)

Level 1	Level 2	Level 3	Description
PRECIP			Enables/disables the Precipitation weather product overlay.
IR SAT			Enables/disables the Infrared Satellite weather product overlay.
SIG/AIR			Enables/disables the SIGMET/AIRMET weather product overlay.
METAR			Enables/disables the METAR weather product overlay.
Legend			Enables/disables the Connext Weather Legends Window. Softkey available for selection when at least one Connext Weather product is enabled.
More WX			Displays second-level Connext Weather product softkeys.
	Wind		Displays third level softkeys for enabling/disabling the Winds Aloft weather product and selecting a winds aloft altitude.
		PREV	Shows the previous level of winds aloft altitude softkeys.
		Off	Disables the Winds Aloft weather product overlay.
		Softkeys available for selecting winds from the Surface to 42,0000 feet	Enables/disables the Winds Aloft weather product for the surface (SFC) through 15,000 feet. Softkeys available for 3,000 foot increments of altitude.
		Next	Shows the next level of winds aloft altitude softkeys.
		Legend	Enables/disables the Connext Weather Legends Window. Softkey available for selection when at least one Connext Weather product is enabled.
		Back	Returns to the second-level softkeys.
	PIREPs		Enables/disables the PIREPs weather product overlay.
	Back		Returns to the first level softkeys.

WEATHER DATA LINK (FIS-B) PAGE SOFTKEYS)

Level 1	Level 2	Level 3	Description
NEXRAD or **US** or **RGNL** or **US/RGNL**			Cycles through NEXRAD display modes with each press: NEXRAD (with annunciator disabled): No NEXRAD is shown. US: Displays NEXRAD data for the Continental US (CONUS). RGNL: Displays regional NEXRAD data. US/RGNL: Displays regional NEXRAD data where available, and CONUS NEXRAD data in other coverage areas.
IR SAT			Enables/disables the Infrared Satellite weather product overlay.
SIG/AIR			Enables/disables the SIGMET/AIRMET weather product overlay.
METAR			Enables/disables the METAR weather product overlay.
Legend			Enables/disables the Connext Weather Legends Window. Softkey available for selection when at least one Connext Weather product is enabled.
More WX			Displays second-level Connext Weather product softkeys.

Level 1	Level 2	Level 3	Description
	Wind		Displays third level softkeys for enabling/disabling the Winds Aloft weather product and selecting a winds aloft altitude.
		PREV	Shows the previous level of winds aloft altitude softkeys.
		Off	Disables the Winds Aloft weather product overlay.
		Softkeys available for selecting winds from the Surface to 42,0000 feet	Enables/disables the Winds Aloft weather product for the surface (SFC) through 15,000 feet. Softkeys available for 3,000 foot increments of altitude.
		Next	Shows the next level of winds aloft altitude softkeys.
		Legend	Enables/disables the Connext Weather Legends Window. Softkey available for selection when at least one Connext Weather product is enabled.
		Back	Returns to the second-level softkeys.
	PIREPs		Enables/disables the PIREPs weather product overlay.
	Back		Returns to the first level softkeys.

The Weather Data Link Page can display a legend for each enabled weather product.

Viewing legends for displayed weather products on the Weather Data Link Page:

1) Select the Weather Data Link Page.
2) Press the **Legend** Softkey to display the legends for the displayed weather products.

   Or:

   a) Press the **MENU** Key.

   b) Select 'Weather Legend' and press the **ENT** Key.
3) Turn the **FMS** Knob to scroll through the legends if more are available than fit in the window.
4) To remove the XM Weather Legends Window, press the **Legend** Softkey, the **ENT** or the **CLR** Key, or press the **FMS** Knob.

Additional information about the following weather products can be displayed by panning the Map Pointer over the following products on the Weather Data Link Page:

- Echo Tops
- Cloud Tops
- Cell Movement
- SIGMETs
- AIRMETs
- METARs
- County Warnings
- TFRs
- AIREPs
- PIREPs

The map panning feature is enabled by pressing the **Joystick**. The map range is adjusted by turning the **Joystick**. If the map range is adjusted while panning is enabled, the map is re-centered on the Map Pointer.

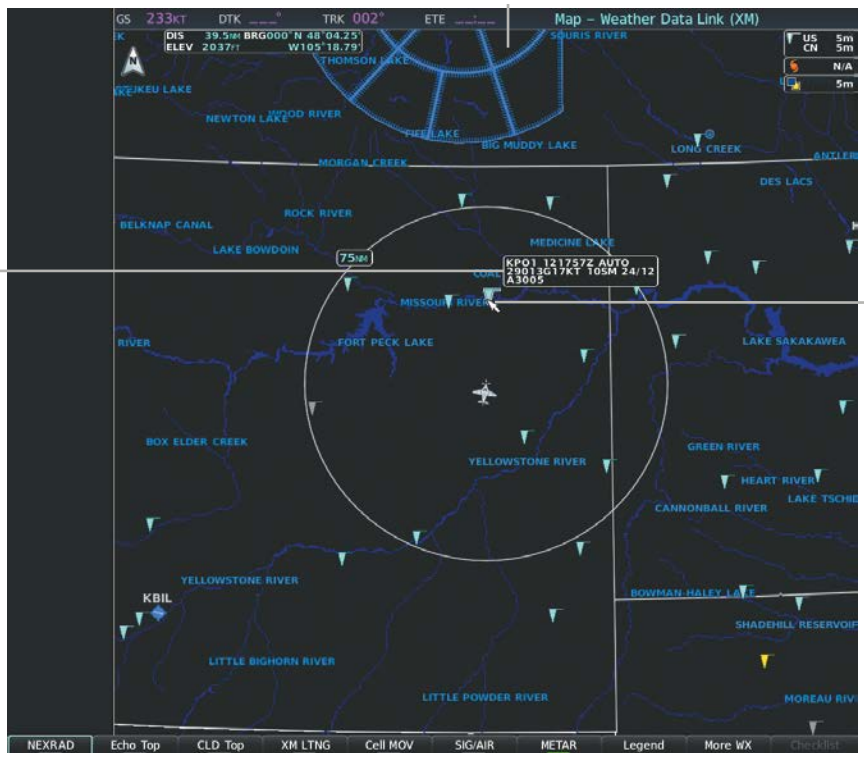


Figure 6-6 Panning on the Weather Data Link (XM) Page

Certain weather products, such as METARs or TFRs have full text associated with a graphic shown on the map. When a weather product is selected with the Map Pointer, press the **ENT** Key. The system displays the full text for the selected weather product in a window. To remove the window, press the **FMS** Knob or the **CLR** Key.

The Weather Data Link Page also has a page menu that can be accessed by pressing the **MENU** Key. It has controls for enabling/disabling the weather products as an alternative to using the softkeys.

Customizing the Weather Data Link Page

The Weather Data Link Page includes controls for selecting the maximum map range to display each weather product on the page. If the pilot increases the map range beyond this selected maximum range, the system removes the weather product from the map. If more than one data link weather source has been installed, the system uses the same maximum map range for the comparable weather product of another source.

Setting up and customizing the Weather Data Link Page:

1) Select the Weather Data Link Page.
2) Press the **MENU** Key.
3) Turn the **FMS** Knob to highlight 'Weather Setup', then press the **ENT** Key.
4) Turn the small **FMS** Knob to select 'Product Group 1' or 'Product Group 2', and press the **ENT** Key.

NOTE: *'Product Group 2' is only applicable to SiriusXM and Garmin Connext Weather.*

5) Turn the large **FMS** Knob or press the **ENT** Key to scroll through product selections.
6) Turn the small **FMS** Knob to scroll through options for each product (On/Off, range settings, etc.).
7) Press the **ENT** Key to select an option.
8) Press the **FMS** Knob or **CLR** Key to return to the Weather Data Link (XM) Page with the changed settings.

The pilot can select a map orientation for the Weather Data Link Page, or choose to synchronize the map orientation to the same orientation used on the Navigation Map Page.

Selecting a map orientation for the Weather Data Link Page:

1) Select the Weather Data Link Page.
2) Press the **MENU** Key.
3) Turn the **FMS** Knob to highlight 'Weather Setup'.
4) Turn the small **FMS** Knob to display the Group options.
5) If SiriusXM is the selected data link weather source, turn the small **FMS** Knob to highlight the 'Map' Group and press the **ENT** Key.

   Or:

   If FIS-B or Garmin Connext is the selected data link weather source, turn the large **FMS** Knob to highlight the 'Orientation ' field at the bottom of the Product Group 1 list.
6) Turn the small **FMS** Knob to highlight the desired map orientation: North up, Track up, HDG up, or SYNC, then press the **ENT** Key.

Restoring default Weather Data Link Page settings:

1) Select the Weather Data Link Page.
2) Press the **MENU** Key.
3) Turn the **FMS** Knob to highlight 'Weather Setup', then press the **ENT** Key.
4) Press the **MENU** Key.
5) Highlight the desired default(s) to restore (all or for selection) and press **ENT** Key.
6) When finished, press the **FMS** Knob or press the **CLR** Key.

WEATHER PRODUCT MAP OVERLAYS

Other PFD and MFD maps and pages can display a smaller set of data link weather products. The following table shows which data link weather products can be displayed on specific maps, indicated with a '+' symbol.

Data Link Weather Product	PFD Maps	Navigation Map Page	Weather Data Link Page	Weather Information Page	Aux - Trip Planning Page	Nearest Page Group	Flight Plan Pages
NEXRAD/Radar Precipitation	+	+	+		+	+	+
Cloud Top			+				
Echo Top			+				
Infrared Satellite			+				
Data Link Lightning	+	+	+		+	+	+
Cell Movement		+	+		+		
SIGMETs/AIRMETs			+				
METARs	+	+	+	+	+	+	+
Surface Analysis & City Forecast			+				
Freezing Levels			+				
Winds Aloft		+*	+				
County Warnings			+				
Cyclone Warnings			+				
Icing Potential			+				
PIREPs			+	+			
AIREPs			+	+			
Turbulence (TURB)			+				
No Radar Coverage	+	+	+		+	+	+
TFRs	+	+	+	+	+	+	+
TAFs			+	+			

* *Winds Aloft data is available inside the VSD when VSD is enabled on the Navigation Map Page.*

Table 6-4 Weather Product Display Maps

Displaying Data Link Weather Products on the Navigation Map Page:

1) Select the 'Map - Navigation Map' Page.

2) Press the **Map Opt** Softkey.

3) Press the softkey to enable/disable the desired weather product.

The Navigation Map Page also can display legends for weather products enabled on this map with the **Legend** Softkey. This softkey is subdued if no weather products are enabled.

Showing/removing the weather legend on the Navigation Map Page:

1) Select the 'Map - Navigation Map' Page.
2) Press the **Map Opt** Softkey.
3) Press the **Legend** Softkey to show the weather legends window.
4) When finished, press the **Legend** Softkey again, or press the **FMS** Knob or the **CLR** Key to remove the window.

The Navigation Map Page also allows the pilot to select the maximum map range to display weather products. If the pilot increases the map range beyond this selected maximum range, the system removes the weather product from the map. The system uses this setting for all navigation maps, including those displayed on the PFD.

Setting up and customizing weather data for the navigation maps:

1) Select the 'Map - Navigation Map' Page.
2) Press the **MENU** Key.
3) With 'Map Settings' highlighted, press the **ENT** Key.
4) Turn the small **FMS** Knob to select the 'Weather' Group and press the **ENT** Key.
5) Turn the large **FMS** Knob or press the **ENT** Key to scroll through product selections.
6) Turn the small **FMS** Knob to scroll through options for each product (On/Off, range settings).
7) Press the **ENT** Key to select an option.
8) Press the **FMS** Knob or **CLR** Key to return to the Navigation Map Page with the changed settings.

The system can also display data link weather information on the PFD navigation maps.

Displaying Data Link Weather products on the PFD:

NOTE: *Data link lightning is not applicable to the FIS-B Weather service.*

1) On the PFD, press the **Map/HSI** Softkey.
2) Press the desired weather product softkey(s) to enable/disable the display of data link products on the PFD map.
3) To enable/disable a data link lightning weather product on a PFD, press the **Lightning** Softkey.
   a) Press the **Datalink** Softkey to enable data link lightning or press the **LTNG Off** Softkey.
   b) Press the Back Softkey twice to return to the top-level PFD Softkeys.

On the MFD maps, the weather product icon and age appear automatically when a weather is enabled and the range is within the maximum display limits. On PFD maps, this information is available using the PFD softkeys.

Enabling/disabling the weather product icon and age display (PFD maps):

1) On the PFD, press the **Map/HSI** Softkey.
2) Press the **Layout** Softkey.
3) Press the **WX LGND** Softkey to enable/disable the weather product age, source, and icon box display on PFD Maps.

The setup menus for the Navigation Map Page and the Weather Data Link Page control the map range settings above which weather products data are decluttered from the display. If a map range larger than the weather product map range setting is selected, the weather product data is removed from the map. The page menus also provide an alternative to using the softkeys to enable/disable data link weather product overlays on maps.

CONNEXT DATA REQUESTS

NOTE: *Data requests are not applicable to the SiriusXM Weather or FIS-B Weather services.*

The Connext Data Request Menu provides the pilot with the options to define the requested weather coverage area(s), choose automatic weather update intervals (if desired), and the ability to send or cancel weather data requests. A Request Status Window inside the menu shows the status of the Connext Data Request.

Before a Connext Data Request can occur, a valid request coverage area must be defined from which all currently available Garmin Connext Weather products will be retrieved. At a minimum, either the aircraft's present position or a waypoint (as part of a flight plan or entered directly in the 'WAYPOINT' coverage field) must be part of the request coverage area, otherwise the request status window indicates 'INVALID COVERAGE AREA' and the system will not allow a request to occur.

It is not necessary for a destination (based on an active flight plan), a flight plan, or waypoint to be specified prior to enabling these coverage areas; however no weather data will be retrieved for these option(s) until a flight plan or waypoint is provided, respectively.

Manually Requesting Garmin Connext Weather information:

1) Select the 'Map - Weather Data Link (CNXT)' Page.
2) Press the **MENU** Key.
3) With 'Connext Data Request' highlighted, press the **ENT** Key.
4) Turn the large **FMS** Knob to highlight the desired coverage option(s) and press the **ENT** Key to show or hide a green check mark to select one of more of the following coverage selections (Figures 6-8, 6-9):
   - Present Position – Requests data based on current location.
   - Destination – Requests data based on the active flight plan destination (Direct-To destinations excluded). See the Flight Management section for more information about entering and activating flight plans.
   - FPL – Requests data along an active flight plan, if one currently exists. Turn the small **FMS** Knob to select the desired flight plan look-ahead distance option (or choose 'Remaining FPL' to request weather data for the remainder of the flight plan), then press the **ENT** Key.

- Waypoint – Requests data based on a waypoint (which may be off-route). Turn the large and small **FMS** Knobs to enter a waypoint, then press the **ENT** Key.

5) Turn the large **FMS** Knob highlight to the 'Diameter / Route Width' distance field and turn the small **FMS** Knob to select the desired diameter and route width of the request, then press the **ENT** Key.

6) Turn the large **FMS** Knob until the 'Send Request' field is highlighted. Press the **ENT** Key to initiate the request immediately or press the **FMS** Knob to return to the Weather Data Link (CNXT) Page without requesting weather data.

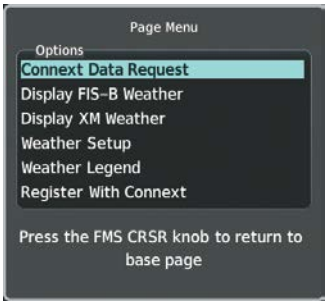


Figure 6-7 Weather Data Link (CNXT) Page Menu

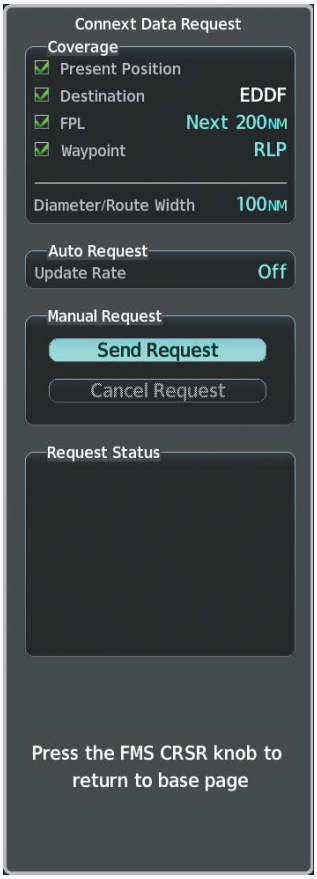
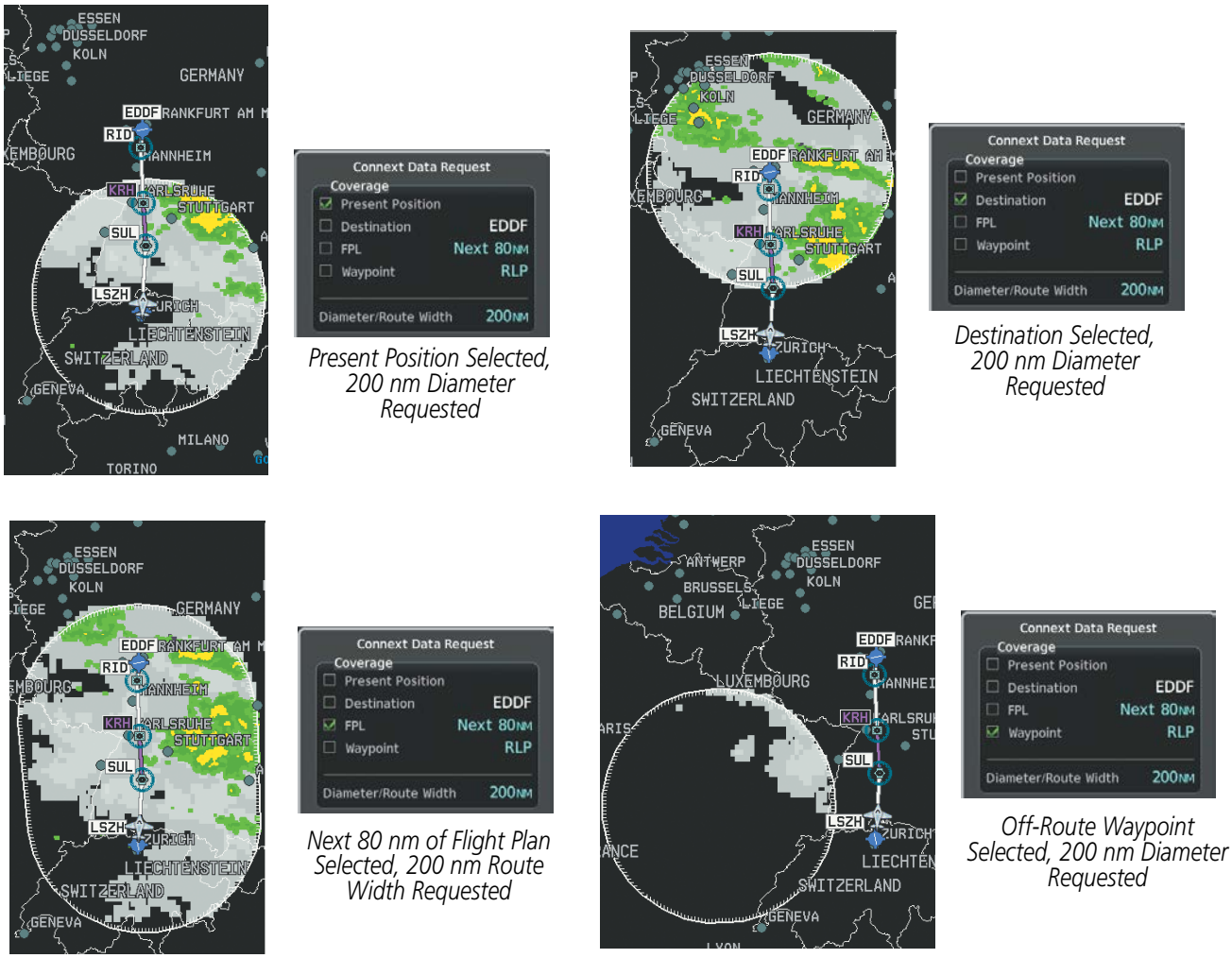


Figure 6-8 Connext Data Request Window



Present Position Selected, 200 nm Diameter Requested

Destination Selected, 200 nm Diameter Requested

Next 80 nm of Flight Plan Selected, 200 nm Route Width Requested

Off-Route Waypoint Selected, 200 nm Diameter Requested

Figure 6-9 Garmin Connext Weather Data Request Results with Precipitation Data Displayed

During a Connext Data Request, the Request Status Window initially displays "Contacting Connext...". Once a connection is established, the Request Status Window displays "Receiving Wx Data... Time Remaining:" with an estimated data transfer time (either minutes or seconds). If desired, the Connext Data Request Menu may be removed while the data request is processing by pressing the **FMS** Knob; the data request will continue to process in the background. Connext Data Requests typically take between 1 to 4 minutes to complete depending on the size of the selected weather coverage area, the amounts of weather activity present, and the Iridium signal strength.

The system retrieves all available Garmin Connext Weather products within the selected coverage area during an initial Connext Data Request, regardless of which products (if any) are currently enabled for display. On subsequent requests, the system retains previously retrieved textual data (such as METARs and TAFS) if it has not expired, while new textual weather data matching the current coverage area and all graphical weather data is transferred to the aircraft during every data request.

At the completion of a successful weather data request, the Request Status Window indicates 'OK' if the Connext Data Request menu is still within view.

Cancelling a Connext Data Request in Progress:

1) Select the 'Map - Weather Data Link (CNXT)' Page.
2) Press the **MENU** Key.
3) With 'Connext Data Request' highlighted, press the **ENT** Key.
4) Turn the large **FMS** Knob to select the 'Cancel Request' field and press the **ENT** Key. The request status box indicates 'Request Cancelled'.
5) Press the **FMS** Knob to return to the Weather Data Link (CNXT) Page.

The flight crew can schedule Connext Data Requests to recur automatically. Automatic requests remain enabled until the flight crew them, or the system power is removed. The Request Status Window indicates the number of minutes or seconds until the next automatic data request occurs.

NOTE: *If automatic Connext Data Requests were enabled prior to the system entering Reversionary Mode, the automatic weather data requests will continue in Reversionary Mode, however the Connext Data Request Window and its associated options will not be available in Reversionary Mode.*

Enabling/disabling automatic Connext Data Requests:

1) Select the 'Map - Weather Data Link (CNXT)' Page.
2) Press the **MENU** Key.
3) With 'Connext Data Request' highlighted, press the **ENT** Key.
4) Choose the desired weather coverage options.
5) Turn the large **FMS** Knob to select the 'Update Rate' field. Then turn the small **FMS** Knob to highlight the desired automatic update frequency (Off, 5 Min, 10 Min, 15 Min, 20 Min, 30 Min, 45 Min, or 60 Min), then press the **ENT** Key.
6) The 'Send Request' field is highlighted and a countdown timer is displayed in the 'Request Status' Window based on the currently selected update rate. Press the **ENT** Key to immediately send an immediate Connext Data Request.

   Or:

   Press the **FMS** Knob to return to the Weather Data Link (CNXT) Page.

WEATHER PRODUCT OVERVIEW

The following is an overview of data link weather products the system can display.

NEXRAD (SIRIUSXM)

NOTE: *Datalink weather radar information cannot be displayed at the same time as terrain, echo tops, icing, or turbulence data.*

The National Weather Service (NWS) operates the WSR-88D, or NEXRAD (NEXt-generation RADar) system, an extensive network of 156 high-resolution Doppler radar systems. The NEXRAD network provides centralized meteorological information for the continental United States and selected overseas locations. The maximum range of a single NEXRAD site is 250 nm.

Individual NEXRAD sites supply the network with radar images, and the images from each radar site may arrive at the network at different rates and times. Periodically, the weather data provider compiles the available individual site images from the network to form a composite image, and assigns a single time to indicate when it created the image. This image becomes the NEXRAD weather product. Individual images--gathered from each NEXRAD site--differ in age, and are always older than the displayed NEXRAD weather product age. The data provider then sends the NEXRAD data to the SiriusXM Weather service, whose satellites transmit this information during the next designated broadcast time for the NEXRAD weather product.

Because of the time required to detect, assemble, and distribute the NEXRAD weather product, the displayed weather information contained within the product may be significantly older than the current radar synopsis and may not depict the current weather conditions. The NEXRAD weather product should never be used as a basis for maneuvering in, near, or around areas of hazardous weather regardless of the information it contains.

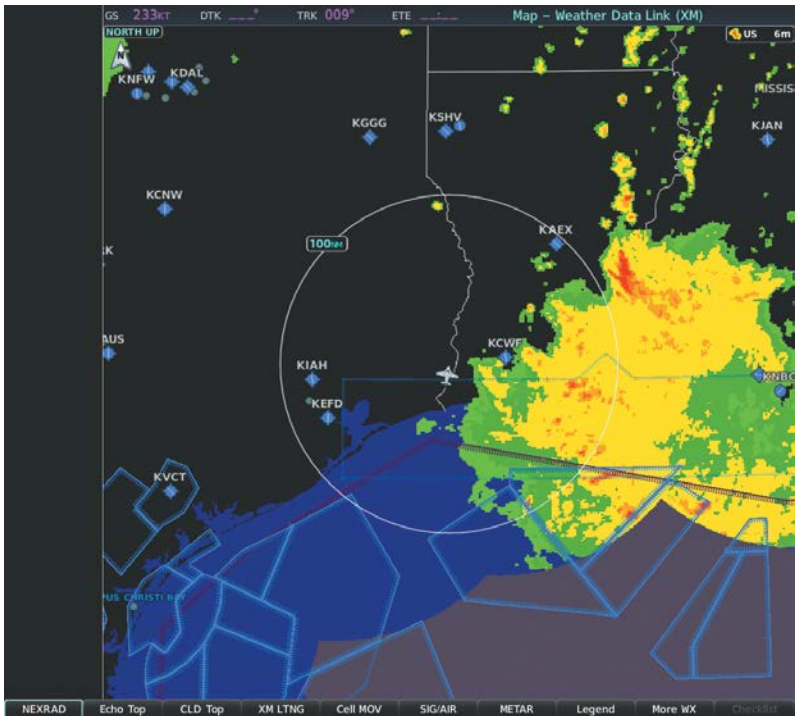


Figure 6-10 NEXRAD Data on the Weather Data Link (XM) Page

For radar sites in the United States, the NEXRAD weather product shows a composite reflectivity image. This shows the *highest* radar energy received from multiple antenna tilt angles at various altitudes. For radar sites based in Canada, the NEXRAD weather product shows radar returns from the lowest antenna tilt angle, known as base reflectivity. The display of the information is color-coded to indicate the intensity of the echoes and the type of precipitation, if known.

Enabling/disabling NEXRAD weather information on the Weather Data Link (XM) Page:

1) Select the 'Map - Weather Data Link (XM)' Page.
2) Press the **NEXRAD** Softkey.

Enabling/disabling NEXRAD weather information on MFD navigation maps:

1) Press the **Map Opt** Softkey.
2) Press the **NEXRAD** Softkey.

Enabling/disabling NEXRAD weather information on PFD maps:

1) Press the **Map/HSI** Softkey.
2) Press the **NEXRAD** Softkey.

A mosaic of data from all the available NEXRAD radar sites is shown for the selected region (US or Canada). The pilot can change the region on the Weather Data Link (XM) Page.

Changing the NEXRAD coverage region:

1) Select the 'Map - Weather Data Link (XM)' Page.
2) Press the **MENU** Key.
3) Turn the large **FMS** Knob to highlight 'Weather Setup' and press the **ENT** Key.
4) Turn the large **FMS** Knob to highlight the NEXRAD Region datafield.
5) Turn the small **FMS** Knob to highlight 'US' or 'CNDA' (Canada) and press the **ENT** Key.

The display of No Radar Coverage is always active when either NEXRAD or Echo Tops is selected. Areas where NEXRAD radar coverage and Echo Tops information is not currently available or is not being collected are indicated in gray shade of purple.

Reflectivity

Reflectivity is the amount of transmitted power returned to the radar receiver. Colors on the NEXRAD display are directly correlative to the level of detected reflectivity. Reflectivity as it relates to hazardous weather can be very complex.

The role of radar is essentially to detect moisture in the atmosphere. Simply put, certain types of weather reflect radar better than others. The intensity of a radar reflection is not necessarily an indication of the weather hazard level. For instance, wet hail returns a strong radar reflection, while dry hail does not. Both wet and dry hail can be extremely hazardous.

The different NEXRAD echo intensities are measured in decibels (dB) relative to reflectivity (Z). NEXRAD measures the radar reflectivity ratio, or the energy reflected *back to* the radar receiver (designated by the letter Z). The value of Z increases as the returned signal strength increases.

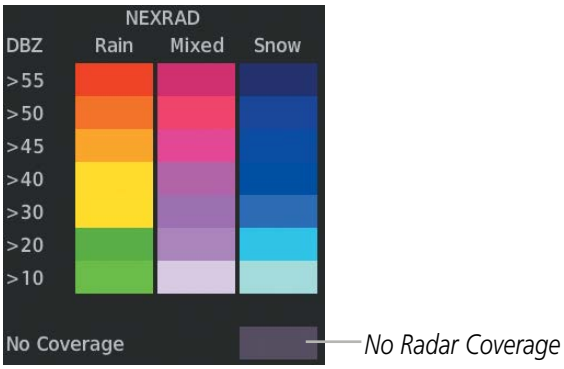
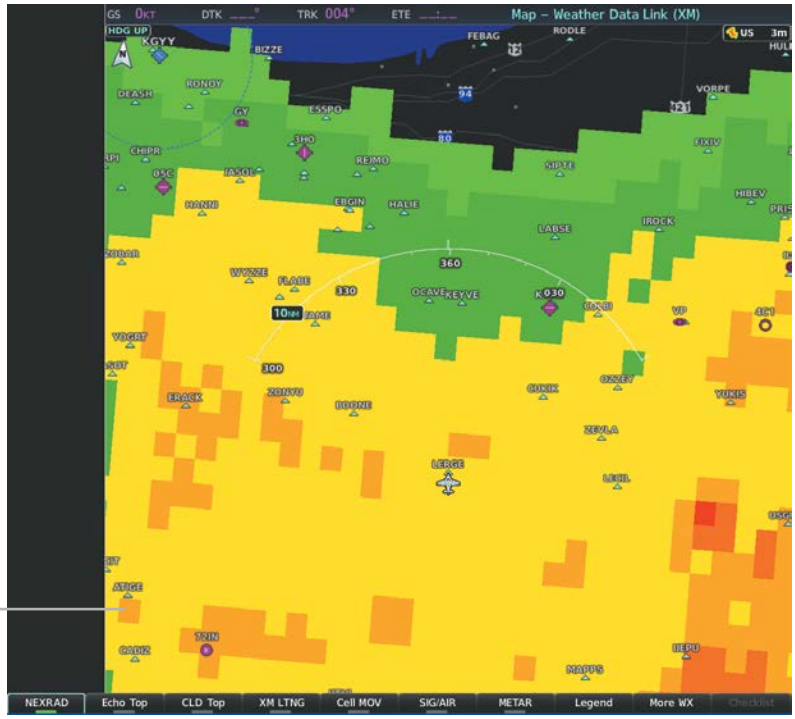


Figure 6-11 NEXRAD Weather Product Legend

NEXRAD Limitations

NEXRAD radar images may have certain limitations:

- Undetermined precipitation types may be displayed as mixed.
- An individual NEXRAD site cannot depict high altitude storms at close ranges. It has no information about storms directly over the site.
- Precipitation may be occurring below the lowest antenna tilt angle (0.5°), and therefore the radar beam overshoots the precipitation. For example, at a distance of 124 miles from the radar site, the radar beam is approximately 18,000 feet above the radar site. The radar cannot detect any precipitation occurring below the beam at this distance and altitude.
- At smaller map ranges, the smallest square block on the display represents an area of approximately four square kilometers. The intensity level reflected by each square represents the highest level of radar reflectivity sampled within the area.
- Unknown precipitation below 52°N is displayed as rain regardless of actual precipitation type.



Block represents approximately 4 km²

Figure 6-12 NEXRAD Weather Product at a 10 NM Map Range

The following may cause abnormalities in displayed NEXRAD radar images:

- Ground clutter
- Strobes and spurious radar data
- Sun strobes (when the radar antenna points directly at the sun)
- Interference from buildings or mountains, which may cause shadows
- Metallic dust (chaff) from military aircraft, which can cause alterations in radar scans

NEXRAD Limitations (Canada)

- Radar coverage extends to 55ºN.
- Any precipitation displayed between 52ºN and 55ºN is displayed as mixed precipitation regardless of actual precipitation type.
- If the precipitation type is unknown, the system displays the precipitation as rain, regardless of actual precipitation type.

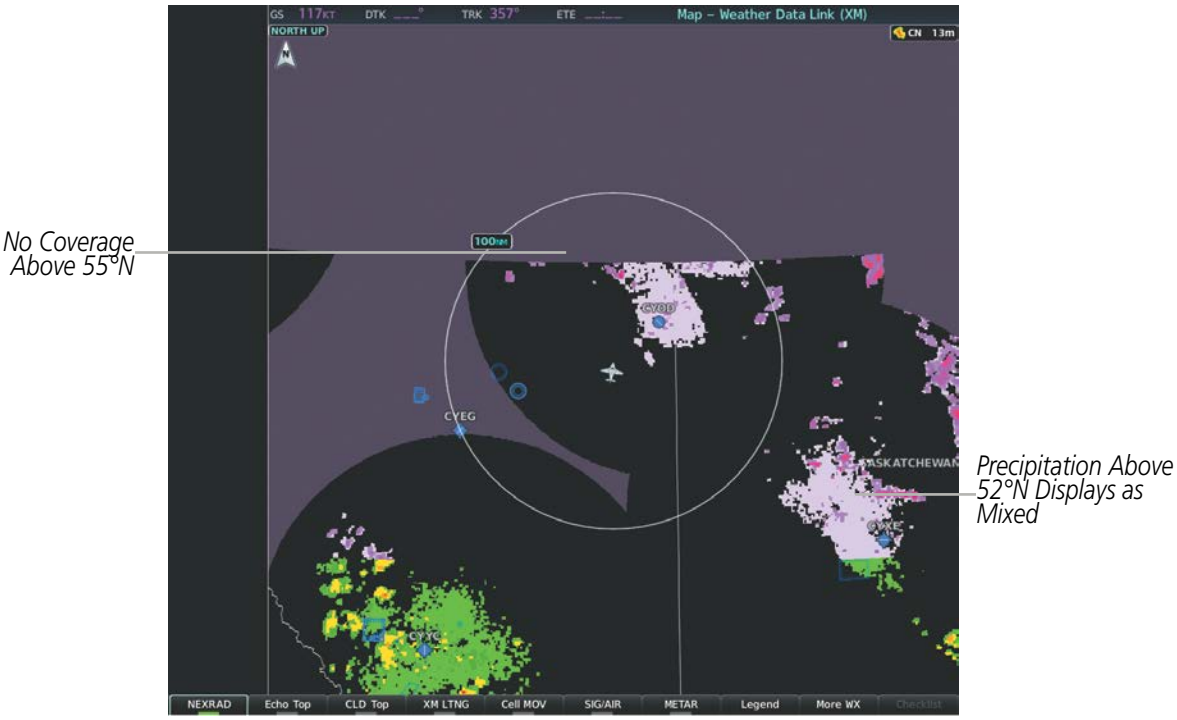


Figure 6-13 NEXRAD Weather Product - Canada

NEXRAD (FIS-B)

NOTE: *The NEXRAD weather product cannot be displayed at the same time as terrain.*

The National Weather Service (NWS) operates the WSR-88D, or NEXRAD (NEXt-generation RADar) system, an extensive network of 156 high-resolution Doppler radar systems. The NEXRAD network provides centralized meteorological information for the continental United States and selected overseas locations. The maximum range of a single NEXRAD site is 250 nm.

Individual NEXRAD sites supply the network with radar images, and the images from each radar site may arrive at the network at different rates and times. Periodically, the weather data provider to FIS-B compiles the available individual site images from the network to form a composite image, and assigns a single time to indicate when it created the image. This image becomes the NEXRAD weather product. Individual images--gathered from each NEXRAD site--differ in age, and are always older than the displayed NEXRAD weather product age. The data provider then sends the NEXRAD data to the FIS-B GBTs, which transmit this information during the next designated broadcast time for the NEXRAD weather product.

Because of the time required to detect, assemble, and distribute the NEXRAD weather product, the displayed weather information contained within the product may be older than the current radar synopsis and may not depict the current weather conditions. NEXRAD information should never be used as a basis for maneuvering in, near, or around areas of hazardous weather regardless of the information it contains.

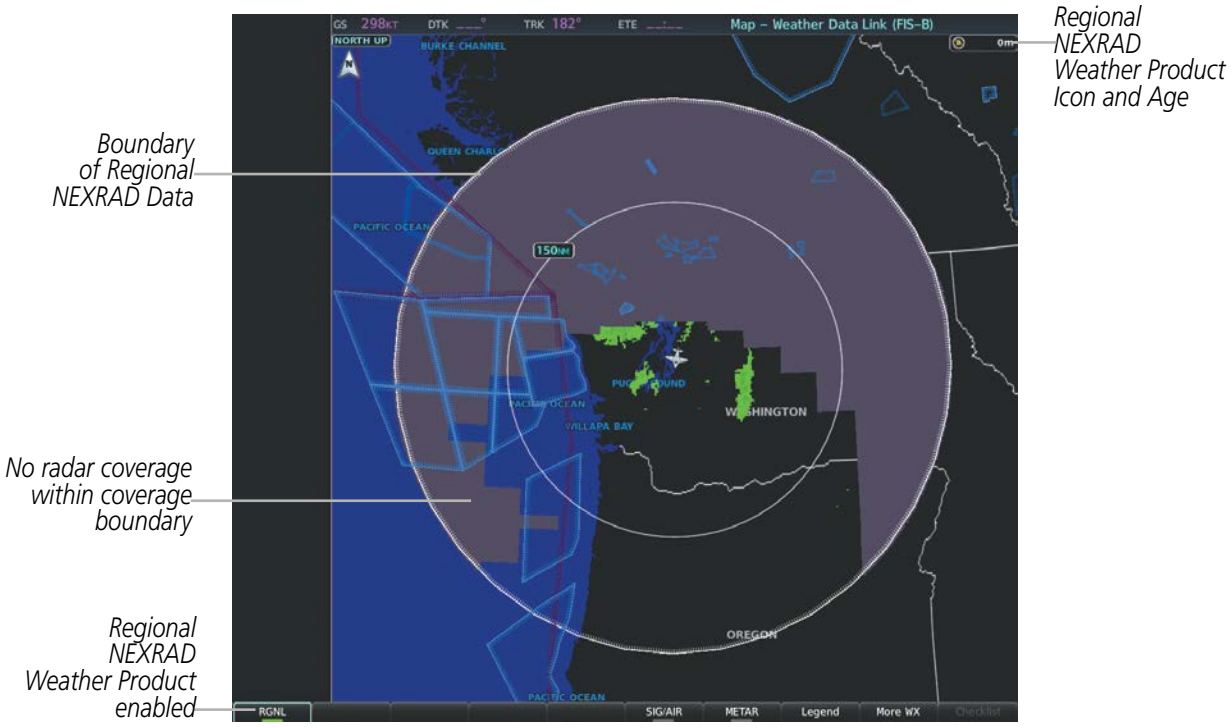


Figure 6-14 Regional NEXRAD Weather Product on the Weather Data Link (FIS-B) Page

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 same map. 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.

Displaying the NEXRAD weather product on the Weather Data Link (FIS-B) Page:

1) Select the 'Map - Weather Data Link (FIS-B)' Page.

2) Select the **NEXRAD** Softkey. Each selection cycles though a coverage option as the softkey name changes (**US**, **RGNL**, or **US/RGNL**.

Or:

1) Press the **MENU** Key.

2) Turn the **FMS** Knob to highlight 'Weather Setup' and press the **ENT** Key.

3) To enable/disable the display of NEXRAD information for the continental United States, turn the small **FMS** Knob to highlight the NEXRAD On/Off field.

a) Turn the small **FMS** Knob to highlight 'On' to enable the display of NEXRAD for the continental United States or 'Off' to disable.

b) Press the **ENT** Key.

4) To enable/disable the display of Regional NEXRAD information, turn the small **FMS** Knob to highlight the Regional On/Off field.

a) Turn the small **FMS** Knob to highlight 'On' to enable the display of Regional NEXRAD or 'Off' to disable.

b) Press the **ENT** Key.

5) When finished, push the **FMS** Knob.

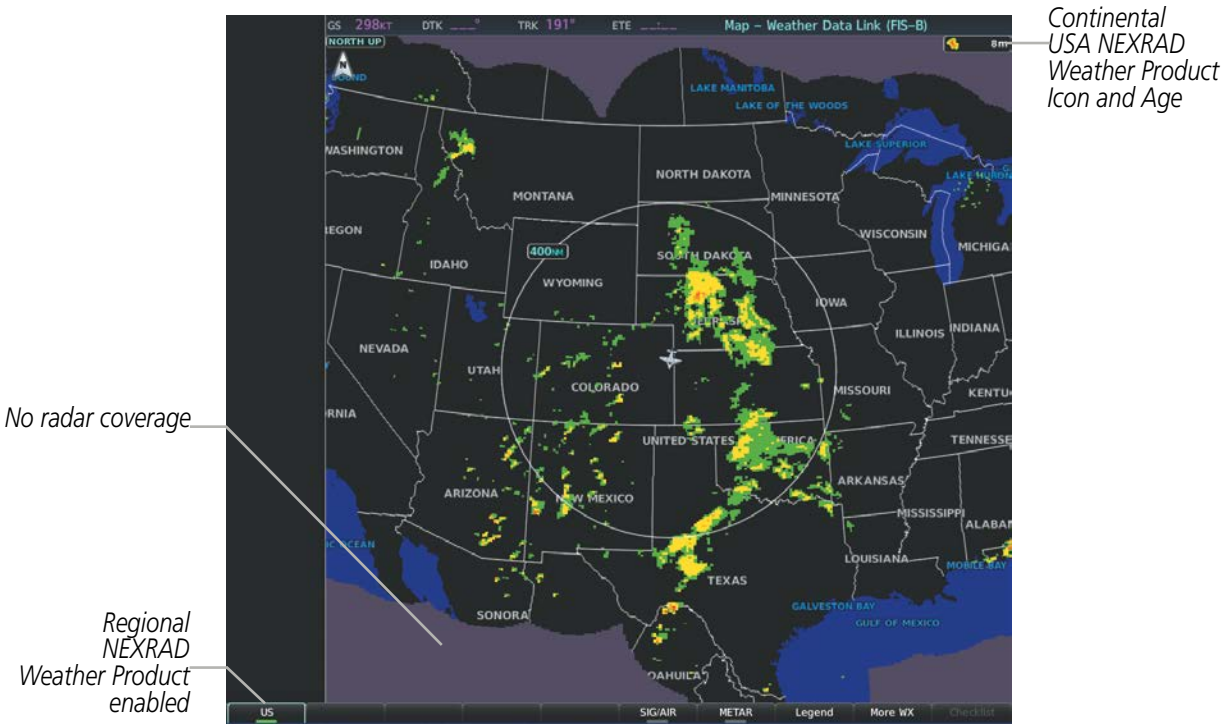


Figure 6-15 Continental US (CONUS) NEXRAD Weather Product on the Weather Data Link (FIS-B) Page

NOTE: *When both NEXRAD options are enabled on the Weather Data Link (FIS-B) Page, a combined version is displayed.*

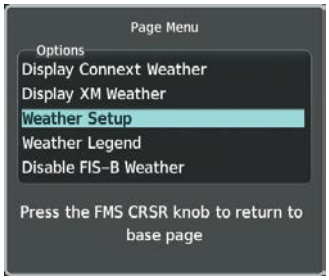


Figure 6-16 Weather Data Link (FIS-B) Page Menu

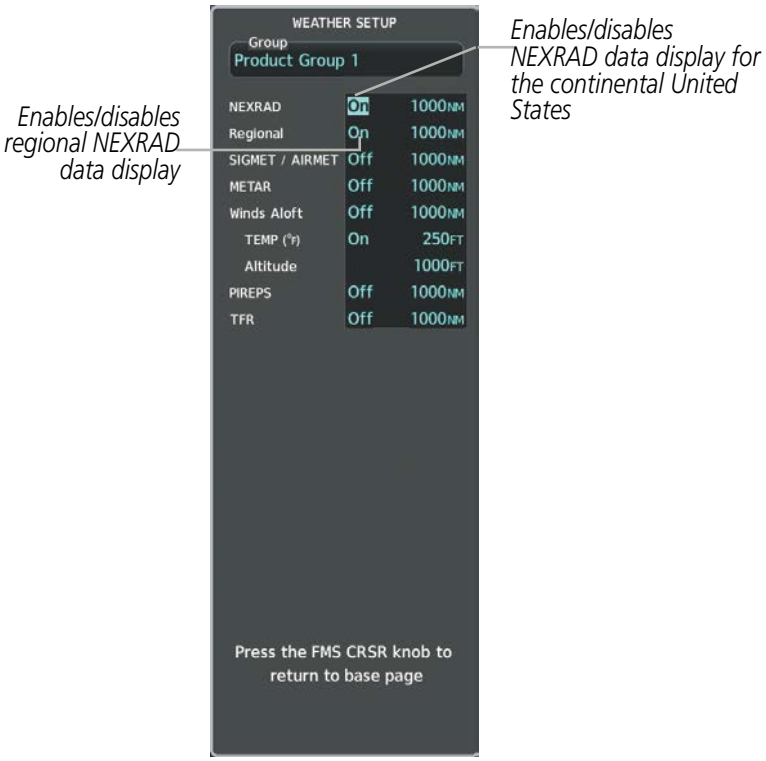


Figure 6-17 Weather Data Link (FIS-B) Page Setup Menu

Displaying the FIS-B NEXRAD weather product on the Navigation Map Page:

1) Select the **Map Opt** Softkey.
2) Select the **NEXRAD** Softkey.
3) To change the type of NEXRAD displayed, press the **MENU** Key.
4) With 'Map Settings' highlighted, press the ENT Key.
5) Turn the small **FMS** Knob to select the 'Weather' Group, then press the **ENT** Key.
6) Turn the large **FMS** Knob to highlight the NEXRAD Data Region field.
7) Turn the small **FMS** Knob to highlight 'CONUS' (continental United States), 'RGNL' (regional), or 'Combined', then press the **ENT** Key. This selection also affects display of NEXRAD on the PFD Maps.
8) When finished, press the **FMS** Knob or press the **CLR** Key.

Displaying the FIS-B NEXRAD weather product on PFD maps:

1) Press the **Map/HSI** Softkey.
2) Press the **NEXRAD** Softkey to enable/disable the display of NEXRAD information.

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 spiked 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.

If the continental United States version of the NEXRAD weather product is shown (**US** Softkey enabled), the coverage boundary is not shown on the map.

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. All weather product legends can be viewed on the Weather Data Link (FIS-B) Page. For the NEXRAD legend, select the **Legend** Softkey when the NEXRAD weather product is enabled.

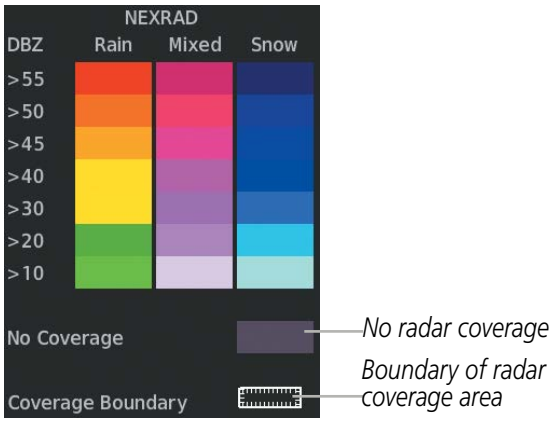


Figure 6-18 NEXRAD Weather Product Legend

The display of no radar coverage is enabled when NEXRAD is selected for display. Areas where radar data is not currently available, has not yet been received, or is not being collected are indicated in gray shade of purple.

NOTE: *If the system has not received all available NEXRAD weather data (such as during initial FIS-B signal acquisition or in areas of marginal or poor signal reception), the system may display areas of no radar coverage which are subsequently removed as radar data is received. It may take up to approximately ten minutes to receive all FIS-B data, when adequate reception is available.*

Reflectivity

Reflectivity is the amount of transmitted power returned to the radar receiver. Colors on the NEXRAD display are directly correlative to the level of detected reflectivity. Reflectivity as it relates to hazardous weather can be very complex.

The role of radar is essentially to detect moisture in the atmosphere. Simply put, certain types of weather reflect radar better than others. The intensity of a radar reflection is not necessarily an indication of the weather hazard level. For instance, wet hail returns a strong radar reflection, while dry hail does not. Both wet and dry hail can be extremely hazardous.

The different NEXRAD echo intensities are measured in decibels (dB) relative to reflectivity (Z). NEXRAD measures the radar reflectivity ratio, or the energy reflected *back to* the radar receiver (designated by the letter Z). The value of Z increases as the returned signal strength increases.

NEXRAD Limitations

NEXRAD radar images may have certain limitations:

- At smaller map ranges, individual blocks of NEXRAD weather data are viewable. For the regional version of the NEXRAD weather product, the smallest block represents 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 color of each block represents the *highest* radar reflectivity detected within that area.
- 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
- Strobes and spurious radar data
- Sun strobes (when the radar antenna points directly at the sun)
- Interference from buildings or mountains, which may cause shadows
- Metallic dust (chaff) from military aircraft, which can cause alterations in radar scans

PRECIPITATION (GARMIN CONNEXT)

NOTE: *Precipitation data cannot be displayed at the same time as terrain data.*

The Precipitation weather product provides radar precipitation information in selected radar coverage areas. This information comes from individual weather radar sites and weather data sources such as government agencies. Each radar site or source may provide weather data at differing rates and times. Periodically, the Garmin Connext Weather service compiles the available information to form a composite image, and assigns a single time to indicate when it created the image. This image becomes the Precipitation weather product. Individual images--gathered from each radar site--differ in age, and are always older than the displayed Precipitation weather product age.

Because of the time required to detect, assemble, and distribute the Precipitation weather product, the displayed weather information contained within the product may be significantly older than the current radar synopsis and may not depict the current weather conditions. The Precipitation weather product should never be used as a basis for maneuvering in, near, or around areas of hazardous weather regardless of the information it contains.

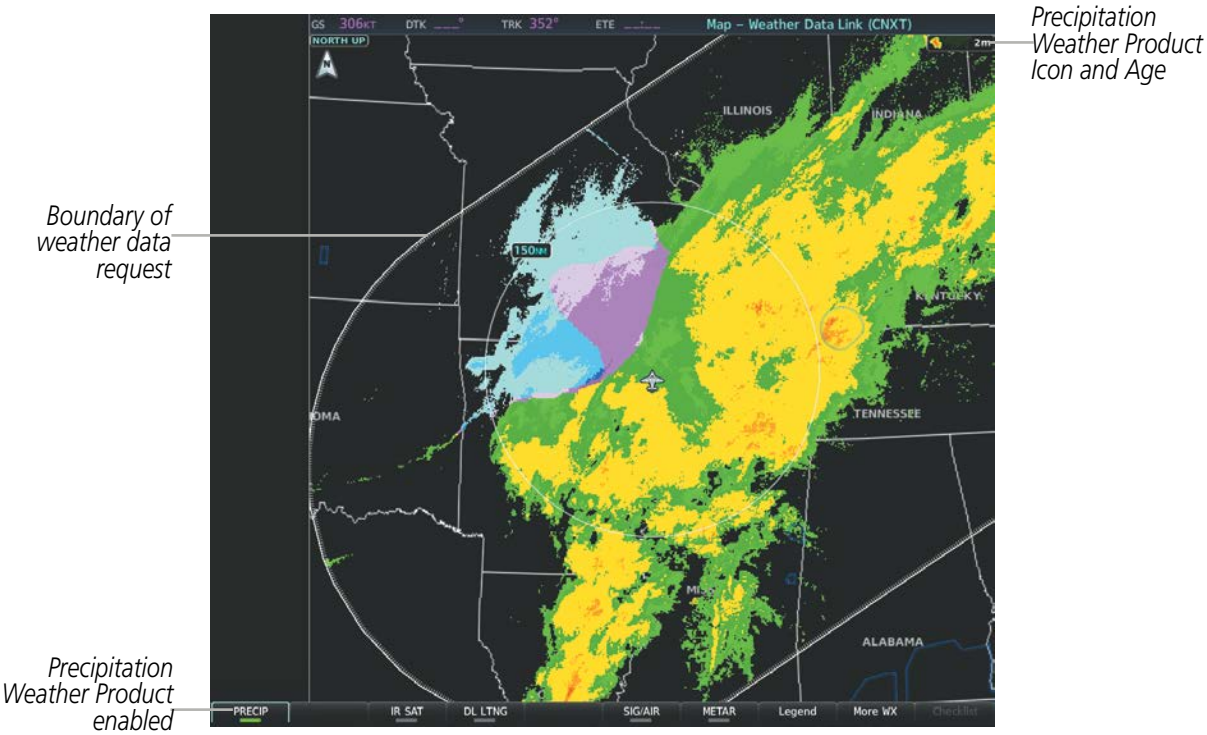


Figure 6-19 Precipitation Weather Product on the Weather Data Link (CNXT) Page

Displaying Precipitation weather information:

1) Select the **Map Opt** Softkey (for PFD maps, press the **Map/HSI** or **Map Opt** Softkey). This step is not necessary on the 'Map - Weather Data Link (CNXT)' Page.
2) Select the **PRECIP** Softkey.

The system displays either base or composite radar imagery, depending on the region.

Region	Radar Reflectivity Type
United States	Composite Reflectivity
Canada, Europe, Australia	Base Reflectivity

The base reflectivity precipitation weather product shows the radar returns from the perspective of a single antenna tilt angle. The composite reflectivity precipitation weather product shows the *highest* radar energy received from multiple antenna tilt angles. The display of the information is color-coded to indicate the intensity of the echoes and the type of precipitation.

All weather product legends can be viewed on the Weather Data Link (CNXT) Page. For the Precipitation legend, select the **Legend** Softkey when Precipitation is selected for display.

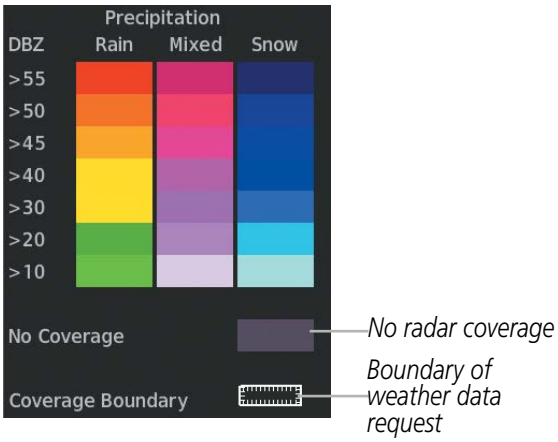


Figure 6-20 Precipitation Weather Product Legend

The display of radar coverage is enabled active when Precipitation is selected for display. Areas where precipitation radar coverage is not currently available or is not being collected are indicated in gray shade of purple. A white boundary line depicting the selected coverage area of the Connext Data Request encloses the precipitation data when this weather product is displayed.

Reflectivity

Reflectivity is the amount of transmitted power returned to the radar receiver. Colors on the Precipitation display directly correlate to the level of detected reflectivity. Reflectivity as it relates to hazardous weather can be very complex.

The role of radar is essentially to detect moisture in the atmosphere. Simply put, certain types of weather reflect radar better than others. The intensity of a radar reflection is not necessarily an indication of the weather hazard level. For instance, wet hail returns a strong radar reflection, while dry hail does not. Both wet and dry hail can be extremely hazardous.

The different radar echo intensities are measured in decibels (dB) relative to reflectivity (Z). Weather radars measure the reflectivity ratio, or the energy reflected *back to* the radar receiver (designated by the letter Z). The value of Z increases as the returned signal strength increases.

Precipitation Limitations

Radar images may have certain limitations:

- Radar composite reflectivity does not provide sufficient information to determine precipitation characteristics (wet hail vs. rain). For example, it is not possible to distinguish between wet snow, wet hail, and rain.
- An individual radar site cannot depict high altitude storms at close ranges. It has no information about storms directly over the site.
- At smaller map ranges, individual blocks of radar data are viewable. Each block of radar information represents approximately four square kilometers and depicts the highest level of reflectivity detected within that area.

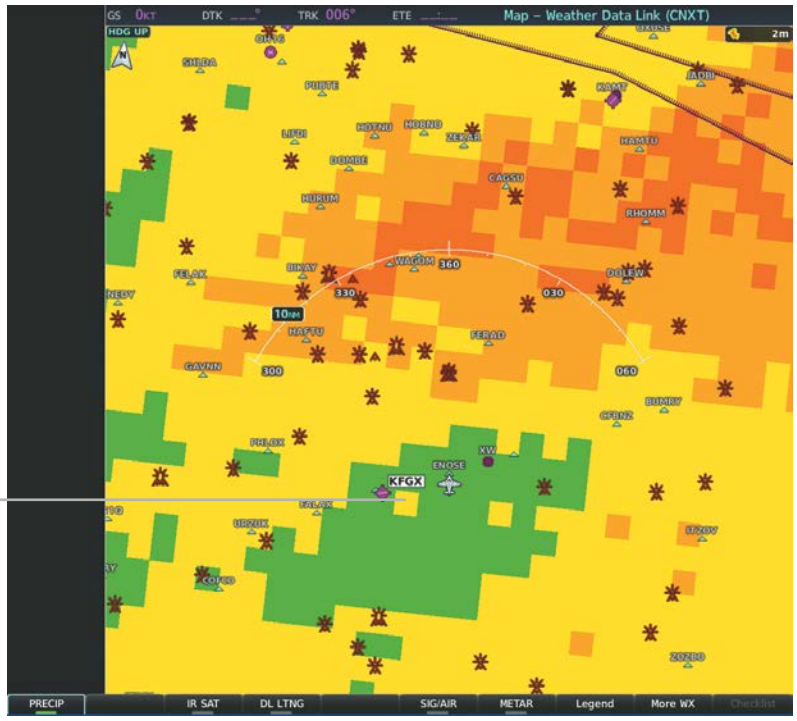


Figure 6-21 Precipitation Weather Product at 10 NM Map Range

The following may cause abnormalities in displayed radar images:

- Ground clutter
- Strobes and spurious radar data
- Sun strobes (when the radar antenna points directly at the sun)
- Interference from buildings or mountains, which may cause shadows
- Metallic dust (chaff) from military aircraft, which can cause alterations in radar scans

ECHO TOPS (SIRISUXM)

NOTE: *Echo Tops cannot be displayed at the same time as Cloud Tops or NEXRAD data is displayed.*

The Echo Tops weather product shows the location, elevation, and direction of the highest radar echo. The highest radar echo does not indicate the top of a storm or clouds; rather it indicates the highest altitude at which precipitation is detected. Information is derived from NEXRAD data.

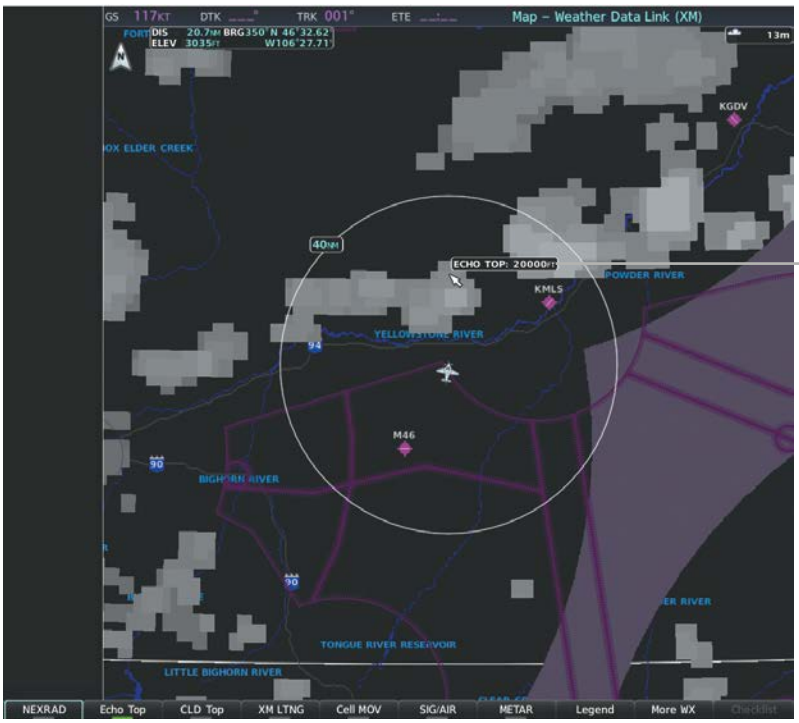


Figure 6-22 Echo Tops Weather Product on the Weather Data Link (XM) Page

Displaying Echo Tops information:

1) Select the 'Map - Weather Data Link (XM)' Page.
2) Press the **Echo Top** Softkey.

Since Echo Tops and Cloud Tops use the same color scaling to represent altitude, display of these weather products is mutually exclusive. When Echo Tops is activated, NEXRAD and Cloud Tops data are removed.

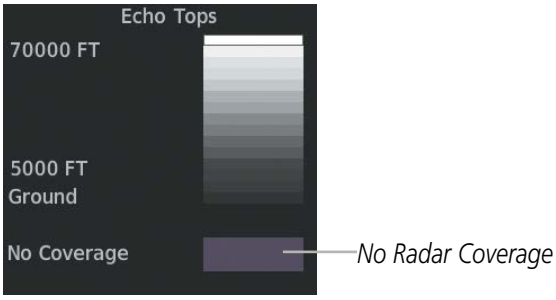


Figure 6-23 Echo Tops Legend

CLOUD TOPS (SIRIUSXM)

NOTE: *Cloud Tops and Echo Tops cannot be displayed at the same time.*

NOTE: *The broadcast rate for Cloud Tops is 30 minutes. As with all SiriusXM Weather products, the product age becomes amber when it reaches half of the expiration time, which is 60 minutes for Cloud Tops. Therefore, this weather product age may be amber during routine operation.*

The Cloud Tops weather product depicts cloud top altitudes as determined from satellite imagery.

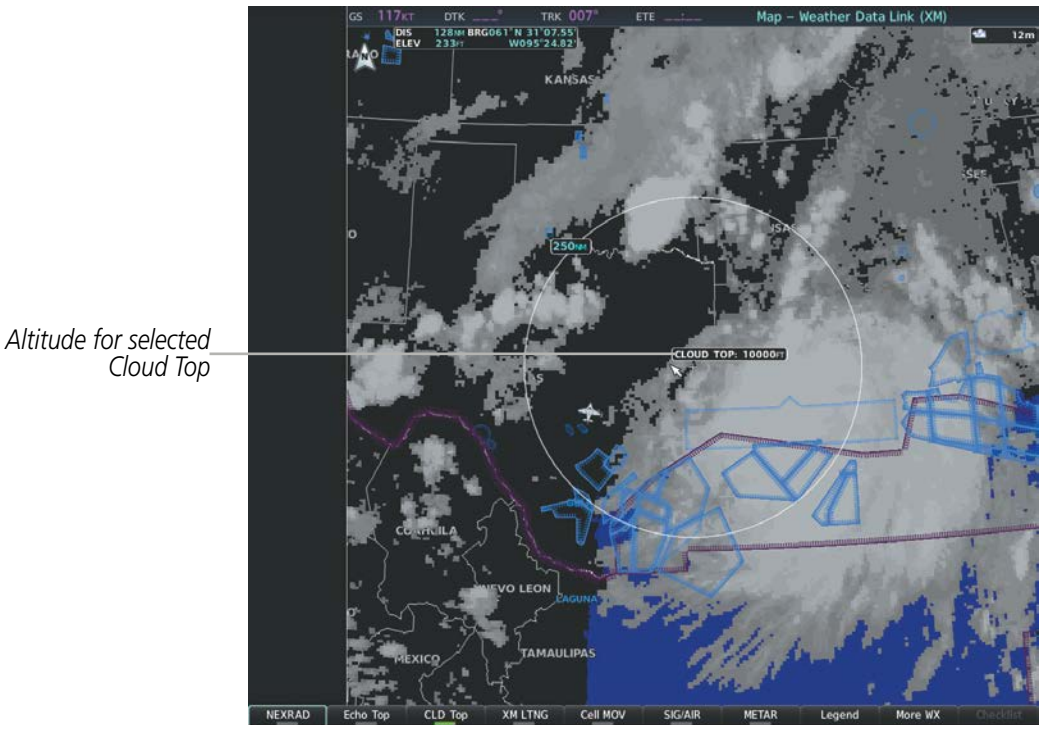


Figure 6-24 Cloud Tops Weather Product

Displaying Cloud Tops information:

1) Select the 'Map - Weather Data Link (XM)' Page with the **FMS** Knob.
2) Select the **CLD Top** Softkey.

Since Cloud Tops and Echo Tops use the same color scaling to represent altitude, display of these weather products is mutually exclusive. When Cloud Tops is activated, Echo Tops data is removed.

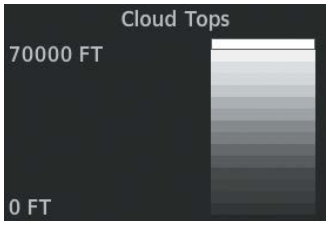


Figure 6-25 Cloud Tops Legend

DATA LINK LIGHTNING (SIRIUSXM, GARMIN CONNEXT)

NOTE: *Lightning from a data link source cannot be displayed simultaneously on the same map as information from an optional on-board lightning detection system.*

The Data Link Light weather product shows the approximate location of cloud-to-ground lightning strikes. A strike icon represents a strike that has occurred within a two-kilometer region. The exact location of the lightning strike is not displayed.

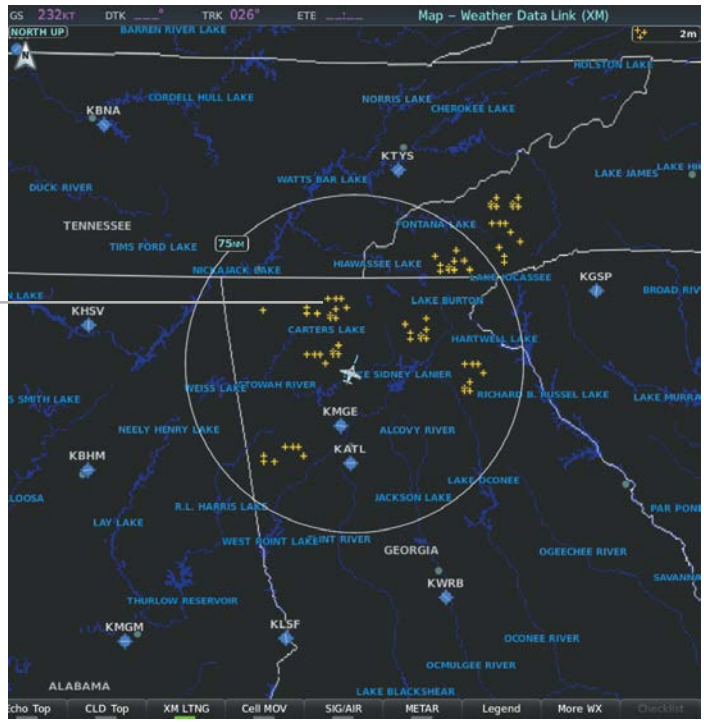


Figure 6-26 SiriusXM Lightning Weather Product on the Weather Data Link (XM) Page

Displaying Data Link Lightning information on Weather Data Link Page:

1) Turn the **FMS** Knob to select the 'Map - Weather Data Link (XM or CNXT)' Page.
2) Press the **XM LTNG** or **DL LTNG** Softkey.

To display the Lightning legend on the Weather Data Link (XM or CNXT) Page, select the **Legend** Softkey when SiriusXM Lightning is selected for display.

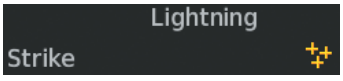


Figure 6-27 SiriusXM Lightning Legend

Displaying Data Link Lightning information on the Navigation Map Page:

1) Turn the **FMS** Knob to select the Navigation Map Page.
2) Select the **Map Opt** Softkey.
3) Select the **XM LTNG** or **DL LTNG** Softkey.

Displaying Data Link Lightning information on PFD maps:

1) On the PFD, press the **Map/HSI** Softkey.
2) Press the **Lightning** Softkey.
3) Press the **Datalink** Softkey.
4) When finished, press the **Back** Softkey.

NOTE: *The source of the data link lightning weather product for the PFD Maps is determined by which source is selected on the Weather Data Link (XM or CNXT) Page.*

CELL MOVEMENT (SIRIUSXM)

The Cell Movement weather product shows the location and movement of storm cells as identified by the ground-based system. Cells are represented by yellow squares, with direction of movement indicated with short, orange arrows.

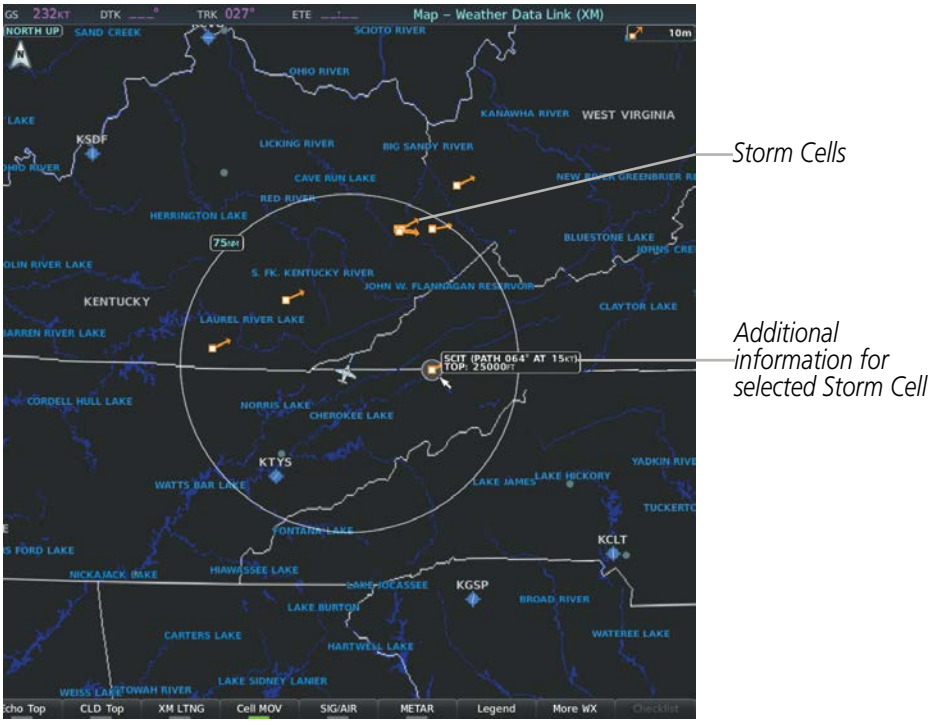


Figure 6-28 Cell Movement Weather Product on the Weather Data Link (XM) Page

On the Weather Data Link (XM) Page, the Cell Movement weather product has a dedicated **CEL MOV** softkey for enabling/disabling this weather product on this page.

NOTE: *The Storm Cell base height is not available if a GDL 69 SXM or 69A SXM data link receiver is installed. In this case, the Storm Cell base height is displayed as 0 feet when the map pointer selects a storm cell.*

Displaying Cell Movement information on the Weather Data Link (XM) Page:

1) Select the 'Map - Weather Data Link (XM)' Page using the **FMS** Knob.
2) Select the **Cell MOV** Softkey.

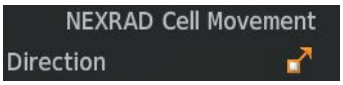


Figure 6-29 Cell Movement Legend

For navigation maps, the pilot can enable/disable the Cell Movement weather product using the **NEXRAD** Softkey. For this to occur, the pilot must first enable the 'Cell Movement' option in the Map Settings menu of the Navigation Map Page.

Setting up the system to display Cell Movement with NEXRAD on navigation maps:

1) Use the **FMS** Knob to select the 'Map - Navigation Map' Page.
2) Press the **MENU** Key.
3) With 'Map Settings' highlighted, press the **ENT** Key.
4) Turn the small **FMS** Knob to highlight 'Weather' and press the **ENT** Key.
5) Turn the large **FMS** Knob to 'On' or 'Off' for the Cell Movement menu option. When set to 'On', Cell Movement is enabled/disabled with the NEXRAD weather product on navigation maps. When set to 'Off', Cell Movement is not displayed on navigation maps.
6) When finished, push the **FMS** Knob or **CLR** Key to remove the menu.

After the 'Cell Movement' option is set to 'On', refer to the previous procedures for enabling/disabling the NEXRAD weather product to control both products simultaneously on navigation maps using the **NEXRAD** Softkey.

INFRARED SATELLITE (GARMIN CONNEXT)

The Infrared Satellite (IR SAT) weather product depicts cloud top temperatures from satellite imagery. Brighter cloud top colors indicate cooler temperatures occurring at higher altitudes.

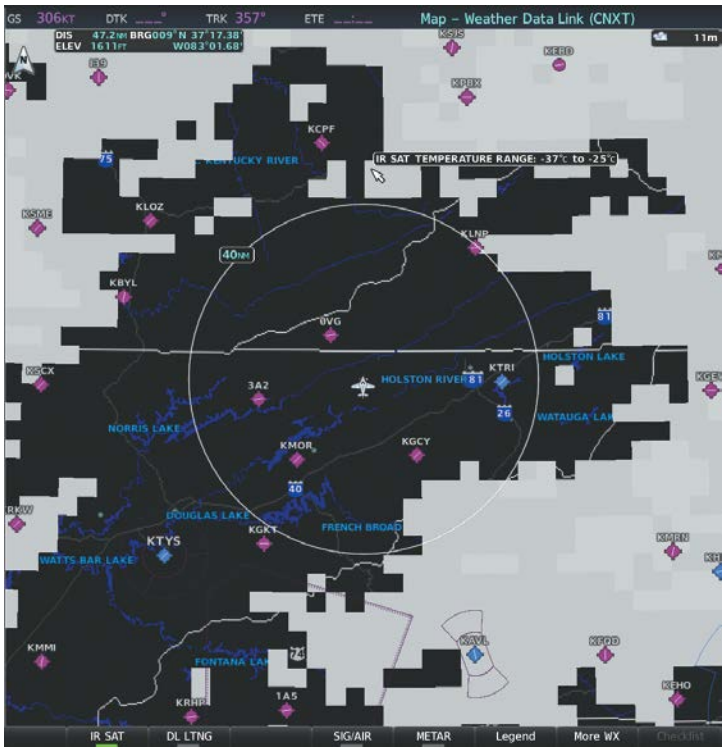


Figure 6-30 Infrared Satellite Weather Product on the Weather Data Link (CNXT) Page

Displaying Infrared Satellite information:

1) Select the 'Map - Weather Data Link (CNXT)' Page.
2) Select the **IR SAT** Softkey.

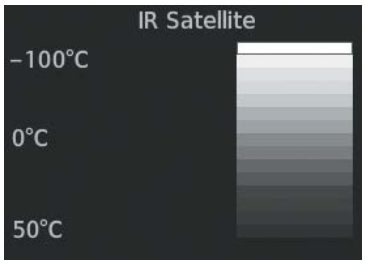


Figure 6-31 Infrared Satellite Legend

SIGMETS AND AIRMETS

SIGMET (SIGnificant METeorological Information) and AIRMET (AIRmen's METeorological Information) are issued for potentially hazardous weather. A Convective SIGMET is issued for hazardous convective weather such as severe or widespread thunderstorms. A localized SIGMET is a significant weather condition occurring at a localized geographical position.

NOTE: *If SiriusXM Weather is the active data link weather source and a GDL 69A SXM receiver installed, 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.*

NOTE: *For Garmin Connext Weather only, the entire SIGMET or AIRMET is shown on the map as long as any portion of it is issued within the selected coverage area of the Connext Data Request.*

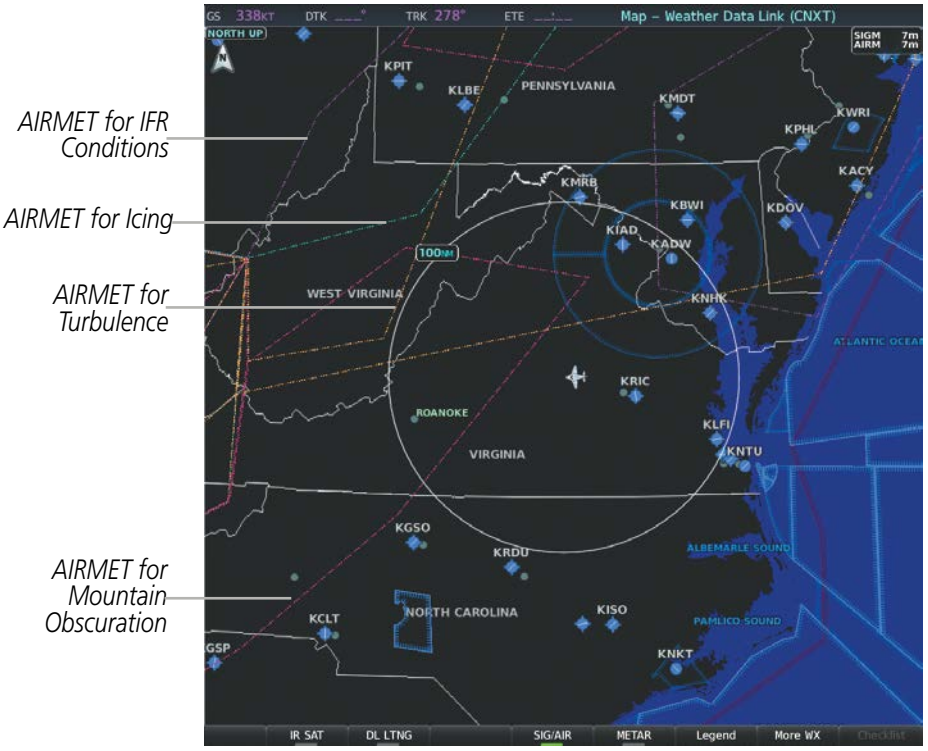
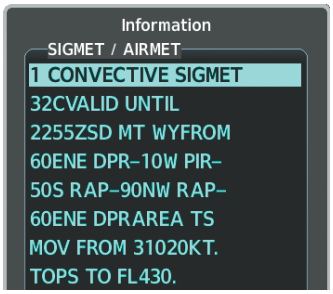


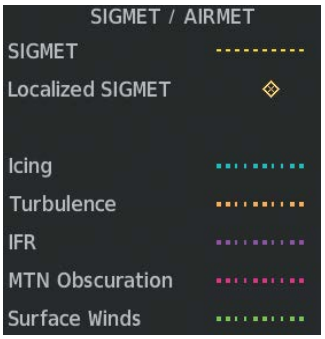
Figure 6-32 SIGMET/AIRMET Weather Product on the Weather Data Link (CNXT) Page

Displaying SIGMETs and AIRMETs:

1) Select the 'Map- Weather Data Link (XM or CNXT or FIS-B)' Page.
2) Press the **SIG/AIR** Softkey.
3) To view the text of the SIGMET or AIRMET, press the **Joystick** and move the Map Pointer over the icon.
4) Press the **ENT** key. The following figure shows sample SIGMET text.



Sample SIGMET Text



SIGMET/AIRMET Legend

Figure 6-33 SIGMET/AIRMET Text and Legend

METARS AND TAFS

NOTE: *Atmospheric pressure as reported for METARs is given in hectopascals (hPa), except for in the United States, where it is reported in inches of mercury (in Hg). Temperatures are reported in Celsius.*

NOTE: *METAR information is only displayed within the installed navigation database service area.*

METARs (METeorological Aerodrome Reports) typically contain information about the temperature, dewpoint, wind, precipitation, cloud cover, cloud heights, visibility, and barometric pressure at an airport or observation station. They can also contain information on precipitation amounts, lightning, and other critical data. METARs reflect hourly observations; non-routine updates include the code "SPECI" in the report. METARs are shown as colored flags at airports that provide them.

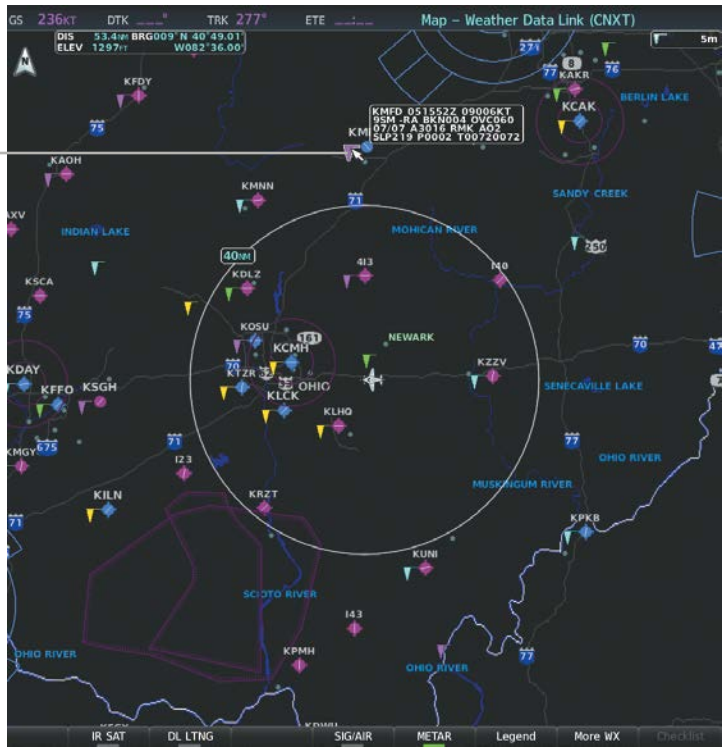


Figure 6-34 METAR Flags on the Weather Data Link (CNXT) Page

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.

METAR and TAF text are displayed on the Weather Information Page. METAR data is displayed first in a decoded fashion, followed by the original text. Note the original text may contain additional information not found in the decoded version. TAF information is displayed only in its original form when TAFs are available.

Displaying METAR and TAF text on the MFD:

1) On the 'Map - Weather Data Link (XM or FIS-B or CNXT)' Page, press the **METAR** Softkey.
2) Press the **Joystick** and pan to the desired airport.
3) Press the **ENT** Key. The Weather Information Page is shown with METAR and TAF text.
4) Use the **FMS** Knob or the **ENT** Key to scroll through the METAR and TAF text. METAR text must be completely scrolled through before scrolling through the TAF text.
5) Press the **FMS** Knob or the **CLR** Key to return to the Weather Data Link Page.

Or:

1) Select the Weather Information Page.
   a) Turn the large **FMS** Knob to select the Waypoint Page Group.
   b) Select the **WX** Softkey to select the Weather Information Page.
2) Press the **FMS** Knob to display the cursor.
3) Use the **FMS** Knob to enter the desired airport and press the **ENT** Key.
4) Use the **FMS** Knob or the **ENT** Key to scroll through the METAR and TAF text. Note that the METAR text must be completely scrolled through before scrolling through the TAF text.

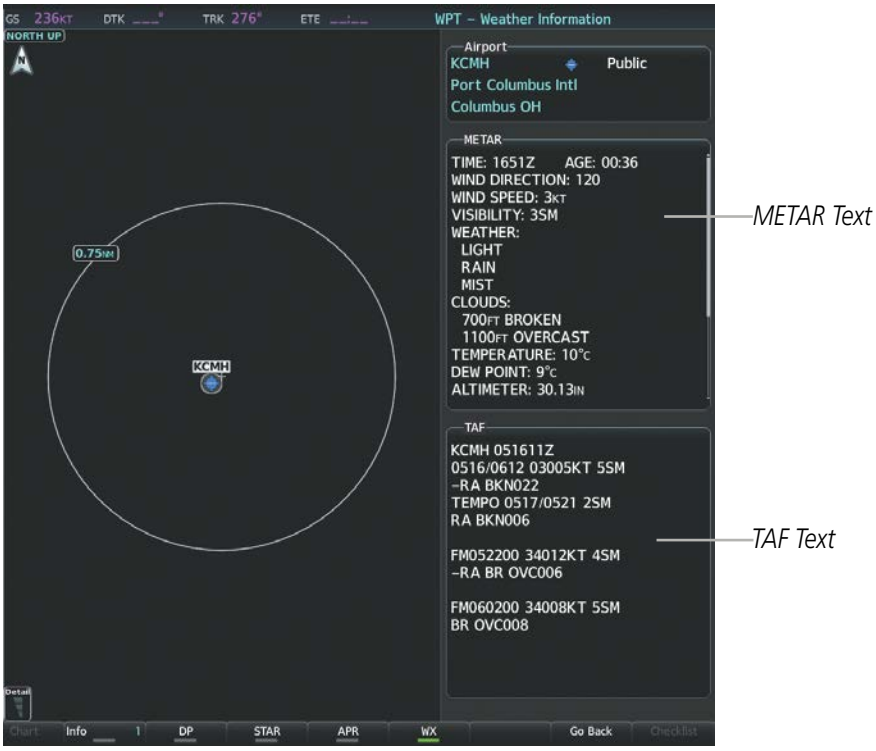


Figure 6-35 METAR and TAF Text on the Waypoint - Weather Information Page

To display the METAR legend on the Weather Data Link (XM) Page, select the Legend Softkey when METARs are enabled for display.

The METAR flag color is determined by the information in the METAR text. The system displays a gray METAR flag when the system cannot determine the METAR category based on the information available.

Figure 6-36 METAR Legend

The system also shows METAR flags and their associated text on the Active Flight Plan Page on the MFD. The system shows a METAR flag next to waypoints in the flight plan with an available METAR.

Displaying original METAR text on the Active Flight Plan Page:

1) Select the 'FPL - Active Flight Plan' Page on the MFD.
2) Press the **FMS** Knob to activate the cursor.
3) Turn the large **FMS** Knob to highlight a waypoint with an available METAR (indicated with a METAR flag next to it). The METAR text will appear in the 'Selected Waypoint Weather' Window below.
4) When finished, press the **FMS** Knob to remove the cursor or press the **FPL** Key to exit the Active Flight Plan Page.

Original METAR text is also accessible on navigation maps displaying METAR flags. When the map pointer is panned over a METAR flag, the METAR text is shown in a box near the flag.

Displaying original METAR text information on the PFD Inset Map:

1) On the PFD, press the **Map/HSI** Softkey.
2) Press the **METAR** Softkey.
4) Press the **Joystick** and pan to the desired METAR flag. Original METAR text appears on the map.
5) When finished, press the **Joystick** to remove the Map Pointer.

SURFACE ANALYSIS AND CITY FORECAST (SIRIUSXM)

Surface Analysis and City Forecast information is available for current and forecast weather conditions. Forecasts are available for intervals of 12, 24, 36, and 48 hours.

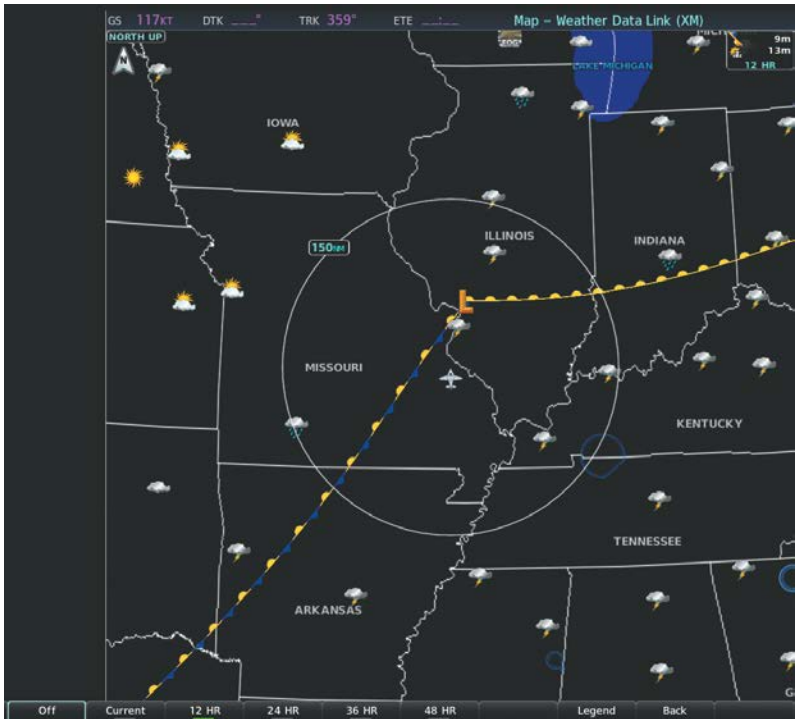


Figure 6-37 Surface Analysis Data - 24-Hour

Displaying Surface Analysis and City Forecast information:

1) Select the 'Map - Weather Data Link (XM)' Page.
2) Select the **More WX** Softkey.
3) Select the **SFC** Softkey.
4) Press the softkey for the desired forecast time: **Current**, **12 HR**, **24 HR**, **36 HR**, or **48 HR**. The **SFC** Softkey label changes to show the forecast time selected.

   Or:

   Press the **Off** Softkey to disable the display of the weather product.

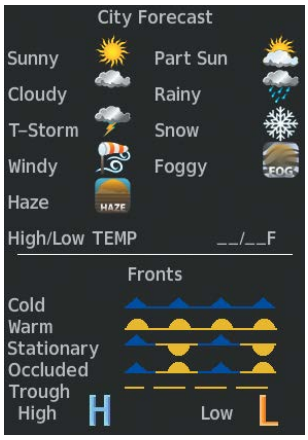


Figure 6-38 Surface Analysis Legend

FREEZING LEVEL (SIRIUSXM)

The Freezing Level weather product shows the color-coded contour lines for the altitude and location at which the first isotherm is found. When no data is displayed for a given altitude, the data for that altitude has not been received, or is out of date and has been removed from the display. New data appears when it becomes available.

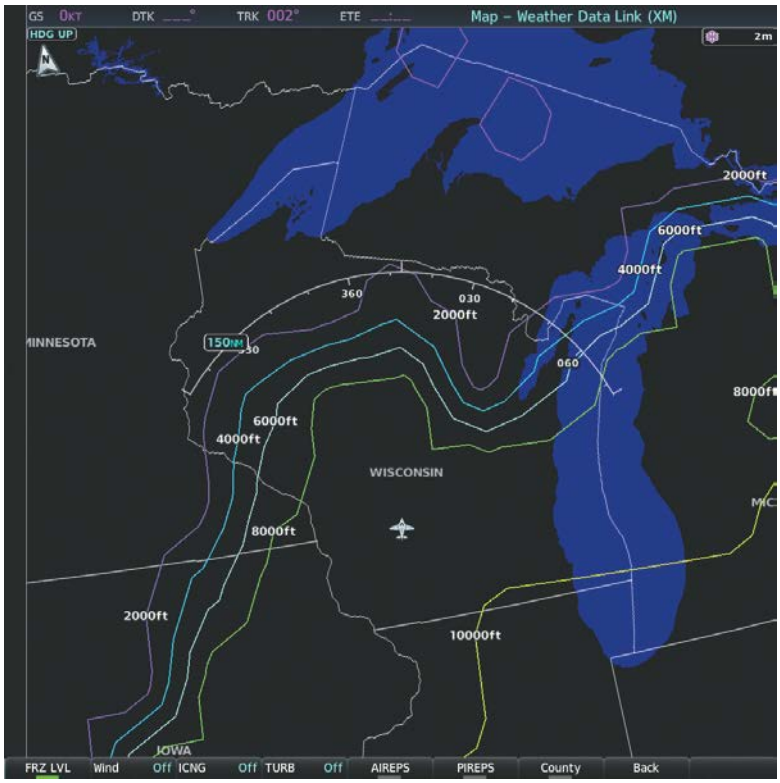


Figure 6-39 Freezing Levels Weather Product on the Weather Data Link (XM) Page

Displaying Freezing Level information:

1) Select the 'Map - Weather Data Link (XM)' Page.
2) Select the **More WX** Softkey.
3) Select the **FRZ LVL** Softkey.

Figure 6-40 Freezing Levels Legend

WINDS ALOFT

The Winds Aloft weather product shows the forecast wind speed and direction at the surface and at selected altitudes. Altitude can be displayed in 3000-foot increments beginning at the surface up to 42,000 feet MSL.

If the FIS-B option is installed and FIS-B is the active data link weather source, the Winds Aloft weather product also displays temperatures aloft next to the winds aloft arrows on the Weather Data Link (FIS-B) Page.

Displaying the Winds Aloft weather product:

1) Select the 'Map - Weather Data Link (XM)' Page.
2) Select the **More WX** Softkey.
3) Select the **Wind** Softkey.
4) Select a softkey for the desired altitude level: **SFC** (surface) up to 42,000 feet. Select the **Next** or **Prev** Softkey to cycle through the altitude softkeys. The **Wind** Softkey label changes to reflect the altitude selected.

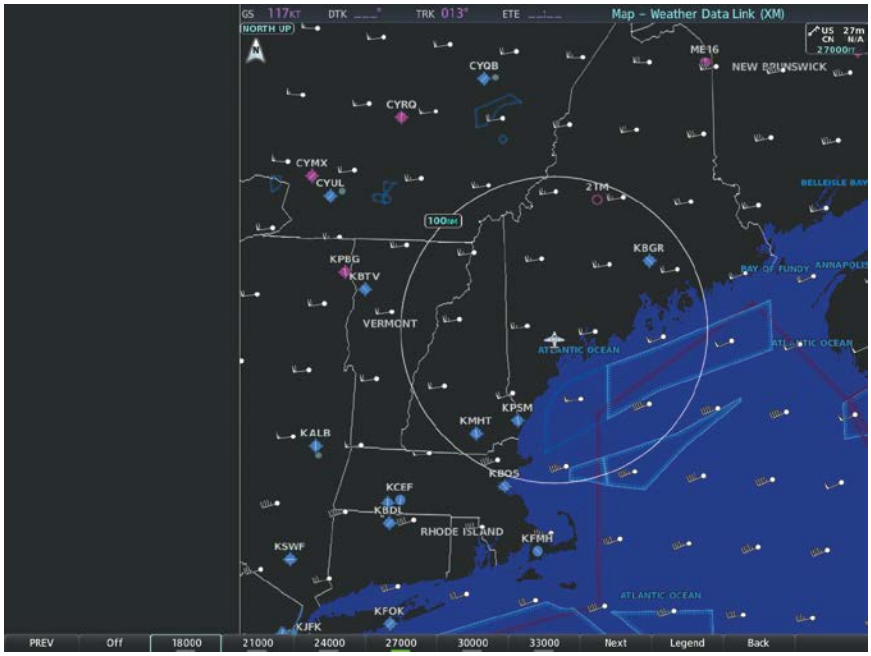


Figure 6-41 Winds Aloft Weather Product with 27,000 Feet Selected

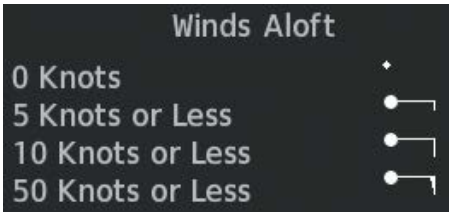


Figure 6-42 Winds Aloft Data with Legend

Headwind and tailwind components aloft are available inside the Vertical Situation Display (VSD) on the Navigation Map Page. The displayed components are relative to current aircraft altitude and track, but not to aircraft speed.

Figure 6-43 Navigation Map Page with Winds Aloft Data in the VSD

Arrows pointing to the left indicate headwind components; tailwind component arrows point to the right, as shown in Table 6-5.

Headwind Symbol	Tailwind Symbol	Headwind/Tailwind Component
None	None	Less than 5 knots
		5 knots
		10 knots
		50 knots

Table 6-5 VSD Headwind/Tailwind Component Symbols

Enabling/disabling the Vertical Situation Display (containing winds aloft data):

1) Select the 'Map - Navigation Map' Page.
2) Press the **Map Opt** Softkey.
3) Press the **Inset** Softkey.
4) Press the **VSD** Softkey to enable/disable the Vertical Situation Display.

Or:

1) Select the Navigation Map Page.
2) Press the **MENU** Key.
3) Turn the FMS Knob to highlight 'Show VSD' or 'Hide VSD' and press the **ENT** Key.

Winds Aloft data inside the VSD is enabled by default when the VSD is displayed on the Navigation Map Page. This behavior can be changed on the Navigation Map Page.

Enabling/disabling winds aloft data display for the VSD:

1) Select the 'Map - Navigation Map' Page.
2) Press the **MENU** Key.
3) With 'Map Settings' highlighted, press the **ENT** Key.
4) Turn the small **FMS** Knob to select 'VSD' and press the **ENT** Key.
5) Turn the large **FMS** Knob to highlight the Winds on/off field.
6) Turn the small **FMS** Knob to select 'On' or 'Off'.
7) Press the **FMS** Knob or **CLR** Key to return to the Navigation Map Page with the changed settings.

COUNTY WARNINGS (SIRIUSXM)

The County warning weather product provides specific public awareness and protection weather warnings from the National Weather Service (NWS). This can include information on tornadoes, severe thunderstorms, and flood conditions.

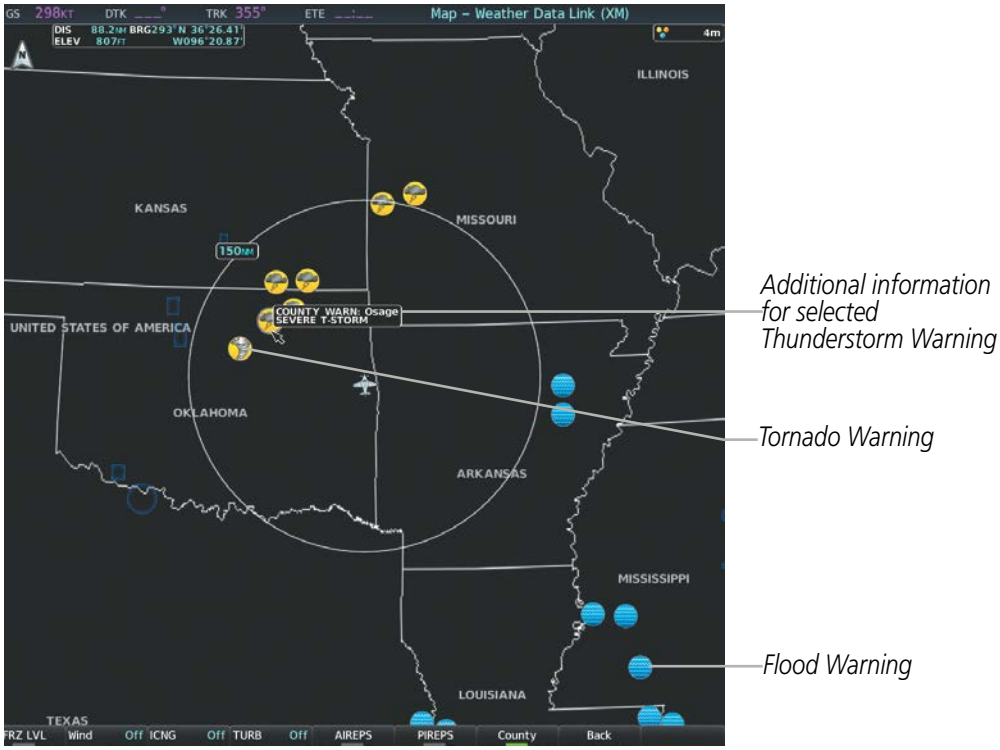


Figure 6-44 County Flood and Severe Weather Warnings

Displaying County Warning information:

1) Select the 'Map - Weather Data Link (XM)' Page.
2) Press the **More WX** Softkey.
3) Press the **County** Softkey.

Figure 6-45 County Warnings Legend

CYCLONE (SIRIUSXM)

The Cyclone weather product shows the current location of cyclones (hurricanes), tropical storms, and their projected tracks. The system displays the projected track information in the form of DD/HH:MM.

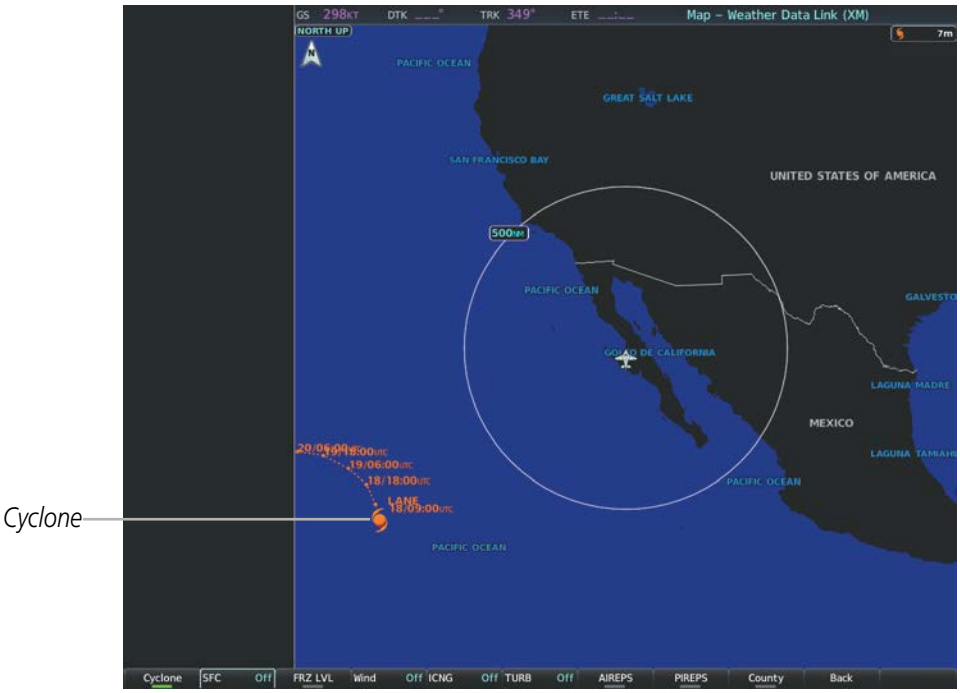


Figure 6-46 Cyclone Weather Product on the Weather Data Link (XM) Page

Displaying cyclone (hurricane) track information:

1) Select the 'Map - Weather Data Link (XM)' Page.
2) Select the **More WX** Softkey.
3) Select the **Cyclone** Softkey.

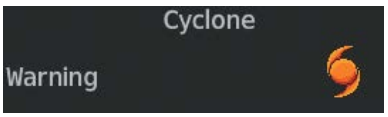


Figure 6-47 Cyclone Legend

NOTE: *The Cyclone weather product is not available unless at least one cyclone or tropical storm has been received. The weather product age indicates 'N/A' when no cyclone or tropical storm has been received.*

ICING (CIP & SLD) (SIRIUSXM)

The Current Icing Product (CIP) weather product shows a graphical view of the current icing environment. Icing severity is displayed in four categories: light, moderate, severe, and extreme (not specific to aircraft type). The CIP product is not a forecast, but a presentation of the current conditions at the time of the analysis.

Supercooled Large Droplet (SLD) icing conditions are characterized by the presence of relatively large, super cooled water droplets indicative of freezing drizzle and freezing rain aloft. SLD threat areas are depicted as magenta dots over the CIP colors.

Displaying Icing data:

1) Select the 'Map - Weather Data Link (XM)' Page.
2) Select the **More WX** Softkey.
3) Select the **ICNG** Softkey.
4) Select a softkey for the desired altitude level: 1,000 feet up to 30,000 feet. Select the **Next** or **PREV** Softkey to cycle through the altitude softkeys. The **ICNG** Softkey label changes to indicate the altitude selected.

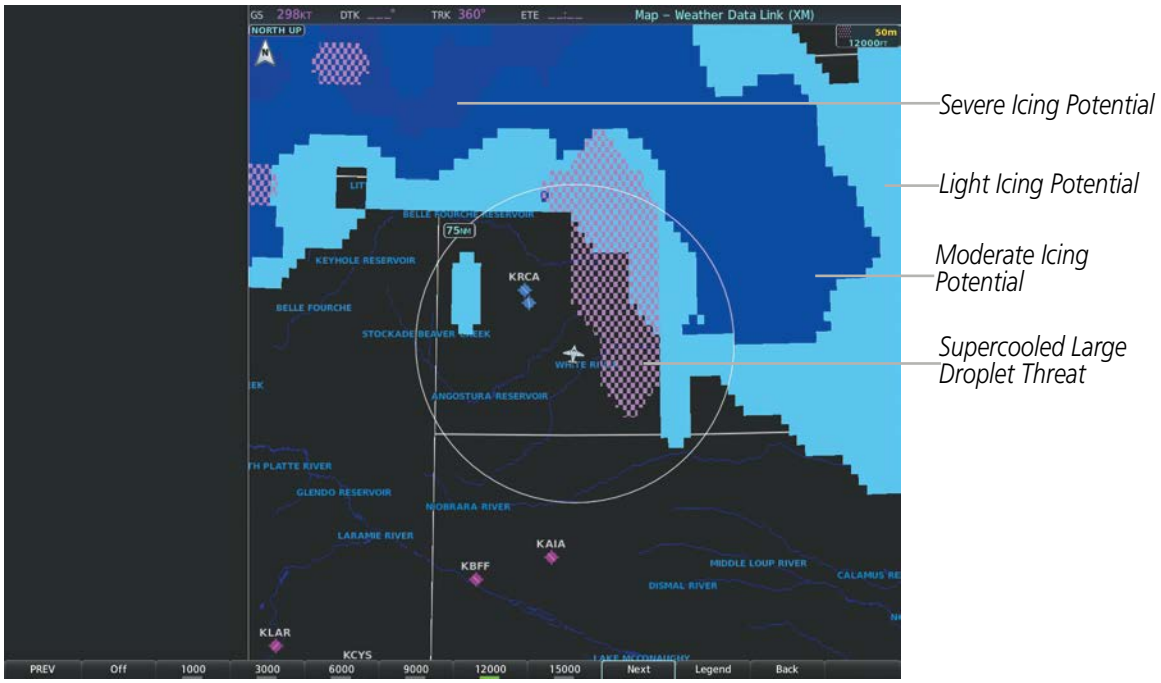


Figure 6-48 Icing Weather Product, 12,000 Feet Selected

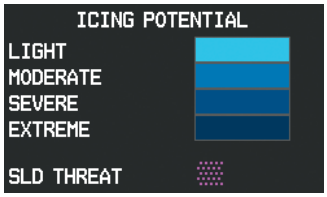


Figure 6-49 Icing Potential Legend

TURBULENCE (SIRIUSXM)

The Turbulence weather product identifies the potential for erratic movement of high-altitude air mass associated winds. Turbulence is classified as light, moderate, severe or extreme, at altitudes between 21,000 and 45,000 feet. Turbulence information is intended to supplement AIRMETs, SIGMETs, and PIREPs.

Displaying Turbulence data:

1) Select the 'Map - Weather Data Link (XM)' Page.
2) Select the **More WX** Softkey.
3) Select the **TURB** Softkey.
4) Select a softkey for the desired altitude: 21,000 feet up to 45,000 feet. Press the **Next** or **PREV** Softkey to cycle through the altitude softkeys. The **TURB** Softkey label changes to indicate the altitude selection.

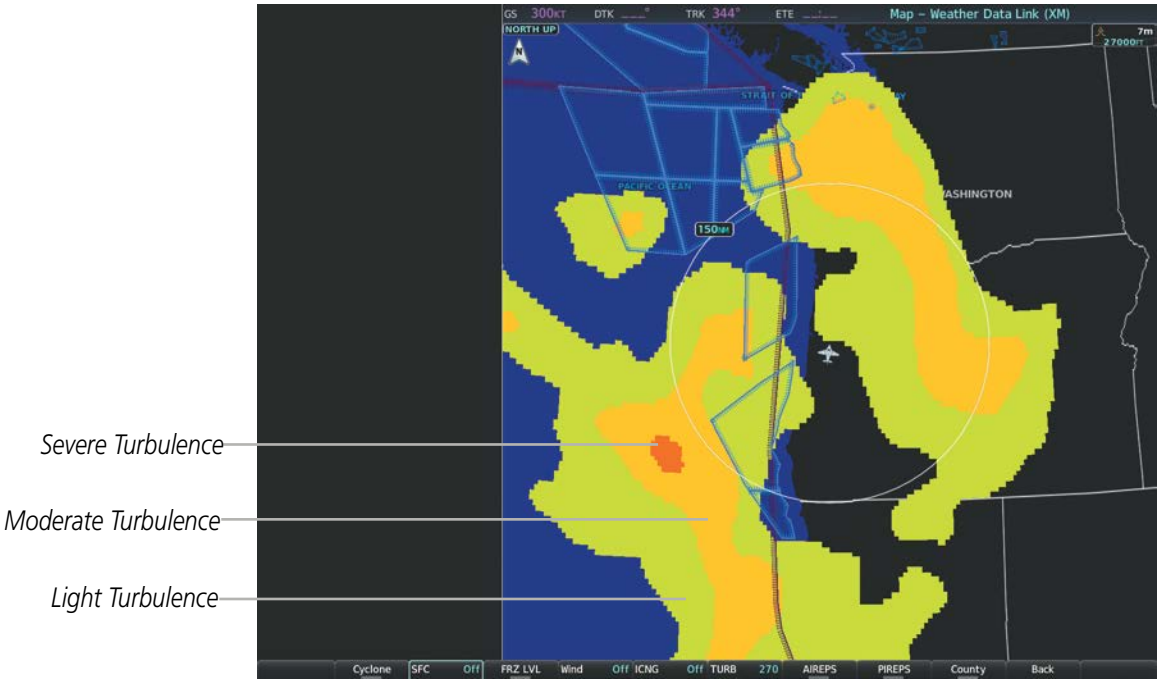


Figure 6-50 Turbulence Weather Product with 27,000 Feet Selected

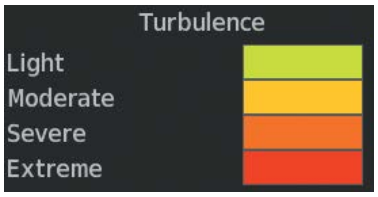


Figure 6-51 Turbulence Legend

PIREPS AND AIREPS

NOTE: *AIREPs are only available with the SiriusXM Weather service.*

Pilot Weather Reports (PIREPs) are in-flight weather observations collected from pilots. When significant weather conditions are reported or forecast, Air Traffic Control (ATC) facilities are required to solicit PIREPs. A PIREP may contain adverse weather conditions, such as low in-flight visibility, icing conditions, wind shear, and turbulence. PIREPs are issued as either Routine (UA) or Urgent (UUA).

Another type of PIREP is an Air Report (AIREP). Commercial airlines typically generate AIREPs.

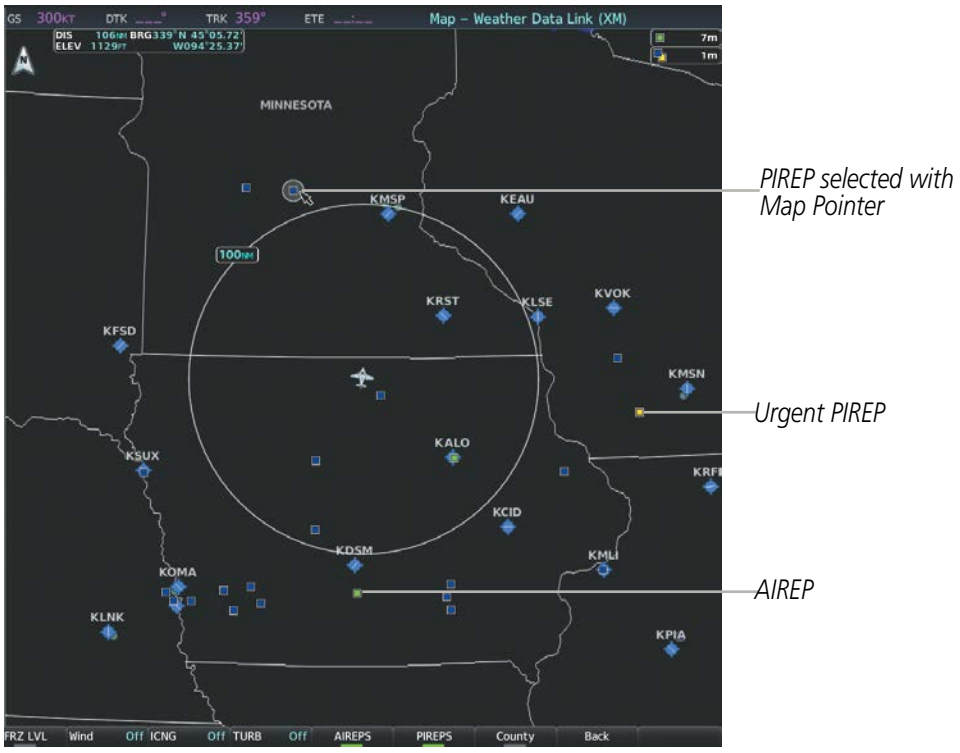


Figure 6-52 AIREPs and PIREPs on the Weather Data Link (XM) Page

Displaying PIREP and AIREP text:

1) Select the 'Map - Weather Data Link (XM or FIS-B or CNXT)' Page.
2) Select the **More WX** Softkey.
3) Select the **PIREPS** or **AIREPS** Softkey. (Note the **AIREPS** Softkey is only available with the SiriusXM Weather service.)
4) Press the **Joystick** and pan to the desired weather report. A gray circle will appear around the weather report when it is selected.
5) Press the **ENT** Key. The Weather Information Page is shown with PIREP or AIREP text. The data is first displayed in a decoded fashion, followed by the original text. Note the original text may contain additional information not present in the decoded version.
6) Use the **FMS** Knob or the **ENT** Key to scroll through the PIREP or AIREP text.
7) Press the **FMS** Knob or the **CLR** Key to return to the Weather Data Link (XM) Page.

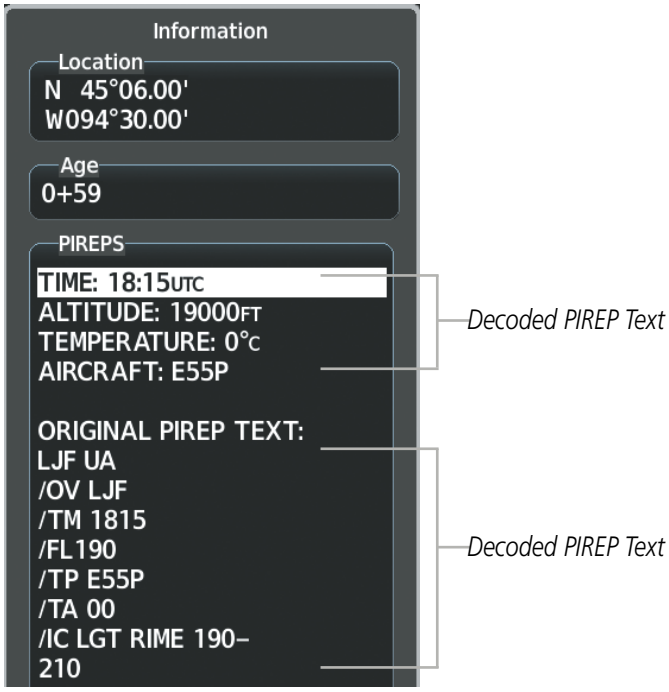


Figure 6-53 PIREP Text on the Weather Data Link (XM) Page

The PIREP color is determined by the type (routine or urgent).

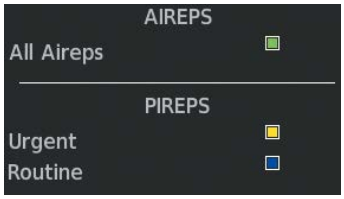


Figure 6-54 AIREPs & PIREPs Legend

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.*

NOTE: *Temporary Flight Restriction (TFR) data from Garmin Connext is only available in the United States (not including any U.S. territories.) Refer to http://sites.garmin.com/connext for product coverage information.*

In the United States, the FAA issues Temporary Flight Restrictions (TFRs) to designate areas where flight is restricted. TFRs are issued to restrict flight for a variety of reasons including national security, law enforcement, natural disasters, and large sporting events. TFRs may be issued at any time, and TFR data displayed on the system is only intended to supplement official TFR information obtained from Flight Service Stations (FSS), and air traffic control.

The age of TFR data is not shown; however, if TFR data is not available or has expired, the system displays 'TFR N/A' in the upper-left corner of maps on which TFRs can be displayed.

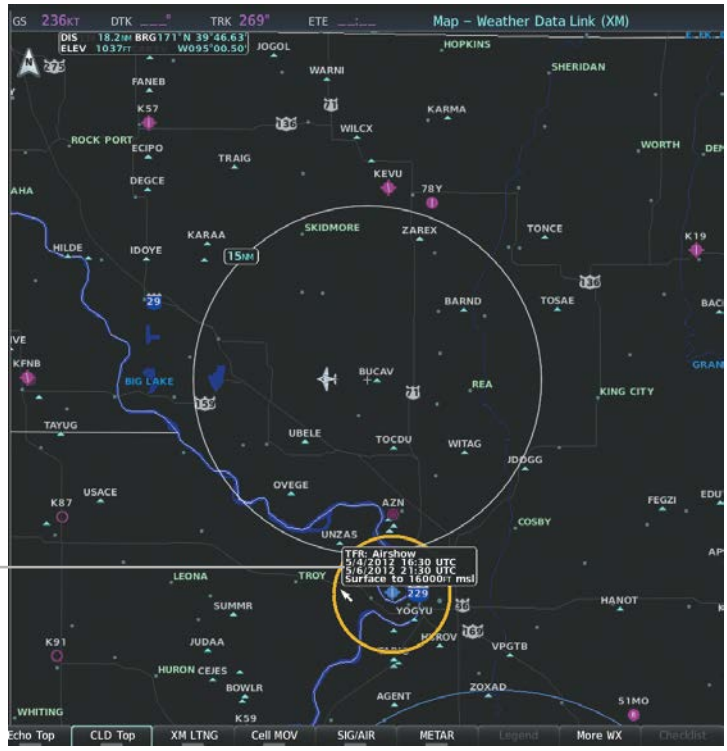


Figure 6-55 TFR Data on the Weather Data Link (XM) Page

Displaying TFR Data:

1) Select the 'Map - Weather Data Link (XM or FIS-B or CNXT)' Page or Navigation Map Page.
2) Press the **Joystick** and pan the map pointer over a TFR to highlight it. The system displays TFR summary information above the map.
3) Press the **ENT** Key. The system displays a pop-up menu.
4) If necessary, turn the **FMS** Knob to select 'Review Airspaces' and press the **ENT** Key. The system displays the TFR Information window.
5) Press the **FMS** Knob or the **CLR** Key to remove the TFR Information window.

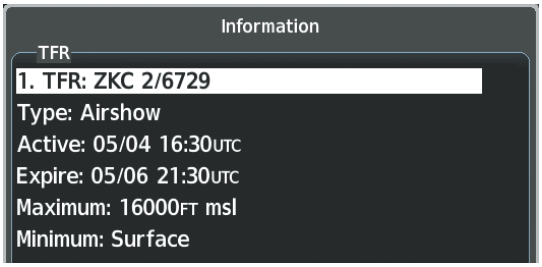


Figure 6-56 Full Text for Selected TFR

The setup menus for the Navigation Map Page control the map range settings above which TFR data is decluttered from the display. If a map range larger than the TFR product map range setting is selected, the TFR product data is removed from the map.

Maps other than the Navigation Map Page use settings based on those selected for the Navigation Map Page.

Setting up and customizing TFR data for maps on which TFR data can be displayed:

1) Select the 'Map - Navigation Map' Page.
2) Press the **MENU** Key.
3) With 'Map Settings' highlighted, press the **ENT** Key.
4) Turn the small **FMS** Knob to select the 'Aviation' Group and press the **ENT** Key.
5) Turn the large **FMS** Knob to scroll to the TFR product range settings.
6) Turn the small **FMS** Knob to scroll through options (Off, range settings).
7) Press the **ENT** Key to select an option.
8) Press the **FMS** Knob or **CLR** Key to return to the Navigation Map Page with the changed settings.

FIS-B WEATHER STATUS

Additional information about the status of FIS-B weather products is available on the Aux - ADS-B Status Page.

Viewing FIS-B status:

1) Turn the large **FMS** Knob to select the Aux Page Group.
2) Turn the small **FMS** Knob to select the 'Aux - ADS-B Status' Page.

On the Weather Data Link (FIS-B) page, the pilot can enable/disable the FIS-B weather feature, which includes all FIS-B weather products and related softkeys on various maps.

Enabling/disabling the FIS-B weather feature:

1) Select the 'Map - Weather Data Link (FIS-B)' Page.
2) Press the **MENU** Key.
3) Turn the small **FMS** Knob to highlight 'Enable FIS-B Weather' or 'Disable FIS-B Weather', and press the **ENT** Key.

Figure 6-57 Viewing FIS-B Weather Status on ADS-B Status Page

ADS-B Status Page Item	Status Message	Description
FIS-B Weather Status: FIS-B Processing	ENABLED	The FIS-B weather feature is enabled to process and display FIS-B weather products.
	DISABLED	The FIS-B weather feature is disabled.
	----------	No FIS-B weather data received from the transponder.
Weather Products: AIRMET CONUS NEXRAD METAR METAR GRAPHICAL NOTAM/TFR PIREP REGIONAL NEXRAD SIGMET TAF WINDS/TEMPS ALOFT	AVAILABLE	FIS-B weather data is available for display for the weather product.
	NOT AVAILABLE	FIS-B weather data is not available for the weather product, and/or the system is not receiving the FIS-B weather service.
	AWAITING DATA	The system is receiving the FIS-B weather service, and is waiting to receive the weather product from the FIS-B data broadcast.

Table 6-6 Aux-ADS-B Status Page Messages for FIS-B Weather

ABNORMAL OPERATIONS FOR GARMIN CONNEXT WEATHER

If the system cannot complete a Connext Data Request, one or more messages will appear in the Request Status Window.

Weather Request Status Message	Description
Auto requests inhibited Send manual request to reset.	The system has disabled automatic weather data requests due to excessive errors. Automatic weather data requests have stopped. Send a manual weather data request to resume automatic updates.
Auto update retry: ## Seconds	The system will attempt another automatic weather data request after an error occurred during the previous request. Timer counts down until the next automatic request occurs.
Connext Comm Error [1]	A general error has occurred. If the error persists, the system should be serviced.
Connext Comm Error [2]	A communications error has occurred with the GIA. The system should be serviced.
Connext Comm Error [3]	A general error has occurred. If the error persists, the system should be serviced.
Connext Comm Error [4]	This occurs if multiple automatic weather data requests have recently failed, or a GIA is off-line.
Connext Comm Error [5]	This can occur if the Iridium or Garmin Connext services are not accessible. Check Iridium signal strength. If this error persists, the system should be serviced.
Connext Comm Error [6]	A communications error has occurred. It this error persists, the system should be serviced.
Connext Comm Error [7]	A weather data transfer has timed out. Check Iridium signal strength and re-send the data request.
Connext Comm Error [8]	A server error has occurred or invalid data received.
Connext Comm Error [9]	An error occurred while reading or writing data. If the error persists, the system should be serviced.
Connext Login Invalid	There is a problem with the Garmin Connext registration. Contact Garmin at 1-866-739-5687 in the United States or 913-397-8200, wait for the operator, and request Extension 1135 for assistance.
Connext Server Temp Inop	The Garmin Connext Weather data server is temporarily out of service, but is expected to return to service in less than 30 minutes.
Connext Server Inop	The Garmin Connext Weather data server will be out of service for at least 30 minutes.
Invalid Coverage Area	The weather data request coverage area does not contain at least one of the following: a waypoint, a flight plan, or a flight plan destination. Verify at least one of the coverage options is enabled (checked) and contains required criteria, then re-send the data request.
No Connext Subscription	The system is not be currently subscribed to Garmin Connext services or the access code is incorrect. Verify the access code. Contact Garmin at 1-866-739-5687 in the United States or 913-397-8200, wait for the operator, and request Extension 1135 for assistance.
Reduce Request Area	The size of the received weather data has exceeded system memory limits. Reduce the size of the coverage area and issue another Connext Data Request to ensure all available weather data has been received.
Request Canceled	The user has cancelled a Connext Data Request.
Request Failed - Try Again	The weather data request timed-out. Re-send data request.

Table 6-7 Abnormal Garmin Connext Data Request Status Messages

When the system is operating in Reversionary Mode, only those weather products which can be displayed on the PFD maps will be available for display (see Table 6-4 for a list of weather products and their associated map availability).

If manual Connext Data Requests were enabled prior to entering Reversionary Mode, no new weather data will be retrieved while operating in Reversionary Mode. If automatic Connext Data Requests were enabled prior to Reversionary Mode operation, the system will continue the automatic data requests in Reversionary Mode (provided automatic requests have not been inhibited due to a system error).

6.2 STORMSCOPE LIGHTNING DETECTION SYSTEM

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

NOTE: *Stormscope lightning information cannot be displayed simultaneously on the same map as lightning information from data link lightning sources.*

The system can display L-3 WX-500 Stormscope lightning detection system information on the Stormscope Page, and as an overlay on navigation maps. The system uses the symbols shown in the following table to depict lightning strikes and cells based on the age of the information.

Lightning Age	Symbol
Strike is less than 6 seconds old	
Strike is between 6 and 60 seconds old	
Strike is between 1 and 2 minutes old	
Strike is between 2 and 3 minutes old	

Table 6-8 Lightning Age and Symbols

USING THE STORMSCOPE PAGE

On the Stormscope Page, lightning information can be displayed at the ranges of 25 nm, 50 nm, 100 nm, and 200 nm.

Adjusting the Stormscope Map Range:

1) Turn the large **FMS** Knob to select the Map Page Group.
2) Turn the small **FMS** Knob to select the Stormscope Page.
3) Turn the **Joystick** clockwise to increase the map range or counter-clockwise to decrease the map range.

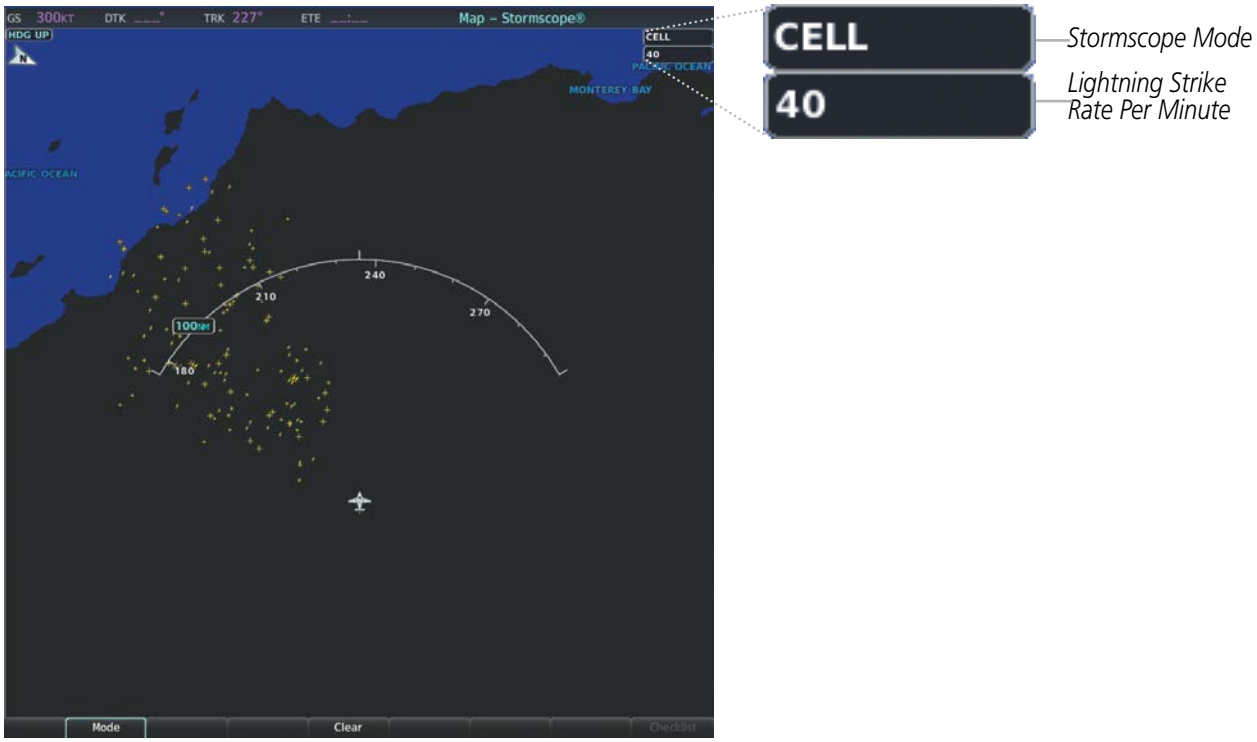


Figure 6-58 Stormscope Page with Cell Mode Selected

Cell mode identifies cells of lightning activity. Stormscope identifies clusters of electrical activity that indicate cells. Strike mode indicates the approximate location of lightning strikes.

Selecting 'cell' or 'strike' mode on the Stormscope Page:

1) Select the 'Map - Stormscope' Page.
2) Select the **Mode** Softkey. The **Cell** and **Strike** softkeys are displayed.
3) Select the **Cell** Softkey to display 'CELL' data or select the **Strike** Softkey to display 'STRIKE' data. 'CELL' or 'STRIKE' is displayed in the mode box in the upper right corner of the Stormscope Page.
4) Press the **Back** Softkey to return to the top-level softkeys for the Stormscope Page.

Or:

1) Select the 'Map - Stormscope' Page.
2) Press the **MENU** Key to display the Stormscope Page Menu. Either 'Cell Mode' or 'Strike Mode' is highlighted in cyan to indicate the mode to be selected.
3) Press the **ENT** Key to select the highlighted mode and remove the menu. To remove the menu without changing modes, press the **MENU** Key or the **CLR** Key, or press the **FMS** Knob.

If heading input is lost, strikes and/or cells must be cleared manually after the execution of each turn . This is to ensure that the strike and/or cell positions are depicted accurately in relation to the nose of the aircraft. Clearing Stormscope lightning on any map clears this information from all displays on the system.

Manually clearing Stormscope cell or strike information:

1) Select the 'Map - Stormscope' Page.
2) Select the **Clear** Softkey.

   Or:

   a) Press the **MENU** Key.

   b) Turn the **FMS** Knob to highlight 'Clear Lightning Data', then press the **ENT** Key.

   Or:

1) Select the 'Map - Navigation Map' Page.
2) Press the **MENU** Key.
3) Turn the **FMS** Knob to highlight 'Clear Stormscope® Lightning', then press the **ENT** Key.

Displaying Stormscope information on MFD navigation maps:

1) Press the **Map Opt** Softkey.
2) Press the **STRMSCP** Softkey.

Displaying Stormscope information on PFD maps:

1) On the PFD, press the **Map/HSI** Softkey.
2) Press the **Lightning** Softkey.
3) Press the **STRMSCP** Softkey.
4) Press the **Back** Softkey twice to return to the top-level softkeys.

SETTING UP STORMSCOPE ON THE NAVIGATION MAP

Setting up Stormscope options on the Navigation Map:

1) On the 'Map - Navigation Map Page', press the **MENU** Key.
2) With 'Map Settings' selected, press the **ENT** Key.
3) Turn the small **FMS** Knob to display the group selection window. Turn the small **FMS** Knob to select 'Weather', and press the **ENT** Key.
4) Turn the large **FMS** Knob to highlight and move between the product selections.
5) When an item is highlighted, turn the small **FMS** Knob to select the option.
6) Press the **ENT** Key.
7) Press the **FMS** Knob to return to the 'Map - Navigation Map' Page.

The following options are available:

- Stormscope On/Off field – Enables/disables the display of Stormscope lightning symbols.
- Stormscope maximum display range – Selects the maximum map range to display Stormscope symbols. Stormscope data is removed when a map range greater than the STRMSCP SMBL value is selected.
- Stormscope Mode – Selects the Cell or Strike mode of lightning activity. Cell mode identifies clusters or cells of electrical activity. Strike mode indicates the approximate location of lightning strikes.

CELL AND STRIKE MODE ON THE NAVIGATION MAP

Selecting the 'cell' or 'strike' mode on the Navigation Map:

1) Press the **MENU** Key.
2) With 'Map Settings' selected, press the **ENT** Key.
3) Turn the **FMS** Knob to select the 'Weather' group and press the **ENT** Key.
4) Turn the large **FMS** Knob to select the Stormscope Mode field.
5) Turn the small **FMS** Knob to change between 'Cell' and 'Strike' options. When the desired item is selected, press the **ENT** Key.
6) Press the **FMS** knob to return to the Navigation Map Page.

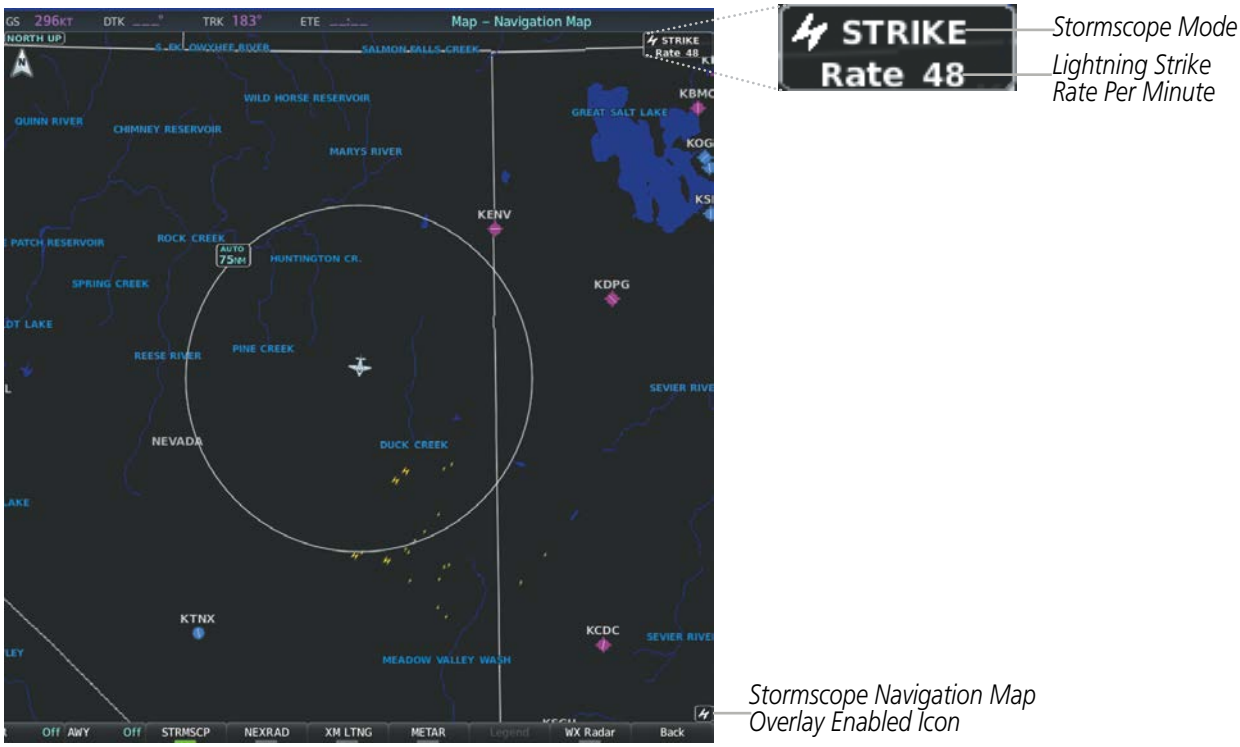


Figure 6-59 Navigation Map Page with Stormscope Lightning Overlay Enabled

If heading input is lost, strikes and/or cells must be cleared manually after the execution of each turn. This is to ensure that the strike and/or cell positions are depicted accurately in relation to the nose of the aircraft.

Manually clearing Stormscope data on the Navigation Map:

1) Press the **MENU** Key.
2) Turn the FMS Knob to highlight 'Clear Stormscope® Lightning'.
3) Press the **ENT** Key.

ZOOM RANGE ON THE NAVIGATION MAP

Stormscope lightning data can be displayed up to 1000 nm zoom range regardless of map orientation on the Navigation Map page.

The maximum zoom range can also be set on the Navigation Map. Note that Stormscope data above the selected maximum zoom range will not be displayed.

Selecting a Stormscope range on the Navigation Map:

1) Press the **MENU** Key.
2) With 'Map Settings' highlighted, press the **ENT** Key.
3) Turn the **FMS** Knob to highlight the select the 'Weather' group, and press the **ENT** Key.
4) Turn the large **FMS** Knob to highlight the Stormscope maximum map display range distance.
5) Turn the small **FMS** Knob to select the Stormscope maximum map display range distance.
6) Press the **ENT** Key.
7) Press the **FMS** Knob to return to the Navigation Map Page.

To change the display range on the Navigation Map Page, turn the **Joystick** clockwise to increase the map range or counter-clockwise to decrease the map range.

Selecting 'cell' or 'strike' mode:

1) Select the Stormscope Page.
2) Select the **Mode** Softkey. The **Cell** and **Strike** softkeys are displayed.
3) Select the **Cell** Softkey to display 'CELL' data or select the **Strike** Softkey to display 'STRIKE' data. 'CELL' or 'STRIKE' is displayed in the mode box in the upper right corner of the Stormscope Page.
4) Press the **Back** Softkey to return to the top level softkeys for the Stormscope Page.

Or:

1) Select the 'Map - Stormscope' Page.
2) Press the **MENU** Key to display the Stormscope Page Menu. Either 'Cell Mode' or 'Strike Mode' is highlighted in cyan to indicate the mode to be selected.
3) Press the **ENT** Key to select the highlighted mode and remove the menu. To remove the menu without changing modes, press the **MENU** Key or the **CLR** Key, or push the **FMS** Knob.

If heading input is lost, strikes and/or cells must be cleared manually after the execution of each turn . This is to ensure that the strike and/or cell positions are depicted accurately in relation to the nose of the aircraft. Clearing Stormscope lightning on any map clears this information from all displays on the system.

Manually clearing Stormscope cell or strike information:

1) Select the 'Map - Stormscope' Page.
2) Select the **Clear** Softkey.

   Or:l

   a) Press the **MENU** Key.

   b) Turn the **FMS** Knob to highlight 'Clear Lightning Data', then press the **ENT** Key.

   Or:

1) Select the 'Map - Navigation Map' Page.
2) Press the **MENU** Key.
3) Turn the **FMS** Knob to highlight 'Clear Stormscope® Lightning', then press the **ENT** Key.

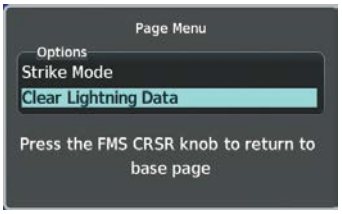


Figure 6-60 Navigation Map Page Options Menu

6.3 AIRBORNE COLOR WEATHER RADAR

SYSTEM DESCRIPTION

The Garmin GWX 70 Airborne Color Weather Radar is a solid-state pulsed radar with forty watts of output power. The radar combines excellent range and adjustable scanning profiles with a high-definition target display. The GWX 70 has an effective pulse length of 27.31 microseconds (µs), and the system optimizes the pulse length to maximize resolution at each range setting.

This aircraft uses a 10-inch phased array antenna that is fully stabilized to accommodate 30º of pitch and roll.

To focus radar scanning on specific areas, Sector Scanning offers pilot-adjustable horizontal scan angles. A vertical scanning function helps to analyze storm tops, gradients, and cell buildup activity at various altitudes.

Radar features include:

- Extended Sensitivity Time Constant (STC) logic that automatically correlates distance of the return echo with intensity, so cells do not suddenly appear to get larger as they get closer.
- WATCH® (Weather ATtenuated Color Highlight) helps identify possible shadowing effects of short-range cell activity, identifying areas where radar return signals are weakened or attenuated by intense precipitation (or large areas of lesser precipitation) and may not fully reflect the weather behind a storm.
- Weather Alert that looks ahead for intense cell activity in the 80-320 nm range, even if these ranges are not being monitored.
- Altitude-Compensated Tilt (ACT) management, which automatically adjusts the antenna tilt angle as the aircraft altitude changes.
- Independent weather radar scans for each PFD HSI Map while the aircraft is in the air.

PRINCIPLES OF PULSED AIRBORNE WEATHER RADAR

The term RADAR is an acronym for RAdio Detecting And Ranging. Pulsed radar locates targets by transmitting a microwave pulse beam that, upon encountering a target, is reflected back to the radar receiver as a return echo. The microwave pulses are focused and radiated by the antenna, with the most intense energy in the center of the beam and decreasing intensity near the edge. The same antenna is used for both transmitting and receiving. The system processes the returned signal for display.

Radar detection is a two-way process that requires 12.36 µs for the transmitted microwave pulses to travel out and back for each nautical mile of target range. It takes 123.6 µs for a transmitted pulse to make the round trip if a target is ten nautical miles away.

Airborne weather radar should be used to avoid severe weather, not for entering areas of severe weather. The decision to fly into an area of radar targets depends on target intensity, spacing between the targets, aircraft capabilities, and pilot experience. Airborne weather radar detects rain or hail, not clouds or mist. The display may indicate clear areas between intense returns, but this does not necessarily mean it is safe to fly between them. The airborne weather radar cannot detect turbulence.

Airborne weather radar has other capabilities beyond weather detection. It also has the ability to detect and provide distance to cities, mountains, coastlines, rivers, lakes, and oceans.

NEXRAD AND AIRBORNE WEATHER RADAR

Both Airborne Weather Radar and NEXRAD measure weather reflectivity in decibels (dB). A decibel is a logarithmic expression of the ratio of two quantities. Airborne Weather Radar measures the ratio of power against the gain of the antenna, while NEXRAD measures the energy reflected back to the radar, or the radar reflectivity ratio.

Both systems use colors to identify the different echo intensities, but the colors are not interchangeable. Airborne color radar values used by Garmin Airborne Color Weather Radar should not be confused with NEXRAD radar values.

ANTENNA BEAM ILLUMINATION

The radar beam is much like the beam of a spotlight. The further the beam travels, the wider it becomes. The radar is only capable of seeing what is inside the boundaries of the beam. The following figure depicts a radar beam's characteristics. The figure illustrates vertical dimensions of the radar beam, although the same holds true for the horizontal dimensions. In other words, the beam is as wide as it is tall. Note that it is possible to miss areas of precipitation on the radar display because of the antenna tilt setting. With the antenna tilt set to zero in this illustration, the beam overshoots the precipitation at 15 nautical miles.

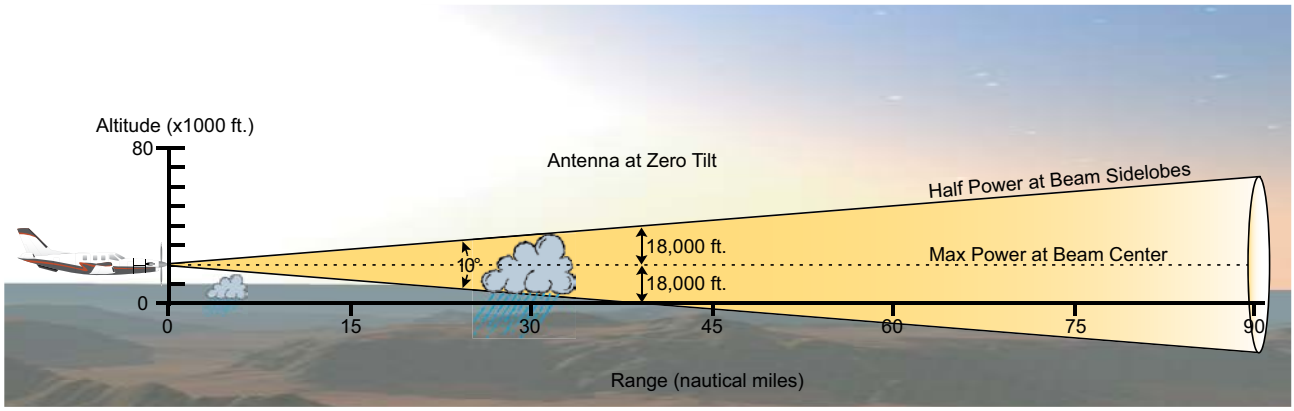


Figure 6-61 Radar Beam from a 10 inch Antenna

The curvature of the Earth can also be a factor in missing areas of precipitation, especially at range settings of 150 nautical miles or more. Here the beam overshoots the precipitation at less than 320 nautical miles.

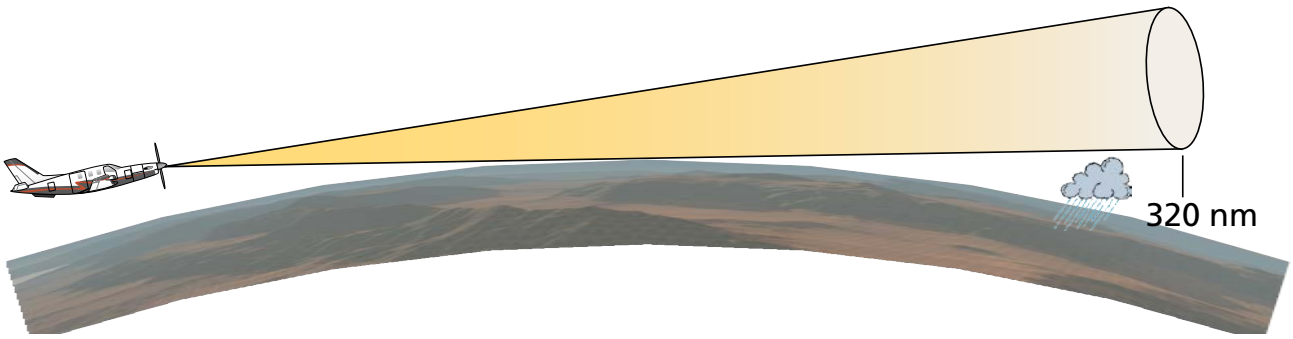


Figure 6-62 Radar Beam in Relation to the Curvature of the Earth

RADAR SIGNAL ATTENUATION

The phenomenon of radar signal attenuation affects the operation of weather radar. When the radar signal is transmitted, it is progressively absorbed and scattered, making the signal weaker. This weakening, or attenuation, is caused by two primary sources, distance and precipitation.

Attenuation because of distance is due to the fact that the radar energy leaving the antenna is inversely proportional to the square of the distance. The reflected radar energy from a target 40 miles away that fills the radar beam is one fourth the energy reflected from an equivalent target 20 miles away. This would appear to the operator that the storm is gaining intensity as the aircraft gets closer. Internal signal processing within the radar system compensates for much of this distance attenuation.

Attenuation due to precipitation is not as predictable as distance attenuation. It is also more intense. As the radar signal passes through moisture, a portion of the radar energy is reflected back to the antenna. However, much of the energy is absorbed. If precipitation is very heavy, or covers a large area, the signal may not reach completely through the area of precipitation. The weather radar system cannot distinguish between an attenuated signal and an area of no precipitation. If the signal has been fully attenuated, the radar displays a radar shadow. This appears as an end to the precipitation when, in fact, the heavy rain may extend much further. A cell containing heavy precipitation may block another cell located behind the first, preventing it from being displayed on the radar. Never fly into these shadowed areas and never assume that all of the heavy precipitation is being displayed unless another cell or a ground target can be seen beyond the heavy cell. The WATCH® feature can help in identifying these shadowed areas. Areas in question appear as shadowed or gray on the radar display. Proper use of the antenna tilt control can also help detect radar shadows.

Attenuation can also be due to poor maintenance or degradation of the radome. Even the smallest amount of wear and scratching, pitting, and pinholes on the radome surface can cause damage and system inefficiency.

RADAR SIGNAL REFLECTIVITY

Precipitation

Precipitation or objects more dense than water, such as the surface of the Earth or solid structures, are detected by the weather radar. The weather radar does not detect clouds, thunderstorms, or turbulence directly. It detects precipitation associated with clouds, thunderstorms, and turbulence. The best radar signal reflectors are raindrops, wet snow, or wet hail. The larger the raindrop, the better the reflectivity. The size of the precipitation droplet is the most important factor in radar reflectivity. Because large drops in a small concentrated area are characteristic of a severe thunderstorm, the radar displays the storm as a strong return. Ice crystals, dry snow, and dry hail have low levels of reflectivity as shown in the illustration, and often not displayed by the radar. Additionally, a cloud that contains only small raindrops, such as fog or drizzle, does not reflect enough radar energy to produce a measurable target return.

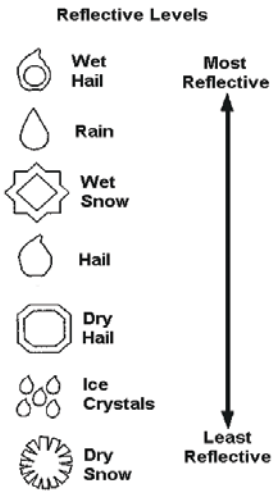


Figure 6-63 Precipitation Type and Reflectivity

Ground Returns

The intensity of ground target returns depends upon the angle at which the radar beam strikes the ground target (Angle of Incidence) and the reflective properties of that target. The gain can be adjusted so shorelines, rivers, lakes, and cities are well-defined. Increasing the gain too much causes the display to fill in between targets, thus obscuring some landmarks.

Cities normally provide a strong return signal. While large buildings and structures provide good returns, small buildings can be shadowed from the radar beam by the taller buildings. As the aircraft approaches and shorter ranges are selected, details become more noticeable as the highly reflective regular lines and edges of the city become more defined.

Bodies of water such as lakes, rivers, and oceans are not good reflectors and normally do not provide good returns. The energy is reflected in a forward scatter angle with inadequate energy being returned. They can appear as dark areas on the display. However, rough or choppy water is a better reflector and provides stronger returns from the downwind sides of the waves.

Mountains also provide strong return signals to the antenna, but also block the areas behind. However, over mountainous terrain, the radar beam can be reflected back and forth in the mountain passes or off canyon walls, using up all or most of the radar energy. In this case, no return signal is received from this area, causing the display to show a dark spot which could indicate a pass where no pass exists.

Angle of Incidence

The angle at which the radar beam strikes the target is called the Angle of Incidence. The figure illustrates the incident angle ('A'). This directly affects the detectable range, the area of illumination, and the intensity of the displayed target returns. A large incident angle gives the radar system a smaller detectable range and lower display intensity due to minimized reflection of the radar energy.

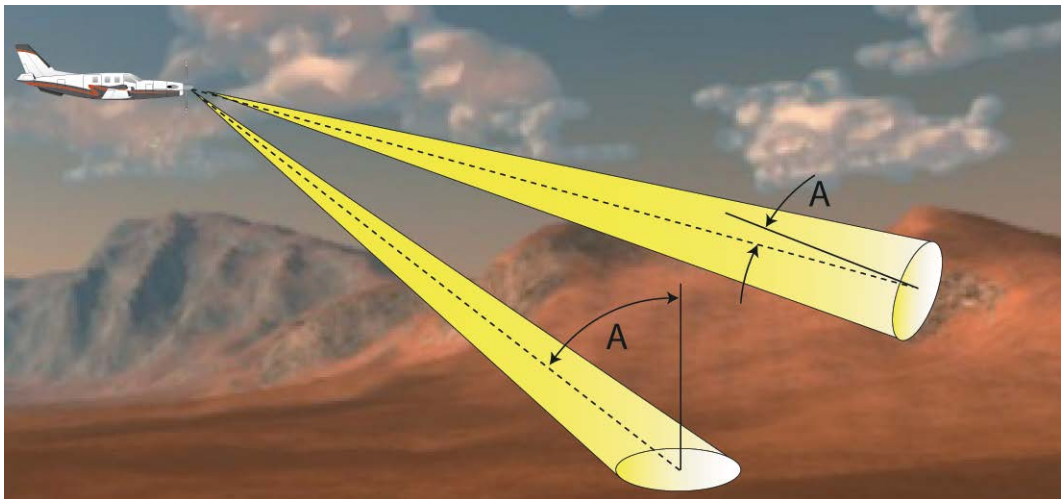


Figure 6-64 Angle of Incidence

A smaller incident angle gives the radar a larger detectable range of operation and the target display shows a higher intensity. Since more radar energy is reflected back to the antenna with a low incident angle, the resulting detectable range is increased for mountainous terrain.

SAFE OPERATING DISTANCE

The following information establishes a minimum safe distance from the antenna for personnel near operating weather radar. The minimum safe distance is based on the FCC's exposure limit at 9.3 to 9.5 GHz for general population/uncontrolled environments, which is 1 mW/cm2. See Advisory Circular 20-68B for more information on safe distance determination.

MAXIMUM PERMISSIBLE EXPOSURE LEVEL (MPEL)

The zone in which the radiation level exceeds the US Government standard of 1 mW/cm2 is the semicircular area of at least 9.16 feet from the 10-inch antenna. All personnel must remain outside of this zone. This recommendation slightly exceeds the calculation methods defined in Advisory Circular 20-68B. With a scanning or rotating beam, the averaged power density at the MPEL boundary is significantly reduced.

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

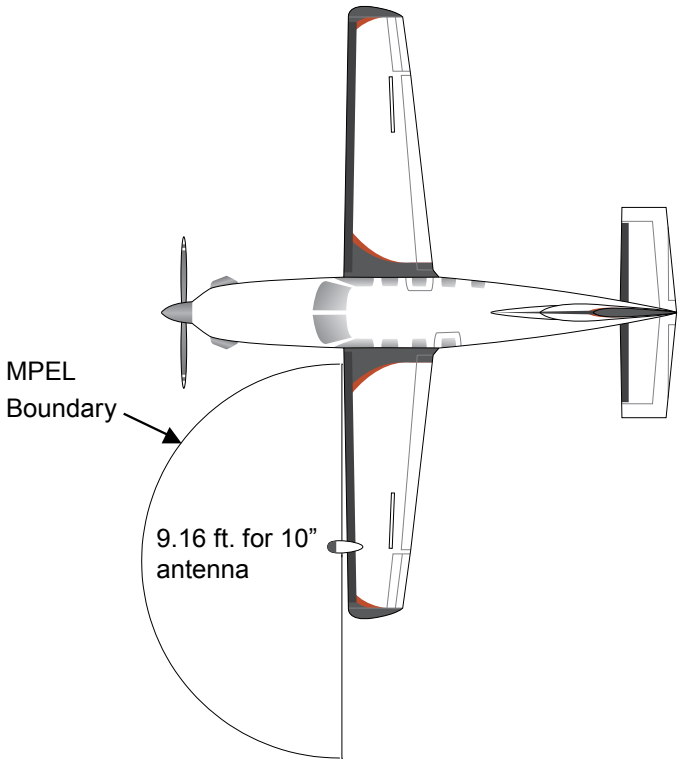


Figure 6-65 MPEL Boundary

BASIC ANTENNA TILT SETUP

The following discussion is a simple method for setting up the weather radar antenna tilt for most situations. It is not to be considered an all encompassing setup that works in all situations, but this method does provide good overall parameters for the monitoring of threats. Ultimately, it is desired to have the antenna tilted so that the bottom of the radar beam is four degrees below parallel with the ground. The following example explains one way of achieving this.

With the aircraft flying level, adjust the antenna tilt so ground returns are displayed at a distance that equals the aircraft's current altitude (AGL) divided by 1,000. For example, if the aircraft is at 14,000 feet, adjust the tilt so the front edge of ground returns are displayed at 14 nautical miles. Note this antenna tilt angle setting. Now, raise the antenna tilt six degrees above this setting. The bottom of the radar beam is now angled down four degrees from parallel with the ground.

PRACTICAL APPLICATION USING THE BASIC TILT SETUP

With the antenna tilt set as previously described, any displayed target return should be scrutinized when flying at altitudes of 2,000 feet AGL or higher. If the displayed target advances on the screen to within five nautical miles of the aircraft, avoid it. This may be either weather or ground returns that are 2,000 feet or less below the aircraft. Raising the antenna tilt four degrees can help separate ground returns from weather returns in relatively flat terrain. This aligns the bottom of the radar beam parallel with the ground. Return the antenna tilt to the previous setting after a few sweeps.

If the aircraft is above 29,000 feet, be cautious of any target return that gets to within 30 nautical miles. This is likely a thunderstorm that has a top high enough that the aircraft cannot fly over it safely.

If the aircraft altitude is 15,000 feet or lower, setting the displayed range to 60 miles may be more helpful. Closely monitor anything that enters the display.

Also, after setting up the antenna tilt angle as described previously, ground returns can be monitored for possible threats. The relationship between antenna tilt angle, altitude, and distance is one degree of tilt equals 100 feet of altitude for every one nautical mile.

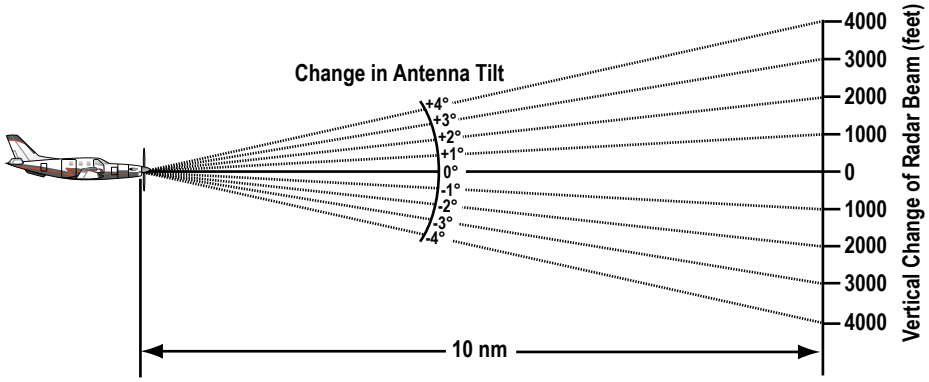


Figure 6-66 Vertical Change in Radar Beam per Nautical Mile

Therefore, with the antenna tilt set so that the bottom of the beam is four degrees below parallel with the ground, a target return at 10 nm is approximately 4,000 feet below the aircraft; at 20 nm, 8,000 feet; at 50 nm, 20,000 feet. In other words, at this tilt setting, a ground return (such as a mountain peak) being displayed at 10 nm would have a maximum distance below the aircraft of 4,000 feet. When the ground target return moves to 5 nm, maximum distance below the aircraft is 2,000 feet.

This setup provides a good starting point for practical use of the airborne weather radar. There are many other factors to consider in order to become proficient at using weather radar in all situations.

ALTITUDE COMPENSATED TILT (ACT)

The Altitude Compensated Tilt feature of the GWX 70 enables the system to automatically adjust the antenna beam tilt angle setting based on aircraft altitude changes. For example, if the ACT feature is enabled and the aircraft climbs, the system compensates by adjusting the tilt downward. As the aircraft descends with ACT enabled, the system adjusts the antenna tilt upward.

WEATHER MAPPING AND INTERPRETATION

WEATHER DISPLAY INTERPRETATION

When evaluating various target returns on the weather radar display, the colors denote precipitation intensity and rates shown in the table.

Weather Mode Color	Intensity (in dBz)	Approximate Precipitation Rate (in/hr.)
Black	< 23 dBZ	< .01
Green	23 dBZ to < 33 dBZ	.01 - 0.1
Yellow	33 dBZ to < 41 dBZ	0.1 - 0.5
Red	41 dBZ and greater	greater than 0.5

Table 6-9 Precipitation Intensity Levels in Weather Mode (GWX 70)

THUNDERSTORMS

Updrafts and downdrafts in thunderstorms carry water through the cloud. The more severe the drafts, the greater the number and size of the precipitation droplets. With this in mind, the following interpretations can be made from what is displayed on the weather radar. Avoid these areas by an extra wide margin.

- In areas where the displayed target intensity is red or magenta (indicating large amounts of precipitation), the turbulence is considered severe.
- Areas that show steep color gradients (intense color changes) over thin bands or short distances suggest irregular rainfall rate and strong turbulence.
- Areas that show red or magenta are associated with hail or turbulence, as well as heavy precipitation. Vertical scanning and antenna tilt management may be necessary to identify areas of maximum intensity.

Along squall lines (multiple cells or clusters of cells in a line) individual cells may be in different stages of development. Areas between closely spaced, intense targets may contain developing clouds not having enough moisture to produce a return. However, these areas could have strong updrafts or downdrafts. Targets showing wide areas of green are generally precipitation without severe turbulence.

Irregularities in the target return may also indicate turbulence, appearing as hooks, fingers, or scalloped edges. These irregularities may be present in green areas with no yellow or red indications and should be treated as highly dangerous areas. Avoid these areas as if they are red.

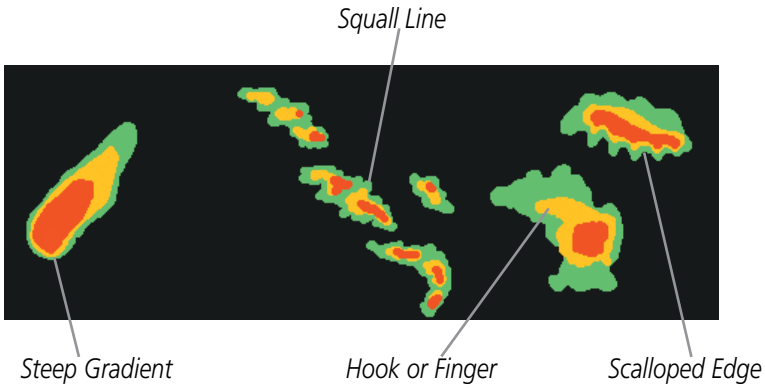


Figure 6-67 Cell Irregularities

Thunderstorm development is rapid. A course may become blocked within a short time. When displaying shorter ranges, periodically select a longer range to see if problems are developing further out. That can help prevent getting trapped in a blind alley or an area that is closed at one end by convective weather.

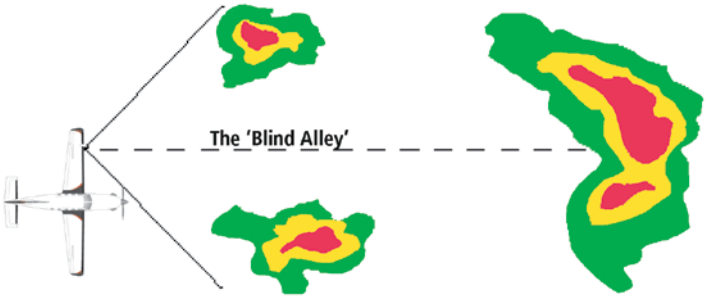
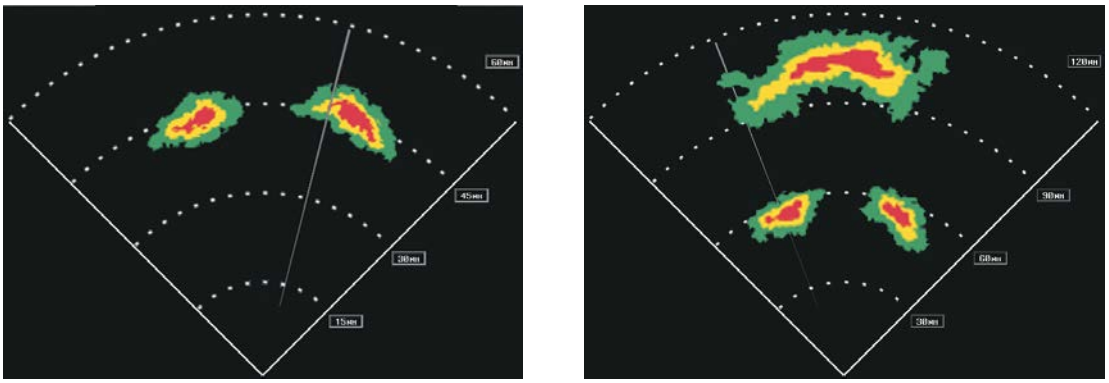


Figure 6-68 The Blind Alley - Horizontal Scan

In areas of multiple heavy cells, use the Vertical Scan feature along with antenna tilt management to examine the areas. Remember to avoid shadowed areas behind targets.



The Blind Alley at Close Range *The Large Storm Behind*

Figure 6-69 The Blind Alley

TORNADOES

There are no conclusive radar target return characteristics which identify a tornado. However, tornadoes may be present if the following characteristics are observed:

- A narrow, finger-like portion extends and in a short time curls into a hook and closes on itself.
- A hook, which may be in the general shape of the numeral 6 (9 in the southern hemisphere), especially if bright and projecting from the southwest quadrant (northeast quadrant in the southern hemisphere) of a major thunderstorm.
- V-shaped notches.
- Doughnut shapes.

These shapes do not always indicate tornadoes, and tornado returns are not limited to these characteristics. Confirmed radar observations of tornadoes most often have not shown shapes different from those of a normal thunderstorm display.

Hail

Hail results from updrafts carrying water high enough to freeze. Therefore, the higher the top of a thunderstorm, the greater the probability that it contains hail. Vertically scanning the target return can give the radar top of a thunderstorm that contains hail. Radar top is the top of a storm cell as detected by radar. It is not the actual top, or true top of the storm. The actual top of a storm cell is seen with the eyes in clear air and may be much higher than the radar top. The actual top does not indicate the top of the hazardous area.

Hail can fall below the minimum reflectivity threshold for radar detection. It can have a film of water on its surface, making its reflective characteristics similar to a very large water droplet. Because of this film of water, and because hail stones usually are larger than water droplets, thunderstorms with large amounts of wet hail return stronger signals than those with rain. Some hail shafts are extremely narrow (100 yards or less) and make poor radar targets. In the upper regions of a cell where ice particles are dry (no liquid coating), target returns are less intense.

Hail shafts are associated with the same radar target return characteristics as tornados. U-shaped cloud edges three to seven miles across can also indicate hail. These target returns appear quite suddenly along any edge of the cell outline. They also change in intensity and shape in a matter of seconds, making vigilant monitoring essential.

OPERATION IN WEATHER MODE

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

When the weather radar system is in the Weather or Ground Map mode, the system automatically switches to Standby mode on landing.

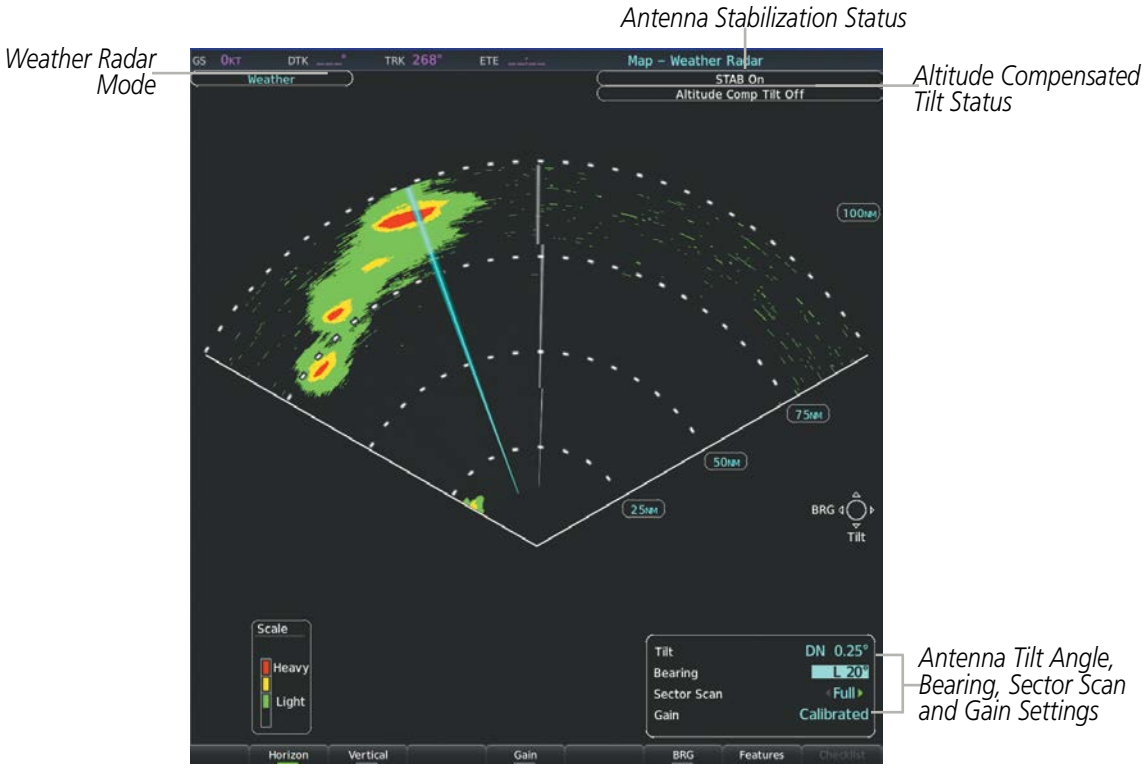


Figure 6-70 Weather Radar Page with a Horizontal Scan Selected

Displaying weather on the Weather Radar Page:

1) Select the 'Map - Weather Radar' Page.
2) Select the **Mode** Softkey.
3) While on the ground, the weather radar will be in 'Standby' mode.
   a) Select the **Weather** Softkey. A confirmation window is displayed.

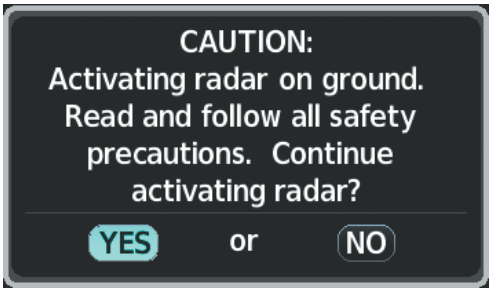


Figure 6-71 Confirming Activating Radar

b) Turn the small **FMS** Knob to highlight **YES** and press the **ENT** Key to continue radar activation.

Or:

If the aircraft is airborne, select the **Weather** Softkey.

4) Turn the **Joystick** to select the desired map range.

5) The horizontal scan is initially displayed. If desired, select the **Vertical** Softkey to change to vertical scanning.

Vertically scanning a storm cell:

NOTE: *Vertical scanning of a storm cell should be done with the aircraft wings level to avoid constant adjustment of the Bearing Line.*

1) While in the Horizontal Scan view, select the **BRG** Softkey. This places the cursor in the Bearing field and displays the Bearing Line.

If the Bearing Line is not displayed, press the **MENU** Key and turn the large **FMS** Knob to select 'Show Bearing Line'. Press the **ENT** Key.

2) Turn the small **FMS** Knob to place the Bearing Line on the desired storm cell or other area to be vertically scanned.

3) Press the **Vertical** Softkey. A vertical scan of the selected area is now displayed.

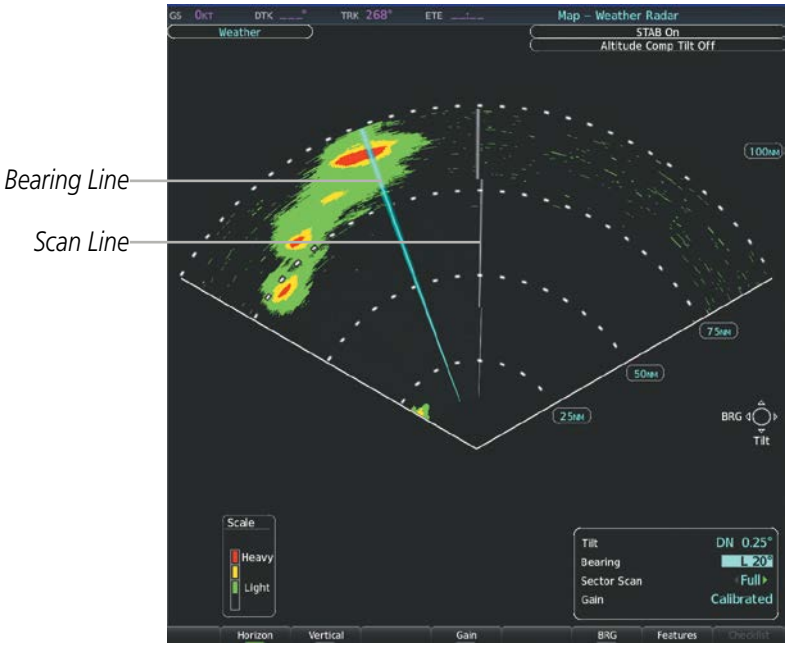


Figure 6-72 Bearing Line on Horizontal Scan

4) The small **FMS** Knob may be used to move the scanned bearing line a few degrees right or left.

5) Turn the **Joystick** to adjust the range.

6) Press the **FMS** Knob to remove the cursor.

7) To select a new area to be vertically scanned, select the **Horizon** Softkey to return to the Horizontal Scan view and repeat the previous steps.

The **Joystick** can also be used to adjust bearing from left to right.

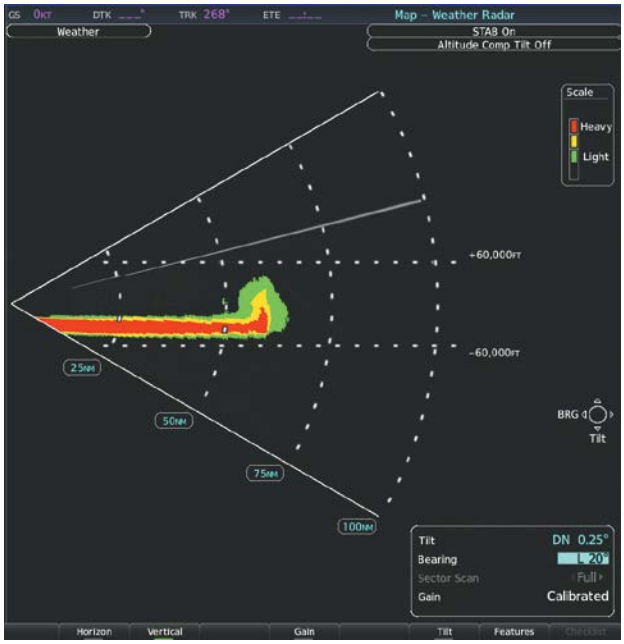


Figure 6-73 Vertical Scan Display

Adjusting Antenna Tilt Angle

In order to make an accurate interpretation of a storm cell, the radar beam should be pointed at the wet part of the weather cell to record the proper rainfall intensity (color level). The ideal aiming point is just below the freezing level of the storm. The best way to find this point is to use the Vertical Scan feature. The antenna tilt angle can be centered on the strongest return area in the vertical scan to get a more accurate view of the coverage and intensity of the target in the horizontal scan.

Adjusting antenna tilt on the Horizontal Scan display:

1) Press the **FMS** Knob to activate the cursor in the Tilt field.
2) Turn the small **FMS** Knob to select the desired antenna tilt angle.
3) Press the **ENT** Key.
4) Press the **FMS** Knob to remove the cursor.

The **Joystick** can also be used to adjust tilt up and down.

Adjusting antenna tilt on the Vertical Scan display:

1) Select the **Tilt** Softkey to activate the cursor in the Tilt field and display the Tilt Line.

   If the Tilt Line is not displayed, press the **MENU** Key and turn the large **FMS** Knob to select Show Tilt Line. Press the **ENT** Key.

2) Turn the small **FMS** Knob to adjust the antenna tilt angle. The selected tilt angle is implemented when Horizontal Scan is again selected.

The **Joystick** can also be used to adjust tilt.

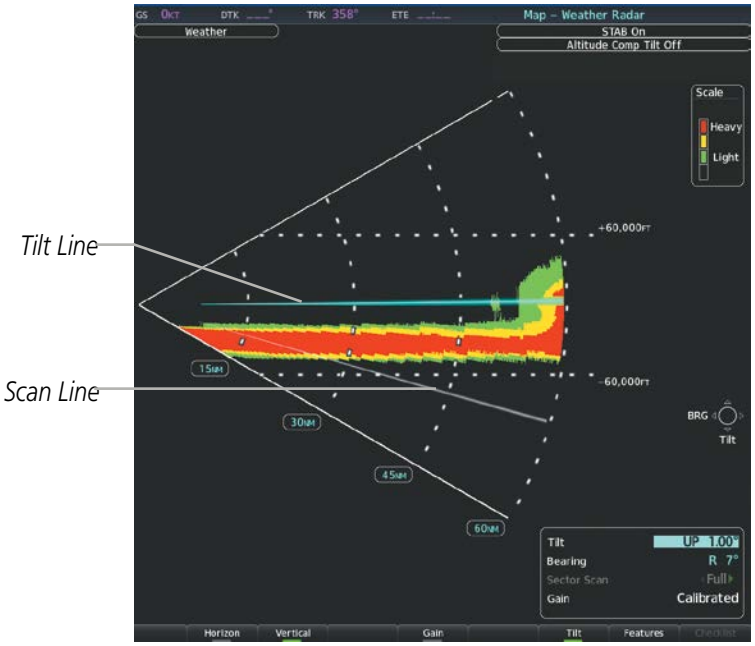
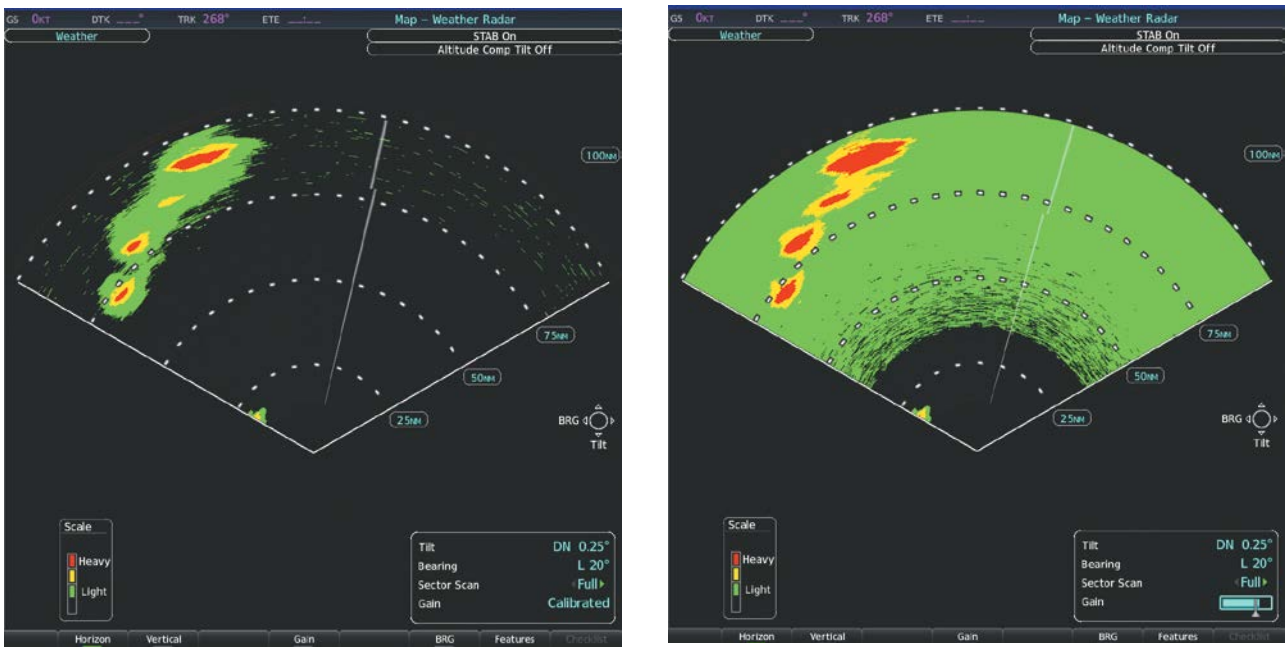


Figure 6-74 Adjusting Antenna Tilt Angle on a Vertical Scan Display

Enabling/disabling manual gain adjustment:

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

1) Select the **Gain** Softkey to activate the cursor in the Gain field.
2) Turn the small **FMS** Knob to adjust the gain for the desirable level. The gain setting is visible in the Gain field as a movable horizontal bar in a flashing box. The line pointer is a reference depicting the calibrated position.
3) Press the **FMS** Knob to remove the cursor.
4) Select the **Gain** Softkey again to return to the calibrated gain setting. 'Calibrated' is displayed in the Gain field.



Calibrated Gain Setting

Manual Gain Set Greater than Calibrated Gain Setting

Figure 6-75 Gain Calibration

Enabling/disabling Sector Scanning:

1) While in horizontal scan mode, press the **BRG** Softkey to display the Bearing Line and place the cursor in the Bearing field. If the Bearing Line is not displayed, press the **MENU** Key and turn the large **FMS** Knob to select Show Bearing Line. Press the **ENT** Key.
2) Turn the small **FMS** Knob to place the Bearing Line in the desired position. The location of the Bearing Line becomes the center point of the Sector Scan.
3) Turn the large **FMS** Knob to place the cursor in the Sector Scan field.
4) Turn the small **FMS** Knob to highlight the desired scan. Selecting 'Full' enables a 90**º** scan.
5) If desired, readjust the Bearing Line as discussed previously to change the center of the Sector Scan.
6) Select the **BRG** Softkey again to remove the Bearing Line and cursor. The bearing reference is reset to 0º.

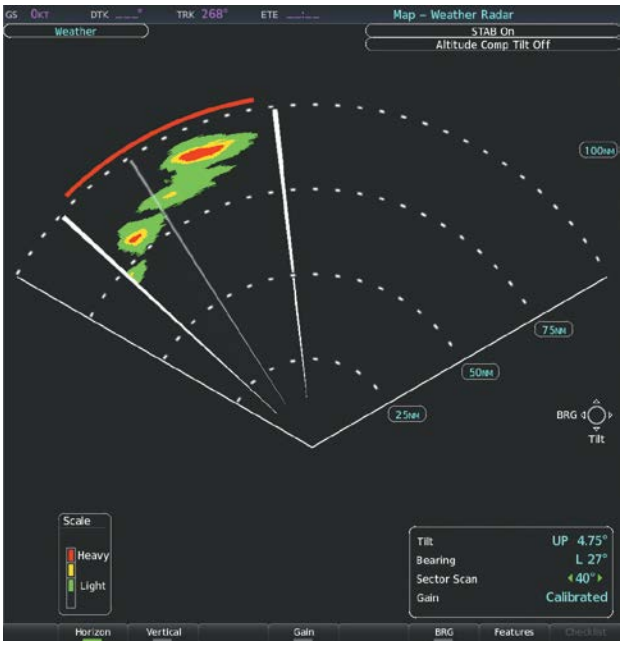


Figure 6-76 40° Sector Scan

Antenna Stabilization

When radar stabilization is active, the radar tilt is corrected for pitch and roll, and therefore is kept steady with respect to an earth fixed reference. The commanded tilt angle is kept constant with respect to the earth. When the stabilization is turned off, corrections are no longer made for pitch and roll, and the radar tilt angle is kept constant with respect to the aircraft reference system.

Enabling/disabling antenna stabilization:

1) On the 'Map - Weather Radar' Page, press the **Mode** Softkey.
2) Press the **STAB** Softkey to enable/disable antenna stabilization. The current stabilization condition is, 'STAB On' or 'STAB Off' is shown in the upper right of the Weather Radar Page.

Weather Attenuated Color Highlight (WATCH™)

While in horizontal scan mode, this feature can be used as a tool to determine areas of possible inaccuracies in displayed intensity due to weakening of the radar energy. This weakening is known as attenuation. The radar energy weakens as it passes through areas of intense precipitation, large areas of lesser precipitation, and distance. Issues with the radome also attenuates the radar energy. All these factors have an effect on the return intensity. The more energy that dissipates, the lesser the displayed intensity of the return. Accuracy of the displayed intensity of returns located in the shaded areas are suspect. Make maneuvering decisions with this information in mind. Proper antenna tilt management should still be employed to determine the extent of attenuation in a shaded area.

Enabling/disabling the WATCH feature:

1) On the 'Map - Weather Radar' Page, select the **Features** Softkey.
2) Select the **WATCH** Softkey to enable/disable the WATCH feature.
3) Select the **Back** Softkey to return to the top-level softkeys.

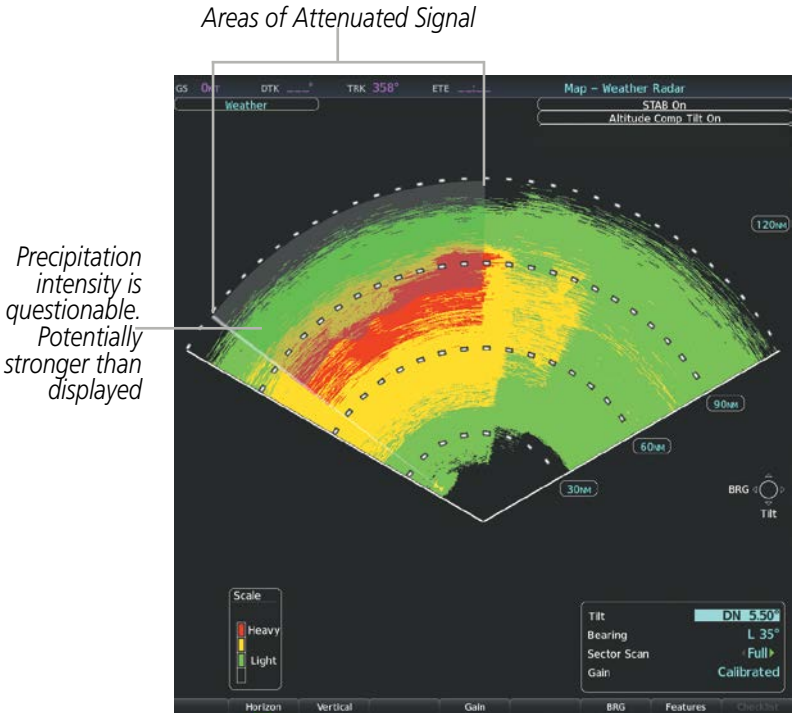


Figure 6-77 Horizontal Scan with WATCH Enabled

Weather Alert

The Weather Alert feature indicates the presence of heavy precipitation between the ranges of 80 and 320 nm regardless of the currently displayed range. Weather Alerts are displayed as red bands along the outer range ring at the approximate azimuth of the detected returns.

If a Weather Alert is detected within ±10° of the aircraft heading, and the **WX ALRT** Softkey is enabled, the system also displays an alert on the PFD in the Alerts Window.

If the antenna tilt is adjusted too low, a weather alert can be generated by ground returns. To avoid unwanted weather alerts, deselect the **WX ALRT** Softkey.

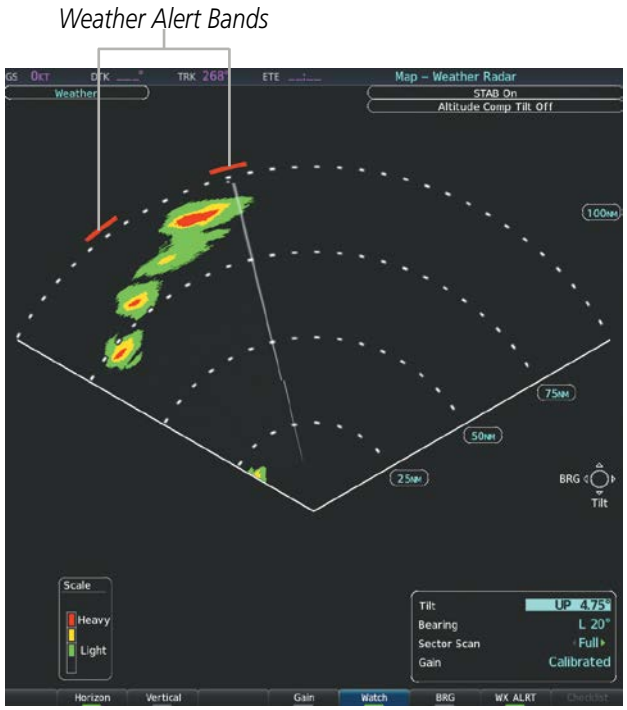


Figure 6-78 Weather Alert Bands on the Weather Radar Page

The pilot can enable or disable the Weather Alert Bands and the Weather Alerts which appear in the Alerts Window on the PFD.

Enabling/disabling the Weather Alerts Bands and Alerts Window Message:

1) Select the 'Map - Weather Radar' Page.
2) Select the **Features** Softkey.
3) Select the **WX ALRT** Softkey to enable/disable the Weather Alert Bands and Alerts Window message for severe weather head.
4) Select the **Back** Softkey to return to the top-level softkeys.

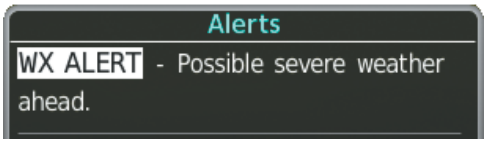


Figure 6-79 Weather Alert on PFD

GROUND MAPPING AND INTERPRETATION

A secondary use of the weather radar system is for the presentation of terrain. This can be a useful tool for verifying aircraft position. A picture of the ground is represented much like a topographical map that can be used as a supplement to the navigation map on the MFD.

Ground Map mode uses a different gain range than Weather mode. Different colors are also used to represent the intensity levels. The displayed intensity of ground target returns are defined in the table below. Use of the **Gain** and **Tilt** Softkeys help improve contrast so that specific ground targets can be recognized more easily. As previously discussed, the type and orientation of the target in relation to the aircraft affects the intensity displayed.

When the weather radar system is in either the Weather or Ground Map mode, the system automatically switches to Standby mode upon landing.

Ground Map Mode Color	Intensity
Black	0 dB
Cyan	> 0 dB to < 9 dB
Yellow	9 dB to < 18 dB
Magenta	18 dB to < 27 dB
Blue	27 dB and greater

Table 6-10 Ground Target Return Intensity Levels

Operation in Ground Map Mode:

1) Select the **Mode** Softkey.
2) Select the **Ground** Softkey to place the radar in Ground Map mode.
3) Select the **Back** Softkey.
4) Press the **FMS** Knob to activate the cursor.
5) Turn the large **FMS** Knob to place the cursor in the Tilt field.
6) Adjust the antenna tilt angle by turning the small **FMS** Knob to display ground returns at the desired distance.
7) Press the **FMS** Knob to remove the cursor.

ADDITIONAL WEATHER RADAR DISPLAYS

The Map - Weather Radar Page is the principal map page for viewing airborne weather radar information. Airborne weather radar information may also be shown as an overlay on the Navigation Map Page. The airborne weather radar is also available on the HSI Map with independent weather radar controls for each PFD, allowing for different settings and modes for each display.

When the airborne weather radar overlay is enabled on a navigation map, a weather radar information box appears on the map. It indicates the selected radar mode, radar range, antenna tilt angle, and gain setting. The navigation map overlay uses a horizontal scan. The GWX 70 allows either horizontal or vertical scan to be selected on the Weather Radar Page, and shows a horizontal scan on the navigation maps with the weather radar overlay.

NOTE: *When viewing airborne weather radar information overlay on the Navigation Map Page, selecting a Heading Up navigation map orientation may be desired, since it is identical to the orientation on the Weather Radar Page.*

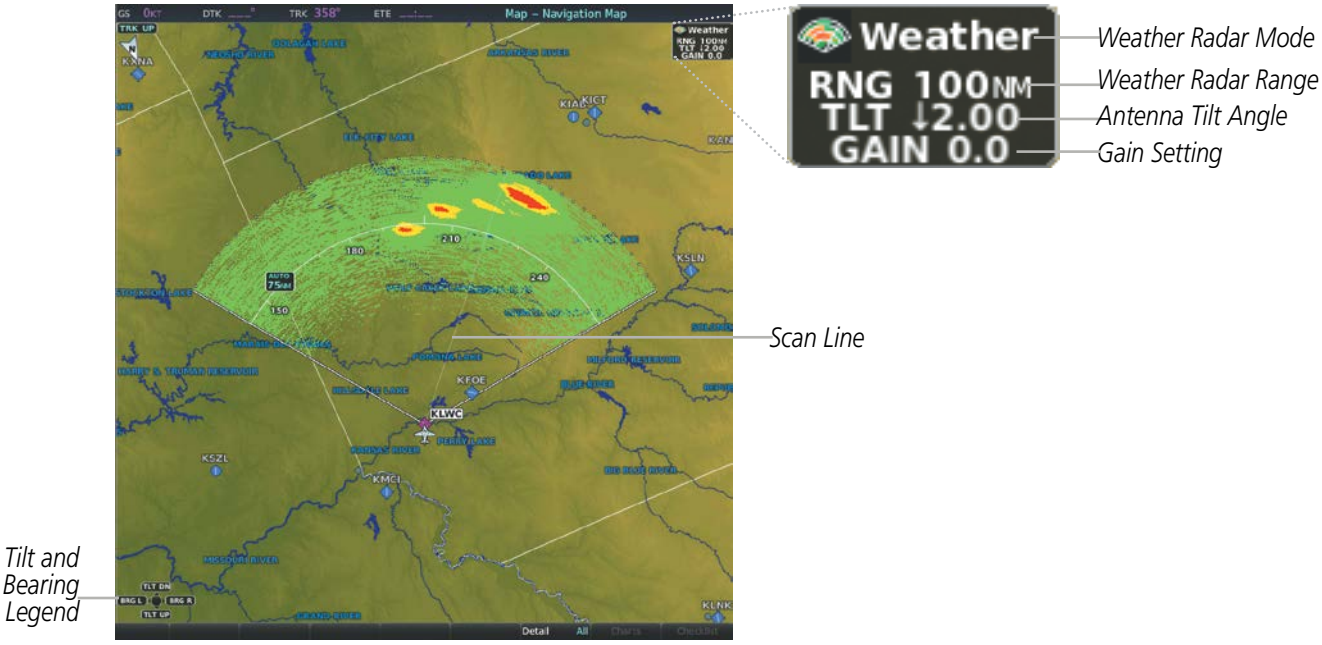


Figure 6-80 Airborne Weather Radar Overlay on the Navigation Map Page

Enabling/disabling Airborne Weather Radar Overlay on the Navigation Map Page:

1) Select the 'Map- Navigation Map' Page.
2) Select the **Map Opt** Softkey.
3) Select the **WX Radar** Softkey.

Or:

1) On the 'Map - Navigation Map' Page, press the **MENU** Key.
2) With 'Map Settings' highlighted, press the **ENT** Key.
3) Turn the small **FMS** Knob to select the 'Weather' group, then press the **ENT** Key.
4) Turn the large **FMS** Knob to scroll through the product selections and highlight the 'Weather Radar' overlay selection ('On' or 'Off'). Turn the small **FMS** knob to highlight the desired selection.
5) To remove the menu, press the **FMS** Knob or **CLR** Key.

Weather radar controls on the Navigation Map Page are limited to adjustment of the radar range, bearing, and antenna tilt angle. The airborne weather radar overlay is viewable at Navigation Map Ranges between 1.5 and 500 nautical miles. At map ranges beyond these limits, the system removes the weather radar information from the map. Adjusting the range on the Navigation Map Page simultaneously adjusts the range of the weather radar proportionally. This radar range is annunciated in the weather radar information box that appears when the overlay is enabled. When the radar range is adjusted on the Navigation Map Page, system synchronizes the same range to the Weather Radar Page.

The radar bearing is adjustable in one degree increments on the Navigation Map Page using the **Joystick** when the overlay is enabled. The bearing line appears on the Navigation Map Page as a white dashed line, and is displayed during and momentarily after adjustment.

Radar antenna tilt angle is adjustable in 0.25 degree increments on the Navigation Map Page using the **Joystick**. An up or down arrow next to the antenna tilt angle setting indicates the direction of the antenna tilt angle.

Adjusting the bearing and antenna tilt angle on the Navigation Map Page:

1) With the weather radar overlay enabled, push the **Joystick** twice. The bearing and tilt legend is displayed in the lower-left corner of the map.
2) Move the **Joystick** up to adjust the antenna tilt angle downward, or move the **Joystick** up to adjust the antenna tilt angle upward.
3) Move the **Joystick** left or right to adjust the bearing line in the desired direction. A dashed bearing line is displayed during and momentarily after adjustment.

If the aircraft is in the air, PFD softkeys control the airborne weather radar overlay for the HSI Map. These softkeys are subdued if the aircraft is on the ground. The pilot and copilot can select a weather radar mode for each PFD (Standby, Weather, Ground), make adjustments to antenna gain, antenna tilt angle, or enable/disable antenna stabilization or Altitude Compensated Tilt features. Weather radar settings on the HSI Map are independent for each PFD. For example, the pilot's PFD may have Weather Mode selected while the copilot's PFD may have Standby Mode selected. The GWX 70 weather radar performs multiple scans as necessary to accommodate displays of weather radar data among the PFDs and MFD.

Controlling of weather radar information on the HSI Map:

1) If necessary, enable the HSI Map on the PFD.
2) On the PFD, press the **Map/HSI** Softkey.
3) Press the **WX Radar** Softkey to enable/disable the airborne weather radar HSI Map overlay.
4) Press the **RDR Opt** Softkey.
5) To select a weather radar mode, press the **Mode SEL** Softkey
   a) Press a softkey for the desired mode: **Standby**, **Weather,** or **Ground**. The selected mode only affects the PFD on which the softkey is selected.
   b) When finished, press the **Back** Softkey.
6) Press the **Gain-** Softkey to decrease the gain setting or press the **Gain+** Softkey to increase the gain setting in increments of 0.5 with each press, or press and hold the softkey for continuous adjustment. A gain setting of 0.0 is equivalent to the calibrated gain setting.
7) Move the PFD **Joystick** up to adjust the antenna tilt angle downward, or move the **Joystick** down to adjust the antenna tilt angle upward.
8) Press the **STAB** Softkey to enable/disable antenna stabilization feature.
9) Press the **ACT** Softkey to enable/disable the Altitude Compensated Tilt feature.
10) When finished adjusting the HSI Map display of the airborne weather radar, press the **Back** Softkey.

The weather radar overlay uses the same colors as those shown on the Weather Radar Page to indicate the intensity of radar returns. However, the display of gray WATCH radar attenuation and red weather alert bands is exclusive to the Weather Radar Page. Because data link radar precipitation and relative terrain present information using similar colors, enabling the airborne weather radar overlay on the navigation amps disables the display of the data link radar and relative terrain information for this page.

SYSTEM STATUS

The system displays the radar mode annunciation in the upper left corner of the Weather Radar Page. Additional information may be displayed in the center of the Weather Radar Page as a center banner annunciation. Refer to the following tables for a list of annunciations and their locations for airborne weather radar.

Radar Mode	Radar Mode Annunciation Box	Center Banner Annunciation
Standby	Standby	STANDBY
Weather	Weather	None
Ground Mapping	Ground	None
Radar Failed*	FAIL	RADAR FAIL

** See Table 6-12 for additional failure annunciations*

Table 6-11 Radar Modes on the Weather Radar Page

The system displays the status of the weather radar features in the upper-right corner of the Weather Radar Page.

Radar Feature Status	Description
STAB On	Antenna stabilization is selected on.
STAB Off	Antenna stabilization is selected off.
STAB Inop	The radar is not receiving pitch and roll information. The antenna stabilization feature is inoperative.
Altitude Comp Tilt On	The altitude-compensated tilt feature is selected on.
Altitude Comp Tilt Off	The altitude-compensated tilt feature is selected off.

Table 6-12 Radar Feature Status Annunciations on the Weather Radar Page

If the weather radar unit fails, an annunciation as to the cause of the failure is shown as a banner in the center of the Weather Radar Page.

Weather Radar Page Center Banner Annunciation	Description
BAD CONFIG	The radar configuration is invalid. The radar should be serviced.
RDR FAULT	The radar unit is reporting a fault. The radar should be serviced.
RADAR FAIL	The system is not receiving valid data from the radar unit. The system should be serviced.

Table 6-13 Abnormal Radar Status Annunciations on the Weather Radar Page

6.4 TERRAIN DISPLAYS

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

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

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

NOTE: *Terrain and obstacle alerting requires the Terrain-SVT or TAWS-B option. No terrain or obstacle alerting occurs for the Terrain Proximity feature.*

The terrain system increases situational awareness and aids in reducing controlled flight into terrain (CFIT) and obstacles.

One of the following terrain systems is installed on this aircraft:

- Terrain Proximity
- Terrain-SVT (included with the Garmin SVT option when the Terrain Awareness and Warning System Class-B (TAWS-B) is not installed; refer to the Flight Instruments section for more information about Garmin SVT.)
- TAWS-B (optional)

The installed terrain system provides color indications on map displays when terrain or obstacles are within a certain altitude threshold from the aircraft. Terrain-SVT and TAWS-B furthermore provide advisory visual annunciations and voice alerts to indicate the presence of threatening terrain or obstacles relevant to the projected flight path. This alerting capability is **not** present in the Terrain Proximity feature. Compared to Terrain-SVT alerting, TAWS-B uses more sophisticated algorithms to assess aircraft distance from terrain and obstacles. Only the TAWS-B system complies with TSO-C15b certification standards, and includes additional alerting capabilities than the Terrain-SVT system.

The terrain system requires the following for proper operation:

- Valid 3-D GPS position
- Valid terrain and obstacle databases

The terrain system uses terrain and obstacle information supplied by government sources. Terrain information is based on terrain elevation information in a database that may contain inaccuracies. Individual obstructions may be shown if available in the database. Garmin verifies the data to confirm accuracy of the content. However, the displayed information should never be understood as being all-inclusive and data may still contain inaccuracies.

The terrain system uses information provided from the GPS receiver to provide a horizontal position and altitude. GPS altitude is derived from satellite measurements. GPS altitude is then converted to the height above geodetic sea level (GSL), which is the height above mean sea level (MSL) calculated geometrically. The system

uses GSL altitude to determine alerts for the Terrain-SVT and TAWS-B systems. GSL altitude accuracy is affected by satellite geometry, but is not subject to variations in pressure and temperature that normally affect pressure altitude sensors. GSL altitude does not require local altimeter settings to determine MSL altitude. It is a widely-used MSL altitude source. Therefore, GSL altitude provides a highly accurate and reliable MSL altitude source to calculate terrain and obstacle alerts.

The terrain and obstacle databases used by the terrain system are referenced to MSL. Using the GPS position and GSL altitude, terrain system displays a 2-D picture of the surrounding terrain and obstacles relative to the position and altitude of the aircraft. Furthermore, the system uses the GPS position and GSL altitude to calculate and "predict" the aircraft's flight path in relation to the surrounding terrain and obstacles. In this manner, the Terrain-SVT or TAWS-B systems can provide advanced alerts of predicted dangerous terrain conditions.

Baro-corrected altitude (or indicated altitude) is derived by adjusting the altimeter setting for local atmospheric conditions. The most accurate baro-corrected altitude can be achieved by frequently updating the altimeter setting to the nearest reporting station along the flight path. However, because actual atmospheric conditions seldom match the standard conditions defined by the International Standard Atmosphere (ISA) model (where pressure, temperature, and lapse rates have fixed values), it is common for the baro-corrected altitude (as read from the altimeter) to differ from the GSL altitude. This variation results in the aircraft's GSL altitude differing from the baro-corrected altitude.

RELATIVE TERRAIN SYMBOLOGY

The terrain system uses colors and symbols to represent terrain and obstacles (with heights greater than 200 feet above ground level, AGL) present in the databases relative to aircraft altitude. The system dynamically adjusts these colors as the aircraft altitude changes, and after takeoff and landing.

While the aircraft is on the ground, the system displays relative terrain 400 feet or more above the aircraft altitude using red, and terrain at less than 400 feet above aircraft altitude using black, as shown on the On-Ground Legend. When the aircraft is in the air, the system displays relative terrain information using red, yellow, green, and black, as shown on the In-Air Legend. As the aircraft transitions from on-ground to in-air, or from in-air to on-ground, the display of relative terrain momentarily fades into the corresponding colors. For Terrain-SVT or TAWS-B systems, if an alert occurs, the relative terrain colors transition to the In-Air Legend if the On-Ground Legend was shown in order to provide the pilot with the most information possible.

Figure 6-81 Relative Terrain Legend

The following figure shows relative terrain coloring for the Terrain-SVT and TAWS-B systems.

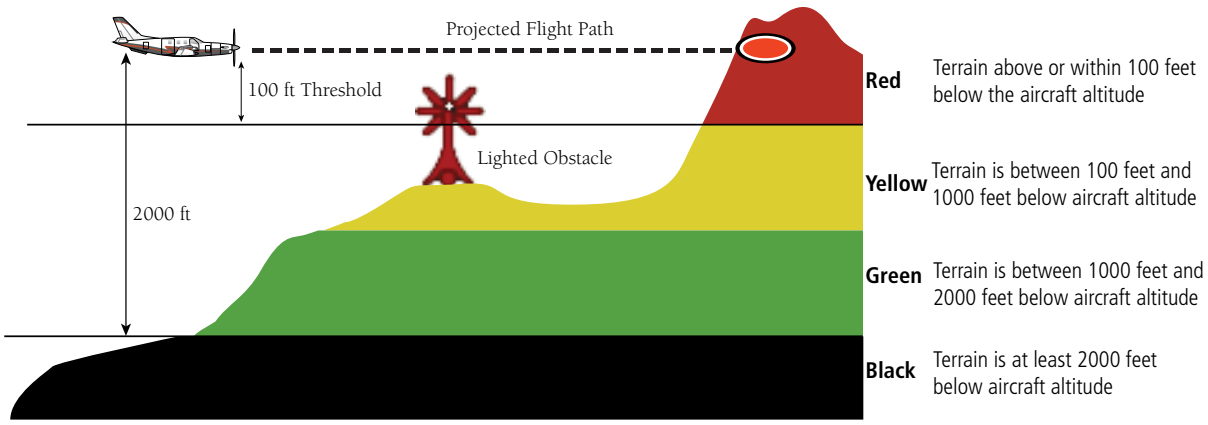


Figure 6-82 Terrain Altitude/Color Correlation for Terrain-SVT or TAWS-B Systems

NOTE: *The Vertical Situation Display (VSD) Inset Window shows terrain at least 2000 feet below the aircraft altitude as gray.*

The following tables show the relative obstacle coloring used by the terrain systems.

Unlighted Obstacle		Lighted Obstacle		Obstacle Location
< 1000' AGL	> 1000' AGL	< 1000' AGL	> 1000' AGL	
				Red obstacle is above or within 100 ft below the aircraft altitude
				Yellow obstacle is between 100 ft and 1000 ft below the aircraft altitude
				White obstacle is more than 1000 ft below aircraft altitude

Table 6-14 Relative Obstacle Symbols and Colors

Unlighted Wind Turbine Obstacle	Lighted Wind Turbine Obstacle	Wind Turbine Obstacle Location
		Red obstacle is above or within 100 ft below the aircraft altitude
		Yellow obstacle is between 100 ft and 1000 ft below the aircraft altitude
		White obstacle is more than 1000 ft below aircraft altitude

Table 6-15 Wind Turbine Obstacles and Colors

The Terrain-SVT and TAWS-B systems show potential impacts areas for terrain and obstacles using yellow and red as shown in the the following table.

Potential Impact Area Examples	Alert Type	Example Annunciation
	Warning	
	Caution	

Table 6-16 Terrain-SVT and TAWS-B Potential Impact Area with Annunciations

The Map - Terrain Proximity/Terrain-SV/TAWS-B Page is the principal map page for viewing terrain information. Terrain and obstacle information can be displayed on the following maps and pages:

- PFD Maps
- Navigation Map Page
- Terrain Proximity/Terrain-SVT/TAWS-B Page
- Trip Planning Page
- Flight Plan Page

Displaying terrain and obstacle information (MFD maps other than the terrain page):

1) Press the **Map Opt** Softkey (for the PFD Inset Map, press the **Map/HSI** Softkey).
2) Press the **TER** Softkey until **REL** is shown to display terrain and obstacle data.

When relative terrain is selected on maps other than the terrain page, an icon to indicate the feature is enabled for display and a legend for the relative terrain colors are shown.

The Navigation Map Page Setup Menu provides a means in addition to the softkey for enabling/disabling display of terrain and obstacles. The setup menu also controls the map range settings above which terrain and obstacle data are decluttered from the display. If a map range larger than the map range setting is selected, the data is removed from the map.

Terrain information can be selected for display independently of obstacle data.

Maps besides the Terrain Page use settings based on those selected for the Navigation Map Page. The maximum display ranges for obstacles on each map are dependent on the range setting made for the Navigation Map.

Customizing terrain and obstacle display on the Navigation Map Page:

1) Select the 'Map - Navigation Map' Page.
2) Press the **MENU** Key.
3) With 'Map Settings' highlighted, press the **ENT** Key.
4) Turn the small **FMS** Knob to select the 'Map' Group and press the **ENT** Key.
5) Turn the large **FMS** Knob or press the **ENT** Key to scroll through selections.

- Terrain Display – Turns the display of relative ('REL') terrain data on or off and sets maximum range at which terrain is shown
- Point Obstacle – Turns the display of obstacle data on or off and sets maximum range at which obstacles are shown

6) Turn the small **FMS** Knob to scroll through options for each item (On/Off, range settings, etc.).

7) Press the **ENT** Key to select an option.

8) Press the **FMS** Knob or **CLR** Key to return to the 'Map- -Navigation Map' Page with the changed settings.

Additional information about obstacles can be displayed by panning over the display on the map. The map panning feature is enabled by pressing the **Joystick**. The map range is adjusted by turning the **Joystick**. If the map range is adjusted while panning is enabled, the map is re-centered on the Map Pointer.

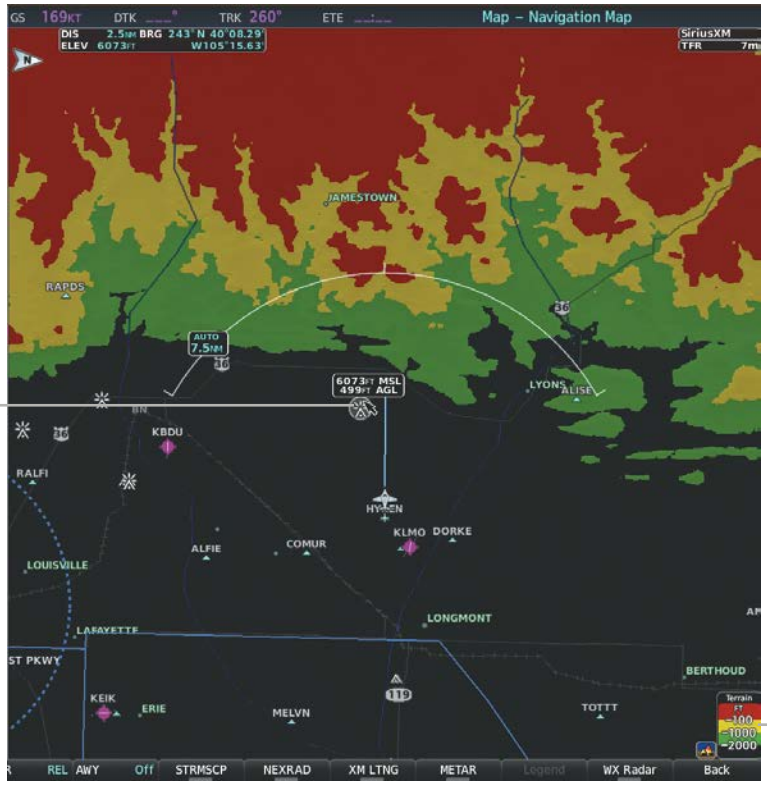


Figure 6-83 Relative Terrain Information on the Navigation Map Page

TERRAIN PAGE

The Map - Terrain Proximity/Terrain-SVT/TAWS-B Page is specialized to show terrain, and obstacle in relation to the aircraft's current altitude, without clutter from the basemap. This page is the principal page for viewing terrain information. Aviation data (airports, VORs, and other NAVAIDs) can be enabled for reference.

For Terrain-SVT and TAWS-B systems, this page also shows potential impact areas. If an obstacle and the projected flight path of the aircraft intersect, the display automatically adjusts to a map range if necessary to emphasize the display of the potential impact area.

Aircraft orientation on this map is always heading up unless there is no valid heading, in which case the orientation is track up. Map range is adjustable with the **Joystick** from 1 to 200 nm, as indicated by the map range arcs.

Displaying the terrain page:

1) Turn the large **FMS** Knob to select the Map Page Group.
2) Turn the small **FMS** Knob to select the Map - Terrain Proximity/Terrain-SVT/TAWS-B Page.

Showing/hiding aviation information on the terrain page:

1) Press the **MENU** Key.
2) Select 'Show Aviation Data' or 'Hide Aviation Data' (choice dependent on current state) and press the **ENT** Key.

Figure 6-84 TAWS-B Page

VERTICAL SITUATION DISPLAY (VSD) TERRAIN

The system offers a Vertical Situation Display (VSD), which includes a profile of terrain and obstacles in an inset window on the bottom of the Navigation Map Page. Although the VSD does not display Terrain-SVT or TAWS-B alerts and potential impact areas, the VSD does use many of the same colors and symbols as these systems to depict relative terrain and obstacles within the VSD.

Enabling/Disabling the Vertical Situation Display (VSD):

1) Select the 'Map - Navigation Map' Page.
2) Select the **Map Opt** Softkey.
3) Select the **Inset** Softkey.
4) Select the **VSD** Softkey to enable or disable the VSD.

Or:

1) Select the 'Map - Navigation Map' Page.
2) Press the **MENU** Key.
3) Select 'Show VSD' or 'Hide VSD' (choice dependent on current state) and press the **ENT** Key.

The same controls which enable/disable the display of relative terrain and obstacles on the Navigation Map Page also control the display of this information in the VSD.

VSD DISPLAY

When the VSD is enabled, terrain and obstacles in the VSD will be shown if the aircraft altitude is low enough or the VSD altitude range is high enough for the terrain to be in view (absolute terrain will be shown in gray if the **TER** Softkey is selected off on the Navigation Map Page).

The depicted terrain profile represents an approximate forward-looking contour of the terrain based upon the highest reported terrain elevations, measured at intervals defined by the terrain database resolution, within a predefined width along the aircraft track between the aircraft present position and the end of the map range. The predefined width is determined by the flight phase, as annunciated on the HSI, and is widest during enroute or oceanic phases.

Flight Phase	Total VSD Width
Approach	0.6 nm
Departure	0.6 nm
Terminal	2.0 nm
Enroute	4.0 nm
Oceanic	4.0 nm

Table 6-17 VSD Terrain Width Varies with Phase of Flight

The forward looking swath of terrain is based on the selected VSD Mode, annunciated in the top-left corner of the VSD Inset Window. In Flight Plan Mode, the contour follows the active flight plan, and if no active flight plan is present, the VSD Inset Window displays 'Flight Plan Not Available'. In Track Mode, the contour is based on the aircraft ground track. In Auto Mode, the contour is based on the active flight plan, when available, otherwise, it is based on the ground track.

Selecting a VSD Mode:

1) Select the 'Map - Navigation Map' Page.
2) Select the **Inset** Softkey.
3) Select the **VSD** Softkey displaying the VSD mode in cyan. Each press of the softkey cycles through a mode selection: FPL (flight plan), TRK (track), or Auto.

When the Navigation Map range is adjusted with the **Joystick**, the horizontal distance of the VSD is adjusted to match the distance shown on the map range arc, down to one nautical mile. If the Navigation Map range is adjusted below one nautical mile, the VSD range remains at one nautical mile. When Navigation Map range is adjusted to remove altitude-correlated colored terrain data (as shown in the Terrain Legend) or obstacles from the Navigation Map, these items are also removed from the VSD; only an outline of the terrain will be displayed in black in the VSD Inset Window.

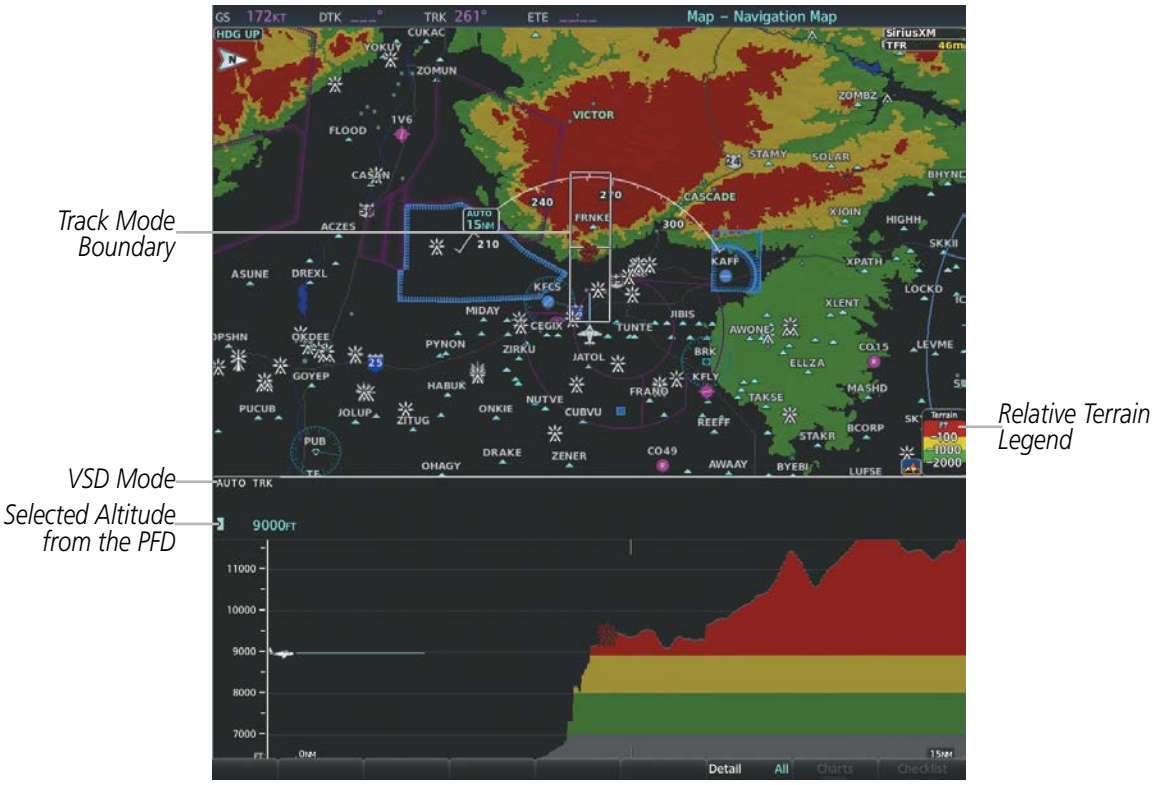


Figure 6-85 VSD on the Navigation Map Page with Relative Terrain Information

Obstacles with heights greater than 200 feet AGL appear relative to aircraft altitude along the altitude scale. The top of the obstacle symbol on the scale represents the obstacle's height AGL. If the obstacle's height AGL is higher than can be represented by the obstacle symbol itself (e.g. for especially tall obstacles), a vertical line appears below the obstacle symbol in order to depict the top of the obstacle symbol at its height AGL, as shown in the following figure.

Figure 6-86 VSD with Tall Obstacles

TRACK MODE BOUNDARY

The Track Mode Boundary represents the horizontal and lateral boundaries of the VSD. The boundary is shown as a white rectangle on the Navigation Map Page and is only available when the VSD is enabled in Track Mode. White range markers both edges of the Track Mode Boundary rectangle match the range markers along the distance scale inside the VSD Inset Window whenever the profile range is at least 2500 feet (or 500 meters if metric distance units are selected).

The Track Mode Boundary may be enabled/disabled, and the Navigation Map range at which the Profile Path is removed from map display can be changed.

Customizing the Track Mode Boundary display on the Navigation Map Page:

1) Select the 'Map - Navigation Map' Page.
2) Press the **MENU** Key.
3) With 'Map Settings' highlighted, press the **ENT** Key.
4) Turn the small **FMS** Knob to select the 'VSD' Group and press the **ENT** Key.
5) Turn the large **FMS** Knob or press the **ENT** Key to scroll through product selections.
   - TRK Mode BNDRY – Enables/disables the display of the Track Mode Boundary and sets maximum range at which Track Mode Boundary is shown.
6) Turn the small **FMS** Knob to scroll through options (On/Off range settings).
7) Press the **ENT** Key to select an option.
8) Press the **FMS** Knob or **CLR** Key to return to the 'Map - Navigation Map' Page with the changed settings.

TERRAIN-SVT AND TAWS-B ALERTING DISPLAYS

Alerts are issued when flight conditions meet parameters that are set within Terrain-SVT or TAWS-B software algorithms. Terrain alerts typically employ a CAUTION or a WARNING alert severity level, or both. When an alert is issued, visual annunciations are displayed and voice alerts are simultaneously issued.

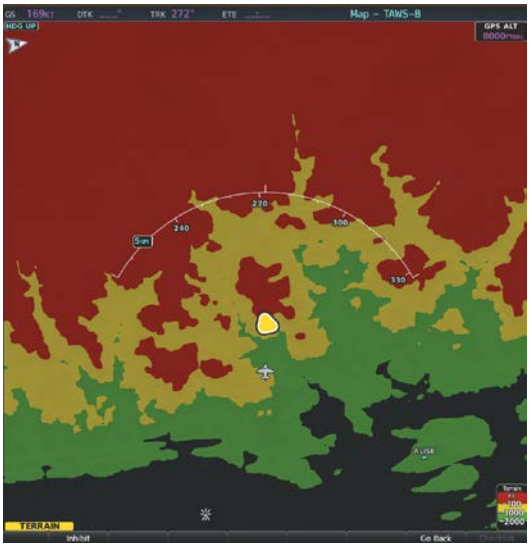
When an alert is issued, annunciations appear on the PFDs and MFD. The terrain alert annunciation appears to the left of the Selected Altitude box on the PFD, and bottom left on the MFD. If the terrain page is not displayed at the time, a pop-up alert appears on the MFD. To acknowledge the pop-up alert:

- Press the **CLR** Key (returns to the currently viewed page), or
- Press the **ENT** Key (accesses the Terrain-SVT or TAWS-B Page)

TAWS Terrain Caution Annunciation

PFD with TAWS-B Annunciation

MFD Pop-Up Alert (if not viewing Terrain-SVT or TAWS-B Page



MFD TAWS-B Page with Alert Annunciation

Figure 6-87 Example TAWS-B Annunciations

The following table lists the Terrain-SVT alerts.

Alert Type	PFD/MFD* Alert Annunciation	MFD Pop-Up Alert (except Terrain-SVT Page)	Voice Alert
Reduced Required Terrain Clearance Warning (RTC)	TERRAIN	WARNING - TERRAIN	"Warning; Terrain, Terrain"
Imminent Terrain Impact Warning (ITI)	TERRAIN	WARNING - TERRAIN	"Warning; Terrain, Terrain"
Reduced Required Obstacle Clearance Warning (ROC)	TERRAIN	WARNING - OBSTACLE	"Warning; Obstacle, Obstacle"
Imminent Obstacle Impact Warning (IOI)	TERRAIN	WARNING - OBSTACLE	"Warning; Obstacle, Obstacle"
Reduced Required Terrain Clearance Caution (RTC)	TERRAIN	CAUTION - TERRAIN	"Caution; Terrain, Terrain"
Imminent Terrain Impact Caution (ITI)	TERRAIN	CAUTION - TERRAIN	"Caution; Terrain, Terrain"
Reduced Required Obstacle Clearance Caution (ROC)	TERRAIN	CAUTION - OBSTACLE	"Caution; Obstacle, Obstacle"
Imminent Obstacle Impact Caution (IOI)	TERRAIN	CAUTION - OBSTACLE	"Caution; Obstacle, Obstacle"

** Annunciation is displayed on the MFD when terrain display is enabled.*

Table 6-18 Terrain-SVT Alerts Summary

The following table lists the TAWS-B alerts.

Alert Type	PFD/MFD** Alert Annunciation	MFD Pop-Up Alert (except TAWS-B Page)	Voice Alert
Excessive Descent Rate Warning (EDR)	PULL UP	PULL-UP	"Pull Up"
Reduced Required Terrain Clearance Warning (RTC)	PULL UP	TERRAIN - PULL-UP or TERRAIN AHEAD - PULL-UP *	"Terrain, Terrain; Pull Up, Pull Up" or "Terrain Ahead, Pull Up; Terrain Ahead, Pull Up"*
Imminent Terrain Impact Warning (ITI)	PULL UP	TERRAIN - PULL-UP or TERRAIN AHEAD - PULL-UP	"Terrain, Terrain; Pull Up, Pull Up"* or "Terrain Ahead, Pull Up; Terrain Ahead, Pull Up"
Reduced Required Obstacle Clearance Warning (ROC)	PULL UP	OBSTACLE - PULL-UP or OBSTACLE AHEAD - PULL-UP *	"Obstacle, Obstacle; Pull Up, Pull Up" or "Obstacle Ahead, Pull Up; Obstacle Ahead, Pull Up"*
Imminent Obstacle Impact Warning (IOI)	PULL UP	OBSTACLE - PULL-UP * or OBSTACLE AHEAD - PULL-UP	"Obstacle, Obstacle; Pull Up, Pull Up"* or "Obstacle Ahead, Pull Up; Obstacle Ahead, Pull Up"
Reduced Required Terrain Clearance Caution (RTC)	TERRAIN	CAUTION - TERRAIN or TERRAIN AHEAD *	"Caution, Terrain; Caution, Terrain" or "Terrain Ahead; Terrain Ahead"*
Imminent Terrain Impact Caution (ITI)	TERRAIN	CAUTION - TERRAIN * or TERRAIN AHEAD	"Caution, Terrain; Caution, Terrain"* or "Terrain Ahead; Terrain Ahead"
Reduced Required Obstacle Clearance Caution (ROC)	TERRAIN	CAUTION - OBSTACLE or OBSTACLE AHEAD *	"Caution, Obstacle; Caution, Obstacle" or "Obstacle Ahead; Obstacle Ahead"*
Imminent Obstacle Impact Caution (IOI)	TERRAIN	CAUTION - OBSTACLE * or OBSTACLE AHEAD	"Caution, Obstacle; Caution, Obstacle"* or "Obstacle Ahead; Obstacle Ahead"
Premature Descent Alert Caution (PDA)	TERRAIN	TOO LOW - TERRAIN	"Too Low, Terrain"
Altitude Voice Callout (VCO) "500"	None	None	"Five-Hundred"
Excessive Descent Rate Caution (EDR)	TERRAIN	SINK RATE	"Sink Rate"
Negative Climb Rate Caution (NCR)	TERRAIN	DON'T SINK * or TOO LOW - TERRAIN	"Don't Sink"* or "Too Low, Terrain"

** Alerts with multiple messages are configurable at installation and are installation-dependent. Alerts for the default configuration when more than one option is available are indicated with asterisks.*
*** Annunciation is displayed on the MFD when terrain display is enabled.*

Table 6-19 TAWS-B Alerts Summary

EXCESSIVE DESCENT RATE ALERT

The purpose of the **Excessive Descent Rate (EDR)** alert is to provide suitable notification when the aircraft is determined to be closing (descending) upon terrain at an excessive speed. Figure 6-153 shows the parameters for the alert as defined by TSO-C151b.

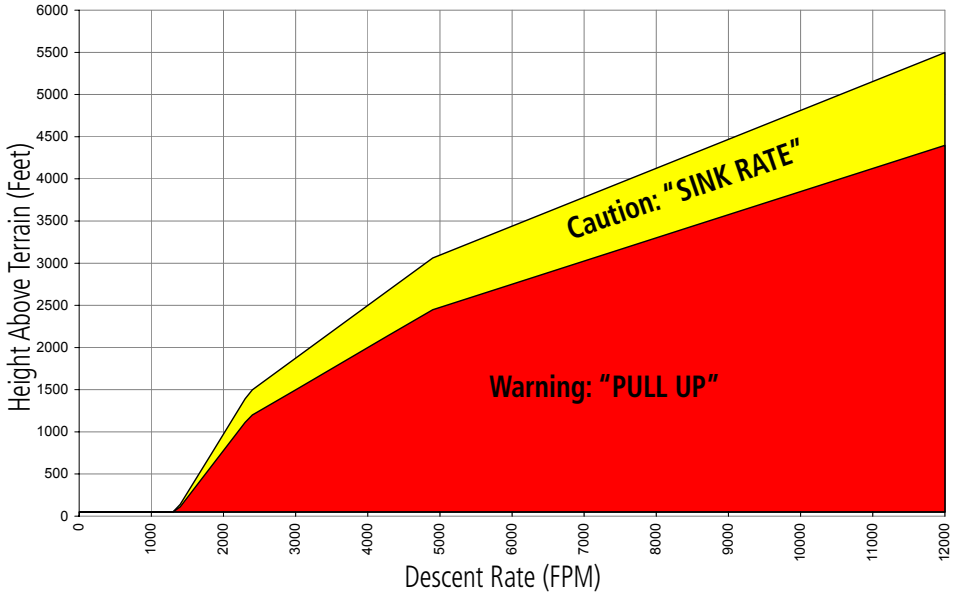


Figure 6-88 Excessive Descent Rate Alert Criteria

FORWARD LOOKING TERRAIN AVOIDANCE

The Forward Looking Terrain Avoidance (FLTA) feature of Terrain-SVT or TAWS-B compares the projected flight path as derived from GPS data with terrain features and obstacles from the terrain and obstacle databases. The system issues FLTA alerts when the projected flight path conflicts with terrain or obstacles.

The projected flight path is a calculated area ahead of, to the sides, and below the aircraft. The size of the projected flight path varies based on factors including ground speed (the path ahead is larger when the ground speed is higher), whether the aircraft is level, turning, or descending, and the proximity to the nearest 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 pilot manually inhibits them.

There are two types of FLTA alerts, Reduced Required Terrain/Obstacle Clearance (RTC or ROC respectively) and Imminent Terrain/Obstacle Impact (ITI or IOI respectively).

Figure 6-89 FLTA Alert Minimum Terrain and Obstacle Clearance Values

The system automatically disables FLTA alerts when the aircraft is less than 200 feet above the destination runway elevation while within 0.5 nm of the approach runway or the aircraft is between runway ends.

When Terrain-SVT or TAWS-B FLTA alerts are manually inhibited, the annunciation is shown on the PFDs and in the MFD for maps displaying relative terrain

Terrain-SVT System *TAWS-B System*

Figure 6-90 FLTA Alerting is Inhibited when Annunciation is displayed

Inhibiting Terrain-SVT or TAWS-B FLTA and PDA Alerting:

1) Select the Terrain Page.

2) Select the **Inhibit** Softkey.

Or:

a) Press the **MENU** Key.

b) Turn the **FMS** Knob to highlight 'Inhibit Terrain' or 'Inhibit TAWS'.

c) Press the **ENT** Key.

ADDITIONAL TAWS-B ALERTING

In addition to the FLTA alerting discussed previously, TAWS-B provides the following additional types of alerts.

PREMATURE DESCENT ALERTING

A **Premature Descent Alert (PDA)** is issued when the system detects that the aircraft is significantly below the normal approach path to a runway.

PDA alerting begins when the aircraft is below 700 feet AGL within 15 nm of the destination airport and ends when the aircraft is 0.5 nm from the runway threshold.

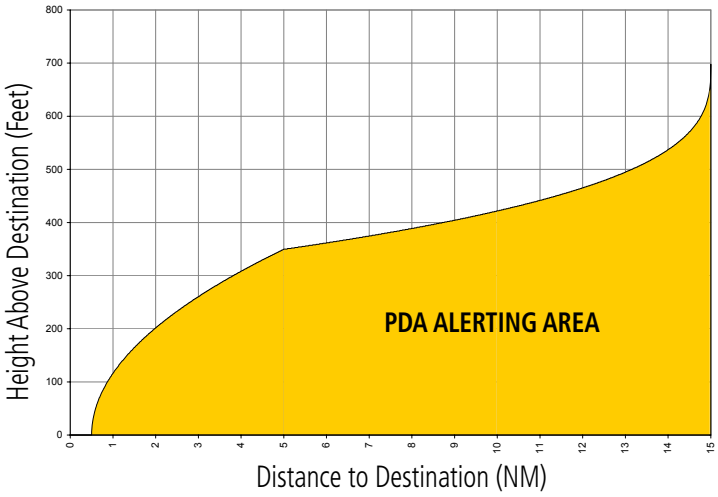


Figure 6-91 PDA Alerting Threshold

ALTITUDE VOICE CALLOUT (VCO) ALERT

The system provides a ***"Five-hundred"*** voice alert when the aircraft descends to within 500 feet above the terrain or runway threshold. When the aircraft is within five nautical miles of an airport, the ***"Five Hundred"*** voice alert is based on the nearest runway threshold elevation. When the aircraft is more than five nautical miles from the nearest airport, the ***"Five Hundred"*** voice alert is based on the height above terrain, by comparing the aircraft's GPS-GSL altitude to the terrain database.

There are no display annunciations or pop-up alerts that accompany the VCO alert. This alert cannot be inhibited.

NEGATIVE CLIMB RATE AFTER TAKEOFF ALERT (NCR)

The **Negative Climb Rate (NCR) After Takeoff** alert (also referred to as "Altitude Loss After Takeoff") provides alerts when the system determines the aircraft is losing altitude (closing upon terrain) after takeoff. The voice alert ***"Don't Sink"*** is given for NCR alerts, accompanied by visual annunciations. NCR alerting is only active when departing from an airport and when the following conditions are met:

- Height above the terrain is less than 700 feet
- Distance from the departure airport is 5 nm or less

- Heading change from the departure heading is less than 110 degrees

NCR alerts can be triggered by either altitude loss or sink rate.

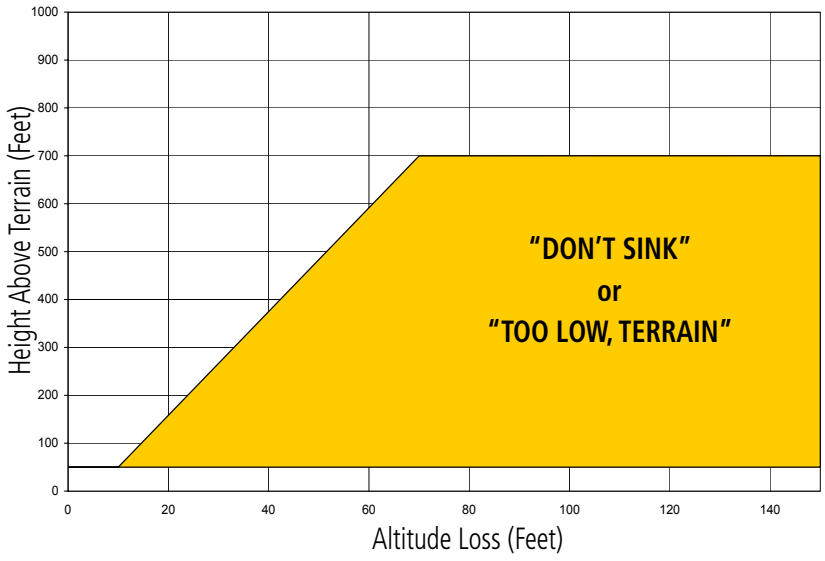


Figure 6-92 Negative Climb Rate (NCR) Altitude Loss

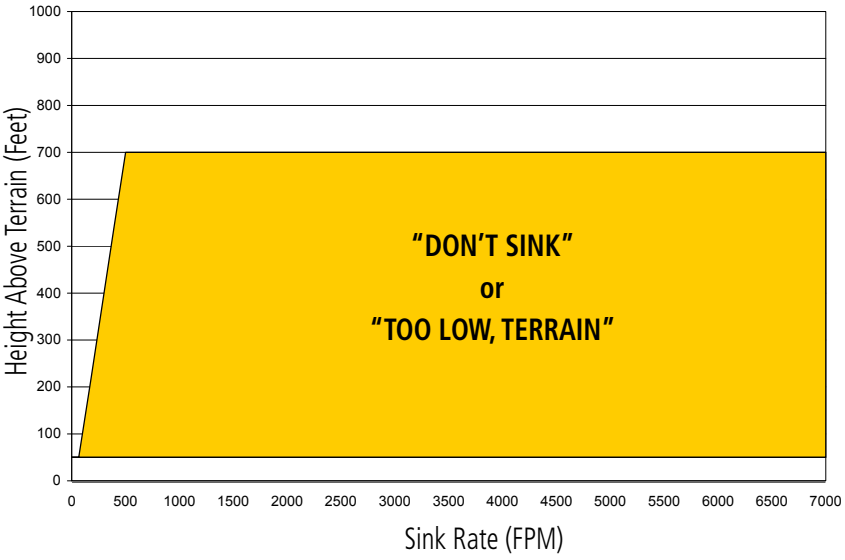


Figure 6-93 Negative Climb Rate (NCR) Sink Rate

SYSTEM STATUS

TERRAIN-SVT

During power-up, Terrain-SVT conducts a self-test of its visual annunciations and voice alerts. An voice alert is issued at test completion.

Terrain-SVT continually monitors several system-critical items such as database validity, hardware status, and GPS status. If the terrain/obstacle database is not available, the system issues the voice alert ***"Terrain System Failure"*** along with the 'TER FAIL' alert annunciation.

Terrain-SVT requires a 3-D GPS navigation solution along with specific vertical accuracy minimums. Should the navigation solution become degraded or if the aircraft is out of the database coverage area, the annunciation 'TER N/A' is generated in the annunciation window and on the Terrain-SVT Page. The voice alert ***"Terrain System Not Available"*** is generated. When sufficient GPS signal is returns and the aircraft is within the database coverage area, the voice alert "***Terrain System Available***" is generated.

Alert Type	PFD/MFD† Alert Annunciation	Terrain-SVT Page Center Banner Annunciation	Voice Alert
System Test in Progress	TER TEST	TERRAIN TEST	None
System Test Pass	None	None	"Terrain System Test OK"
Terrain Alerting Inhibited	TER INH	None	None
No GPS position	TER N/A	NO GPS POSITION	"Terrain System Not Available"*
Excessively degraded GPS signal; or Out of database coverage area	TER N/A	None	"Terrain System Not Available"*
Terrain System Test Fail; Terrain or Obstacle database unavailable or invalid; Invalid software configuration; or System audio fault	TER FAIL	TERRAIN FAIL	"Terrain System Failure"
MFD Terrain or Obstacle database unavailable or invalid, and Terrain-SVT operating with PFD Terrain or Obstacle databases	None	TERRAIN DATABASE FAILURE	None

† *Annunciation is shown on Terrain-SVT Page and the Navigation Map Page when Terrain is enabled.*
* *"Terrain System Available" will be heard when sufficient GPS signal is received, or Terrain database coverage area re-entered.*

Table 6-20 Terrain-SVT System Status Annunciations

TAWS-B

During power-up, TAWS-B conducts a self-test of its visual annunciations and voice alerts. An voice alert is issued at test completion.

TAWS-B continually monitors several system-critical items such as database validity, hardware status, and GPS status. If the terrain/obstacle database is not available, the voice alert ***"TAWS System Failure"*** is generated along with the 'TAWS FAIL' alert annunciation.

TAWS-B requires a 3-D GPS navigation solution along with specific vertical accuracy minimums. Should the navigation solution become degraded or if the aircraft is out of the database coverage area, the system displays the 'TAWS N/A' annunciation, and issues the ***"TAWS Not Available"*** voice alert. When the GPS signal integrity returns and the aircraft is within the database coverage area, the system issues the voice alert, ***"TAWS Available"***

Alert Type	PFD/MFD* Alert Annunciation	TAWS-B Page Center Banner Annunciation	Voice Alert
System Test in progress	TAWS TEST	TAWS TEST	None
System Test pass	None	None	"TAWS System Test Test OK"
TAWS-B FLTA Alerting Inhibited	TAWS INH	None	None
No GPS position	TAWS N/A	NO GPS POSITION	"TAWS Not Available"
Excessively degraded GPS signal; or Out of database coverage area	TAWS N/A	None	"TAWS Not Available"
TAWS-B System Test Fail; Terrain or Obstacle database unavailable or invalid; Invalid software configuration; or System audio fault	TAWS FAIL	TAWS FAIL	"TAWS System Failure"
MFD Terrain or Obstacle database unavailable or invalid. TAWS operating with PFD Terrain or Obstacle databases	None	TERRAIN DATABASE FAILURE	None

† *Annunciation is shown on TAWS-B Page and the Navigation Map Page when Terrain is enabled.*
* *"TAWS Available" will be heard when sufficient GPS signal is received, or Terrain database coverage area re-entered.*

Table 6-21 TAWS-B System Status Annunciations

6.5 TRAFFIC INFORMATION SERVICE (TIS)

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.*

NOTE: *TIS is available only when the aircraft is within the service volume of a TIS-capable terminal radar site. Aircraft without an operating transponder are invisible to both Traffic Advisory Systems (TAS), Traffic Alert and Collision Avoidance Systems (TCAS) and TIS. Aircraft without altitude reporting capability are shown without altitude separation data or climb descent indication.*

NOTE: *Mode S TIS is disabled if another traffic system such as TAS or Automatic Dependent Surveillance-Broadcast (ADS-B) is installed.*

Traffic Information Service (TIS) is designed to help in detection and avoidance of other aircraft. TIS uses the Mode S transponder for the traffic data link. TIS receives traffic information from ground stations, and is updated every five seconds. The system displays up to eight traffic symbols within a 7.5-nm radius, from 3000 feet below to 3500 feet above the requesting aircraft. The system displays TIS traffic with the symbology shown in the following table.

TIS Symbol	Description
	Non-Threat Traffic
	Traffic Advisory (TA)
	Traffic Advisory Off Scale

Table 6-22 TIS Traffic Symbols

Traffic Advisories (TA) alert the crew to intruding aircraft. When traffic meets the advisory criteria for the TA, a solid amber circle symbol appears. A TA which is detected but is outside the range of the map on which traffic is displayed are indicated with a message in the lower left corner of the map.

TIS also provides a vector line showing the direction in which the traffic is moving, to the nearest 45°. Traffic information for which TIS is unable to determine the bearing (non-bearing traffic) is displayed in the center of the Traffic Map Page or in a banner at the lower left corner of maps other than the Traffic Map Page on which traffic can be displayed.

The altitude difference between the requesting aircraft and other intruder aircraft is displayed above/below the traffic symbol in hundreds of feet. If the other aircraft is above the requesting aircraft, the altitude separation appears above the traffic symbol; if below, the altitude separation appears below. Altitude trend is displayed as an up/down arrow (for speeds greater than 500 fpm in either direction) to the right of the target symbol. Traffic symbols for aircraft without altitude reporting capability appear without altitude separation or climb/descent information.

DISPLAYING TRAFFIC DATA

The Map - Traffic Map Page is the principal map page for viewing traffic information. Traffic information can also be displayed on the following other maps for additional reference on the MFD when the traffic TIS is operating:

- PFD Maps
- Navigation Map Page
- Traffic Map Page
- Trip Planning Page
- Nearest Pages
- Active Flight Plan Page
- Map - IFR/VFR Charts Page

Traffic information can also be displayed on the PFD when the Terrain-SVT option is installed and enabled. See the Additional Features Section for details.

Enabling/disabling traffic overlays (MFD navigation maps):

1) Select the **Map Opt** Softkey.
2) Select the **Traffic** Softkey. Traffic is now displayed on the navigation map.

When traffic is selected on maps other than the Traffic Map Page, an icon is shown to indicate the feature is enabled for display.

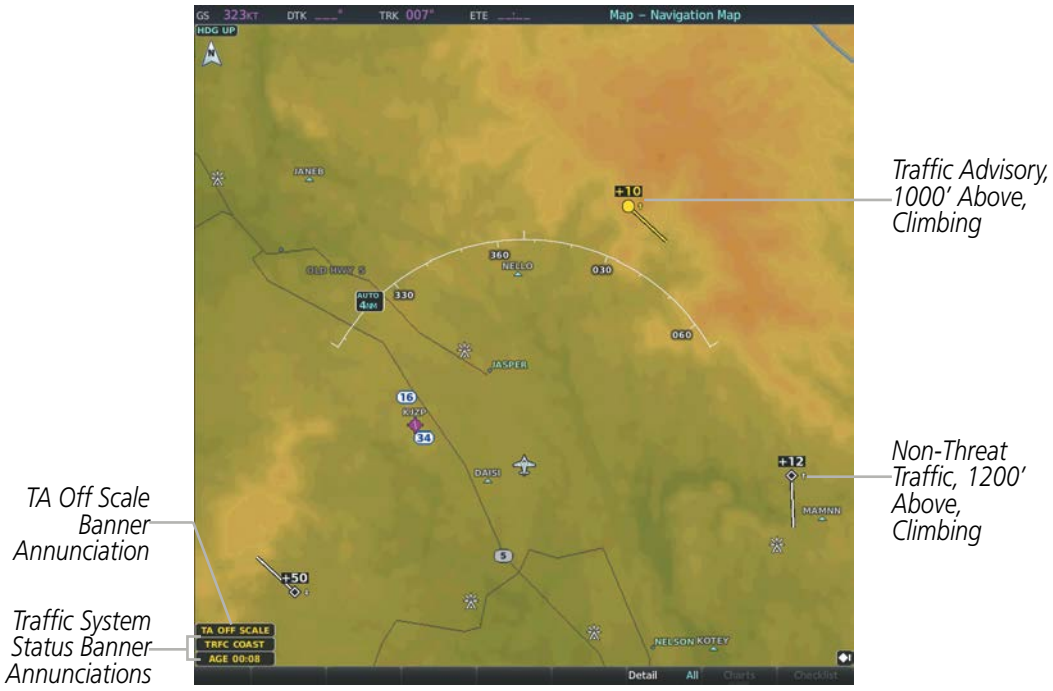


Figure 6-94 TIS Traffic on Navigation Map Page

The Navigation Map Page Setup Menu provides a means in addition to the softkey for enabling/disabling display of traffic. The setup menu also controls the map range settings above which traffic data (symbols and labels) are decluttered from the display. If a map range larger than the map range setting is selected, the data is removed from the map. Maps besides the Traffic Map Page use settings based on those selected for the Navigation Map Page.

Enabling/disabling traffic information on the PFD Inset Map or HSI Map:

1) On the PFD, press the **Map/HSI** Softkey.
2) Press the **Traffic** Softkey to enable/disable the display traffic information on the Inset Map or HSI Map.

Customizing traffic display on the Navigation Map Page:

1) Select the 'Map - Navigation Map' Page.
2) Press the **MENU** Key.
3) With 'Map Setup' highlighted, press the **ENT** Key.
4) Turn the small **FMS** Knob to select the 'Traffic' Group and press the **ENT** Key.
5) Turn the large **FMS** Knob or press the **ENT** Key to scroll through product selections.
   - Traffic – Turns the display of traffic data on or off
   - Traffic Mode – Selects the traffic mode for display; select from:
     - All Traffic - Displays all traffic
     - TA Only - Displays Traffic Alerts only
   - Traffic Symbols – Selects the maximum range at which traffic symbols are shown
   - Traffic Labels – Selects the maximum range at which traffic labels are shown (with the option to turn off)
6) Turn the small **FMS** Knob to scroll through options for each product (On/Off, range settings, etc.).
7) Press the **ENT** Key to select an option.
8) Press the **FMS** Knob or **CLR** Key to return to the 'Map - Navigation Map' Page with the changed settings.

TRAFFIC MAP PAGE

The Traffic Map Page is specialized to show surrounding TIS traffic data in relation to the aircraft's current position and altitude, without clutter from the basemap. Aircraft orientation on this map is always heading up unless there is no valid heading. Map range is adjustable with the **Joystick** from 2 to 12 nm, as indicated by the map range rings.

The traffic mode is annunciated in the upper left corner of the Traffic Map Page. When the aircraft is on the ground, TIS automatically enters Standby Mode. Once the aircraft is airborne, TIS switches from Standby to Operating Mode and the system begins to display traffic information. Refer to the System Status discussion for more information.

Displaying traffic on the Traffic Map Page:

1) Turn the large **FMS** Knob to select the Map Page Group.
2) Turn the small **FMS** Knob to select the 'Map - Traffic Map' Page.
3) Confirm TIS is in Operating Mode:

a) Press the **TIS OPER** Softkey to begin displaying traffic.

Or:

a) Press the **MENU** Key.

b) Select 'Operate Mode' (shown if TIS is in Standby Mode) and press the **ENT** Key.

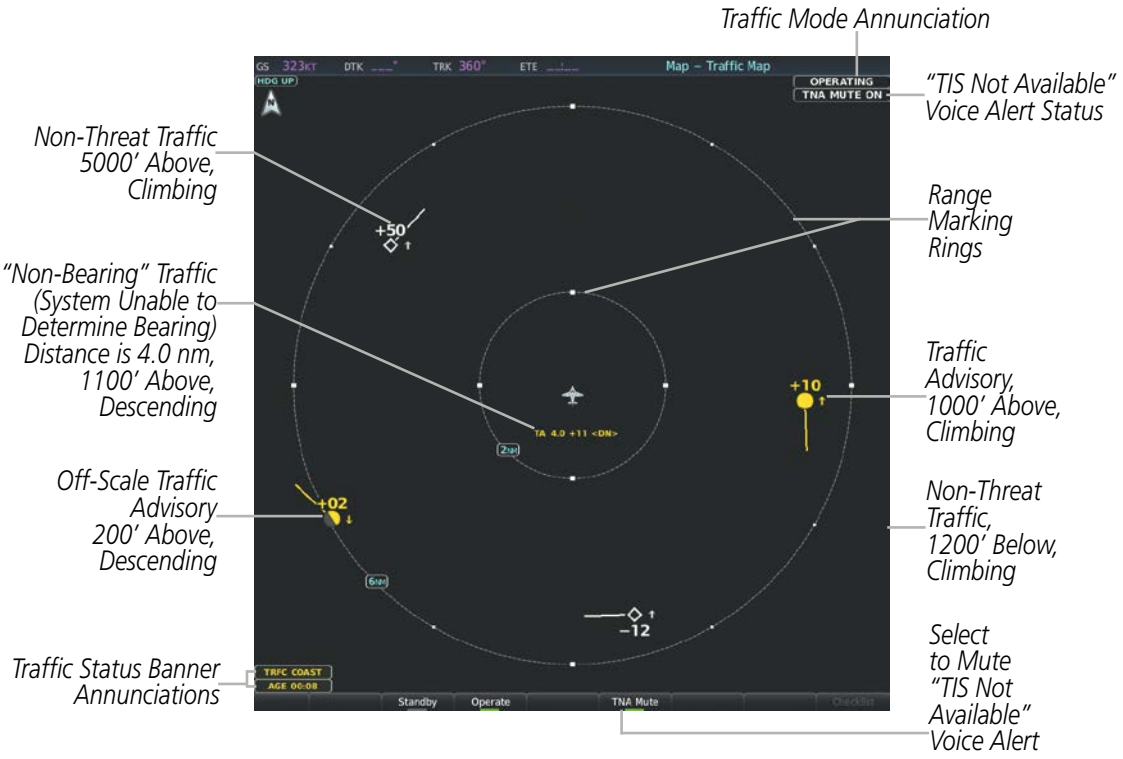


Figure 6-95 Traffic Map Page

TIS ALERTS

When the number of TAs on the Traffic Map Page increases from one scan to the next, the following occur:

- A single ***"Traffic"*** voice alert is generated.
- A 'TRAFFIC' Annunciation appears to the right of the airspeed tape, flashes for five seconds, and remains displayed until no TAs are detected in the area.
- The PFD Inset Map or HSI Map is automatically displayed with traffic.

To reduce the number of nuisance alerts due to proximate aircraft, the ***"Traffic"*** voice alert is generated only when the number of TAs increases. For example, when the first TA is displayed, a voice and visual annunciation are generated. As long as a single TA remains on the display, no additional voice alerts are generated. If a second TA appears on the display or if the number of TAs initially decreases and then subsequently increases, another voice alert is generated.

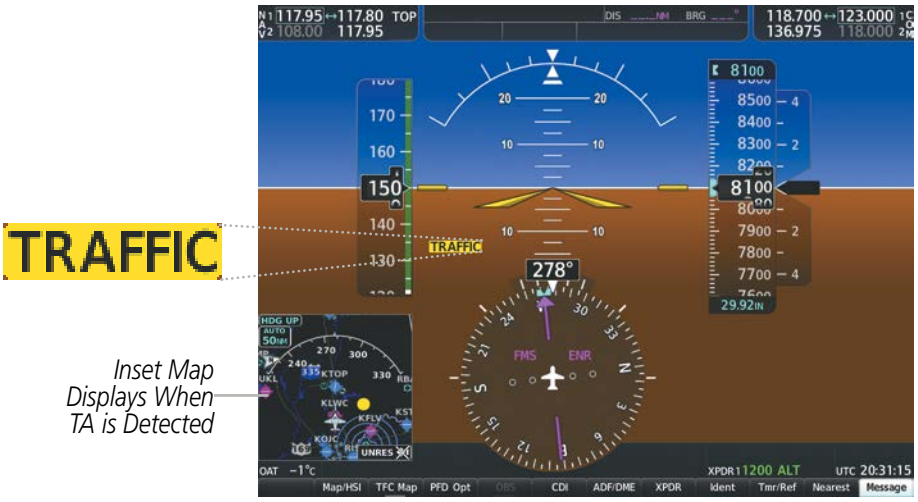


Figure 6-96 Traffic Annunciation (PFD)

A ***"TIS Not Available"*** (TNA) voice alert is generated when the TIS service becomes unavailable or is out of range. TIS may be unavailable in the radar coverage area due to the following:

- Radar site TIS Mode S sensor is not operational or is out of service
- Traffic or requesting aircraft is beyond the maximum range of the TIS-capable Mode S radar site.
- Traffic or requesting aircraft is above the radar site in the cone of silence and out of range of an adjacent site.
- Traffic or requesting aircraft is below radar coverage. In flat terrain, the coverage extends from about 3000 feet upward at 55 miles. Terrain and obstacles around the radar site can further decrease radar coverage in all directions.
- Traffic does not have an operating transponder.

The ***"TIS Not Available"*** (TNA) voice alert can be manually muted to reduce nuisance alerting. TNA muting status is shown in the upper right corner of the Traffic Map Page.

Muting the "TIS Not Available" voice alert:

1) Select the 'Map - Traffic Map' Page.

2) Press the **TNA Mute** Softkey. The status is displayed in the upper left corner of the Traffic Map Page.

Or:

a) Press the **MENU** Key.

b) Select "'Not Available" Mute On' (shown if TNA muting is currently off) and press the **ENT** Key.

SYSTEM STATUS

The system performs an automatic test of TIS during power-up. If TIS passes the test, TIS enters Standby Mode (on the ground) or Operating Mode (in the air). If TIS fails the power up test, an annunciation is shown in the center of the Traffic Map Page.

Traffic Map Page Center Banner Annunciation	Description
NO DATA	Data is not being received from the transponder*
DATA FAILED	Data is being received from the transponder, but a failure is detected in the data stream*
FAILED	The transponder has failed*
UNAVAILABLE	TIS is unavailable or out of range

** Contact a service center or Garmin dealer for corrective action*

Table 6-23 TIS Failure Annunciations

The traffic mode is annunciated in the upper right corner of the Traffic Map Page. When the aircraft is on the ground, TIS automatically enters Standby Mode. If traffic is selected for display on another map while Standby Mode is selected, the traffic display enabled icon is crossed out (also the case whenever TIS has failed). Once the aircraft is airborne, TIS switches to Operating Mode and traffic information is displayed. The mode can be changed manually using softkeys or the page menu.

Traffic Map Mode Annunciation	Traffic Map Center Banner Annunciation	Traffic Overlay Status Icon (Navigation Maps)	Description
DATA FAILED	TRFC FAIL		Data is being received from the transponder, but a failure is detected in the data stream*
NO DATA	TRFC FAIL		Data is not being received from the transponder*
OPERATING	None		TIS is operating and is receiving traffic data from a data link.
OPERATING	UNAVAILABLE		TIS is operating, but the traffic service is currently unavailable or is out of reception range.
STANDBY	STANDBY		TIS is in Standby Mode.
UNIT FAILED	TRFC FAIL		The transponder has failed*

** Contact a service center or Garmin dealer for corrective action*

Table 6-24 TIS Modes and Status Annunciations

Switching between TIS modes:

1) Select the 'Map - Traffic Map' Page.

2) Press the **Standby** or **Operate** Softkey to switch between modes. The mode is displayed in the upper right corner of the Traffic Map Page.

Or:

a) Press the **MENU** Key.

b) Select 'Operate Mode' or 'Standby Mode' (choice dependent on current state) and press the **ENT** Key.

The annunciations to indicate the status of traffic information appear in a banner at the lower left corner of maps on which traffic can be displayed, as shown in the following table.

Traffic Status Banner Annunciation	Description
TA OFF SCALE	A Traffic Advisory is outside the selected display range* Annunciation is removed when traffic comes within the selected display range
TA X.X ± XX ↕	System cannot determine bearing of Traffic Advisory** Annunciation indicates distance in nm, altitude separation in hundreds of feet, and altitude trend arrow (climbing/descending)
AGE MM:SS	Appears if traffic data is not refreshed within 6 seconds If after another 6 seconds data is not received, traffic is removed from the display The quality of displayed traffic information is reduced as the age increases
TRFC COAST	The displayed data is not current (6 to 12 seconds since last message) The quality of displayed traffic information is reduced when this message is displayed
TRFC RMVD	Traffic is removed because it is too old for coasting (12 to 60 seconds since last message) Traffic may exist within the selected display range, but it is not displayed
TRFC FAIL	Traffic data has failed
NO TRFC DATA	Traffic has not been detected
TRFC UNAVAIL	The traffic service is unavailable or out of range

**Shown as symbol on Traffic Map Page*
***Shown in center of Traffic Map Page*

Table 6-25 TIS Traffic Status Annunciations

6.6 TAS TRAFFIC

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

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

NOTE: *Pilots should be aware of traffic system limitations. Traffic systems require transponders of other aircraft to respond to system interrogations. If the transponders do not respond to interrogations due to phenomena such as antenna shading or marginal transponder performance, traffic may be displayed intermittently, or not at all. Aircraft without altitude reporting capability are shown without altitude separation data or climb descent indication. Pilots should remain vigilant for traffic at all times.*

NOTE: *Mode-S TIS is disabled when another traffic system is installed.*

NOTE: *If Garmin GTX 345R transponder is installed, refer to the Automatic Dependent Surveillance-Broadcast (ADS-B) Traffic discussion for more information about ADS-B traffic displays.*

The optional Garmin GTS 820 is a Traffic Advisory System (TAS). It enhances flight crew situational awareness by displaying traffic information for transponder-equipped aircraft. The system also provides visual annunciations and voice alerts to help the pilot visually acquire traffic.

The Garmin GTS 820 is capable of tracking up to 45 intruding aircraft equipped with Mode A or C transponders, and up to 30 intruding aircraft equipped with Mode S transponders. A maximum of 30 aircraft with the highest threat potential can be displayed simultaneously.

No TAS surveillance is provided for aircraft without operating transponders.

TAS THEORY OF OPERATION

When the traffic system is in Operating Mode, the system directly interrogates the transponders of other aircraft in the vicinity. The traffic 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 traffic 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 traffic system provides visual annunciations and voice alerts.

TAS SURVEILLANCE VOLUME AND SYMBOLOGY

The GTS 820 TAS surveillance system actively scans the airspace within ±10,000 feet of its altitude. Under ideal conditions, the GTS 820 scans transponder traffic up to 22 nm in the forward direction. The range is somewhat reduced to the sides and aft of the aircraft due to the directional interrogation signal patterns. In areas of greater transponder traffic density or when TCAS II (Traffic Alert and Collision Avoidance System II) systems are detected, the on-board traffic system automatically reduces its interrogation transmitter power (and therefore range) in order to limit potential interference from other signals.

If a Garmin GTX 33 ES or GTX 330 transponder is installed with this TAS, the system uses the following symbols to represent traffic.

TAS Symbol	Description
	Non-Threat Traffic
	Proximity Advisory (PA)
	Traffic Advisory (TA)
	Traffic Advisory Off Scale

Table 6-26 TAS Symbol Description with GTX 33 ES/335 Transponder

If a Garmin GTX 345 transponder is installed with the TAS, the symbols in the following table depict traffic, and include Automatic Dependent Surveillance-Broadcast (ADS-B) information. Refer to the ADS-B Traffic discussion later in this section for more information.

Symbol	Description
	Traffic Advisory with ADS-B directional information. Arrow points in the direction of the intruder aircraft track.
	Traffic Advisory without directional information.
	Traffic Advisory with ADS-B directional information is beyond the selected display range. Displayed at outer range ring at proper bearing. Arrow points in the direction of the intruder aircraft track.
	Traffic Advisory out of the selected display range without directional information. Displayed at outer range ring at proper bearing.
	Proximity Advisory with ADS-B directional information. Arrow points in the direction of the aircraft track.
	Proximity Advisory without directional information.
	Other Non-Threat traffic with ADS-B directional information. Arrow points in the direction of the intruder aircraft track.
	Other Non-Threat traffic without directional information.
	Traffic located on the ground with ADS-B directional information. Arrow points in the direction of the aircraft track. Ground traffic is only displayed when ADS-B is in Surface (SURF) Mode or own aircraft is on the ground.
	Ground traffic without ADS-B directional information. Ground traffic is only displayed when ADS-B is in Surface (SURF) Mode or own aircraft is on the ground.
	Non-aircraft ground traffic with ADS-B directional information. Pointed end indicates direction of travel. Ground traffic is only displayed when ADS-B is in Surface (SURF) Mode or own aircraft is on the ground.
	Non-aircraft ground traffic without ADS-B directional information. Ground traffic is only displayed when ADS-B is in Surface (SURF) Mode or own aircraft is on the ground.

Table 6-27 ADS-B Traffic Symbology with GTX 345R Transponder

A Traffic Advisory (TA), displayed as a solid amber circle or circle enclosing an arrow, alerts the crew to a potentially hazardous intruding aircraft, if the closing rate, distance, and vertical separation meet TA criteria. A TA that is beyond the selected display range (off scale) is indicated by a half TA symbol at the edge of the screen at the relative bearing of the intruder.

A Proximity Advisory (PA), displayed as a solid white diamond or arrow, indicates the intruding aircraft is within ±1200 feet and is within a 6 nm range, but is still not considered a TA threat.

Other, non-threat traffic, shown as an open white diamond or arrow, is displayed for traffic beyond six nautical miles that is neither a TA or PA.

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 speeds greater than 500 fpm in either direction) to the right of the intruder symbol.

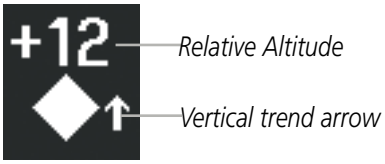


Figure 6-97 Intruder Altitude and Vertical Trend Arrow

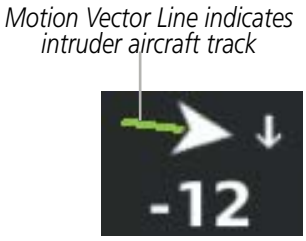


Figure 6-98 Intruder Traffic with ADS-B Directional Information and Motion Vector

TA ALERTING CONDITIONS

The GTS 820 traffic system automatically adjusts its TA sensitivity level to reduce the likelihood of nuisance TA alerting when the aircraft is more likely to be near an airport. The system uses Level A (less) sensitivity when the landing gear is extended or 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 6-28 TA Sensitivity Level and TA Alerting Criteria

TAS ALERTS

When the TAS 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 triggered the TA. For example, the announcement "***Traffic! 12 o'clock, high, four miles***," would indicate the traffic is in front of own aircraft, above own altitude, and approximately four nautical miles away.

Bearing	Relative Altitude	Approximate Distance (nm)
"One o'clock" through "Twelve o'clock" or "No Bearing"	"High", "Low", "Same Altitude" (if within 200 feet of own altitude), or "Altitude not available"	"Less than one mile", "One Mile" through "Ten Miles", or "More than ten miles"

Table 6-29 TA Descriptive Voice Announcements

- A TRAFFIC Annunciation appears at the right of the airspeed on the PFD, flashes for five seconds, and remains displayed until no TAs are detected in the area.
- A PFD map is automatically displayed with TA traffic.

If the bearing of TA traffic cannot be determined, a yellow text banner will be displayed in the center of the Traffic Map Page and in the lower-left of the PFD inset 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.

A TA will be displayed for at least eight seconds, even if the condition(s) that initially triggered the TA are no longer present.

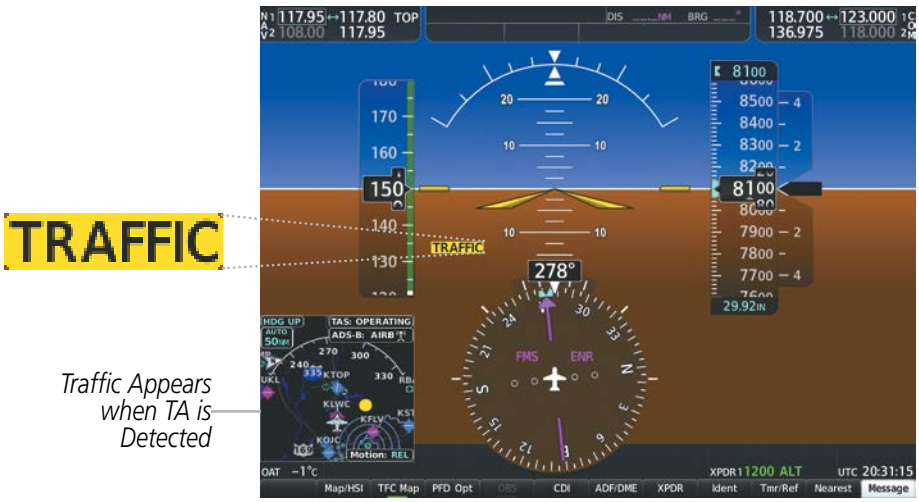


Figure 6-99 Traffic Annunciation (PFD)

SYSTEM TEST

The traffic system provides a system test mode to verify the TAS is operating normally. The test takes about ten seconds to complete. When the system test is initiated, a test pattern of traffic symbols appears on the Traffic Map Page. If system test passes, the system announces, ***"TAS System Test Passed"*** or ***"TAS System Test Failed."*** When the system test is complete, the traffic system enters Standby Mode.

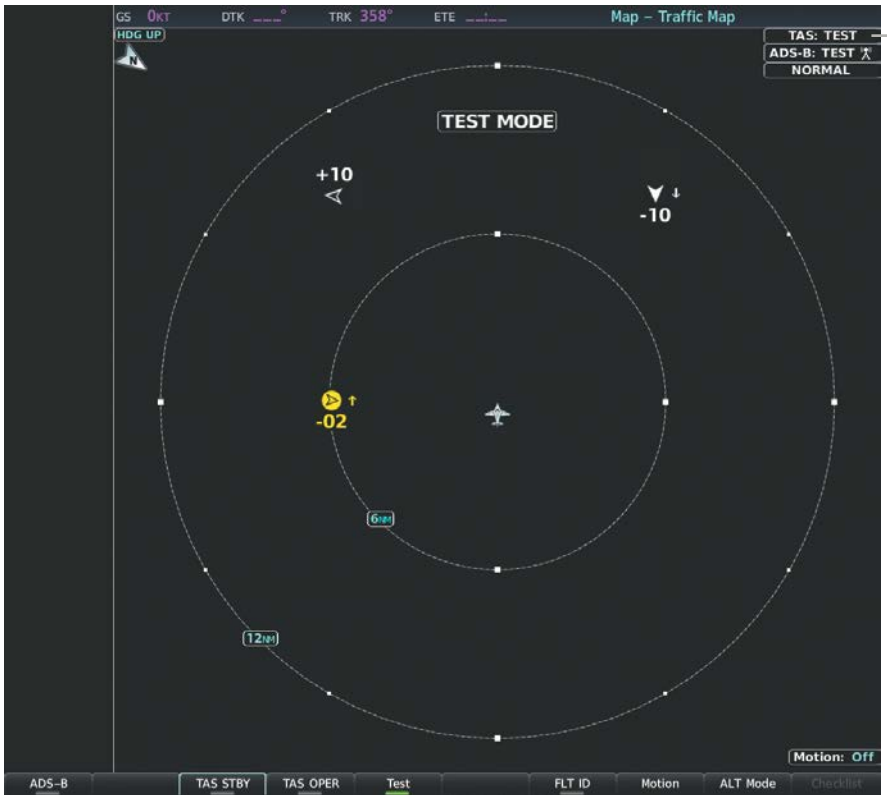
Testing the traffic system:

1) Turn the large **FMS** Knob to select the Map Page Group.
2) Turn the small **FMS** Knob to select the 'Map - Traffic Map' Page.
3) Turn the **Joystick** to set the range to 2/6 nm to allow for full test pattern to be displayed during test.
4) Press the **Standby** or **TAS STBY** Softkey.
5) Press the **Test** Softkey.

Or:

1) With the Traffic system in Standby mode, press the MENU Key.
2) Turn the small **FMS** Knob to select 'Test Mode'.
3) Press the **ENT** Key.

NOTE: *Traffic surveillance is not available during the system test. Use caution when performing a system test during flight.*



TAS Test Mode

Figure 6-100 Traffic Map Page with Test Mode Enabled

OPERATION

NOTE: *The TAS automatically changes from **Standby** to **Operating** mode eight seconds after takeoff. The system also automatically changes from **Operating** to **Standby** mode 24 seconds after landing.*

When the avionics system initially receives power on the ground, the traffic system is in Standby Mode. The system must be in Operating Mode for traffic to be displayed and for TAs to be issued.

Changing traffic system modes on the Traffic Map Page:

1) Turn the large **FMS** Knob to select the Map Page Group.
2) Turn the small **FMS** Knob to select the 'Map - Traffic Map' Page.
3) Press the **Operate** or **TAS OPER** Softkey to begin displaying traffic. 'OPERATING' is displayed in the Traffic mode field.
4) Press the **Standby** or **TAS STBY** Softkey to place the system in the Standby mode. 'STANDBY' is displayed in the Traffic mode field.

Or:

1) With the 'Map - Traffic Map' Page displayed, press the **MENU** Key.
2) Turn the small **FMS** knob to highlight the desired mode.
3) Press the **ENT** Key.

TRAFFIC MAP PAGE

The Map - Traffic Map Page shows surrounding traffic data in relation to the aircraft's current position and altitude, without basemap clutter. It is the principal map page for viewing traffic information. Aircraft orientation is always heading up unless there is no valid heading. The pilot can adjust the map range with the **Joystick.** A range indication appears on each range ring.

The system annunciates the traffic mode and altitude display mode in the upper right corner of the Traffic Map Page.

Figure 6-101 Traffic Map Page with TAS and ADS-B Traffic Displayed

Altitude Display Mode

The pilot can select the volume of airspace in which Other Non-Threat and Proximity Advisory traffic is displayed. If traffic meets the criteria for a TA, it is also displayed even if it is outside of the selected volume of airspace.

Changing the altitude range:

1) On the 'Map - Traffic Map' Page, select the **ALT Mode** Softkey.
2) Select one of the following Softkeys:
   - **Above:** Displays Other Non-Threat and Proximity Advisory traffic from 9900 feet above the aircraft to 2700 feet below the aircraft. Typically used during climb phase of flight.
   - **Normal:** Displays Other Non-Threat and Proximity Advisory traffic from 2700 feet above the aircraft to 2700 feet below the aircraft. Typically used during enroute phase of flight.
   - **Below:** Displays Other Non-Threat and Proximity Advisory traffic from 2700 feet above the aircraft to 9900 feet below the aircraft. Typically used during descent phase of flight.
   - **UNREST** (unrestricted)**:** All traffic is displayed from 9900 feet above and 9900 feet below the aircraft.
3) To return to the Traffic Page, select the **Back** Softkey.

   Or:

1) Press the **MENU** Key.
2) Turn the small **FMS** Knob to select one of the following (see softkey description in the previous step 2):
   - Above
   - Normal
   - Below
   - Unrestricted
3) Select the **ENT** Softkey.

Flight ID Display

The Flight IDs of other aircraft (when available) can be enabled for display on the Traffic Map Page. When a flight ID is received, it will appear above or below the corresponding traffic symbol on the Traffic Map Page when this option is enabled.

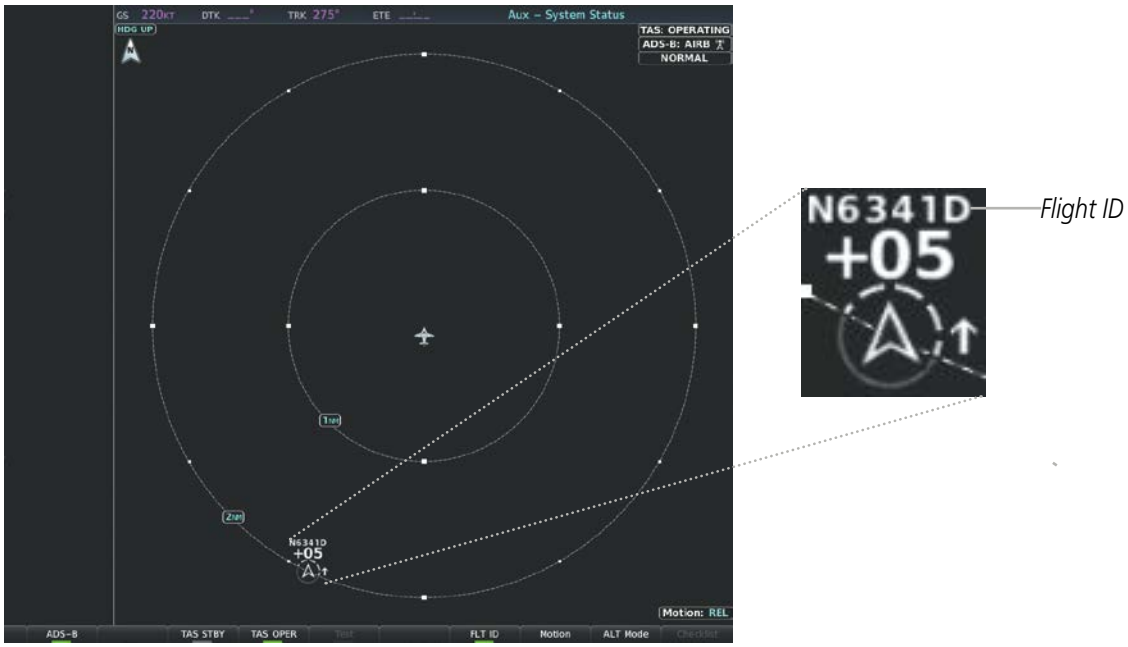


Figure 6-102 Traffic Map Page with Flight IDs Enabled

Enabling/Disabling Flight ID Display:

On the 'Map - Traffic Map' Page, select the **FLT ID** Softkey.

Or:

1) Press the **MENU** Key.
2) Turn the small **FMS** Knob to choose 'Show Flight IDs' or 'Hide Flight IDs' (choice dependent on current state) (Figure 6-178).
3) Press the **ENT** Key.

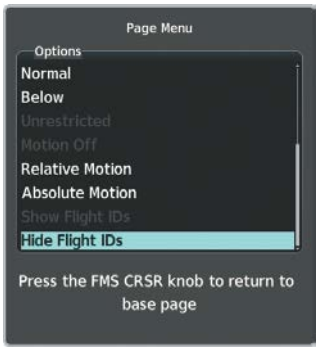


Figure 6-103 Traffic Map Page Menu

Traffic Map Page Display Range

The display range on the Traffic Map Page can be changed at any time. Map range is adjustable with the **Joystick**, and rings on the map denote the ranges.

Changing the display range on the Traffic Map Page:

1) Turn the **Joystick**.
2) The following range options are available:
   - 750 ft (with optional ADS-B)
   - 750 ft and 1500 ft (with optional ADS-B)
   - 1500 ft and 0.5 nm (with optional ADS-B)
   - 0.5 nm and 1 nm (with optional ADS-B)
   - 1 nm and 2 nm (with optional ADS-B)
   - 2 nm
   - 2 and 6 nm
   - 6 and 12 nm
   - 12 and 24 nm
   - 24 and 40 nm

Enabling/disabling the display of Flight ID for traffic:

1) Select the Traffic Map Page.
2) Select the **FLT ID** Softkey to enable/disable the display of Flight IDs for displayed traffic.

ADDITIONAL TRAFFIC DISPLAYS

The Map - Traffic Map Page is the principal map page for viewing traffic information. Traffic information can also be displayed on the following other maps for additional reference on the MFD when the traffic unit is operating:

- Navigation Map Page
- Traffic Map Page
- Trip Planning Page
- Nearest Pages
- Active Flight Plan Page
- Map - IFR/VFR Charts Page

Enabling/disabling traffic information (MFD maps other than the Traffic Map Page):

1) Select the **Map Opt** Softkey.
2) Select the **Traffic** Softkey. Traffic is now displayed on the map.

When traffic is selected on maps other than the Traffic Map Page, the system shows a traffic status icon to indicate traffic is enabled for display as well as the altitude display mode (Above, Below, Normal, Unres).

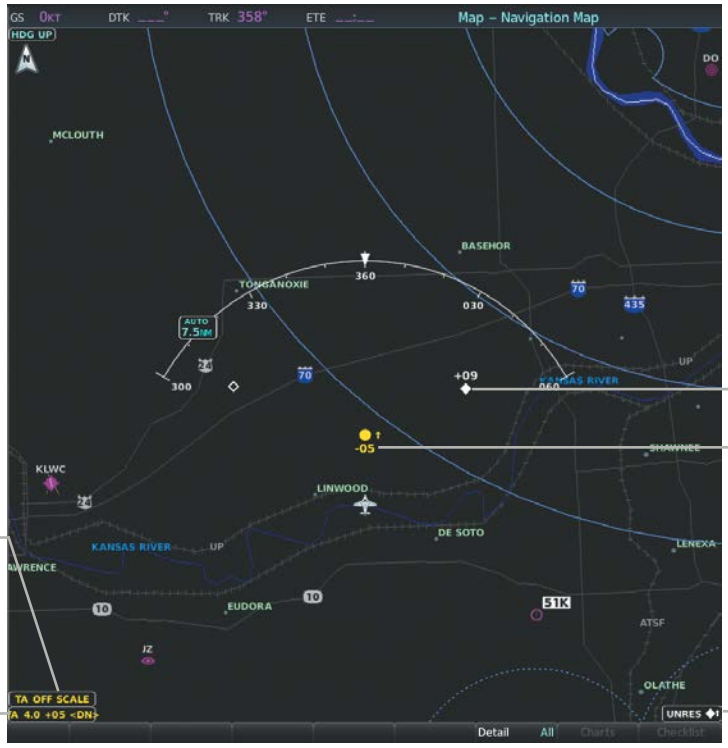


Figure 6-104 Displaying Traffic on the Navigation Map Page

Customizing the traffic display on the Navigation Map Page:

1) Select the 'Map - Navigation Map' Page.
2) Press the **MENU** Key.
3) With 'Map Settings' highlighted, press the **ENT** Key.
4) Turn the small **FMS** Knob to select the Traffic Group and press the **ENT** Key.
5) Turn the large **FMS** Knob or press the **ENT** Key to scroll through the selections.
   - Traffic – Turns the display of traffic data on or off
   - Traffic Mode – Selects the traffic mode for display; select from:
     - All Traffic - Displays all traffic
     - TA/PA - Displays only Traffic Advisories and Proximity Advisories
     - TA Only - Displays Traffic Advisories only
   - Traffic Symbols – Selects the maximum range at which traffic symbols are shown
   - Traffic Labels – Selects the maximum range at which traffic labels (relative altitude, vertical trend) are shown with the option to turn off
6) Turn the small **FMS** Knob to scroll through options (On/Off, range settings, etc.).
7) Press the **ENT** Key to select an option.
8) Press the **FMS** Knob or **CLR** Key to return to the 'Map - Navigation Map' Page.

The Navigation Map Page Setup Menu also controls the display of traffic. The setup menu controls the map range settings. Traffic data symbols and labels can be decluttered from the display. If a map range larger than the map range setting is selected, the data is removed from the map. Maps besides the Traffic Map Page use settings based on those selected for the Navigation Map Page.

A traffic-only inset map is available on the PFD by pressing the **TFC Map** Softkey. A traffic map appears on the PFD. This map resembles the Traffic Map Page, and presents a heading up format.

An HSI map is also available which resembles the Traffic Map.

Showing the HSI Traffic Map:

1) Press the **Map/HSI** Softkey.
2) Press the **Layout** Softkey.
3) Press the **HSI Trfc** Softkey.

Traffic information can also be overlaid on PFD navigation maps.

Enabling/disabling traffic overlay on PFD navigation maps:

1) With the Inset Map or HSI Map displayed, press the **Map/HSI** Softkey on the PFD.
2) Press the **Traffic** Softkey to enable/disable the display traffic information.

SYSTEM STATUS

The traffic mode is annunciated in the upper right corner of the Traffic Map Page.

Mode	Traffic Mode Annunciation (Traffic Map Page)	Traffic Display Status Icon (Other Maps)
Traffic System Test Initiated	**TEST** ('**TEST MODE**' shown in center of page)	
Operating	**OPERATING**	
Standby	**STANDBY** (also shown in white in center of page)	
Traffic System Failed*	**FAIL**	

** See Table 6-31 for additional failure annunciations*

Table 6-30 Traffic Modes

If the traffic unit fails, an annunciation as to the cause of the failure is shown in the center of the Traffic Map Page. During a failure condition, the Operating Mode cannot be selected.

Traffic Map Page Center Annunciation	Description
NO DATA	Data is not being received from the TAS unit
DATA FAILED	Data is being received from the TAS unit, but the unit is self-reporting a failure
FAILED	Incorrect data format received from the TAS unit

Table 6-31 TAS Failure Annunciations

The annunciations to indicate the status of traffic information appear in a banner at the lower left corner of maps on which traffic can be displayed.

Traffic Status Banner Annunciation	Description
TA OFF SCALE	A Traffic Advisory is outside the selected display range*. Annunciation is removed when traffic comes within the selected display range.
TA X.X ± XX ↕	System cannot determine bearing of Traffic Advisory**. Annunciation indicates distance in nm, altitude separation in hundreds of feet, and altitude trend arrow (climbing/descending).
TRFC FAIL	TAS unit has failed (unit is self-reporting a failure or sending incorrectly formatted data)
NO TRFC DATA	Data is not being received from the TAS unit

**Shown as symbol on Traffic Map Page*
***Shown in center of Traffic Map Page*

Table 6-32 TAS Traffic Status Annunciations

6.7 ADS-B TRAFFIC

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

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

ADS-B SYSTEM OVERVIEW

Automatic Dependent Surveillance-Broadcast (ADS-B) is a core technology in the FAA NextGen air traffic control system. It offers improved surveillance services, both air-to-air and air-to-ground, especially in areas where radar coverage is ineffective due to terrain, or where it is impractical or cost prohibitive. ADS-B is comprised of three segments for the purposes of providing traffic information: ADS-B (Broadcast), ADS-R (Rebroadcast), and Traffic Information Service-Broadcast (TIS-B).

ADS-B includes the automatic broadcast of position reports by aircraft, surface vehicles, and transmitters on fixed objects. These broadcasts contain information such as GPS position, identity (Flight ID, Call Sign, Tail Number, ICAO registration number, etc.), ground track, ground speed, pressure altitude, and emergency status.

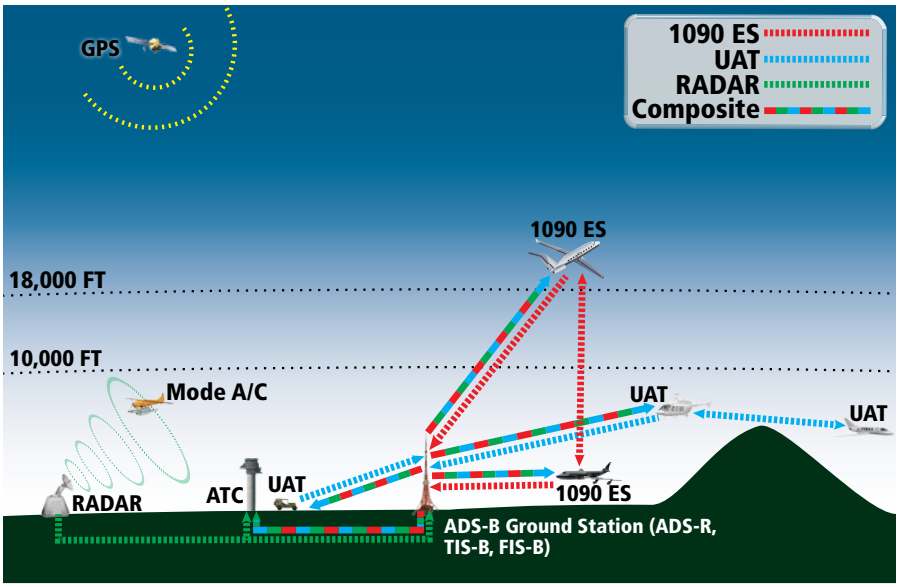


Figure 6-105 ADS-B System

For the purpose of distinguishing between levels of ADS-B service, there are three classifications of aircraft or system capability: ADS-B In, ADS-B Out, and ADS-B participating. ADS-B In refers to the capability to receive ADS-B information. ADS-B Out refers to the capability to transmit ADS-B information. ADS-B participating refers to the capability to both send and receive ADS-B information. Aircraft lacking either ADS-In, ADS-B Out, or both ADS-B capabilities may also be referred to as ADS-B nonparticipating aircraft.

The ADS-B system operates on two frequencies: 1090 MHz and 978 MHz. Both frequencies provide the same traffic information. An aircraft may be ADS-B In, Out, or participating on one or both frequencies, depending on the installed equipment. The 1090 MHz frequency portion of ADS-B is known as 1090 Extended Squitter (1090 ES). The 978 MHz portion of ADS-B is known as Universal Access Transceiver (UAT).

The optional Garmin GTX 33 ES/330 transponder provides ADS-B Out functions using the 1090 ES data link, and no ADS-B In traffic display is provided.

The optional Garmin GTX 345R transponder provides ADS-B Out functions using the 1090 ES data link. It also performs ADS-B In functions using the UAT data link. For the GTX 345, this includes the reception of Flight Information Services-Broadcast (FIS-B) data link weather service, provided when the aircraft is receiving data from a participating ground station; refer to the Data Link Weather section for more information about FIS-B Weather.

AUTOMATIC DEPENDENT SURVEILLANCE-REBROADCAST (ADS-R)

Because it is not required that ADS-B In capable aircraft be able to receive ADS-B data on both the 1090 MHz and 978 MHz data links, a method exists to get data from one data link to the other. ADS-R is the rebroadcast of ADS-B data by FAA ground stations, which provide this service by taking traffic data from one link and rebroadcasting it on the other. For example, if two aircraft are in the service volume for a ground station, and one is transmitting on 1090 MHz and the other is transmitting on 978 MHz, the ground station retransmits the data from each aircraft on the other link to ensure the two aircraft can "see" each other as traffic.

For example, if another aircraft can only receive 978 MHz UAT information, it cannot directly 'see' another aircraft sending only 1090 ES information aircraft unless an ADS-R ground station in the vicinity rebroadcasts the 1090 ES data over the 978 MHz UAT frequency. This is also true for an aircraft when can only receive 1090 ES data; it would need an ADS-R ground station to 'see' another aircraft operating on the UAT frequency.

TRAFFIC INFORMATION SERVICE-BROADCAST (TIS-B)

TIS-B provides a link between the secondary surveillance radar (SSR)-based system ATC uses and the ADS-B-based system. When an ADS-B In or Out capable aircraft is within the service volume of an FAA ADS-B ground station, the ground station broadcasts a portion of the ATC radar data to the aircraft. This aircraft is then included in the list of aircraft being provided TIS-B service and is then considered a "TIS-B participant."

TIS-B coverage is available when the aircraft is within ground station coverage, in 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 WITH TAS

When the system is receiving ADS-B In traffic and with a TAS in Operating Mode, the system attempts to match (or "correlate") data the two traffic sources. When a correlation is made, the system displays the traffic information for the tracked aircraft determined to be the most accurate. Any traffic that is not correlated (i.e., only detected by one system but not the other) is also displayed for the flight crew. This may occur, for example, if another aircraft is beyond the surveillance range of the TAS, but own aircraft is receiving information via ADS-B for the other aircraft. The traffic correlation feature improves the accuracy of the traffic displayed, while reducing the occurrence of displaying the same traffic for a given aircraft twice.

NOTE: *When operating on the edges of ATC radar coverage or when using an optional active traffic system providing intermittent traffic data, a single aircraft may be briefly or periodically be depicted as two aircraft on the display.*

CONFLICT SITUATIONAL AWARENESS & ALERTING (CSA)

Conflict Situational Awareness (CSA) is an alerting algorithm which provides ADS-B traffic alerting similar to the TAS system discussed previously.

When a TA occurs with is equipment, the displays a 'TRAFFIC' annunciation and provides a voice alert. This annunciation and voice alert is the same as the alerts issues by the Garmin GTS 820 TAS discussed previously.

The own aircraft altitude above terrain determines the sensitivity of the CSA algorithm to minimize nuisance alerts. Height Above Terrain, and Geodetic Sea Level (GSL) altitude are used to adjust the sensitivity of the CSA algorithm in accordance with the following table:

Sensitivity Level	Height Above Terrain (HAT)	GPS Phase of Flight	Own Altitude (Feet)	Look-ahead time (sec)	Vertical Threshold for Alert (feet)	Protected Volume (NM)
4	Any	Any	Any	20	850	0.20
4	Any	Any	Any	20	850	0.20
4	Unavailable	Approach	Any	20	850	0.20
5	Any	Any	Any	25	850	0.20
5	>1000 <=2350	Any	Any	25	850	0.20
5	Unavailable	Terminal	Any	25	850	0.20
6	Unavailable or >2350	Not approach and not Terminal (including unavailable)	<=5000	30	850	0.35
7	Unavailable or >2350	Not approach and not Terminal (including unavailable)	>5000 <=10,000	40	850	0.55
8	Unavailable or >2350	Not approach and not Terminal (including unavailable)	>10,000 <=20,000	45	850	0.80
9	Unavailable or >2350	Not approach and not Terminal (including unavailable)	>20,000 <=42,000	48	850	1.10
10	Unavailable or >2350	Not approach and not Terminal (including unavailable)	> 42,000	48	1200	1.10

Table 6-33 CSA Alerting Thresholds for ADS-B Traffic

AIRBORNE AND SURFACE APPLICATIONS

ADS-B traffic can help the pilot visually acquire traffic both in the air and on-the-ground. There are two ADS-B applications or modes: Airborne Situational Awareness (AIRB) and Surface Situational Awareness (SURF). The system automatically selects the appropriate application based on conditions.

The AIRB application is on when the aircraft is more than five 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 Map Page range of one nm or less, the airport environment (including taxiways and runways) appears in addition to traffic. The airport displays are derived from the SafeTaxi database. Refer to the Additional Features section for more information about SafeTaxi displays.

NOTE: *Do not rely on the solely on the traffic display to determine the runway alignment of traffic, especially when runways are in close proximity to each other.*

Due to the varying precision of the data received via ADS-B, ADS-R, and TIS-B services, not all traffic symbols may not be depicted on the traffic display. Because higher data precision is required for traffic to be displayed in the SURF environment, some traffic eligible for AIRB will not be displayed while SURF is on. Availability for AIRB and SURF is depicted on the Aux - ADS-B Status Page, discussed later in this section.

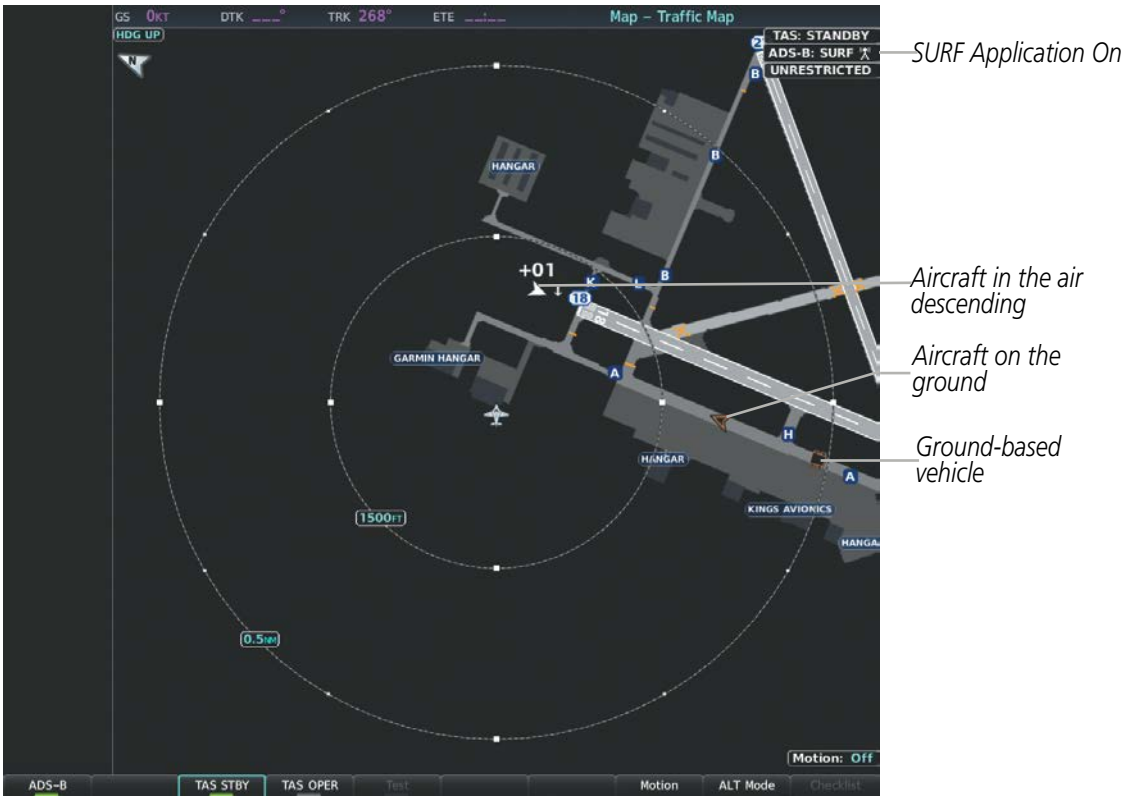


Figure 6-106 Traffic Map Page with SURF Mode On

TRAFFIC DESCRIPTION

The symbols used to display ADS-B traffic are shown in the following table.

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 6-34 ADS-B Traffic Symbology

OPERATION

TRAFFIC MAP PAGE

The Traffic Map Page 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 **Joystick**, as indicated by the map range rings.

The traffic mode and altitude display mode are annunciated in the upper right corner of the page.

A tower icon appears in the ADS-B status box to indicate when the system is receiving ADS-R and TIS-B services from a ground station. When these services are not available, a white-'X' appears over the tower icon.

Figure 6-107 Traffic Map Page with ADS-B Traffic Displayed

Enabling/disabling the display of ADS-B traffic:

1) Select the 'Map - Traffic Map' Page.
2) Select the **ADS-B** Softkey.

   Or:

   a) Press the **MENU** Key and turn the small **FMS** Knob to highlight 'ADS-B On' or 'ADS-B Off'.

   b) Press the **ENT** Key.

Testing the display of ADS-B traffic:

1) Select the 'Map - Traffic Map' Page.

2) If necessary, turn the Joystick to select a map range of 2 and 6 nm to ensure full test pattern display.

3) Ensure the **ADS-B** Softkey is disabled.

4) If the optional TAS is installed, ensure the **TAS STBY** Softkey is enabled.

5) Press the **Test** Softkey.

Or:

a) Press the **MENU** Key.

b) Turn the small **FMS** Knob to highlight 'Test Mode'.

c) Press the **ENT** Key.

A test pattern of traffic symbols appears during the test, and a 'TRAFFIC' annunciation appears on the PFDs. At the conclusion of the test, the system issues the voice alert "Traffic System Test". If the test pattern is displayed and the voice alert is heard, the system has passed the test.

ADS-B Test Mode

Figure 6-108 Traffic Map Page with Test Mode Enabled

The pilot can select the volume of airspace in which Other Non-Threat and Proximity traffic is displayed. TAs occurring outside of these limits will always be shown.

Changing the altitude range:

1) On the 'Map - Traffic Map' Page, select the **ALT Mode** Softkey.
2) Select one of the following softkeys:
   - **Above:** Displays Other Non-Threat and proximity traffic from 9900 feet above the aircraft to 2700 feet below the aircraft. Typically used during climb phase of flight.
   - **Normal:** Displays Other Non-Threat and proximity traffic from 2700 feet above the aircraft to 2700 feet below the aircraft. Typically used during enroute phase of flight.
   - **Below:** Displays Other Non-Threat and proximity traffic from 2700 feet above the aircraft to 9900 feet below the aircraft. Typically used during descent phase of flight.
   - **UNREST** (unrestricted)**:** All traffic is displayed from 9900 feet above and 9900 feet below the aircraft.
3) To return to the Traffic Map Page, select the **Back** Softkey.

Or:

1) Press the **MENU** Key.
2) Turn the small **FMS** Knob to highlight one of the following options (see softkey description in the previous step 2):
   - Above
   - Normal
   - Below
   - Unrestricted
3) Press the **ENT** Key.

DISPLAYING MOTION VECTORS

When Absolute Motion Vectors are selected, the vectors extending from the traffic symbols depict the traffic's reported track and speed over the ground. When Relative Motion Vectors are selected, the vectors extending from the traffic symbols display how the traffic is moving relative to own aircraft. These vectors are calculated using the traffic's track and ground speed and own aircraft's track and ground speed. These two values are combined to depict where the traffic is moving purely with respect to own aircraft, and provide a forecast of where the traffic will be, relative to own aircraft, in the near future.

Figure 6-109 Traffic Map Page with Absolute Motion Vectors Enabled

Figure 6-110 Traffic Map Page with Relative Motion Vectors Enabled

Enabling/disabling the Motion Vector display:

1) Select the 'Map - Traffic Map' Page.
2) Select the **Motion** Softkey.
3) Select one of the following softkeys:
   - **Absolute:** Displays the motion vector pointing in the absolute direction.
   - **Relative**: Displays the motion vector relative to own aircraft
   - **Off**: Disables the display of the motion vector.

Or:

1) Select the 'Map - Traffic Map' Page.
2) Press the **MENU** Key.
3) Turn the small **FMS** Knob to highlight 'Relative Motion', 'Absolute Motion' or 'Motion Vector Off'.
4) Press the **ENT** Key.

Adjusting the duration for the Motion Vector projected time:

1) Select the 'Map - Traffic Map' Page.
2) Select the **Motion** Softkey.
3) Select the **Duration** Softkey.
4) Select a softkey for the desired duration (**30 SEC**, **1 MIN**, **2 MIN**, **5 MIN**).
5) When finished, select the **Back** Softkey to return to the Traffic Map Page.

Displaying Additional Traffic Information

The Traffic Map 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.

Showing additional traffic information:

1) Select the 'Map - Traffic Map' Page.
2) Press the **FMS** Knob. A cyan border appears on the first selected traffic symbol. Additional information appears in a window in the lower-left corner of the Traffic Map Page.
3) To select a different aircraft symbol, turn the **FMS** Knob to move the cyan border until another symbol is selected.
4) When finished, press the **FMS** Knob again to disable the traffic selection.

Traffic Map Page Display Range

The display range on the Traffic Map Page can be changed at any time. Map range is adjustable with the **Joystick**, as indicated by the map range rings.

Changing the display range on the Traffic Map Page:

1) Turn the **Joystick**.
2) The following range options are available:
   - 500 feet
   - 500 feet and 1000 feet
   - 1000 feet and 2000 feet
   - 2000 feet and 1 nm
   - 1 and 2 nm
   - 2 and 6 nm
   - 6 and 12 nm
   - 12 and 24 nm
   - 24 and 40 nm

NOTE: *ADS-B traffic can be displayed as an overlay to navigation maps. Refer to the previous TAS discussions for information about these additional traffic displays.*

ADS-B SYSTEM STATUS

The traffic mode is annunciated in the upper right corner of the Traffic Map Page.

ADS-B Mode	Traffic Mode Annunciation (Traffic Map Page)	Traffic Map Page Center Banner Annunciation	Traffic Display Status Icon (Other Maps)
ADS-B System Test Initiated	ADS-B: TEST	TEST MODE	
ADS-B Operating in Airborne Mode	ADS-B: AIRB	None	
ADS-B Operating in Surface Mode	ADS-B: SURF	None	
ABS-B Traffic Off	ADS-B: OFF	ADS-B TRFC OFF	
ADS-B Traffic Not Available	ADS-B: N/A	ADS-B TRFC N/A	
ADS-B Failed*	ADS-B: FAIL	ADS-B TRFC FAIL	

** See Table 6- for additional failure annunciations*

Table 6-35 ADS-B Modes

A white tower icon appears in the ADS-B status box on the traffic map page to indicate the reception of ADS-R and TIS-B services from a ground station. If these services are not available, a white-'X' appears over the tower icon.

NOTE: *If the optional TAS fails, the display of ADS-B traffic (ADS-B In) also fails, unless a GTX 345R transponder is installed. In this case, if the TAS fails, the display of ADS-B traffic continues even if the TAS has failed.*

If the traffic unit fails, an annunciation as to the cause of the failure is shown in the center of the Traffic Map Page. During a failure condition, the Operating Mode cannot be selected.

Traffic Map Page Center Annunciation	Description
NO DATA	Data is not being received from the traffic unit
DATA FAILED	Data is being received from the traffic unit, but the unit is self-reporting a failure
FAILED	Incorrect data format received from the traffic unit

Table 6-36 Traffic Failure Annunciations

The annunciations to indicate the status of traffic information appear in a banner at the lower left corner of maps on which traffic can be displayed.

Traffic Status Banner Annunciation	Description
TA OFF SCALE	A Traffic Advisory is outside the selected display range*. Annunciation is removed when traffic comes within the selected display range.
TA X.X ± XX ↕	System cannot determine bearing of Traffic Advisory**. Annunciation indicates distance in nm, altitude separation in hundreds of feet, and altitude trend arrow (climbing/descending).
TRFC FAIL	Traffic unit has failed (unit is self-reporting a failure or sending incorrectly formatted data)
NO TRFC DATA	Data is not being received from the traffic unit

**Shown as symbol on Traffic Map Page*
***Shown in center of Traffic Map Page*

Table 6-37 Traffic Status Annunciations

Additional information about the status of ADS-B traffic products is available on the Aux - ADS-B Status Page.

Viewing ADS-B Traffic Status:

1) Turn the large **FMS** Knob to select the Aux Page Group.
2) Turn the small **FMS** Knob to select the Aux - ADS-B Status Page.

Figure 6-111 Viewing ADS-B Traffic Status on ADS-B Status Page

ADS-B Status Page Item	Status Message	Description
Traffic Application Status: Airborne (AIRB), Surface (SURF), Airborne Alerts (CSA)	On	Traffic application is currently on. Required input data is available, and it meets performance requirements.
	Available to Run	Traffic application is not currently active, but application is ready to run when condition(s) determine the application should be active. Required input data is available, and it meets performance requirements.
	Not Available	Traffic application is not available. Required input data is available, but it does not meet performance requirements.
	Fault	Traffic application is not available. Required input data is not available or the application has failed.
	Not Configured	Traffic application is not available, because it has not been configured. If this annunciation persists, the system should be serviced.
	----------	Traffic application status is invalid or unknown.
TIS-B/ADS-R Coverage	Available	The system is receiving the ADS-R coverage from an FAA ground station.
	Not Available	The system is not receiving the ADS-R coverage from an FAA ground station.
	----------	ADS-R coverage is invalid or unknown.
GPS Status: GPS Source	External #1	The system is using the #1 GPS receiver for the GPS position source.
	External #2	The system is using the #2 GPS receiver for the GPS position source.
	---------	The GPS source is invalid or unknown.
Ground Uplink Status: Last Uplink	Number of minutes, or '------'	Displays the number of minutes since the last uplink from a ground station occurred. If no uplink has been received, or the status is invalid, dashes appear instead of the number of minutes.

Table 6-38 Aux-ADS-B Status Page Messages for ADS-B Traffic

SECTION 7 AUTOMATIC FLIGHT CONTROL SYSTEM

7.1 AFCS OVERVIEW

NOTE: *The approved Pilot's Operating Handbook (POH) always supersedes this Pilot's Guide.*

The Garmin AFCS is a digital Automatic Flight Control System (AFCS), fully integrated within the system avionics architecture. The System Overview section provides a block diagram to support this system description.

The Garmin AFCS can be divided into these main operating functions:

- **Flight Director (FD)** — The aircraft has two flight directors, each operating within an IAU and referred to as pilot-side and copilot-side. Commands for the selected flight director are displayed on both PFDs.

  The flight 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 pitch trim servos. It also provides servo monitoring and automatic flight control in response to flight director steering commands, Attitude and Heading Reference System (AHRS) attitude and rate information, and airspeed.
- **Yaw Damper (YD**) — The yaw servo is self-monitoring and provides Dutch roll damping and turn coordination in response to yaw rate, roll angle, lateral acceleration, and airspeed.
- **Manual Electric Pitch Trim (MEPT)** — The pitch trim servo provides manual electric pitch trim capability when the autopilot is not engaged.
- **Manual Electric Yaw Trim (MEYT)** — The yaw trim adapter provides manual electric yaw trim capability when the autopilot is not engaged.

AFCS CONTROL UNIT

The AFCS Control Unit is positioned above the MFD, and has the following controls:

NOTE: *With the exception fo the FD and SPD Keys all keys have a coresponding LED light.*

1	**HDG Key**	Selects/deselects Heading Select Mode
2	**APR Key**	Selects/deselects Approach Mode
3	**NAV Key**	Selects/deselects Navigation Mode
4	**FD Key**	Activates/deactivates the flight director only Pressing once turns on the selected flight director in the default vertical and lateral modes. Pressing again deactivates the flight director and removes the Command Bars. If the autopilot is engaged, the key is disabled.
5	**XFR Key**	Transfers between the pilot and copilot flight directors and controls which flight director the autopilot is tracking
6	**ALT Key**	Selects/deselects Altitude Hold Mode
7	**VS Key**	Selects/deselects Vertical Speed Mode
8	**FLC Key**	Selects/deselects Flight Level Change Mode
9 17	**CRS Knobs**	Adjust the Selected Course (while in VOR, LOC, or OBS Mode) in 1° increments on the Horizontal Situation Indicator (HSI) of the corresponding PFD Press to re-center the Course Deviation Indicator (CDI) and return course pointer directly TO the bearing of the active waypoint/station
10	**SPD Key**	Toggles Airspeed Reference between IAS and Mach for Flight Level Change Mode
11	**NOSE UP/DN Wheel**	Adjusts the reference in Pitch Hold, Vertical Speed, and Flight Level Change modes
12	**VNV Key**	Selects/deselects Vertical Path Tracking Mode for Vertical Navigation flight control
13	**ALT SEL Knob**	Controls the Selected Altitude in 100-ft increments (a finer resolution of 10 feet is available under approach conditions)
14	**YD Key**	Engages/disengages the yaw damper
15	**AP Key**	Engages/disengages the autopilot
16	**BANK Key**	Manually selects/deselects Low Bank Mode
18	**BC Key**	Selects/deselects Backcourse Mode
19	**HDG Knob**	Adjusts the Selected Heading and bug in 1° increments on the HSI (both PFDs) Press to synchronize the Selected Heading to the current heading on the pilot-side PFD

Figure 7-1 GMC 710 AFCS Control Unit

ADDITIONAL AFCS CONTROLS

The following AFCS controls are located separately from the AFCS Control Unit:

AP DISC Switch (Autopilot Disconnect)

Disengages the autopilot, yaw damper, and interrupts pitch trim operation

An **AP DISC** Switch is located on each control wheel.

This switch may be used to acknowledge an autopilot disconnect alert and mute the associated aural tone.

CWS Button (Control Wheel Steering)

While pressed, allows manual control of the aircraft while the autopilot is engaged and synchronizes the flight director's Command Bars with the current aircraft pitch (if not in a Vertical Navigation, Glideslope, or Glidepath Mode) and roll (if in Roll Hold Mode)

A **CWS** Button is located on each control wheel.

Upon release of the **CWS** Button, the flight director may establish new pitch and roll references, depending on the current vertical and lateral modes. CWS operation details are discussed in the respective mode sections of this manual.

GA Button (Go Around)

Disengages the autopilot and selects flight director Takeoff (on ground) or Go Around (in air) Mode

NOTE: *If Underspeed Protection (USP) is installed, AP does not disconnect upon selection of GA Button.*

If an approach procedure is loaded this button also activates the missed approach when the selected navigation source is GPS or when the navigation source is VOR/LOC and a valid frequency has been tuned.

The **GA** Button is located on the throttle.

MEPT Switch (Manual Electric Pitch Trim)

Used to command manual electric pitch trim

An **MEPT** Switch is located on each control wheel.

The aircraft uses a four direction switch. Pushing down on the switch and operating the switch forward and backward adjusts pitch trim down (forward) and up (rearward). Pushing the switch in either direction disengages the autopilot, if currently engaged, but does not affect yaw damper operation.

MEYT Switch (Manual Electric Yaw Trim)

Used to command manual electric yaw trim

The aircraft uses a four direction switch. Operating the switch left and right adjusts yaw trim left or right.

LVL Button (Level)

Engages the autopilot (if the autopilot is disengaged and the aircraft is within the autopilot engagement limitations) in level vertical and lateral modes.

The LVL Button is located above the AFCS Controller.

BASIC AUTOPILOT OPERATION

This section provides an overview for autopilot engagement and disengagement. A more detailed description follows in Section 7.4.

- **Autopilot Engagement —** The autopilot may be engaged by pushing the **AP** Key on the AFCS Control Unit. Annunciations regarding the engagement are indicated on the PFD.
- **Autopilot Engagement with Flight Director Off —** Upon engagement, the autopilot will be set to hold the current attitude of the airplane, if the flight director was not previously on. In this case, 'PIT' and 'ROL' will be annunciated.
- **Autopilot Engagement with Flight Director On —** If the flight director is on, the autopilot will smoothly pitch and roll the airplane to capture the FD command bars. The prior flight director modes remain unchanged.
- **Autopilot Disengagement —** One way to disconnect the autopilot is to press and release the **AP DISC** Switch, which is located on the control stick. An autopilot disconnect tone will be heard and annunciated on the PFD. Other ways to disconnect the autopilot include:
  - Pressing the **AP** Key on the AFCS Control Unit
  - Pressing the **GA** Switch (located on the left throttle)
  - Operating the **MEPT** Switch (located on each control wheel)
  - Pulling the autopilot circuit breaker

In the event of unexpected autopilot behavior, pressing and holding the **AP DISC** Switch will disconnect the autopilot and remove all power to the servos for as long as the **AP DISC** Switch is held.

7.2 FLIGHT DIRECTOR OPERATION

The flight director function provides pitch and roll commands to the AFCS and displays them on the PFDs. With the flight director active, the aircraft can be hand-flown to follow the path shown by the Command Bars. Maximum commanded pitch (–15°, +25°) and roll (25°) angles, vertical acceleration, and roll rate are limited to values established during AFCS certification (if underspeed protection is installed, maximum commanded pitch is +/- 50° and roll is +/- 75°). The flight director also provides commands to the autopilot.

ACTIVATING THE FLIGHT DIRECTOR

An initial press of a key listed in the following table (when the flight director is not active) activates the pilot-side flight director in the listed modes. The flight director may be turned off and the Command Bars removed from the displays by pressing the **FD** Key again. The **FD** Key is disabled when the autopilot is engaged.

Control Pressed	Modes Selected			
	Lateral		Vertical	
FD Key	Roll Hold (default)	ROL	Pitch Hold (default)	PIT
AP Key	Roll Hold (default)	ROL	Pitch Hold (default)	PIT
CWS Button	Roll Hold (default)	ROL	Pitch Hold (default)	PIT
GA 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
VNV Key	Roll Hold (default)	ROL	Vertical Path Tracking*	VPTH
NAV Key	Navigation**	FMS VOR LOC	Pitch Hold (default)	PIT
BC Key	Backcourse***	BC	Pitch Hold (default)	PIT
APR Key	Approach**	FMS VOR LOC	Pitch Hold (default)	PIT
HDG Key	Heading Select	HDG	Pitch Hold (default)	PIT
LVL Button	Level	LVL	Level	LVL

Valid VNV flight plan must be entered before* **VNV *Key press activates flight director.*

The selected navigation receiver must have a valid VOR or LOC signal or active FMS course before* ***NAV *or* ***APR*** *Key press activates flight director.*

****The selected navigation receiver must have a valid LOC signal before* ***BC*** *Key press activates flight director.*

Table 7-1 Flight Director Activation

AFCS STATUS BOX

Flight director mode annunciations are displayed on the PFDs when the flight director is active. Flight director selection and autopilot and yaw damper statuses are shown in the center of the AFCS Status Box. Lateral flight director modes are displayed on the left and vertical on the right. Armed modes are displayed in white and active in green.

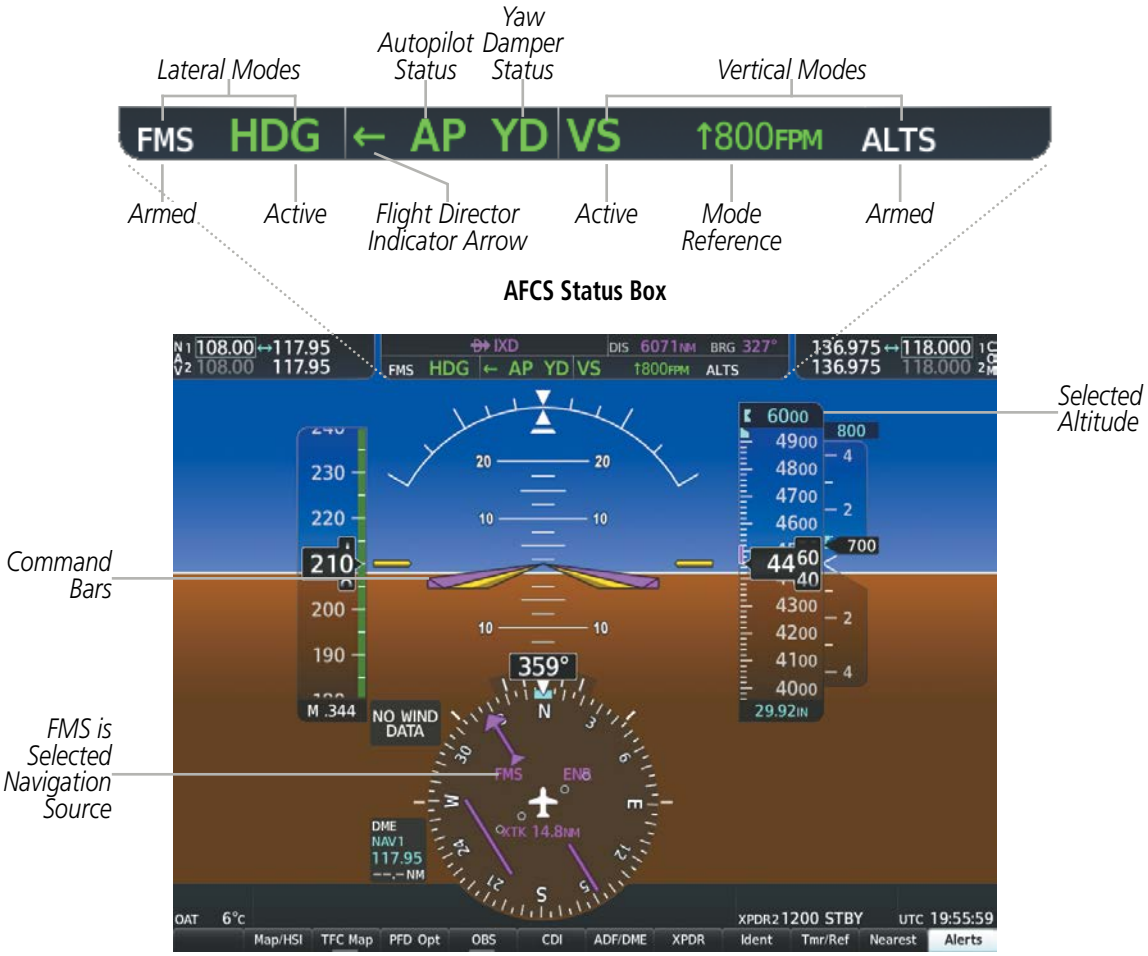


Figure 7-2 PFD AFCS Display

FLIGHT DIRECTOR MODES

Flight director modes are normally selected independently for the pitch and roll axes. Unless otherwise specified, all mode keys are alternate action (i.e., press on, press off). In the absence of specific mode selection, the flight director reverts to the default pitch and/or roll modes. Mode keys on the AFCS controller are accompanied by annunciator lights which are illuminated when their respective modes are armed or active.

Armed modes are annunciated in white and active in green in the AFCS Status Box. Under normal operation, when the control for the active flight director mode is pressed, the flight director reverts to the default mode(s) for the axis(es). Automatic transition from armed to active mode is indicated by the white armed mode annunciation moving to the green active mode field and flashing for 10 seconds.

If the information required to compute a flight director mode becomes invalid or unavailable, the flight director automatically reverts to the default mode for that axis. A flashing yellow mode annunciation and annunciator light indicate loss of sensor (ADC) or navigation data (VOR, LOC, GPS, VNV, SBAS) required to compute commands. When such a loss occurs, the system automatically begins to roll the wings level (enters Roll Hold Mode) or maintain the pitch angle (enters Pitch Hold Mode), depending on the affected axis. The flashing annunciation stops when the affected mode key is pressed or another mode for the axis is selected. If after 10 seconds no action is taken, the flashing annunciation stops.

Figure 7-3 Loss of GPS Signal

The flight director is automatically disabled if the attitude information required to compute the default flight director modes becomes invalid or unavailable.

SWITCHING FLIGHT DIRECTORS

The aircraft has two flight directors, each operating within an IAU. The autopilot follows the selected flight director only, indicated by an arrow pointing toward either the pilot or copilot side, in the center of the AFCS Status Box. Flight directors may be switched by pressing the **XFR** Key. The annunciator light arrow for the selected flight director is also illuminated beside the **XFR** Key. When the flight directors are switched, the vertical and lateral modes revert to default.

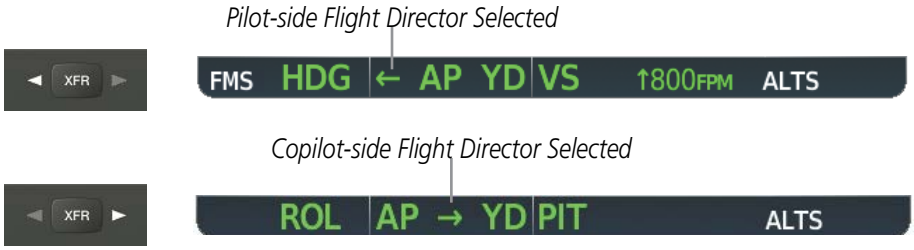


Figure 7-4 Flight Director Selection Indications

COMMAND BARS

Upon activation of the flight director, Command Bars are displayed in magenta on the PFDs as a single cue. The Aircraft Symbol (in yellow) changes to accommodate the Command Bar format; the Command Bars do not override the Aircraft Symbol. The single-cue Command Bars move together vertically to indicate pitch commands and bank left or right to indicate roll commands.

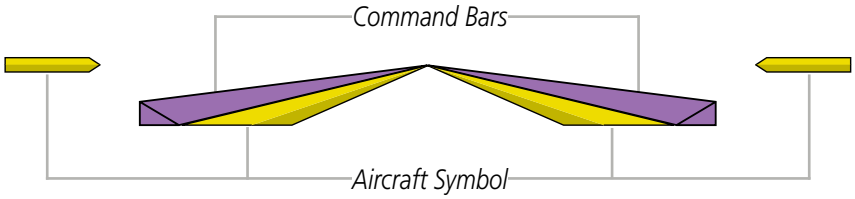


Figure 7-5 Single-cue Command Bars

If the attitude information being sent to the flight director becomes invalid or unavailable, the Command Bars are removed from the display. The flight director Command Bars also disappear if the pitch exceeds +30°/-20° or bank exceeds 65°.

7.3 AFCS MODES

The AFCS is capable of operating in a variety of independent Lateral Modes, Vertical Modes and Combination of both the Lateral and Vertical Modes.

VERTICAL MODES

The following table lists the vertical modes with their corresponding controls and annunciations. The mode reference is displayed next to the active mode annunciation for Altitude Hold, Vertical Speed, and Flight Level Change modes. The **NOSE UP/DN** Wheel can be used to change the vertical mode reference while operating under Pitch Hold, Vertical Speed, or Flight Level Change Mode. Increments of change and acceptable ranges of values for each of these references using the **NOSE UP/DN** Wheel are also listed in the table.

Vertical Mode	Description	Control	Annunciation	Reference Range	Reference Change Increment
Pitch Hold	Holds the current aircraft pitch attitude; may be used to climb/descend to the Selected Altitude	(default)	PIT	-15° to +25°	0.5°
Selected Altitude Capture	Captures the Selected Altitude	*	ALTS		
Altitude Hold	Holds the current Altitude Reference	**ALT** Key	ALT nnnnn FT		
Vertical Speed	Maintains the current aircraft vertical speed; may be used to climb/descend to the Selected Altitude	**VS** Key	VS nnnn FPM	-4000 to +3000 fpm	100 fpm
Flight Level Change, IAS Hold	Maintains the current aircraft airspeed (in IAS or Mach) while the aircraft is climbing/descending to the Selected Altitude	**FLC** Key	FLC nnn KT	75 to 265 kt	1 kt
Flight Level Change, Mach Hold			FLC M .nnn	M 0.20 to 0.69	M 0.01

* *ALTS armed automatically when PIT, VS, FLC, TO, or GA active, and under VPTH when Selected Altitude is to be captured instead of VNV Target Altitude*

Table 7-2 Flight Director Vertical Modes

PITCH HOLD MODE (PIT)

When the flight director is activated (the **FD** Key is pressed) or switched (the **XFR** Key is pressed), Pitch Hold Mode is selected by default. Pitch Hold Mode is indicated as the active vertical mode by the 'PIT' annunciation. This mode may be used for climb or descent to the Selected Altitude (shown above the Altimeter), since Selected Altitude Capture Mode is automatically armed when Pitch Hold Mode is activated.

In Pitch Hold Mode, the flight director maintains a constant pitch attitude, the pitch reference. The pitch reference is set to the aircraft pitch attitude at the moment of mode selection. If the aircraft pitch attitude exceeds the flight director pitch command limitations, the flight director commands a pitch angle equal to the nose-up/down limit.

Changing the Pitch Reference

When operating in Pitch Hold Mode, the pitch reference can be adjusted by:

- Using the **NOSE UP/DN** Wheel
- Pressing the **CWS** Button, hand-flying the aircraft to establish a new pitch reference, then releasing the **CWS** Button

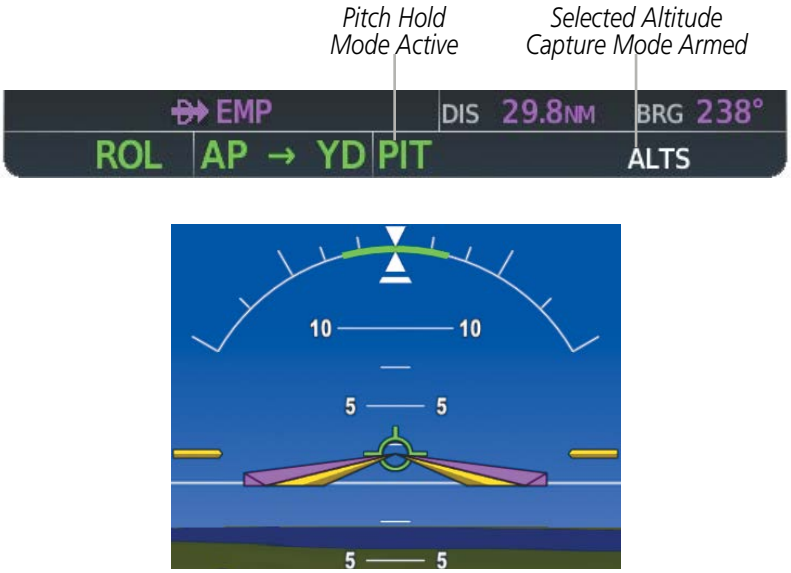


Figure 7-6 Pitch Hold Mode

SELECTED ALTITUDE CAPTURE MODE (ALTS)

Selected Altitude Capture Mode is automatically armed with activation of the following modes:

- Pitch Hold
- Vertical Speed
- Flight Level Change
- Takeoff/Go Around (if the Selected Altitude is at least 400 feet above the current aircraft altitude)
- Vertical Path Tracking (if the Selected Altitude is to be captured instead of the VNV Target Altitude)

The white 'ALTS' annunciation indicates Selected Altitude Capture Mode is armed (see previous figure for example). The **ALT SEL** Knob is used to set the Selected Altitude (shown above the Altimeter) until Selected Altitude Capture Mode becomes active.

As the aircraft nears the Selected Altitude, the flight director automatically transitions to Selected Altitude Capture Mode with Altitude Hold Mode armed (next figure). This automatic transition is indicated by the green 'ALTS' annunciation flashing for up to 10 seconds and the appearance of the white 'ALT' annunciation. The Selected Altitude is shown as the Altitude Reference beside the 'ALTS' annunciation.

At 50 feet from the Selected Altitude, the flight director automatically transitions from Selected Altitude Capture to Altitude Hold Mode and holds the Selected Altitude (shown as the Altitude Reference). As Altitude Hold Mode becomes active, the white 'ALT' annunciation moves to the active vertical mode field and flashes green for 10 seconds to indicate the automatic transition.

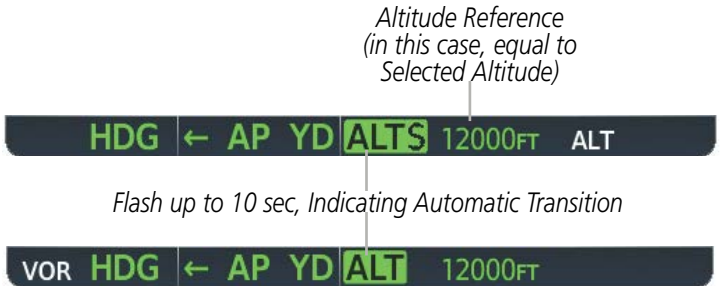


Figure 7-7 Automatic Mode Transitions During Altitude Capture

Changing the Selected Altitude

NOTE: *Pressing the **CWS** Button while in Selected Altitude Capture Mode does not cancel the mode.*

Use of the **ALT SEL** Knob to change the Selected Altitude while Selected Altitude Capture Mode is active causes the flight director to revert to Pitch Hold Mode with Selected Altitude Capture Mode armed for the new Selected Altitude.

ALTITUDE HOLD MODE (ALT)

Altitude Hold Mode can be activated by pressing the **ALT** Key; the flight director maintains the current aircraft altitude (to the nearest 10 feet) as the Altitude Reference. The flight director's Altitude Reference, shown in the AFCS Status Box, is independent of the Selected Altitude, displayed above the Altimeter. Altitude Hold Mode active is indicated by a green 'ALT' annunciation in the AFCS Status Box.

Altitude Hold Mode is automatically armed when the flight director is in Selected Altitude Capture Mode. Selected Altitude Capture Mode automatically transitions to Altitude Hold Mode when the altitude error is less than 50 feet. In this case, the Selected Altitude becomes the flight director's Altitude Reference.

Changing the Altitude Reference

NOTE: *Turning the **ALT SEL** Knob while in Altitude Hold Mode changes the Selected Altitude, but not the flight director's Altitude Reference, and does not cancel the mode.*

With the **CWS** Button depressed, the aircraft can be hand-flown to a new Altitude Reference. When the **CWS** Button is released at the desired altitude, the new altitude is established as the Altitude Reference.

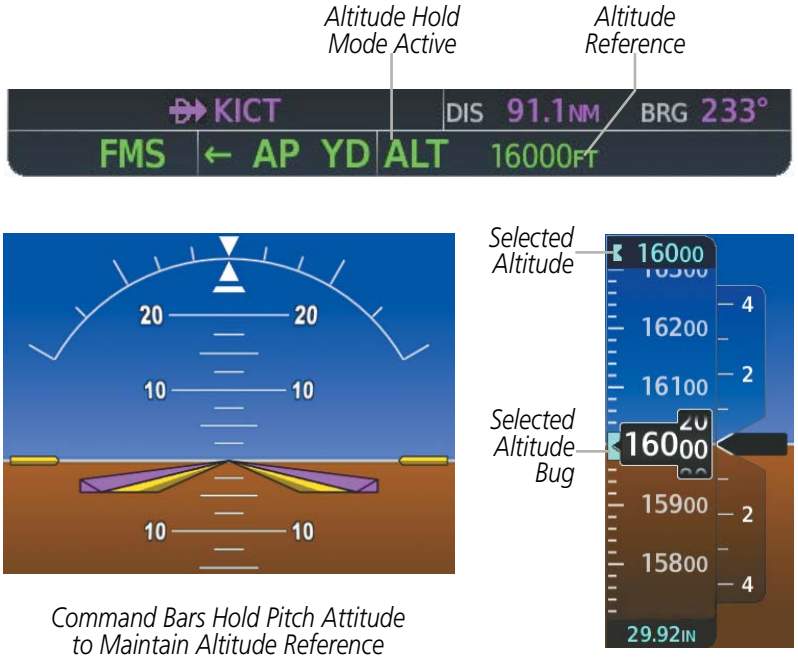


Figure 7-8 Altitude Hold Mode

VERTICAL SPEED MODE (VS)

In Vertical Speed Mode, the flight director acquires and maintains a Vertical Speed Reference. Current aircraft vertical speed (to the nearest 100 fpm) becomes the Vertical Speed Reference at the moment of Vertical Speed Mode activation. This mode may be used for climb or descent to the Selected Altitude (shown above the Altimeter) since Selected Altitude Capture Mode is automatically armed when Vertical Speed Mode is selected.

When Vertical Speed Mode is activated by pressing the **VS** Key, 'VS' is annunciated in green in the AFCS Status Box along with the Vertical Speed Reference. The Vertical Speed Reference is also displayed above the Vertical Speed Indicator. A Vertical Speed Reference Bug corresponding to the Vertical Speed Reference is shown on the indicator.

Changing the Vertical Speed Reference

The Vertical Speed Reference (shown both in the AFCS Status Box and above the Vertical Speed Indicator) may be changed by:

- Using the **NOSE UP/DN** Wheel
- Pressing the **CWS** Button, hand-flying the aircraft to attain a new Vertical Speed Reference, then releasing the **CWS** Button

NOTE: *If the Selected Altitude is reached during CWS maneuvering, the Altitude Reference is not changed. To adjust the Altitude Reference in this case, the* ***CWS*** *Button must be pressed again after the Selected Altitude is reached.*

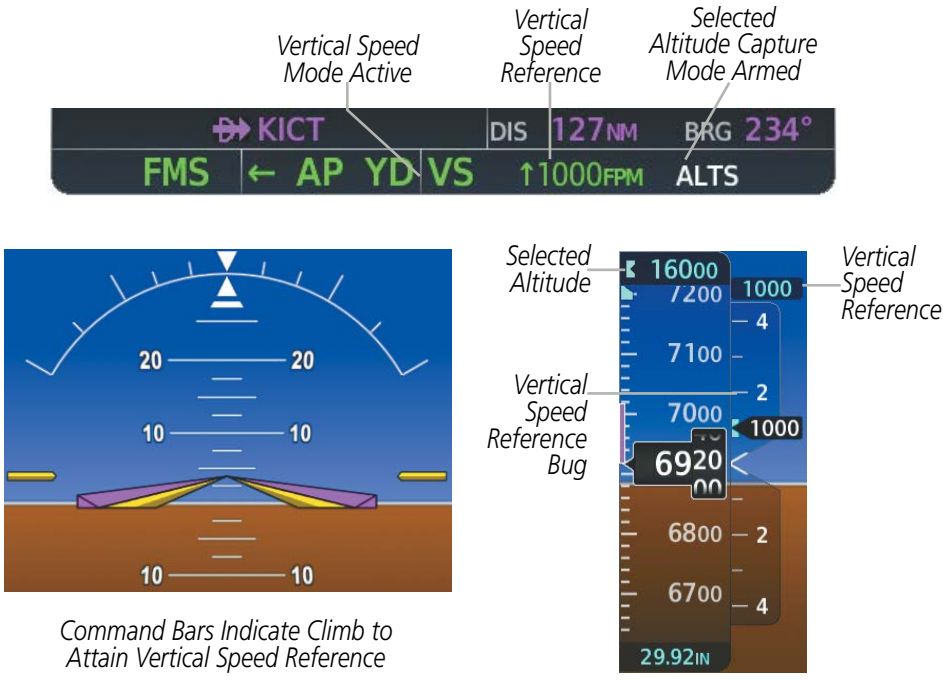


Figure 7-9 Vertical Speed Hold Mode

FLIGHT LEVEL CHANGE MODE (FLC)

NOTE: *The Selected Altitude should be set before selecting Flight Level Change Mode.*

Flight Level Change Mode is selected by pressing the **FLC** Key. This mode acquires and maintains the Airspeed Reference in IAS while climbing or descending to the Selected Altitude (shown above the Altimeter). When Flight Level Change Mode is active, the flight director continuously monitors Selected Altitude, airspeed, and altitude.

The Airspeed Reference is set to the current airspeed upon mode activation. Flight Level Change Mode is indicated by a green 'FLC' annunciation beside the Airspeed Reference in the AFCS Status Box. The Airspeed Reference is also displayed directly above the Airspeed Indicator, along with a bug corresponding to the Airspeed Reference along the tape.

Engine power must be adjusted to allow the autopilot to fly the aircraft at a pitch attitude corresponding to the desired flight profile (climb or descent) while maintaining the Airspeed Reference. The flight director maintains the current altitude until either engine power or the Airspeed Reference are adjusted and does not allow the aircraft to climb or descend away from the Selected Altitude.

Airspeed Reference units can be manually toggled between IAS and Mach units using the **SPD** Key. When the FLC Airspeed Reference is displayed in Mach, the Airspeed Reference Bug is displayed on the Airspeed Indicator at the IAS corresponding to the selected Mach target speed and the current Mach number is shown below the Airspeed Indicator.

Changing the Airspeed Reference

The Airspeed Reference (shown in both the AFCS Status Box and above the Airspeed Indicator) may be adjusted by:

- Using the **NOSE UP/DN** Wheel
- Pressing the **CWS** Button, hand-flying the aircraft to attain a new Airspeed Reference, then releasing the **CWS** Button

NOTE: *If the Selected Altitude is reached during CWS maneuvering, the Airspeed Reference is not changed. To adjust the Airspeed Reference in this case, the* ***CWS*** *Button must be pressed again after the Selected Altitude is reached.*

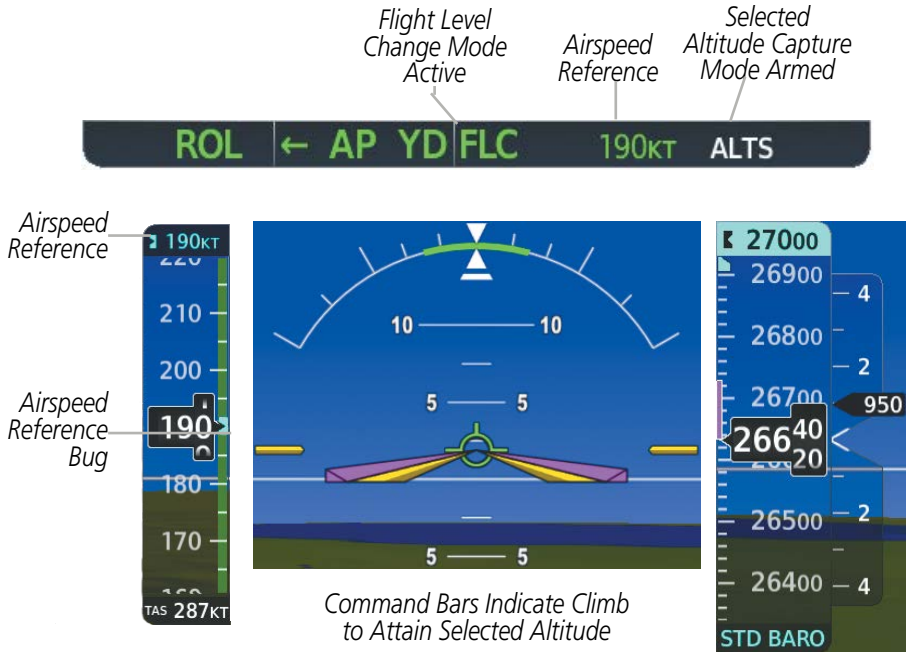


Figure 7-10 Flight Level Change Mode (IAS)

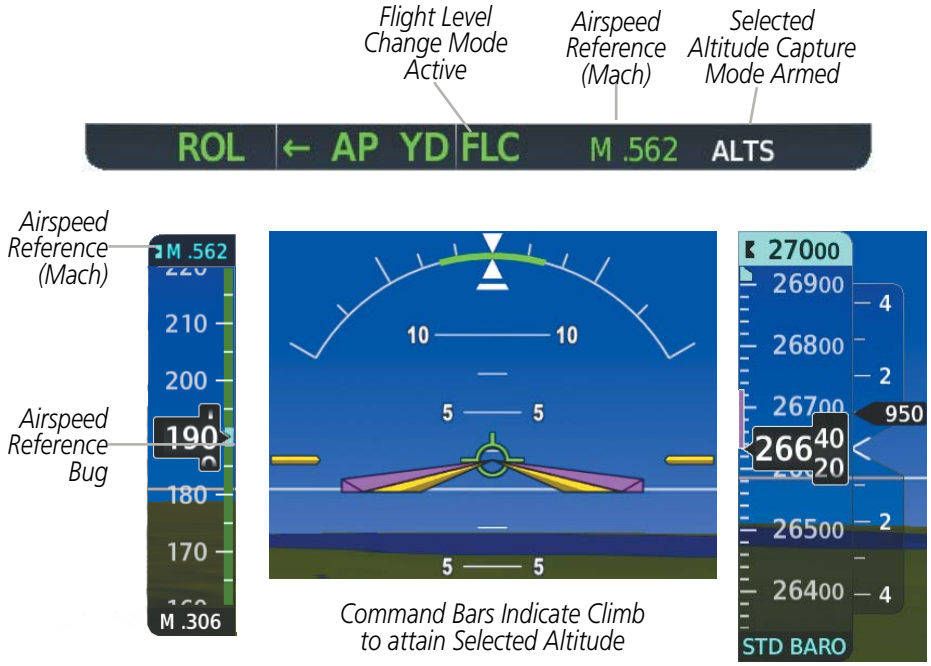


Figure 7-11 Flight Level Change Mode (Mach)

LATERAL MODES

The following table relates each Garmin AFCS lateral mode to its respective control and annunciation. Refer to the combination modes section for information regarding Go Around and Takeoff modes.

NOTE: *The AFCS may generate a lower bank angle than the maximum roll command limit in degrees indicated in table by the amount needed to produce a turn rate equal to or less than standard rate.*

Lateral Mode	Description	Control	Annunciation	Maximum Roll Command Limit
Roll Hold	Holds the current aircraft roll attitude or rolls the wings level, depending on the commanded bank angle	(default)	ROL	25°
Low Bank	Limits the maximum commanded roll angle	**BANK** Key	*	15°
Heading Select**	Captures and tracks the Selected Heading	**HDG** Key	HDG	25°
Navigation, GPS Arm/Capture/Track**	Captures and tracks the selected navigation source (GPS, VOR, LOC)	**NAV** Key	FMS	25°
Navigation, VOR Enroute Arm/Capture/Track**			VOR	25° Capture/ 10° Track
Navigation, LOC Arm/Capture/Track (No Glideslope)			LOC	25° Capture/ 10° Track

** No annunciation appears in the AFCS Status Box. The acceptable bank angle range is indicated in green along the Roll Scale of the Attitude Indicator.*
*** The Heading, Navigation GPS and Navigation VOR mode maximum roll command limit will be limited to the Low Bank mode value if it is engaged.*

Table 7-3 Flight Director Lateral Modes

The **CWS** Button does not change lateral references for Heading Select, Navigation, Backcourse, or Approach Mode. The autopilot guides the aircraft back to the Selected Heading/Course upon release of the **CWS** Button.

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 AFCS Status Box. The current aircraft bank angle is held, subject to the bank angle condition.

Figure 7-12 Roll Hold Mode Annunciation

Bank Angle	Flight Director Response
< 6°	Rolls wings level
6 to 30°	Maintains current aircraft roll attitude
> 30°	Limits bank to 25°

Table 7-4 Roll Hold Mode Responses

Changing the Roll Reference

The roll reference can be changed by pressing the **CWS** Button, establishing the desired bank angle, then releasing the **CWS** Button.

LOW BANK MODE

When in Low Bank Mode, the flight director limits the maximum commanded roll angle to 15°. Low bank arc limits are displayed in green along the Roll Scale.

Low Bank Mode can be manually selected/deselected by pressing the **BANK** Key while in Heading Select or Navigation Modes (GPS and VOR). Low Bank Mode is activated automatically above 25,000 feet (FL250). The flight director deactivates Low Bank Mode when descending through 25,000 feet. The annunciator light next to the **BANK** Key illuminates while Low Bank Mode is selected.

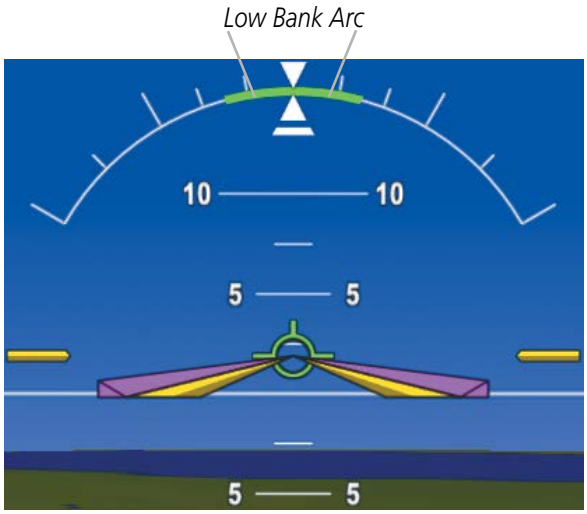


Figure 7-13 Low Bank Mode Limits

HEADING SELECT MODE (HDG)

Heading Select Mode is activated by pressing the **HDG** Key. Heading Select Mode acquires and maintains the Selected Heading. The Selected Heading is shown by a light blue bug on the HSI and in the box to the upper left of the HSI.

Changing the Selected Heading

NOTE: *Pressing the **HDG** Knob synchronizes the Selected Heading to the current heading.*

The Selected Heading is adjusted using the **HDG** Knob on either PFD. Pressing the **CWS** Button and hand-flying the aircraft does not change the Selected Heading. The autopilot guides the aircraft back to the Selected Heading upon release of the **CWS** Button.

Turns are commanded in the same direction as Selected Heading Bug movement, even if the bug is turned more than 180° from the present heading (e.g., a 270° turn to the right). However, Selected Heading changes of more than 330° at a time result in turn reversals.

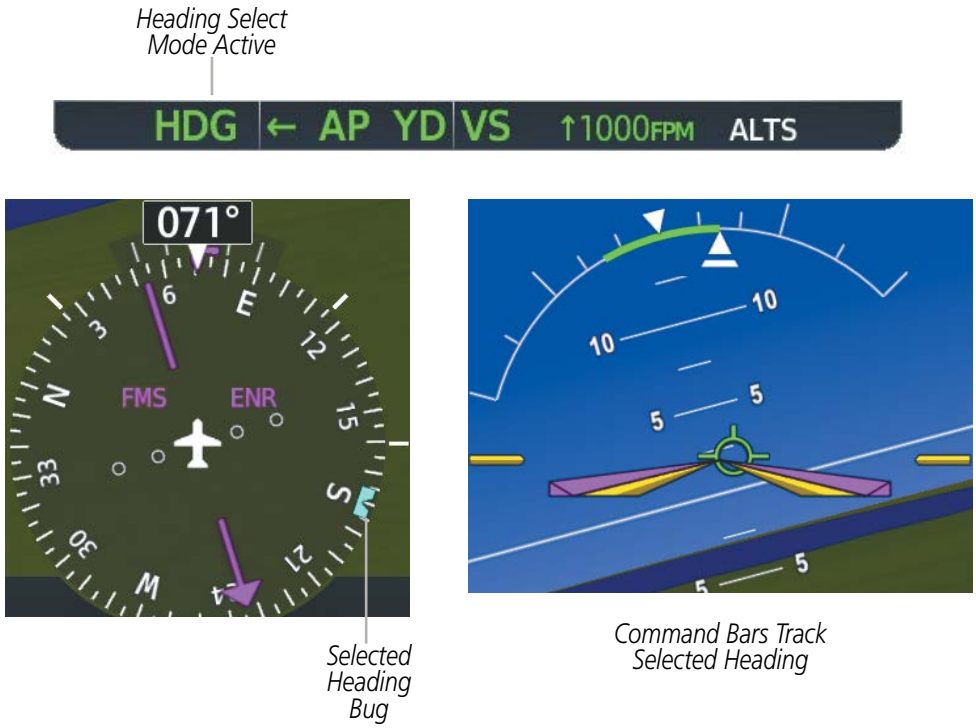


Figure 7-14 Heading Select Mode

NAVIGATION MODES (GPS, VOR, LOC)

NOTE: *The selected navigation receiver must have a valid VOR or LOC signal or active GPS course for the flight director to enter Navigation Mode.*

Pressing the **NAV** Key selects Navigation Mode. Navigation Mode acquires and tracks the selected navigation source (GPS, VOR, LOC). The flight director follows GPS roll steering commands when GPS is the selected navigation source. When the navigation source is VOR or LOC, the flight director creates roll steering commands from the Selected Course and deviation. Navigation Mode can also be used to fly non-precision GPS and LOC approaches where vertical guidance is not required.

If the Course Deviation Indicator (CDI) shows greater than one dot when the **NAV** Key is pressed, the selected mode is armed. If the CDI shows less than one dot, Navigation Mode is automatically captured when the **NAV** Key is pressed. The armed annunciation appears in white to the left of the active lateral mode.

Figure 7-15 GPS Navigation Mode Armed

When the CDI has automatically switched from GPS to LOC during a LOC/ILS approach, GPS Navigation Mode remains active, providing GPS steering guidance until the localizer signal is captured. LOC Navigation Mode is armed automatically when the navigation source switch takes place if the **APR** Key is not pressed prior to the automatic source switch.

If Navigation Mode is active and either of the following occur, the flight director reverts to Roll Hold Mode (wings rolled level):

- Different VOR tuned while in VOR Navigation Mode (VOR Navigation Mode reverts to armed)
- Navigation source manually switched (with the **CDI** Softkey)
- During a LOC/ILS approach, the FAF is crossed while in GPS Navigation Mode after the automatic navigation source switch from GPS to LOC

Changing the Selected Course

If the navigation source is VOR or localizer or OBS Mode has been enabled when using GPS, the Selected Course is controlled using the **CRS** Knob corresponding to the selected flight director (**CRS1** for the pilot side, **CRS2** for the copilot side).

Pressing the **CWS** Button and hand-flying the aircraft does not change the Selected Course while in Navigation Mode. The autopilot guides the aircraft back to the Selected Course (or GPS flight plan) when the **CWS** Button is released.

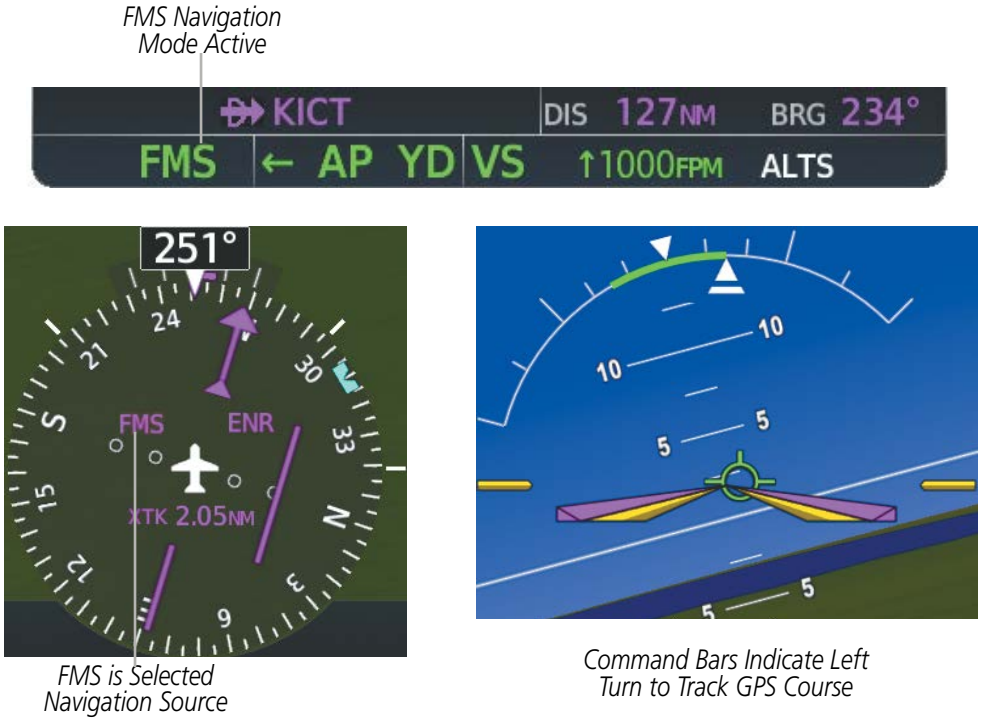


Figure 7-16 Navigation Mode

COMBINATION MODES (VNV, APR, NAV, BC, GA)

The following table lists the modes that operating by using both Vertical and Lateral Modes with their corresponding controls and annunciations.

Mode	Description	Control	Annunciation	Maximum Roll Command Limit	Reference Range
Vertical Path Tracking	Captures and tracks descent legs of an active vertical profile	**VNV** Key	VPTH		
VNV Target Altitude Capture	Captures the Vertical Navigation (VNV) Target Altitude	*	ALTV		
Glidepath	Captures and tracks the SBAS glidepath on approach	**APR** Key	GP		
Glideslope	Captures and tracks the ILS glideslope on approach		GS		
Backcourse Arm/Capture/Track	Captures and tracks a localizer signal for backcourse approaches	**BC** Key	BC	25° Capture 10 Track	
Approach, FMS Arm/Capture/Track	Captures and tracks the selected navigation source (FMS, VOR, LOC)	**APR** Key	FMS	25°	
Approach, VOR Arm/Capture/Track			VAPP	25° Capture 10 Track°	
Approach, ILS Arm/Capture/Track (Glideslope Mode automatically armed)			LOC		
Takeoff	Disengages the autopilot and commands a constant pitch angle and wings level on the ground in preparation for takeoff	**GA** Button	TO		10°
Go Around	Disengages the autopilot and commands a constant pitch angle and wings level in the air	**GA** Button	GA		10°
Level	Autopilot engages and commands pitch angle necessary to establish zero vertical fpm	**LVL** Button	LVL		N/A

** ALTV is armed automatically under VPTH when VNV Target Altitude is to be captured instead of Selected Altitude.*

Table 7-5 Flight Director Combination Modes

VERTICAL NAVIGATION MODES (VPTH, ALTV)

NOTE: *VNV is disabled when parallel track or Dead Reckoning Mode is active. Refer to the Flight Management Section for more information on VNV flight plans*

NOTE: *The Selected Altitude takes precedence over any other vertical constraints.*

Vertical Navigation (VNV) flight control is available for enroute/terminal cruise and descent operations any time that VNV flight planning is available. Refer to the GPS Navigation Section for more information on VNV flight plans. Conditions for availability include, but are not limited to:

- The selected navigation source is GPS.
- A VNV flight plan (with at least one altitude-constrained waypoint) or vertical direct-to is active.
- VNV is enabled (**VNV ENBL** Softkey pressed on the MFD).
- Crosstrack error is valid and within certain limits.
- Desired/actual track are valid or track angle error is within certain limits.
- The VNV Target Altitude of the active waypoint is no more than 250 ft above the current aircraft altitude.

The flight director may be armed for VNV at any time, but no target altitudes are captured during a climb. The Command Bars provide vertical profile guidance based on specified altitudes (entered manually or loaded from the database) at waypoints in the active flight plan or vertical direct-to. The appropriate VNV flight control modes are sequenced by the flight director to follow the path defined by the vertical profile. Upon reaching the last waypoint in the VNV flight plan, the flight director transitions to Altitude Hold Mode and cancels any armed VNV modes.

Vertical Path Tracking Mode (VPTH)

NOTE: *If another vertical mode key is pressed while Vertical Path Tracking Mode is selected, Vertical Path Tracking Mode reverts to armed.*

NOTE: *Pressing the **CWS** Button while Vertical Path Tracking Mode is active does not cancel the mode. The autopilot guides the aircraft back to the descent path upon release of the **CWS** Button.*

When a vertical profile (VNV flight plan) is active and the **VNV** Key is pressed, Vertical Path Tracking Mode is armed in preparation for descent path capture. 'VPTH' (or '/V' when Glidepath or Glideslope Mode is concurrently armed) is annunciated in white in addition to previously armed modes. If applicable, the appropriate altitude capture mode is armed for capture of the next VNV Target Altitude (ALTV) or the Selected Altitude (ALTS), whichever is greater.

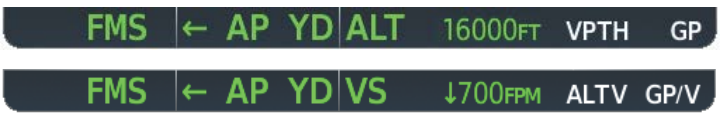


Figure 7-17 Vertical Path Tracking Armed Annunciations

Prior to descent path interception, the Selected Altitude must be set below the current aircraft altitude by at least 75 feet. For the flight director to transition from Altitude Hold to Vertical Path Tracking Mode, acknowledgment is required within five minutes of descent path interception by:

- Pressing the **VNV** Key
- Adjusting the Selected Altitude

If acknowledgment is not received within one minute of descent path interception, the white 'VPTH' annunciation starts to flash. Flashing continues until acknowledged or the descent path is intercepted. If the descent is not confirmed by the time of interception, Vertical Path Tracking Mode remains armed and the descent is not captured.

In conjunction with the "TOD [top of descent] within 1 minute" annunciation in the PFD Navigation Status Box and the "Vertical track" voice message, VNV indications (VNV Target Altitude, vertical deviation, and vertical speed required) appear on the PFDs in magenta.

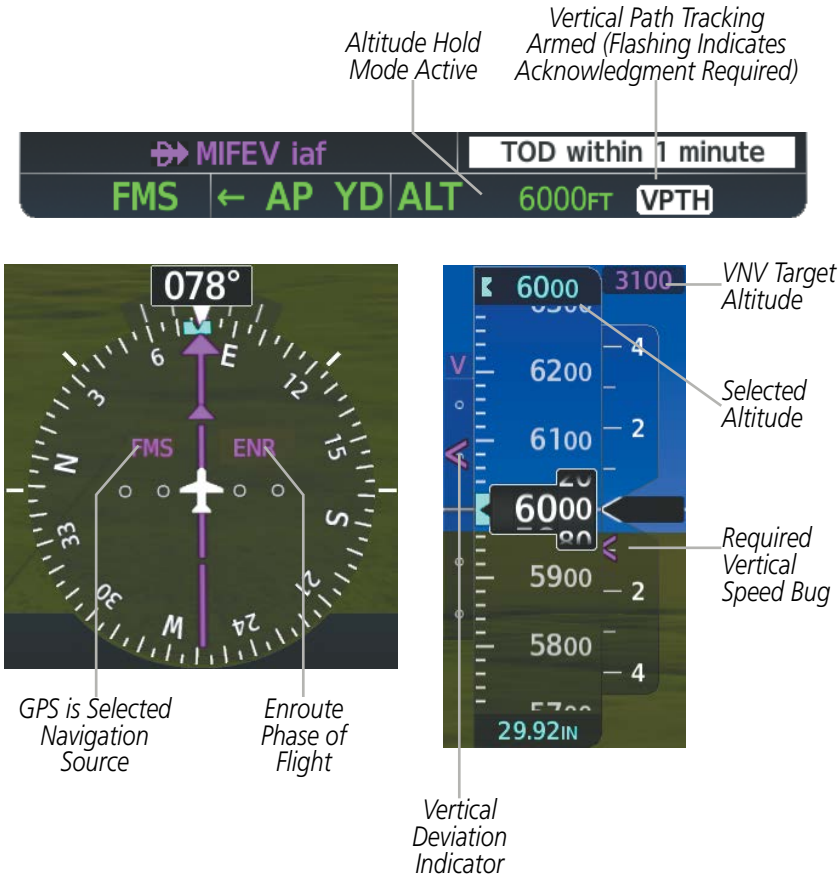


Figure 7-18 Vertical Path Capture

When a descent leg is captured (i.e., vertical deviation becomes valid), Vertical Path Tracking becomes active and tracks the descent profile (next figure). An altitude capture mode ('ALTS' or 'ALTV') is armed as appropriate.

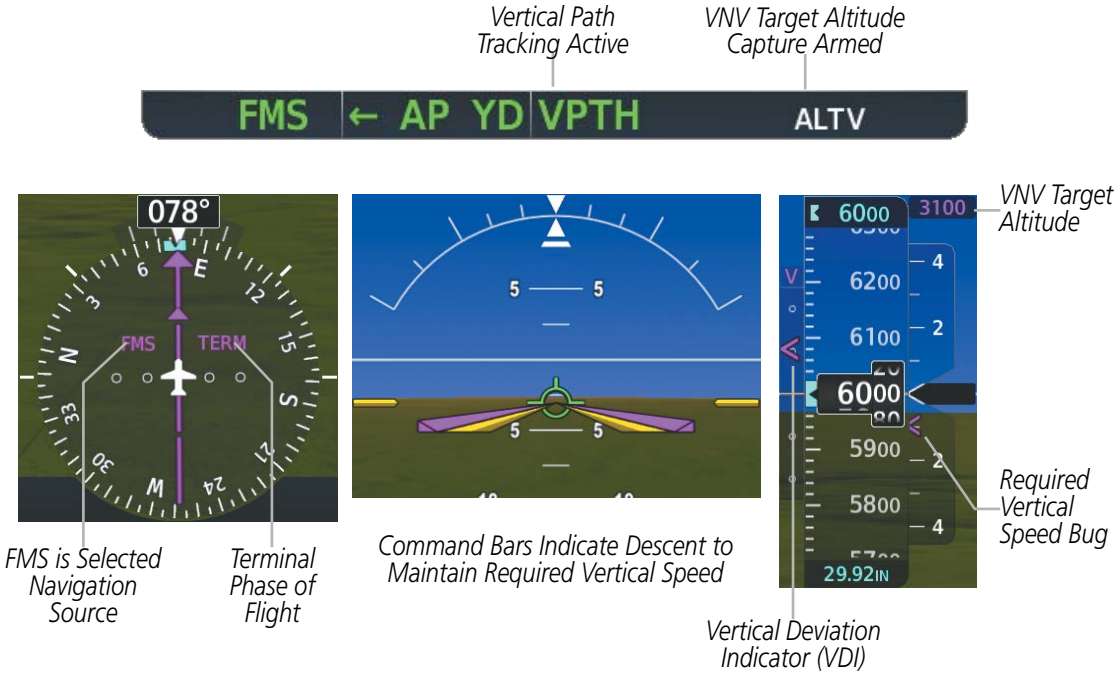


Figure 7-19 Vertical Path Tracking Mode

If the altimeter barometric setting is adjusted while Vertical Path Tracking is active, the flight director increases/decreases the descent rate by up to 500 fpm to re-establish the aircraft on the descent path (without commanding a climb). Adjusting the altimeter barometric setting creates discontinuities in VNV vertical deviation, moving the descent path. For large adjustments, it may take several minutes for the aircraft to re-establish on the descent path. If the change is made while nearing a waypoint with a VNV Target Altitude, the aircraft may not re-establish on the descent path in time to meet the vertical constraint.

Automatic Reversion to Pitch Hold Mode

Several situations can occur while Vertical Path Tracking Mode is active which cause the flight director to revert to Pitch Hold Mode:

- Vertical deviation exceeds 200 feet during an overspeed condition.
- Vertical deviation experiences a discontinuity that both exceeds 200 feet in magnitude and results in the vertical deviation exceeding 200 feet in magnitude. Such discontinuities are usually caused by flight plan changes that affect the vertical profile.
- Vertical deviation becomes invalid (the Vertical Deviation Indicator is removed from the PFD).
- A display enters Reversionary Mode (this does not apply to an active vertical direct-to).

Unless VNV is disabled, Vertical Path Tracking Mode and the appropriate altitude capture mode become armed following the reversion to Pitch Hold Mode to allow for possible profile recapture.

Non-Path Descents

Pitch Hold, Vertical Speed, and Flight Level Change modes can also be used to fly non-path descents while VNV flight control is selected. If the **VS** or **FLC** Key is pressed while Vertical Path Tracking Mode is selected, Vertical Path Tracking Mode reverts to armed along with the appropriate altitude capture mode to allow profile re-capture.

Figure 7-20 Flight Level Change VNV Non-Path Descent

To prevent immediate profile re-capture, the following must be satisfied:

- At least 10 seconds have passed since the non-path transition was initiated
- Vertical deviation from the profile has exceeded 250 feet, but is now less than 200 feet

Pressing the **VNV** Key twice re-arms Vertical Path Tracking for immediate profile re-capture.

VNV Target Altitude Capture Mode (ALTV)

NOTE: *Armed VNV Target Altitude and Selected Altitude capture modes are mutually exclusive. However, Selected Altitude Capture Mode is armed implicitly (not annunciated) whenever VNV Target Altitude Capture Mode is armed.*

VNV Target Altitude Capture is analogous to Selected Altitude Capture Mode and is armed automatically after the **VNV** Key is pressed and the next VNV Target Altitude is to be intercepted before the Selected Altitude. The annunciation 'ALTV' indicates that the VNV Target Altitude is to be captured. VNV Target Altitudes are shown in the active flight plan or vertical direct-to, and can be entered manually or loaded from a database (see the GPS Navigation Section for details). At the same time as "TOD within 1 minute" is annunciated in the Navigation Status Box, the active VNV Target Altitude is displayed above the Vertical Speed Indicator.

As the aircraft nears the VNV Target Altitude, the flight director automatically transitions to VNV Target Altitude Capture Mode with Altitude Hold Mode armed. This automatic transition is indicated by the green 'ALTV' annunciation flashing for up to 10 seconds and the appearance of the white 'ALT' annunciation. The VNV Target Altitude is shown as the Altitude Reference beside the 'ALTV' annunciation and remains displayed above the Vertical Speed Indicator. The Required Vertical Speed Indication (RSVI) is removed once VNV Target Altitude Capture Mode becomes active.

At 50 feet from the VNV Target Altitude, the flight director automatically transitions from VNV Target Altitude Capture to Altitude Hold Mode and tracks the level leg. As Altitude Hold Mode becomes active, the white 'ALT' annunciation moves to the active vertical mode field and flashes green for 10 seconds to indicate the automatic transition. The flight director automatically arms Vertical Path Tracking, allowing upcoming descent legs to be captured and subsequently tracked.

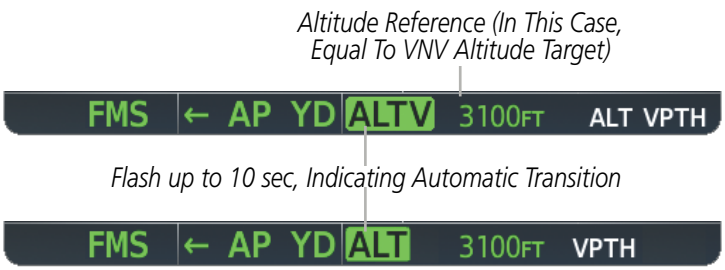


Figure 7-21 Automatic Mode Transitions During Altitude Capture

Changing the VNV Target Altitude

NOTE: *Pressing the **CWS** Button while in VNV Target Altitude Capture Mode does not cancel the mode.*

Changing the current VNV Target Altitude while VNV Target Altitude Capture Mode is active causes the flight director to revert to Pitch Hold Mode. Vertical Path Tracking and the appropriate altitude capture mode are armed in preparation to capture the new VNV Target Altitude or the Selected Altitude, depending on which altitude is to be intercepted first.

VNV target altitudes can be changed while editing the active flight plan (see the GPS Navigation Section for details).

GLIDEPATH MODE (GP)

Glidepath Mode is used to track the SBAS-based glidepath. When Glidepath Mode is armed, 'GP' is annunciated in white in the AFCS Status Box.

Selecting Glidepath Mode:

1) Ensure a GPS approach is loaded into the active flight plan. The active waypoint must be part of the flight plan (cannot be a direct-to a waypoint not in the flight plan).
2) Ensure that GPS is the selected navigation source (use the **CDI** Softkey to cycle through navigation sources if necessary).
3) Press the **APR** Key.

NOTE: *Some RNAV (GPS) approaches provide a vertical descent angle as an aid in flying a stabilized approach. These approaches are NOT considered Approaches with Vertical Guidance (APV). Approaches that are annunciated on the HSI as LNAV or LNAV+V should be flown to an MDA, until visual with the landing surface, even though vertical glidepath (GP) information may be provided.*

WARNING: *When flying an LNAV approach (with vertical descent angle) with the autopilot coupled, the aircraft will not level off at the MDA even if the MDA is set in the altitude preselect.*

Upon reaching the glidepath, the flight director transitions to Glidepath Mode and begins to capture and track the glidepath.

Figure 7-22 Glidepath Mode Armed

Once the following conditions have been met, the glidepath can be captured:

- A GPS approach with vertical guidance (LPV, LNAV/VNAV, LNAV+V) is loaded into the active flight plan.
- The active waypoint is at or after the final approach fix (FAF).
- Vertical deviation is valid.
- The CDI is at less than full-scale deviation
- Automatic sequencing of waypoints has not been suspended (no 'SUSP' annunciation on the HSI)

NOTE: *Pressing the **CWS** Button while Glidepath Mode is active does not cancel the mode. The autopilot guides the aircraft back to the glidepath upon release of the **CWS** Button.*

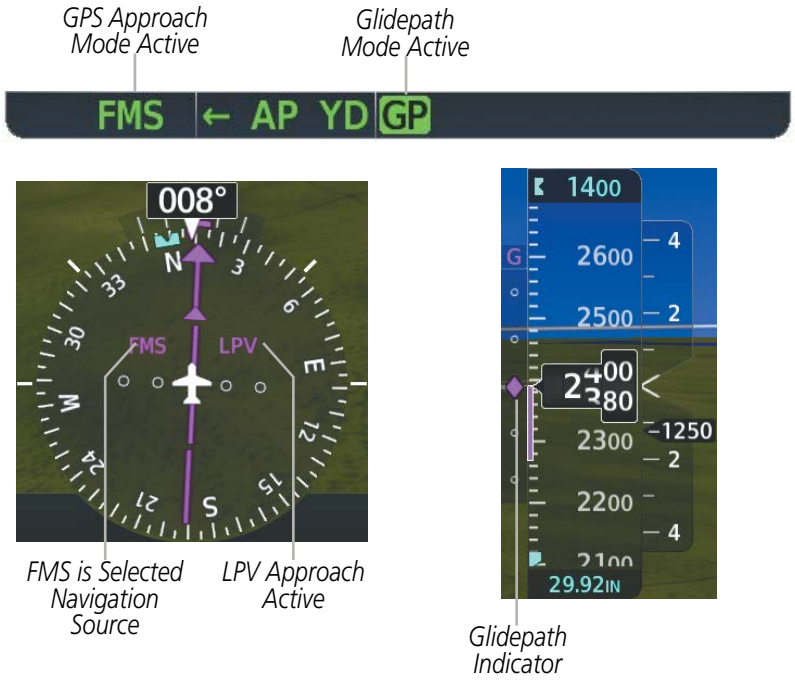


Figure 7-23 Glidepath Mode

GLIDESLOPE MODE (GS)

Glideslope Mode is available for LOC/ILS approaches to capture and track the glideslope. When Glideslope Mode is armed (annunciated as 'GS' in white), LOC Approach Mode is armed as the lateral flight director mode.

Selecting Glideslope Mode:

1) Ensure a valid localizer frequency is tuned.
2) Ensure that LOC is the selected navigation source (use the **CDI** Softkey to cycle through navigation sources if necessary).
3) Press the **APR** Key.

Or:

1) Ensure that GPS is the selected navigation source (use the **CDI** Softkey to cycle through navigation sources if necessary).
2) Ensure a LOC/ILS approach is loaded into the active flight plan.
3) Ensure the corresponding LOC frequency is tuned.
4) Press the **APR** Key.

Figure 7-24 Glideslope Mode Armed

Once LOC is the navigation source, the localizer and glideslope can be captured. Upon reaching the glideslope, the flight director transitions to Glideslope Mode and begins to capture and track the glideslope.

NOTE: *Pressing the **CWS** Button while Glideslope Mode is active does not cancel the mode. The autopilot guides the aircraft back to the glideslope upon release of the **CWS** Button.*

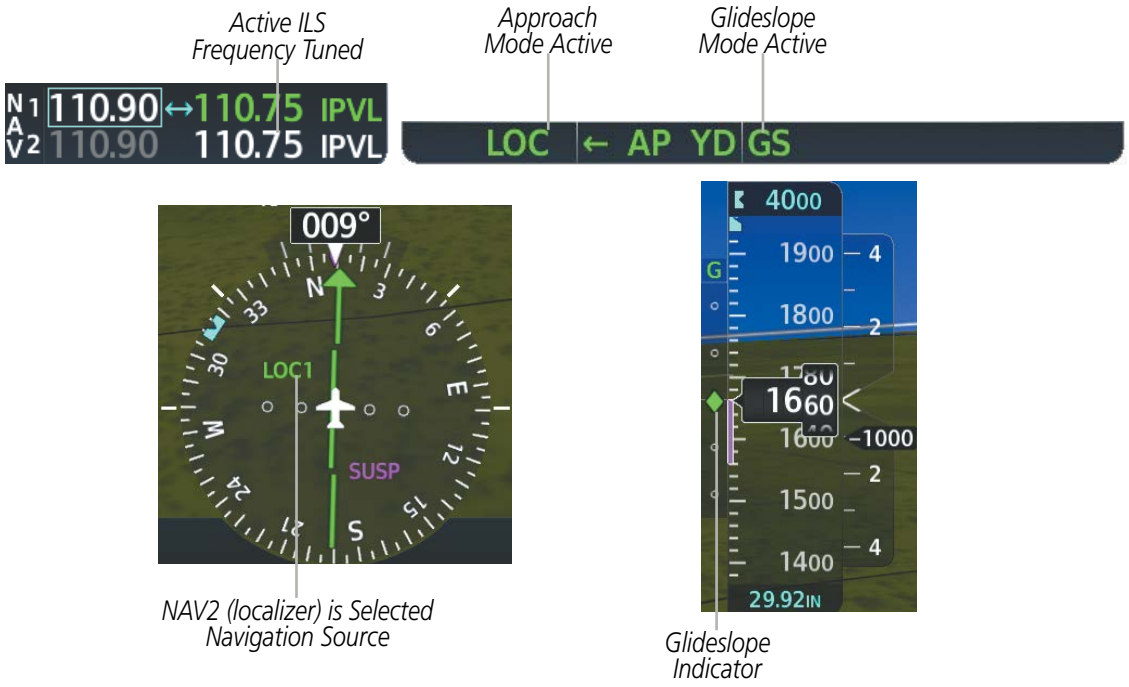


Figure 7-25 Glideslope Mode

APPROACH MODES (GPS, VAPP, LOC)

NOTE: *The selected navigation receiver must have a valid VOR or LOC signal or active GPS course for the flight director to enter Approach Mode.*

Approach Mode is activated when the **APR** Key is pressed. Approach Mode acquires and tracks the selected navigation source (GPS, VOR, or LOC), depending on loaded approach. This mode uses the selected navigation receiver deviation and desired course inputs to fly the approach. Pressing the **APR** Key when the CDI is greater than one dot arms the selected approach mode (annunciated in white to the left of the active lateral mode). If the CDI is less the 1 dot, the LOC is automatically captured when the **APR** Key is pressed.

VOR Approach Mode (VAPP) provides greater sensitivity for signal tracking than VOR Navigation Mode.

Selecting VOR Approach Mode:

1) Ensure a valid VOR frequency is tuned
2) Ensure that VOR is the selected navigation source (use the **CDI** Softkey to cycle through navigation sources if necessary).
3) Press the **APR** Key.

When GPS Approach Mode is armed, Glidepath Mode is also armed.

Selecting GPS Approach Mode:

1) Ensure a GPS approach is loaded into the active flight plan. The active waypoint must be part of the flight plan (cannot be a direct-to a waypoint not in the flight plan).
2) Ensure that GPS is the selected navigation source (use the **CDI** Softkey to cycle through navigation sources if necessary).
3) Press the **APR** Key.

Figure 7-26 GPS Approach Mode Armed

LOC Approach Mode allows the autopilot to fly a LOC/ILS approach with a glideslope. When LOC Approach Mode is armed, Glideslope Mode is also armed automatically. LOC captures are inhibited if the difference between aircraft heading and localizer course exceeds 105°.

Selecting LOC Approach Mode:

1) Ensure a valid localizer frequency is tuned.
2) Ensure that LOC is the selected navigation source (use the **CDI** Softkey to cycle through navigation sources if necessary).
3) Press the **APR** Key.

Or:

1) Ensure that GPS is the selected navigation source (use the **CDI** Softkey to cycle through navigation sources if necessary).
2) Ensure a LOC/ILS approach is loaded into the active flight plan.
3) Ensure the corresponding LOC frequency is tuned.
4) Press the **APR** Key.

If the following occurs, the flight director reverts to Roll Hold Mode (wings rolled level):

- Approach Mode is active and a Vectors-To-Final is activated
- Approach Mode is active and Navigation source is manually switched
- During a LOC/ILS approach, GPS Navigation Mode is active and the FAF is crossed after the automatic navigation source switch from GPS to LOC

Changing the Selected Course

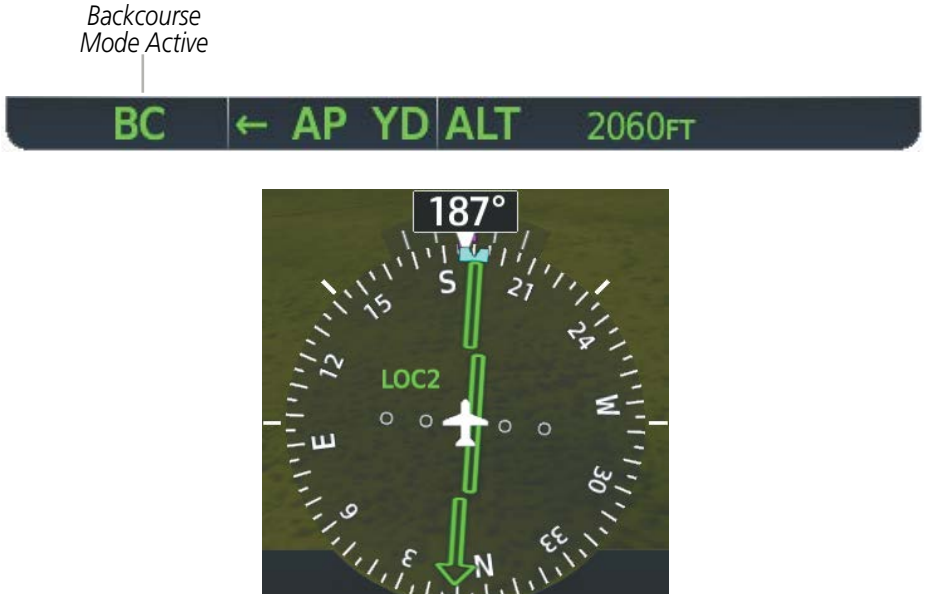
If the navigation source is VOR or localizer or OBS Mode has been enabled when using GPS, the Selected Course is controlled using the **CRS** Knob corresponding to the selected flight director (**CRS1** for the pilot side, **CRS2** for the copilot side).

Pressing the **CWS** Button and hand-flying the aircraft does not change the Selected Course while in Approach Mode. The autopilot guides the aircraft back to the Selected Course (or GPS flight plan) when the **CWS** Button is released.

BACKCOURSE MODE (BC)

NOTE: *When making a backcourse approach, set the Selected Course to the localizer front course.*

Backcourse Mode captures and tracks a localizer signal in the backcourse direction. The mode may be selected by pressing the **BC** Key. Backcourse Mode is armed if the CDI is greater than one dot when the mode is selected. If the CDI is less than one dot, Backcourse Mode is automatically captured when the **BC** Key is pressed. The flight director creates roll steering commands from the Selected Course and deviation when in Backcourse Mode.



LOC2 is Selected Navigation Source

Figure 7-27 Backcourse Mode

Changing the Selected Course

If the navigation source is VOR or localizer or OBS Mode has been enabled when using GPS, the Selected Course is controlled using the **CRS** Knob corresponding to the selected flight director (**CRS1** for the pilot side, **CRS2** for the copilot side).

Pressing the **CWS** Button and hand-flying the aircraft does not reset any reference data while in Backcourse Mode. The autopilot guides the aircraft back to the Selected Course when the **CWS** Button is released.

INTERCEPTING AND FLYING A DME ARC

The AFCS will intercept and track a DME arc that is part of the active flight plan provided that GPS Navigation Mode is engaged, GPS is the active navigation source on the CDI, and the DME arc segment is the active flight plan leg. It is important to note that automatic navigation of DME arcs is based on GPS. Thus, even if the APR key is pressed and LOC or VOR Approach Mode is armed prior to reaching the Initial Approach Fix (IAF), Approach Mode will not activate until the arc segment is completed.

If the pilot decides to intercept the arc at a location other than the published IAF (i.e. ATC provides vectors to intercept the arc) and subsequently selects Heading Mode or Roll Mode, the AFCS will not automatically intercept or track the arc unless the pilot activates the arc leg of the flight plan and arms GPS Navigation Mode. The AFCS will not intercept and fly a DME arc before reaching an IAF that defines the beginning of the arc segment. Likewise, if at any point while established on the DME arc the pilot deselects GPS Navigation Mode, the AFCS will no longer track the arc.

TAKEOFF (TO) AND GO AROUND (GA) MODES

Go Around and Takeoff 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 wings level. The **GA** Button is used to select both modes. The mode entered by the flight director depends on whether the aircraft is on the ground.

Takeoff Mode provides an attitude reference during rotation and takeoff. This mode can be selected only while on the ground by pushing the **GA** Button. The flight director Command Bars assume a wings-level, pitch-up attitude.

Pressing the **GA** Button while in the air activates the flight director in wings level, pitch-up attitudes, allowing the execution of a missed approach or a go around. Go Around Mode disengages the autopilot and arms Selected Altitude Capture Mode automatically. Subsequent autopilot engagement is allowed. Attempts to modify the aircraft attitude (i.e., with the **NOSE UP/DN** Wheel or **CWS** Button) result in reversion to Pitch and Roll Hold modes.

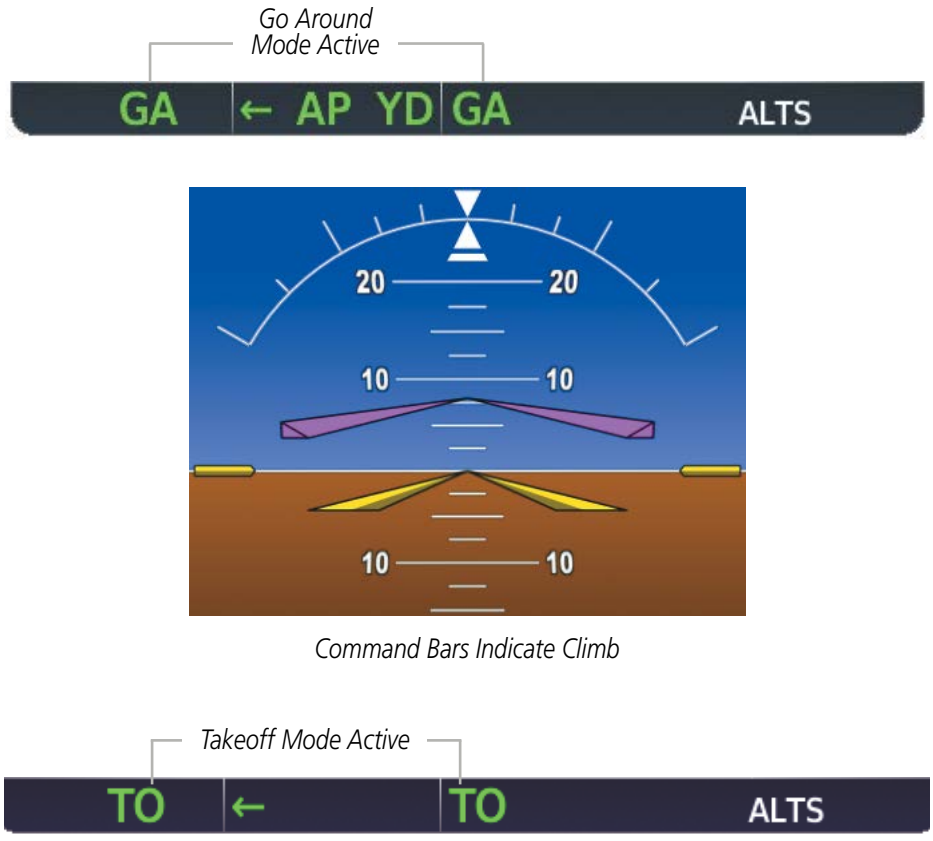


Figure 7-28 Takeoff and Go Around Modes

7.4 AUTOPILOT AND YAW DAMPER OPERATION

NOTE: *Refer to the POH for specific instructions regarding emergency procedures.*

The autopilot and yaw damper operate the flight control surface servos to provide automatic flight control. The autopilot controls the aircraft pitch and roll attitudes following commands received from the flight director. Pitch autotrim provides trim commands to the pitch trim servo to relieve any sustained effort required by the pitch servo. Autopilot operation is independent of the yaw damper.

The yaw damper reduces Dutch roll tendencies and coordinates turns. It can operate independently of the autopilot and may be used during normal hand-flight maneuvers. Yaw rate commands are limited to 6 deg/sec by the yaw damper.

FLIGHT CONTROL

Pitch and roll commands are provided to the servos based on the active flight director modes. Yaw damping is provided by the yaw servo. Servo motor control limits the maximum servo speed and torque. The servo gearboxes are equipped with slip-clutches set to certain values. This allows the servos to be overridden in case of an emergency.

PITCH AXIS AND TRIM

The autopilot pitch axis uses pitch rate to stabilize the aircraft pitch attitude during flight director maneuvers. Flight director pitch commands are rate- and attitude-limited, combined with pitch damper control, and sent to the pitch servo motor. The pitch servo measures the output effort (torque) and provides this signal to the pitch trim servo. The pitch trim servo commands the motor to reduce the average pitch servo effort.

When the autopilot is not engaged, the pitch trim servo may be used to provide manual electric pitch trim (MEPT). This allows the aircraft to be trimmed using a control wheel switch rather than the trim wheel. Manual trim commands are generated only when both halves of the **MEPT** Switch are operated simultaneously. Trim speeds are scheduled with airspeed to provide more consistent response.

ROLL AXIS

The autopilot roll axis uses roll rate to stabilize aircraft roll attitude during flight director maneuvers. The flight director roll commands are rate- and attitude-limited, combined with roll damper control, and sent to the roll servo motor.

YAW AXIS

The yaw damper uses yaw rate and roll attitude to dampen the aircraft's natural Dutch roll response. It also uses lateral acceleration to coordinate turns. Yaw damper operation is independent of autopilot engagement.

When the yaw damper is not engaged, the yaw trim adapter may be used to provide manual electric yaw trim (MEYT). This allows the aircraft to be trimmed using a control wheel switch. Trim speeds are scheduled with airspeed to provide more consistent response.

ENGAGEMENT

NOTE: *Autopilot engagement/disengagement is not equivalent to servo engagement/disengagement. Use the* ***CWS*** *Button to disengage the pitch and roll servos while the autopilot remains active.*

When the **YD** Key is pressed, the system engages the yaw damper independently of the autopilot and the yaw damper annunciator light is illuminated. When the **AP** Key is pressed, the autopilot, yaw damper, and flight director (if not already active) are activated and the annunciator lights on the AFCS controller for the autopilot and yaw damper are illuminated. The flight director engages in Pitch and Roll Hold Modes when initially activated.

Figure 7-29 Autopilot and Yaw Damper Engaged

Autopilot and yaw damper status are displayed in the center of the AFCS Status Box. Engagement is indicated by green 'AP' and 'YD' annunciations, respectively.

CONTROL WHEEL STEERING

During autopilot operation, the aircraft may be hand-flown without disengaging the autopilot. Pressing and holding the **CWS** Button disengages the pitch and roll servos from the flight control surfaces and allows the aircraft to be hand-flown. At the same time, the flight director is synchronized to the aircraft attitude during the maneuver. CWS activity has no effect on yaw damper engagement.

The 'AP' annunciation is temporarily replaced by 'CWS' in white for the duration of CWS maneuvers.

Figure 7-30 CWS Annunciation

In most scenarios, releasing the **CWS** Button reengages the autopilot with a new reference. Refer to flight director mode descriptions for specific CWS behavior in each mode.

DISENGAGEMENT

NOTE: *If Underspeed Protection (USP) is installed, AP does not disconnnect at stall warning.*

The autopilot may be manually disengaged by pushing the **AP DISC**, **GA**, **MEYT** Switch, **MEPT** Switch, or the **AP** Key on the AFCS Control Unit. Manual disengagement is indicated by a five-second flashing yellow 'AP' annunciation and a three-second autopilot disconnect aural alert. The **AP DISC** or **MEPT** Switch may be used to cancel the aural alert.

Figure 7-31 Manual Autopilot Disengagement

The **YD** Key, **MEYT** and **AP DISC** Switches can be used to disengage the yaw damper (the autopilot, if engaged, also disengages when the **AP DISC** Switch is pressed). The 'YD' and 'AP' annunciations turn yellow and flash for 5 seconds upon disengagement.

Figure 7-32 Yaw Damper Disengagement

Automatic autopilot disengagement is indicated by a flashing red and white 'AP' annunciation and by the autopilot disconnect aural alert, which continue until acknowledged by pushing the **AP DISC** or **MEPT** Switch. Automatic autopilot disengagement occurs due to:

- System failure
- Invalid sensor data
- Inability to compute default flight director modes (FD also disengages automatically)
- Stall warning (YD also disengages)
- Inability to compute default flight director modes (FD also disengages automatically)

Yaw damper disengagement is indicated by a five-second flashing yellow 'YD' annunciation. Automatic yaw damper disengagement occurs when autopilot disengagement is caused by failure in a parameter also affecting the yaw damper. This means the yaw damper can remain operational in some cases where the autopilot automatically disengages. A localized failure in the yaw damper system or invalid sensor data also cause yaw damper disengagement.

Figure 7-33 Automatic Autopilot and Yaw Damper Disengagement

7.5 AFCS ANNUNCIATIONS AND ALERTS

AFCS ALERTS

Figure 7-34 AFCS System Status Field

The following alert annunciations appear in the AFCS System Status field on the PFD.

Condition	Annunciation	Description
Pitch Failure	PTCH	Pitch axis control failure. AP is inoperative.
Roll Failure	ROLL	Roll axis control failure. AP is inoperative.
MEPT Switch Stuck, or Pitch Trim Axis Control Failure	PTRM	If annunciated when AP is engaged, take control of the aircraft and disengage the autopilot. If annunciated when AP is not engaged, move each half of the **MEPT** switch separately to check if a stuck switch is causing the annunciation.
Yaw Damper Failure	YAW	YD control failure; AP also inoperative
MEYT Switch Stuck, or Yaw Trim Failure	YTRM	If AP engaged, take control of the aircraft and disengage AP If AP disengaged, move MEYT switch to unstick
System Failure	AFCS	AP and MEPT are unavailable. FD may still be available.
Elevator Mistrim Up	↑ELE	A condition has developed causing the pitch servo to provide a sustained force. Be prepared to apply nose up control wheel force upon autopilot disconnect.
Elevator Mistrim Down	↓ELE	A condition has developed causing the pitch servo to provide a sustained force. Be prepared to apply nose down control wheel force upon autopilot disconnect.
Aileron Mistrim Left	←AIL	A condition has developed causing the roll servo to provide a sustained left force. Ensure the slip/skid indicator is centered and observe any maximum fuel imbalance limits.
Aileron Mistrim Right	AIL→	A condition has developed causing the roll servo to provide a sustained right force. Ensure the slip/skid indicator is centered and observe any maximum fuel imbalance limits.
Rudder Mistrim Left	←RUD	A condition has developed causing the yaw servo to provide a sustained force. Ensure the slip/skid indicator is centered and observe any maximum fuel imbalance limits.
Rudder Mistrim Right	RUD→	A condition has developed causing the yaw servo to provide a sustained force. Ensure the slip/skid indicator is centered and observe any maximum fuel imbalance limits.
Preflight Test	PFT	Performing preflight system test; aural alert sounds at completion. Do not press the **AP DISC** Switch during servo power-up and preflight system tests as this may cause the preflight system test to fail or never to start (if servos fail their power-up tests). Power must be cycled to the servos to remedy the situation.
	PFT	Preflight system test has failed.

Table 7-6 AFCS Alert Messages

OVERSPEED PROTECTION

NOTE: *Overspeed protection is not active in ALT, GS or GP modes.*

While Pitch Hold, Vertical Speed, Flight Level Change, Vertical Path Tracking, or an altitude capture mode is active, airspeed is monitored by the flight director. Overspeed protection is provided to limit the flight director's pitch command in situations where the flight director cannot acquire and maintain the mode reference for the selected vertical mode without exceeding Vmo.

When Overspeed Protection is active, the Airspeed Reference appears in a box above the Airspeed Indicator, flashing a yellow 'MAXSPD' annunciation. Engine power should be reduced and/or the pitch reference adjusted to slow the aircraft. The annunciation disappears when the overspeed condition is resolved.

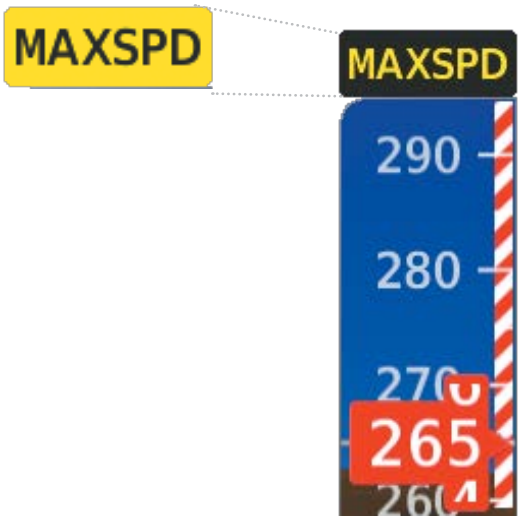


Figure 7-35 Overspeed Annunciation

UNDERSPEED PROTECTION

Underspeed Protection is available when the optional Underspeed Protection (USP) system is installed, the aircraft is fitted with an AOA sensor, and the autopilot is on. It is designed to discourage aircraft operation below minimum established airspeeds.

When the aircraft reaches a predetermined airspeed (specific to each flap setting), a yellow MINSPD annunciation will appear above the airspeed indicator. When aircraft angle of attack is within four degrees of stall warning, the Pitch Limit Indicator will be displayed approximately four degrees above the aircraft symbol on the pitch attitude indicator. If deceleration continues, the Pitch Limit Indicator will move downward on the pitch attitude indicator until coincident with the aircraft symbol at stall warning angle of attack.

Flaps	MINSPD Annunciation	Airspeed Alert
0%	95 kts	92 kts
Takeoff	87 kts	84 kts
100%	75 kts	72 kts

*Airspeed alert based on speed trend

Table 7-7 AFCS Status Alerts

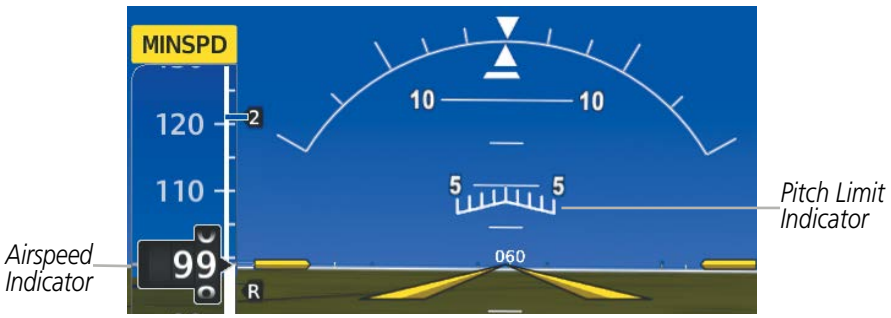


Figure 7-36 MINSPD Annunciation and Pitch Limit Indicator

If the aircraft continues to decelerate, Underspeed Protection functionality depends on which vertical flight director mode is selected. For the purpose of this discussion, the vertical flight director modes can be divided into two categories: Those in which it is important to maintain altitude for as long as possible (altitude-critical modes), and those in which maintaining altitude is less crucial (non-altitude critical modes).

ALTITUDE-CRITICAL MODES (ALT, ALTV, ALTS, GS, GP, TO, GA, FLC)

If the aircraft decelerates to stall warning and IAS is below MINSPD speed trigger +2 kts, the lateral and vertical flight director modes will change from active to armed, and the autopilot will provide input causing the aircraft to pitch down and the wings to level.

Figure 7-37 Lateral and Vertical Flight Director Modes Armed

An aural "AIRSPEED" alert will sound every five seconds and a red "USP ACTIVE" annunciation (next figure) will appear in the CAS window. The pitch down force will continue until the aircraft reaches a pitch attitude at which IAS equals the IAS at which stall warning turns off, plus two knots.

Figure 7-38 USP Active Annunciation

When airspeed increases (as a result of adding power/thrust) to above the IAS at which MINSPD turns off, plus two knots (see previous table for values), the autopilot will cause the aircraft to pitch up until recapturing the vertical reference. The vertical and lateral flight director modes will change from armed to active, and when aircraft angle of attack reaches approximately five degrees below stall warning angle of attack, the Pitch Limit Indicator will be removed.

NON-ALTITUDE CRITICAL MODES (VS, VNAV, PIT, LVL)

When the airspeed trend vector (specific to each flap setting) reaches a predetermined airspeed, a single aural "AIRSPEED" will sound, alerting the pilot to the impending underspeed condition. If the aircraft decelerates to an IAS below the minimum commandable autopilot airspeed (see values in previous table), a red "USP ACTIVE" annunciation (previous figure) will appear in the CAS window. The vertical flight director mode will change from active to armed (next figure), and the autopilot will cause the aircraft to pitch down until reaching a pitch attitude at which IAS equals the minimum commandable autopilot airspeed.

Figure 7-39 Vertical Flight Director Mode Armed

When airspeed increases (as a result of adding power/thrust) to an IAS above the minimum commandable autopilot airspeed, plus five knots (see previous table for values), the autopilot will cause the aircraft to pitch up until recapturing the vertical reference. The vertical flight director mode will change from armed to active, and when aircraft angle of attack reaches approximately five degrees below stall warning angle of attack, the Pitch Limit Indicator will be removed.

LEVEL MODE

Level Mode is coupled pitch and roll modes and is annunciated as both the vertical and lateral modes when active. Pressing the LVL Key engages the autopilot and Yaw Damper (if the autopilot is disengaged and the aircraft is within the autopilot engagement limitations) in level vertical and lateral modes. Level Mode does not track altitude or heading. When engaged all armed and active modes are cancelled and the autopilot and flight director revert to LVL mode for pitch and roll. While in level mode, all other modes are available by pressing the corresponding button.

Level mode also becomes active as a function of Electronic Stability and Protection (ESP). Refer to the Additional Features section for a detailed discussion of the ESP feature.

Figure 7-40 Level Mode Annunciation

EMERGENCY DESCENT MODE

ACTIVATION

The aircraft is equipped with an Emergency Descent Mode (EDM). EDM is automatically activated when the autopilot is engaged and:

- Pressure Altitude is greater than 15,000 feet MSL

  AND

- CABIN ALTITUDE CAS warning message is triggered.

Throttle should be reduced to idle to achieve a maximum rate of decent. EDM is annunciated on the PFD and the following AFCS modes are engaged: FLC Mode with a target speed of 265 KIAS or Mach equivalent, Heading Mode with a course 90° left of current heading, and a target altitude of 15,000 feet MSL.

NOTE: *Refer to the POH for specific instructions regarding emergency procedures.*

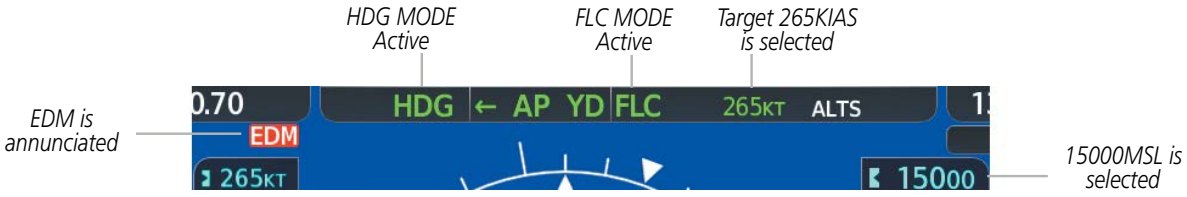


Figure 7-41 Emergency Descent Mode Armed

EDM OVERRIDE

To exit the EDM Mode press the **AP** Key on the AFCS Controller. If the **AP** Key is pressed again an EDM Override advisory will appear and the pilot will have the ability to change AFCS modes as necessary. EDM Mode cannot be reentered until the EDM Override is cleared. To clear the EDM Override the CABIN ALTITUDE CAS warning needs to be cleared and the **AP** Key needs to be cycled off and back on again.

7.6 ABNORMAL OPERATION

SUSPECTED AUTOPILOT MALFUNCTION

NOTE: *Consult the aircraft documentation for the location of circuit breakers as well as specifics that may supplement or amplify this procedure.*

If an autopilot failure or trim failure is suspected to have occurred, perform the following steps:

1) Firmly grasp the control wheel.
2) Press and hold the **AP DISC** Switch. The autopilot will disconnect and power is removed from the trim motor. Power is also removed from all primary servo motors and engaged solenoids. Note the visual and aural alerting indicating autopilot disconnect.
3) Retrim the aircraft as needed. Substantial trim adjustment may be needed.
4) Pull the appropriate circuit breaker(s) to electrically isolate the servo and solenoid components.
5) Release the **AP DISC** Switch.

OVERPOWERING AUTOPILOT SERVOS

In the context of this discussion, "overpowering" refers to any pressure or force applied to the pitch controls when the autopilot is engaged. A small amount of pressure or force on the pitch controls can cause the autopilot automatic trim to run to an out-of-trim condition. Therefore, any application of pressure or force to the controls should be avoided when the autopilot is engaged.

Overpowering the autopilot during flight will cause the autopilot's automatic trim to run, resulting in an out-of-trim condition or cause the trim to hit the stop if the action is prolonged. In this case, larger than anticipated control forces are required after the autopilot is disengaged.

The following steps should be added to the preflight check:

1) Check for proper autopilot operation and ensure the autopilot can be overpowered.
2) Note the forces required to overpower the autopilot servo clutches.

SECTION 8 ADDITIONAL FEATURES

NOTE: *With the availability of SafeTaxi®, ChartView, IFR/VFR, or FliteCharts®, it may be necessary to carry another source of charts on-board the aircraft.*

Additional features of the system include the following:

- SafeTaxi® diagrams
- ChartView, FliteCharts®, and IFR/VFR electronic charts
- Airport Directory
- SiriusXM Satellite Radio entertainment
- Flight Data Logging
- Iridium Satellite Telephone and SMS text messaging
- Connext Setup, FlightStream 510
- Maintenance Logs
- Electronic Stability and Protection (ESP™) System (optional)
- Electronic Checklists

SafeTaxi diagrams provide detailed taxiway, runway, and ramp information at more than 1300 airports in the United States. By decreasing range on an airport that has a SafeTaxi diagram available, a close up view of the airport layout can be seen.

The optional ChartView, FliteCharts and IFR/VFR electronic charts provides on-board electronic terminal procedures charts. Electronic charts offer the convenience of rapid access to essential information.

The Airport Directory offers detailed information for a selected airport, such as available services, hours of operation, and lodging options.

The optional SiriusXM Satellite Radio entertainment audio feature of the GDL 69A SXM Data Link Receiver handles more than 170 channels of music, news, and sports. SiriusXM Satellite Radio offers more entertainment choices and longer range coverage than commercial broadcast stations.

The Flight Data Logging feature automatically stores critical flight and engine data on an SD data card. Approximately 1,000 flight hours can be recorded for each 1GB of available space on the card.

Iridium Telephone Services and SMS messaging is an optional subscription service offered through Garmin Connext and Iridium Satellite LLC.

Connext allows for setting up the installed optional Flight Stream device for a Bluetooth connection between the system and a mobile device running the Garmin Pilot™ application. The optional Flight Stream 510 device provides a Bluetooth® connection between the system and a mobile device running the Garmin Pilot™ application. GPS and AHRS data can then be shared with the mobile device. Also, flight plans can be transferred from the mobile device to the system.

The Maintenance Log feature records maintenance data specified by the aircraft manufacturer. The recording of this data is not visible to the pilot and requires no pilot interaction.

The optional Garmin Electronic Stability and Protection (ESP™) system discourages aircraft operation outside the normal flight envelope.

Electronic checklists allow a pilot to quickly find the proper procedure for a particular phase of flight.

8.1 SAFETAXI

SafeTaxi is an enhanced feature that gives greater map detail when viewing airports at close range. 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 MFD display is within the SafeTaxi ranges, the airplane symbol on the airport provides enhanced position awareness.

Designated Hot Spots are recognized at airports with many intersecting taxiways and runways, and/or complex ramp areas. Airport Hot Spots are outlined to caution pilots of areas on an airport surface where positional awareness confusion or runway incursions happen most often. Hot Spots are defined with a magenta circle or outline around the region of possible confusion.

Any map page that displays the navigation view can also show the SafeTaxi airport layout within the maximum configured range. The following is a list of pages where the SafeTaxi feature can be seen:

- Navigation Map Page
- PFD Maps
- Weather Datalink Page
- Airport Information Page
- Intersection Information Page
- NDB Information Page
- VOR Information Page
- User Waypoint Information Page
- Trip Planning Page
- Nearest Pages
- Active and Stored Flight Plan Pages

During ground operations the aircraft's position is displayed in reference to taxiways, runways, and airport features. In the example shown, the aircraft is on taxiway Bravo inside the High Alert Intersection boundary on KSFO airport. Airport Hot Spots are outlined in magenta. When panning over the airport, features such as runway holding lines and taxiways are shown at the cursor.

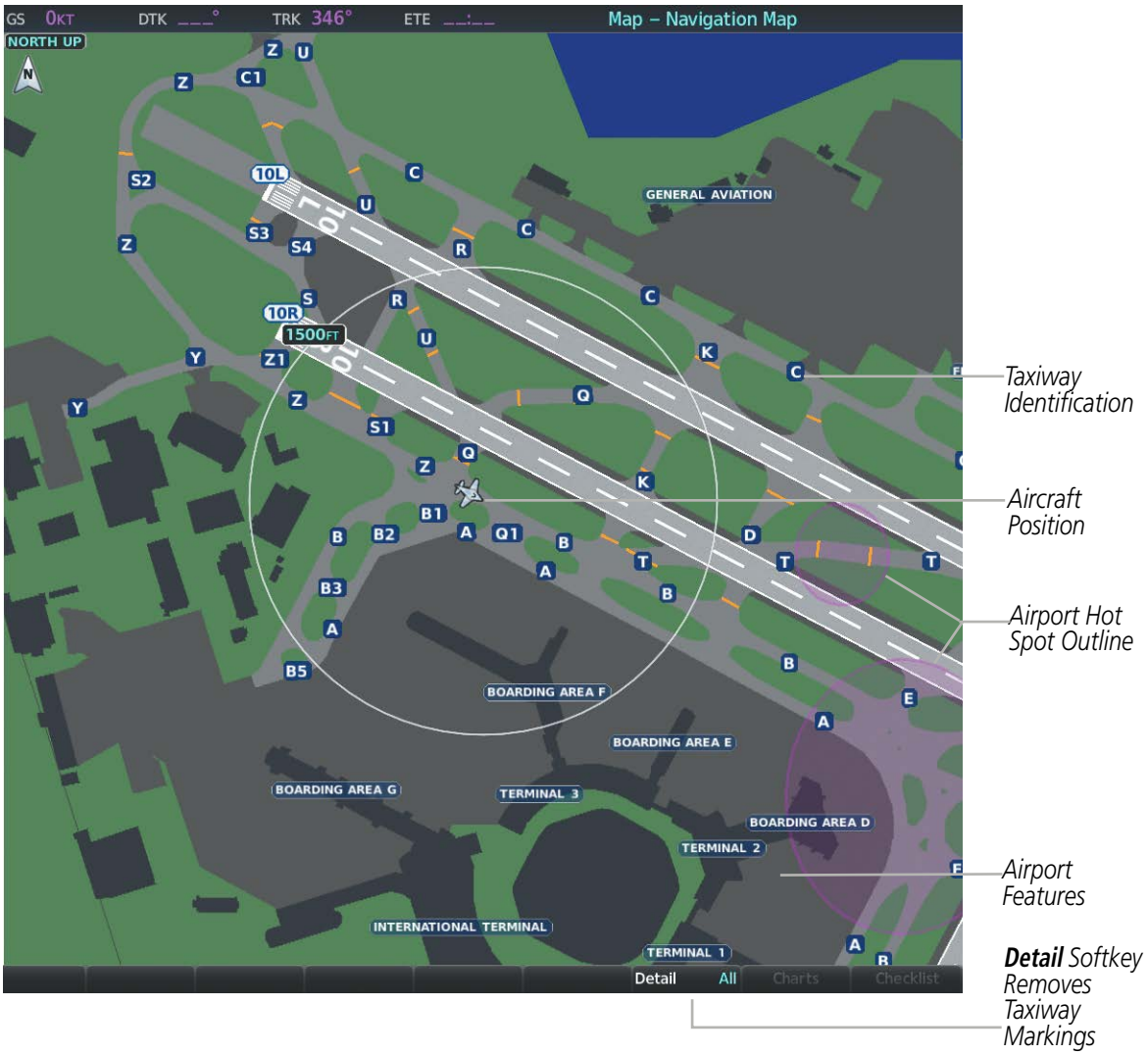


Figure 8-1 SafeTaxi Depiction on the Navigation Map Page

The **Detail** Softkey (declutter) label advances to Detail All, Detail 3, Detail 2 and Detail 1 each time the softkey is selected for easy recognition of decluttering level. Pressing the **Detail All** Softkey removes the taxiway markings and airport feature labels. Pressing the **Detail 3** Softkey removes VOR station ID, the VOR symbol, and intersection names if within the airport plan view. Pressing the **Detail 2** Softkey removes the airport runway layout, unless the airport in view is part of an active route structure. Pressing the **Detail 1** Softkey cycles back to the original map detail. Refer to Map Declutter Levels in the Flight Management Section.

Configuring SafeTaxi range:

1) While viewing the 'Map-Navigation Map' Page, press the **MENU** Key to display the 'Page Menu.'
2) Turn the large **FMS** Knob to highlight the 'Map Settings' Menu Option and press the **ENT** Key.
3) Turn the **FMS** Knob to select the 'Aviation' Group and press the **ENT** Key.
4) Turn the large **FMS** Knob to scroll through the 'Aviation' Group options to SafeTaxi.
5) Turn the small **FMS** Knob to display the range of distances.
6) Turn either **FMS** Knob to select the desired distance for maximum SafeTaxi display range.
7) Press the **ENT** Key to complete the selection.
8) Press the **FMS** Knob to return to the 'Map-Navigation Map' Page.

8.2 CHARTS

Electronic charts that resemble the paper versions of AeroNav Services terminal procedures charts (FliteCharts) and Jeppesen terminal procedures charts (ChartView) can be displayed on the MFD.

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 information pane under Source.

Selecting Preferred Charts Source:

1) While viewing a chart select the **MENU** Softkey to display the 'Page Menu' options.
2) Turn the large **FMS** Knob to highlight the 'Chart Setup' menu option and press the **ENT** Key.
3) Turn the large **FMS** Knob to move to the 'Preferred Charts Source' option.
4) Turn the small **FMS** Knob to choose between the available options (FliteCharts, ChartView).

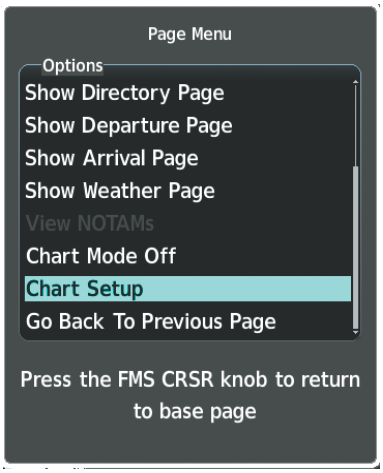
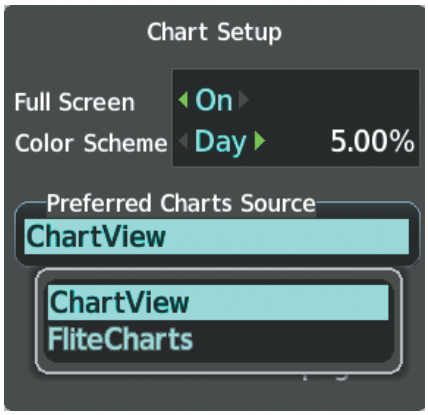


Chart Setup Option



Preferred Charts Source Option

Figure 8-2 Preferred Charts Source

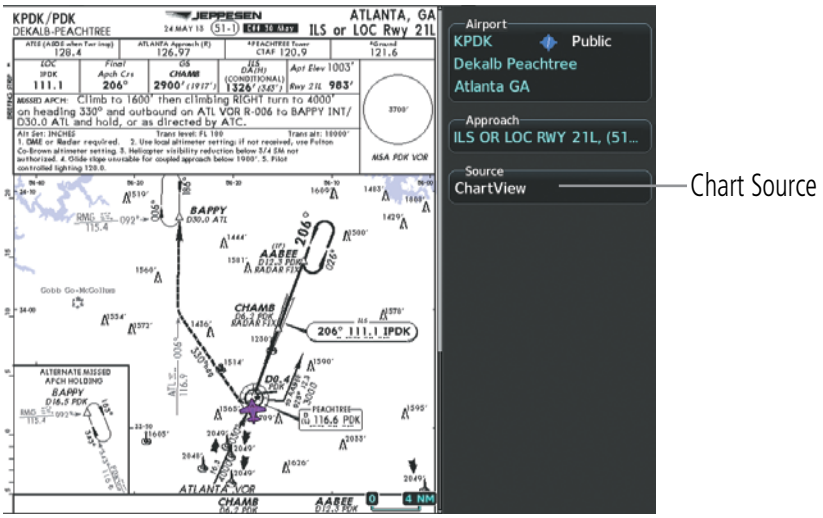


Figure 8-3 Chart Source

Rotating selected chart:

1) While viewing a chart press the **CHRT Opt** Softkey to display the available options.
2) Press the **ROT CCW** or **ROT CW** Softkeys to rotate the displayed chart in 90 degree increments counter-clockwise or clockwise respectively.

SPLIT VIEW

Split view allows for displaying several items such as a selected chart and navigation map simultaneously. This capability is available for charts within the MAP and FPL page groups. The pane that is currently selected and can be controlled is outlined in cyan. More information on enabling/disabling split view can be found in the System Overview section.

When "[Auto]" is appended at the end of the page title (ex. Map - Chart + Navigation Map [Auto]), this indicates that the chart is corresponding to phase of flight. For information on automatically accessing the appropriate chart for the current phase of flight, see Flight Management section.

Changing split view orientation:

While in split view mode, pressing and holding **Joystick** for several seconds toggles between narrow (vertical) split screens and wide (horizontal) split screens.

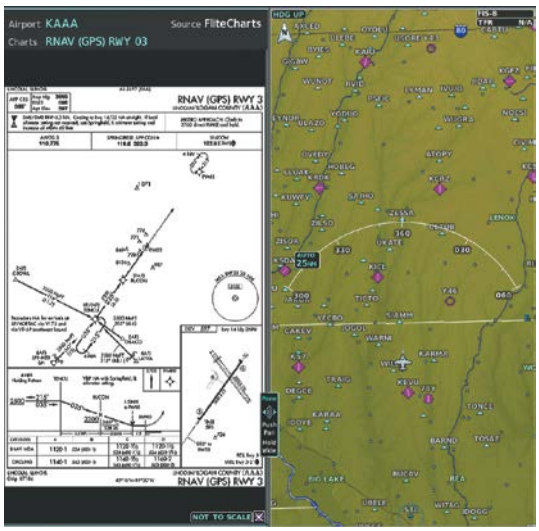


Figure 8-4 Navigation Map Vertical Split Screen

Figure 8-5 FPN Horizontal Split Screen

CHARTVIEW

ChartView resembles the paper version of Jeppesen terminal procedures charts. The charts are displayed in full color with high-resolution. The MFD depiction shows the aircraft position on the moving map in the planview of approach charts and on airport diagrams. Airport Hot Spots are outlined in magenta.

The geo-referenced aircraft position is indicated by an aircraft symbol displayed on the chart when the current position is within the boundaries of the chart. Inset boxes are not considered within the chart boundaries. Therefore, when the aircraft symbol reaches a chart boundary line, or inset box, the aircraft symbol is removed from the display.

The following figure shows examples of off-scale areas, indicated by the grey shading. Note, the grey shading is for illustrative purposes only and will not appear on the published chart or MFD display. These off-scale areas appear on the chart to convey supplemental information. However, the depicted geographical position of this information, as it relates to the chart planview, is not the actual geographic position. Therefore, when the aircraft symbol appears within one of these areas, the aircraft position indicated is relative to the chart planview, not to the off-scale area.

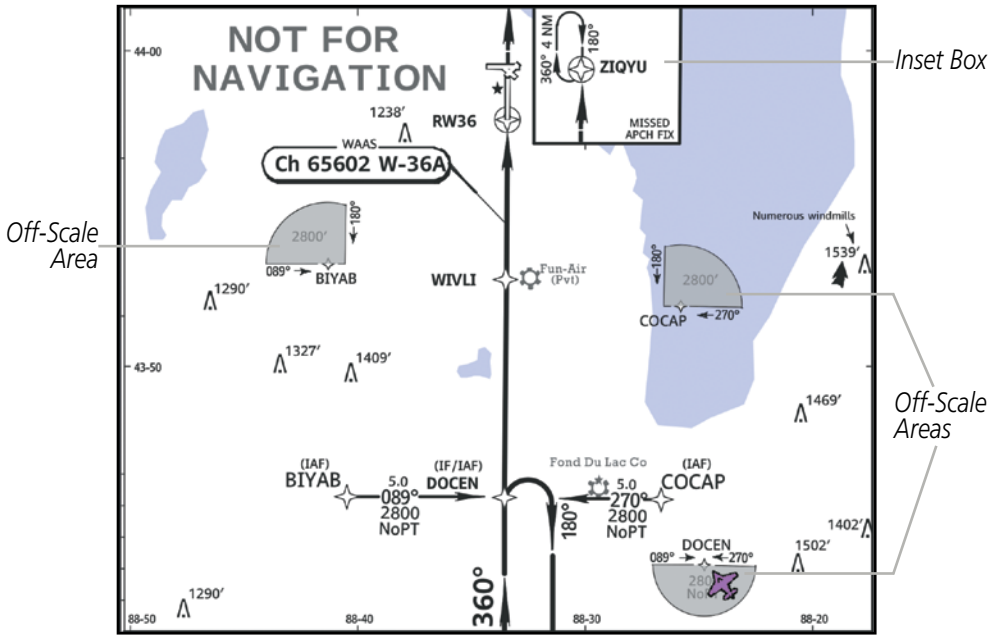


Figure 8-6 Sample Chart Indicating Off-Scale Areas

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
- NOTAMs

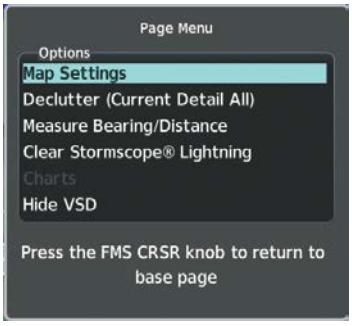
TERMINAL PROCEDURES CHARTS

Selecting Terminal Procedures Charts:

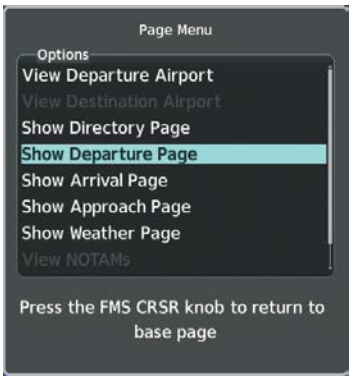
While viewing the 'Map-Navigation Map' Page, NRST-Nearest Airport' Page, or 'FPL-Active Flight Plan' Page, press the **Charts** Softkey.

Or:

1) Press the **MENU** Key to display the 'Page Menu.'
2) Turn the large **FMS** Knob to scroll through the 'Options' Menu to Charts.
3) Press the **ENT** Key to display the chart.



Navigation Map Page Options Menu



Waypoint Airport Information Page Options Menu

Figure 8-7 Option Menus

On the Waypoint Airport Information Page Options Menu, select the desired chart and press the **ENT** Key to display the chart.

When no terminal procedure chart is available, the banner Chart Not Available appears on the screen. The Chart Not Available banner does not refer to the ChartView subscription, but rather the availability of a particular airport chart selection or procedure for a selected airport.

Figure 8-8 Chart Not Available Banner

If there is a problem in rendering the data (such as a data error or a failure of an individual chart), the banner Unable To Display Chart is then displayed.

Figure 8-9 Unable To Display Chart Banner

When a chart is not available by pressing the **Charts** Softkey or selecting a Page Menu Option, charts may be obtained for other airports from the WPT Pages or Active Flight Plan Pages.

If a chart is available for the destination airport, or the airport selected in the active flight plan, the chart appears on the screen. When no flight plan is active, or when not flying to a direct-to destination, pressing the **Charts** Softkey displays the chart for the nearest airport, if available.

The chart shown is one associated with the WPT – Airport Information page. Usually this is the airport runway diagram. Where no runway diagram exists, but Take Off Minimums or Alternate Minimums are available, that page appears. If Airport Information pages are unavailable, the Approach Chart for the airport is shown.

Selecting a chart:

1) While viewing the 'Map-Navigation Map' Page, 'FPL-Active Flight Plan' Page, or 'NRST-Nearest Airports' Page, press the **Charts** Softkey. The airport diagram or approach chart is displayed on the 'WPT-Airport Information' Page.
2) Press the **FMS** Knob to activate the cursor.
3) Turn the large **FMS** Knob to select either the Airport Identifier Box or the 'Approach' Box. (Press the **APR** Softkey if the 'Approach' Box is not currently shown).
4) Turn the small and large **FMS** Knob to enter the desired airport identifier.
5) Press the **ENT** Key to complete the airport selection.
6) Turn the large **FMS** Knob to select the 'Approach' Box.
7) Turn the small **FMS** Knob to show the approach chart selection choices.
8) Turn either **FMS** Knob to scroll through the available charts.
9) Press the **ENT** Key to complete the chart selection.

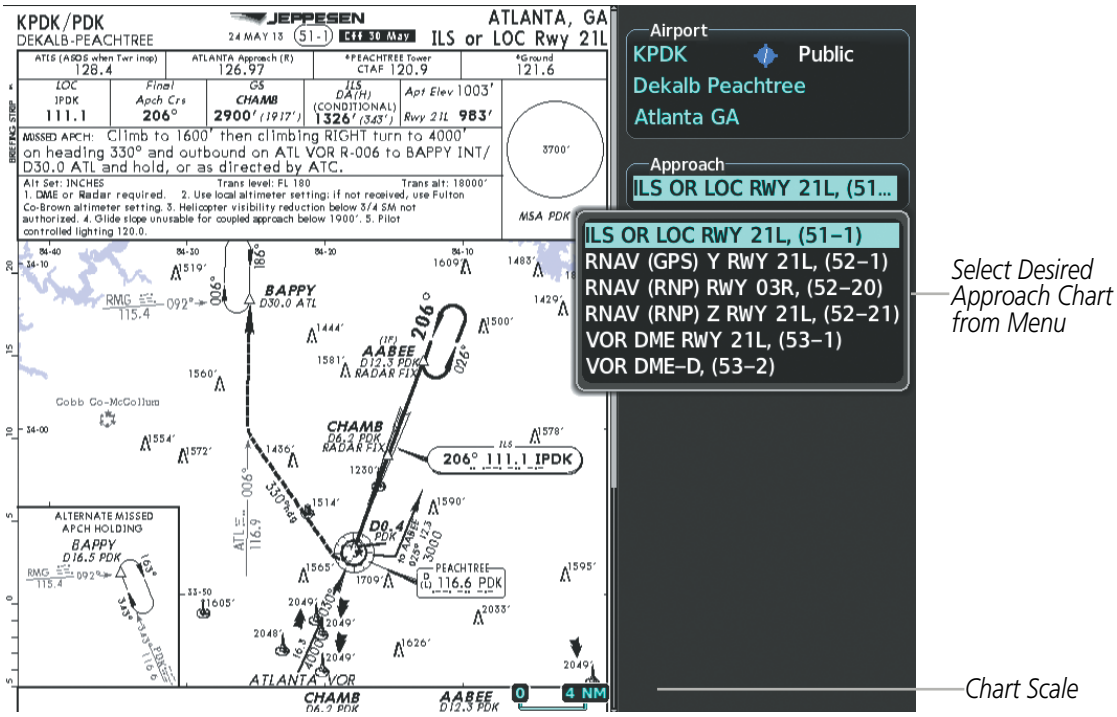


Figure 8-10 Approach Information Page, Chart Selection

While the Approaches Box is selected using the **FMS** Knob, the softkeys are blank. Once the desired chart is selected, the chart scale can be changed and the chart page can be scrolled using the **Joystick**. Pressing the **Joystick** centers the chart on the screen.

The aircraft symbol is shown on the chart only if the chart is to scale and the aircraft position is within the boundaries of the chart. The aircraft symbol is not displayed when the Aircraft Not Shown Icon appears. If

the Chart Scale Box displays a banner NOT TO SCALE, the aircraft symbol is not shown. The Aircraft Not Shown Icon may appear at certain times, even if the chart is displayed to scale.

Pressing the **Chart** Softkey switches between the ChartView diagram and the associated map in the WPT page group. In the example shown, the **Chart** Softkey switches between the Gainesville, FL (KGNV) Airport Diagram and the navigation map on the WPT – Airport Information page.

Pressing the **Info 1** or **Info 2** Softkey returns to the airport diagram when the view is on a different chart. If the displayed chart is the airport diagram, the **Info 1** or **Info 2** Softkey has no effect. The aircraft position is shown in magenta on the ChartView diagrams when the location of the aircraft is within the chart boundaries.

Another source for additional airport information is from the Info Box above the chart for certain airports. This information source is not related to the **Info 1** or **Info 2** Softkey. When the Info Box is selected using the **FMS** Knob, the softkeys are blank. The Charlotte, NC airport has five additional charts offering information; the Airport Diagram, Take-off Minimums, Class B Airspace, Airline Parking Gate Coordinates, and Airline Parking Gate Location. (The numbers in parentheses after the chart name are Jeppesen designators.)

Figure 8-11 Airport Information Page, Info View, Full Screen Width

In the example shown in following figure, the Class B Chart is selected. Pressing the **ENT** Key displays the Charlotte Class B Airspace Chart.

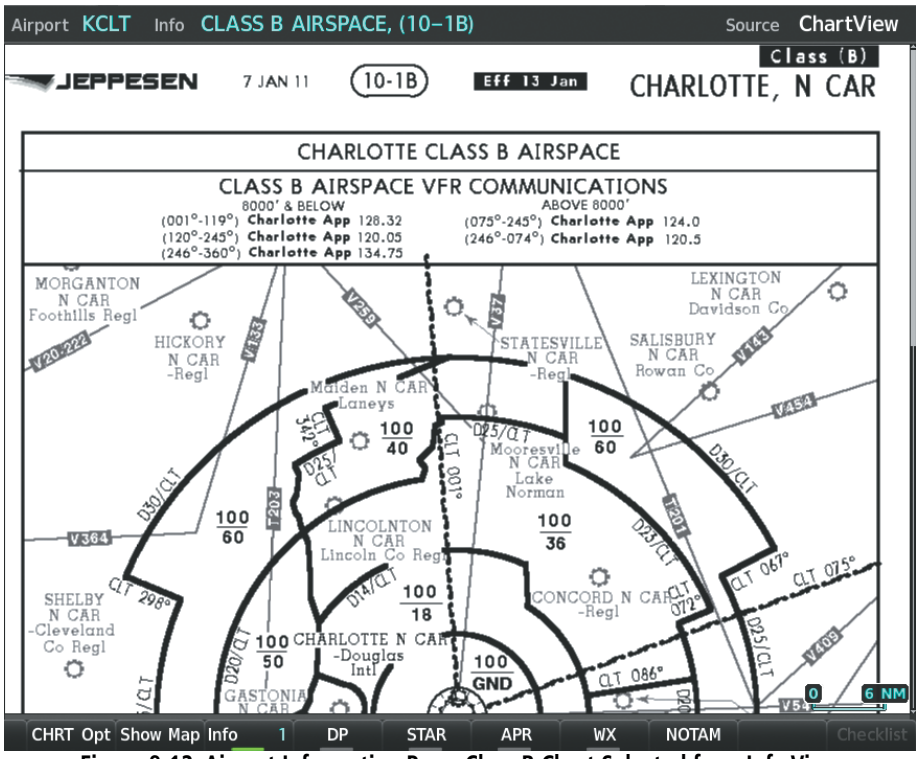


Figure 8-12 Airport Information Page, Class B Chart Selected from Info View

- Pressing the **DP** Softkey displays the Departure Procedure Chart if available.
- Pressing the **STAR** Softkey displays the Standard Terminal Arrival Chart if available.
- Pressing the **APR** Softkey displays the approach chart for the airport if available.
- Pressing the **WX** Softkey shows the airport weather frequency information, and includes weather data such as METAR and TAF from the SiriusXM Data Link Receiver, when available. Weather information is available only when a SiriusXM Data Link Receiver is installed and the SiriusXM Weather subscription is current.
- Recent NOTAMS applicable to the current ChartView cycle are included in the ChartView database. Pressing the **NOTAM** Softkey shows the local NOTAM information for selected airports, when available. When NOTAMS are not available, the **NOTAM** Softkey label appears subdued and is disabled. The **NOTAM** Softkey may appear on the Airport Information Page and all of the chart page selections. Pressing the **NOTAM** Softkey again removes the NOTAMS information.

NOTE: *A subdued softkey label indicates the function is disabled.*

NOTE: *Only NOTAMs applicable to specific information conveyed on the displayed Jeppesen chart are available when the NOTAM Softkey is pressed. There may be other NOTAMs available pertaining to the flight that may not be displayed. Contact Jeppesen for more information regarding Jeppesen database published NOTAMs.*

CHART OPTIONS

Pressing the **CHRT Opt** Softkey displays the next level of softkeys, the chart options level.

Pressing the **All** Softkey shows the complete approach chart on the screen.

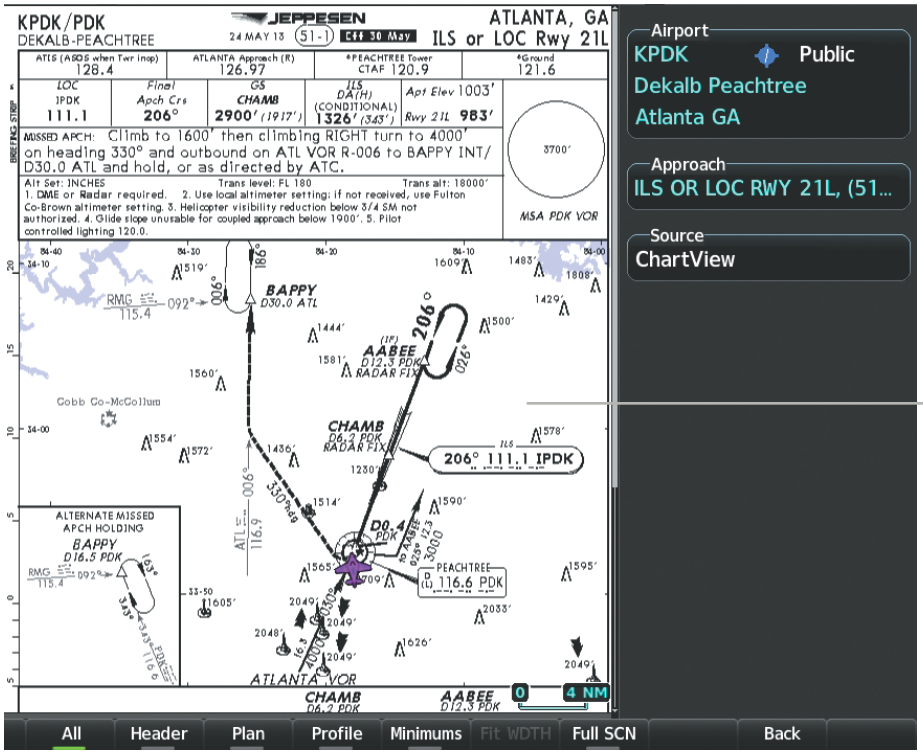


Figure 8-13 Approach Information Page, All View

- Pressing the **Header** Softkey shows the header view (approach chart briefing strip) on the screen.
- Pressing the **Plan** Softkey shows the approach chart two dimensional plan view.
- Pressing the **Profile** Softkey displays the approach chart descent profile strip.
- Pressing the **Minimums** Softkey displays the minimum descent altitude/visibility strip at the bottom of the approach chart.
- If the chart scale has been adjusted to view a small area of the chart, pressing the **Fit WDTH** Softkey changes the chart size to fit the available screen width.
- Pressing the **Full SCN** Softkey alternates between removing and replacing the data window to the right.

Selecting Additional Information:

1) While viewing the Airport Information, press the **FMS** Knob to activate the cursor.
3) Turn the large **FMS** Knob to highlight the Airport, Runways, or Frequencies Box.
4) Turn the small **FMS** Knob to select the Info Box choices. If multiple choices are available, scroll to the desired choice with the large **FMS** Knob and press the **ENT** Key to complete the selection.
5) Press the **FMS** Knob again to deactivate the cursor.

Pressing the **Back** Softkey, or waiting for 45 seconds reverts to the chart selection softkeys. The full screen view can also be selected by using the page menu option.

Selecting full screen On or Off:

1) While viewing a terminal chart press the **MENU** Key to display the 'Page Menu' Options.
2) Turn the large **FMS** Knob to highlight the 'Full Screen Off' or 'Full Screen On' Menu Option and press the **ENT** Key to toggle full screen off or on respectively.

Or:

1) While viewing a terminal chart press the **CHRT Opt** Softkey to display additional chart view options.
2) Press **Full SCN** Softkey to toggle full screen on or off for the selected chart.

Full Screen On/Off Selection

Figure 8-14 Page Menus

DAY/NIGHT VIEW

ChartView can be displayed on a white or black background for day or night viewing. The Day View offers a better presentation in a bright environment. The Night View gives a better presentation for viewing in a dark environment. When the Chart Setup Box is selected the MFD softkeys are blank.

Selecting Day, Night, or Automatic View:

1) While viewing a terminal chart press the **MENU** Key to display the 'Page Menu' Options.
2) Turn the large **FMS** Knob to highlight the 'Chart Setup' Menu Option and press the **ENT** Key.

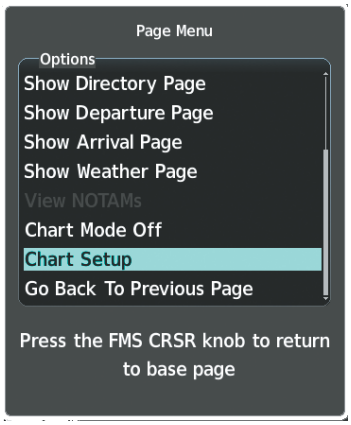


Figure 8-15 Page Menu Chart Setup

3) Turn the large **FMS** Knob to move to the 'Color Scheme' Option.

4) Turn the small **FMS** Knob to choose between 'Day, Auto, and Night' Options.

5) If Auto Mode is selected, turn the large **FMS** Knob to select the percentage field. Use the small **FMS** Knob to change the percentage value. The percentage value is the day/night crossover point based on the percentage of backlighting intensity. For example, if the value is set to 15%, the day/night display changes when the display backlight reaches 15% of full brightness.

   The display must be changed in order for the new setting to become active. This may be accomplished by selecting another page or changing the display range.

6) Press the **FMS** Knob when finished to remove the 'Chart Setup' Menu.

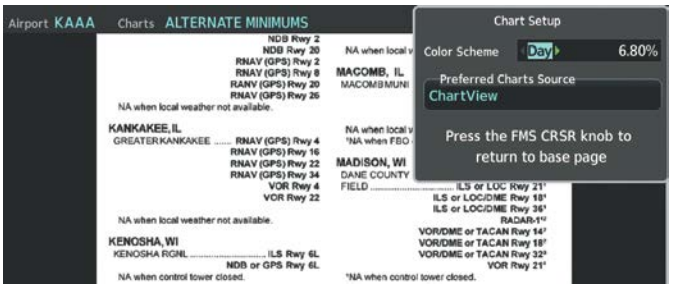


Figure 8-16 Chart Information Page, Day View

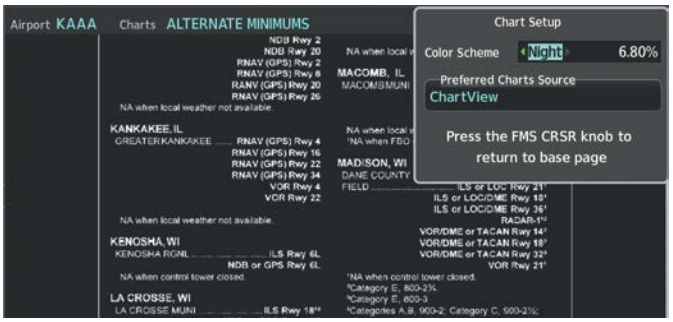


Figure 8-17 Chart Information Page, Night View

FLITECHARTS

FliteCharts resemble the paper version of AeroNav Services terminal procedures charts. The charts are displayed with high-resolution and in color for applicable charts.

The geo-referenced aircraft position is indicated by an aircraft symbol displayed on the chart when the current position is within the boundaries of the chart. Not all charts are geo-referenced. These charts will display an Aircraft Not Shown Icon in the lower right corner of the MFD.

Figure 8-18 Aircraft Not Shown Icon

An aircraft symbol may be displayed within an off-scale area depicted on some charts. Off-scale areas are indicated by the grey shading. Note, these areas are not shaded on the published chart. These off-scale areas appear on the chart to convey supplemental information. However, the depicted geographical position of this information, as it relates to the chart planview, is not the actual geographic position. Therefore, when the aircraft symbol appears within one of these areas, the aircraft position indicated is relative to the chart planview, not to the off-scale area.

The FliteCharts database subscription is available from Garmin. Available data includes:

- Arrivals (STAR)
- Departure Procedures (DP)
- Approaches
- Airport Diagrams

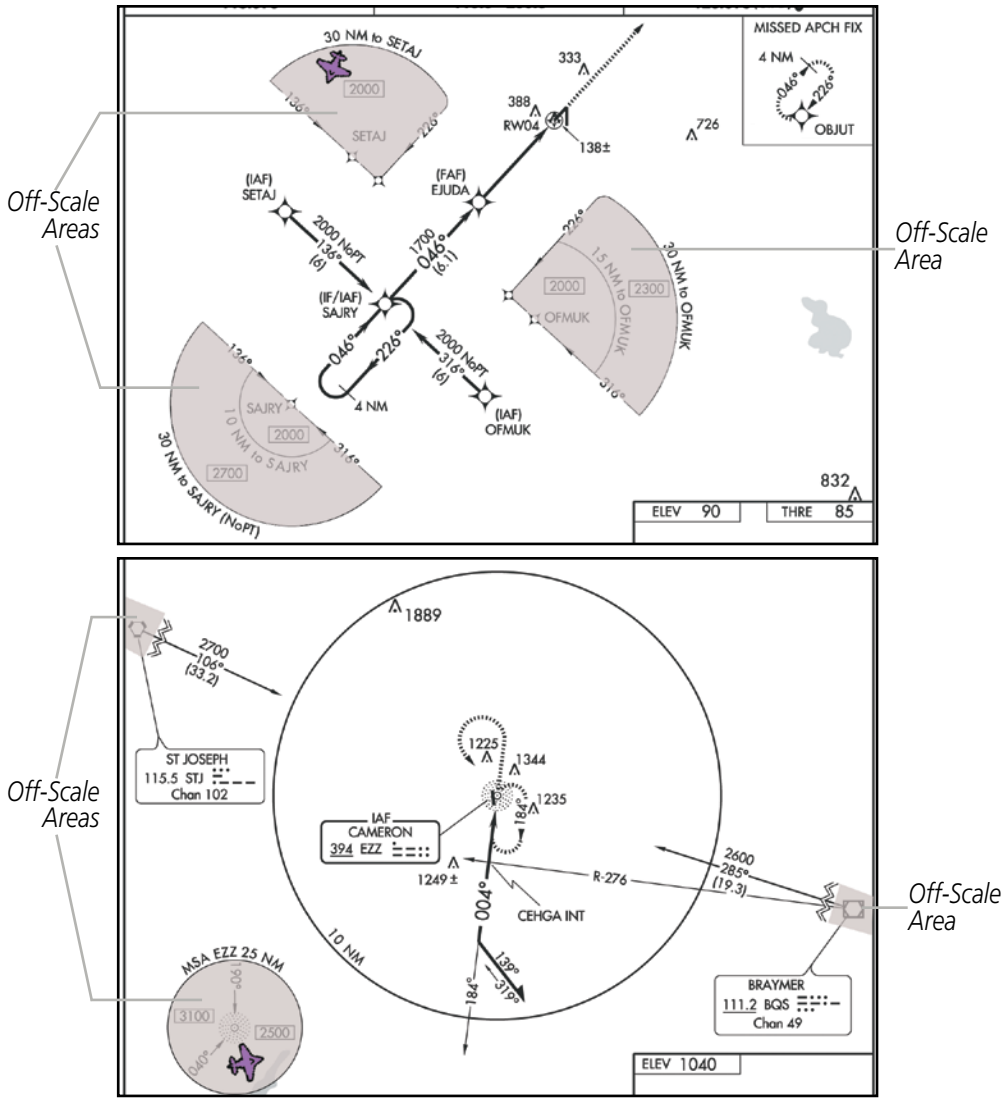


Figure 8-19 Sample Chart Indicating Off-Scale Areas

NOTE: *Do not maneuver the aircraft based solely upon the geo-referenced aircraft symbol.*

FLITECHARTS SOFTKEYS

FliteCharts functions are displayed on three levels of softkeys. While on the Navigation Map Page, Nearest Airports Page, or Active Flight Plan Page, pressing the **Charts** Softkey displays the available terminal chart and advances to the chart selection level of softkeys: **CHRT Opt**, **Chart**, **Info**, **DP**, **STAR**, **APR**, **WX**, and **Go Back**. The chart selection softkeys appear on the Airport Information Page.

Pressing the **Go Back** Softkey reverts to the top level softkeys and previous page.

Pressing the **CHRT Opt** Softkey displays the available terminal chart and advances to the next level of softkeys: **All**, **Fit WDTH**, **Full SCN**, and **Back**.

While viewing the **CHRT Opt** Softkeys, after 45 seconds of softkey inactivity, the system reverts to the chart selection softkeys.

NOTAMs are not available with FliteCharts. The NOTAM Softkey label appears subdued and is disabled.

TERMINAL PROCEDURES CHARTS

Selecting Terminal Procedures Charts:

While viewing the 'Map-Navigation Map' Page, 'NRST-Nearest Airport' Page, or 'FPL-Active Flight Plan' Page, press the **Charts** Softkey.

Or:

1) Press the **MENU** Key to display the 'Page Menu.'
2) Turn the large **FMS** Knob to scroll through the 'Options' Menu to 'Charts.'
3) Press the **ENT** Key to display the chart.

On the Waypoint Airport Information Page Options Menu, select the desired chart and press the **ENT** Key to display the chart.

When no terminal procedure chart is available, the banner No Available Charts appears on the screen. The No Available Charts banner does not refer to the FliteCharts subscription, but rather the availability of a particular airport chart selection or procedure for a selected airport.

Figure 8-20 No Available Charts Banner

If there is a problem in rendering the data (such as a data error or a failure of an individual chart), the banner Unable To Display Chart is then displayed.

Figure 8-21 Unable To Display Chart Banner

When a chart is not available by pressing the **Charts** Softkey or selecting a Page Menu Option, charts may be obtained for other airports from the WPT Pages or Active Flight Plan Pages.

If a chart is available for the destination airport, or the airport selected in the active flight plan, the chart appears on the screen. When no flight plan is active, or when not flying to a direct-to destination, pressing the **Charts** Softkey displays the chart for the nearest airport, if available.

The chart shown is one associated with the WPT – Airport Information page. Usually this is the airport runway diagram. Where no runway diagram exists, but Take Off Minimums or Alternate Minimums are available, that page appears. If Airport Information pages are unavailable, the Approach Chart for the airport is shown.

Selecting a chart:

1) While viewing the 'Map-Navigation Map' Page, 'FPL-Active Flight Plan' Page, or 'NRST-Nearest Airports' Page, press the **Charts** Softkey. The airport diagram or approach chart is displayed on the 'WPT-Airport Information' Page.
2) Press the **FMS** Knob to activate the cursor.
3) Turn the large **FMS** Knob to select either the Airport Identifier Box or the 'Approach' Box. (Press the **APR** Softkey if the Approach Box is not currently shown).
4) Turn the small and large **FMS** Knob to enter the desired airport identifier.
5) Press the **ENT** Key to complete the airport selection.
6) Turn the large **FMS** Knob to select the 'Approach' Box.
7) Turn the small **FMS** Knob to show the approach chart selection choices.
8) Turn either **FMS** Knob to scroll through the available charts.
9) Press the **ENT** Key to complete the chart selection.

While the Approach Box is selected using the **FMS** Knob, the softkeys are blank. Once the desired chart is selected, the chart scale can be changed and the chart can be panned using the **Joystick**. Pressing the **Joystick** centers the chart on the screen.

The aircraft symbol is not shown on FliteCharts. The Chart Scale Box displays a banner NOT TO SCALE, and the Aircraft Not Shown Icon is displayed in the lower right corner of the screen.

Pressing the **Chart** Softkey switches between the FliteCharts diagram and the associated map in the WPT page group. In the example shown, the **Chart** Softkey switches between the Gainesville, FL (KGNV) Airport Diagram and the navigation map on the WPT – Airport Information page.

Pressing the **Info 1** or **Info 2** Softkey returns to the airport diagram when the view is on a different chart. If the displayed chart is the airport diagram, the **Info 1** or **Info 2** Softkey has no effect.

Another source for additional airport information is from the Info Box above the chart or to the right of the chart for certain airports. This information source is not related to the **Info 1** or **Info 2** Softkey. When the Info Box is selected using the **FMS** Knob, the softkeys are blank.

Pressing the **ENT** Key displays the IFR Alternate Minimums Chart.

Pressing the **DP** Softkey displays the Departure Procedure Chart if available.

Pressing the **STAR** Softkey displays the Standard Terminal Arrival Chart if available.

Pressing the **APR** Softkey displays the approach chart for the airport if available.

Pressing the **WX** Softkey shows the airport weather frequency information, when available, and includes weather data if a data link weather receiver is installed.

Selecting Additional Information:

1) While viewing the Airport Taxi Diagram, press the **WX** Softkey to display the information windows.
2) Press the **FMS** Knob to activate the cursor.
3) Turn the large **FMS** Knob to highlight the 'Info' Box.
4) Turn the small **FMS** Knob to select the 'Info' Box choices. When the 'Info' Box is selected the softkeys are blank. If multiple choices are available, scroll to the desired choice with the large **FMS** Knob and press the **ENT** Key to complete the selection.
5) Press the **FMS** Knob again to deactivate the cursor.

Pressing the **Go Back** Softkey reverts to the previous page ('Navigation Map' Page or 'Active Flight Plan' Page).

CHART OPTIONS

Pressing the **CHRT Opt** Softkey displays the next level of softkeys, the chart options level.

Pressing the **All** Softkey shows the complete chart on the screen.

Pressing the **Fit WIDTH** Softkey fits the width of the chart in the display viewing area. In the example shown, the chart at close range is replaced with the full width chart.

Pressing the **Full SCN** Softkey alternates between removing and replacing the data window to the right.

Pressing the **Back** Softkey, or waiting for 45 seconds reverts to the chart selection softkeys.

The full screen view can also be selected by using the page menu option.

Selecting full screen On or Off:

1) While viewing a terminal chart press the **MENU** Key to display the 'Page Menu' Options.
2) Turn the large **FMS** Knob to highlight the 'Full Screen Off' or 'Full Screen On' Menu Option and press the **ENT** Key to toggle full screen off or on respectively.

Or:

1) While viewing a terminal chart press the **CHRT Opt** Softkey to display additional chart view options.
2) Press **Full SCN** Softkey to toggle full screen on or off for the selected chart.

DAY/NIGHT VIEW

FliteCharts can be displayed on a white or black background for day or night viewing. The Day View offers a better presentation in a bright environment. The Night View gives a better presentation for viewing in a dark environment. When the Chart Setup Box is selected the MFD softkeys are blank.

Selecting Day, Night, or Automatic View:

1) While viewing a terminal chart press the **MENU** Key to display the Page Menu 'Options.'
2) Turn the large **FMS** Knob to highlight the 'Chart Setup' Menu Option and press the **ENT** Key.
3) Turn the large **FMS** Knob to move to the 'Color Scheme' Option.
4) Turn the small **FMS** Knob to choose between 'Day, Auto, and Night' Options.
5) If Auto Mode is selected, turn the large **FMS** Knob to select the percentage field. Use the small **FMS** Knob to change the percentage value. The percentage value is the day/night crossover point based on the percentage of backlighting intensity. For example, if the value is set to 15%, the day/night display changes when the display backlight reaches 15% of full brightness.

   The display must be changed in order for the new setting to become active. This may be accomplished by selecting another page or changing the display range.
6) Press the **FMS** Knob when finished to remove the 'Chart Setup' Menu.

IFR/VFR CHARTS

IFR/VFR charts resemble the paper version and are displayed with high-resolution and in color for applicable charts.

The geo-referenced aircraft position is indicated by an aircraft symbol displayed on the chart when the current position is within the boundaries of the chart. Not all charts are geo-referenced. IFR/VFR charts may be viewed by selecting the 'Map - IFR/VFR Charts' Page.

Selecting IFR Low, IFR High, VFR Charts:

Select the 'Map - IFR/VFR Charts' Page.

1) Press the **VFR**, **IFR Low**, or **IFR High** Softkey to display the desired chart.

Or:

1) Press the **MENU** Key to display the 'Page Menu.'
2) Select 'Display VFR', 'Display IFR Low' or 'Display IFR High' to display the desired chart.
3) Press the **ENT** Key.

AIRPORT DIRECTORY

The Aircraft Owners and Pilots Association (AOPA) and optional AC-U-KWIK Airport Directory databases offer detailed information regarding services, hours of operation, lodging options, and more. This information is viewed on the 'Airport Information' Page by pressing the Info Softkey until **Info 2** is displayed.

Both Airport Directories are available for downloading at flygarmin.com. However, copy only one of the databases to the Supplemental Data Card. The system cannot recognize both databases simultaneously.

Selecting the Airport Directory Page:

1) Turn the large **FMS** Knob to select the 'WPT' page group.
2) Turn the small **FMS** Knob to select the 'Airport Information' Page. Initially, information for the airport closest to the aircraft's present position is displayed.
3) If necessary, press the Info softkey until **Info 2** is displayed.

Figure 8-22 AOPA Information on the Airport Information Page

8.3 DATABASE CYCLE NUMBER AND REVISIONS

CYCLE NUMBER AND REVISION

Databases that may be available include FliteCharts, Obstacle, Terrain, IFR/VFR, Navigation, ChartView, SafeTaxi, Airport Directory. Data is revised and expiration dates vary. Data is still viewable during a period that extends from the cycle expiration date to the disables date. When turning on the system, the Power-up Page displays the current status of the databases. As an example, see the table below for the various FliteCharts Power-up Page displays and the definition of each. The expiration date and disables date varies for each database.

Example Power-up Page Display Text
FliteCharts Data: └ N/A
FliteCharts Data: └ Expires DD-MMM-YYYY
FliteCharts Data: └ Disables DD-MMM-YYYY
FliteCharts Data: └ Disabled

Table 8-1 Database Power-up Page Annunciations

White text, such as 'FliteCharts Data Expires' plus a date, indicates the chart database is current. Yellow text, such as 'Chart data is out of date!' or 'FliteCharts Data: Disabled", indicates charts are no longer viewable and have expired.

Database time critical information can also be found on the Aux - System Status page. The database Region, Cycle number, Effective, Expires, and Disables dates of the subscription appear in either blue or yellow text. Dates shown in blue are current data. Dates shown in yellow indicate the data is not within the current subscription period.

NOTE: *A subdued softkey label indicates the function is disabled.*

Press the **MFD1 DB** Softkey to place the cursor in the Database window. Scroll through the listed information by turning the **FMS** Knob or pressing the **ENT** Key until the applicable database information is shown.

Database cycle numbers are in a format such as YYTI or YYII, which are deciphered as follows:

YYTI

YY – Indicates the last two digits of the year (ex. 18 represents 2018)

T – Indicates the database type (ex. S is for SafeTaxi, D is for Airport Directory)

I – Indicates the numerical issue of the database for the year (ex. 5 is the fifth issue of the year)

YYII

YY – Indicates the last two digits of the year (ex. 18 represents 2018)

II – Indicates the numerical issue of the database for the year (ex. 05 is the fifth issue of the year)

Refer to Updating Garmin Databases in Appendix for instructions on revising databases.

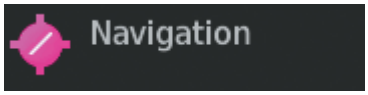
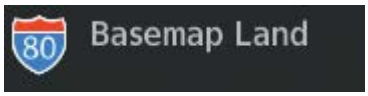
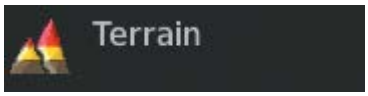
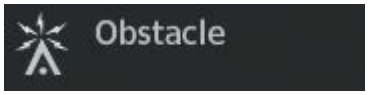
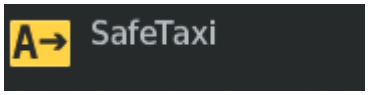
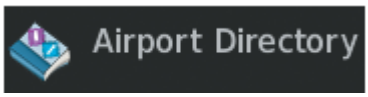
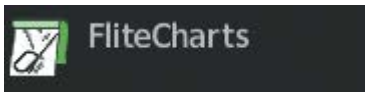
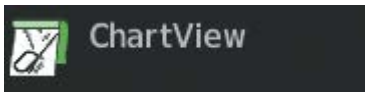
Example Power-up Page Display Text	Database Cycle Number Format	Revision Cycle
	YYII	28 days
	YYMI	Not Applicable
	YYTI	Not Applicable
	YYBI	56 days
	YYSI	56 days
	YYDI	56 days
	YYII	28 days
	YYII	14 days
	YYII	28 days

Table 8-2 Database Cycle Number and Revision

8.4 SIRIUSXM RADIO ENTERTAINMENT

NOTE: *Refer to the Hazard Avoidance Section for information about SiriusXM Weather products.*

The optional SiriusXM Satellite Radio entertainment feature of the GDL 69A SXM Data Link Receiver is available for the pilot's and passengers' enjoyment. The GDL 69A SXM can receive SiriusXM Satellite Radio entertainment services at any altitude throughout the Continental U.S.

SiriusXM Satellite Radio offers a variety of radio programming over long distances without having to constantly search for new stations. Based on signals from satellites, coverage far exceeds land-based transmissions. SiriusXM Satellite Radio services are subscription-based. For more information on specific service packages, visit www.siriusxm.com.

ACTIVATING SIRIUSXM SATELLITE RADIO SERVICES

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

It is not required to activate both the entertainment and weather service subscriptions with the GDL 69A SXM. Either or both services can be activated. SiriusXM Satellite Radio uses one or both of the coded IDs to send an activation signal that, when received by the GDL 69A SXM, allows it to play entertainment programming.

These IDs are located:

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

Contact the installer if the Data Radio ID and the Audio Radio ID cannot be located.

Activating the SiriusXM Satellite Radio services:

1) Contact SiriusXM Satellite Radio. Follow the instructions provided by SiriusXM Satellite Radio services.
2) Select the Auxiliary Page Group.
3) Select the 'Aux - XM Radio' page.
4) Press the **Info** Softkey to display the 'Aux-XM Information' Page.
5) Verify that the desired services are activated.

Figure 8-23 XM Information Page

If SiriusXM Weather services have not been activated, all the weather product boxes are blank on the 'XM Information' Page and a yellow Activation Required message is displayed in the center of the 'Weather Data Link' Page (Map Page Group). The Service Class refers to the groupings of weather products available for subscription.

USING SIRIUSXM RADIO

The 'XM Radio' Page provides information and control of the audio entertainment features of the SiriusXM Satellite Radio.

Selecting the XM Radio Page:

1) Turn the large **FMS** Knob to select the Auxiliary Page Group.
2) Turn the small **FMS** Knob to select the displayed 'Aux - XM Information' Page.
3) Press the **Radio** Softkey to show the 'XM Radio' Page where audio entertainment is controlled.

ACTIVE CHANNEL AND CHANNEL LIST

The Active Channel Box on the 'XM Radio' Page displays the currently selected channel that the SiriusXM Radio is using.

The Channels List Box of the 'XM Radio' Page shows a list of the available channels for the selected category. Channels can be stepped through one at a time or may be selected directly by channel number.

Selecting a channel from the channel list:

1) While on the 'Aux-XM Radio' Page, press the **Channel** Softkey.
2) Press the **CH +** Softkey to go up through the list in the 'Channels' Box, or move down the list with the **CH –** Softkey.

   Or:

1) Press the **FMS** Knob to highlight the channel list and turn the large **FMS** Knob to scroll through the channels.
2) Press the **ENT** Key to activate the selected channel.

Selecting a channel directly:

1) While on the 'Aux-XM Radio' Page, press the **Channel** Softkey.
2) Press the **Direct CH** Softkey. The channel number in the 'Active Channel' Box is highlighted.
3) Press the numbered softkeys located on the bottom of the display to directly select the desired channel number.
4) Press the **ENT** Key to activate the selected channel.

CATEGORY

The Category Box of the XM Radio Page displays the currently selected category of audio. Categories of channels such as jazz, rock, or news can be selected to list the available channels for a type of music or other contents. One of the optional categories is Presets to view channels that have been programmed.

Selecting a category:

1) Press the **Category** Softkey on the 'Aux-XM Radio' Page.
2) Press the **CAT +** and **CAT -** Softkeys to cycle through the categories.

   Or:

   Turn the small **FMS** Knob to display the Categories list. Highlight the desired category with the small **FMS** Knob and press the **ENT** Key. Selecting All Categories places all channels in the list.

PRESETS

Up to 15 channels from any category can be assigned a preset number. The preset channels are selected by pressing the **Presets** and **More** Softkeys. Then the preset channel can be selected directly and added to the channel list for the Presets category.

Setting a preset channel number:

1) On the 'XM Radio' Page, while listening to an 'Active Channel' that is wanted for a preset, press the **Presets** Softkey to access the first five preset channels (**Preset 1 - Preset 5**).
2) Press the **More** Softkey to access the next five channels (**Preset 6 – Preset 10**), and again to access the last five channels (**Preset 11 – Preset 15**). Pressing the **More** Softkey repeatedly cycles through the preset channels.
3) Press any one of the (**Preset 1 - Preset 15**) softkeys to assign a number to the active channel.
4) Press the **Set** Softkey on the desired channel number to save the channel as a preset.

Pressing the **Back** Softkey, or 45 seconds of softkey inactivity, returns the system to the top level softkeys.

VOLUME

Radio volume is shown as a percentage. Volume level is controlled by pressing the **Volume** Softkey, which brings up the **Mute** Softkey and the volume increase and decrease softkeys.

Adjusting the volume:

1) With the 'Aux-XM Radio' Page displayed, press the **Volume** Softkey.
2) Press the **VOL –** Softkey to reduce volume or press the **VOL +** Softkey to increase volume. (Once the **VOL** Softkey is pressed, the volume can also be adjusted using the small **FMS** Knob.)

Mute SiriusXM audio:

1) Select the 'Aux-XM Radio' Page or 'Aux-XM Information' Page.
2) Press the **Mute** Softkey to mute the audio. Press the **Mute** Softkey again to unmute the audio.

8.5 FLIGHT DATA LOGGING

NOTE: *Some aircraft installations may not provide all aircraft/engine data capable of being logged by the system.*

The Flight Data Logging feature will automatically store critical flight and engine data on an SD data card (up to 16GB) inserted into the top card slot of the MFD. Approximately 1,000 flight hours can be recorded for each 1GB of available space on the card.

Data is written to the SD card once each second while the MFD is powered on. All flight data logged on a specific date is stored in a file named in a format which includes the date, time, and nearest airport identifier. The file is created automatically each time the system is powered on, provided an SD card has been inserted.

The status of the Flight Data Logging feature can be viewed on the 'Aux-Utility Page'. If no SD card has been inserted, "NO CARD" is displayed. When data is being written to the SD card, "LOGGING DATA" is displayed.

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.

- Local Date (YYYY-MM-DD)
- Local Time (HH:MM:SS)
- Active Waypoint Distance (nm)
- Active Waypoint Bearing (degrees mag.)
- UTC Offset (HH:MM)
- Mag. Variation (degrees)
- Active Waypoint Identifier
- Voltage 1 (volts)
- Voltage 2 (volts)
- Amps 1 (amps)
- Amps 2 (amps)
- AFCS On (0 – false, 1 – true)
- Latitude (degrees)
- AFCS Roll Mode (e.g. HDG, LOC, GPS, VOR, ROL)
- Longitude (degrees)
- Right Fuel Qty (gals or lbs)
- Left Fuel Qty (gals or lbs)
- Center Fuel Qty (gals or lbs)
- AFCS Pitch Mode (e.g. ALT, GS, GP, VS)
- Barometric Altitude (feet)
- Altimeter Setting (in. Hg.)
- GPS Altitude (ft)
- Pitch Commanded (degrees)
- Roll Commanded (degrees)
- OAT (deg. C)
- True Airspeed (kts)
- Selected Vertical Speed (fpm)
- Vertical Speed (fpm)
- HSI Selection (GPS,NAV1/2)
- GPS Fix (e.g. 2D, 3D, 3DDiff)
- Indicated Airspeed (kts)
- Horizontal Alert Limit (HAL, meters)
- Gnd Speed (kts)
- Vertical Alert Limit (VAL, meters)
- Vertical Speed (fpm)
- NAV1 Frequency (MHz)
- NAV2 Frequency (MHz)
- Horizontal Protection Level (HPLWAS, meters)
- Pitch (degrees)
- Roll (degrees)
- Horizontal Protection Level (HPLFD, meters)
- Vertical Protection Level (VPLWAS, meters)
- COM1 Frequency (MHz)
- COM2 Frequency (MHz)
- Lateral Acceleration (g)
- CDI Deflection (0.0 to 1.0)
- VDI Deflection (0.0 to 1.0)
- Normal Acceleration (g)
- Heading (degrees magnetic)
- Course (deg)
- Wind Direction (degrees mag.)
- Wind Speed (kts)
- Gnd Trk (degrees magnetic)
- Fuel Flow (gph)
- Fuel Press. (psi)
- Oil Temperature (deg. F)
- Oil Pressure (psi)
- Engine Speed (rpm)
- Power (%)
- Torque (ft. lbs.)
- Np (rpm)
- Ng (%)
- ITT (deg. C)

The file containing the recorded data will appear in the format shown in the following figure. This file can be imported into most computer spreadsheet applications.

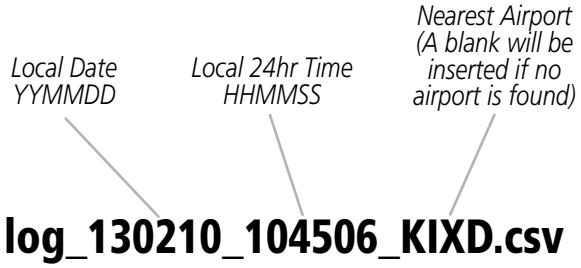


Figure 8-24 Log File Format

Data logging status can be monitored on the 'Aux-Utility' Page.

8.6 SATELLITE TELEPHONE AND SMS MESSAGING

NOTE: An account must be established to access the Iridium satellite network for voice/SMS.

The GSR 56 Iridium Transceiver provides an airborne low speed data link, Iridium Satellite Telephone service, and Short Message Service (SMS).

The telephone is available to the flight crew through the audio panel and headsets.

REGISTERING WITH GARMIN CONNEXT®

A subscriber account must be established prior to using the Iridium Satellite System. Before setting up an Iridium account, obtain the serial number of the Iridium Transceiver (GSR1) and the System ID by selecting the 'Aux- System Status' Page. Contact Garmin at 1-866-739-5687 in the United States or 913-397-8200, ext. 1135.

DISABLE/ENABLE IRIDIUM TRANSCEIVER

Iridium telephone and data communications may be turned on or off by performing these simple steps.

Disabling/enabling telephone and low speed data services:

1) Turn the large **FMS** Knob on the MFD to select the Aux page group.
2) Turn the small **FMS** Knob to select the 'Aux-Telephone' Page.

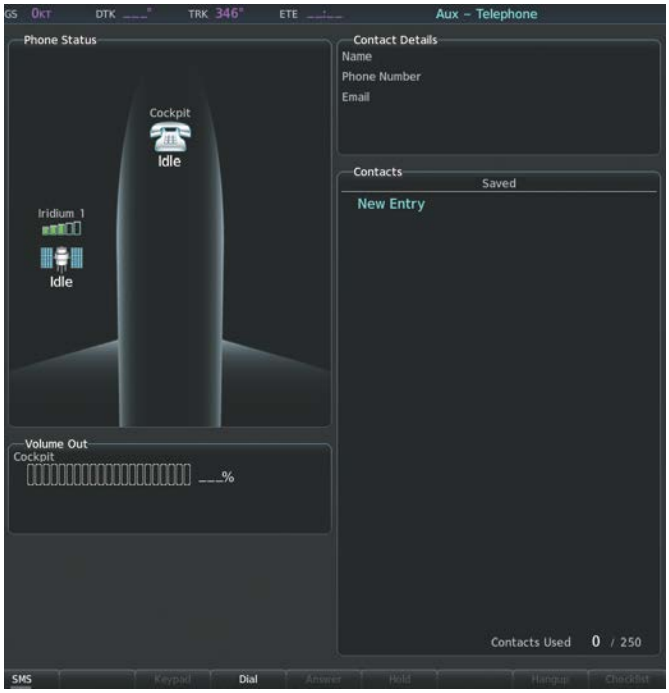


Figure 8-25 Report Status Page

3) Press the **MENU** Key. The Page Menu window is now displayed.
4) Turn the **FMS** Knob to select 'Disable Iridium Transmission' in the menu list.

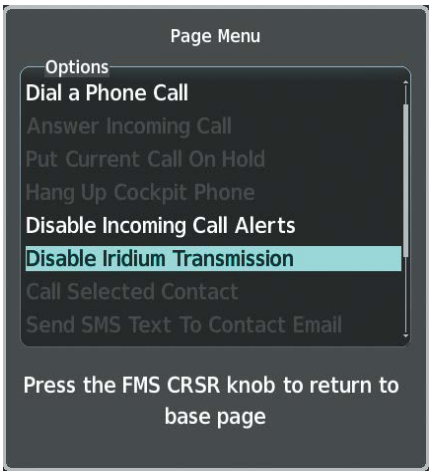


Figure 8-26 Select Disable Iridium Transmission

5) Press the **ENT** Key. The Iridium transceiver is now disabled.

6) To enable the Iridium transceiver, repeat steps 1 through 3, then select 'Enable Iridium Transceiver'.

TELEPHONE COMMUNICATION

The pilot or copilot can place and answer calls on the Iridium satellite network. Control and monitoring of telephone functions are accomplished through the 'Aux-Telephone' Page.

Viewing the Telephone Page:

1) Turn the large **FMS** Knob on the MFD to select the Aux page group.

2) Turn the small **FMS** Knob to select the 'Aux - Telephone' or 'Aux - Text Messaging' Page.

3) If necessary, press the **Phone** Softkey to display the 'Aux-Telephone' Page.

The phone status display gives a graphical representation of the current disposition of voice and/or data transmissions.

Internal Phone	External Phone	Description
		Phone is Idle
		Phone is ringing
		Phone has a dial tone (off hook) or connected to another phone
		Phone dialed is busy
		Phone is dialing another phone
		Phone has failed
		Phone status not known
		Phone is disabled
		Phone is reserved for data transmission
		Calling other phone or incoming call from other phone
		Other phone is on hold
		Phones are connected

Table 8-3 Telephone Symbols

CONTACTS

The names, telephone number, and email addresses can be saved in a list of contacts for easy use when making telephone calls.

Entering a new contact:

1) With the 'Aux - Telephone' Page displayed, press the **FMS** Knob to display the cursor.
2) If necessary, turn either **FMS** Knob to place the cursor on 'New Entry'.
3) Press the **ENT** Key. The cursor moves the 'Name' field of the 'Contact Details' window.
4) Enter the desired name of the new contact. Entry can be accomplished through the alphanumeric keys on the MFD Controller, or the **FMS** Knobs on the controller or the MFD.
5) Press the **ENT** Key. The cursor moves to the 'Phone Number' field.
6) Enter the desired telephone number. Entry can be accomplished through the alphanumeric keys on the MFD Controller, or the **FMS** Knobs on the controller or the MFD.
7) Press the **ENT** Key. The cursor moves to the 'Email' field.
8) Enter the desired email address. Entry can be accomplished through the alphanumeric keys on the MFD Controller, or the **FMS** Knobs on the controller or the MFD.
9) Press the **ENT** Key. The **Save** button is highlighted.
10) Press the **ENT** Key. The new contact entry is added to the list of saved contacts.

Delete a contact:

1) With the 'Aux - Telephone' Page displayed, press the **FMS** Knob to display the cursor.
2) Turn either **FMS** Knob to place the cursor on the desired contact name.
3) Press the **Delete** Softkey. A confirmation window is displayed.
4) With 'OK' highlighted, press the **ENT** Key to delete the selected contact.

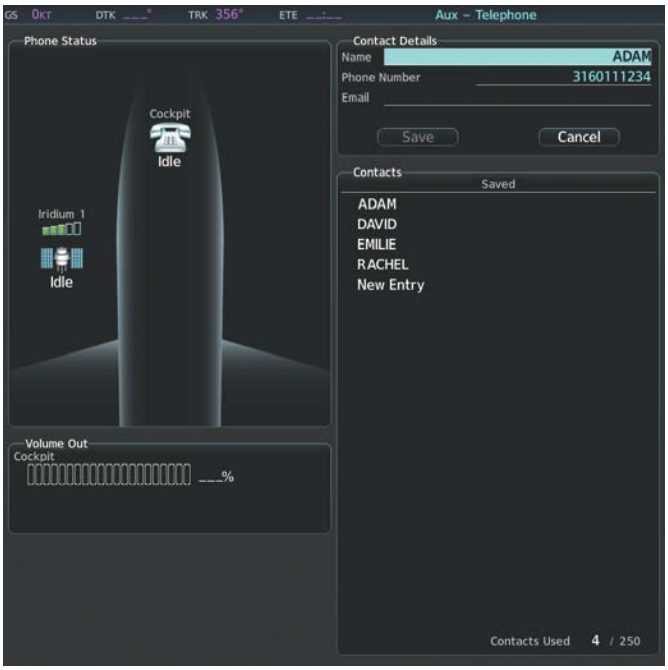


Figure 8-27 Editing a Contact

Edit a contact:

1) With the 'Aux - Telephone Page' displayed, press the **FMS** Knob to display the cursor.
2) Turn either **FMS** Knob to place the cursor on the desired contact name.
3) Press the **Edit** Softkey. The cursor is placed in the 'Name' field. Enter the desired changes. Entry can be accomplished through the alphanumeric keys on the MFD Controller, or the **FMS** Knobs on the controller or the MFD.
4) Press the **ENT** Key when each field is complete. The **Save** Button is now highlighted.
5) Press the **ENT** Key to save the changes.

INCOMING CALLS

When viewing MFD pages other than the 'Aux-Telephone' Page, a pop-up alert will be displayed and an aural alert "Incoming Call" will be heard. If the incoming call is an Iridium network call, Iridium will be displayed. The pop-up alert may be inhibited at times, such as during takeoff. In addition to the pop-up alert, a ringing phone symbol will be displayed to the right of the MFD page title. Also, the voice alert "Incoming Call" will be heard on the selected cockpit audio.

Answering an incoming call in the cockpit:

1) Press the **Phone** Key on the appropriate audio panel.
2) Press the **Answer** Softkey on the MFD.

   Or:

   While viewing the 'Aux-Telephone' Page

*NOTE: The Push-to-Talk switch is not utilized for telephone communication. The microphone is active after pressing the **Answer** Softkey, and stays active until the call is terminated.*

1) Press the **Phone** Key on the appropriate audio panel.
2) Press the **MENU** Key to display the Page Menu.
3) Turn either **FMS** Knob to place the cursor on 'Answer Incoming Call'.
4) Press the **ENT** Key.

Pressing the **Ignore** Softkey will extinguish the pop-up window and leave the call unanswered. Pressing the **Phone** Softkey will display the 'Aux-Telephone' Page allowing additional call information to be viewed before answering.

Muting incoming call alerts:

1) With the 'Aux-Telephone' Page displayed, press the **MENU** Key on the MFD to display the Page Menu.
2) Turn either **FMS** Knob to place the cursor on 'Disable Incoming Call Alerts'.
3) Press the **ENT** Key. The voice and pop-up alert will not be displayed now when an incoming call is received.

OUTGOING CALLS

Making an external call from the cockpit using the Iridium satellite network:

1) Press the **Phone** Key on the appropriate audio panel.
2) Press the **Dial** Softkey on the MFD.
3) Turn the small **FMS** Knob to select 'Iridium'.
4) Press the **ENT** Key. The cursor has now moved to the phone number entry field.

The International dialing sequence is necessary to place a call from the cockpit to an external phone: Country Code + City/Area Code (if any) + Telephone Number. The following country codes may be used when calling other satellite telephone systems.

Satellite System	Country Code
Inmarsat	870
ICO	8810 or 8811
Ellipso	8812 or 8813
Iridium	8816 or 8817
Globalstar	8818 or 8819

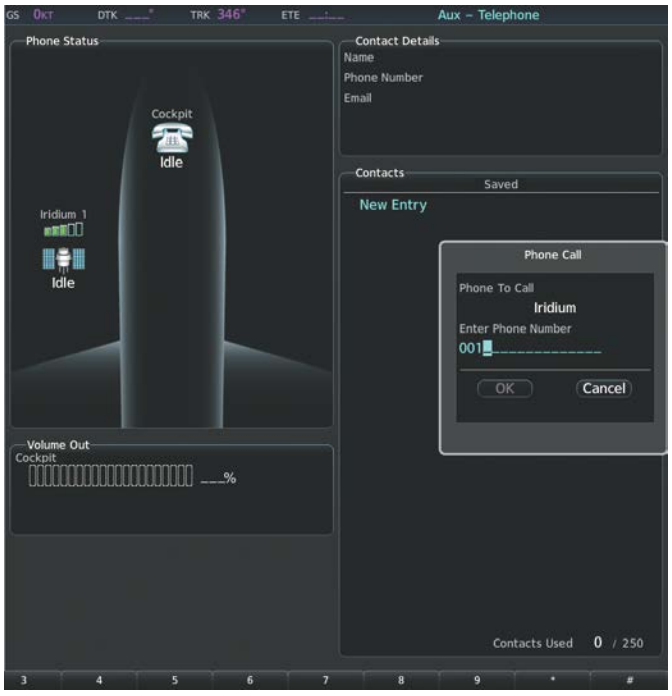


Figure 8-28 Enter Phone Number

5) Enter the desired telephone number (country code first) by pressing the number softkeys on the MFD.
6) Press the **ENT** Key. 'OK' is highlighted.

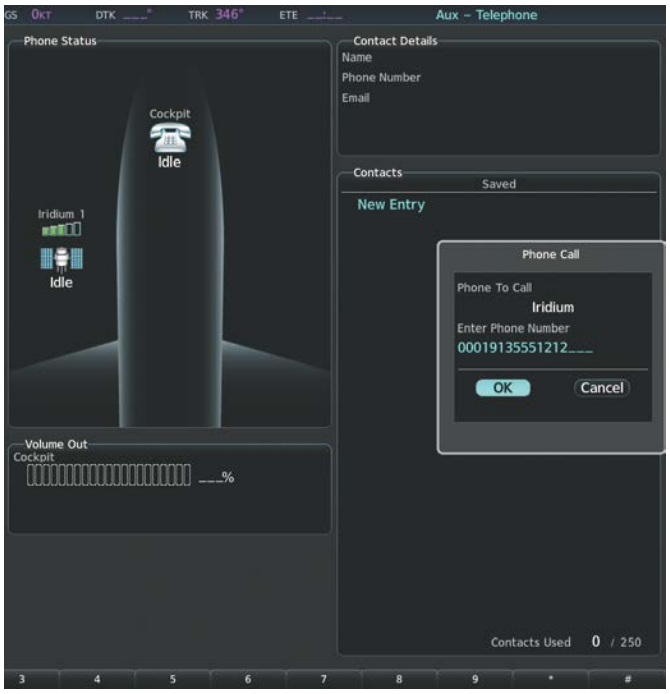


Figure 8-29 Make the Call

7) Press the **ENT** Key. The system will begin calling the number.

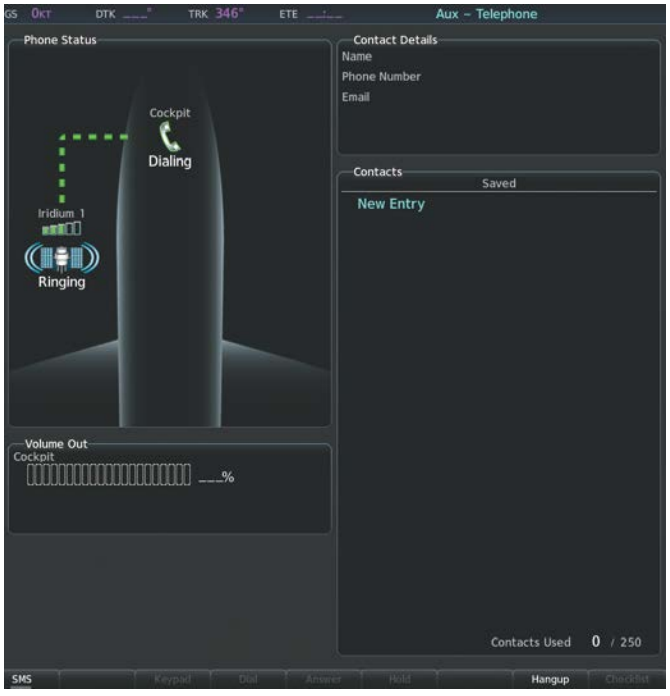


Figure 8-30 System is Making the Connection

When the phone is answered, the connection is established. To exit the call, press the **Hangup** Softkey.

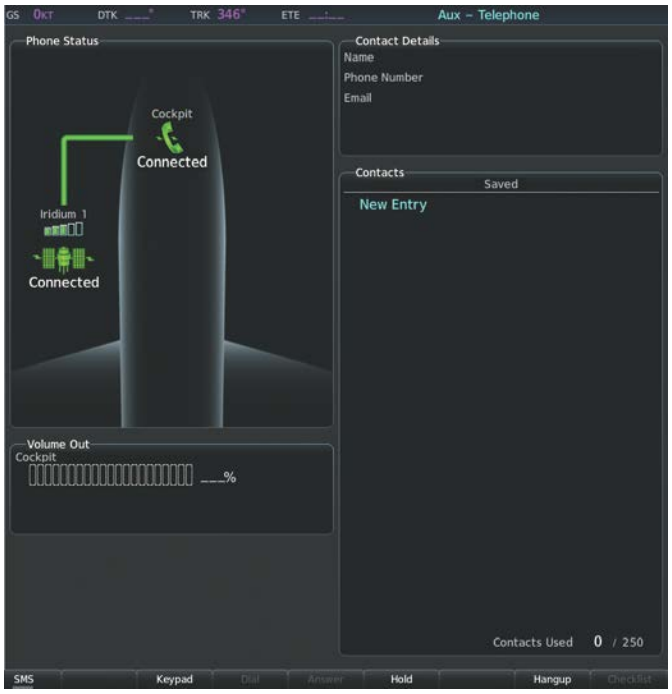


Figure 8-31 Phone is Answered, Connection Complete

Making an external call from the cockpit by using the Contact List:

1) Press the **Phone** Key on the appropriate audio panel.
2) Press the **FMS** Knob to activate the cursor.
3) Turn the small **FMS** Knob to select the desired contact name in the list of contacts.
4) Press the **Call** Softkey. The external call is initiated and the number associated with the contact name is dialed.

PLACING THE COCKPIT PHONE ON HOLD

Placing a call on hold:

Press the **Hold** Softkey on the MFD.

Or:

1) Press the **MENU** Key to display the Page Menu.
2) Turn either **FMS** Knob to place the cursor on 'Put Current Call On Hold'.
3) Press the **ENT** Key.

The cockpit phone is now isolated from the call. This figure illustrates a call between the cockpit and an external phone in which the cockpit phone has been put on hold. Press the **Hold** Softkey again to resume the call.

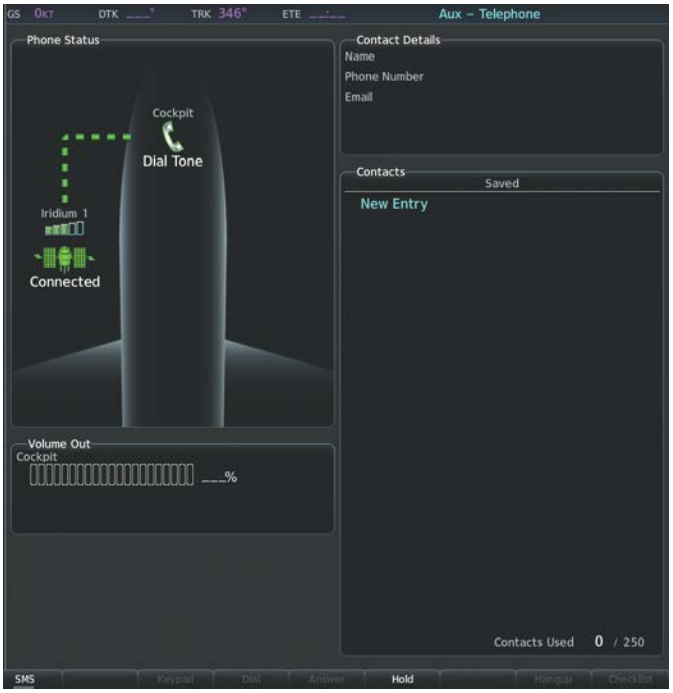


Figure 8-32 Cockpit Phone on Hold

TEXT MESSAGING (SMS)

The pilot or copilot can send and receive text messages on the Iridium satellite network. Messages may be sent to an email address or text message capable cellular telephone. Message length is limited to 160 characters, including the email address. Senders should address text messages to aircraft by entering [aircraft Iridium phone number]@msg.iridium.com.

The text messaging user interface is mainly through the 'Aux-Text Messaging' Page.

Viewing the Text Messaging Page:

1) Turn the large **FMS** Knob on the MFD to select the Aux page group.
2) Turn the small FMS Knob to select the 'Aux-Telephone' or 'Aux-Text Messaging' Page.
3) If necessary, press the **SMS** Softkey to display the 'Aux-Text Messaging' Page.

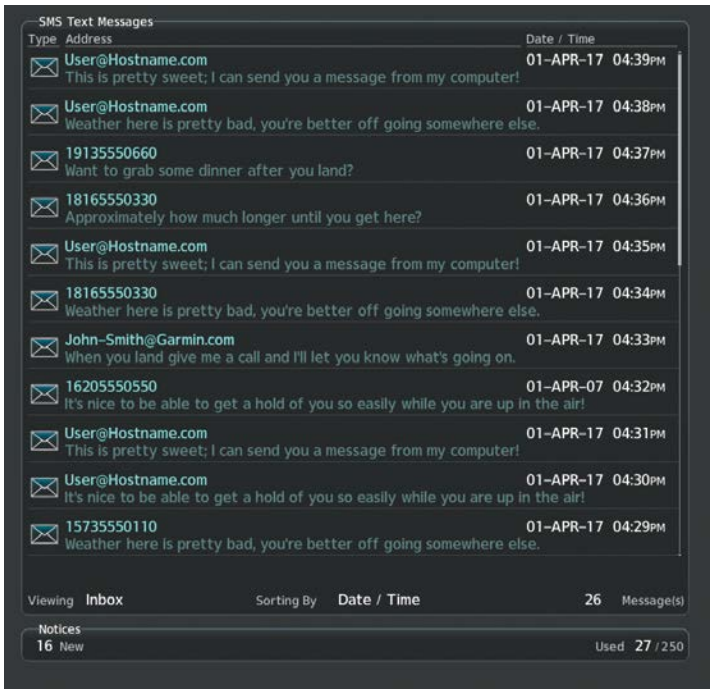


Figure 8-33 Text Messaging Page

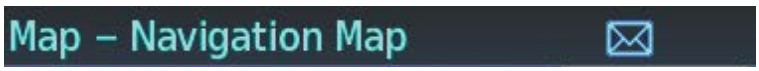
Message Symbol	Description
	Received text message that has not been opened
	Received text message that has been opened
	Saved text message, draft not sent
	System is sending text message
	Text message has been sent
	System failed to send text message
	Predefined text message

Table 8-4 Text Message Symbols

VIEWING A TEXT MESSAGE WHEN RECEIVED

When viewing MFD pages other than the 'Aux-Text Messaging' Page, a pop-up alert will be displayed when a new text message is received.

New Text Message Pop-up



New Text Message Symbol on MFD Page

Figure 8-34 New Text Message Received

Press the **View** Softkey to view the message. Pressing the **Ignore** Softkey will extinguish the pop-up window and leave the text message unopened. Pressing the **Ignore All** Softkey will extinguish the pop-window and ignore all future incoming text messages. Pressing the **SMS** Softkey will display the 'Aux-Text Messaging' Page.

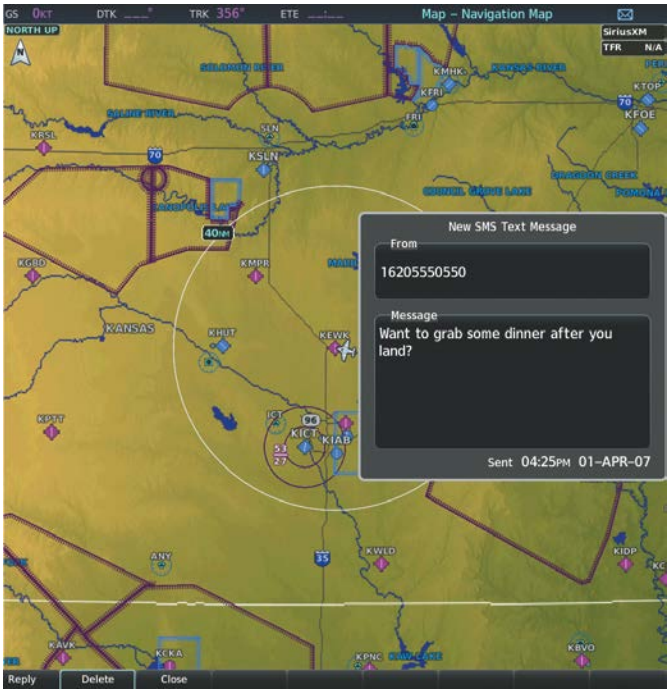


Figure 8-35 Text Message Displayed from Pop-Up Alert

The pop-up alerts may be enabled or disabled through the Page Menu.

Enabling/disabling incoming text message pop-up alerts:

1) With the 'Aux-Text Messaging' Page displayed, press the **MENU** Key on the MFD to display the Page Menu.
2) Turn either **FMS** Knob to place the cursor on 'Disable New Message Popups' or 'Enable New Message Popups'.
3) Press the **ENT** Key. The pop-up alert will not be displayed when an incoming text message is received.

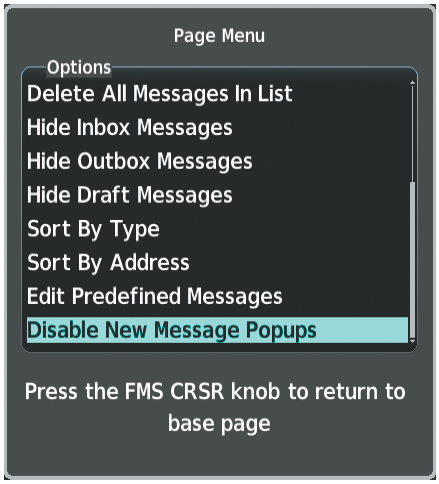


Figure 8-36 Disabling New Text Message Pop-Ups

REPLY TO A TEXT MESSAGE

After reading a text message, a reply may be sent.

Replying to a text message:

While viewing the text message, press the **Reply** Softkey.

Or:

1) Press the **MENU** Key to display the Page Menu.
2) Turn either **FMS** Knob to place the cursor on 'Reply To Message'.
3) Press the **ENT** Key.

SENDING A TEXT MESSAGE

Text messages may be sent from the 'Aux-Text Messaging' Page.

Sending a new text message:

1) While viewing the 'Aux-Text Messaging' Page, press the New Softkey.

Or:

a) Press the **MENU** Key to display the Page Menu.
b) Turn either **FMS** Knob to place the cursor on 'Draft New Message'.
c) Press the **ENT** Key.

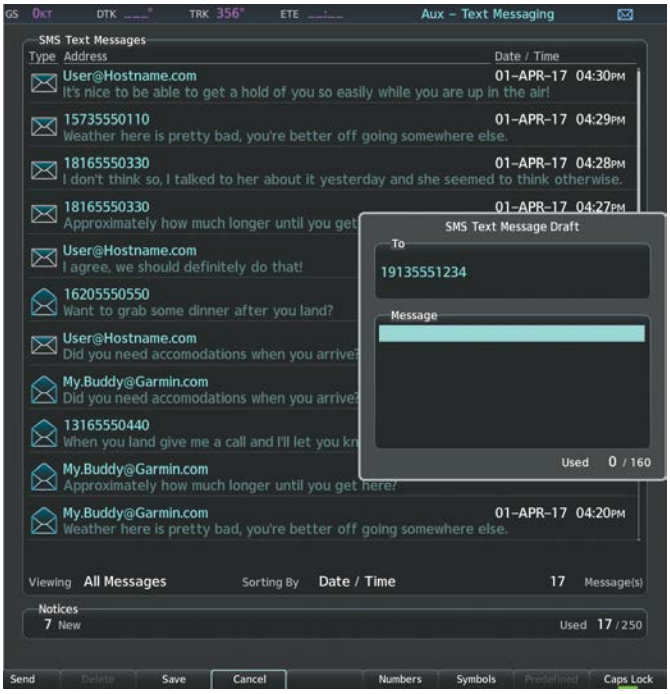


Figure 8-37 Composing a New Text Message

2) The SMS Text Message Draft Window is now displayed with the cursor in the 'To' field. Enter the desired telephone number or email address. Entry can be accomplished through the alphanumeric keys on the MFD Controller, or combination of the **FMS** Knob on the controller and softkeys on the MFD. The **FMS** Knob is used to enter letters and numbers, or numbers can be entered from the MFD by pressing the **Numbers** Softkey. Press the **CapsLock** Softkey to create upper and lower case alpha characters. Special characters can be accessed by pressing the **Symbols** Softkey.

3) Press the **ENT** Key. The cursor is now displayed in the 'Message' field.

4) Enter the desired message using any combination of entry methods as described in step 2.

5) Press the **ENT** Key.

6) Press the **Send** Softkey to send the message immediately, or press the **Save** Softkey to save the message in Outbox for sending at a later time. Press the **Cancel** Softkey to delete the message.

PREDEFINED TEXT MESSAGES

Time and effort can be saved in typing text messages that are used repeatedly by saving these messages as a predefined message.

Creating a predefined text message:

1) While viewing the 'Aux-Text Messaging' Page, press the **MENU** Key to display the Page Menu.

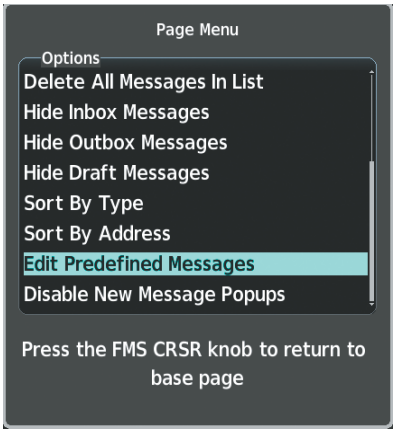


Figure 8-38 Creating/Editing Predefined Messages

2) Turn either **FMS** Knob to select 'Edit Predefined Messages'.
3) Press the **ENT** Key. The Predefined Messages view is now displayed.
4) Press the **New** Softkey.

Or:

a) Press the **MENU** Key to display the Page Menu.
b) Turn either **FMS** Knob to place the cursor on 'Draft New Predefined Message'.
c) Press the **ENT** Key. The Predefined SMS Text Message Window is now displayed.

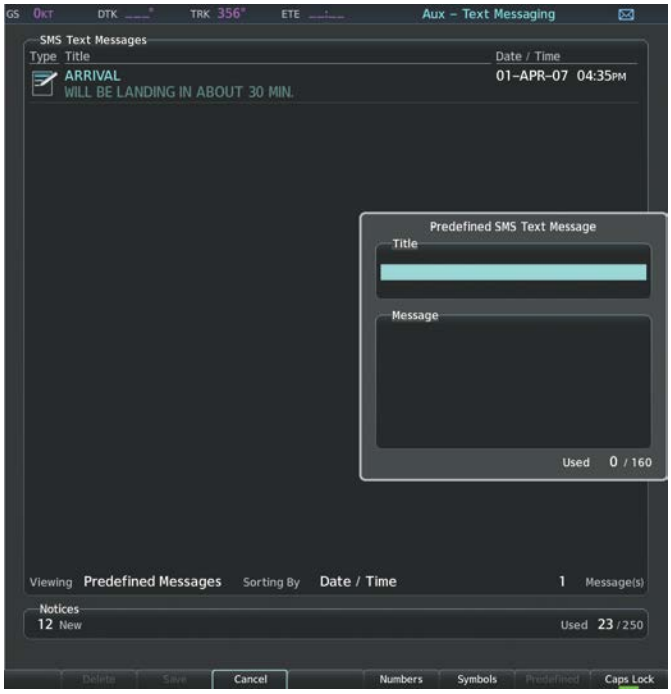


Figure 8-39 Composing a Predefined Message

5) The cursor is displayed in the 'Title' field. Enter the desired message title. Entry can be accomplished through the alphanumeric keys on the MFD Controller, or combination of the **FMS** Knob on the controller and softkeys on the MFD. The **FMS** Knob is used to enter letters and numbers, or numbers can be entered from the MFD by pressing the **Numbers** Softkey. Press the **CapsLock** Softkey to create upper and lower case alpha characters. Special characters can be accessed by pressing the **Symbols** Softkey.

6) Press the **ENT** Key. The cursor is now displayed in the 'Message' field.

7) Enter the desired message using any combination of entry methods as described in step 5.

8) Press the **ENT** Key.

9) Press the **Save** Softkey. The new predefined message is now shown in the displayed list. Pressing the **Cancel** Softkey will delete the message without saving.

10) Press the **MENU** Key to display the Page Menu.

11) Turn either **FMS** Knob to place the cursor on 'Cancel Drafting Message'.

12) Press the **ENT** Key.

Sending a predefined text message:

1) While viewing the 'Aux-Text Messaging' Page, select the New Softkey.
2) The Predefined SMS Text Message Window is now displayed with the cursor in the 'To' field. Enter the desired telephone number or email address. Entry can be accomplished through the alphanumeric keys on the MFD Controller, or combination of the **FMS** Knob on the controller and softkeys on the MFD. The **FMS** Knob is used to enter letters and numbers, or numbers can be entered from the MFD by pressing the **Numbers** Softkey. Press the **CapsLock** Softkey to create upper and lower case alpha characters. Special characters can be accessed by pressing the **Symbols** Softkey.
3) Press the **ENT** Key. The cursor is now displayed in the 'Message' field.

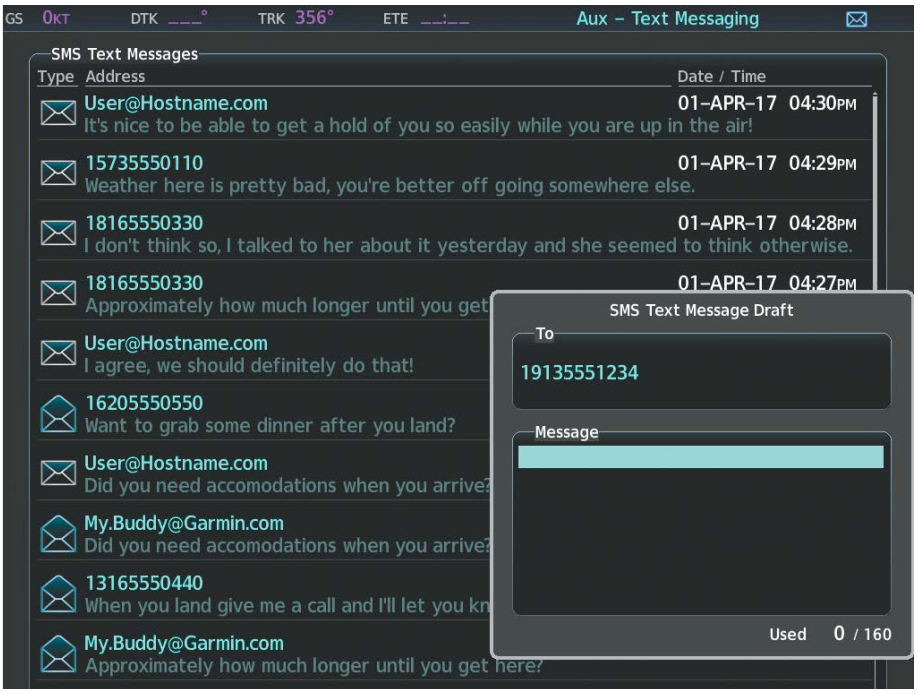


Figure 8-40 Predefined Message Softkey Shown When Composing a Message

4) Press the **Predefined** Softkey. The Predefined Message Menu Window is displayed.
5) Turn either **FMS** Knob to select the desired predefined message.
6) Press the **ENT** Key. The predefined message text is inserted into the message field. If desired, the message can be edited by using the FMS Knobs.
7) Press the **ENT** Key.
8) Press the **Send** Softkey to transmit the message.

TEXT MESSAGE BOXES

Received text messages reside in the Inbox as 'Read' or 'Unread' messages. The Outbox contains 'Sent" and 'Unsent' text messages. Saved messages that are meant to be sent later are stored as Drafts. Each text message box may be viewed separately, or together in any combination.

Show Inbox messages:

While viewing the 'Aux-Text Messaging' Page, press the Arrange Softkey, then press the Inbox Softkey.

Or:

1) Press the **MENU** Key to display the Page Menu.
2) Turn either **FMS** Knob to place the cursor on 'Show Inbox Messages'.
3) Press the **ENT** Key. The message box selected for viewing is indicated at the bottom left of the list window.

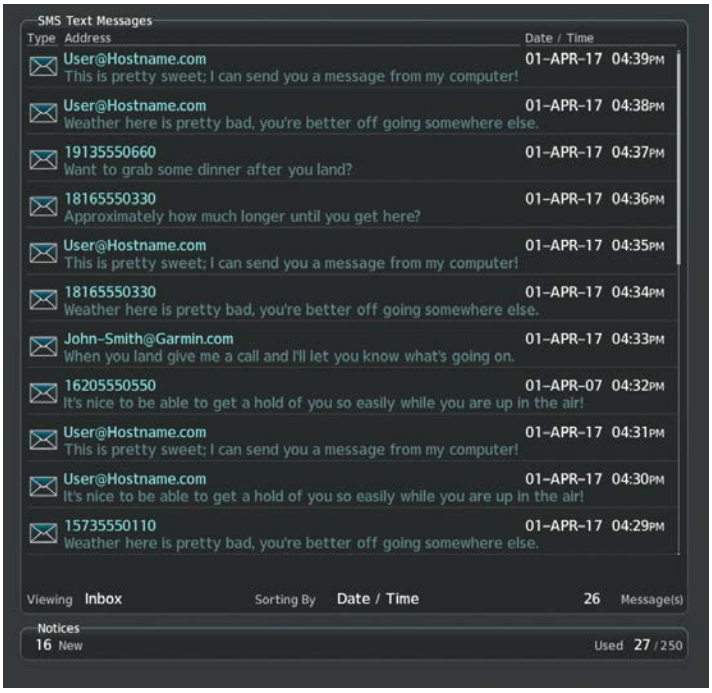


Figure 8-41 Text Message Inbox

Show Outbox messages:

While viewing the 'Aux-Text Messaging' Page, press the Arrange Softkey, then press the Outbox Softkey.

Or:

1) Press the **MENU** Key to display the Page Menu.
2) Turn either **FMS** Knob to place the cursor on 'Show Outbox Messages'.
3) Press the **ENT** Key. The message box selected for viewing is indicated at the bottom left of the list window.

Show Draft messages:

While viewing the 'Aux-Text Messaging' Page, press the Arrange Softkey, then press the Drafts Softkey.

Or:

1) Press the **MENU** Key to display the Page Menu.
2) Turn either **FMS** Knob to place the cursor on 'Show Draft Messages'.
3) Press the **ENT** Key. The message box selected for viewing is indicated at the bottom left of the list window.

MANAGING TEXT MESSAGES

The viewed messages may be listed according to the date/time the message was sent or received, the type of message (read, unread, sent, unsent, etc.), or by message address.

Viewing messages sorted by message date/time:

While viewing the 'Aux-Text Messaging' Page, press the Arrange Softkey, then press the Time Softkey.

Or:

1) Press the **MENU** Key to display the Page Menu.
2) Turn either **FMS** Knob to place the cursor on 'Sort By Date/Time'.
3) Press the **ENT** Key. The sorting selection is indicated at the bottom center of the list window.

Viewing messages sorted by message type:

While viewing the 'Aux-Text Messaging' Page, press the Arrange Softkey, then press the Type Softkey.

Or:

1) Press the **MENU** Key to display the Page Menu.
2) Turn either **FMS** Knob to place the cursor on 'Sort By Type'.
3) Press the **ENT** Key. The sorting selection is indicated at the bottom center of the list window.

Viewing messages sorted by address:

While viewing the 'Aux-Text Messaging' Page, press the Arrange Softkey, then press the Address Softkey.

Or:

1) Press the **MENU** Key to display the Page Menu.
2) Turn either **FMS** Knob to place the cursor on 'Sort By Address'.
3) Press the **ENT** Key. The sorting selection is indicated at the bottom center of the list window.

Viewing the content of a text message:

1) While viewing the 'Aux-Text Messaging' Page, select the desired message box.
2) Press the **FMS** Knob to activate the cursor.
3) Turn either **FMS** Knob to select the desired message.
4) Press the **VIEW** Softkey.

Or:

Press the **ENT** Key.

Or:

a) Press the **MENU** Key to display the Page Menu.
b) Turn either **FMS** Knob to place the cursor on 'View Selected Message'.
c) Press the **ENT** Key.

Message content is displayed.

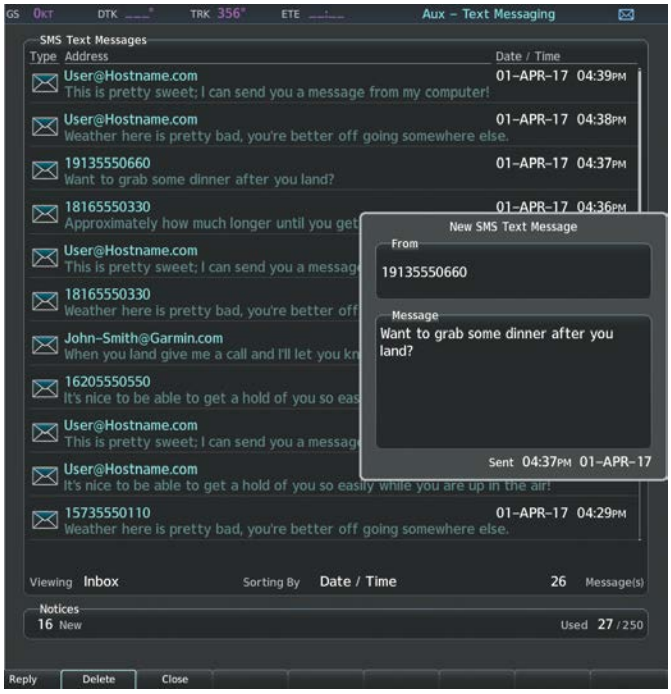


Figure 8-42 Viewing Message Content

5) To close the text message, press the **Close** Softkey.

Or:

a) Press the **MENU** Key to display the Page Menu.

b) Turn either **FMS** Knob to place the cursor on 'Close Message'.

c) Press the **ENT** Key.

Marking selected message as read:

1) While viewing the Inbox on the 'Aux-Text Messaging' Page, press the FMS Knob to activate the cursor.

2) Turn either **FMS** Knob to select the desired message.

3) Press the **MRK Read** Softkey.

Or:

a) Press the **MENU** Key to display the Page Menu.

b) Turn either **FMS** Knob to place the cursor on 'Mark Selected Message As Read'.

c) Press the **ENT** Key.

The message symbol now indicates the message has been opened.

Marking all messages as read:

1) While viewing the Inbox on the 'Aux-Text Messaging' Page, press the **MENU** Key to display the Page Menu.
2) Turn either **FMS** Knob to place the cursor on 'Mark All New Messages As Read'.
3) Press the **ENT** Key. A confirmation window is displayed.
4) With cursor highlighting 'YES', press the **ENT** Key. The message symbols now indicate all the message have been opened.

Delete a message:

1) While viewing the Inbox on the 'Aux-Text Messaging' Page, press the FMS Knob to activate the cursor.
2) Turn either **FMS** Knob to select the desired message.
3) Press the **Delete** Softkey.

   Or:

   a) Press the **MENU** Key to display the Page Menu.

   b) Turn either **FMS** Knob to place the cursor on 'Delete Selected Message'.

   c) Press the **ENT** Key.

8.7 CONNEXT SETUP

The Connext Setup Page allows for setting up the installed optional Flight Stream device for a Bluetooth connection between the system and a mobile device running the Garmin Pilot™ application.

The mobile device must be 'paired' with the system in order to use the various functions. Pairing is accomplished by first placing the system in pairing mode by displaying the Connext Setup Page. The system is 'discoverable' whenever this page is displayed. The pairing operation is completed from the mobile device and the Garmin Pilot application. See the device Bluetooth pairing instructions and the connection instructions in the Garmin Pilot application.

Viewing the Connext Setup Page

1) Turn the large **FMS** Knob on the MFD to select the Aux page group.
2) Turn the small **FMS** Knob to select the Connext Setup page.

Changing the Bluetooth Name

1) While viewing the Connext Setup Page, press the **FMS** Knob to activate the cursor.
2) Turn the large **FMS** Knob to place the cursor in the 'Bluetooth Name' field.
3) Enter the desired name by using the large **FMS** Knob to select the character field, and the small **FMS** Knob select the desired alphanumeric character for that field.
4) Press the **ENT** Key. The cursor is removed and the new name is displayed.

Enabling/Disabling Flight Plan Importing from Garmin Pilot

1) While viewing the Connext Setup Page, press the **FMS** Knob to activate the cursor.
2) Turn the large **FMS** Knob to place the cursor in the 'Flight Plan Import' field.
3) Turn the small **FMS** Knob to select 'Enabled' or 'Disabled'.
4) Press the **FMS** Knob to remove the cursor.

Enabling/Disabling WiFi Database Importing from Garmin Pilot

1) While viewing the Connext Setup Page, press the **FMS** Knob to activate the cursor.
2) Turn the large **FMS** Knob to place the cursor in the 'WiFi Database Import' field.
3) Turn the small **FMS** Knob to select 'Enabled' or 'Disabled'.
4) Press the **FMS** Knob to remove the cursor.

Enabling/Disabling Automatic Reconnection of a Specific Paired Device

1) While viewing the Connext Setup Page, press the **FMS** Knob to activate the cursor.
2) Turn the large **FMS** Knob to highlight the desired paired device.
3) Turn the small **FMS** Knob to select 'Enabled' or 'Disabled'. Selecting 'Enabled' allows the system to automatically connect to a previously paired device when detected.
4) Press the **FMS** Knob to remove the cursor.

Remove a Specific Paired Device from the List of Paired Devices:

1) While viewing the Connext Setup Page, press the **FMS** Knob to activate the cursor.
2) Turn the large **FMS** Knob to highlight the desired paired device.
3) Press the **Remove** Softkey. A confirmation screen is displayed.
4) If necessary, turn the large **FMS** Knob to select 'Yes'.
5) Press the **ENT** Key to remove the device from the list of paired devices.

8.8 MAINTENANCE LOGS

The system provides recording of CAS, CMC, exceedances, and other critical aircraft data that occur while the aircraft is on the ground or in flight. This information may be used by aircraft maintenance personnel in determining specific maintenance requirements.

The Maintenance Logs feature is accessible by entering a password. No pilot action is required.

Viewing the Maintenance Logs Page:

1) Turn the large **FMS** Knob on the MFD to select the Aux page group.
2) Turn the small **FMS** Knob to select 'Maintenance Logs'. The 'Aux - Maintenance Logs' Page is now displayed.

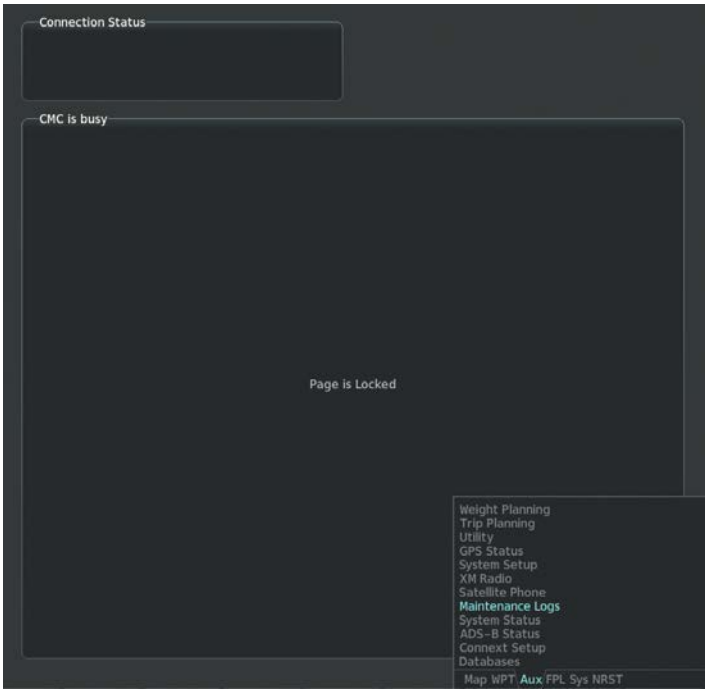


Figure 8-43 Maintenance Logs Page

8.9 ELECTRONIC STABILITY AND PROTECTION (ESP™)

NOTE: Refer to the Airplane Flight Manual to determine approval of ESP functionality.

The Garmin Electronic Stability and Protection (ESP™) is designed to provide automatic control inputs to discourage aircraft operation outside a normal flight envelope. Garmin ESP™ works to maintain the desired pitch, roll, and airspeed operating envelope by automatically engaging one or more servos when the aircraft is near a defined pitch, roll, and/or airspeed operating limit. While ESP™ utilizes the same sensors, processors, and actuators as the autopilot, it is a separate function. The ESP™ system only operates when autopilot is not engaged and the aircraft is above 200 feet AGL.

ESP engages when the aircraft exceeds one or more conditions (pitch, roll, Vmo, Mmo, and/or angle of attack) beyond the normal flight parameters. Enhanced stability for each condition is provided by applying a force to the appropriate control surface to return the aircraft to the normal flight envelope. This is perceived by the pilot as resistance to control movement in the undesired direction when the aircraft approaches a steep attitude, high airspeed, or when a stall is imminent.

As the aircraft deviates further from the normal attitude, or airspeed continues to increase, the force increases (up to an established maximum) to encourage control movement in the direction necessary to return to the normal attitude and/or airspeed range. Except in the case of high airspeed and AOA beyond threshold, when maximum force is reached, force remains constant up to the maximum engagement limit. Above the maximum engagement limit, forces are no longer applied. There is no maximum engagement related to a high airspeed condition or AOA HIGH condition.

When ESP™ has been engaged for more than ten seconds (cumulative; not necessarily consecutive seconds) of a 20-second interval, the autopilot is automatically entgaged with the flight director in Level Mode, bringing the aircraft into level flight. An aural "Engaging Autopilot" alert is played and the flight director mode annunciation will indicate 'LVL' for vertical and lateral modes.

The pilot can interrupt ESP by pressing and holding either the Control Wheel Steering (**CWS**) or Autopilot Disconnect (**AP DISC**) switch. Upon releasing the **CWS** or **AP DISC** switch, ESP force will again be applied, provided aircraft attitude and/or airspeed are within their respective engagement limits. ESP can also be overridden by overpowering the servo's mechanical torque limit. ESP is not functional when Trim/Servo has failed.

ESP™ can be enabled or disabled on the 'Aux - System Setup 2' Page on the MFD.

To enable or disable ESP™:

1) Turn the large **FMS** Knob to select the Aux Page Group.
2) Turn the small **FMS** Knob to select the System Setup Page.
3) If necessary, press the **Setup 2** Softkey to display the 'Aux - System Setup 2' Page. If the 'Aux - System Setup 2' is already displayed, proceed to step 4.
4) Press the **FMS** Knob to activate the cursor.
5) Turn the large **FMS** Knob to place the cursor in the Stability & Protection field.
6) Turn the small **FMS** Knob to select 'Enable' or 'Disable'.
7) Press the **FMS** Knob to remove the cursor.

ESP™ is automatically enabled on system power up.

ROLL ENGAGEMENT

Roll Limit Indicators are displayed on the roll scale at 45° right and left, indicating where ESP™ will engage. As roll attitude exceeds 45°, ESP™ will engage and the on-side Roll Limit Indicator will move to 30°. The Roll Limit Indicator is now showing where ESP™ will disengage as roll attitude decreases.

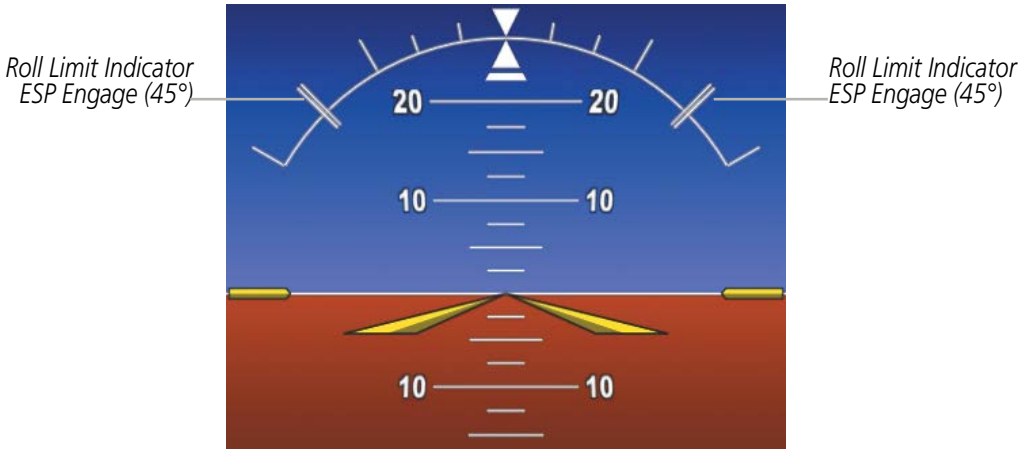
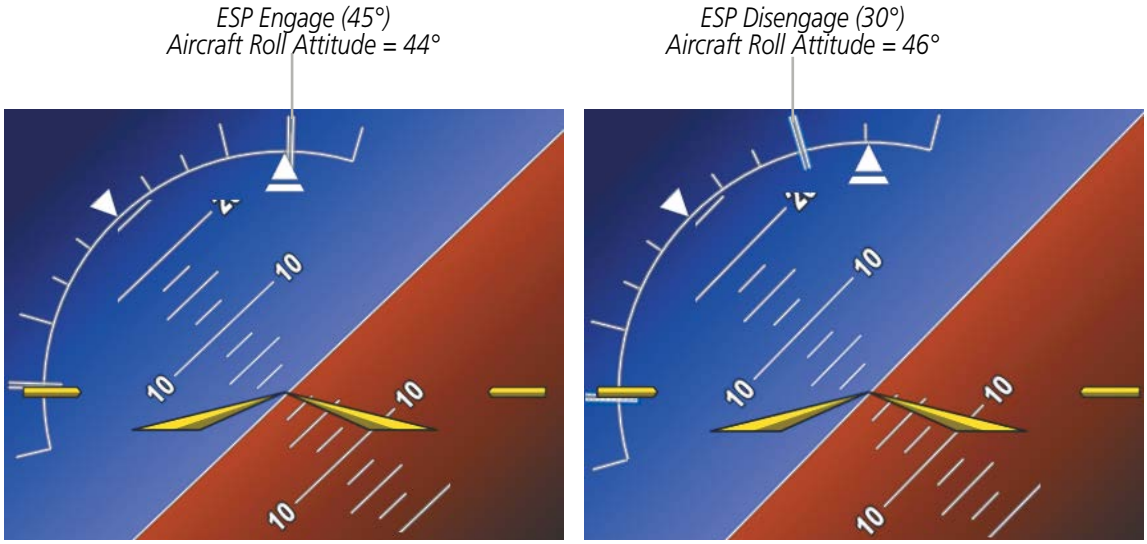


Figure 8-44 ESP Roll Engagement Indication (ESP NOT Engaged)



Before ESP Engage **After ESP Engage**

Figure 8-45 Roll Increasing to ESP Engagement

Once engaged, ESP™ force will be applied between 30° and 75°, as illustrated in the following figure. The force increases as roll attitude increases and decreases as roll attitude decreases. The applied force is intended to encourage pilot input that returns the airplane to a more normal roll attitude. As roll attitude decreases, ESP™ will disengage at 30°.

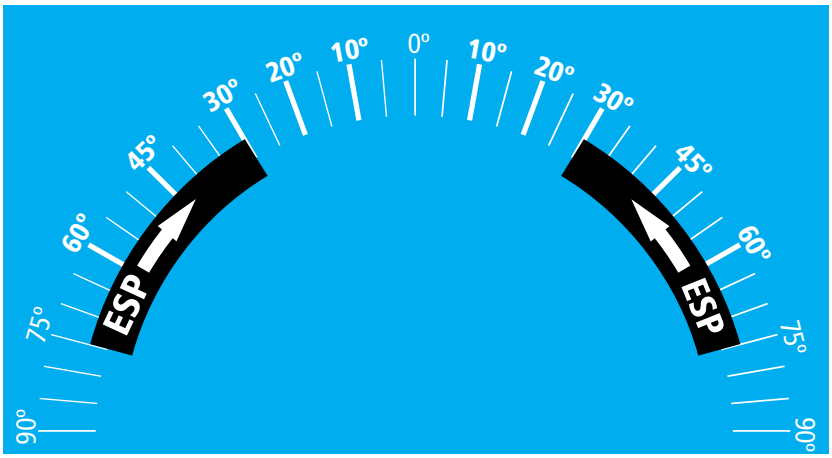


Figure 8-46 ESP Roll Operating Range When Engaged
(Force Increases as Roll Increases & Decreases as Roll Decreases)

ESP™ is automatically disengaged if the aircraft reaches the autopilot roll engagement attitude limit of 75°.

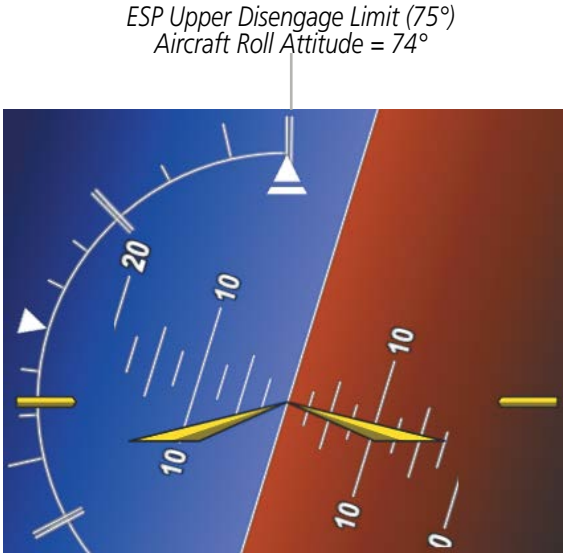


Figure 8-47 Roll Attitude Autopilot Engagement Limit (ESP Engaged)

PITCH ENGAGEMENT

ESP™ engages at 20° nose-up and 22° nose-down. Once ESP™ is engaged, it will apply increasing opposing force between 15° and 50° nose-up and between 12° and 50° nose-down, as indicated in the following figure. Maximum opposing force is applied between 25° and 50° nose-up and between 27° and 50° nose-down. ESP™ disengages when 50° is exceeded in a nose-up or nose-down attitude.

With ESP™ engaged, and the aircraft in a nose-up condition, opposing force steadily decreases from 25° nose-up to 15° nose-up as aircraft pitch moves toward zero degrees. ESP™ disengages at 15° nose-up. With ESP™ engaged, and the aircraft in a nose-down condition, opposing force steadily decreases from 27° nose-down to 12° nose-down as aircraft pitch moves toward zero degrees. ESP™ disengages at 12° nose-down.

The opposing force increases or decreases depending on the pitch angle and the direction of pitch travel. This force is intended to encourage movement in the pitch axis in the direction of the normal pitch attitude range for the aircraft.

There are no indications marking the pitch ESP™ engage and disengage limits in these nose-up/nose-down conditions.

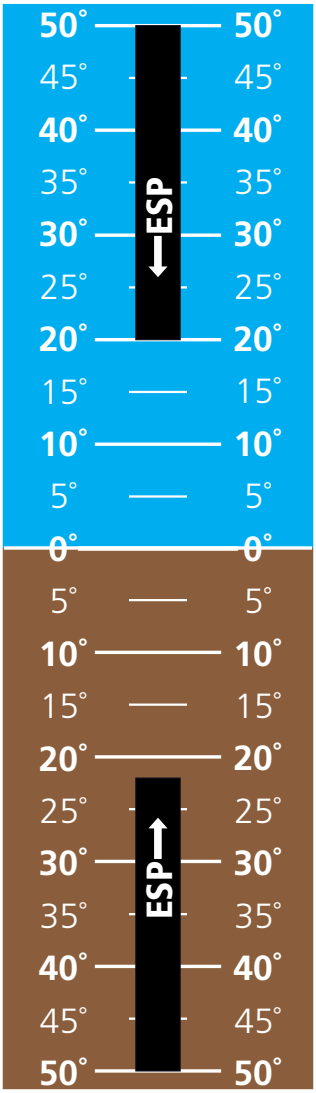


Figure 8-48 - ESP Pitch Operating Range When Engaged
(Force Increases as Pitch Increases & Decreases as Pitch Decreases)

ANGLE OF ATTACK PROTECTION

Angle of attack protection is provided as part of the ESP feature. ESP force may be applied if a stall warning condition is imminent. In this condition, the Pitch Limit Indicator will be initially displayed 4° below this computed pitch attitude. When pitch attitude equals that indicated by the Pitch Limit Indicator, ESP will engage, applying a force in the direction necessary to lower the nose of the aircraft.

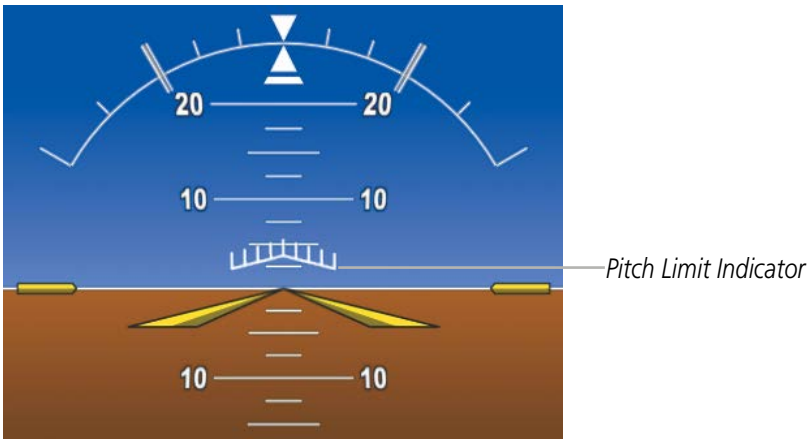


Figure 8-49 Pitch Limit Indicator

HIGH AIRSPEED PROTECTION

Exceeding 268 kts IAS will result in ESP™ applying force to raise the nose of the aircraft. When the indicated airspeed decreases to below 256 kts, ESP™ force is no longer applied.

8.10 ELECTRONIC CHECKLISTS

NOTE: *The optional checklists presented here are for example only and may differ from checklists available for the aircraft. The information described in this section is not intended to replace the checklist information described in the AFM or the Pilot Safety and Warning Supplements document.*

NOTE: *Garmin is not responsible for the content of checklists. Checklists are created by the aircraft manufacturer. Modifications or updates to the checklists are coordinated through the aircraft manufacturer. The user cannot edit these checklists.*

The MFD is able to display optional electronic checklists which allow a pilot to quickly find the proper procedure on the ground and during each phase of flight. The system accesses the checklists from an SD card inserted into the bezel slot. If the SD card contains an invalid checklist file or no checklist, the Power-up Page messages display 'Checklist File: Invalid' or 'Checklist File: N/A' (not available) and the **Checklist** Softkey is not available.

Accessing and navigating checklists:

1) From any page on the MFD (except the EIS Pages), press the **Checklist** Softkey or turn the large **FMS** Knob to select the Checklist Page.
2) Turn the large **FMS** Knob to select the 'Group' field.
3) Turn the small **FMS** Knob to select the desired procedure and press the **ENT** Key.
4) Turn the large **FMS** Knob to select the 'Checklist' field.
5) Turn the **FMS** Knob to select the desired checklist and press the **ENT** Key. The selected checklist item is indicated with white text surrounded by a white box.
6) Press the **ENT** Key or **Check** Softkey to check the selected checklist item. The line item turns green and a checkmark is placed in the associated box. The next line item is automatically selected for checking.

   Either **FMS** Knob can be used to scroll through the checklist and select the desired checklist item.

   Press the **CLR** Key or **Uncheck** Softkey to remove a check mark from an item.
7) When all checklist items have been checked, '*Checklist Finished*' is displayed in green text at the bottom left of the checklist window. If all items in the checklist have not be checked, '*Checklist Not Finished*' will be displayed in yellow text.
8) Press the **ENT** Key. 'Go To Next Checklist?' will be highlighted by the cursor.
9) Press the **ENT** Key to advance to the next checklist.
10) Press the **Exit** Softkey to exit the Checklist Page and return to the page last viewed.

Accessing emergency procedures:

1) From any page on the MFD (except the EIS Pages), press the **Checklist** Softkey or turn the large **FMS** Knob to select the Checklist Page.
2) Press the **EMER** Softkey.
3) Turn the **FMS** Knob to select the desired emergency checklist and press the **ENT** Key.
4) Press the **ENT** Key or **Check** Softkey to check the selected emergency checklist item. The line item turns green and a checkmark is placed in the box next to it. The next line item is automatically highlighted for checking.

   Either **FMS** Knob can be used to scroll through the checklist and select the desired checklist item.

   Press the **CLR** Key or **Uncheck** Softkey to remove a check mark from an item.
5) When all checklist items have been checked, '*Checklist Finished*' is displayed in green text at the bottom left of the checklist window. If all items in the checklist have not be checked, '*Checklist Not Finished*' will be displayed in yellow text.
6) Press the **ENT** Key. 'Go To Next Checklist?' will be highlighted by the cursor.
7) Press the **ENT** Key to advance to the next checklist.
8) Press the **Return** Softkey to return to the previous checklist.
9) Press the **Exit** Softkey to exit the Checklist Page and return to the page last viewed.

8.11 ABNORMAL OPERATION

SIRIUSXM DATA LINK RECEIVER TROUBLESHOOTING

For troubleshooting purposes, check the LRU Information Box on the 'Aux - System Status' Page for GDL 69A SXM status, serial number, and software version number. If a failure has been detected in the GDL 69A SXM the status is marked with a red X.

Selecting the Aux - System Status Page:

1) Turn the large **FMS** Knob to select the Aux Page Group.
2) Turn the small **FMS** Knob to select the 'Aux - System Status' Page.

Some quick troubleshooting steps listed below can be performed to find the possible cause of a failure.

- Ensure the installed Data Link Receiver or Iridium Transceiver has an active subscription or account
- Perform a quick check of the circuit breakers to ensure that power is applied to the Data Link Receiver or Iridium Transceiver

Ensure that nothing is plugged into the MUSIC 1 or MUSIC 2 jacks because that would prevent SiriusXM radio from being heard

If a failure still exists, the following messages may provide insight as to the possible problem:

Message	Message Location	Description
CHECK ANTENNA	XM Information Page (MFD)	Data Link Receiver antenna error; service required
UPDATING	XM Information Page (MFD)	Data Link Receiver updating encryption code
NO SIGNAL	XM Information Page Weather Datalink Page (MFD)	Loss of signal; signal strength too low for receiver
LOADING	XM Radio Page (MFD)	Acquiring channel audio or information
OFF AIR	XM Radio Page (MFD)	Channel not in service
--------	XM Radio Page (MFD)	Missing channel information
WEATHER DATA LINK FAILED	Weather Datalink Page (MFD)	No communication from Data Link Receiver within last 5 minutes
ACTIVATION REQUIRED	XM Information Page (MFD)	SiriusXM subscription is not activated
DETECTING ACTIVATION	Weather Datalink Page (MFD)	SiriusXM subscription is activating.
WAITING FOR DATA...	Weather Datalink Page (MFD)	SiriusXM subscription confirmed downloading weather data.

Table 8-5 GDL 69A SXM Data Link Receiver Messages

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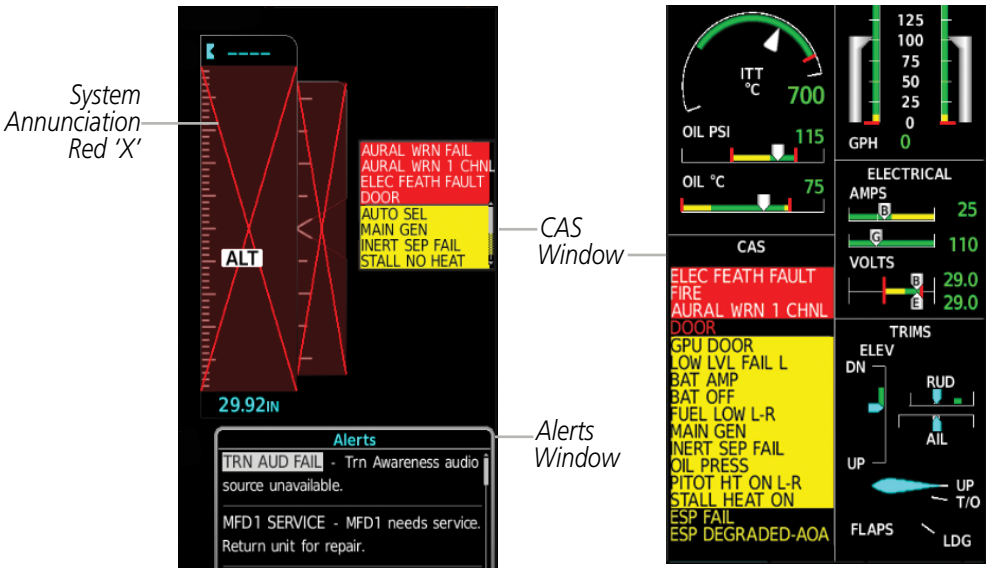
ANNUNCIATIONS AND ALERTS

The Alerting System conveys alerts using the following:

- **CAS Window:** The CAS Window displays abbreviated annunciation text. Text color is based on alert levels described in the CAS Messages section. The CAS Window is on the lower left side of the MFD on the EIS display. In Reversionary Mode, the CAS Window is displayed on the right side of the PFD. A white horizontal line separates annunciations that are acknowledged from annunciations that are not yet acknowledged. Higher priority annunciations are displayed towards the top of the window.
- **Alerts Window:** The Alerts Window displays text messages for up to 64 prioritized alert messages. Pressing the **Message** Softkey displays the Alerts Window. Pressing the **Message** Softkey a second time removes the Alerts Window from the display; the softkey then returns to the previous **Alerts** label. When the Alerts Window is displayed, the **FMS** Knob can be used to scroll through the alert message list.
- **System Annunciations:** Typically, a large red 'X' appears over instruments whose information is supplied by a failed Line Replaceable Unit (LRU).



PFD Reversionary Mode

MFD Normal Mode

Figure A-1 CAS Message Displays and Alerts Window

CAS MESSAGE PRIORITIZATION

NOTE: *Refer to the Pilot's Operating Handbook (POH) for corrective pilot actions.*

NOTE: *Any CAS messages that are generated when the system is first powered on are considered already acknowledged. They do not flash or trigger the Master Warning or Master Caution.*

The Crew Alerting System (CAS) Window is located on the right side of the PFD in Reversionary Mode, and in the lower left corner of the EIS display in normal conditions. When more caution and advisory messages exist than can be displayed at once, selecting the **CAS** Softkey displays softkeys for scrolling up and down through the messages in the CAS Window. Warning messages cannot be scrolled through and remain at the top of the CAS display.

Figure A-2 CAS Scrolling

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

NOTE: *Refer to the Pilot's Operating Handbook (POH) for corrective pilot actions.*

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

The Alerting System uses three alert levels. 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: This level of alert requires immediate crew awareness and action. The Master Warning is triggered. When a new warning CAS message appears in the CAS Window, it flashes (inversely red on white) and is accompanied by a repeating triple chime. Pressing the Master Warning button on the airframe acknowledges all flashing warning messages. Once acknowledged, warning messages are shown in red text and are displayed until the issue is corrected. Warning voice alerts repeat continuously until acknowledged by pressing the **Warning** button on the airframe.

Caution: This level of alert requires immediate crew awareness and possible future corrective action required. The Master Caution is triggered. When a new caution message appears in the CAS Window, it is shown in black on amber inverse video and is accompanied by a double chime. Pressing the Master Caution button on the airframe acknowledges all caution messages. Once acknowledged, caution messages are displayed until the issue is corrected.

Advisory: This level of alert provides general information. When a new white advisory appears on the CAS display, it flashes for 5 seconds is accompanied by a single chime. Advisory messages display white on black background until conditions are cleared.

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

After the acknowledgment, a message remains displayed at the top of its respective priority group in the CAS Window until either a newer message of the same priority appears, or the condition(s) that caused the alert to display no longer exist.

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

Figure A-3 Panel Layout

Some CAS messages can be displayed in more than one alert level group. For example, a message might display as both a warning and a caution, but cannot appear more than once at any given time (unless the CAS is being tested). If the received signals justify multiple priorities for a certain message, the message is displayed for the higher priority condition. When graduating to a higher priority, the message flashes and 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.

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

After the acknowledgment, a message remains displayed at the top of its respective priority group in the CAS Window until either a newer message of the same priority appears, or the condition(s) that caused the alert to display no longer exist.

CAS MESSAGES

WARNING MESSAGES

Message	Description
ABORT APR	Loss of GPS navigation. Abort approach
AURAL WRN FAIL	Aural warning system failure due to non-communicating LRUs
AURAL WARN 1 CHNL	Aural warning failure of one LRU
CABIN ALTITUDE	Cabin altitude over 10,000 ft
CABIN DIFF PRESS	Cabin pressure differential over 6.2 psi
DOOR	Pilot or cabin door open
ELEC FEATH FAULT	Feathering system failure
EDM	Autopilot has activated emergency descent mode
FIRE	Engine compartment fire (temperature over 200°C; if installed)
FLAPS ASYM	Dissymmetry between left- and right-hand flaps
FUEL OFF	Fuel tank selectors set to "Off"
FUEL PRESS	Fuel pressure below 10 psi
GEAR UNSAFE	Gears are in an unsafe configuration
ITT	Engine start: ITT over 1000°C, 870°C (5 s), or 840°C (20 s) Engine running: ITT over 840°C
OIL PRESS	Oil pressure below 60 psi
O2 CYL CLOSED	Oxygen cylinder closed
PARK BRAKE	Parking brake applied
PRESSU OFF	No Bleed air provided to cabin
USP ACTIVE	Underspeed protection is active

CAUTION MESSAGES

Message	Description
AP ON YD OFF	The autopilot is ON while the Yaw Damper is OFF
APR DWNGRADE	Approach downgraded , vertical guidance generated by SBAS is unavailable,. Use LNAV only minimums
AUTO SEL	Fuel timer off or out of service
AUX BOOST PMP ON	Electric fuel pump running (manual or automatic mode)
BAT AMP	Battery current over 50 A while on ground
BAT OFF	Battery off

Message	Description
CARGO DOOR	Forward cargo door open
CHIP	Oil chip detector on (if installed)
ESP DEGRADED - AOA	Electronic Stability and Protection (ESP™)) angle of attack (AOA) mode is inoperative. The system should be serviced
ESP DEGRADED - IAS	Electronic Stability and Protection (ESP™)) indicated air speed (IAS) mode is inoperative. The system should be serviced
ESP FAIL	The ESP function has failed and is inoperative. The system should be serviced
FUEL IMBALANCE	Fuel tanks imbalanced by more than 15 USGAL for >30 seconds
FUEL LOW L-R*	Fuel quantity less than or equal to 9.1 USGAL in specified tank
GAS EVENT	Global Air System needs servicing
GAS DEGRADED	Global Air System failure. The system should be serviced.
GPU DOOR	GPU receptacle door not closed
GWX FAIL	The GDU is not receiving status packet from the GWX 68/GWX 70 is reporting a fault. The GWX 68/GWX 70 radar system should be serviced
IGNITION	Ignition exciter running
INERT SEP FAIL	Inertial separator failure
LOW LVL FAIL L-R*	Low fuel level sensor failure for specified tank
LOW VOLTAGE	Battery voltage below 26 V
MAIN GEN	Starter generator unconnected
NG HI	Generator speed is more than 103%
OIL PRESS	Oil pressure between 60 and 100 psi
OIL TEMP	Oil temperature below 0°C or above 104°C
PITOT HT ON L-R*	Specified pitot heat (left or right) on while engine off
PITOT NO HT L-R*	Specified pitot heat (left or right) off
PRESSU BACKUP	GASC cannot compute optimal cabin altitude (cabin altitude default value is set at 9800 feet)
PROP DEICE FAIL	Prop deice selected and not on
PROP DEICE ON	Prop deice on while engine off
REAR CARGO DOOR	The rear cargo door is open
STALL HEAT ON	Stall heat on while engine off
STALL NO HEAT	Stall warning heat off
TCAS FAIL	TCAS has failed and is inoperative. The system should be serviced
TRAFFIC FAIL	Traffic has failed and is inoperative. The system should be serviced
VACUUM LOW	Vacuum pressure less than 3.75 in Hg
USE OXYGEN MASK	Cabin altitude high
XPDR1 ADS-B FAIL	ADS-B of XPDR1 is inoperative. The transponder may not be receiving a valid GPS position. Other transponder functions may be available. Service when possible.
XPDR1 FAIL	XPDR1 has failed and is inoperative. The system should be serviced
XPDR2 ADS-B FAIL	ADS-B of XPDR2 is inoperative. The transponder may not be receiving a valid GPS position. Other transponder functions may be available. Service when possible.
XPDR2 FAIL	XPDR2 has failed and is inoperative. The system should be serviced

** Only affected side (L, R, or L-R) displayed in CAS message; applicable messages listed here display L-R for example*

ADVISORY MESSAGES

Message	Description
EDM OVERRIDE	Emergency Descent Mode has been overridden by the crew
ESP OFF	Electronic Stability and Protection has been disabled on the Avionics Settings Screen
INERT SEP ON	Inertial separator extended
MAX DIFF MODE	Cabin pressurization system in MAX DIFF MODE.
STARTER	Starter generator running

DISPLAY INHIBITS

Inhibits prevent certain CAS messages from being displayed during the following conditions:

If two alert levels of the same message are active simultaneously (e.g., L FUEL QTY warning and L FUEL QTY caution) only the higher alert level is displayed.

If a GEA or GIA fails, all CAS messages depending on sensors associated with that LRU are automatically inhibited. Inhibits cannot be activated by invalid sensor data.

AUDIO ALERTS

Voice Alert	Description
"Airspeed"	Played when the indicated airspeed is below a given threshold for a given aircraft configuration. Note, this alert may be heard under normal conditions during the landing flare.
"Aural Warning OK"	Played when both audio paths are OK, following a previous audio path or audio processing issue.
"Engaging Autopilot"	Played when ESP has been engaged for more than 10 seconds cumulative of a 20 second interval, and the autopilot is automatically engaged.
"Incoming Call"	Satellite telephone is receiving a call.
"Landing Gear, Landing Gear"	Gear up in landing condition.
"Minimums, minimums"	The aircraft has descended below the preset barometric minimum descent altitude.
"Overspeed, Overspeed"	Airspeed has exceeded 265 Kts.
"Stall, Landing Gear"	Combination of airplane in stall condition and gear up in landing condition.
"Stall, Stall"	Airplane in stall condition.
"Traffic"	Played when a Traffic Advisory (TA) is issued with the TIS system.
"TIS Not Available"	The aircraft is outside the Traffic Information Service (TIS) coverage area.
"Traffic, Traffic"	Played when a Traffic Advisory (TA) is issued with a TAS system.
"TAS System Test Failed"	Played when the TAS system fails a pilot-initiated self test.
"TAS System Test Passed"	Played when the TAS system passes a pilot-initiated self test.
"Use Oxygen Mask, Use Oxygen Mask"	Played in conjuction with associated CAS messages when cabin altiude exceeds 10,000 ft.
"Vertical track"	The aircraft is one minute from Top of Descent. Issued only when vertical navigation is enabled.
"One o'clock" through "Twelve o'clock" or "No Bearing"	Played to indicate bearing of traffic from own aircraft (GTS 820 only).
"High", "Low", "Same Altitude" (if within 200 feet of own altitude), or "Altitude not available"	Played to indicate altitude of traffic relative to own aircraft (GTS 820 only).
"Less than one mile", "One Mile" through "Ten Miles", or "More than ten miles"	Played to indicate distance of traffic from own aircraft (GTS 820 only).

SYSTEM MESSAGE ADVISORIES

This section describes various system message advisories. Certain messages are issued due to an LRU or an LRU function failure. Such messages are normally accompanied by a corresponding red 'X' annunciation.

NOTE: *This section provides information regarding message advisories that may be displayed by the system. Knowledge of the aircraft, systems, flight conditions, and other existing operational priorities must be considered when responding to a message. Always use sound pilot judgment. The Pilot's Operating Handbook (POH) takes precedence over any conflicting guidance found in this section.*

Message	Comments
ADC1 ALT EC – ADC1 altitude error correction is unavailable.	GDC1 is reporting that the altitude error correction is unavailable.
ADC1 AS EC – ADC1 airspeed error correction is unavailable.	GDC1 is reporting that the airspeed error correction is unavailable.
ADC2 ALT EC – ADC2 altitude error correction is unavailable.	GDC2 is reporting that the altitude error correction is unavailable.
ADC2 AS EC – ADC2 airspeed error correction is unavailable.	GDC2 is reporting that the airspeed error correction is unavailable.
AHRS MAG DB – AHRS magnetic model database version mismatch.	The #1 AHRS and #2 AHRS magnetic model database versions do not match.
AHRS1 CAL – AHRS1 calibration version error. Srvc req'd.	The AHRS1 calibration version error. The system should be serviced.
AHRS1 CONFIG – AHRS1 config error. Config service req'd.	AHRS configuration settings do not match those of backup configuration memory. The system should be serviced.
AHRS1 GPS – AHRS1 not receiving any GPS information.	The #1 AHRS is not receiving any or any useful GPS information. Check AFMS limitations. The system should be serviced.
AHRS1 GPS – AHRS1 not receiving backup GPS information.	The #1 AHRS is not receiving backup GPS information. The system should be serviced.
AHRS1 GPS – AHRS1 operating exclusively in no-GPS mode.	The #1 AHRS is operating exclusively in no-GPS mode. The system should be serviced.
AHRS1 GPS – AHRS1 using backup GPS source.	The #1 AHRS is using the backup GPS path. Primary GPS path has failed. The system should be serviced when possible.
AHRS1 SRVC – AHRS1 Magnetic-field model needs update.	The #1 AHRS earth magnetic field model is out of date. Update magnetic field model when practical.
AHRS1 TAS – AHRS1 not receiving airspeed.	The #1 AHRS is not receiving true airspeed from the air data computer. The AHRS relies on GPS information to augment the lack of airspeed. The system should be serviced.
AHRS2 CAL – AHRS2 calibration version error. Srvc req'd.	The AHRS2 calibration version error. The system should be serviced.
AHRS2 CONFIG – AHRS2 config error. Config service req'd.	AHRS configuration settings do not match those of backup configuration memory. The system should be serviced.

Message	Comments
AHRS2 GPS – AHRS2 not receiving any GPS information.	The #2 AHRS is not receiving any or any useful GPS information. Check AFMS limitations. The system should be serviced.
AHRS2 GPS – AHRS2 not receiving backup GPS information.	The #2 AHRS is not receiving backup GPS information. The system should be serviced.
AHRS2 GPS – AHRS2 operating exclusively in no-GPS mode.	The #2 AHRS is operating exclusively in no-GPS mode. The system should be serviced.
AHRS2 GPS – AHRS2 using backup GPS source.	The #2 AHRS is using the backup GPS path. Primary GPS path has failed. The system should be serviced when possible.
AHRS2 SRVC – AHRS2 Magnetic-field model needs update.	The #2 AHRS earth magnetic field model is out of date. Update magnetic field model when practical.
AHRS2 TAS – AHRS2 not receiving airspeed.	The #2 AHRS is not receiving true airspeed from the air data computer. The AHRS relies on GPS information to augment the lack of airspeed. The system should be serviced.
APR INACTV – Approach is not active.	The system notifies the pilot that the loaded approach is not active. Activate approach when required.
ARSPC AHEAD – Airspace ahead less than 10 minutes.	Special use airspace is ahead of aircraft. The aircraft will penetrate the airspace within 10 minutes.
ARSPC NEAR – Airspace near – less than 2 nm.	Special use airspace is within 2 nm of the aircraft position.
ARSPC NEAR – Airspace near and ahead.	Special use airspace is near and ahead of the aircraft position.
AUDIO MANIFEST - Audio software mismatch, communication halted.	The GDC 74B has incorrect software installed. The system should be serviced.
CHECK CRS – Database course for LOC1 / [LOC ID] is [CRS]°.	Selected course for LOC1 differs from published localizer course by more than 10 degrees.
CHECK CRS – Database course for LOC2 / [LOC ID] is [CRS]°.	Selected course for LOC2 differs from published localizer course by more than 10 degrees.
CNFG MODULE – PFD1 configuration module is inoperative.	The PFD1 configuration module backup memory has failed. The system should be serviced.
COM1 CONFIG – COM1 config error. Config service req'd.	The COM1 configuration settings do not match backup configuration memory. The system should be serviced.
COM 1 MANIFEST – COM1 software mismatch, communication halted.	The COM1 has incorrect software installed. The system should be serviced.
COM1 PTT – COM1 push-to-talk key is stuck.	The COM1 external push-to-talk switch is stuck in the enable (or "pressed") position. Press the PTT switch again to cycle its operation. If the problem persists, the system should be serviced.
COM1 RMT XFR – COM1 remote transfer key is stuck.	The COM1 transfer switch is stuck in the enabled (or "pressed") position. Press the transfer switch again to cycle its operation. If the problem persists, the system should be serviced.
COM1 SERVICE – COM1 needs service. Return unit for repair.	The system has detected a failure in COM1. COM1 may still be usable. The system should be serviced when possible.

Message	Comments
COM1 TEMP – COM1 over temp. Reducing transmitter power.	The system has detected an over temperature condition in COM1. The transmitter is operating at reduced power. If the problem persists, the system should be serviced.
COM2 CONFIG – COM2 config error. Config service req'd.	The COM2 configuration settings do not match backup configuration memory. The system should be serviced.
COM 2 MANIFEST – COM2 software mismatch, communication halted.	The COM2 has incorrect software installed. The system should be serviced.
COM2 PTT – COM2 push-to-talk key is stuck.	The COM2 external push-to-talk switch is stuck in the enable (or "pressed") position. Press the PTT switch again to cycle its operation. If the problem persists, the system should be serviced.
COM2 RMT XFR – COM2 remote transfer key is stuck.	The COM2 transfer switch is stuck in the enabled (or "pressed") position. Press the transfer switch again to cycle its operation. If the problem persists, the system should be serviced.
COM2 SERVICE – COM2 needs service. Return unit for repair.	The system has detected a failure in COM2. COM2 may still be usable. The system should be serviced when possible.
COM2 TEMP – COM2 over temp. Reducing transmitter power.	The system has detected an over temperature condition in COM2. The transmitter is operating at reduced power. If the problem persists, the system should be serviced.
CRUISE I – Cruise I conditions met.	Cruise I engine trend data log has been captured.
CRUISE II – Cruise II conditions met.	Cruise II engine trend data log has been captured.

DATA LOST – Pilot stored data was lost. Recheck settings.	The pilot profile data was lost. System reverts to default pilot profile and settings. The pilot may reconfigure the MFD & PFDs with preferred settings, if desired.
DB CHANGE – Database changed. Verify user modified procedures.	This occurs when a stored flight plan contains procedures that have been manually edited. This alert is issued only after an navigation database update. Verify that the user-modified procedures in stored flight plans are correct and up to date.
DB CHANGE – Database changed. Verify stored airways.	This occurs when a stored flight plan contains an airway that is no longer consistent with the navigation database. This alert is issued only after an navigation database update. Verify use of airways in stored flight plans and reload airways as needed.
DB MISMATCH – Navigation database mismatch. Xtalk is off.	The PFDs and MFD have different navigation database versions or regions installed. Crossfill is off. Check the Aux-System Status Page to determine versions or regions. Also, check the Aux-System Status Page for a database synchronization function not completed. After synchronization is complete, power must be turned off, then on.
DB MISMATCH – Obstacle database mismatch.	The PFDs and MFD have different obstacle database versions or regions installed. Check the Aux-System Status Page to determine versions or regions. Also, check the Aux-System Status Page for a database synchronization function not completed. After synchronization is complete, power must be turned off, then on.
DB MISMATCH – Standby Navigation database mismatch.	The PFDs and MFD have different standby navigation database versions or regions installed. Check the Aux-System Status Page to determine versions or regions. Also, check the Aux-System Status Page for a database synchronization function not completed. After synchronization is complete, power must be turned off, then on.
DB MISMATCH – Terrain database mismatch.	The PFDs and MFD have different terrain database versions or regions installed. Check the Aux-System Status Page to determine versions or regions. Also, check the Aux-System Status Page for a database synchronization function not completed. After synchronization is complete, power must be turned off, then on.

Message	Comments
DME CHECK RANGE – DME range disagreement. Check position sensors.	A failure or disagreement has been detected in a DME receiver. Check position sensors.

ECS – Service required.	The Environmental Control System has failed.
EPS – Service required.	Electrical Power System needs servicing.
EPS – S/G speed sensor failed.	Starter Generator speed sensor has failed.
ESP CONFIG – ESP config error. Config service req'd.	ESP is not configured properly. The system should be serviced.
EXCEEDANCE – Exceedance data is being logged.	An exceedance log has been captured.

FAILED PATH – A data path has failed.	A data path connected to the GDU or the GIA 63/W has failed.
FPL WPT LOCK – Flight plan waypoint is locked.	Upon power-up, the system detects that a stored flight plan waypoint is locked. This occurs when an navigation database update eliminates an obsolete waypoint. The flight plan cannot find the specified waypoint and flags this message. This can also occur with user waypoints in a flight plan that is deleted. Remove the waypoint from the flight plan if it no longer exists in any database, Or update the waypoint name/identifier to reflect the new information.
FPL WPT MOVE – Flight plan waypoint moved.	The system has detected that a waypoint coordinate has changed due to a new navigation database update. Verify that stored flight plans contain correct waypoint locations.
FPL TRUNC – Flight plan has been truncated.	This occurs when a newly installed navigation database eliminates an obsolete approach or arrival used by a stored flight plan. The obsolete procedure is removed from the flight plan. Update flight plan with current arrival or approach.
FS510 CARD ERROR – FS510 not detected in MFD Bottom Slot.	The SD card was removed from the bottom card slot of the MFD. The SD card needs to be reinserted.

G/S1 FAIL – G/S1 is inoperative.	A failure has been detected in glideslope receiver 1. The system should be serviced.
G/S1 SERVICE – G/S1 needs service. Return unit for repair.	A failure has been detected in glideslope receiver 1. The receiver may still be available. The system should be serviced when possible.
G/S2 FAIL – G/S2 is inoperative.	A failure has been detected in glideslope receiver 2. The system should be serviced.
G/S2 SERVICE – G/S2 needs service. Return unit for repair.	A failure has been detected in glideslope receiver 2. The receiver may still be available. The system should be serviced when possible.
GCU CNFG – GCU Config error. Config service req'd.	GCU 475 configuration settings do not match those of backup configuration memory. The system should be serviced.
GCU FAIL – GCU is inoperative.	A failure has been detected in the GCU 475. The GCU 475 is unavailable.
GCU KEYSTK – GCU [key name] Key is stuck.	A key is stuck on the GCU 475 bezel. Attempt to free the stuck key by pressing it several times. The system should be serviced if the problem persists.
GCU MANIFEST – GCU software mismatch, communication halted.	The GCU 475 has incorrect software installed. The system should be serviced.

Message	Comments
GDC1 MANIFEST – GDC1 software mismatch, communication halted.	The GDC 74B has incorrect software installed. The system should be serviced.
GDC2 MANIFEST – GDC2 software mismatch, communication halted.	The GDC 74B has incorrect software installed. The system should be serviced.
GDL MANIFEST – GDL software mismatch, communication halted.	The GDL 69A SXM has incorrect software installed. The system should be serviced.
GDL69 CONFIG – GDL 69 config error. Config service req'd.	GDL 69A SXM configuration settings do not match those of backup configuration memory. The system should be serviced.
GDL69 FAIL – GDL 69 has failed.	A failure has been detected in the GDL 69A SXM. The receiver is unavailable. The system should be serviced
GEA1 CONFIG – GEA1 config error. Config service req'd.	The GEA1 configuration settings do not match those of backup configuration memory. The system should be serviced.
GEA1 MANIFEST – GEA1 software mismatch, communication halted.	The #1 GEA 71 has incorrect software installed. The system should be serviced.
GEA2 CONFIG – GEA2 config error. Config service req'd.	The GEA2 configuration settings do not match those of backup configuration memory. The system should be serviced.
GEA2 MANIFEST – GEA2 software mismatch, communication halted.	The #2 GEA 71 has incorrect software installed. The system should be serviced.
GEO LIMITS – AHRS1 too far North/ South, no magnetic compass.	The aircraft is outside geographical limits for approved AHRS operation. Heading is flagged as invalid.
GEO LIMITS – AHRS2 too far North/ South, no magnetic compass.	
GFC MANIFEST – GFC software mismatch, communication halted.	Incorrect servo software is installed, or gain settings are incorrect.
GIA1 CONFIG – GIA1 audio config error. Config service req'd.	The GIA1 have an error in the audio configuration. The system should be serviced.
GIA1 CONFIG – GIA1 config error. Config service req'd.	The GIA1 configuration settings do not match backup configuration memory. The system should be serviced.
GIA1 COOLING – GIA1 over temperature.	The GIA1 temperature is too high. If problem persists, the system should be serviced.
GIA1 COOLING – GIA1 temperature too low.	he GIA1 configuration settings do not match backup configuration memory. The system should be serviced.
GIA1 MANIFEST – GIA1 software mismatch, communication halted.	The GIA1 has incorrect software installed. The system should be serviced.
GIA1 SERVICE – GIA1 needs service. Return the unit for repair.	The GIA1 self-test has detected a problem in the unit. The system should be serviced.
GIA2 CONFIG – GIA2 config error. Config service req'd.	The GIA2 configuration settings do not match backup configuration memory. The system should be serviced.
GIA2 CONFIG – GIA2 audio config error. Config service req'd.	The GIA2 have an error in the audio configuration. The system should be serviced.
GIA2 COOLING – GIA2 temperature too low.	The GIA2 temperature is too low to operate correctly. Allow units to warm up to operating temperature.

Message	Comments
GIA2 COOLING – GIA2 over temperature.	The GIA2 temperature is too high. If problem persists, the system should be serviced.
GIA2 MANIFEST – GIA2 software mismatch, communication halted.	The GIA 2 has incorrect software installed. The system should be serviced.
GIA2 SERVICE – GIA2 needs service. Return the unit for repair.	The GIA2 self-test has detected a problem in the unit. The system should be serviced.
GMA XTALK – GMA crosstalk error has occurred.	An error has occurred in transferring data between the two GMAs. The system should be serviced.
GMA1 AUX MANIFEST – GMA 1 AUX software mismatch, communication halted.	The digital audio controller has incorrect software installed. The system should be serviced.
GMA1 CONFIG – GMA1 config error. Config service req'd.	The audio panel configuration settings do not match backup configuration memory. The system should be serviced.
GMA1 FAIL – GMA1 is inoperative.	The audio panel self-test has detected a failure. The audio panel is unavailable. The system should be serviced.
GMA1 MANIFEST – GMA1 software mismatch, communication halted.	The audio panel has incorrect software installed. The system should be serviced.
GMA1 SERVICE – GMA1 needs service. Return unit for repair.	The audio panel self-test has detected a problem in the unit. Certain audio functions may still be available, and the audio panel may still be usable. The system should be serviced when possible.
GMA2 CONFIG – GMA2 config error. Config service req'd.	The audio panel configuration settings do not match backup configuration memory. The system should be serviced.
GMA2 FAIL – GMA2 is inoperative.	The audio panel self-test has detected a failure. The audio panel is unavailable. The system should be serviced.
GMA2 MANIFEST – GMA2 software mismatch, communication halted.	The audio panel has incorrect software installed. The system should be serviced.
GMA2 SERVICE – GMA2 needs service. Return unit for repair.	The audio panel self-test has detected a problem in the unit. Certain audio functions may still be available, and the audio panel may still be usable. The system should be serviced when possible.
GMC CONFIG – GMC Config error. Config service req'd.	Error in the configuration of the GMC 710.
GMC FAIL – GMC is inoperative.	A failure has been detected in the GMC 710. The GMC 710 is unavailable.
GMC KEYSTK – GMC [key name] Key is stuck.	A key is stuck on the GMC 710 bezel. Attempt to free the stuck key by pressing it several times. The system should be serviced if the problem persists.
GMC MANIFEST – GMC software mismatch. Communication halted.	The GMC 710 has incorrect software installed. The system should be serviced.
GMU1 MANIFEST – GMU1 software mismatch, communication halted.	The GMU 44 has incorrect software installed. The system should be serviced.
GMU2 MANIFEST – GMU2 software mismatch, communication halted.	he GMU 44 has incorrect software installed. The system should be serviced.
GPS NAV LOST – Loss of GPS navigation. Insufficient satellites.	Loss of GPS navigation due to insufficient satellites.

Message	Comments
GPS NAV LOST – Loss of GPS navigation. Position error.	Loss of GPS navigation due to position error.
GPS NAV LOST – Loss of GPS navigation. GPS fail.	Loss of GPS navigation due to GPS failure.
GPS1 SERVICE – GPS1 needs service. Return unit for repair.	A failure has been detected in the GPS1 and/or GPS2 receiver. The receiver may still be available. The system should be serviced.
GPS2 SERVICE – GPS2 needs service. Return unit for repair.	
GRA1 CAL – GRA1 calibration. Service req'd.	GRA1 has improper calibration. The system should be serviced.
GRA1 CONFIG – GRA1 config error. Config service req'd.	The GRA and GDU have incompatible configurations.
GRA1 MANIFEST – GRA1 software mismatch, communication halted.	The GRA has incorrect software installed. The system should be serviced.
GRA1 SERVICE – GRA1 needs service. Return unit for repair	The GRA self-test has detected a problem in the unit. The system should be serviced.
GRA1 TEMP – GRA1 over temperature.	The system has detected an over temperature condition in GRA1.
GRS1 CONFIG – GRS1 config error. Config service req'd.	GRS configuration settings do not match those of backup configuration memory. The system should be serviced.
GRS1 MANIFEST – GRS1 software mismatch, communication halted.	The #1 AHRS has incorrect software installed. The system should be serviced.
GRS1 SERVICE – GRS1 needs service. Return unit for repair.	The AHRS1 should be serviced when practical.
GRS2 CONFIG – GRS2 config error. Config service req'd.	GRS configuration settings do not match those of backup configuration memory. The system should be serviced.
GRS2 MANIFEST – GRS2 software mismatch, communication halted.	The #2 AHRS has incorrect software installed. The system should be serviced.
GRS2 SERVICE – GRS1 needs service. Return unit for repair.	The AHRS1 should be serviced when practical.
GSR1 FAIL – GSR1 has failed.	A failure has been detected in the #1 GSR 56. The system should be serviced.
GTS CONFIG – GTS config error. Config service req'd.	The GTS and GDU have incompatible configurations. This alert is also set when the GTS has an invalid mode S address configured or the mode S address does not match both XPDR mode S addresses.
GTS MANIFEST – GTS software mismatch, communication halted.	The GTS has incorrect software installed. The system should be serviced.
GTX1 MANIFEST – GTX1 software mismatch, communication halted.	The transponder has incorrect software installed. The system should be serviced.
GTX2 MANIFEST – GTX2 software mismatch, communication halted.	The transponder has incorrect software installed. The system should be serviced.
GWX CONFIG – GWX config error. Config service req'd.	GWX 68 or GWX 70 configuration settings do not match those of the GDU configuration. The system should be serviced.

Message	Comments
GWX MANIFEST – GWX software mismatch, communication halted.	The GWX 68/GWX 70 has incorrect software installed. The system should be serviced.
GWX SERVICE – GWX needs service. Return unit for repair.	A failure has been detected in the GWX 68 or GWX 70. The GWX 68 or GWX 70may still be usable.
HDG FAULT – AHRS1 magnetometer fault has occurred.	A fault has occurred in the #1 GMU 44. Heading is flagged as invalid. The AHRS uses GPS for backup mode operation. The system should be serviced.
HDG FAULT – AHRS2 magnetometer fault has occurred.	A fault has occurred in the #2 GMU 44. Heading is flagged as invalid. The AHRS uses GPS for backup mode operation. The system should be serviced.
HOLD EXPIRED – Holding EFC time expired.	Expect Further Clearance (EFC) time has expired for the User Defined Hold.
HW MISMATCH – GIA hardware mismatch. GIA1 communication halted.	A GIA mismatch has been detected, where only one is SBAS capable.
HW MISMATCH – GIA hardware mismatch. GIA2 communication halted.	A GIA mismatch has been detected, where only one is SBAS capable.
INSIDE ARSPC – Inside airspace.	The aircraft is inside the special use airspace.
INVALID ADM – Invalid ADM: ATN communication halted.	Data link avionics were not configured correctly and therefore will not be able to communicate with the ground network.
LOCKED FPL – Cannot navigate locked flight plan.	This occurs when the pilot attempts to activate a stored flight plan that contains locked waypoint. Remove locked waypoint from flight plan. Update flight plan with current waypoint.
LOI – GPS integrity lost. Crosscheck with other NAVS.	GPS integrity is insufficient for the current phase of flight.
LOSS OF GPS NAVIGATION – Poor Satellite Coverage.	Loss of GPS navigation due to insufficient/poor satellite coverage.
LOW BANK ACTIVE – Disengage for approach.	Low Bank mode is active. Disengage to continue approach.
LOW BANK ACTIVE – Disengage for RNP less than 1.0.	Low Bank mode is active. Disengage to continue RNP 1.0.
LRG MAG VAR – Verify all course angles.	The GDU's internal model cannot determine the exact magnetic variance for geographic locations near the magnetic poles. Displayed magnetic course angles may differ from the actual magnetic heading by more than 2°.
MFD1 CONFIG – MFD1 config error. Config service req'd.	The MFD configuration settings do not match backup configuration memory. The system should be serviced.
MFD1 COOLING – MFD1 has poor cooling. Reducing power usage.	The MFD is overheating and is reducing power consumption by dimming the display. If problem persists, the system should be serviced.
MFD1 DB ERR – MFD1 navigation database error exists.	The MFD detected a failure in the navigation database. Attempt to reload the navigation database. If problem persists, the system should be serviced.

Message	Comments
MFD1 DB ERR – MFD1 basemap database error exists.	The MFD detected a failure in the basemap database.
MFD1 DB ERR – MFD1 basemap database is incompatible.	The MFD detected a that the basemap database is incompatible.
MFD1 DB ERR – MFD1 terrain database error exists.	The MFD detected a failure in the terrain database. Ensure that the terrain card is properly inserted in display. Replace terrain card. If problem persists, The system should be serviced.
MFD1 DB ERR – MFD1 terrain database missing.	The terrain database is present on another LRU, but is missing on the specified LRU.
MFD1 DB ERR – MFD1 Chartview database error exists.	The MFD detected a failure in the ChartView database (optional feature). Ensure the data card is properly inserted. Replace data card. If problem persists, the system should be serviced.
MFD1 DB ERR – MFD1 FliteCharts database error exists.	The MFD detected a failure in the FliteCharts database (optional feature). Ensure the data card is properly inserted. Replace data card. If problem persists, the system should be serviced.
MFD1 DB ERR – MFD1 Airport Directory database error exists.	The MFD detected a failure in the Airport Directory database. Ensure the data card is properly inserted. Replace data card. If problem persists, the system should be serviced.
MFD1 DB ERR – MFD1 obstacle database error exists.	The MFD detected a failure in the obstacle database. Ensure that the data card is properly inserted. Replace data card. If problem persists, The system should be serviced.
MFD1 DB ERR – MFD1 obstacle database missing.	The obstacle database is present on another LRU, but is missing on the specified LRU.
MFD1 DB ERR – MFD1 Safe Taxi database error exists.	The MFD detected a failure in the Safe Taxi database. Ensure that the data card is properly inserted. Replace data card. If problem persists, The system should be serviced.
MFD1 KEYSTK – MFD [key name] Key is stuck.	A key is stuck on the PFD and/or MFD bezel. Attempt to free the stuck key by pressing it several times. The system should be serviced if the problem persists.
MFD1 MANIFEST – MFD1 software mismatch, communication halted.	The MFD has incorrect software installed. The system should be serviced.
MFD1 SERVICE – MFD1 needs service. Return unit for repair.	The MFD self-test has detected a problem. The system should be serviced.
MFD1 VOLTAGE – MFD1 has low voltage. Reducing power usage	The MFD voltage is low. The system should be serviced.

NAV1 MANIFEST – NAV1 software mismatch, communication halted.	The NAV1 has incorrect software installed. The system should be serviced.
NAV1 RMT XFR – NAV1 remote transfer key is stuck.	The remote NAV1 transfer switch is stuck in the enabled (or "pressed") state. Press the transfer switch again to cycle its operation. If the problem persists, the system should be serviced.
NAV1 SERVICE – NAV1 needs service. Return unit for repair.	A failure has been detected in the NAV1 receiver. The receiver may still be available. The system should be serviced.
NAV2 MANIFEST – NAV2 software mismatch, communication halted.	The NAV2 has incorrect software installed. The system should be serviced.

Message	Comments
NAV2 RMT XFR – NAV2 remote transfer key is stuck.	The remote NAV2 transfer switch is stuck in the enabled (or "pressed") state. Press the transfer switch again to cycle its operation. If the problem persists, the system should be serviced.
NAV2 SERVICE – NAV2 needs service. Return unit for repair.	A failure has been detected in the NAV2 receiver. The receiver may still be available. The system should be serviced.
NAV DB UPDATED – Active navigation database updated.	System has updated the active navigation database from the standby navigation database.
NON-MAG UNITS – Non-magnetic NAV ANGLE display units are active.	Navigation angle is not set to MAGNETIC at power-up.
NON WGS84 WPT – Do not use GPS for navigation to [xxxx]	The position of the selected waypoint [xxxx] is not calculated based on the WGS84 map reference datum and may be positioned in error as displayed. Do not use GPS to navigate to the selected non-WGS84 waypoint.
PFD POSITIONS DIFFERENT – PFD positions mismatch. Check position sensors.	There is a mismatch in the position sensed by the PFDs. Check position sensor settings. If message persists the system should be serviced.
PFD1 CONFIG – PFD1 config error. Config service req'd.	The PFD configuration settings do not match backup configuration memory. The system should be serviced.
PFD1 COOLING – PFD1 has poor cooling. Reducing power usage.	The PFD is overheating and is reducing power consumption by dimming the display. If problem persists, the system should be serviced.
PFD1 DB ERR – PFD1 basemap database error exists.	The PFD detected a failure in the basemap database.
PFD1 DB ERR – PFD1 multiple database errors exists.	The PFD detected a failure in more than one database. If problem persists, the system should be serviced.
PFD1 DB ERR – PFD1 navigation database error exists.	The PFD detected a failure in the navigation database. Attempt to reload the navigation database. If problem persists, the system should be serviced.
PFD1 DB ERR – PFD1 obstacle database error exists.	The PFD detected a failure in the obstacle database. Ensure that the data card is properly inserted. Replace data card. If problem persists, The system should be serviced.
PFD1 DB ERR – PFD1 obstacle database missing.	The obstacle database is present on another LRU, but is missing on the specified LRU.
PFD1 DB ERR – PFD1 Safe Taxi database error exists.	The PFD detected a failure in the Safe Taxi database. Ensure that the data card is properly inserted. Replace data card. If proble m persists, the system should be serviced.
PFD1 DB ERR – PFD1 terrain database error exists.	The PFD detected a failure in the terrain database. Ensure that the terrain card is properly inserted in display. Replace terrain card. If problem persists, the system should be serviced.
PFD1 DB ERR – PFD1 terrain database missing.	The terrain database is present on another LRU, but is missing on the specified LRU.
PFD1 KEYSTK – PFD1 [key name] is stuck.	A key is stuck on the PFD bezel. Attempt to free the stuck key by pressing it several times. The system should be serviced if the problem persists.
PFD1 CARD 1 REM – Card 1 was removed. Reinsert card.	The SD card was removed from the top card slot of the specified PFD or MFD. The SD card needs to be reinserted.

Message	Comments
PFD1 CARD 2 REM – Card 2 was removed. Reinsert card.	The SD card was removed from the bottom card slot of the specified PFD or MFD. The SD card needs to be reinserted.
PFD1 CARD 1 ERR – Card 1 is invalid.	The SD card in the top card slot of the specified PFD or MFD contains invalid data.
PFD1 CARD 2 ERR – Card 2 is invalid.	The SD card in the bottom card slot of the specified PFD or MFD contains invalid data.
PFD1 SERVICE – PFD1 needs service. Return unit for repair.	The PFD self-test has detected a problem. The system should be serviced.
PFD1 VOLTAGE – PFD1 has low voltage. Reducing power usage	The PFD1 voltage is low. The system should be serviced.
PFD2 CARD 1 REM – Card 1 was removed. Reinsert card.	The SD card was removed from the top card slot of the specified PFD or MFD. The SD card needs to be reinserted.
PFD2 CARD 2 REM – Card 2 was removed. Reinsert card.	The SD card was removed from the bottom card slot of the specified PFD or MFD. The SD card needs to be reinserted.
PFD2 CARD 1 ERR – Card 1 is invalid.	The SD card in the top card slot of the specified PFD or MFD contains invalid data.
PFD2 CARD 2 ERR – Card 2 is invalid.	The SD card in the bottom card slot of the specified PFD or MFD contains invalid data.
PFD2 CONFIG – PFD2 config error. Config service req'd.	The PFD configuration settings do not match backup configuration memory. The system should be serviced.
PFD2 COOLING – PFD2 has poor cooling. Reducing power usage.	The PFD is overheating and is reducing power consumption by dimming the display. If problem persists, the system should be serviced.
PFD2 DB ERR – PFD2 basemap database error exists.	The PFD detected a failure in the basemap database.
PFD2 DB ERR – PFD2 basemap database is incompatible.	The PFD detected a that the basemap database is incompatible.
PFD2 DB ERR – PFD2 navigation database error exists.	The PFD detected a failure in the navigation database. Attempt to reload the navigation database. If problem persists, the system should be serviced.
PFD2 DB ERR – PFD2 obstacle database error exists.	The PFD detected a failure in the obstacle database. Ensure that the data card is properly inserted. Replace data card. If problem persists, The system should be serviced.
PFD2 DB ERR – PFD2 obstacle database missing.	The obstacle database is present on another LRU, but is missing on the specified LRU.
PFD2 DB ERR – PFD2 Safe Taxi database error exists.	The PFD detected a failure in the Safe Taxi database. Ensure that the data card is properly inserted. Replace data card. If problem persists, The system should be serviced.
PFD2 DB ERR – PFD2 terrain database error exists.	The PFD detected a failure in the terrain database. Ensure that the terrain card is properly inserted in display. Replace terrain card. If problem persists, The system should be serviced.
PFD2 DB ERR – PFD2 terrain database missing.	The terrain database is present on another LRU, but is missing on the specified LRU.
PFD2 KEYSTK – PFD2 [key name] Key is stuck.	A key is stuck on the PFD bezel. Attempt to free the stuck key by pressing it several times. The system should be serviced if the problem persists.
PF2 MANIFEST – PFD2 software mismatch, communication halted.	The PFD has incorrect software installed. The system should be serviced.

Message	Comments
PFD2 SERVICE – PFD2 needs service. Return unit for repair.	The PFD self-test has detected a problem. The system should be serviced.
PFD2 VOLTAGE – PFD2 has low voltage. Reducing power usage	The PFD2 voltage is low. The system should be serviced.
PILOT RADIOS MUTED – Pilot radios are muted.	The pilot radios are set on mute.
PTK FAIL – Parallel track unavailable: invalid leg type.	Invalid leg type for parallel offset.
PTK FAIL – Parallel track unavailable: past IAF.	IAF waypoint for parallel offset has been passed.
PTK FAIL – Parallel track unavailable: bad geometry.	Bad parallel track geometry.
RAIM UNAVAIL – RAIM is not available from FAF to MAP waypoints.	GPS satellite coverage is insufficient to perform Receiver Autonomous Integrity Monitoring (RAIM) from the FAF to the MAP waypoints.
RECORDER SERVICE REQUIRED - The CVDR needs service.	The CVDR should be serviced.
REGISTER CONNEXT – Data services are inoperative, register w/ Connext.	The system is not registered with Garmin Connext, or its current registration data has failed authentication.
SCHEDULER [#] – <message>.	Message criteria entered by the user.
SLCT FREQ – Select appropriate frequency for approach.	The system notifies the pilot to load the approach frequency for the appropriate NAV receiver. Select the correct frequency for the approach.
SLCT MAG – Select MAGNETIC NAV ANGLE display units.	The system notifies the pilot to set the Nav Angle units on the Avioncs Settings Screen to Magnetic.
SLCT NON-MAG – Select alternate NAV ANGLE display units.	The system notifies the pilot to set the Nav Angle units on the Avioncs Settings Screen to True.
STEEP TURN – Steep turn ahead.	A steep turn is 15 seconds ahead. Prepare to turn.
STRMSCP FAIL – Stormscope has failed.	Stormscope has failed. The system should be serviced.
SVT – SVT DISABLED: Out of available terrain region.	Synthetic Vision is disabled because the aircraft is not within the boundaries of the installed terrain database.
SVT – SVT DISABLED: Terrain DB resolution too low.	Synthetic Vision is disabled because a terrain database of sufficient resolution (9 arc-second or better) is not currently installed.
SW MISMATCH – GDU software version mismatch. Xtalk is off.	The MFD and PFDs have different software versions installed. The system should be serviced.
TERRAIN DSP – [PFD1, PFD2 or MFD1] Terrain awareness display unavailable.	One of the terrain, or obstacle databases required for TAWS in the specified PFD or MFD is missing or invalid.
TIMER EXPIRD – Timer has expired.	The system notifies the pilot that the timer has expired.

Message	Comments
UNABLE V WPT – Can't reach current vertical waypoint.	The current vertical waypoint can not be reached within the maximum flight path angle and vertical speed constraints. The system automatically transitions to the next vertical waypoint.

VNV UNAVAILABLE – Excessive crosstrack error.	The current crosstrack exceeds the limit, causing vertical deviation to go invalid.
VNV UNAVAILABLE – Unavailable. Excessive track angle error.	The current track angle error exceeds the limit, causing the vertical deviation to go invalid.
VNV UNAVAILABLE – Parallel course selected.	A parallel course has been selected, causing the vertical deviation to go invalid.
VNV UNAVAILABLE – Unsupported leg type in flight plan.	The lateral flight plan contains a procedure turn, vector, or other unsupported leg type prior to the active vertical waypoint. This prevents vertical guidance to the active vertical waypoint.

WPT ARRIVAL – Arriving at waypoint -[xxxx]	Arriving at waypoint [xxxx], where [xxxx] is the waypoint name.
WX ALERT – Possible severe weather ahead.	The GWX 68/GWX 70 indicates severe weather within ±10º of the aircraft heading at a range of 80 to 320 nm.

XPDR1 ADS-B 1090 – Datalinik: ADS-B 1090 receiver has failed.	A failure has been detected in the 1090 receiver.
XPDR1 ADS-B NO POS – Transponder: ADS-B is not transmitting position.	The transponder is not able to receive position information.
XPDR1 ADS-B TRFC – Transponder: ADS-B traffic has failed	The Transponder is incapable of processing traffic information.
XPDR1 ADS-B UAT – Datalink: ADS-B in UAT receiver has failed.	A failure has been detected in the UAT receiver.
XPDR1 CONFIG – XPDR1 config error. Config service req'd.	The transponder configuration settings do not match those of backup configuration memory. The system should be serviced.
XPDR1 SRVC – XPDR1 needs service. Return unit for repair.	The #1 transponder should be serviced when possible.
XPDR2 ADS-B 1090 – Datalinik: ADS-B 1090 receiver has failed.	A failure has been detected in the 1090 receiver.
XPDR2 ADS-B NO POS – Transponder: ADS-B is not transmitting position.	The transponder is not able to receive position information.
XPDR2 ADS-B TRFC – Transponder: ADS-B traffic has failed	The Transponder is incapable of processing traffic information.
XPDR2 ADS-B UAT – Datalink: ADS-B in UAT receiver has failed.	A failure has been detected in the UAT receiver.

Message	Comments
XPDR2 CONFIG – XPDR2 config error. Config service req'd.	The transponder configuration settings do not match those of backup configuration memory. The system should be serviced.
XPDR2 SRVC – XPDR2 needs service. Return unit for repair.	The #2 transponder should be serviced when possible.
XTALK ERROR – A flight display crosstalk error has occurred.	The MFD and PFDs are not communicating with each other. The system should be serviced.

DATABASE MANAGEMENT

Database information is obtained from third party sources. Inaccuracies in the data may be discovered from time to time. Garmin communicates this information by issuing a Database Alert. These notifications are available on http://fly.garmin.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 http://fly.garmin.com and select Aviation Data Error Report.

The system uses Secure Digital (SD) cards to load and store various types of data. For basic flight operations, SD cards are required for database storage as well as database updates. Not all SD cards are compatible with the system.

LOADING UPDATED DATABASES

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

NOTE: *When loading database updates, the 'DB Mismatch' system messages will be displayed until database synchronization is complete, followed by turning system power off, then on. Synchronization can be monitored on the Aux-Database Page.*

NOTE: *Loading a database in the system prior to its effective date will result in the expiration date on the power-up screen and the effective date on the Aux – Databases Page being displayed in amber.*

Databases may be loaded through Garmin Pilot and Flight Stream 510. When loading databases through Garmin Pilot and the Flight Stream 510, it must be enabled on the system and the multimedia card inserted in the bottom SD slot of the MFD.

The cycles and dates for both standby and active databases are displayed on the "Aux – Databases" page on the MFD. Any active databases with expiration dates in the past will be highlighted with amber text. When an expired active database has a standby database that is ready to become effective, a cyan double-sided arrow will be displayed between the database cycles. When this arrow is visible, it indicates that the standby and active databases in that row will be switched on the next power cycle, activating the current standby database. Databases can also be manually selected (or deselected) by highlighting a list item and pressing the ENT key, provided a valid, verified standby database is present.

In some cases it may be necessary to obtain an unlock code from Garmin in order to make the database product functional. It may also be necessary to have the system configured by a Garmin authorized service facility in order to use some database features.

The navigation database contains the aeronautical data used by the system for the flight management and flight planning functions. Included is detailed data for waypoints, procedures (arrivals, departures, approaches), and airways. The navigation database is updated every 28 days.

The basemap database contains data for the topography and land features, such as rivers, lakes, and towns. It is updated only periodically, with no set schedule. There is no expiration date.

The terrain database contains the terrain mapping data. These databases are updated periodically and have no expiration date.

The obstacle database contains data for obstacles, such as towers, that pose a potential hazard to aircraft. Obstacles 200 feet and higher are included in the obstacle database. It is very important to note that not all obstacles are necessarily charted and therefore may not be contained in the obstacle database. This database is updated on a 56-day cycle.

NOTE: *The data contained in the terrain and obstacle databases comes from government agencies. Garmin accurately processes and cross-validates the data, but cannot guarantee the accuracy and completeness of the data.*

The 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.

The SafeTaxi database contains detailed airport diagrams for selected airports. These diagrams aid in following ground control instructions by accurately displaying the aircraft position on the map in relation to taxiways, ramps, runways, terminals, and services. This database is updated on a 56-day cycle.

The FliteCharts database contains procedure charts for the United States only. This database is updated on a 28-day cycle. If not updated within 180 days of the expiration date, FliteCharts will no longer function.

The ChartView database is updated on a 14-day cycle. If the ChartView database is not updated within 70 days of the expiration date, ChartView will no longer function. The ChartView database must be purchased directly from Jeppesen, but can be updated at www.jeppesen.com or www.flygarmin.com.

Database Updates Using a Supplemental Data Card

All databases are updated through a single SD card in the bottom slot of the MFD. When the card is inserted, the databases on the card will be copied to standby and synchronized across all powered, configured units. After update, the card is removed and the databases are stored on the system. When in standby, databases are not immediately available for use, but stored to be activated at a later time.

Database updates can be obtained by following the instructions detailed in the 'Aviation Databases' section of the Garmin website (fly.garmin.com). Once the updated files have been downloaded from the website, a PC equipped with an appropriate SD card reader is used to unpack and program the new databases onto an existing Supplemental Data Card. Equipment required to perform the update is as follows:

- Windows-compatible PC computer
- SD Card Reader: SanDisk SDDR-93, SanDisk SDDR-99, Verbatim #96504, or equivalent
- Updated database obtained from the Garmin website
- Supplemental SD Cards

Updating Databases using an SD Card:

1) With the system OFF, remove an SD Card from the bottom SD card slot of the MFD.

2) Download and install the databases on an SD card.

3) Put the SD Card in the bottom SD card slot of the MFD.

4) Turn the system ON.

5) Press the **ENT** Key or the right most softkey on MFD display to acknowledge the startup screen.

6) Turn the large **FMS** Knob to select the Aux page group on the MFD.

7) Turn the small **FMS** Knob to select the Database page group on the MFD.

8) Monitor the Sync Status on the Database page. Wait for all databases to complete syncing, indicated by 'Sync Complete' being displayed. A cyan double arrow will appear between the Standby and Active columns to show which Standby databases will be transferred to Active at the next power cycle.

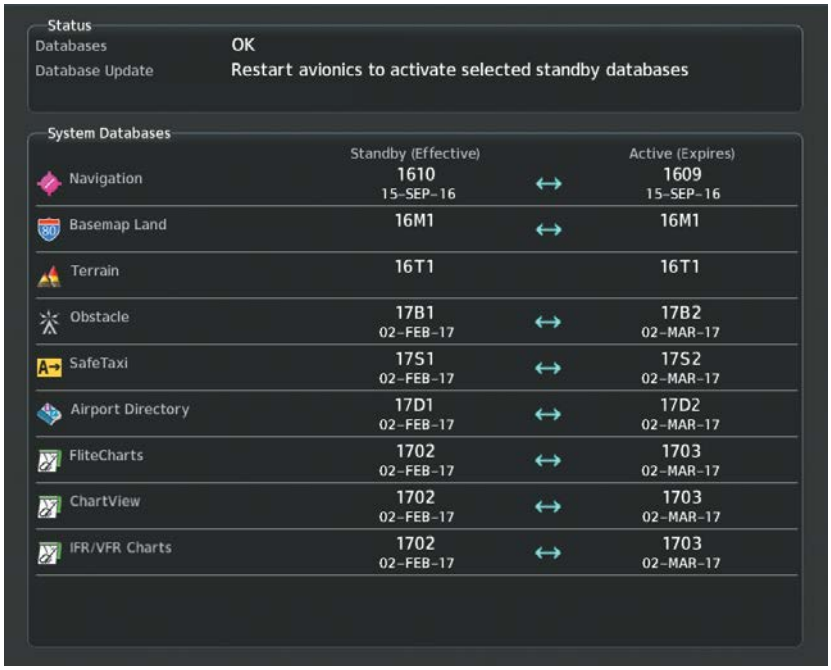


Figure B-1 Aux - Databases Page before Activation of Standby Databases

9) Verify the correct database cycle information is shown in the Standby Database column.

10) Remove power from the system.

11) Remove the SD card from the bottom slot of the MFD.

12) After restarting the system, turn the large **FMS** Knob and select the Aux page group on the MFD.

13) Turn the small **FMS** Knob and select the Databases page.

14) Verify that the standby databases transferred and are now in the active database column.

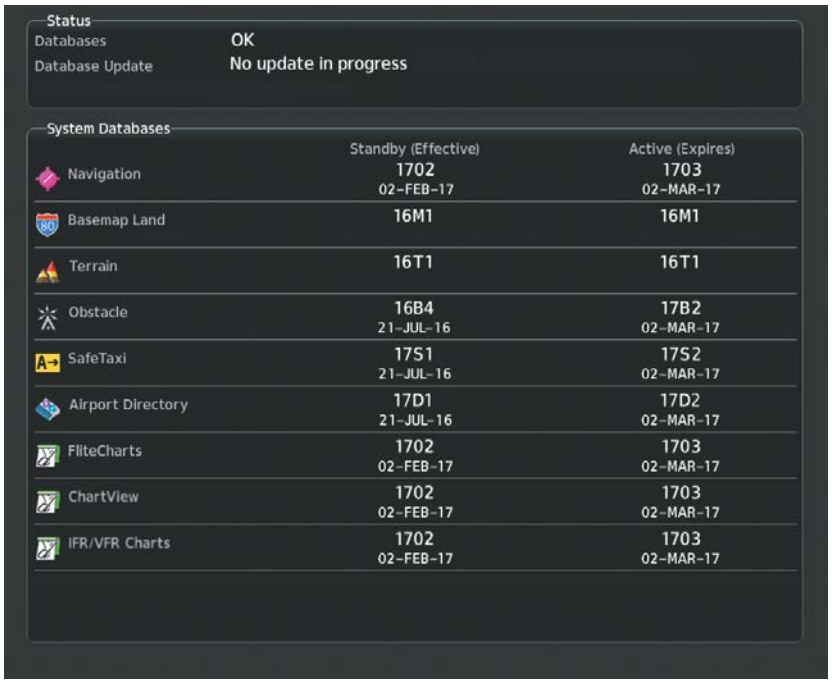


Figure B-2 Aux - Databases Page with Updated Databases

15) To view database information for an individual display, press and then turn the **FMS** Knob to select the database, and then press the **Details** Softkey. Press the **ENT** Key or the **FMS** Knob to exit.

16) To manually activate any databases that did not transfer to the active column:

a) Press the **FMS** Knob. The first database title on the screen will be selected.

b) Turn the small **FMS** Knob as necessary to select the database title.

c) Press the **ENT** Key. A cyan double-sided arrow will appear indicating that the standby database will become active.

d) Remove and reapply power to the system.

e) Verify that the standby databases transferred and are now in the active database column.

17) Remove power from the system.

Database Updates Using Flight Stream 510

In order to load databases through Garmin Pilot and the Flight Stream 510, the Flight Stream 510 must be enabled on the system with the Multimedia card inserted in the bottom SD slot of the MFD. A mobile device with Garmin Pilot must be paired with the Flight Stream 510 over Bluetooth (refer to the Additional Features section). When there is at least one paired device available to connect, the Flight Stream 510 will automatically connect to the system's preferred mobile device. The preferred device can be selected on the Aux – Databases page from a menu list of paired devices.

Once a connection to the paired mobile device is made, Garmin Pilot makes available databases that can be transferred to the Flight Stream 510. If any of these databases is more recent than the respective standby database on the system, (or if there is no standby database on the system) those databases will be automatically selected to load. The database updates may be initiated from the Aux - Databases page, or from other pages on the MFD.

Updating Databases using Flight Stream 510 from any MFD page (except the Aux - Databases page):

1) Insert the Flight Stream Mutimedia Card in the bottom slot of the MFD.
2) Press the **Update** softkey when the Database Update screen appears.

Figure B-3 Database Update Available

3) The Flight Stream 510 will enter WI-FI mode. The following screen will appear.

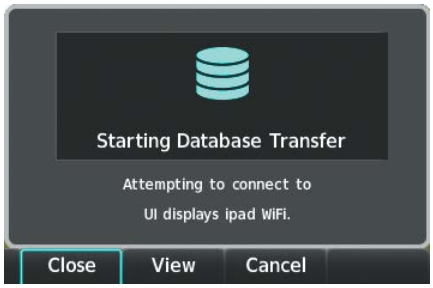


Figure B-4 Starting Database Transfer

4) Put the mobile device in WI-FI mode (refer to the Additional Features section).
5) Connect the mobile device to the Flight Stream 510 WI-FI (refer to the Additional Features section). The 'WI-FI Not Connected' screen will close when the WI-FI connection is established.
6) When the transfer is complete, the following screen will appear.

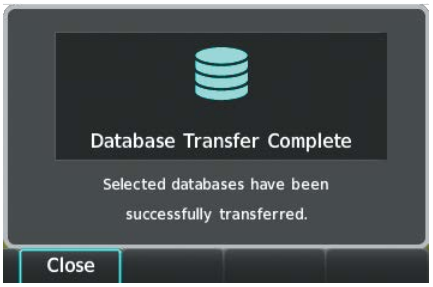


Figure B-5 Database Transfer Complete

7) Press the **Close** softkey.

9) Remove power from the system.

10) After restarting the system, turn the large **FMS** Knob and select the Aux page group on the MFD.

11) Turn the small **FMS** Knob and select the Databases page.

12) Verify that the standby databases transferred and are now in the active database column.

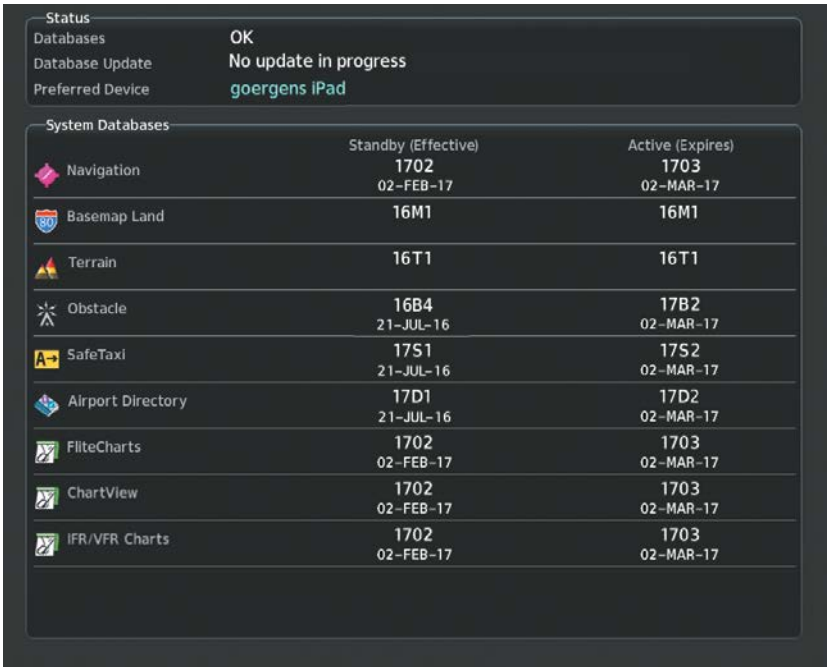


Figure B-6 Aux - Databases Page with Updated Databases

13) To view database information for an individual display, press and then turn the **FMS** Knob to select the database, and then press the **Details** Softkey. Press the **ENT** Key or the **FMS** Knob to exit.

14) To manually activate any databases that did not transfer to the active column:

a) Press the **FMS** Knob. The first database title on the screen will be selected.

b) Turn the small **FMS** Knob as necessary to select the database title.

c) Press the **ENT** Key. A cyan double-sided arrow will appear indicating that the standby database will become active.

d) Remove and reapply power to the system.

e) Verify that the standby databases transferred and are now in the active database column.

Updating Databases using Flight Stream 510 from the Aux - Databases page:

1) With the system OFF, insert the Flight Stream Mutimedia Card in the bottom slot of the MFD.

2) Turn the large **FMS** Knob to select the Aux page group on the MFD.

3) Turn the small **FMS** Knob to select the Database page group on the MFD.

4) Press the **Device** Softkey.

5) The Aux - Databases page will show the databases connected to the mobile device in place of the active databases on the system. Databases selected to load will be indicated by a cyan arrow.

6) Press the **Update** softkey. The Flight Stream 510 will enter WI-FI mode.

7) Put the mobile device in WI-FI mode (refer to the Additional Features section).

8) Connect the mobile device to the Flight Stream 510 WI-FI (refer to the Additional Features section).

9) The Database Update status will appear in the Status window at the top of the page.

10) Remove power from the system.

11) After restarting the system, turn the large **FMS** Knob and select the Aux page group on the MFD.

12) Turn the small **FMS** Knob and select the Databases page.

13) Verify that the standby databases transferred and are now in the active database column.

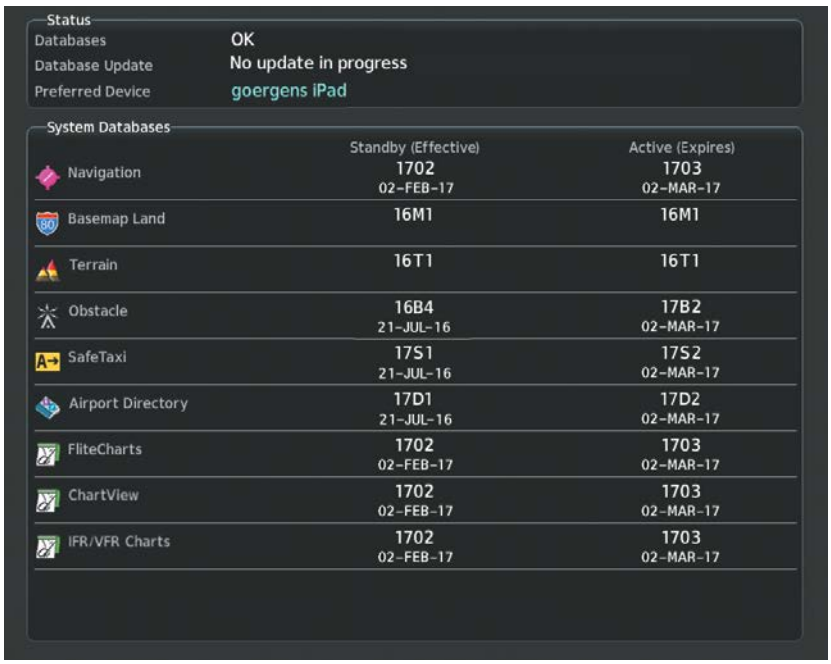


Figure B-7 Aux - Databases Page with Updated Databases

14) To view database information for an individual display, press and then turn the **FMS** Knob to select the database, and then press the **Details** Softkey. Press the **ENT** Key or the **FMS** Knob to exit.

15) To manually activate any databases that did not transfer to the active column:

a) Press the **FMS** Knob. The first database title on the screen will be selected.

b) Turn the small **FMS** Knob as necessary to select the database title.

c) Press the **ENT** Key. A cyan double-sided arrow will appear indicating that the standby database will become active.

d) Remove and reapply power to the system.

e) Verify that the standby databases transferred and are now in the active database column.

MAGNETIC FIELD VARIATION DATABASE UPDATE

A copy of the current magnetic field variation database (MV DB) is included with the navigation database. At startup, the system compares this version of the MV DB with that presently being used by each AHRS (GRS1 and GRS2). If the system determines the MV DB needs to be updated, a prompt is displayed on the MFD, as shown in Figure B-8. Note, in the following example, GRS1 is the first AHRS to indicate an update is available. In actuality, this is dependent on which AHRS is the first to report status to the system. GRS2 may be displayed before GRS1. The order is not important, only that both AHRS be updated.

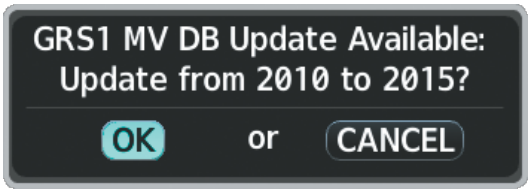


Figure B-8 GRS1 Magnetic Field Variation Database Update Prompt

Loading the magnetic field variation database update:

1) With 'OK' highlighted, as seen in Figure B-8, press the **ENT** Key on the MFD. A progress monitor is displayed as shown in Figure B-9.

Figure B-9 Uploading Database to GRS1

2) When the upload is complete, the prompt for the next GRS upload is displayed, as seen in Figure B-10.

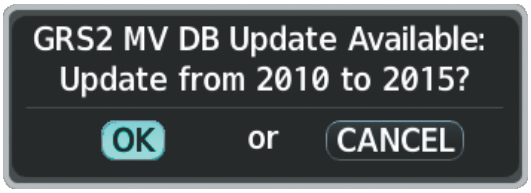


Figure B-10 GRS2 Magnetic Field Variation Database Update Prompt

3) With 'OK' highlighted, press the **ENT** Key on the MFD. A progress monitor is displayed as shown in Figure B-11. When the upload is complete, the system is ready for use.

Figure B-11 Uploading Database to GRS2

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GARMIN AVIATION GLOSSARY

ACARS	Airborne Communications Addressing and Reporting System
ACC	Accuracy
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
ADS-B	Automatic Dependent Surveillance-Broadcast
ADS-R	Automatic Dependent Surveillance-Rebroadcast
AF	Arc to Fix Leg
AFCS	Automatic Flight Control System
AFM	Airplane Flight Manual
AFMS	Airplane Flight Manual Supplement
AFRM	Airframe
AGL	Above Ground Level
AHRS	Attitude and Heading Reference System
AIM	Aeronautical Information Manual
AIRB	Airborne
AIRMET	Airman's Meteorological Information
AIRREP	Air Reports
ALRT	Alert
ALT	Altitude
ALT, ALTN	Alternator
ALTS	Selected Altitude Capture Mode
ALTV	VNAV Altitude Capture Mode
AMPS	Amperes
ANNUNC/ANN	Annunciation/Annunciator
ANT	Antenna
AOA	Angle of Attack, ACARS Over AVLC
AOC	Aeronautical Operational Control
AOG	Aircraft On Ground
AOPA	Aircraft Owners and Pilots Association
AP	Autopilot
AP DISC	Autopilot Disconnect
APPR, APR	Approach
APT	Airport, Aerodrome
APTSIGNS	Airport Signs
ARINC	Aeronautical Radio Incorporated
ARSPC	Airspace
ARTCC	Air Route Traffic Control Center
ARV	Arrival
AS	Airspeed
ASB	Aviation Support Branch
ASOS	Automated Surface Observing System
AT	Auto Throttle
ATC	Air Traffic Control
ATCRBS	ATC Radar Beacon System
ATIS	Automatic Terminal Information Service
ATK	Along Track
AUTOSEQ	Automatic Sequence
AUX	Auxiliary
AVG	Average
AVLC	Aviation VHF Link Control
AWOS	Automated Weather Observing System
B	Both Runways
B ALT	Barometric Altitude
BARO	Barometer, Barometric
BATT	Battery
BC	Backcourse
Bearing	The compass direction from the present position to a destination waypoint.
BFO	Beat Frequency Oscillator
BKSP	Backspace
Bluetooth	Wireless standard for data exchange over short distances
BOC	Bottom of Climb
BOD	Bottom of Descent
BRG	see also Bearing

°C	Degrees Celsius
C	Center Runway
CA	Course to Altitude Leg
CAL	Calibrated
CALC	Calculator
Calibrated Airspeed	Indicated airspeed corrected for installation and instrument errors.
CAS	Crew Alerting System
CD	Course to DME Distance Leg
CDI	Course Deviation Indicator
CDU	Control Display Unit
CF	Course to Fix Leg
CG	Center of Gravity
CH, CHNL	Channel
CHT	Cylinder Head Temperature
CHKLIST	Checklist
CI	Course to Intercept Leg
CLD	Cloud
CLR	Clear
CM	Centimeter
CMC	Central Maintenance Computer
CN	Canada
CNS	Communication, Navigation, & Surveillance
CO	Carbon Monoxide
COM	Communication Radio
CONFIG	Configuration
COOL	Coolant
COPLT	Copilot
Course	The line between two points to be followed by the aircraft.
Course to Steer	The recommended direction to steer in order to reduce course error or stay on course. Provides the most efficient heading to get back to the desired course and proceed along the flight plan.
CPDLC	Controller Pilot Datalink Communications
CPL	Couple
CR	Course to Radial Leg
CRG	Cockpit Reference Guide
CRNT	Current
Crosstrack Error	The distance the aircraft is off a desired course in either direction, left or right.
CRS	see also Course, Course to Steer
CRSR	Cursor
CSA	Conflict Situational Awareness
CSC	Current Speed Control
CTA	Control Area
CTR	Center
CTRL	Control
Cumulative, CUM	The total of all legs in a flight plan.
CVDR	Cockpit Voice Data Recorder
CVR	Cockpit Voice Recorder
CVRG	Coverage
CWS	Control Wheel Steering
CYL	Cylinder
D ALT	Density Altitude
D-ATIS	Digital Automatic Terminal Info Service
DB, DBASE	Database
dBZ	Decibels 'Z' (Radar Return)
DCL	Departure Clearance
DCLTR, DECLTR	Declutter
DEC FUEL	Decrease Fuel
DEG	Degree
DEIC, DEICE	De-icing
DEP	Departure
Desired Track	The desired course between the active "from" and "to" waypoints.
DES, DEST	Destination
DEV	Deviation
DF	Direct to Fix Leg
DFLT	Default
DG	Directional Gyro
DGRD	Degrade
DH	Decision Height

Dilution of Precision	A measure of GPS satellite geometry quality on a scale of one to ten (lower numbers equal better geometry, where higher numbers equal poorer geometry).
DIR	Direction
DIS	Distance
Distance	The 'great circle' distance from the present position to a destination waypoint.
DL LTNG	Datalink Lightning
DLS	Data Link System
DME	Distance Measuring Equipment
DN	Down
DOP	see also Dilution of Precision
DP	Departure Procedure
DPRT	Departure
DR	Dead Reckoning
DSBL	Disabled
DTG	Distance To Go, Remaining distance to last active FPL waypoint
DTK	see also Desired Track
DQR	Data Quality Requirements
E	Empty, East
EAS	Engine and Airframe Systems
ECU	Engine Control Unit
EDM	Emergency Descent Mode
EFC	Expected Further Clearance
Efficiency	A measure of fuel consumption, expressed in distance per unit of fuel.
EGNOS	European Geostationary Navigation Overlay Service
EGT	Exhaust Gas Temperature
EICAS	Engine Indication and Crew Alerting System
EIS	Engine Indication System
ELEV	Elevation, Elevator
ELT	Emergency Locator Transmitter
EMER, EMERG, EMERGCY	Emergency
EMI	Electromagnetic Interference
END, ENDUR	Endurance
Endurance	Flight endurance, or total possible flight time based on available fuel on board.
ENG	Engine
ENGD	Engaged
ENR	Enroute; ETE to Final Destination
Enroute Safe Altitude (ESA)	Uses Grid MORAs to determine a safe altitude within ten miles left or right of the desired course on an active flight plan or direct-to.
ENT	Enter
EPE	see also Estimated Position Error
EPU	Estimated Position Uncertainty
ERR	Error
ES	Extended Squitter
ESA	see also Enroute Safe Altitude
ESP	Electronic Stability and Protection
Estimated Position Error (EPE)	A measure of horizontal GPS position error derived by satellite geometry conditions and other factors.
Estimated Time of Arrival (ETA)	The estimated time at which the aircraft should reach the destination waypoint, based upon current speed and track.
Estimated Time Enroute (ETE)	The estimated time it takes to reach the destination waypoint from the present position, based upon current groundspeed.
ETA	see also Estimated Time of Arrival
ETE	see also Estimated Time Enroute
EVS	Enhanced Vision System
EXPIRD	Expired
°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
FBO	Fixed Base Operator
FC	Course From Fix to Distance Leg
FCC	Federal Communication Commission
FCST	Forecast

FD	Flight Director, Course From Fix to DME Distance Leg
FDE	Fault Detection and Exclusion
FF, FFLOW	see also Fuel Flow
FIS-B	Flight Information Services-Broadcast
FISDL	Flight Information Service Data Link
FL	Flight Level
FLC	Flight Level Change
FLT	Flight Timer
FLTA	Forward Looking Terrain Avoidance
FM	Course From Fix to Manual Termination Leg
FMS	Flight Management System
FOB	see also Fuel On Board
FOD	see also Fuel Over Destination
FPA	Flight Path Angle
FPL	Flight Plan
FPM	Feet Per Minute, Flight Path Marker
FREQ	Frequency
FRMT	Format
FRZ	Freezing
FSM	Flight System Messages
FSS	Flight Service Station
FT	foot/feet
Fuel Flow	The fuel flow rate, expressed in units of fuel per hour.
Fuel On Board	The total amount of usable fuel on board the aircraft.
Fuel Over Destination	The estimated fuel remaining when the aircraft reaches the destination waypoint, based upon current fuel flow.
FWD	Forward
G/S	Glideslope
GA	Go-Around
GAL, GL	Gallon(s)
GBOX	Gearbox
GBT	Ground Based Transceiver
GCU	Garmin Control Unit
GCS	Ground Clutter Suppression
GDC	Garmin Air Data Computer
GDL	Garmin Satellite Data Link
GDR	Garmin Data Radio
GDU	Garmin Display Unit
GEA	Garmin Engine/Airframe Unit
GEO	Geographic
GFC	Garmin Flight Control
GIA	Garmin Integrated Avionics Unit
GLONASS	Global Orbiting Navigation Satellite Landing System
GLS	Global Navigation Satellite Landing System
GMA	Garmin Audio Panel System
GMC	Garmin Mode Controller
GMT	Greenwich Mean Time
GMU	Garmin Magnetometer Unit
GND	Ground
GPH	Gallons per Hour
GPN	Garmin Part Number
GPS	Global Positioning System
GPWS	Ground Proximity Warning System
Grid MORA (Minimum Off—Route Altitude)	One degree latitude by one degree longitude in size and clears the highest elevation reference point in the grid by: a) 1,000 feet where the highest elevation is <5001MSL or b) 2,000 feet where the highest elevation is >5000MSL
Groundspeed	The velocity that the aircraft is travelling relative to a ground position.
Ground Track	See Track
GRS	Garmin Reference System
GS	Ground Speed, Glideslope
GSA	Garmin Servo Adapter
GSD	Garmin Data Concentrator
GSL	Geodetic Sea Level
GSR	Garmin Satellite Radio
GSU	Garmin Sensor Unit
GTC	Garmin Touchscreen Controller
GTS	Garmin Traffic System
GTX	Garmin Transponder
GWX	Garmin Weather Radar
HA	Hold Terminating at Altitude Leg
HDG	see also Heading

HDOP	Horizontal Dilution of Precision
Heading	The direction an aircraft is pointed, based upon indications from a magnetic compass or a properly set directional gyro.
HF	High Frequency, Hold Terminating at Fix Leg
HFOM	see also Horizontal Figure of Merit
Hg	Mercury
HI	High
HI SENS	High Sensitivity
HM	Hold with Manual Termination Leg
HNS	Hybrid Navigation System
Horizontal Figure of Merit	A measure of the uncertainty in the aircraft's horizontal position.
hPa	Hectopascal
HPL	Horizontal Protection Level
HR	Hour
HRZN HDG	Horizon Heading
HSDB	High-Speed Data Bus
HSI	Horizontal Situation Indicator
HT	Heat
HUL	Horizontal Uncertainty Level
Hz	Hertz (cycles per second)
I	Inner Marker
IAF	Initial Approach Fix
IAS	Indicated Air Speed
IAT	Indicated Air Temperature
IAU	Integrated Avionics Unit
ICAO	International Civil Aviation Organization
ICS	Intercom System
ID	Identification/Morse Code Identifier
IDENT, IDNT	Identification
IEEE	Institute of Electrical & Electronics Engineers
IF	Initial Fix
IFR	Instrument Flight Rules
IG	Imperial Gallon
ILS	Instrument Landing System
IMC	Instrument Meteorological Conditions
IN	Inch
INACTV	Inactive
INC FUEL	Increase Fuel
IND	Indicator, Indicated
Indicated	Information provided by properly calibrated and set instrumentation on the aircraft panel.
INFO	Information
IN Hg	Inches of Mercury
INS	Inertial Navigation System
INT	Intersection(s)
INTEG	Integrity (RAIM unavailable)
IrDA, IRDA	Infrared Data Association
ISA	International Standard Atmosphere; ISA Relative Temperature
ITT	Inter-Turbine Temperature, Interstage Turbine Temperature
KEYSTK	Key Stuck
KG	Kilogram
kHz	Kilohertz
KM	Kilometer
KT	Knot
L	Left, Left Runway
LAT	Latitude
LBL	Label
LB	Pound
LCD	Liquid Crystal Display
LCL	Local
LDA	Landing Distance Available
LDG	ETA at Final Destination
LED	Light Emitting Diode
Left Over Fuel On Board	The amount of fuel remaining on board after the completion of one or more legs of a flight plan or direct-to.
Left Over Fuel Reserve	The amount of flight time remaining, based on the amount of fuel on board after the completion of one or more legs of a flight plan or direct-to, and a known consumption rate.
Leg	The portion of a flight plan between two waypoints.
LGND	Legend

LIFR	Low Instrument Flight Rules
LMM	Location Middle Marker
LNAV	Lateral Navigation
LO	Low
LOA	Letter of Authorization
LOC	Localizer
LOI	Loss of Integrity (GPS)
LOM	Location Outer Marker
LON	Longitude
LP	Localizer Performance
LPV	Localizer Performance with Vertical Guidance
LRU	Line Replaceable Unit
LT	Left
LTNG	Lightning
LVL	Level
M	Meter, Middle Marker, Mach
M_{MO} (V_{MO})	Maximum Speed
Mach Number	Mach number is the ratio of the true airspeed to the speed of sound.
MAG	Magnetic
MAG VAR	Magnetic Variation
MAHP	Missed Approach Hold Point
MAN IN	Manifold Pressure (inches Hg)
MAN SQ	Manual Squelch
MANSEQ	Manual Sequence
MAP	Missed Approach Point
MASQ	Master Avionics Squelch
MAX	Maximum
MAXSPD	Maximum Speed (overspeed)
MB	Marker Beacon
MDA	Barometric Minimum Descent Altitude
MEPT	Manual Electric Pitch Trim
MET	Manual Electric Trim
METAR	Aviation Routine Weather Report
MFD	Multi Function Display
MFW	Multi Function Window
MGRS	Military Grid Reference System
MHz	Megahertz
MIC	Microphone
MIN	Minimum
Minimum Safe Altitude (MSA)	Uses Grid MORAs to determine a safe altitude within ten miles of the aircraft present position.
MKR	Marker Beacon
MOA	Military Operations Area
MON	Monitor
MOV	Movement
MORA	Minimum Off-Route Altitude
MPEL	Maximum Permissible Exposure Level
MPM	Meters per Minute
MSA	see also Minimum Safe Altitude
MSAS	Multi-functional Satellite Augmentation System
MSG	Message
MSL	Mean Sea Level
MT, M	Meter
mV	Millivolt(s)
MVFR	Marginal Visual Flight Rules
N	North
NAV	Navigation
NAVAID	Navigation Aid
NDB	Non-Directional Beacon
NEXRAD	Next Generation Radar
NM	Nautical Mile(s)
NoPT	No Procedure Turn Required (procedure shall not be executed without ATC clearance)
NOTAM	Notice To Airman
NRST	Nearest
O	Outer Marker
OAT	Outside Air Temperature
OBS	Omni Bearing Selector
OFST	Offset
OOOI	Out of the gate, Off the ground, On the ground, and In the gate
OXY	Oxygen
P ALT	Pressure Altitude
PA	Passenger Address, Proximity Advisory

PASS	Passenger(s)
PC	Personal Computer
PDC	Pre-Departure Clearance
PFD	Primary Flight Display
PG	Pilot's Guide
PI	Procedure Turn to Course Intercept Leg
PIREP	Pilot Report
PIT, PTCH	Pitch
POA	Plain Old ACARS
POH	Pilot's Operating Handbook
POHS	Pilot's Operating Handbook Supplement
POS, POSN	Position
PPH	Pounds per Hour
PPM	Parts per Million
P. POS	Present Position
PRES, PRESS	Pressure
PROC	Procedure(s), Procedure Turn
PROP	Propeller
PROX	Proximity
PSI	Pounds per Square Inch
PT	Procedure Turn
PTK	Parallel Track
PTT	Push-to-Talk
PWR	Power
QFE	Field Elevation Pressure
QNH	Sea Level Pressure
QTY	Quantity
R	Right, Right Runway
RA	Resolution Advisory, Radio Altimeter
RAD	Radial
RAD ALT	Radio Altimeter
RAIM	Receiver Autonomous Integrity Monitoring
RAM	Random Access Memory
RAT	Ram Air Temperature
RCVR	Receiver
REF	Reference
REM	Remaining (fuel remaining), Reminder
REQ	Required
RES	Reserve (fuel reserve entered by pilot)
REV	Reverse, Revision, Revise
RF	Radio Frequency, Constant Radius Turn to Fix Leg
RMI	Radio Magnetic Indicator
RMT	Remote
RNAV	Area Navigation
RNG	Range
RNP	Required Navigation Performance
RNWY, RWY	Runway
ROL	Roll
ROM	Read Only Memory
RPM	Revolutions Per Minute
RST FUEL	Reset Fuel
RSV	Reserve (fuel reserve entered by pilot)
RT	Right
RVRSNRY	Reversionary
RVSM	Reduced Vertical Separation Minimums
RX	Receive
S	South
SA	Selective Availability
SAR	Search and Rescue
SAT	Static Air Temperature
SBAS	Satellite-Based Augmentation System
SCIT	Storm Cell Identification and Tracking
SD	Secure Digital
SEC	Second(s)
SEL, SLCT	Select
SELCAL	Selective Calling
SENS	Sense
SFC	Surface
SIAP	Standard Instrument Approach Procedures
SID	Standard Instrument Departure
SIG/AIR	SIGMET/AIRMET
SIGMET	Significant Meteorological Information
SIM	Simulator
SLD	Supercooled Large Droplet
SLP/SKD	Slip/Skid
SMBL	Symbol

SMS	Short Message System
SNGL	Single
SPC	Space
SPD	Speed
SPI	Special Position Identification
SPKR	Speaker
SQ	Squelch
SRVC, SVC	Service
SSID	Wireless Service Set Identifier
STAB	Stabilization
STAL	Stall
STAR	Standard Terminal Arrival Route
STATS	Statistics
STBY	Standby
STD	Standard
STRMSCP	Stormscope
SUA	Special Use Airspace
SURF	Surface
SUSP	Suspend
SVT	Synthetic Vision Technology
SW	Software
SYNC	Synchronize
SYN TERR	Synthetic Terrain
SYN VIS	Synthetic Vision
SYS	System
T	True
TA	Traffic Advisory
TACAN	Tactical Air Navigation System
TAF	Terminal Aerodrome Forecast
TAS	True Airspeed, Traffic Advisory System
TAT	Total Air Temperature
TAWS	Terrain Awareness and Warning System
TCA	Terminal Control Area
TCAS	Traffic Alert Collision Avoidance System
TEL	Telephone
TEMP	Temperature
TERM	Terminal
TF	Track Between Two Fixes Leg
TFR	Temporary Flight Restriction
TGT	Target
T HDG	True Heading
TIS	Traffic Information Service
TIS-B	Traffic Information Service-Broadcast
TIT	Turbine Inlet Temperature
TKE	see also Track Angle Error
TMA	Terminal Maneuvering Area
TMR/REF	Timer/Reference
TOC	Top of Climb
TOD	Top of Descent
TOGA, TO/GA	Take-Off, Go-Around
TOLD	Takeoff and Landing Data
TOPO	Topographic
TORA	Takeoff Run Available
TOT	Total
TPA	Traffic Pattern Altitude
Track	Direction of aircraft movement relative to a ground position; also 'Ground Track'.
Track Angle Error	The angle difference between the desired track and the current track.
TRK	see also Track
TRSA	Terminal Radar Service Area
TRUNC	Truncated
TTL	Total
TURB	Turbulence
TURN	Procedure Turn
TWIP	Terminal Weather Information for Pilots
TX	Transmit
UAT	Universal Access Transceiver
UHF	Ultra-High Frequency
UNAVAIL	Unavailable
US	United States
USR	User
UTC	Coordinated Universal Time
UTM/UPS	Universal Transverse Mercator/ Universal Polar Stereographic Grid
V	Volts
V, Vspeed	Velocity (airspeed)
V_1	Takeoff Decision Speed

V_2	Takeoff Safety Speed
V_A	Maneuvering Speed
V_{APP}, V_{AC}	Approach Climb Speed
V_{FE}	Maximum Flap Extended Speed
V_{LE}	Maximum Landing Gear Extended Speed
V_{LNDx}	Approach Speed (Flaps at x°)
V_{LO}	Maximum Landing Gear Operating Speed
V_{MC}	Minimum Control Speed
V_{MO} (M_{MO})	Maximum Operating Speed
V_{NE}	Never-Exceed Speed
V_R	Takeoff Rotate Speed
V_{REF}	Landing Approach Speed, Reference Landing Speed
V_{SB}	Maximum Speedbrake Speed
V_{SR}	Stall Speed
V_T	Takeoff Flap Retraction Speed
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
V DEV	Vertical Deviation
VA	Heading Vector to Altitude Leg
VAC	Volts Alternating Current
VAPP	VOR Approach
VAR	Variation
VD	Heading Vector to DME Distance Leg
VDC	Volts Direct Current
VDL	VHF Datalink
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.
VFOM	see also Vertical Figure of Merit
VFR	Visual Flight Rules
VHF	Very High Frequency
VI	Heading Vector to Intercept Leg
VLOC	VOR/Localizer Receiver
VM	Heading Vector to Manual Termination Leg
VMC	Visual Meteorological Conditions
VNAV, VNV	Vertical Navigation
VOL	Volume
VOR	VHF Omnidirectional Range
VORTAC	VHF Omnidirectional Range Station and Tactical Air Navigation
VPATH, VPTH	Vertical Path
VPL	Vertical Protection Level
VPROF	VNAV Profile, Vertical Profile
VR	Heading Vector to Radial Leg
VRP	Visual Reporting Point
VS	Vertical Speed
VSD	Vertical Situation Display
VSI	Vertical Speed Indicator
VSR, VS REQ	see also Vertical Speed Required
VTF	Vector to Final
W	Watt(s), West
WAAS	Wide Area Augmentation System
WARN	Warning
WATCH	Weather Attenuated Color Highlight
WGS-84	World Geodetic System - 1984
WI-FI, WIFI	Wireless Local Area Network based on IEEE 802.11
WOG	Weight on Gear
WOW	Weight on Wheels
WPT	Waypoint(s)
WT	Weight
WW	World Wide
WX	Weather
XFER, XFR	Transfer
XM LTNG	SiriusXM Lightning
XPDR	Transponder
XTALK	Cross-Talk
XTK	Cross-Track, Crosstrack Error
YD	Yaw Damper

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FREQUENTLY ASKED QUESTIONS

If a particular aspect of system operational capability is not addressed by these commonly asked questions or in the index, contact Garmin (see the copyright page or back cover for contact information) or a Garmin-authorized dealer. Garmin is dedicated to supporting its products and customers.

WHAT IS SBAS?

The Satellite Based Augmentation System (SBAS) uses a system of ground stations to correct any GPS signal errors. These ground stations correct for errors caused by ionospheric disturbances, timing, and satellite orbit errors. It also provides vital integrity information regarding the health of each GPS satellite. The signal correction is then broadcast through geostationary satellites. This correction information can then be received by any SBAS-enabled GPS receiver.

SBAS is designed to provide the additional accuracy, availability, and integrity necessary to enable users to rely on GPS for all phases of flight.

There are several SBAS systems serving different parts of the world. The Wide Area Augmentation System (WAAS) is currently available in the United States, including Alaska and Hawaii. The European Geostationary Navigation Overlay Service (EGNOS) offers coverage of Europe, parts of the middle east and northern Africa. The Multi-functional Satellite Augmentation System (MSAS) covers mainly Japan and parts of northern Australia.

HOW DOES SBAS AFFECT APPROACH OPERATIONS?

Both LNAV/VNAV and LPV approaches use the accuracy of SBAS to include vertical (glide path) guidance capability. The additional accuracy and vertical guidance capability allows improved instrument approaches to an expanded number of airports throughout the U.S.

The implementation of LPV approaches further improves precision approach capabilities. LPV approaches are designed to make full use of the improved GPS signal from the SBAS. This approach combines the LNAV/VNAV vertical accuracy with lateral guidance similar to the typical Instrument Landing System (ILS). LPV approaches allow lower approach minimums.

WHAT IS RAIM AND HOW DOES IT AFFECT APPROACH OPERATIONS?

RAIM is an acronym for Receiver Autonomous Integrity Monitoring. RAIM is a GPS receiver function that performs the following functions:

- Monitors and verifies integrity and geometry of tracked GPS satellites
- Notifies the pilot when satellite conditions do not provide the necessary coverage to support a certain phase of flight
- Predicts satellite coverage of a destination area to determine whether the number of available satellites is sufficient to satisfy requirements

NOTE: *If RAIM is not predicted to be available for the final approach course, the approach does not become active, as indicated by the "RAIM not available from FAF to MAP" message and the LOI annunciation flagging on the HSI.*

For RAIM to work correctly, the GPS receiver must track at least five satellites. A minimum of six satellites is required to allow RAIM to eliminate a single corrupt satellite from the navigation solution.

RAIM ensures that satellite geometry allows for a navigation solution calculation within a specified protection limit (2.0 nm for oceanic and en route, 1.0 nm for terminal, and 0.3 nm for non-precision approaches). The system monitors RAIM and issues an alert message when RAIM is not available (see Appendix A). Without RAIM, GPS position accuracy cannot be monitored. If RAIM is not available when crossing the FAF, the pilot must fly the missed approach procedure.

What is GSL altitude?

GSL (Geodetic Sea Level) altitude is the height above Mean Sea Level (MSL), as calculated geometrically, generally using a global positioning system (GPS) as the primary data source. The calculated result may or may not include a barometric component, but the primary source is geometric.

Why are there not any approaches available for a flight plan?

Approaches are available for the final destination airport in a flight plan or as a direct-to (keep in mind that some VOR/VORTAC identifiers are similar to airport identifiers). If a destination airport does not have a published approach, the system indicates "NONE" for the available procedures.

What happens when an approach is selected? Can a flight plan with an approach, a departure, or an arrival be stored?

When an approach, departure, or arrival is loaded into the active flight plan, a set of approach, departure, or arrival waypoints is inserted into the flight plan, along with a header line showing the title of the selected instrument procedure. The original en route portion of the flight plan remains active, unless the instrument procedure is activated. This may be done either when the procedure is loaded or at a later time.

Flight plans can also be stored with an approach, a departure, or an arrival. Note that the active flight plan is erased when the system is turned off. Also, the active flight plan is overwritten when another flight plan is activated. When storing flight plans with an approach, a departure, or an arrival, the system uses the waypoint information from the current database to define the waypoints. If the database is changed or updated, the system automatically updates the information, provided the procedure has not been modified. Should an approach, departure, or arrival procedure no longer be available, the flight plan becomes locked until the procedure is deleted from the flight plan.

Can "slant Golf" ("/G") be filed using the G1000 NXi?

"/G" may be filed for a flight plan. The system meets the requirements of TSO-C145a Class 3 and ETSO C145 Class 3 installations. GPS approaches are not to be flown with an expired database. See the approved Pilot's Operating Handbook (POH) as well as the Aeronautical Information Manual (AIM) for more information.

What does the OBS Softkey do?

The **OBS** Softkey is used to select manual sequencing of waypoints. Activating OBS mode sets the current active-to waypoint as the primary navigation reference and prevents the system from sequencing to the next waypoint in a flight plan. When OBS mode is cancelled, automatic waypoint sequencing is continued, and the system automatically activates the next waypoint in the flight plan once the aircraft has crossed the present active waypoint.

Normal (OBS not activated)	OBS
• Automatic sequencing of waypoints	• Manual sequencing - 'holds' on selected waypoint
• Manual course change on HSI not possible	• Manually select course to waypoint from HSI
• Always navigates 'TO' the active waypoint	• Indicates 'TO' or 'FROM' waypoint
• Must be in this mode for final approach course	• Cannot be set for final approach course or published holding patterns

When OBS mode is active, the system allows the pilot to set a desired course to/from a waypoint using the **CRS/BARO** Knob and HSI (much like a VOR).

The most common application for using the **OBS** Softkey is the missed approach. The system suspends automatic waypoint sequencing (indicated by a 'SUSP' annunciation placed on the HSI) when the missed approach point (MAP) is crossed. This prevents the system from automatically sequencing to the missed approach holding point (MAHP). During this time, the **OBS** Softkey designation changes to **SUSP**. Pressing the **SUSP** Softkey reactivates automatic waypoint sequencing. The **OBS** Softkey then resumes its normal functionality.

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 on the MFD from the Active Flight Plan Page by highlighting the desired waypoint and pressing the **ACT Leg** Softkey then the **ENT** Key to approve the selection. The GPS then provides navigation along the selected flight plan leg.

When does turn anticipation begin?

The system smooths adjacent leg transitions based on a normal 15° bank angle (with the ability to roll up to 30°) and provides three pilot cues for turn anticipation:

- A waypoint alert ('Next DTK ###° in # seconds' or 'Next HDG ###° in # seconds') appears on the PFD 10 seconds before the turn point and flashes as it counts down to zero.
- A flashing turn advisory ('Turn [right/left] to ###° in # seconds') appears on the PFD 10 seconds before the turn and flashes as it counts down to zero. 'Turn [right/left] to ###° now' or 'Next [DTK/HDG] to ###° now' is displayed when the pilot is to begin the turn and the HSI (GPS mode) automatically sequences to the next DTK or HDG value.
- The To/From indicator on the HSI flips momentarily to indicate that the midpoint of the turn has been crossed.

When does the CDI scale change?

Once a departure is activated, the Course Deviation Indicator (CDI) full scale deflection is set to 0.3 nm. The CDI scale changes to 1.0 nm (terminal mode) then ramps up to 2.0 nm (enroute mode) at 30 nm from the departure airport. When 31 nm from the destination, the CDI scale smoothly transition from 2.0 nm back to 1.0 nm (terminal mode). At 2.0 nm before the FAF during an active approach, the CDI scale transitions down further based on the type of approach activated (LNAV, LNAV/VNAV, LPV). When a missed approach is activated, the CDI is set to 0.3 nm. See the Flight Instruments Section for more details on CDI scaling.

Why does the HSI not respond like a VOR when OBS mode is active?

Unlike a VOR, the CDI scale used on GPS equipment is based on the crosstrack distance to the desired course, not on the angular relationship to the destination. Therefore, the CDI deflection on the GPS is constant regardless of the distance to the destination and does not become less sensitive when further away from the destination.

What is the correct missed approach procedure? How is the missed approach holding point selected?

To comply with TSO specifications, the system does not automatically sequence past the MAP. The first waypoint in the missed approach procedure becomes the active waypoint when the **SUSP** Softkey is selected *after* crossing the MAP. All published missed approach procedures must be followed, as indicated on the approach plate.

To execute the missed approach procedure prior to the MAP (not recommended), select the Active Flight Plan Page and use the **ACT Leg** Softkey to activate the missed approach portion of the procedure.

After a missed approach, how can the same approach be re-selected? How can a new approach be activated?

NOTE: *Do not attempt to reactivate the current approach prior to crossing the missed approach point (MAP). If an attempt to do so is made, an alert message "Are you sure you want to discontinue the current approach?" appears. The system directs the pilot back to the transition waypoint and does not take into consideration any missed approach procedures, if the current approach is reactivated.*

After flying the missed approach procedure, the pilot may reactivate the same approach for another attempt by pressing the **PROC** Key. Once the clearance is given for another attempt, activate the approach by highlighting 'Activate Approach' using the large **FMS** Knob and pressing the **ENT** Key. 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 pressing the **PROC** Key. Choose 'Select Approach', select the desired approach from the list shown, and press the **ENT** Key. Select the desired transition, then activate the approach using the **ENT** Key.

To activate a new approach to a different airport, press the **Direct-to** Key and select the desired airport using the **FMS** Knobs. Press the **ENT** Key to accept the selected airport, then follow the steps in the preceding paragraph to select an approach for the new airport.

MAP SYMBOLS

AVIATION SYMBOLS

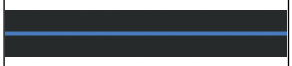
Item	Symbol
Unknown Airport	
Non-towered, Non-serviced Airport	
Towered, Non-serviced Airport	
Non-towered, Serviced Airport	
Towered, Serviced Airport	
Restricted (Private) Airport	
Heliport	
Intersection	
LOM (compass locator at outer marker)	
NDB (non-directional radio beacon)	
VOR	
VOR/DME	
VOR/ILS	
VORTAC	
VRP	
TACAN	

LAND SYMBOLS

Item	Symbol
User Waypoint	
Interstate Highway	
State Highway	

US Highway	
National Highway	
Large City (> 200,000)	
Medium City (> 50,000)	
Small City (> 5,000)	
State or Province Border	
International Border	
Road	
Railroad	
Latitude/Longitude	
River/Lake	
Latitude/Longitude (LAT/LON)	

AIRSPACE SYMBOLS

Item	Symbol
Class B Airspace Altitude Label (ceiling/floor)	
Class C Airspace Altitude Label (ceiling/floor)	
Class D Airspace Altitude Label (ceiling)	
ICAO Control Area Class B Airspace	
Mode C Tower Area	
Warning Area Prohibited Area Alert Area Restricted Area Caution Area Training Area Danger Area Unknown Area	
Class C Terminal Radar Service Area Mode C Area	
Military Operations Area (MOA)	

MISCELLANEOUS

Item	Symbol
ARTCC Frequency or FSS Frequency	
Map Pointer (when panning)	
Elevation Pointer (on Topography Scale when panning)	
Measuring Pointer	
Wind Vector	
Overzoom Indicator	
User Waypoint	
Vertical Navigation Along Track Waypoint	
Parallel Track Waypoint	
Unanchored Flight Path Waypoint	
Top of Descent (TOD)	
Bottom of Descent (BOD)	
Navigating using Dead Reckoning	

A

Activate a Flight Plan ---- 223
Active frequency ---- 116, 121, 122
  ADF ---- 126
AC-U-KWIK ---- 474, 536
ADF
  ADF mode ---- 126, 127
  ANT mode ---- 127
  Volume ---- 126
ADF audio ---- 122
ADF/BFO ---- 127
ADF/DME tuning ---- 128
ADF frequency tuning ---- 127
ADF volume ---- 128
ADS-R ---- 400
AFCS Status Box ---- 48
AHRS ---- 528
AHRS2 ---- 522
AIRB ---- 402
Aircraft Symbol ---- 60, 420
Air Data Computer ---- 96
Airport
  Information ---- 177
Airport Directory ---- 474, 536
Airport Signs ---- 82
Airspace Alerts ---- 194, 269
Airspeed Indicator ---- 48, 50
Airspeed Reference ---- 414, 426–427
Airways
  Collapsing/Expanding ---- 236
Alerting system ---- 515
Alerts
  Arrival ---- 40
  Levels ---- 517
Alerts, Aircraft ---- 518
Along Track Offset ---- 228, 229
Altimeter ---- 54–57
Altimeter Barometric Setting ---- 48
Altitude
  Constraints ---- 243
Altitude Alerting ---- 78
Altitude Compensated Tilt (ACT) ---- 345
Altitude Hold Mode ---- 424
Altitude Reference ---- 423, 424, 437
Angle of Attack (AOA) Indicator ---- 72
Annunciations
  Comparator ---- 95
  System ---- 12
  Test tone ---- 14
Annunciator lights ---- 134
ANT/BFO ---- 127
AOPA ---- 453, 536
AP ---- 447
Approach ---- 556
  Activating ---- 258
  Loading ---- 220, 256, 258
  Removing ---- 259
Approach channel ---- 220, 256
Approach Mode ---- 440
Approach Mode (GPS, VAPP, LOC) ---- 433
APR softkey ---- 258, 268
Arrival procedure ---- 201, 218, 253, 254
Attitude & Heading Reference System (AHRS) ---- 15, 96
Attitude Indicator ---- 48, 53–54
Audio Panel Fail-Safe Operation ---- 140
Automatic Flight Control System (AFCS) ---- 413–452
  Alerts and annunciations ---- 447–448
  Controls ---- 414–415
  Status Box ---- 418
Automatic squelch ---- 116
Autopilot ---- 413, 444–446, 447
Autopilot Disconnect ---- 415
Auto-tuning ---- 124
  NAV ---- 123
Auto-tuning, COM ---- 117
Auto Zoom ---- 148
Auxiliary Boost Pump ---- 107
AUX - system status page ---- 475
Aviation Symbols ---- 158, 159, 163

B

Backcourse Mode ---- 442
Backlighting ---- 46
Barometric Setting ---- 55–56
Barometric Setting, Altimeter ---- 48
Basic Empty Weight ---- 262
Basic Operating Weight ---- 262
Battery ---- 105
  Alerts ---- 518
Bearing/distance, measuring ---- 153
Bearing Information ---- 63–64
Bearing Information Windows ---- 49
Bearing Line ---- 350, 353
Bearing Source ---- 63
Bluetooth ---- 207, 453, 503

C

Cabin Door Open ---- 108
Cabin pressure altitude
  Warning ---- 518
Cabin speaker ---- 134
Calibrated Airspeed ---- 265
Cargo ---- 263
CAUTION ---- 517
Chart Not Available ---- 461
Chart options ---- 465, 472
CHART SETUP box ---- 466, 473
ChartView ---- 453, 458, 459

Checklists ---------- 511–512
Clearance Recorder ---------- 135
Closest Point ---------- 236
Cloud Tops ---------- 312
COM channel spacing ---------- 120
COM Frequency Box ---------- 116, 121
Command Bars ---------- 420
Comparator ---------- 95
COM Tuning Failure ---------- 139
Conflict Situational Awareness (CSA) ---------- 401
Control Wheel Steering (CWS) ---------- 415, 445
Copy a Flight Plan ---------- 223
Correlation ---------- 400
Course Deviation Indicator (CDI) --------- 60, 64–67, 255
  Changing scale ---------- 558
Course Pointer ---------- 60
Crew Alerting System (CAS)
  Inhibits ---------- 520
  Messages ---------- 516–517
Current Heading ---------- 48, 60
Current Vertical Speed ---------- 49

D

Database(s) ---------- 9
Data Link Receiver ---------- 513
Datalink receiver troubleshooting ---------- 513
Data logging ---------- 482
Date and time ---------- 34
Day/Night views ---------- 466, 473
Day view ---------- 467
DB Mismatch ---------- 535
Dead Reckoning ---------- 94
Decision Height (DH) ---------- 49, 79
Declutter, Display ---------- 97
Delete Flight Plans ---------- 224
Deleting
  An entire airway ---------- 225, 226
  An entire procedure ---------- 225, 226
  An individual waypoint ---------- 225, 226
  Flight Plan Items ---------- 225
Density Altitude ---------- 267
Departure
  Procedure ---------- 216, 251, 252
  Select ---------- 251, 253, 256, 258
  Time ---------- 265
Differential cabin pressure
  Warning ---------- 518
Digital audio entertainment ---------- 2
Dilution of Precision (DOP) ---------- 17
Direct-to ---------- 170, 196, 197, 198, 199, 241, 242
Display backup ---------- 11, 115
Display Pane ---------- 32
DME
  HOLD mode ---------- 128
  NAV1 mode ---------- 128
  NAV2 mode ---------- 128
  Tuning mode ---------- 126, 128
DME audio ---------- 122
DME Information Window ---------- 64
DME Information Window (optional) ---------- 49

E

Electronic Checklists ---------- 511, 512
Electronic Stability and Protection (ESP) 40, 453, 506, 509, 510
Emergency Checklist ---------- 512
Emergency Descent Mode (EDM) ---------- 451
Emergency frequency ---------- 139
Engine Driven Boost Pump ---------- 107
Entering Flight ID ---------- 129
Entertainment inputs ---------- 136
Estimated Landing Fuel ---------- 264
Estimated Position Error (EPE) ---------- 17
Excess Fuel Weight ---------- 264

F

Failure
  Input ---------- 16
FD ---------- 447
Field of View (SVT) ---------- 166
Flap position
  Asymmetrical deflection warning ---------- 518
Flight Director (FD) ---------- 413, 417–418
  Pitch modes ---------- 421–427
  Switching ---------- 416, 419
Flight Level Change Mode ---------- 426
Flight Path Marker ---------- 82
Flight Phase ---------- 60
Flight plan
  Storing ---------- 556
Flight Plan, Active
  Creating ---------- 204
  Leg Type ---------- 201
Flight Plan Map ---------- 234, 235
Flight Plan View ---------- 232
Flight Plan Window ---------- 49
Flight Stream ---------- 453
Flight Stream 510 ---------- 1, 207, 503
FliteCharts ---------- 453, 468
  Functions ---------- 469
Fly-by Waypoint ---------- 212
Fly-over Waypoint ---------- 212
Forward Cargo Door Open ---------- 108
FPA ---------- 242

Frequency
Nearest ---- 192
Frequency spacing ---- 120
Frequently asked questions ---- 555
Fuel
Alerts ---- 518–519
Efficiency ---- 267
Endurance ---- 267
Remaining ---- 267
Required ---- 267
Statistics ---- 267
Fuel Flow Data ---- 107
Fuel on Board ---- 263, 264, 267

G

Garmin Connext Weather ---- 274, 275
Garmin Pilot ---- 503
Garmin SVT ---- 81
GCU Configuration Error ---- 524
Geodetic Sea Level (GSL) ---- 361
GFC 700 ---- 413
GIA Hardware Mismatch ---- 528
Glidepath Mode (GP) ---- 438, 441
Glideslope Indicator ---- 49, 57
Glideslope Mode ---- 439
Global Positioning System (GPS)
Navigation ---- 196–270
Receiver information ---- 18–20
GMA 1347 ---- 9
GMC Connfiguration Error ---- 526
Go Around Mode ---- 443
Ground Mapping, Weather Radar ---- 357
Groundspeed ---- 43

H

Heading
Select Mode ---- 430
HI SENS ---- 125
Horizon Heading ---- 82
Horizontal Scan ---- 349, 350, 351, 352, 356
Horizontal Situation Indicator (HSI) 48, 60–62, 255, 557, 558
HSI double green arrow ---- 122
HSI magenta arrow ---- 122
HSI single green arrow ---- 122

I

IDENT function ---- 130
ID indicator ---- 121
IFR/VFR Charts ---- 167
Chart settings ---- 169
Importing a Flight Plan ---- 205
Import/Export Messages ---- 206
Indicated Airspeed ---- 50
Indicated Altitude ---- 265
Inset Map, PFD ---- 49
Intercom ---- 134
Intersection
Information ---- 178–179
Interturbine Temperature ---- 101
Interturbine Temperature (ITT)
Warning ---- 518
Inverting a flight plan ---- 223
IOI ---- 371, 372
Iridium ---- 488
Iridium satellite network ---- 483, 484, 488, 491

K

Key(s) ---- 5, 7

L

Land Symbols ---- 157
Lateral Deviation Scale ---- 60
Left Fuel Tank ---- 107
Level Mode ---- 506
LO SENS ---- 125
Low Altitude Annunciation ---- 79
Low speed data ---- 483
Lubber Line ---- 60

M

Mach Number ---- 48
Magnetometer ---- 16
Main Bus ---- 105
Main Generator ---- 105
Map
Panning ---- 150
Map symbols ---- 559
Marker Beacon ---- 125
Marker Beacon Annunciations ---- 78
MASQ processing ---- 111
Measurement units, changing displayed ---- 38
Menus ---- 27
Messages
Reminder ---- 44
MET ---- 447
Minimum Descent Altitude (MDA) ---- 49, 79
Minimums ---- 520
MISCOMP ---- 95
Missed Approach ---- 201, 259
Mistrim ---- 447
MKR/MUTE ---- 125

Mnimum Runway Length ---- 177
Mode S ---- 129
Mode selection softkeys ---- 129, 130
Morse code identifier ---- 121
Motion Vectors ---- 407
Music 1 ---- 136
Music 1 muting ---- 136

N

National Weather Service (NWS) ---- 322
NAV audio ---- 122
Navigation
  Database ---- 243
  Map ---- 198
  Mode ---- 431–432
  Mode Selection ---- 122
Navigation (NAV) Frequency Box ---- 48
Navigation Source ---- 60, 65–67
Navigation Status Box ---- 48
Nav radio selection ---- 122
Nearest
  Airport ---- 174, 175, 176, 177, 258
  Airport Minimum Runway Length ---- 177
  Airports Page ---- 175, 176, 177
  Airport Surface Matching ---- 177
  VOR ---- 183
  VRP ---- 184, 185
Nearest airports, frequency tuning ---- 117
NEXRAD ---- 303
NextGen ---- 399
Night view ---- 467
No Available Charts ---- 470
NO COMP ---- 95
Non-path descent ---- 436
Normal display operation ---- 10
Normal operating mode ---- 10

O

OAT ---- 75
OBS Mode ---- 60, 71–72
Obstacles Database Mismatch ---- 523
Odometer ---- 43
Oil, engine
  Alerts ---- 518
Oil Pressure (OIL PSI) ---- 101
Omni Bearing Selector (OBS) ---- 556–557
Other Statistics ---- 265, 267
Outside Air Temperature (OAT) ---- 48, 75
Oxygen
  Warning ---- 518

P

Page groups ---- 29–32
Page navigation ---- 40
Pairing ---- 503
Parallel Track ---- 229
Passenger Address (PA) System ---- 135
Passenger(s) ---- 263
Pending flight plan ---- 207, 208, 209
PFD failure ---- 139
Pilot and Stores Weight ---- 262
Pitch Hold Mode ---- 422
Pitch Indication ---- 53
Pitch Modes, Flight Director ---- 421–427
Pitot Tube 1 ---- 108
Power ON settings ---- 134
Power-up Page ---- 511
Predefined message ---- 496, 497, 498
Propeller Speed ---- 101

R

Radar Altimeter (optional) ---- 49
Radar Signal Attenuation ---- 341
Radar Signal Reflectivity ---- 341
Rear Cargo Door Open ---- 108
Receiver Autonomous Integrity Monitoring (RAIM) 17 – 18, 255, 555
Reminder messages ---- 44
Reversionary Mode ---- 81, 140
Reversionary Sensor Annunciations ---- 49
Reversionary Sensor Window ---- 96
ROC ---- 371, 372
Roll Hold Mode ---- 428
Rotating Compass Card ---- 60
RS-232 ---- 1
RS-485 ---- 1, 2
Runway ---- 82
Runway Extension ---- 160
RX indicator ---- 117

S

SafeTaxi ---- 453, 454
SBAS ---- 518, 528, 555
Scheduler ---- 44–45
Sector Scan ---- 353
Secure Digital (SD) card ---- 8, 511, 535
Selected Altitude 48, 54, 78, 422, 423, 424, 425, 426, 434, 437
Selected Altitude Bug ---- 48
Selected Altitude Intercept Arc ---- 164
Selected Course ---- 49, 60, 62, 432, 441, 442
Selected Heading ---- 60, 62, 414, 430
Selected Heading Bug ---- 48, 60
Sensor ---- 96
Sequencing waypoints
  Automatic ---- 557

Sequencing Waypoints, Suspend ---------- 71
SIGMET ---------- 313
Simultaneous COM Operation ---------- 135
SiriusXM Radio ---------- 477, 478
SiriusXM Radio Active Channel ---------- 478
SiriusXM radio entertainment ---------- 136
SiriusXM Radio Presets ---------- 479
SiriusXM Radio Service Class ---------- 478
SiriusXM Radio Volume ---------- 480
SiriusXM Weather
AIREPs ---------- 326
AIRMETs ---------- 313
Cell Movement ---------- 310
Cloud Tops ---------- 308
County Warnings ---------- 322
Cyclones & Hurricanes ---------- 323
Echo Tops ---------- 307
Freezing Level ---------- 318
Icing ---------- 324
Lightning ---------- 309
PIREPs ---------- 326
SIGMETs ---------- 313
Surface Analysis ---------- 317
Turbulence ---------- 325
Winds Aloft ---------- 319
Slip/Skid Indicator ---------- 48, 53
Softkeys ---------- 21–26, 23
MFD ---------- 25
PFD ---------- 21
Speaker ---------- 134
Split Screen ---------- 31, 32, 234, 235
Stabilization, Antenna ---------- 354
Standby frequency ---------- 116, 117, 121, 122
ADF ---------- 126
Standby frequency field ---------- 116, 121
Standby Generator ---------- 105
Standby Navigation Database ---------- 537
Stereo headsets ---------- 134
Stuck microphone ---------- 139
Sunrise / Sunset ---------- 266
SURF ---------- 402
Surface Analysis ---------- 317
SVT ---------- 532
SVT Troubleshooting ---------- 513
Symbols, map ---------- 559
Synoptics ---------- 104–110
Synthetic Vision Technology (SVT) ---------- 81
System
Annunciations ---------- 515
Message advisories ---------- 521
System Alerting ---------- 78
System Status Page ---------- 14
System Time ---------- 48

T

TA ---------- 520
Takeoff Mode ---------- 443
TAS ---------- 520, 521, 522
TAS Traffic
Non-Threat Traffic ---------- 387
PA ---------- 387
Proximity Advisory ---------- 387
Telephone ---------- 2, 483, 484, 485
Terminal Aerodrome Forecast (TAF) ---------- 315
Terminal procedures charts ---------- 457, 460, 470, 473
Terrain ---------- 523
Terrain Awareness and Warning System (TAWS)
Excessive Descent Rate ---------- 373
Terrain Proximity ---------- 361
Terrain-SVS ---------- 506
Text messaging ---------- 491, 493, 496, 498
Tilt, Antenna ---------- 351, 352
Tilt Line ---------- 352
Timer ---------- 41
Departure ---------- 41, 42
Flight ---------- 41, 42
Generic ---------- 41
To/From Indicator ---------- 60
TOPO Data ---------- 156
TOPO Scale ---------- 156
Torque ---------- 101
Track Indicator ---------- 60
Traffic Advisory ---------- 520
Traffic Advisory System (TAS) ---------- 349, 351, 352, 354
Traffic Information Service-Broadcast (TIS-B) ---------- 400
Transponder ---------- 24
Transponder code entry ---------- 132
Transponder data box ---------- 111
Transponder mode field ---------- 111, 131
Transponder standby mode ---------- 130
Transponder Status Box ---------- 48
Trend Vector
Turn Rate ---------- 63
Trip Planning ---------- 265, 266, 267
Trip statistics ---------- 43
Trip Statistics ---------- 266, 267
True Airspeed (TAS) ---------- 267
Turn anticipation ---------- 557
Turn Rate and Heading Trend Vector ---------- 60
Turn Rate Indicator ---------- 48, 63
TX indicator ---------- 117

U

Unable to Display Chart ---------- 461, 470
User-Defined Holding Pattern ---------- 239

V

Vectors to Final ---------- 258
Vertical Deviation ---------- 55, 436
Vertical Deviation Indicator (VDI) ---------- 57
Vertical Navigation (VNAV) ---------- 199, 243
  Direct-to ---------- 242
  Flight Control ---------- 434–438
  Guidance ---------- 243
Vertical Path Tracking Mode ---------- 434–435
Vertical Scan, Weather Radar ---------- 351, 352, 354
Vertical Situation Display (VSD) ---------- 246
Vertical Speed Indicator (VSI) ---------- 48, 57
Vertical Speed Mode ---------- 425
Vertical Speed Reference ---------- 425
Vertical track ---------- 520
VFR code ---------- 132
VNAV Target Altitude ---------- 434–437
VNAV Target Altitude Capture Mode ---------- 437
VNV guidance
  Enabling ---------- 241
VNV Indications, PFD ---------- 77
Voice Alerts, TIS Traffic ---------- 382
Volume ---------- 480
Volume level
  ADF ---------- 126, 128
VOR, Nearest *See* Nearest: VOR
VOR selection ---------- 122
VRP ---------- 158, 184, 185
Vspeed Reference Bug ---------- 49
Vspeed References ---------- 49
Vspeeds ---------- 51–52
VS TGT ---------- 242

W

WAAS ---------- 555
Waypoint
  Automatic sequencing ---------- 557
  Skipping ---------- 557
Waypoint Submenu ---------- 197, 204, 211
Weather Attenuated Color Highlight (WATCH) ---------- 354
Weather (real-time) ---------- 2
Wind ---------- 165
Wind Data ---------- 49

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