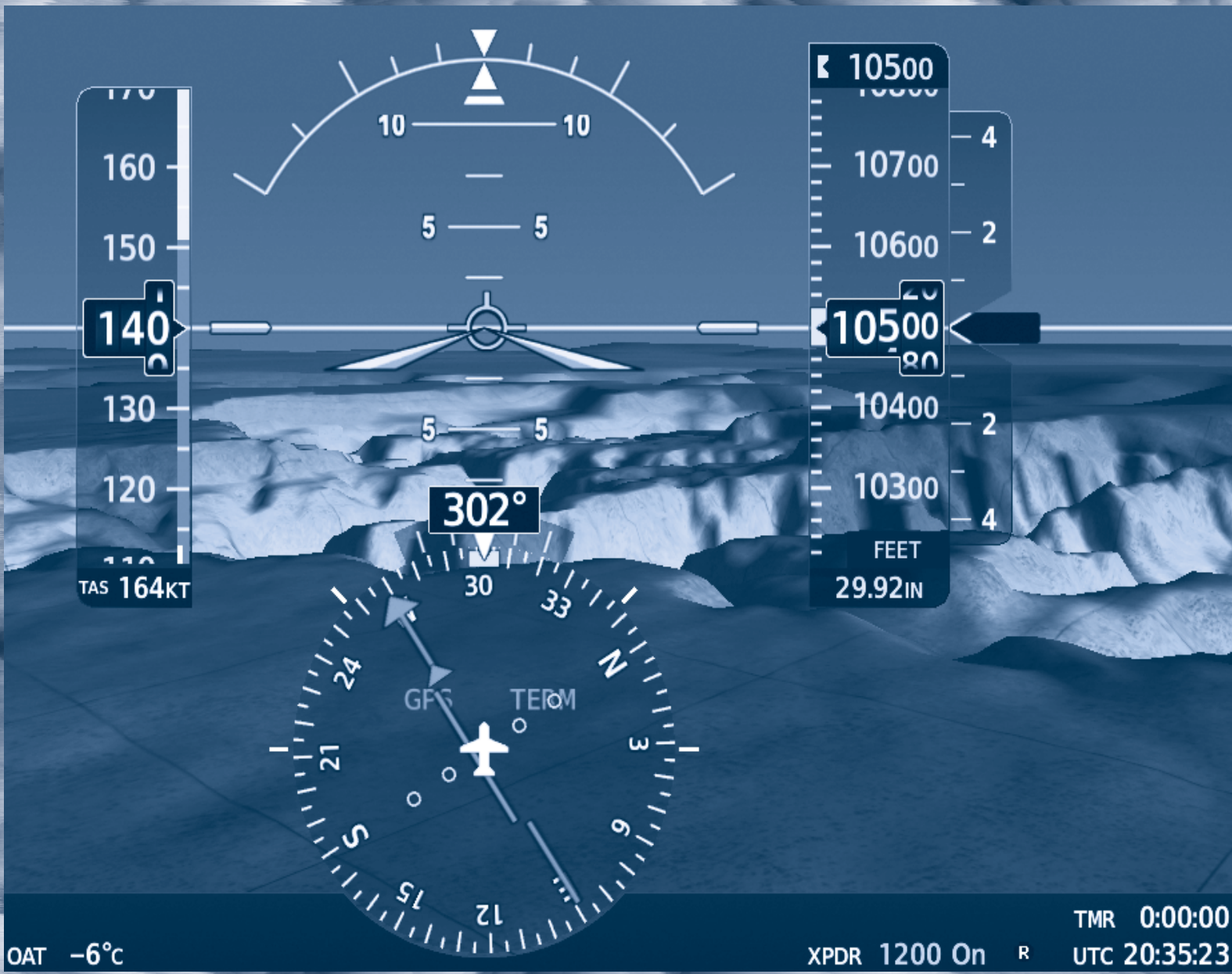


GARMIN[®]

G1000[®] NXi

Pilot's Guide



Diamond DA42NG

System Software Version 1916.12 or later

Copyright © 2018, 2021 Garmin Ltd. or its subsidiaries. All rights reserved.

This manual reflects the operation of System Software version 1916.12 or later for the Diamond DA42NG. Some differences in operation may be observed when comparing the information in this manual to earlier or later software versions.

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

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

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

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

Contact Garmin Product Support or view warranty information at flygarmin.com.

Except as expressly provided herein, no part of this manual may be reproduced, copied, transmitted, disseminated, downloaded or stored in any storage medium, for any purpose without the express written permission of Garmin. Garmin hereby grants permission to download a single copy of this manual and of any revision to this manual onto a hard drive or other electronic storage medium to be viewed for personal use, provided that such electronic or printed copy of this manual or revision must contain the complete text of this copyright notice and provided further that any unauthorized commercial distribution of this manual or any revision hereto is strictly prohibited.

Garmin®, G1000® NXi, FliteCharts®, and SafeTaxi® are registered trademarks of Garmin International, Inc. or its subsidiaries. Garmin ESP™, Garmin SVT™, and Connex™ are trademarks of Garmin International, Inc. or its subsidiaries. These trademarks may not be used without the express permission of Garmin.

Stormscope® is a registered trademark of L-3 Communications. Avidyne® is a registered trademark of Avidyne Corporation. AC-U-KWIK® is a registered trademark of Penton Business Media Inc. Bendix/King® and Honeywell® are registered trademarks of Honeywell International, Inc. NavData® is a registered trademark of Jeppesen, Inc.; Wi-Fi® is a registered trademark of the Wi-Fi Alliance. Sirius, XM, and all related marks and logos are trademarks of Sirius XM Radio, Inc. and its subsidiaries. The Bluetooth® word mark and logos are owned by the Bluetooth SIG, Inc. and any use of such marks by Garmin is under license.

AOPA Membership Publications, Inc. and its related organizations (hereinafter collectively "AOPA") expressly disclaim all warranties, with respect to the AOPA information included in this data, express or implied, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose. The information is provided "as is" and AOPA does not warrant or make any representations regarding its accuracy, reliability, or otherwise. Under no circumstances including negligence, shall AOPA be liable for any incidental, special or consequential damages that result from the use or inability to use the software or related documentation, even if AOPA or an AOPA authorized representative has been advised of the possibility of such damages. User agrees not to sue AOPA and, to the maximum extent allowed by law, to release and hold harmless AOPA from any causes of action, claims or losses related to any actual or alleged inaccuracies in the information. Some jurisdictions do not allow the limitation or exclusion of implied warranties or liability for incidental or consequential damages so the above limitations or exclusions may not apply to you.

AC-U-KWIK and its related organizations (hereafter collectively "AC-U-KWIK Organizations") expressly disclaim all warranties with respect to the AC-U-KWIK information included in this data, express or implied, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose. The information is provided "as is" and AC-U-KWIK Organizations do not warrant or make any representations regarding its accuracy, reliability, or otherwise. Licensee agrees not to sue AC-U-KWIK Organizations and, to the maximum extent allowed by law, to release and hold harmless AC-U-KWIK Organizations from any cause of action, claims or losses related to any actual or alleged inaccuracies in the information arising out of Garmin's use of the information in the datasets. Some jurisdictions do not allow the limitation or exclusion of implied warranties or liability for incidental or consequential damages so the above limitations or exclusions may not apply to licensee.

Printed in the U.S.A.



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



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



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



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



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



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



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




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





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





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


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


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


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


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


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

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


 **WARNING:** Do not consider the overflight of thunderstorms to be safe, as extreme turbulence may exist significantly above observed returns.


 **WARNING:** Do not rely on information from the reactive windshear detection system display as the sole basis for detecting windshear conditions. The system cannot predict the conditions in which windshear is likely to develop.


 **WARNING:** Do not rely only on the Turbulence Detection function for hazardous weather avoidance, or to maneuver in, near, or around areas of hazardous weather.


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


-
-  **WARNING:** Do not rely solely upon the display of traffic information for collision avoidance maneuvering. The traffic display does not provide collision avoidance resolution advisories and does not under any circumstances or conditions relieve the pilot's responsibility to see and avoid other aircraft.
-
-  **WARNING:** Do not use QFE altimeter setting outside of the terminal environment for the corresponding issuing airport to ensure adequate obstacle clearance.
-
-  **WARNING:** Do not fly QFE procedures above the Transition Altitude or when navigating to a waypoint that contains a QNE (flight level) altitude constraint.
-
-  **WARNING:** Always fly a procedure that provides terrain and obstacle clearance from the reference airfield when operating in IMC while conducting QFE procedures.
-
-  **WARNING:** Do not use SurfaceWatch™ information as the primary method of flight guidance during airborne or ground operations. SurfaceWatch does not have NOTAM or ATIS information regarding the current active runway, condition, or information about the position of hold lines.
-
-  **CAUTION:** Do not clean display surfaces with abrasive cloths or cleaners containing ammonia. They will harm the anti-reflective coating.
-
-  **CAUTION:** Do not allow repairs to be made by anyone other than an authorized Garmin service center. Unauthorized repairs or modifications could void both the warranty and affect the airworthiness of the aircraft.
-
-  **CAUTION:** Never disconnect power to the system when loading a database. Power interruption during the database loading process could result in maintenance being required to reboot the system.
-
-  **CAUTION:** Avoid areas on the radar display that appear "shadowed" (gray). The accuracy of the intensity of returns in the shaded areas should be treated as suspect. Exercise extreme caution, making maneuvering decisions with this information in mind.
-
-  **CAUTION:** In Standby mode, the antenna is parked at the center line. It is always a good idea to put the radar in Standby mode before taxiing the aircraft to prevent the antenna from bouncing on the bottom stop and possibly causing damage to the radar assembly.
-
-  **NOTE** All visual depictions contained within this document, including screen images of the system panel and displays, are subject to change and may not reflect the most current system and aviation databases. Depictions of equipment may differ slightly from the actual equipment.
-


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


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

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

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

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

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

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



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

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



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



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



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




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





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





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

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

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

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

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

 **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.

SOFTWARE LICENSE AGREEMENT

BY USING THE DEVICE, COMPONENT OR SYSTEM MANUFACTURED OR SOLD BY GARMIN (“THE GARMIN PRODUCT”), YOU AGREE TO BE BOUND BY THE TERMS AND CONDITIONS OF THE FOLLOWING SOFTWARE LICENSE AGREEMENT. PLEASE READ THIS AGREEMENT CAREFULLY. Garmin Ltd. and its subsidiaries (“Garmin”) grants you a limited license to use the software embedded in the Garmin Product (the “Software”) in binary executable form in the normal operation of the Garmin Product. Title, ownership rights, and intellectual property rights in and to the Software remain with Garmin and/or its third-party providers. You acknowledge the Software is the property of Garmin and/or its third-party providers and is protected under the United States of America copyright laws and international copyright treaties. You further acknowledge the structure, organization, and code of the Software are valuable trade secrets of Garmin and/or its third-party providers and the Software in source code form remains a valuable trade secret of Garmin and/or its third-party providers. You agree not to reproduce, decompile, disassemble, modify, reverse assemble, reverse engineer, or reduce to human readable form the Software or any part thereof or create any derivative works based on the Software. You agree not to export or re-export the Software to any country in violation of the export control laws of the United States of America.

Blank Page

Record of Revisions				
Part Number	Revision	Date	Page Range	Description
190-02526-00	A	11/2018	All	Initial Release at GDU 20.81
190-02526-01	A	06/2021	All	Production Release at GDU 20.92 Updated Warnings/Cautions/Notes Added Surfacewatch Added WireAware Updated Altimeter Information Updated CAS Messages Updated System Messages Updated Weather Radar Information Updated Terrain Avoidance Information

Blank Page

SECTION 1 SYSTEM OVERVIEW		
1.1 System Description	1	
1.2 System Controls	4	
PFD/MFD Controls	4	
Secure Digital (SD) Cards	7	
1.3 System Operation	8	
Applying Power to the System	8	
Normal Operation	8	
Reversionary Mode	9	
System Annunciations	10	
System Status	11	
AHRS Operation	12	
GPS Receiver Operation	14	
1.4 Accessing System Functionality	19	
Softkey Functions	19	
Menus	24	
MFD Page Groups	25	
Split Screen Functionality	27	
System Settings	28	
System Utilities	35	
1.5 Display Backlighting	40	
SECTION 2 FLIGHT INSTRUMENTS		
2.1 Flight Instruments	44	
Airspeed Indicator	44	
Attitude Indicator	46	
Altimeter	47	
Vertical Speed Indicator (VSI)	51	
Vertical Deviation Indicator (VDI)	51	
Vertical Navigation (VNV) Indications	52	
Horizontal Situation Indicator (HSI)	53	
Course Deviation Indicator (CDI)	58	
2.2 Supplemental Flight Data	65	
Temperature Displays	65	
Wind Data	65	
2.3 Garmin Synthetic Vision Technology (SVT)	67	
SVT Operation	68	
SVT Features	69	
Field of View	79	
2.4 PFD Annunciations and Alerting Functions	81	
Marker Beacon Annunciations	81	
Altitude Alerting	81	
Baro Transition Alerts	81	
BARO QFE Indications	82	
Low Altitude Annunciation	83	
Minimum Altitude Alerting	83	
Radar Altimeter	84	
2.5 Abnormal Operations	86	
Abnormal GPS Conditions	86	
Garmin SVT Troubleshooting	87	
Garmin SVT In Reversionary Mode	87	
Unusual Attitudes	87	
Garmin SVT Unusual Attitudes	88	
SECTION 3 ENGINE INDICATION SYSTEM (EIS)		
3.1 Engine Display	90	
3.2 Engine Page	93	
Fuel Calculations	96	
3.3 EIS Display (Reversionary Mode)	97	
SECTION 4 AUDIO PANEL AND CNS		
4.1 Overview	99	
PFD Controls and Frequency Display	100	
Audio Panel Controls	102	
4.2 COM Operation	105	
COM Tuning Boxes	105	
COM Transceiver Manual Tuning	106	
Auto-Tuning the COM Frequency	106	
Frequency Spacing	109	
4.3 NAV Operation	111	
NAV Tuning Boxes	111	
NAV Radio Selection and Activation	112	
NAV Receiver Manual Tuning	112	
Auto-Tuning a NAV Frequency from the MFD	112	
Marker Beacon Receiver	115	
ADF/DME	116	
ADF Tuning	117	
DME Tuning	119	
4.4 Mode S Transponder	120	
Transponder Controls	120	
Transponder Mode Selection	121	
Entering a Transponder Code	123	
IDENT Function	124	
4.5 Additional Audio Panel Functions	125	
Power-Up	125	
Mono/Stereo Headsets	125	
Speaker	125	
Intercom	126	
Blue-Select Mode (Telephone/Entertainment Distribution)	128	
3D Audio	129	
Bluetooth	129	
Clearance Recorder and Player	130	
Entertainment Inputs	130	

4.6 Audio Panel Preflight Procedure..... 131

4.7 Abnormal Operation 132

 Stuck Microphone 132

 COM Tuning Failure..... 132

 Audio Panel Fail-Safe Operation..... 132

 Reversionary Mode 132

SECTION 5 FLIGHT MANAGEMENT

5.1 Introduction 133

 PFD Navigation Status Box and MFD Data Bar 135

5.2 Using Map Displays..... 137

 Map Orientation 137

 Map Range 139

 Map Panning..... 141

 Measuring Bearing and Distance 143

 Topography 144

 Map Display Symbols..... 146

5.3 Waypoints 157

 Airports 158

 Non-Airport and User Created Waypoints 164

5.4 Airspaces..... 172

 Nearest Airspace 173

 Smart Airspace 175

5.5 Flight Planning..... 176

 Direct-To Navigation 177

 Selection and Modification Methods 180

 Flight Plan Display 182

 Creating a Basic Flight Plan 184

 Flight Plan Waypoint and Airway Modifications..... 186

 Flight Plan Waypoint Constraints 194

 Flight Plan Vertical Navigation..... 198

 Vertical Navigation Direct-To 204

 Flight Plan Operations 204

 Managing Flight Plans 215

5.6 Procedures 224

 Departures 225

 Arrivals 228

 Approaches 230

5.7 Trip Planning 242

 Trip Statistics..... 242

 Fuel Statistics..... 243

 Other Statistics..... 244

5.8 Abnormal Operation 246

 Dead Reckoning 246

SECTION 6 HAZARD AVOIDANCE

6.1 Data Link Weather..... 250

 Activating Data Link Weather Services..... 251

 Weather Product Age 254

 Displaying Data Link Weather Products 258

 Connex Data Requests..... 267

 Weather Product Overview 270

 FIS-B Weather Status..... 304

 Abnormal Operations for Garmin Connex Weather 306

6.2 Stormscope Lightning Detection System..... 308

 Using the Stormscope Page..... 308

 Setting Up Stormscope on the Navigation Map 310

6.3 Airborne Color Weather Radar..... 312

 System Description..... 312

 Principles of Airborne Weather Radar..... 312

 NEXRAD and Airborne Weather Radar 313

 Antenna Beam Illumination 314

 Safe Operating Distance 318

 Basic Antenna Tilt and Range Setup..... 319

 Weather Mapping and Interpretation 322

 Ground Mapping and Interpretation..... 335

 Additional Weather Radar Displays..... 336

 System Status..... 340

6.4 Terrain Displays..... 342

 Relative Terrain Symbology 343

 Wire Obstacle Information and Alerting..... 348

 Alerting Displays 349

 Forward Looking Terrain Avoidance 352

 System Status..... 353

 TAWS-B Abnormal operations..... 354

6.5 Traffic Information Service (TIS) 355

 Displaying Traffic Data 356

 Traffic Map Page 357

 TIS Alerts..... 358

 System Status..... 360

6.6 TAS Traffic..... 362

 TAS Theory of Operation 362

 TAS Alerts..... 366

 System Test 367

 Operation..... 368

 System Status..... 373

6.7 ADS-B Traffic 374

 ADS-B System Overview 374

 Conflict Situational Awareness & Alerting (CSA)..... 377

 Airborne and Surface Applications..... 379

 Traffic Description 380

 Operation..... 381

 ADS-B System Status..... 386

SECTION 7 AUTOMATIC FLIGHT CONTROL SYSTEM

7.1 AFCS Overview.....389
 AFCS Controls390
 Additional AFCS Controls391
 Basic Autopilot Operation392

7.2 Flight Director Operation.....393
 Activating the Flight Director393
 AFCS Status Box.....394
 Flight Director Modes.....394
 Command Bars395

7.3 AFCS Modes396
 Vertical Modes396
 Flight Level Change Mode (FLC)400
 Lateral Modes401

7.4 Autopilot and Yaw Damper Operation.....417
 Flight Control417
 Engagement.....418
 Control Wheel Steering418
 Disengagement.....418

7.5 AFCS Annunciations and Alerts.....420

7.6 Abnormal Operation421
 Overspeed Protection.....421
 Underspeed Protection.....421

SECTION 8 ADDITIONAL FEATURES

8.1 SafeTaxi.....426

8.2 SurfaceWatch (Optional)428
 Information Box428
 Alerts430
 SurfaceWatch Setup.....432

8.3 Charts.....434
 FliteCharts (Optional).....435
 ChartView (Optional)441
 IFR/VFR Charts (Optional)445

8.4 Database Management.....448
 Cycle Number and Revision448

8.5 SiriusXM Satellite Radio (Optional)451
 Activating SiriusXM Satellite Radio Services451
 Using SiriusXM Radio.....452
 SiriusXM Data Link Receiver Troubleshooting455

8.6 Satellite Telephone and Datalink Services (Optional)457
 Registering the System with Garmin Connex.....457
 Disabling/Enabling the Iridium Transceiver.....458
 Contacts.....459
 Telephone Communication.....460
 Text Messaging (SMS).....465

8.7 Connex (Optional).....476

8.8 Maintenance WIFI Connections.....478

8.9 Data Logging481

8.10 Electronic Stability and Protection (ESP™) (Optional).....483
 Roll Engagement.....484
 Pitch Engagement.....485
 High Airspeed Protection486

8.11 Auxiliary Video (Optional).....487
 Video Setup.....487
 Display Selection488
 Zoom/Range.....489

8.12 Enhanced Electronic Checklist490
 Enhanced Checklist features490

APPENDICES

Annunciations and Alerts497
 CAS and Alert Definition Prioritization498

Database Management513
 Loading Updated Databases513
 Updating Databases with SD card or Wireless Transceiver Card.....514
 Updating Databases with Garmin Pilot / Wireless Transceiver517
 Deleting Databases525
 Magnetic Field Variation Database Update526

Aviation Terms, Abbreviations, and Acronyms.....527

Frequently Asked Questions.....541

INDEX

Index I-1

Blank Page

SECTION 1 SYSTEM OVERVIEW

1.1 SYSTEM DESCRIPTION

This section provides an overview of the G1000 NXi Integrated Avionics System as installed in the Diamond DA42NG. The system is an integrated flight control system that presents flight instrumentation, position, navigation, communication, and identification information to the flight crew using flat-panel color displays. The system consists of the following Line Replaceable Units (LRUs):

- **GDU 1050** (1) – The Display Unit is configured as a Primary Flight Display (PFD) that features a 10 inch high resolution LED backlit display. The display communicates with the Multifunction Display (MFD) and with the #1 Integrated Avionics Unit.
- **GDU 1055** (1) – The Display Unit is configured as a Multifunction Display (MFD) that features a 10 inch high resolution LED backlit display. The display communicates with the PFD and with the #2 Integrated Avionics Unit.
- **GIA 64W** (2) – The Integrated Avionics Unit (IAU) functions as the main communication hub, linking all LRUs with the PFD and MFD. Each IAU contains a GPS SBAS receiver, VHF COM/NAV/GS receivers, a flight director (FD) and system integration microprocessors. #1 IAU is paired with the PFD, and #2 IAU is paired with the MFD. The IAUs are not paired together and do not communicate with each other directly.
- **GDC 72** (1) – The Air Data Computer (ADC) processes data from the pitot/static system as well as the Outside Air Temperature (OAT) probe. This unit provides pressure altitude, airspeed, vertical speed and OAT information to the system. It communicates with both IAUs, the PFD, MFD, and AHRS (it also interfaces directly with the OAT probe). The ADC is designed to operate in Reduced Vertical Separation Minimum (RVSM) airspace.
- **GRS 79** (1) – The Attitude and Heading Reference System (AHRS) provides aircraft attitude and heading information to the PFD, MFD and both IAUs. The AHRS contains advanced sensors (including accelerometers and rate sensors) and interfaces with the Magnetometer to obtain magnetic field information, with the ADC to obtain air data, and with both IAUs to obtain GPS information. AHRS operation is discussed later in this section.
- **GEA 71B** (1) – The Engine Airframe Unit receives and processes signals from the engine and airframe sensors. This unit communicates with both IAUs.
- **GMU 44** (1) or **GMU 44B** (1) – The Magnetometer measures local magnetic field. Data is sent to the AHRS for processing to determine aircraft magnetic heading. The Magnetometer communicates with and receives power directly from the AHRS.
- **GMA 1360** (1) – The Audio Panel integrates NAV/COM digital audio, intercom system and marker beacon controls and offers Bluetooth® capability. This unit also enables manual control of the display reversionary mode (via the red **DISPLAY BACKUP** Button). It communicates with both IAUs.
- **GTX 335R** (1) or **GTX 345R** (1 alternate) – The solid state Transponder provides Mode A, C, S capabilities and ADS-B Out functionality. The GTX 345R additionally provides ADS-B In functionality. The Transponder can be controlled from the PFD. The Transponder communicates with both IAUs.
- **GSA 80** (1) and **GSA 81** (3) – The Servos are used for the automatic control of roll, pitch, yaw, and pitch trim. These units interface with each IAU.
- **GSM 86** (4) – The Servo Gearboxes are responsible for transferring the output torque of the servo actuators to the mechanical flight-control surface linkages.

- **GDL 69A SXM** (1 optional) – The Satellite Datalink Radio Receiver receives weather information, as well as digital audio entertainment. Subscriptions to the SiriusXM Weather or SiriusXM Satellite Radio are required to enable services. The unit communicates with the #1 IAU.
- **GRA 55** (1 optional) – The Radar Altimeter provides altitude above the ground information, called radar altitude or radio altitude. It is connected to #2 IAU.
- **GSR 56** (1 optional) – The Iridium Transceiver provides voice communication by means of pilot and copilot headsets. The transceiver can also send and receive short message service (SMS) text messages and receive data link weather products from the Garmin Connex weather service through the Iridium satellite network. It is connected to #2 IAU.
- **GWX 70** (1 optional) or **GWX 75** (1 optional) – The Weather Radar provides airborne weather and ground mapped radar data to the MFD.
- **GTS 800** (1 optional) – The Traffic Advisory System (TAS) uses active interrogations of Mode S and Mode C transponders to provide traffic advisories to the pilot, independent of the air traffic control system.
- **GDL 59** (1 optional) – The Wi-Fi Datalink Transceiver provides Wi-Fi capability. It communicates with the #2 IAU.
- **Flight Stream 510** (1 optional) – The Flight Stream Wireless Transceiver provides wireless Bluetooth® connectivity between a compatible tablet/mobile device and the avionics system. 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 Wi-Fi link. The system is capable of interfacing with the following non-Garmin optional components:
 - **KN 63** (1) DME
 - **RA 3502** (1) ADF
 - **TAS 600** (1) Traffic Advisory System
 - **WX-500** (1) Stormscope Lightning Sensor
 - **Max-Viz 600** (1) Enhanced Vision System

A top-level system block diagram is shown in Figure 1-1.

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

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

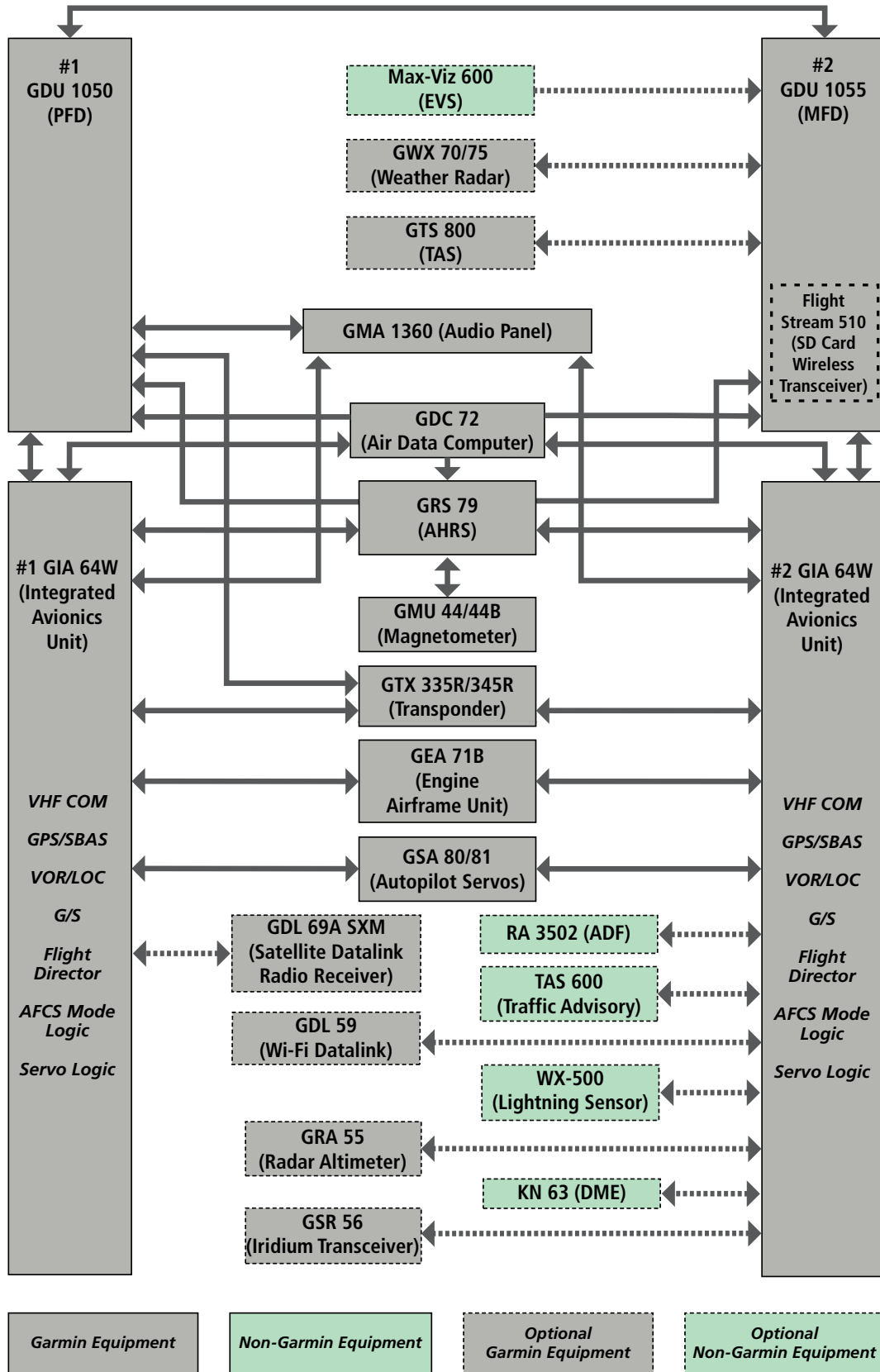


Figure 1-1 System Block Diagram

1.2 SYSTEM CONTROLS

The system controls have been designed to simplify operation of the system and minimize workload and the time required to access sophisticated functionality. These controls are located on the PFD and MFD bezels and the Audio Panel. The controls for the PFD and MFD are discussed within this section.

NOTE: The Audio Panel is described in the Audio Panel & CNS Section.

PFD/MFD CONTROLS

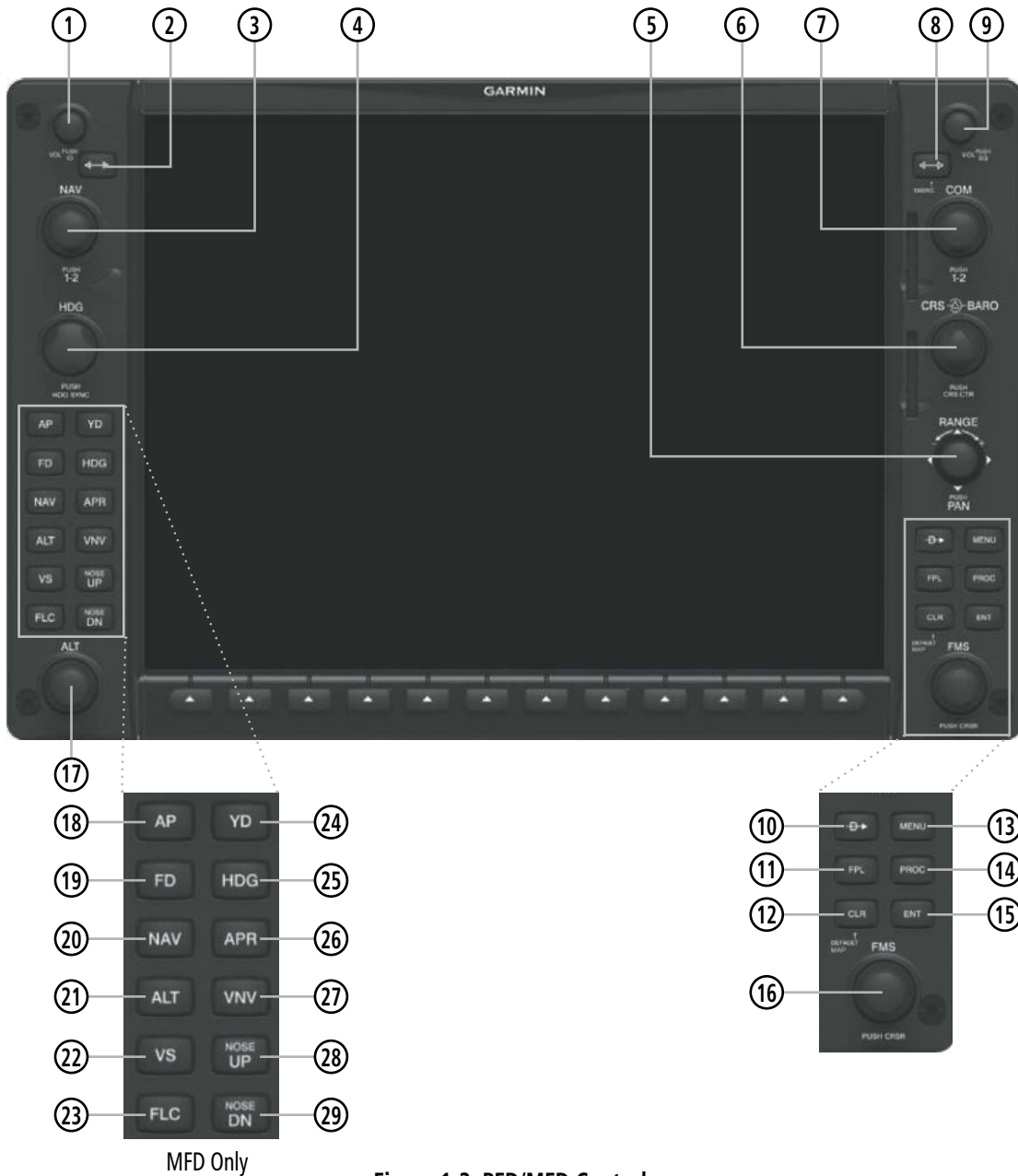


Figure 1-2 PFD/MFD Controls

- ① **NAV VOL/ID Knob** Turn to control NAV audio volume (shown in the NAV frequency box as a percentage). Push to toggle Morse code identifier audio ON/OFF.
- ② **NAV Frequency Transfer Key** Transfers the standby and active NAV frequencies.
- ③ **NAV Knob** Turn to tune NAV receiver standby frequencies (large knob for MHz; small for kHz). Push to toggle cyan tuning box between NAV1 and NAV2.
- ④ **Heading Knob** Turn to manually select a heading. When operating in heading select mode, this knob provides the heading reference to the flight director. Push to display a digital heading momentarily to the left of the HSI and synchronize the Selected Heading to the current heading.
- ⑤ **Range Knob/Joystick** Turn to change map range. Push to activate map pointer for map panning.
- ⑥ **CRS/BARO Knob** Turn large knob for altimeter barometric pressure setting. Turn small knob to set the pilot-selected course on the HSI when the VOR1, VOR2, or OBS/SUSP Mode is selected. Pushing this knob centers the CDI on the currently selected VOR. The pilot-selected course provides course reference to the pilot-side flight director when operating in navigation and approach modes. Push to re-center the CDI and return course pointer directly TO bearing of active waypoint/station.
- ⑦ **COM Knob** Turn to tune COM transceiver standby frequencies (large knob for MHz; small for kHz). Push to toggle cyan tuning box between COM1 and COM2. The selected COM (green) is controlled with the **COM MIC** Key on the Audio Panel.
- ⑧ **COM Frequency Transfer Key (EMERG)** Transfers the standby and active COM frequencies. Press and hold two seconds to tune the emergency frequency (121.5 MHz) automatically into the active frequency field.
- ⑨ **COM VOL/SQ Knob** Turn to control COM audio volume level (shown as a percentage in the COM frequency box). Push to turn the COM automatic squelch ON/OFF.
- ⑩ **Direct-to Key (D→)** Activates the direct-to function and 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).
- ⑪ **FPL Key** Accesses flight plan information and allows for creating and editing the active flight plan.
- ⑫ **CLR Key (DFLT MAP)** Erases information, cancels entries, or removes menus. Press and hold to display the 'Map – Navigation Map' Page (MFD only).
- ⑬ **MENU Key** Displays a context-sensitive list of options for accessing additional features or making setting changes.
- ⑭ **PROC Key** Gives access to IFR departure procedures (DPs), arrival procedures (STARs), and approach procedures (IAPs) for a flight plan or selected airport.
- ⑮ **ENT Key** Validates/confirms menu selection or data entry.

- SYSTEM OVERVIEW
- FLIGHT INSTRUMENTS
- EIS
- AUDIO PANEL & CNS
- FLIGHT MANAGEMENT
- HAZARD AVOIDANCE
- AFCS
- ADDITIONAL FEATURES
- APPENDICES
- INDEX

SYSTEM OVERVIEW

FLIGHT INSTRUMENTS

EIS

AUDIO PANEL & CNS

FLIGHT MANAGEMENT

HAZARD AVOIDANCE

AFCS

ADDITIONAL FEATURES

APPENDICES

INDEX

- 16 **FMS Knob**
(Flight Management System Knob)

Push to turn the selection cursor ON/OFF.

 - **Data Entry:** With cursor ON, turn to enter data in the highlighted field (large knob moves cursor location; small knob selects character for highlighted cursor location).
 - **Scrolling:** When a list of information is too long for the window/box, a scroll bar appears, indicating more items to view. With cursor ON, turn large knob to scroll through the list.
 - **Page Selection:** Turn knob on MFD to select the page to view (large knob selects a page group; small knob selects a specific page from the group).
- 17 **ALT Knob**

Sets the Selected Altitude in the selected altitude box (the large knob selects the thousands, the small knob selects the hundreds). In addition to providing the standard system altitude alert function, Selected Altitude provides an altitude setting for the altitude capture/hold mode of the AFCS.
- 18 **AP Key¹**

Engages/disengages the autopilot and flight director in the default vertical and lateral modes.
- 19 **FD Key¹**

Activates/deactivates the flight director only. Pressing the **FD** Key turns on the flight director in the default vertical and lateral modes. Pressing the **FD** Key again deactivates the flight director and removes the command bars, unless the autopilot is engaged. If the autopilot is engaged, the **FD** Key is disabled.
- 20 **NAV Key¹**

Selects/deselects the navigation mode.
- 21 **ALT Key¹**

Selects/deselects the altitude hold mode.
- 22 **VS Key¹**

Selects/deselects the vertical speed mode.
- 23 **FLC Key¹**

Selects/deselects the flight level change mode.
- 24 **YD Key¹**

Engages/disengages the yaw damper.
- 25 **HDG Key¹**

Selects/deselects the heading select mode.
- 26 **APR Key¹**

Selects/deselects the approach mode.
- 27 **VNV Key¹**
(if equipped)

Selects/deselects vertical navigation mode.
- 28 **NOSE UP Key¹**

Controls the active pitch reference for the pitch hold, vertical speed, and flight level change modes.
- 29 **NOSE DN Key¹**

Controls the active pitch reference for the pitch hold, vertical speed, and flight level change modes.

¹Key appears only on the MFD.

The **NAV**, **CRS/BARO**, **COM**, **FMS**, and **ALT** knobs are concentric dual knobs, each having a small (inner) and large (outer) control portion. When a portion of the knob is not specified in the text, either may be used.

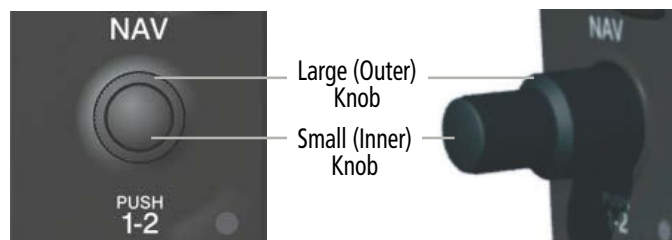





Figure 1-3 Dual Concentric Knob

SECURE DIGITAL (SD) CARDS

-  **NOTE:** DO NOT use the database SD cards for any purpose other than database storage.
-  **NOTE:** Refer to the Appendices for instructions on updating the aviation databases.
-  **NOTE:** Ensure the system is powered off before inserting the SD card.

The data card slots on the PFD and MFD use Secure Digital (SD) cards and are located on the top right portion of the display bezels. Each display bezel is equipped with two SD card slots. SD cards are used for various databases, system software updates, recording flight data, and storing electronic documents. Also, flight plans may be imported or exported from an SD card in the MFD. Not all SD cards are compatible with the system. Use only SD cards supplied by Garmin or the aircraft manufacturer.

Inserting 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.

Removing an SD card

Gently press on the SD card to release the spring latch and eject the card.

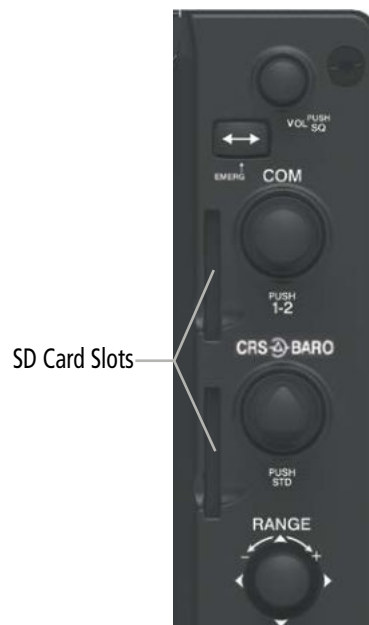


Figure 1-4 PFD/MFD Display Bezel SD Card Slots

1.3 SYSTEM OPERATION

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

APPLYING POWER TO THE SYSTEM



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



NOTE: See the current version of the pertinent flight manual 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 processors, memory, external inputs, and outputs to provide safe operation.

The system momentarily displays test annunciations and illuminates annunciator lights on the Audio Panel and display bezels when power is applied. All annunciations and annunciator lights should be extinguished typically within the first minute of applying power.

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

When the MFD is powered on, the initial screen displays the following information:

- Copyright
- System Version
- Checklist Files Information
- Land Database Name and Version
- Safe Taxi Database Name and Expiration Date
- Terrain Database Name and Version
- Obstacle Database Name and Expiration Date
- Navigation Database Name and Expiration Date
- Airport Directory Name and Expiration Date
- ChartView Database Information
- FliteCharts Database Information
- IFR/VFR Chart Database Information
- Crew Profile

Current database information includes database type, cycle number, or valid operating dates. Review the listed information for currency (to ensure no databases have expired). Then, press the **ENT** Key or the right-most softkey on the MFD to acknowledge the information and continue.

NORMAL OPERATION



NOTE: In normal operating mode, the system automatically adjusts display and key backlighting via built in sensors. Further manual adjustment, if desired, can be made from the PFD or individual dimmer bus control for the desired display. In reversionary mode, backlighting can be adjusted from the remaining display.

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



Figure 1-5 System 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.

In the event of a display failure, the system automatically switches to reversionary (backup) mode. Reversionary mode may also be manually activated. In reversionary mode, all important flight information is presented on the remaining display in the same format as in normal operating mode.

If a display fails, the appropriate IAU interface is cut off. Thus, the IAU can no longer communicate with the remaining display, and the NAV and COM functions provided to the failed display by the IAU are flagged as invalid on the remaining display. The system reverts to backup paths for the AHRS, ADC, Engine/Airframe Unit, and Transponder, as required. The change to backup paths is completely automated for all LRUs and no pilot action is required.

Reversionary mode may be manually activated by pressing the Audio Panel's red **DISPLAY BACKUP** Button. Pressing this button again deactivates reversionary mode.

NAV1 and COM1 Flagged Invalid Due to Failed PFD



DISPLAY BACKUP Button
Manually Activates/Deactivates Reversionary Mode on Both Displays

Figure 1-6 Reversionary Mode (Failed PFD)

SYSTEM ANNUNCIATIONS

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



NOTE: For a detailed description of all annunciations and alerts, refer to the Appendices. Refer to the current version of the pertinent flight manual for additional information regarding pilot responses to these annunciations.

System Annunciation	Comment
	AHRS 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 navigational use. Note that AHRS utilizes GPS inputs during normal operation. AHRS operation may be degraded if GPS signals are not present (see pertinent flight manual).
	Display system is not receiving airspeed input from the AHRS.

- SYSTEM OVERVIEW
- FLIGHT INSTRUMENTS
- EIS
- AUDIO PANEL & CNS
- FLIGHT MANAGEMENT
- HAZARD AVOIDANCE
- AFCS
- ADDITIONAL FEATURES
- APPENDICES
- INDEX






System Annunciation	Comment
	Display system is not receiving vertical speed input from the AHRS.
	Display system is not receiving valid heading input from the AHRS or Magnetometer.
	Display system is not receiving altitude input from the AHRS.
	Display system is not receiving valid temperature information.
	Display system is not receiving valid transponder information.
Other Various Red or Amber 'X' Indications	A red or amber 'X' through any other display field (such as engine instrumentation fields), indicates the field is not receiving valid data.

Table 1-1 System Failure Annunciations

SYSTEM STATUS

The status and software version numbers of detected LRUs can be checked on the 'Aux – System Status' Page. Pertinent information on all system databases is also displayed. Active LRUs are indicated by green check marks; failed 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, press 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.



Figure 1-7 Example 'Aux - System Status' Page

The **LRU** and **ARFRM** softkeys on the 'Aux - System Status' Page select the applicable box ('LRU Information' or 'Airframe') through which the **FMS** Knob can be used to scroll information.

Pressing the **MFD1 DB** Softkey (label annunciator turns green, indicating the softkey is selected) places the cursor in the 'MFD1 Database' Box. Use the **FMS** Knob to scroll through database information for the MFD. Pressing the softkey again will change the softkey label to **PFD1 DB**. PFD1 database information is now displayed in the 'PFD1 Database' Box. Pressing the softkey a third time will change the softkey label back to **MFD1 DB**.

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

AHRS OPERATION



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



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 via system messages.

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.

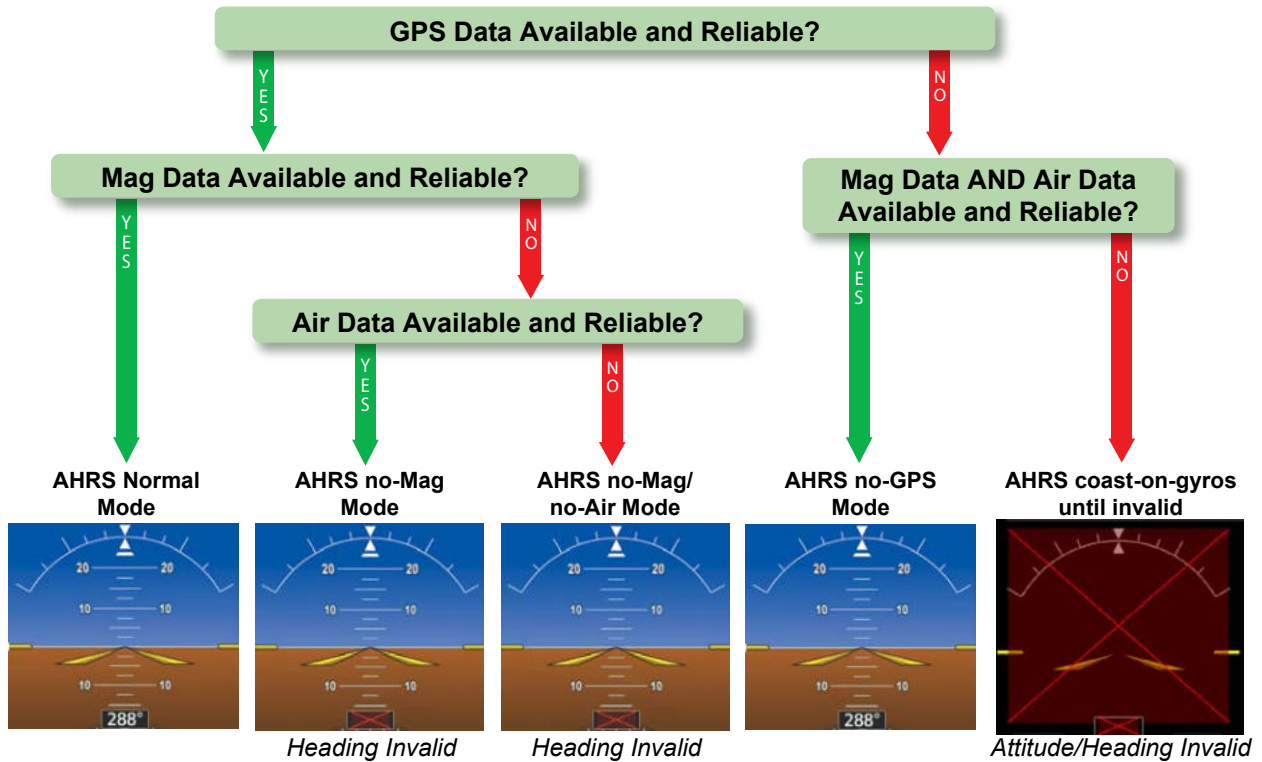


Figure 1-8 AHRS Operation

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's).

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 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.

Internal system checking is performed to ensure both GPS receivers are providing accurate data to the system. In some circumstances, both GPS receivers may be providing accurate data, but one receiver may be providing a better GPS solution than the other. In this case, the GPS receiver producing the better solution is automatically coupled to the PFD.

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

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

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 **GPS1** or **GPS2** Softkey.

Or:

- a) Press the **MENU** Key.
- b) Use the **FMS** Knob to highlight the receiver which is not selected ('GPS1' or 'GPS2') and press the **ENT** Key.

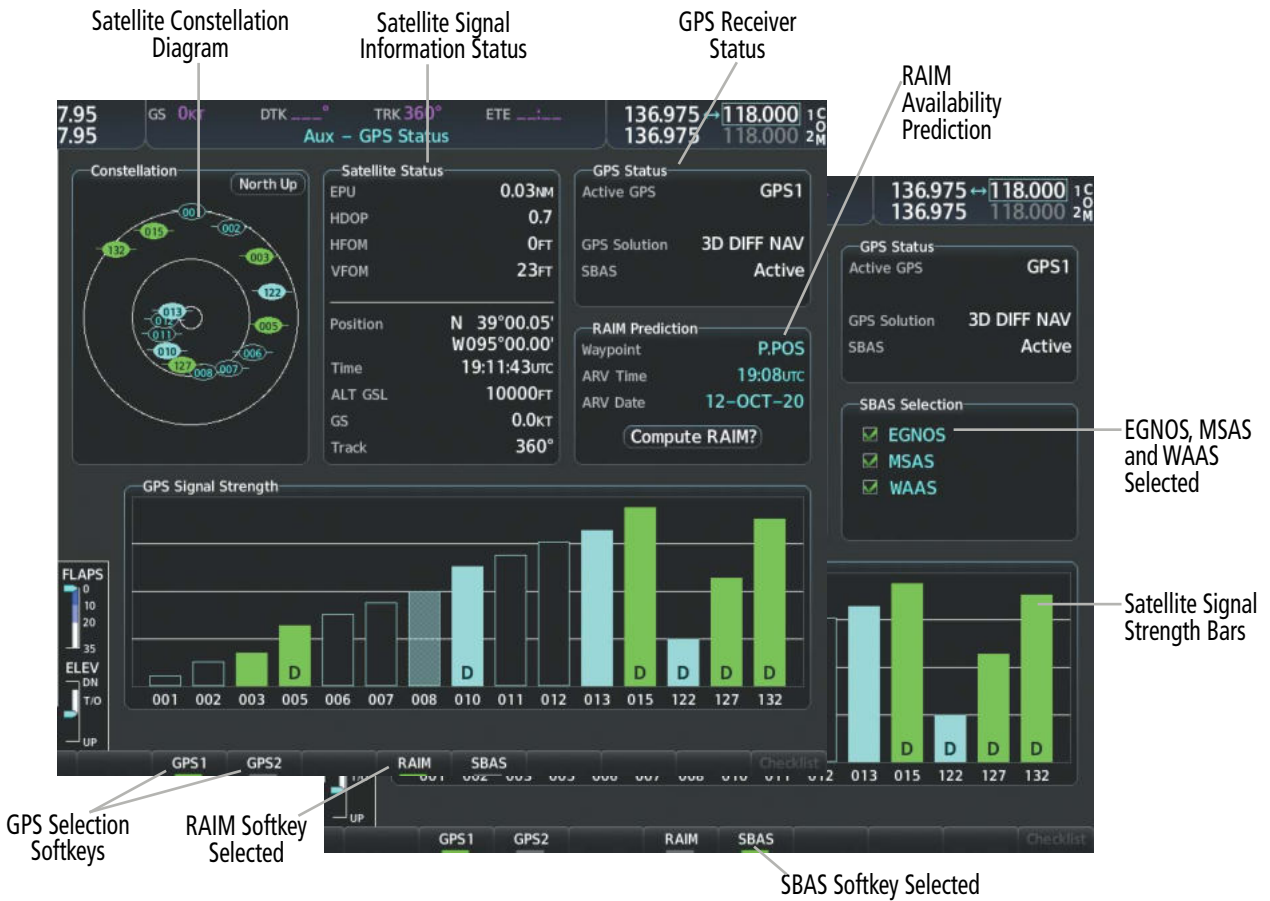


Figure 1-9 'Aux – GPS Status' Page (RAIM or SBAS Selected)

SATELLITE CONSTELLATION DIAGRAM

The 'Aux – GPS Status' Page displays satellites currently in view 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 Pseudorandom Noise (PRN) number (i.e., satellite identification number). Satellites whose signals are currently being used are represented by solid ovals.

SATELLITE SIGNAL INFORMATION 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 the actual position has a 95% probability of laying. EPU is a statistical error indication and not an actual error measurement.

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

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

GPS RECEIVER STATUS

The GPS solution type (ACQUIRING, 2D NAV, 2D DIFF NAV, 3D NAV, 3D DIFF NAV) for the active GPS receiver (GPS1 or GPS2) is shown on the upper right of the 'Aux – 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. Satellite-Based Augmentation System (SBAS) indicates 'INACTIVE'. When acquisition is complete, the solution status indicates '3D DIFF NAV' and SBAS indicates 'ACTIVE'.

RECEIVER AUTONOMOUS INTEGRITY MONITORING (RAIM) PREDICTION

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

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

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

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



NOTE: The system's RAIM prediction capability does not meet all RAIM prediction requirements. Reference the RAIM/Fault Detection and Exclusion (FDE) Prediction Tool at flygarmin.com, as required.

Predicting RAIM availability at a selected waypoint:

- 1) Use the **FMS** Knob to select the 'Aux – GPS Status' Page.
- 2) If necessary, press the **RAIM** Softkey.
- 3) Push the **FMS** Knob. The 'Waypoint' Field is highlighted.
- 4) Turn the small **FMS** Knob to display the 'Waypoint Information' Window.
- 5) 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 flight plan list is populated only when navigating a flight plan).
- b) Turn the small **FMS** Knob clockwise to display the Nearest, Recent, or User waypoints, if required.

- c) Turn the large **FMS** Knob clockwise to select the desired waypoint. Press the **ENT** Key. The system automatically fills in the identifier, facility, and city fields with the information for the selected waypoint.
 - d) Press the **ENT** Key again 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) Use the **FMS** Knob to select the 'Aux – GPS Status' Page.
- 2) If necessary, press the **RAIM** Softkey.
- 3) Push the **FMS** Knob. 'P.POS' in the 'Waypoint' Field is highlighted.
- 4) Press the **ENT** Key to accept the present position waypoint entry.
- 5) Use the **FMS** Knob to enter an arrival time and press the **ENT** Key.
- 6) Use the **FMS** Knob to enter an arrival date and press the **ENT** Key.
- 7) 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 EGNOS, WAAS and MSAS enabling/disabling.

Disabling SBAS:

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

GPS SATELLITE SIGNAL STRENGTHS

The 'Aux – 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 — 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 FUNCTIONS

Selection softkeys are located along the bottom of the displays. 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 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.



Figure 1-10 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. 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 column. 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 in Level 2 provides yet another set of softkey functions, those new available softkeys are then explained in the Level 3 column, etc.

Softkeys are listed in order by row for each level as they appear on the screen left to right. 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).

Level 1	Level 2	Level 3	Level 4	Description
CAS				When available, opens CAS scrolling buttons.
	CAS Up			When available, scrolls up through CAS messages.
	CAS Dn			When available, scrolls down through CAS messages.
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, HSI, 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.

SYSTEM OVERVIEW

FLIGHT INSTRUMENTS

EIS

AUDIO PANEL & CNS

FLIGHT MANAGEMENT

HAZARD AVOIDANCE

AFCS

ADDITIONAL FEATURES

APPENDICES

INDEX

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			Selects desired amount of terrain detail: - Topo : Displays topographical data (e.g., coastlines, terrain, rivers, lakes) and elevation scale on PFD map. - REL : Displays relative terrain information on the PFD map. - Off : Removes terrain.
	WX LGND			Displays/removes the name of the selected weather data provider and the weather product icon and age box (for enabled weather products).
	NEXRAD			Displays NEXRAD weather and coverage on PFD map (optional).
	METAR			Displays METAR information on Inset Map (optional).
	Lightning			Adds/removes the display of lightning information on PFD map (optional).
		LTNG Off		Disables lightning function on PFD map. The softkey annunciator is green when the lightning function is off.
		Datalink		Selects the datalink lightning source for the PFD map.
		STRMSCP		Adds or removes the display of Stormscope information on the PFD map.
	WX Radar			Displays the airborne weather radar overlay on HSI Map (optional).
	RDR Opt			Displays softkeys for airborne weather radar options.
		Mode		Displays softkeys for weather radar mode selection.
			Standby	Selects standby weather radar mode.
			Weather	Activates weather radar mode.
			Ground	Activates ground map weather radar mode.
		Gain -		Decreases weather radar gain setting.
		Gain +		Increases weather radar gain setting.
		GCS		Removes ground clutter from the displays.
		Features		Displays softkeys for weather radar feature selection.
			WX Alert	Provides message to crew when a weather alert is within 10 degrees of aircraft heading.
			WX Watch	Activates Weather Attenuated Color Highlight (WATCH).
			ACT	Activates Altitude Compensated Tilt (ACT).
			TURB	Activates the identification of potential erratic movement of high altitude air mass associated winds (i.e., turbulence).
TFC Map				Replaces the PFD map with a dedicated traffic display.
PFD Opt				Displays second-level softkeys for additional PFD options.

Level 1	Level 2	Level 3	Level 4	Description
	SVT			Displays additional SVT overlay softkeys (optional).
		Pathways		Displays Pathways 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.
		Wire		Displays power lines on the synthetic vision display.
	Wind			Displays the wind option softkeys.
		Off		Wind information not displayed.
		Option 1		Wind displayed as headwind/tailwind and crosswind arrows with numeric speed components.
		Option 2		Wind displayed as a single arrow which points in the direction the wind is blowing relative to the nose of the aircraft, and a digital display of the magnitude of wind velocity.
		Option 3		Wind displayed as a single arrow which points in the direction the wind is blowing relative to the nose of the aircraft, with a digital display of the headwind/tailwind component of wind velocity, and digital display of the crosswind component of wind velocity.
	ADF/DME			Displays ADF and/or DME information (optional).
	Bearing 1			Cycles the Bearing 1 Information Window through NAV1, NAV2, GPS/waypoint identifier and GPS-derived distance information, ADF/DME frequency, and Off.
	Bearing 2			Cycles the Bearing 2 Information Window through NAV1, NAV2, GPS/waypoint identifier and GPS-derived distance information, ADF/DME frequency, and Off.
	ALT Units			Displays softkeys to select altitude unit parameters.
		Meters		Displays Altimeter settings in meters.
		IN		Displays the BARO setting as inches of mercury.
		HPA		Displays 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 GPS, NAV1, and NAV2 navigation modes on the CDI.
ADF/DME				Displays the 'ADF/DME Tuning' Window, allowing selection and tuning of the ADF and DME (optional).
XPDR				Displays the transponder selection softkeys.
	Standby			Selects transponder standby mode (transponder does not reply to any interrogations).

SYSTEM OVERVIEW

FLIGHT INSTRUMENTS

EIS

AUDIO PANEL & CNS

FLIGHT MANAGEMENT

HAZARD AVOIDANCE

AFCS

ADDITIONAL FEATURES

APPENDICES

INDEX

Level 1	Level 2	Level 3	Level 4	Description
	On			Activates transponder (transponder replies to identification interrogations).
	ALT			Selects 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 'References' Window.
Nearest				Displays 'Nearest Airports' Window.
Alerts or Message				Displays 'Alerts' Window. System generated messages cause the Alerts Softkey to change to a flashing Message Softkey. Pressing the Message Softkey opens the 'Alerts' Window, acknowledges the message, and the softkey reverts to Alerts .

Table 1-2 PFD Softkeys

MFD SOFTKEYS

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

The following table provides an example of the MFD softkey functions accessed from the 'Map – Navigation Map' Page. 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
Engine			Displays the 'EIS – Engine' Page and second-level engine softkeys; press again to exit page (see the EIS Section for more information).
	Engine		Returns to previously shown softkeys.
	DEC Fuel		Decreases calculated fuel remaining by 1 gallon for each softkey press.
	INC Fuel		Increases calculated fuel remaining by 1 gallon for each softkey press.
	RST Fuel		Resets calculated fuel remaining to the maximum fuel capacity (50 gallons).
Map Opt			Displays map softkey selectable features.
	Traffic		Displays traffic information on the 'Map – Navigation Map' Page.

Level 1	Level 2	Level 3	Description
	Inset		Displays second level softkeys for the VSD Inset.
		Off	Removes VSD Inset from 'Map – Navigation Map' Page.
		VSD	Displays VSD Inset profile information of terrain/obstacles along the current track, vertical track vector and Selected Altitude.
		VSD	Determines information displayed on VSD Inset: <ul style="list-style-type: none"> - Auto: Automatically displays either VSD profile information for active flight plan 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.
	TER		Selects desired amount of terrain detail: <ul style="list-style-type: none"> - 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 MFD map.
	AWY		Displays airways on the map; cycles through the following: <ul style="list-style-type: none"> - 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		Adds or removes the display of Stormscope information on the 'Map – Navigation Map' Page (optional).
	NEXRAD		Displays NEXRAD weather information on the 'Map – Navigation Map' Page (optional).
	XM LTNG		Displays XM lightning information on the 'Map – Navigation Map' Page (optional).
	METAR		Displays METAR information on MFD Map (optional).
	Legend		Displays legends for the displayed weather products (optional).
	WX Radar		Displays weather radar overlay (optional).
Detail			Selects desired amount of map detail: <ul style="list-style-type: none"> - 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.
Charts			Displays optional airport and terminal procedure charts, when available.
	CHRT Opt		Displays chart display settings softkeys, when available.
		ROT CCW	Rotates chart 90 degrees counter clockwise.
		ROT CW	Rotates chart 90 degrees clockwise.
		Fit WDTN	Chart zoom adjusted to fill width of display.
		Full SCN	When the annunciator bar is green, full screen mode is enabled. The annunciator bar is grey when in split screen mode.

- SYSTEM OVERVIEW
- FLIGHT INSTRUMENTS
- EIS
- AUDIO PANEL & CNS
- FLIGHT MANAGEMENT
- HAZARD AVOIDANCE
- AFCS
- ADDITIONAL FEATURES
- APPENDICES
- INDEX

Level 1	Level 2	Level 3	Description
	SYNC		Displays the chart associated with the current phase of flight.
	Info		Returns to the selected airport information chart (Airport Diagram, Alternate Minimums, Climb/Descent Table, Diverse Vector Area, Hot Spot, INOP Components, LAHSO, and Takeoff Minimums).
	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.
	Charts		Displays optional airport and terminal procedure charts, when available.
	Checklist		Displays optional checklists, when available.
Checklist			Displays optional checklists, when available.

Table 1-3 MFD 'Map – 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 this section. Softkey selection does not display menus or submenus.

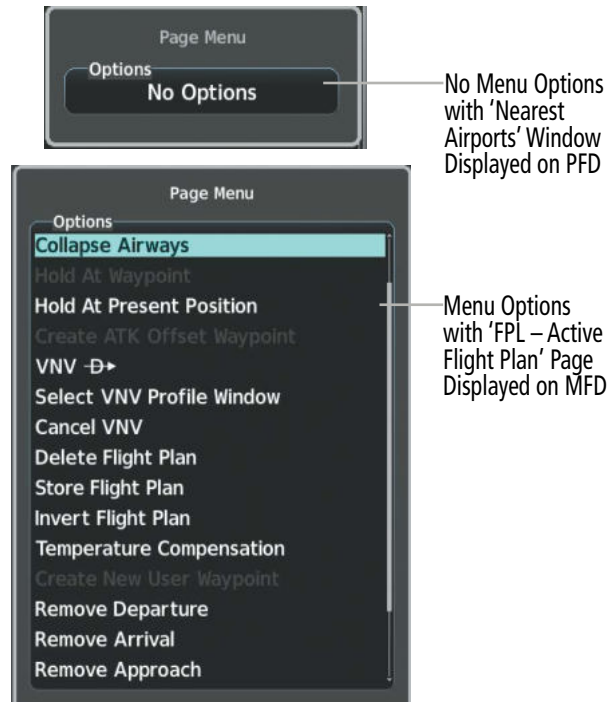


Figure 1-11 Page Menu Examples

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. Pushing the **FMS** Knob also removes the displayed menu.

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, the active title of the page changes while the page name in the list remains the same.

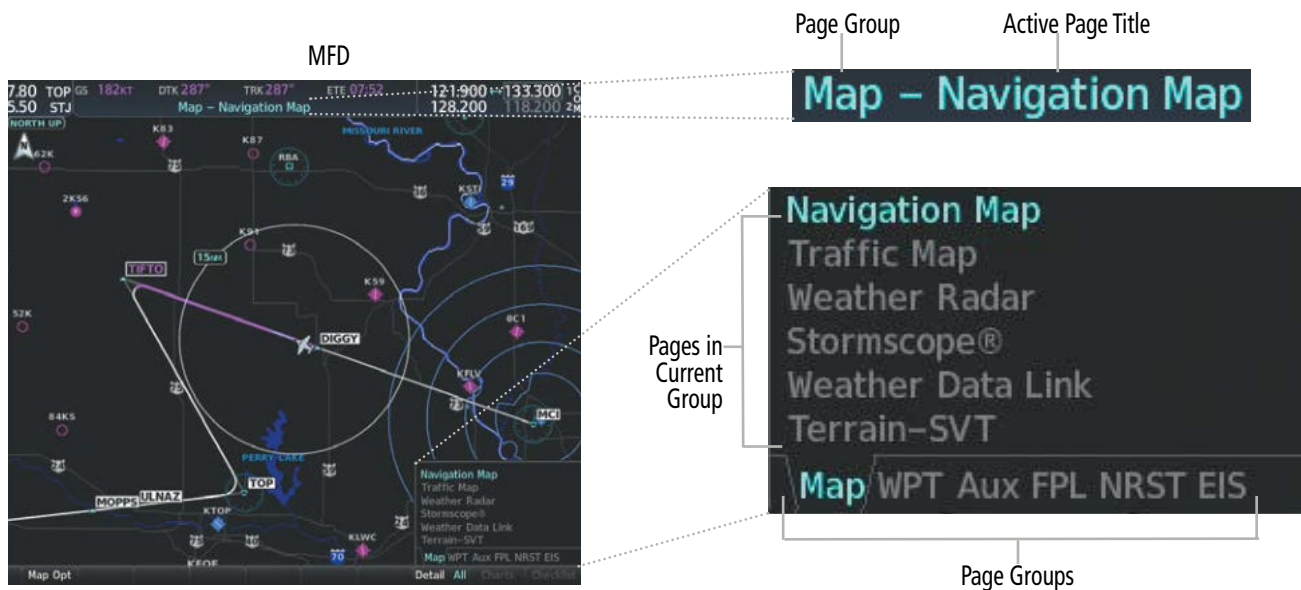


Figure 1-12 Page Title and Page Group Example

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 on the MFD 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 on the MFD to display the desired page within a specific page group.

There are several pages which may be selected by pressing the appropriate softkey at the bottom of the page (or from the page menu). In this case, the active page title will change when a different page softkey is selected, but the page will remain the same (i.e., the **Radio** and **Info** softkeys show different active page titles ('Aux – XM Radio' and 'Aux – XM Information' respectively) within the same page, 'XM Radio'.

Page Group	Pages within Page Group
Map (Map Page Group)	Navigation Map Traffic Map Weather Radar (optional) Stormscope® (optional) Weather Data Link (optional) Terrain-SVT
WPT (Waypoint Page Group)	Airport/Procedures/Weather Information Pages <ul style="list-style-type: none"> - 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 (WX Softkey) - NOTAM information (NOTAM Softkey) - Electronic checklists (Checklist Softkey) Intersection Information NDB Information VOR Information VRP Information User WPT (Waypoint) Information
Aux (Auxiliary Page Group)	Trip Planning Utility GPS Status System Setup 1 and 2 XM Radio (optional) <ul style="list-style-type: none"> - XM Radio (Radio Softkey) - XM Information (Info Softkey) System Status Satellite Phone (optional) Maintenance WiFi Setup System Status Video (optional) ADS-B Status Connex Setup (optional) Databases

SYSTEM OVERVIEW
 FLIGHT INSTRUMENTS
 EIS
 AUDIO PANEL & CNS
 FLIGHT MANAGEMENT
 HAZARD AVOIDANCE
 AFCS
 ADDITIONAL FEATURES
 APPENDICES
 INDEX

Page Group	Pages within Page Group
FPL (Flight Plan Page Group)	Active Flight Plan - Wide View, Narrow View (View Softkey) Flight Plan Catalog - Stored Flight Plan (New Softkey) SurfaceWatch Setup (optional)
NRST (Nearest Page Group)	Nearest Airports Nearest Intersections Nearest NDB Nearest VOR Nearest VRP Nearest User WPTS (Waypoints) Nearest Frequencies Nearest Airspaces
EIS	'EIS – Engine' Page

Table 1-4 Page Groups 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 either the 'Map – Navigation Map' or 'FPL – Active Flight Plan' Page open. 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 'Map – Navigation Map' Page, the page title will show 'Map – Chart + Navigation Map'. If split screen is activated from the 'FPL – Active Flight Plan' Page, the page title will change to show 'FPL – Chart + Active Flight Plan'.

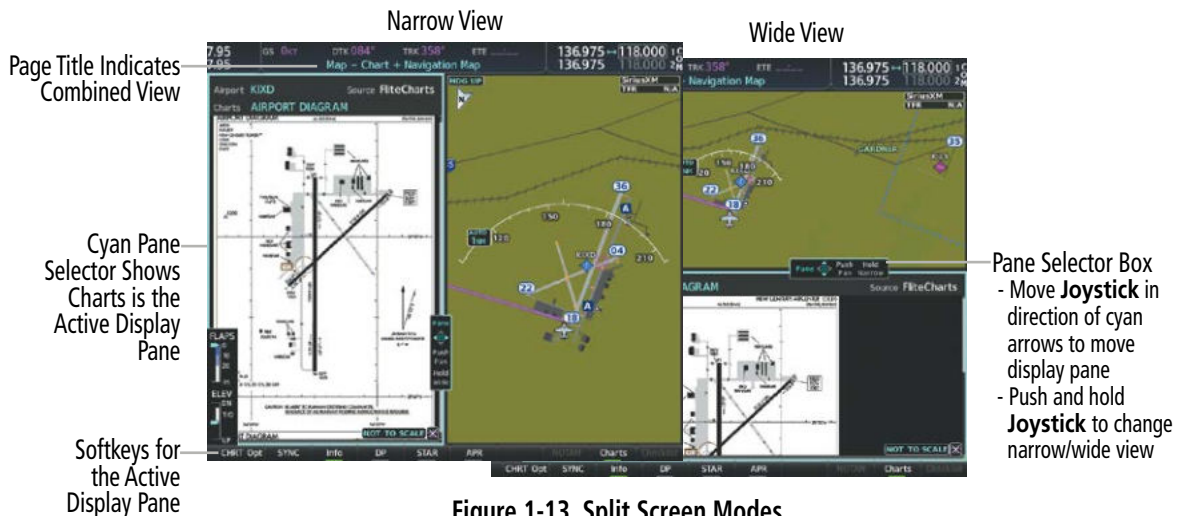


Figure 1-13 Split Screen Modes

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**.

For information on viewing charts and the 'FPL – Active Flight Plan' Page with the flight plan map, see the Flight Management Section. For more information on charts and how to enable charts full screen, see the Additional Features Section.

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'. If necessary, press the **CHRT Opt** Softkey and press the **Full SCN** Softkey to disable full screen mode.
- 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 'Map – Navigation Map' Page or the 'FPL – Active Flight Plan' Page.

SYSTEM SETTINGS

System settings are managed from the 'Aux – System Setup (1 or 2)' Page. Fields shown in cyan text may be edited. Managing crew profiles, system time format, display units, page navigation, and audio voice format settings are discussed in this section. For other system settings, see the reference given to their respective sections.

If desired, the default system settings may be restored at any time.

- Time Format (local or UTC)
- Display (measurement) Units
- Barometric Transition Alert (see the Flight Instruments Section)
- Airspace Alerts (see the Flight Management Section)
- Arrival Alert (see the Flight Management Section)
- SurfaceWatch Alerts (optional; see the Additional Features Section)
- Flight Director Format (see the AFCS Section)
- BARO QFE Settings (see the Flight Instruments Section)
- MFD Data Bar (Navigation Status Box) Fields (see the Flight Management Section)
- GPS Course Deviation Indicator (CDI) Format (see the Flight Instruments Section)
- COM Configuration (see the Audio Panel & CNS Section)
- Nearest Airport (see the Flight Management Section)
- Stability & Protection (see the Additional Features Section)
- Audio
- Charts (see the Additional Features Section)

Restoring system setup defaults:

- 1) Use the **FMS** Knob to 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 (1 or 2) Page Defaults?' is displayed.
- 3) With 'OK' highlighted, press the **ENT** Key.

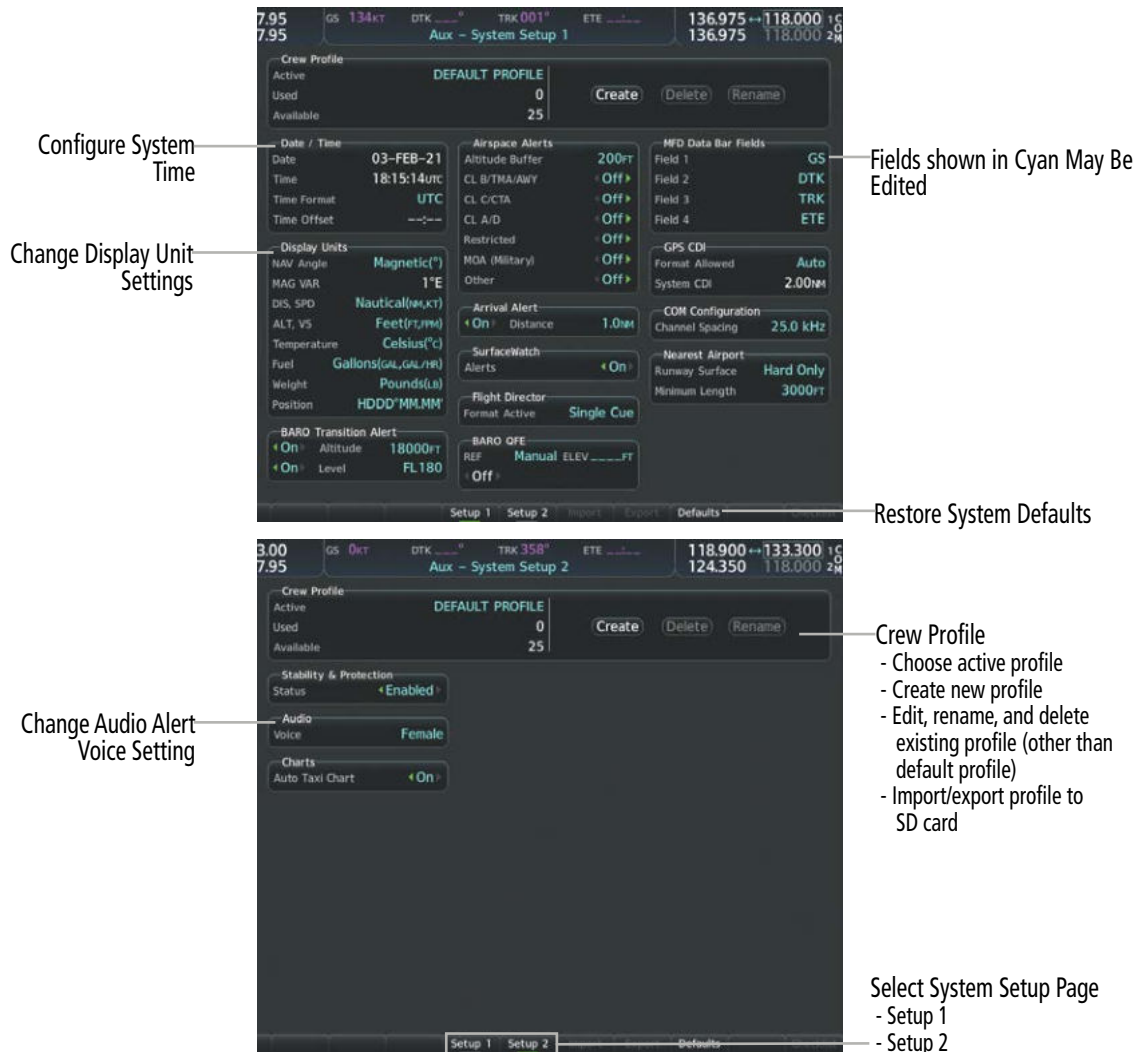


Figure 1-14 'Aux – System Setup 1/2' Pages (Fields Shown In Cyan May Be Edited)

CREW PROFILES

System settings may be saved under a crew profile. 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 pages 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.

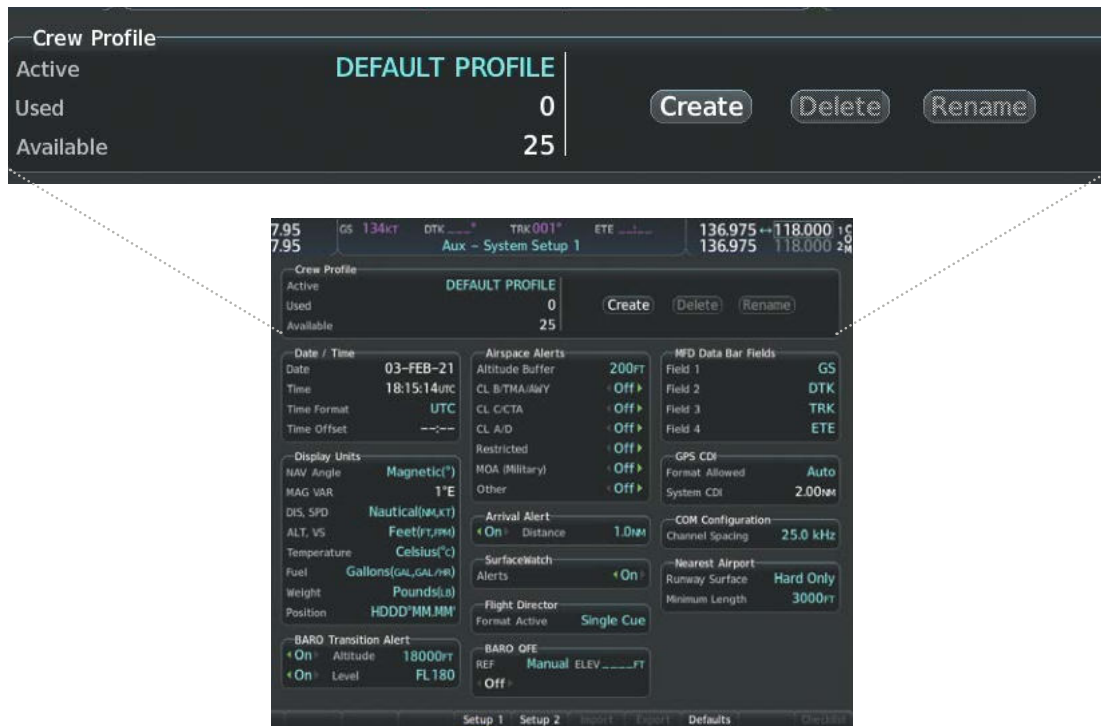


Figure 1-15 Crew Profile Settings on 'Aux – System Setup 1' Page

Creating a profile:

- 1) Use the **FMS** Knob to select the 'Aux – System Setup (1 or 2)' Page.
- 2) Push 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 character.
- 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 (i.e., current) 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) Use the **FMS** Knob to select the 'Aux – System Setup (1 or 2)' Page.
- 2) Push the **FMS** Knob momentarily to activate the flashing cursor.

- 3) Turn the large **FMS** Knob to highlight the 'Active' 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) Use the **FMS** Knob to select the 'Aux – System Setup (1 or 2)' Page.
- 2) Push 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) Use the **FMS** Knob to select the 'Aux – System Setup (1 or 2)' Page.
- 2) Push 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 (1 or 2)' 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. Next, scroll to the desired profile name with the **FMS** Knob, then press the **ENT** Key. 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 the 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 'Crew Profile Importing' Window. With 'OK' highlighted, press the **ENT** or **CLR** Key or push the **FMS** Knob to return to the 'Aux – System Setup (1 or 2)' Page. The imported profile becomes the active profile.



Figure 1-16 Pilot Profile Import 'Aux – System Setup (1 or 2)' Page

Exporting a profile to an SD card:

- 1) Insert an SD card for storing the crew profile into the top card slot on the MFD.
- 2) Use the **FMS** Knob to select the 'Aux – System Setup (1 or 2)' 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' Field. Next, scroll to the desired profile name with the **FMS** Knob, then press the **ENT** Key. 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 'Crew 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** Key, or push the **FMS** Knob to return to the 'Aux – System Setup (1 or 2)' Page.



'Crew Profile Exporting' Window



Export Successful

Figure 1-17 Pilot Profile Export on the 'Aux – System Setup (1 or 2)' Page

CREW PROFILE IMPORT/EXPORT MESSAGES

In certain circumstances, some messages may appear in conjunction with others:

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

Table 1-5 Crew Profile Import/Export Messages

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 12hr, Local 24hr, or UTC. Local time is set by adding/subtracting an offset (hours:minutes) to/from UTC.

Configuring the system time:

- 1) Use the **FMS** Knob to select the 'Aux – System Setup 1' Page.
- 2) Push the **FMS** Knob momentarily to activate the flashing 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 1-18 Date/Time Settings on 'Aux – System Setup 1' Page

DISPLAY UNITS

Units in which various quantities are displayed on the system screens are listed on the 'Aux – System Setup 1' Page. The navigation angle reference, distance, speed, altitude, vertical speed, temperature, fuel, weight and position units can be set from this page.

Category	Settings	Affected Quantities	Exceptions
Navigation Angle	Magnetic (North) ¹ True (North)	Heading Course Bearing Track Desired Track Wind Direction (Trip Planning Page)	N/A
Distance and Speed	Metric Nautical ¹	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 ('Map – Traffic Map' Page) CDI Scaling (System Setup) Fuel Range Calculation (EIS)
Altitude and Vertical Speed	Feet ¹ Meters	All Altitudes on MFD All Elevations on MFD	Altimeter Vertical Speed Indicator VNV Altitudes (Active Flight Plan)
Temperature	Celsius ¹ Fahrenheit	All Temperatures on PFD Total Air Temperature (Trip Planning Page)	Engine Indication System (EIS)

Category	Settings	Affected Quantities	Exceptions
Fuel and Fuel Flow	Gallons ¹ IMP GAL Kilograms Liters Pounds	Fuel Parameters (Trip Planning Page)	Engine Indication System (EIS)
Weight	Kilograms Pounds ¹	N/A	N/A
Position	HDDD°MM.MM ¹ HDDD°MM'SS.S" MGRS 1m MGRS 10m UTM/UPS	All Positions	N/A

¹ Default setting

Table 1-6 Display Units Settings ('Aux – System Setup 1' Page)

Changing a display unit setting:

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



NOTE: The altimeter barometric pressure units may only be changed using softkeys on the PFD.

AUDIO ALERTS

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

Changing the audio alert voice:

- 1) Use the **FMS** Knob (and press the **Setup 2** Softkey, if necessary) to select the 'Aux – System Setup 2' Page.
- 2) Push 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) Turn the small **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 ground speeds—are displayed from the time of the last reset.

SYSTEM OVERVIEW

FLIGHT INSTRUMENTS

EIS

AUDIO PANEL & CNS

FLIGHT MANAGEMENT

HAZARD AVOIDANCE

AFCS

ADDITIONAL FEATURES

APPENDICES

INDEX



Figure 1-19 'Aux – Utility' Page

TIMERS

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

- » Stopwatch-like Generic Timer
- » 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 (MFD):

- 1) Use the **FMS** Knob to select the 'Aux – Utility' Page.
- 2) Push 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 starting time is desired:
 - a) Use the large **FMS** Knob to highlight 'HH:MM:SS' in the 'Generic' Field.
 - b) Use the small **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 generic timer may also be accessed via the **TMR/REF** Softkey on the PFD.

Setting the generic timer (PFD):

- 1) Press the **TMR/REF** Softkey. This opens the 'References' Window.
- 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.

The flight timer can be set to count up from zero starting at system power application or from the time 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) Push the **FMS** Knob momentarily to activate the flashing cursor.
- 3) Turn the large **FMS** Knob to highlight the 'Flight' Field in the 'Timers' Box.
- 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 application 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 'Aux – System Setup 1' Page.

Setting the departure timer starting criterion:

- 1) Use the **FMS** Knob to select the 'Aux – Utility' Page.
- 2) Push the **FMS** Knob momentarily to activate the flashing cursor.
- 3) Turn the large **FMS** Knob to highlight the 'Departure Time' Field in the 'Timers' Box.
- 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 trip average ground speed. Maximum ground speed for the period of time since the last reset is also displayed.

Resetting trip statistics displays:

- 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 display and odometer.
 - 'Reset Odometer' — Resets odometer display only.
 - 'Reset Maximum Speed' — Resets maximum speed display only.
 - 'Reset All' — Resets flight timer, departure timer, odometers, and ground speed displays.
- 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., "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.

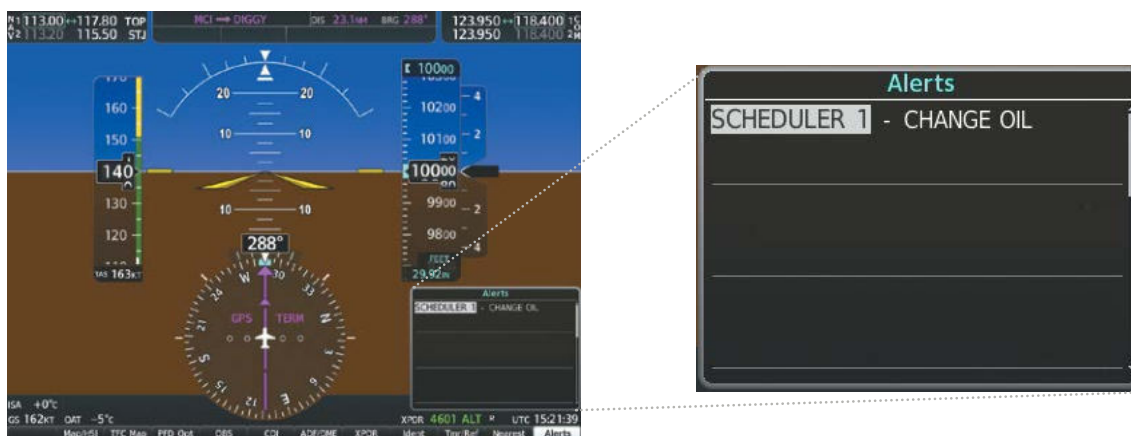


Figure 1-20 PFD 'Alerts' Window

Scheduler messages 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.

Entering a scheduler message:

- 1) Use the **FMS** Knob to select the 'Aux – Utility' Page.
- 2) Push the **FMS** Knob momentarily to activate the flashing cursor.
- 3) Turn the large **FMS** Knob to highlight the first empty field within the 'Scheduler' Box.
- 4) Use the **FMS** Knob to enter text within the 'Message' Field to be displayed in the '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 'Type' Field.
- 6) Turn the small **FMS** Knob to select 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 messages, use the **FMS** Knob to enter the timer value (HHH:MM:SS) from which to count down and press the **ENT** Key.
- 9) For event-based messages:
 - a) Use the **FMS** Knob to enter the desired date (DD-MMM-YY) 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) Push the **FMS** Knob to remove the cursor, or use the large **FMS** Knob to move the cursor to enter the next message.

Deleting a scheduler message:

- 1) Use the **FMS** Knob to select the 'Aux – Utility' Page.
- 2) Push the **FMS** Knob momentarily to activate the flashing cursor.
- 3) Turn the large **FMS** Knob to highlight the 'Message' 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.

1.5 DISPLAY BACKLIGHTING

The PFD and MFD display backlighting, the PFD and MFD bezels, and the audio panel keys automatically adjust via built in sensors. These settings can be further 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. In reversionary mode, adjustments can be made from any remaining display.

Adjusting display backlighting:

- 1) Press the PFD **MENU** Key to display the 'PFD Setup Menu' Window. 'Auto' is now highlighted next to 'PFD 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 setting, then press the **ENT** Key.
- 4) If desired, use the large **FMS** Knob to select 'Auto' next to 'MFD Display'. Repeat steps 2 and 3 to adjust the MFD display backlighting.
- 5) To remove the menu, press the **CLR** or **MENU** Key.

Adjusting key backlighting:

- 1) Press the PFD **MENU** Key to display the 'PFD Setup Menu' Window. 'Auto' is now highlighted next to 'PFD Display'.
- 2) Turn the large **FMS** Knob to highlight 'PFD Display' or 'MFD Display', as desired.
- 3) Turn the small **FMS** Knob in the direction of the green arrowhead to display 'PFD Key' or 'MFD 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 1-21 'PFD Setup Menu' Window

SECTION 2 FLIGHT INSTRUMENTS



NOTE: The Automatic Flight Control System (AFCS) provides additional indications such as bugs and annunciations on selected flight instruments during certain AFCS flight director modes. Refer to the AFCS Section for more information about these indications.

The system increases pilot situational awareness by providing an easy-to-scan Primary Flight Display (PFD) 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 PFD and are explained in other sections of this Pilot's Guide.

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

- Airspeed Indicator, showing
 - True Airspeed
 - Ground Speed
 - Airspeed Awareness Ranges
 - Vspeed Reference Bugs
 - Trend Vector
- Attitude Indicator with Slip/Skid Indication
- Altimeter, showing
 - Barometric Setting
 - Selected Altitude
 - Trend Vector
- Vertical Deviation, Glideslope, and Glidepath Indicators
- Vertical Speed Indicator (VSI)
- Outside Air Temperature (OAT)
- International Standard Atmosphere (ISA)
- Horizontal Situation Indicator, showing
 - Turn Rate Indicator
 - Bearing Pointers and Information Windows
 - Course Deviation Indicator (CDI)
 - Navigation Source
 - DME Information Window (optional)
- ADF/DME Tuning Window (optional)
- System Time
- Wind Data
- Vertical Navigation (VNV) Indications
- Transponder Mode, Code, and Ident/Reply
- Radar Alimeter (optional)
- 'References' Window, showing
 - Generic Timer
 - Vspeed Values
 - Minimum Altitude Alerts

The PFD also displays various alerts and annunciations.



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

Figure 2-1 Primary Flight Display (Default)



- ① Selected Heading
- ② Wind Data Box
- ③ HSI Map
- ④ DME Information Box
- ⑤ Bearing Information Windows
- ⑥ Minimum Altitude Setting
- ⑦ Flight Plan Window
- ⑧ Required Vertical Speed Indicator
- ⑨ Vertical Deviation Indicator
- ⑩ VNV Target Altitude

Figure 2-2 Primary Flight Display (Additional Information)

2.1 FLIGHT INSTRUMENTS

AIRSPEED INDICATOR

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

The Airspeed Indicator displays airspeed on a moving tape rolling number gauge. The true airspeed is displayed in knots below the Airspeed Indicator. 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 shown at intervals of 5 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 never exceed speed (V_{NE}), at which point it appears red.

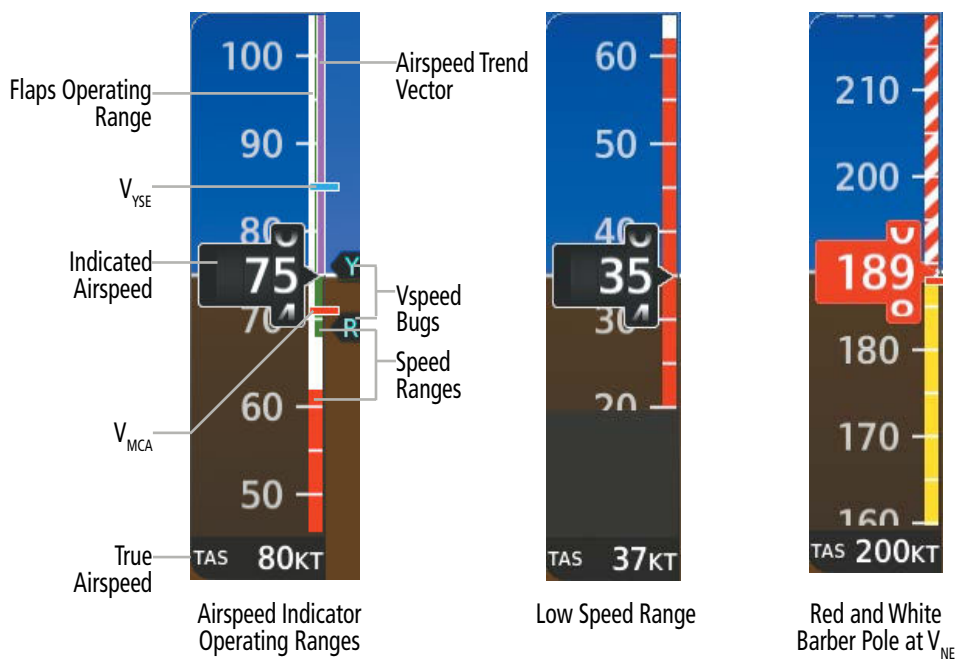


Figure 2-3 Airspeed Indicator Ranges

Color coded stripes appear on the Airspeed Indicator to show the operating ranges. The low speed range stripe is red. Normal operating range is green, caution range is amber, and the never exceed speed (V_{NE}) begins with a red and white barber pole. The flap operating range is indicated by a white stripe.

A red horizontal bar on the airspeed tape represents V_{MCA} . A cyan horizontal bar represents V_{YSE} .

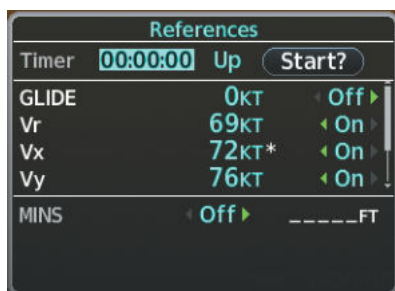
The Airspeed Trend Vector is a vertical magenta line that appears to the right of the color-coded speed range stripe when airspeed is either accelerating or decelerating. One end of the magenta line is anchored to the tip of the airspeed pointer while the other end moves continuously up or down corresponding 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 6 seconds. If the trend vector crosses V_{NE} , the number in the indicated airspeed pointer changes to amber. 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.

The pilot can modify and enable/disable the display of Vspeed Reference Bugs (Glide, V_R , V_X , V_Y , V_{LE} , and V_{LO}) from the 'References' Window. When enabled, the Vspeed Reference Bugs appear in their respective positions to the right of the airspeed scale. When the indicated airspeed is below 20 knots, enabled Vspeeds Reference Bugs and their numeric values appear in a list at the bottom of the airspeed tape, ordered from highest to lowest.

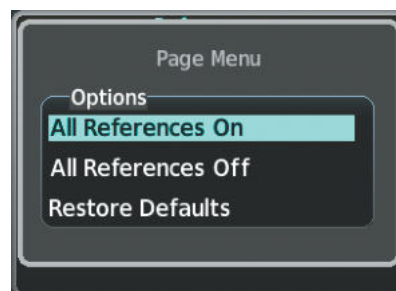
All Vspeed values are reset with each power cycle, but their On/Off status carries through power cycles.

Modifying Vspeeds and turning Vspeed Bugs On/Off:

- 1) Press the **TMR/REF** Softkey.
- 2) Turn the large **FMS** Knob to highlight the desired Vspeed.
- 3) Use the small **FMS** Knob to change the Vspeed in 1 knot increments (when a speed has been 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 clockwise to 'On' or counterclockwise to 'Off'.
- 6) To remove the window, press the **CLR** Key or the **TMR/REF** Softkey.



'References' Window



'References' Window Menu

Figure 2-4 'References' Window and Menu

Vspeed bugs can be enabled, disabled, and/or reset to default settings individually, or collectively.

Enabling/disabling or restoring all Vspeed bugs as a group:

- 1) Press the **TMR/REF** Softkey.
- 2) Press the **MENU** Key.
- 3) Turn the **FMS** Knob to highlight 'All References On', 'All References Off', or 'Restore Defaults', as desired.
- 4) Press the **ENT** Key.
- 5) 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.

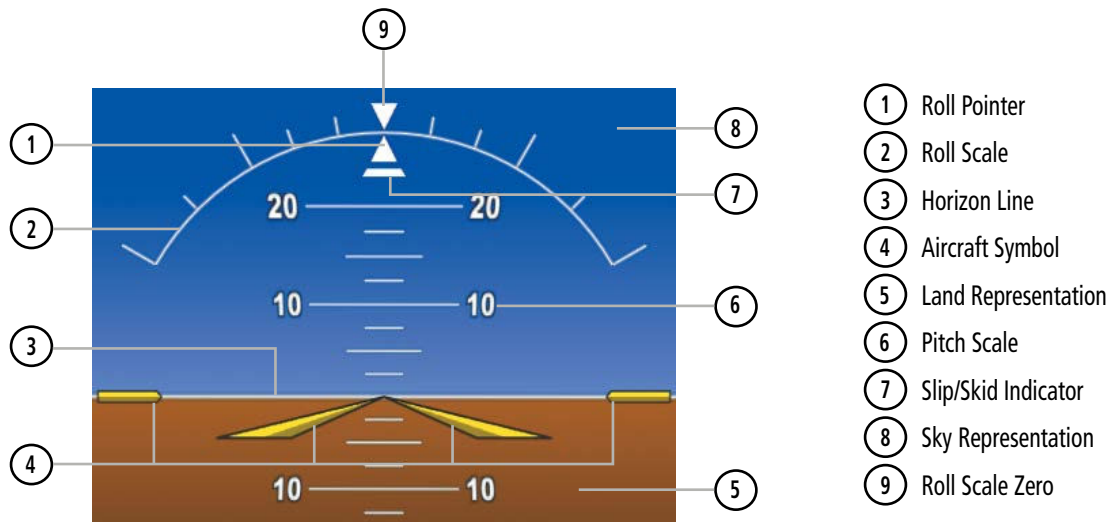


Figure 2-5 Attitude Indicator

The horizon line is part of the pitch scale. Above and below the horizon line, major pitch marks and numeric labels are shown for every 10°, up to 80°. Minor pitch marks are shown for intervening 5° increments, up to 25° below and 45° above the horizon line. Between 20° below to 20° above the horizon line, minor pitch marks occur every 2.5°. When the Synthetic Vision Technology (SVT) is activated, the pitch scale is reduced to 10° up and 7.5° down (refer to the Flight Instruments Section for information about Garmin SVT).

The symbolic aircraft on the Attitude Indicator changes appearance based on the selected flight director command bar format. The command bar format (Single Cue or X Pointer) is pilot selectable on the 'Aux – System Setup 1' Page. See the AFCS Section for additional details.

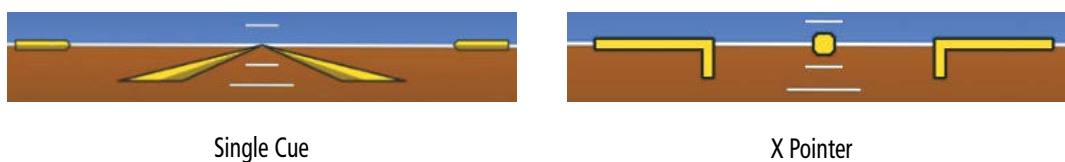


Figure 2-6 Flight Director Command Bar/Symbolic Aircraft Format Settings

Changing command bar/aircraft symbol format:

- 1) Use the **FMS** Knob (and press the **Setup 1** Softkey, if necessary) to select the 'Aux – System Setup 1' Page.
- 2) Push the **FMS** Knob to activate the cursor.
- 3) Turn the large **FMS** Knob to highlight the 'Format Active' Field in the 'Flight Director' Box.
- 4) Turn the small **FMS** Knob to select 'Single Cue' or 'X Pointer', and press the **ENT** Key.
- 5) Push the **FMS** Knob to remove the cursor.

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.

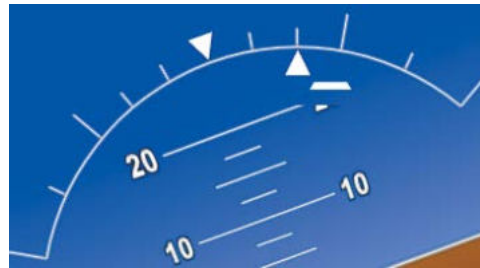


Figure 2-7 Slip/Skid Indication

When the 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 and AFCS sections for more information about Garmin ESP and related indications.

ALTIMETER

INTRODUCTION

The Altimeter displays 600 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 inside the black pointer.

A magenta Altitude Trend Vector extends up or down the left of the altitude tape, the end resting at the approximate altitude to be reached in 6 seconds at the current vertical speed. The trend vector is not shown if altitude remains constant or if data needed for calculation is not available due to a system failure.

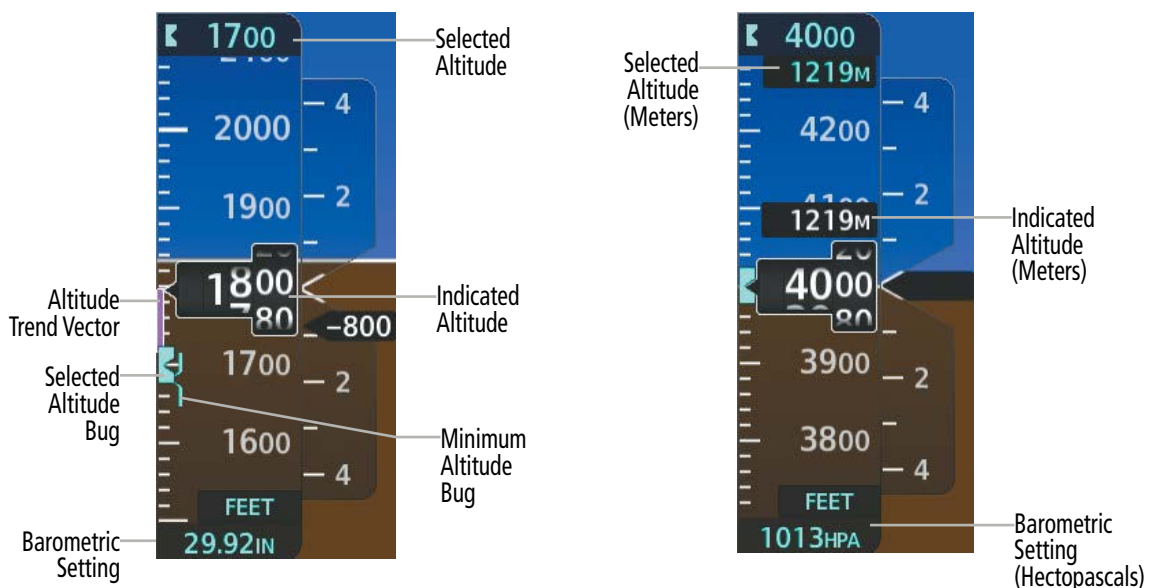


Figure 2-8 Altimeter

BAROMETRIC SETTING

The barometric pressure setting is displayed below the Altimeter in inches of mercury (in Hg), or hectopascals (hPa) when metric units are selected. Adjusting the altimeter barometric pressure 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.

Selecting the altimeter barometric pressure setting:

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

Selecting standard barometric pressure (29.92 in Hg):

- 1) Press the **PFD Opt** Softkey to display the second-level softkeys.
- 2) Press the **STD Baro** Softkey.
- 3) Press the **Back** Softkey to return to the top-level softkeys.

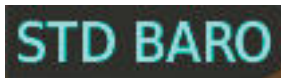


Figure 2-9 Standard Barometric Altimeter Setting

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.

BARO QFE ALTIMETER SETTING



WARNING: Do not use a QFE altimeter setting outside of the terminal environment for the corresponding issuing airport to ensure adequate obstacle clearance.

BARO QFE is the isobaric surface pressure at the airfield reference point. With BARO QFE set, the altimeter will read zero at the airfield reference point or the touch-down zone of the runway in use. At other altitudes the altimeter will read an indication of the height above the reference point. Refer to this section for QFE annunciations.

QFE mode should be enabled and the baro setting should be set to the QFE setting in conjunction with each other. This can be done automatically by arming QFE while the baro setting is still set to STD BARO ahead of time; at the appropriate time adjust the baro setting on the PFD to the QFE setting when QFE operation is required. When the baro setting is set to something other than STD BARO with QFE armed, BARO QFE mode will automatically become active.

When entering QFE VNV altitude constraints, it is important to note that only the current QFE reference is used. It is not possible to enter a QFE constraint for the destination while the origin is the current reference. Therefore, while QFE is active and the QFE reference is the origin:

- » QFE constraints cannot be entered for the destination airport/runway.
- » QFE constraints cannot be entered for any arrival/approach waypoints.
- » Entering an MSL/AGL constraint for any departure/enroute waypoints displays a message clarifying the constraint will be shown as a converted QFE value relative to the origin.



NOTE: 'FMS ORIG' and 'FMS DEST' references do not dynamically update with flight plan changes. Always verify QFE settings when changing the QFE reference (airfield, runway, etc.) or flight plan and re-enter settings on the 'Aux – System Setup 1' Page.



NOTE: VPTH changes and VSD and/or VNV discontinuities may occur when switching from QNH to QFE Baro settings.

Setting BARO QFE while on the ground:

- 1) Set the appropriate QFE BARO setting on the PFD.
- 2) Use the **FMS** Knob to select the 'Aux – System Setup 1' Page on the MFD.
- 3) Push the **FMS** Knob to activate the cursor.
- 4) Turn the large **FMS** Knob to select the 'REF' Field in the 'BARO QFE' Box.
- 5) Use the small **FMS** Knob to select 'Manual' or 'FMS ORIG', and press the **ENT** Key to accept.
- 6) If 'Manual' was selected, use the **FMS** Knob to enter the field elevation of the departure airport in the 'ELEV' Field and press the **ENT** Key.
- 7) If 'FMS ORIG' was selected, the field elevation of the selected departure airport/runway from the flight plan will be shown in the 'BARO QFE' Box. Verify this information is correct.
- 8) The 'On/Off' Field will automatically highlight; turn the small **FMS** Knob to change the selection from 'Off' to 'On'.
- 9) Push the **FMS** Knob to deactivate the cursor. QFE mode is now active.
Change the BARO setting to STD BARO to disable BARO QFE.

Setting BARO QFE while in flight:

- 1) Set the BARO setting to STD BARO on the PFD.
- 2) Use the **FMS** Knob to select the 'Aux – System Setup 1' Page on the MFD.
- 3) Push the **FMS** Knob to activate the cursor.
- 4) Turn the large **FMS** Knob to select the 'REF' Field in the 'BARO QFE' Box.
- 5) Use the small **FMS** Knob to select 'Manual' or 'FMS DEST', and press the **ENT** Key to accept.
- 6) If 'Manual' was selected, use the **FMS** Knob to enter the field elevation of the destination airport in the 'ELEV' Field and press the **ENT** Key.

- 7) If 'FMS DEST' was selected, the field elevation of the selected destination airport/runway from the flight plan will be shown in the 'BARO QFE' Box. Verify this information is correct.
- 8) The 'On/Off' Field will automatically highlight; turn the small **FMS** Knob to change the selection from 'Off' to 'On'.
- 9) Push the **FMS** Knob to deactivate the cursor. BARO QFE mode is now armed.
- 10) Enter the reference field QFE BARO setting. As soon as barometric settings change from STD BARO, QFE mode activates.

Change the BARO setting to STD BARO to disable BARO QFE. The desired BARO setting can now be entered.

SELECTED ALTITUDE

The Selected Altitude is displayed above the Altimeter in the box indicated by a selection bug symbol. A bug corresponding to this altitude is shown on the tape. If the Selected Altitude exceeds the range shown on the tape, the bug appears at the upper or lower edge of the tape. When the metric value is selected, it is displayed in a separate box below the Selected Altitude.

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

Setting the Selected Altitude:

Turn the **ALT** Knob to set the Selected Altitude. Turn the large knob for 1000-ft increments or the small knob for 100-ft increments. If set to metric units, the large and small knobs adjust the Selected Altitude in 50-meter increments. When the unit overlay function is enabled, the Selected Altitude will stop at both the standard increments and the metric increments.

If a Minimum Altitude value has been set, this altitude is also available for the Selected Altitude while turning the **ALT** Knob.

UNITS OVERLAY

The system is set to display feet by default. However, the pilot can choose to display a meters overlay for the indicated altitude and Selected Altitude.

Enabling altitude units overlay:

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

VERTICAL SPEED INDICATOR (VSI)

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

A magenta chevron is displayed on the VSI to indicate the Required Vertical Speed for reaching a VNV Target Altitude once the 'TOD [Top of Descent] within 1 minute' alert has generated. See the Flight Management Section for details on VNV features and refer to this section for more information about VNV indications on the PFD.

VERTICAL DEVIATION INDICATOR (VDI)

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

When vertical navigation is being used, the Vertical Deviation Indicator (VDI) appears to the left of the Altimeter and is displayed with a magenta 'V' at the top of the scale and a magenta chevron indicating the VNV vertical deviation. The VDI appears in conjunction with the 'TOD within 1 minute' alert. The VDI is removed from the display if vertical deviation becomes invalid. See the Flight Management Section for details on VNV features, and refer to this section for more information on VNV indications.

The Glideslope Indicator appears to the left of the Altimeter whenever an ILS frequency is tuned in the active NAV field. A green diamond acts as the Glideslope Indicator, like a glideslope needle on a conventional indicator. The Glideslope Preview, a hollow gray diamond, is displayed when the navigation source is set to GPS, in addition to a localizer frequency being tuned on the navigation receiver and receiving glideslope information. When the system auto-switches the active navigation source to the localizer frequency, the Glideslope Indicator is displayed as a solid green diamond. If a localizer frequency is tuned and there is no glideslope, 'NO GS' is displayed in place of the diamond.

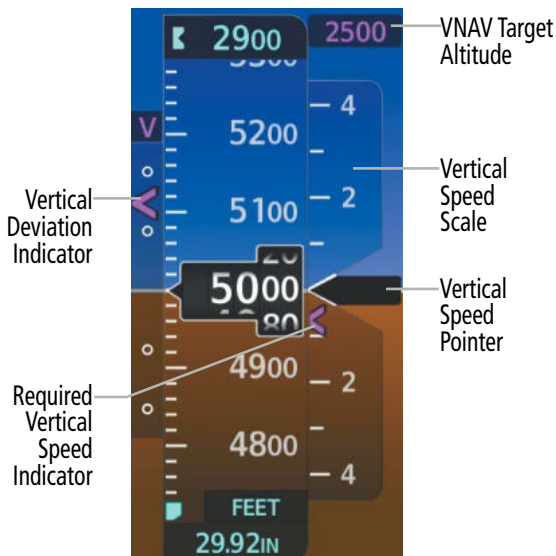


Figure 2-10 Vertical Speed and Deviation Indicators (VSI and VDI)

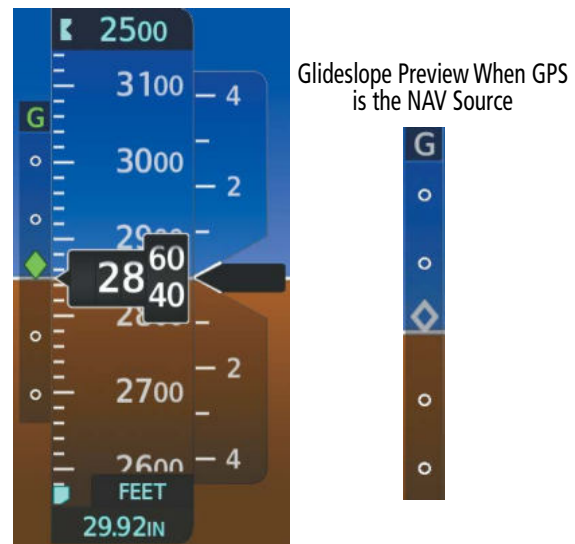


Figure 2-11 Glideslope Indicator



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



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

The Glidepath Indicator is a vertical deviation scale for GPS approaches supporting SBAS vertical guidance or advisory vertical guidance. The Glidepath Indicator, a magenta diamond, appears on the PFD as soon as the FAF becomes the active waypoint and GPS is the selected navigation source. Full-scale deflection (two dots), is angular with upper and lower limits. The upper limit is ± 492 feet (150 meters) and lower limits depend on approach service level.

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

If the approach type downgrades past the FAF, 'NO GP' is displayed in place of the diamond.

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



Figure 2-12 Glidepath Indicator

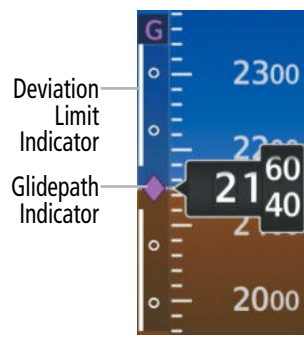


Figure 2-13 Glidepath Indicator and Vertical Deviation Limit Indicator

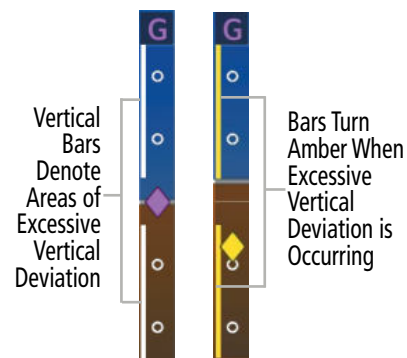


Figure 2-14 Glidepath with Excessive Vertical Deviation

VERTICAL NAVIGATION (VNV) INDICATIONS

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



Figure 2-15 Vertical Navigation Indications (PFD)

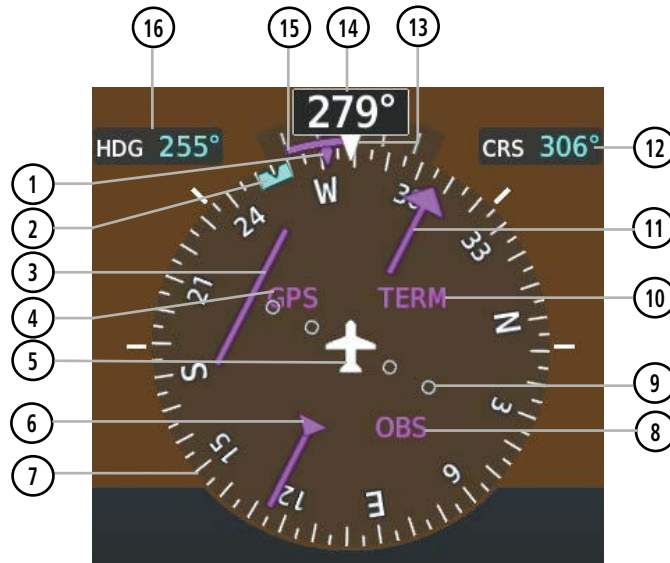
Criteria	VNV Indication Removed		
	Required Vertical Speed (RVSI)	Vertical Deviation (VDI)	VNV Target Altitude
Aircraft > 1 min before the next TOD due to flight plan change	X	X	X
VNV cancelled (Cncl VNV Softkey pressed on MFD)	X	X	X
Distance to active waypoint cannot be computed due to unsupported flight 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 2-1 VNV Indication Removal Criteria

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 is available as a traditional 360° compass rose and a 210° HSI Map. The HSI Map offers two selectable map formats: a navigation map or traffic map. The HSI Map and Inset Map cannot be displayed simultaneously.

The traditional (360°) HSI contains a Course Deviation Indicator (CDI) with a Course Pointer, To/From Indicator, sliding deviation bar and scale. The Course Pointer is a single line arrow (GPS, VOR1, and LOC1) or a double line arrow (VOR2 and LOC2), which points in the direction of the set course. The To/From Indicator rotates with the Course Pointer and appears when the system is receiving valid NAVAID data.



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

Figure 2-16 Horizontal Situation Indicator (360° HSI)

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

Enabling/disabling the HSI Map on the PFD:

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

Or:

Press the **Map Off** Softkey to disable the HSI Map.

The following information appears above the Current Heading when the HSI Map is enabled:

- Sliding Course Deviation Indicator (To/From and Deviation Indicators are Combined)
- Deviation Scale
- Navigation Source
- Flight Phase
- OBS Mode/Suspend Mode Status
- Dead Reckoning (DR) Mode Annunciation
- Crosstrack Error (XTK)
- Back Course Annunciation (BC)

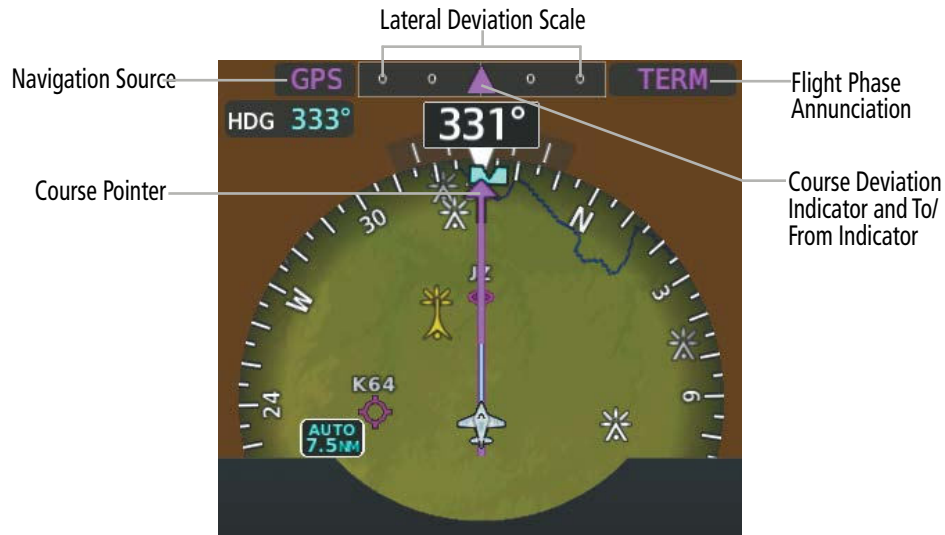


Figure 2-17 HSI Map

The current track indicator, represented by a magenta diamond on the HSI, is the current over the ground track the aircraft is flying. To the upper left of the HSI, the Selected Heading value is shown in cyan during and momentarily after adjustment. The cyan bug on the compass rose corresponds to the Selected Heading. If the Selected Heading Bug is adjusted to a heading not included on the HSI Map compass rose, the Selected Heading Bug will appear at the corresponding edge of the HSI Map compass rose. The Desired Track (DTK) is shown in magenta to the upper right of the HSI when the selected navigation source is GPS and OBS Mode is not active. The Selected Course (CRS) is shown in cyan 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 GPS with OBS Mode active.

Upon station passage, the To/From Indicator flips and points to the tail of the aircraft, just like a conventional to/from flag.



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, Selected Course and track indicator, even when there is no crosswind.

Adjusting the Selected Heading:

- Turn the **HDG** Knob to set the Selected Heading.
- Push the **HDG** Knob to synchronize the bug to the current heading.

Adjusting the Selected Course:

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

Push the **CRS** Knob to re-center the CDI and return the Course Pointer to the bearing of the active waypoint or navigation station.



Figure 2-18 Heading and Course Indications

Navigation angles (track, heading, course, bearing) are corrected to the computed magnetic variation (Mag Var) or referenced to true north (°T), set on the ‘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 2-19 Heading and Course Indications (True)

Changing the navigation angle true/magnetic setting:

- 1) Use the **FMS** Knob (and press the **Setup 1** Softkey, if necessary) to select the ‘Aux – System Setup 1’ Page.
- 2) Push the **FMS** Knob to activate the cursor.
- 3) Turn the large **FMS** Knob to highlight the ‘NAV Angle’ Field in the ‘Display Units’ Box.
- 4) Turn the small **FMS** Knob to highlight the desired setting and press the **ENT** Key:
 - ‘True(°T)’ – References angles to true north.
 - ‘Magnetic(°)’ – Angles corrected to the computed magnetic variation (Mag Var).
- 5) Push the **FMS** Knob to remove the cursor.

TURN RATE INDICATOR

The Turn Rate Indicator is located directly above the rotating compass card. Tick marks to the left and right of the lubber line denote half-standard and standard turn rates. A magenta Turn Rate Trend Vector shows the current turn rate. The end of the trend vector gives the heading predicted in 6 seconds, based on the present turn rate. A standard-rate turn is shown on the indicator by the trend vector stopping at the standard turn rate tick mark, corresponding to a predicted heading of 18° from the current heading. At rates greater than 4 deg/sec, an arrowhead appears at the end of the magenta trend vector and the prediction is no longer valid.

SYSTEM OVERVIEW
 FLIGHT INSTRUMENTS
 EIS
 AUDIO PANEL & CNS
 FLIGHT MANAGEMENT
 HAZARD AVOIDANCE
 AFCS
 ADDITIONAL FEATURES
 APPENDICES
 INDEX



Figure 2-20 Turn Rate Indicator and Trend Vector

BEARING POINTERS AND INFORMATION WINDOWS

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

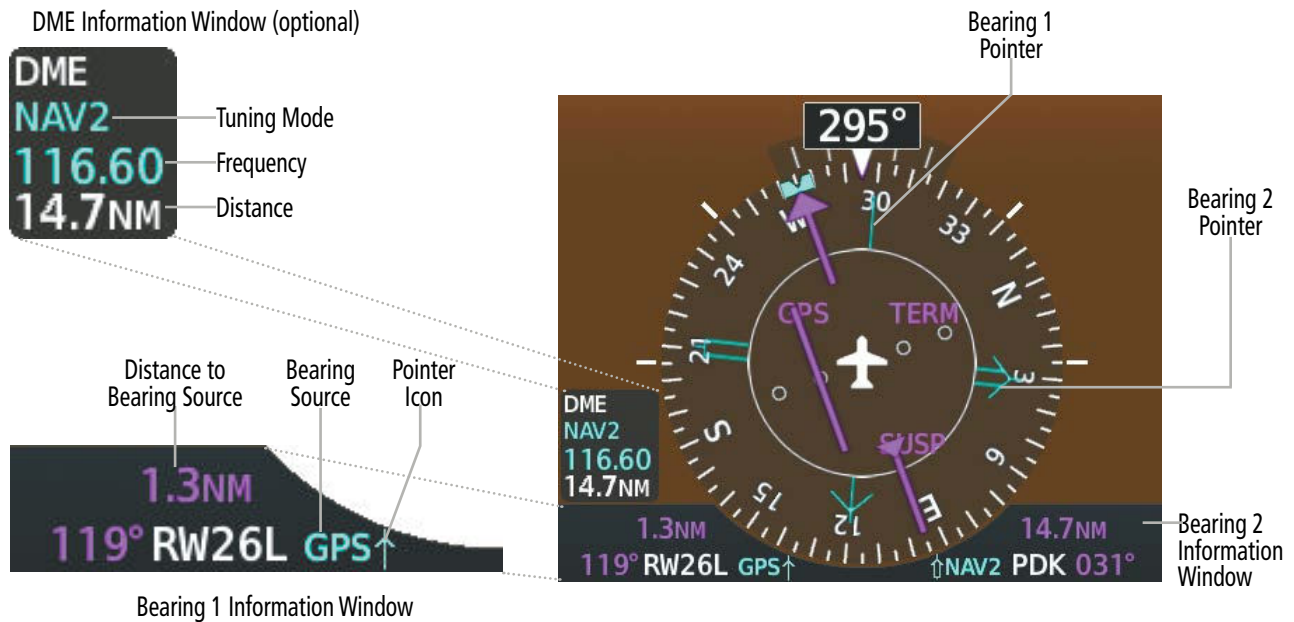


Figure 2-21 HSI with Bearing Information Windows

When a bearing pointer is displayed, the associated information window is also displayed. The bearing information windows are displayed at the lower sides of the HSI and give the following information:

- » Bearing Source (NAV, GPS, ADF)
- » Pointer Icon (Bearing 1 = Single Line, Bearing 2 = Double Line)
- » Frequency (NAV, ADF)
- » Station/Waypoint Identifier (NAV, GPS)
- » GPS-Derived Great Circle Distance to Bearing Source

When the NAV radio is tuned to an ILS frequency, the bearing source and the bearing pointer are removed from the HSI and 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 GPS is the bearing source, the active waypoint identifier is displayed instead of a frequency.

The bearing pointer is removed from the HSI and dashes are displayed in the information window if the NAV radio is not receiving a VOR station or if GPS 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 the **Bearing 1** or **Bearing 2** Softkey to display the desired bearing pointer and information window with NAV1.
- 3) Press either the **Bearing 1** or **Bearing 2** Softkey again to change the bearing source to NAV2.
- 4) Press either the **Bearing 1** or **Bearing 2** Softkey a third time to change the bearing source to GPS.
- 5) Press either the **Bearing 1** or **Bearing 2** Softkey a fourth time to change the bearing source to ADF (optional).
- 6) To remove the bearing pointer and information window, press either the **Bearing 1** or **Bearing 2** Softkey again.

DME INFORMATION WINDOW



NOTE: DME radio installation is optional.

The DME Information Window is displayed above the Bearing 1 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 & CNS Section for information on tuning 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 Bearing 1 Information Window.
- 3) To remove the DME Information Window, press the **DME** Softkey again.

COURSE DEVIATION INDICATOR (CDI)

The Deviation Bar 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 Deviation Bar is not displayed.

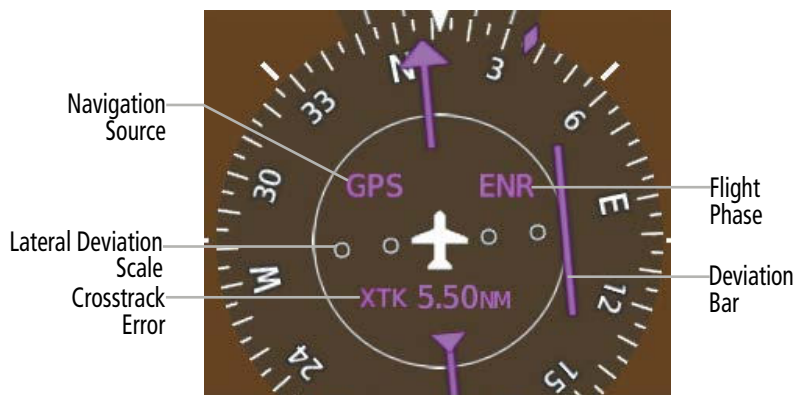


Figure 2-22 Course Deviation Indicator (CDI)

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



Figure 2-23 Navigation Sources

Changing navigation sources:

- 1) Press the **CDI** Softkey to change from GPS 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 GPS.

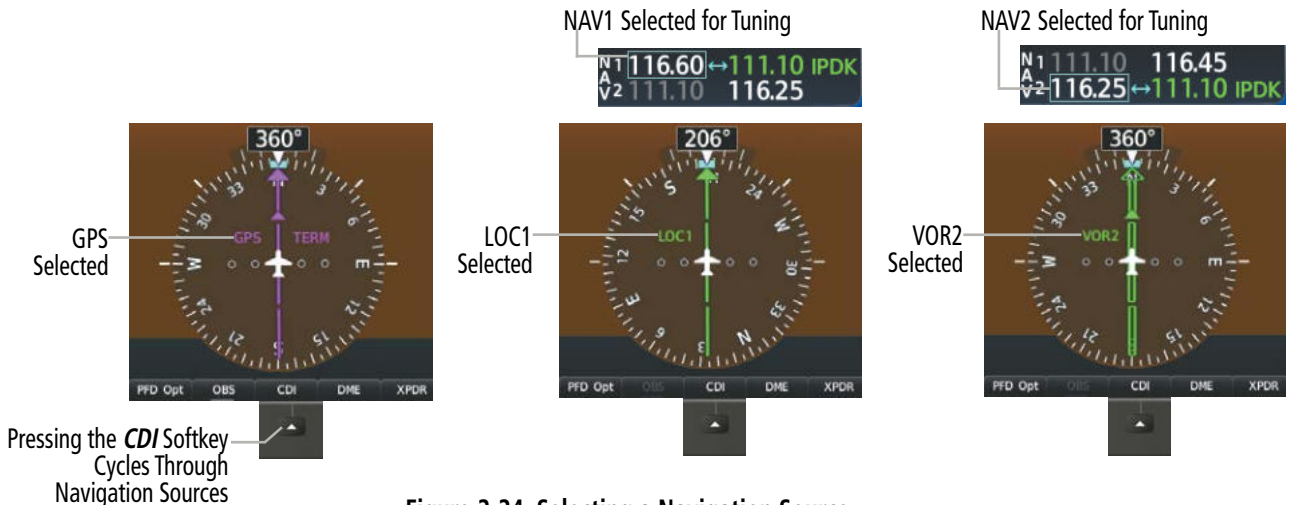


Figure 2-24 Selecting a Navigation Source

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

- A localizer or ILS approach has been loaded into the active flight plan
- The FAF is the active leg, the FAF is less than 15 nm away, and the aircraft is moving toward the FAF

- A valid localizer frequency has been tuned
- The GPS CDI deviation is less than 1.2 times full-scale deflection

GPS steering guidance is still provided after the CDI automatically changes to LOC until LOC capture, up to the FAF for an ILS approach, or until GPS information becomes invalid. Activating a Vector-to-Final (VTF) also causes the CDI to switch to LOC navigation source. GPS steering guidance is not provided after the change.

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

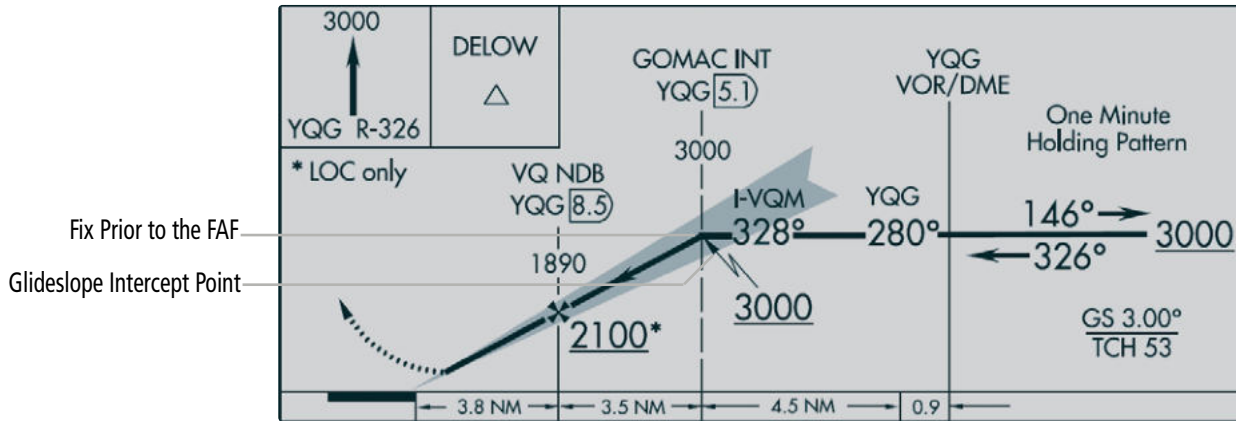


Figure 2-25 ILS Approach with Glideslope Intercept Point at Fix Prior to the FAF

GPS CDI SCALING

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

The current GPS CDI scale setting is displayed in the 'System CDI' Field of the 'GPS CDI' Box on the 'Aux – System Setup 1' Page. The full-scale deflection setting may also be changed (2.00NM, 1.00NM, 0.30NM, 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 displayed rather than the flight phase annunciation.

Changing the selected GPS CDI setting:

- 1) Use the **FMS** Knob (and press the **Setup 1** Softkey, if necessary) to select the 'Aux – System Setup 1' Page.
- 2) Push the **FMS** Knob to activate the cursor.
- 3) Turn the large **FMS** Knob to highlight the 'Format Allowed' Field 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 **CLR** Key, or push the **FMS** Knob to deactivate the cursor.

When set to 'Auto' (default), the GPS CDI scale automatically adjusts to the desired limits based upon the current phase of flight, as follows:

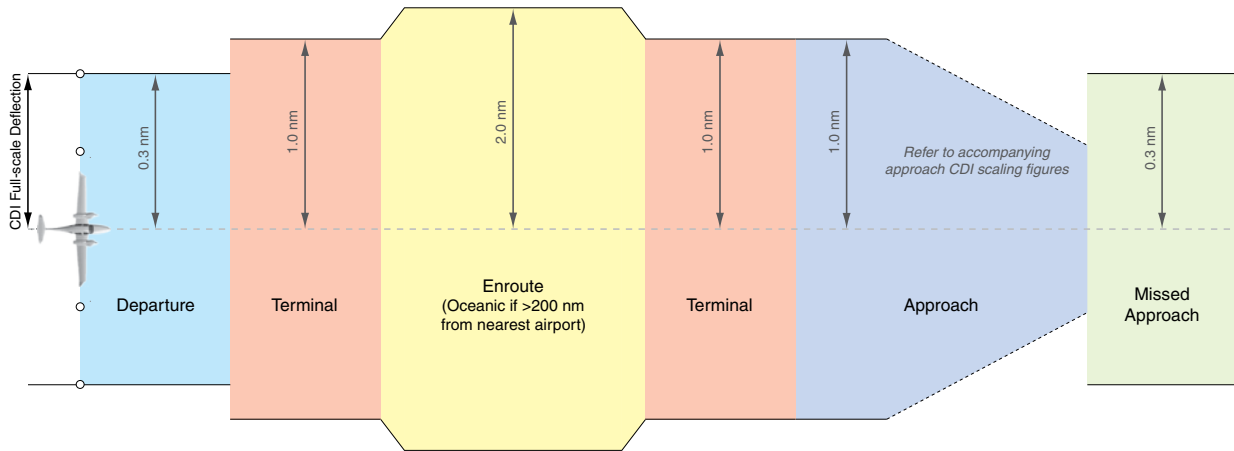


Figure 2-26 Automatic CDI Scaling

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

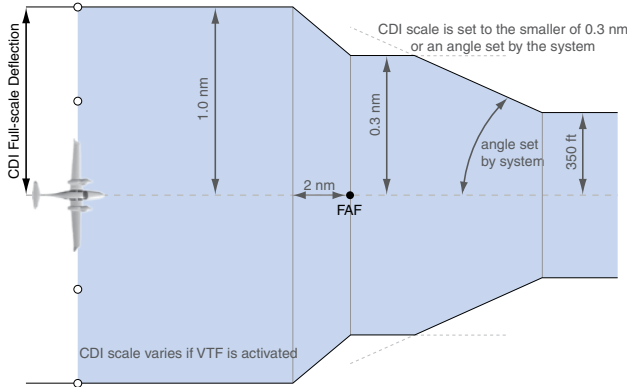


Figure 2-27 Typical LNAV, LNAV+V, and Visual Approach Service Level CDI Scaling

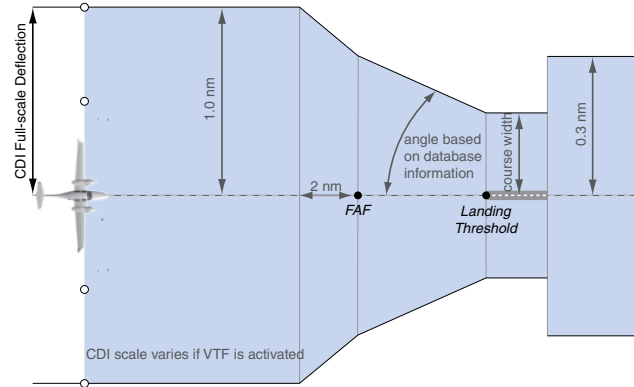


Figure 2-28 Typical LNAV/VNAV, LP, LP+V and LPV Approach Service Level CDI Scaling

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

Flight Phase	Annunciation ¹	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.
Approach (Non-precision with Advisory Vertical Guidance)	LNAV + V	
Approach (Non-precision with Advisory Vertical Guidance)	VISUAL	
Approach (LNAV/VNAV)	L/VNAV	1.0 nm decreasing to a specified course width, then 0.3 nm, depending on variables.
Approach (LP)	LP	
Approach (LP+V)	LP+V	
Approach (LPV)	LPV	
Missed Approach	MAPR	0.3 nm

¹ Flight phase annunciations are normally shown in magenta, but when cautionary conditions exist the color changes to amber.

Table 2-2 Automatic GPS 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 GPS flight plan (GPS must be the selected navigation source), but retains the current “active-to” waypoint as the navigation reference even after passing the waypoint. ‘OBS’ is annunciated to the lower right of the aircraft symbol when OBS Mode is selected on the HSI, or to the upper right of the HSI Map.

While OBS Mode is enabled, a course line is drawn through the active-to waypoint on the moving map. If desired, the course to/from the waypoint can now be adjusted. When OBS Mode is disabled, the flight plan returns to normal operation with automatic sequencing of waypoints, following the course set in OBS Mode. The flight path on the moving map retains the modified course line.

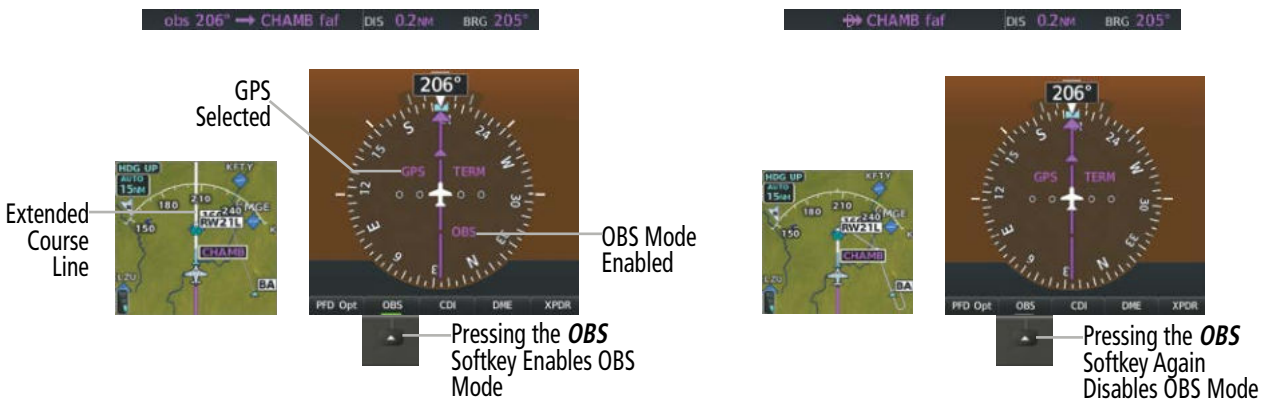


Figure 2-29 Omni-bearing Selector (OBS) Mode

Enabling/disabling OBS Mode while navigating a GPS flight plan:

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

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 a **SUSP** Softkey label to indicate the suspension is active. Pressing the **SUSP** Softkey deactivates the suspension and resumes automatic sequencing of approach waypoints.

- SYSTEM OVERVIEW
- FLIGHT INSTRUMENTS
- EIS
- AUDIO PANEL & CNS
- FLIGHT MANAGEMENT
- HAZARD AVOIDANCE
- AFCS
- ADDITIONAL FEATURES
- APPENDICES
- INDEX

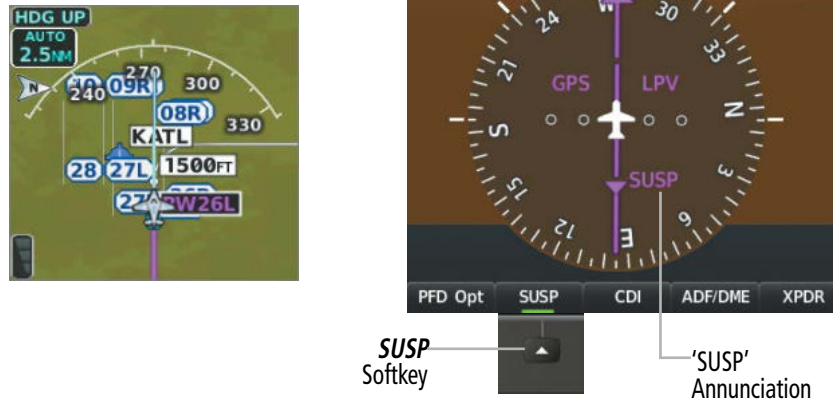


Figure 2-30 Suspending Automatic Waypoint Sequencing

2.2 SUPPLEMENTAL FLIGHT DATA

In addition to the flight instruments, the PFD also displays various supplemental information, including temperatures and wind data.

TEMPERATURE DISPLAYS

The Outside Air Temperature (OAT) and deviation from International Standard Atmosphere (ISA) temperature are displayed in the lower left corner of the PFD under normal conditions. Both are displayed in either degrees Celsius (°C) (default) or Fahrenheit (°F), depending on the temperature units selected on the 'Aux – System Setup 1' Page.



Figure 2-31 ISA and OAT Displayed on PFD



NOTE: ISA is removed from view if the display enters reversionary mode.

Changing temperature display units:

- 1) Use the **FMS** Knob (and press the **Setup 1** Softkey, if necessary) to select the 'Aux – System Setup 1' Page.
- 2) Push the **FMS** Knob to activate the cursor.
- 3) Turn the large **FMS** Knob to highlight the 'Temperature' Field in the 'Display Units' Box.
- 4) Turn the small **FMS** Knob to highlight either 'Celsius(°C)' or 'Fahrenheit(°F)' and press the **ENT** Key to confirm the selection.
- 5) To cancel the selection press the **CLR** Key, or push the **FMS** Knob to deactivate the cursor.

WIND DATA

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

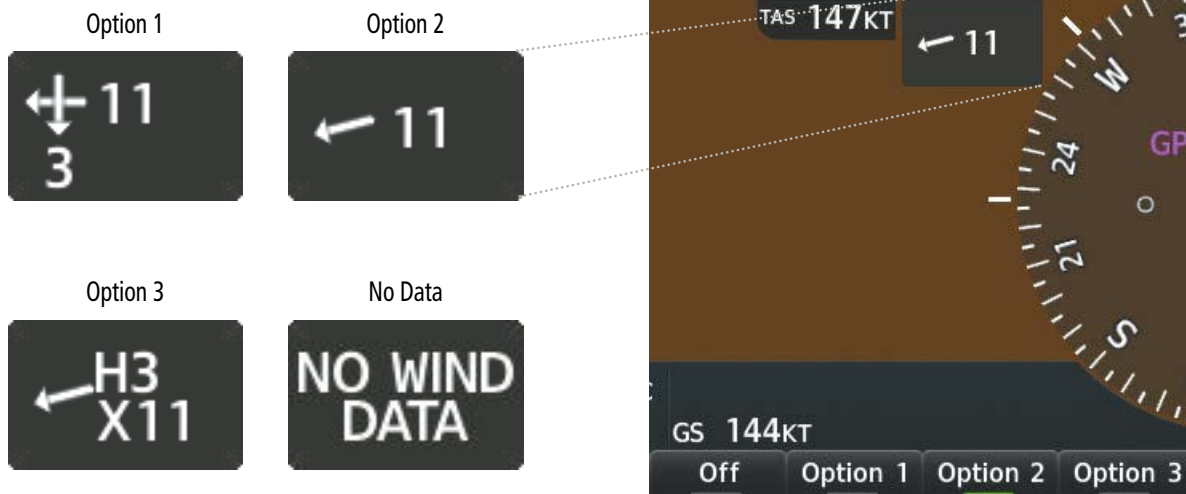


Figure 2-32 Wind Data

Displaying wind data:

- 1) Press the **PFD Opt** Softkey.
- 2) Press the **Wind** Softkey to display wind data option softkeys.
- 3) Press one of the option softkeys to change how wind data is displayed to the left of the HSI:
 - **Option 1:** Headwind/tailwind and crosswind arrows with numeric speed components
 - **Option 2:** Total wind direction arrow with numeric speed
 - **Option 3:** Total wind direction arrow with numeric headwind/tailwind (H/T) and crosswind (X) components
- 4) To remove the window, press the **Off** Softkey.

2.3 GARMIN SYNTHETIC VISION TECHNOLOGY (SVT)



NOTE: Garmin SVT is an optional feature.



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



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



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

Garmin SVT™ (Synthetic Vision Technology) is a visual enhancement to the system. SVT depicts a forward-looking attitude display of the topography immediately in front of the aircraft. The Field of View is 29 degrees to the left and 35.5 degrees to the right. During reversionary mode, 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 Display (PFD), or on the Multifunction Display (MFD) in reversionary mode. The depicted imagery is derived from the aircraft attitude, heading, GPS three-dimensional position, and a 4.9 arc-second database of terrain, obstacles, and other relevant features. The terrain data resolution is 4.9 arc-seconds, meaning the terrain elevation contours are stored in squares measuring 4.9 arc-seconds on each side. Loss of any of the required data, including temporary loss of the GPS signal, will cause SVT to be disabled (although the softkeys will still appear functional) until the required data is restored.

The SVT terrain display shows land contours (colors are consistent with those of the topographical map display), large water features, towers, and other obstacles over 200' AGL that are included in the obstacle database. Wire obstacles, such as high voltage transmission lines, may also be shown when present in the 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 navigation maps. The terrain display also includes a north-south east-west grid with lines oriented to true north and spaced at one arc-minute intervals to assist in orientation relative to the terrain.

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

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

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

The following SVT enhancements appear on the PFD:

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



Figure 2-33 Synthetic Vision Imagery

SVT OPERATION

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**, **APT Sign**, and **Wire**. 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**, **APT Sign**, and **Wire** softkeys are only available when the **Terrain** Softkey is activated (annunciator turns green). After activating the **Terrain** Softkey, the **Pathways**, **HDG LBL**, **APT Sign**, and **Wire** softkeys may be activated in any combination to display desired features. When system power is cycled, the last selected state (on or off) of the **Pathways**, **Terrain**, **HDG LBL**, **APT Sign**, and **Wire** softkeys is remembered by the system.

- **Pathways** Softkey enables display of rectangular boxes that represent course guidance.
- **Terrain** Softkey enables synthetic terrain depiction.
- **HDG LBL** Softkey enables the display of heading marks and digits on the Zero Pitch Line.
- **APT Sign** Softkey enables airport signposts.
- **Wire** Softkey enables display of power lines.

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.

SVT FEATURES



Figure 2-34 SVT on the Primary Flight Display

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.

Activating and deactivating Horizon Heading:

- 1) Press the **PFD Opt** Softkey.
- 2) Press the **SVT** Softkey.
- 3) Press the **HDG LBL** Softkey. The Horizon Heading display will cycle on or off with the **HDG LBL** Softkey.

FLIGHT PATH MARKER

NOTE: Do not use the Flight Path Marker as a flight director.

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

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

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

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



Figure 2-35 Flight Path Marker

PATHWAYS

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

NOTE: Pathways are not available when the X Pointer symbolic aircraft/flight director format is selected.

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 Pathways 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.

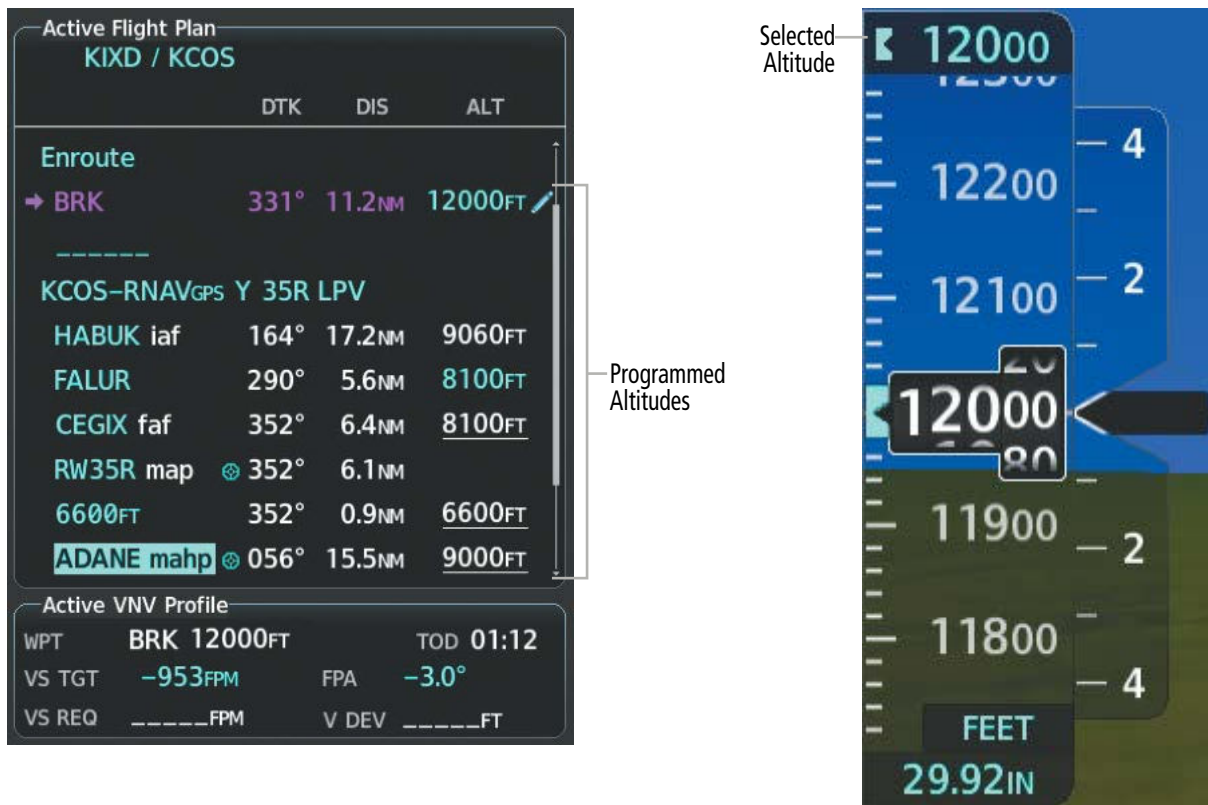


Figure 2-36 Programmed and Selected Altitudes

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

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

DEPARTURE AND ENROUTE

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

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

DESCENT AND APPROACH

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

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

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

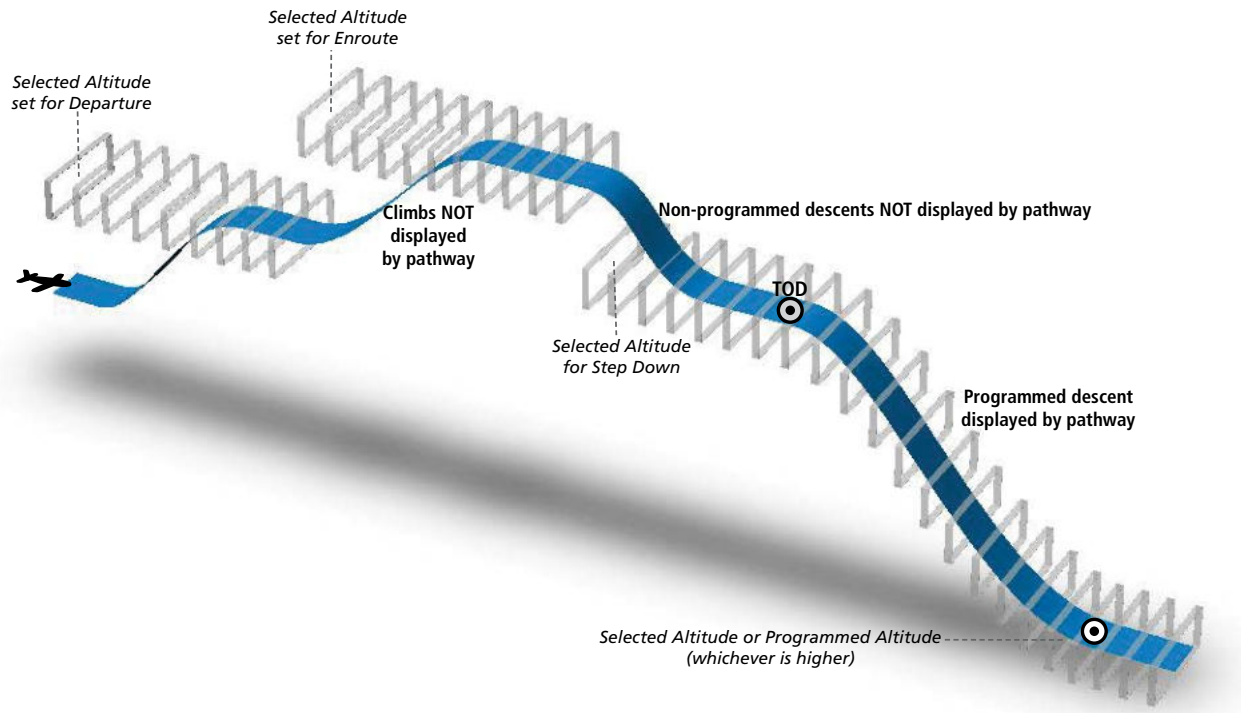


Figure 2-37 SVT Pathways, Enroute and Descent

MISSED APPROACH

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

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

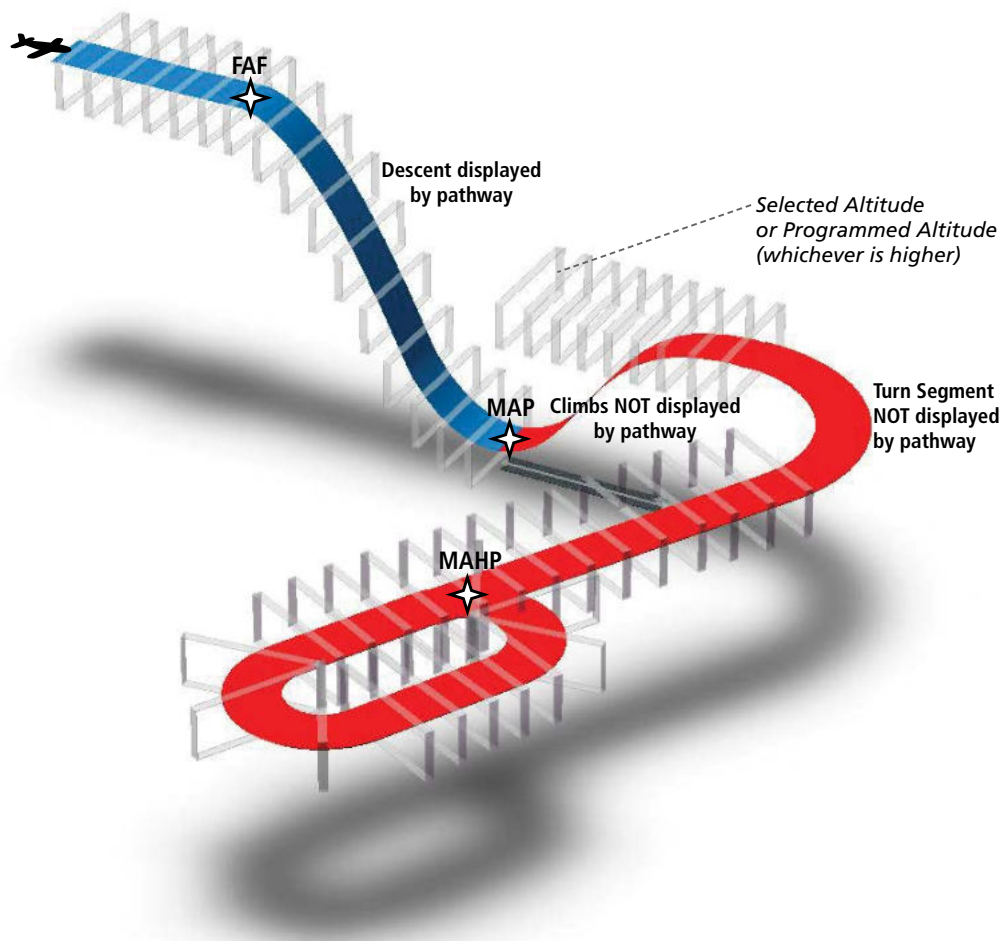


Figure 2-38 SVT Pathways, Approach, Missed Approach, and Holding

TRAFFIC



NOTE: Intruder aircraft at or below 500 ft. AGL may not appear on the Garmin 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 that used for traffic displayed on the Inset Map or MFD traffic page. 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 8 nm 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.

Activating and deactivating Airport Signs:

- 1) Press the **PFD Opt** Softkey.
- 2) Press the **SVT** Softkey.
- 3) Press the **APT Sign** Softkey. Display of Airport Signs will cycle on or off with the **APT Sign** Softkey.



Figure 2-39 Airport Signs

RUNWAYS

WARNING: Do not use 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.

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. If the optional SurfaceWatch feature is enabled, when a specific runway is associated with an approach in the flight plan or when the origin/destination runway with defined dimensions is entered into the system, the runway

perimeter will be outlined with a cyan box. The cyan box may include chevrons to indicate runway direction, depending on the need for decluttering. As the aircraft nears the runway, the cyan runway border will overlay the white runway border.



Figure 2-40 Airport Runways

TERRAIN AND OBSTACLE 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 navigation map displays. For more detailed information regarding Terrain-SVT, 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.

- SYSTEM OVERVIEW
- FLIGHT INSTRUMENTS
- EIS
- AUDIO PANEL & CNS
- FLIGHT MANAGEMENT
- HAZARD AVOIDANCE
- AFCS
- ADDITIONAL FEATURES
- APPENDICES
- INDEX

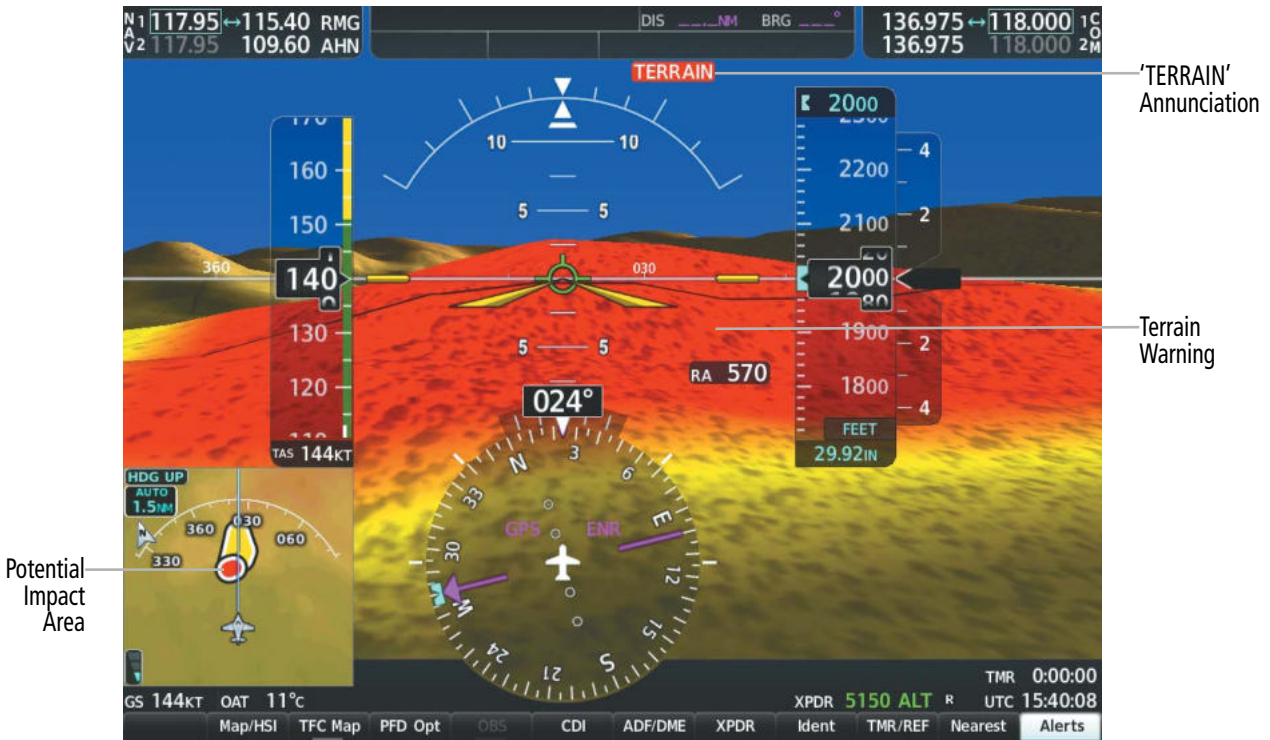


Figure 2-41 Terrain Warning

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

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

- SYSTEM OVERVIEW
- FLIGHT INSTRUMENTS
- EIS
- AUDIO PANEL & CNS
- FLIGHT MANAGEMENT
- HAZARD AVOIDANCE
- AFCS
- ADDITIONAL FEATURES
- APPENDICES
- INDEX



Figure 2-42 Obstacle Alerts

WIREAWARE POWER LINE OBSTACLES



NOTE: The WireAware obstacle database does not contain all known power lines. And as such, obstacle avoidance is the sole responsibility of the flight crew.

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

Activating and deactivating WireAware depiction:

- 1) Press the **PFD Opt** Softkey.
- 2) Press the **SVT** Softkey.
- 3) Press the **Wire** Softkey. Display of power lines will cycle on or off with the **Wire** Softkey.



Figure 2-43 Wire Caution

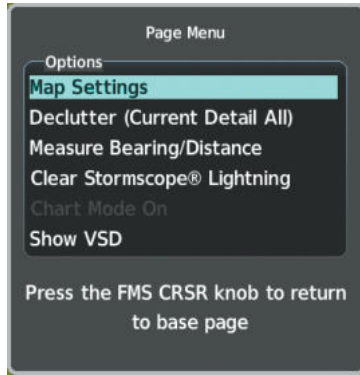
FIELD OF VIEW

The PFD Field of View can be represented on the 'Map – 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.

Configuring Field of View:

- 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 'Map Settings' and press the **ENT** Key.
- 3) Turn the small **FMS** Knob to highlight 'Map' in the 'Group' Box 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) Push the **FMS** Knob to return to the 'Map – Navigation Map' Page.

- SYSTEM OVERVIEW
- FLIGHT INSTRUMENTS
- EIS
- AUDIO PANEL & CNS
- FLIGHT MANAGEMENT
- HAZARD AVOIDANCE
- AFCS
- ADDITIONAL FEATURES
- APPENDICES
- INDEX



'Map – Navigation Map' Page Menu



Field of View

'Map Settings' Menu, 'Map' Group, 'Field of View' Option

Figure 2-44 Field of View Option Menus

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



SVT View on the PFD



Lines Depict PFD Field of View

Field of View on the MFD

Figure 2-45 PFD and MFD Field of View Comparison

2.4 PFD ANNUNCIATIONS AND ALERTING FUNCTIONS

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

MARKER BEACON ANNUNCIATIONS

Marker Beacon Annunciations are displayed on the PFD to the left of the Altimeter. The outer marker (O) reception is indicated in cyan, middle (M) in amber, and inner (I) in white. Refer to the Audio Panel & CNS Section for more information on Marker Beacon Annunciations.

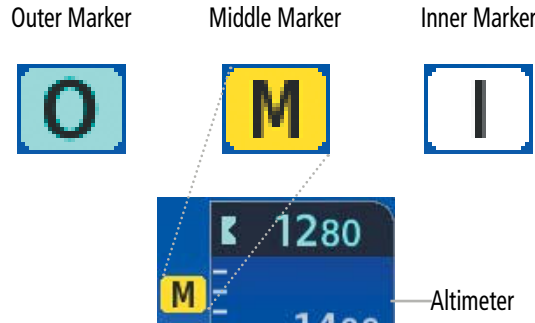


Figure 2-46 Marker Beacon Annunciations

ALTITUDE ALERTING

Altitude alerting 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 following occur when approaching the Selected Altitude:

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



Figure 2-47 Altitude Alerting Visual Annunciations

BARO TRANSITION 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 Alert, and choose the altitude or flight level used to trigger the alerts.

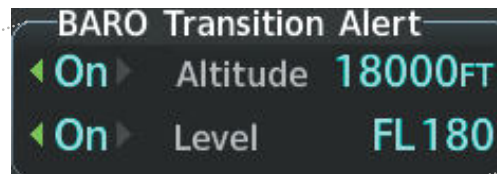


Figure 2-48 BARO Transition Alert ('Aux – System Setup 1' Page)

Setting the Baro Transition Alerts:

- 1) Use the **FMS** Knob (and press the **Setup 1** Softkey, if necessary) to select the 'Aux – System Setup 1' Page.
- 2) Push the **FMS** Knob to activate the cursor.
- 3) Turn the large **FMS** Knob to highlight 'On' or 'Off' associated with the 'Altitude' Field in the 'BARO Transition Alert' Box.
- 4) Turn the small **FMS** Knob to set the BARO Transition Alert Altitude to 'On' or 'Off'.
- 5) Turn the large **FMS** Knob to highlight the 'Altitude' Field in the 'BARO Transition Alert' Box.
- 6) Use the **FMS** Knob 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 'On' or 'Off' associated with the 'Level' Field in the 'BARO Transition Alert' Box.
- 8) Turn the small **FMS** Knob to set the BARO Transition Alert Flight Level to 'On' or 'Off'.
- 9) Turn the large **FMS** Knob to highlight the 'Level' Field in the 'BARO Transition Alert' Box.
- 10) Use the **FMS** Knob 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.

BARO QFE INDICATIONS

BARO QFE will be set to armed mode if the Altimeter is set to STD BARO and BARO QFE on the 'Aux – System Setup Page 1' is set to 'On'. When the altimeter setting is moved from STD BARO, BARO QFE mode is active. During QFE operations an annunciation will be displayed to the left of the Altimeter.

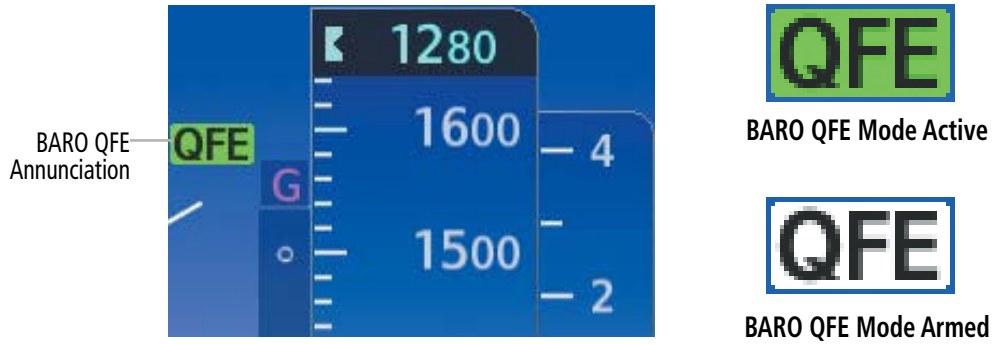


Figure 2-49 BARO QFE Altimeter Annunciations on the PFD

LOW ALTITUDE ANNUNCIATION



NOTE: A Low Altitude Annunciation is available only when SBAS is available. This annunciation is only available when terrain alerting has been inhibited, is not available, or has failed.

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

LOW ALT

Figure 2-50 Low Altitude Annunciation on PFD

MINIMUM ALTITUDE ALERTING

For altitude awareness, a barometric, temperature compensated, or radar altimeter Minimum Altitude Alert can be set in the 'References' Window and is reset if the current approach is deleted, another approach is loaded, or the system power is cycled. For example, while enroute, the crew may choose to set the MEA. When the crew loads an approach, the set Minimum Altitude Alert is removed, and the crew may enter approach minimums. When active, the altitude setting is displayed to the bottom left of the Altimeter. The function serves only as an alert and does not couple to the autopilot. 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 Minimum Altitude Alert:

- When the aircraft altitude is over 100 feet above the Minimum Altitude Alert setting, the BARO MIN, COMP MIN, or RA MIN box appears with the altitude in cyan 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 altitude alert, the bug and text turn white.
- Once the aircraft reaches the alert value, the bug and text become amber and a "Minimums, Minimums" voice alert occurs.

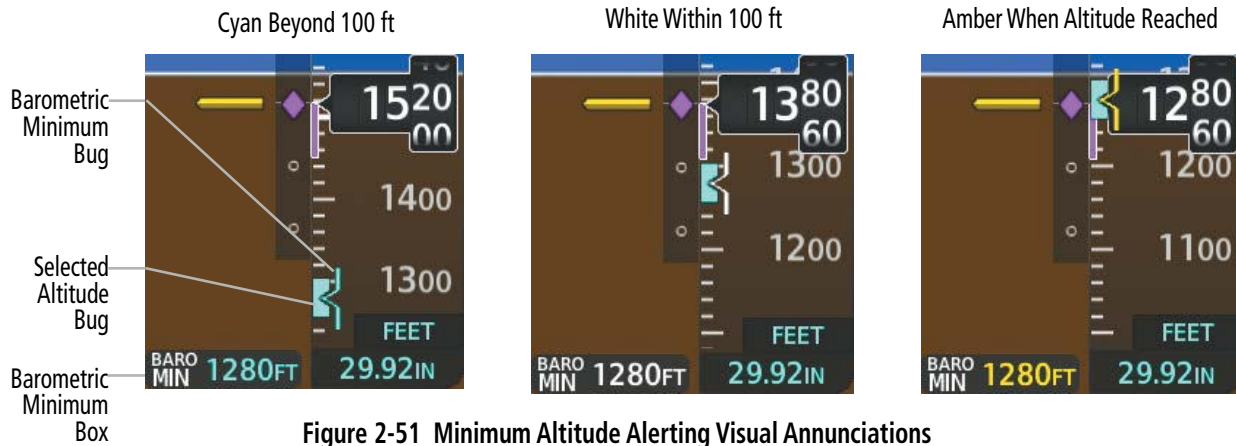


Figure 2-51 Minimum Altitude Alerting Visual Annunciations

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

Setting the Minimum Altitude Alert and bug:

- 1) Press the **TMR/REF** Softkey.
- 2) Turn the large **FMS** Knob to highlight the Minimums ('MINS') Field.
- 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).
- 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.

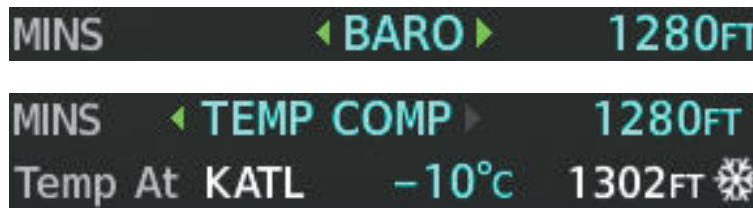


Figure 2-52 BARO and TEMP COMP Minimum Altitude Alerting

RADAR ALTIMETER

NOTE: Radar Altimeter installation is optional.

When the radar height (the aircraft altitude above ground level as 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. Display of radar height becomes more sensitive as the height above ground decreases.



Figure 2-53 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 Radar Altimeter is selected as the altitude source for the Minimum Altitude Alert, the color of the radar height changes to amber upon reaching or descending below the alerting altitude.



Figure 2-54 RA as Altitude Source for Minimum Altitude Alerting

A ground line is shown on the Altimeter to display the aircraft's height relative to the ground. Diagonal lines appear below the ground line. If the data becomes invalid, the annunciation '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 above the Radar Altimeter.



Figure 2-55 Altimeter Displaying Ground Line (Radar Altimeter Installed)



Figure 2-56 Radar Altimeter with Invalid Data

2.5 ABNORMAL OPERATIONS

ABNORMAL GPS CONDITIONS

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

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 2-4 Abnormal GPS Conditions Annunciated on HSI

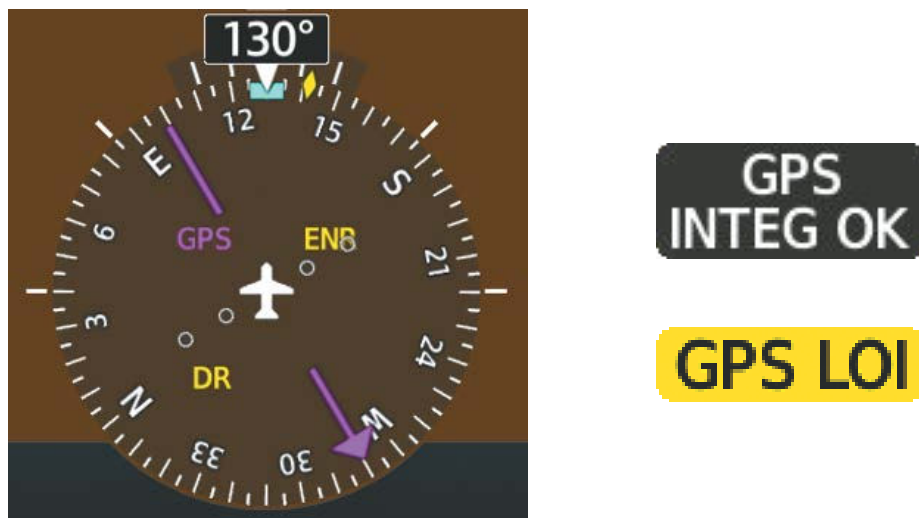


Figure 2-57 Example HSI Annunciations

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

- Current Track Bug
- Wind Data (calculated based on GPS information)
- Distances in the Bearing Information Windows
- GPS Bearing Pointers
- Active Flight Plan Distances, Bearings, and ETE Values
- Ground Speed

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

GARMIN SVT TROUBLESHOOTING

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

SVT becomes disabled without the following data resources:

- Attitude Data
- Heading Data
- GPS Position Data
- Terrain Data
- Obstacle Data
- TAWS Function is not Available, in Test Mode, or Failed
- The Position of the Aircraft Exceeds the Range of the Terrain Database

GARMIN SVT IN REVERSIONARY MODE

SVT can be displayed on the MFD in reversionary mode. If it is enabled when switching to reversionary mode, SVT will take up to 30 seconds to be displayed. The standard, non-SVT PFD, display will be shown in the interim.

UNUSUAL ATTITUDES

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

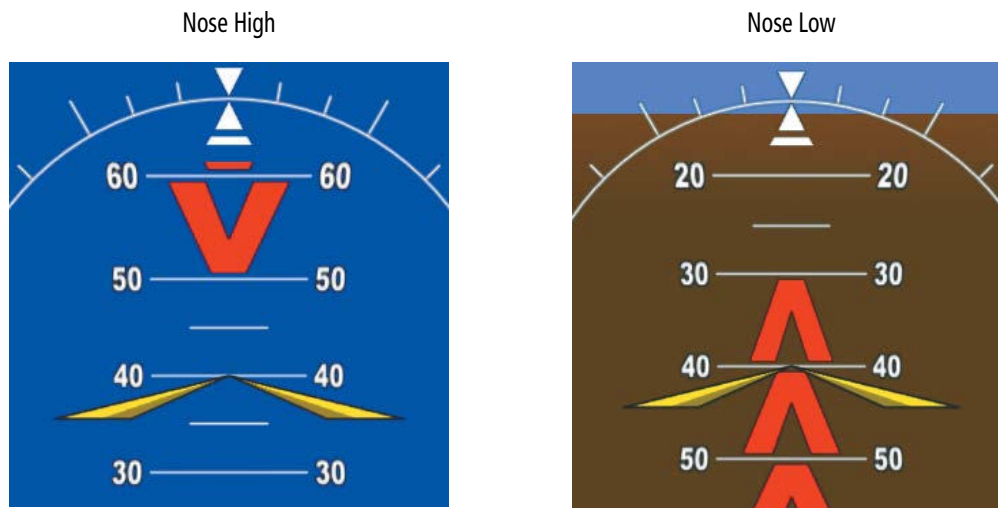


Figure 2-58 Pitch Attitude Warnings

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 their softkeys are disabled when the aircraft experiences unusual attitudes:

- Traffic Annunciations
- AFCS Annunciations
- True Airspeed
- Inset Map
- OAT and ISA Temperature Deviation
- Wind Data
- Selected Heading Indication
- Selected Course Indication
- System Time
- Transponder Status Box
- Windows Displayed on the PFD with the Exception of CAS
- Minimum Altitude Alert Setting
- Vertical Deviation, Glideslope, and Glidepath Indicators
- Altimeter Barometric Setting
- Selected Altitude
- VNV Target Altitude

GARMIN SVT UNUSUAL ATTITUDES

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



Figure 2-59 Blue Sky Bar with Full Display Terrain

SECTION 3 ENGINE INDICATION SYSTEM (EIS)



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



NOTE: Limitations shown in this section may be superseded by the current version of the pertinent flight manual.

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 engine, electrical, fuel, engine information on the left side of the Multi Function Display (MFD). Detailed EIS information can be viewed by pressing the **Engine** Softkey.



Figure 3-1 Multi Function Display (Model DA42NG Shown)

The EIS instrument types include vertical slider gauges, horizontal slide bar indicators, and digital displays. Green bands indicate normal ranges of operation; amber and red bands indicate caution and warning, respectively. When unsafe operating conditions occur, displays and labels may change color corresponding to the level of the condition. The pointers (labeled left, L, and right, R) on the horizontal bar indicators appear in white to indicate normal operation and change to amber or red to indicate caution or warning conditions.

If sensory data to an instrument becomes invalid or unavailable, an red or amber “X” is shown across the instrument. If a display value is out of range, dashes ‘---’ are shown instead of a display.

3.1 ENGINE DISPLAY



NOTE: The Fuel Quantity Indicator shows 25 gallons of fuel per side in the main tanks when full; the Fuel Quantity Indicator does not account for fuel in the auxiliary tanks.

Beneath the vertical slider gauges are displays for fuel flow and horizontal bar indicators for oil temperature and pressure, coolant temperature, and fuel temperature and quantity.

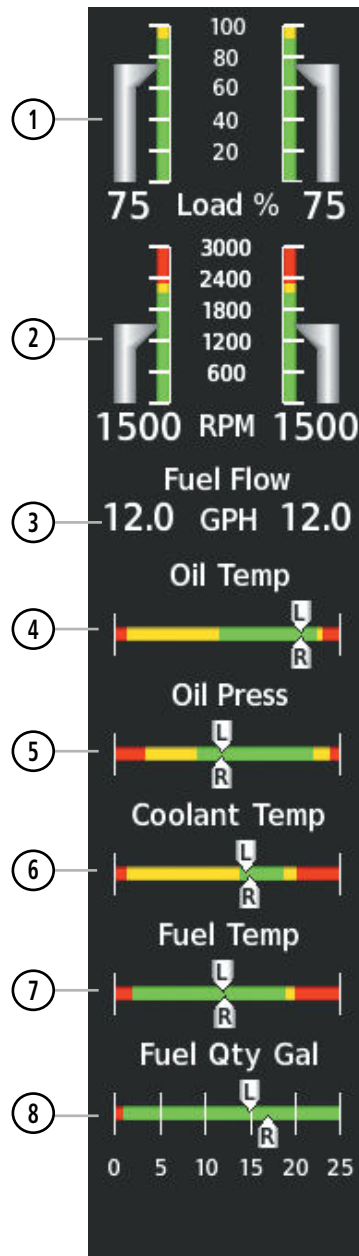


Figure 3-2 Engine Display (Model DA42NG Shown)

- SYSTEM OVERVIEW
- FLIGHT INSTRUMENTS
- EIS
- AUDIO PANEL & CNS
- FLIGHT MANAGEMENT
- HAZARD AVOIDANCE
- AFCS
- ADDITIONAL FEATURES
- APPENDICES
- INDEX

- ① **Engine Load Indicator (Load %)** Displays current engine loads as percentages.

The green band indicates the normal operating range. The amber band indicates the cautionary range. If the indicated percentage is in the cautionary range, the LOAD %, the vertical slider, and the digital indications will display solid amber and black.
- ② **Tachometer (RPM)** Displays propeller speeds in revolutions per minute (rpm).

The green band indicates the normal operating range. The red bands indicate the warning range. If the indicated RPM is in the warning range, the RPM, the slider, and the digital indication will flash red and white.
- ③ **Fuel Flow (Fuel Flow GPH)** Displays digital value of current fuel flow for each engine in gallons per hour (gph).
- ④ **Oil Temperature (Oil Temp)** Displays engine oil temperature ranges; pointers labeled ‘L’ and ‘R’ indicate the oil temperature for each engine.

The green band indicates the normal operating range. The amber band indicates the cautionary ranges, and the red band indicates the warning ranges. If the indicated oil temperature is in the cautionary ranges, the OIL TEMP, ‘L’ pointer and/or ‘R’ pointer, and the digital indication will display solid amber and black. If the indicated oil temperature is in the warning ranges, the OIL TEMP, ‘L’ pointer and/or ‘R’ pointer, and the digital indication will flash red and white.
- ⑤ **Oil Pressure (Oil Press)** Displays engine oil pressure ranges; pointers labeled L and R indicate the oil pressure for each engine.

The green band indicates the normal operating range. The amber band indicates the cautionary ranges, and the red band indicates the warning ranges. If the indicated oil pressure is in the cautionary ranges, the OIL PRESS, ‘L’ pointer and/or ‘R’ pointer, and the digital indication will display solid amber and black. If the indicated oil pressure is in the warning ranges, the OIL PRESS, ‘L’ pointer and/or ‘R’ pointer, and the digital indication will flash red and white.
- ⑥ **Coolant Temperature (Coolant Temp)** Displays coolant temperature ranges; pointers labeled ‘L’ and ‘R’ indicate coolant temperature for each engine.

The green band indicates the normal operating range. The amber band indicates the cautionary ranges, and the red band indicates the warning ranges. If the indicated coolant temperature is in the cautionary ranges, the COOLANT TEMP, ‘L’ pointer and/or ‘R’ pointer, and the digital indication will display solid amber and black. If the indicated coolant temperature is in the warning ranges, the COOLANT TEMP, ‘L’ pointer and/or ‘R’ pointer, and the digital indication will flash red and white.

⑦ Fuel Temperature (Fuel Temp)

Displays fuel temperature range; pointers labeled 'L' and 'R' indicate the fuel temperature in each tank.

The green band indicates the normal operating ranges. The amber band indicates the cautionary ranges, and the red band indicates the warning ranges. If the indicated fuel temperature is in the cautionary ranges, the FUEL TEMP, 'L' pointer and/or 'R' pointer, and the digital indication will display solid amber and black. If the indicated fuel temperature is in the warning ranges, the FUEL TEMP, 'L' pointer and/or 'R' pointer, and the digital indication will flash red and white.

⑧ Fuel Quantity (Fuel Qty Gal)

Displays the fuel quantity in gallons (gal) of fuel in the main tanks; pointers labeled 'L' and 'R' indicate the fuel quantity in each tank.

Indicator ranges from 0 to 25 gal per side with tick marks every 5 gal; the warning range indicates 1 gal of unusable fuel.

3.2 ENGINE PAGE

The EIS - Engine Page displays all engine, fuel, electrical, and fuel calculation information. To access this page, press the **Engine** Softkey or turn the large **FMS** Knob and select EIS. Refer to Table 3-1 for 'EIS - Engine' Page softkey functions.

Level 1	Level 2	Description
Engine		Displays 'EIS - Engine' Page and second-level engine softkeys; press again to exit page
	DEC Fuel	Decreases displayed fuel remaining in 1-gal increments
	INC Fuel	Increases displayed fuel remaining in 1-gal increments
	RST Fuel	Resets displayed fuel remaining to maximum fuel capacity for aircraft and fuel used to zero

Table 3-1 Engine Page Softkeys



Figure 3-3 Engine Page (Model DA42NG Shown)

① Oil Pressure (Oil bar)

Displays engine oil pressure ranges in bar.

The green band indicates the normal operating range. The amber band indicates the cautionary ranges, and the red band indicates the warning ranges. If the indicated oil pressure is in the cautionary ranges, the OIL BAR, slider pointer, and the digital indication will display solid amber and black. If the indicated oil pressure is in the warning ranges, the OIL BAR, slider pointer, and the digital indication will flash red and white.

② Oil Temperature (Oil °C)

Displays engine oil temperature ranges in degrees Celsius (°C).

The green band indicates the normal operating range. The amber band indicates the cautionary ranges, and the red band indicates the warning ranges. If the indicated oil pressure is in the cautionary range, the OIL °C, slider pointer, and the digital indication will display solid amber and black. If the indicated oil pressure is in the warning ranges, the OIL °C, slider pointer, and the digital indication will flash red and white.

③ Tachometer (RPM)

Displays propeller speeds in revolutions per minute (rpm).

The green band indicates the normal operating range. The red band indicates the warning range. If the indicated rpm is in the warning ranges, the RPM, slider pointer, and the digital indication will flash red and white.

④ Engine Load (Load %)

Displays current engine loads as percentages.

The green band indicates the normal operating range. The amber band indicates the cautionary range. If the indicated oil pressure is in the cautionary range, the LOAD %, slider pointer, and the digital indication will display solid amber and black.

⑤ Fluids

Displays coolant temperature in degrees Celsius (°C), the gearbox temperature in degrees Celsius (°C), and the deice fluid in liters (*optional*).

The green bands indicates the normal operating range. The amber bands indicates the cautionary ranges, and the red bands indicates the warning ranges. If an indication is in the cautionary range, the label, slider pointer, and the digital indication will display solid amber and black. If an indication is in the warning ranges, the label, slider pointer, and the digital indication will flash red and white.

⑥ Electrical

Displays the primary bus voltage for each side; pointers labeled ‘L’ and ‘R’ indicate the voltage for each side, and each alternator load in amperes (amps); pointers labeled ‘L’ and ‘R’ indicate the amps for each side.

The green bands indicates the normal operating range. The amber bands indicates the cautionary ranges, and the red bands indicates the warning ranges. If an indication is in the cautionary range, the label, ‘L’ pointer and/or ‘R’ pointer, and the digital indication will display solid amber and black. If an indication is in the warning ranges, the label, ‘L’ pointer and/or ‘R’ pointer, and the digital indication will flash red and white.

⑦ Total Service

Displays the aircraft’s total flight hours (hrs); activated when the aircraft becomes airborne.

⑧ Fuel System

Displays fuel quantity in the main tanks in gallons (gal), fuel temperature for each main tank in degrees Celsius (°C); pointers labeled L and R indicate the fuel temperature in each tank, and current fuel flow for each engine in gallons per hour (GPH).

The green bands indicates the normal operating range. The amber bands indicates the cautionary ranges, and the red bands indicates the warning ranges. If an indication is in the cautionary range, the label, slider pointer or ‘L’ pointer and/or ‘R’ pointer (as applicable), and the digital indication will display solid amber and black. If an indication is in the warning ranges, the label, slider pointer or ‘L’ pointer and/or ‘R’ pointer (as applicable), and the digital indication will flash red and white.

⑨ Fuel Calculator

Gallons Remain - Displays current fuel remaining (gal) as set by the pilot and adjusted for fuel burn since last set.

Gallons Used - Displays quantity of fuel used (gal) based on fuel flow since last reset.

Endurance - Displays flight time remaining in hours and minutes (HH+MM) based on the calculated fuel remaining.

Range NM - Displays aircraft range in nautical miles (nm) based on the calculated fuel remaining.

FUEL CALCULATIONS



NOTE: Fuel calculations do not use the aircraft fuel quantity indicators and are calculated from the last time the fuel was reset.

Fuel used (Gallons Used), Endurance, and range (in nautical miles, Range NM) are calculated based on the displayed fuel remaining (Gallons Remain) and the fuel flow totalizer. The calculated range also takes into account the aircraft's heading and the wind direction and speed.

Adjusting the fuel totalizer quantity:

On the Engine Page, use the **DEC Fuel** and **INC Fuel** Softkeys to obtain the desired fuel remaining (Gallons Remain).

Resetting the fuel totalizer:

On the Engine Page, select the **RST Fuel** Softkey; this resets displayed fuel remaining (Gallons Remain) to the maximum fuel capacity for the aircraft and fuel used to zero.

A map feature related to the EIS Fuel Calculations is the Fuel Range Ring, which graphically illustrates the aircraft's remaining range based on the endurance, heading, groundspeed, and wind direction and speed. The solid green circle represents the range until all the remaining fuel is depleted. The dashed green circle indicates the aircraft range until only reserve fuel remains. Once on reserve fuel, the range is indicated by a solid amber circle.

The Fuel Range Ring shifts position in relation to the aircraft according to wind effects. For example, more fuel is required for flying into a headwind, and the aircraft's decreased range in that direction is indicated by the Fuel Range Ring shifting toward the tail of the Aircraft Symbol.

The amount of reserve fuel (only for purposes of the Fuel Range Ring) is set on the Navigation Map Page Setup Menu in terms of remaining flight time. When enabled, the Fuel Range Ring appears on the Navigation Map Page, the Weather Data Link Page, and PFD Inset Map. (Refer to Flight Management for more information on the Fuel Range Ring.)

Enabling/disabling the Fuel Range Ring and selecting a reserve fuel time:

- 1) On the MFD, display the Navigation Map Page (press and hold the **CLR** Key for 2 seconds to quickly select this map).
- 2) Press the **MENU** Key.
- 3) Highlight 'Map Settings' and press the **ENT** Key. The Map Settings Menu is displayed.
- 4) Use the small **FMS** Knob to select the 'Map' group and press the **ENT** Key.
- 5) Highlight the 'Fuel Range (RSV)' field.
- 6) Turn the small **FMS** Knob to select 'On' or 'Off'.
- 7) Turn the large **FMS** Knob to highlight the reserve fuel time, how long the aircraft can fly after reaching the reserve fuel.
- 8) Enter the desired reserve fuel time (00+00 to 23+59; hours+minutes) and press the **ENT** Key.
- 9) Push the **FMS** Knob to return to the Navigation Map Page.

3.3 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).



Figure 3-4 Primary Flight Display (Reversionary Mode - Model DA42NG Shown)

SYSTEM
OVERVIEW

FLIGHT
INSTRUMENTS

EIS

AUDIO PANEL
& CNS

FLIGHT
MANAGEMENT

HAZARD
AVOIDANCE

AFCS

ADDITIONAL
FEATURES

APPENDICES

INDEX

Blank Page

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

The MFD/PFD controls are used to tune the communication transceivers and navigation radios.

The Audio Panel provides the traditional audio selector functions of microphone and receiver audio selection. The Audio Panel includes an intercom system (ICS) between the pilot, copilot, and passengers, a marker beacon receiver, 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 transponder is controlled with softkeys and the **FMS** Knob located on the Primary Flight Display (PFD). The Transponder Data Box is located to the left of the System Time Box. The data box displays the active four-digit code, mode, and reply status.

PFD CONTROLS AND FREQUENCY DISPLAY



Figure 4-1 PFD Controls, NAV/COM Frequency Tuning Boxes, and ADF/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 (light blue 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 is displayed in green.
- ⑤ **COM Frequency Box** – Displays COM standby and active frequency fields and volume. If available, the communication source description is displayed in green underneath the COM Frequency Box.
- 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 (light blue 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 optional **ADF/DME** Softkey.
- ⑩ **ENT Key** – Validates or confirms an ADF frequency or ADF/DME mode and Auto-tune selection..
- ⑪ **FMS Knob** – Flight Management System Knob, used to enter transponder codes, select ADF/DME modes, and Auto-tune entries when ADF/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 optional ADF/DME Tuning Window.

AUDIO PANEL CONTROLS

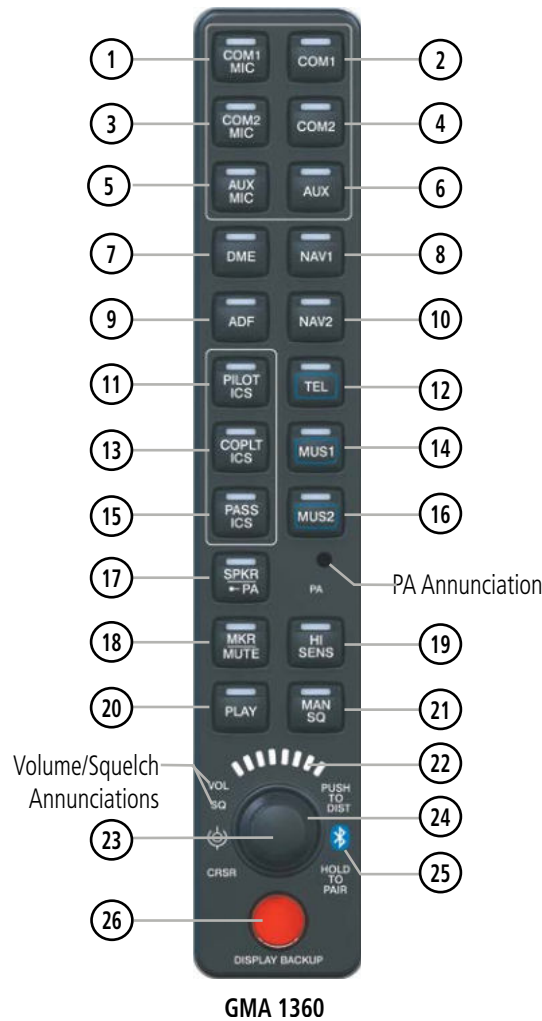


Figure 4-2 Audio Panel Controls

NOTE: When a GMA 1360 Key is selected, the in-key annunciation 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 **AUX MIC** – Not used in the Diamond DA42NG aircraft.
- ⑥ **AUX** – Not used in the Diamond DA42NG aircraft.
- ⑦ **DME** – Turns optional DME audio on or off.
- ⑧ **NAV1** – When selected, audio from the #1 NAV receiver can be heard.
- ⑨ **ADF** – Turns optional ADF receiver audio on or off.
- ⑩ **NAV2** – When selected, audio from the #2 NAV receiver can be heard.
- ⑪ **PILOT ICS** – Controls the pilot intercom system. Press and hold to enable/disable Bluetooth recording mode.
- ⑫ **TEL** – When selected, audio from the satellite telephone can be heard.
- ⑬ **COPLT ICS** – Controls the copilot intercom system. Press and hold to enable/disable Bluetooth recording mode.
- ⑭ **MUS1** – Selects/Deselects the MUS1 audio source and assigns the Bluetooth device to the MUS1 audio. Press the **MUS1** key until the annunciator turns blue. The in-key annunciator will cycle from OFF to WHITE to BLUE. WHITE selects the wired audio source and BLUE selects the Bluetooth audio source. NOTE: The Bluetooth audio can only be assigned to one source at a time for each audio panel. Once the Bluetooth audio is assigned to an audio source, the remaining entertainment audio sources will only cycle between OFF and WHITE.
- ⑮ **PASS ICS** – Controls the passenger intercom system. Press and hold to enable/disable Bluetooth recording mode.
- ⑯ **MUS2** – Selects/Deselects the MUS2 audio source and can assign the Bluetooth device to the MUS2 audio. Press the **MUS2** key until the annunciator turns blue. The in-key annunciator will cycle from OFF to WHITE to BLUE. WHITE selects the wired audio source and BLUE selects the Bluetooth audio source. NOTE: The Bluetooth audio can only be assigned to one source at a time for each audio panel. Once the Bluetooth audio is assigned to an audio source, the remaining entertainment audio sources will only cycle between OFF and WHITE.
- ⑰ **SPKR/PA** – Selects and deselects the cabin speaker. The selected COM transmitter is deselected when the **SPKR/PA** Key is pressed.
 Press and hold **SPKR/PA** for 2 seconds to select the PA system. When the PA is active the annunciation to the right of the **SPKR/PA** softkey will be illuminated. The annunciator will flash when PA mode is active and the PTT is pressed.
- ⑱ **MKR/MUTE** – Selects marker beacon receiver audio. Mutes the currently received marker beacon receiver audio. Unmutes automatically when new marker beacon audio is received. Also, stops play of recorded COM audio.
- ⑲ **HI SENS** – Press to increase marker beacon receiver sensitivity. Press again to return to low sensitivity.
- ⑳ **PLAY** – Press once to play the last recorded COM audio. Press again while audio is playing and the previous block of recorded audio is played. Each subsequent press plays each previously recorded block. Pressing the **MKR/MUTE** Key during play of a memory block stops play.
- ㉑ **MAN SQ** – Enables manual squelch for the intercom. When the intercom is active, press the **PILOT** Knob to illuminate the squelch annunciation. Turn the **PILOT/PASS** Knobs to adjust squelch.

- ②② **Volume/Squelch Indicator** – Indicates volume/squelch setting relative to full scale.
- ②③ **Volume/Squelch (VOL/SQ) Control Knob** – Turn the smaller knob to control volume or squelch of the selected source (indicated by the flashing white or blue annunciator). When the volume control cursor is not active press to switch to Blue-Select mode. If the volume control cursor is active, press twice (once to cancel the cursor, twice to activate Blue-Select mode). Press and hold for five seconds to enable the audio panel as discoverable for pairing. The Bluetooth Annunciator will flash to indicate that the unit is discoverable. The unit will remain discoverable for 90 seconds or until a successful pair is established. Once a successful pair is established, the audio “Bluetooth paired” is played.
- ②④ **Cursor (CRSR) Control Knob** – Turn to move the cursor (flashing white or blue annunciator) to the desired source.
- ②⑤ **Bluetooth[®] Connection Annunciator** – A flashing cyan annunciator indicates the unit is discoverable. A solid blue annunciator indicates an active Bluetooth connection.
- ②⑥ **DISPLAY BACKUP Button** – Manually selects Reversionary Mode.

4.2 COM OPERATION

COM TUNING BOXES

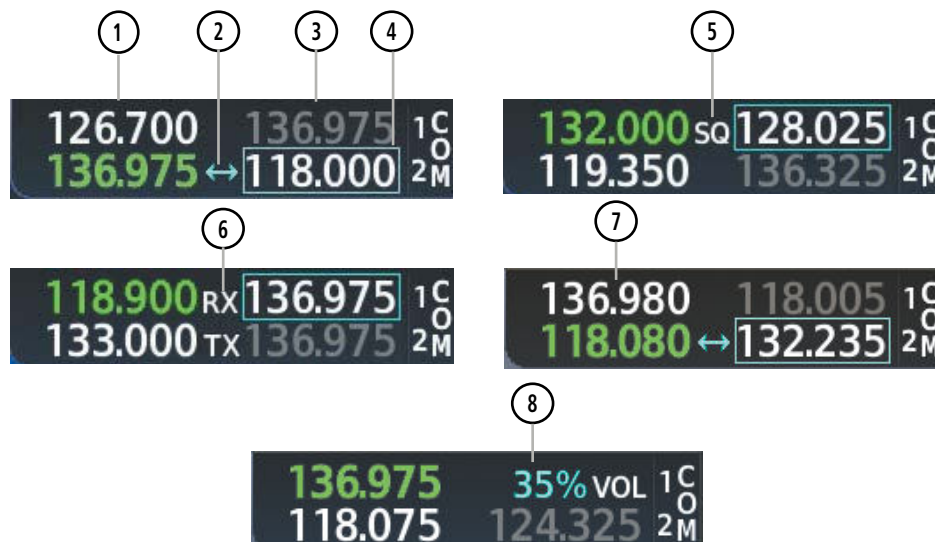


Figure 4-3 COM Tuning Box Indications



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 Field** – 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 transceiver is selected for frequency transfer between the Standby and Active fields.
- ③ **Standby Field** – 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 the MFD and 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)
- 'NRST – Nearest Frequencies' Page (ARTCC, FSS, WX)
- 'WPT – Airport Information' Page
- 'NRST – Nearest Airspaces' Page
- 'NRST – Nearest Airports' 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) Press 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.



Press 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 Boxes 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 pressing 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' Window.
- 4) Turn the **FMS** Knob to place the cursor on the desired COM frequency field.
- 5) Press the **ENT** Key to load the COM frequency into the selected COM frequency 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.
- 5) Press the **ENT** Key to display the 'Load Frequency' Window.
- 6) Turn the **FMS** Knob to place the cursor on the desired COM frequency field.
- 7) Press the **ENT** Key to load the COM frequency into the selected COM frequency field.

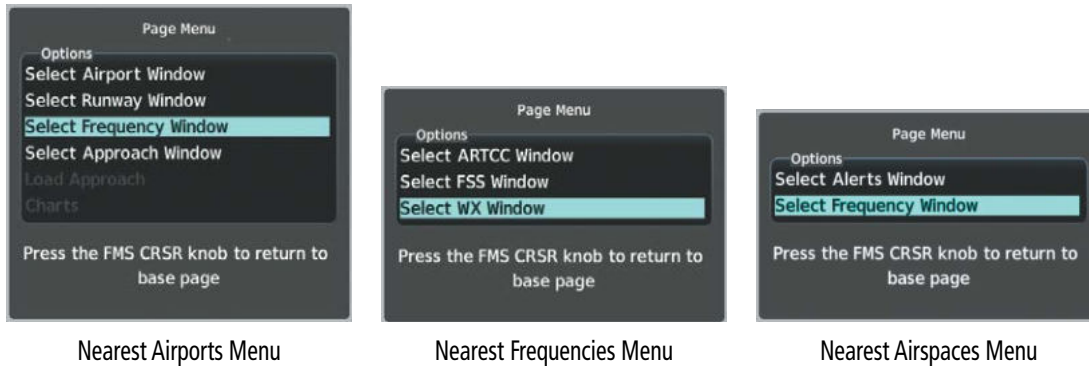


Figure 4-5 Nearest Pages Menus

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. The frequency is transferred to the COM Standby Field with the **ENT** Key.



Figure 4-6 'WPT - Airport Information' Page COM Auto-Tune

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** Knob, 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 from the Aux Page Group.

Changing COM frequency channel spacing:

- 1) From 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 Configuration' Window is selected, the softkeys are blank.



Select 8.33-kHz or 25.0-kHz COM Frequency Channel Spacing

Figure 4-7 'Aux – System Setup 1' Page

- SYSTEM OVERVIEW
- FLIGHT INSTRUMENTS
- EIS
- AUDIO PANEL & CNS
- FLIGHT MANAGEMENT
- HAZARD AVOIDANCE
- AFCS
- ADDITIONAL FEATURES
- APPENDICES
- INDEX

4.3 NAV OPERATION

NAV TUNING BOXES

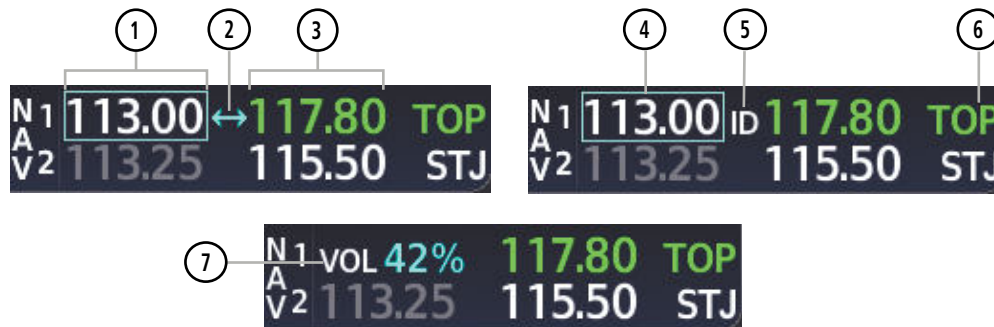


Figure 4-8 NAV Tuning Box Indications

- 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 transceiver 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 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/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.

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 pressing the **CDI** Softkey located on the PFD. The active NAV frequency selected for navigation is displayed in green. Pressing the **CDI** Softkey once selects NAV1 as the navigation radio. Pressing the **CDI** Softkey a second time selects NAV2 as the navigation radio. Pressing the **CDI** Softkey a third time activates GPS mode. Pressing 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 MFD and PFD.

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 NAV **VOL/ID** Knob.
- 4) Press the NAV **VOL/ID** Knob to turn the Morse code identifier audio 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’ Page
- ‘WPT – VOR Information’ Page
- ‘NRST – Nearest Airports’ Page
- ‘NRST – Nearest VOR’ Page
- ‘NRST – Nearest Frequencies’ (FSS, WX) Page
- ‘NRST – Nearest Airspaces’ Page

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 or 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 and Nearest Airports pages, press the **FREQ** Softkey to place the cursor on the NAV frequency.
- 4) Press the **ENT** Key to display the 'Load Frequency' Window.
- 5) Turn the **FMS** Knob to place the cursor on the desired NAV frequency field.
- 6) Press the **ENT** Key to load the NAV frequency into the selected NAV frequency field.

Or:

- 1) When on the NRST pages, press the **MENU** Key on the PFD/MFD Controller 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.
- 5) Press the **ENT** Key to display the 'Load Frequency' Window.
- 6) Turn the **FMS** Knob to select the desired NAV frequency field.
- 7) Press the **ENT** Key to load the NAV frequency into the selected NAV frequency field.

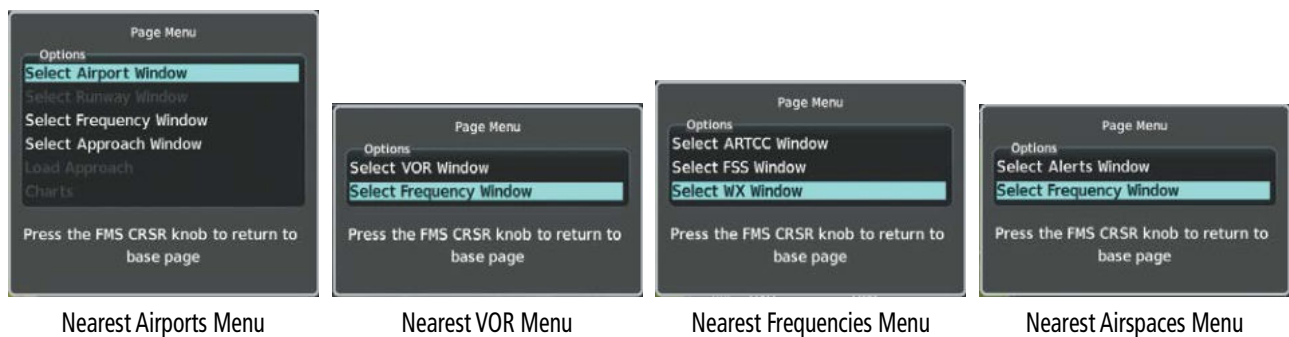


Figure 4-9 Nearest Pages Menus

SYSTEM OVERVIEW

FLIGHT INSTRUMENTS

EIS

AUDIO PANEL & CNS

FLIGHT MANAGEMENT

HAZARD AVOIDANCE

AFCS

ADDITIONAL FEATURES

APPENDICES

INDEX

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 NAV Tuning Box with the **ENT** Key.

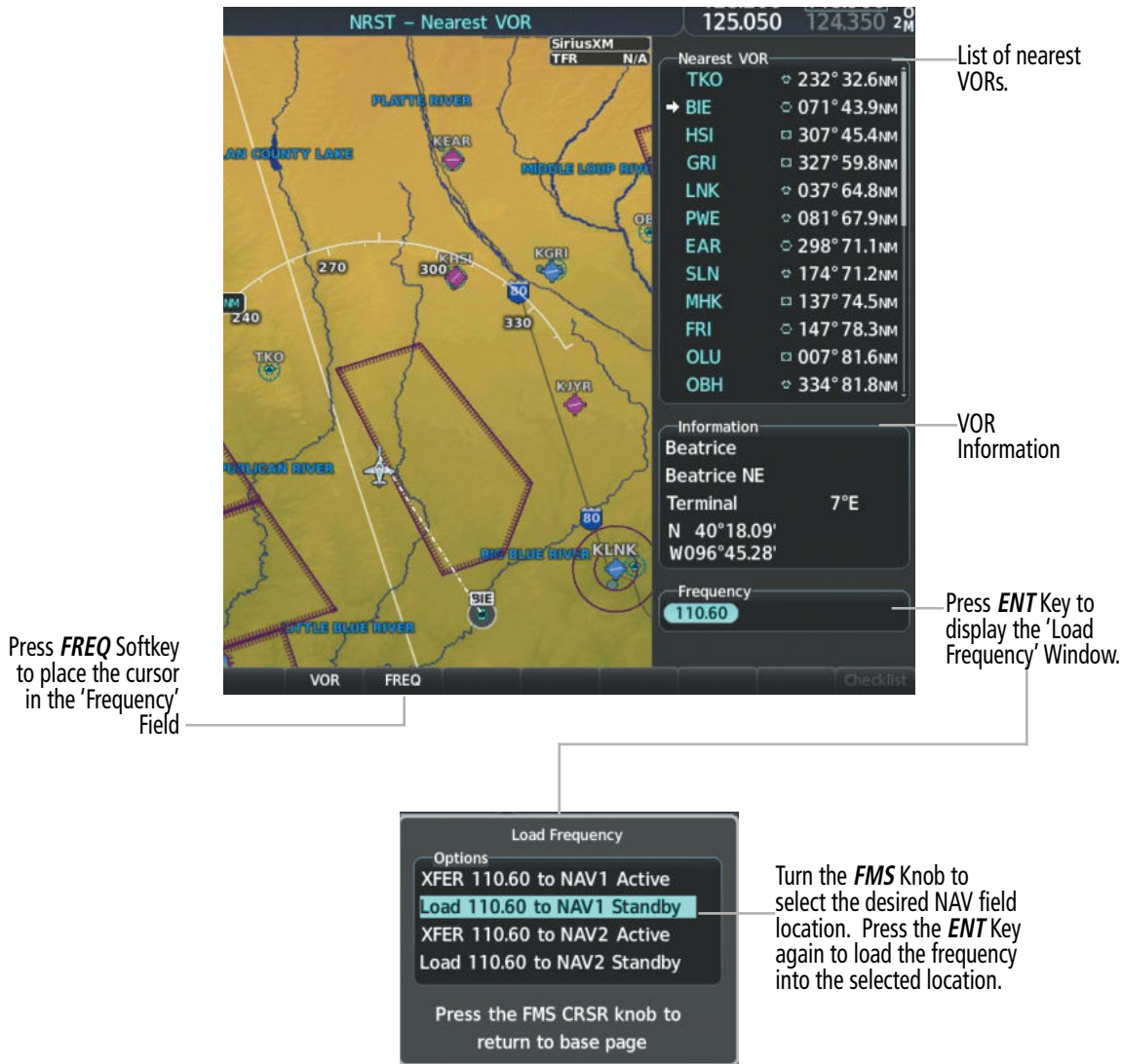


Figure 4-10 'NRST - Nearest VOR' Page NAV Auto-Tune

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.

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 deselected 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



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 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.

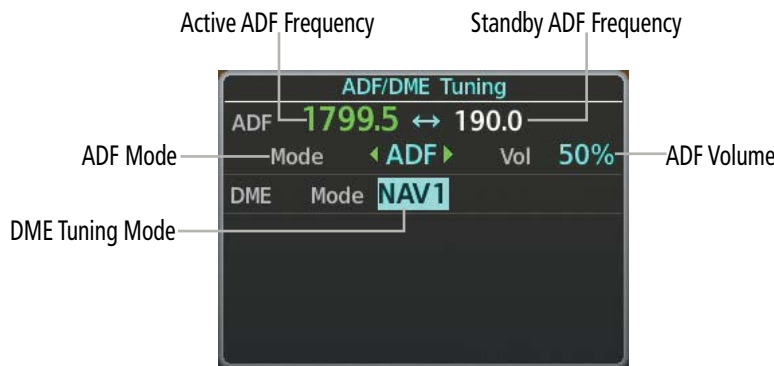


Figure 4-12 ADF/DME Tuning Window

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.

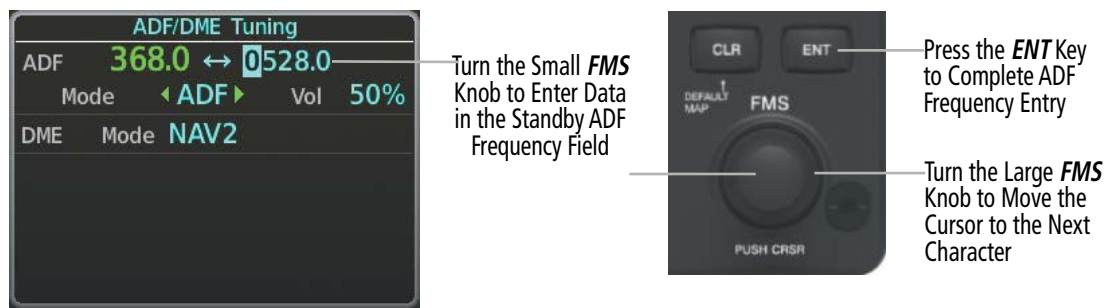


Figure 4-13 Entering ADF Standby Frequencies

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.

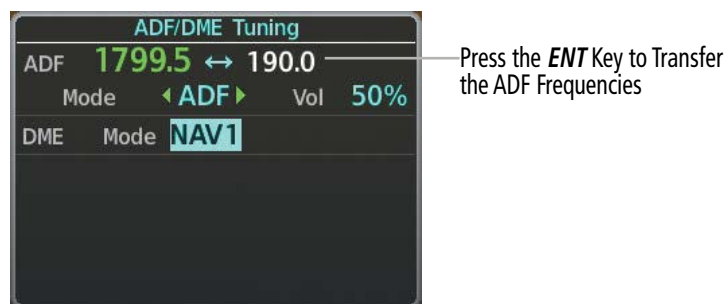


Figure 4-14 Transferring ADF Frequencies

SELECTING ADF RECEIVER MODE

The following modes can be selected: (In all modes NDB audio can be heard by selecting 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.



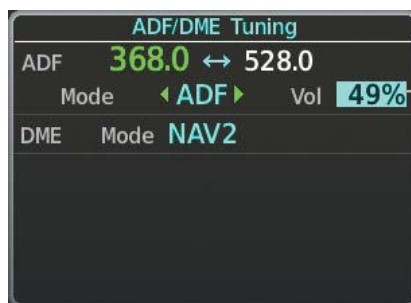
Turn the Small **FMS** Knob to Select the Mode

Figure 4-15 Selecting 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%.

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.



Turn the Small **FMS** Knob to Select the Volume

Figure 4-16 Adjusting ADF Receiver Volume

DME TUNING



NOTE: When turning on the G1000 NXi for use, the system remembers the last frequency used for DME tuning and the NAV1, NAV2, or HOLD state prior to shutdown.

The system tunes the optional DME transceiver. 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 ADF/DME Tuning Window is located to the right of the HSI in the lower right corner of the PFD. The DME transceiver is tuned by selecting NAV1, NAV2, or HOLD in the DME Tuning Window. Pressing the **DME** Softkey switches the ADF/DME Tuning Window on and off.



Figure 4-17 ADF/DME Tuning Window, DME Modes

The following DME transceiver pairing 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 HOLD mode, the DME frequency remains paired with the last selected NAV frequency.

Selecting DME transceiver pairing:

- 1) Press the **ADF/DME** or **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 tuning 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.

See the Flight Instruments Section for displaying the DME information window.

4.4 MODE S TRANSPONDER

The Mode S Transponder provides Mode A, Mode C, and Mode S interrogation and reply capabilities. Selective addressing or Mode Select (Mode S) capability includes the following features:

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

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

TRANSPONDER CONTROLS

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: **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.

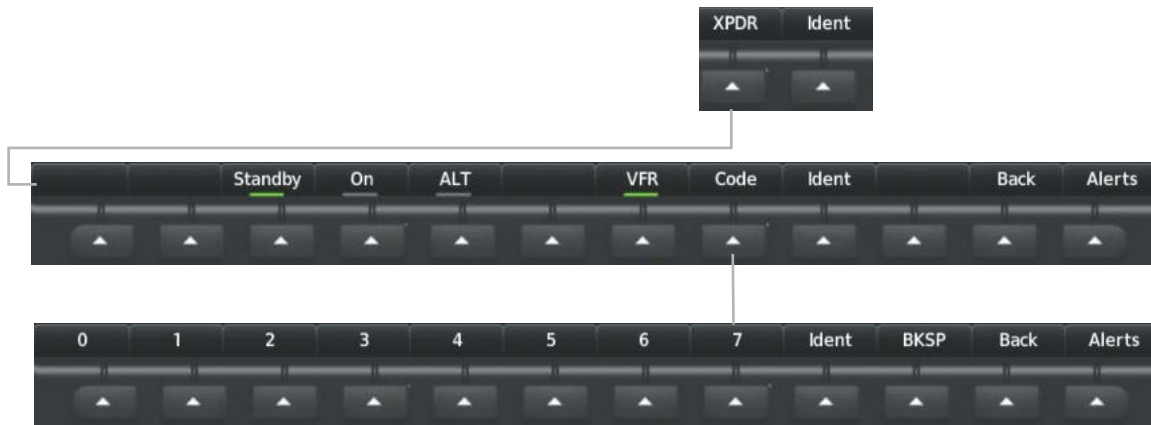


Figure 4-18 XPDR Softkeys (PFD)

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) Press 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.

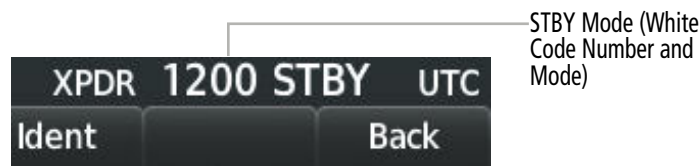


Figure 4-19 Standby Mode

MANUAL ON MODE

On Mode can be selected at any time by pressing the **On** Softkey. An On indication will appear in the mode field of the Transponder Data Box. Selecting On mode enables transmission of transponder replies and squitters, but transmissions will not include altitude information. The On indication and transponder code in the Transponder Data Box will appear green while airborne and white while on the ground. When the transponder is operating with an air state of on-ground it will disable replies to Mode A, Mode C, and Mode S all-call interrogations so the aircraft will not show up on the traffic systems of other aircraft.

- SYSTEM OVERVIEW
- FLIGHT INSTRUMENTS
- EIS
- AUDIO PANEL & CNS
- FLIGHT MANAGEMENT
- HAZARD AVOIDANCE
- AFCS
- ADDITIONAL FEATURES
- APPENDICES
- INDEX

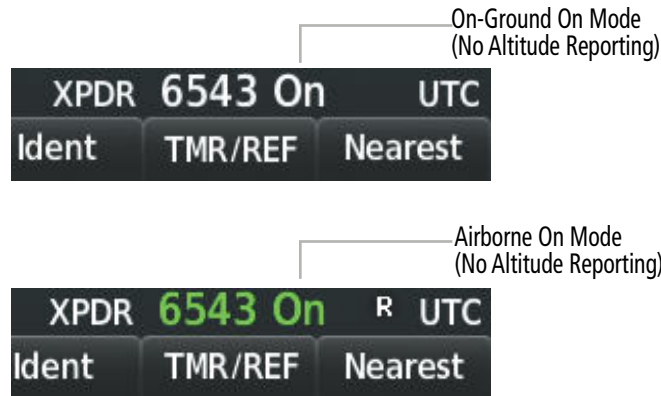


Figure 4-20 On Mode

ALTITUDE MODE

ALT Mode can be selected at any time by pressing the **ALT** Softkey. When ALT mode is selected, an ALT indication will appear in the mode field of the Transponder Data Box. Selecting ALT mode enables transmission of transponder replies and squitters. Transmissions will include pressure altitude information. The ALT indication and transponder code in the Transponder Data Box will appear green while airborne and white while on the ground. When the transponder is operating with an air state of on-ground it will disable replies to Mode A, Mode C, and Mode S all-call interrogations so the aircraft will not show up on the traffic systems of other aircraft.

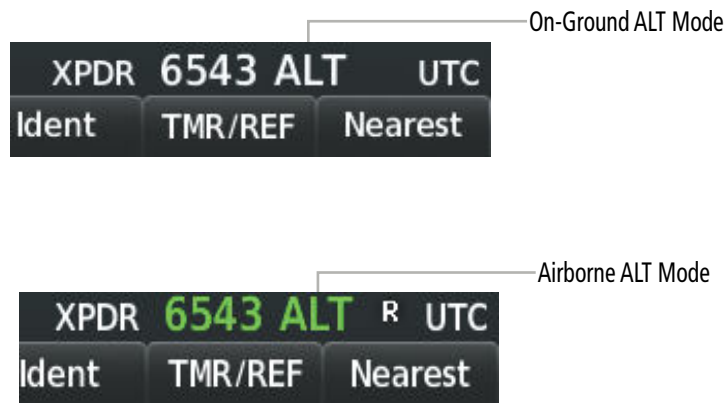


Figure 4-21 Altitude Mode

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 4-22 Reply Indication

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 or 7000. If a VFR code change is required, contact a Garmin-authorized service center for configuration.



Figure 4-23 VFR Code

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 pressed within 10 seconds, or the entry is cancelled and restored to the previous code. Press the **BKSP** Softkey to move 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 on the PFD 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.

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 identifying 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.



Figure 4-24 Ident Softkey and Indication

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

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

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

PASSENGER ADDRESS MODE (PA MODE)

Press and hold the **SPKR/PA** Key for 2 seconds to initiate the Passenger Address Mode. Active PA Mode is annunciated by the PA Annunciator on the audio panel. When in PA Mode the crew can use the PTT “Push-to-Talk” button to deliver announcements over the speaker, to the passenger headsets, or both depending on configuration.

SPLIT-PA MODE

During Split-PA Mode the pilot can continue to use the radio(s) while the copilot delivers PA announcements. To initiate Split-PA Mode, first enter Split-COM mode by pressing the **COM1 MIC** Key and the **COM2 MIC** Key simultaneously, then press and hold the **SPKR/PA** Key for 2 seconds.

INTERCOM

The GMA 1360 includes an intercom system, two MUSIC inputs, and one telephone/entertainment input for the pilot, copilot and passengers. The intercom provides Pilot, Copilot, and Passenger audio isolation.



Figure 4-25 Intercom Controls

Press the **PILOT ICS**, **COPLT ICS**, and/or the **PASS ICS** Key to enable intercom audio for the selected position. If the annunciators are lit, those positions will share intercom audio. If an annunciator is NOT lit that position is isolated from the others.

The color of the an ICS annunciation while in an “On” state will be blue if an active Bluetooth connection is made to a recording device. Otherwise, the “On” state annunciation will be white.

INTERCOM MODES

Audio Panel	Pilot Hears	Copilot Hears	Passenger Hears
	Selected Radios Aural Alerts	Selected Radios Aural Alerts	Passenger MIC
	Selected Radios Aural Alerts	Selected Radios Aural Alerts	Selected Radios Aural Alerts Passenger MIC
	Selected Radios Aural Alerts Copilot MIC	Selected Radios Aural Alerts Pilot MIC	Passenger MIC




Audio Panel	Pilot Hears	Copilot Hears	Passenger Hears
	Selected Radios Aural Alerts	Selectd Radios Aural Alerts Passenger MIC	Selected Radios Aural Alerts Copilot MIC Passenger Mic
	Selected Radios Aural Alerts Passenger MIC	Selected Radios Aural Alerts	Selected Radios Aural Alerts Pilot MIC Passenger MIC
	Selected Radios Aural Alerts Copilot MIC Passenger MIC	Selected Radios Aural Alerts Pilot MIC Passenger MIC	Pilot MIC Copilot MIC Passenger MIC

Table 4-1 ICS Isolation Modes (GMA 1360)

INTERCOM VOLUME AND SQUELCH

The **VOL/CRSR** Knob controls selection and volume or manual squelch adjustment for audio sources that may not be adjustable anywhere else in the system. The small knob controls the volume or squelch. Turning the large knob activates and/or moves the cursor (flashing white annunciator or flashing blue annunciator in Blue-Select Mode) to select the audio source to adjust. The cursor will time-out after a few seconds and the position of the cursor will always default back to the **CREW** Key. Pressing the small knob cancels the cursor.

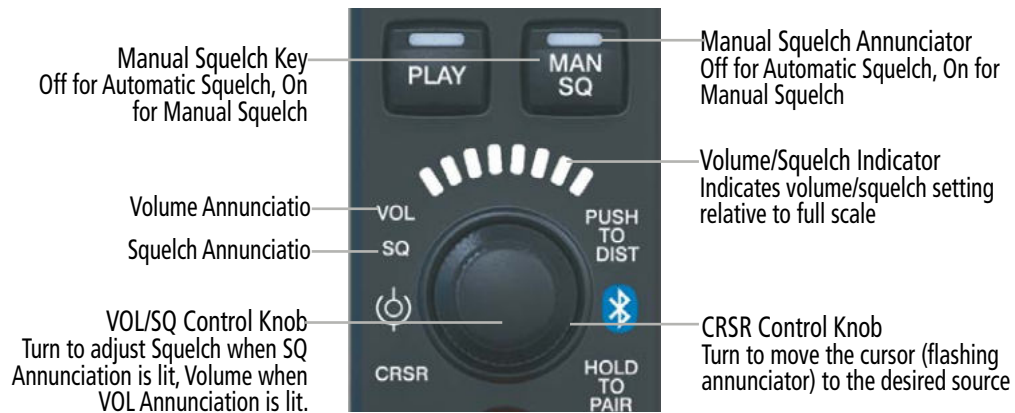


Figure 4-26 Volume/Squelch Control (GMA 1360)

BLUE-SELECT MODE (TELEPHONE/ENTERTAINMENT DISTRIBUTION)

The music and telephone (**TEL**, **MUS1**, and **MUS2**) audio are distributed using the Blue-Select Mode. The following example indicates that the pilot, copilot, and passengers will all hear the telephone audio.



Figure 4-27 Blue Select Mode (GMA 1360)

The Blue-Select Mode is entered by pressing the small knob when the volume control cursor (flashing white annunciator) is not active. If the volume control cursor is active, press the small knob twice. The first press will cancel the volume control cursor, the second will activate Blue-Select Mode.

The annunciator over the **TEL** Button will be flashing blue. Any combination of the annunciators over the **PILOT ICS**, **COPLT ICS**, and **PASS ICS** buttons may be blue. Select the desired button to turn the blue annunciator on or off to distribute the telephone audio to selected crew/passenger positions. Turn the large knob to select **MUS1** or **MUS2**, and select the crew/passenger positions to receive the music audio.

Selecting any button other than **PILOT ICS**, **COPLT ICS**, **PASS ICS**, **TEL**, **MUS1**, or **MUS2** will cancel Blue-Select Mode. Pressing the small knob will also cancel Blue-Select Mode. After approximately ten seconds with no input, the Blue-Select Mode will automatically cancel.

ADJUSTING INTERCOM VOLUME

When the cursor is on **PILOT ICS**, **COPLT ICS**, or **PASS ICS**, the Volume Control Knob adjusts the intercom volume for the listener.

ADJUSTING SPEAKER VOLUME

When the cursor is on **SPKR**, the Volume Control Knob adjusts the speaker volume of the selected sources (**COM**, **NAV**, **AUX**, **MKR**). Alert volumes are not affected by the speaker volume control knob.

ADJUSTING MKR, MUS1, OR MUS2 VOLUME

When the cursor is on **MKR**, **MUS1**, or **MUS2** the Volume Control Knob adjusts the individual volume of the selected source.

ADJUSTING MANUAL SQUELCH

When the cursor is on **MAN SQ**, the Volume Control Knob adjusts the ICS Squelch Threshold (the volume level that must be exceeded to be heard over the intercom).

3D AUDIO

3D Audio is useful when multiple COM audio sources are present. By using different responses in each ear, 3D audio processing creates the illusion that each COM audio source is coming from a unique location on the horizontal plane.

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

With a single COM selected and 3D Audio enabled, the listener hears the audio source at the 12 o'clock position. If both COMs are selected, the listener hears COM1 at 11 o'clock and COM2 at the 1 o'clock position. All other audio inputs are processed so that the listener hears the audio source at the 12 o'clock position. By default, the system assumes the pilot sits in the left seat. A Garmin authorized service center can make changes to the default configuration.

BLUETOOTH



NOTE: Pairing is only necessary during the first attempt to connect a Bluetooth device to the audio panel. Once paired, the audio panel and the device will connect automatically.

PAIRING A BLUETOOTH DEVICE WITH THE AUDIO PANEL

Press and hold the inner knob for two seconds. The Bluetooth Annunciator flashes to indicate the unit is discoverable and the aural message “**Bluetooth discoverable**” is heard. The audio panel will remain discoverable for 90 seconds or until a successful pair is established. Once paired, the Bluetooth Annunciator turns steady blue and the aural message “**Bluetooth paired**” is heard.

ASSIGNING AN AUDIO SOURCE TO THE BLUETOOTH DEVICE

Press the **TEL**, **MUS1**, or **MUS2** key until the annunciator turns blue (the audio from the Bluetooth source will not be heard until this step is complete). The key annunciator cycles OFF-WHITE-BLUE. WHITE selects the wired audio source. BLUE selects the Bluetooth audio source. The BLUE source assignment will persist through Bluetooth audio connection disruptions.



NOTE: The Bluetooth audio can only be assigned to one source at a time. Once the Bluetooth audio is assigned to an audio source, the remaining entertainment audio sources will only cycle between OFF and WHITE.

Bluetooth audio will maintain a separate volume level and Blue Select distribution from the wired audio source. If the Bluetooth connection is supporting a phone call, all intercom positions listening to that source can also speak on the call through the headset MICs.

ADDITIONAL BLUETOOTH CONTROL FUNCTIONS

When the Audio Panel detects a recording device as the Bluetooth connected device, the Pilot ICS Annunciator will turn blue. All audio heard by the Pilot will be recorded. Press and hold the **PILOT ICS** Key to enable/disable Bluetooth recording mode.

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

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 either MUSIC INPUT #1 or MUSIC INPUT #2 jacks 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 INPUT #2 jack.

4.6 AUDIO PANEL PREFLIGHT PROCEDURE



NOTE: If the pilot and/or copilot are 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 maximum volume setting. On single-pilot flights, verify that all other headsets are not connected to avoid excess noise in the audio system.



NOTE: When the **MAN SQ** Key is pressed, the ICS squelch can be set manually by the pilot and copilot. If manual squelch is set to full open (SQ annunciated and the knobs 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 in maximizing the use of the Audio Panel as well as preventing pilot and copilot induced issues. The system will retain the audio settings from the last power up; however, these preflight procedures can be performed each time a pilot boards the aircraft to ensure awareness of all audio levels for the Audio Panel and radios.

Manually Adjusting the Squelch and Volume Settings:

- 1) Press the **MAN SQ** Key so that the in-key annunciation is illuminated.
- 2) Verify manual squelch is set to full open.
- 3) To enable the intercom selection(s) press the **PILOT ICS**, **COPILOT ICS**, and/or **PASS ICS** Keys so that the in-key annunciation(s) are illuminated.
- 4) Turn **CRSR Control** Knob to select the intercom audio source to be adjusted. Once selected, turn **VOL/SQ Control** Knob to set the intercom audio level for that position.
- 5) Turn **CRSR Control** Knob to select the COM/NAV radios and each remaining audio source to be adjusted. Once selected, turn **VOL/SQ Control** Knob to adjust the volume level for that position.
- 6) Press the **MAN SQ** Key so that the in-key annunciation is no longer illuminated. Auto Squelch will now be active.

Once this procedure has been completed, the pilot and copilot can change settings, keeping in mind the notes above.

4.7 ABNORMAL OPERATION

Abnormal operation of the system includes equipment failures of the 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 in the Alerts Window 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.

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. Depending on the failure mode, a red X may appear on the frequency display.

AUDIO PANEL FAIL-SAFE OPERATION

If there is a failure of the Audio Panel, a fail-safe circuit connects the pilot's headset and microphone directly to the COM1 transceiver. Audio is not available on the speaker during Fail-safe operation.

REVERSIONARY MODE

The red **DISPLAY BACKUP** Button selects the 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 full color displays. The information to successfully navigate the aircraft using the GPS sensors is displayed on the PFD and the MFD. A brief description of the GPS navigation data on the PFD and MFD follows.

Navigation mode indicates which sensor is providing the course data (e.g., 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)).

The Inset Map and HSI Map are small versions of the MFD 'Map – Navigation Map' Page. The Inset Map is displayed in the lower left corner of the PFD (lower right during reversionary mode), and the HSI Map is displayed in the center of the HSI. The Inset Map and the HSI Map may each be referred to as the PFD Map. A PFD Map is displayed by pressing the **Map/HSI** Softkey, pressing the **Layout** Softkey, then pressing either the **Inset Map** or **HSI Map** Softkey. Pressing the **Map Off** Softkey removes the PFD Map.

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

Aviation data and flight plan data may also be viewed on other display pages, such the waypoint pages. Hereafter, references to "map displays" implies the 'Map – Navigation Map' Page and all other pages capable of displaying a map with aviation or flight plan data. An aircraft icon is placed on the map display at the location corresponding to the calculated present position. The aircraft position and the flight plan legs are accurately based on GPS calculations. 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 map display. 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.

- SYSTEM OVERVIEW
- FLIGHT INSTRUMENTS
- EIS
- AUDIO PANEL & CNS
- FLIGHT MANAGEMENT
- HAZARD AVOIDANCE
- AFCS
- ADDITIONAL FEATURES
- APPENDICES
- INDEX



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

PFD NAVIGATION STATUS BOX AND MFD 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., '→ 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		

Table 5-1 PFD Navigation Status Box Symbols

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

- **BRG** (Bearing)
- **DEST** (Destination airport identifier)
- **DIS** (Distance)
- **DTG** (Distance to go to destination)
- **DTK** (Desired track)
- **END** (Endurance)
- **ENR** (ETE to final destination)
- **ESA** (Enroute safe altitude)
- **ETA** (Estimated time of arrival)
- **ETE** (Estimated time enroute)
- **FLT** (Flight timer)
- **FOB** (Fuel on Board)
- **FOD** (Fuel over destination)
- **GS** (Groundspeed)
- **ISA** (Temperature at standard pressure)
- **LDG** (ETA at final destination)
- **MSA** (Minimum safe altitude)
- **TAS** (True airspeed)
- **TKE** (Track angle error)
- **TRK** (Track)
- **VSR** (Vertical speed required)
- **XTK** (Cross-track error)



Figure 5-5 MFD Navigation Data Bar



NOTE: The MSA altitude displayed will equal the highest grid MORA (Minimum Off Route Altitude) within a 10 mile square, surrounding the aircraft. The square is aligned to the cardinal directions and provides 1,000 feet separation (2,000 feet in designated mountainous terrain within the U.S.). Grid MORA data (or its equivalent) must be present in the database to provide an MSA value.

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) Push 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, user waypoints, 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)
- Obstacles
- Map Pointer information (distance and bearing to pointer, location of pointer, name, and other pertinent information)
- Fuel range ring
- Flight plan legs
- Track vector
- Terrain
- Topography scale and 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' Page ('Aux')
- Flight Plan Pages ('FPL')
- All Nearest Group Pages ('NRST')
- 'Direct To' Window
- PFD Maps
- 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.

The North Up Above setting configures the map to switch automatically to a north up orientation when the map range reaches a minimum range.



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.

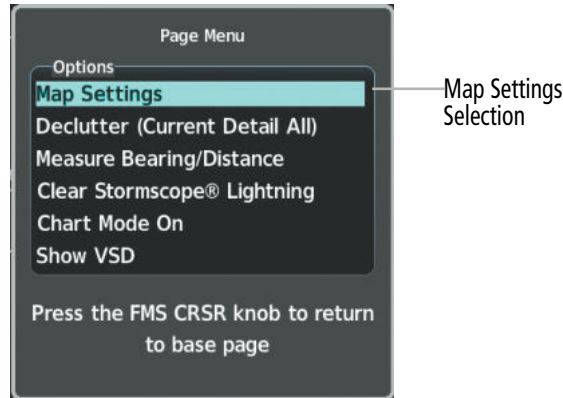


Figure 5-7 Navigation Map Page Menu

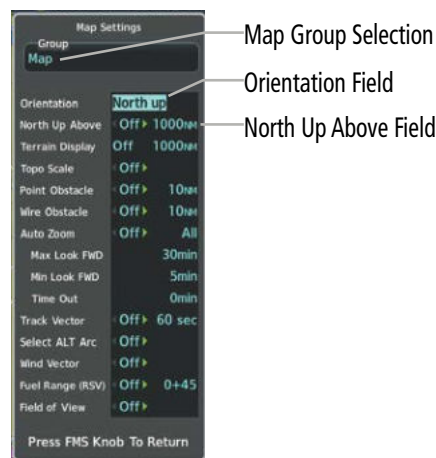


Figure 5-8 Map Settings Menu - 'Map' Group

Changing the orientation for map displays:

- 1) With the 'Map – Navigation Map' Page displayed, press the **MENU** Key. The cursor flashes on the 'Map Settings' option.
- 2) Press the **ENT** Key to display the 'Map Settings' Window.
- 3) Select the 'Map' Group.
- 4) Press the **ENT** Key.
- 5) Turn the small **FMS** Knob to select the desired orientation.
- 6) Press the **ENT** Key to select the new orientation.
- 7) Push the **FMS** Knob to return to the base page.

Enabling/disabling North Up Above 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) Push the **FMS** Knob to return to the 'Map – Navigation Map' Page.

MAP RANGE

There are 28 different map ranges available, from 250 feet to 1000 nm. The current range is indicated in the upper left corner of the map and represents the top-to-bottom distance covered by the map. 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 map displays automatically adjust to the smallest map range clearly showing the potential impact areas. If a new traffic advisory alert occurs, any map display showing 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' Field (configurable on the 'Map Settings' Window 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' Field to zero causes the manual override to never time out.
- » When the 'Max Look FWD' Field is set to zero, the upper limit becomes the maximum range available (1000 nm).
- » When the 'Min Look FWD' Field 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) Turn the small **FMS** Knob to select the 'Map' Group.
- 4) Press the **ENT** Key.
- 5) Turn the large **FMS** Knob to 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) Push the **FMS** Knob to return to the 'Map – 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
- Graphically create user waypoints
- Measure the bearing distance from the aircraft present position to any location on the map display, or between any two points on the map display
- View obstacle, 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.



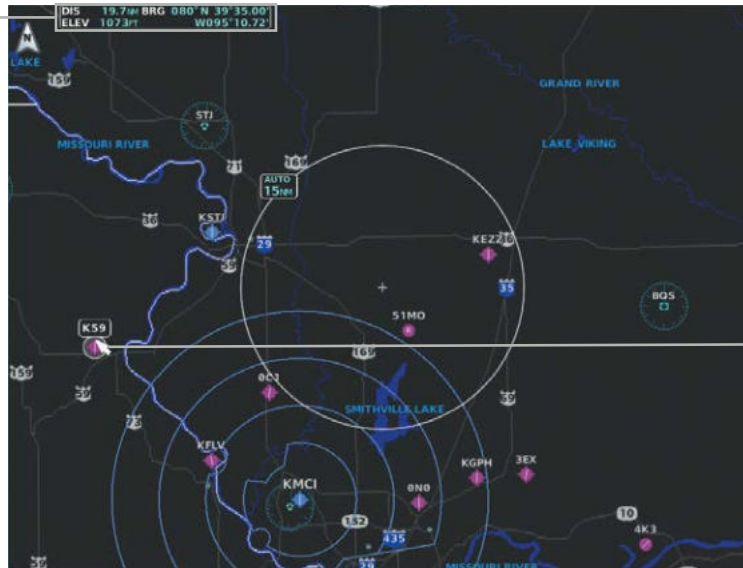
NOTE: The map is normally centered on the aircraft's position. If the map has been panned and there has been no pointer movement for about 60 seconds, the map reverts back to centered on the aircraft position and the flashing pointer is removed.



Figure 5-10 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.

Information about Point of Interest



Map Pointer on POI

Figure 5-11 Map Pointer on Point of Interest

Panning the map:

- 1) With the desired map display shown on the MFD, 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.

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

- 1) With the desired map display shown on the MFD, push the **Joystick** to display the Map Pointer and place the Map Pointer on a waypoint.
- 2) Press the **ENT** Key to display the information page for the selected waypoint.
- 3) Press the **Go Back** Softkey, the **CLR** Key, or the **ENT** Key to exit the information page and return to the 'Map – Navigation Map' Page.

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 display shown on the MFD, push the **Joystick** to display the Map Pointer. Place the Map Pointer on the boundary of an airspace. Information about the airspace is displayed on the map next to the map pointer.
- 2) Push the **Joystick** to remove the Map Pointer and center the map on the aircraft.

Or:

- 1) With the desired map display shown on the MFD, push the **Joystick** to display the Map Pointer and place the Map Pointer on an open area within the boundaries of an airspace.
- 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) Push the **FMS** Knob, or press the **CLR** or **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 map display may be calculated using the 'Measure Bearing and Distance' selection from page menu. This function is only available on the 'Map – Navigation Map' Page and the optional VFR/IFR map pages. 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 map display.

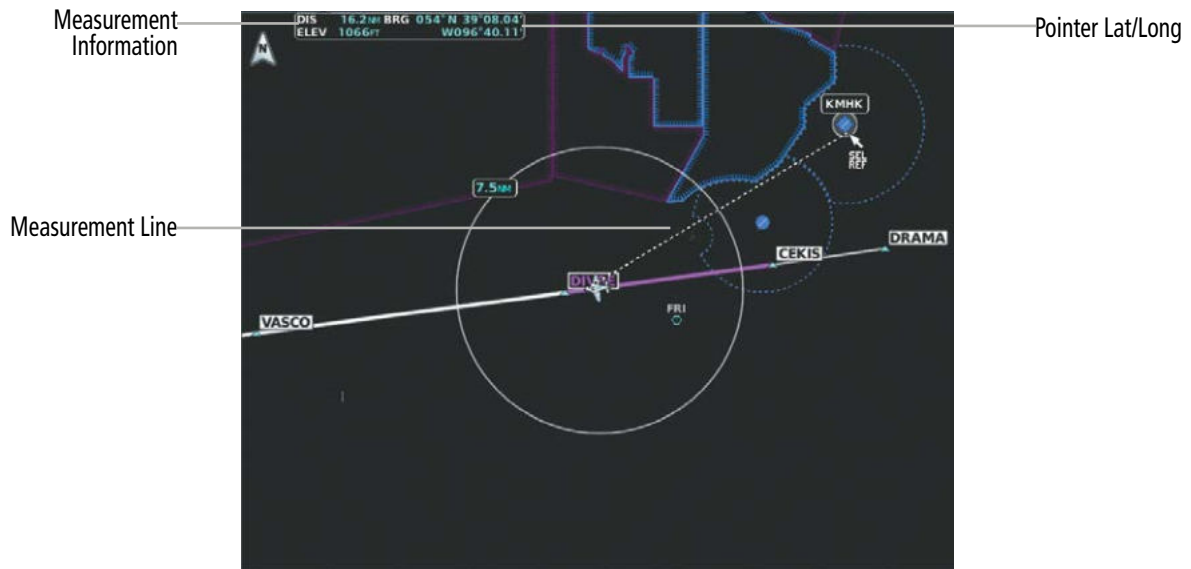


Figure 5-12 Measuring Bearing and Distance

Measuring bearing and distance between any two points:

- 1) Press the **MENU** Key (with the 'Map – Navigation Map' Page or one of the optional VFR/IFR pages displayed).
- 2) Use the **FMS** Knob to 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' Window and press the **ENT** Key.

SYSTEM OVERVIEW

FLIGHT INSTRUMENTS

EIS

AUDIO PANEL & CNS

FLIGHT MANAGEMENT

HAZARD AVOIDANCE

AFCS

ADDITIONAL FEATURES

APPENDICES

INDEX

TOPOGRAPHY

All map displays can show various shades of topography colors representing land elevation, similar to aviation sectional charts. The topographic data range is the maximum map range on which topographic data is displayed.

Topographic data can be displayed or removed as described in the following procedures. Topographic data can also be displayed on the selectable VSD Inset at the bottom of the 'Map – Navigation Map' Page. In addition, the 'Map – Navigation Map' Page 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.

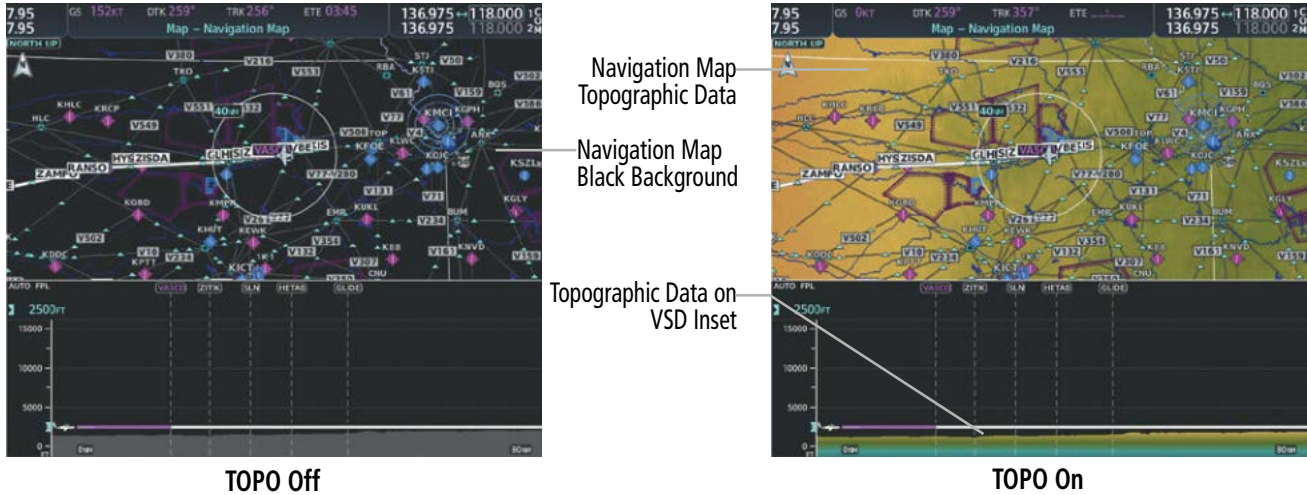


Figure 5-13 Navigation Map - Topographic Data

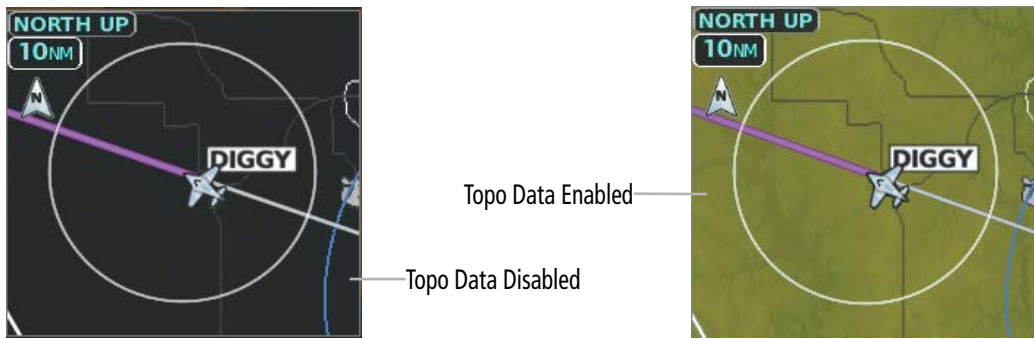


Figure 5-13 PFD Inset Map - Absolute Terrain Data

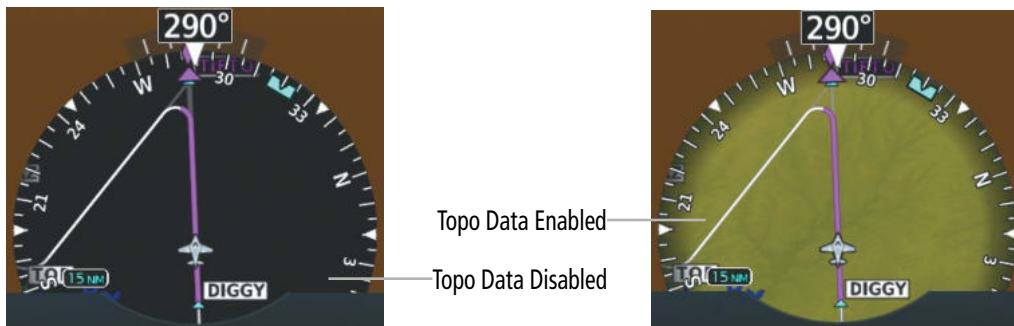


Figure 5-14 PFD HSI Map - Topographic Data

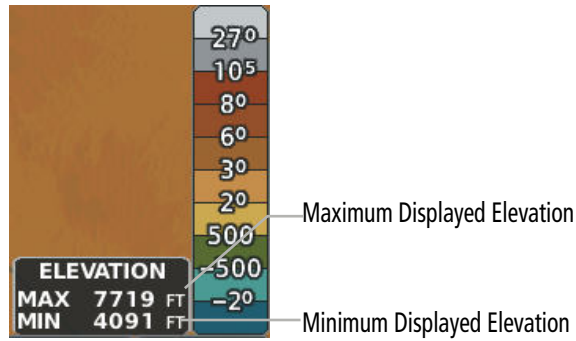


Figure 5-15 Navigation Map - Topo Scale

Displaying/removing topographic data on MFD map displays:

- 1) Press the **Map Opt** Softkey on the 'Map – Navigation Map' Page.
- 2) Press the **TER** Softkey until 'Topo' is shown on the softkey to display topographic data.
- 3) Press the **TER** Softkey until 'Off' is shown on the softkey to remove topographic data from the map. When topographic data is removed from the page, all navigation data is presented on a black background.

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 'Map' Group.
- 4) Press the **ENT** Key.
- 5) Turn the large **FMS** Knob to highlight the 'Terrain Display' Field.
- 6) Turn the small **FMS** Knob to select 'Topo' or 'Off'. Press the **ENT** Key.
- 7) Push the **FMS** Knob to return to the 'Map – Navigation Map' Page.

Displaying/removing topographic data on the PFD Map:

- 1) Press the **Map/HSI** Softkey.
- 2) Press the **TER** Softkey until 'Topo' is displayed.
- 3) Press the **TER** Softkey until 'Off' is shown on the softkey to remove topographic data from the map display. When topographic data is removed from the page, all navigation data is presented on a black background.

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) Turn the small **FMS** Knob to select the 'Map' Group.
- 4) Press the **ENT** Key.
- 5) Use the large **FMS** Knob to 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) Push the **FMS** Knob to return to the 'Map – Navigation Map' Page.

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) Turn the small **FMS** Knob to select the 'Map' Group and press the **ENT** Key.
- 4) Turn the large **FMS** Knob to highlight the 'Topo Scale' Field.
- 5) Turn the small **FMS** Knob to select 'On' or 'Off'. Press the **ENT** Key.
- 6) Push the **FMS** Knob to return to the 'Map – Navigation Map' Page.

MAP DISPLAY SYMBOLS

This section discusses the types of land, aviation, airspace, airway, and map symbols that can be displayed. Each listed type of symbol can be turned on or off, and the maximum range to display each symbol can be set. The maximum range is based upon the range ring setting, not distance from the aircraft. The decluttering of the symbols from the map using the **Detail** Softkey is also discussed. For information on VSD inset settings, reference the Flight Planning discussion later in this section.

LAND SYMBOLS

The following items are configured on the land menu:

Land Symbol Name	Symbol	Default Range (nm)	Maximum Range (nm)
User Waypoint		25	1000
Highways and Roads		(see below)	
Interstate Highway (Freeway)		50	400
International Highway (Freeway)		50	400
US Highway (National Highway)		15	150
State Highway (Local Highway)		2.5	100
Local Road (Local Road)	N/A	4	25
Railroad		7.5	25
Large City (> 200,000)		100	1000

- SYSTEM OVERVIEW
- FLIGHT INSTRUMENTS
- EIS
- AUDIO PANEL & CNS
- FLIGHT MANAGEMENT
- HAZARD AVOIDANCE
- AFCS
- ADDITIONAL FEATURES
- APPENDICES
- INDEX

Land Symbol Name	Symbol	Default Range (nm)	Maximum Range (nm)
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 5-2 Land Symbol Information

AVIATION SYMBOLS

The following items are configured on the aviation menu:

Aviation Symbol Name	Symbol	Default Range (nm)	Maximum Range (nm)
Large Airport (Longest Runway ≥ 8100 ft)		100	1000
Medium Airport (8100 ft > Longest Runway ≥ 5000 ft, or Longest Runway < 5000 ft with control tower)		50	400
Small Airport (Longest Runway < 5000 ft without a control tower)		25	100
Taxiways (SafeTaxi)	See Additional Features	1.5	5
Runway Extension		7.5	150
Intersection (INT)		25	40
Non-directional Beacon (NDB)		25	50
VOR (VOR, VOR/DME, DME, VORTAC, TACAN)		50	250
- VOR Compass Rose On/Off		N/A	N/A
Visual Reporting Point (VRP)		25	40
Temporary Flight Restriction (TFR)		250	1000
VNAV Constraints (manually modified)('Show All' also displays auto-designated and published constraints)		1000	1000

Table 5-3 Aviation Symbol Information

AIRSPACE SYMBOLS

The following items are configured on the airspace menu:

Airspace Symbol Name	Symbol	Default Range (nm)	Maximum Range (nm)
Class B Airspace Altitude Label (ceiling/floor)		Variable ¹	
Class C Airspace Altitude Label (ceiling/floor)			
Class D Airspace Altitude Label (ceiling)			
CL B/TMA/AWY	(see below)		
- Class B (CL B) and Terminal Manoeuvring Area (TMA) ²		50	150
- Airway (AWY) ²			
CL C/CTA	(see below)		
- Class C Airspace (CL C)		50	100
- Control Area (CTA) ²			
CL A/D	(see below)		
- Terminal Radar Service Area (TRSA), Controlled Traffic Region (CTR) ² , and Class A (CL A) ²		10	100
- Class D			
- Aerodrome Traffic Zone (ATZ) ²			
- Traffic Information Zone (TIZ) ²			
Restricted and Prohibited Areas (Restricted)		50	100
Military Operations Areas (MOA (Military))		50	250

Airspace Symbol Name	Symbol	Default Range (nm)	Maximum Range (nm)
Other	(see below)		
- ADIZ		50	250
- Alert			
- Class E ²			
- Class G ²			
- Temporary ²			
- Danger, Warning, Unknown, Special Rules ² , and Training ²			

¹ Label placement and range is determined by the system for best display and minimal clutter

² Not located in the United States

Table 5-4 Airspace Symbol Information

AIRWAY SYMBOLS

This airways discussion is based upon the North American airway structure. The airway structure in places other than North America vary by location, etc. and are not discussed in this book.

Low Altitude Airways are drawn in gray (the same shade used for roads). High Altitude Airways are drawn in green. When both types of airways are displayed, High Altitude Airways are drawn on top of Low Altitude Airways. When airways are selected for display on the map, the airway waypoints (VORs, NDBs and Intersections) are also displayed.

The following items are configured on the airways menu:

Airway Symbol Name	Symbol	Default Range (nm)	Maximum Range (nm)
Low Altitude Airway (V Routes and T Routes)		50	100
High Altitude Airway (J Routes and Q Routes)		50	100

Table 5-5 Airways Symbol Information



Figure 5-16 Airways on MFD Navigation Page

SYMBOL SETUP

All map displays can show land, aviation, airspace and airway 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.



NOTE: The HSI Map does not display Intersections, Cities, Roads, or Lat/Lon lines.

Setting up the ‘Land’, ‘Aviation’, ‘Airspace’, or ‘Airways’ 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) Push the **FMS** Knob to return to the ‘Map – Navigation Map’ Page.

The preceding procedure can be used for selecting which Airspaces should be shown on the map display. Additionally, airspace altitude labels may also be shown, as explained in the following procedure.

Displaying and removing airspace altitude labels:

- 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 'Airspace' Group, if necessary, and press the **ENT** Key.
- 4) Turn the large **FMS** Knob to select the 'Airspace ALT LBL' Field.
- 5) Turn the small **FMS** Knob to select 'On' to display labels and 'Off' to remove labels.
- 6) Push the **FMS** Knob to return to the 'Map – Navigation Map' Page.

Airways may be displayed on the map at the pilot's discretion using either a combination of **AWY** Softkey selections, or menu selections using the **MENU** Key from the 'Map – 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) Press the **Map Opt** Softkey with the 'Map – Navigation Map' Page displayed.
- 2) Press the **AWY** Softkey. Both High and Low Altitude Airways are displayed (AWY On).
- 3) Press the softkey again to display Low Altitude Airways only (AWY LO).
- 4) Press the softkey again to display High Altitude Airways only (AWY HI).
- 5) Press 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 'Low ALT Airways' or the 'High ALT Airways' On/Off Field.
- 5) Turn the small **FMS** Knob to select 'Off' or 'On'. Press the **ENT** Key.
- 6) Push the **FMS** Knob to return to the 'Map – Navigation Map' Page.

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) Turn the large **FMS** Knob to highlight the Low ALT Airways Range Field 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) Push 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.

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

Item	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
Latitude/Longitude Grid		X	X
User Waypoints and VRPs		X	X
NAVAIDs and Intersections (does not declutter if used to define airway)		X	X
Class B Airspaces/TMA/AWY		X	X
Class C Airspaces/CTA		X	X
Class A/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 5-6 Map Items Decluttered for each Detail Level

Decluttering the MFD map display:

Press 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) Turn the **FMS** Knob to highlight 'Declutter'. The current declutter level is shown.
- 3) Press the **ENT** Key to apply the next declutter level and return to the 'Map – Navigation Map' Page.

Decluttering the PFD Map:

- 1) Press the **Map/HSI** Softkey.
- 2) Press the **Detail** Softkey. The current declutter level is shown. With each selection, another level of map information is removed.

ADDITIONAL MAP DISPLAY ITEMS

Map displays can show some additional items. Some items can be displayed through the use of the nearest frequency, map panning, and map measuring functions. Other items (e.g. optional SVT Field of View, track vector, selected altitude intercept arc, wind vector, and fuel range ring) can be displayed/removed individually through the 'Map Settings' Window option. Refer to the Hazard Avoidance Section for information on displaying obstacles (Point Obstacle, Wire Obstacle) on the map.

The icons in the following table will be displayed when specific map functions are conducted or the heading or GPS solution is invalid:






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

Table 5-7 Miscellaneous Map Display Symbols

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 through 7, as necessary.
- 9) Push the **FMS** Knob to return to the 'Map – Navigation Map' Page.

TRACK VECTOR

Map displays can show a track vector that is useful in minimizing track angle error. The track vector is a solid cyan line segment extended to a predicted location. The track vector look-ahead time is selectable (30 sec, 60 sec (default), 2 min, 5 min, 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.

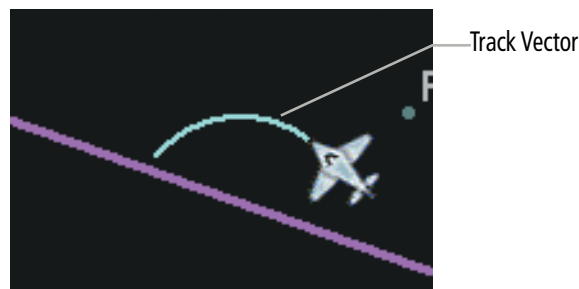


Figure 5-17 Track Vector

SELECTED ALTITUDE INTERCEPT ARC

Map displays can show 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 Selected Altitude Arc

WIND VECTOR ON MFD

The map displays a wind vector arrow in the upper right-hand portion of the display. 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 5-19 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. Fuel reserve time can be input into the Fuel Range (RSV) time field within the 'Map Settings' Window.



Figure 5-19 Fuel Range Ring

FIELD OF VIEW (SVT)

Map displays can show the boundaries of the optional 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.

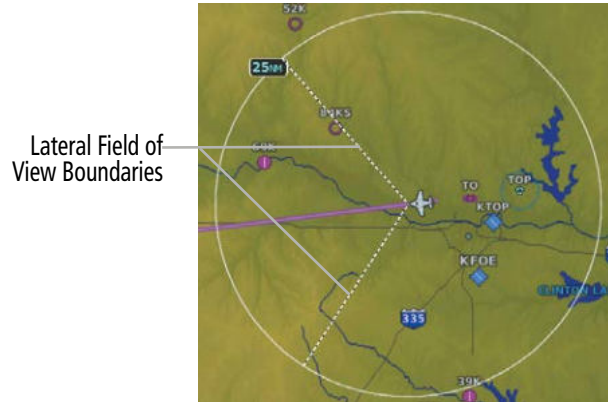


Figure 5-20 Field of View

SYSTEM OVERVIEW

FLIGHT INSTRUMENTS

EIS

AUDIO PANEL & CNS

FLIGHT MANAGEMENT

HAZARD AVOIDANCE

AFCS

ADDITIONAL FEATURES

APPENDICES

INDEX

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 system 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 **→** Key on any of the waypoint pages.

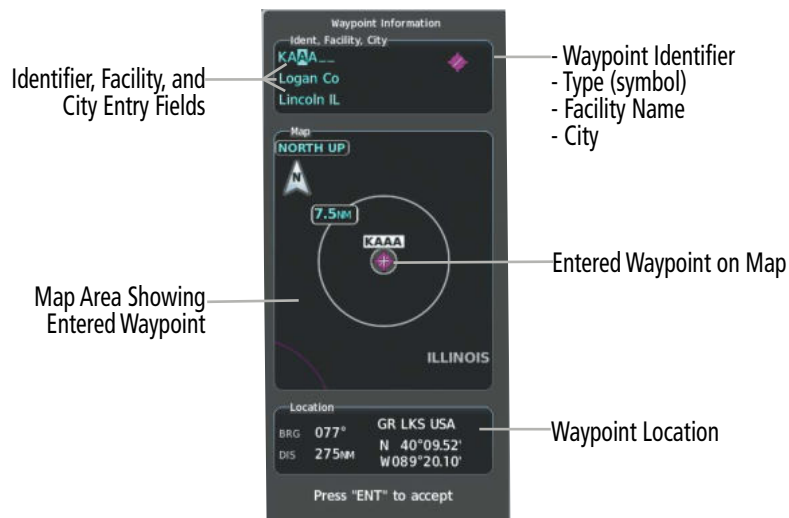


Figure 5-20 Waypoint Information

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.

SYSTEM OVERVIEW
 FLIGHT INSTRUMENTS
 EIS
 AUDIO PANEL & CNS
 FLIGHT MANAGEMENT
 HAZARD AVOIDANCE
 AFCS
 ADDITIONAL FEATURES
 APPENDICES
 INDEX



Figure 5-21 Waypoint Information - Duplicate Identifier

AIRPORTS

AIRPORT INFORMATION



NOTE: ‘North Up’ orientation on the ‘WPT – Airport Information’ Page cannot be changed; the pilot needs to be aware of proper orientation if the other map display orientation is different from the ‘WPT – Airport Information’ Page Map.

The ‘WPT – 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 ‘WPT – 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 ‘WPT – 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 ‘WPT – Airport Information’ Page by pressing the **Info** Softkey until **1** is displayed.

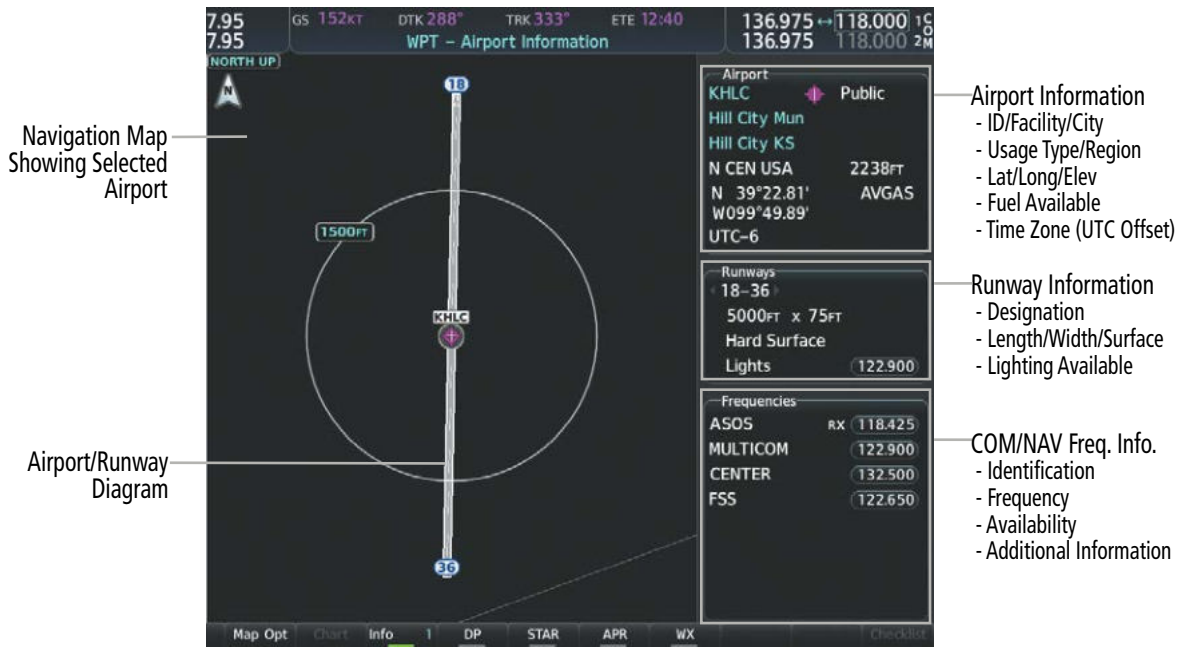


Figure 5-22 'WPT - Airport Information' Page

The following descriptions and abbreviations are used on the 'WPT – 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 (pilot-controlled lighting)
- » COM Availability: TX (transmit only), RX (receive only), PT (part time), i (additional information available)

The 'Frequencies' Box uses the descriptions and abbreviations listed in the following table:

Communication Frequencies			Navigation Frequencies
Approach ¹	Control	Pre-Taxi	ILS
Arrival ¹	CTA ¹	Radar	LOC
ASOS	Departure ¹	Ramp	
ATIS	FSS	Terminal ¹	
AWOS	Gate	TMA ¹	
Center	Ground	Tower	
Class B ¹	Helicopter	TRSA ¹	
Class C ¹	Multicom	Unicom	
Clearance	Other		

¹ May include Additional Information

Table 5-8 Airport Frequency Abbreviations

A departure, arrival, or approach can be loaded using the softkeys on the 'WPT – 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).



Figure 5-23 'WPT - Airport Directory' Page Example

The airport directory information is viewed on the 'WPT – Airport Directory' Page by pressing the **Info** Softkey until **2** is displayed. The Aircraft Owners and Pilots Association (AOPA) and AC-U-KWIK Airport Directory databases provide detailed information. Both directories are available for downloading at flygarmin.com, however copy only one of the databases to the Supplemental Data Card since the system cannot recognize both databases simultaneously:

Selecting an airport for review by identifier, facility name, or location:

- 1) From the 'WPT – Airport Information' Page (**Info 1** Softkey), push the **FMS** Knob.
- 2) Use the **FMS** Knobs and enter an identifier, facility name, or location within the 'Airport' Box.
- 3) Press the **ENT** Key.
- 4) Push the **FMS** Knob to remove the flashing cursor.

Selecting a runway:

- 1) With the 'WPT – Airport Information' Page (**Info 1** Softkey) displayed, push 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, push the **FMS** Knob.

Viewing a destination airport:

From the 'WPT – Airport Information' Page (**Info 1** Softkey) press the **MENU** Key. Select 'View Destination Airport'. The Destination Airport is displayed.

NEAREST AIRPORT

The system can display the nearest airports on both the PFD and the MFD. This gives the pilot quick access to nearest airport information (very useful if an immediate landing is required).

The **Nearest** Softkey on the PFD, displays the ‘Nearest Airports’ Window containing 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.

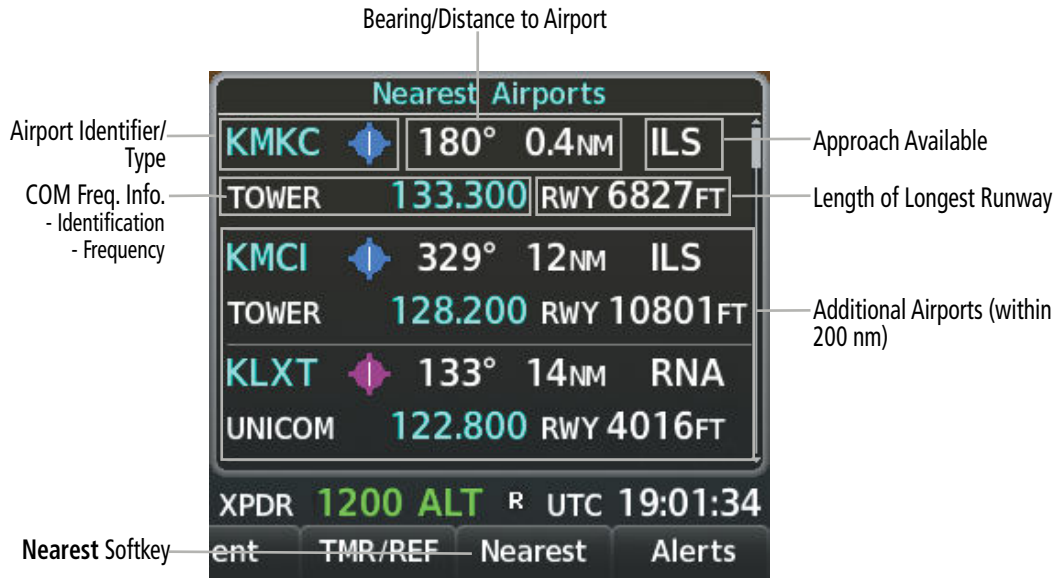


Figure 5-24 Nearest Airports on PFD

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 5-25 Airport Information on PFD

Viewing information for a nearest airport on the PFD:

- 1) Press 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 the **Nearest** Softkey to close the PFD 'Nearest Airports' Window.

The 'NRST – 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. The selected airport is indicated by a white arrow, and a dashed white line is drawn on the map from the aircraft position to the nearest airport. The currently selected airport remains in the list until it is unselected.

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'. If there are more than can be shown in the given box, each list can be scrolled. If there are no items for display in a boxed area, text indicating that fact is displayed.

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

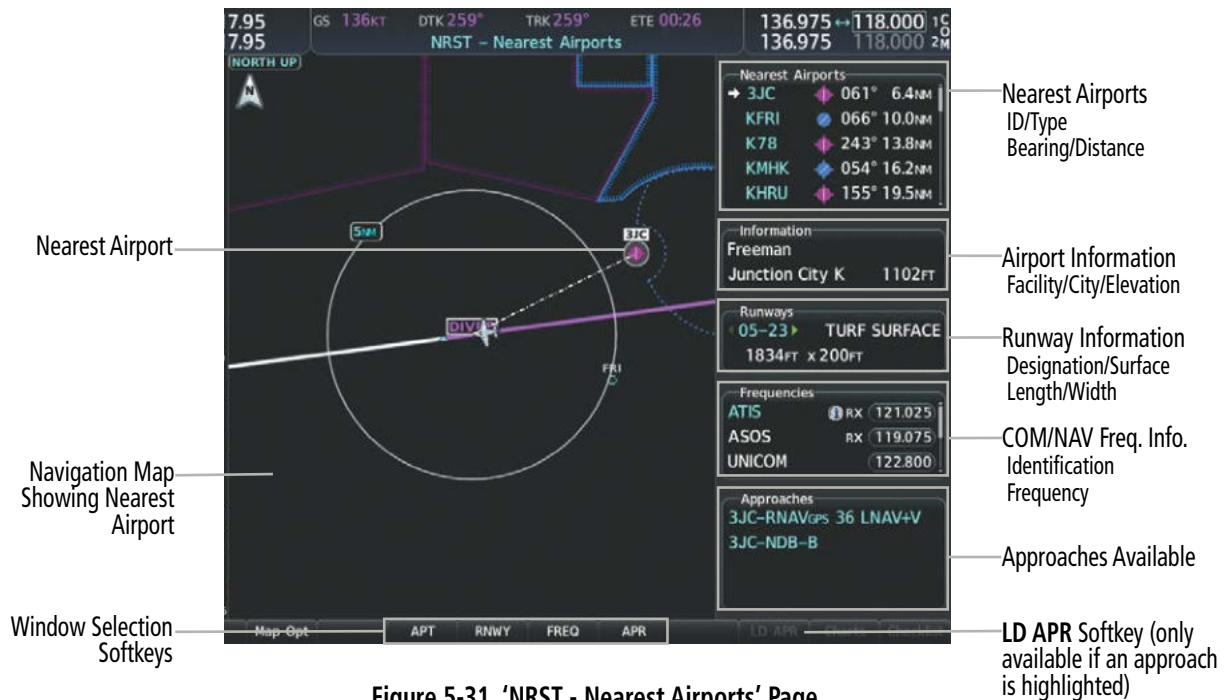


Figure 5-31 'NRST - Nearest Airports' Page

Viewing information for a nearest airport on the MFD:

- 1) Turn the **FMS** Knobs 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.
- 2) Press the **APT** Softkey; or push 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.
- 3) Turn the **FMS** Knob to highlight the desired airport. (Pressing the **ENT** Key also moves to the next airport.)
- 4) Push the **FMS** Knob to remove the flashing cursor.

Viewing runway information for a specific airport:

- 1) With the 'NRST – Nearest Airports' Page displayed, press the **RNWX** 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) Push the **FMS** Knob to remove the flashing cursor.

The 'Nearest Airports' Box on the 'Aux – System Setup 1' Page defines the minimum runway length and surface type used when determining the 25 nearest airports to display on the MFD 'NRST – 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 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) Push 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) Push the **FMS** Knob to remove the flashing cursor.

NON-AIRPORT AND USER CREATED WAYPOINTS

WAYPOINT INFORMATION

Information pages for Intersections, VORs, NDBs, VRPs, and User Waypoints will show a map of the currently selected waypoint, the waypoint identifier, and location. Additionally, intersections will show the nearest VOR while both the VOR and NDB waypoints will show their frequency and the nearest airport. User Waypoint information also provides the reference Type (radial/radial, radial/DME, or latitude/longitude), temporary status, comments, and a User Waypoint list.

The ‘VOR Information’ Page can be used to view information about VOR and ILS signals (since ILS signals can be received on a NAV receiver), or to quickly tune a VOR or ILS frequency. If a VOR station is combined with a TACAN station it is listed as a VOR-TACAN on the ‘VOR Information’ Page and if it includes only DME, it is displayed as VOR-DME. Also, the VOR class (Low Altitude, High Altitude, and Terminal) will be shown in the VOR ‘Information’ Box.

The system can create and store up to 1,000 user-defined waypoints. User waypoints can be created from any map display (except PFD Inset Map, ‘Aux – Trip Planning’ Page, or Procedure Pages) by selecting a position on the map using the **Joystick**, or from the ‘WPT – User WPT 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, removed, or moved. Temporary user waypoints are erased upon system power down.



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



Figure 5-26 Non-Airport Waypoint Information Page (Intersection Example)

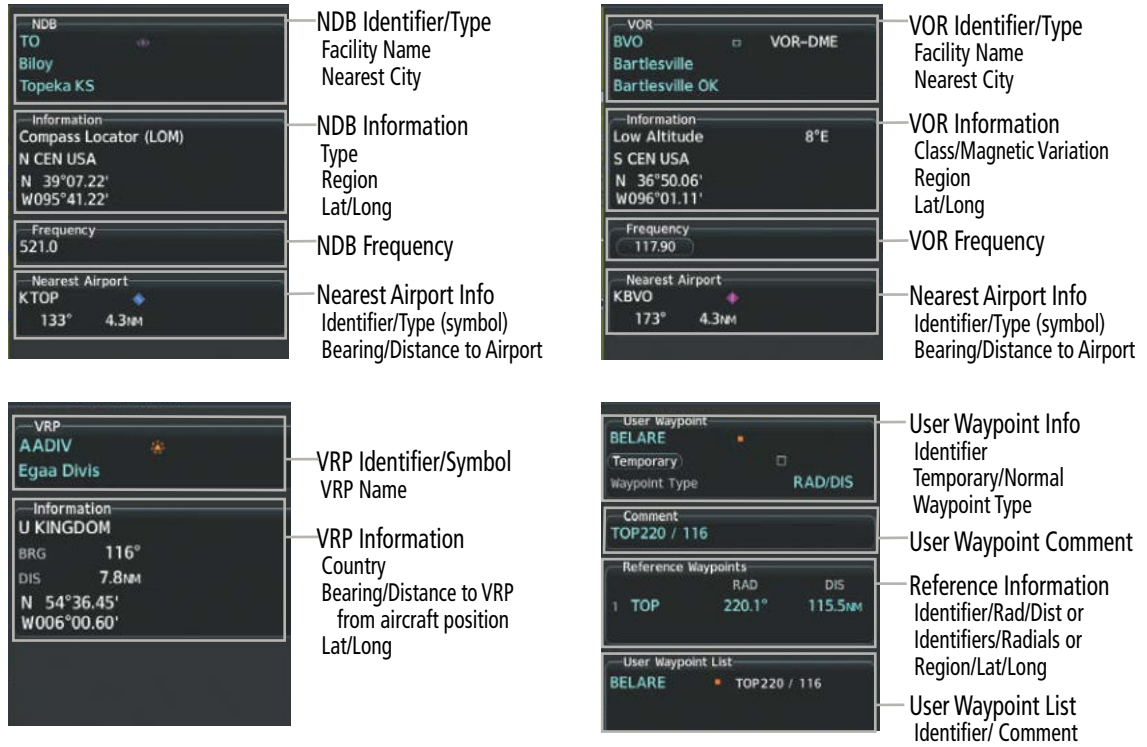


Figure 5-27 Non-Airport Waypoint Information Pages (NDB, VOR, VRP, and User Waypoint)

Viewing Waypoint Information:

- 1) Turn the **FMS** Knobs to select the 'WPT – (Intersection, NDB, VOR, VRP, or User WPT) Information' Page.
- 2) Push the **FMS** Knob to display the flashing cursor in the Intersection, NDB, VOR, VRP, or User Waypoint Box.
- 3) Use the **FMS** Knobs and enter an identifier, facility name, or location.
- 4) Press the **ENT** Key, if needed.
- 5) Push the **FMS** Knob to remove the flashing cursor.

NEAREST WAYPOINTS

The Nearest pages can be used to quickly find waypoints close to the aircraft. The system will display a scrollable list up to 25 nearest waypoints with bearing and distance from the aircraft, a map of the surrounding area, and additional information particular to the type of waypoint chosen. A white arrow before the waypoint identifier/name indicates the currently selected waypoint shown on the map, with its associated information in the lower box or boxes:

- » The 'NRST – Nearest Intersection' Page will show three boxes labeled 'Nearest INT', 'Information', and a 'Reference VOR'.
- » The 'NRST – Nearest NDB' Page will show three boxes labeled 'Nearest NDB', 'Information', and 'Frequency'. The NDB 'Information' Box will show a Compass Locator if the NDB is associated with either a Locator Outer Marker (LOM) or Locator Middle Marker (LMM).
- » The 'NRST – Nearest VOR' Page will show three boxes labeled 'Nearest VOR', 'Information', and 'Frequency'. The NAV frequency from a selected VOR station can be loaded from the 'NRST – Nearest VOR' Page via the **FREQ** Softkey. See the Audio & CNS Section for more information.
- » The 'NRST – Nearest VRP' Page will show two boxes labeled 'Nearest VRP' and 'Information'. Information will contain the VRP Name, Country and latitude/longitude.
- » The 'NRST – Nearest User WPTS' Page will show three boxes labeled 'Nearest User', 'Information', and 'Reference Waypoints'. Information will include any Comments and the latitude/longitude. The 'Reference Waypoints' Box will provide a reference NAVAID with a radial/DME that coincides with the User Waypoint.

The nearest waypoint list will only include waypoints within 200nm. If there are no waypoints in the list, text indicating that there are no nearest waypoints will be displayed, and the information and frequency fields (if applicable) will be dashed.



Figure 5-28 'NRST - Nearest Intersection' Page



Figure 5-29 Nearest Non-Airport Waypoints (NDB, VOR, VRP, and User WPTS)

Viewing Nearest Non-Airport Waypoints:

- 1) Turn the **FMS** Knobs to select the 'NRST – Nearest (Intersections, NDB, VOR, VRP, or User WPTS)' Page.
- 2) Push the **FMS** Knob to display the flashing cursor in the 'Nearest INT, NDB, VOR, VRP, or User' Box,

Or:

If the 'NRST – Nearest VOR' Page is displayed, to display the flashing cursor:

Press the **VOR** Softkey.

Or:

- a) Press the **MENU** Key
 - b) Highlight 'Select VOR Window', and press the **ENT** Key.
- 3) If needed, press the **ENT** Key or turn either **FMS** Knob as needed to select an identifier.
 - 4) Push the **FMS** Knob to remove the flashing cursor.

USER WAYPOINTS

The system can create and store up to 1,000 user-defined waypoints. User waypoints can be created on most MFD map displays by selecting a position on the map using the **Joystick**, or through the 'WPT – User WPT Information' or flight plan pages. Waypoints created from WPT or FPL pages will default to the current aircraft position.

Temporary user waypoints, as indicated by a green check mark in the 'Temporary' Field, will be automatically deleted upon the next power cycle. The default storage setting for creating a new user waypoint can be changed from the 'Waypoint Setup' Window.

Three Types of reference are available to define the user waypoint position: radial/distance from an existing waypoint (RAD/DIS), radial intersection from two existing waypoints (RAD/RAD), or latitude and longitude (LAT/LON). By default, new waypoints will be created as a Route waypoint type using the RAD/DIS mode of reference.

A system generated comment for a user-defined waypoint incorporates the reference waypoint identifier, bearing, and distance. A new comment may be entered, limited to 25 characters.

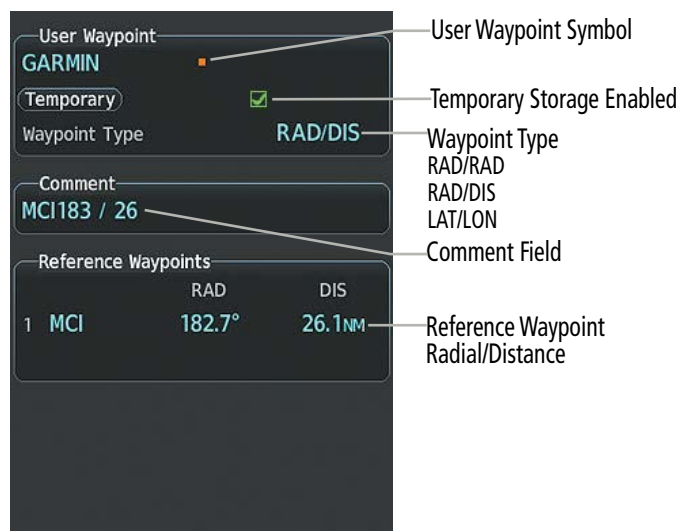


Figure 5-30 User Waypoint

Creating a user waypoint:

- 1) Create a new waypoint name:
 - a) From any page showing a map display, push the **Joystick** to activate the panning function and pan to the map location of the desired user waypoint (excluding the 'Aux – Trip Planning' and Procedure pages).
 - b) Press the **ENT** Key. The system provides an automated User Waypoint name. (If the map pointer is within the boundaries of an airspace, a menu pops. Use the **FMS** Knob to highlight 'Create User Waypoint' and press the **ENT** Key.) The 'WPT – User WPT Information' Page is displayed with the captured position.
 - c) If desired, use the large **FMS** Knob to highlight the User Waypoint name, and use the **FMS** Knobs to change the name.

Or:

 - a) With the 'WPT – User WPT Information' Page displayed, press the **New** Softkey, or press the **MENU** Key and select 'Create New User Waypoint' and press the **ENT** Key.
 - b) Use the **FMS** Knobs to enter a user waypoint name.
 - c) Press the **ENT** Key to accept the waypoint name.

Or:

 - a) With the 'WPT – User WPT Information' Page displayed, push the **FMS** Knob to activate the cursor. Use the large **FMS** Knob to highlight the waypoint name.
 - b) Enter a user waypoint name.
 - c) Press the **ENT** Key. The message 'Are you sure you want to create the new user waypoint AAAAAA?' is displayed.
 - d) With 'Yes' highlighted, press the **ENT** Key to accept the waypoint name.

Or:

 - a) With a flight plan page or window displayed, push the **FMS** Knob to activate the cursor (not required on the PFD).
 - b) Select the point in the flight plan before which to add the new user waypoint. The new waypoint is placed directly in front of (above) the highlighted waypoint.
 - c) Turn the small **FMS** Knob clockwise to display the 'Waypoint Information' Window.
 - d) Enter the name of the new user waypoint (a waypoint that does not match any existing waypoint in the database) and press the **ENT** Key.
 - e) The message 'AAAAA does not exist. Create User Waypoint?' is displayed. Press the **ENT** Key with 'Yes' highlighted to accept the waypoint name.
- 2) If desired, use the large **FMS** Knob to highlight the 'Temporary' Field and press the **ENT** Key to check or uncheck the box to change the storage method to temporary or normal, as desired.
- 3) Use the large **FMS** Knob to highlight the 'Waypoint Type' Field if necessary. If desired, change the waypoint type of reference 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.

- 4) If desired, use the large **FMS** Knob to highlight the field in the 'Comment' Box, then use the **FMS** Knobs to change the comment (limited to 25 characters).
- 5) When finished, push the **FMS** Knob to remove the flashing cursor.

Or:

With a flight plan page or window displayed, turn the large **FMS** Knob to highlight 'Load WPT to FPL' and press the **ENT** Key.

Editing a user waypoint comment or location:

- 1) With the 'WPT – User WPT Information' Page displayed, push the **FMS** Knob to activate the cursor. The cursor is placed in the 'User Waypoint' Box.
- 2) Use the **FMS** Knobs to enter the name of the User Waypoint; or turn the large **FMS** Knob and scroll to the desired waypoint in the 'User Waypoint List' Box.
- 3) Turn the large **FMS** Knob to move the cursor to the desired field.
- 4) Use the **FMS** Knobs to make any changes.
- 5) Press the **ENT** Key to accept the changes.
- 6) Push the **FMS** Knob to remove the flashing cursor.

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 select 'Waypoint Setup', and press the **ENT** Key.
- 3) Use the small **FMS** Knob to select 'Normal' or 'Temporary' as desired, and press the **ENT** Key.
- 4) Push the **FMS** Knob to remove the flashing cursor and return to the 'WPT – User WPT Information' Page.

Deleting a single user waypoint:

- 1) With the 'WPT – User WPT Information' Page displayed, highlight a User Waypoint in the 'User Waypoint List' Box, or enter a waypoint in the 'User Waypoint' Box.
- 2) Press the **Delete** Softkey or press the **CLR** Key. 'Yes' is highlighted in the confirmation window.
- 3) Press the **ENT** Key.
- 4) Push the **FMS** Knob to remove the flashing cursor.

Or:

- 1) With the 'WPT – User WPT Information' Page displayed, push the **FMS** Knob to activate the cursor.
- 2) Use the large **FMS** Knob to highlight a User Waypoint in the 'User Waypoint List' Box, or use the **FMS** Knobs to enter a waypoint in the 'User Waypoint' Box.
- 3) Press the **MENU** Key. Use the **FMS** Knobs to highlight 'Delete User Waypoint'.
- 4) Press the **ENT** Key twice to confirm the selection.
- 5) Push 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 WPT Information' Page displayed, highlight a User Waypoint in the 'User Waypoint List' Box.
- 2) Press the **MENU** Key.
- 3) Use the **FMS** Knobs to highlight 'Delete All User Waypoints.'
- 4) Press the **ENT** Key twice to confirm the selection.

NEAREST AIRSPACE

SETTING AIRSPACE ALERTS

The ‘Airspace Alerts’ Box (‘Aux – System Setup 1’ Page) on the MFD allows the pilot to turn the controlled/special-use airspace message alerts on or off. This does not affect the alerts listed on the ‘NRST – Nearest Airspaces’ Page or the airspace boundaries depicted on the map display. It simply turns on/off the system messages related to airspace alerts provided when the aircraft is approaching or near an airspace.

The following system messages will be generated on the PFD when airspace alerts are set to on.

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 track. The aircraft current ground track 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 5-9 Airspace Messages

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.

Enabling/disabling airspace alerts:

- 1) Use the **FMS** Knob to select the ‘Aux – System Setup 1’ Page (**Setup 1** Softkey).
- 2) Push 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) Push the **FMS** Knob to remove the flashing cursor.

Changing the altitude buffer distance setting:

- 1) Use the **FMS** Knob to select the ‘Aux – System Setup 1’ Page (**Setup 1** Softkey).
- 2) Push 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) Push the **FMS** Knob to remove the flashing cursor.

VIEWING NEAREST AIRSPACE INFORMATION

The 'NRST – 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 'NRST – Nearest Airspaces' Page. In addition to displaying a map of airspace boundaries and surrounding area, the 'NRST – Nearest Airspaces' Page displays airspace information in four boxes labelled 'Airspace Alerts', 'Airspace Agency', 'Vertical Limits', and 'Frequencies'.

Airspace alerts and associated frequencies are shown in scrollable lists on the 'NRST – 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.

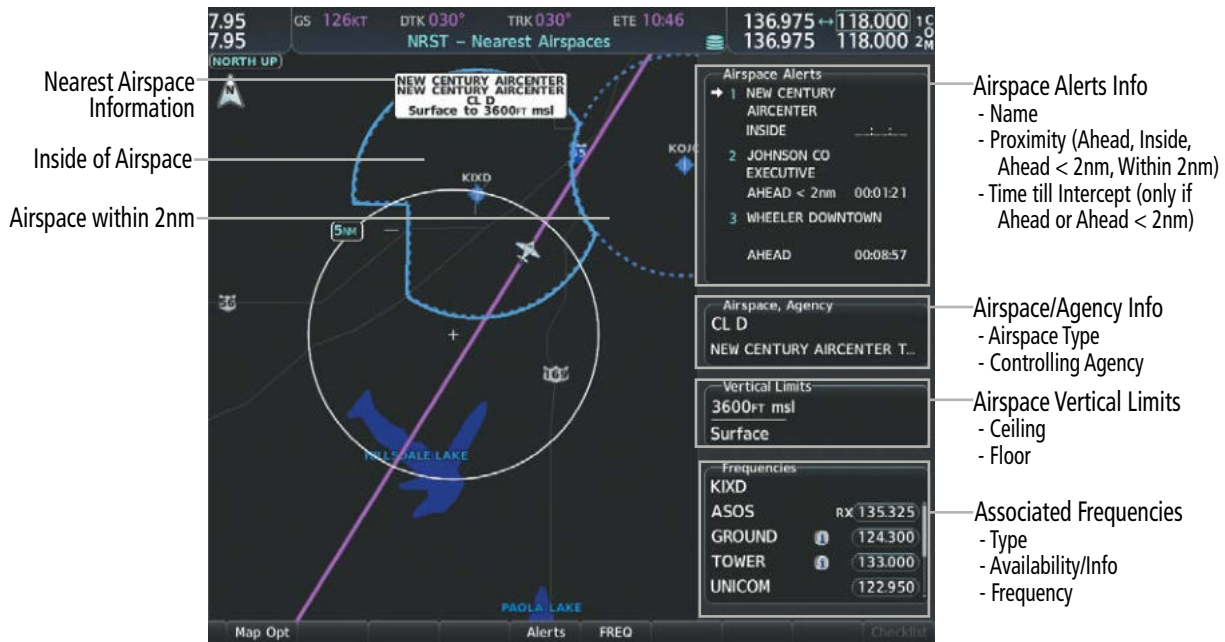


Figure 5-32 Nearest Airspaces Page

Selecting and viewing an airspace alert with its associated information:

- 1) Use the **FMS** Knob to select the 'NRST – Nearest Airspaces' Page.
- 2) Press the **Alerts** Softkey on the MFD; or push 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) Use the **FMS** Knob to highlight the desired airspace.
- 4) Push the **FMS** Knob to remove the flashing cursor.

SMART AIRSPACE

The Smart Airspace function de-emphasizes airspaces above or below the current aircraft altitude. The function does not require the aircraft's 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.



Figure 5-33 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 'Map Settings' Window is displayed.
- 3) Turn the small **FMS** Knob to highlight the 'Airspace' and press the **ENT** Key.
- 4) Turn the large **FMS** Knob to highlight the 'Smart Airspace' Field.
- 5) Turn the small **FMS** Knob clockwise to turn smart airspace 'On' or counterclockwise to turn smart airspace 'Off'.
- 6) Push the **FMS** Knob to remove the flashing cursor.

5.5 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. Additionally, the system provides direct-to functionality, allowing short-term navigation to a single waypoint. Activated direct-to navigation information is displayed in the 'Active Flight Plan' Box above the Active Flight Plan. 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 Symbol Name	Description	Symbol
Course Leg	Course leg currently flown	
	A future course leg in the current phase of flight	
	A course leg in either a previously flown course leg, or a future course leg not in the current phase of flight	
Heading Leg	Heading leg currently flown	
	Future heading leg	
Roll Steering Path ¹	Turning path currently flown	
	Turning path for the next flight plan leg	
	Turning path beyond the next flight plan leg	
Turn Anticipation Arc	Displayed when sequencing to the next flight plan leg via a fly-by waypoint, a lead turn is created, adjusting for groundspeed	
Fly-Over Waypoint	Displayed as a fly-over waypoint	
Along Track Waypoint	Displayed when an along track waypoint is created	
Flight Path Fix	A fix that terminates: manually, at a specified altitude, or at a specified distance or radial when flying a heading	
Top of Descent (TOD) and Bottom of Descent (BOD)	When vertically navigating, the system will display where the aircraft will begin complete the descent	
Parallel Track Waypoint	Displayed when a parallel track is created	

¹ Roll Steering Path transitions between two disconnected legs (i.e. holding), some procedure turn segments, parallel track segments, or after some fly-over waypoints.

Table 5-10 Flight Plan Symbols on Map

SYSTEM OVERVIEW

FLIGHT INSTRUMENTS

EIS

AUDIO PANEL & CNS

FLIGHT MANAGEMENT

HAZARD AVOIDANCE

AFCS

ADDITIONAL FEATURES

APPENDICES

INDEX

DIRECT-TO NAVIGATION

The Direct-to method of navigation, initiated by pressing the **→** Key, allows quick selection of a destination and provides guidance to the selected point. 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 5-45 Direct-to Window - MFD

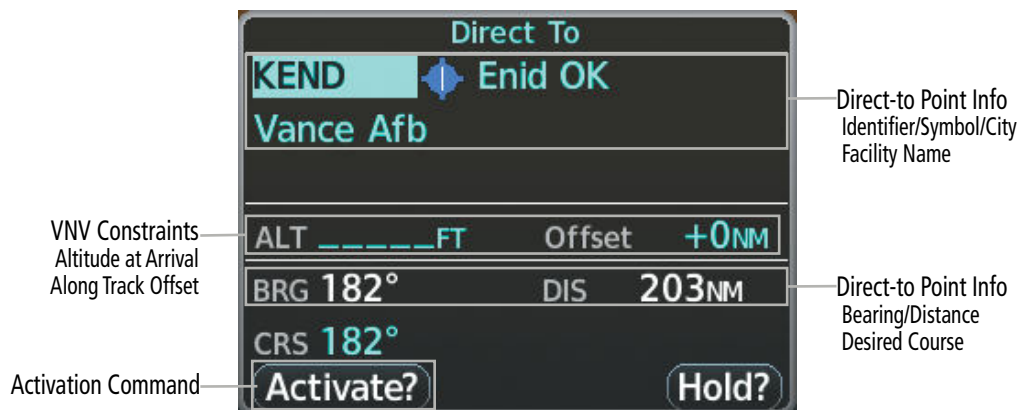


Figure 5-46 Direct-to Window - PFD

Any waypoint can be entered as a direct-to destination from a 'Direct To' Window. Also, any waypoint contained in the active flight plan can be selected as a direct-to waypoint from a 'Direct To' Window, the 'FPL – Active Flight Plan' Page, or the active 'Flight Plan' Window.

The 'Direct To' Window can always be displayed 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.

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 'CRS' or 'Course' Field on the 'Direct To' Window.

Entering a waypoint identifier, facility name, or city as a direct-to destination:

- 1) Press the **→** 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.

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

- 1) While navigating an active flight plan, press the **→** 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 the waypoint submenu window with a list of flight plan waypoints.
- 3) Turn the large **FMS** Knob to 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) Press the **FPL** Key.
- 2) Push the **FMS** Knob to activate the cursor (not required on PFD), and turn the large **FMS** Knob to highlight the desired waypoint.
- 3) Press the **→** Key.
- 4) Press the **ENT** Key. The cursor is now displayed on 'Activate?'.
- 5) Press the **ENT** Key again to activate the direct-to.

Selecting a Nearest, Recent or User Waypoint as a direct-to destination:

- 1) Press the **→** 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 the waypoint submenu window.
- 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.

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 **→** 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 on the MFD and push the **FMS** Knob.
- 2) Use the **FMS** Knob to select the desired airport (the nearest one is already selected).
- 3) Press the **→** Key.
- 4) Press the **ENT** Key. The cursor is now displayed on 'Activate?'
- 5) Press the **ENT** Key again to activate the direct-to.

Selecting a manual direct-to course:

- 1) Press the **→** 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 large **FMS** Knob to highlight the 'CRS' or 'Course' Field.
- 3) Use the small **FMS** Knob to 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 **→** Key. The 'Direct To' Window is displayed.
- 2) Press the **ENT** Key. The cursor is now displayed on 'Activate?'
- 3) Press the **ENT** Key again to activate the direct-to.

Direct-to destinations may also be selected by using the Map Pointer on any map display (Map Pointer functionality is not available for traffic or terrain 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 Map Pointer:

- 1) From any page showing a map display (excluding the traffic and terrain pages), push the **Joystick** to display the Map Pointer.
- 2) Move the **Joystick** to place the pointer at the desired destination location. If the Map Pointer is placed on a waypoint, the waypoint name is highlighted.
- 3) Press the **→** Key to display the 'Direct To' Window with the selected point entered as the direct-to destination.
- 4) Press the **ENT** Key. The cursor is now displayed on 'Activate?'
- 5) Press the **ENT** Key again to activate the direct-to.

Cancelling a Direct-to:

- 1) Press the **→** 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.

A direct-to with altitude constraints creates a vertical path (and provides guidance to stay on the path) from the aircraft's current altitude to the altitude constraint of the direct-to waypoint. The altitude is reached at the waypoint, or at the specified distance along the flight path if VNV offset distance has been entered. Direct-to vertical navigation is discussed in the Flight Plan Vertical Navigation portion of Flight Management. Offset distances (Along Track Offsets) are discussed in the Flight Plan Operations portion of Flight Management.

SELECTION AND MODIFICATION METHODS

There are three methods to create or modify a flight plan:

- 'FPL – 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)
- 'FPL – Flight Plan Catalog' Page on the MFD (create/modify a stored flight plan)

To create or modify a flight plan, the cursor can be used to edit the required fields within the flight plan and the 'Active VNV Profile' Box within the 'FPL – Active Flight Plan' Page. The cursor will appear as a field consisting of a solid cyan or magenta rectangle. The cursor can be activated by pushing the **FMS** Knob. The Insertion Point Indicator is displayed as a small cyan triangle and is associated with the cursor location.

Fields can be highlighted by turning the large **FMS** Knob, and edits can be accomplished within the field by combining small and large **FMS** Knob turns.



Figure 5-34 'Flight Plan' Window on PFD



Figure 5-35 'FPL - Active Flight Plan' Page

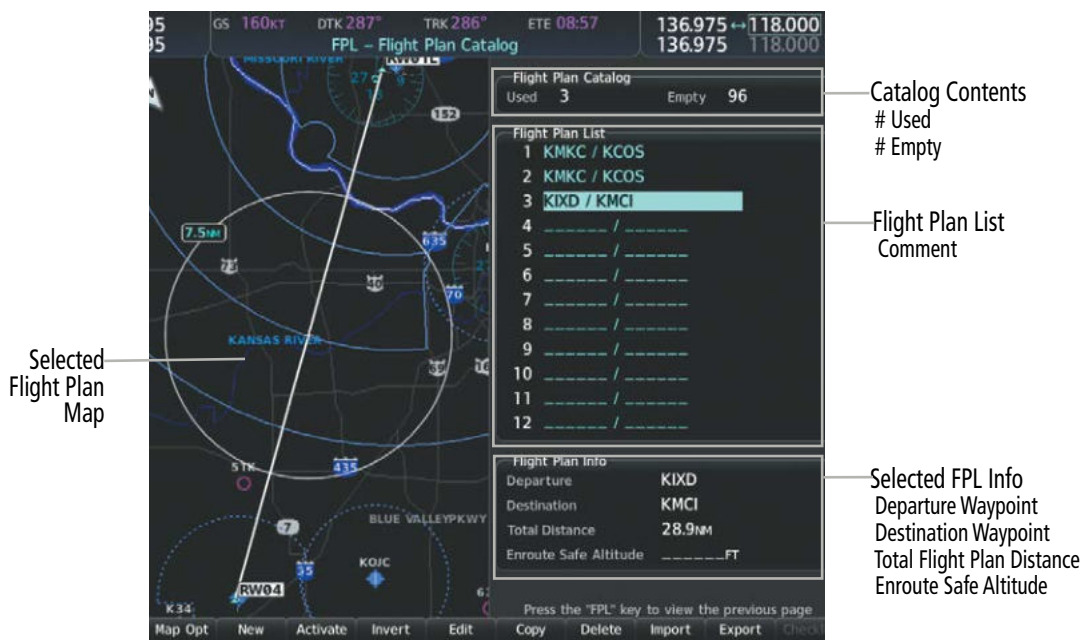


Figure 5-36 'FPL - Flight Plan Catalog' Page



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

FLIGHT PLAN DISPLAY

Flight plan information can be displayed in different locations and formats. Profile information for the active flight plan may also be displayed; see the Vertical Situation Display portion of Flight Management for more information. Active flight plan creation and modifications can be made on the 'FPL – Active Flight Plan' Page or on the 'Flight Plan' Window. The MFD Split Screen feature allows a side by side display of the active flight plan and corresponding chart.

FLIGHT PLAN VIEWS

The 'FPL – Active Flight Plan' Page 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 it 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 for the MFD to display the 'FPL – Active Flight Plan' Page.
- 2) Press the **View** Softkey to display the **Wide**, **Narrow**, **Leg-Leg**, and **CUM** Softkeys.
- 3) Press the **CUM** Softkey to view cumulative waypoint distance, or press the **Leg-Leg** Softkey to view leg-to-leg waypoint distance.
- 4) Press the **Wide** Softkey to display the wide view, or press the **Narrow** Softkey to display the narrow view.
- 5) Press the **Back** Softkey to return to the top level active flight plan softkeys.

SPLIT SCREEN

Charts may be viewed alongside the active flight plan in Split Screen mode. Pressing the **Charts** Softkey from the 'FPL – Active Flight Plan' Page will remove the active flight plan map to display a Charts Pane alongside the Active Flight Plan Pane. The active flight plan map can be re-displayed. However, displaying the map in split screen 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 depicting the different split screen displays with the active flight plan.

See the System Overview section for more information on Split Screen Mode. For more information on Charts, see the Additional Features Section.

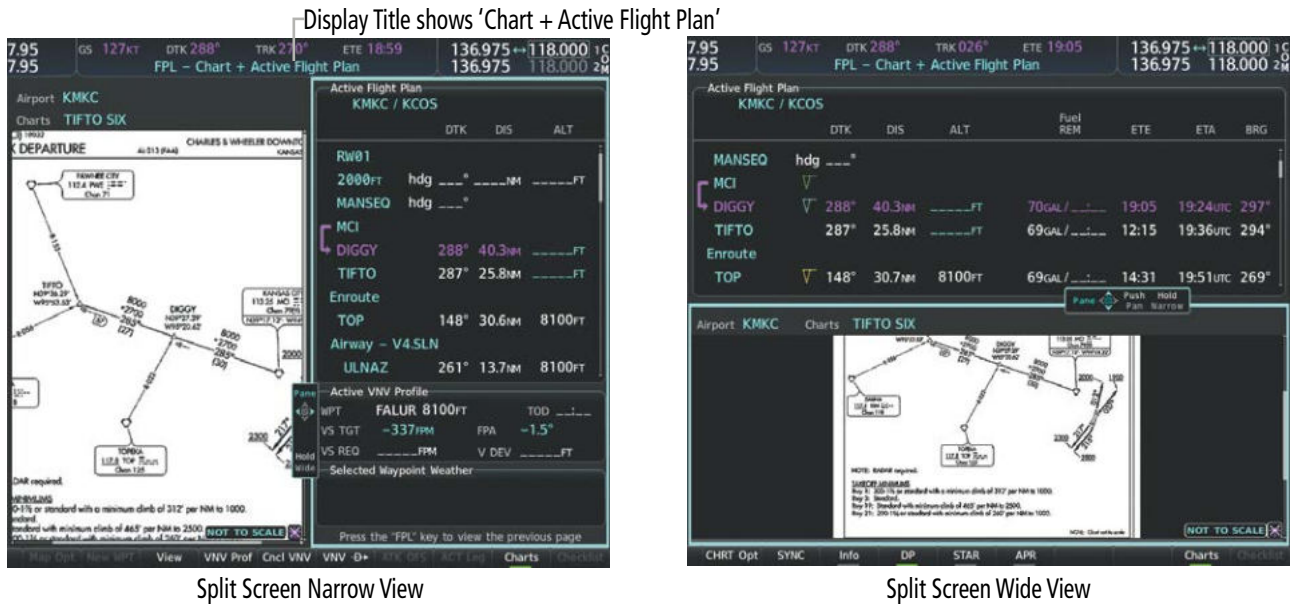


Figure 5-37 Split Screen Mode Narrow and Wide View



Figure 5-38 Split Screen Mode with Flight Plan Map

Enabling/Disabling split screen mode from the 'FPL – Active Flight Plan' Page:

- 1) Press the **FPL** Key for the MFD to display the 'FPL – Active Flight Plan' Page.
- 2) Press the **Charts** Softkey. If necessary, press the **CHRT Opt** Softkey and press the **Full SCN** Softkey to disable full screen mode. Split screen mode is now enabled showing two display panes. The Chart Pane is highlighted by a cyan border indicating it is the active pane.
- 3) To quickly view the chart corresponding to the active flight plan leg, press the **Sync** Softkey.
- 4) Press the **Charts** Softkey again to disable split screen mode.

Displaying the flight plan map on the 'FPL – Active Flight Plan' Page in split screen mode:

- 1) Press the **FPL** Key for the MFD to display the 'FPL – Active Flight Plan' Page.
- 2) Press the **Charts** Softkey. If necessary, press the **CHRT Opt** Softkey and press the **Full SCN** Softkey to disable full screen mode. Split screen mode is now enabled showing two display panes. The Chart Pane is highlighted by a cyan border indicating it is the active pane.
- 3) Use the **Joystick** to select the 'Active Flight Plan' Pane as the active pane.
- 4) Press the **MENU** Key. 'Show Flight Plan Map' is highlighted. Press the **ENT** Key.
- 5) To remove the Flight Plan Map, press the **MENU** Key and select 'Hide Flight Plan Map'. Press the **ENT** Key.

CREATING A BASIC FLIGHT PLAN

The active flight plan is listed on the 'FPL – 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 map displays. One flight plan can be activated at a time and becomes the active flight plan. The active flight plan is overwritten when another flight plan is activated.

Stored flight plans are listed on the 'FPL – Flight Plan Catalog' Page, and are available for activation (becomes the active flight plan).

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



NOTE: *If the 'RW' Field is filled, then the first point in the flight plan is auto-populated with the runway selected, located in the line immediately below the 'RW' Field.*

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

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

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

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

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

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

Creating a flight plan:

- 1) For an active flight plan, press the **FPL** Key. Push the **FMS** Knob to activate the cursor (not required on PFD).
Or:
For a stored flight plan:
 - a) Press the **FPL** Key for the MFD. Turn the small **FMS** Knob to select the 'FPL – Flight Plan Catalog' Page.
 - b) Press the **New** Softkey; push the **FMS** Knob and select an empty Flight Plan List Field, and press the **ENT** Key; or press the **ENT** Key; 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.
- 2) If the system auto-designated the Origin, proceed to Step 3.
Or:
Enter or modify the origin airport and runway as follows:
 - a) Select the field below the Origin header to enter the origin airport identifier.
 - b) Use the **FMS** Knob, or the waypoint submenu to enter the identifier, facility, or city name of the airport.
 - 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 airport/runway to the flight plan.
- 3) Select the destination airport and runway by highlighting the field below the Destination header and completing steps 2b – 2e.
- 4) Select the enroute waypoints:
 - a) Select the location to insert the waypoint.
 - b) Use the **FMS** Knob to enter the identifier, facility, or city name of the waypoint.
 - c) Press the **ENT** Key. The 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, push the **FMS** Knob to remove the flashing cursor.

FLIGHT PLAN WAYPOINT AND AIRWAY MODIFICATIONS

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

FLIGHT PLAN WAYPOINTS

Within flight plans, waypoints can be added, removed and designated as fly-over or fly-by. Flight plans are limited to 100 waypoints (including waypoints within airways and procedures). If the number of waypoints in the flight plan exceeds 100, the message “Flight plan is full. Remove unnecessary waypoints.” appears and the new waypoint(s) are not added to the flight plan.

ADDING WAYPOINTS

To add a waypoint, choose the flight plan, select the desired point of insertion, enter the waypoint, and the waypoint will be added prior to the selected waypoint. Either the ‘Waypoint Information’ Window or Waypoint Submenu can be used when entering the waypoint.

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.

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 ‘FPL – 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 ‘FPL – Active Flight Plan’ Page with the accepted changes.

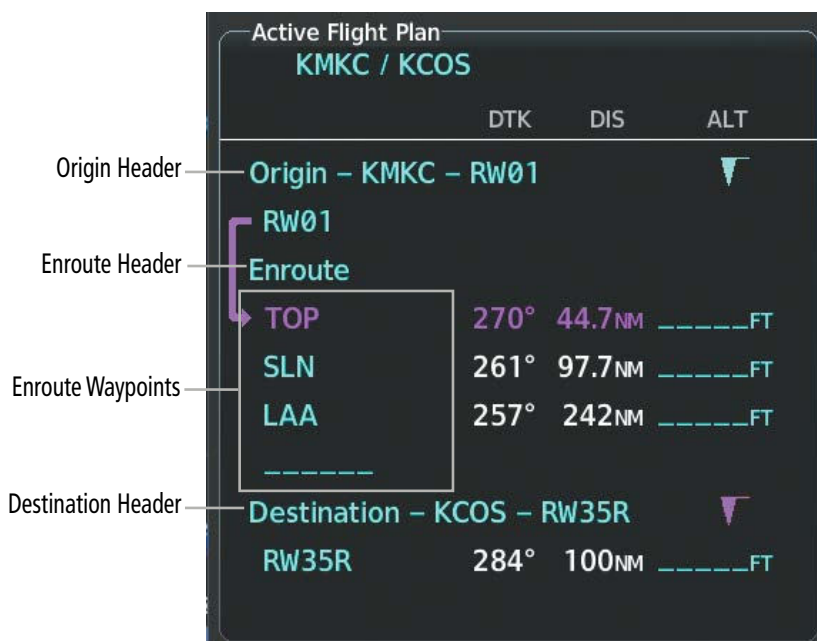
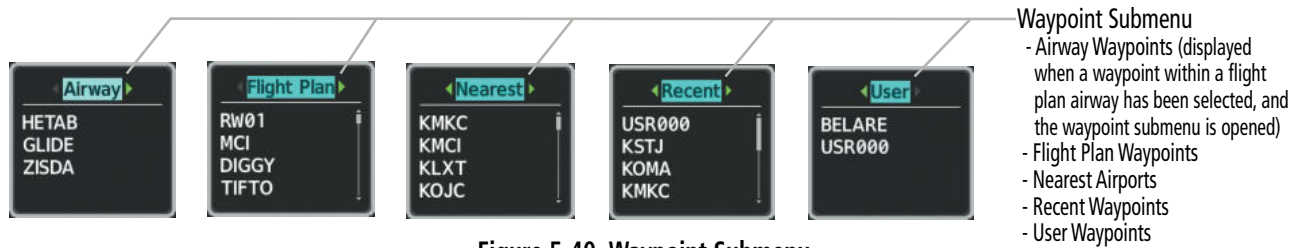


Figure 5-39 Active Flight Plan Waypoints


Figure 5-40 Waypoint Submenu
Adding a waypoint to a flight plan:

- 1) For the active flight plan, press the **FPL** Key, and push the **FMS** Knob to activate the cursor (not required on PFD).
Or:
For a stored flight plan:
 - a) Press the **FPL** Key for the MFD. Turn the small **FMS** Knob to select the 'FPL – Flight Plan Catalog' Page and push the **FMS** Knob to activate the cursor.
 - b) Turn the **FMS** Knob to highlight the desired flight plan.
 - c) Press the **EDIT** Softkey; or press the **ENT** Key, turn the large **FMS** Knob clockwise to select 'Edit' and press the **ENT** Key; or press the **MENU** Key, select 'Edit Flight Plan' and press the **ENT** Key. The 'FPL – Stored Flight Plan' Page is displayed.
- 2) Select the point in the flight plan before which to add the new waypoint. The new waypoint is placed directly in front of the highlighted waypoint.
- 3) 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).
- 4) 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 flight plan is modified as each waypoint is entered.

Creating and adding user waypoints to a flight plan using the map pointer on the MFD:

- 1) For the active flight plan, press the **FPL** Key, and push the **FMS** Knob to activate the cursor (not required on PFD).
Or:
For a stored flight plan:
 - a) Press the **FPL** Key. Turn the small **FMS** Knob to select the 'FPL – Flight Plan Catalog' Page and push the **FMS** Knob to activate the cursor.
 - b) Turn the **FMS** Knob to highlight the desired flight plan.
 - c) Press the **EDIT** Softkey; or press the **ENT** Key, turn the large **FMS** Knob clockwise to select 'Edit' and press the **ENT** Key; or press the **MENU** Key, select 'Edit Flight Plan' and press the **ENT** Key. The 'FPL – Stored Flight Plan' Page is displayed.
- 2) Select the location to insert the waypoint.
- 3) Push the **Joystick** for the MFD to activate the panning function on the flight plan map and pan to the location of the desired user waypoint.
- 4) 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 MAPxxx (using the next available in sequence) and is added to the flight plan.

REMOVING WAYPOINTS

Individual waypoints and airways can be removed from a flight plan. Some waypoints in the final approach segment (such as the FAF or MAP) can not be removed individually. Attempting to remove a waypoint that is not allowed results in a window displaying 'Invalid flight plan modification'. To remove a waypoint, choose the flight plan, select the desired point of insertion or waypoint to remove, enter/remove the waypoint, and it is added in front of the selected waypoint.



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

Removing an individual waypoint from a flight plan:

- 1) For the active flight plan, press the **FPL** Key, and push the **FMS** Knob to activate the cursor (not required on PFD).

Or:

For a stored flight plan:

 - a) Press the **FPL** Key for the MFD. Turn the small **FMS** Knob to select the 'FPL – Flight Plan Catalog' Page and push the **FMS** Knob to activate the cursor.
 - b) Turn the **FMS** Knob to highlight the desired flight plan.
 - c) Press the **EDIT** Softkey; or press the **ENT** Key, turn the large **FMS** Knob clockwise to select 'Edit' and press the **ENT** Key; or press the **MENU** Key, select 'Edit Flight Plan' and press the **ENT** Key. The 'FPL – Stored Flight Plan' Page is displayed.
- 2) Turn the large **FMS** Knob to highlight the waypoint to be removed.
- 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) Push the **FMS** Knob to remove the flashing cursor.

FLY-OVER WAYPOINTS

Waypoints entered in the enroute segment of the flight plan may be treated as either fly-by or fly-over waypoints.

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

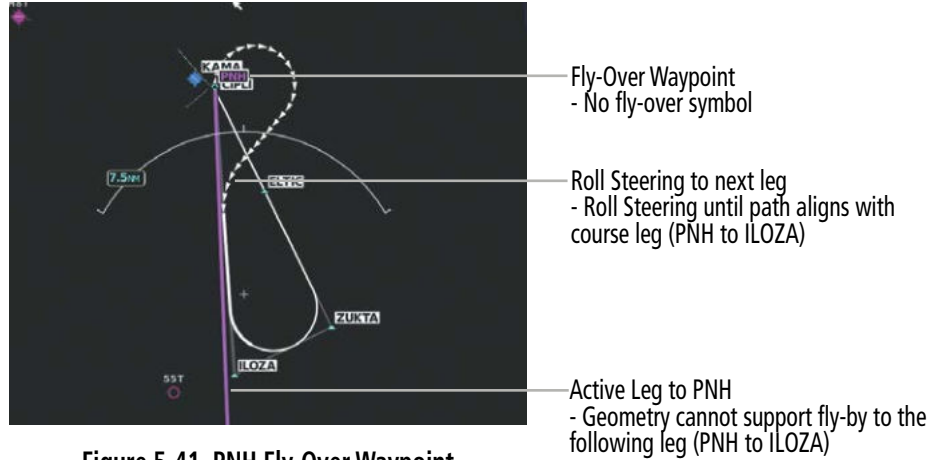


Figure 5-41 PNH Fly-Over Waypoint

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

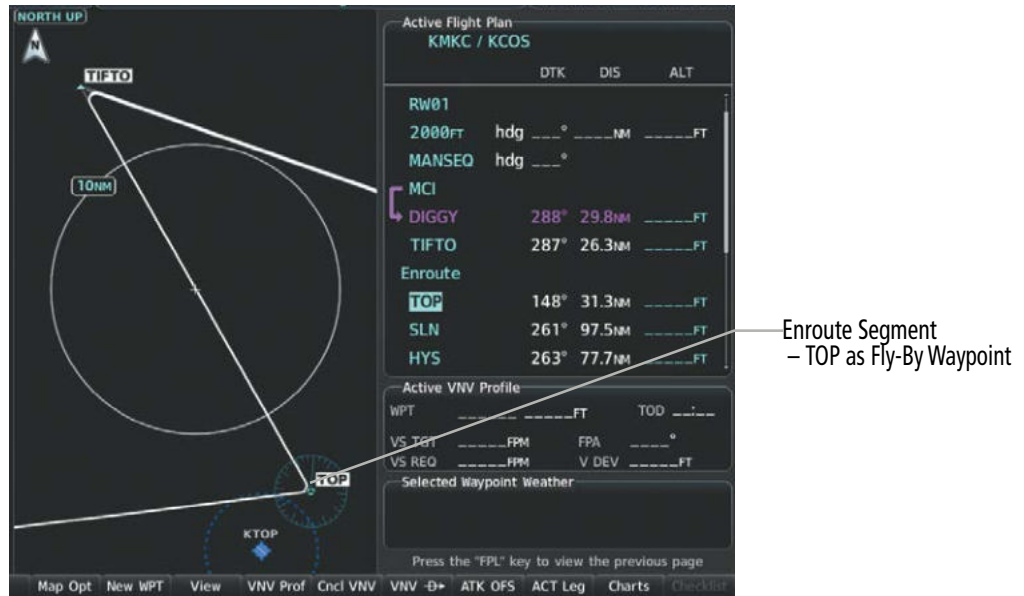


Figure 5-42 TOP Fly-By Waypoint

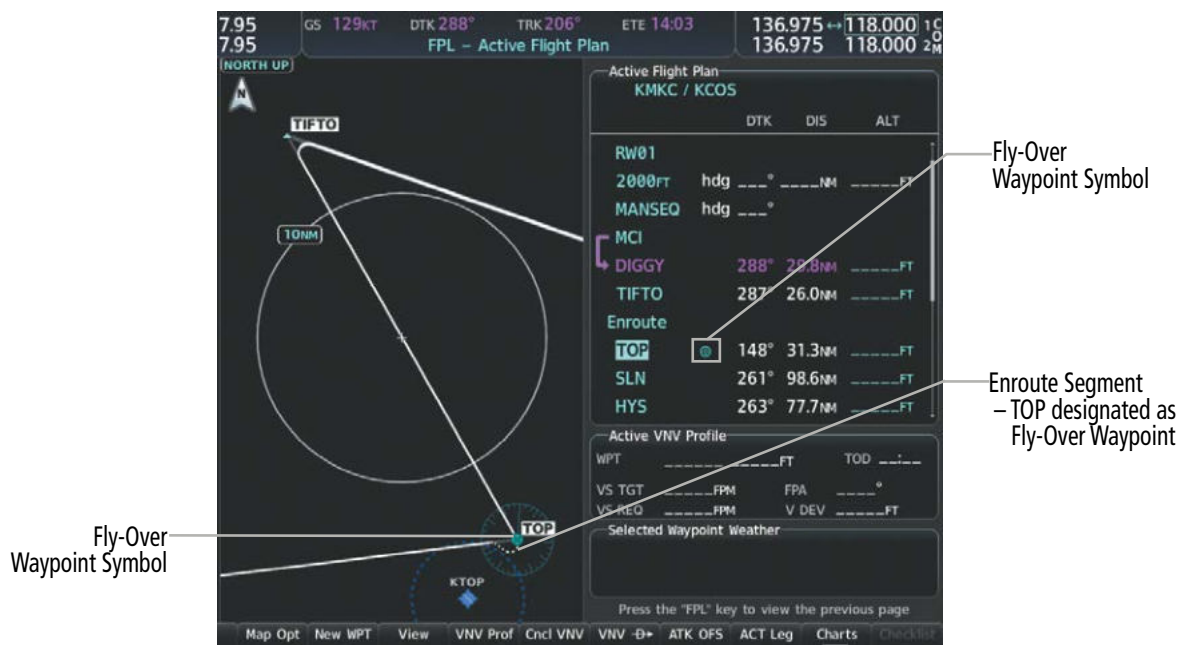


Figure 5-43 TOP Fly-Over Waypoint

Designating a fly-over waypoint:

- 1) For the active flight plan, press the **FPL** Key, and push the **FMS** Knob to activate the cursor (not required on PFD).
Or:
 For a stored flight plan:
 - a) Press the **FPL** Key for the MFD. Turn the small **FMS** Knob to select the 'FPL – Flight Plan Catalog' Page and push the **FMS** Knob to activate the cursor.
 - b) Turn the **FMS** Knob to highlight the desired flight plan.
 - c) Press the **EDIT** Softkey; or press the **ENT** Key, turn the large **FMS** Knob clockwise to select 'Edit' and press the **ENT** Key; or press the **MENU** Key, select 'Edit Flight Plan' and press the **ENT** Key. The 'FPL – Stored Flight Plan' Page is displayed.
- 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.

FLIGHT PLAN AIRWAYS

Within flight plans, airways can be added, removed and collapsed/expanded.

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 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.

ADDING AIRWAYS

Airways can be added to any flight plan. An airway can only be added if there is an existing entry waypoint in the flight plan that is part of the desired airway and is not part of an arrival or approach procedure. The system anticipates the desired airway based on the selected waypoint and the flight plan.



Figure 5-44 Select Airway Page – Selecting Airway



Figure 5-45 Select Airway Page – Selecting Exit Point

Adding an airway to a flight plan:

- 1) For the active flight plan, press the **FPL** Key, and push the **FMS** Knob to activate the cursor (not required on PFD).
Or:
 For a stored flight plan:
 - a) Press the **FPL** Key for the MFD. Turn the small **FMS** Knob to select the 'FPL – Flight Plan Catalog' Page and push the **FMS** Knob to activate the cursor.
 - b) Turn the **FMS** Knob to highlight the desired flight plan.
 - c) Press the **EDIT** Softkey; or press the **ENT** Key, turn the large **FMS** Knob clockwise to select 'Edit' and press the **ENT** Key; or press the **MENU** Key, select 'Edit Flight Plan' and press the **ENT** Key. The 'FPL – Stored Flight Plan' Page is displayed.
- 2) Turn the large **FMS** Knob to move the cursor below the airway entry waypoint for the insertion point. If there is no valid airway entry waypoint in the flight plan, one must be entered first.
- 3) Turn the small **FMS** Knob for the MFD one click clockwise and press the **LD AIRWY** Softkey, or press the **MENU** Key and select "Load Airway" (PFD or MFD). The **LD AIRWY** Softkey or the "Load Airway" menu item is available only when a valid airway entry waypoint has already been entered in the flight plan.
- 4) Turn the **FMS** Knob to highlight 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.
- 5) Turn the **FMS** Knob to highlight the desired airway exit point from the list, and press the **ENT** Key. 'Load?' is highlighted.
- 6) Press the **ENT** Key. The system returns to editing the flight plan with the new airway inserted.

Some airways have directional restrictions on all or part of the route. Airway “A2” in Europe has a directional restriction requiring the route to be flown in one direction only.

For 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.

REMOVING AIRWAYS

Removing an entire airway from a flight plan:

- 1) For the active flight plan, press the **FPL** Key, and push the **FMS** Knob to activate the cursor (not required on PFD).

Or:

For a stored flight plan:

- a) Press the **FPL** Key for the MFD. Turn the small **FMS** Knob to select the ‘FPL – Flight Plan Catalog’ Page and push the **FMS** Knob to activate the cursor.
 - b) Turn the **FMS** Knob to highlight the desired flight plan.
 - c) Press the **EDIT** Softkey; or press the **ENT** Key, turn the large **FMS** Knob clockwise to select ‘Edit’ and press the **ENT** Key; or press the **MENU** Key, select ‘Edit Flight Plan’ and press the **ENT** Key. The ‘FPL – Stored Flight Plan’ Page is displayed.
- 2) Select the header of the airway to be removed.
 - 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) Push the **FMS** Knob to remove the flashing cursor.

COLLAPSING/EXPANDING AIRWAYS

The system allows airways on the active flight plan to be collapsed or expanded. 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 flight plan will always keep 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.

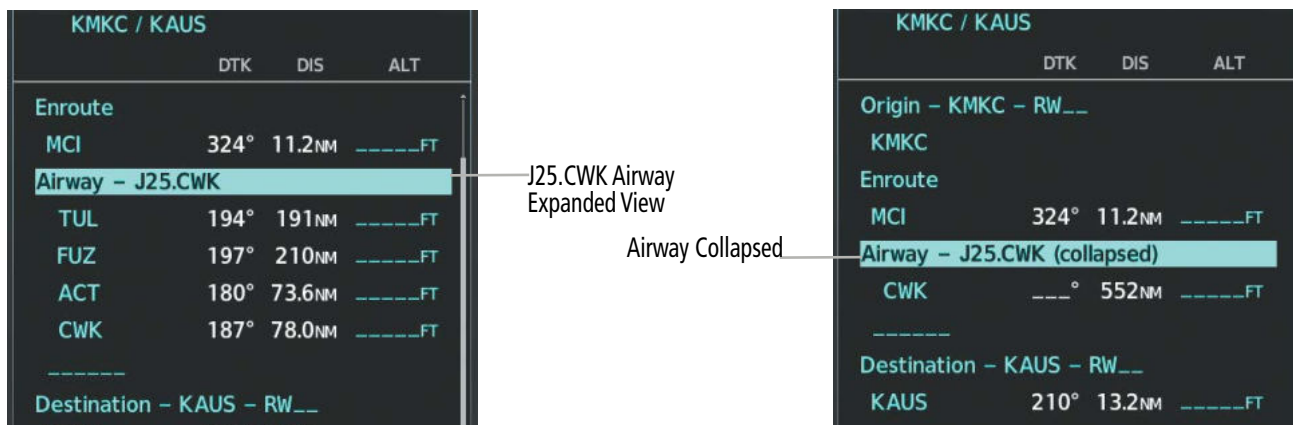


Figure 5-46 Expanded/Collapsed Airways

Collapsing/expanding the airways in a flight plan:

- 1) For the active flight plan, press the **FPL** Key.

Or:

For a stored flight plan:

- a) Press the **FPL** Key for the MFD. Turn the small **FMS** Knob to select the 'FPL – Flight Plan Catalog' Page and push the **FMS** Knob to activate the cursor.
 - b) Turn the **FMS** Knob to highlight the desired flight plan.
 - c) Press the **EDIT** Softkey; or press the **ENT** Key, turn the large **FMS** Knob clockwise to select 'Edit' and press the **ENT** Key; or press the **MENU** Key, select 'Edit Flight Plan' and press the **ENT** Key. The 'FPL – Stored Flight Plan' Page is displayed.
- 2) Press the **MENU** Key, highlight 'Collapse Airways' or 'Expand Airways', and press the **ENT** Key. The airways are collapsed/expanded.

FLIGHT PLAN WAYPOINT CONSTRAINTS

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. See the following figure for an example of how different Altitude Constraint Types are displayed in the active flight plan. Any published BETWEEN altitude restriction derived from the database is displayed in white text as an AT-or-ABOVE constraint type; the lower altitude of the published restriction is used to define the constraint.

The system will auto-designate (automatically enter and enable) altitude constraints to be used for vertical guidance when an approach is loaded. An altitude constraint which has been auto-designated by the system will be displayed as cyan text.

An altitude constraint may be manually designated for procedure waypoints and enroute waypoints by activating and moving the cursor to the desired altitude in the active flight plan, turning the small **FMS** Knob and pressing the **ENT** Key. An altitude constraint may be manually designated only if it is available for vertical guidance. Altitudes that are not available for vertical guidance are shown in white text and cannot be selected by the cursor.

The system is capable of providing vertical navigation for crossing AT the altitude constraint designated for use, regardless of published constraint type. For example, a published departure procedure may contain an AT-or-ABOVE 3,000 feet altitude crossing restriction. Designating this altitude constraint in the flight plan allows vertical navigation for crossing AT 3,000 feet.

NOTE: All designated altitudes (cyan text) will be displayed in the active flight plan without restriction bars regardless of what is shown on the published procedure.

For all designated altitudes, the system will automatically calculate advisory altitudes prior to the designated altitude constraint. These advisory altitudes are not auto-designated and are displayed as white text.

Altitudes that have been designated for use in vertical guidance can be “un-designated”. Pressing the **CLR** Key with the altitude constraint highlighted in the active flight plan removes the altitude constraint designation. The altitude will not be used for vertical guidance and the text displayed will be shown in white. The system will recalculate advisory altitudes (white text) once any altitude constraint is designated, modified, or un-designated.

An altitude constraint may be entered as a flight level (FL), height above mean sea level (MSL), or height above ground level (AGL). AGL format is only available for airport waypoints.

VNAV guidance is only provided for valid descent altitude constraints which have been designated for use. An altitude constraint that is crossed out indicates the system has determined this constraint to be invalid based on aircraft limitations or logical sequencing of the altitude constraint within the flight plan.

Altitude constraints can be modified or removed after having been added to the flight plan. If an altitude constraint is removed and the navigation database contains an altitude restriction for the lateral waypoint, the system will display that altitude restriction in white text. The system also provides a way to reinstate a published altitude constraint that has been modified.

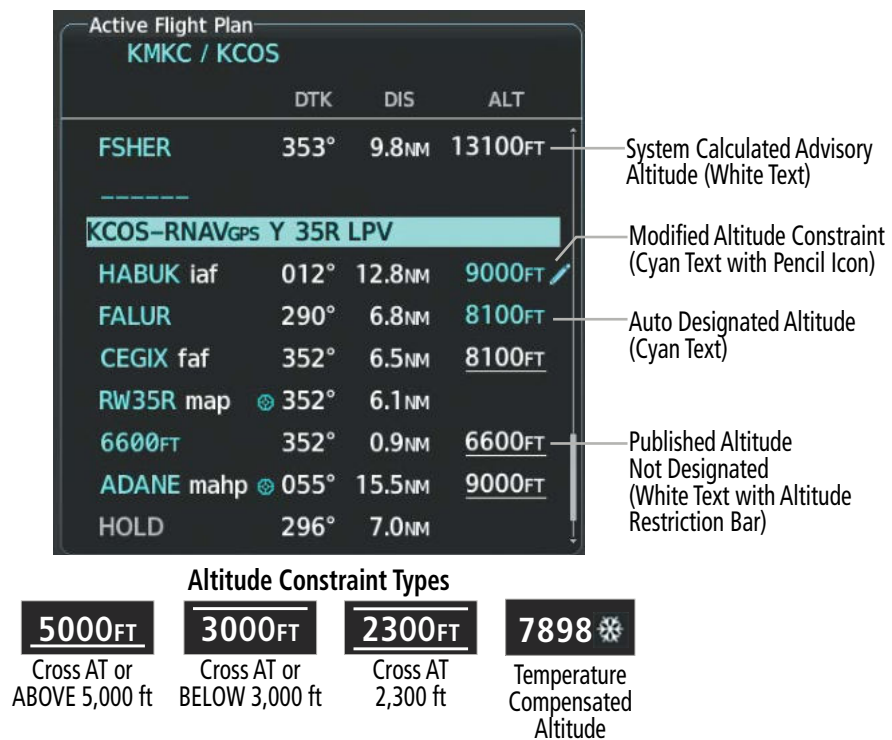


Figure 5-47 Waypoint Altitude Constraints

White Text	Cyan Text
<p>5000FT</p> <p>Advisory altitude calculated by the system estimating the altitude of the aircraft as it passes the waypoint.</p>	<p>8600FT ✎</p> <p>Altitude is designated for vertical guidance. A pencil icon indicates a manually modified altitude constraint.</p>
<p>5000FT</p> <p>Altitude retrieved from the navigation database. White line(s) above and/or below indicate the type of constraint, as shown in the preceding figure.</p> <p>These altitudes are provided as a reference, and are not designated to be used in determining vertical guidance.</p>	<p>8100FT</p> <p>The system cannot use this altitude in determining vertical guidance because of an invalid constraint condition.</p>

Table 5-11 Altitude Constraint Legend

Entering/designating or modifying an altitude constraint:

- 1) Press the **FPL** Key for the MFD to display the ‘FPL – Active Flight Plan’ Page.
- 2) Push the **FMS** Knob to activate the cursor.
- 3) Turn the small **FMS** Knob and enter an altitude constraint value using the **FMS** Knob. 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 aerodrome without a runway selected, an additional choice is displayed. Turn the small **FMS** Knob to choose ‘MSL’ or ‘AGL’, and press the **ENT** Key to accept the altitude.

Removing/undesignating an altitude constraint:

- 1) Press the **FPL** Key for the MFD to display the ‘FPL – Active Flight Plan’ Page.
- 2) Push the **FMS** Knob to activate the cursor 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.

Reverting a manually entered altitude constraint back to the navigation database value:

- 1) Press the **FPL** Key for the MFD to display the ‘FPL – Active Flight Plan’ Page.
- 2) Push the **FMS** Knob to activate the cursor 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.

QFE CONSTRAINTS

Baro QFE settings may be enabled within the System Setup Page so the altimeter will read zero at the selected airfield reference point (Origin or Destination airfield) or to a manual setting. Once QFE is enabled, altitude constraints based on Baro QFE may be entered or modified in the flight plan. All former QNH altitude constraints in the flight plan will be displayed as the height above the reference airfield and will be in parenthesis. QNE altitudes in the flight plan will continue to appear as “FLXXX” in white or cyan text without parenthesis. See the Flight Instruments Section for more information on how to enable Baro QFE.

WARNING: Do not fly QFE procedures above the Transition Altitude or when navigating to a waypoint that contains a QNE (flight level) altitude constraint.

WARNING: Always fly a procedure that provides terrain and obstacle clearance from the reference airfield when operating in IMC while conducting QFE procedures.

NOTE: The system will generate a system message and inhibit VNAV guidance when the aircraft is vertically approaching a flight level altitude constraint with QFE active. The system will automatically resume VNAV guidance if QFE is disabled or the flight level altitude constraint is bypassed.

NOTE: ‘FMS ORIG’ and ‘FMS DEST’ references do not dynamically update with flight plan changes. Always verify QFE settings when changing the QFE reference (airfield, runway, etc.) or flight plan and re-enter settings within the Avionics Settings.

Entering or modifying a Baro QFE altitude constraint:

- 1) With Baro QFE enabled, press the **FPL** Key for the MFD to display the ‘FPL – Active Flight Plan’ Page.
- 2) Push the **FMS** Knob, and turn the large **FMS** Knob to highlight the desired waypoint altitude constraint (‘ALT’).
- 3) Turn the small **FMS** Knob to begin entry of the altitude constraint, and use the **FMS** Knobs to enter the constraint in reference to Baro QFE. If modifying an existing Baro QFE altitude constraint, turning the small **FMS** Knob displays the existing constraint in MSL in the entry field. If adding a new altitude constraint, turning the small **FMS** Knob displays ‘00000FT’ in the entry field.
- 4) Press the **ENT** Key. Turn the small **FMS** Knob to highlight ‘QFE’ and press the **ENT** Key to accept the altitude constraint. The constraint is shown in parenthesis indicating it is based on the Baro QFE setting.

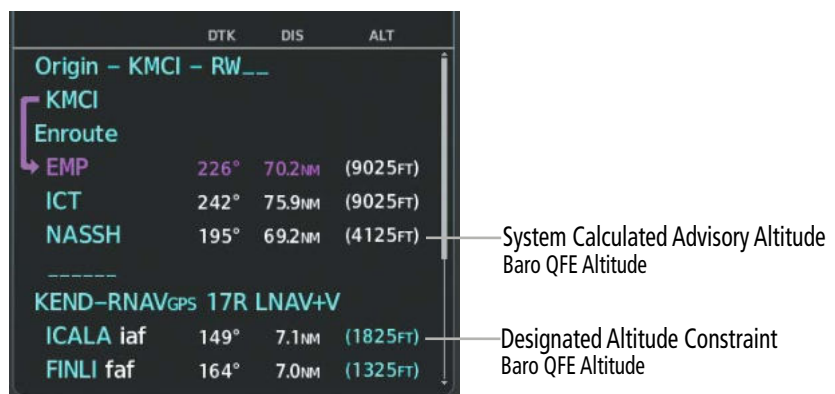


Figure 5-48 Baro QFE Altitude Constraints

FLIGHT PLAN 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 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.

Vertical navigation is available for flight director guidance when valid VNV data is entered in flight plan and the **ENBL VNV** Softkey is pressed (softkey label changes to **Cncl VNV** once enabled) on the 'FPL – Active Flight Plan' Page. Refer to the AFCS Section for more information on utilizing vertical navigation for aircraft control.

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.



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

Enabling and Disabling VNV guidance:

- 1) Press the **FPL** Key for the MFD to display the 'FPL – Active Flight Plan' Page.
- 2) Press 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, press the **Cncl VNV** Softkey; or press the **MENU** Key, highlight 'Cancel VNV', and press the **ENT** Key. Vertical navigation is disabled.

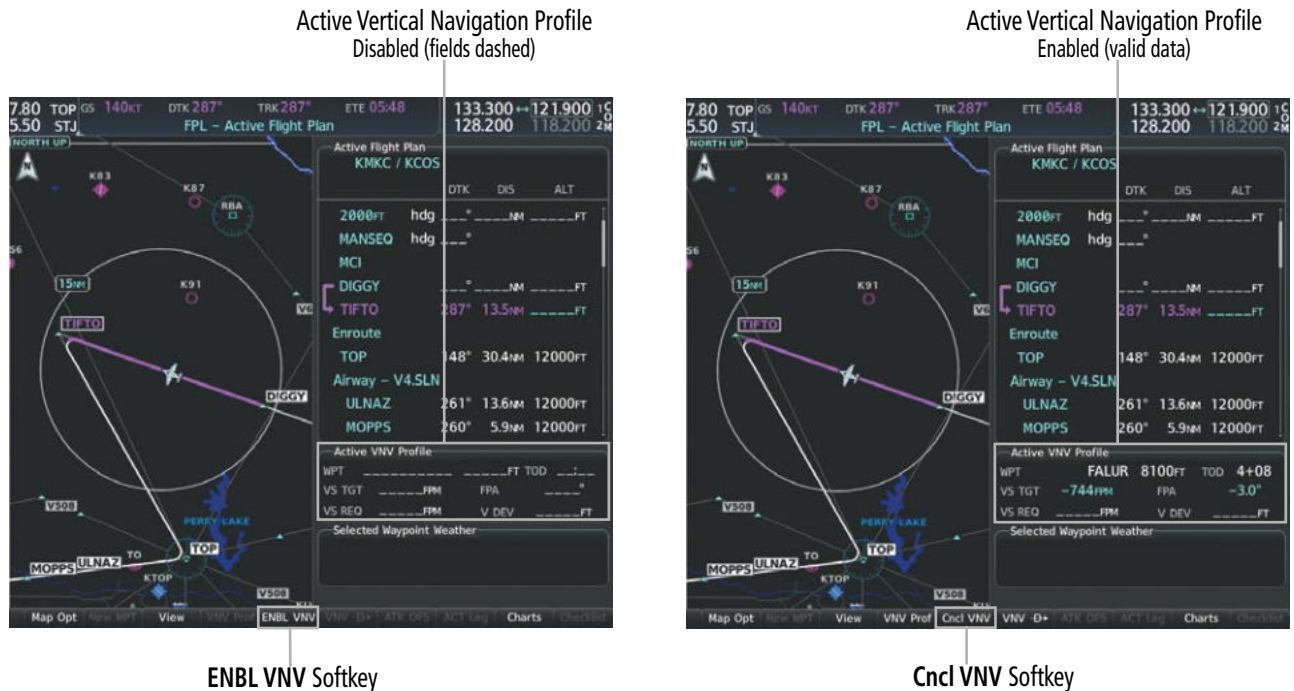


Figure 5-70 Enabling/Disabling Vertical Navigation

ACTIVE VNAV PROFILE

The active 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. The default FPA is -3.0 degrees.

Modifying the VS TGT and FPA:

- 1) Press the **FPL** Key for the MFD to display the 'FPL – Active Flight Plan' Page.
- 2) Press 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) Push the **FMS** Knob to remove the flashing cursor.

VERTICAL SITUATION DISPLAY (VSD)

A Vertical Situation Display (VSD) can be shown on the bottom of the 'Map – 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, TOD/BOD, and destination runway) can be displayed on the VSD, depending on the selected mode. See the Hazard Avoidance section for information about winds aloft, obstacles, and relative terrain on the VSD.

The VSD horizontal range is equal to the 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 map indicated range or the lowest range the displays all of the remaining active flight plan. The VSD altitude range automatically changes when the 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.

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). The depicted terrain profile represents an approximate forward-looking contour of the terrain based upon the highest reported terrain elevations, measured at intervals defined by the terrain database resolution, within a predefined width along the active flight plan between the aircraft present position and the end of the map range or active flight plan. The predefined width is determined by the flight phase.

The numeric constraint values are displayed below the waypoint label, using the same color and format as on the Active Flight Plan Page. See the Altitude Constraints discussion earlier in this section for more information.

Additionally, a constraint icon is displayed on the VSD along the vertical profile path for each altitude constraint, as shown in the following figure.



NOTE: Certain leg types (e.g. holds, heading legs) do not support VNV descents because the lateral distance of those legs is unknown. The VSD will not show a VNV profile for any legs that have no vertical path guidance.



Figure 5-49 VSD Inset on 'Map - Navigation Map' Page

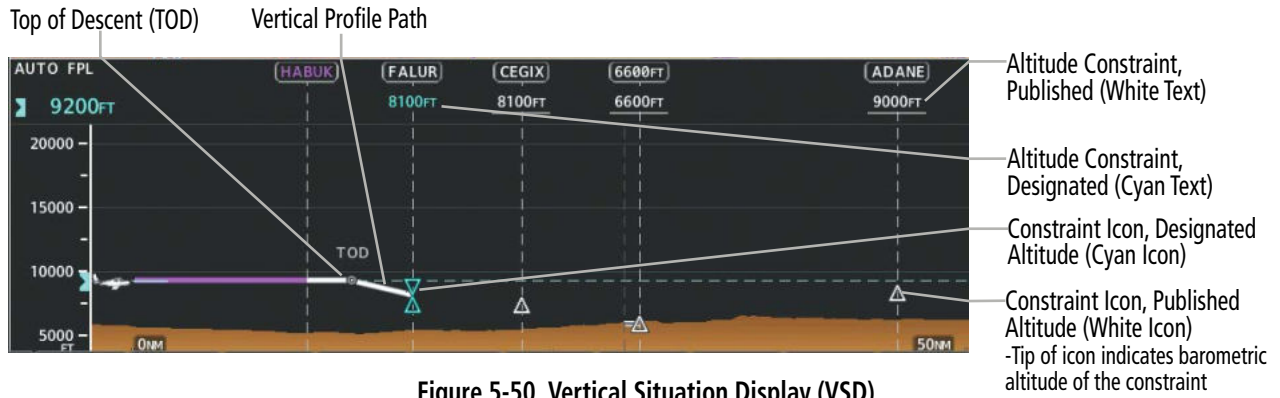


Figure 5-50 Vertical Situation Display (VSD)

VSD Mode Softkey	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 ¹
	AUTO TRK	(1) Active FPL available & aircraft not within FPL swath, or (2) Active FPL not available	Terrain/obstacles along the current track, vertical track vector, and selected altitude
Flight Plan	FPL	Active FPL available	Terrain/obstacles along the active flight plan route, vertical track vector, selected altitude, and active flight plan information ¹
		Active FPL not available	Only shows message 'Flight Plan Not Available'
Track	TRK	N/A	Terrain/obstacles along the current track, vertical track vector, and selected altitude

¹ Active flight plan information consists of waypoints, associated altitude constraints, current VNAV profile, TOD/ BOD, and destination runway

Table 5-12 VSD Modes

Flight Phase	Width of Swath
Approach, Departure	0.6 nm
Terminal	2.0 nm
En Route, Oceanic	4.0 nm

Table 5-13 VSD Width of Swath

VSD MESSAGES

Under certain conditions, some messages may appear in conjunction with others.

Message	Description
'Loading...'	VSD is loading data due to a range change, full/half switch, or first being selected for display.
'Flight Plan Not Available'	Flight Plan mode is selected and there is not a flight plan loaded with at least one leg.
'Flight Plan mode unavailable because aircraft off course and active leg over 200 NM'	All of the following are true: - Flight Plan mode is selected - The active leg is greater than 200 nm - The aircraft is outside the swath
'Aircraft Beyond Active Leg'	Flight Plan mode is selected and the aircraft's position, as projected on the flight plan, is past the end of the active leg.
'VSD Not Available'	At least one of the following is true: - Valid terrain database not available - GPS MSL altitude not available - Current barometric altitude not available - Neither current track nor current heading available - GPS position not available - Map range setting is less than 1 nm
'VSD Data is old, disable and enable VSD'	The system has encountered a delay and VSD data has failed to update for 2 seconds or more. This message may be momentarily displayed and then removed as the delay is overcome. In the event the message persists, it is recommended to disable and enable VSD.

Table 5-14 VSD System Messages

Enabling and changing settings for the Vertical Situation Display:

- 1) Select the 'Map – Navigation Map' Page.
- 2) Press the **Map Opt** Softkey.
- 3) Press the **Inset** Softkey.
- 4) Press the **VSD** or **Off** Softkey to enable or disable the Vertical Situation Display.
- 5) If desired, press the VSD Mode Softkey to choose between **Auto**, **FPL**, or **TRK**.

Or:

- 1) Select the 'Map – Navigation Map' Page.
- 2) Press the **MENU** Key:
 - a) Turn the **FMS** Knob to highlight 'Show VSD' or 'Hide VSD' and press the **ENT** Key.
 - b) Press the **Map Opt** Softkey.
 - c) Press the **Inset** Softkey.
 - d) Press the VSD Mode softkey to choose between **Auto**, **FPL**, or **TRK**.

Or:

 - a) Press the **ENT** Key to select Map Settings.
 - b) Turn the large **FMS** Knob to select 'VSD' and press the **ENT** Key.
 - c) Highlight the 'Mode' 'On' or 'Off' Field and turn the small FMS Knob to enable/disable VSD.
 - d) To change the Mode setting, highlight the 'Mode' Field.
 - e) Use the small FMS Knob to select 'Auto', 'FPL', or 'TRK', and press the **ENT** Key.

Disabling the Vertical Situation Display:

- 1) Select the 'Map – Navigation Map' Page.
- 2) Press the **Map Opt** Softkey.
- 3) Press the **Inset** Softkey.
- 4) Press the **Off** Softkey.



Or:

 - 1) Select the 'Map – Navigation Map' Page.
 - 2) Press the **MENU** Key:
 - a) Turn the **FMS** Knob to highlight 'Show VSD'
 - b) Press the **ENT** Key.

Or:

 - a) Press the **ENT** Key to select Map Settings.
 - b) Turn the large **FMS** Knob to select 'VSD' and press the **ENT** Key.
 - c) Highlight the 'Mode' On/Off Field and turn the small FMS Knob to select 'Off'.
 - d) Press the **ENT** Key.

VERTICAL NAVIGATION DIRECT-TO


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**  Softkey on the ‘FPL – 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  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. 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.

Activating a vertical navigation direct-to:

- 1) Press the **FPL** Key for the MFD to display the ‘FPL – Active Flight Plan’ Page.
- 2) Push the **FMS** Knob to activate the cursor and turn 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) Press the **VNV**  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) Push the **FMS** Knob to remove the flashing cursor.

Removing a VNV altitude constraint:

- 1) Press the  Key to display the ‘Direct To’ Window.
- 2) Press the **MENU** Key.
- 3) With ‘Clear Vertical Constraints’ highlighted, press the **ENT** Key.

FLIGHT PLAN OPERATIONS

This section will discuss activating a flight plan leg and conducting enroute operations such as creating an along track offset, parallel track, closest point from a reference point and user defined holding. For information on departures, arrivals, and approaches refer to the Procedures portion in the Flight Management Section.

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

ACTIVATING A FLIGHT PLAN LEG

The flight plan leg which is currently being used for navigation guidance is referred to as the ‘active leg’. The system automatically sequences from one active leg to the next as defined by the active flight plan. Any leg in the active flight plan successive to the leg currently being flown may be selected to become the new active leg.

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) Push the **FMS** Knob to activate the cursor (not required on 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) Push 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 the active flight plan. Along track offset waypoints lie along the path of the existing flight plan, and can be used to make the system reach a specified altitude before or after reaching the specified flight plan waypoint. Offset distances can be entered from 1 to 999 nm in increments of 1 nm. Entering a negative offset distance results in an along track offset waypoint inserted before the selected waypoint, whereas entering a positive offset distance results in an along track offset waypoint inserted after the selected waypoint. Multiple offset waypoints are allowed.

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

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



Figure 5-51 Along Track Offset

Entering an along track offset distance:

- 1) For the active flight plan, press the **FPL** Key. Push the **FMS** Knob to activate the cursor (not required on PFD).
- 2) 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 Waypoint', 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) Push the **FMS** Knob to remove the flashing cursor.

Removing an along track offset distance:

- 1) For the active flight plan, press the **FPL** Key. Push the **FMS** Knob to activate the cursor (not required on PFD).
- 2) Turn the large **FMS** Knob to highlight the along track offset.
- 3) Press the **CLR** Key. The 'Remove VNAV along-track 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.

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

- 1) Press the **→** Key to display the 'Direct To' Window.
- 2) Turn the large **FMS** Knob to place the cursor in the altitude field ('VNV' or 'ALT').
- 3) Enter the desired altitude.
- 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.
- 5) The cursor is now flashing in the offset distance field.
- 6) Enter the desired along-track distance.
- 7) Press the **ENT** Key. 'Activate?' is highlighted.
- 8) Press the **ENT** Key to activate.

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 flight plan to a selected waypoint:

- 1) For the active flight plan, press the **FPL** Key.
Or:
For a stored flight plan:
 - a) Press the **FPL** Key for the MFD. Turn the small **FMS** Knob to select the 'FPL – Flight Plan Catalog' Page and push the **FMS** Knob to activate the cursor.
 - b) Turn the **FMS** Knob to highlight the desired flight plan.
 - c) Press the **EDIT** Softkey; or press the **ENT** Key, turn the large **FMS** Knob clockwise to select 'Edit' and press the **ENT** Key. The 'FPL – Stored Flight Plan' Page is displayed.
- 2) Press the **MENU** Key, 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 and press the **ENT** Key. 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. The name for the new user waypoint is derived from the identifier of the reference waypoint.

PARALLEL TRACK

The Parallel Track feature allows creation of a parallel course offset of 1 to 50 nm left or right of the current flight plan. When Parallel Track is activated, the course line drawn on the map pages shows the parallel course, and waypoint names have a lower case “p” placed after the identifier. 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.

If the parallel track proposed by the offset direction and distance is not allowed by the system, the activation prompt is displayed, but disabled.

The following will inhibit activation of a parallel track:

- » Initiating a direct-to, to the selected waypoint.
- » If an approach leg is active, the status indicates the system is unable to activate the parallel track with the message ‘Parallel Track Unavailable Approach Leg Active’.
- » If the offset direction and distance results in an unreasonable route geometry (e.g., there is a sharp turn of more than 120 degrees), the status indicates the system is unable to activate the parallel track because of invalid geometry (‘Parallel Track Unavailable Invalid Route Geometry’).
- » If the active leg is not a track between two fixes (TF) or a course to a fix (DF) leg, the status indicates the system is unable to activate the parallel track because parallel track is not available for the active leg type (‘Parallel Track Unavailable Not Allowed for Active Leg’).

If there are no legs remaining in the flight plan after the given leg, or OBS mode is active. The following will cancel the parallel track:

- » Initiating a direct-to, to a waypoint.
- » Initiating a hold at the present position.
- » If a course change occurs greater than 120° or the parallel tracks overlap as a result of the course change.
- » No legs are remaining in the flight plan after the given leg, or OBS mode is active. 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.



NOTE: Vertical navigation is unavailable while the Parallel Track feature is active.



Figure 5-52 Parallel Track 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 1-50 nm and press the **ENT** Key. 'Activate Parallel Track?' 'Activate Parallel Track' is highlighted.
- 5) Press the **ENT** Key to activate parallel track. Push the **FMS** Knob or the **CLR** Key to cancel the parallel track activation.

Cancelling parallel track:

- 1) Press the **FPL** Key to display the 'FPL – Active Flight Plan' Page (MFD) or the Active '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.

USER-DEFINED HOLDING PATTERNS

A holding pattern can be defined at any active flight plan waypoint, at the aircraft present position, or at a direct-to waypoint.

Creating a user-defined hold at a flight plan waypoint:

- 1) For the active flight plan, press the **FPL** Key. Push the **FMS** Knob to activate the cursor (not required on PFD).

Or:

For the standby flight plan, press the **FPL** Key for the MFD. Turn the small **FMS** Knob to select the 'FPL – Standby Flight Plan' Page and push the **FMS** Knob to activate the cursor.

Or:

For a stored flight plan:

- a) Press the **FPL** Key for the MFD. Turn the small **FMS** Knob to select the 'FPL – Flight Plan Catalog' Page and push the **FMS** Knob to activate the cursor.
 - b) Turn the **FMS** Knob to highlight the desired flight plan.
 - c) Press the **EDIT** Softkey; or press the **ENT** Key, turn the large **FMS** Knob clockwise to select 'Edit' and press the **ENT** Key. The 'FPL – Stored Flight Plan' Page is displayed.
- 2) Turn the large **FMS** Knob to highlight the 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.

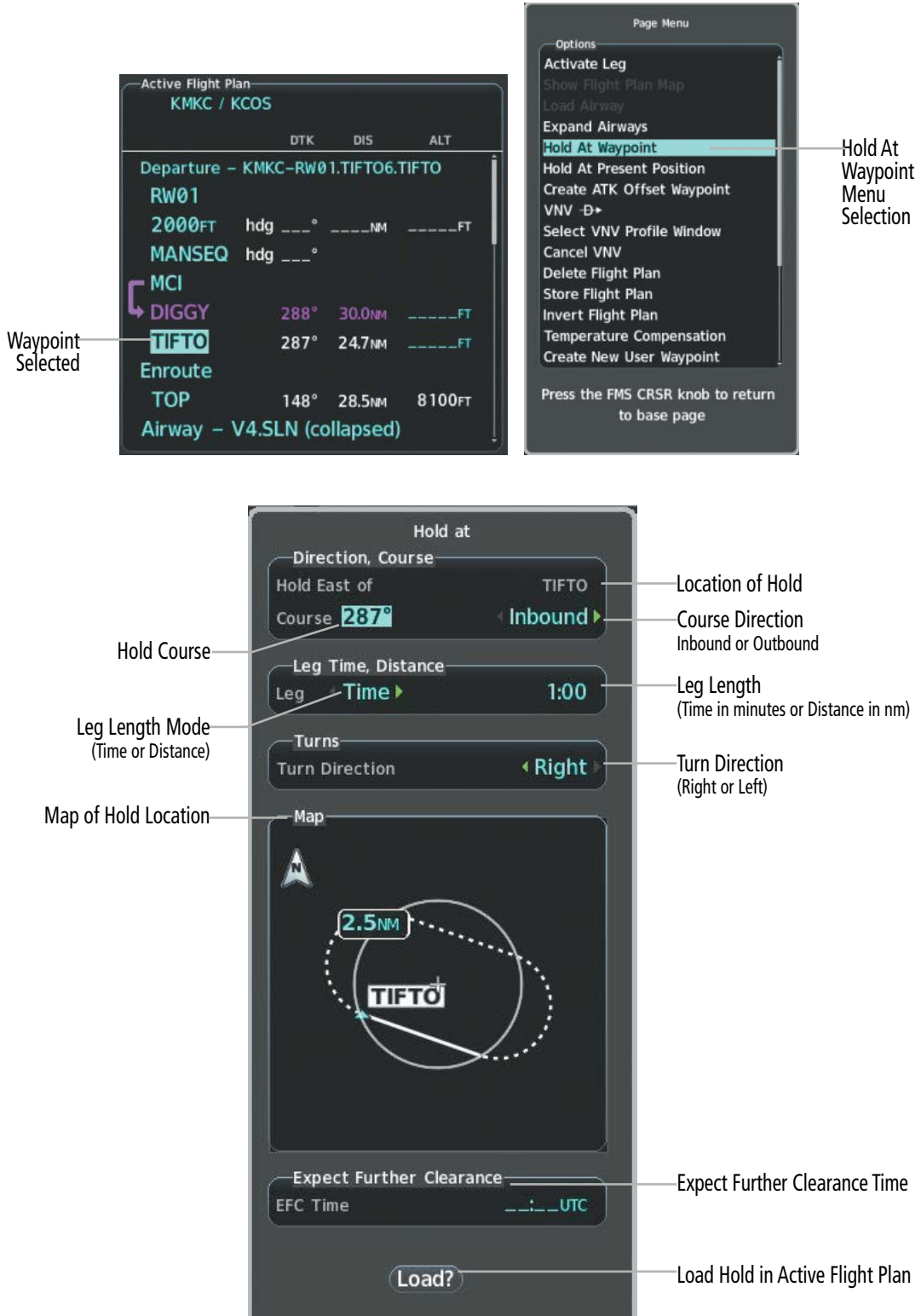


Figure 5-53 Creating a User Defined Holding Pattern at an Active Flight Plan Waypoint

- SYSTEM OVERVIEW
- FLIGHT INSTRUMENTS
- EIS
- AUDIO PANEL & CNS
- FLIGHT MANAGEMENT
- HAZARD AVOIDANCE
- AFCS
- ADDITIONAL FEATURES
- APPENDICES
- INDEX

Active Flight Plan
KMKC / KCOS

	DTK	DIS	ALT
Departure - KMKC-RW01.TIFTO6.TIFTO			
RW01			
2000FT	hdg ___°	___NM	___FT
MANSEQ	hdg ___°		
MCI			
DIGGY	288°	30.0NM	___FT
TIFTO	287°	24.7NM	___FT
Enroute			
TOP	148°	28.5NM	8100FT
Airway - V4.SLN (collapsed)			

Waypoint Selected

Direct To

Ident, Facility, City
TIFTO ▲ N CEN USA

VNV
___FT +0NM

Map
NORTH UP
7.5NM
TIFTO
52K

Location
BRG 287° DIS 56.4NM

Course
285°

Activate? **Hold?**

Hold at

Direction, Course
Hold East of TIFTO
Course 287° Inbound

Leg Time, Distance
Leg Time 1:00

Turns
Turn Direction Right

Map
2.5NM
TIFTO

Expect Further Clearance
EFC Time ___:___UTC

Activate?

Hold Course

Location of Hold

Course Direction (Inbound or Outbound)

Leg Length (Time in minutes or Distance in nm)

Turn Direction (Right or Left)

Leg Length Mode (Time or Distance)

Map of Hold Location

Expect Further Clearance Time

Hold At Direct To Waypoint Selection
 Figure 5-54 Creating a User Defined Holding Pattern at a Direct To Waypoint

212 Garmin G1000 NXi Pilot's Guide for the Diamond DA42NG 190-02526-01 Rev. A

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

- 1) Press a **➔** Key and set up the direct-to waypoint as desired, then select 'Hold?' when finished.
- 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, '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.)

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.

Exiting a user-defined hold inserted into the active flight plan:

Press 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 from a flight plan:

- 1) For the active flight plan, press the **FPL** Key. Push the **FMS** Knob to activate the cursor (not required on PFD).
Or:
 For a stored flight plan:
 - a) Press the **FPL** Key for the MFD. Turn the small **FMS** Knob to select the 'FPL – Flight Plan Catalog' Page and push the **FMS** Knob to activate the cursor.
 - b) Turn the **FMS** Knob to highlight the desired flight plan.
 - c) Press the **EDIT** Softkey; or press the **ENT** Key, turn the large **FMS** Knob clockwise to select 'Edit' and press the **ENT** Key. The 'FPL – Stored Flight Plan' Page is displayed.
- 2) Turn the large **FMS** Knob to highlight the 'HOLD' in the flight plan.
- 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 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 **→** Key to display the 'Direct To' Window.
- 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.

ARRIVAL ALERTS

The 'Arrival Alert' Box on the 'Aux – System Setup 1' Page allows arrival alert messages to be turned On/Off and the alert trigger distance (up to 99.9 units) set for alerts provided on the PFD. 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 on the PFD. 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 5-55 Arrival Alert Settings ('Aux - System Setup 1' Page)

Enabling/disabling the Arrival Alert:

- 1) Use the **FMS** Knob to select the 'Aux – System Setup 1' Page (**Setup 1** Softkey).
- 2) Push 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 arrival 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 (**Setup 1** Softkey).
- 2) Push 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.

MANAGING FLIGHT PLANS

The pilot can manage flight plans by importing/exporting via SD Card or the optional Wireless Transceiver (FlightStream 510), and by storing, copying, inverting, and deleting. Also, the comment field (name) of each flight plan can be changed to something that is useful for identification and sorting.

IMPORTING AND EXPORTING FLIGHT PLANS

Flight plans can be transferred to or from a wireless connection via the optional Wireless Transceiver. Wireless transfer of a flight plan to a mobile device is controlled by the wireless device. When a wireless connection is attempting to transfer a flight plan to the system, the pending flight plan may be ignored, previewed, stored, or activated by the pilot.

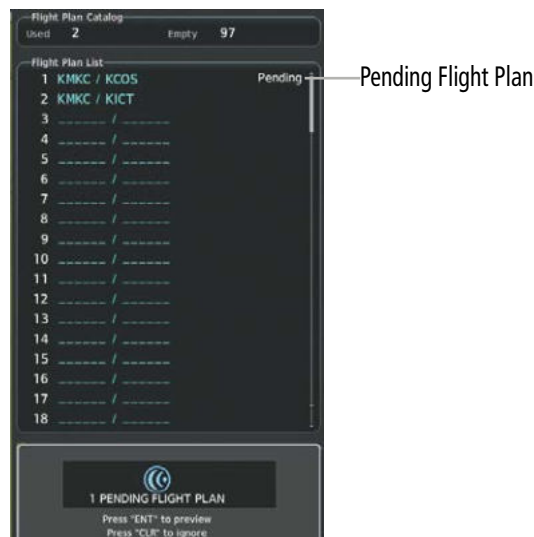


Figure 5-56 Pending Flight Plan Transfer from a Wireless Device

Ignoring a flight plan transfer from a wireless connection:

- 1) When a flight plan transfer has been initiated from a wireless connection, a Pending Flight Plan pop-up alert appears in the lower right corner of the MFD, and a Connex annunciator 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.

Previewing a flight plan transfer from a wireless connection:

- 1) When a flight plan transfer has been initiated from a wireless connection, a Pending Flight Plan pop-up alert appears in the lower right corner of the MFD, and a Connex annunciator 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.

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) Push the **FMS** Knob to activate the cursor.
- 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) Push 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) Push 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) Push 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) Push 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.

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) Push 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) Push 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.*

Under certain conditions, some messages may appear when a flight plan is imported or exported.

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 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 contains invalid waypoint(s)'	One or more imported flight plan waypoints is/are invalid or locked (this may occur if waypoints in the flight plan were removed in a recent database cycle). The imported flight plan can be deleted or it can be viewed and edited to remove invalid waypoints prior to use.
'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 5-15 Flight Plan Import/Export Messages

INVERTING A FLIGHT PLAN

A flight plan may be inverted (reversed) for navigation back to the original departure point.

Inverting the active flight plan:

- 1) Press the **FPL** Key.
- 2) Press the **MENU** Key, highlight 'Invert Flight Plan', and press the **ENT** Key.
- 3) An 'Invert active flight plan?' confirmation window is displayed. Press the **ENT** Key to invert and activate the flight plan. To cancel, 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) Push 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.

DELETING THE ACTIVE FLIGHT PLAN

The active flight plan is erased when the system is turned off, overwritten when another flight plan is activated. Additionally, the system allows the pilot to delete the active flight plan. Deleting the active flight plan suspends navigation by the system.

Deleting the active flight plan:

- 1) Press the **FPL** Key.
- 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 flight plan. To cancel the request, press the **CLR** Key, or highlight 'Cancel' and press the **ENT** Key.

STORED FLIGHT PLAN FUNCTIONS

Up to 99 flight plans with up to 100 waypoints each can be created and stored in memory. Details about each stored flight plan can be viewed on the 'FPL – Flight Plan Catalog' Page and on the 'FPL – Stored Flight Plan' Page. If the flight plan memory is full and a flight plan is imported, it will overwrite the last flight plan in the catalog.

A stored flight plan may be viewed or edited. The system also 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.

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).

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 removed 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.

Lastly, individual or all stored flight plans can be deleted from the system memory.



Figure 5-57 'FPL - Flight Plan Catalog' Page

Viewing information about a stored flight plan:

- 1) Press the **FPL** Key for 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) Push the **FMS** Knob to activate the cursor and turn the **FMS** Knob to highlight the desired flight plan.
- 4) The Flight Plan Information is displayed showing 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) Push the **FMS** Knob to exit the 'FPL – Stored Flight Plan' Page.

Storing a flight plan:

- 1) For the active flight plan, press the **FPL** Key.
- 2) Press the **Menu** Key. 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.

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) Push the **FMS** Knob to activate the cursor, and turn the **FMS** Knob to highlight the desired flight plan.
- 3) Open the 'Activate stored flight plan?' window:
 - Press the **Activate** Softkey.
 - Or:**
 - Press the **ENT** Key. An 'Activate stored flight plan?' window will appear.
 - Or:**
 - a) Press the **MENU** Key.
 - b) Highlight 'Activate Flight Plan' and press the **ENT** Key.
- 4) With 'OK' highlighted, press the **ENT** Key. To cancel the request, press the **CLR** Key, or highlight 'Cancel' and press the **ENT** Key.

Copying a stored flight plan to another flight plan memory slot, on the MFD:

- 1) Press the **FPL** Key and turn the small **FMS** Knob to display the 'FPL – Flight Plan Catalog' Page.
- 2) Push the **FMS** Knob to activate the cursor, and turn the **FMS** Knob to highlight the desired flight plan.
- 3) Open the 'Copy to flight plan XX?' window:
 - Press the **Copy** Softkey.
 - Or:**
 - a) Press the **MENU** Key, highlight 'Copy Flight Plan'.
 - b) 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.

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) Push the **FMS** Knob to activate the cursor, and turn the **FMS** Knob to highlight the desired flight plan.
- 3) Open the 'Delete flight plan XX?' window:
 - Press the **Delete** Softkey.
 - Or:**
 - Press the **CLR** Key.
 - Or:**
 - a) Press the **MENU** Key.
 - b) Highlight 'Delete Flight Plan', and press the **ENT** Key.
- 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.

Changing a Flight Plan Comment (Name):

- 1) For the active flight plan, press the **FPL** Key. Push the **FMS** Knob to activate the cursor (not required on PFD).

Or:

For a stored flight plan:

- a) Press the **FPL** Key for the MFD. Turn the small **FMS** Knob to select the 'FPL – Flight Plan Catalog' Page and push the **FMS** Knob to activate the cursor.
 - b) Turn the **FMS** Knob to highlight the desired flight plan.
 - c) Press the **EDIT** Softkey; or press the **ENT** Key, turn the large **FMS** Knob clockwise to select 'Edit' and press the **ENT** Key. The 'FPL – Stored Flight Plan' Page is displayed.
- 2) Select the comment field.
 - 3) Use the **FMS** Knobs to edit the comment.
 - 4) Press the **ENT** Key to accept the changes.
 - 5) Push the **FMS** Knob to remove the flashing cursor.

5.6 PROCEDURES

The system can access the whole range of instrument procedures available. Departures (DPs), arrivals (STARs), and non-precision and precision approaches (APPRs) are stored within the database and can be loaded using any Procedures (**PROC**) Key.

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

NOTE: Some airports may have published instrument approach procedures not contained within the navigation database. These procedures may be available for preview from the charts database, but are not available for navigation guidance. See the Additional Features Section for more information on previewing Charts.

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. Furthermore, only one procedure for each type of procedure (DP, STAR, APPR) can be loaded at a time in a flight plan.

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.

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 (6368 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 5-58 Procedure Leg Identifiers

Viewing available procedures at an airport:

- 1) From the 'WPT – Airport Information' Page (**Info 1** Softkey):
 Press the **DP** Softkey. The 'WPT – Departure Information' Page is displayed, defaulting to the airport displayed on the 'WPT – Airport Information' Page.
Or:
 Press the **STAR** Softkey. The 'WPT – Arrival Information' Page is displayed, defaulting to the airport displayed on the 'WPT – Airport Information' Page.
Or:
 Press the **APR** Softkey. The 'WPT – Approach Information' Page is displayed, defaulting to the airport displayed on the 'WPT – Airport Information' Page.
- 2) To select another airport, push 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) Repeat Step 5, until desired information has been viewed for the chosen procedure.
- 7) Press the **Info 1** Softkey to return to the 'WPT - Airport Information' Page.

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.

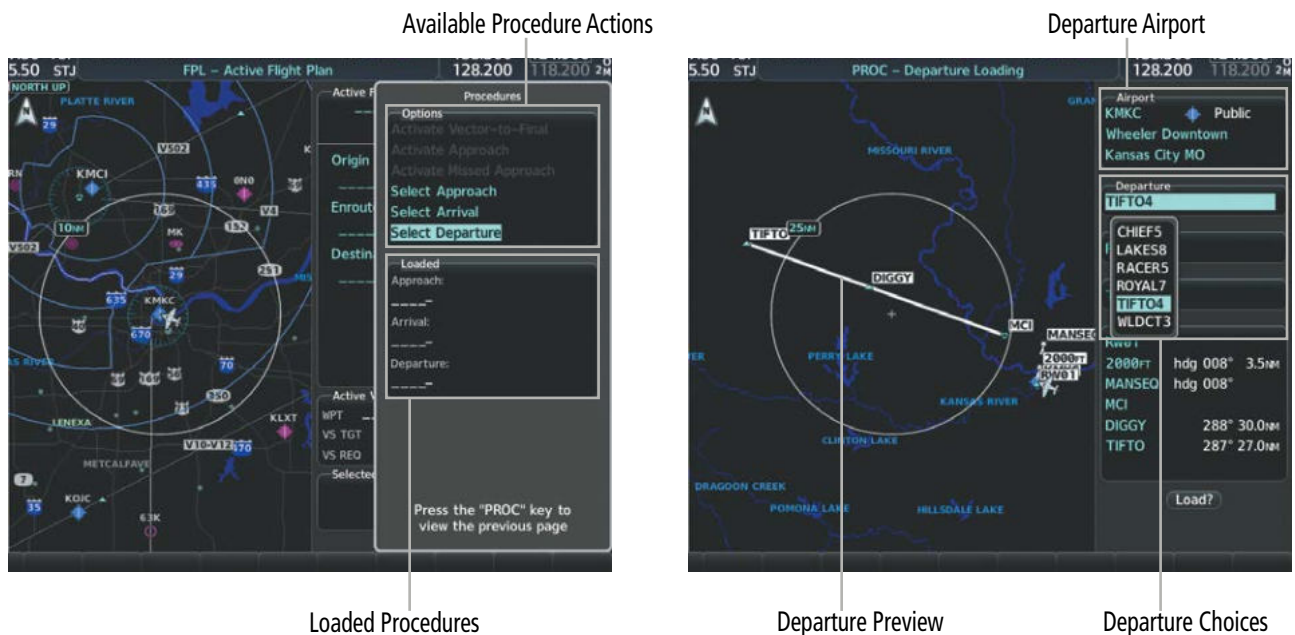
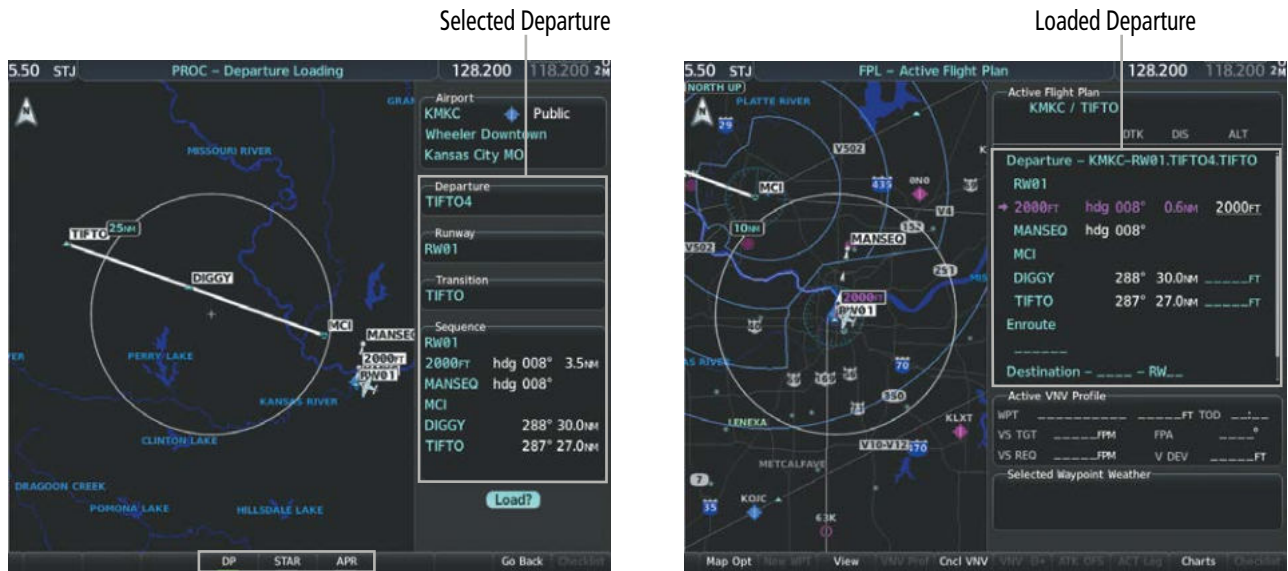


Figure 5-59 Departure Selection



Procedure Loading Page Selection Softkeys

Figure 5-60 Departure Loading

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 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.

Loading a departure into the active flight plan from the 'WPT – Departure Information' Page:

- 1) From the 'WPT – Airport Information' Page (first page in the WPT group), press the **DP** Softkey. The 'WPT – Departure Information' Page is displayed, defaulting to the airport displayed on the 'WPT – Airport information' Page.
- 2) To select another airport, push the **FMS** Knob to activate the cursor, enter an identifier/facility name/city, and press the **ENT** Key.
- 3) Select a different departure, if desired.
 - a) Turn the large **FMS** Knob to place the cursor in the 'Departure' Box. The departure is previewed on the map.
 - b) Turn the small **FMS** Knob to view the available departures. Press the **ENT** Key to select the departure. The cursor moves to the 'Runway' Box. The departure is previewed on the map.
 - c) Turn the small **FMS** Knob to view the available runways. Press the **ENT** Key to select the runway. The cursor moves to the 'Transition' Box (only if there are available transitions). The departure 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. The departure is previewed on the map.
- 4) Press the **MENU** Key to display the 'Page Menu' Window.
- 5) Turn the **FMS** Knob to highlight 'Load Departure'.
- 6) Press the **ENT** Key to load the departure procedure into the active flight plan.

Loading a departure procedure into a stored flight plan:

- 1) Press the **FPL** Key for the MFD. Turn the small **FMS** Knob to select the 'FPL – Flight Plan Catalog' Page.
- 2) Push the **FMS** Knob to activate the cursor.
- 3) Turn the **FMS** Knob to highlight the desired flight plan.
- 4) 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.
- 5) 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.
- 6) Select a departure. Press the **ENT** Key.
- 7) Select a runway served by the selected departure (if required). Press the **ENT** Key.
- 8) Select a transition for the selected departure (if required). Press the **ENT** Key.
- 9) Press the **ENT** Key to load the selected departure procedure.

Removing a departure procedure from a flight plan:

- 1) If removing from the active flight plan, press the **FPL** Key for the MFD.
Or:
 If removing from the stored flight plan:
 - a) Press the **FPL** Key for the MFD. Turn the small **FMS** Knob to select the 'FPL – Flight Plan Catalog' Page.
 - b) Push the **FMS** Knob to activate the cursor.
 - c) Turn the **FMS** Knob to highlight the desired flight plan.
 - d) Press the **EDIT** Softkey; or press the **ENT** Key, turn the large **FMS** Knob clockwise to select 'Edit' and press the **ENT** Key. The 'FPL – Stored Flight Plan' Page is displayed.
- 2) Select the departure for removal:
 - a) Press the **MENU** Key, and highlight 'Remove Departure'.
 - b) Press the **ENT** Key. A confirmation window is displayed listing the departure procedure.
Or:
 - a) Push the **FMS** Knob to activate the cursor (not required on PFD).
 - b) Turn the large **FMS** Knob to highlight the departure header in the flight plan.
 - c) Press the **CLR** Key. A confirmation window is displayed listing the departure procedure.
- 3) With 'OK' highlighted, press the **ENT** Key. To cancel the removal request, highlight 'Cancel' and press the **ENT** Key.
- 4) Push the **FMS** Knob to remove the flashing cursor.

- SYSTEM OVERVIEW
- FLIGHT INSTRUMENTS
- EIS
- AUDIO PANEL & CNS
- FLIGHT MANAGEMENT
- HAZARD AVOIDANCE
- AFCS
- ADDITIONAL FEATURES
- APPENDICES
- INDEX

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 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 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

Loading an arrival into the active flight plan from the 'WPT – Arrival Information' Page:

- 1) From the 'WPT – Airport Information' Page (first page in the WPT group), press the **STAR** Softkey. The 'WPT – Arrival Information' Page is displayed, defaulting to the airport displayed on the 'WPT – Airport Information' Page.
- 2) To select another airport, push the **FMS** Knob to activate the cursor, enter an identifier/facility name/city, and press the **ENT** Key.
- 3) Select a different arrival, if desired.
 - a) Turn the large **FMS** Knob to highlight the arrival. The arrival is previewed on the map.
 - b) Turn the small **FMS** Knob to view the available arrivals. Press the **ENT** Key to select the arrival. The cursor moves to the 'Transition' Box (only if there are available transitions). The arrival is previewed on the map.
 - c) Turn the small **FMS** Knob to view the available transitions. Press the **ENT** Key to select the transition. The cursor moves to the 'Runway' Box. The arrival is previewed on the map.
 - d) Turn the small **FMS** Knob to view the available runways. Press the **ENT** Key to select the runway. The cursor moves to the 'Sequence' Box. The arrival is previewed on the map.
- 4) Press the **MENU** Key to display the Arrival Information 'Page Menu' Window.
- 5) Turn the **FMS** Knob to highlight 'Load Arrival'.
- 6) Press the **ENT** Key to load the arrival procedure into the active flight plan.

Loading an arrival procedure into a stored flight plan:

- 1) Press the **FPL** Key for the MFD. Turn the small **FMS** Knob to select the 'FPL – Flight Plan Catalog' Page.
- 2) Push the **FMS** Knob to activate the cursor.
- 3) Turn the **FMS** Knob to highlight the desired flight plan.

- 4) 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.
- 5) 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.
- 6) Select an arrival. Press the **ENT** Key.
- 7) Select a transition for the selected arrival (if required). Press the **ENT** Key.
- 8) Select a runway served by the selected arrival (if required). Press the **ENT** Key.
- 9) Press the **ENT** Key to load the selected arrival procedure.

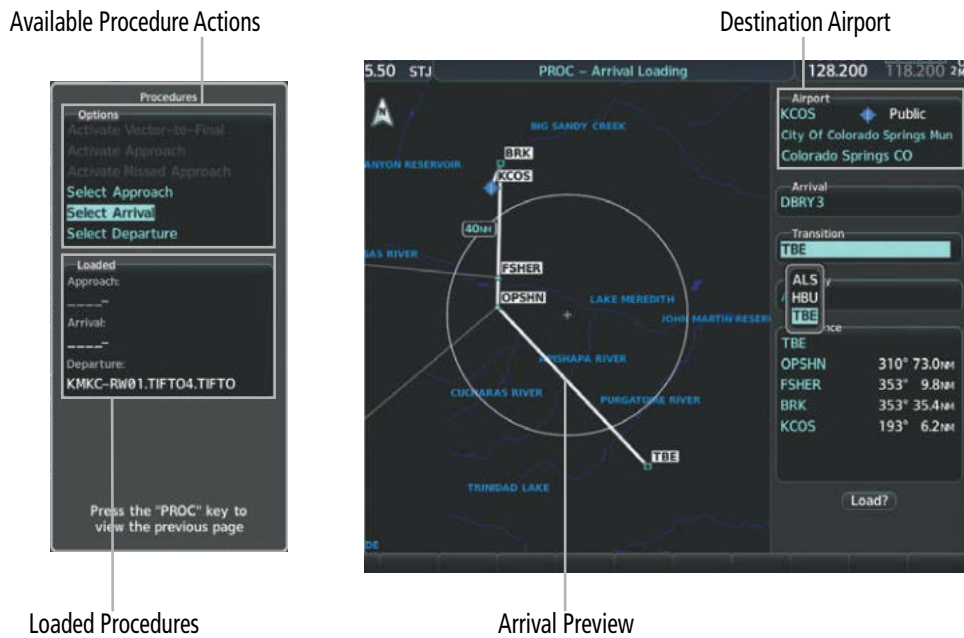


Figure 5-61 Arrival Selection



Figure 5-62 Arrival Loading

Removing an arrival procedure from a flight plan:

- 1) If removing from the active flight plan, press the **FPL** Key for the MFD.
Or:
 If removing from the stored flight plan:
 - a) Press the **FPL** Key for the MFD. Turn the small **FMS** Knob to select the 'FPL – Flight Plan Catalog' Page.
 - b) Push the **FMS** Knob to activate the cursor.
 - c) Turn the **FMS** Knob to highlight the desired flight plan.
 - d) Press the **EDIT** Softkey; or press the **ENT** Key, turn the large **FMS** Knob clockwise to select 'Edit' and press the **ENT** Key. The 'FPL – Stored Flight Plan' Page is displayed.
- 2) Select the arrival for removal:
 - a) Press the **MENU** Key, and highlight 'Remove Arrival'.
 - b) Press the **ENT** Key. A confirmation window is displayed listing the arrival procedure.
Or:
 - a) Push the **FMS** Knob to activate the cursor (not required on PFD).
 - b) Turn the large **FMS** Knob to highlight the arrival header in the flight plan.
 - c) Press the **CLR** Key. A confirmation window is displayed listing the arrival procedure.
- 3) With 'OK' highlighted, press the **ENT** Key. To cancel the removal request, highlight 'Cancel' and press the **ENT** Key.
- 4) Push the **FMS** Knob to remove the flashing cursor.

APPROACHES

The system can provide navigation guidance for GPS and NAVAID instrument approach procedures. This section will discuss loading, activating, and removing approaches designated for navigation. For information on changing the navigation source of the CDI, and for information on the display of vertical guidance on the PFD, see the Flight Instruments Section. See the Audio Panel & CNS Section for information on selecting and tuning a NAV receiver.

INSTRUMENT APPROACH

The system provides guidance for non-precision and precision approaches to airports with published instrument approach procedures. Only one approach can be loaded at a time in a flight plan. If an approach is loaded when another approach is already in the active flight plan, the new approach replaces the previous approach. The route is defined by selection of an approach and the transition waypoints.



NOTE: When flying Direct-to the Final Approach Fix (FAF), the system will suspend (SUSP) leg sequencing if the approach intercept angle exceeds 45 degrees.



NOTE: When Vectors to Final is selected, the system will display an extended centerline, but guidance is not provided to the Final Approach Course.

PUBLISHED APPROACHES USING GPS

RNAV/GPS approach procedures require GPS and can be selected for use. When the display shows ‘GPS’ after a NAVAID prefix (such as ‘VOR_{GPS} 17L’), this indicates the procedure is an Overlay Approach. The procedure may be flown either as a conventional, ground-based approach procedure or may be flown using GPS. When the display shows an approach with ‘+V’, this indicates the system will provide advisory vertical guidance when using GPS to fly the approach.

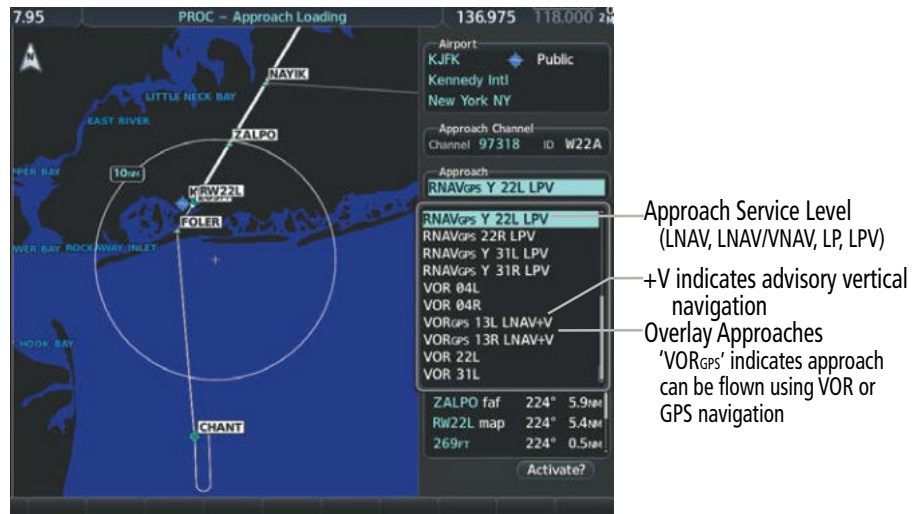


Figure 5-63 Example of Available Approaches with GPS Guidance

The system will allow the applicable level of service for the chosen approach using GPS navigation. See the following table for approach service levels allowed by the system:

HSI Annunciation	Description	Example on HSI
LNAV	Approach to the published MDA	<p>Approach Service Level - LNAV, LNAV+V, L/VNAV, LP, LP+V, LPV</p>
LP		
LNAV+V	Approach with advisory vertical guidance to the published MDA	
LP+V		
L/VNAV	Approach with approved vertical guidance to the published DA	
LPV		

Table 5-16 Approach Service Levels

The system GPS receivers will use Satellite Based Augmentation (SBAS) when available. Some approaches require the use of SBAS for lateral and/or vertical GPS navigation. For information on how lateral and vertical guidance is depicted on the PFD, see the Flight Instruments Section.

Approach Service Level	Lateral Navigation Source	Vertical Navigation Source
LNAV	GPS	N/A
LNAV+V	GPS	GPS (advisory only)
LNAV/VNAV	GPS	GPS ¹
LP	GPS ¹	N/A
LP+V	GPS ¹	GPS ¹ (advisory only)
LPV	GPS ¹	GPS ¹

¹ SBAS required

Table 5-17 Source of Lateral and Vertical Navigation per Approach Service Level

Loss of SBAS

Due to the high level of precision required by some approach service levels, losing SBAS may require the pilot to acknowledge a downgrade of approach service level, or to abort the approach. See the following table for approach degradation behavior:



NOTE: Refer to the current, pertinent flight manual for additional information regarding crew responses for loss of SBAS and approach downgrade procedures.

Approach	SBAS Becomes Unavailable	Description	Action Required	Downgrade
LNAV	Approach phase not specified	SBAS not required. The approach is continued.	None	N/A
LNAV+V	Prior to the FAF	HSI displays approach service level in amber; VDI displays 'NO GP'. ²	None	N/A
	At/after the FAF	HSI displays downgraded approach service level in magenta; VDI displays 'NO GP'.	None	LNAV ¹

- SYSTEM OVERVIEW
- FLIGHT INSTRUMENTS
- EIS
- AUDIO PANEL & CNS
- FLIGHT MANAGEMENT
- HAZARD AVOIDANCE
- AFCS
- ADDITIONAL FEATURES
- APPENDICES
- INDEX

Approach	SBAS Becomes Unavailable	Description	Action Required	Downgrade
LNAV/ VNAV	Prior to the FAF	HSI displays approach service level in amber; VDI displays 'NO GP'. ²	None	N/A
	At/after the FAF	HSI displays downgraded approach service level in magenta; VDI displays 'NO GP'.	None	LNAV ¹
LP	More than 1 min prior to the FAF	HSI displays approach service level in amber.	None	N/A
	Within 1 min prior to the FAF	HSI displays downgraded approach service level in magenta; CDI is removed. ²	Acknowledge message to redisplay CDI with LNAV ¹	LNAV ¹
	At/after the FAF	CDI is removed. ²	Acknowledge ABORT APR message to redisplay CDI	N/A
LP+V	More than 1 min prior to the FAF	HSI displays approach service level in amber; VDI displays 'NO GP'.	None	N/A
	Within 1 min prior to the FAF	HSI displays downgraded approach service level in magenta; CDI is removed. VDI displays 'NO GP'. ²	Acknowledge message to redisplay CDI with LNAV ¹	LNAV ¹
	At/after the FAF	CDI is removed; VDI displays 'NO GP'. ²	Acknowledge ABORT APR message	N/A
LPV	More than 1 min prior to the FAF	HSI displays approach service level in amber.	None	N/A
	Within 1 min prior to the FAF	HSI displays downgraded approach service level in magenta; VDI displays 'NO GP'. ²	None	LNAV ¹
	At/after the FAF	HSI displays downgraded approach service level in magenta; VDI displays 'NO GP'.	None	LNAV ¹

¹ Some approaches may not publish minimums for the downgrade given as an example in this table. The system will determine the appropriate downgrade, if available, for each published approach as it is derived from the database. If an appropriate downgrade is not available, the approach should be aborted.

² System message is generated.

Table 5-18 Approach Degradation Behavior

- SYSTEM OVERVIEW
- FLIGHT INSTRUMENTS
- EIS
- AUDIO PANEL & CNS
- FLIGHT MANAGEMENT
- HAZARD AVOIDANCE
- AFCS
- ADDITIONAL FEATURES
- APPENDICES
- INDEX

Loss of GPS on a Published GPS Approach

When the system is no longer receiving sufficient GPS integrity while on the final segment of a GPS approach, the approach service level on the HSI will turn amber, the annunciation 'GPS LOI' will be displayed on the PFD, and the 'LOSS OF GPS NAVIGATION' system message will be given. If the aircraft is at or beyond the FAF when the condition occurs, the 'ABORT APR' system message is given, and the CDI deviation bar is removed from the HSI. The CDI deviation bar will reappear when the 'ABORT APR' message is acknowledged.

If a total loss of GPS positioning occurs while on the final segment of a GPS approach, the approach service level on the HSI will turn amber, the annunciation 'GPS LOI' will be displayed on the PFD, and the 'LOSS OF GPS NAVIGATION' system message will be given. If the aircraft is at or beyond the FAF when the condition occurs, the 'ABORT APR' message is displayed. The CDI deviation bar is removed from the HSI and cannot be restored when GPS positioning is unavailable.

LOADING AND ACTIVATING AN APPROACH

Whenever an approach is selected, the choice to either 'Load?' or 'Activate?' is given. 'Load' 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. 'Activate' also adds the procedure to the end of the flight plan but immediately begins to provide guidance to the first waypoint in 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.

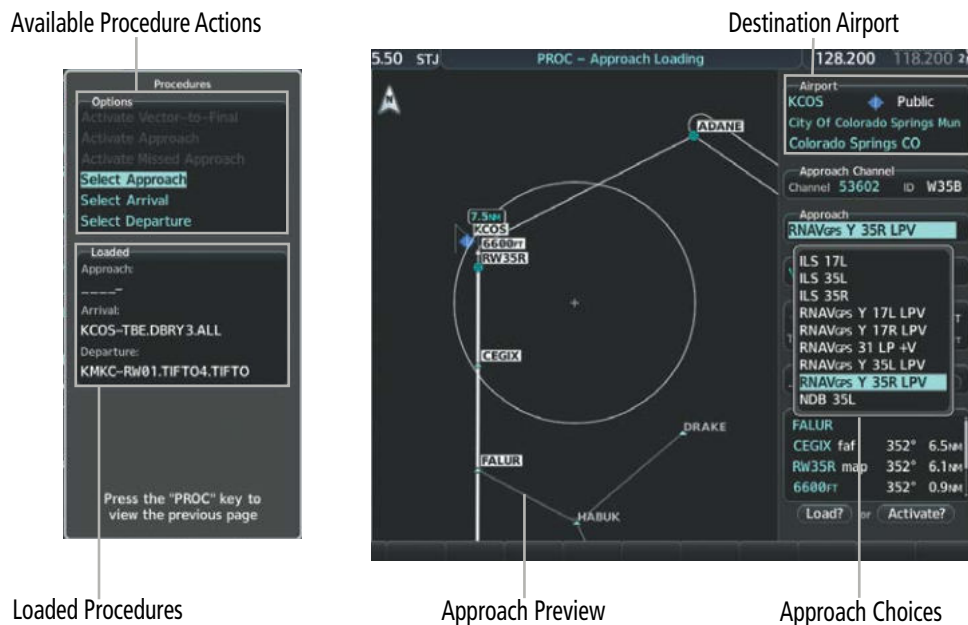
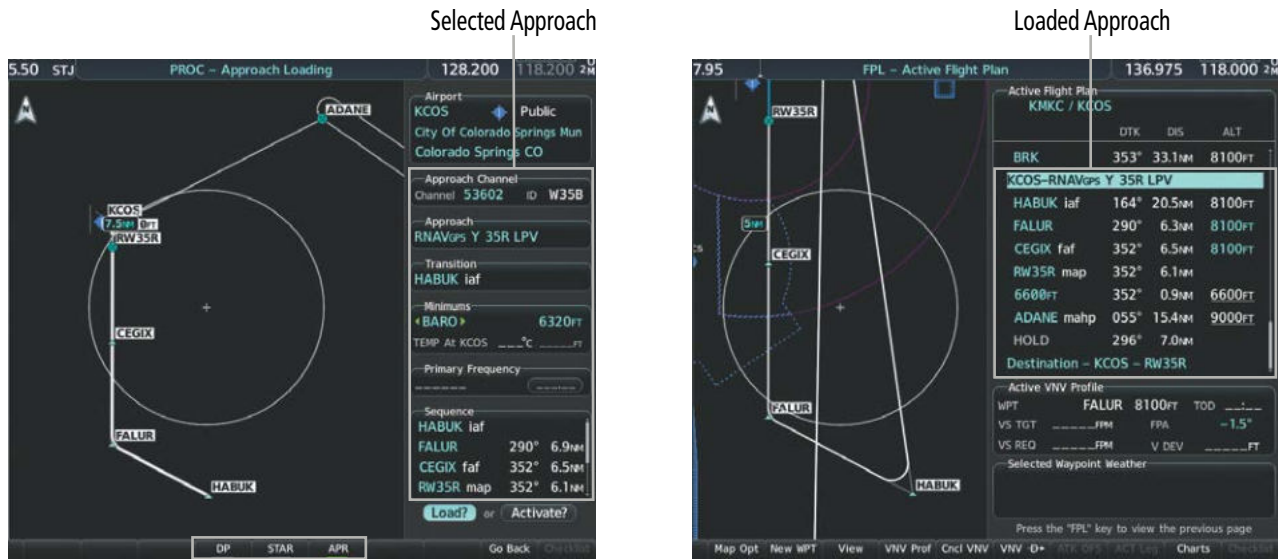


Figure 5-64 Approach Selection



Procedure Loading Page Selection Softkeys

Figure 5-65 Approach Loading

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 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) Enter minimums:

To skip setting minimums, press the **ENT** Key.

Or:

 - 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 (as reported at the destination airport), and press the **ENT** Key.
- 6) Press the **ENT** Key with 'Load?' highlighted to load the approach procedure; or turn the large **FMS** Knob to highlight 'Activate?' and press the **ENT** Key to load and activate the approach procedure.

When selecting a NAVAID exclusive approach, the popup message is displayed: 'NOT APPROVED FOR GPS - GPS guidance is for monitoring only. Load approach?' With 'Yes' highlighted, press the **ENT** Key.



NOTE: The popup message, 'NOT APPROVED FOR GPS' will be generated when selecting a NAVAID exclusive approach. This message is intended for localizer-based approaches. Refer to the current flight manual and applicable regulations for information on approach navigation requirements.



NOTE: If there is no arrival procedure in the active flight plan, loading an approach to a flight plan in which the destination airport has already been entered, will result in the previously entered destination airport waypoint becoming a fly-over waypoint followed by the newly loaded approach.

Loading an approach into the active flight plan from the 'NRST – Nearest Airport' Page:

- 1) Select the 'NRST – Nearest Airports' Page.
- 2) Push the **FMS** Knob, then turn the large **FMS** Knob to highlight the desired nearest airport. The airport is previewed on the map.
- 3) Press the **APR** Softkey; or press the **MENU** Key, highlight 'Select Approach Window', and press the **ENT** Key.
- 4) Turn the **FMS** Knob to highlight the desired approach.
- 5) Press the **LD APR** Softkey; or press the **MENU** Key, highlight 'Load Approach', and press the **ENT** Key. The 'PROC – Approach Loading' Page is displayed with the 'Transition' Field highlighted.
- 6) Turn the **FMS** Knob to highlight the desired transition, and press the **ENT** Key.
- 7) Enter Minimums:

To skip setting minimums, press the **ENT** Key. The 'Load?' Field is highlighted.

Or:

- 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.
- 8) Press the **ENT** Key with 'Load?' highlighted to load the approach procedure; or turn the large **FMS** Knob to highlight 'Activate?' and press the **ENT** Key to load and activate the approach procedure.

When selecting a NAVAID exclusive approach, the popup message is displayed: 'NOT APPROVED FOR GPS - GPS guidance is for monitoring only. Load approach?' With 'Yes' highlighted, press the **ENT** Key.

Loading an approach procedure into a stored flight plan:

- 1) Press the **FPL** Key for the MFD. Turn the small **FMS** Knob to select the 'FPL – Flight Plan Catalog' Page and push the **FMS** Knob to activate the cursor.
- 2) Turn the **FMS** Knob to 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.

- SYSTEM OVERVIEW
- FLIGHT INSTRUMENTS
- EIS
- AUDIO PANEL & CNS
- FLIGHT MANAGEMENT
- HAZARD AVOIDANCE
- AFCS
- ADDITIONAL FEATURES
- APPENDICES
- INDEX

- 4) 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.
- 5) 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.
- 6) Select a transition for the selected approach. Press the **ENT** Key.
- 7) Press the **ENT** Key to load the selected approach procedure.

Activating a previously loaded approach:

- 1) Press the **PROC** Key. The 'Procedures' Window is displayed with 'Activate Approach' highlighted.
- 2) Press the **ENT** Key to activate the approach.

Activating a previously loaded approach with vectors to final:

- 1) Press the **PROC** Key to display the 'Procedures' Window.
- 2) Highlight 'Activate Vector-to-Final' and press the **ENT** Key.

Loading and activating an approach using the MENU Key:

- 1) 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 selecting a NAVAID exclusive approach, the popup message is displayed: 'NOT APPROVED FOR GPS - GPS guidance is for monitoring only. Load approach?' With 'Yes' highlighted, press the **ENT** Key.

Or:

- 1) Press the **PROC** Key.
- 2) Use the large **FMS** Knob to highlight 'Select Approach' and press the **ENT** Key.
- 3) From the 'PROC – Approach Loading' Page, press the **MENU** Key for the MFD. The 'Page Menu' Window is displayed with 'Load & Activate Approach' highlighted.

- 4) Press the **ENT** Key.

When selecting a NAVAID exclusive approach, the popup message is displayed: 'NOT APPROVED FOR GPS - GPS guidance is for monitoring only. Load approach?' With 'Yes' highlighted, press the **ENT** Key.

REMOVING AN APPROACH

Removing an approach from the active or stored flight plan:

- 1) Open the appropriate flight plan page:

For the active flight plan, press the **FPL** Key, or turn the **FMS** Knobs to select the 'FPL – Active Flight Plan' Page.

Or:

For a stored flight plan:

- a) Turn the **FMS** Knobs to select the 'FPL – Flight Plan Catalog' Page and push the **FMS** Knob to activate the cursor.
- b) Turn the **FMS** Knob to highlight the desired flight plan.
- c) Press the **EDIT** Softkey; or press the **ENT** Key, turn the large **FMS** Knob clockwise to select 'Edit Flight Plan' and press the **ENT** Key. The 'FPL – Stored Flight Plan' Page is displayed.

- 2) Remove the approach:

- a) Press the **MENU** Key, and highlight 'Remove Approach'.
- b) Press the **ENT** Key. A confirmation window is displayed listing the approach procedure.
- c) With 'OK' highlighted, press the **ENT** Key.

Or:

- a) Push the **FMS** Knob to activate the cursor if not already activated.
- b) Turn the large **FMS** Knob to highlight the approach header in the active flight plan.
- c) Press the **CLR** Key. A confirmation window is displayed listing the approach procedure.
- d) With 'OK' highlighted, press the **ENT** Key.
- e) Push the **FMS** Knob to remove the flashing cursor.

MISSED APPROACH

The system is capable of providing guidance for the approach as well as the missed approach. Once the missed approach is activated, MAPR will be displayed on the HSI next to the CDI. If the missed approach is activated prior to the Missed Approach Point (MAP), waypoint sequencing will continue along the approach to the missed approach. If the missed approach is not activated prior to the MAP, the system will enter SUSP Mode once the aircraft crosses the MAP until the missed approach is activated or SUSP Mode is disabled. See the Flight Instruments, Course Deviation Indicator section for more information on SUSP Mode.

See the Using Map Displays, Map Symbols discussion previously given in this section for information on displaying the missed approach preview on map displays.

In the missed approach procedure shown in the following figure, the altitude immediately following the MAP may or may not be part of the published procedure. Regardless, it represents a Course to Altitude (CA) leg along the runway centerline. The altitude shown must be achieved before turning safely toward the MAHP. If the aircraft altitude is below the specified altitude after crossing the MAP, a direct-to is established to provide a course on runway heading until the altitude is reached. After reaching the altitude, a direct-to is established to the next published waypoint. If the aircraft altitude is above the specified altitude after crossing the MAP, a direct-to is established to the published fix to begin the missed approach procedure.

KROA-RNAV _{GPS} 06 LNAV+V			
RIVRE	iaf	061°	3704NM 6000FT
DIXXY		072°	5.0NM 5200FT
CLAMM	faf	073°	5.3NM 4300FT
HIVLU		073°	5.0NM 2700FT
CAKIX	map	073°	4.2NM
			1575FT
DEWET	mahp	165°	14.8NM 4000FT
HOLD		259°	4.0NM

Figure 5-66 Course to Altitude

Activating a missed approach in the active flight plan:

Press the Go-Around Button.

Or:

Fly past the MAP, and press the **SUSP** Softkey on the PFD.

Or:

- 1) Press the **PROC** Key.
- 2) Turn the **FMS** Knob to highlight 'Activate Missed Approach'. (This option is selectable after the leg to the FAF becomes active and GPS is the active NAV source.)
- 3) Press the **ENT** Key.

TEMPERATURE COMPENSATED ALTITUDE

TEMPERATURE COMPENSATION FOR APPROACH ALTITUDES

If desired, the system can calculate temperature compensation for waypoint crossing altitudes loaded as part of an approach procedure. The pilot must manually enable temperature compensation and then enter the destination airport temperature. The system adjusts the altitudes accordingly, and the snowflake icon (❄️) is displayed next to those altitudes.

Manually setting temperature compensation for approach waypoint altitudes:

- 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 with the temperature highlighted.
- 4) Use the small **FMS** Knob to change the 'Temperature at <airport>' Field. The compensated altitude is computed as the temperature is selected.
- 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.

Canceling temperature compensation setting for approach waypoint altitudes:

- 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.

NOTE: Activating/canceling 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.

NOTE: Regardless of when the destination temperature setting is entered (when enabling temperature compensation for approach waypoint altitudes, or when enabling temperature compensation for approach minimums), the system will use the same temperature setting for all temperature compensation calculations.

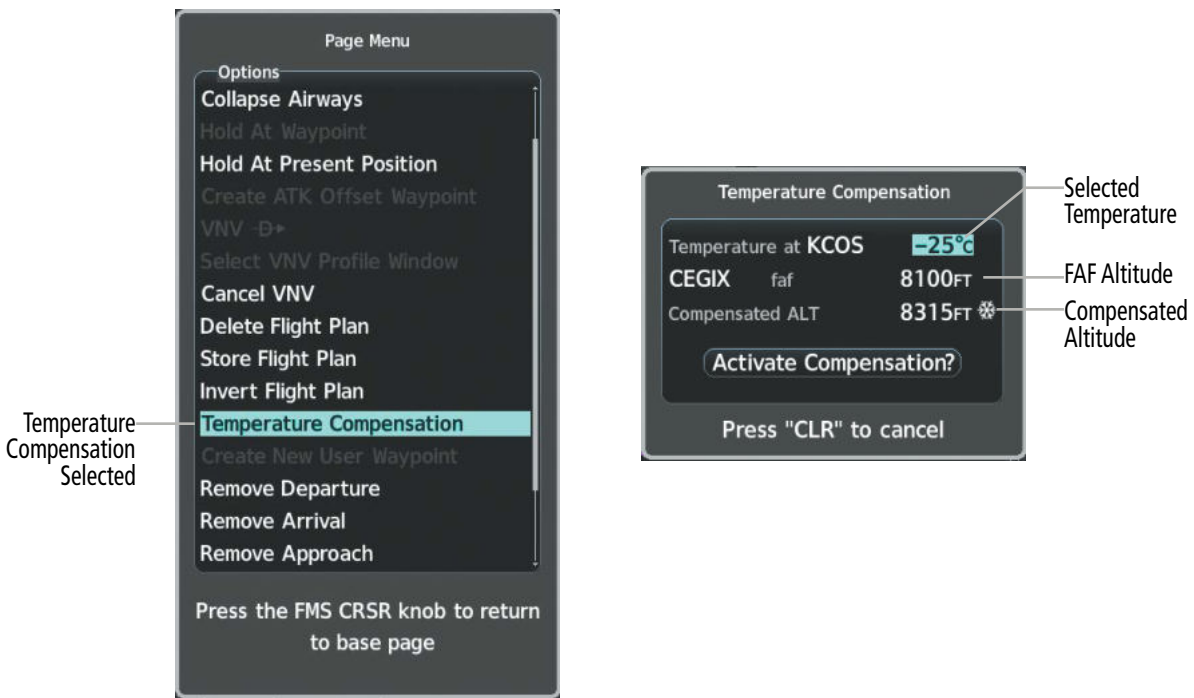


Figure 5-67 Temperature Compensation

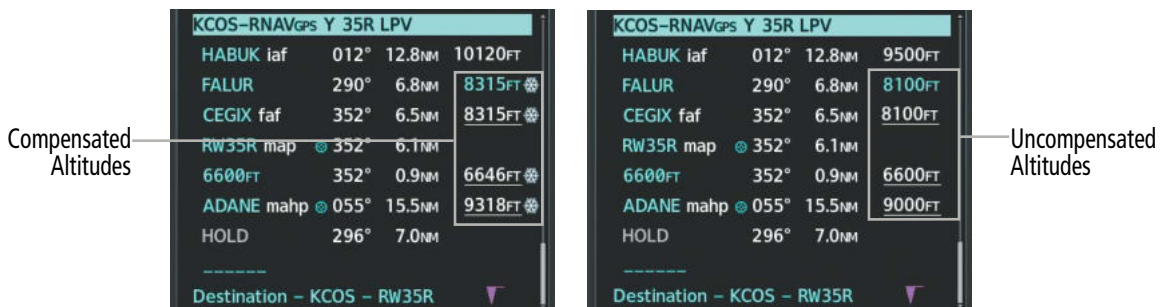


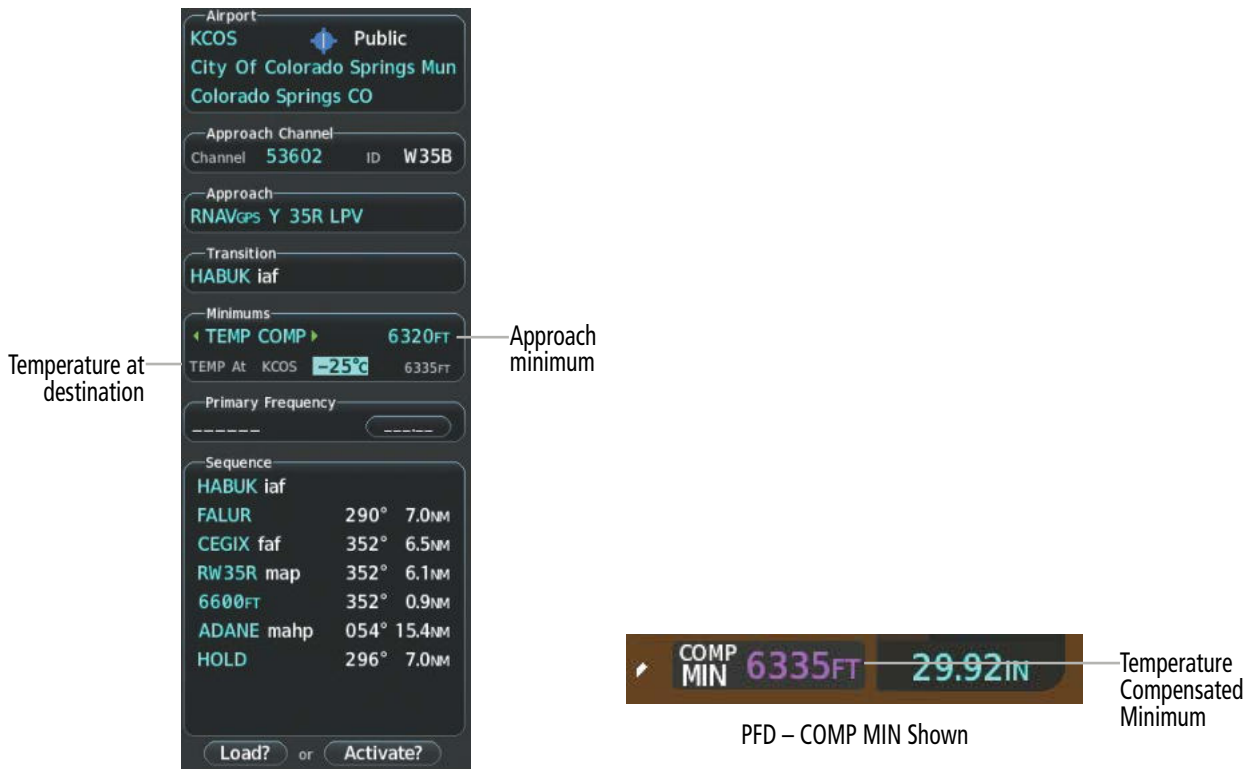
Figure 5-68 Temperature Compensation in the Active Flight Plan

TEMPERATURE COMPENSATION FOR APPROACH MINIMUMS

A temperature compensated minimum descent altitude can be entered for the approach. Once this is entered, the altitude is also displayed on the PFD.

Entering a temperature compensated minimum into an approach:

- 1) From the 'FPL – Active Flight Plan' Page, press the **PROC** Key. The 'Procedures' Window is displayed.
- 2) If necessary, turn the large **FMS** Knob to highlight 'Select Approach'. Press the **ENT** Key.
- 3) If necessary, use the **FMS** Knob and the **ENT** Key to select the desired airport, approach, and transition.
- 4) Use the **FMS** Knob to place the flashing cursor in the 'Minimums' Box. Turn the small **FMS** Knob to select 'TEMP COMP'. Press the **ENT** Key.
- 5) Turn the small **FMS** Knob to enter the minimums altitude. Press the **ENT** Key. The cursor is placed in the 'TEMP AT <destination airport>' Field.
- 6) Turn the small **FMS** Knob to enter the temperature at the destination. Press the **ENT** Key.
- 7) Press the **ENT** Key with either 'Load?' or 'Activate?' highlighted. The approach is added to the active flight plan, and the temperature compensated minimums are displayed on the PFD.



MFD – 'PROC – Approach Loading' Page

Figure 5-69 Entering Temp Comp Minimums for an Approach

5.7 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. All of the input of data needed for calculation and viewing of the statistics is displayed on the 'Aux - Trip Planning' Page.

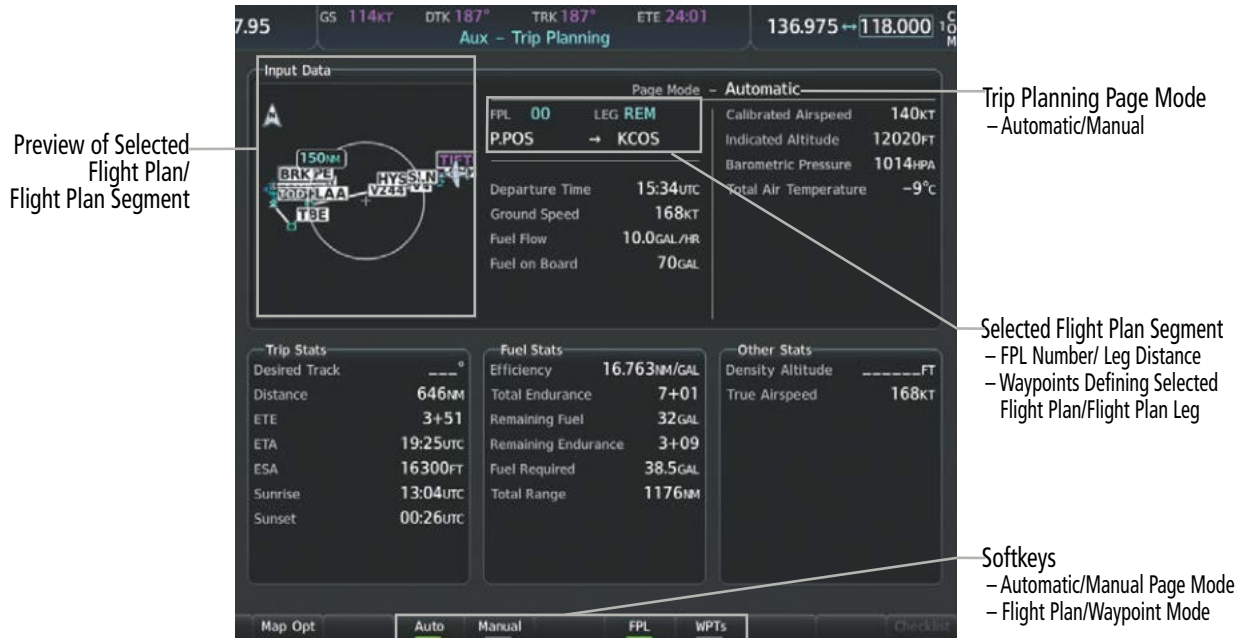


Figure 5-70 'Aux - Trip Planning' Page

The trip planning calculations for the current flight plan are based on fuel weight and sensor inputs (automatic page mode) or 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 (01-99), 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 (01-99) and a specific leg 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 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 on Board 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 Remaining Endurance and subtracting the ETE 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 Remaining 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). 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.

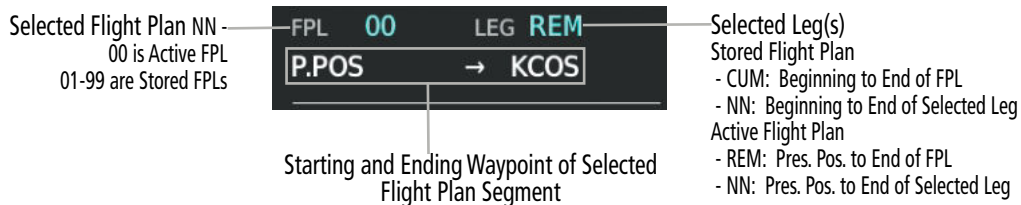


Figure 5-71 Trip Planning - Flight Plan Mode

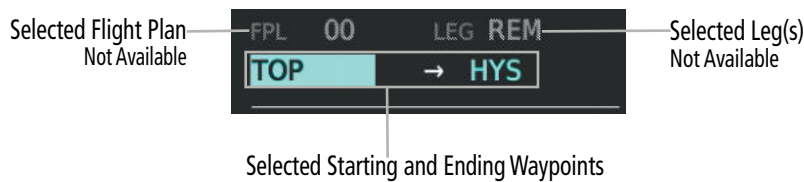


Figure 5-72 Trip Planning - Waypoint Mode

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, push 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 select from the 'Page Menu' Window '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.

Entering manual data for trip statistics calculations:

- 1) From the 'Aux – Trip Planning' Page, press 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 within the input data box.
- 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.

5.8 ABNORMAL OPERATION

DEAD RECKONING

This section discusses the Dead Reckoning mode of operation and the subsequent indications.



NOTE: *Dead Reckoning Mode only functions in the Enroute or Oceanic 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.*

The system will revert to Dead Reckoning (DR) Mode if the system is no longer using GPS for position fixing. In DR Mode, the system uses its last-known position combined with continuously updated airspeed and heading data (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.

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” displayed in amber on the HSI below and to the left of the aircraft symbol, and on top of the aircraft symbol on map displays. The CDI deviation bar is removed. The autopilot will not couple in DR Mode. Lastly, but at the same time, 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 data that is dependent upon GPS is displayed as amber text to denote degraded navigation source information. The accuracy of all bearing and distance information on nearest pages (airports, airspaces, and waypoints) and waypoint information pages is questionable, and is displayed in amber. If the VSD Inset is enabled, ‘VSD Not Available’ will be displayed. Airspace alerts continue to function, but with degraded accuracy. Also, while the system is in DR mode, optional SVT and terrain alerting functions are disabled.

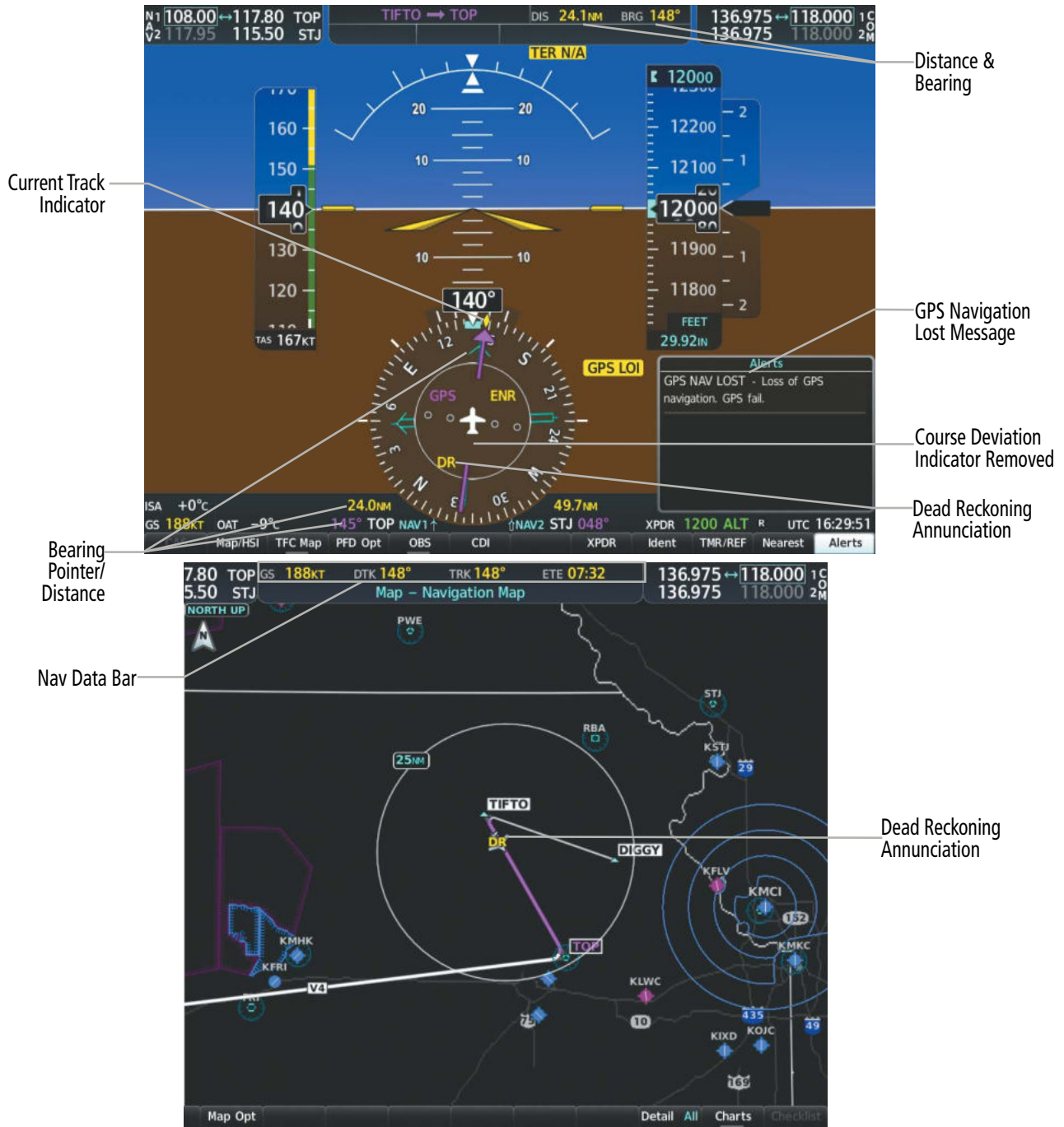


Figure 5-73 Dead Reckoning Mode - GPS Derived Data Shown in Amber

- SYSTEM OVERVIEW
- FLIGHT INSTRUMENTS
- EIS
- AUDIO PANEL & CNS
- FLIGHT MANAGEMENT
- HAZARD AVOIDANCE
- AFCS
- ADDITIONAL FEATURES
- APPENDICES
- INDEX

SYSTEM OVERVIEW

FLIGHT INSTRUMENTS

EIS

AUDIO PANEL & CNS

FLIGHT MANAGEMENT

HAZARD AVOIDANCE

AFCS

ADDITIONAL FEATURES

APPENDICES

INDEX

Blank Page

SECTION 6 HAZARD AVOIDANCE

Hazard avoidance features available for the system 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 Connex Weather (Optional)
 - Flight Information Services-Broadcast (Optional)
 - L-3 Stormscope® WX-500 Lightning Detection System (Optional)
 - GWX 70/75 Weather Radar (Optional)
- **Terrain Avoidance**
 - Terrain Proximity
 - Terrain-SVT (included with Garmin SVT option)
 - TAWS-B (Optional)
- **Traffic**
 - Traffic Information Service (TIS)
 - Traffic Advisory System (TAS) (Optional)
 - Automatic Dependent Surveillance-Broadcast (ADS-B) Traffic (Optional)

6.1 DATA LINK WEATHER



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



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

The Data Link Weather feature enables the system to receive weather information from a variety of weather sources, depending on the equipment installed in the aircraft. These sources may include SiriusXM Weather, Garmin Connex Weather, and Flight Information Services-Broadcast (FIS-B). 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 GDL 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 Connex 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 Connex Data Request. The transceiver then contacts the Garmin Connex Weather service using the Iridium Satellite telephone system and retrieves the weather data for the specified area. The Garmin Connex Weather service offers worldwide weather coverage, but the availability of individual weather products, such as radar precipitation, varies by region.



NOTE: To check the availability of Garmin Connex weather products offered in a particular region, visit flygarmin.com

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

The Garmin Connex weather service requires an active Iridium satellite telephone and weather data subscription. Registration begins by first obtaining the serial number(s) for the installed Iridium Satellite Transceiver (GSR 1), and the System ID. Then go to the website flygarmin.com and follow the instructions for establishing an account for Garmin Connex data services. Note additional information about the airframe may be required. After an account has been established, Garmin provides an access code that must be entered on the system and successfully transmitted to the Garmin Connex service via the Iridium satellite network.

Obtaining the LRU serial numbers and System ID:

- 1) Select the 'Aux - System Status' Page.
- 2) Press the **LRU** Softkey.
- 3) Turn the **FMS** Knob to scroll the cursor until 'GSR 1' is visible in the 'LRU Information' window.
- 4) Note the serial number displayed for 'GSR 1'.
- 5) Push the **FMS** Knob to deactivate the cursor.



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 Connex Weather:

- 1) Go to flygarmin.com. Locate the information for subscribing to Garmin Connex Satellite Services on the website.
- 2) Choose a desired service which includes weather data and enter the requested information about the aircraft.
- 3) Note the Access Code provided during the registration process and any additional instructions received.
- 4) 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.
- 5) 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.
- 6) If the system displays the Connex Registration Window, proceed to step 8. Otherwise, press the **MENU** Key. The page menu window is now displayed.
- 7) Turn the large **FMS** Knob to select 'Register With Connex' in the menu list.
- 8) Press the **ENT** Key. The Connex Registration Window appears as shown in the following figure.
- 9) Enter the access code provided by Garmin in the 'Access Code' field.

- 10) Press the **ENT** Key. 'Register' is highlighted.
- 11) 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.
- 12) When finished, push the **FMS** Knob to remove the Connex Registration Window.



Figure 6-3 Enter Access Code

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.



NOTE: 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 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 Connex service, the pilot schedules a one-time or repeating data request at regular intervals.

Each data link weather product age has an expiration time. The weather product age is shown in white if it is less than half of this expiration time, otherwise it is shown in amber until reaching its expiration time. After a weather product has expired, the system removes the expired weather product from the displays, and shows white dashes instead of the age. If the data link receiver has not yet received a weather product 'N/A' appears instead of the age to show the product is currently not available for display. This may occur, for example, after powering on the system but before the data link receiver has received a complete weather data transmission. It could also indicate a possible outage of a weather product.

The weather product age is shown automatically for weather products displayed on MFD maps. For PFD maps, the pilot can manually enable/disable the age information.

Enabling/disabling 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.

The following tables show the weather product symbols, and the expiration times for SiriusXM Weather and FIS-B Weather, respectively. The FIS-B broadcast rate represents the interval at which the FIS-B Weather service 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.

- SYSTEM OVERVIEW
- FLIGHT INSTRUMENTS
- EIS
- AUDIO PANEL & CNS
- FLIGHT MANAGEMENT
- HAZARD AVOIDANCE
- AFCS
- ADDITIONAL FEATURES
- APPENDICES
- INDEX

SiriusXM Weather Product	Product Symbol	Expiration Time (Minutes)
Next-generation Radar (NEXRAD)		30
Cloud Tops		60
Echo Tops		30
SiriusXM Lightning		30
Storm Cell Movement		30
SIGMETs	SIGM	60
AIRMETs	AIRM	60
METARs		90
City Forecast		90
Surface Analysis		60
Freezing Levels		120
Winds Aloft		90
County Warnings		60
Cyclone (Hurricane) Warnings		60
Icing Potential (CIP and SLD)		90
Pilot Weather Report (PIREPs)		90
Air Report (AIREPs)		90
Turbulence		180
No Radar Coverage	No product symbol	30
Temporary Flight Restrictions (TFRs)	TFR	60
Terminal Aerodrome Reports (TAFs)	No product symbol	60

Table 6-1 SiriusXM Weather Product Symbols and Data Timing














FIS-B Weather Product	Product Symbol	Expiration Time (Minutes)
NEXRAD Composite (US)		30
NEXRAD Composite (Regional)		30
METARs		90
Pilot Weather Report (PIREP)		90
Winds Aloft		90
SIGMETs/AIRMETs		60
No Radar Coverage	No product symbol	30
Terminal Aerodrome Forecast (TAF)	No product symbol	60
Temporary Flight Restriction (TFR)		60

Table 6-2 FIS-B Weather Product Symbols and Data Timing

The following table shows the Garmin Connex Weather product symbols, the expiration times and the refresh rates. The refresh rate represents the interval at which Garmin Connex weather service makes available the most current known weather data. It does not necessarily represent the rate at which the service receives new data from various weather sources. The pilot chooses how often to contact the Garmin Connex weather service in order to retrieve weather data through the Connex Data Request.

Garmin Connex Weather Product	Product Symbol	Expiration Time (Minutes)
Connex Radar		30
IR Satellite		60
Connex Lightning		30
SIGMETs	SIGM	60
AIRMETs	AIRM	60
Meteorological Aerodrome Report (METARs)		90
Winds Aloft		90
Pilot Weather Reports (PIREPs)		90
Temporary Flight Restrictions (TFRs)	TFR	60
Terminal Aerodrome Reports (TAFs)	No product symbol	60

The composite precipitation image is updated every 3 minutes, but individual radar sites may take between 3 and 10 minutes to provide new data.

Canadian radar precipitation data provided by Environment Canada.

Australian radar precipitation data provided by the Australia Bureau of Meteorology.

Table 6-3 Garmin Connex Weather Product Symbols and Data Timing

DISPLAYING DATA LINK WEATHER PRODUCTS

WEATHER DATA LINK PAGE

The Weather Data Link 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').

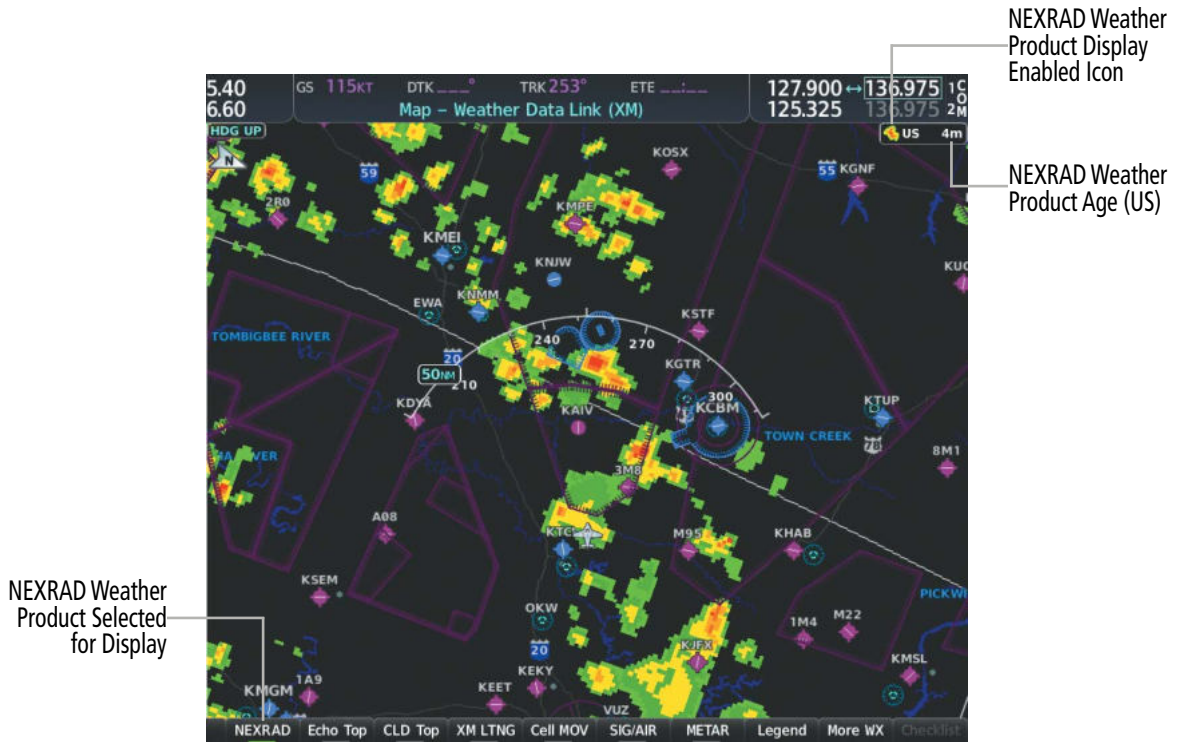


Figure 6-4 Weather Data Link (XM) Page

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.

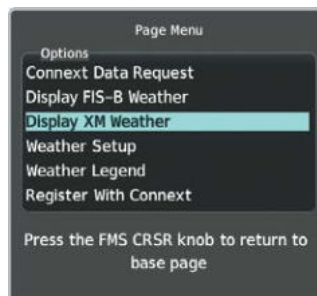


Figure 6-5 Changing the Data Link Weather Source

The system presents the softkeys for the selected source on the Weather Data Link Page, and for map overlays used throughout the system. The following figures show the softkeys for the Weather Data Link Page based on the selected 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.
	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 42,000 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.

Level 1	Level 2	Level 3	Description
		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 Connex Weather Legends Window. Softkey available for selection when at least one Connex Weather product is enabled.
More WX			Displays second-level Connex 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 42,000 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.

Level 1	Level 2	Level 3	Description
		Next	Shows the next level of winds aloft altitude softkeys.
		Legend	Enables/disables the Connex Weather Legends Window. Softkey available for selection when at least one Connex 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 Connex Weather Legends Window. Softkey available for selection when at least one Connex Weather product is enabled.
More WX			Displays second-level Connex 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 42,000 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 Connex Weather Legends Window. Softkey available for selection when at least one Connex 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 Weather Legends Window, press the **Legend** Softkey, the **ENT** or the **CLR** Key, or push 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 pushing 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 associated full text. 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, push 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.
- 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) Push the **FMS** Knob or press the **CLR** Key to return to the Weather Data Link (XM) Page with the changed settings.



NOTE: 'Product Group 2' is only applicable to SiriusXM and Garmin Connex Weather.

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, push 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 Map	Navigation Map	Weather Data Link Page	Weather Information Page	Aux - Trip Planning Page	Aux - Video Page	Nearest Page Group	Flight Plan Pages
NEXRAD	+	+	+		+	+	+	+
Cloud Top			+					
Echo Top			+					
Data Link Lightning	+	+	+		+	+	+	+
Cell Movement		+	+		+			
SIGMETs/AIRMETs			+					
METARs	+	+	+	+	+	+	+	+
Surface Analysis & City Forecast			+					
Freezing Levels			+					
Winds Aloft		+ ¹	+					
County Warnings			+					
Cyclone Warnings			+					
Icing Potential			+					
PIREPs			+	+				
AIREPs			+	+				
Turbulence (TURB)			+					
No Radar Coverage	+	+	+		+	+	+	+
TFRs	+	+	+	+	+	+	+	+
TAFs				+				

¹ Winds Aloft data is available inside the VSD when VSD is enabled on the 'Map - Navigation Map' Page.

Table 6-4 Weather Product Display Maps

Displaying Data Link Weather Products on the 'Map - 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 'Map - 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 'Map - 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 'Map - 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) Push the **FMS** Knob or press the **CLR** Key to return to the 'Map - 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:

- 1) On the PFD, press the **Map/HSI** Softkey.
- 2) To enable/disable a data link lightning weather product on a PFD, press the **Lightning** Softkey.
 - a) Press the desired source of lightning or press the **LTNG Off** Softkey.
 - b) Press the **Back** Softkey twice to return to the top-level PFD Softkeys.



NOTE: Data link lightning is not applicable to the FIS-B Weather service.

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 **WX LGND** Softkey to enable/disable the weather product age, source, and icon box display on PFD Maps.

The setup menus for the 'Map - 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 '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 or more of the following coverage selections:
 - 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 push the **FMS** Knob to return to the 'Map - Weather Data Link (CNXT)' Page without requesting weather data.

- SYSTEM OVERVIEW
- FLIGHT INSTRUMENTS
- EIS
- AUDIO PANEL & CNS
- FLIGHT MANAGEMENT
- HAZARD AVOIDANCE
- AFCS
- ADDITIONAL FEATURES
- APPENDICES
- INDEX

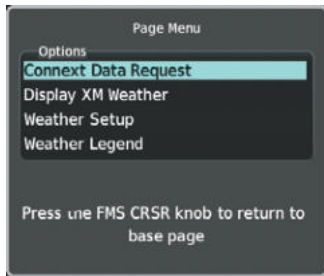


Figure 6-7 'Map - Weather Data Link (CNXT)' Page Menu

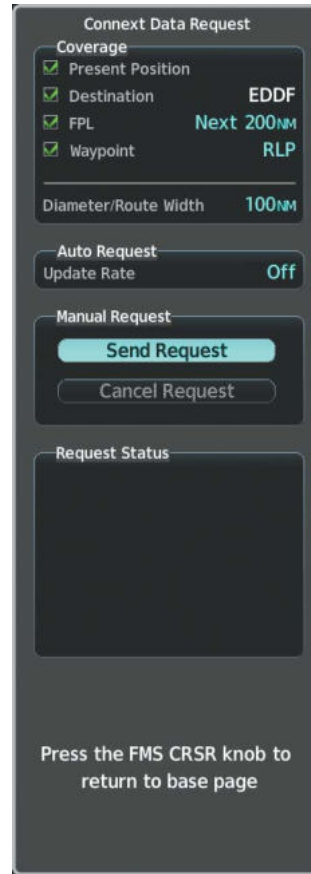


Figure 6-8 Connext Data Request Window

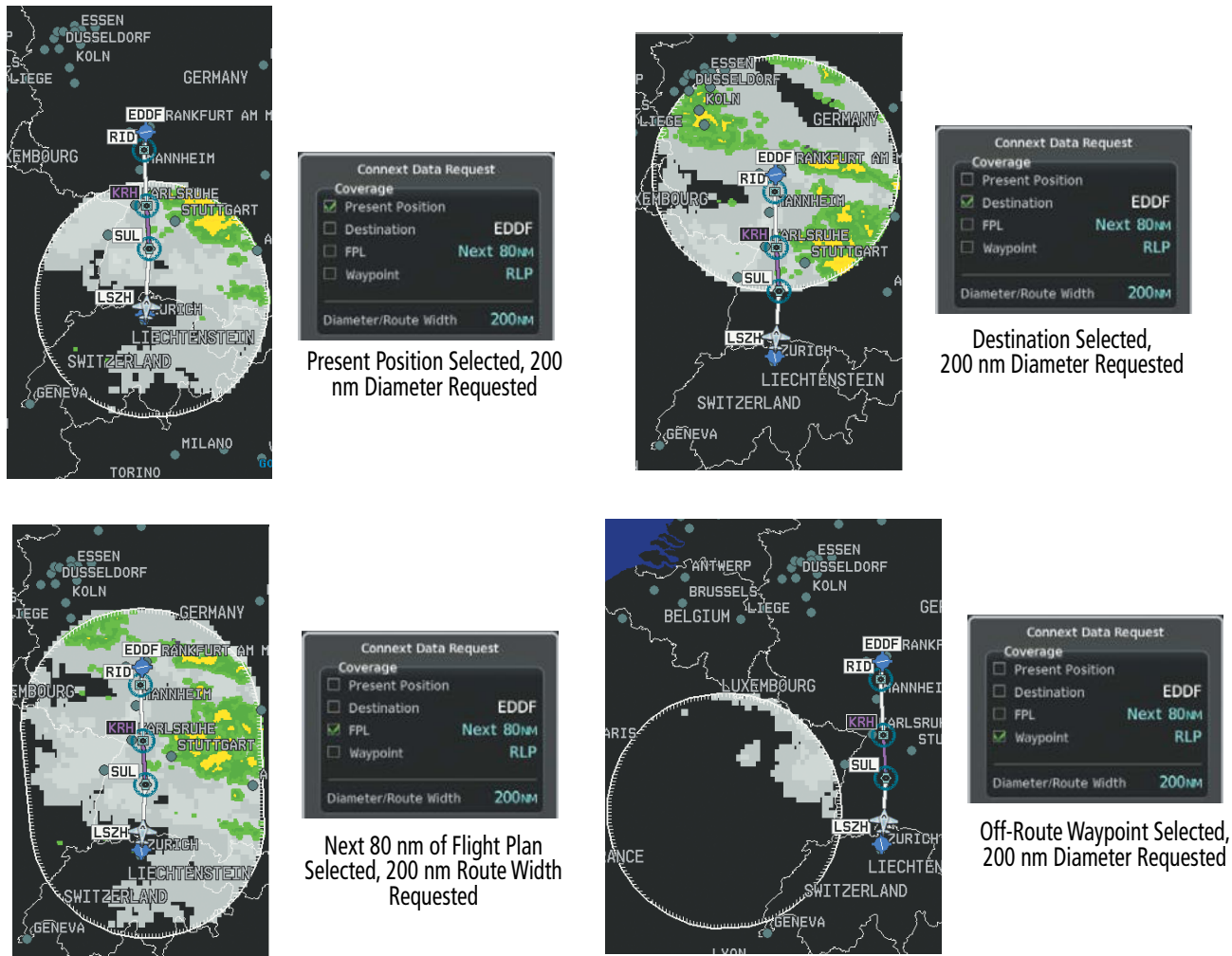


Figure 6-9 Garmin Connex Weather Data Request Results with Precipitation Data Displayed

During a Connex Data Request, the Request Status Window initially displays “Contacting Connex...”. 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 Connex Data Request Menu may be removed while the data request is processing by pushing the **FMS** Knob; the data request will continue to process in the background. Connex 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 Connex Weather products within the selected coverage area during an initial Connex 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 Connex Data Request menu is still within view.

Cancelling a Connex Data Request in Progress:

- 1) Select the 'Weather Data Link (CNXT)' Page.
- 2) Press the **MENU** Key.
- 3) With 'Connex 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) Push the **FMS** Knob to return to the 'Weather Data Link (CNXT)' Page.

The flight crew can schedule Connex 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 Connex Data Requests were enabled prior to the system entering Reversionary Mode, the automatic weather data requests will continue in Reversionary Mode, however the Connex Data Request Window and its associated options will not be available in Reversionary Mode.*

Enabling/disabling automatic Connex Data Requests:

- 1) Select the 'Weather Data Link (CNXT)' Page.
- 2) Press the **MENU** Key.
- 3) With 'Connex 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 Connex Data Request.
- 7) Push 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 relative 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.

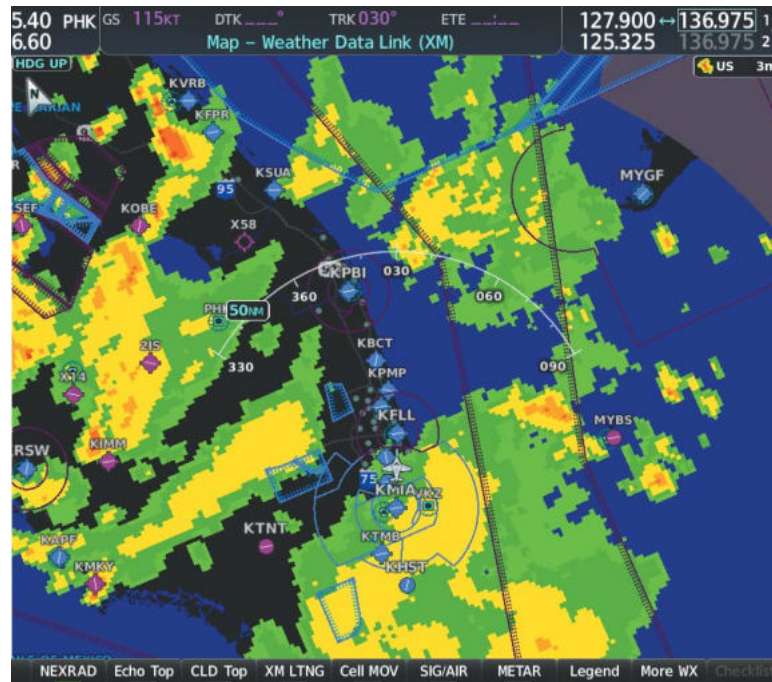


Figure 6-10 NEXRAD Weather Product on the Weather Data Link (XM) Page

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.

Displaying the NEXRAD weather product on the 'Map - Weather Data Link (XM)' Page

- 1) Select the 'Map - Weather Data Link (XM)' Page.
- 2) Press the **NEXRAD** Softkey.

A mosaic of data from all the available NEXRAD radar sites is shown.

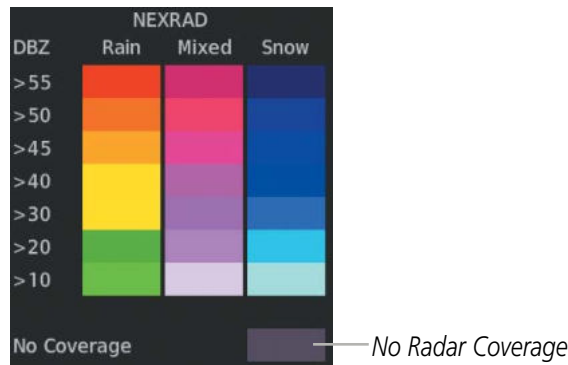


Figure 6-11 NEXRAD Weather Product Legend

Displaying the NEXRAD weather product on the 'Map - Navigation Map' Page

- 1) Press the **Map Opt** Softkey.
- 2) Press the **NEXRAD** Softkey.

Displaying the 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 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.

The pilot can select either the United States or Canada region for the desired NEXRAD coverage area on the Weather Data Link (XM) Page. NEXRAD information is shown for the selected region, while a gray shade of purple is shown for the region which is not selected.

Selecting the NEXRAD Coverage Region on the 'Map - Weather Data Link (XM)' Page:

- 1) Press the **MENU** Key.
- 2) Turn the **FMS** Knob to select 'Weather Setup' and press the **ENT** Key.
- 3) With Product Group 1 selected, turn the large **FMS** Knob to highlight the NEXRAD Region field.
- 4) Turn the small **FMS** Knob to select 'US' or 'CNDA', then press the **ENT** Key.
- 5) To remove the menu, push the **FMS** Knob or the **CLR** Key.

The NEXRAD weather product age display indicates either 'US' or 'CN' for the selected coverage region.

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:

- 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.

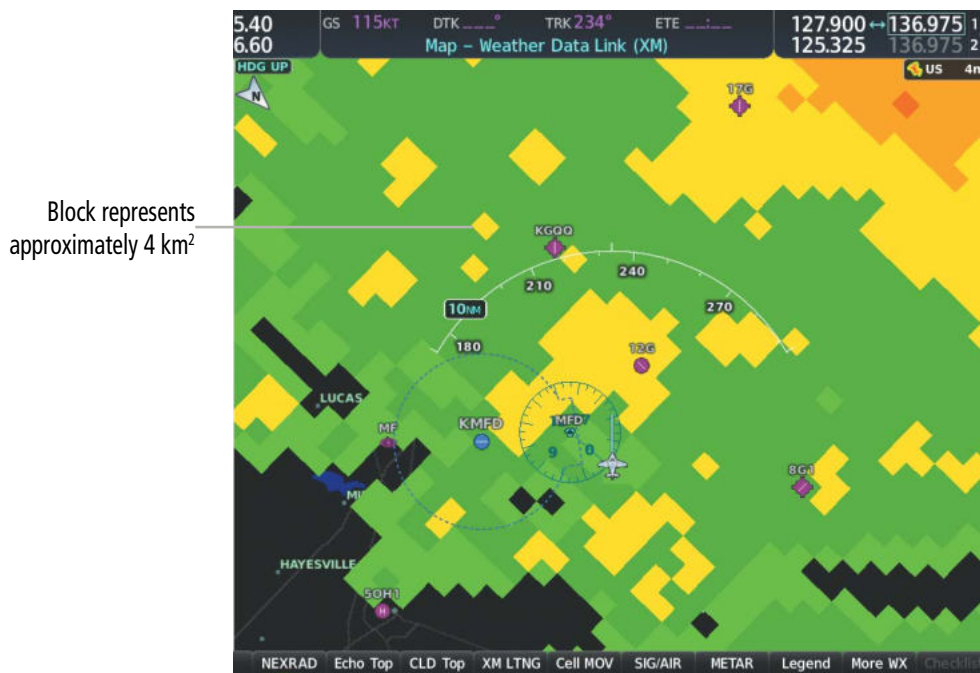


Figure 6-12 NEXRAD Weather Product with 30 NM Map Range

The following may cause abnormalities in displayed NEXRAD radar images:

- Ground clutter
- Strokes and spurious radar data
- Sun strokes (when the radar antenna points directly at the sun)
- Interference from buildings or mountains, which may cause shadows
- Metallic dust (chaff) from military aircraft, which can cause alterations in radar scans

NEXRAD LIMITATIONS (CANADA)

- Radar coverage extends to 55°N.
- Any precipitation displayed between 52°N and 55°N is displayed as mixed 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 'Map - 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 FIS-B NEXRAD weather product on the 'Map - Weather Data Link (FIS-B)' Page

- 1) Select the 'Map - Weather Data Link (FIS-B)' Page.
 - 2) Press the **NXRD** Softkey. Each press cycles through a coverage option as the softkey name changes (**NXRD US**, **NXRD REG**, **NXRD OFF**, or **NXRD ALL**).
- 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 or 'Off' to disable.
 - b) Press the **ENT** Key.
 - 4) To select the region, turn the small **FMS** Knob to highlight the Region field.
 - a) Turn the small **FMS** Knob to select the desired region. (CONUS, Regional, or Combined)
 - b) Press the **ENT** Key.
 - 5) When finished, push the **FMS** Knob.

- SYSTEM OVERVIEW
- FLIGHT INSTRUMENTS
- EIS
- AUDIO PANEL & CNS
- FLIGHT MANAGEMENT
- HAZARD AVOIDANCE
- AFCS
- ADDITIONAL FEATURES
- APPENDICES
- INDEX

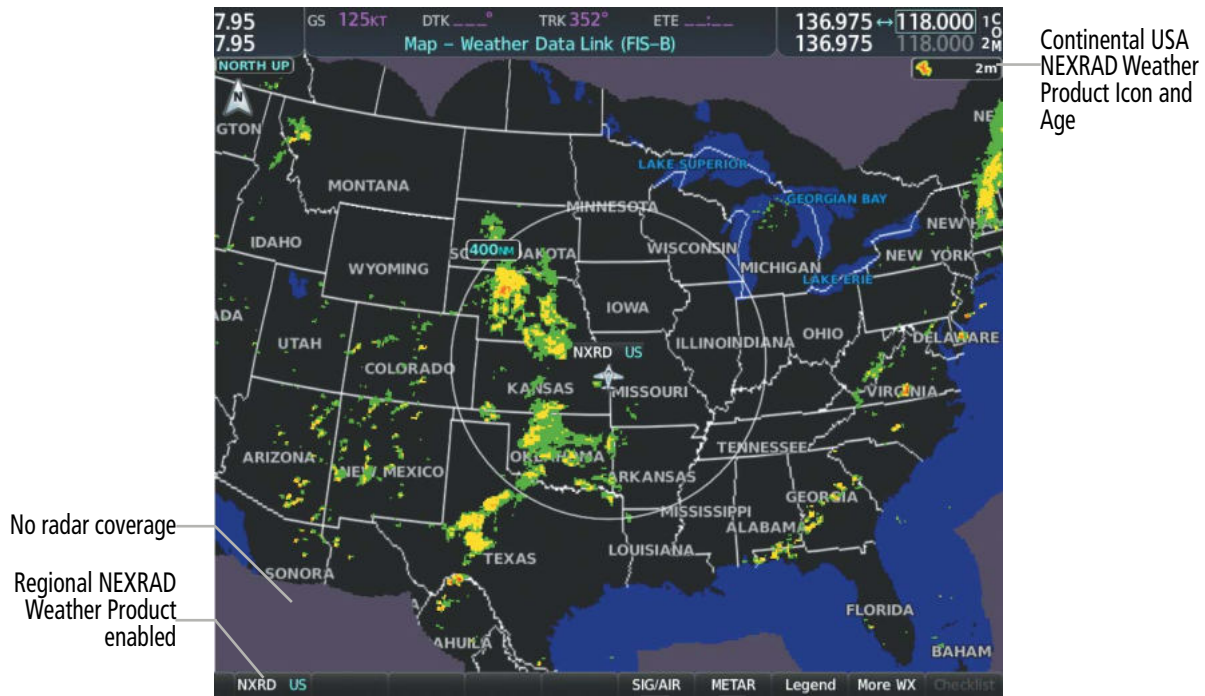


Figure 6-15 Continental US (CONUS) NEXRAD Weather Product on the 'Map - Weather Data Link (FIS-B)' Page

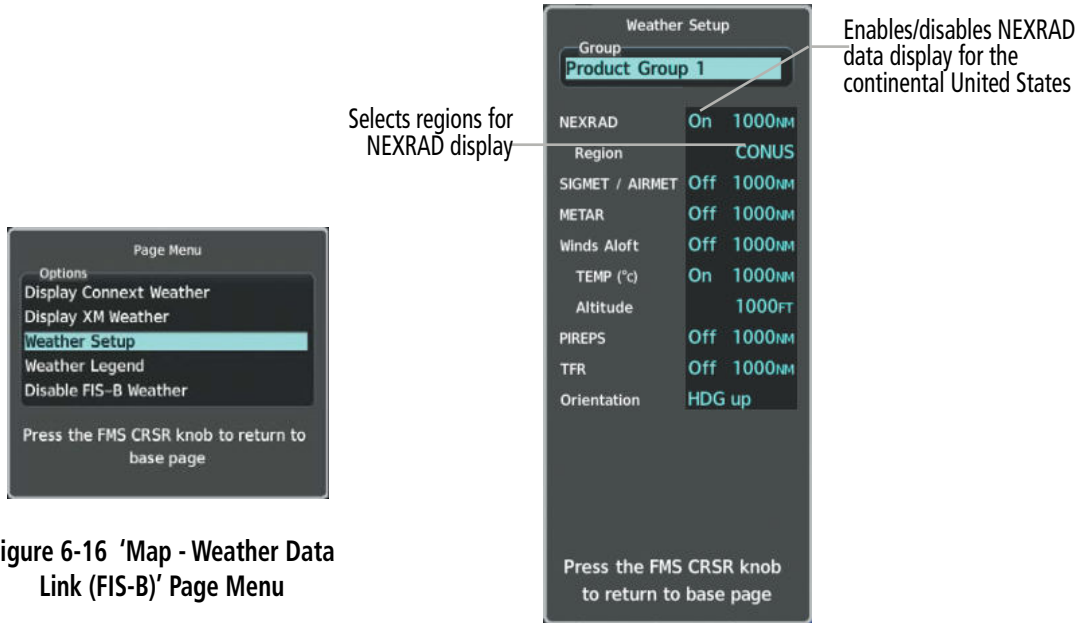


Figure 6-16 'Map - Weather Data Link (FIS-B)' Page Menu

Figure 6-17 'Map - Weather Data Link (FIS-B)' Page Setup Menu

Displaying the FIS-B NEXRAD weather product on the 'Map - Navigation Map' Page

- 1) Press the **Map Opt** Softkey.
- 2) Press the **NEXRAD** Softkey. Each press cycles through a coverage option as the softkey name changes (**US**, **RGNL**, or **US/RGNL**).
Or:
- 3) 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, push 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 'Map - Weather Data Link (FIS-B)' Page. For the NEXRAD legend, select the **Legend** Softkey when the NEXRAD weather product is enabled.

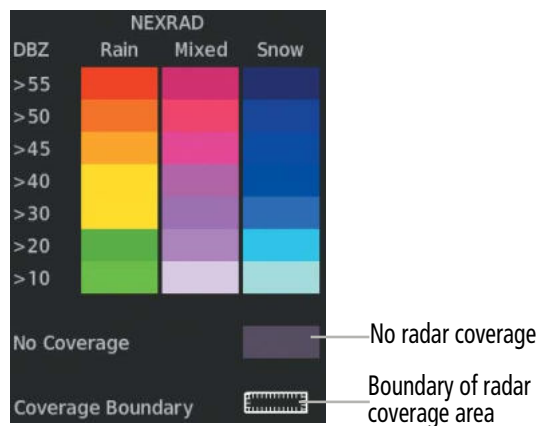


Figure 6-18 NEXRAD Weather Product Legend

SYSTEM OVERVIEW

FLIGHT INSTRUMENTS

EIS

AUDIO PANEL & CNS

FLIGHT MANAGEMENT

HAZARD AVOIDANCE

AFCS

ADDITIONAL FEATURES

APPENDICES

INDEX

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 60° of latitude. The following may cause abnormalities in displayed NEXRAD radar images:
 - Ground clutter
 - Strokes and spurious radar data
 - Sun strokes (when the radar antenna points directly at the sun)
 - Interference from buildings or mountains, which may cause shadows
 - Metallic dust (chaff) from military aircraft, which can cause alterations in radar scans

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 Connex 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.

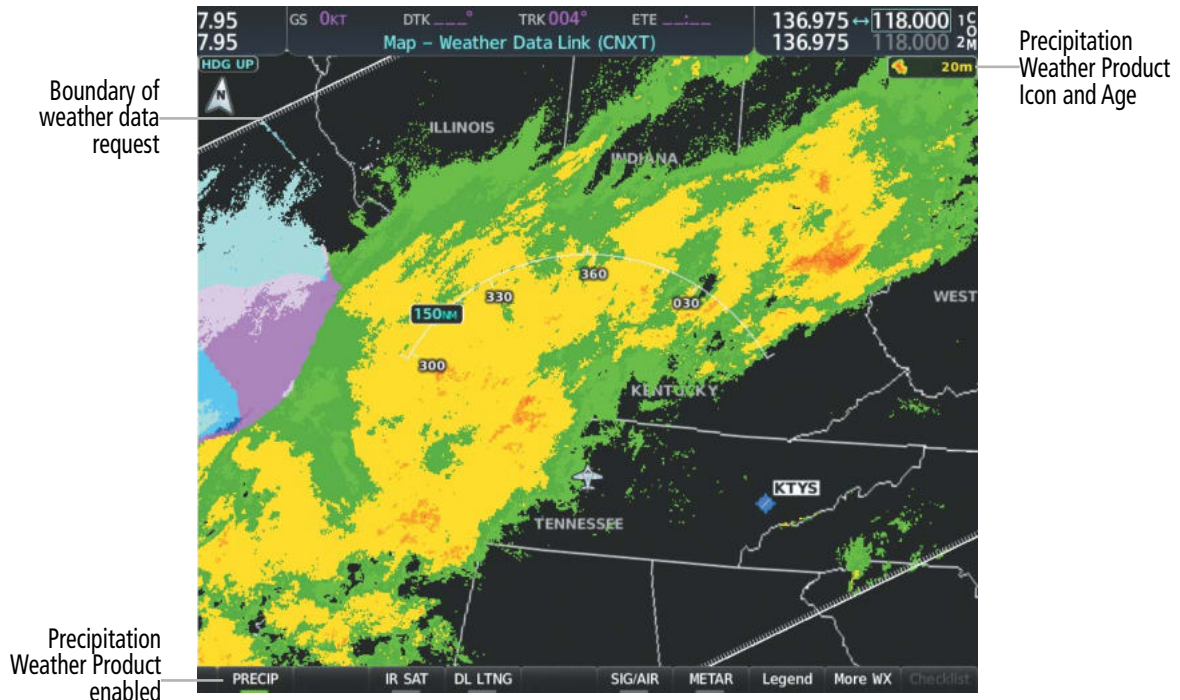


Figure 6-19 Precipitation Weather Product on the 'Map - Weather Data Link (CNXT)' Page

Displaying Precipitation weather information:

- 1) Press the **Map Opt** Softkey (for PFD maps, press the **Map/HSI** Softkey). This step is not necessary on the 'Map - Weather Data Link (CNXT)' Page.
- 2) Press 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 'Map - Weather Data Link (CNXT)' Page. For the Precipitation legend, press the **Legend** Softkey when Precipitation is selected for display.

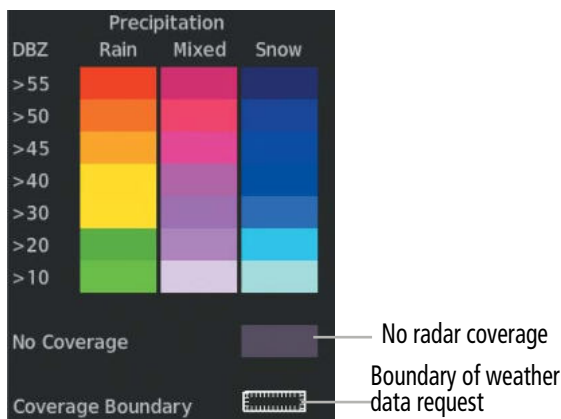


Figure 6-20 Precipitation Weather Product Legend

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 Connex 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.

Block represents approximately 4 km²

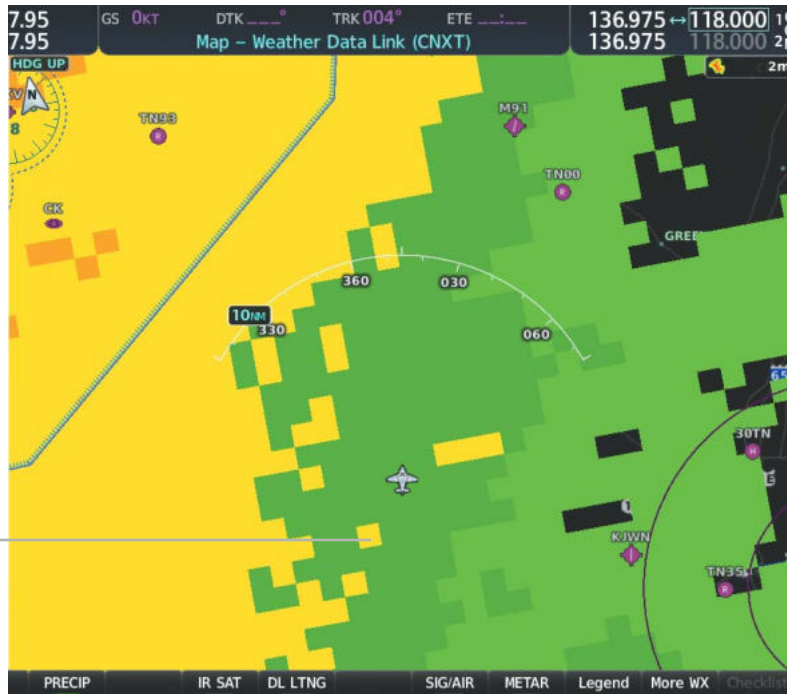


Figure 6-21 Precipitation Weather Product at 10 NM Map Range

The following may cause abnormalities in displayed radar images:

- Ground clutter
- Strokes and spurious radar data
- Sun strokes (when the radar antenna points directly at the sun)
- Interference from buildings or mountains, which may cause shadows
- Metallic dust (chaff) from military aircraft, which can cause alterations in radar scans

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.

- SYSTEM OVERVIEW
- FLIGHT INSTRUMENTS
- EIS
- AUDIO PANEL & CNS
- FLIGHT MANAGEMENT
- HAZARD AVOIDANCE
- AFCS
- ADDITIONAL FEATURES
- APPENDICES
- INDEX



Altitude for selected Echo Top

Figure 6-22 Echo Tops Weather Product

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.

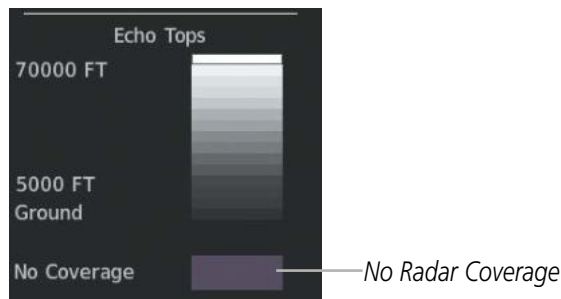


Figure 6-23 Echo Tops Legend

CLD TOPS (SIRIUSXM)

NOTE: Cloud Tops and Echo Tops cannot be displayed at the same time.

NOTE: If a GDL 69/69A SXM receiver is installed, 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.

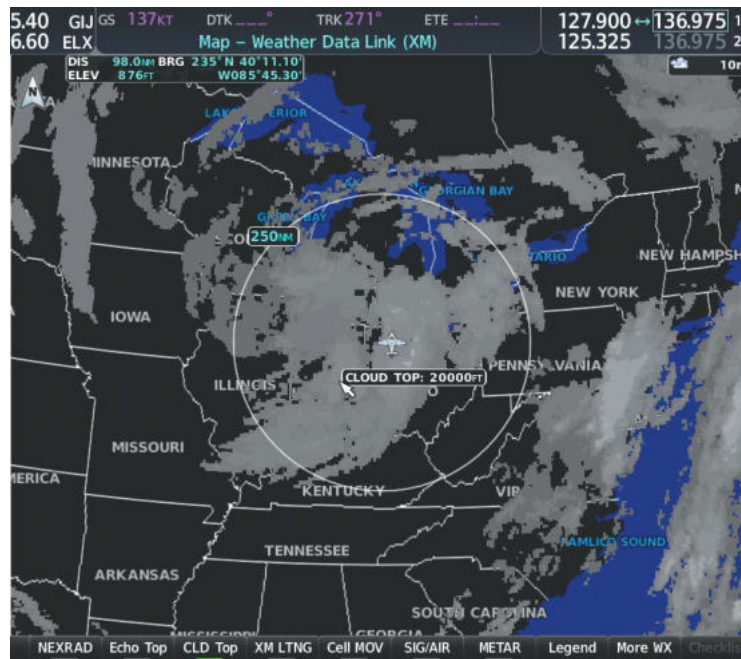


Figure 6-24 Cloud Tops Weather Product

Displaying Cloud Tops information:

- 1) Select the 'Map - Weather Data Link (XM)' Page with the **FMS** Knob.
- 2) Press 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.

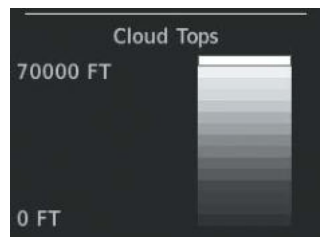


Figure 6-25 Cloud Tops Legend

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.

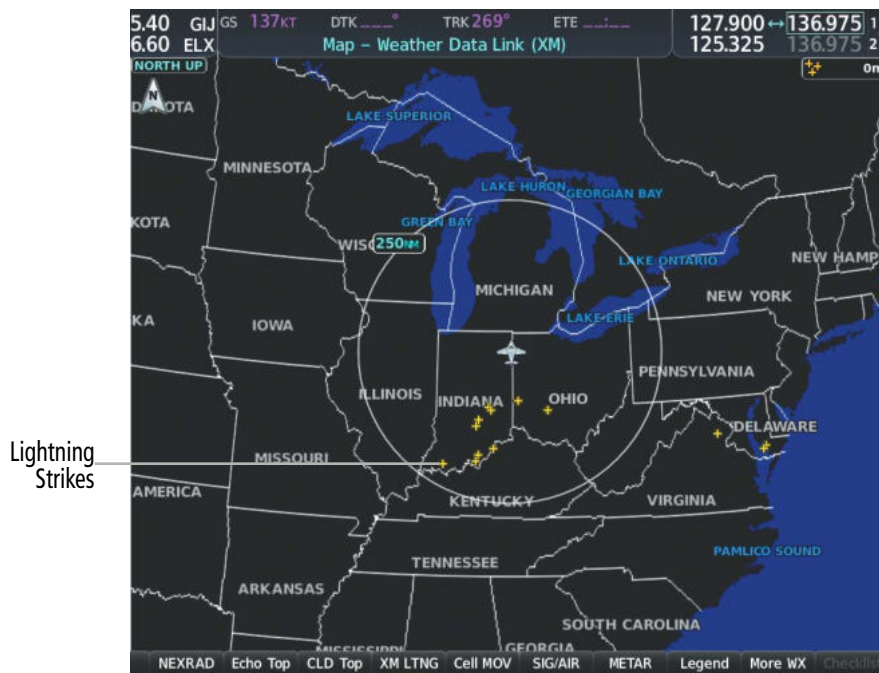


Figure 6-26 Data Link Weather Product

Displaying Data Link Lightning information on Weather Data Link Page:

- 1) Turn the **FMS** Knob to select the Weather Data Link (XM, CNXT) Page.
- 2) Press the **XM LTNG** or **DL LTNG** Softkey (softkey name depends on the selected weather source).

To display the Lightning legend on the Weather Data Link Page, press the **Legend** Softkey when Data Link Lightning is selected for display.

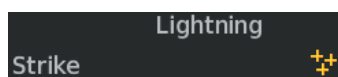


Figure 6-27 Data Link Lightning Legend

Displaying Data Link Lightning information on the 'Map - Navigation Map' Page:

- 1) Turn the **FMS** Knob to select the 'Map - Navigation Map' Page.
- 2) Press the **Map Opt** Softkey.
- 3) Press the **XM LTNG** or **DL LTNG** Softkey.

Enabling/disabling 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 to enable data link lightning from the selected data link weather source, or press the **LTNG Off** Softkey to disable data link lightning.
- 4) When finished, press the **Back** Softkey.

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, the Cell Movement weather product has a dedicated **Cell 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) Press the **Cell MOV** Softkey.

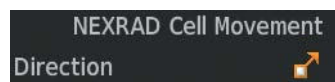


Figure 6-29 Cell Movement Legend

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 'Map - 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.

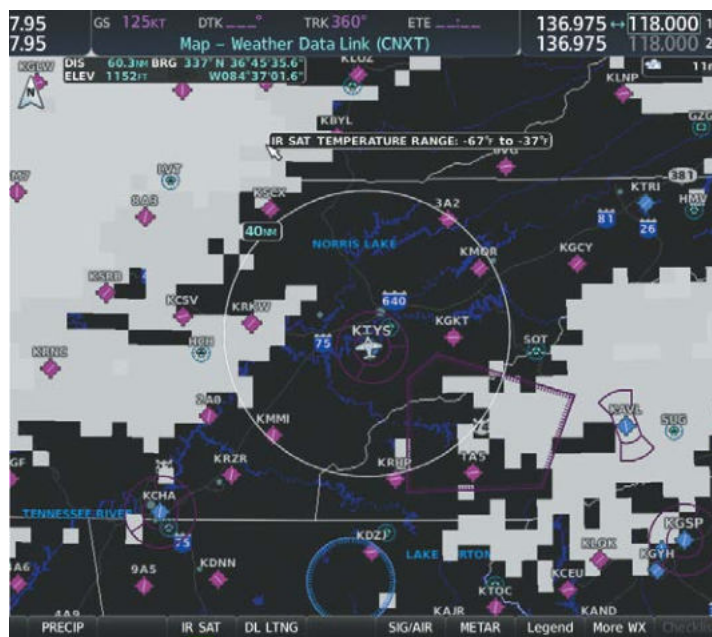


Figure 6-30 Infrared Satellite Weather Product on the 'Map - Weather Data Link (CNXT)' Page

Displaying Infrared Satellite information:

- 1) Select the 'Weather Data Link (CNXT)' Page.
- 2) Select the **IR SAT** Softkey.

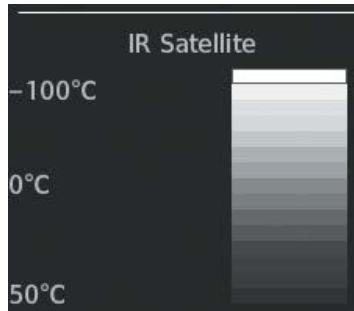


Figure 6-31 Infrared Satellite Legend

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 69/69A 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.

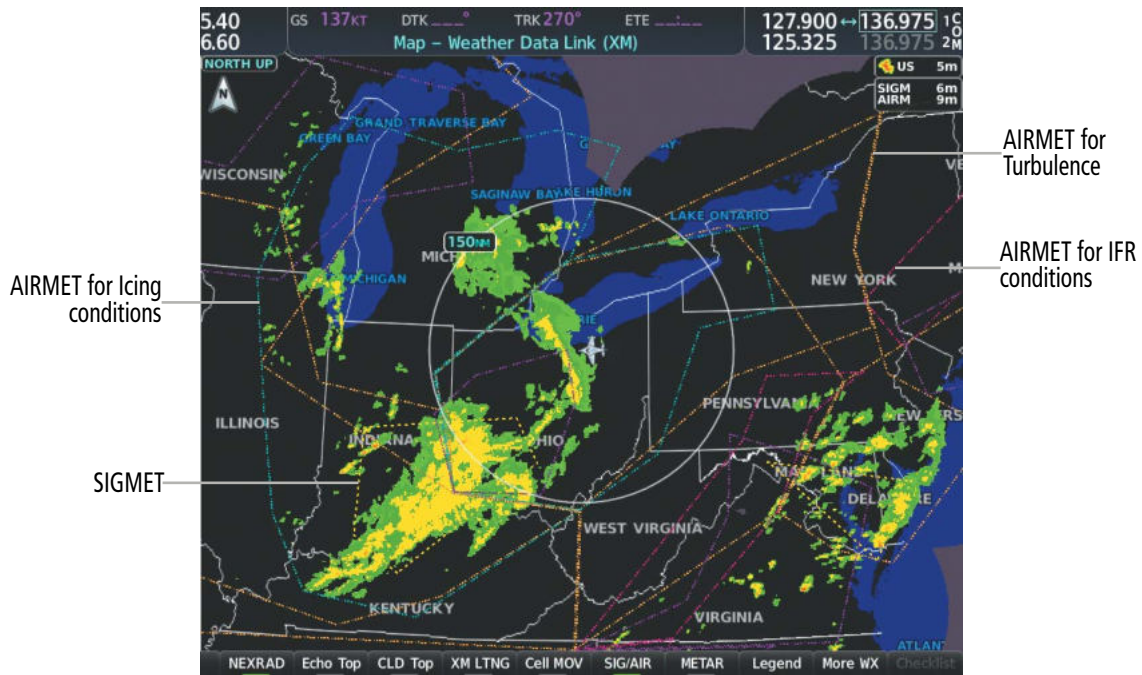


Figure 6-32 SIGMET/AIRMET Data

Displaying SIGMETs and AIRMETs:

- 1) Select the Weather Data Link Page.
- 2) Press the **SIG/AIR** Softkey.
- 3) To view the text of the SIGMET or AIRMET, push the **Joystick** and move the Map Pointer over the icon.
- 4) Press the **ENT** key. The following figure shows sample SIGMET text.

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 Weather Data Link Page, press the **METAR** Softkey.
- 2) Push 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) Push the **FMS** Knob or the **CLR** Key to return to the Weather Data Link Page.

Or:

- 1) Turn the large **FMS** Knob to select the Waypoint Page Group
 - a) Select the Airport Information Page.
 - b) Press the **WX** Softkey to select the Weather Information Page.
- 2) Push 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.

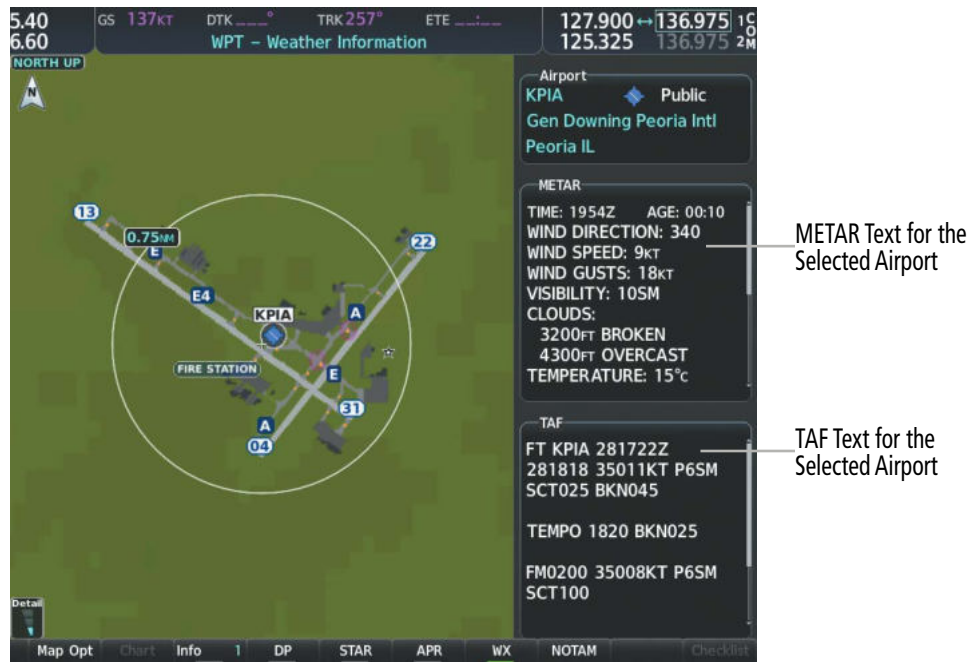


Figure 6-35 METAR and TAF Text on the Weather Information Page

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.

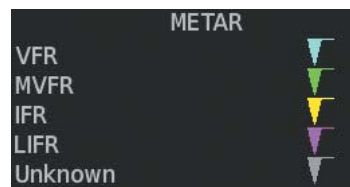


Figure 6-36 METAR Legend

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) Push 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, push 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.
- 3) Push the **Joystick** and pan to the desired METAR flag. Original METAR text appears on the map.
- 4) When finished, push 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.

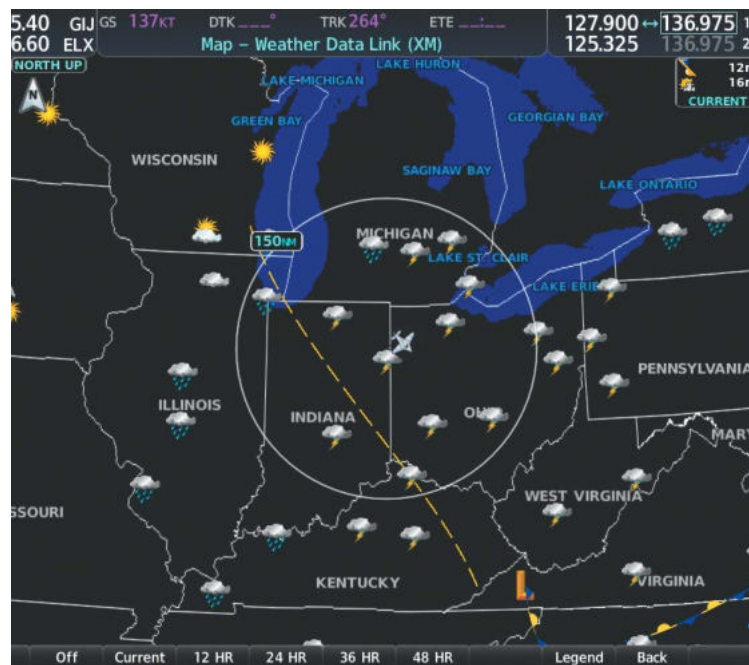


Figure 6-37 Current Surface Analysis Data

Displaying Surface Analysis and City Forecast information:

- 1) Select the 'Map - Weather Data Link' Page.
- 2) Press the **More WX** Softkey.
- 3) Press 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 Level Data

Displaying Freezing Level information:

- 1) Select the 'Map - Weather Data Link' Page.
- 2) Press the **More WX** Softkey.
- 3) Press 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 'Map - Weather Data Link (FIS-B)' Page.

Displaying the Winds Aloft weather product:

- 1) Select the 'Map - Weather Data Link' Page with the **FMS** Knob.
- 2) Press the **More WX** Softkey.
- 3) Press the **Wind** Softkey.
- 4) Select a softkey for the desired altitude level: **SFC** (surface) up to 42,000 feet. Press 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 Data at 12,000 Feet

SYSTEM OVERVIEW

FLIGHT INSTRUMENTS

EIS

AUDIO PANEL & CNS

FLIGHT MANAGEMENT

HAZARD AVOIDANCE

AFCS

ADDITIONAL FEATURES

APPENDICES

INDEX



Figure 6-42 Winds Aloft Data with Legend

Headwind and tailwind components aloft are available inside the Vertical Situation Display (VSD) on the 'Map - 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 on VSD

Arrows pointing to the left indicate headwind components; tailwind component arrows point to the right, as shown in the following table.

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 'Map - 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 'Map - Navigation Map' Page. This behavior can be changed on the 'Map - 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) Push the **FMS** Knob or **CLR** Key to return to the 'Map - 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.

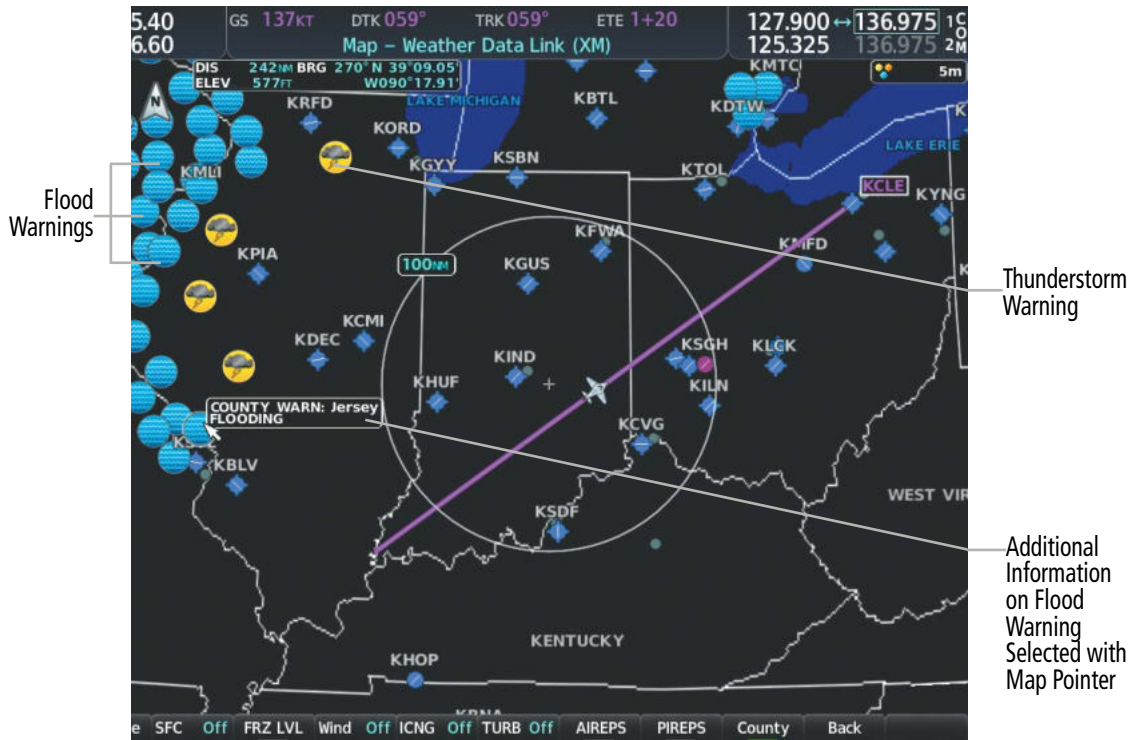


Figure 6-44 County Flood Warning

Displaying County Warning information:

- 1) Select the 'Map - Weather Data Link' Page with the **FMS** Knob.
- 2) Press the **More WX** Softkey.
- 3) Press the **County** Softkey.

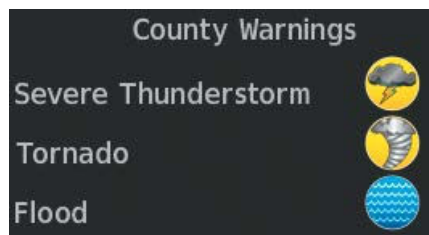


Figure 6-45 County Warnings Legend

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' Page with the **FMS** Knob.
- 2) Press the **More WX** Softkey.
- 3) Press the **Cyclone** Softkey.

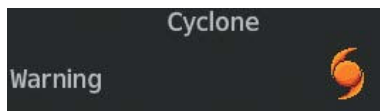


Figure 6-47 Cyclone Legend



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' Page.
- 2) Press the **More WX** Softkey.
- 3) Press the **ICNG** Softkey.
- 4) Select a softkey for the desired altitude level: 1,000 feet up to 30,000 feet. Press 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 Data at 18,000 Feet

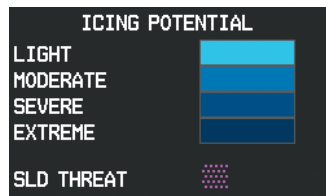


Figure 6-49 Icing Potential Legend

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' Page.
- 2) Press the **More WX** Softkey.
- 3) Press 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.

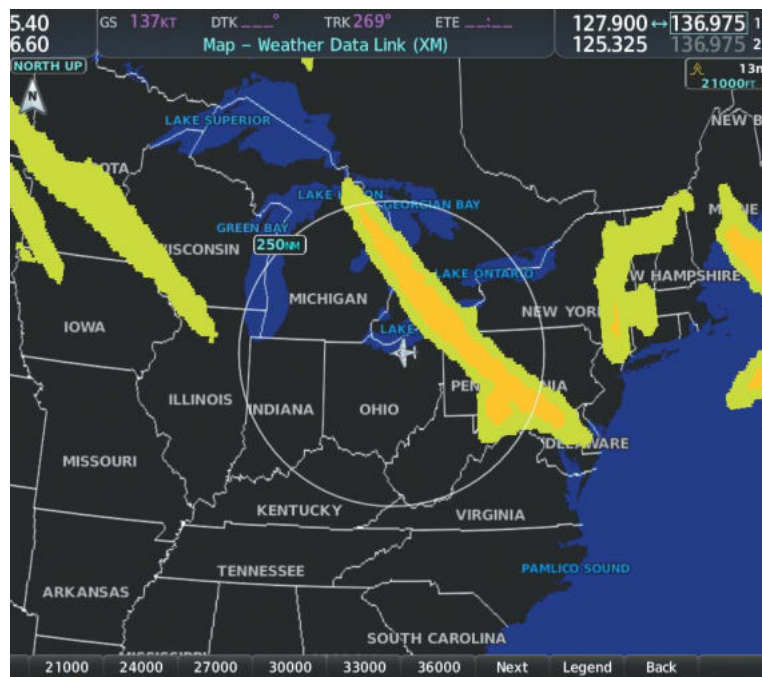


Figure 6-50 Turbulence Weather Product at 21,000 Feet

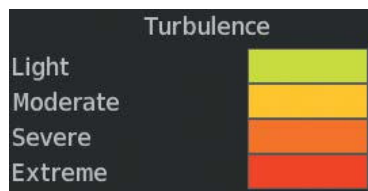


Figure 6-51 Turbulence Legend

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.

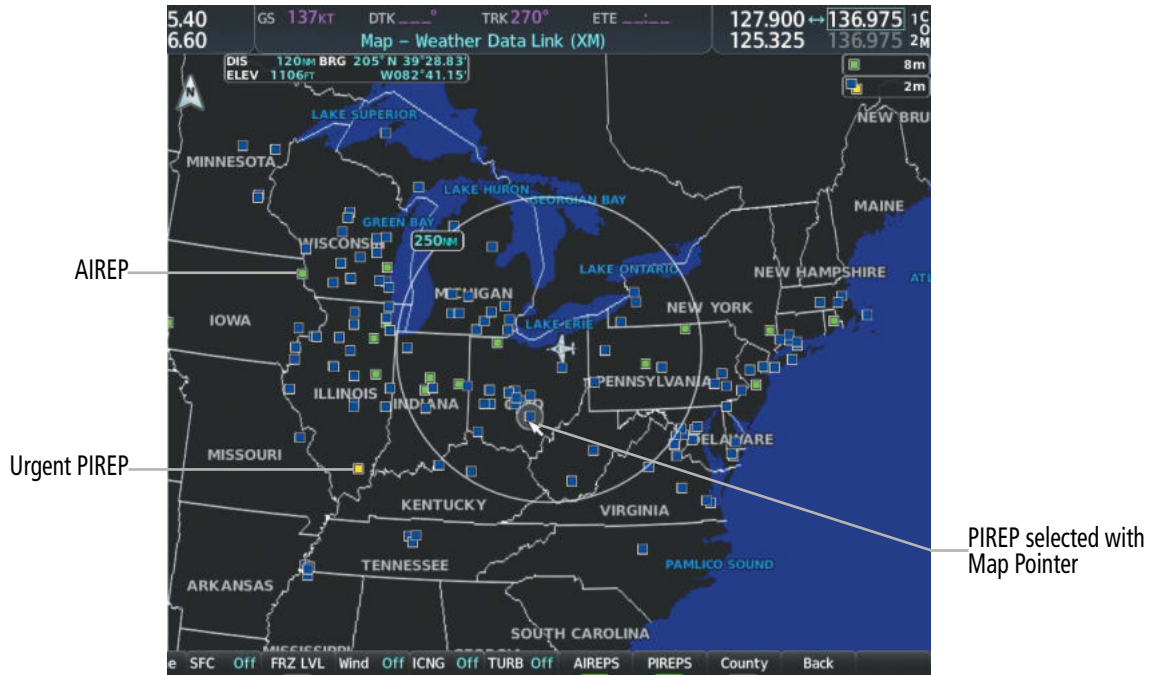


Figure 6-52 PIREPs and AIREPS on the Weather Data Link (XM) Page

Displaying PIREP and AIREP text:

- 1) Select the Map - Weather Data Link Page.
- 2) Press the **More WX** Softkey.
- 3) Press the **PIREPS** or **AIREPS** Softkey. (Note the **AIREPS** Softkey is only available with the SiriusXM Weather service.)
- 4) Push 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) Push the **FMS** Knob or the **CLR** Key to return to the 'Map - Weather Data Link' Page.

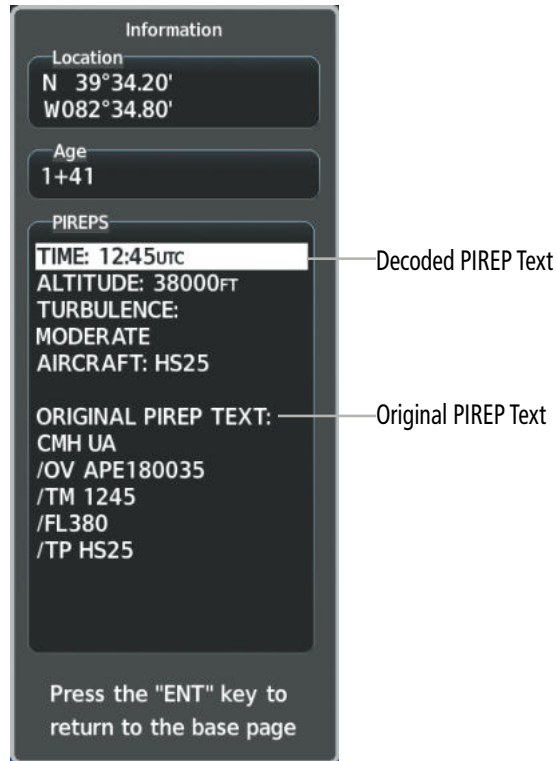


Figure 6-53 PIREP Text on the Weather Data Link (XM) Page

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 Connex is only available in the United States (not including any U.S. territories.) Refer to <http://sites.garmin.com/connex> 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' Page or the 'Map - Navigation Map' Page.
- 2) Push 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) Push the **FMS** Knob or the **CLR** Key to remove the TFR Information window.

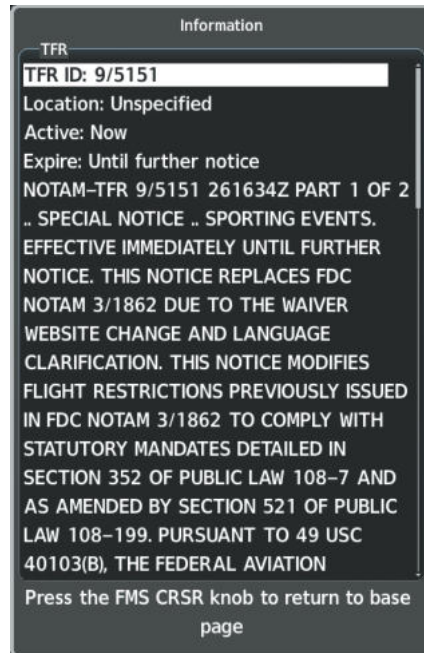


Figure 6-56 Full Text for Selected TFR

The setup menus for the 'Map - 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 'Map - Navigation Map' Page use settings based on those selected for the 'Map - 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 setting.
- 6) Turn the small **FMS** Knob to scroll through options (Off, range settings).
- 7) Press the **ENT** Key to select an option.
- 8) Push the **FMS** Knob or **CLR** Key to return to the 'Map - 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 'Map - 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' 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 the 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/Temp 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 Connex 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.
Connex Comm Error [1]	A general error has occurred. If the error persists, the system should be serviced.
Connex Comm Error [2]	A communications error has occurred with the GIA. The system should be serviced.
Connex Comm Error [3]	A general error has occurred. If the error persists, the system should be serviced.
Connex Comm Error [4]	This occurs if multiple automatic weather data requests have recently failed, or the GIA is off-line.
Connex Comm Error [5]	This can occur if the Iridium or Garmin Connex services are not accessible. Check Iridium signal strength. If this error persists, the system should be serviced.
Connex Comm Error [6]	A communications error has occurred. If this error persists, the system should be serviced.
Connex Comm Error [7]	A weather data transfer has timed out. Check Iridium signal strength and re-send the data request.
Connex Comm Error [8]	A server error has occurred or invalid data received.
Connex Comm Error [9]	An error occurred while reading or writing data. If the error persists, the system should be serviced.
Connex Login Invalid	There is a problem with the Garmin Connex registration.
Connex Server Temp Inop	The Garmin Connex Weather data server is temporarily out of service, but is expected to return to service in less than 30 minutes.
Connex Server Inop	The Garmin Connex Weather data server will be out of service for at least 30 minutes.
Invalid Coverage Area	The 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 Connex Subscription	The system is not currently subscribed to Garmin Connex services or the access code is incorrect. Verify the access code.
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 Connex Data Request to ensure all available weather data has been received.
Request Canceled	The user has cancelled a Connex Data Request.
Request Failed - Try Again	The weather data request timed-out. Re-send data request.

Table 6-7 Abnormal Garmin Connex 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.

If manual Connex Data Requests were enabled prior to entering Reversionary Mode, no new weather data will be retrieved while operating in Reversionary Mode. If automatic Connex 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

Selecting 'cell' or 'strike' mode:

- 1) Select the 'Map - Stormscope®' Page.
- 2) Press the **Mode** Softkey. The **Cell** and **Strike** softkeys are displayed.
- 3) Press 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) Press 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.

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) Push 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

On the Navigation Map, 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 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) Push the **FMS** knob to return to the 'Map - Navigation Map' Page.

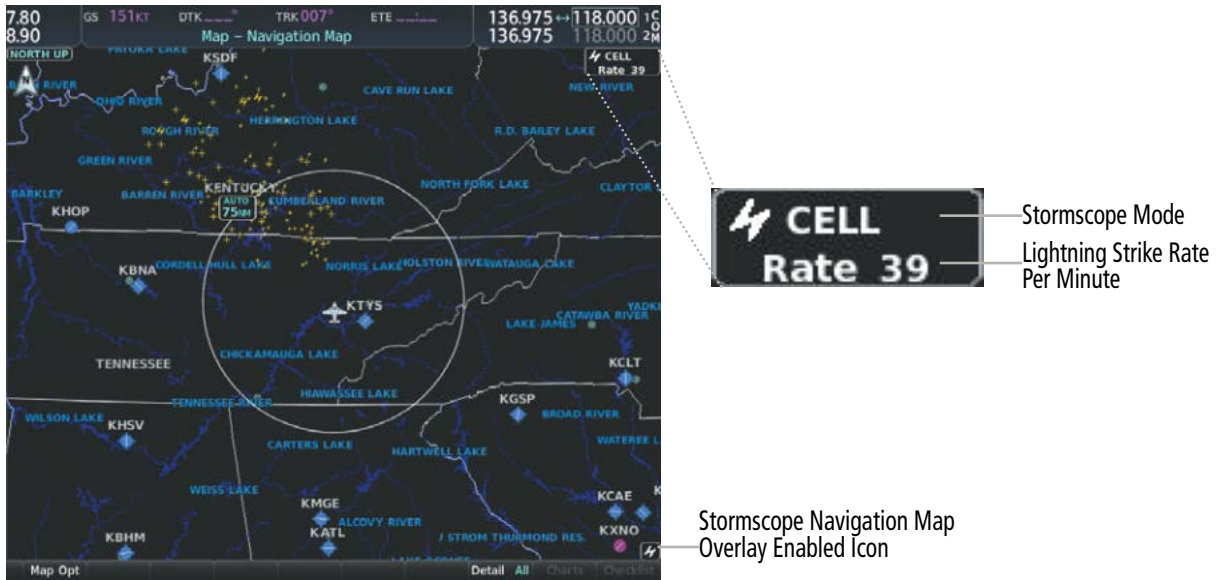


Figure 6-59 Navigation Map Page with Stormscope Lightning Data

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.

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) Push the **FMS** Knob to return to the 'Map - Navigation Map' Page.

To change the display range on the 'Map - Navigation Map' Page, turn the **Joystick** clockwise to increase the map range or counter-clockwise to decrease the map range.

6.3 AIRBORNE COLOR WEATHER RADAR

SYSTEM DESCRIPTION

The Garmin GWX 70/75 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 70/75 has an effective pulse length of 27.31 microseconds (μs), and the system optimizes the pulse length to maximize resolution at each range setting.

Differences between the GWX 70 and GWX 75 are discussed throughout this section, where applicable.

The Diamond DA42NG uses a 10-inch antenna that is fully stabilized to accommodate 30° of pitch and roll.

To focus radar scanning on specific areas, Sector Scanning offers 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.

If a GWX 70/75 is installed, the following features may also be available:

- Altitude-Compensated Tilt (ACT) management, which automatically adjusts the antenna tilt angle as the aircraft altitude changes.
- Independent weather radar scans for each PFD HSI Map while the aircraft is in the air.
- Optional Turbulence Detection presents areas of turbulence associated with precipitation using Doppler measurements.
- Optional Ground Clutter Suppression (GCS), to remove ground clutter from the displays.



NOTE: *Garmin recommends the user obtain instruction in the proper operation of airborne weather radar.*

PRINCIPLES OF AIRBORNE WEATHER RADAR

The term RADAR is an acronym for RAdio Detecting And Ranging. Pulsed radar locates targets by transmitting a microwave pulse beam that, upon encountering a target, is reflected back to the radar receiver as a return echo. The microwave pulses are focused and radiated by the antenna, with the most intense energy in the center of the beam and decreasing intensity near the edge. The same antenna is used for both transmitting and receiving.

Radar detection is a two-way process that requires 12.36 μs for the transmitted microwave pulses to travel out and back for each nautical mile of target range. It takes 123.6 μs for a transmitted pulse to make the round trip if a target is ten nautical miles away.

The airborne weather radar has the capability to detect the velocity of precipitation moving toward or away from the radar antenna. As the radar pulse beam strikes a moving object, the frequency of the returned echo shifts in relation to the speed at which the object is moving. This effect is analogous to the audible pitch change observed when an emergency vehicle's siren gets closer or moves away. Doppler radar employs this effect to detect areas of precipitation moving at a high rate of speed (indicative of turbulence), and to determine when

an object, such as the ground, is stationary. The system can use this information to suppress the display of ground clutter.

Airborne weather radar should be used to avoid severe weather. The decision to fly into an area of radar targets depends on target intensity, spacing between the targets, aircraft capabilities, and crew experience. Airborne weather radar is efficient at detecting wet precipitation such as rain, wet snow, and water coated hail, however it will not detect clouds or mist. The display may indicate clear areas between intense returns, but this does not necessarily mean it is safe to fly between them, as these areas may contain severe turbulence or other hazards such as hail. In addition, Doppler radar measurement of precipitation velocity only occurs when rain or hail is moving along the radar beam and either toward or away from the antenna. Airborne weather radar systems cannot detect Clear Air Turbulence (CAT) as there are no particulate for the radar to detect.

Airborne weather radar has other capabilities beyond weather detection. It also has the ability to detect and provide distance to cities, mountains, coastlines, rivers, lakes, and oceans.

NEXRAD AND AIRBORNE WEATHER RADAR

Both Airborne Weather Radar and NEXRAD measure weather reflectivity in decibels (dB). A decibel is a logarithmic expression of the ratio of two quantities. Airborne Weather Radar measures the ratio of power against the gain of the antenna, while NEXRAD measures the energy reflected back to the radar, or the radar reflectivity ratio.

Although both radar systems use colors to identify the different echo intensities, the thresholds and colors are not interchangeable. Airborne color radar values from the installed weather radar system must not be confused with NEXRAD radar values. In addition, NEXRAD depicts lower intensity returns than airborne weather radar. Airborne weather radar return images will not appear the same as NEXRAD return images.

Convective weather activity is known to develop rapidly, with cell growth capable of exceeding several thousand feet per minute. Airborne weather radar provides the flight crew with real-time weather avoidance information for precipitation detected within the airborne weather radar's beam. NEXRAD information is **not** real-time. It is intended to assist the flight crew with hazardous weather avoidance planning. NEXRAD images are comprised of individual radar scans arriving at a network at different rates and times, which are periodically compiled into a mosaic (the NEXRAD weather product) and transmitted via data link. Due to inherent delays in this process, it is common for the displayed NEXRAD images to be significantly older than the current weather situation, and may also differ from information the airborne weather radar presents.

Because NEXRAD operates from an extensive network of ground-based radar antennas performing 360° scans, it is capable of providing information on large-scale weather patterns such as precipitation associated with significant frontal activity from multiple radar locations. The airborne weather radar can perform up to 90° scan, but is more affected by distance and precipitation attenuation discussed earlier in this section. Other factors including curvature of the earth (particularly at map ranges greater than 150 miles), antenna tilt setting, and aircraft altitude may also cause the airborne weather radar's antenna beam to miss areas of precipitation which are detected by NEXRAD. In addition, since the airborne weather radar's beam often produces ground returns, it may be difficult to distinguish precipitation from ground returns, especially stratus rain when the aircraft is above the precipitation.

Both airborne weather radar and the NEXRAD system can detect a radar top of a storm cell. Airborne weather radar can display this information in vertical scan mode, while NEXRAD radar top information appears in the Echo Tops SiriusXM Weather Product (Refer to Section 6.1 for more information about SiriusXM Weather). Because airborne weather radar and NEXRAD use different detection thresholds, a radar top from airborne weather radar may appear 5,000 feet or more below the NEXRAD-derived Echo Top. Furthermore, radar top information provided from either source is not the actual or true top of the storm, which is only observable with the eyes in clear air and may be much higher than the radar top detected by either system.

Because airborne weather radar and NEXRAD present information using similar (but not interchangeable colors), only one radar source may be shown on a map Display Page at a time. Pilots should carefully consider information from airborne and data link weather sources, in addition to other available resources to avoid flight into hazardous weather conditions.

ANTENNA BEAM ILLUMINATION

Radar beams are much like the beam of a flashlight, in that they will illuminate targets within the beam. Just as with a flashlight, the further the beam travels, the wider it becomes and the less effective it is at illuminating targets. The certified beam width contains 90% of the energy of the radar signal, with the strongest part of the beam in the center. Pointing the center of the beam at targets to investigate provides the best returns for a particular target.

The remaining 10% of beam energy (outside the certified beam) has sufficient strength and the antenna has the sensitivity to display highly reflective targets, including additional weather and ground returns. Weather returns from this portion of the beam energy will most likely be under representative of the true intensity of the hazards, because they are so far from the center of the beam (and outside of the certified beam width). The strong reflective nature of terrain features will cause the display of ground clutter well short of where the certified beam width intersects the ground. For the 10-inch antenna this additional beam energy represents approximately four additional degrees at the top and bottom of the certified beam width of 10 degrees.

The following figure depicts the radar beam as seen from the side, with both the certified beam width and the additional beam energy illustrated. With the aircraft at 30,000 ft. AGL and a radar tilt angle of zero degrees, ground clutter may be observed starting at approximately 30 NM. The cell located 20 NM from own ship would be over-scanned by the beam, and as a result would not be represented on the radar display. The cell located 80 NM from own ship displays radar tops of 22,000 ft. AGL which is relatively close to the beam center, so this cell would be represented on the display. However, utilizing a lower radar tilt angle would better depict the precipitation intensities of this cell. The cell located at approximately 190 NM displays radar tops of 28,000 ft. AGL, while the center of the beam is at about 65,500 ft. AGL (due to the Earth's curvature at that distance). While this particular cell may appear on the display due to being within the certified beam width, it would most likely be under-represented due to being so distant from the beam center. The radar tilt angle would need to be adjusted downwards to properly explore this cell's precipitation intensity.

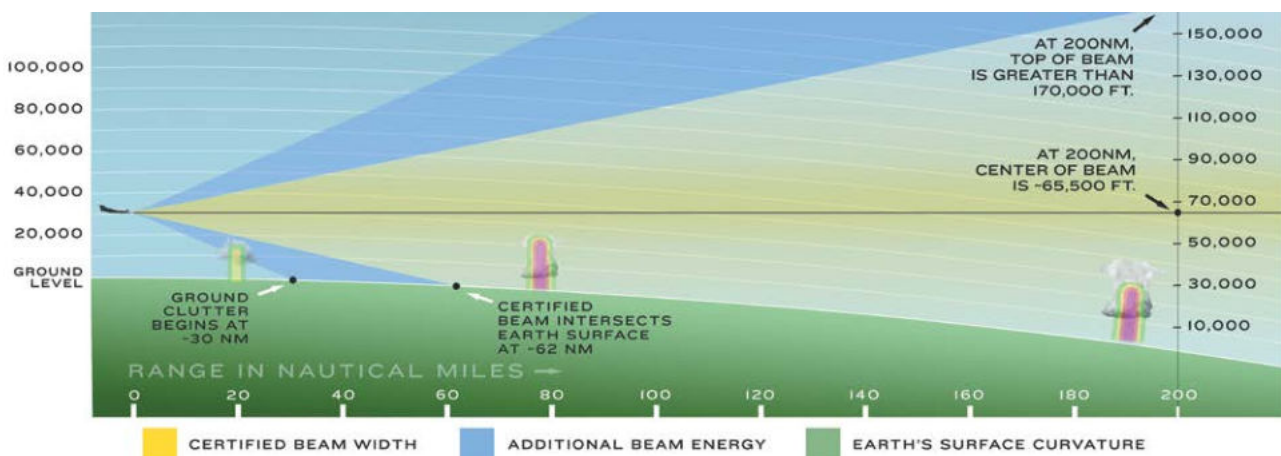


Figure 6-60 Radar Beam in Relation to the Curvature of the Earth from a 10 inch Antenna

RADAR SIGNAL ATTENUATION

The phenomenon of radar signal attenuation affects the operation of weather radar. When the radar signal is transmitted, it is progressively absorbed and scattered, making the signal weaker. This weakening, or attenuation, is caused by two primary sources, distance and precipitation.

Distance attenuation occurs due to the fact the radar energy leaving the antenna is inversely proportional to the square of the distance. The reflected radar energy from a target 40 miles away that fills the radar beam is one fourth the energy reflected from an equivalent target 20 miles away. This would appear to the operator the storm is gaining intensity as the aircraft gets closer. Internal signal processing within the equipped weather radar system compensates for much of this distance attenuation.

Attenuation due to precipitation is not as predictable as distance attenuation. It is also more intense. As the radar signal passes through moisture, a portion of the radar energy is reflected back to the antenna. However, much of the energy is absorbed. If precipitation is very heavy, or covers a large area, the signal may not reach completely through the area of precipitation. The weather radar system cannot distinguish between an attenuated signal and an area of no precipitation. If the signal has been fully attenuated, the radar displays a radar shadow. This appears as an end to the precipitation when, in fact, the heavy rain may extend much further. A cell containing heavy precipitation may block another cell located behind the first, preventing it from being displayed on the radar. Never fly into these shadowed areas and never assume that all of the heavy precipitation is being displayed unless another cell or a ground target can be seen beyond the heavy cell. The WATCH[®] feature of the installed weather radar system can help to identify these shadowed areas. Areas in question appear as shadowed or gray on the radar display. Proper use of the antenna tilt control can also help detect radar shadows.

Attenuation can also be due to poor maintenance or degradation of the radome. Even the smallest amount of wear and scratching, pitting, and pinholes on the radome surface can cause damage and system inefficiency.

RADAR SIGNAL REFLECTIVITY

PRECIPITATION

Precipitation or objects more dense than water, such as the surface of the earth or solid structures, are detected by the weather radar. The weather radar does not detect clouds, thunderstorms, or turbulence directly. It detects precipitation associated with clouds, thunderstorms, and turbulence. The best radar signal reflectors are raindrops, wet snow, or wet hail. The larger the raindrop, the better the reflectivity. The size of the precipitation droplet is the most important factor in radar reflectivity. Because large drops in a small concentrated area are characteristic of a severe thunderstorm, the radar displays the storm as a strong return. Ice crystals, dry snow, and dry hail have low levels of reflectivity as shown in the illustration, and often are not displayed by the radar. Additionally, a cloud that contains only small raindrops, such as fog or drizzle, does not reflect enough radar energy to produce a measurable target return.

- SYSTEM OVERVIEW
- FLIGHT INSTRUMENTS
- EIS
- AUDIO PANEL & CNS
- FLIGHT MANAGEMENT
- HAZARD AVOIDANCE
- AFCS
- ADDITIONAL FEATURES
- APPENDICES
- INDEX

Reflective Levels

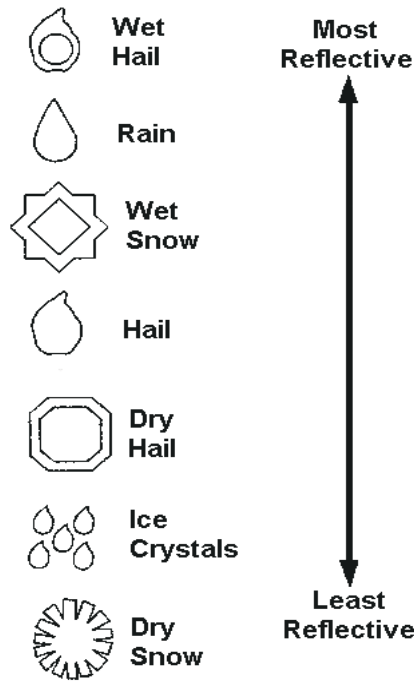


Figure 6-61 Precipitation Type and Reflectivity

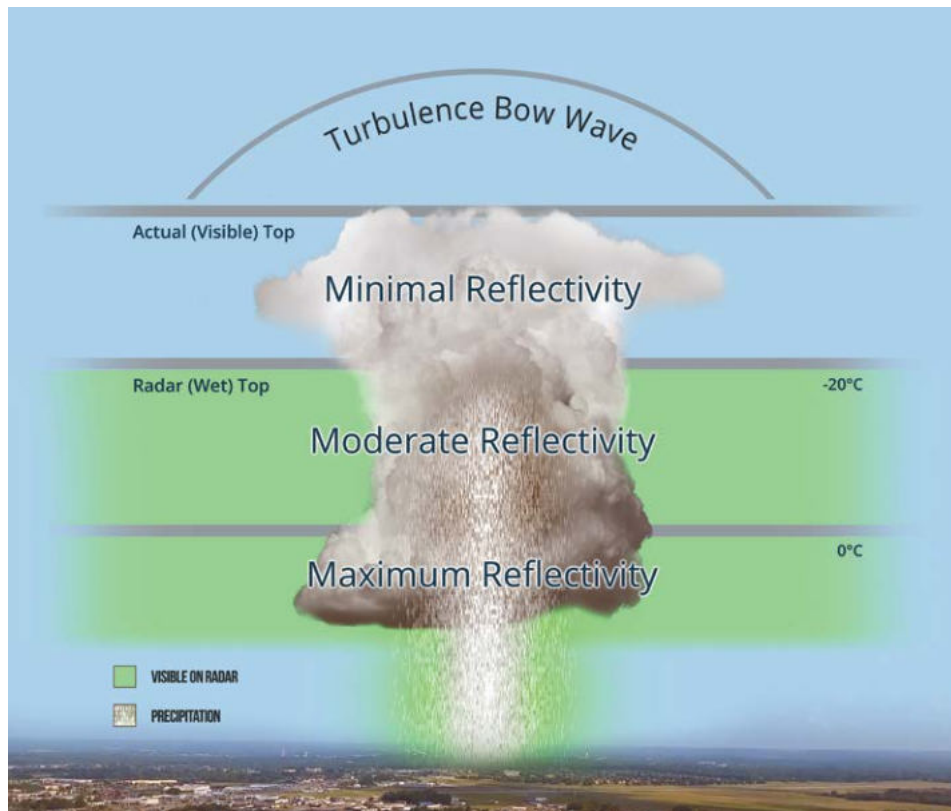


Figure 6-62 Precipitation Reflectivity by Altitude

When using the airborne weather radar to explore a more intense thunderstorm cell, it is critical to understand where radar returns can be expected to be intense, and where they can be expected to decrease to a point where no returns will be displayed. Since wet precipitation reflects radar energy far better than dry precipitation, strong radar returns can be expected at lower altitudes, with the strongest radar returns found near the melting level. At higher altitudes, precipitation becomes frozen, and reflectivity is significantly reduced. At a certain altitude within a thunderstorm cell, returns will begin to diminish. This is the “echo top” of a cell, where radar can no longer detect the frozen precipitation, but this is not the actual top of the cell, which could extend significantly further into the atmosphere. Since it is difficult to detect the actual tops of a thunderstorm cell with radar, and invisible bow waves may extend beyond visible tops, overflight of thunderstorms should never be attempted.

GROUND RETURNS

The intensity of ground target returns depends upon the angle at which the radar beam strikes the ground target (Angle of Incidence) and the reflective properties of that target. The gain can be adjusted so shorelines, rivers, lakes, and cities are well defined. Increasing the gain too much causes the display to fill in between targets, thus obscuring some landmarks.

Cities normally provide a strong return signal. While large buildings and structures provide good returns, small buildings can be shadowed from the radar beam by the taller buildings. As the aircraft approaches and shorter ranges are selected, details become more noticeable as the highly reflective regular lines and edges of the city become more defined.

Bodies of water such as lakes, rivers, and oceans are not good reflectors and normally do not provide good returns. The energy is reflected in a forward scatter angle with inadequate energy being returned. They can appear as dark areas on the display. However, rough or choppy water is a better reflector and provides stronger returns from the downwind sides of the waves.

Mountains also provide strong return signals to the antenna, but also block the areas behind. However, over mountainous terrain, the radar beam can be reflected back and forth in the mountain passes or off canyon walls, using up all or most of the radar energy. In this case, no return signal is received from this area, causing the display to show a dark spot which could indicate a pass where no pass exists.

GROUND CLUTTER SUPPRESSION (OPTIONAL)

Ground Clutter Suppression (GCS) enhances the flight crews ability to differentiate precipitation returns from ground clutter, by suppressing most, but not all, returns from ground objects. The optional feature is most effectively used by first obtaining the desired tilt and range settings, and then activating GCS. For normal surveillance of an air mass, tilt angle and range should be adjusted to obtain minimal ground clutter prior to activation of the GCS feature. This ensures the radar beam is functioning and tilt is set to observe the air above the ground clutter before that clutter is suppressed. The same holds true for investigating suspected precipitation returns. Tilt angle and range should be set to maximize the precipitation return image prior to activation of GCS to suppress clutter.

ANGLE OF INCIDENCE

The angle at which the radar beam strikes the target is called the Angle of Incidence. The figure illustrates the incident angle (A). This directly affects the detectable range, the area of illumination, and the intensity of the displayed target returns. A large incident angle gives the radar system a smaller detectable range and lower display intensity due to minimized reflection of the radar energy.

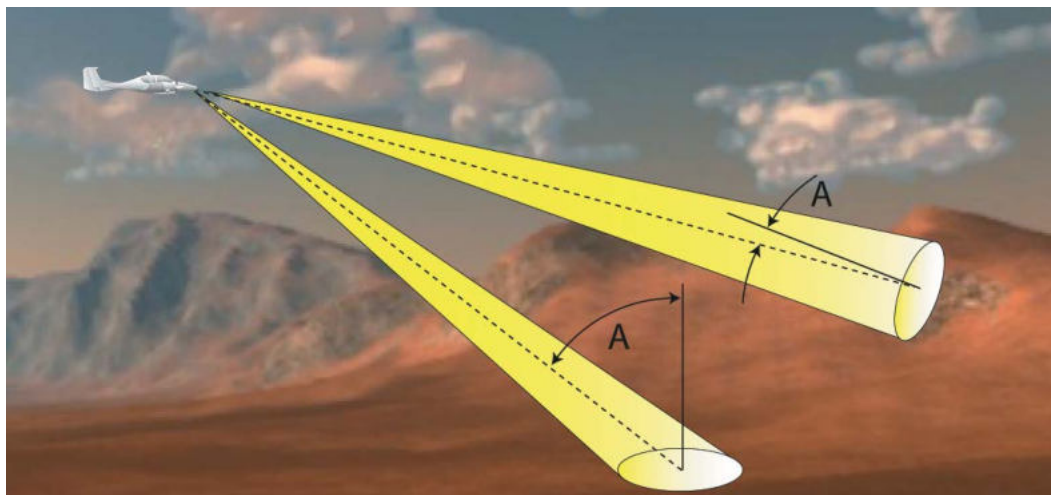


Figure 6-63 Angle of Incidence

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



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

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 12 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.

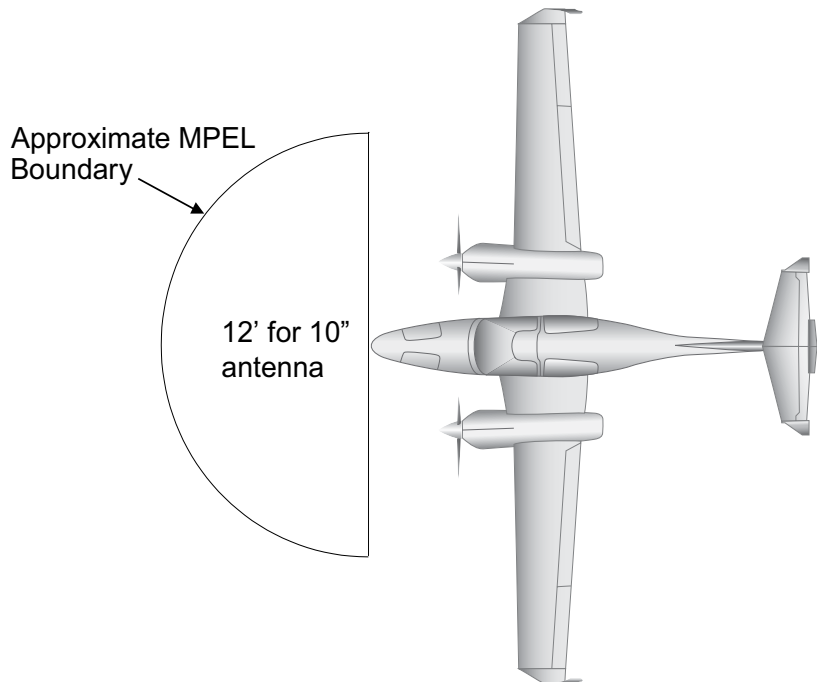


Figure 6-64 MPEL Boundary



NOTE: The previously published MPEL values are still valid and beyond the minimum safe distances as determined by AC 20-68B. For elevated safety margins, Garmin recommends minimum safe distance values that exercise further caution than those determined in AC 20-68B.

BASIC ANTENNA TILT AND RANGE SETUP

Proper antenna tilt management techniques are a major factor for the successful use of any airborne weather system. If the antenna tilt angle is set too low, the radar display will show excessive ground returns, making it difficult for the pilot to distinguish adverse weather phenomena from ground clutter. If the antenna tilt angle is set too high, the radar beam will overscan the top of the adverse weather. In either of these examples, the flight crew would be unable to adequately recognize critical weather information.

The following discussion is a simple method for setting up the weather radar antenna tilt for most situations. It is not to be considered an all encompassing setup that works in all situations, but this method does provide good overall parameters for the monitoring of intense weather threats. Correct application of tilt angle is directly dependent on the storms height and intensity and its relative distance from own ship. Adjusting the airborne weather radar tilt angle setting until minimal ground clutter is displayed is the simplest setup method for general surveillance of precipitation returns. For ranges of up to 80 NM this ground clutter should appear on the outer portion of the radar display. At ranges greater than 80 NM, the displayed ground clutter will move lower on the radar display due to the curvature of the earth. By displaying a minimal amount of ground clutter on the installed weather radar system the flight crew can ensure the system is operating and the air mass above the ground clutter is being scanned.

When a strong weather return is detected within the ground clutter it must be further investigated to determine the source of this return. Further tilt angle adjustment of the airborne radar may be required to explore this return. Adjusting the radar tilt angle upwards can reveal the radar tops of this return, while adjusting the tilt angle downwards may be necessary to investigate the strongest intensity of a particular return.

Effective airborne weather radar range management during all phases of flight should be based on the volume of air to be scanned for returns ahead of own aircraft, to allow sufficient time needed to investigate, analyze, decide, and tactically maneuver around these hazardous weather returns. Longer ranges may be used to tactically identify intense weather returns that may warrant further investigation, and closer ranges may be used during the investigation process.

There is no one tilt or range setting that works for all situations. It is best to remember that active tilt and range management is necessary to identify and then investigate returns.

NOTE: When a strong weather return is displayed on the weather radar, the tilt angle may be adjusted to explore return intensities at various altitudes to aid in determination of radar tops.

NOTE: It is the sole responsibility of the flight crew to avoid areas of hazardous weather by adequate margins.

WARNING: Overflight of thunderstorms should not be considered safe, as extreme turbulence may exist significantly above observed returns.

MANAGING TILT ANGLE AND RANGE

There are many factors to be considered in order to become proficient at using airborne weather radar in all situations. The following setup provides a good starting point for the practical application of radar tilt management.

Radar tilt management can easily be remembered by use of the 1-10-1000 rule. The summary of this rule is the fact that when the flight crew changes the radar tilt angle by 1 degree the resulting change will displace the center of the beam 1000 feet vertically at a range of 10 nautical miles. Applying the 1-10-1000 rule to various distances provides the flight crew with the ability to determine how much a 1-degree change in tilt will move the beam vertically. The radar tilt angle is capable of being adjusted in one-quarter degree increments, allowing for greater accuracy in the placement of the beam center at desired altitudes.

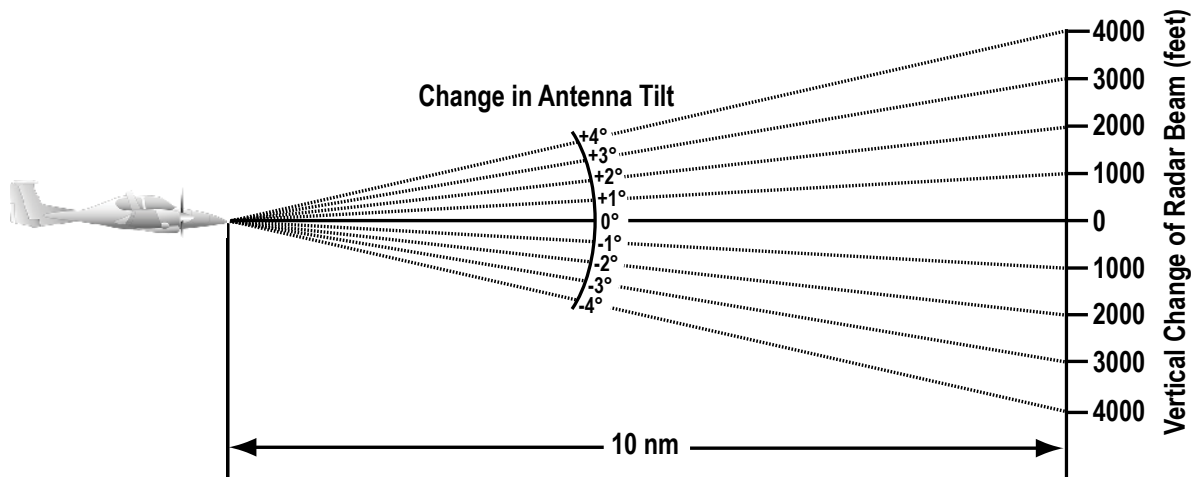


Figure 6-65 Vertical Change in Radar Beam per Nautical Mile

The 10-inch antenna has a certified beam width of 10 degrees, which means that the beam is approximately 10,000 feet in height (and width) at 10 NM and approximately 100,000 feet in height (and width) at 100 NM.

- » At 20 NM range the beam height changes by 2,000 ft. per degree of tilt change.
- » At 40 NM range the beam height changes by 4,000 ft. per degree of tilt change.
- » At 100 NM range the beam height changes by 10,000 ft. per degree of tilt change.

Additionally, setting the tilt to UP 4.00 degrees places the bottom of the certified beam at the same altitude as the aircraft, which is a technique used to determine whether radar tops reach your current altitude.

Phase of Flight	Tilt Angle	Range Setting	Notes
Taxi	Up 7.50° to 10.00°	20 NM	Activate weather mode when clear of ramp area.
Takeoff / Initial Climb	Up 7.50° to 10.00° Altitude Compensated Tilt On	40 - 60 NM	If precipitation is observed in the departure path, gain can be reduced to aid in identification of intense returns.
10,000 Ft. AGL	Up 3.00 to 5.00° Altitude Compensated Tilt On	60 - 80 NM	Range setting is dependent upon ground speed and time available for deviations.
Cruise	Tilt to Minimize Clutter Altitude Compensated Tilt On	60 - 120 NM	Range setting is dependent upon ground speed and time available for deviations. Tilt angle set to show minimal ground clutter.
Descent To 10,000 FT	Tilt to Minimize Clutter Altitude Compensated Tilt On	60 - 120 NM	Range setting is dependent upon ground speed and time available for deviation.
Descent Below 10,000 FT	Up 7.50° to 10.00° Altitude Compensated Tilt On	40 - 60 NM	Range setting is dependent upon ground speed and time available for deviation. Tilt angle set to show ground clutter in outer 1/3 of radar display.
Approach	Up 7.50° to 10.00° Altitude Compensated Tilt On	20 NM	These settings allow for observation of the approach area and the missed approach holding area.

Table 6-9 Typical Tilt Settings by Phase of Flight



NOTE: Garmin recommends the user obtain instruction in the proper operation of airborne weather radar.

ALTITUDE COMPENSATED TILT (ACT)

After the pilot has identified an area of precipitation using manual antenna tilt controls, the Altitude Compensated Tilt (ACT) feature can help maintain the display of the identified precipitation during climbs or descents. ACT automatically adjusts the antenna tilt angle setting as the aircraft altitude changes. It keeps the center of the radar beam at a constant altitude at 75% of the map range.

For example, if the ACT feature is enabled and the aircraft climbs, the system compensates by adjusting the tilt downward. As the aircraft descends with ACT enabled, the system adjusts the antenna tilt upward. The system uses the ground as a reference for adjusting the antenna tilt setting with ACT enabled. The ACT feature is not typically used for an extended period during level flight.

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.



NOTE: The color white only represents turbulence on the GWX 75 when the turbulence detection option is installed.

Weather Mode Color	Intensity (in dBz)
Black	< 23 dBZ
Green	23 dBZ to < 33 dBZ
Yellow	33 dBZ to < 41 dBZ
Red	41 dBZ and greater
Magenta (Optional)	TURB- (Optional) Turbulence Detection uses the color magenta to show areas of rain or hail that may also contain turbulence

Table 6-10 Precipitation Intensity Levels (GWX-70)

Weather Mode Color	Intensity (in dBZ)
Black	< 23 dBZ
Green	23 dBZ or 24 dBZ
Green	25 dBZ or 26 dBZ
Green	27 dBZ or 28 dBZ
Green	29 dBZ or 30 dBZ
Green	31 dBZ or 32 dBZ
Yellow	33 dBZ or 34 dBZ
Yellow	35 dBZ or 36 dBZ
Yellow	37 dBZ or 38 dBZ
Yellow	39 dBZ or 40 dBZ
Red	41 dBZ or 42 dBZ
Red	43 dBZ or 44 dBZ
Red	45 dBZ or 46 dBZ
Red	47 dBZ or 48 dBZ
Magenta	49 dBZ to 50 dBZ
Magenta	51 dBZ to 53 dBZ
Magenta	> 54 dBZ
White	TURB- Turbulence Detection uses the color white to show areas of rain or hail that may also contain turbulence

Table 6-11 Precipitation Intensity Levels (GWX-75)

In addition, when the optional Turbulence Detection feature is enabled, the system uses the color Magenta (GWX-70) or white (GWX-75) to show areas of rain or hail which likely contain turbulence.

THUNDERSTORMS

Updrafts and downdrafts in thunderstorms carry water through the cloud. The more severe the drafts, the greater the number and size of the precipitation droplets. With this in mind, the following interpretations can be made from what is displayed on the weather radar. Avoid these areas by an extra wide margin.

- Areas that show steep color gradients (intense color changes) over thin bands or short distances suggest irregular rainfall rate, hail, and severe turbulence. Vertical scanning and antenna tilt management may be necessary in order to assist in identifying areas of maximum intensity.
- In areas where the displayed weather return intensity is strong (indicating high precipitation rates), the associated turbulence should be considered severe.
- Areas of radar shadowing which can result from an attenuated (weakened) signal from a nearby storm, hiding a larger and more dangerous storm which may exist in the apparently benign area directly behind the nearby return.

Along squall lines (multiple cells or clusters of cells in a line) individual cells may be in different stages of development. Areas between closely spaced, intense 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.

SYSTEM OVERVIEW

FLIGHT INSTRUMENTS

EIS

AUDIO PANEL & CNS

FLIGHT MANAGEMENT

HAZARD AVOIDANCE

AFCS

ADDITIONAL FEATURES

APPENDICES

INDEX

SYSTEM OVERVIEW

FLIGHT INSTRUMENTS

EIS

AUDIO PANEL & CNS

FLIGHT MANAGEMENT

HAZARD AVOIDANCE

AFCS

ADDITIONAL FEATURES

APPENDICES

INDEX

Irregularities in the target return may also indicate turbulence, appearing as hooks, fingers, or scalloped edges. These irregularities may be present in green areas in the absence of a steep color gradient return and should be treated as highly dangerous areas. These areas of irregularity should be avoided.

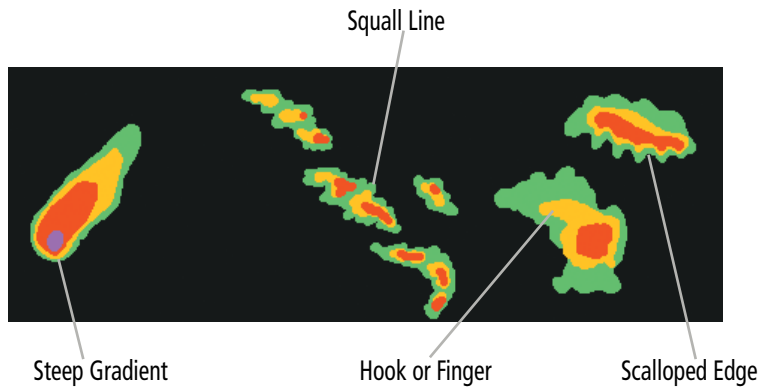


Figure 6-66 Cell Irregularities

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.

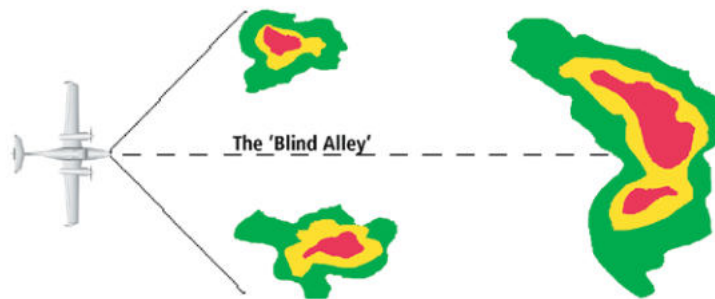
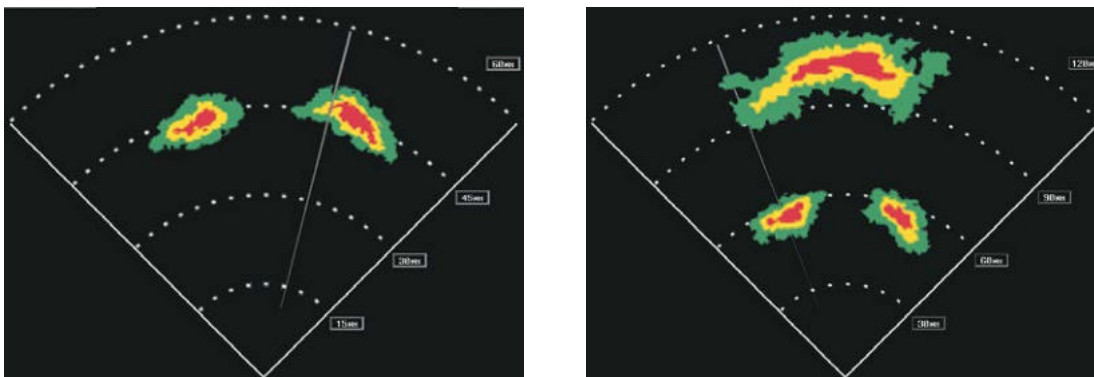


Figure 6-67 The Blind Alley - Horizontal Scan

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 6-68 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 AND RADAR TOPS

Hail results from updrafts carrying water high enough to freeze. Therefore, the higher the top of a thunderstorm, the greater the probability it contains hail. Vertically scanning the target return can give the radar top of a thunderstorm that contains hail. Radar top is the top of a storm cell as detected by radar. It is not the actual top, or true top of the storm. The actual top of a storm cell is seen with the eyes in clear air and may be much higher than the radar top. Neither the radar top nor the actual top necessarily indicate the top of the hazardous area, which may be much higher.

Hail can fall below the minimum reflectivity threshold for radar detection. It can have a film of water on its surface, making its reflective characteristics similar to a very large water droplet. Because of this film of water, and because hail stones usually are larger than water droplets, thunderstorms with large amounts of wet hail return stronger signals than those with rain. Some hail shafts are extremely narrow (100 yards or less) and make poor radar targets. In the upper regions of a cell where ice particles are dry (no liquid coating), target returns are less intense.

Hail shafts are associated with the same radar target return characteristics as tornados. U-shaped cloud edges three to seven miles across can also indicate hail. These target returns appear quite suddenly along any edge of the cell outline. They also change in intensity and shape in a matter of seconds, making vigilant monitoring essential.



WARNING: *Overflight of thunderstorms should not be considered safe, as extreme turbulence may exist significantly above observed returns.*

STRATUS PRECIPITATION

Detecting areas of low altitude, stratus precipitation while the aircraft altitude is significantly above the precipitation is difficult to accomplish with airborne weather radar. This is because as the radar beam detects the low altitude precipitation, it also receives significant ground returns which are displayed with the precipitation. Raising the antenna tilt angle may reduce the ground returns, however the radar beam is likely to overshoot the low-altitude precipitation when the aircraft is at a high altitude above the precipitation.

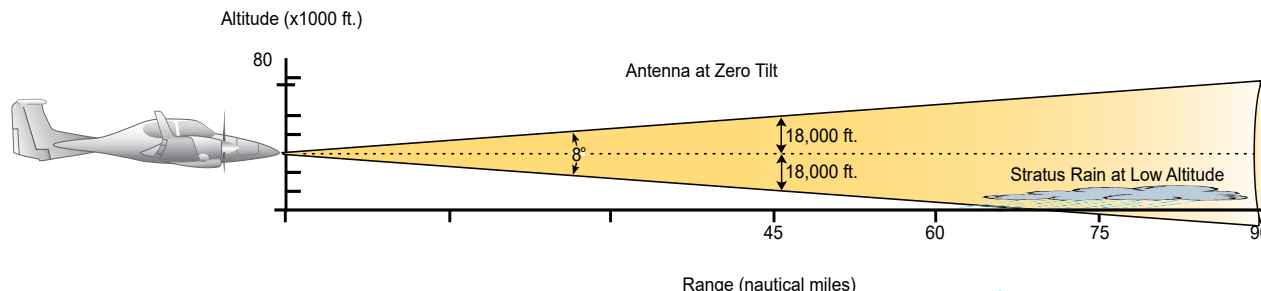


Figure 6-69 Stratus Rain Combines with Ground Returns when Aircraft is at Higher Altitudes

As the aircraft descends to a lower altitude, increasing the antenna tilt angle may help to reduce unwanted ground returns and make the display of stratus precipitation more apparent.

OPERATION IN WEATHER MODE



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



WARNING: Do not assume weather radar transmission is disabled unless all display panes displaying weather radar are set to Standby Mode, and are displaying 'STANDBY' in the center of each weather radar display.



CAUTION: In Standby mode, the antenna is parked at the center line. It is always a good idea to ensure the radar is in Standby mode before taxiing the aircraft to prevent the antenna from bouncing on the bottom stop and possibly causing damage to the radar assembly.



NOTE: Garmin recommends the user obtain instruction in the proper operation of airborne weather radar.

When the weather radar system is in the Weather or Ground Map mode, the system automatically switches to Standby mode on landing.

In Reversionary mode, the weather radar system automatically switches to Standby mode. The system remains in Standby mode until both displays are restored. In Reversionary mode, the weather radar system cannot be controlled.

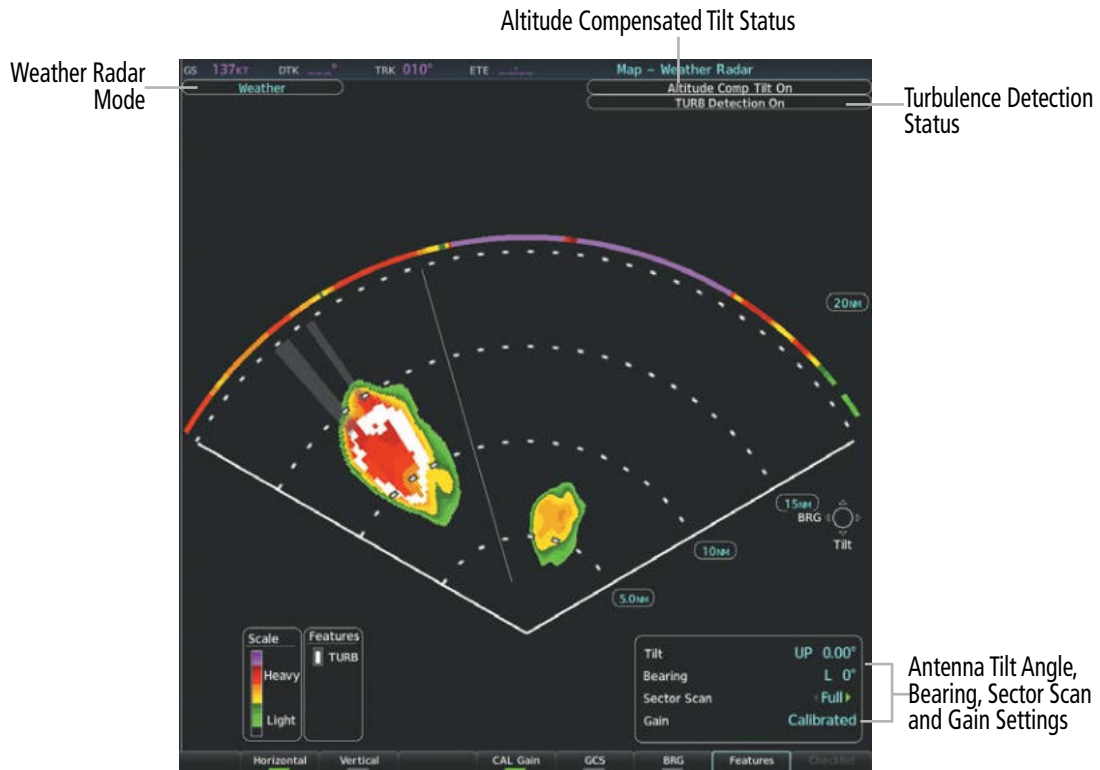


Figure 6-70 Weather Radar Page with a Horizontal Scan Selected (GWX-75)

Displaying weather on the Weather Radar Page:

- 1) Select the Weather Radar Page in the Map Page Group with the **FMS** Knob.
- 2) Select the **Mode** Softkey.
- 3) While on the ground, select the **Standby** Softkey.
 - a) Select the **Weather** Softkey. A confirmation window is displayed.
 - 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.

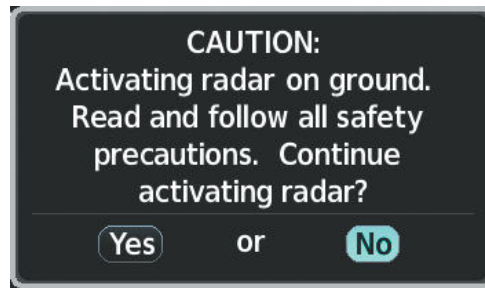


Figure 6-71 Confirming Activating Radar



NOTE: Vertical scanning of a storm cell should be done with the aircraft wings level to avoid constant adjustment of the Bearing Line.

Vertically scanning a storm cell:

- 1) While in the Horizontal Scan view, press 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) Press the **ENT** Key.
- 3) Turn the small **FMS** Knob to place the Bearing Line on the desired storm cell or other area to be vertically scanned.
- 4) Press the **Vertical** Softkey. A vertical scan of the selected area is now displayed.
- 5) The small **FMS** Knob may be used to move the scanned bearing line a few degrees right or left.
- 6) Turn the **Joystick** to adjust the range.
- 7) Press the **FMS** Knob to remove the cursor.
- 8) To select a new area to be vertically scanned, press the **Horizontal** Softkey to return to the Horizontal Scan view and repeat the previous steps.

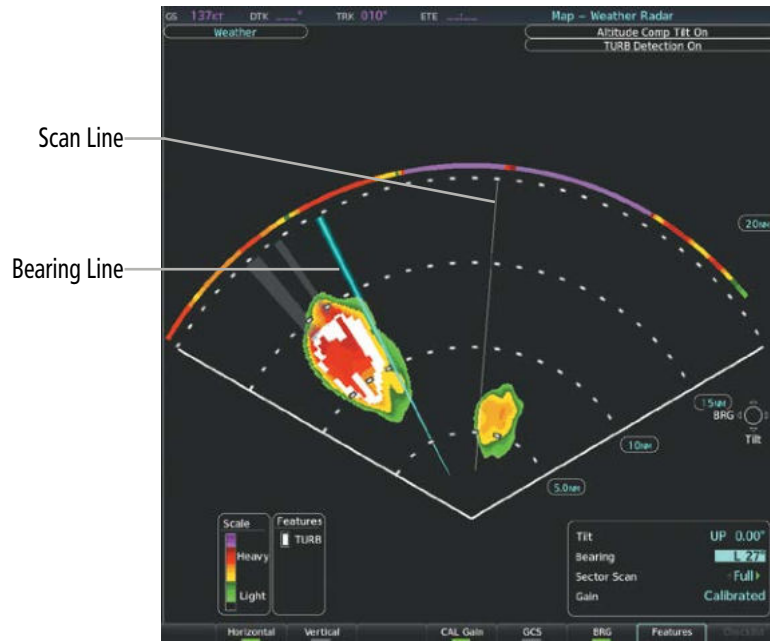


Figure 6-72 Bearing Line on Horizontal Scan (GWX-75)

The **Joystick** can also be used to adjust bearing from left to right.

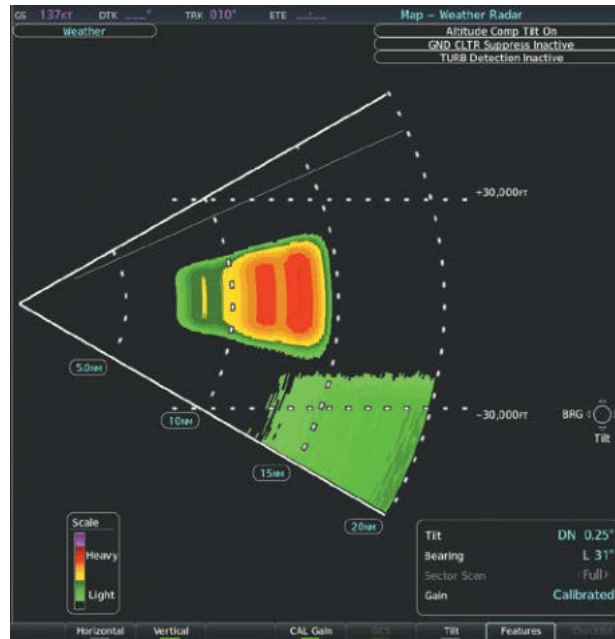


Figure 6-73 Vertical Scan Display (GWX-75)

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) Press 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.

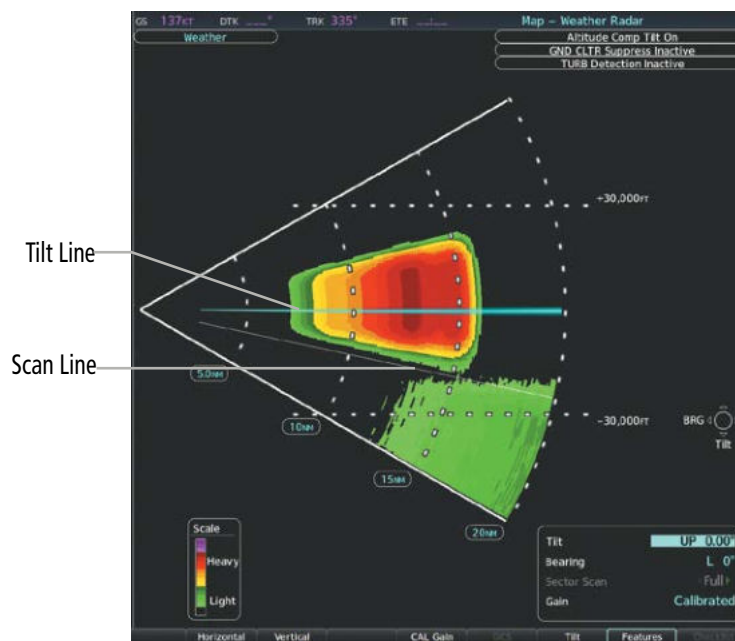


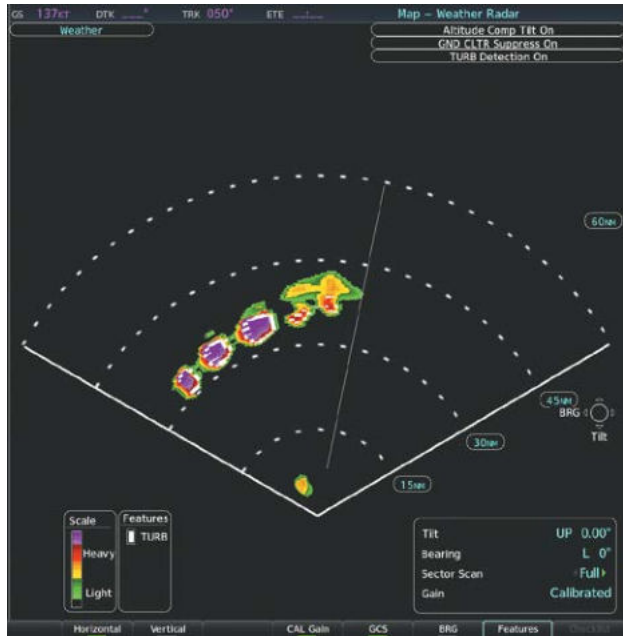
Figure 6-74 Adjusting Antenna Tilt Angle on a Vertical Scan Display (GWX-75)

Enabling/disabling manual gain adjustment:

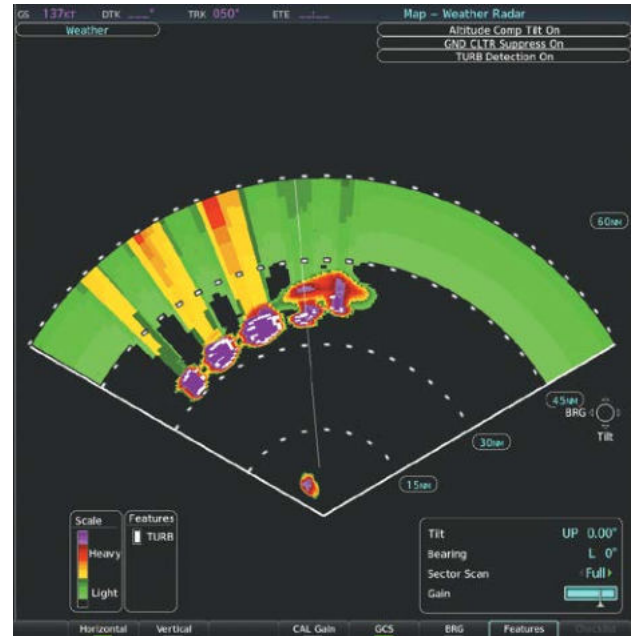
- 1) Press the **CAL Gain** Softkey to activate the cursor in the 'Gain' Field.
- 2) Turn the small **FMS** Knob to adjust the gain for the desirable level. The gain setting is visible in the 'Gain' Field as a movable horizontal bar in a flashing box. The line pointer is a reference depicting the calibrated position.
- 3) Press the **FMS** Knob to remove the cursor.
- 4) Press the **CAL Gain** Softkey again to return to the calibrated gain setting. 'Calibrated' is displayed in the 'Gain' Field.



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.



Calibrated Gain Setting



Manual Gain Set Greater than Calibrated Gain Setting

Figure 6-75 Gain Calibration (GWX-75)

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.
- 2) Press the **ENT** Key.
- 3) 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.
- 4) Turn the large **FMS** Knob to place the cursor in the 'Sector Scan' Field.
- 5) Turn the small **FMS** Knob to highlight the desired scan. Selecting 'Full' enables a 120° scan.
- 6) If desired, readjust the Bearing Line as discussed previously to change the center of the Sector Scan.
- 7) Press the **BRG** Softkey again to remove the Bearing Line and cursor. The bearing reference is reset to 0°.

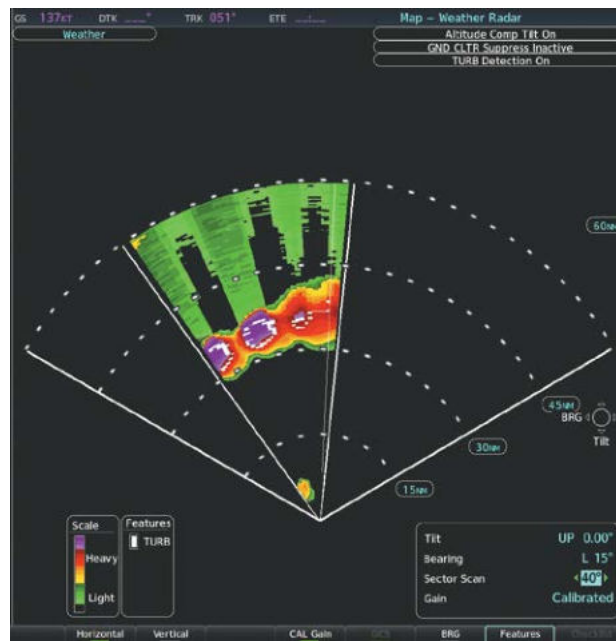


Figure 6-76 40° Sector Scan (GWX-75)

TURBULENCE DETECTION

The optional Turbulence Detection feature, available with the GWX 70/75, identifies areas of turbulence associated with precipitation using the color magenta (GWX 70) or white (GWX 75) during a horizontal scan. The magenta or white areas represent precipitation moving at a high rate of speed either toward or away from the radar antenna, using Doppler radar measurements. This feature cannot detect areas of Clear Air Turbulence.

The Turbulence Detection feature is only available in Weather Mode while a horizontal scan is selected. The GWX 70/75 can detect turbulence up to 40 nm in front of the aircraft. However, while the optional Turbulence Detection is enabled on the GWX 70, if the radar range is 160 nm or greater, or a vertical scan is selected, the system automatically removes turbulence information and shows a 'TURB Detection Inactive' annunciation on the 'Map - Weather Radar' Page. The GWX 75 does not share this limitation as the GWX 70, turbulence detection will be shown regardless of the range selected beyond 40 nm. If the system is missing information needed to detect turbulence, a 'TURB Detection Unavailable' annunciation appears on the "Map - Weather Radar' Page.

Enabling/Disabling Turbulence Detection during a Horizontal Scan:

- 1) Select the 'Map - Weather Radar' Page.
- 2) With the radar in weather mode, press the **Features** Softkey.
- 3) To activate or deactivate the turbulence detection feature, press the **TURB** Softkey. Turbulence detection is enabled when the softkey annunciator is green; turbulence detection is disabled when the softkey annunciator is gray. The system indicates the current turbulence detection feature status in the upper right of the 'Map - 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 Weather Attenuated Color Highlight (WATCH) during a Horizontal Scan:

- 1) Select the 'Map - Weather Radar' Page.
- 2) With the radar in weather mode, press the **Features** Softkey.
- 3) To activate or deactivate the WATCH feature, press the **WATCH** Softkey. The WATCH feature is enabled when the softkey annunciator is green; WATCH is disabled when the softkey annunciator is gray.

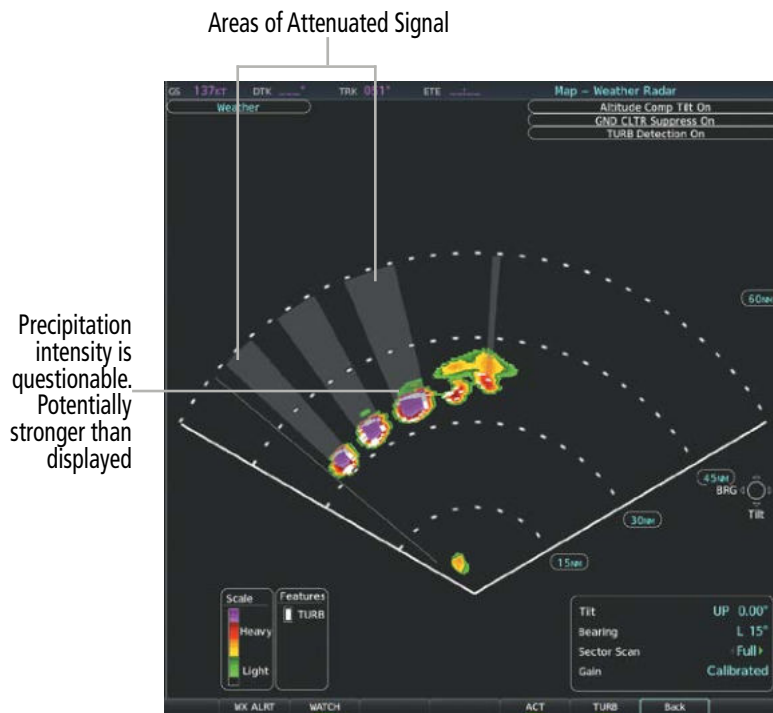


Figure 6-77 Horizontal Scan with WATCH Enabled (GWX-75)

REMOVING GROUND CLUTTER

The optional Ground Clutter Suppression (GCS) feature which is available on either the GWX 70/75, the system can distinguish between reflected ground returns (such as terrain features and buildings) and airborne weather phenomena. Ground clutter may be most pronounced when using a low antenna tilt angle, or when approaching mountainous terrain.

The Ground Clutter Suppression feature is available while the weather radar Sector Scan is set to **Full**. When Ground Clutter Suppression is enabled, the system removes echoes determined to be ground clutter from the display. While viewing a map with GCS enabled, adjustment of the map range or antenna tilt angle will momentarily cause the display of ground clutter to return.

NOTE: The GCS feature of the airborne weather radar may remove the display of low-intensity precipitation in addition to ground returns when the feature is enabled.

NOTE: The ground clutter suppression feature is optional.

Enabling/disabling Ground Clutter Suppression:

- 1) Select the 'Map - Weather Radar' Page.
- 2) Press the **Mode** Softkey.
- 3) To enable or disable the ground clutter suppression feature, press the **GCS** Softkey. Ground clutter suppression is enabled when the softkey annunciator is green; ground clutter suppression is disabled when the annunciator is gray.

WEATHER ALERT BANDS AND PFD 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 $\pm 10^\circ$ 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 from being displayed on the PFD, deselect the **WX ALRT** Softkey.

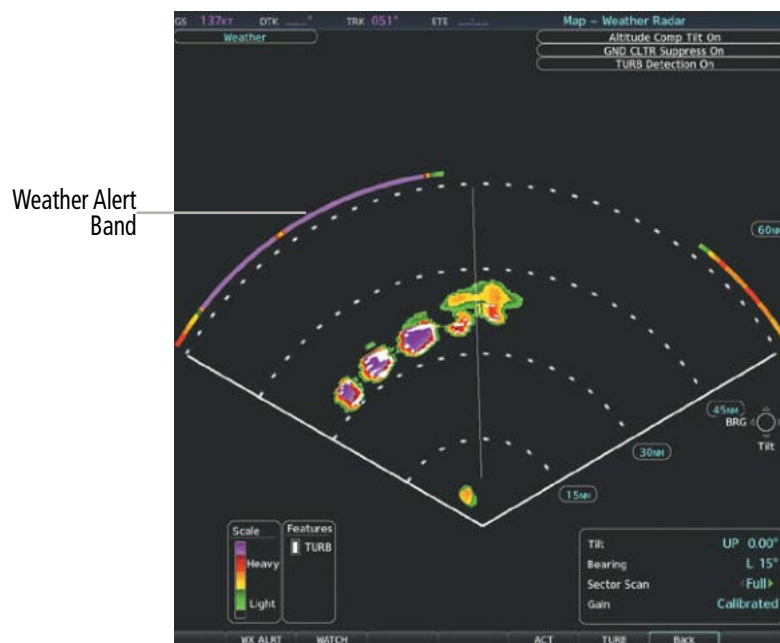


Figure 6-78 Weather Alert Bands on the 'Map - Weather Radar' Page (GWX-75)

The pilot can enable or disable the Weather Alert Bands and the Weather Alerts which appear in the Alerts Window on the PFD, press the **WX ALRT** Softkey.

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.

Enabling/disabling the Weather Alerts Bands and Alerts Window Message on the PFD.

- 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) Press the **Features** Softkey.
- 6) Press the **WX ALRT** Softkey to enable/disable the Weather Alert Bands and 'Alerts' Window message for severe weather head.
- 7) Press the **Back** Softkey three times to return to the top-level softkeys.

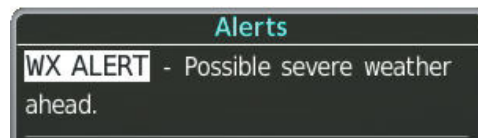


Figure 6-79 Weather Alert on PFD

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 to 2 dB
Cyan	3 dB to < 13 dB
Yellow	13 dB to less than 21 dB
Magenta	21 dB to less than 29 dB
Blue	29 dB and greater

Table 6-12 Ground Target Return Intensity Levels

Operation in Ground Map Mode:

- 1) Press the **Mode** Softkey.
- 2) Press the **Ground** Softkey to place the radar in Ground Map mode.
- 3) Press 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

NOTE: The NEXRAD weather product cannot be displayed simultaneously on the 'Map - Navigation Map' Page with weather radar information.

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 'Map - Navigation Map' Page. The airborne weather radar is also available on the HSI Map (GWX 70/75), with independent weather radar controls on the PFD, allowing for different settings and modes for each display. The radar range increases or decreases automatically as the map range increases or decreases.

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 70/75 allow for either horizontal or vertical scan to be selected on the 'Map - Weather Radar' Page, and shows a horizontal scan on the navigation maps with the weather radar overlay.

The pilot may enable airborne weather radar information with other map overlays on navigation maps, such as traffic, absolute terrain information, and aviation data. However, relative terrain and data link weather radar (such as NEXRAD) cannot be enabled simultaneously with airborne weather radar information on the same navigation map. If relative terrain or data link radar is enabled, the system automatically disables the airborne weather radar overlay for the selected map.



NOTE: When viewing airborne weather radar information overlay on the 'Map - Navigation Map' Page, selecting a Heading Up navigation map orientation may be desired, since it is identical to the orientation on the 'Map - Weather Radar' Page.

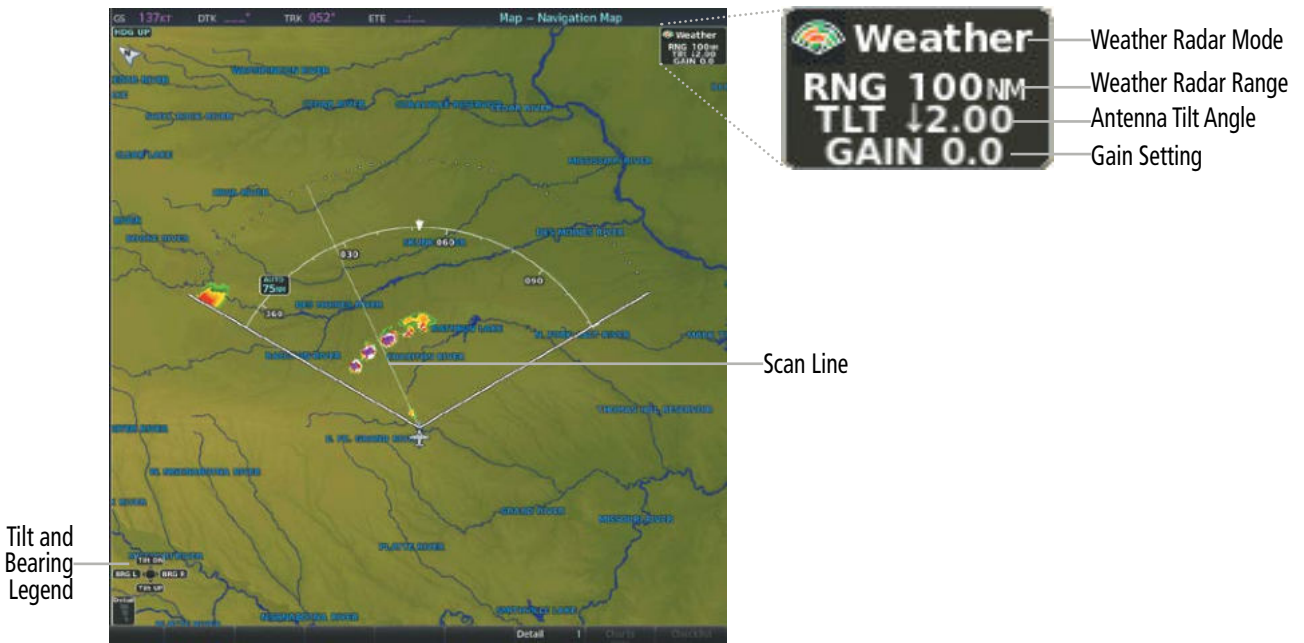


Figure 6-80 Airborne Weather Radar Overlay on the 'Map - Navigation Map' Page

Enabling/disabling Airborne Weather Radar Overlay on the 'Map - 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 'Map - 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 'Map - 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 'Map - Navigation Map' Page, system synchronizes the same range to the 'Map - Weather Radar' Page.

The radar bearing is adjustable in one degree increments on the 'Map - Navigation Map' Page using the **Joystick** when the overlay is enabled. The bearing line appears on the 'Map - 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 'Map - 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 'Map - Navigation Map' Page:

- 1) With the weather radar overlay enabled, push the **Joystick** twice. The bearing and tilt legend is displayed.
- 2) Move the **Joystick** up to adjust the antenna tilt angle downward, or move the **Joystick** down to adjust the antenna tilt angle upward.
- 3) Move the **Joystick** left or right to adjust the bearing line in the desired direction. The bearing line is displayed during and momentarily after adjustment.

If either a GWX 70 or GWX 75 is installed and the aircraft is in the air, PFD softkeys control the airborne weather radar overlay when the HSI Map is displayed. These softkeys are subdued if the aircraft is on the ground. The pilot can select a weather radar mode for the 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 the PFD. Both the GWX 70 and GWX 75 weather radars perform multiple scans as necessary to accommodate displays of weather radar data among the PFD and MFD.

When the airborne weather radar overlay is enabled on the HSI Map, a weather radar information box appears on the right side of this map. It indicates the selected radar mode, radar range, antenna tilt angle, and gain setting. When increasing or decreasing the HSI Map range the corresponding airborne weather radar range overlay will be the same as the HSI Map range, in most cases. However, a few instances do exist where the selected airborne weather radar overlay range does not match the current displayed HSI Map range. For example, if 25 nm is selected for the HSI Map range, the airborne weather radar range will be automatically selected to 40 nm, but only 25 nm of radar data will be displayed.



NOTE: *The aircraft must be in the air in order for HSI Map airborne weather radar softkeys to become available.*

Controlling of weather radar information on the HSI Map (GWX-70/75):

- 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**.
 - 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 **WX Alert** Softkey to enable/disable the display of Weather Alerts.
- 9) Press the **ACT** Softkey to enable/disable the Altitude Compensated Tilt feature.
- 10) Press the **GCS** Softkey to enable/disable the optional Ground Clutter Suppression feature.
- 11) Press the **TURB** Softkey to enable/disable the optional Turbulence Detection feature.
- 12) When finished adjusting the HSI Map display of the airborne weather radar, press the **Back** Softkey.

The airborne weather radar overlay uses the same colors as those shown on the ‘Map - 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 ‘Map - 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.



Figure 6-81 HSI Map with Airborne Weather Radar Overlay and Softkeys

SYSTEM STATUS

The system displays the radar mode annunciation in the upper left corner of the 'Map - Weather Radar' Page. Additional information may be displayed in the center of the 'Map - 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.

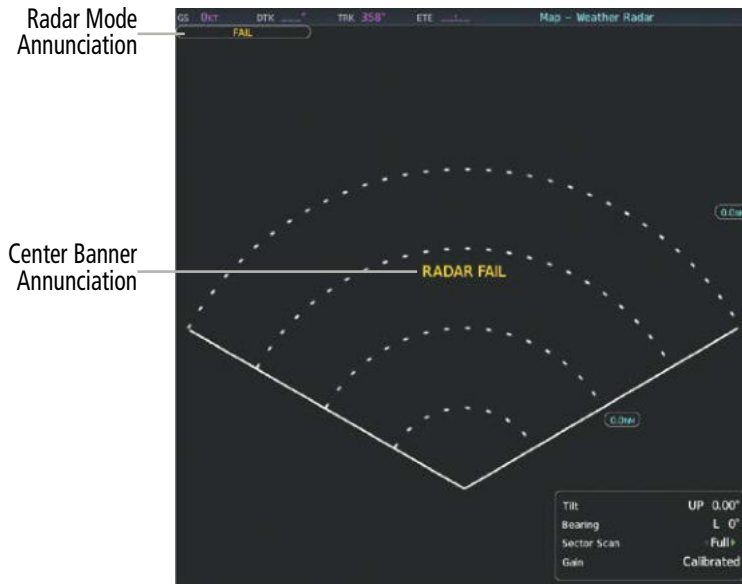


Figure 6-82 Radar System Status Indications on 'Map - Weather Radar' Page

Radar Mode	Radar Mode Annunciation Box	Center Banner Annunciation
Standby	Standby	STANDBY
Weather	Weather	None
Ground Mapping	Ground Mapping	None
Radar Failed ¹	FAIL	RADAR FAIL

¹ See Table 6-15 for additional failure annunciations

Table 6-13 Radar Modes on the 'Map - Weather Radar' Page

The system displays the status of the weather radar features in the upper-right corner of the 'Map - Weather Radar' Page.

Radar Feature Status	Description
STAB INOP	The radar is not receiving pitch and roll information. The antenna stabilization feature is inoperative.
ALTITUDE COMP TILT ON	The altitude-compensated tilt feature is selected on.
ALTITUDE COMP TILT OFF	The altitude-compensated tilt feature is selected off.
GND CLTR SUPPRESS ON	The ground clutter suppression feature is selected on.
GND CLTR SUPPRESS INACTIVE	The ground clutter suppression feature is enabled, but the radar is in a mode which cannot support ground clutter suppression (e.g. vertical scan or sector scan).
GND CLTR SUPPRESS UNAVAILABLE	The radar is missing data needed to suppress ground clutter.
TURB DETECTION ON	The turbulence detection feature is selected on.
TURB DETECTION INACTIV	Turbulence detection is inactive when a radar is in a mode which cannot support turbulence detection.
TURB DETECTION UNAVAILABLE	The radar is missing data needed to detect turbulence.

Table 6-14 Radar Feature Status Annunciations on the 'Map - 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 'Map - 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 6-15 Abnormal Radar Status Annunciations on the 'Map - 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 89° North latitude and south of 89° South latitude. This is due to limitations present within the Terrain database and the system's ability to process the data representing the affected areas.



NOTE: Terrain and obstacle alerting requires the Terrain-SVT option included with Garmin SVT. 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) is not installed; refer to the Flight Instruments section for more information about Garmin SVT.)
- TAWS-B

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 furthermore provides 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. 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 system. GSL altitude accuracy is affected by satellite geometry, but is not subject to variations in pressure and temperature that normally affect pressure altitude sensors. GSL altitude does not require local altimeter settings to determine MSL altitude. It is a widely-used MSL altitude source. Therefore, GSL altitude provides a highly accurate and reliable MSL altitude source to calculate terrain and obstacle alerts.

The terrain and obstacle databases used by the terrain system are referenced to MSL. Using the GPS position and GSL altitude, terrain system displays a 2-D picture of the surrounding terrain and obstacles relative to the position and altitude of the aircraft. Furthermore, for the Terrain-SVT, 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 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 system, if an alert occurs, the relative terrain colors transition to the In-Air Legend if in the On-Ground Legend was shown in order to provide the flight crew with the most information possible.

On-Ground Legend



In-Air Legend



Figure 6-83 Relative Terrain Legend

The following figure shows the relative terrain coloring for the Terrain Proximity system.

SYSTEM OVERVIEW

FLIGHT INSTRUMENTS

EIS

AUDIO PANEL & CNS

FLIGHT MANAGEMENT

HAZARD AVOIDANCE

AFCS

ADDITIONAL FEATURES

APPENDICES

INDEX

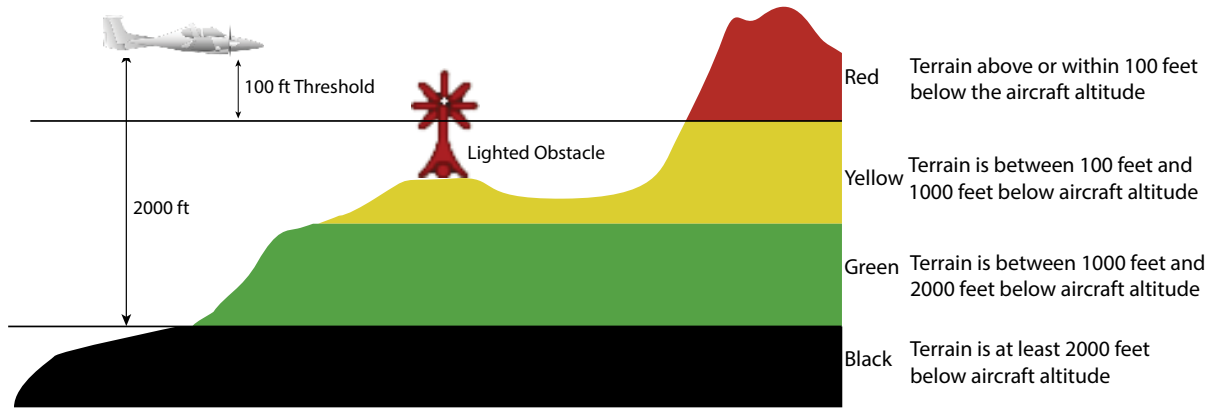


Figure 6-84 Terrain Altitude/Color Correlation for Terrain Proximity

The following figure shows relative terrain coloring for the Terrain-SVT and TAWS-B systems.

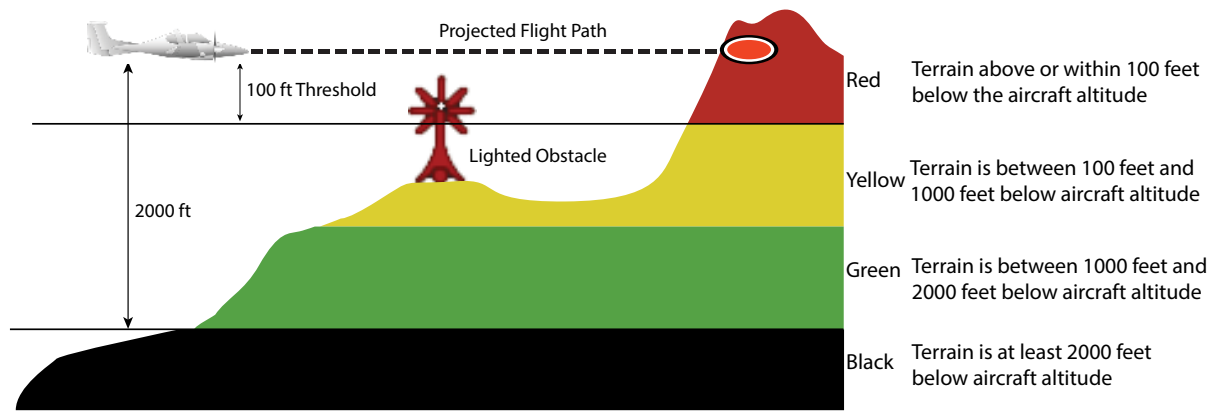


Figure 6-85 Terrain Altitude/Color Correlation for the Terrain-SVT System

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 6-16 Relative Obstacle Symbols and Colors




Wire Obstacle	Wire Obstacle Location
	Red wire obstacle is at or above the aircraft altitude
	Yellow wire obstacle is between the aircraft altitude to within 250 feet below the aircraft altitude
	White wire obstacle is more than 250 ft below the aircraft altitude

Table 6-17 Relative Wire Obstacles and Colors







Unlighted Wind Turbine Obstacle	Lighted Wind Turbine Obstacle	Wind Turbine Obstacle Location
		Red obstacle is above or within 100 ft below the aircraft altitude
		Yellow obstacle is between 100 ft and 1000 ft below the aircraft altitude
		White obstacle is more than 1000 ft below aircraft altitude

Table 6-18 Wind Turbine Obstacles and Colors

The Terrain-SVT system shows potential impacts areas for terrain and obstacles using yellow and red as shown in the following table.







Potential Impact Area Examples	Alert Type	Example Annunciation
 or 	Warning	
 or 	Caution	

Table 6-19 Terrain-SVT and TAWS-B Potential Impact Area with Annunciations

The Map - Terrain Proximity or Terrain-SVT 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 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 to cycle through a terrain option with each press. The selected mode is displayed in cyan: Off, Topo, REL. Press the **TER** Softkey as needed until 'REL' is displayed on the softkey.

Displaying relative terrain information on PFD Inset Map or HSI Map

- 1) Press the **Map/HSI** Softkey.
- 2) Press the **Rel Ter** Softkey.

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 'Map - Navigation Map' Page Setup Menu provides a means in addition to the softkey for enabling/disabling display of relative terrain, point obstacles (such as towers), and wire obstacles (such as power lines). 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.

The pilot can display relative terrain information independently of point or wire obstacle information; however, obstacles for which Terrain-SVT or TAWS-B warnings and cautions are issued are shown when terrain is selected for display and the map range is within the setting limit.

Maps besides the Terrain Proximity Page use settings based on those selected for the 'Map - 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 'Map - 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 product 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
 - Wire Obstacle – Enables/disables the display of wire obstacle data and sets maximum range at which wire obstacles are shown
- 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) Push the **FMS** Knob or press the **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 6-86 Terrain Information on the Navigation Map Page

TERRAIN PAGE

The 'Map - Terrain Proximity', 'Map - Terrain-SVT', 'Map - 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 only, this page also shows potential impact areas. If terrain or obstacles (including wire obstacles) and the projected flight path of the aircraft intersect, the display automatically adjusts to a map range if necessary to emphasize the display of the potential impact area.

Aircraft orientation on this map is always heading up unless there is no valid heading, in which case the orientation is track up. Map range is adjustable with the **Joystick** from 1 to 200 nm, as indicated by the map range rings (or 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 Page/Terrain-SVT' 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.

- SYSTEM OVERVIEW
- FLIGHT INSTRUMENTS
- EIS
- AUDIO PANEL & CNS
- FLIGHT MANAGEMENT
- HAZARD AVOIDANCE
- AFCS
- ADDITIONAL FEATURES
- APPENDICES
- INDEX

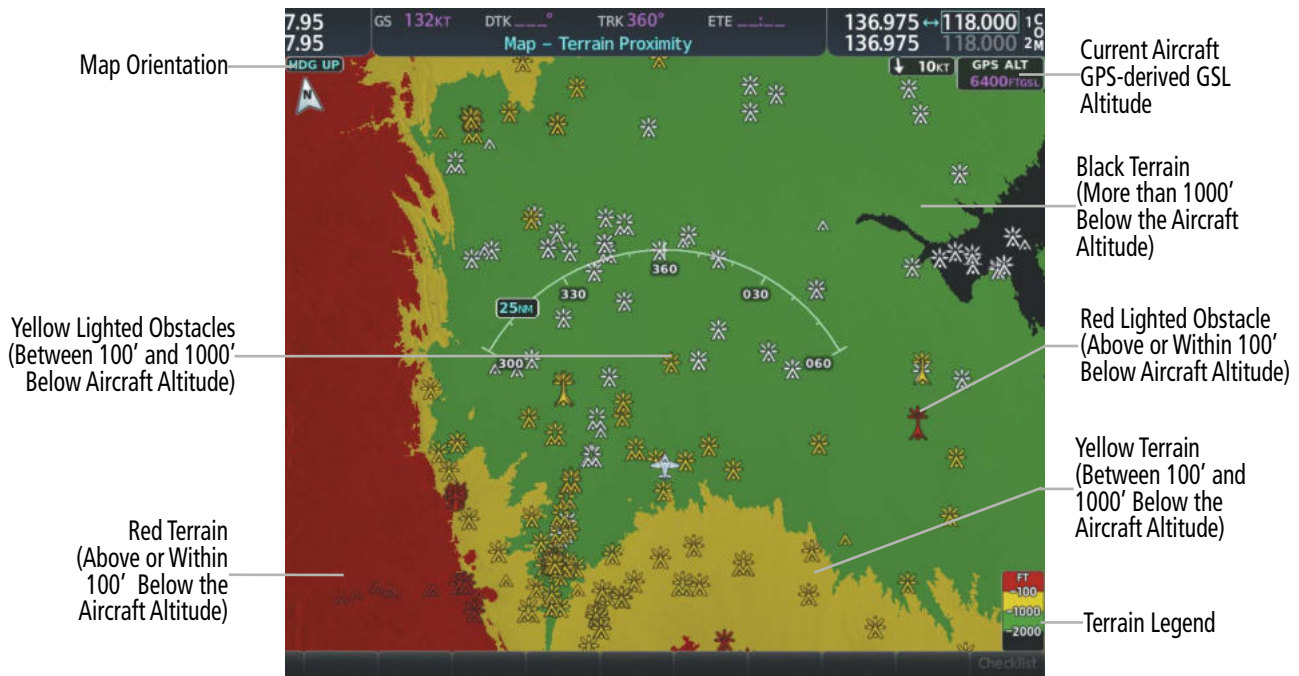


Figure 6-87 Terrain Proximity Page

WIRE OBSTACLE INFORMATION AND ALERTING

For additional safety, the terrain system incorporates Garmin’s WireAware™ wire obstacle information. For wire obstacles such as power lines present in the obstacle database, the system shows these on the maps as well as the Synthetic Vision display; see the Flight Instruments section for more information about Synthetic Vision displays of power lines. For the Terrain-SVT and TAWS-B only, this system can also issue cautions or warnings for potential impact with wire obstacles.

WireAware database information mainly includes Hazardous Obstacle Transmission (HOT) power lines which are typically high voltage transmission lines depicted on VFR Sectional charts, and are considered of special interest to fixed-wing pilots. These include power lines which may span rivers, valleys, canyons, or be in close proximity to airports/heliports.

It is important to note the obstacle database does not contain all power lines. In fact, WireAware database coverage is mostly limited to HOT power lines, such as the especially tall transmission lines and their associated support structures. It does not typically have information for the more prevalent smaller utility poles or lines, such as those found in residential areas. Furthermore, WireAware obstacle database coverage exists mainly in the United States; with limited coverage in portions of Canada and Mexico. In addition, the height of the wire obstacles is commonly estimated and should not be relied upon for maneuvering decisions.



NOTE: Wire obstacle symbols are not depicted in the Vertical Situation Display (VSD).

ALERTING DISPLAYS

Alerts are issued when flight conditions meet parameters that are set within Terrain-SVT 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 PFD and MFD. The terrain alert annunciation appears to the left of the Selected Altitude box on the PFD, and bottom left on the MFD on the Terrain-SVT Page. 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 Page)

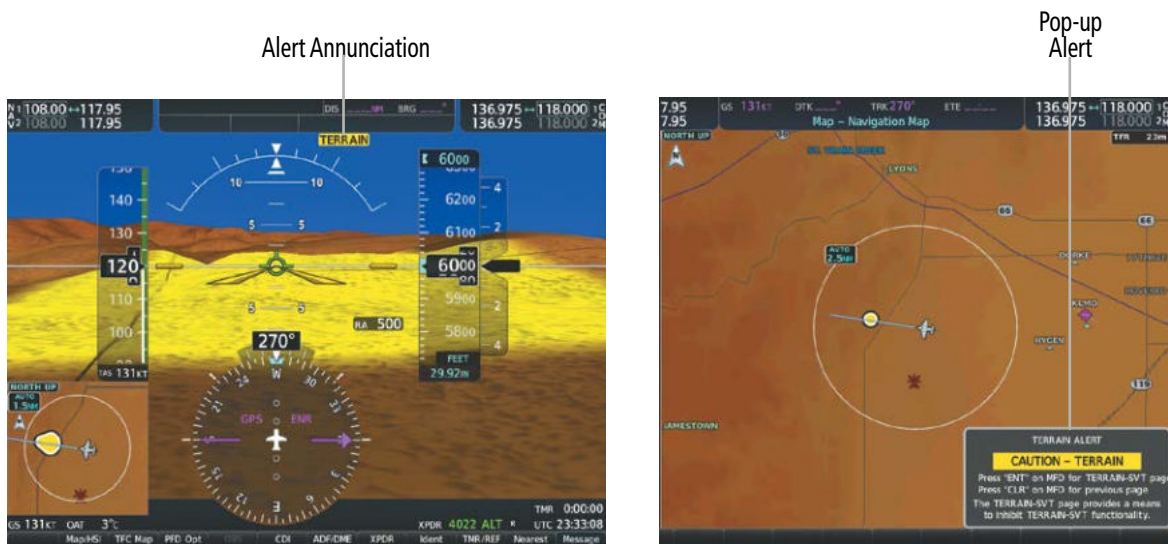


Figure 6-88 Terrain-SVT Alert Annunciations

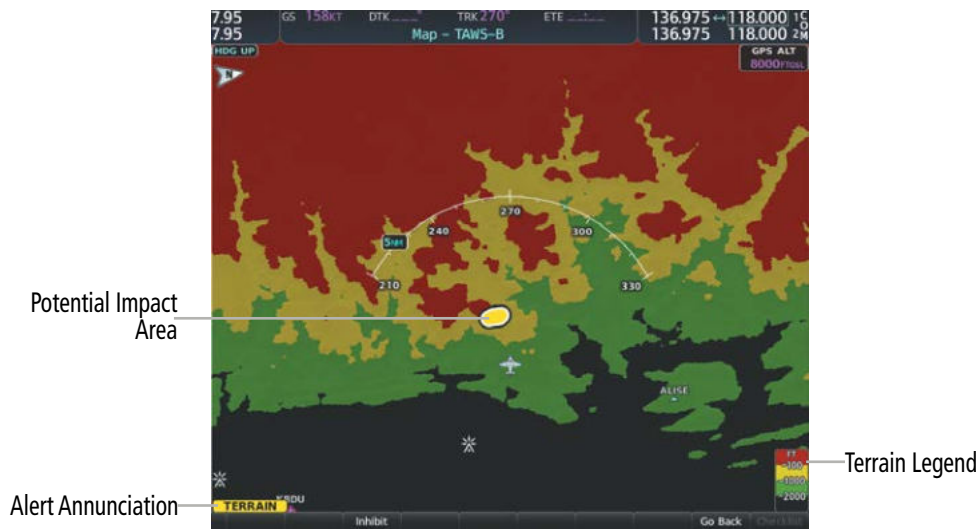


Figure 6-89 TAWS-B Page With Impact Point

The following table lists the possible Terrain-SVT alerts.

Alert Type	PFD/Terrain-SVT Annunciation	MFD Pop-Up Alert (except Terrain-SVT Page)	Voice Alert
Reduced Required Terrain Clearance Warning (RTC)	TERRAIN	WARNING – TERRAIN	“Warning; Terrain, Terrain”
Reduced Required Line Clearance (RLC)	TERRAIN	WARNING – WIRE	“Warning; Wire, Wire”
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 Line Impact Caution (ILI)	TERRAIN	CAUTION – WIRE	“Caution; Wire, Wire”
Imminent Terrain Impact Caution (ITI)	TERRAIN	CAUTION – TERRAIN	“Caution; Terrain, Terrain”
Reduced Required Line Clearance Caution (RLC)	TERRAIN	CAUTION – WIRE	“Caution; Wire, Wire”
Reduced Required Obstacle Clearance Caution (ROC)	TERRAIN	CAUTION – OBSTACLE	“Caution; Obstacle, Obstacle”
Imminent Obstacle Impact Caution (IOI)	TERRAIN	CAUTION – OBSTACLE	“Caution; Obstacle, Obstacle”

Table 6-20 Terrain-SVT Alerts Summary

- SYSTEM OVERVIEW
- FLIGHT INSTRUMENTS
- EIS
- AUDIO PANEL & CNS
- FLIGHT MANAGEMENT
- HAZARD AVOIDANCE
- AFCS
- ADDITIONAL FEATURES
- APPENDICES
- INDEX

The following table lists the TAWS-B alerts.

Alert Type	PFD/MFD ¹ 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	"Terrain, Terrain; Pull Up, Pull Up"
Imminent Line Impact Warning (ILI)	PULL UP	WIRE AHEAD – PULL-UP	"Wire Ahead; Pull Up, Pull Up"
Reduced Required Line Clearance Warning (RLC)	PULL UP	WARNING – WIRE	"Wire, Wire; Pull Up, Pull Up"
Imminent Terrain Impact Warning (ITI)	PULL UP	TERRAIN – PULL-UP	"Terrain, Terrain; Pull Up, Pull Up"
Reduced Required Obstacle Clearance Warning (ROC)	PULL UP	OBSTACLE – PULL-UP	"Obstacle, Obstacle; Pull Up, Pull Up"
Imminent Obstacle Impact Warning (IOI)	PULL UP	OBSTACLE – PULL-UP	"Obstacle, Obstacle; Pull Up, Pull Up"
Reduced Required Terrain Clearance Caution (RTC)	TERRAIN	CAUTION – TERRAIN	"Caution, Terrain; Caution, Terrain"
Imminent Terrain Impact Caution (ITI)	TERRAIN	CAUTION – TERRAIN	"Caution, Terrain; Caution, Terrain"
Required Reduced Line Clearance Impact Caution (RLC)	TERRAIN	CAUTION – WIRE	"Caution, Wire; Caution, Wire"
Imminent Line Clearance Impact Caution (ILI)	TERRAIN	WIRE AHEAD	"Wire Ahead; Wire Ahead"
Reduced Required Obstacle Clearance Caution (ROC)	TERRAIN	CAUTION – TERRAIN	"Caution, Obstacle; Caution, Obstacle"
Imminent Obstacle Impact Caution (IOI)	TERRAIN	CAUTION – OBSTACLE	"Caution, Obstacle; Caution, Obstacle"
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	DONT SINK	"Don't Sink"

¹ Annunciation is displayed on the MFD when terrain display is enabled.

Table 6-21 TAWS-B Alerts Summary

- SYSTEM OVERVIEW
- FLIGHT INSTRUMENTS
- EIS
- AUDIO PANEL & CNS
- FLIGHT MANAGEMENT
- HAZARD AVOIDANCE
- AFCS
- ADDITIONAL FEATURES
- APPENDICES
- INDEX

FORWARD LOOKING TERRAIN AVOIDANCE

The Forward Looking Terrain Avoidance (FLTA) feature of Terrain-SVT and 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).

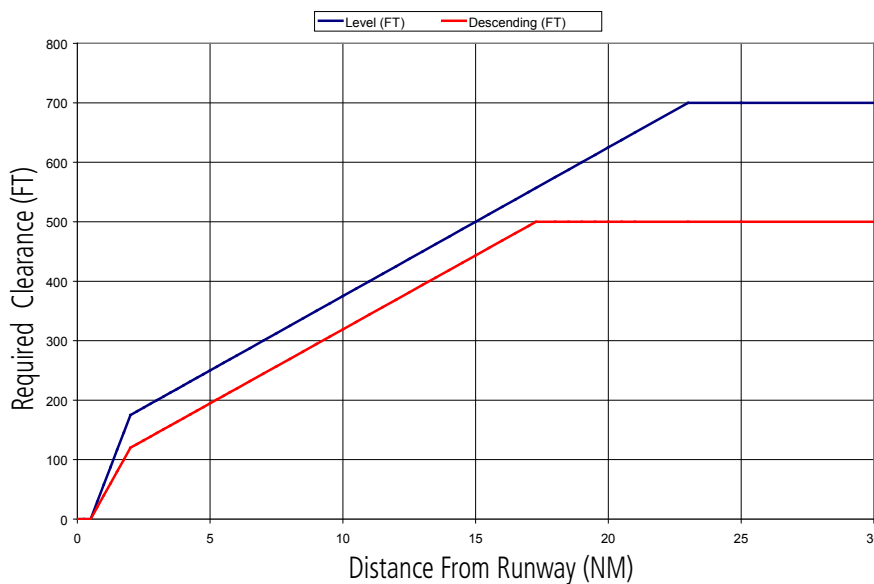


Figure 6-90 FLTA Alert Minimum Terrain and Obstacle Clearance Values

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 PFD and in the MFD for maps displaying relative terrain



Figure 6-91 Alerting is Inhibited when Annunciation is displayed

SYSTEM STATUS

TERRAIN-SVT

During power-up, Terrain-SVT conducts a self-test of its visual annunciators and voice alerts. A voice alert is issued at test completion.

Terrain-SVT continually monitors several system-critical items such as database validity, hardware status, and 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 returned and the aircraft is within the database coverage area, the voice alert “Terrain System Available” is generated.

Alert Type	PFD/Terrain-SVT 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” ¹
Excessively degraded GPS signal; or Out of database coverage area	TER N/A	None	“Terrain System Not Available” ¹
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

¹ “Terrain System Available” will be heard when sufficient GPS signal is received, or Terrain database coverage area re-entered.

Table 6-22 Terrain-SVT System Status Annunciations

TAWS-B

During power-up, TAWS conducts an automatic system test of its alerting capabilities. A voice alert occurs at test completion. TAWS-B System Testing is disabled when ground speed exceeds 30 knots. TAWS terrain and obstacle alerts will not be issued while a test is in progress.

Alert Type	'TAWS' Pane Annunciation	'TAWS' Pane Center Banner Annunciation	Voice Alert
TAWS System Fail	TAWS FAIL	TAWS FAIL	"TAWS System Failure"
TAWS Not Available	TAWS N/A	NO FMS POSITION (if FMS position lost)	"TAWS Not Available"
TAWS Available	None	None	"TAWS Available"
System Test in progress	TAWS TEST	TAWS TEST	None
TAWS System Test pass	None	None	"TAWS System Test OK"
TAWS PDA/FLTA Alerting Inhibited	TAWS INH	None	None

Table 6-23 TAWS-B System Test Status Annunciations

TAWS-B ABNORMAL OPERATIONS

TAWS-B continually monitors several system-critical items such as database validity and GPS status.


If no PFD or MFD contains Terrain, Airport Terrain, and Obstacle databases (or the databases are invalid), the voice alert "TAWS System Failure" is generated along with the 'TAWS FAIL' alert annunciation.


TAWS-B requires a 3-D GPS navigation solution along with specific vertical accuracy minimums. Should the navigation solution become degraded or if the aircraft is out of the database coverage area, the annunciation 'TAWS N/A' appears on the 'TAWS' Pane and the PFDs. The voice alert "TAWS Not Available" is also generated if airborne. When the GPS signal is re-established and the aircraft is within the database coverage area, the system issues a "TAWS Available" voice alert


Alert Cause	'TAWS' Pane Annunciation(s)	TAWS Alert Types Not Available
TAWS System Test Fail; Terrain, Airport Terrain or Obstacle database unavailable or invalid on all displays; software mismatch among displays; TAWS audio fault	TAWS FAIL and TAWS FAIL	FLTA, PDA
MFD Terrain or Obstacle database unavailable or invalid. TAWS operating with PFD Terrain or Obstacle databases	TERRAIN DATABASE FAILURE	
No FMS position	TAWS N/A and NO FMS POSITION	FLTA, PDA, VCO*
Excessively degraded GPS signal, or out of database coverage area	TAWS N/A	FLTA, PDA

Table 6-24 TAWS-B Abnormal Status Alerts

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 6-25 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.

Customizing traffic display on the 'Map - 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 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/PA - Traffic Alerts and Proximity Alerts.
 - 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) Push the **FMS** Knob or **CLR** Key to return to the 'Map - Navigation Map' Page with the changed settings.

TRAFFIC MAP PAGE

The 'Map - 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 'Map - 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.

- SYSTEM OVERVIEW
- FLIGHT INSTRUMENTS
- EIS
- AUDIO PANEL & CNS
- FLIGHT MANAGEMENT
- HAZARD AVOIDANCE
- AFCS
- ADDITIONAL FEATURES
- APPENDICES
- INDEX

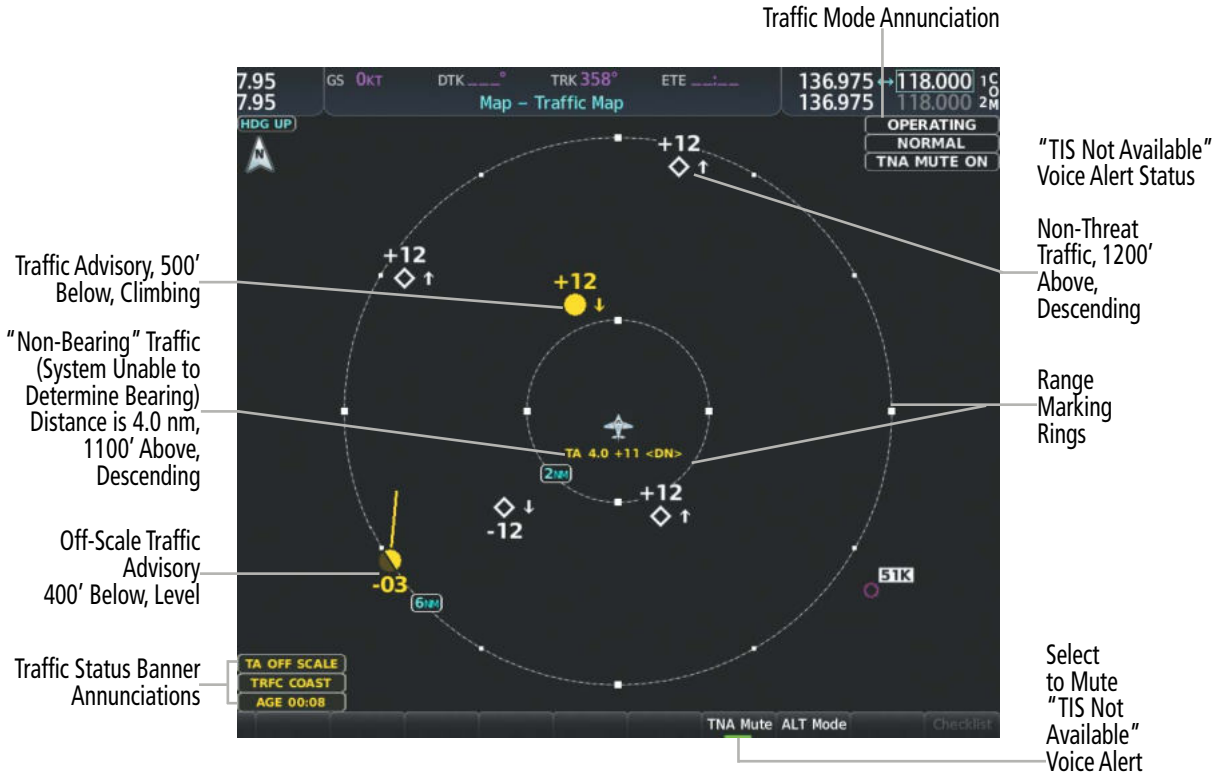


Figure 6-93 Traffic Map Page

TIS ALERTS

When the number of TAs on the 'Map - 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 6-94 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 'Map - Traffic Map' Page.

Traffic Map Page Center Banner Annunciation	Description
NO DATA	Data is not being received from the transponder ¹
DATA FAILED	Data is being received from the transponder, but a failure is detected in the data stream ¹
FAILED	The transponder has failed ¹
UNAVAILABLE	TIS is unavailable or out of range

¹ Contact a service center or Garmin dealer for corrective action

Table 6-26 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 ¹
NO DATA	TRFC FAIL		Data is not being received from the transponder ¹
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 ¹

¹ Contact a service center or Garmin dealer for corrective action

Table 6-27 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 ¹ Annunciation is removed when traffic comes within the selected display range
TA X.X ± XX ↓	System cannot determine bearing of Traffic Advisory ² 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

¹ Shown as symbol on Traffic Map Page

² Shown in center of Traffic Map Page

Table 6-28 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: Refer to the Avidyne TAS600 Series Pilot's Guide for a detailed discussion of the Avidyne TAS600 System.

The optional Garmin GTS 800 or Avidyne TAS600 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 800 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 800 TAS surveillance system actively scans the airspace within $\pm 10,000$ feet of its altitude. Under ideal conditions, the GTS 800 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 335R or GTX 345R transponder is installed with the TAS, the symbols in the following tables 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.





Traffic Symbol	Description
	Other Non-Threat Traffic
	Proximity Advisory (PA)
	Traffic Advisory (TA)
	Traffic Advisory Off Scale

Table 6-29 TAS Symbol Description




Traffic Symbol	Description
	Traffic Advisory with ADS-B directional information. Points in the direction of the intruder aircraft track.
	Proximity Advisory with ADS-B directional information. Points in the direction of the aircraft track.
	Other Non-threat traffic with ADS-B directional information. Points in the direction of the intruder aircraft track.

Table 6-30 Traffic with ADS-B Symbology (GTX 335R Transponder)













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 6-31 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.

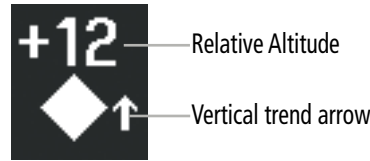


Figure 6-95 Intruder Altitude and Vertical Trend Arrow

TA ALERTING CONDITIONS (GTS 800)

The GTS 800 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 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 6-32 TA Sensitivity Level and TA Alerting Criteria

TAS ALERTS



NOTE: If an optional Avidyne TAS600 is installed, refer to the applicable Pilot’s Guide from the manufacturer for information about applicable voice alerts for the system test.

When the GTS 800 or Avidyne TAS600 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 6-33 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.
- The system displays the TA traffic on a PFD map. If a navigation map, such as the Inset Map or HSI Map was already shown on the PFD prior to a TA occurrence, the system automatically enables the traffic overlay on the map if necessary in order to show the TA. If no map was shown on the PFD prior to the TA, then the Traffic Inset Map is displayed on the PFD.
- If the bearing of TA traffic cannot be determined, a yellow text banner will be displayed in the center of the ‘Map - 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 6-96 Traffic Annunciation (PFD)

SYSTEM TEST

NOTE: If an optional Avidyne TAS600 is installed, refer to the applicable Pilot’s Guide from the manufacturer for information about applicable voice alerts for the 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 ‘Map - Traffic Map’ Page. For the GTS 800, 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.



Figure 6-97 System Test in Progress with Test Pattern

OPERATION



NOTE: The Garmin GTS 800 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.



NOTE: Refer to the Avidyne TAS600 Series Pilot's Guide for a detailed discussion of the Avidyne TAS600 system operation.

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 'Map - 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. 'TAS: OPERATING' is displayed in the Traffic mode field.
- 4) Press the **Standby** or **TAS STBY** Softkey to place the system in the Standby mode. 'TAS: 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 'Map - Traffic Map' Page.



Figure 6-98 'Map - Traffic Map' Page

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.

TRAFFIC MAP PAGE DISPLAY RANGE

The display range on the 'Map - 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 'Map - 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 (available with ADS-B)

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:

- » 'Map - Navigation Map' Page
- » 'Map - Traffic Map' Page
- » Trip Planning Page
- » Nearest Pages
- » 'FPL - Active Flight Plan' Page
- » 'Aux - Aux Video' Page

Enabling/disabling traffic information (MFD maps other than the 'Map - Traffic Map' Page):

- 1) Press the **Map Opt** Softkey.
- 2) Press the **Traffic** Softkey. Traffic is now displayed on the map.

When traffic is selected on maps other than the 'Map - 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 6-99 TAS Traffic on Navigation Map

Customizing the traffic display on the 'Map - 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) Push the **FMS** Knob or **CLR** Key to return to the 'Map - Navigation Map' Page.

The 'Map - 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 'Map - Traffic Map' Page, use settings based on those selected for the 'Map - 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 'Map - Traffic Map' Page, and presents a heading up format. 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 ‘Map - 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 ¹	FAIL	

¹ See Table 6-35 for additional failure annunciations

Table 6-34 Traffic Modes

If the traffic unit fails, an annunciation as to the cause of the failure is shown in the center of the ‘Map - 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 6-35 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. ¹ Annunciation is removed when traffic comes within the selected display range.
TA X.X ± XX ↓	System cannot determine bearing of Traffic Advisory. ² 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

¹ Shown as symbol on ‘Map - Traffic Map’ Page

² Shown in center of ‘Map - Traffic Map’ Page

Table 6-36 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.

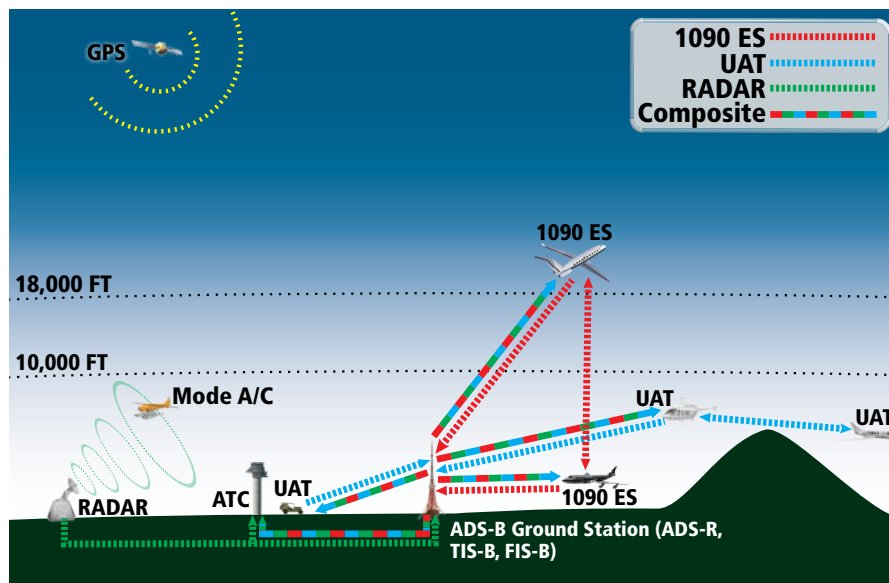


Figure 6-100 ADS-B System

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 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. 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.

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 that 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 $\pm 3,500$ feet and 15 NM of the participant, to include altitude, position, ground speed, and ground track. TIS-B broadcasts occur once every three to thirteen seconds, depending on the characteristics of the ground station providing the TIS-B service.

The following table describes the aircraft that are observed by a GTX 345R-equipped aircraft according to the level of equipment installed in the other aircraft.

Other Aircraft Equipment	Viewable by GTX 345R Equipped Aircraft
1090ES Out Equipped	Yes
UAT Receive Only Capable	No
UAT Transmit Equipped	Yes
No Transponder, No ADS-B	No
Non ADS-B Equipped, but with Mode C or S Transponder	Yes ¹

¹ Only when in ADS-B ground station coverage and when the other aircraft is in ATC radar coverage.

Table 6-37 Aircraft Available for Viewing by an ADS-B Equipped Own Aircraft

ADS-B WITH TAS

When an optional Traffic Advisory System (TAS) is also installed and operating with the UAT, the UAT receives traffic from the active traffic system and attempts to match (or “correlate”) this traffic with ADS-B traffic the UAT is tracking. When a correlation is made, only the traffic with the most accurate information is displayed to the flight crew. Any traffic that is not correlated (i.e., only detected by one system but not the other) is also displayed for the flight crew. This correlation of traffic by the UAT improves the accuracy of the traffic displayed, while reducing the occurrence of the same aircraft being displayed twice.



NOTE: In certain situations, a single aircraft may be depicted as two aircraft on the display if the system is unable to correlate the traffic. This may occur, for example, when operating on the edges of ATC radar coverage, or when using an optional active traffic system providing intermittent data. This may also occur if TIS-B traffic data does not closely match the traffic data from other sources, especially while the traffic tracked by ATC radar is turning.



NOTE: The TAS system issues alerts for traffic it is tracking using TAS alerting criteria. The ADS-B system issues alerts for traffic it is tracking using the Conflict Situational Awareness & Alerting (CSA) criteria.

Either the TAS or the UAT unit can issue a traffic alert. If both systems determine an alert is necessary, and the traffic is correlated, only the TAS-generated alert is issued. If traffic is not correlated, and both systems determine an alert is necessary, the TAS-generated alert occurs first, followed by the UAT-generated alert.

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 this equipment, the system displays a ‘TRAFFIC’ annunciation and provides a voice alert for example “Traffic! Two O’clock, Low, Two Miles.”.

The own aircraft altitude above terrain determines the sensitivity of the CSA algorithm to minimize nuisance alerts. Height Above Terrain, and Geodetic Sea Level (GSL) altitude are used to adjust the sensitivity of the CSA algorithm in accordance with the following table:

Sensitivity Level	Height Above Terrain (HAT)	GPS Phase of Flight	Own Altitude (Feet)	Look-ahead time (sec)	Vertical Threshold for Alert (feet)	Protected Volume (NM)
4	Any	Any	Any	20	850	0.20
4	Unavailable	Approach	Any	20	850	0.20
5	Any	Any	Any	25	850	0.20
5	>1000 <=2350	Any	Any	25	850	0.20
5	Unavailable	Terminal	Any	25	850	0.20
6	Unavailable or >2350	Not approach and not Terminal (including unavailable)	<=5000	30	850	0.35
7	Unavailable or >2350	Not approach and not Terminal (including unavailable)	>5000 <=10,000	40	850	0.55
8	Unavailable or >2350	Not approach and not Terminal (including unavailable)	>10,000 <=20,000	45	850	0.80
9	Unavailable or >2350	Not approach and not Terminal (including unavailable)	>20,000 <=42,000	48	850	1.10
10	Unavailable or >2350	Not approach and not Terminal (including unavailable)	> 42,000	48	1200	1.10

Table 6-38 CSA Alerting Thresholds for ADS-B Traffic

When the system detects a new Traffic Advisory (TA), the following occur:

- The system issues a single “Traffic!” voice alert, followed by additional voice information about the bearing, relative altitude, and approximate distance from the intruder that triggered the TA. 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”	“Zero miles”, “Less than one mile”, “One Mile” through “Ten Miles”, or “More than ten miles”

Table 6-39 TA Descriptive Voice Announcements

- A ‘TRAFFIC’ annunciation appears to the right of the Airspeed Indicator on the PFD, flashes for five seconds, and remains displayed until no TAs are detected in the area..
- If the PFD Inset Map or HSI Map was already displayed, the traffic is shown on the displayed map. Otherwise the Traffic Map is shown on the PFD.
- If the bearing of TA traffic cannot be determined, a yellow text banner will be displayed in the center of the Traffic Map 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 a factor.



Figure 6-101 Traffic Annunciation (PFD)



NOTE: ADS-B traffic voice alerts are suppressed when below 500 feet.

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 application 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 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 6-102 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 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 6-40 ADS-B Traffic Symbolology

OPERATION

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. 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.



Figure 6-103 'Map - Traffic Map' Page (GTS 800)

Enabling/disabling the display of ADS-B traffic:

- 1) Select the 'Map - Traffic Map' Page.
- 2) Press 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 PFD. 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.



Figure 6-104 System Test in Progress on the 'Map - Traffic Map' Page (GTS 800)

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, press the **ALT Mode** Softkey.
 - 2) Press one of the following softkeys:
 - **Above:** Displays Other Non-Threat and proximity traffic from 9000 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 9000 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 'Map - Traffic Map' Page, press 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)
 - 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.

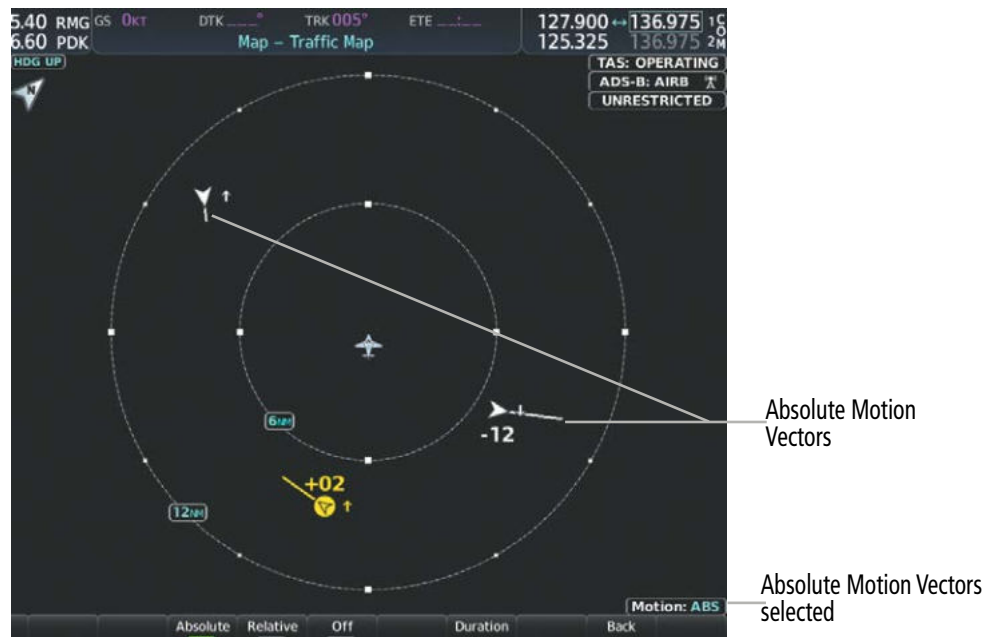


Figure 6-105 Absolute Motion Vectors Enabled on the 'Map - Traffic Map' Page (GTS 800)



Figure 6-106 Relative Motion Vectors Enabled on the 'Map - Traffic Map' Page (GTS 800)

Enabling/disabling the Motion Vector display:

- 1) Press the 'Map -Traffic Map' Page.
- 2) Press 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) Press the **Motion** Softkey.
- 3) Press the **Duration** Softkey.
- 4) Press a softkey for the desired duration (**30 SEC, 1 MIN, 2 MIN, 5 MIN**).
- 5) When finished, press the **Back** Softkey to return to the 'Map - Traffic Map' Page.

DISPLAYING ADDITIONAL TRAFFIC INFORMATION

The 'Map - 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) Push 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 'Map - 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, push the **FMS** Knob again to disable the traffic selection.

TRAFFIC MAP PAGE DISPLAY RANGE

The display range on the 'Map - 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:
 - 750 feet
 - 750 feet and 1500 feet
 - 1500 feet and 0.5 nm
 - 0.5 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 and IFR/VFR Charts. 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 'Map - 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	
ADS-B Traffic Off	ADS-B: OFF	ADS-B TRFC OFF	
ADS-B Traffic Not Available	ADS-B: N/A	ADS-B TRFC N/A	
ADS-B Failed ¹	ADS-B: FAIL	ADS-B TRFC FAIL	

¹ See Table 6-42 for additional failure annunciations

Table 6-41 ADS-B Modes



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 'Map - 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 6-42 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 ¹ . Annunciation is removed when traffic comes within the selected display range.
TA X.X ± XX ↓	System cannot determine bearing of Traffic Advisory ² . 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

¹ Shown as symbol on Traffic Map Page

² Shown in center of Traffic Map Page

Table 6-43 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.

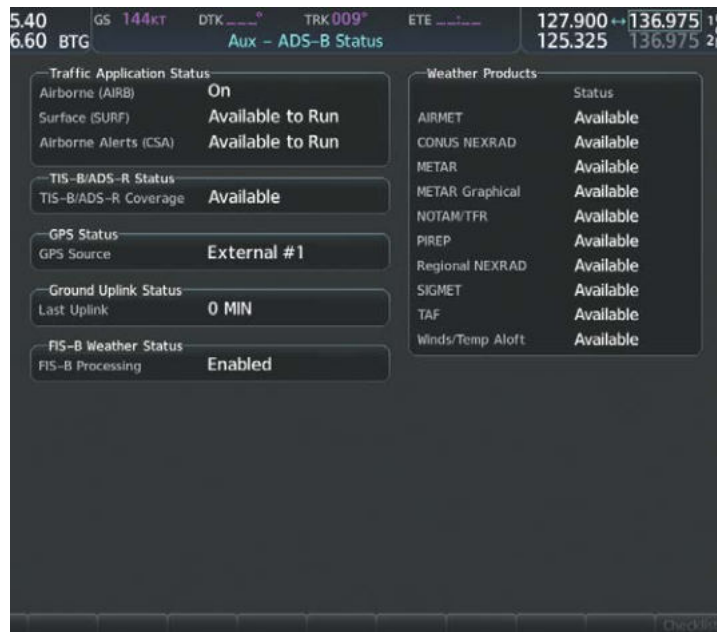


Figure 6-107 Viewing ADS-B Traffic Status on ADS-B Status Page

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 6-44 Aux-ADS-B Status Page Messages for ADS-B Traffic

The ‘Traffic Map’ Page displays a white antenna icon to indicate the successful reception of ADS-B traffic services from a ground station. A white-X over this icon indicates reception of ADS-B services is unavailable.



ADS-B Ground Station Reception Status	‘Traffic Map’ Pane Icon
Receiving ADS-B traffic services from a ground station	
Not receiving ADS-B traffic services from a ground station	

Table 6-45 ADS-B Modes