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G1000® Integrated Flight Deck
Pilot's Guide

Beechcraft G58

LIMITED WARRANTY

Within the warranty period, Garmin will, at its sole discretion, repair or replace any components that fail in normal use. Such repairs or replacement will be made at no charge to the customer for parts and/or labor incidental to the direct repair of said product. Garmin may, at its discretion with prior approval, reimburse an authorized Garmin Service Center for associated labor costs incurred for removal and replacement of the panel mount product installed in an aircraft. The customer shall be responsible for any transportation or other cost. This warranty does not apply to: (i) cosmetic damage, such as scratches, nicks and dents; (ii) consumable parts, such as batteries, unless product damage has occurred due to a defect in materials or workmanship; (iii) damage caused by accident, abuse, misuse, water, flood, fire, or other acts of nature or external causes; (iv) damage caused by service performed by anyone who is not an authorized service provider of Garmin; or (v) damage to a product that has been modified or altered without the written permission of Garmin. In addition, Garmin reserves the right to refuse warranty claims against products or services that are obtained and/or used in contravention of the laws of any country.

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WARNING: Navigation and terrain separation must NOT be predicated upon the use of the terrain avoidance feature. The terrain avoidance feature is NOT intended to be used as a primary reference for terrain avoidance and does not relieve the pilot from the responsibility of being aware of surroundings during flight. The terrain avoidance feature is only to be used as an aid for terrain avoidance. Terrain data is obtained from third party sources. Garmin is not able to independently verify the accuracy of the terrain data.

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

WARNING: The altitude calculated by G1000 GPS receivers is geometric height above Mean Sea Level and could vary significantly from the altitude displayed by pressure altimeters, such as the GDC 74A Air Data Computer, or other altimeters in aircraft. GPS altitude should never be used for vertical navigation. Always use pressure altitude displayed by the G1000 PFD or other pressure altimeters in aircraft.

WARNING: Do not use outdated database information. Databases used in the G1000 system must be updated regularly in order to ensure that the information remains current. Pilots using any outdated database do so entirely at their own risk.

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

WARNING: Traffic information shown on system displays is provided as an aid in visually acquiring traffic. Pilots must maneuver the aircraft based only upon ATC guidance or positive visual acquisition of conflicting traffic.

WARNING: Use of the Stormscope is not intended for hazardous weather penetration (thunderstorm penetration). Stormscope information, as displayed on the G1000 MFD, is to be used only for weather avoidance, not penetration.

WARNING: Do not use datalink weather products (e.g., XM WX Satellite Weather, GFDS World Wide Weather, or FIS-B) for hazardous weather penetration. Weather information provided by these products is aged by up to several minutes and may not depict actual weather conditions as they currently appear.

WARNING: NEXRAD weather data is to be used for long-range planning purposes only. Due to inherent delays in data transmission and the relative age of the data, NEXRAD weather data should not be used for short-range weather avoidance.

WARNING: For safety reasons, G1000 operational procedures must be learned on the ground.

⚠ *WARNING: The Garmin G1000, as installed in this aircraft, has a very high degree of functional integrity. However, the pilot must recognize that providing monitoring and/or self-test capability for all conceivable system failures is not practical. Although unlikely, it may be possible for erroneous operation to occur without a fault indication shown by the G1000. It is thus the responsibility of the pilot to detect such an occurrence by means of cross-checking with all redundant or correlated information available in the cockpit.*

⚠ *WARNING: 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 Garmin G1000 utilize GPS as a precision electronic NAVigation AID (NAVAID). Therefore, as with all NAVAIDs, information presented by the G1000 can be misused or misinterpreted and, therefore, become unsafe.*

⚠ *WARNING: To reduce the risk of unsafe operation, carefully review and understand all aspects of the G1000 Pilot's Guide documentation and the G1000 Integrated Avionics System in the Airplane Flight Manual. Thoroughly practice basic operation prior to actual use. During flight operations, carefully compare indications from the G1000 to all available navigation sources, including the information from other NAVAIDs, visual sightings, charts, etc. For safety purposes, always resolve any discrepancies before continuing navigation.*

⚠ *WARNING: The illustrations in this guide are only examples. Never use the G1000 to attempt to penetrate a thunderstorm. Both the FAA Advisory Circular, Subject: Thunderstorms, and the Aeronautical Information Manual (AIM) recommend avoiding "by at least 20 miles any thunderstorm identified as severe or giving an intense radar echo."*

⚠ *WARNING: Lamp(s) inside this product may contain mercury (HG) and must be recycled or disposed of according to local, state, or federal laws. For more information, refer to our website at www.garmin.com/aboutGarmin/environment/disposal.jsp.*

⚠ *WARNING: Because of variation in the earth's magnetic field, operating the G1000 within the following areas could result in loss of reliable attitude and heading indications. North of 72° North latitude at all longitudes; South of 70° South latitude at all longitudes; North of 65° North latitude between longitude 75° W and 120° W. (Northern Canada); North of 70° North latitude between longitude 70° W and 128° W. (Northern Canada); North of 70° North latitude between longitude 85° E and 114° E. (Northern Russia); South of 55° South latitude between longitude 120° E and 165° E. (Region south of Australia and New Zealand)*

⚠ *WARNING: Do not use 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.*

CAUTION: *The PFD and MFD displays use a lens coated with a special anti-reflective coating that is very sensitive to skin oils, waxes, and abrasive cleaners. CLEANERS CONTAINING AMMONIA WILL HARM THE ANTI-REFLECTIVE COATING. It is very important to clean the lens using a clean, lint-free cloth and an eyeglass lens cleaner that is specified as safe for anti-reflective coatings.*

CAUTION: *The Garmin G1000 does not contain any user-serviceable parts. Repairs should only be made by an authorized Garmin service center. Unauthorized repairs or modifications could void both the warranty and the pilot's authority to operate this device under FAA/FCC regulations.*

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: *All visual depictions contained within this document, including screen images of the G1000 panel and displays, are subject to change and may not reflect the most current G1000 system and aviation databases. Depictions of equipment may differ slightly from the actual equipment.*

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

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

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

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

Record of Revisions				
Part Number	Revision	Date	Page Range	Description
190-00629-00	A	10/18/05	-	Initial Release
190-00629-00	B	11/09/05	All	ECO 34504: Corrected figure numbering sequence in Section 7
190-00629-01	A	12/21/07	All	Reformatted PG, Updated to GDU SW version 8.10, and added WAAS
	B	4/08/08	All	Change System Software version, update description of two warning messages, delete PA function, and other minor corrections
190-00629-02	A	6/11/10	All	Updated to GDU SW version 11.01, added SVS, added extended squitter, added GTS 820 TAS, and other minor corrections
190-00629-03	A	4/9/12	All	Updated to GDU SW version 11.12, added profile view, added selected altitude arc, added METARs on active flight plan, and other minor corrections

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SECTION 1 SYSTEM OVERVIEW

1.1 SYSTEM DESCRIPTION

This section provides an overview of the G1000 Integrated Flight Deck as installed in the Beechcraft G58 Baron. The G1000 system is an integrated flight control system that presents flight instrumentation, position, navigation, communication, and identification information to the pilot through large-format displays. The system consists of the following Line Replaceable Units (LRUs):

- **GDU 1040** Primary Flight Display (PFD)
- **GDU 1043/1045** Multi Function Display (MFD)
- **GIA 63W** Integrated Avionics Unit
- **GDC 74A** Air Data Computer (ADC)
- **GEA 71** Engine/Airframe Unit
- **GRS 77** Attitude and Heading Reference System (AHRS)
- **GMU 44** Magnetometer
- **GMA 1347** Audio System with Integrated Marker Beacon Receiver

- **GTX 33** Mode S Transponder with Extended Squitter
- **GDL 69A** Satellite Data Link Receiver
- **GWX 68** Weather Radar
- **GTP 59** Outside Air Temperature (OAT) Probe
- **GSA 81** AFCS Servos
- **GSM 85** Servo Gearboxes
- **GTS 820** Traffic Advisory System (if installed)

A top-level G1000 system block diagram is shown in Figure 1-1 (it does not include the GSM 85A).

> **NOTE:** *Refer to the AFCS section for details on the GFC 700 AFCS.*

In the Beechcraft G58 Baron, the GFC 700 Automated Flight Control System (AFCS) provides the flight director (FD), autopilot (AP), and yaw damper (YD) functions of the G1000 system.

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1.2 LINE REPLACEABLE UNITS (LRU)

- **GDU 1040** (1) – The GDU 1040 is configured as a Primary Flight Display (PFD) that features a 10.4-inch LCD with 1024 x 768 resolution. The display communicates with the MFD and with the #1 GIA 63W Integrated Avionics Unit through a High-Speed Data Bus (HSDB) Ethernet connection.

- **GDU 1043/1045** (1) – The GDU 1043 or GDU 1045 is configured as an MFD that features a 10.4-inch LCD with 1024 x 768 resolution. The display communicates with the PFD and with the #2 GIA 63W Integrated Avionics Unit through a High-Speed Data Bus (HSDB) Ethernet connection. The GDU 1045 has a VNV Button, which is needed to enable optional coupled Baro-VNAV AFCS mode.

- **GIA 63W** (2) – Functions as the main communication hub, linking all LRUs with the PFD and MFD. Each GIA 63W contains a GPS receiver, VHF COM/NAV/GS receivers, a flight director (FD) and system integration microprocessors. Each GIA 63W contains a GPS SBAS receiver. Each GIA 63W is paired with a display via HSDB connection. The GIA 63Ws are not paired together and do not communicate with each other directly.

- **GDC 74A** (1) – Processes data from the pitot/static system as well as the OAT probe. This unit provides pressure altitude, airspeed, vertical speed and OAT information to the G1000 system, and it communicates with the GIA 63Ws, the displays, and the GRS 77, using an ARINC 429 digital interface (it also interfaces directly with the GTP 59).

- **GEA 71** (2) – Receives and processes signals from the engine and airframe sensors. This unit communicates with both GIA 63Ws using an RS-485 digital interface.

- **GRS 77** (1) – Provides aircraft attitude and heading information via ARINC 429 to both displays and both GIA 63Ws. The GRS 77 contains advanced sensors (including accelerometers and rate sensors) and interfaces with the GMU 44 to obtain magnetic field information, with the GDC 74A to obtain air data, and with both GIA 63Ws to obtain GPS information. AHRS modes of operation are discussed later in this document.

- **GMU 44** (1) – Measures local magnetic field. Data is sent to the GRS 77 for processing to determine aircraft magnetic heading. This unit receives power directly from the GRS 77 and communicates with the GRS 77 using an RS-485 digital interface.

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- **GMA 1347** (1) – Integrates NAV/COM digital audio, intercom system and marker beacon controls. This unit also enables the manual control of the display reversionary mode (red **DISPLAY BACKUP** button) and communicates with both GIA 63W units, using an RS-232 digital interface.

- **GTX 33 with Extended Squitter**(1) – Solid-state transponder that provides Modes A, C and S capability. The transponder can be controlled from the PFD. The transponder communicates with the GIA 63Ws through an RS-232 digital interface.

- **GDL 69A** (1) – A satellite radio receiver that provides real-time weather information to the G1000 MFD (and, indirectly, to the inset map of the PFD) as well as digital audio entertainment. The GDL 69A communicates with the MFD via HSDB connection. A subscription to the XM Satellite Radio service is required to enable the GDL 69A capability.

- **GWX 68** (1) – Provides airborne weather and ground mapped radar data to the MFD, through the GDL 69A, via HSDB connection.
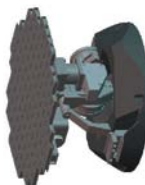
- **GTP 59** (1) – Provides Outside Air Temperature (OAT) data to the GDC 74A.

- **GSA 81** (4), and **GSM 85** (4) – The GSA 81 servos are used for the automatic control of roll, pitch, yaw, and pitch trim. These units interface with each GIA 63W.

  The GSM 85 servo gearbox is responsible for transferring the output torque of the GSA 81 servo actuator to the mechanical flight-control surface linkage.

- **GTS 820** – The GTS 820 Traffic Advisory System (TAS) uses active interrogations of Mode S, Mode A, and Mode C transponders to provide Traffic Advisories to the pilot independent of the air traffic control system.

- **GA 58 (2)** – The GA 58 is a directional antenna for the Traffic Avoidance System. One top-mounted directional antenna and one bottom mounted antenna are required.

GDU 1040
Primary Flight Display

GMA 1347
Audio Panel

GDU 1043/1045
Multi Function Display

Reversionary Control

Reversionary Control

No. 1 GIA 63W
Integrated Avionics Unit

System Integration Processors
I/O Processors
VHF COM
VHF NAV/LOC
GPS
Glideslope

GPS Output

GDC 74A
Air Data Computer

OAT
Airspeed
Altitude
Vertical Speed

GRS 77
AHRS

Attitude
Rate of Turn
Slip/Skid

GMU 44
Magnetometer

Heading

GTX 33
Transponder

GEA 71(2)
Engine/Airframe Units

GSA 81 (4)

Servos

L-3 WX-500 Stormscope

Lightning Sensor
(optional)

L-3 Skywatch SKY497

Traffic Advisory System
(if installed)

Honeywell KN 63

DME
(optional)

No. 2 GIA 63W
Integrated Avionics Unit

System Integration Processors
I/O Processors
VHF COM
VHF NAV/LOC
GPS
Glideslope

GPS Output

GWX 68

Weather Radar

GDL 69A

Data Link Weather and Digital Audio Entertainment

GTS 820

Traffic Advisory System
(if installed)

Figure 1-1 G1000 System Block Diagram

1.3 G1000 CONTROLS

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

The G1000 system controls are located on the PFD and MFD bezels, and the audio panel. The controls for the PFD and MFD are discussed within the following pages of this section.

PFD/MFD CONTROLS
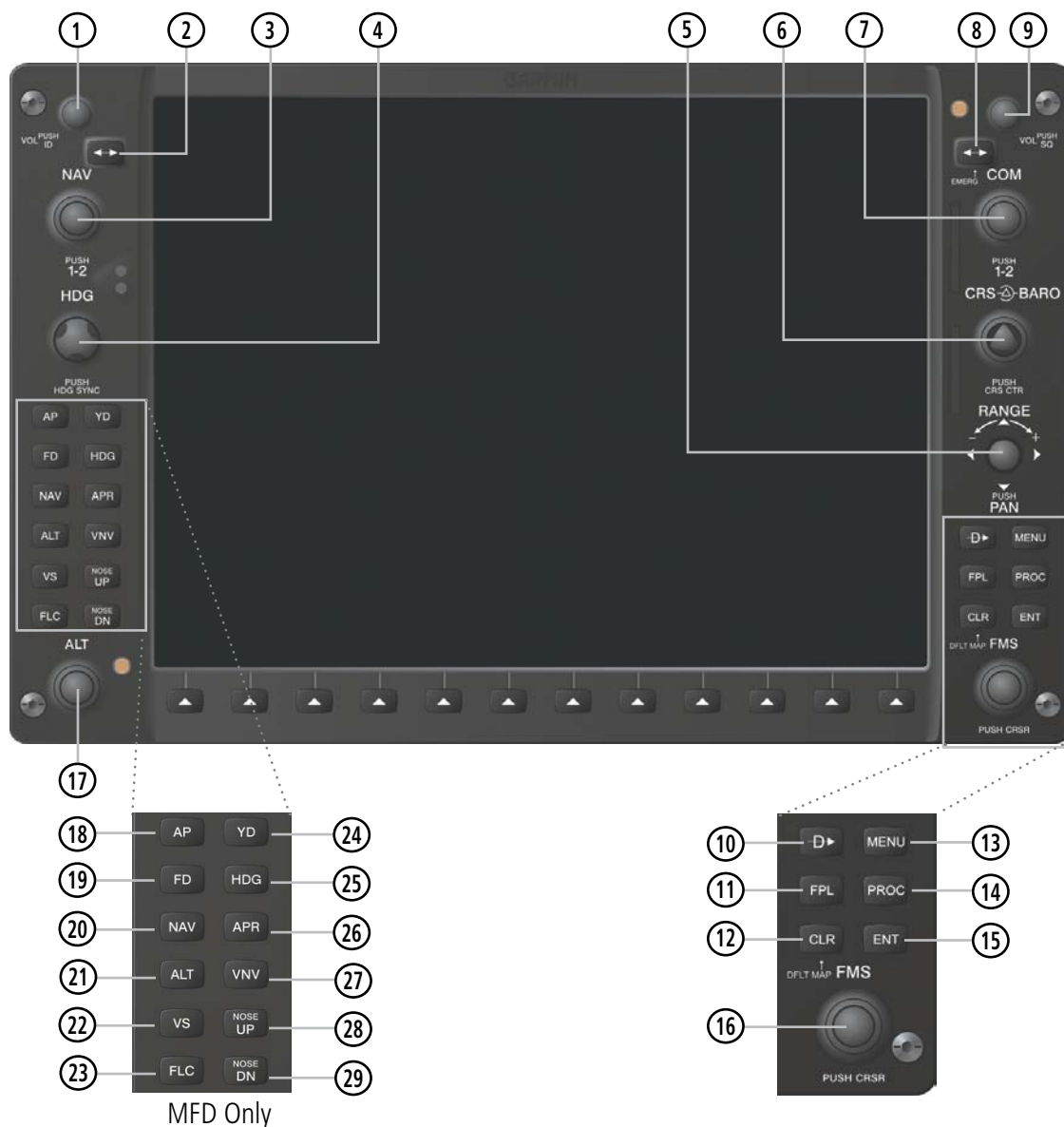
Figure 1-2 PFD/MFD Controls

MFD Only

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①	**NAV VOL/ID Knob**	Turn to control NAV audio volume (shown in the NAV Frequency Box as a percentage) Press 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) Press to toggle light blue 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. Press to display a digital heading momentarily to the left of the HSI and synchronize the Selected Heading to the current heading
⑤	**Joystick**	Turn to change map range Press to activate Map Pointer for map panning
⑥	**CRS/BARO Knob**	Turn large knob for altimeter barometric pressure setting Turn the small knob to set the pilot-selected course on the HSI when the VOR1, VOR2, or OBS/SUSP mode is selected. Pressing 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. Press 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) Press to toggle light blue tuning box between COM1 and COM2 The selected COM (green) is controlled with the **COM MIC** Key (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) Press to turn the COM automatic squelch ON/OFF
⑩	**Direct-to Key (⟿)**	Activates the direct-to function and allows the user to enter a destination waypoint and establish a direct course to the selected destination (specified by identifier, chosen from the active route)
⑪	**FPL Key**	Displays flight plan information
⑫	**CLR Key (DFLT MAP)**	Erases information, cancels entries, or removes menus Press and hold to display the MFD 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

⑯	**FMS Knob** **(Flight Management System Knob)**	Press 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 G1000 altitude alerter function, selected altitude provides an altitude setting for the Altitude Capture/Hold mode of the AFCS.
⑱	**AP Key**	Engages/disengages the Autopilot and Flight Director in the default vertical and lateral modes.
⑲	**FD Key**	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 Key**	Selects/deselects the Navigation mode.
㉑	**ALT Key**	Selects/deselects the Altitude Hold mode.
㉒	**VS Key**	Selects/deselects the Vertical Speed mode.
㉓	**FLC Key**	Selects/deselects the Flight Level Change mode.
㉔	**YD Key**	Engages/disengages the Yaw Damper.
㉕	**HDG Key**	Selects/deselects the Heading Select mode.
㉖	**APR Key**	Selects/deselects the Approach mode.
㉗	**VNV Key** **(if equipped)**	Selects/deselects Vertical Navigation mode
㉘	**NOSE UP Key**	Controls the active pitch reference for the Pitch Hold, Vertical Speed, and Flight Level Change modes.
㉙	**NOSE DN Key**	Controls the active pitch reference for the Pitch Hold, Vertical Speed, and Flight Level Change modes.

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The **NAV**, **CRS/BARO**, **COM**, **FMS**, and **ALT** knobs are concentric dual knobs, each having small (inner) and large (outer) control portion. When a portion of the knob is not specified in the text, either may be used.
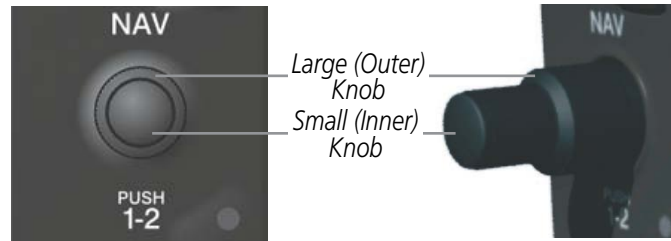
Figure 1-3 Dual Concentric Knob

The bottom portion of the MFD bezel features 12 softkeys that are designed to perform various functions depending upon the specific page being displayed. These softkeys are discussed throughout the Pilot's Guide documentation.

ADDITIONAL AFCS CONTROLS

The **AP DISC** (Autopilot Disconnect) Switch, **CWS** (Control Wheel Steering) Button, **GO AROUND** Switch, and **MEPT** (Manual Electric Pitch Trim) Switch are additional AFCS controls and are located in the cockpit, separately from the AFCS Control Unit. These are discussed in detail in the AFCS section.

AUDIO PANEL CONTROLS
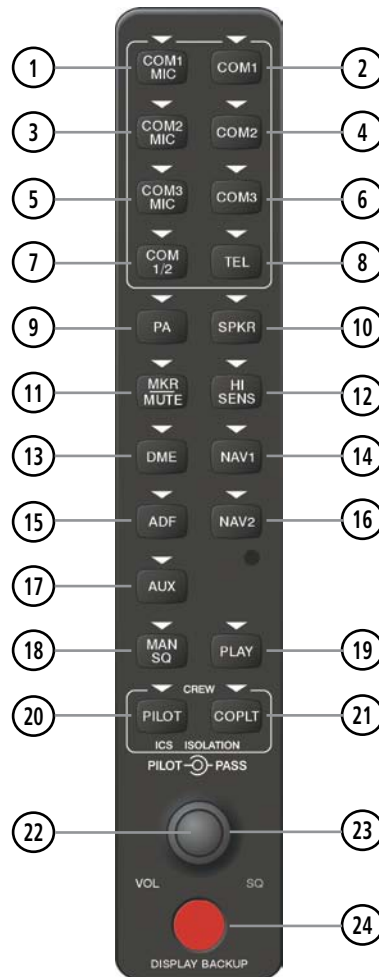
Figure 1-4 Audio Panel Controls (GMA 1347)

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

① **COM1 MIC** – Selects the #1 transmitter for transmitting. COM1 receive is simultaneously selected when this key is pressed allowing received audio from the #1 COM receiver to be heard. COM2 receive can be added by pressing the **COM2** Key.

② **COM1** – When selected, audio from the #1 COM receiver can be heard.

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

④ **COM2** – When selected, audio from the #2 COM receiver can be heard.

⑤ **COM3 MIC** – Not used in Beechcraft G58 aircraft.

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(6) **COM3** – Not used in Beechcraft G58 aircraft.

(7) **COM 1/2** – Split COM Key. Allows simultaneous transmission on COM1 and COM2 by the pilot and copilot.

(8) **TEL** – Not used in Beechcraft G58 aircraft.

(9) **PA** – Not used in Beechcraft G58 aircraft.

(10) **SPKR** – Selects and deselects the cabin speaker. COM and NAV receiver audio can be heard on the speaker.

(11) **MKR/MUTE** – Selects marker beacon receiver audio. Mutes the currently received marker beacon receiver audio. Unmutes automatically when new marker beacon audio is received. Also, stops play of recorded COM audio.

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

(13) **DME** – Pressing turns optional DME audio on or off.

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

(15) **ADF** – Not used in Beechcraft G58 aircraft.

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

(17) **AUX** – Not used in Beechcraft G58 aircraft.

(18) **MAN SQ** – Enables manual squelch for the intercom. When the intercom is active, press the **PILOT** Knob to illuminate SQ. Turn the **PILOT/PASS** Knobs to adjust squelch.

(19) **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.

(20) **PILOT** – Selects and deselects the pilot intercom isolation.

(21) **COPLT** – Selects and deselects the copilot intercom isolation.

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

(23) **PASS Knob** – Turn to adjust Copilot/Passenger intercom volume or squelch. The **MAN SQ** Key must be selected to allow squelch adjustment.

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

1.4 SECURE DIGITAL CARDS

> ✓ **NOTE:** *Refer to the Appendices for instructions on updating the aviation database.*

> ✓ **NOTE:** *Ensure that the G1000 system is powered off before inserting the SD card.*

The GDU 1040 and GDU 1043/1045 data card slots use Secure Digital (SD) cards and are located on the top right portion of the display bezels. Each display bezel is equipped with two SD card slots. SD cards are used for aviation database and system software updates as well as terrain database storage.

Install an SD card

Insert the SD card in the SD card slot, pushing the card in until the spring latch engages. The front of the card should remain flush with the face of the display bezel.

Remove an SD card

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

Figure 1-6 Display Bezel SD Card Slots

1.5 SYSTEM POWER-UP

NOTE: *Refer to the Appendices for AHRS initialization bank angle limitations.*

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

NOTE: *See the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual (AFM/POH) for specific procedures concerning avionics power application and emergency power supply operation.*

The G1000 system is integrated with the aircraft electrical system and receives power directly from electrical busses. The G1000 PFDs, MFD and supporting sub-systems include both power-on and continuous built-in test features that exercise the processor, RAM, ROM, external inputs and outputs to provide safe operation.

During system initialization, test annunciations are displayed, as shown in Figure 1-7. All system annunciations should disappear typically within one minute of power-up. Upon power-up, key annunciator lights also become momentarily illuminated on the audio panels, the control units and the display bezels.

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 one minute of power-up. The AHRS can align itself both while taxiing and during level flight.

When the MFD powers up (Figure 1-8), the MFD Power-up Page displays the following information:

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

Current database information includes the valid operating dates, cycle number and database type. When this information has been reviewed for currency (to ensure that no databases have expired), the pilot is prompted to continue. Pressing the **ENT** Key acknowledges this information and displays the Navigation Map Page.
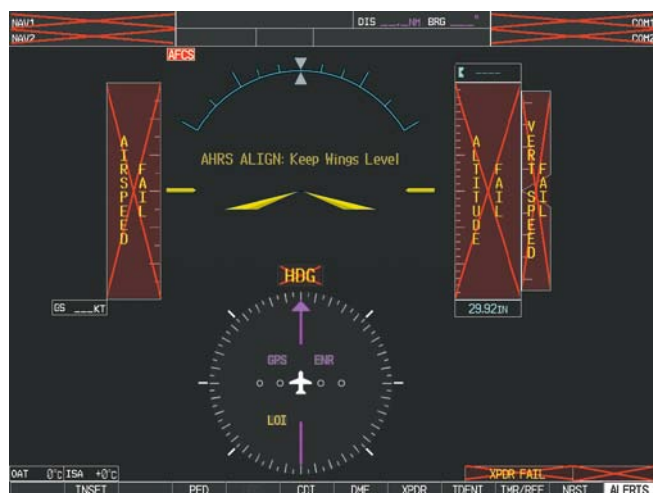
Figure 1-7 PFD Initialization
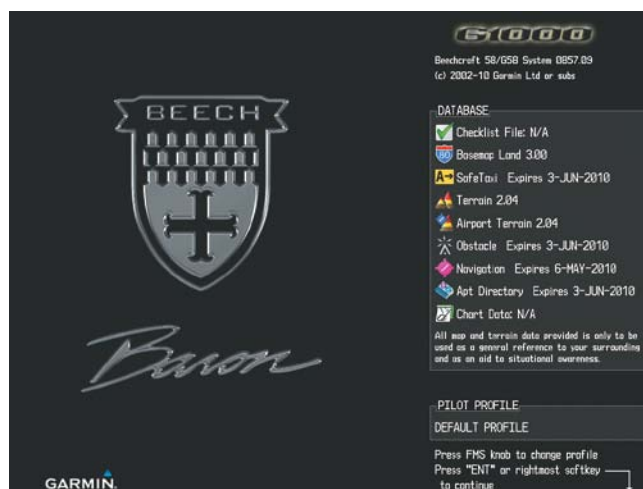
Figure 1-8 MFD Power-up Page

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The displays are connected together via multiple data busses, thus allowing for high-speed communication. As shown in Figure 1-1, each GIA 63W is connected to one display. This section discusses the normal and reversionary modes of operation as well as the various AHRS modes of the G1000 system.

NORMAL OPERATION

PFD

In normal mode, the PFD presents graphical flight instrumentation (attitude, heading, airspeed, altitude and vertical speed), thereby replacing the traditional flight instrument cluster. The PFD also offers control for COM and NAV frequency selection.

MFD

In normal mode, the right portion of the MFD displays a full-color moving map with navigation information, while the left portion of the MFD is dedicated to the Engine Indication System (EIS).

Figure 1-9 gives an example of the G1000 displays in normal mode.

Primary Flight Display   Audio Panel   Multi Function Display

Figure 1-9 Normal Operation

REVERSIONARY MODE

> **NOTE:** The G1000 System alerts the pilot when backup paths are utilized by the LRUs. Refer to Appendix A for further information regarding system-specific alerts.

In the event of a display failure, the G1000 System automatically switches to reversionary (backup) mode. 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 Ethernet interface to the display is cut off. Thus, the IAU can no longer communicate with the remaining display (refer to Figure 1-1), 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.

Primary Flight Display Failed   Audio Panel   Multi Function Display

Figure 1-10 Reversionary Mode Operation

If the system fails to detect a display problem, reversionary mode may be manually activated by pressing the Audio Panel's red **DISPLAY BACKUP** button (refer to the Audio Panel section for further details). Pressing this button again deactivates reversionary mode.

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

DISPLAY BACKUP

Figure 1-11 DISPLAY BACKUP Button

Should the connection between a PFD and the on-side GIA 63W become inoperative, the on-side GIA 63W can no longer communicate with the remaining PFD (refer to Figure 1-1). As a result, the NAV and COM functions provided to the failed PFD by the on-side GIA 63W are flagged as invalid (red "X") on the remaining PFD (see Figure 1-12).

NAV1

Figure 1-12 Inoperative Input (NAV1 Shown)

AHRS OPERATION

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

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

In addition to using internal sensors, the GRS 77 AHRS uses GPS information, magnetic field data and air data to assist in attitude/heading calculations. In normal mode, the AHRS relies upon GPS and magnetic field measurements. If either of these external measurements is unavailable or invalid, the AHRS uses air data information for attitude determination. Four AHRS modes of operation are available (see Figure 1-13) and depend upon the combination of available sensor inputs. Loss of air data, GPS, or magnetometer sensor inputs is communicated to the pilot by message advisory alerts.

The AHRS (GRS 77) corrects for shifts and variations in the Earth's magnetic field by applying the Magnetic Field Variation Database. The Magnetic Field Variation Database is derived from the International Geomagnetic Reference Field (IGRF). The IGRF is a mathematical model that describes the Earth's main magnetic field and its annual rate of change. The database is updated approximately every 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.

GPS Data

available / unavailable

Magnetometer Data   **Magnetometer Data**

available / unavailable   available / unavailable

Air Data   **Air Data**

available / unavailable   available / unavailable

AHRS Normal Operation   **AHRS no-Mag Mode**   **AHRS no-Mag/ no-Air Mode** *Heading Invalid*   **AHRS no-GPS Mode**   *Attitude/Heading Invalid*
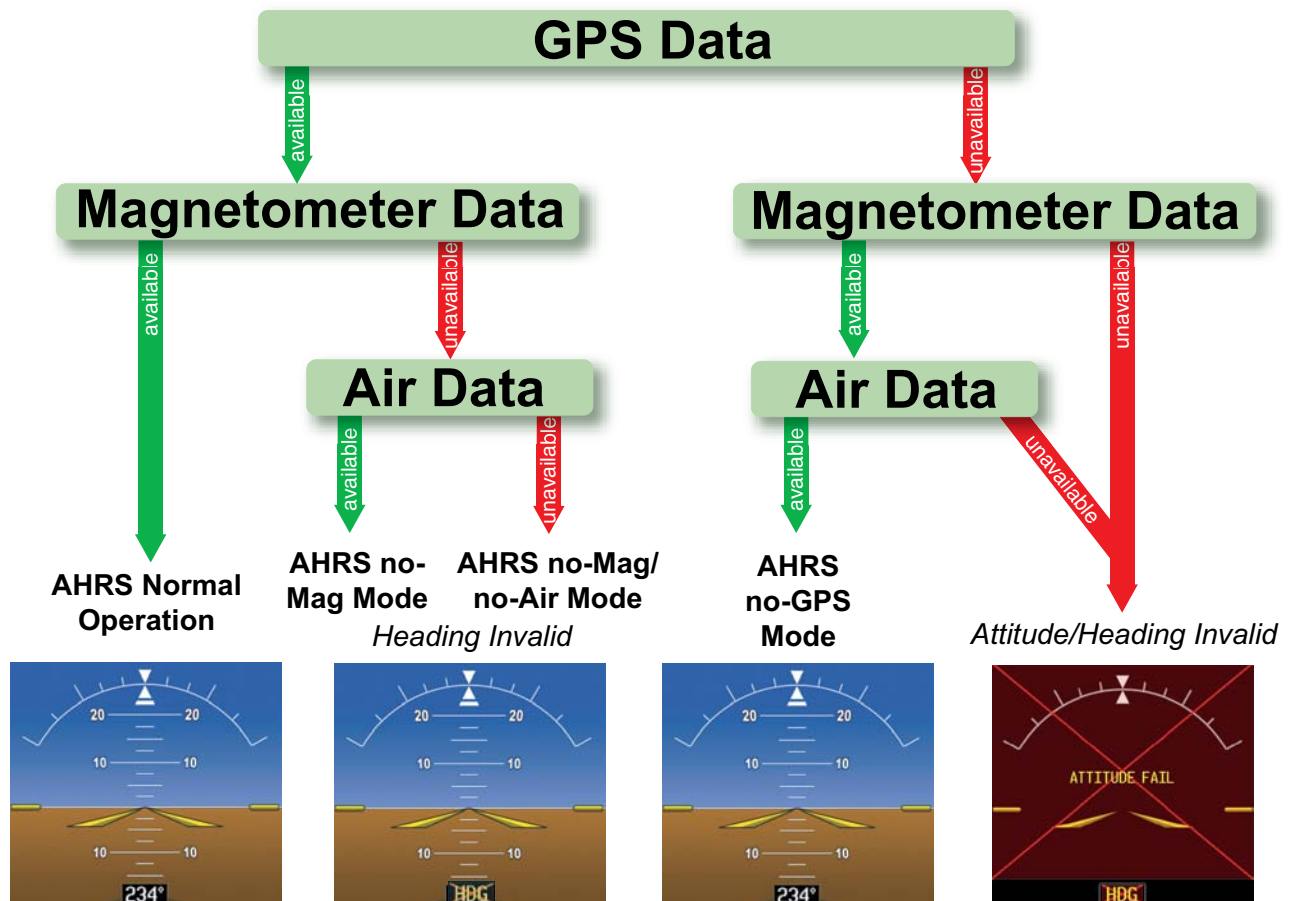
Figure 1-13 AHRS Operation

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 G1000 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.

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AIR DATA INPUT FAILURE

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

MAGNETOMETER FAILURE

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

G1000 SYSTEM ANNUNCIATIONS

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

When an LRU or an LRU function fails, a large red "X" is typically displayed on windows associated with the failed data (Figure 1-14 displays all possible flags and responsible LRUs). Upon G1000 power-up, certain windows remain invalid as equipment begins to initialize. All windows should be operational within one minute of power-up. If any window remains flagged, the G1000 system should be serviced by a Garmin-authorized repair facility.

Figure 1-14 G1000 System Failure Annunciations

SOFTKEY FUNCTION

The softkeys are located along the bottoms of the displays. The softkeys shown depend on the softkey level or page being displayed. The bezel keys below the softkeys can be used to select the appropriate softkey. When a softkey is selected, its color changes to black text on gray background and remains this way until it is turned off, at which time it reverts to white text on black background.

Figure 1-15 Softkeys (Second-Level PFD Configuration)

PFD SOFTKEYS

The **CDI**, **IDENT**, **TMR/REF**, **NRST,** and **ALERTS** Softkeys undergo a momentary change to black text on gray background and automatically switch back to white text on black background when selected. If messages remain after acknowledgement, the **ALERTS** Softkey is black on white.

The PFD softkeys provide control over flight management functions, including GPS, NAV, terrain, traffic, and lightning. Each softkey sublevel has a **BACK** Softkey which can be pressed to return to the previous level. The **ALERTS** Softkey is visible in all softkey levels. For the top level softkeys and the transponder (XPDR) levels, the **IDENT** Softkey remains visible.

INSET	Displays Inset Map in PFD lower left corner
OFF	Removes Inset Map
DCLTR (3)	Selects desired amount of map detail; cycles through declutter levels:
	DCLTR (No Declutter): All map features visible
	DCLTR-1: Declutters land data
	DCLTR-2: Declutters land and SUA data
	DCLTR-3: Removes everything except for the active flight plan
TRAFFIC	Displays traffic information on Inset Map
	TRAFFIC: No Traffic displayed on Inset Map
	TRFC-1: Traffic displayed on Inset Map
	TRFC-2: Traffic Only display shown
TOPO	Displays topographical data (e.g., coastlines, terrain, rivers, lakes) and elevation scale on Inset Map
TERRAIN	Displays terrain information on Inset Map
STRMSCP	Displays Stormscope information on Inset Map (optional)
NEXRAD	Displays NEXRAD weather and coverage on Inset Map (optional)
XM LTNG	Displays XM lightning information on Inset Map (optional)
METAR	Displays METAR information on Inset Map (optional)

PFD			Displays second-level softkeys for additional PFD configurations
	SYN VIS		Displays the softkeys for enabling or disabling Synthetic Vision features
		PATHWAY	Displays rectangular boxes representing the horizontal and vertical flight path of the active flight plan
		SYN TERR	Enables synthetic terrain depiction
		HRZN HDG	Displays compass heading along the Zero-Pitch line
		APTSIGNS	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.
	DFLTS		Resets PFD to default settings, including changing units to standard
	WIND		Displays softkeys to select wind data parameters
		OPTN 1	Headwind/tailwind and crosswind arrows with numeric speed components
		OPTN 2	Wind direction arrow and numeric speed
		OPTN 3	Wind direction arrow with numeric direction and speed
		OFF	Information not displayed
	DME		Displays/removes the DME Information Window (optional)
	BRG1		Cycles the Bearing 1 Information Window between NAV1, and GPS/ waypoint identifier and GPS-derived distance information
	HSI FRMT		Displays the softkeys for selecting the two HSI formats
		360 HSI	Displays HSI as a 360° compass rose
		ARC HSI	Displays HSI as a 140° viewable arc
	BRG2		Cycles the Bearing 1 Information Window between NAV2, and GPS/ waypoint identifier and GPS-derived distance information
	ALT UNIT		Displays softkeys for setting the altimeter and BARO settings to metric units
		METERS	When enabled, displays altimeter in meters
		IN	Press to display the BARO setting as inches of mercury
		HPA	Press to display the BARO setting as hectopacals
	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)
CDI			Cycles through GPS, VOR1, and VOR2 navigation modes on the CDI
DME			Displays the DME Tuning Window, allowing tuning and selection of the DME (optional)
XPDR			Displays transponder mode selection softkeys
	STBY		Selects standby mode (transponder does not reply to any interrogations)
	ON		Selects Mode A (transponder replies to interrogations)
	ALT		Selects Mode C – altitude reporting mode (transponder replies to identification and altitude interrogations)
	GND		Manually selects Ground Mode, the transponder does not allow Mode A and Mode C replies, but it does permit acquisition squitter and replies to discretely addressed Mode S 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
BKSP	Removes numbers entered, one at a time
ADS-B TX	Enables/disables automatic transmission of ADS-B position and speed.
IDENT	Activates the Special Position Identification (SPI) pulse for 18 seconds, identifying the transponder return on the ATC screen
TMR/REF	Displays Timer/References Window
NRST	Displays Nearest Airports Window
ALERTS	Displays Alerts Window
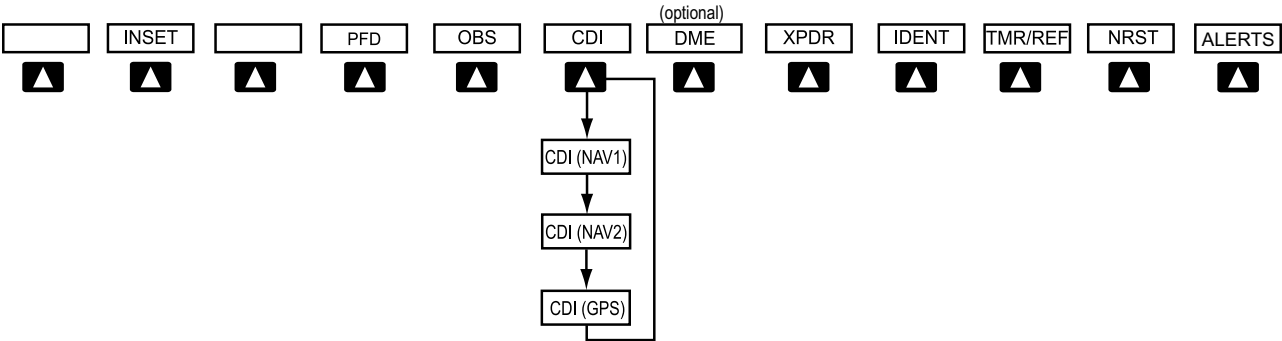
Figure 1-16 Top Level PFD Softkeys
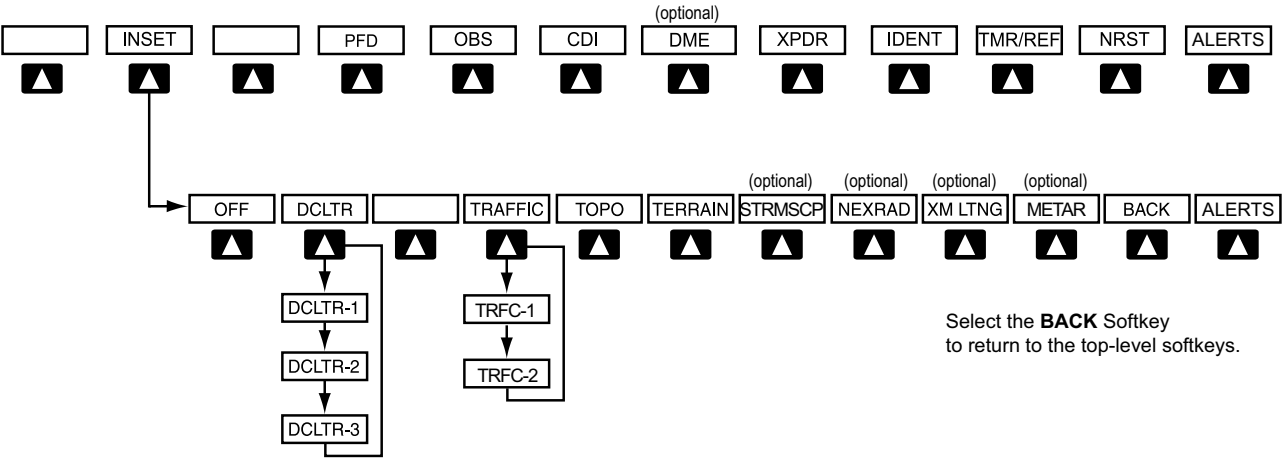
Figure 1-17 INSET Softkeys

(optional)

| | INSET | | PFD | OBS | CDI | DME | XPDR | IDENT | TMR/REF | NRST | ALERTS |

| SYN VIS | DFLTS | WIND | DME | BRG1 | HSI FRMT | BRG2 | | ALT UNIT | STD BARO | BACK | ALERTS |

BRG1 (NAV1)
BRG1 (GPS)
BRG1 (OFF)

BRG1 (NAV1)
BRG1 (GPS)
BRG1 (OFF)

Select the **BACK** Softkey to return to the top-level softkeys

| | | | | METERS | | IN | HPA | | BACK | ALERTS |

| | | | | 360 HSI | ARC HSI | | | | BACK | ALERTS |

| | | OPTN 1 | OPTN 2 | OPTN 3 | OFF | | | | BACK | ALERTS |

| PATHWAY | SYN TERR | HRZN HDG | APTSIGNS | | | | | | BACK | ALERTS |

Figure 1-18 PFD Configuration Softkeys

(optional)

| | INSET | | PFD | OBS | CDI | DME | XPDR | IDENT | TMR/REF | NRST | ALERTS |

| | | STBY | ON | ALT | GND | VFR | CODE | IDENT | ADS-B TX | BACK | ALERTS |

Select the **BACK** Softkey to return to the top-level softkeys.

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | IDENT | BKSP | BACK | ALERTS |

Select the **BACK** Softkey to return to the previous level softkeys.
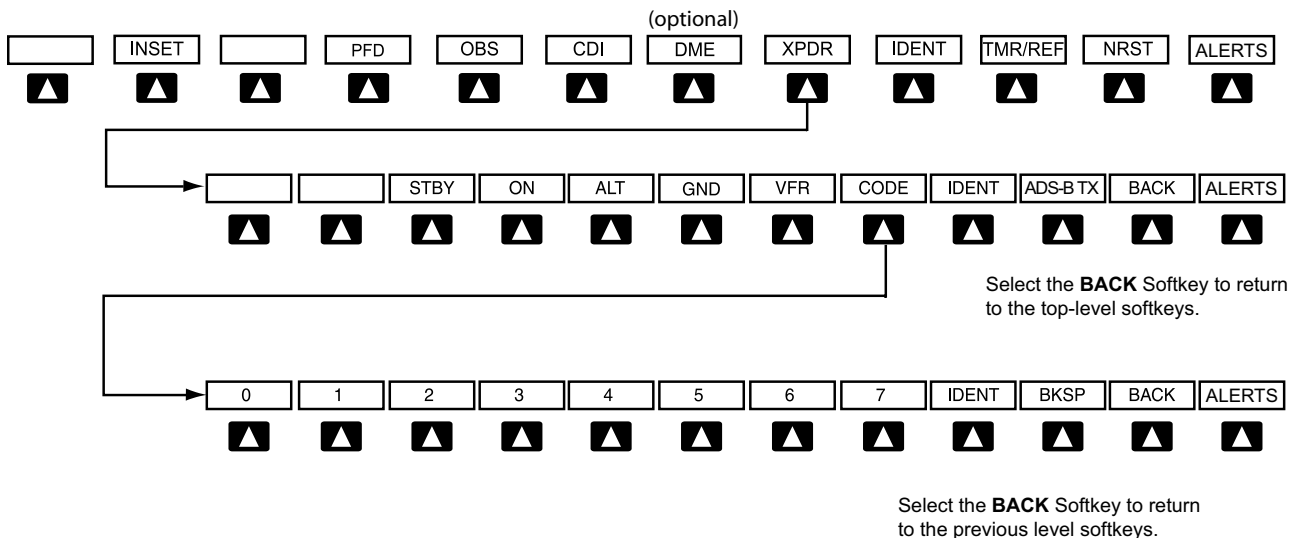
Figure 1-19 XPDR Softkeys

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ENGINE		Displays second-level softkeys for additional EIS configuration
	ENGINE	Displays default EIS display
	LEAN	Displays EIS lean display
		CYL SLCT Allows selection of engine cylinder to view additional information
		ASSIST Enables/disables leaning assist mode
	SYSTEM	Displays system oil pressure and temperature, fuel calculations, and electrical system information
		DEC FUEL Decreases calculated fuel remaining by 1 lb for each softkey press
		INC FUEL Increases calculated fuel remaining by 1 lb for each softkey press
		166 GAL Resets calculated fuel remaining to 166 gallons and resets fuel used to zero
		194 GAL Resets calculated fuel remaining to 194 gallons and resets fuel used to zero
MAP		Enables second-level Navigation Map softkeys
	TRAFFIC	Displays traffic information on Navigation Map
	PROFILE	Displays the profile view on Navigation Map
	TOPO	Displays topographical data (e.g., coastlines, terrain, rivers, lakes) and elevation scale on Navigation Map
	TERRAIN	Displays terrain information on Navigation Map
	AIRWAYS (Default label is dependent on map setup option selected)	Displays airways on the map; cycles through the following: AIRWAYS: No airways are displayed AIRWY ON: All airways are displayed AIRWY LO: Only low altitude airways are displayed AIRWY HI: Only high altitude airways are displayed
	STRMSCP	Displays Stormscope information on Navigation Map (optional)
	NEXRAD	Displays NEXRAD weather and coverage information on Navigation Map
	XM LTNG	Displays XM lightning information on Navigation Map
	METAR	Displays METAR information on Navigation Map (optional)
	LEGEND	Displays selected XM weather product legends on Navigation Map
	BACK	Returns to top-level softkeys
DCLTR (3)		Selects desired amount of map detail; cycles through declutter levels: DCLTR (No Declutter): All map features visible DCLTR-1: Declutters land data DCLTR-2: Declutters land and SUA data DCLTR-3: Removes everything except for the active flight plan
SHW CHRT		When available, displays optional airport and terminal procedure charts
CHKLIST		When available, displays optional checklists

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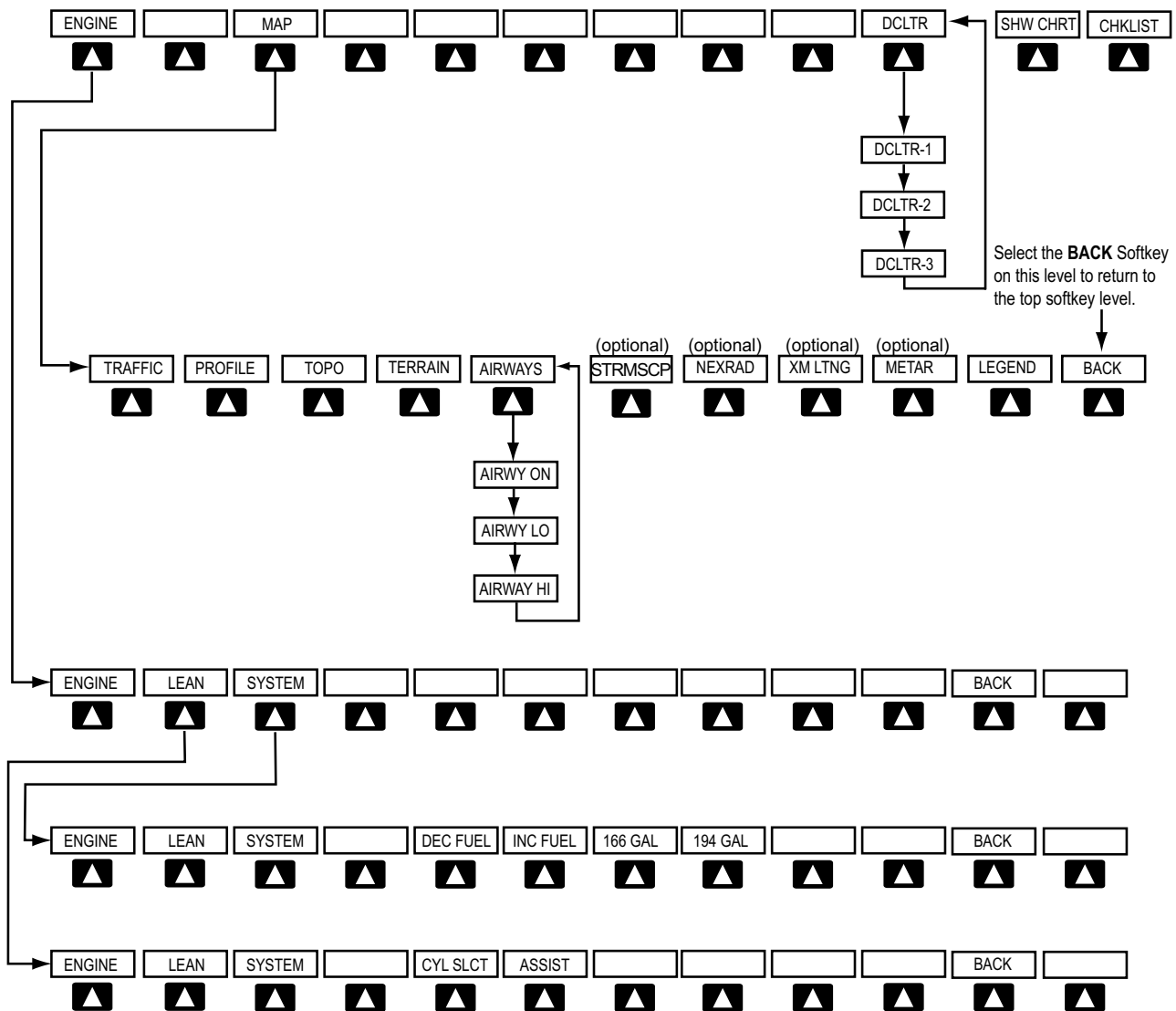
Figure 1-20 MFD Softkeys

GPS RECEIVER OPERATION

Each Integrated Avionics Unit (IAU) contains a GPS receiver. Internal system checking is performed to ensure both GPS receivers are providing accurate data to the PFD. When both GPS receivers are providing accurate data, the GPS receiver producing the better solution is used by the system. Information collected by the specified receiver (GPS1 for the #1 IAU or GPS2 for the #2 IAU) may be viewed on the AUX - GPS Status Page.

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

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

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Viewing GPS receiver status information

1) Use the large **FMS** Knob to select the Auxiliary Page Group (see Section 1.7 for information on navigating MFD page groups).

2) Use the small **FMS** Knob to select GPS Status Page.

Selecting the GPS receiver for which data may be reviewed

1) Use the **FMS** Knob to select the AUX - GPS Status Page.

2) To change the selected GPS receiver:

   a) Press the desired **GPS** Softkey.

   Or:

   a) Press the **MENU** Key.

   b) Use the **FMS** Knob to highlight the receiver which is not selected and press the **ENT** Key.
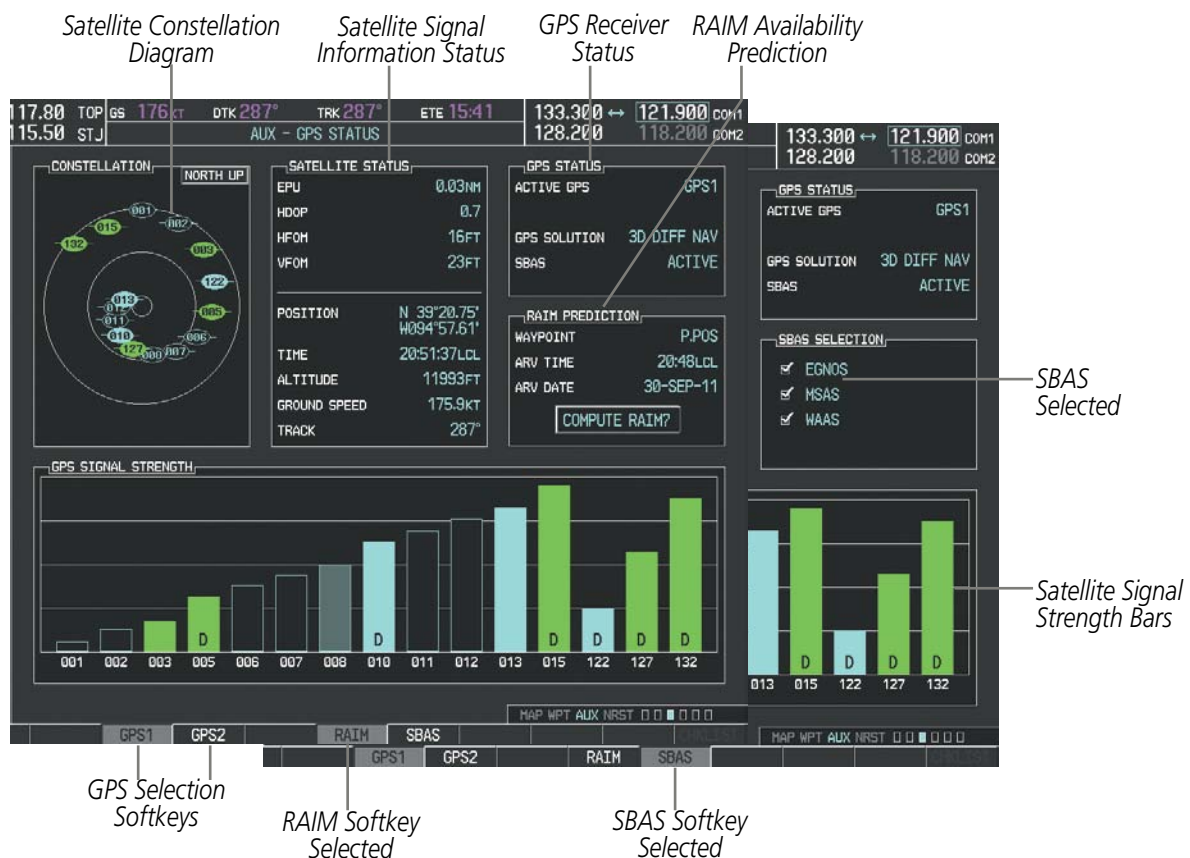
Figure 1-21 GPS Status Page (RAIM or SBAS Selected)

The GPS Status Page provides the following information:

• Satellite constellation diagram

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

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

• Satellite signal 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 actual position has 95% probability of laying. EPU is a statistical error indication and not an actual error measurement.

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

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

• GPS receiver status

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

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

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

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

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

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

Because of the tighter protection limit on approaches, there may be times when RAIM is not available. The G1000 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.

Predicting RAIM availability at a selected waypoint

1) Select the GPS Status Page.

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

3) Press the **FMS** Knob. The 'WAYPOINT' field is highlighted.

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

5) Enter the desired waypoint:

   a) Use the **FMS** Knob to enter the desired waypoint by identifier, facility, or city name and press the **ENT** Key. Refer to Section 1.7 for instructions on entering alphanumeric data into the G1000.

   Or:

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

   b) Turn the small **FMS** Knob clockwise to display the NRST, RECENT, or AIRWAY waypoints, if required.

   c) Turn the large **FMS** Knob clockwise to select the desired waypoint. The G1000 automatically fills in the identifier, facility, and city fields with the information for the selected waypoint.

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

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

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

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

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

   • 'COMPUTING AVAILABILITY'—RAIM calculation in progress

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

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

Predicting RAIM availability at present position

1) Select the GPS Status Page.

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

3) Press the **FMS** Knob. The 'WAYPOINT' field is highlighted.

4) Press the **MENU** Key.

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

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

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

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

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

- 'COMPUTE RAIM?'—RAIM has not been computed for the current waypoint, time, and date combination
- 'COMPUTING AVAILABILITY'—RAIM calculation in progress
- 'RAIM AVAILABLE'—RAIM is predicted to be available for the specified waypoint, time, and date
- 'RAIM NOT AVAILABLE'—RAIM is predicted to be unavailable for the specified waypoint, time, and date

- SBAS Selection (**SBAS** Softkey is selected)

In certain situations, such as when the aircraft is outside or on the fringe of the SBAS coverage area, it may be desireable to disable SBAS (although it is not recommended). When disabled, the SBAS field in the GPS Status box indicates DISABLED.

Disabling SBAS

1) Select the GPS Status Page.

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

3) Press the **FMS** Knob to activate the cursor.

4) Turn either FMS Knob to select 'EGNOS' or 'MSAS' or 'WAAS', as necessary.

5) Press the **ENT** Key to uncheck the box.

6) Repeat steps 4 & 5 as necessary, then press the **FMS** Knob to remove the cursor.

- GPS Satellite Signal Strengths

The GPS Status Page can be helpful in troubleshooting weak (or missing) signal levels due to poor satellite coverage or installation problems. As the GPS receiver locks onto satellites, a signal strength bar is displayed for each satellite in view, with the appropriate satellite PRN number (01-32 or 120-138 for SBAS) 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
- Light blue bar—Receiver has collected the necessary data and the satellite signal can be used
- Green bar—Satellite is being used for the GPS solution
- Checkered bar—Receiver has excluded the satellite (Fault Detection and Exclusion)
- "D" indication—Denotes the satellite is being used as part of the differential computations

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

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1.7 ACCESSING G1000 FUNCTIONALITY

MENUS

The G1000 has a **MENU** Key that, when pressed, displays a context-sensitive list of options. This options list allows the user to access additional features or make settings changes which specifically relate to the currently displayed window/page. There is no all-encompassing menu. Some menus provide access to additional submenus that are used to view, edit, select, and review options. Menus display 'NO OPTIONS' when there are no options for the window/page selected. The main controls used in association with all window/page group operations are described in section 1.3. Softkey selection does not display menus or submenus.

Navigating the Page Menu Window

1) Press the **MENU** Key to display the Page Menu Window.

2) Turn the **FMS** Knob to scroll through a list of available options (a scroll bar appears to the right of the window when the option list is longer than the window).

3) Press the **ENT** Key to select the desired option.

4) The **CLR** Key may be pressed to remove the menu and cancel the operation. Pressing the **FMS** Knob also removes the displayed menu.

No Options with NRST Window Displayed on the PFD

Options with FPL Window Displayed
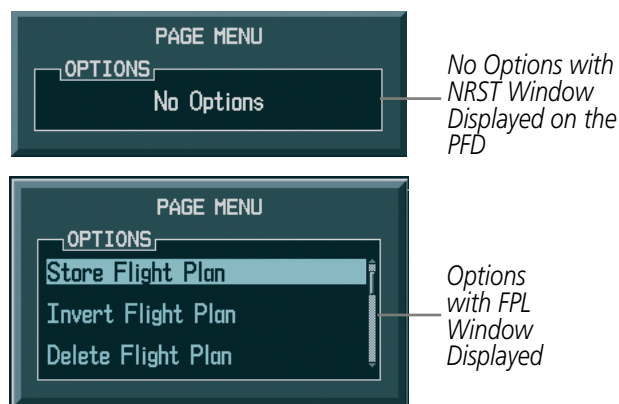
Figure 1-22 Page Menu Examples

MFD PAGE GROUPS

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

Information on the MFD is presented on pages which are 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, the current page group, number of pages available in the group, and placement of the current page within the group are indicated. The MFD displays information in four main page groups; specific pages within each group can vary depending on the configuration of optional equipment.
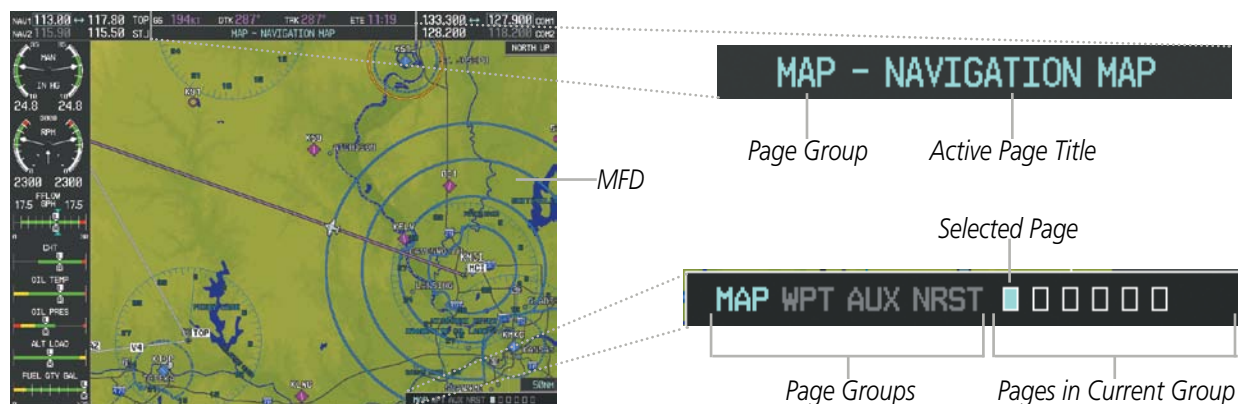
Figure 1-23 Page Title and Page Groups

Selecting a page using the FMS Knob

1) Turn the large **FMS** Knob until the desired page group is selected.

2) Turn the small **FMS** Knob until the desired page is selected.

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

Map Pages (MAP)

Navigation Map

Traffic Map

Weather Radar

Stormscope®(optional)

Weather Data Link (*service optional*)

Terrain
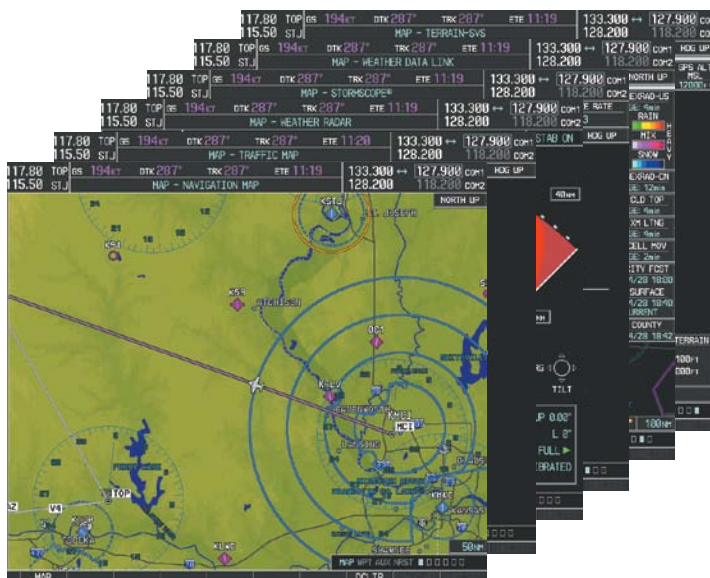
Figure 1-24 Map Pages

Waypoint Page Group (WPT)

Airport/Procedures/Weather Information Pages

- - Airport Information
  (**INFO-1** Softkey)

- - Airport Directory Information
  (**INFO-2** Softkey)

- - Departure Information
  (**DP** Softkey)

- - Arrival Information
  (**STAR** Softkey)

- - Approach Information
  (**APR** Softkey)

- - Weather Information (*optional*)
  (**WX** Softkey)

Intersection Information

NDB Information

VOR Information

User Waypoint Information

Airport Information Pages
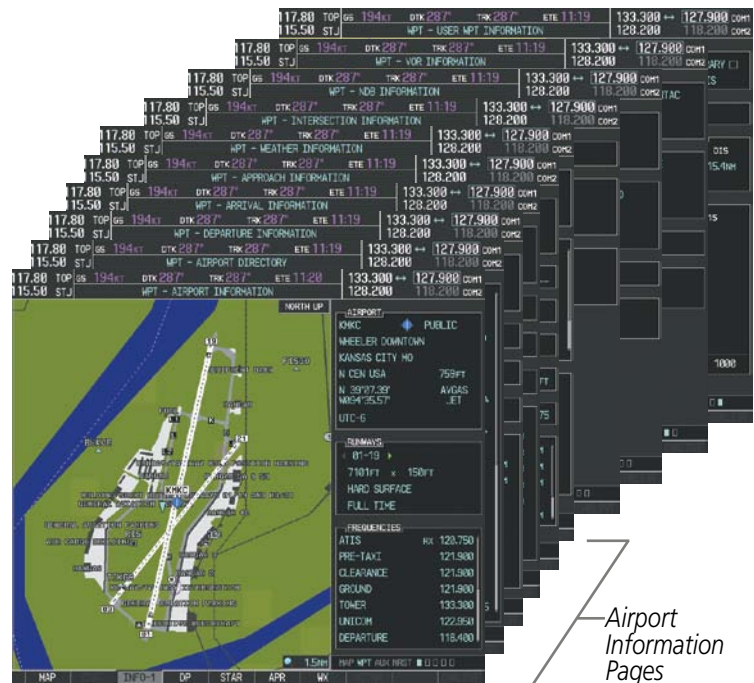
Figure 1-25 Waypoint Pages

Auxiliary Pages (AUX)

Trip Planning

Utility

GPS Status

System Setup

XM Satellite pages

- - XM Information
  (**INFO** Softkey)

- - XM Radio
  (**RADIO** Softkey)

System Status

XM Satellite Pages
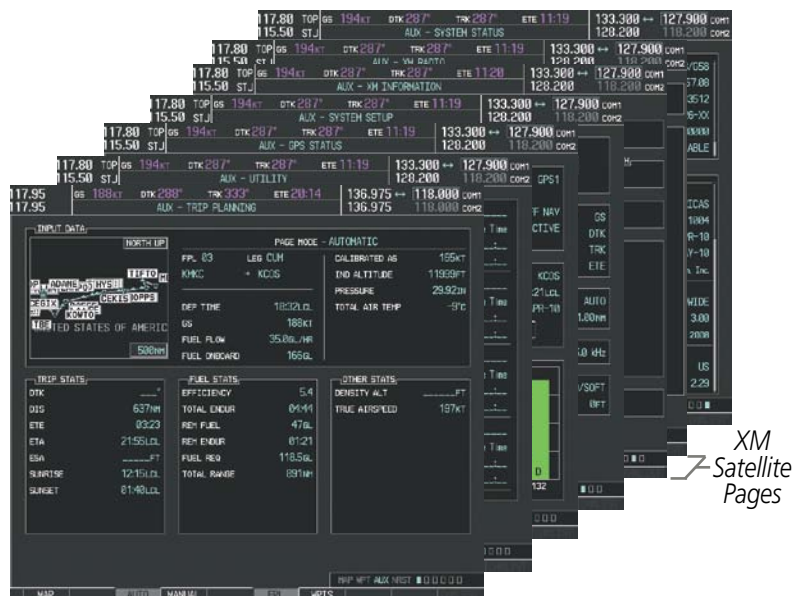
Figure 1-26 Auxiliary Pages

Garmin G1000 Pilot's Guide for the Beechcraft G58

Nearest Pages (NRST)

Nearest Airports

Nearest Intersections

Nearest NDB

Nearest VOR

Nearest User Waypoints

Nearest Frequencies

Nearest Airspaces

Figure 1-27 Nearest Pages

In addition to the main page groups accessed exclusively using the **FMS** Knobs, there are pages for flight planning (FPL) and loading procedures (PROC) which are accessed by a dedicated key. In some instances, softkeys may be used to access the Procedure Pages.

The Flight Plan Pages are accessed using the **FPL** Key.. Main pages within this group are selected by turning the small **FMS** Knob.

Flight Plan Pages (FPL)

Active Flight Plan

- Wide View, Narrow View (**VIEW** Softkey)

Flight Plan Catalog

Stored Flight Plan (**NEW** Softkey)

Narrow and Wide View
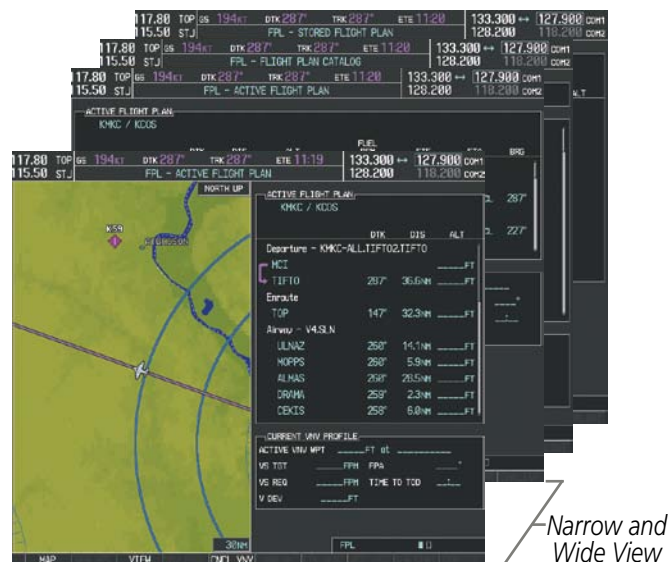
Figure 1-28 Flight Plan Pages

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 (note the single page icon in the lower right corner).

Procedure Pages (PROC)

    Departure Loading

    Arrival Loading

    Approach Loading
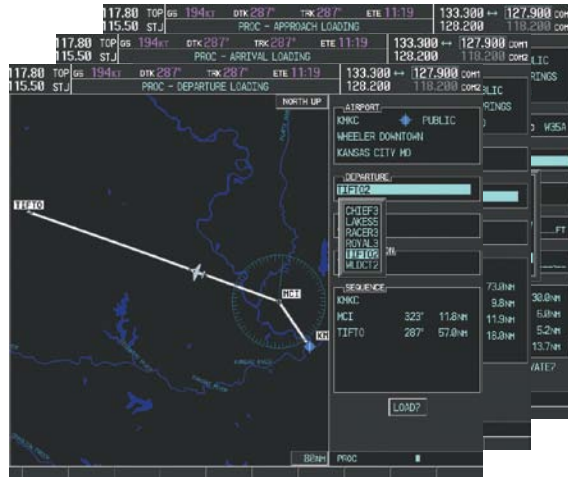
Figure 1-29 Procedure Pages

For some of these pages (Airport Information pages, XM Satellite pages, Procedure pages), the title of the page may change while the page icon remains the same.

MFD SYSTEM PAGES

In the Auxiliary (AUX) Page Group, there are two system pages: System Setup (page 4 of 6) and System Status (page 6 of 6). The System Setup Page allows management of various system parameters, while the System Status Page displays the status of all G1000 system LRUs.

SYSTEM SETUP PAGE

G1000 system settings are managed from the System Setup Page. The following settings can be changed:

- Date/time

- Displayed navigation angle reference, temperature, and position settings

- Baro transition alert
(see the Flight Instruments Section)

- Airspace alerts
(see the Flight Management Section)

- Arrival alerts
(see the Flight Management Section)

- Audio alerts

- MFD Navigation Status Box fields
(see the Flight Management Section)

- CDI scaling for GPS navigation source
(see the Flight Instruments Section)

- COM channel spacing
(see the Audio Panel and CNS Section)

- Criteria for displaying nearest airports
(see the Flight Management Section)

Restoring system setup defaults:

1) Select the AUX - System Setup Page.

2) Press the **DFLTS** Softkey; or press the **MENU** Key, highlight 'Restore Defaults', and press the **ENT** Key.
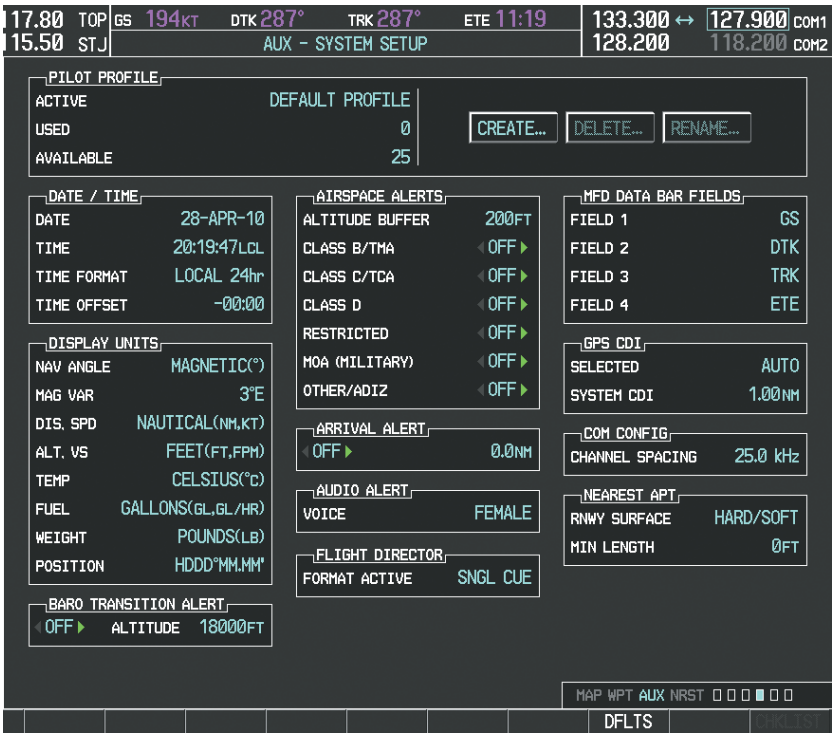
Figure 1-30 System Setup Page

Date/Time

The G1000 obtains the current Universal Coordinated Time (UTC) date and time directly from the GPS satellite signals (shown on the AUX - GPS Status Page). System time (displayed in the lower right corner of the PFD) can be displayed in three formats: local 12-hr, local 24-hr, or UTC. Local time is set by adding/subtracting an offset (hours:minutes) to/from UTC.
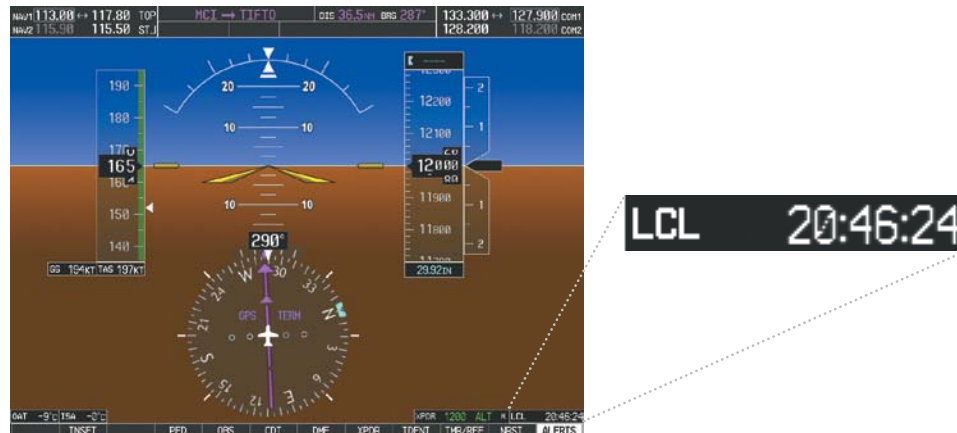
Figure 1-31 System Time (Local 24-hr Format)

Configuring the system time:

1) Select the AUX - System Setup Page.

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

3) Turn the large **FMS** Knob to highlight the 'Time Format' field.

4) Turn the small **FMS** Knob to select the desired format and press the **ENT** Key to confirm selection. The 'Time Offset' field is highlighted.

5) Use the **FMS** Knob to enter the desired time offset (±HH:MM) and press the **ENT** Key to confirm selection.
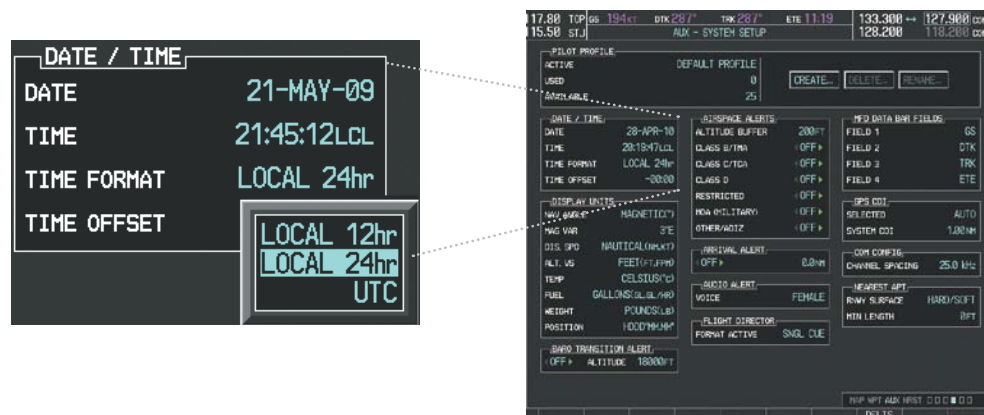
Figure 1-32 Date/Time Settings (System Setup Page)

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PILOT PROFILES

System settings may be saved under a pilot profile. When the system is powered on, the last selected pilot profile is shown on the MFD Power-up Splash Screen (Figure 1-8). The G1000 can store up to 25 profiles; the currently active profile, the amount of memory used, and the amount of memory available are shown at the top of the System Setup Page in the box labeled 'Pilot Profile'. From here, pilot profiles may be created, selected, renamed, or deleted.
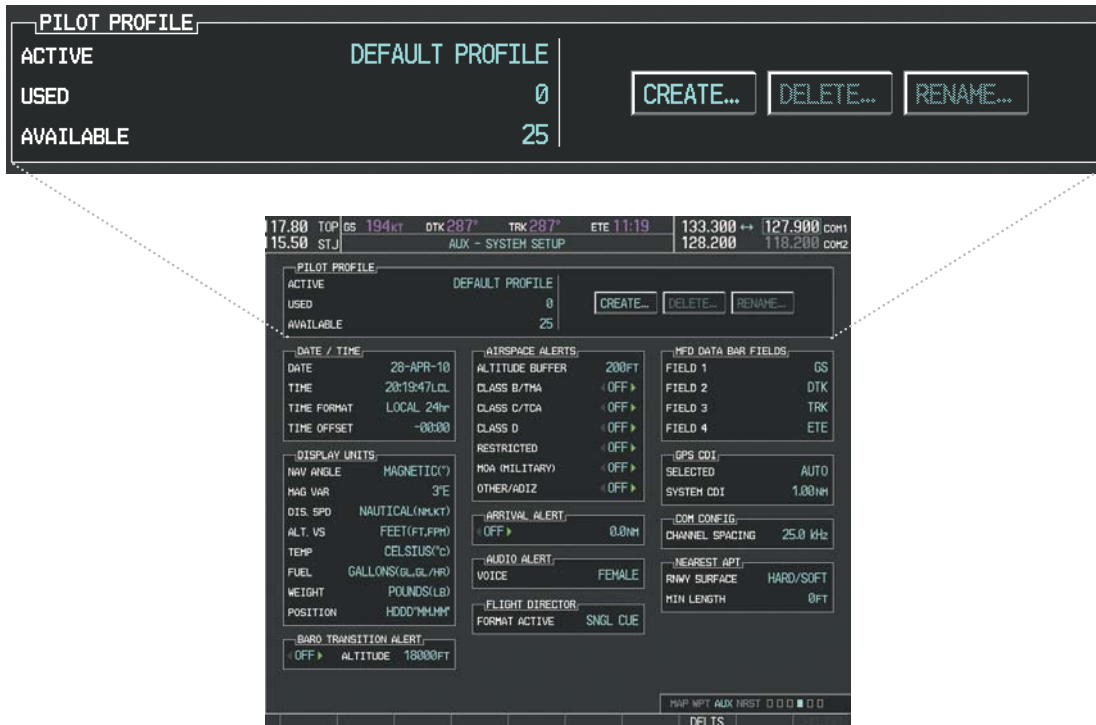
Figure 1-33 Pilot Profile Management (System Setup Page)

Creating a profile:

1) Select the AUX - System Setup Page.

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

3) Turn the large **FMS** Knob to highlight 'CREATE' in the Pilot 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. Pilot profile names cannot begin with a blank as the first letter.

6) In the next field, use the small **FMS** Knob to select the desired settings upon which to base the new profile. Profiles can be created based on Garmin factory defaults, default profile settings (initially based on Garmin factory defaults unless edited by the pilot), or current system 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 and ACTIVATE' and press the **ENT** Key to activate the new profile.

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

Selecting an active profile:

1) Select the AUX - System Setup Page.

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

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

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

5) Press the **ENT** Key. The G1000 loads and displays the system settings for the selected profile.

Renaming a profile:

1) Select the AUX - System Setup Page.

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

3) Turn the large **FMS** Knob to highlight 'RENAME' in the Pilot Profile Box.

4) Press the **ENT** Key.

5) In the 'Rename Profile' window, turn the **FMS** Knob to select the profile to rename.

6) Press the **ENT** Key.

7) Use the **FMS** Knob to enter a new profile name up to 16 characters long and press the **ENT** Key.

8) With 'RENAME' highlighted, press the **ENT** Key.

9) To cancel the process, use the large **FMS** Knob to select 'CANCEL' and press the ENT Key.

Deleting a profile:

1) Select the AUX - System Setup Page.

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

3) Turn the large **FMS** Knob to highlight 'DELETE' in the Pilot 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.

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DISPLAY UNITS

Units in which various quantities are displayed on the G1000 screens are listed on the System Setup Page. The Navigation Angle reference, the Temperature units, and the Position units can be set from here.

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

   * *Default setting*
  ** *Contact a Garmin-authorized service center to change this setting*

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

Changing a display unit setting

1) While on the System Setup Page, press the **FMS** Knob momentarily to activate the flashing cursor.

2) Turn the large **FMS** Knob to highlight the desired field in the Display Units Box.

3) Turn the small **FMS** Knob to select the desired units.

4) Press the **ENT** Key. Press the **CLR** Key to cancel the action without changing the units.

ARRIVAL ALERTS

The Arrival Alert Box on the System Setup Page allows arrival alerts to be turned on/off and the alert trigger distance set. 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). Once the set distance (up to 99.9 units) has been reached, an "Arrival at [waypoint]" message is displayed in the PFD Navigation Status Box.

Figure 1-34 Arrival Alert Settings (System Setup Page)

Enabling/disabling an arrival alert:

1) Use the **FMS** Knob to select the AUX - System Setup Page.

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

3) Turn the large **FM**S Knob to select the ON/OFF field in the Arrival Alert Box.

4) Turn the small **FMS** Knob clockwise to turn the airspace alert ON or counterclockwise to turn the alert OFF.

Changing the arrival alert trigger distance:

1) Use the **FMS** Knob to select the AUX - System Setup Page.

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

3) Turn the large **FMS** Knob to highlight the distance field in the Arrival Alert Box.

4) Use the **FMS** Knob to enter a trigger distance and press the **ENT** Key.

AUDIO ALERTS

The Audio Alert Box on the System Setup Page allows the audio alert voice to be set to male or female.

Changing the audio alert voice

1) While on the System Setup Page, press the **FMS** Knob momentarily to activate the flashing cursor.

2) Turn the large **FMS** Knob to highlight the voice in the Audio Alert Box.

3) Turn the small **FMS** Knob to display and highlight the desired voice and press the **ENT** Key.

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SYSTEM STATUS PAGE

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

Figure 1-35 Example System Status Page

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

Selecting the **MFD1 DB** Softkey (label background changes to grey indicating the softkey is selected) places the cursor in the database window. Use the **FMS** Knob to scroll through database information for the MFD. Selecting the softkey again will change the softkey label to **PFD1 DB**. PFD 1 database information is now displayed in the database window. Selecting the softkey a third time will change the softkey label back to **MFD1 DB**. MFD 1 database information is displayed in the database window again.

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

Selecting the **SYNC DBS** Softkey (label background changes to grey indicting the softkey is selected) activates the Automatic Database Synchronization feature. When this feature is active, databases are updated automatically in the MFD and both PFDs from one SD card. For a detailed discussion on database synchronization, see the Database Management section in the Appendices.

UTILITY PAGE

For flight planning purposes, timers, trip statistics, and a scheduler feature are provided on the AUX - Utility Page. The timers available include a stopwatch-like generic timer, a total time in flight timer, and a record of the time of departure. Trip statistics—odometer, trip odometer, and average trip and maximum groundspeeds—are displayed from the time of the last reset. Refer to the Additional Features section for a dicussion on the Scheduler feature.

Figure 1-36 Utility Page

TIMERS

The G1000 timers available include:

• Stopwatch-like generic timers (available from the PFD Timer/References Window and on the MFD AUX - Utility Page)

• Total-time-in-flight timer (MFD AUX - Utility Page)

• Time since departure (MFD AUX - Utility Page)

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

Setting the generic timer (PFD):

1) Press the **TMR/REF** Softkey.

2) Turn the large **FMS** Knob to select the timer field (hh/mm/ss).

3) Use the **FMS** Knob to enter the desired time and press the **ENT** Key.

4) With the UP/DN field highlighted, turn the small **FMS** Knob to select the timer counting direction (UP/DN) and press the **ENT** Key.

5) With 'START?' highlighted, 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.

8) To remove the window, press the **CLR** Key or the **TMR/REF** Softkey.
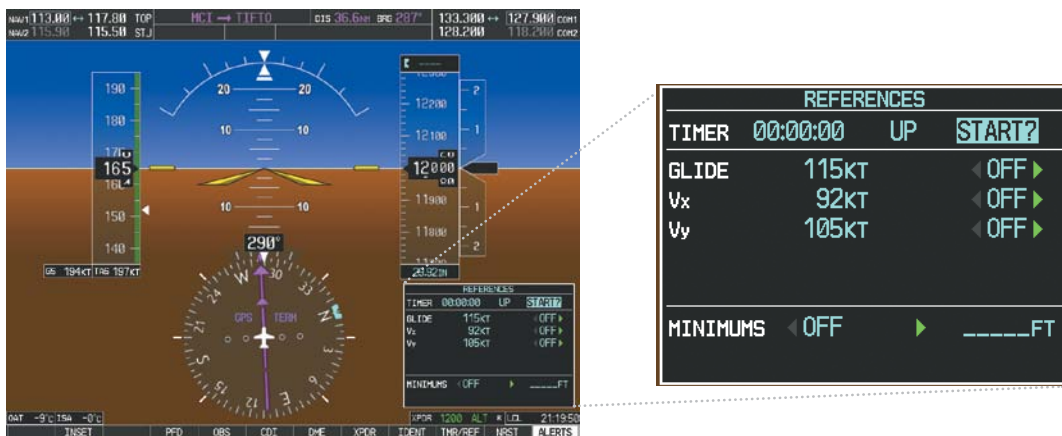
Figure 1-37 Generic Timer (PFD Timer/References Window)

Setting the generic timer (MFD AUX - Utility Page)

1) Use the **FMS** Knob to select the AUX - Utility Page.

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

3) Turn the small **FMS** Knob to select the timer counting direction (UP/DN) and press the **ENT** Key.

4) If a desired starting time is desired:

   a) Use the large **FMS** Knob to highlight the HH:MM:SS field.

   b) Use the **FMS** Knob to enter the desired time and press the **ENT** Key.

5) Turn the large **FMS** Knob to highlight 'START?' and press the **ENT** Key to start the timer. The field changes to 'STOP?'.

6) To stop the timer, press the **ENT** Key with 'STOP?' highlighted. The field changes to 'RESET?'.

7) To reset the timer, press the **ENT** Key with 'RESET?' highlighted. The field changes back to 'START?' and the digits are reset.
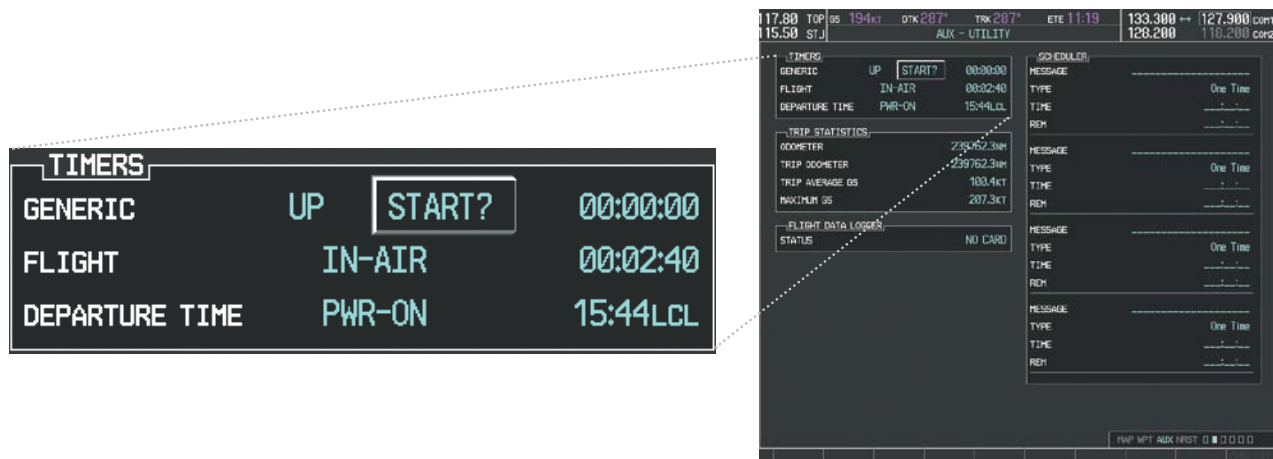
Figure 1-38 Timers (MFD AUX - Utility Page)

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

Setting the flight timer starting criterion

1) Use the **FMS** Knob to select the AUX - Utility Page.

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

3) Turn the large **FMS** Knob to highlight the field next to the flight timer.

4) Turn the small **FMS** Knob to select the starting criterion (PWR-ON or IN-AIR) and press the **ENT** Key.

Resetting the flight timer

1) Use the **FMS** Knob to select the AUX - Utility Page.

2) Press the **MENU** Key.

3) With 'Reset Flight Timer' highlighted, press the **ENT** Key.

The G1000 records the time at which departure occurs, depending on whether the pilot prefers the time to be recorded from system power-up or from aircraft lift off. The displayed departure time can also be reset to display the current time at the point of reset. The format in which the time is displayed is controlled from the System Setup Page.

Setting the departure timer starting criterion

1) Use the **FMS** Knob to select the AUX - Utility Page.

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

3) Turn the large **FMS** Knob to highlight the field next to the departure time.

4) Turn the small **FMS** Knob to select the starting criterion (PWR-ON or IN-AIR) and press the **ENT** Key.

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Resetting the departure time

1) Use the **FMS** Knob to select the AUX - Utility Page.

2) Press the **MENU** Key.

3) Use the **FMS** Knob to highlight 'Reset Departure Time' and press the **ENT** Key.

TRIP STATISTICS

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

Resetting trip statistics readouts

1) Use the **FMS** Knob to select the AUX - Utility Page.

2) Press the **MENU** Key. The following reset options for trip statistics are displayed:

- Reset Trip ODOM/AVG GS—Resets trip average ground speed readout and odometer

- Reset Odometer—Resets odometer readout only

- Reset Maximum Speed—Resets maximum speed readout only

- Reset All—Resets flight timer, departure timer, odometers, and groundspeed readouts

3) Use the **FMS** Knob to highlight the desired reset option and press the **ENT** Key. The selected parameters are reset to zero and begin to display data from the point of reset.

Scheduler

The G1000's Scheduler feature can be used to enter and display reminder messages (e.g., "Change oil", "Switch fuel tanks", "Overhaul") in the Alerts Window on the PFD. Messages can be set to display based on a specific date and time (event), once the message timer reaches zero (one-time; default setting), or recurrently whenever the message timer reaches zero (periodic). Message timers set to periodic alerting automatically reset to the original timer value once the message is displayed. When power is cycled, messages are retained until deleted, and message timer countdown is restarted.
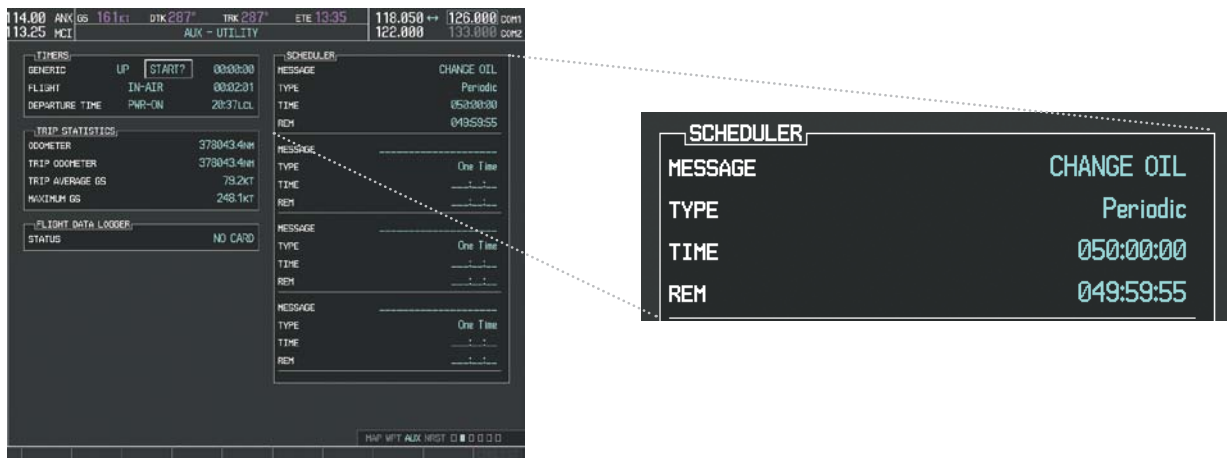
Figure 1-39 Scheduler (Utility Page)

Entering a scheduler message:

1) Select the AUX - Utility Page.

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

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

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

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

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

   • Event—Message issued at the specified date/time

   • One-time—Message issued when the message timer reaches zero (default setting)

   • Periodic—Message issued each time the message timer reaches zero

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

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

9) For event-based messages:

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

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

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

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

Deleting a scheduler message:

1) Select the AUX - Utility Page.

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

3) Turn the large **FMS** Knob to highlight the name field of the scheduler message to be deleted.

4) Press the **CLR** Key to clear the message text. If the **CLR** Key is pressed again, the message is restored.

5) Press the **ENT** Key to confirm message deletion.

Scheduler messages appear in the Alerts Window on the PFD and cause the **ALERTS** Softkey label to change to 'ADVISORY'. Pressing the **ADVISORY** Softkey opens the Alerts Window and acknowledges the scheduler message. The softkey reverts to the 'ALERTS' label and when pressed, the Alerts Window is removed from the display and the scheduler message is deleted from the message queue.
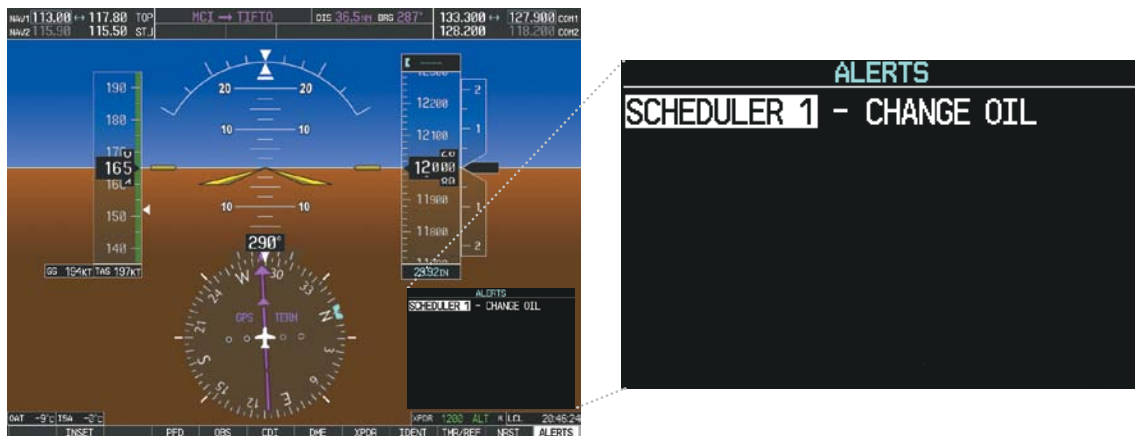
Figure 1-40 PFD Alerts Window

1.8 DISPLAY BACKLIGHTING

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

- Using the individual dimmer bus control for the desired display, or

- Using the PFD Setup Menu and the following procedures. In normal operating mode, backlighting can only be adjusted from the PFD. In reversionary mode, adjustments can be made from any remaining displays.

Adjusting display backlighting:

1) Press the PFD **MENU** Key to display the PFD Setup Menu. 'AUTO' is now highlighted next to 'PFD DSPL'. If desired, turn the large **FMS** Knob to select 'AUTO' next to 'MFD DSPL'.

2) Turn the small **FMS** Knob to select 'MANUAL' and press the **ENT** Key. The intensity value is now highlighted.

3) Use the **FMS** Knob to enter the desired backlighting then press the **ENT** Key.

4) To remove the menu, press the **CLR** or **MENU** Key.

Adjusting key backlighting:

1) Press the PFD **MENU** Key to display the PFD Setup Menu. 'AUTO' is now highlighted next to 'PFD DSPL'.

2) Turn the large **FMS** Knob to highlight 'PFD DSPL' or 'MFD DSPL', 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.
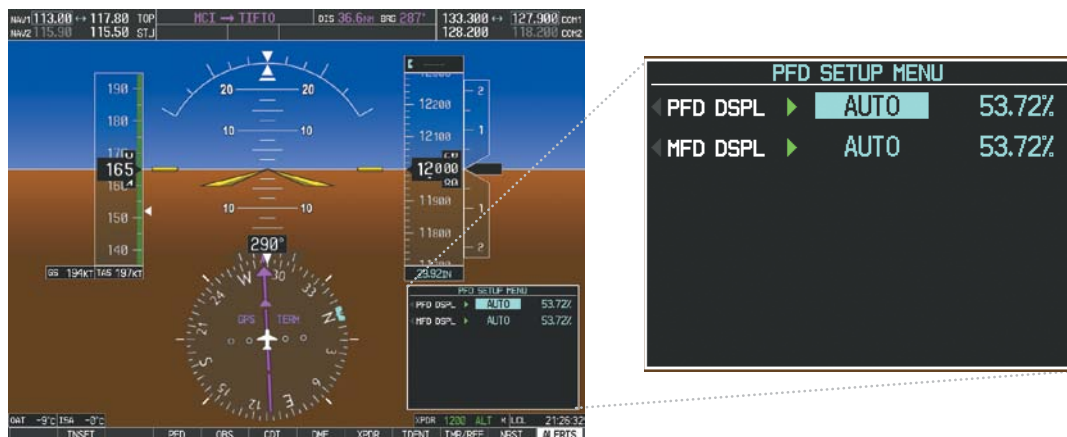
Figure 1-41 PFD Setup Menu

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> ⚠ **WARNING:** *In the event that the airspeed, attitude, altitude, or heading indications become unusable, refer to the backup instruments.*

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

Increased situational awareness is provided by replacing the traditional instruments on the panel with an easy-to-scan Primary Flight Display (PFD) that features a large horizon, airspeed, attitude, altitude, vertical speed, and course deviation information. In addition to the flight instruments, navigation, communication, terrain, traffic, and weather information are also presented on the PFD and 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
  - Airspeed awareness ranges
  - Reference flags
  - Groundspeed
- Attitude Indicator with slip/skid indication
- Altimeter, showing
  - Barometric setting
  - Selected Altitude
- Vertical Deviation/Glideslope Indicators
- Vertical Speed Indicator (VSI)
- Vertical Navigation indications
- Horizontal Situation Indicator, showing
  - Heading and course indications
  - Turn Rate Indicator
  - Navigation source
  - Bearing pointers and information windows
  - DME Information Window (optional)
  - Course Deviation Indicator (CDI)
- DME Tuning Window (optional)
- Outside air temperature (OAT)
- International Standard Atmosphere temperature deviation (ISA)
- System time
- Wind data

The PFD also displays various alerts and annunciations.

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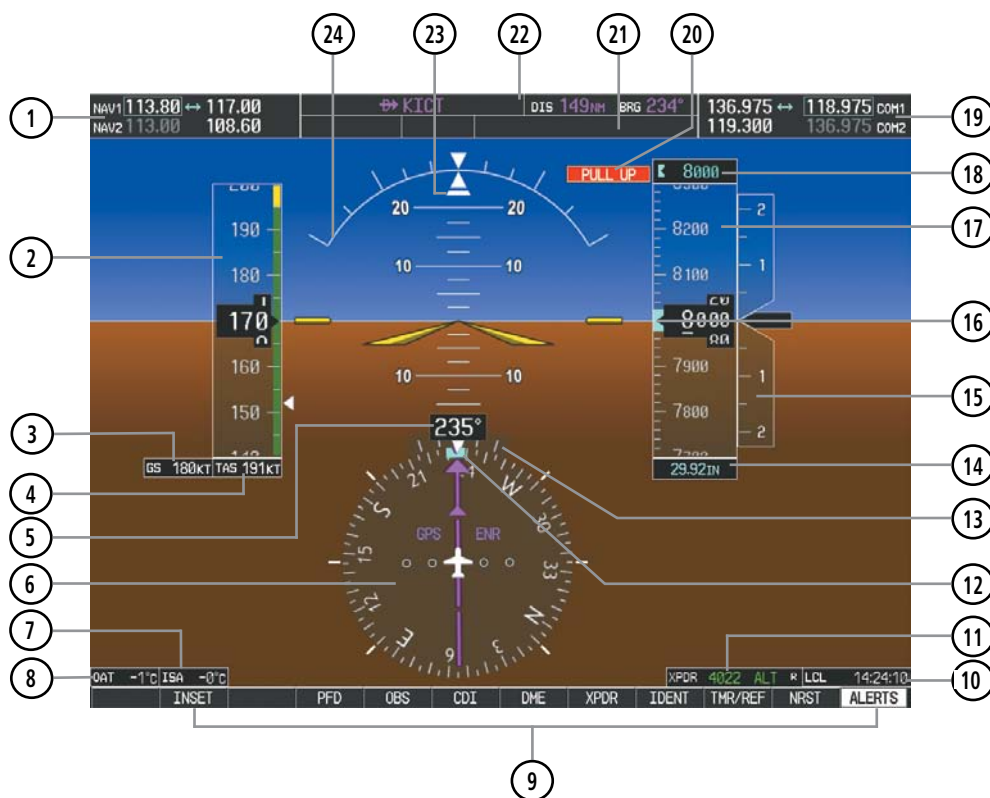
①	NAV Frequency Box	⑬	Turn Rate Indicator
②	Airspeed Indicator	⑭	Altimeter Barometric Setting
③	Groundspeed	⑮	Vertical Speed Indicator (VSI)
④	True Airspeed	⑯	Selected Altitude Bug
⑤	Current Heading	⑰	Altimeter
⑥	Horizontal Situation Indicator (HSI)	⑱	Selected Altitude
⑦	International Standard Atmosphere (ISA) temperature	⑲	COM Frequency Box
⑧	Outside Air Temperature (OAT)	⑳	TAWS Alert Annunciation
⑨	Softkeys	㉑	AFCS Status Box
⑩	System Time	㉒	Navigation Status Box
⑪	Transponder Data Box	㉓	Slip/Skid Indicator
⑫	Selected Heading Bug	㉔	Attitude Indicator

Figure 2-1 Primary Flight Display (Default)

(1)	Traffic Annunciation	(8)	Flight Plan Window
(2)	Selected Heading	(9)	Annunciation Window
(3)	Wind Data	(10)	Selected Course
(4)	Inset Map	(11)	Vertical Speed Required
(5)	DME Information Window (optional)	(12)	Vertical Deviation Indicator (VDI)
(6)	Bearing Information Windows	(13)	Current VNV Target Altitude
(7)	Minimum Descent Altitude/ Decision Height	(14)	AFCS Status Annunciation

Figure 2-2 Additional PFD Information

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AIRSPEED INDICATOR

> **NOTE:** *Refer to the Pilot's Operating Handbook (POH) and FAA Approved Airplane Flight Manual (AFM) for speed criteria and Vspeed values.*

The Airspeed Indicator displays airspeed on a rolling number gauge using a moving tape. The true airspeed (TAS) 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, while minor tick marks on the moving tape are indicated at intervals of 5 knots. Speed indication starts at 20 knots, with 60 knots of airspeed viewable at any time. The actual airspeed is displayed inside the black pointer. The pointer remains black until reaching never-exceed speed (V_{NE}), at which point it turns red.
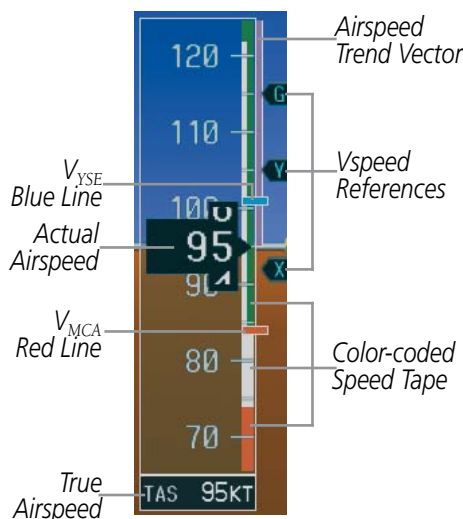
Figure 2-3 Airspeed Indicator
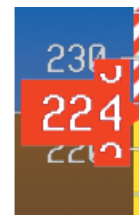
Figure 2-4 Red Pointer Showing Airspeed Above V_{NE}

A color-coded (white, green, yellow, and red) speed range strip is located on the moving tape. The colors denote flaps operating range, normal operating range, caution range, and never-exceed speed (V_{NE}). Speeds above the never-exceed speed (V_{NE}), appear in the high speed warning range, represented on the airspeed tape by red/white "barber pole" coloration.

A red low speed awareness range extends up to the low speed awareness velocity, V_{LSA}. An aural stall warning is generated as the aircraft approaches a stall condition.

The Airspeed Trend Vector is a vertical, magenta line, extending up or down on the airspeed scale, located to the right of the color-coded speed range strip. The end of the trend vector displays approximately what airspeed will be reached in 6 seconds if the current acceleration is maintained. If the trend vector crosses V_{NE}, the text of the actual airspeed readout changes to yellow while the pointer remains black. The trend vector is absent if the speed remains constant or if any data needed to calculate airspeed is not available due to a system failure.

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Black reference markers along the right side of the airspeed scale denote GLIDE, V_X, and V_Y. The blue line displays V_{YSE} while the red line displays V_{MCA}. GLIDE, V_X, and V_Y may be set and displayed using the Timer/References window.
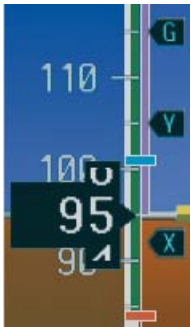
Figure 2-5 VSpeed References

Vspeed	Flag
GLIDE	G
V_x	X
V_y	Y

Table 2-1 Vspeed Flag Labels

A solid white triangle is automatically set at the maximum landing gear extension speed. This indication is always displayed and cannot be turned off by the pilot.

Figure 2-6 Maximum Landing Gear Extended Speed Reference

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> **NOTE:** *Refer to the Pilot's Operating Handbook (POH) and FAA Approved Airplane Flight Manual (AFM) for speed criteria and Vspeed values.*

Changing Vspeeds and turning Vspeed flags 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-kt 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.

**Figure 2-7 Vspeed References
(Timer/References Window)**

Vspeed flags can be turned on or off and values restored all at once.

Modifying Vspeeds (on, off, restore defaults):

1) Press the **TMR/REF** Softkey.

2) Press the **MENU** Key.

3) Turn the **FMS** Knob to highlight the desired selection.

4) Press the **ENT** Key.

5) To remove the window, press the **CLR** Key or the **TMR/REF** Softkey.
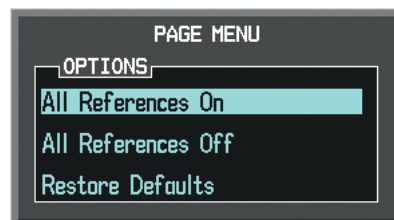
**Figure 2-8 Page Menu
(Timer/References Window)**

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 (indicated by the yellow symbolic aircraft on the pitch scale), roll, and slip/skid information.

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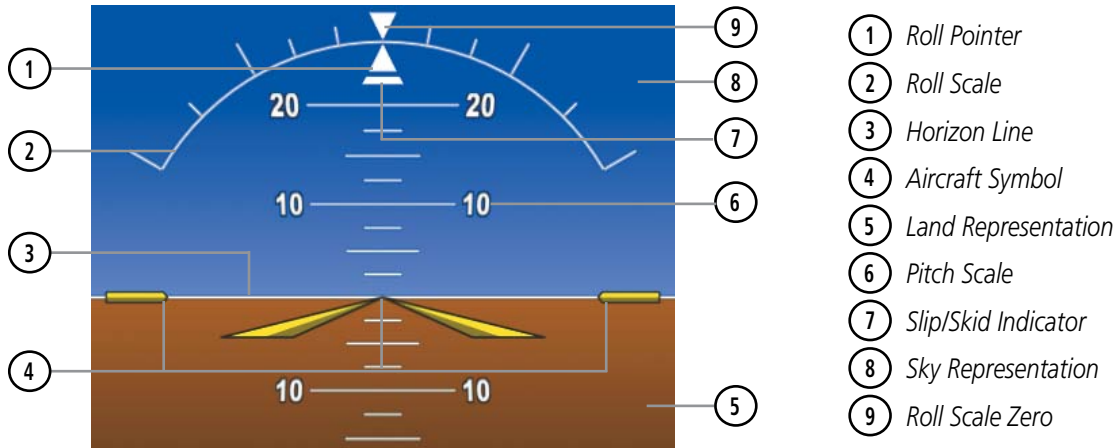
Figure 2-9 Attitude Indicator

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 optional Synthetic Vision System (SVS) is activated, the pitch scale is reduced to 10° up and 7.5° down; refer to the Additional Features section for more information about Synthetic Vision.

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 moves with the roll pointer and moves laterally away from the pointer to indicate lateral acceleration. Slip/skid is indicated by the location of the bar relative to the pointer.

Figure 2-10 Slip/Skid Indication

ALTIMETER

The Altimeter displays 600 feet of barometric altitude values at a time on a rolling number gauge using a moving tape. Numeric labels and major tick marks are shown at intervals of 100 feet. Minor tick marks are at intervals of 20 feet. The current altitude is displayed in the black pointer.

The Selected Altitude is displayed above the Altimeter in the box indicated by a selection bug symbol. A bug corresponding to this altitude is shown on the tape; if the Selected Altitude exceeds the range shown on the tape, the bug appears at the corresponding edge of the tape. See the AFCS Section for more information about how the G1000 uses the Selected Altitude.

Setting the Selected Altitude:

Turn the **ALT SEL** Knob to set the Selected Altitude in 100-ft increments When meters are displayed, Selected Altitude is adjusted in 50 meter increments.

If set, the Minimum Descent Altitude/Decision Height (MDA/DH) value is also available for the Selected Altitude.
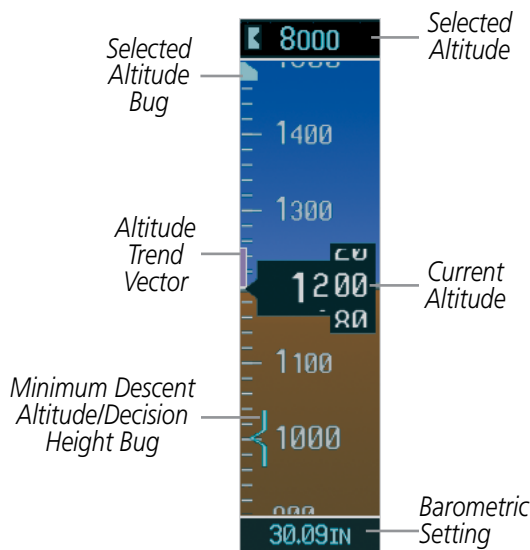
Figure 2-11 Altimeter

Figure 2-12 Altimeter (Metric Units)

Selected and current altitudes can also be displayed in meters (readouts displayed above the normal readouts in feet; Figure 2-12). Note that the altitude tape does not change scale.

Displaying altitude in meters:

1) Press the **PFD** Softkey to display the second-level softkeys.

2) Press the **ALT UNIT** Softkey.

3) Press the **METERS** Softkey to turn on metric altitude readouts.

4) Press the **BACK** Softkey to return to the top-level softkeys.

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.

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 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** Softkey to display the second-level softkeys.

2) Press the **STD BARO** Softkey.

Changing altimeter barometric pressure setting units:

1) Press the **PFD** Softkey to display the second-level softkeys.

2) Press the **ALT UNIT** Softkey.

3) Press the **IN** Softkey to display the barometric pressure setting in inches of mercury (in Hg).

Or, press the **HPA** Softkey to display the barometric pressure setting in hectopascals (hPa; see Figure 2-12).

4) Press the **BACK** Softkey to return to the top-level softkeys.

VERTICAL SPEED INDICATOR (VSI)

The Vertical Speed Indicator (VSI) displays the aircraft vertical speed using a non-moving tape labeled at 1000 and 2000 fpm with minor tick marks every 500 fpm. The current vertical speed is displayed in the pointer along the tape. Digits appear in the pointer when the climb or descent rate is greater than 100 fpm. If the rate of ascent/descent exceeds 2000 fpm, the pointer appears at the corresponding edge of the tape and the rate appears inside the pointer.

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

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VERTICAL DEVIATION

> **NOTE:** The Glidepath Indicator is only available when SBAS is available.

The Vertical Deviation Indicator (VDI; Figure 2-13) uses a magenta chevron to indicate the baro-VNV vertical deviation when Vertical Navigation (VNV) is being used; the VDI appears in conjunction with the "TOD within 1 minute" alert. Full-scale deflection (two dots) is 1000 feet. 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 Section 2.2, Supplemental Flight Data, for more information about VNV indications on the PFD.

The Glideslope Indicator (Figure 2-14) appears to the left of the Altimeter whenever an ILS frequency is tuned in the active NAV field and the heading is less than 105° from the inbound course. A green diamond acts as the Glideslope Indicator, like a glideslope needle on a conventional indicator. If a localizer frequency is tuned and there is no glideslope, "NO GS" is annunciated.

The glidepath is analogous to the glideslope for GPS approaches supporting SBAS vertical guidance (LNAV+V, L/VNV, LPV) and is generated by the system to reduce pilot workload during approach. When an approach of this type is loaded into the flight plan and GPS is the selected navigation source, the Glidepath Indicator (Figure 2-15) appears as a magenta diamond. If the approach type downgrades past the final approach fix (FAF), "NO GP" is annunciated.
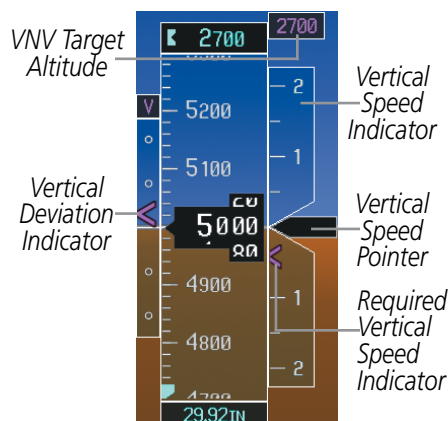
Figure 2-13 Vertical Speed and Deviation Indicators (VSI and VDI)
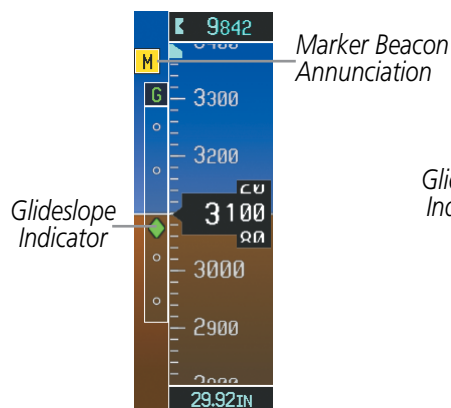
Figure 2-14 Glideslope Indicator
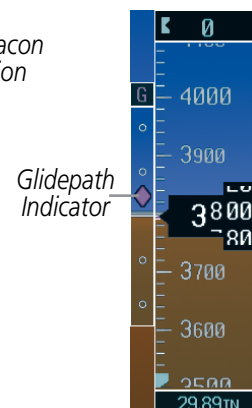
Figure 2-15 Glidepath Indicator

HORIZONTAL SITUATION INDICATOR (HSI)

The Horizontal Situation Indicator (HSI) displays a rotating compass card in a heading-up orientation. Letters indicate the cardinal points and numeric labels occur every 30°. Major tick marks are at 10° intervals and minor tick marks at 5° intervals. A digital reading of the current heading appears on top of the HSI, and the current track is represented on the HSI by a magenta diamond indicator. The HSI also presents turn rate, course deviation, bearing, and navigation source information and is available in two formats (360° compass rose and 140° arc).

Changing the HSI display format:

1) Press the **PFD** Softkey.

2) Press the **HSI FRMT** Softkey.

3) Press the **360 HSI** or **ARC HSI** Softkey.

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

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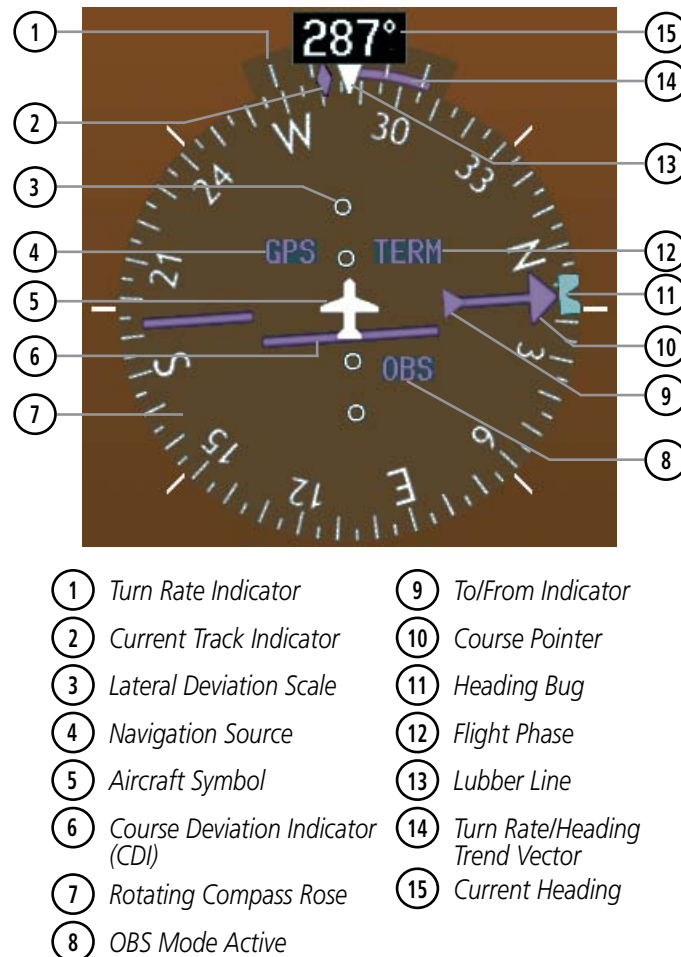
Figure 2-16 Horizontal Situation Indicator (HSI)

The Arc HSI is a 140° expanded section of the compass rose. The Arc HSI contains a Course Pointer, To/From Indicator, a sliding deviation indicator (the To/From and deviation indicators are combined), and a deviation scale. Upon station passage, the To/From Indicator flips and points to the tail of the aircraft, just like a conventional To/From flag. Depending on the navigation source, the CDI on the Arc HSI can appear in two different ways: an arrowhead (GPS, VOR, OBS) or a diamond (LOC).

Figure 2-17 Arc HSI

The Selected Heading is shown to the upper left of the HSI for 3 seconds after being adjusted The light blue bug on the compass rose corresponds to the Selected Heading. While the HSI is displayed as an arc, if the Selected Heading Bug is adjusted off the shown portion of the compass rose, the digital reading is displayed.

Adjusting the Selected Heading:

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

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

The Selected Course is shown to the upper right of the HSI for 3 seconds after being adjusted. While the HSI is displayed as an arc, the Selected Course is displayed whenever the Course Pointer is not within the 140° currently shown.

Adjusting the Selected Course:

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

Press the **CRS** Knob to re-center the CDI and return the course pointer to the bearing of the active waypoint or navigation station (see OBS Mode for adjusting a GPS course).
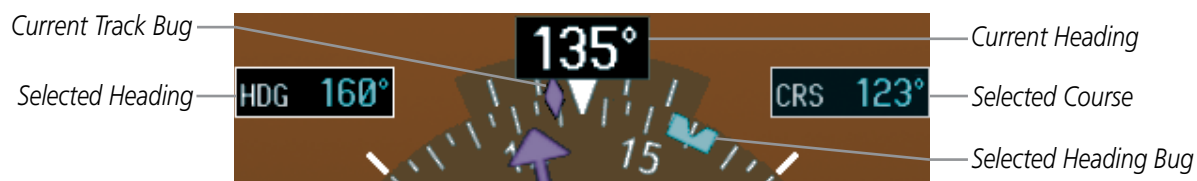
Figure 2-18 Heading and Course Indications

Navigation angles (track, heading, course, bearing) are corrected to the computed magnetic variation ('Mag Var') or referenced to true north (denoted 'T'), set on the AUX - System Setup 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 setting:

1)   Use the **FMS** Knob to select the AUX - System Setup Page on the MFD.

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

3)   Turn the large **FMS** Knob to highlight 'Nav Angle' in the 'Display Units' box (Figure 2-20).

4)   Turn the small **FMS** Knob to highlight the desired setting and press the **ENT** Key.

   • TRUE - References angles to true north (denoted with 'T')

   • MAGNETIC - Angles corrected to the computed magnetic variation ('Mag Var')
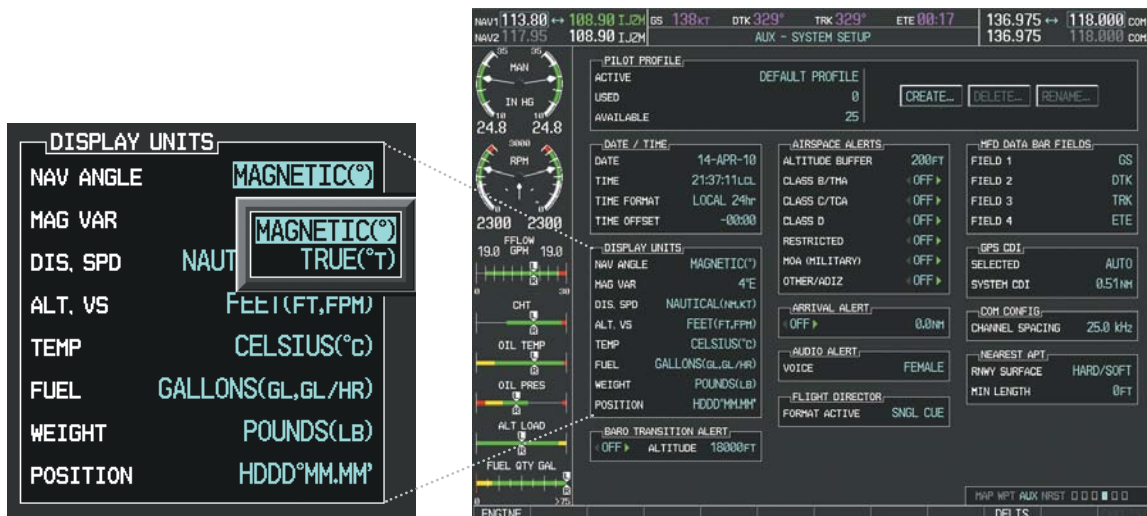
Figure 2-20 Navigation Angle Settings
(AUX-System Setup Page)

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.

Figure 2-21 Turn Rate Indicator and Trend Vector

BEARING POINTERS AND INFORMATION WINDOWS

NOTE: *When the Arc HSI is displayed, the Bearing Information windows and pointers are disabled.*

Two bearing pointers and associated information can be displayed on the HSI for NAV and GPS sources. The pointers are light blue and are single- (BRG1) or double-lined (BRG2); an icon is shown in the respective information window to indicate the pointer type. The bearing pointers never override the CDI and are visually separated from the CDI by a white ring (shown when bearing pointers are selected but not necessarily visible due to data unavailability).
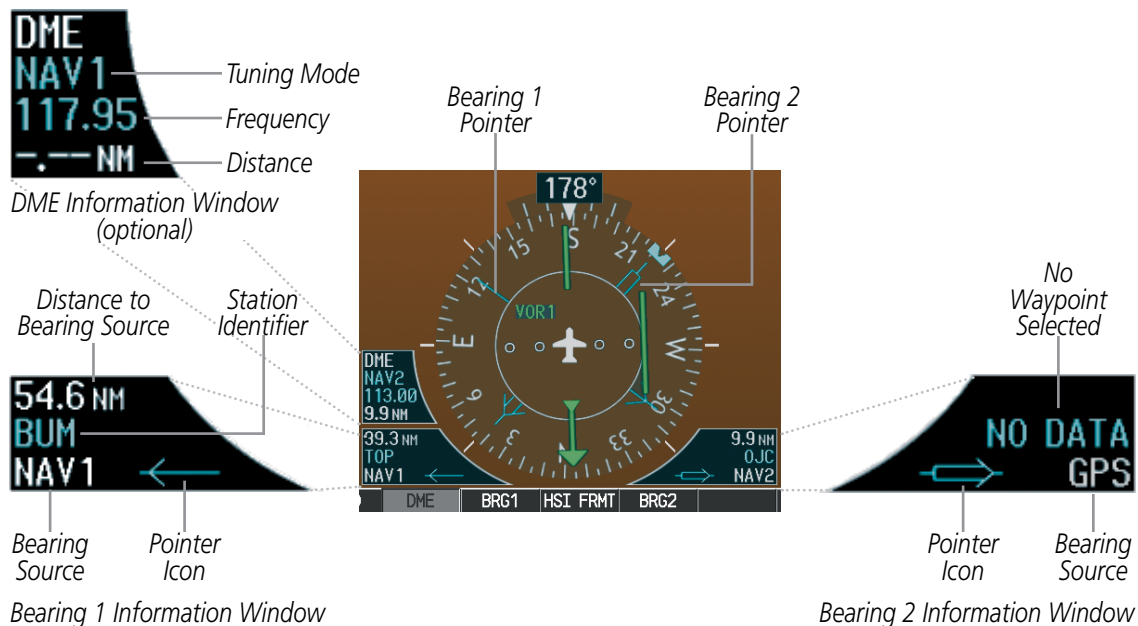
Figure 2-22 HSI with Bearing and DME Information

When a bearing pointer is displayed, its associated information window is also displayed. The Bearing Information windows (Figure 2-22) are displayed to the lower sides of the HSI and show:

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

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

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

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

Selecting bearing display and changing sources:

1) Press the **PFD** Softkey.

2) Press a **BRG** Softkey to display the desired bearing pointer and information window with a NAV source.

3) Press the **BRG** Softkey again to change the bearing source to GPS.

4) To remove the bearing pointer and information window, press the **BRG** Softkey again.

DME INFORMATION WINDOW

NOTE: *DME radio installation is optional.*

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

Displaying the DME Information Window:

1) Press the **PFD** Softkey.

2) Press the **DME** Softkey to display the DME Information Window above the BRG1 Information Window.

3) To remove the DME Information Window, press the **DME** Softkey again.

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COURSE DEVIATION INDICATOR (CDI)

> **NOTE:** If a heading change of greater than 105° with respect to the course is made, the CDI on the Arc HSI switches to the opposite side of the deviation scale and displays reverse sensing.

The Course Deviation Indicator (CDI) moves left or right from the course pointer along a lateral deviation scale to display aircraft position relative to the course. If the course deviation data is not valid, the CDI is not displayed.
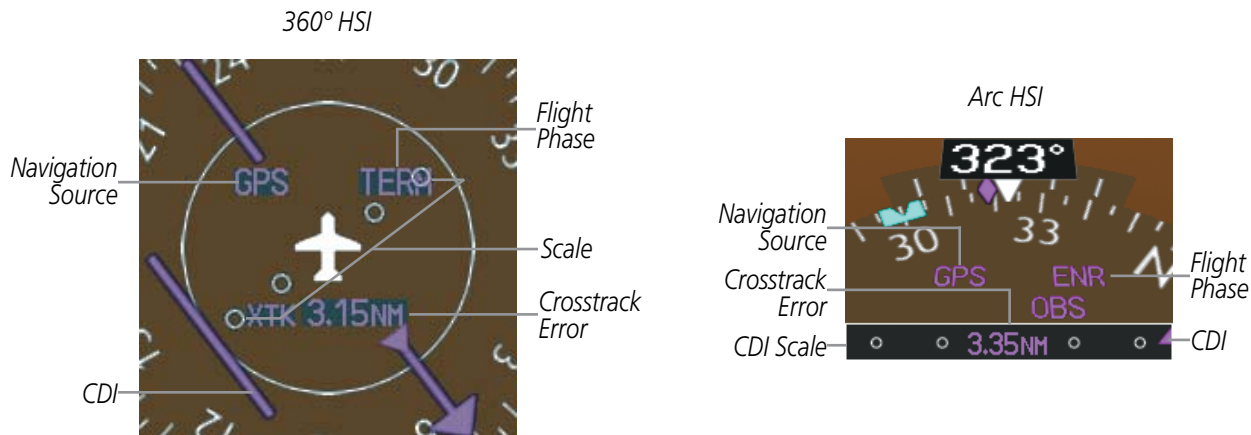
Figure 2-23 Course Deviation Indicator

The CDI can display two sources of navigation: GPS or NAV (VOR, localizer). Color indicates the current navigation source: magenta (for GPS) or green (for VOR and LOC). The full scale limits for the CDI are defined by a GPS-derived distance when coupled to GPS. When coupled to a VOR or localizer (LOC), the CDI has the same angular limits as a mechanical CDI. If the CDI exceeds the maximum deviation on the scale (two dots) while displaying GPS, the crosstrack error (XTK) is displayed below the white aircraft symbol.
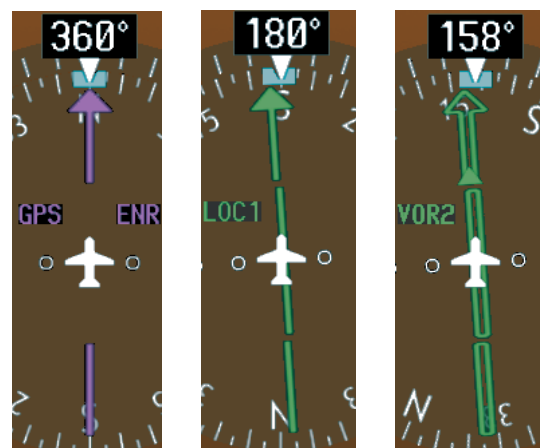
Figure 2-24 Navigation Sources

Changing navigation sources:

1) Press the **CDI** Softkey to change from GPS to VOR1 or LOC1. This places the light blue tuning box over the NAV1 standby frequency in the upper left corner of the PFD.

2) Press the **CDI** Softkey again to change from VOR1 or LOC1 to VOR2 or LOC2. This places the light blue tuning box over the NAV2 standby frequency.

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

NAV1 Selected for Tuning

NAV2 Selected for Tuning

GPS Selected

LOC1 Selected

VOR2 Selected

*Pressing the **CDI** Softkey Cycles through Navigation Sources*
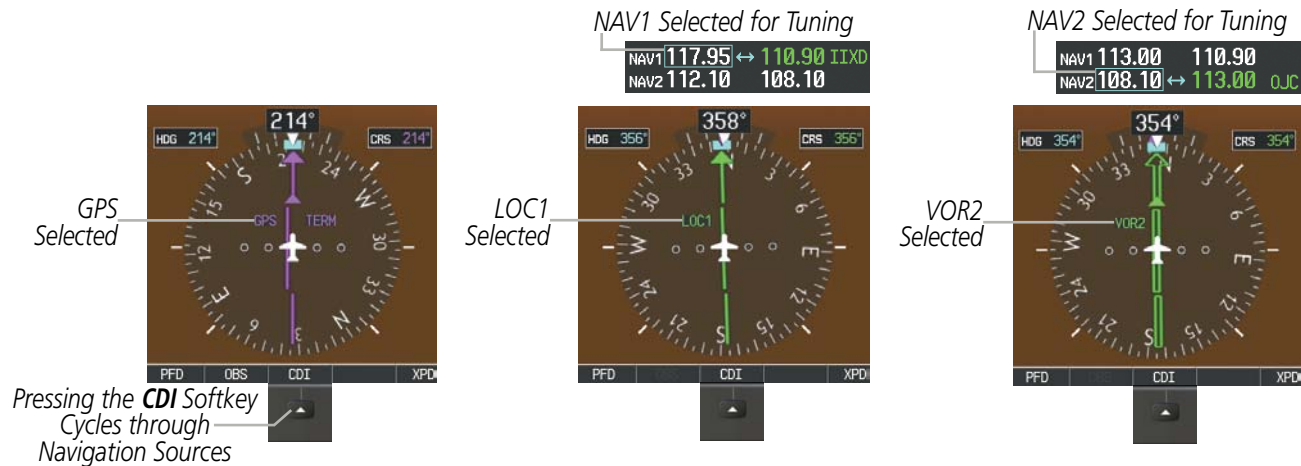
Figure 2-25 Selecting a Navigation Source

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

• A localizer or ILS approach has been loaded into the active flight plan

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

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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 yellow. 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 as 'System CDI' on the AUX - System Setup Page and the full-scale deflection setting may also be changed (2.0 nm, 1.0 nm, 0.3 nm, or Auto) from this page (Figure 2-26). If the selected scaling is smaller than the automatic setting for enroute and terminal phases, the CDI is scaled accordingly and the selected setting is be displayed rather than the flight phase annunciation.

Changing the selected GPS CDI setting:

1) Use the **FMS** Knob to select the AUX - System Setup Page on the MFD.

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

3) Turn the large **FMS** Knob to highlight 'Selected' in the 'GPS CDI' box.

4) Turn the small **FMS** Knob to highlight the desired setting and press the **ENT** Key.

5) To cancel the selection, press the **FMS** Knob or the **CLR** Key.

**Figure 2-26 GPS CDI Settings
(AUX-System Setup Page)**

When set to 'Auto' (default), the GPS CDI scale automatically adjusts to the desired limits based upon the current phase of flight (Figure 2-27, 2-28, 2-29, Table 2-2).

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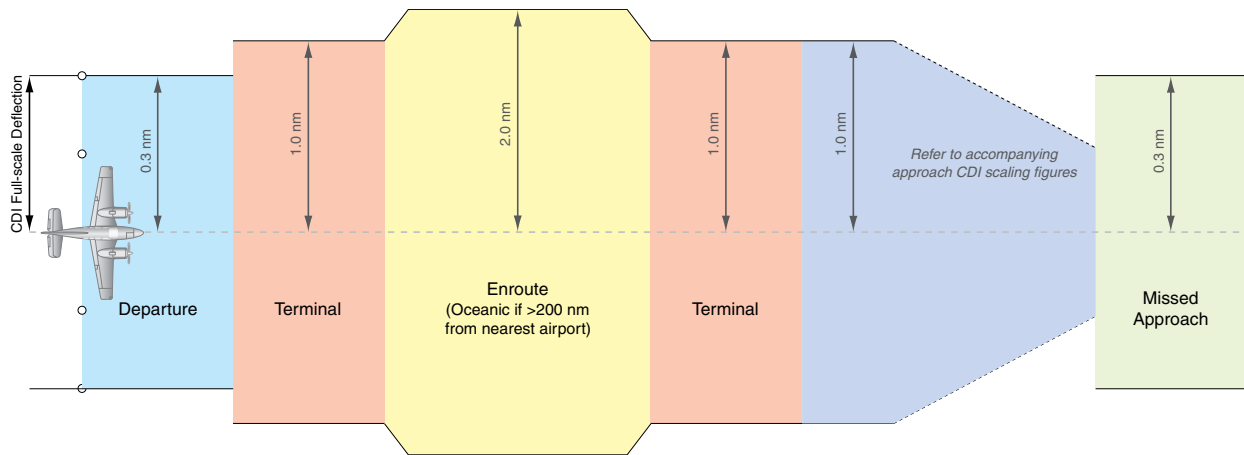
Figure 2-27 Automatic CDI Scaling

- When a departure procedure is active, the CDI is scaled for ***departure*** (0.3 nm).

- The system switches from departure to ***terminal*** CDI scaling (1.0 nm) under the following conditions:

  - The next leg in the procedure is not aligned with the departure runway

  - The next leg in the departure procedure is not CA, CD, CF, CI, CR, DF, FA, FC, FD, FM, IF, or TF (see Glossary for leg type definitions)

  - After any leg in the departure procedure that is not CA or FA

- At 30 nm from the departure airport the ***enroute*** phase of flight is automatically entered and CDI scaling changes to 2.0 nm over a distance of 1.0 nm, except under the following conditions:

  - When navigating with an active departure procedure, the flight phase and CDI scale does not change until the aircraft arrives at the last departure waypoint (if more than 30 nm from the departure airport) or the leg after the last departure waypoint has been activated or a direct-to waypoint is activated.

- If after completing the departure procedure the nearest airport is more than 200 nm away from the aircraft and the approach procedure has not yet commenced, the CDI is scaled for ***oceanic*** flight (2.0 nm).

- Within 31 nm of the destination airport (***terminal*** area), the CDI scale gradually ramps down from 2.0 nm to 1.0 nm over a distance of 1.0 nm; except under the following conditions:

  - Upon reaching the first waypoint of an arrival route that is more than 31 nm from the destination airport, the flight phase changes to terminal and the CDI scale begins to transition down from 2.0 nm to 1.0 nm over a distance of 1.0 nm.

- During ***approach***, the CDI scale ramps down even further (see Figures 2-28 and 2-29). This transition normally occurs within 2.0 nm of the final approach fix (FAF). The CDI switches to approach scaling automatically once the approach procedure is activated or if Vector-to-Final (VTF) is selected.

  - If the active waypoint is the FAF, the ground track and the bearing to the FAF must be within 45° of the final approach segment course.

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

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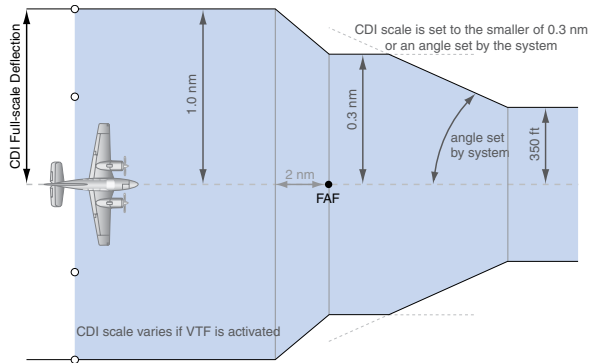
Figure 2-28 Typical LNAV and LNAV+V Approach CDI Scaling
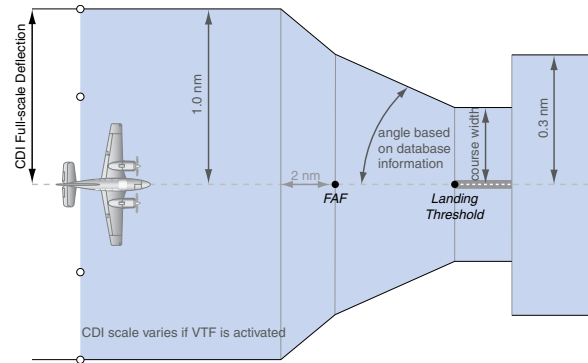
Figure 2-29 Typical LNAV/VNAV and LPV Approach CDI Scaling

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

Flight Phase	Annunciation	Automatic CDI Full-scale Deflection
Departure	DPRT	0.3 nm
Terminal	TERM	1.0 nm
Enroute	ENR	2.0 nm
Oceanic	OCN	2.0 nm
Approach (Non-precision)	LNAV	1.0 nm decreasing to 350 feet depending on variables (see Figure 2-28)
Approach (Non-precision with Vertical Guidance)	LNAV + V	
Approach (LNAV/VNAV)	L/VNAV	1.0 nm decreasing to a specified course width, then 0.3 nm, depending on variables (see Figure 2-29)
Approach (LPV)	LPV	
Missed Approach	MAPR	0.3 nm

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 (see Figure 2-30).

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 GPS flight plan returns to normal operation with automatic sequencing of waypoints, following the course set in OBS Mode. The flight path on the moving map retains the modified course line.

GPS Selected

Extended Course Line

OBS Mode Enabled

*Pressing the **OBS** Softkey Suspends Waypoint Sequencing*

*Pressing the **OBS** Softkey Again Returns to Normal Operation*
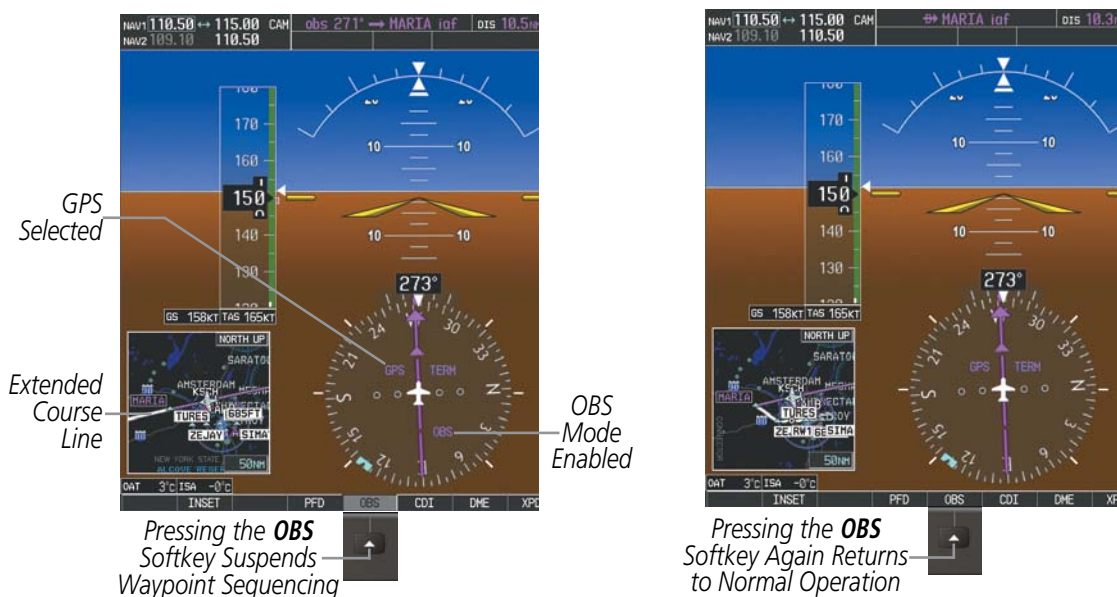
Figure 2-30 Omni-bearing Selector (OBS) Mode

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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. Press the **CRS** Knob to synchronize the Selected Course with the bearing to the next waypoint.

3) Press the **OBS** Softkey again to return to automatic waypoint sequencing.

As the aircraft crosses the missed approach point (in approach mode), automatic approach waypoint sequencing is suspended. 'SUSP' appears on the HSI (to the lower right of the aircraft symbol) in place of 'OBS' and the **OBS** Softkey label changes to **SUSP**.
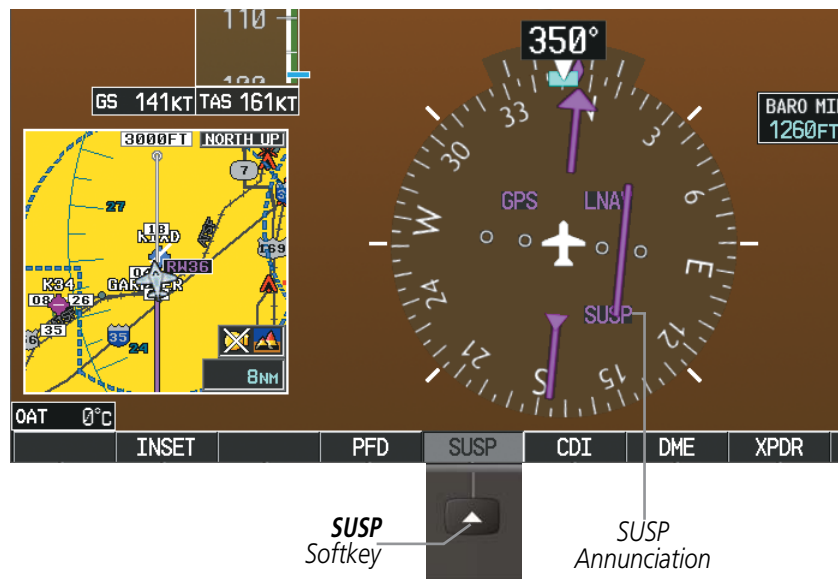
Figure 2-31 Suspending Automatic Waypoint Sequencing

2.2 SUPPLEMENTAL FLIGHT DATA

> ☑ **NOTE:** Selecting the **DFLTS** Softkey (a second-level PFD softkey) turns off metric Altimeter display, the Inset Map, and wind data display.

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

TEMPERATURE DISPLAYS

The Outside Air Temperature (OAT) and the deviation from International Standard Atmosphere (ISA) temperature are displayed in degrees Celsius (°C) by default in the lower left of the PFD under normal display conditions, or below the groundspeed in reversionary mode.

Normal Display

Reversionary Mode
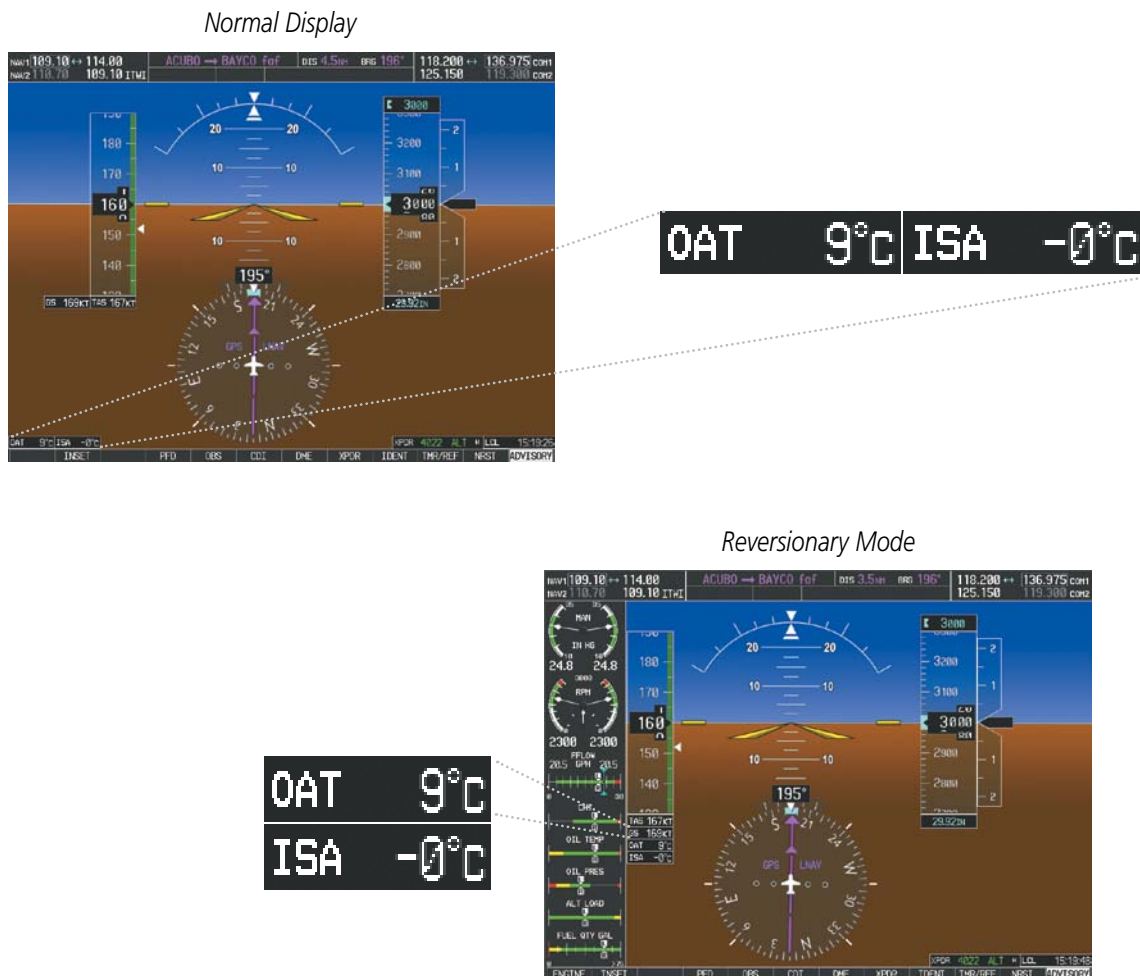
Figure 2-32 Outside Air Temperature

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WIND DATA

Wind direction and speed in knots can be displayed in a window to the upper left of the HSI. When the window is selected for display, but wind information is invalid or unavailable, the window shows "NO WIND DATA". Wind data can be displayed in three different ways:
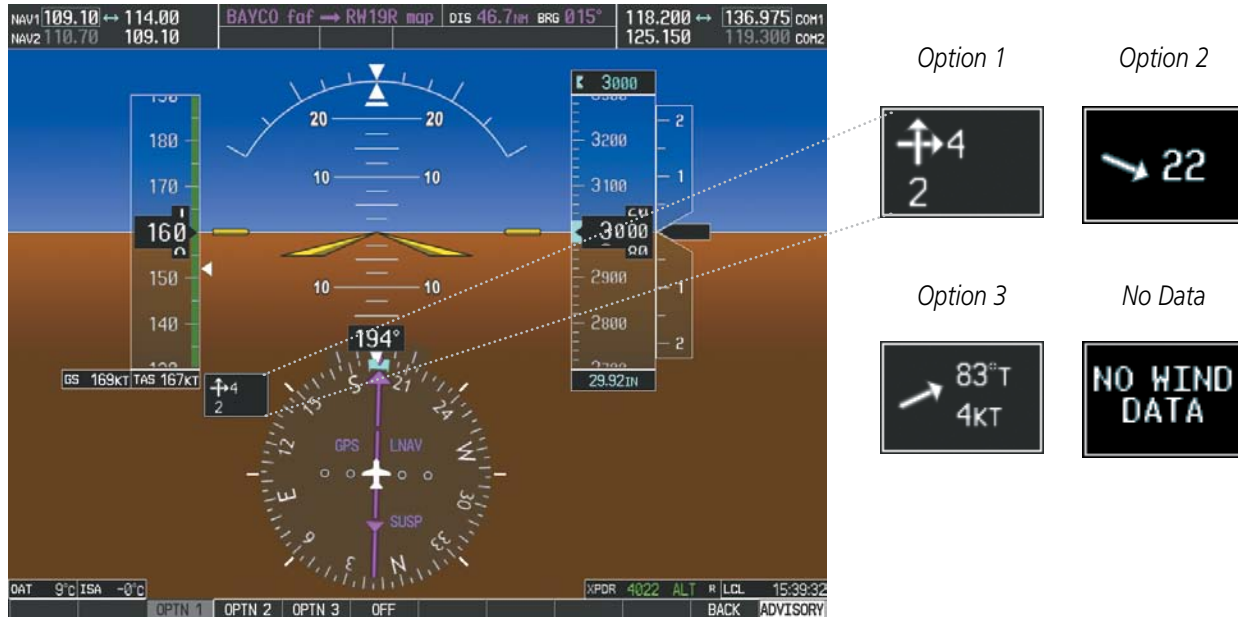
Figure 2-33 Wind Data

Displaying wind data:

1) Press the **PFD** Softkey.

2) Press the **WIND** Softkey to display wind data below the Selected Heading.

3) Press one of the **OPTN** softkeys to change how wind data is displayed:

   - **OPTN 1**: Head and crosswind components

   - **OPTN 2**: Total wind direction and numeric speed

   - **OPTN 3**: Wind direction arrow with numeric True direction and speed

4) To remove the window, press the **OFF** Softkey.

VERTICAL NAVIGATION (VNV) INDICATIONS

When a VNV flight plan has been activated, VNV indications (VNV Target Altitude, RVSI, VDI) appear on the PFD in conjunction with the "TOD within 1 minute" message and "Vertical track" voice alert. See the Flight Management section for details on VNV features. VNV indications are removed from the PFD according to the criteria listed in Table 2-3.

Figure 2-34 Vertical Navigation Indications (PFD)

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

Table 2-3 VNV Indication Removal Criteria

2.3 PFD ANNUNCIATIONS AND ALERTING FUNCTIONS

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

G1000 ALERTING SYSTEM

Messages appear in the Alerts Window (in the lower right corner of the PFD; Figure 2-35) when a warning, caution, advisory alert, or G1000 message advisory occurs. System alert messages are provided for awareness of G1000 system problems or status and may not require pilot action. The Alerts Window allows system alerts to be displayed simultaneously. The **FMS** Knob can be used to scroll through the alert messages. The Alerts Window is enabled/disabled by selecting the **ALERTS** Softkey. If the window is already open when a new message is generated, selecting the **ALERTS** Softkey to acknowledge the message causes it to turn gray.

The Annunciation Window appears to the right of the Vertical Speed Indicator and displays abbreviated annunciation text for aircraft alerts. Text color is based on alert level: warnings appear in red, cautions in yellow, advisory alerts in white, safe operating annunciations in green. New alerts, regardless of priority, are displayed at the top of the Annunciation Window, separated by a white line from acknowledged alerts. Once acknowledged, they are sequenced based on priority.
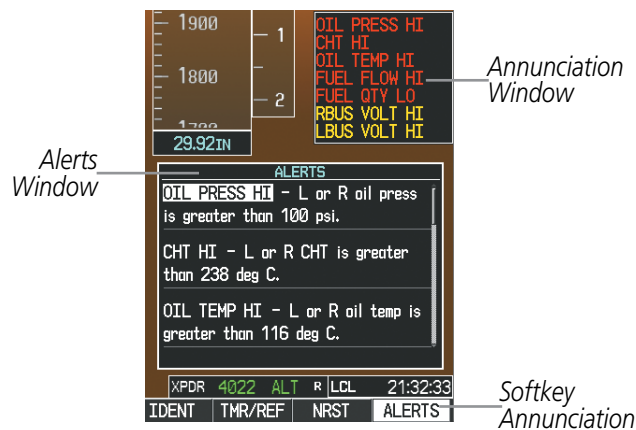
Figure 2-35 G1000 Alerting System

The **ALERTS** Softkey label changes to display the appropriate annunciation when an alert is issued. The annunciation flashes and the appropriate aural alert sounds until acknowledged by pressing the softkey. The softkey then reverts to the **ALERTS** Softkey label, and when selected again opens the Alerts Window to display a descriptive message of the alert.

Warnings are time-critical and require immediate attention. A flashing **WARNING** Softkey annunciation and aural tone (single chime every two seconds) indicate the presence of a warning. The aural tone and flashing **WARNING** Softkey annunciation continue until acknowledged (by pressing the **WARNING** Softkey).

Caution indicates the existence of abnormal conditions on the aircraft that may require pilot intervention. A flashing **CAUTION** Softkey annunciation and single aural tone (one chime) indicate the presence of a caution. The flashing **CAUTION** Softkey annunciation continues to flash until acknowledged (by pressing the **CAUTION** Softkey).

An advisory provides general information to the pilot that may not need immediate attention. A flashing **ADVISORY** Softkey annunciation (no aural tone) indicates the presence of a message advisory. The flashing **ADVISORY** Softkey annunciation continues to flash until acknowledged (by pressing the **ADVISORY** Softkey).

Figure 2-36 Softkey Annunciation (ALERTS Softkey Labels)

MARKER BEACON ANNUNCIATIONS

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

Outer Marker   Middle Marker   Inner Marker

Altimeter
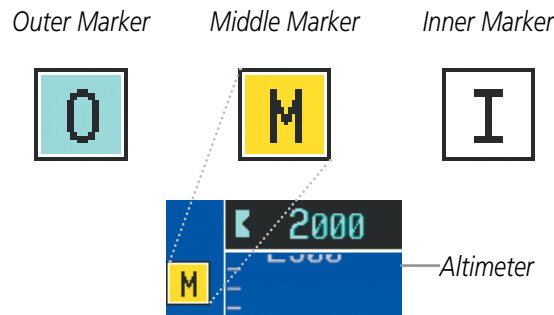
Figure 2-37 Marker Beacon Annunciations

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TRAFFIC ANNUNCIATION

The G1000 System displays traffic symbolically on the PFD Inset Map, the Navigation Map Page (MFD), and various other MFD page maps. Refer to the Hazard Avoidance Section and Appendix E for more details about the Traffic Information Service (TIS) and Traffic Advisory Systems (TAS). When a traffic advisory (TA) is detected, the following automatically occur:

• The PFD Inset Map is enabled and displays traffic

• A flashing black-on-yellow 'TRAFFIC' annunciation (Figure 2-39) appears to the top left of the Attitude Indicator for five seconds and remains displayed until no TAs are detected in the area

If additional TAs appear, new aural and visual alerts are generated.
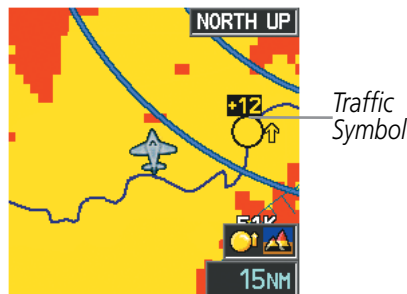
Figure 2-38 Inset Map with Traffic Displayed

TAWS ANNUNCIATIONS

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

Figure 2-39 Traffic and Example TAWS Annunciations

ALTITUDE ALERTING

The Altitude Alerting function provides the pilot with visual and aural alerts when approaching the Selected Altitude. Whenever the Selected Altitude is changed, the Altitude Alerter is reset. The Altitude Alerter is independent of the GFC 700 AFCS, but alerting tones are generated only when the GFC 700 is installed. The following occur when approaching the Selected Altitude:

• Upon passing through 1000 feet of the Selected Altitude, the Selected Altitude (shown above the Altimeter) changes to black text on a light blue background and flashes for 5 seconds.

• When the aircraft passes within 200 ft of the Selected Altitude, the Selected Altitude changes to light blue text on a black background and flashes for 5 seconds, and an aural tone is generated.

• After reaching the Selected Altitude, if the pilot flies outside the deviation band (±200 feet of the Selected Altitude), the Selected Altitude changes to yellow text on a black background, flashes for 5 seconds, and an aural tone is generated.

Within 1000 ft   *Within 200 ft*   *Deviation of ±200 ft*

Figure 2-40 Altitude Alerting Visual Annunciations

LOW ALTITUDE ANNUNCIATION

✓ **NOTE:** *The Low Altitude Annunciation is available only when SBAS is available. This annunciation is normally not shown, unless TAWS alerting is inhibited.*

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

Altimeter
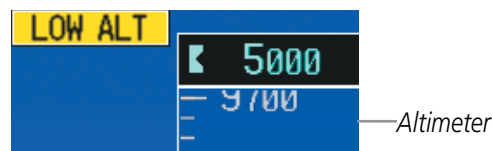
Figure 2-41 Low Altitude on GPS SBAS Approach

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MINIMUM DESCENT ALTITUDE/DECISION HEIGHT ALERTING

For altitude awareness, a barometric Minimum Descent Altitude (MDA, or Decision Height, DH) can be set in the Timer/References Window and is reset when the power is cycled. When active, the altitude setting is displayed to the lower left of the Altimeter and with a bug at the corresponding altitude along the Altimeter (once the altitude is within the range of the tape). The following visual annunciations occur when approaching the MDA/DH:

- When the aircraft altitude descends to within 2500 feet of the MDA/DH setting, the 'BARO MIN' box appears with the altitude in light blue text. The bug appears on the altitude tape in light blue once in range.

- When the aircraft passes through 100 feet of the MDA/DH, the bug and text turn white.

- Once the aircraft reaches the MDA/DH, the bug and text turn yellow and the aural alert, "Minimums Minimums", is generated.

Within 2500 feet   *Within 100 feet*   *Altitude Reached*

MDA/DH Bug

MDA/DH Setting
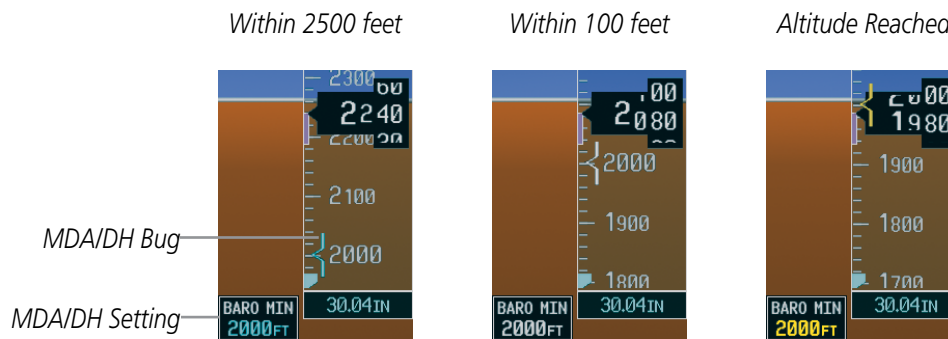
Figure 2-42 Minimum Descent Altitude/Decision Height Alerting Visual Annunciations

Setting the barometric minimum descent altitude/decision height and bug:

1) Press the **TMR/REF** Softkey.

2) Turn the large **FMS** Knob to highlight the 'Minimums' field (Figure 2-43).

3) Turn the small **FMS** Knob to select BARO. 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) To remove the window, press the **CLR** Key or the **TMR/REF** Softkey.

Figure 2-43 Minimum Descent Altitude/Decision Height Setting (Timer/References Window)

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

2.4 ABNORMAL OPERATIONS

ABNORMAL GPS CONDITIONS

The annunciations listed in Table 2-4 can appear on the HSI when abnormal GPS conditions occur; see Figure 2-44 for examples. Refer to the Flight Management Section for more information on Dead Reckoning Mode.

Annunciation	Location	Description
LOI	Lower left of aircraft symbol	Loss of Integrity Monitoring–GPS integrity is insufficient for the current phase of flight
INTEG OK	Lower left of aircraft symbol	Integrity OK–GPS integrity has been restored to within normal limits (annunciation displayed for 5 seconds)
DR	Upper right 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 2-44 Example HSI Annunciations

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

- CDI (removed after 20 minutes)
- Current Track Bug
- Wind Data
- Distances in the Bearing Information Windows
- GPS bearing pointers

It is important to note that estimated navigation data supplied by the G1000 in DR Mode may become increasingly unreliable and must not be used as a sole means of navigation. See the Flight Management section for more information about DR mode

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UNUSUAL ATTITUDES

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

Nose High   *Nose Low*
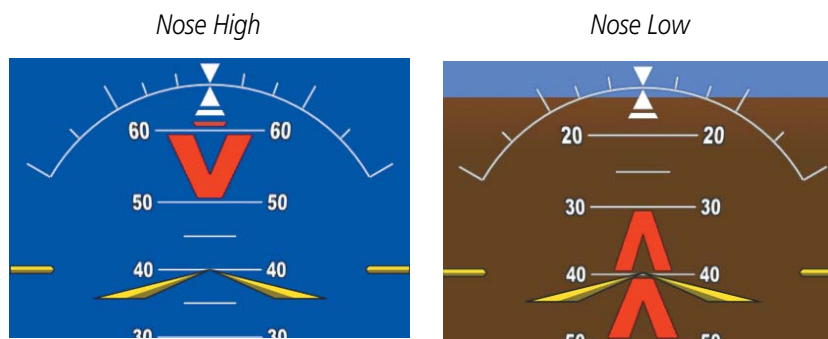
Figure 2-45 Pitch Attitude Warnings

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

- Traffic Annunciations
- AFCS Annunciations
- Flight director Command Bars
- Inset Map
- Outside air temperature (OAT)
- International Standard Atmosphere temperature (ISA)
- Groundspeed
- DME Information Window (optional)
- Wind data
- Transponder Status Box

- System Time
- PFD Setup Menu
- Windows displayed in the lower right corner of the PFD:
  - Timer/References
  - Nearest Airports
  - Flight Plan
  - Alerts
  - Procedures
  - DME Tuning (optional)
- Minimum Descent Altitude/ Decision Height readout

- Vertical Deviation, Glideslope, and Glidepath Indicators
- Altimeter Barometric Setting
- Selected Altitude
- Selected Course
- Selected Heading
- VNV Target Altitude

SECTION 3 ENGINE INDICATION SYSTEM

> **NOTE:** *Refer to the Pilot's Operating Handbook (POH) and FAA Approved Airplane Flight Manual (AFM) for operating limitations.*

The G1000 Engine Indication System (EIS) displays critical engine, electrical, fuel quantity and fuel flow parameters on the left side of the Multi Function Display (MFD) during normal operations (Figure 3-1). In Reversionary Mode, the displays are re-configured to present Primary Flight Display (PFD) symbology together with the EIS (Figure 3-2).
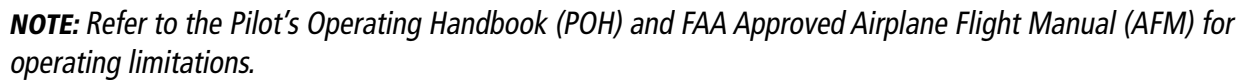
EIS Display

Figure 3-1 MFD (Normal Operations)

Failed NAV/COM

EIS Display

Figure 3-2 PFD (Reversionary Mode)

Green bands on the instrument scales indicate normal ranges of operation; yellow and red bands indicate caution and warning, respectively. White or uncolored bands indicate areas outside of normal operation not yet in the caution or warning ranges. When an unsafe operating condition occurs, readouts, pointers and labels change color corresponding to the level of the condition; warnings also flash. If the sensor data for a parameter becomes invalid or unavailable, a red "X" is displayed across the indicator and/or readout.

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EIS information is presented in three displays, accessed using the **ENGINE** Softkey on the MFD:

- **Engine Display** – Default display, shows all critical engine, fuel and electrical indicators.
- **Lean Display** – Provides engine leaning information.
- **System Display** – Shows numeric readouts of critical engine, fuel and electrical indicators.
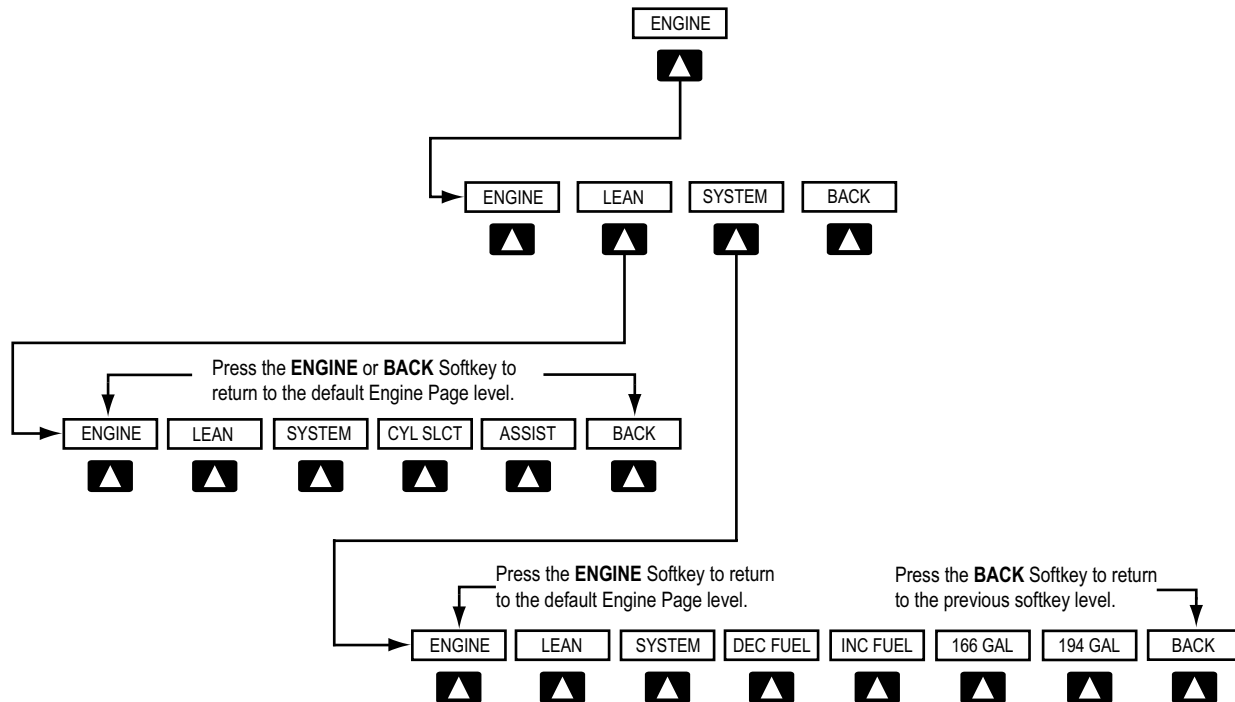
Figure 3-3 Engine Softkey Flowchart

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3.1 ENGINE DISPLAY

> ✓ **NOTE:** *Refer to the Pilot's Operating Handbook (POH) and FAA Approved Airplane Flight Manual (AFM) for operating limitations.*

The Engine Display is the default EIS display and can be selected by pressing the **ENGINE** or **BACK** Softkey when another EIS display is currently shown. Beneath the dial gauges are the horizontal bar indicators for fuel flow, cylinder head temperature, oil temperature and pressure, alternator load and fuel quantity.
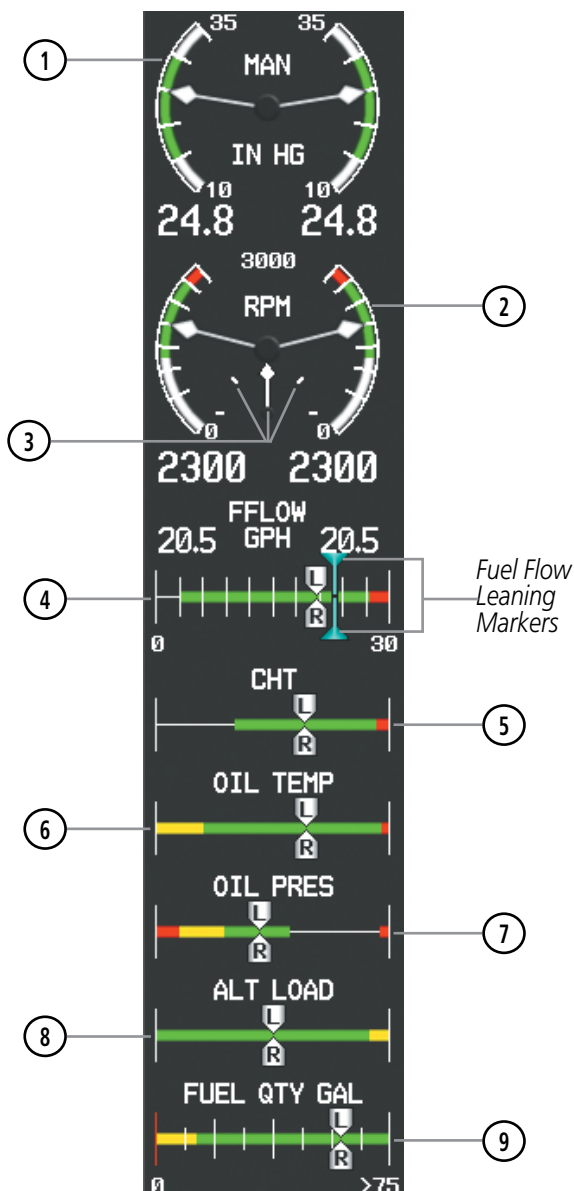
Figure 3-4 Engine Display

GARMIN

(1) **Engine Manifold Pressure Gauge (MAN)** — Displays engine power in inches of Mercury (in Hg)

(2) **Tachometer Gauge (RPM)** — Displays propeller speed in revolutions per minute (rpm); the red band indicates propeller overspeed

(3) **Propeller Sync Indicator** — The small white pointer located in the center of the Tachometer points towards the propeller turning at a lower-speed.

(4) **Fuel Flow Indicator** — Displays current fuel flow in gallons per hour (gph)

(FFLOW GPH) — Fuel Flow Leaning Markers (light blue) provide a leaning reference during a cruise or max power climb (MPC). The pointers are displayed along the horizontal bar indicator if the propeller speed exceeds 2530 rpm or fuel flow exceeds a specified value based on altitude during a cruise or max power (MPC) climb.

(5) **Cylinder Head Temperature Indicator (CHT)** — Displays the highest cylinder head temperature

(6) **Oil Temperature Indicator (OIL TEMP)** — Displays oil temperature

(7) **Oil Pressure Indicator (OIL PRES)** — Displays pressure of oil supplied to the engines

(8) **Ammeter (ALT LOAD)** — Displays current loads for each alternator

(9) **Fuel Quantity Indicator (FUEL QTY GAL)** — Displays the quantity of fuel in each tank in gallons

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3.2 LEAN DISPLAY

NOTE: *The pilot should follow the engine manufacturer's recommended leaning procedures as described in the Pilot's Operating Handbook (POH) and FAA Approved Airplane Flight Manual (AFM).*

The Lean Display is accessed by pressing the **ENGINE** Softkey followed by the **LEAN** Softkey and provides information for performing engine leaning.

Manifold Gauge, Tachometer and Fuel Flow Indicator remain on the Lean Display. Exhaust Gas Temperature (EGT) and Cylinder Head Temperature (CHT) are displayed graphically with numeric readouts for the selected cylinder.

Accessing the EIS Lean Display:

1) Press the **ENGINE** Softkey.

2) Press the **LEAN** Softkey.

3) To return to the default Engine Display, press the **ENGINE** or **BACK** Softkey.

From the Lean Display, the **CYL SLCT** and **ASSIST** Softkeys can be utilized to obtain information about specific cylinders on both the EGT and CHT graphs. Pressing the **CYL SLCT** Softkey cycles through the cylinders; the selected cylinder number is displayed in light blue. The **CYL SLCT** Softkey is disabled during warning or caution conditions or when the **ASSIST** Softkey is pressed.

Monitoring the desired cylinder's EGT and CHT:

From the Lean Display, press the **CYL SLCT** Softkey to cycle through each cylinder and view its EGT and CHT. The selected cylinder is shown in light blue.

When the **ASSIST** Softkey is selected, the system initially highlights and selects the cylinder number with the hottest EGT and displays its temperature below the EGT bar graph. A readout showing the difference between peak (ΔPEAK) and the current temperature for the selected cylinder is displayed above the EGT bar graph.

As the mixture is leaned, a light blue line will appear above each cylinder to indicate EGT peak.

When the system detects the first cylinder to peak, the cylinder numbers below the EGT graph disappear, and the letter "R" is annunciated below the first peaked cylinder to indicate the other cylinders are rich of peak. As the mixture is further leaned, the letter "L" is annunciated below the last peaked cylinder indicating all cylinders are lean of peak. Refer to the POH and AFM for the recommended mixture adjustment procedures.

Monitoring of the cylinder continues until the **ASSIST** Softkey is pressed again which disables lean assist and removes the peak lines from the bar graph and the temperature deviation from peak (ΔPEAK). The system then returns to seeking the hottest cylinder.

Propeller Sync Indicator

Temperature Deviation From Peak
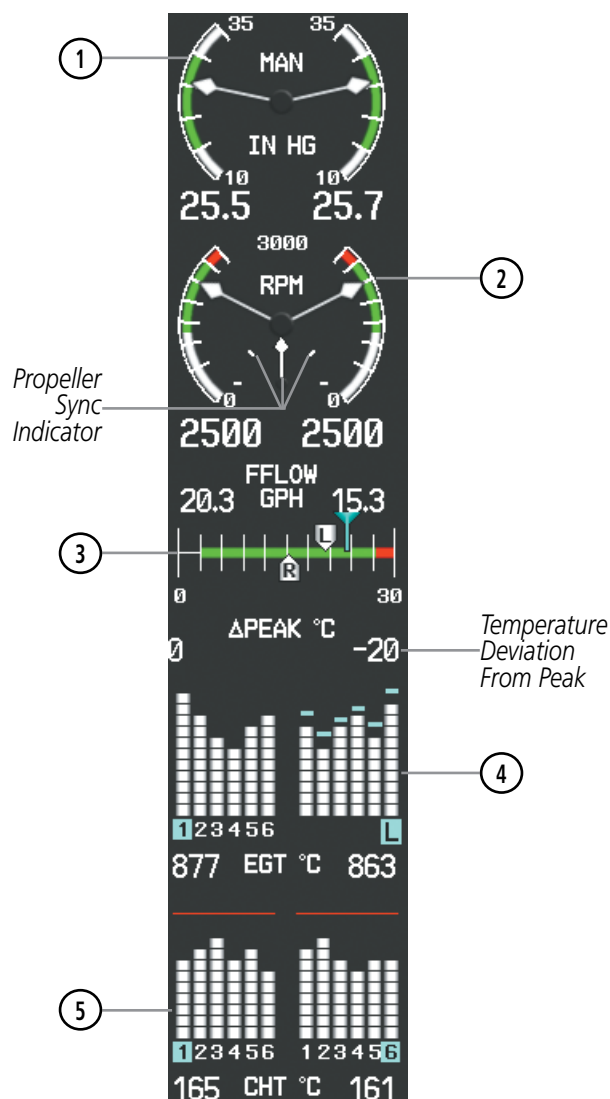
Figure 3-5 Lean Display (G58)

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① **Engine Manifold Pressure Gauge (MAN)** — Displays engine power in inches of Mercury (in Hg)

② **Tachometer Gauge (RPM)** — Displays propeller speed in revolutions per minute (rpm); the red band indicates propeller overspeed

③ **Fuel Flow Indicator (FFLOW GPH)** — Displays current fuel flow in gallons per hour (gph)

Fuel Flow Leaning Markers (light blue) provide a leaning reference during a cruise or max power climb (MPC). The pointers are displayed along the horizontal bar indicator if the propeller speed exceeds 2530 rpm or fuel flow exceeds a specified value based on altitude during a cruise or max power (MPC) climb.

④ **Exhaust Gas Temperature Bar Graph (EGT °C)** — The number of the cylinder with the highest Exhaust Gas Temperature (EGT) is highlighted in light blue and its readout given below the bar graph in degrees Celsius (°C).

When the **ASSIST** Softkey is pressed and the mixture is leaned, a light blue line appears above each cylinder's bar to represent its peak EGT The letter "R" (rich) appears below the first peaked cylinder to indicate some cylinders are rich of peak; the letter "L" (lean) appears below the last cylinder to peak.

⑤ **Cylinder Head Temperature Bar Graph (CHT °C)** — The number of the cylinder with the highest head temperature is highlighted in light blue and its readout given below the bar graph in degrees Celsius (°C).

A caution or warning condition is denoted by color change of a cylinder's bar to yellow or red, respectively.

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3.3 SYSTEM DISPLAY

> **NOTE:** *Fuel calculations do not use the aircraft Fuel Quantity Indicator and are calculated from the last time the fuel was reset.*

> **NOTE:** *Refer to the Pilot's Operating Handbook (POH) and FAA Approved Airplane Flight Manual (AFM) for operating limitations.*

The System Display is accessed by pressing the **ENGINE** Softkey followed by the **SYSTEM** Softkey. Readouts below the Manifold Pressure Gauge and Tachometer are grouped into three categories: System (Oil), Fuel Calculations and Electrical.
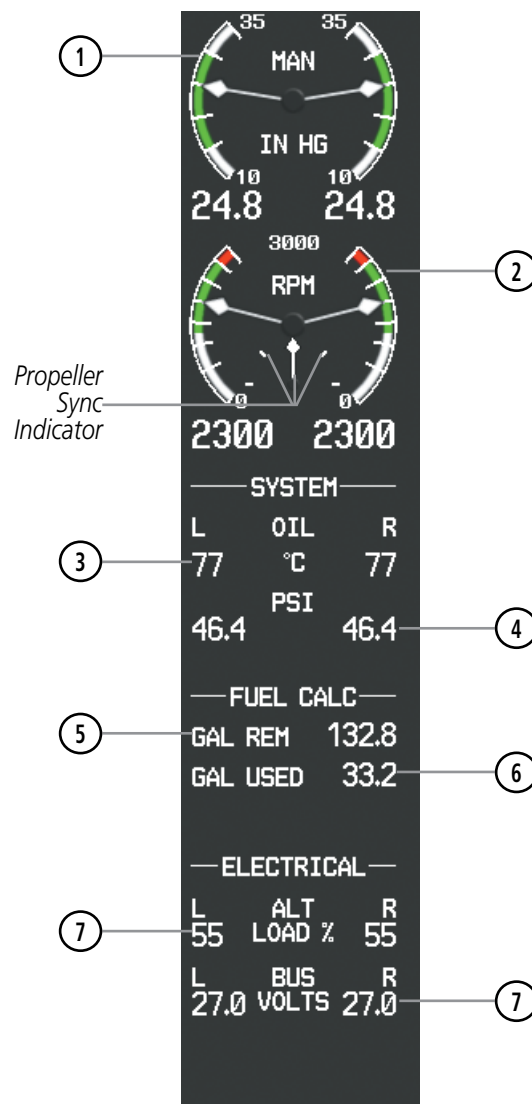
Figure 3-6 System Display

①	**Engine Manifold Pressure Gauge (MAN)**	Displays engine power in inches of Mercury (in Hg)
②	**Tachometer Gauge (RPM)**	Displays propeller speed in revolutions per minute (rpm); the red band indicates propeller overspeed
③	**Oil Temperature Indicator (OIL °C)**	Displays oil temperature in degrees Celsius (°C)
④	**Oil Pressure Indicator (OIL PSI)**	Displays oil pressure in pounds per square inch (psi)
⑤	**Calculated Fuel Remaining (GAL REM)**	Displays the totalizer-based fuel remaining in gallons, adjusted using the **DEC FUEL** and **INC FUEL** Softkeys
⑥	**Calculated Fuel Used (GAL USED)**	Displays fuel used in gallons, based on fuel flow
⑦	**Ammeter (ALT LOAD)**	Displays current loads for each alternator (L and R) as a percentage of the capacity
⑧	**Voltmeter (BUS VOLTS)**	Displays voltage for each bus (L and R)

Fuel calculations are based on the fuel flow totalizer and the displayed fuel remaining (GAL REM), adjusted using the following softkeys:

- **DEC FUEL** – Decreases totalizer-based fuel remaining in one-gallon increments

- **INC FUEL** – Increases totalizer-based fuel remaining in one-gallon increments

- **166 GAL** – Resets totalizer-based fuel remaining to 166 gallons and fuel used display to zero

- **194 GAL** – Resets totalizer-based fuel remaining to 194 gallons and fuel used display to zero

Accessing the EIS System Display:

1) Press the **ENGINE** Softkey.

2) Press the **SYSTEM** Softkey.

3) To return to the default Engine Display, press the **ENGINE** or **BACK** Softkey.

Adjusting the fuel totalizer quantity:

From the System Display, press the **DEC FUEL** or **INC FUEL** Softkey to obtain the desired number of gallons remaining (GAL REM).

Resetting the fuel totalizer:

From the System Display, press the **166 GAL** or **194 GAL** Softkey to rest the totalizer. This also resets the fuel used (GAL USED) to zero.

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SECTION 4 AUDIO PANEL AND CNS

4.1 OVERVIEW

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

CNS operation in Beechcraft G58 aircraft 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 (Figure 4-1).

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MFD/PFD CONTROLS AND FREQUENCY DISPLAY

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

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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 tuning box (light blue box) and 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. The selected COM transceiver frequency is displayed in green.

⑥ **COM Knob** – Tunes the standby frequencies for the COM transceiver (large knob for MHz; small knob for kHz). Press to move the tuning box (light blue box) and 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 **DME Tuning Window** – Displays DME frequency pairing mode. Display by pressing the **DME** Softkey.

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

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

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

AUDIO PANEL CONTROLS
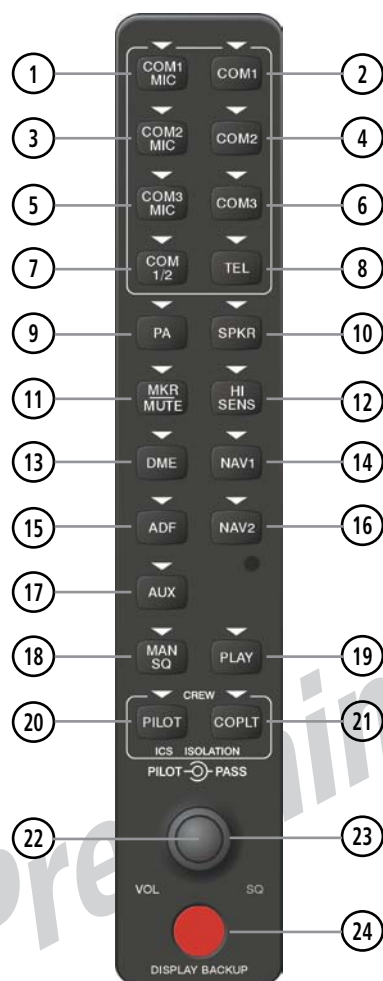
Figure 4-2 Audio Panel Controls

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

① **COM1 MIC** – Selects the #1 transmitter for transmitting. COM1 receive is simultaneously selected when this key is pressed allowing received audio from the #1 COM receiver to be heard. COM2 receive can be added by pressing the **COM2** Key.

② **COM1** – When selected, audio from the #1 COM receiver can be heard.

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

④ **COM2** – When selected, audio from the #2 COM receiver can be heard.

⑤ **COM3 MIC** – Not used in Beechcraft G58 aircraft.

6. **COM3** – Not used in Beechcraft G58 aircraft.

7. **COM 1/2** – Split COM Key. Allows simultaneous transmission on COM1 and COM2 by the pilot and copilot.

8. **TEL** – Not used in Beechcraft G58 aircraft.

9. **PA** – Not used in Beechcraft G58 aircraft.

10. **SPKR** – Selects and deselects the cabin speaker. COM and NAV receiver audio can be heard on the speaker.

11. **MKR/MUTE** – Selects marker beacon receiver audio. Mutes the currently received marker beacon receiver audio. Unmutes automatically when new marker beacon audio is received. Also, stops play of recorded COM audio.

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

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

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

15. **ADF** – Not used in Beechcraft G58 aircraft.

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

17. **AUX** – Not used in Beechcraft G58 aircraft.

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

19. **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.

20. **PILOT** – Selects and deselects the pilot intercom isolation.

21. **COPLT** – Selects and deselects the copilot intercom isolation.

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

23. **PASS Knob** – Turn to adjust Copilot/Passenger intercom volume or squelch. The **MAN SQ** Key must be selected to allow squelch adjustment.

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

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4.2 COM OPERATION

COM TRANSCEIVER SELECTION AND ACTIVATION

NOTE: *When turning on the G1000 for use, the system remembers the last frequencies used and the active COM transceiver state prior to shutdown.*

The COM Frequency Box is composed of four fields; the two active frequencies are on the left side and the two standby frequencies are on the right. The COM transceiver is selected for transmitting by pressing the **COM MIC** Keys on the Audio Panel. During reception of audio from the COM radio selected for transmission, audio from the other COM radio is muted.

An active COM frequency displayed in green indicates that the COM transceiver is selected on the Audio Panel (**COM1 MIC** or **COM2 MIC** Key).

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.
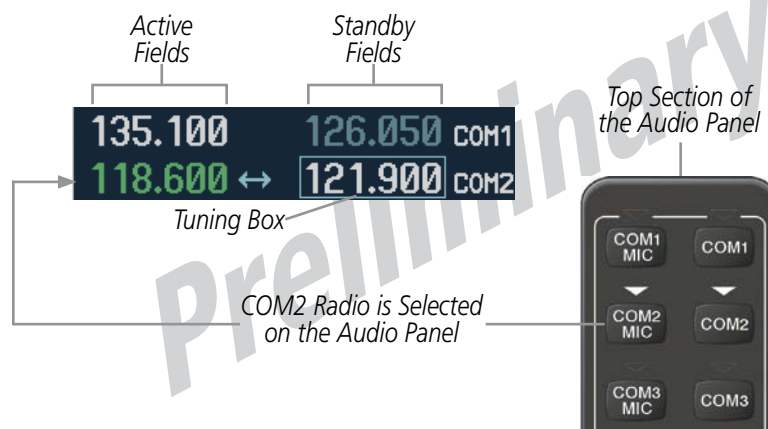
Figure 4-3 Selecting a COM Radio for Transmit

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TRANSMIT/RECEIVE INDICATIONS

During COM transmission, a white TX appears by the active COM frequency replacing the Frequency Transfer Arrow. On the Audio Panel, when the active COM is transmitting, the active transceiver **COM MIC** Key Annunciator flashes approximately once per second.

During COM signal reception, a white RX appears by the active COM frequency replacing the Frequency Transfer Arrow. Entertainment audio, if selected, is muted during active COM radio reception. Refer to Additional Audio Panel Functions later in this section, and details on the Data Link Receiver in the Additional Features Section.

Transmit and Receive Indicators

Annunciator Flashes During Transmission

Figure 4-4 COM Radio Transmit and Receive Indications

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 in the COM Tuning Box (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.

*Turn the **VOL/SQ** Knob to adjust volume. Press the Knob to Turn Automatic Squelch On or Off*

*Press the **Frequency Transfer** Key to Transfer COM Frequencies Between Active and Standby Frequency Boxes*

*Turn the **COM** Knob to Tune the Frequency in the Tuning Box*

Figure 4-5 COM Frequency Tuning

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SELECTING THE RADIO TO BE TUNED

Press the small **COM** Knob to transfer the frequency tuning box and Frequency Transfer Arrow between the upper and lower radio frequency fields.

*Press the **COM** Knob to Switch the Tuning Box From One COM Radio to the Other*
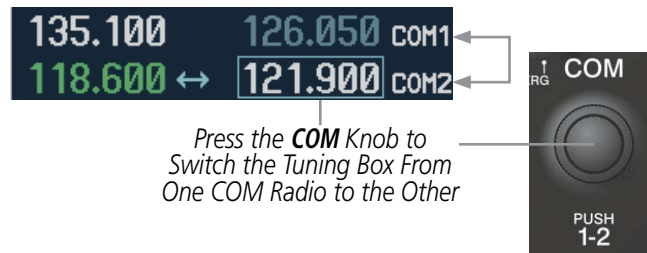
Figure 4-6 Switching COM Tuning Boxes

QUICK-TUNING AND ACTIVATING 121.500 MHZ

Pressing and holding the COM **Frequency Transfer** Key for two seconds automatically loads the emergency COM frequency (121.500 MHz) in the active field of the COM radio selected for tuning (the one with the transfer arrow). In the example shown, pressing the Audio Panel **COM2 MIC** Key activates the transceiver.

Press for Two Seconds to Load 121.500 MHz
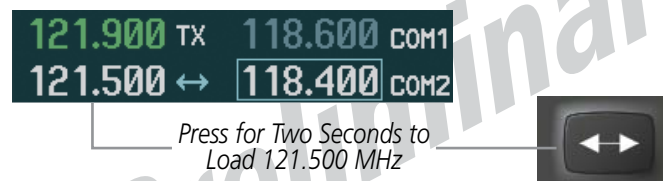
Figure 4-7 Quickly Tuning 121.500 MHz

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AUTO-TUNING THE COM FREQUENCY

COM frequencies can be automatically tuned from the following:

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

AUTO-TUNING FROM THE PFD

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

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

1) Press the **NRST** 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 Tuning Box.

4) Press the **Frequency Transfer** Key to transfer the frequency to the COM Active Frequency Field.

*Press the **NRST** Softkey to Open the Nearest Airports Window*

Figure 4-8 Nearest Airports Window (PFD)

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AUTO-TUNING FROM THE MFD

Frequencies can be automatically loaded into the COM Frequency Box from pages in the NRST or WPT page group by highlighting the frequency and pressing the **ENT** Key (Figures 4-9, 4-10, and 4-11).

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 the appropriate softkey.

2) Turn the **FMS** Knob to place the cursor on the desired COM frequency (Figure 4-11).

3) Press the **ENT** Key to load the COM frequency into the standby field of the selected COM radio.

4) Press the **Frequency Transfer** Key to transfer the frequency to the COM Active Frequency Field.
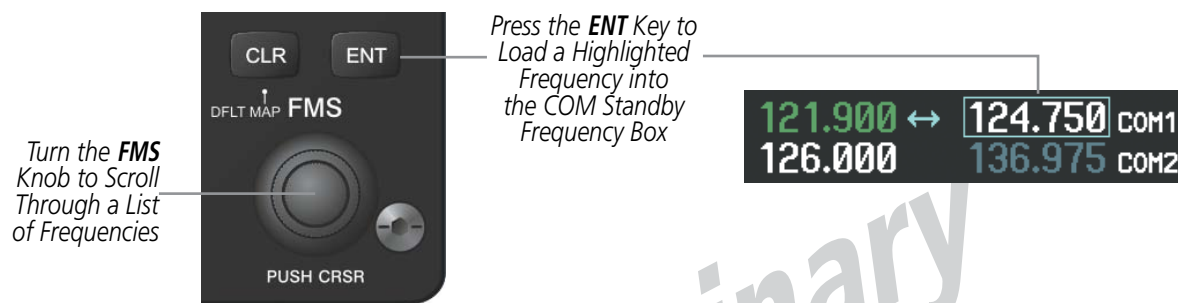
Figure 4-9 Frequency Auto-Tuning from the MFD

Or:

1) On the Nearest Airports, Frequencies, or Airspaces page, 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 load the COM frequency into the standby field of the selected COM radio.

6) Press the **Frequency Transfer** Key to transfer the frequency to the COM Active Frequency Field.

Nearest Airports Menu   *Nearest Frequencies Menu*   *Nearest Airspaces Menu*
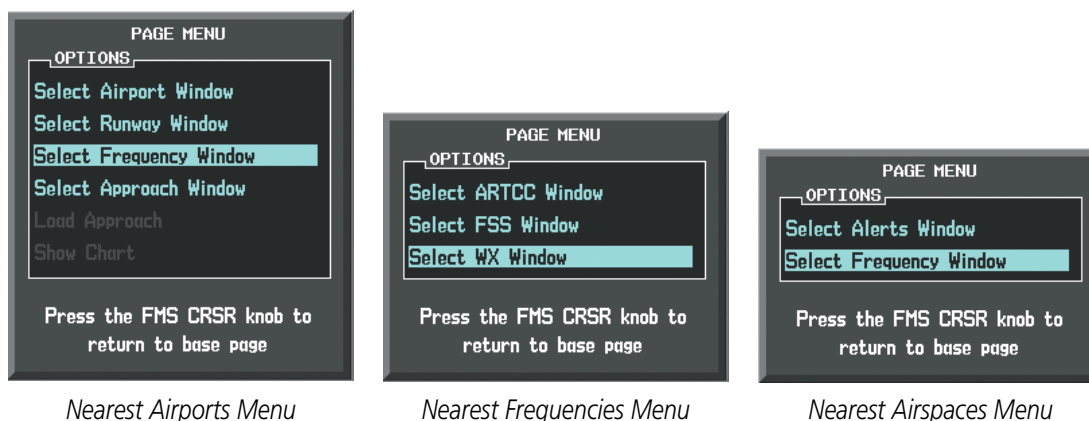
Figure 4-10 Nearest Pages Menus

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.

*Press **Frequency Transfer** Key to Load Frequency into COM Active Frequency Field*

Selected Airport Identifier and Information

Runway Information

*Press **ENT** Key to Load Frequency into COM Standby Field. Cursor then Advances to Next Frequency.*

*Press **INFO-x** Softkey for AIRPORT, RUNWAYS, FREQUENCIES, and AOPA Data*

Figure 4-11 WPT – Airport Information Page

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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.

Figure 4-12 NRST – Nearest Airspaces, NRST – Nearest Airports, and NRST – Nearest Frequencies Pages

FREQUENCY SPACING

The G1000 COM radios can tune either 25-kHz spacing (118.000 to 136.975 MHz) or 8.33-kHz spacing (118.000 to 136.990 MHz) for 760-channel or 3040-channel configuration. When 8.33-kHz channel spacing is selected, all of the 25-kHz channel spacing frequencies are also available in the complete 3040-channel list.

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

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

Figure 4-13 COM Channel Spacing

Changing COM frequency channel spacing:

1) Select the AUX – System Setup Page.

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

3) Turn the large **FMS** Knob to highlight the Channel Spacing Field in the COM Configuration Box.

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

5) Press the **ENT** Key to complete the channel spacing selection.

While the COM CONFIG Window is selected, the G1000 softkeys are blank.

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

AUX - SYSTEM SETUP PAGE
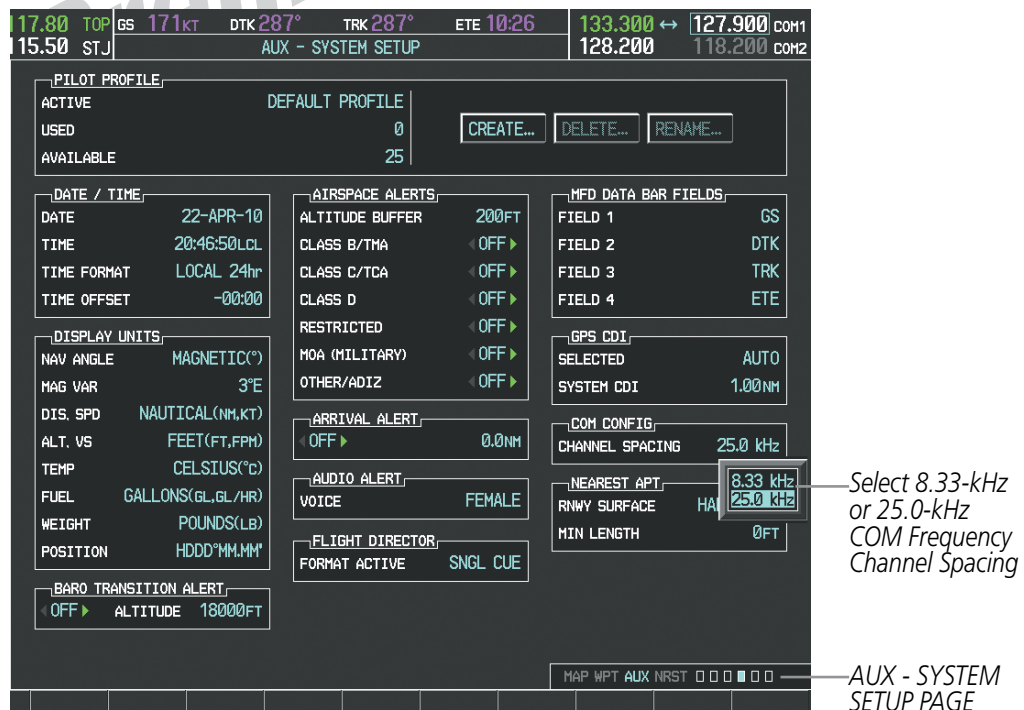
Figure 4-14 AUX – System Setup Page

AUTOMATIC SQUELCH

Automatic Squelch quiets unwanted static noise when no audio signal is received, while still providing good sensitivity to weak COM signals. To disable Automatic Squelch, press the **VOL/SQ** Knob. When Automatic Squelch is disabled, COM audio reception is always on. Continuous static noise is heard over the headsets and speaker, if selected. Pressing the **VOL/SQ** Knob again enables Automatic Squelch.

*Press the COM **VOL/ SQ** Knob to turn off Automatic Squelch. Press again to restore Automatic Squelch.*
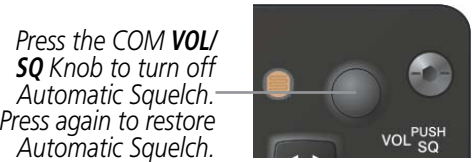
Figure 4-15 Overriding Automatic Squelch

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 Volume Level Remains for Two Seconds

Figure 4-16 COM Volume Level

4.3 NAV OPERATION

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 NAV Tuning Box and the Frequency Transfer Arrow are placed in the active 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.
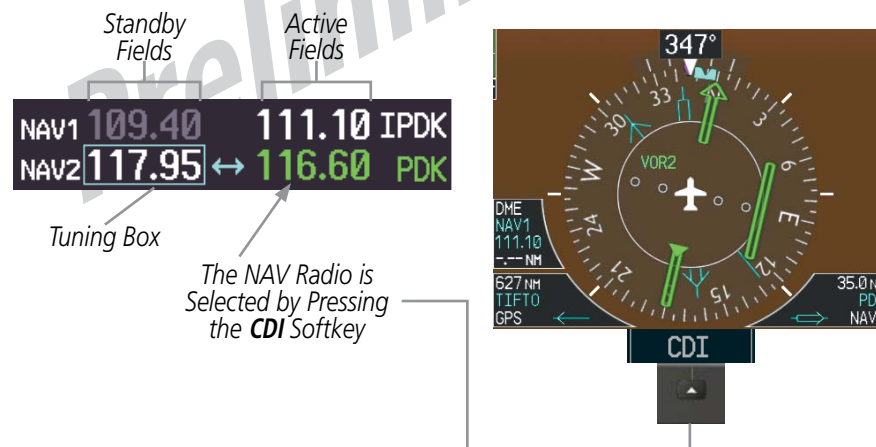
Figure 4-17 Selecting a NAV Radio for Navigation

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

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

Figure 4-18 Selecting a NAV Radio Receiver

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.

*Turn **VOL/ID** Knob to adjust volume. Press Knob to Turn Morse Code On or Off.*

*Press the **Frequency Transfer** Key to Transfer NAV Frequencies Between Active and Standby Frequency Fields*

*Turn the **NAV** Knob to Tune the Frequency in the Tuning Box*
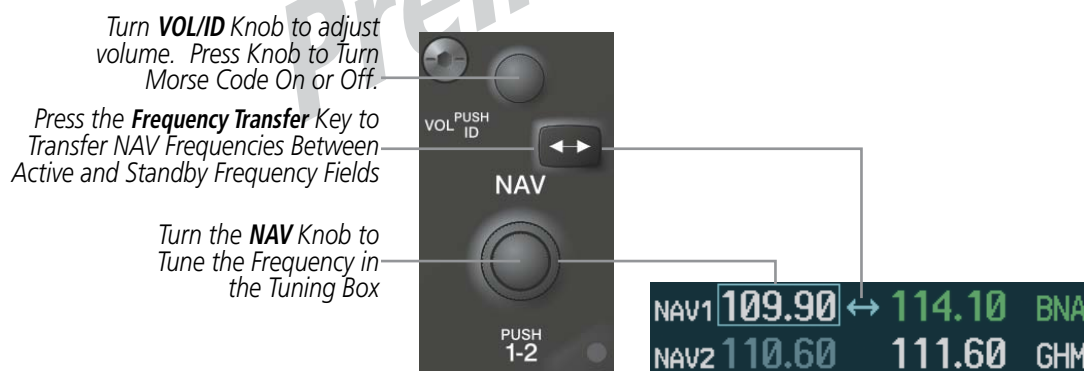
Figure 4-19 NAV Frequency Tuning

SELECTING THE RADIO TO BE TUNED

Press the small **NAV** Knob to transfer the frequency tuning box and Frequency Transfer Arrow between the upper and lower radio frequency fields.

*Press the **NAV** Knob to Switch the Tuning Box From One NAV Radio to the Other*
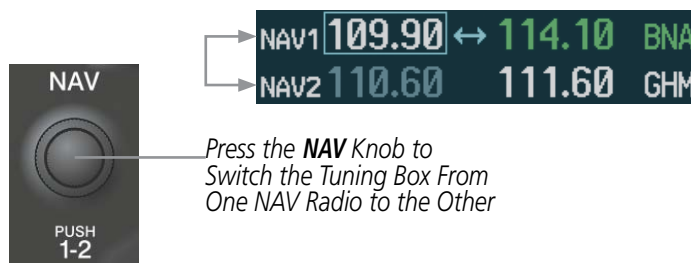
Figure 4-20 Switching NAV Tuning Boxes

VOR/LOC ID

When the Morse code Identifier audio is on for a NAV radio, a white ID appears to the left of the active NAV frequency.

In the example shown, in order to listen to either station identifier, press the **NAV1** or **NAV2** Key on the Audio Panel. Pressing the **VOL/ID** Knob turns off the Morse code audio only in the radio with the NAV Tuning Box. To turn 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.

The Morse Code Identifier for the GHM VOR is On

Station Identifier

Figure 4-21 NAV Radio ID Indication

VOLUME

NAV Radio volume level can be adjusted from 0 to 100% using the **VOL/ID** Knob. Turning the knob clockwise increases volume, counterclockwise decreases volume.

When adjusting, the level is displayed in place of the standby frequencies. Volume level indication remains for two seconds after the change.

NAV Volume Level Remains for Two Seconds

Figure 4-22 NAV Volume Levels

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AUTO-TUNING A NAV FREQUENCY FROM THE MFD

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

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

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

Frequencies can be automatically loaded into the NAV Frequency Box from pages in the NRST or WPT page group by highlighting the frequency and pressing the **ENT** Key (Figures 4-23, 4-24, and 4-25).

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 (Figure 4-25).

4) Press the **ENT** Key to load the NAV frequency into the standby field of the selected NAV radio.

5) Press the **Frequency Transfer** Key to transfer the frequency to the NAV Active Frequency Field.

Press the ENT Key to Load a Highlighted Frequency into the NAV Standby Frequency Box

Turn the FMS Knob to Scroll Through a List of Frequencies

NAV1 112.60 ↔ 116.00
NAV2 110.00 117.30
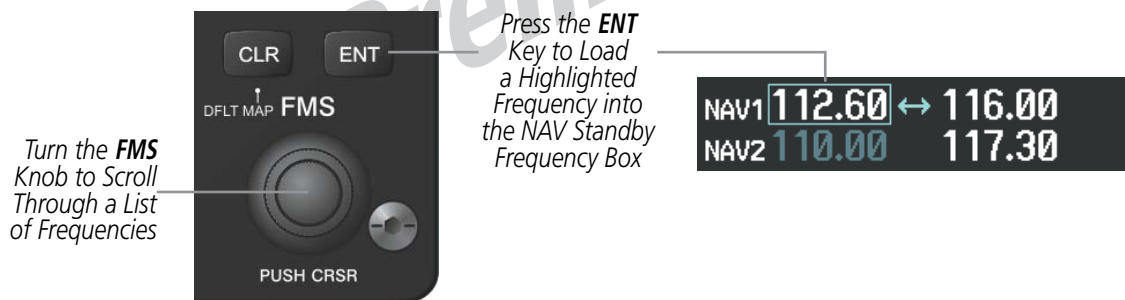
Figure 4-23 NAV Frequency Auto-Tuning from the MFD

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Or:

1) When on the Nearest VOR, Nearest Airspaces, and Nearest Airports pages, 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 in the desired window.

4) Scroll through the frequency selections with the **FMS** Knob.

5) Press the **ENT** Key to load the NAV frequency into the standby field of the selected NAV radio.

6) Press the **Frequency Transfer** Key to transfer the frequency to the NAV Active Frequency Field.

Nearest Airports Menu   *Nearest VOR Menu*   *Nearest Frequencies Menu*   *Nearest Airspaces Menu*
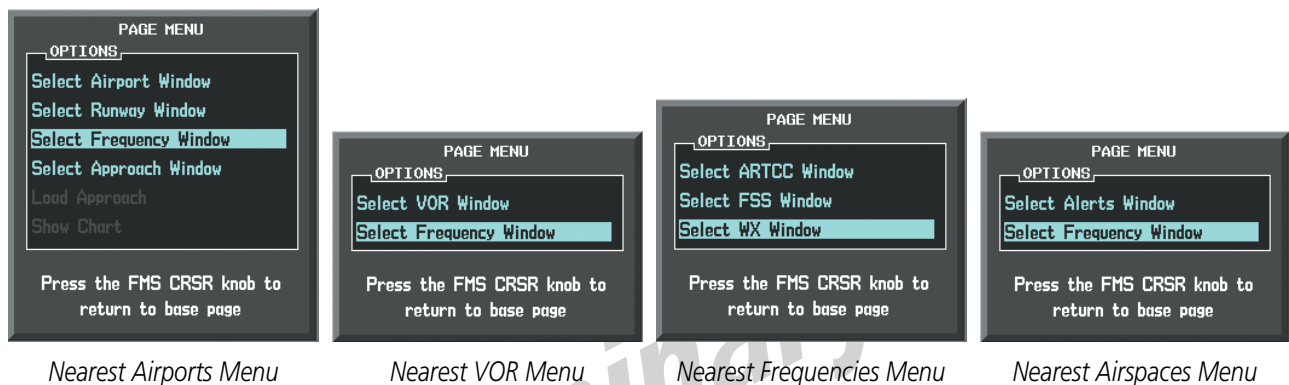
Figure 4-24 Nearest Pages Menus

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

*Press the **ENT** Key to Load the Frequency into the NAV Standby Field.*

*Press the **VOR** Softkey to Place the Cursor on the VOR Identifier*

*Press the **FREQ** Softkey to Place the Cursor on the VOR Frequency*

Figure 4-25 Loading the NAV Frequency from the NRST – Nearest VOR Page

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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.

Figure 4-26 NRST – Nearest Frequencies, WPT – VOR Information, WPT – Airport Information, and NRST – Nearest Airports Pages

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 while navigating by GPS, the system automatically switches to LOC as the final approach course is intercepted (within 15 nm of the FAF). See the Flight Management Section for details.*

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

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

• If the current CDI navigation source is GPS, the approach frequency is transferred to the NAV1 active frequency field. The frequency that was previously in the NAV1 active frequency field is transferred to standby.

• If the current CDI navigation source is GPS, and if the approach frequency is already loaded into the NAV1 standby frequency field, the standby frequency is transferred to active.

• If the current CDI navigation source is NAV1 or NAV2, the approach frequency is transferred to the standby frequency fields of the selected CDI NAV radio.

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MARKER BEACON RECEIVER

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

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

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

Outer Marker Indication

Middle Marker Indication

Inner Marker Indication
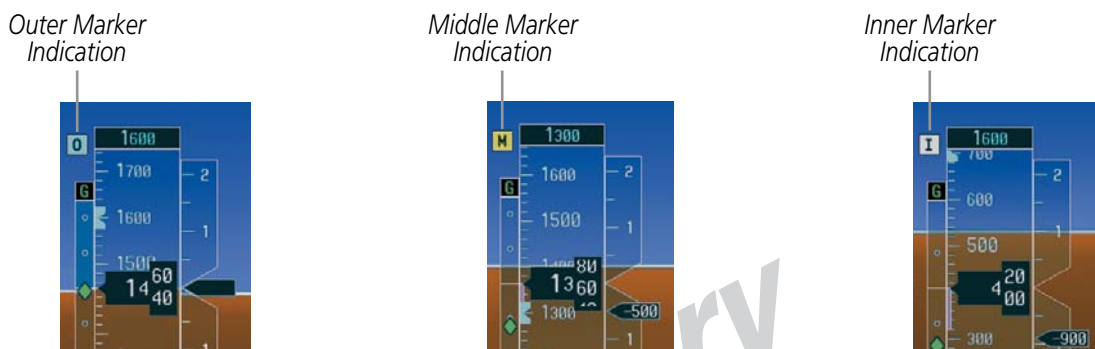
Figure 4-27 Marker Beacon Annunciations on the PFD

Figure 4-28 Marker Beacon Keys

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

During marker beacon audio reception, pressing the **MKR/MUTE** Key mutes the audio but does not affect the marker annunciations (Figure 4-27). 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.

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DME TUNING (OPTIONAL)

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

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

The G1000 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 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 DME Tuning Window on and off.
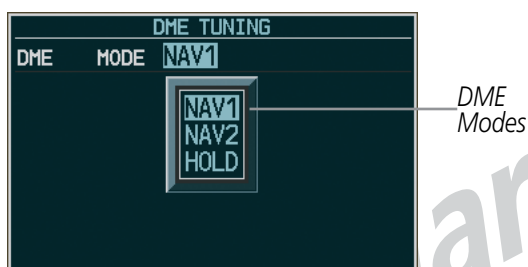
Figure 4-29 DME Tuning Window

The following DME transceiver pairings can be selected:

- NAV1 – Pairs the DME frequency from the selected NAV1 frequency.

- NAV2 – Pairs the DME frequency from the selected NAV2 frequency.

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

Selecting DME transceiver pairing:

1) Press the **DME** Softkey to display the 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 DME Tuning Window.

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

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4.4 GTX 33 ES MODE S TRANSPONDER

The GTX 33 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 – Transmits the Automatic Dependent Surveillance-Broadcast (ADS-B) position, velocity, and heading information periodically without requiring an interrogation.

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: **STBY**, **ON**, **ALT**, **GND**, **VFR**, **CODE**, **IDENT**, **ADS-B TX**, **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, the code selection cursor can be moved back to the left one digit with each press of the **BKSP** Softkey.

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 the 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 softkey inactivity, the system reverts back to the top-level softkeys.

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XPDR	IDENT

		STBY	ON	ALT	GND	VFR	CODE	IDENT	ADS-B TX	BACK	ALERTS

Pressing the **BACK** Softkey returns to the top-level softkeys.

0	1	2	3	4	5	6	7	IDENT	BKSP	BACK	ALERTS

Pressing the **BACK** Softkey returns to the mode selection softkeys.
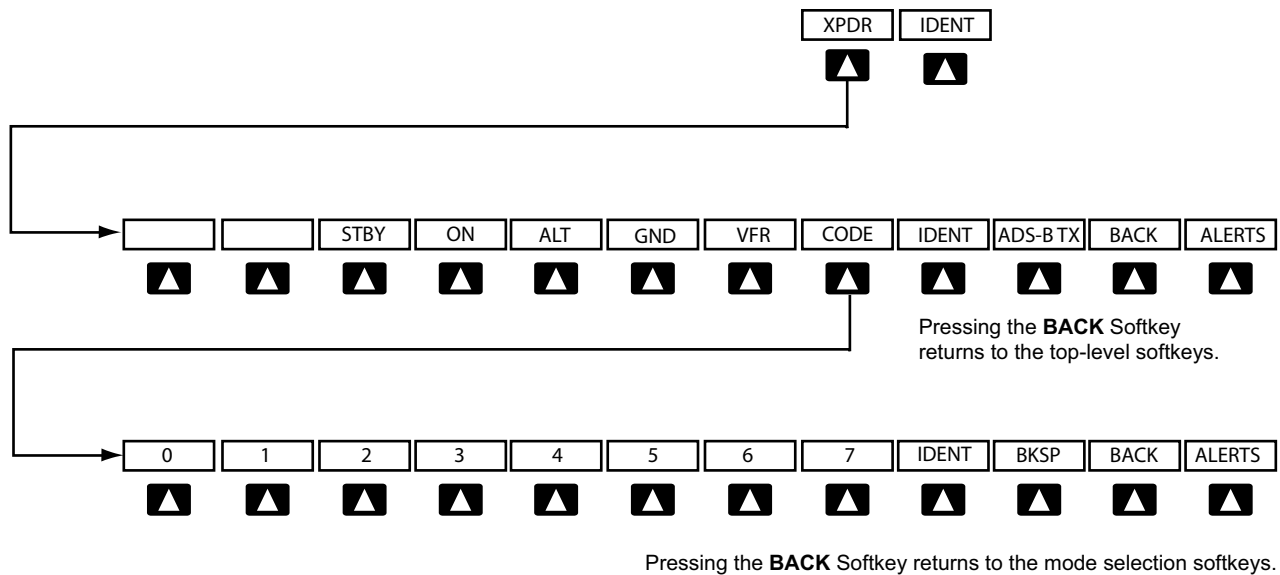
Figure 4-30 Transponder Softkeys (PFD)

TRANSPONDER MODE SELECTION

Mode selection can be automatic (Ground and Altitude Modes) or manual (Standby, ON, and Altitude Modes). The **STBY**, **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.

GROUND MODE

Ground Mode is normally selected automatically when the aircraft is on the ground. The transponder powers up in the last mode it was in when shut down. Ground Mode can be overridden by pressing any one of the Mode Selection Softkeys. A green GND indication and transponder code appear in the mode field of the Transponder Data Box. In Ground Mode, the transponder does not allow Mode A and Mode C replies, but it does permit acquisition squitter and replies to discretely addressed Mode S interrogations.

When Standby Mode has been selected on the ground, the transponder can be returned to Ground Mode by pressing the **GND** Softkey.

GND Mode

XPDR	6543	GND	LCL	20:47:37
ENT	ADS-B TX	BACK	ALERTS	

Figure 4-31 Ground Mode

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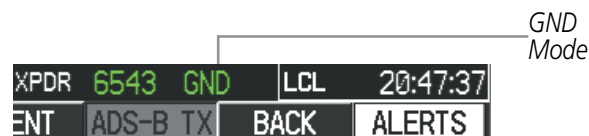
STANDBY MODE (MANUAL)

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

Standby Mode can be selected at any time by pressing the **STBY** Softkey. In Standby, the transponder does not reply to interrogations, but new codes can be entered. When Standby is selected, a white STBY indication and transponder code appear in the mode field of the Transponder Data Box. In all other modes, these fields appear in green.

STBY Mode (White Code Number and Mode)

XPDR 6543 STBY LCL 00:10:39
ENT ADS-B TX BACK ALERTS
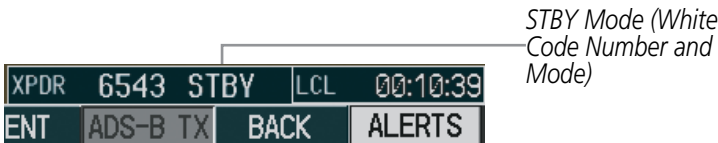
Figure 4-32 Standby Mode

MANUAL ON MODE

ON Mode can be selected at any time by pressing the **ON** Softkey. ON Mode generates Mode A and Mode S replies, but Mode C altitude reporting is inhibited. In ON Mode, a green ON indication and transponder code appear in the mode field of the Transponder Data Box.

ON Mode (No Altitude Reporting)

XPDR 1200 ON R LCL 00:12:25
ENT ADS-B TX BACK ALERTS

Figure 4-33 ON Mode

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ALTITUDE MODE (AUTOMATIC OR MANUAL)

Altitude Mode is automatically selected when the aircraft becomes airborne. Altitude Mode may also be selected manually by pressing the **ALT** Softkey.

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

*ALT Mode
(Mode C Altitude
Reporting)*
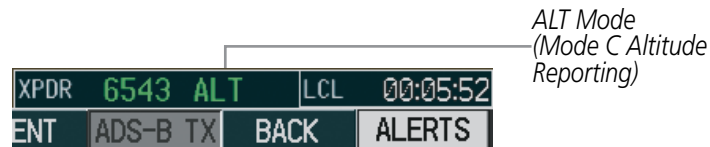
Figure 4-34 Altitude Mode

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.

*Reply to
Interrogation*

Figure 4-35 Reply Indication

ADS-B TX MODE

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

*ADS-B Transmission
Enabled*
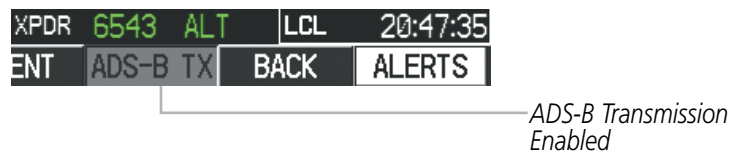
Figure 4-36 Altitude Mode

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. Pressing the **BKSP** Softkey moves the code selection cursor to the previous digit. Five seconds after the fourth digit has been entered, the transponder code becomes active.
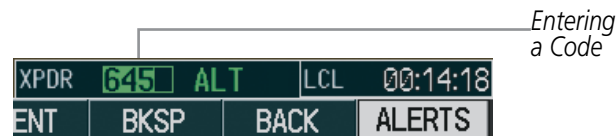
Entering a Code

Figure 4-37 Entering a Code

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.

Turn the Small FMS Knob to Enter Two Code Digits at a Time

Press the ENT Key to Complete Code Entry

Turn the Large FMS Knob to Move the Cursor to the Next Code Field
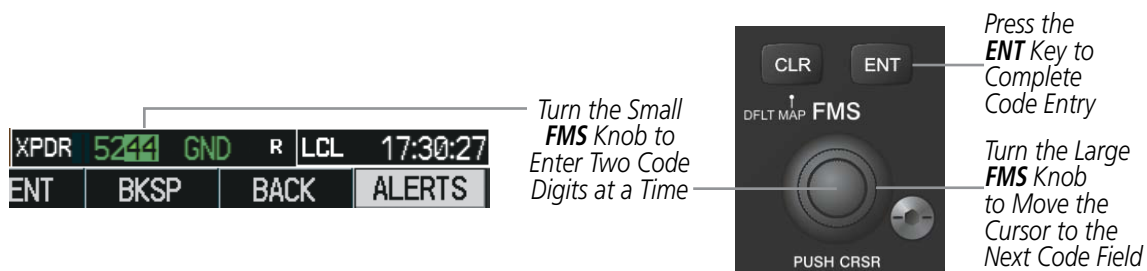
Figure 4-38 Entering a Code with the FMS Knob

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VFR CODE

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

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

Figure 4-39 VFR Code

IDENT FUNCTION

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

Pressing the **IDENT** Softkey sends a distinct identity indication to Air Traffic Control (ATC). The indication distinguishes the identing transponder from all the others on the air traffic controller's screen. The **IDENT** Softkey appears on all levels of transponder softkeys. When the **IDENT** Softkey is pressed, a green IDNT 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.
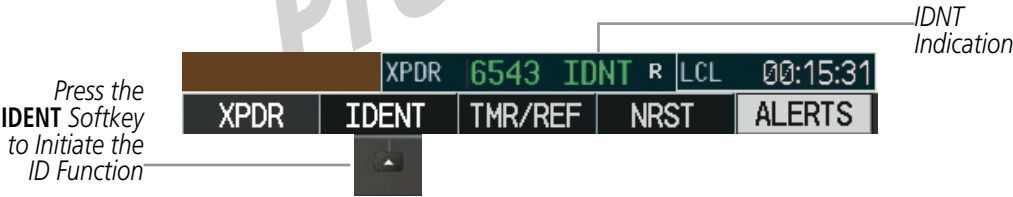
Figure 4-40 IDENT Softkey and Indication

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FLIGHT ID REPORTING

> **NOTE:** If the Flight ID is required but the system is not configured for it, contact a Garmin-authorized service center for configuration.

When the Flight ID must be entered before flight operation, the identifier is placed in the Timer/References Window on the PFD. The Flight ID is not to exceed seven characters. No space is needed when entering Flight ID. When a Flight ID contains a space, the system automatically removes it upon completion of Flight ID entry.

Entering a Flight ID:

1) Press the **TMR/REF** Softkey to display the Timer/References Window.

2) Press the **FMS** Knob to activate the selection cursor, if not already activated.

3) Turn the large **FMS** Knob to scroll down to the Flight ID.

4) Turn the small **FMS** Knob to enter the desired Flight ID.

5) Press the **ENT** Key to complete Flight ID entry.

If an error is made during Flight ID entry, pressing the **CLR** Key returns to the original Flight ID entry. While entering a Flight ID, turning the **FMS** Knob counterclockwise moves the cursor back one space for each detent of rotation. If an incorrect Flight ID is discovered after the unit begins operation, reenter the correct Flight ID using the same procedure.
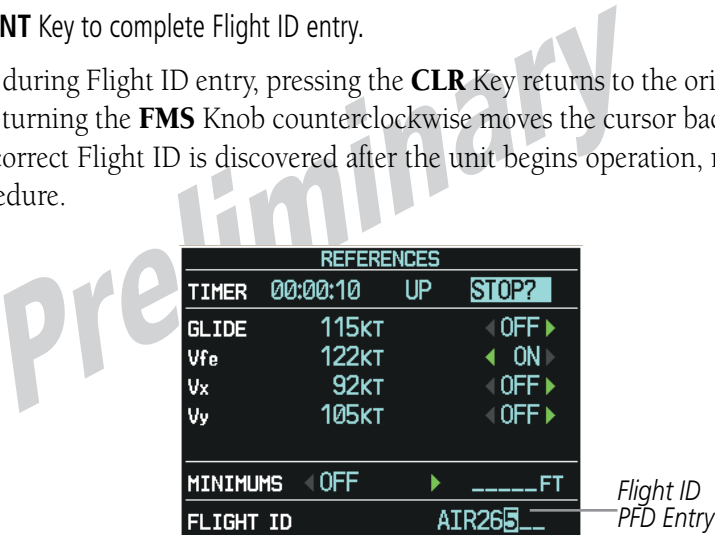
Figure 4-41 Timer/References Window, Entering Flight ID

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4.5 ADDITIONAL AUDIO PANEL FUNCTIONS

POWER-UP

The Audio Panel performs 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.

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** 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.

Figure 4-42 Passenger Address and Speaker Keys

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INTERCOM

The Audio Panel includes a six-position intercom system (ICS) and two stereo music inputs for the pilot, copilot and up to four passengers. The intercom provides Pilot and Copilot isolation from the passengers and aircraft radios.

Figure 4-43 Intercom Controls

PILOT KEY Annunciator	COPLT KEY Annunciator	Pilot Hears	Copilot Hears	Passenger Hears
OFF	OFF	Selected radios, aural alerts, pilot, copilot, passengers, MUSIC INPUT #1	Selected radios, aural alerts, pilot, copilot, passengers, MUSIC INPUT #1	Selected radios, aural alerts, pilot, copilot, passengers, MUSIC INPUT #2
ON	OFF	Selected radios, aural alerts, pilot	Copilot, passengers, MUSIC INPUT #1	Copilot, passengers, MUSIC INPUT #2
OFF	ON	Selected radios, aural alerts, pilot; passengers, MUSIC INPUT #1	Copilot	Selected radios, aural alerts, pilot, passengers, MUSIC INPUT #2
ON	ON	Selected radios, aural alerts, pilot, copilot	Selected radios, aural alerts, pilot, copilot	Passengers; MUSIC INPUT #2

Table 4-1 ICS Isolation Modes

Pilot isolation is selected when the PILOT Annunciator is illuminated. During Pilot isolation, the pilot can hear the selected radios and aural alerts and warnings. The copilot and passengers can communicate with each other. The copilot is isolated from aural alerts and warnings.

Copilot isolation is selected when the COPLT Annunciator is illuminated. The copilot is isolated from the selected radios, aural alerts and warnings, and everyone else. The pilot and passengers can hear the selected radios, aural alerts, and communicate with each other.

When both the PILOT and COPLT Annunciators are illuminated, the pilot and copilot can hear the selected radios, aural alerts, and communicate with each other. The passengers are isolated from the pilot and copilot but can communicate with each other.

When both the PILOT and COPLT Annunciators are extinguished, everyone hears the selected radios, aural alerts, and is able to communicate with everyone else.

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INTERCOM VOLUME AND SQUELCH

The **PILOT/PASS** Knob controls volume or manual squelch adjustment for the pilot and copilot/passenger. The small knob controls the pilot volume and squelch. The large knob controls the copilot/passenger volume and squelch. The VOL and SQ annunciations at the bottom of the unit indicate which function the knob is controlling. Pressing the **PILOT/PASS** Knob switches between volume and squelch control as indicated by the VOL or SQ annunciation being illuminated.

The **MAN SQ** Key allows either automatic or manual control of the squelch setting.

- When the MAN SQ Annunciator is extinguished (Automatic Squelch is on), the **PILOT/PASS** Knob controls only the volume (pressing the **PILOT/PASS** Knob has no effect on the VOL/SQ selection).

- When the MAN SQ Annunciator is illuminated (Manual Squelch), the **PILOT/PASS** Knob controls either volume or squelch (selected by pressing the **PILOT/PASS** Knob and indicated by the VOL or SQ annunciation).

Manual Squelch Annunciator; Off for Automatic Squelch, On for Manual Squelch

Automatic/Manual Squelch

Pilot Volume or Manual Squelch. Press to switch between VOL and SQ. Turn to adjust Squelch when SQ Annunciation is lit, Volume when VOL Annunciation is lit.

Copilot/Passenger Volume or Manual Squelch

Volume Annunciation

Squelch Annunciation
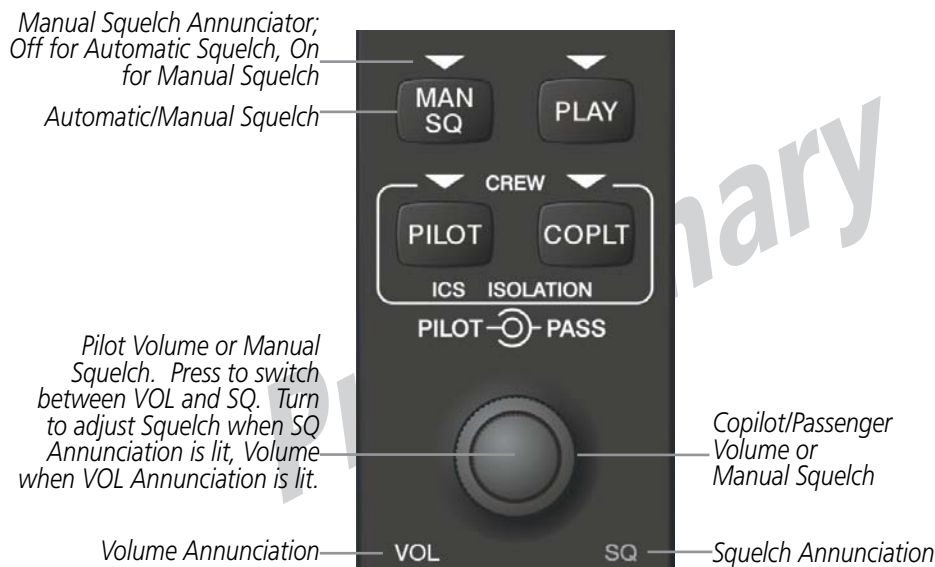
Figure 4-44 Volume/Squelch Control

CLEARANCE RECORDER AND PLAYER

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

The **PLAY** Key controls the play function. Pressing the **PLAY** Key once plays the latest recorded memory block. The PLAY Annunciator flashes to indicate when play is in progress. The PLAY Annunciator turns off after the present memory block has finished playing.

Pressing the **MKR/MUTE** Key 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 while audio is playing begins playing the previously recorded memory block. Each subsequent press of the **PLAY** Key selects the previously recorded memory block.

Powering off the unit automatically clears all recorded blocks.

MKR/MUTE *Key Stops Play*

***PLAY** Key Controls the Play Function*

Figure 4-45 Marker Mute and Play Keys

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SPLIT COM

> **NOTE:** *Split COM performance is affected by the distance between the COM antennas and the separation of the tuned frequencies. If the selected COM1 and COM2 frequencies are too close together, interference may be heard during transmission on the other radio.*

During Split COM operation, both the pilot and the copilot can transmit simultaneously over separate radios. The pilot can still monitor NAV1, NAV2, ADF, DME, and MKR Audio as selected, but the copilot is only able to monitor COM2.

Pressing the **COM 1/2** Key selects Split COM operation. The COM 1/2 Annunciator is illuminated indicating Split COM operation. COM1 and COM2 frequencies are displayed in green indicating that both transceivers are active. Split COM operation is cancelled by pressing the **COM 1/2** Key again, at which time the annunciator is extinguished.

When Split COM operation is selected, COM1 is used by the pilot and COM2 is used by the copilot. The COM1 MIC Annunciator flashes when the pilot's microphone PTT is pressed. The COM2 MIC Annunciator flashes when the copilot's microphone PTT is pressed.

COM1 Radio is Used by the Pilot

COM2 Radio is Used by the Copilot
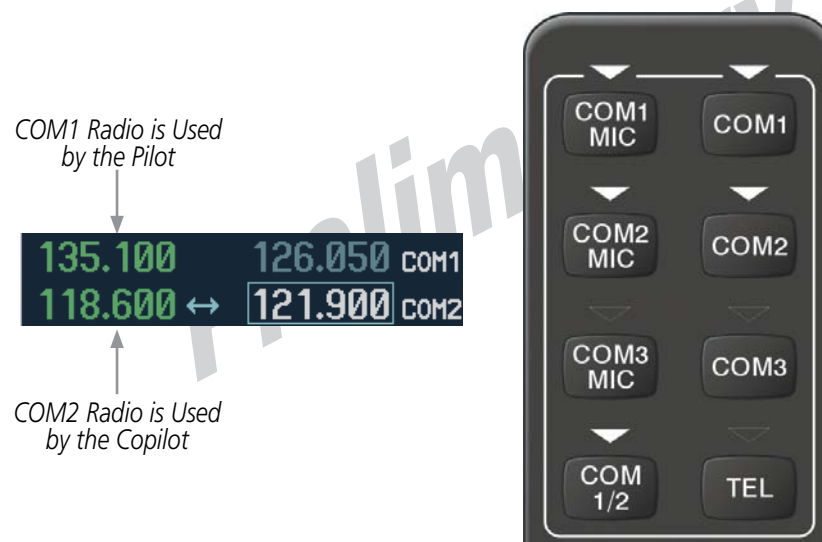
Figure 4-46 Split COM Operation

ENTERTAINMENT INPUTS

> **NOTE:** MUSIC INPUT #1 and MUSIC INPUT #2 cannot be completely turned off. Audio level for MUSIC INPUT #1 and MUSIC INPUT #2 can be adjusted by a Garmin-authorized service center.

The Audio Panel provides two stereo auxiliary entertainment inputs: MUSIC INPUT #1 and MUSIC INPUT #2. These inputs are compatible with popular portable entertainment devices such as MP3 and CD players. Two 3.5-mm stereo phone jacks are installed in convenient locations for audio connection. The headphone outputs of the entertainment devices are plugged into the MUSIC INPUT #1 or MUSIC INPUT #2 jacks.

The current ICS state of isolation affects the distribution of the entertainment input MUSIC INPUT #1 (see Table 4-1).

MUSIC INPUT #1

MUSIC INPUT #1 can be heard by the pilot and copilot when both the PILOT and the COPLT Annunciators are extinguished. MUSIC INPUT #1 can also be heard by the pilot when the COPLT Annunciator is illuminated and by the copilot when the PILOT Annunciator is illuminated.

MUSIC INPUT #1 MUTING

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

MUSIC INPUT #1 MUTING ENABLE/DISABLE

Pressing and holding the **MKR/MUTE** Key for three seconds switches MUSIC INPUT #1 muting on and off. When switching, either one or two beeps are heard; one beep indicates that music muting is enabled, two beeps indicate music muting is disabled. MUSIC INPUT #1 muting is reset (enabled) during power up.

MUSIC INPUT #2

MUSIC INPUT #2 can be heard only by the passengers and is never muted.

XM RADIO ENTERTAINMENT

XM Radio audio from the Data Link Receiver may be heard by the pilot and passengers simultaneously (optional: requires subscription to XM 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 XM Radio Audio from that input. For example, if passengers prefer their own music while the pilot listens to the XM Radio, the entertainment audio should be connected to the MUSIC INPUT #2 jack.

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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 G1000 System, the following steps aid in maximizing the use of the Audio Panel as well as prevent pilot and copilot induced issues. These preflight procedures should be performed each time a pilot boards the aircraft to insure awareness of all audio levels in the Audio Panel and radios.
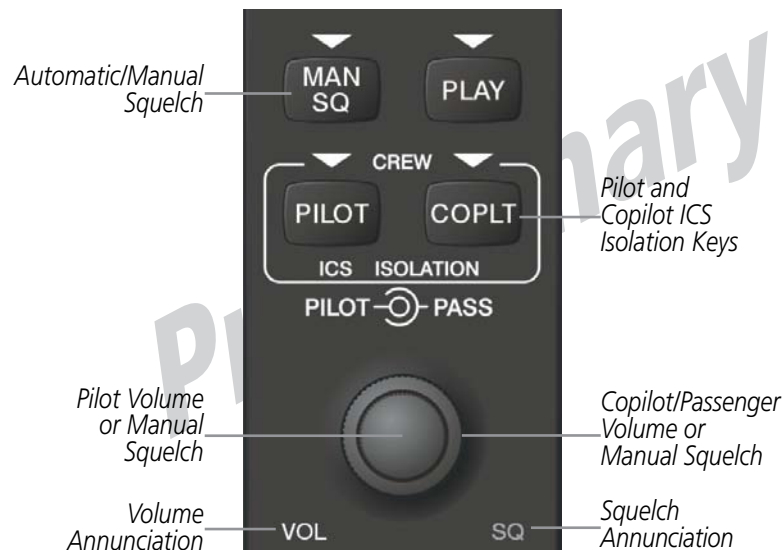
Figure 4-47 Audio Panel Controls

Setting the Audio Panel during preflight:

1) Verify that the PILOT and COPLT Annunciators are extinguished.

2) Verify manual squelch is set to full open.

3) Turn the **PILOT/PASS** Knobs clockwise two full turns. This sets the intercom level to max volume (least amount of attenuation).

4) Adjust radio volume levels (COM, NAV) to a suitable level.

5) Adjust the **PILOT/PASS** Knob volume to the desired intercom level.

6) Reset squelch to automatic, or adjust to the appropriate level manually.

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

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4.7 ABNORMAL OPERATION

Abnormal operation of the G1000 includes equipment failures of the G1000 components and failure of associated equipment, including switches and external devices.

STUCK MICROPHONE

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

The **COM1 MIC** or **COM2 MIC** Key Annunciator on the Audio Panel flashes as long as the PTT Key remains stuck.
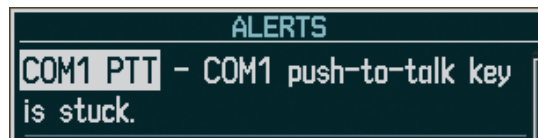
Figure 4-48 Stuck Microphone Alert

COM TUNING FAILURE

In case of a COM system tuning failure, the emergency frequency (121.500 MHz) is automatically tuned in the radio in which the tuning failure occurred. Depending on the failure mode, a red X may appear on the frequency display.

Figure 4-49 COM Tuning Failure

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.

Figure 4-50 Display Backup Button

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SECTION 5 FLIGHT MANAGEMENT

5.1 INTRODUCTION

The G1000 is an integrated flight, engine, communication, navigation and surveillance system. This section of the Pilot's Guide explains flight management using the G1000.

The most prominent part of the G1000 are the two full color displays: a Primary Flight Display (PFD) and a Multi Function Display (MFD). The information to successfully navigate the aircraft using the GPS sensors is displayed on the PFD and the MFD. See examples in the Figure 5-1 and Figure 5-2. Detailed descriptions of flight management functions are discussed later in this section.

A brief description of the flight management 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), Approach (LNAV, LNAV+V, L/VNAV, or LPV), or Missed Approach (MAPR)).

The Inset Map is a small version of the MFD Navigation Map and can be displayed in the lower left corner of the PFD. When the system is in reversionary mode, the Inset Map is displayed in the lower right corner. The Inset Map is displayed by pressing the **INSET** Softkey. Selecting the **INSET** Softkey again, then selecting the **OFF** Softkey removes the Inset Map.

The Navigation Map displays aviation data (e.g., airports, VORs, airways, airspaces), geographic data (e.g., cities, lakes, highways, borders), topographic data (map shading indicating elevation), and hazard data (e.g., traffic, terrain, weather). The amount of displayed data can be reduced by selecting the **DCLTR** Softkey. The Navigation Map can be oriented four different ways: North Up (NORTH UP), Track Up (TRK UP), Desired Track Up (DTK UP), or Heading Up (HDG UP).

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

There are 28 different map ranges available, from 500 feet to 2000 nm. The current range is indicated in the lower right corner of the map and represents the top-to-bottom distance covered by the 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.

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Figure 5-1 GPS Navigation Information on the PFD

Figure 5-2 GPS Navigation Information on the MFD Navigation Page

NAVIGATION STATUS BOX

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

PFD Navigation Status Box

- Active flight plan leg (e.g., 'D-> KICT' or 'KIXD -> KCOS') **or** flight plan annunciations (e.g., 'Turn right to 021° in 8 seconds')

- Distance (DIS) and Bearing (BRG) to the next waypoint **or** flight plan annunciations (e.g., 'TOD within 1 minute')

The symbols used in the PFD status bar are:

Symbol	Description
→	Active Leg
⊅→	Direct-to
	Right Procedure Turn
	Left Procedure Turn
	Right Holding Pattern
	Left Holding Pattern
vtf	Vector to Final
	Right DME Arc
	Left DME Arc

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

- Bearing (BRG)
- Distance (DIS)
- Desired Track (DTK)
- Endurance (END)
- Enroute Safe Altitude (ESA)
- Estimated Time of Arrival (ETA)
- Estimated Time Enroute (ETE)
- Fuel on Board (FOB)
- Fuel over Destination (FOD)
- Ground Speed (GS)
- Minimum Safe Altitude (MSA)
- True Air Speed (TAS)
- Track Angle Error (TKE)
- Track (TRK)
- Vertical Speed Required (VSR)
- Crosstrack Error (XTK)

GS 194KT   DTK 287°   TRK 287°   ETE 08:44

MFD Navigation Status Box

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

Changing a field in the MFD Navigation Status Box:

1) Select the System Setup Page.

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

3) Turn the large **FMS** Knob to highlight the desired field number in the MFD Data Bar Fields Box.

4) Turn the small **FMS** Knob to display and scroll through the data options list.

5) Select the desired data.

6) Press the **ENT** Key. Pressing the **DFLTS** Softkey returns all fields to the default setting.

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5.2 USING MAP DISPLAYS

Map displays are used extensively in the G1000 to provide situational awareness in flight. Most G1000 maps can display the following information:

- Airports, NAVAIDs, airspaces, airways, land data (highways, cities, lakes, rivers, borders, etc.) with names
- Map Pointer information (distance and bearing to pointer, location of pointer, name, and other pertinent information)
- Map range
- Wind direction and speed
- Map orientation
- Icons for enabled map features

- Aircraft icon (representing present position)
- Nav range ring
- Fuel range ring
- Flight plan legs
- User waypoints
- Track vector
- Topography scale
- Topography data
- Obstacle data

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

- All Map Group Pages (MAP)
- All Waypoint Group Pages (WPT)
- AUX - Trip Planning
- All Nearest Group Pages (NRST)

- Flight Plan Pages (FPL)
- Direct-to Window
- PFD Inset Map
- Procedure Loading Pages

MAP ORIENTATION

Maps are shown in one of four 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, desired track up, or heading up). The map orientation is shown in the upper right corner of the map.
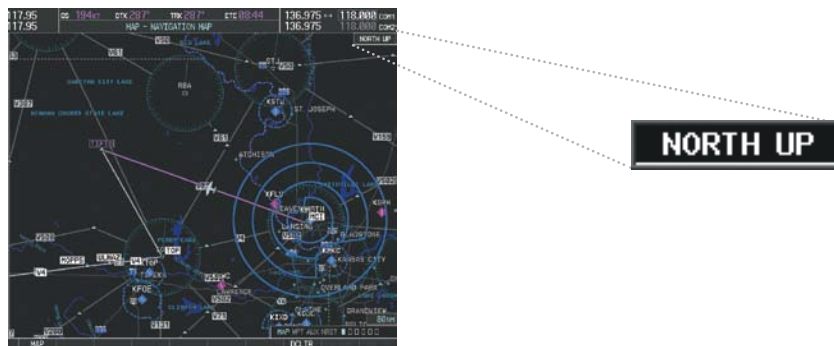
Figure 5-3 Map Orientation

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

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

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

Changing the Navigation Map orientation:

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

Map Setup Selection

Figure 5-4 Navigation Map Page Menu Window

2) Select the **ENT** Key to display the Map Setup Window.

3) Turn the large **FMS** Knob, or select the **ENT** Key once, to select the 'ORIENTATION' field.

Map Group Selection
Orientation Field
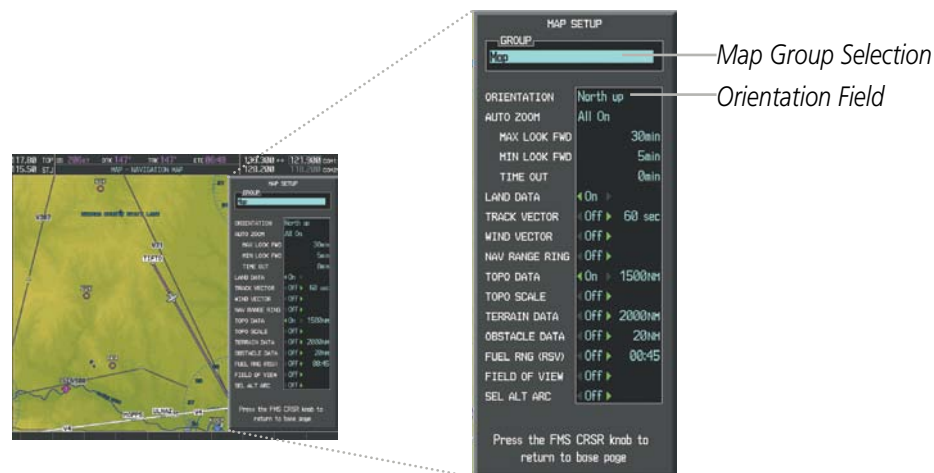
Figure 5-5 Map Setup Menu Window - Map Group

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

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

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

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MAP RANGE

There are 28 different map ranges available, from 500 feet to 2000 nm. The current range is indicated in the lower right corner of the map and represents the top-to-bottom distance covered by the map. When the map range is decreased to a point that exceeds the capability of the G1000 to accurately represent the map, a magnifying glass icon is shown to the left of the map range. To change the map range turn the **Joystick** counter-clockwise to decrease the range, or clockwise to increase the range.

Range Overzoom

Figure 5-6 Map Range

AUTO ZOOM

Auto zoom allows the G1000 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 Setup Window).

If a terrain caution or warning occurs, any map page displaying TAWS/TERRAIN data automatically adjusts to the smallest map range clearly showing the highest priority alert. If a new traffic advisory alert occurs, any map page capable of displaying traffic advisory alerts automatically adjusts to the smallest map range clearly showing the traffic advisory. When terrain or traffic alerts clear, the map returns to the previous auto zoom range based on the active waypoint.

The auto zoom function can be turned on or off independently for the PFDs 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 Setup Window for the Map Group). These settings determines the minimum and maximum distance to display based upon the aircraft's ground speed.

• Waypoints that are long distances apart cause the map range to increase to a point where many details on the map are decluttered. If this is not acceptable, lower the maximum look ahead time to a value that limits the auto zoom to an acceptable range.

• Waypoints that are very short distances apart cause the map range to decrease to a point where situational awareness may not be what is desired. Increase the minimum look ahead time to a value that limits the auto zoom to a minimum range that provides acceptable situational awareness.

• Flight plans that have a combination of long and short legs cause the range to increase and decrease as waypoints sequence. To avoid this, auto zoom can be disabled or the maximum/minimum times can be adjusted.

- The 'time out' time (configurable on the Map Setup Page for the Map Group) determines how long auto zoom is overridden by a manual adjustment of the range knob. At the expiration of this time, the auto zoom range is restored. Setting the 'time out' value to zero causes the manual override to never time out.

- When the maximum 'look forward' time is set to zero, the upper limit becomes the maximum range available (2000 nm).

- When the minimum 'look forward' time is set to zero, the lower limit becomes 1.5 nm.

Figure 5-7 Map Setup Menu Window - Map Group, Auto Zoom

Configuring automatic zoom:

1) Press the **MENU** Key with the Navigation Map Page displayed. The cursor flashes on the 'Map Setup' option.

2) Press the **ENT** Key. The Map Setup Menu is displayed.

3) Select the 'Map' group.

4) Press the **ENT** Key.

5) Highlight the 'AUTO ZOOM' field.

6) Select 'Off', 'MFD Only', 'PFD Only', or 'ALL On'.

7) 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.

8) Use the **FMS** Knobs to set the time. Press the **ENT** Key.

9) Repeat step 8 for 'MIN LOOK FWD' (zero to 99 minutes) and 'TIME OUT' (zero to 99 minutes).

10) Press the **FMS** Knob to return to the Navigation Map Page.

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MAP PANNING

Map panning allows the pilot to:

- View parts of the map outside the displayed range without adjusting the map range

- Highlight and select locations on the map

- Review information for a selected airport, NAVAID or user waypoint

- Designate locations for use in flight planning

- View airspace and airway information

When the panning function is selected by pressing 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.

Map Pointer Information

Map Pointer

Figure 5-8 Navigation Map - Map Pointer Activated

> **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.*

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 5-9 Navigation Map - Map Pointer on Point of Interest

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When the Map Pointer crosses an airspace boundary, the boundary is highlighted and airspace information is shown at the top of the display. The information includes the name and class of airspace, the ceiling in feet above Mean Sea Level (MSL), and the floor in feet MSL.

Information about Airspace

Map Pointer on Airspace

Figure 5-10 Navigation Map - Map Pointer on Airspace

Panning the map:

1)   Press the **Joystick** to display the Map Pointer.

2)   Move the **Joystick** to move the Map Pointer around the map.

3)   Press 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) Place the Map Pointer on a waypoint.

2) Press the **ENT** Key to display the Waypoint Information Page for the selected waypoint.

3) Press the **GO BACK** Softkey, the **CLR** Key, or the **ENT** Key to exit the Waypoint Information Page and return to the Navigation Map showing the selected waypoint.
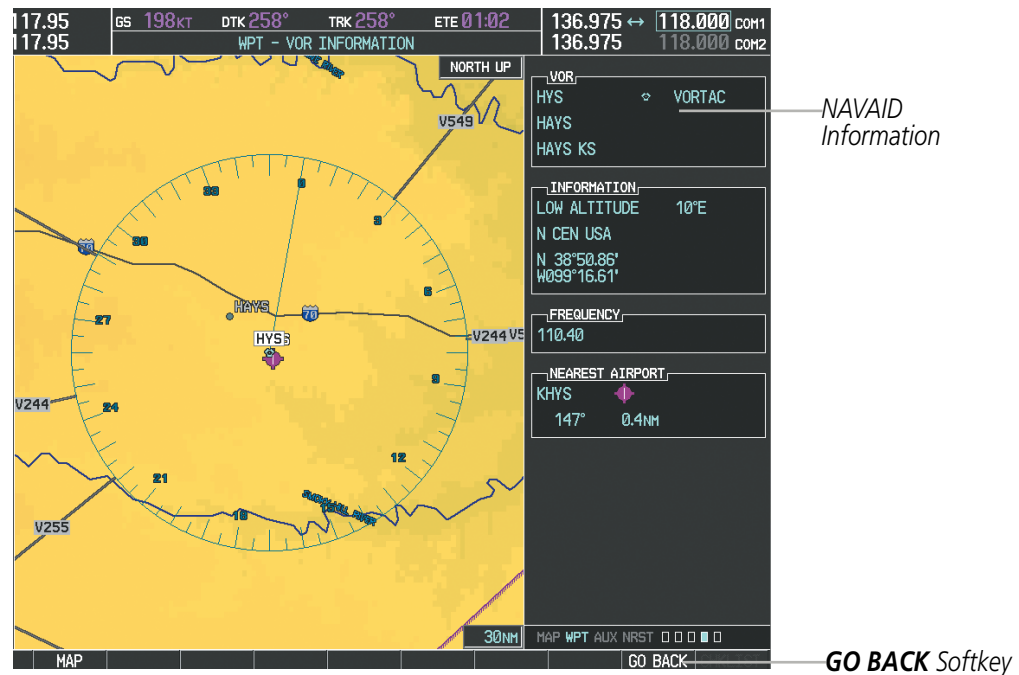
Figure 5-11 Navigation Map - Information Window - NAVAID

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Viewing airspace information for a special-use or controlled airspace:

1) 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 Airspace Information Page for the selected airspace.

4) Press the **CLR** or **ENT** Key to exit the Airspace Information Page.

Figure 5-12 Navigation Map - Information Window - Airspace

MEASURING BEARING AND DISTANCE

Distance and bearing from the aircraft's present position to any point on the viewable navigation map may be calculated using the 'Measure Bearing and Distance' selection from Navigation Map page menu. The bearing and distance tool displays a dashed Measurement Line and a Measure Pointer to aid in graphically identifying points with which to measure. Lat/Long, distance and elevation data for the Measure Pointer is provided in a window at the top of the navigation map.

Measuring bearing and distance between any two points:

1) Press the **MENU** Key (with the Navigation Map Page displayed).

2) Highlight the 'Measure Bearing/Distance' field.

3) Press the **ENT** Key. A Measure Pointer is displayed on the map at the aircraft's present position.

4) Move the **Joystick** to place the reference pointer at the desired location. The bearing and distance are displayed at the top of the map. Elevation at the current pointer position is also displayed. Pressing the **ENT** Key changes the starting point for measuring.

5) To exit the Measure Bearing/Distance option, press the **Joystick**; or select 'Stop Measuring' from the Page Menu and press the **ENT** Key.

Measurement Information

Pointer Lat/Long

Measurement Line

Figure 5-13 Navigation Map - Measuring Bearing and Distance

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TOPOGRAPHY

All navigation maps can display various shades of topography colors representing land elevation, similar to aviation sectional charts. Topographic data can be displayed or removed as described in the following procedures.
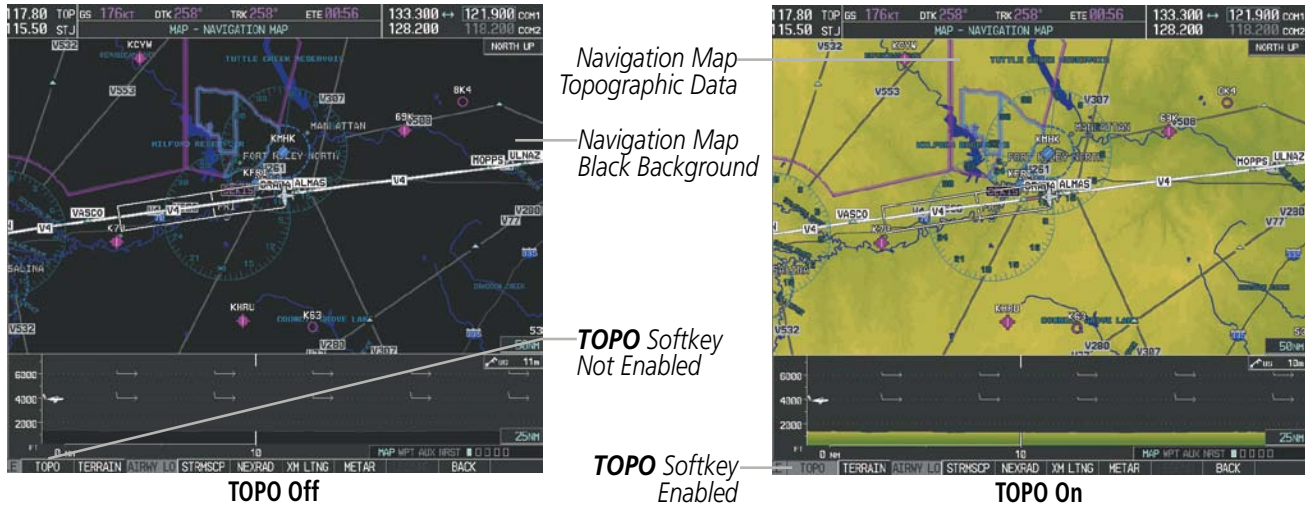
Figure 5-14 Navigation Map - Topographic Data

Displaying/removing topographic data on all pages displaying navigation maps:

1) Press the **MAP** Softkey (the **INSET** Softkey for the PFD Inset Map).

2) Press the **TOPO** Softkey.

3) Press the **TOPO** Softkey again to remove topographic data from the Navigation Map. When topographic data is removed from the page, all navigation data is presented on a black background.

Displaying/removing topographic data (TOPO DATA) using the Navigation Map Page Menu:

1) Press the **MENU** Key with the Navigation Map Page displayed. The cursor flashes on the 'Map Setup' option.

2) Press the **ENT** Key. The Map Setup Menu is displayed.

3) Select the 'Map' group.

4) Press the **ENT** Key.

5) Highlight the 'TOPO DATA' field.

6) Select 'On' or 'Off'.

7) Press the **FMS** Knob to return to the Navigation Map Page.
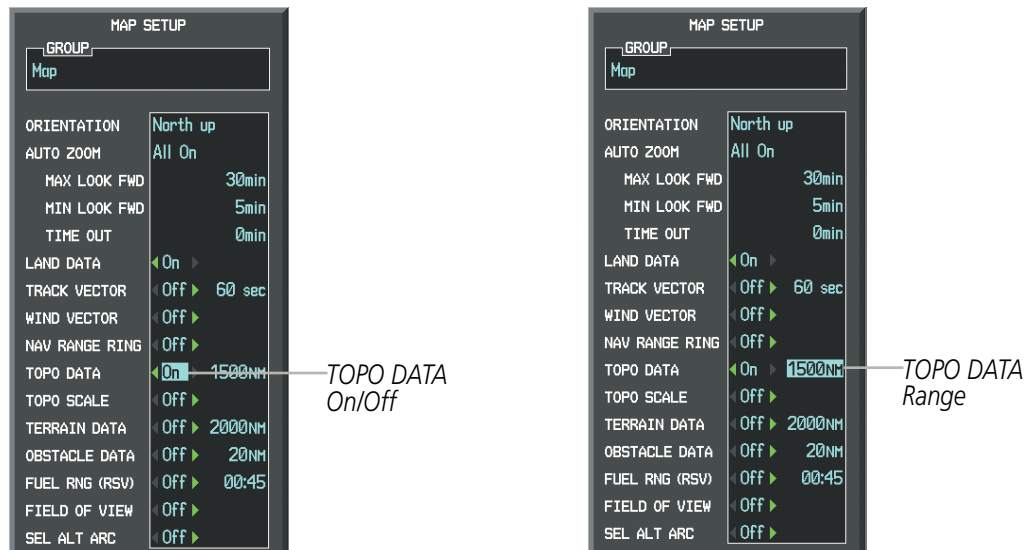
Figure 5-15 Navigation Map Setup Menu - TOPO DATA Setup

The topographic data range is the maximum map range on which topographic data is displayed.

> ✓ **NOTE:** Since the PFD Inset Map is much smaller than the MFD navigation maps, items are removed on the PFD Inset Map two range levels smaller than the range selected in the Map Setup pages (e.g., a setting of 100 nm removes the item at ranges above 100 nm on MFD navigation maps, while the PFD Inset Map removes the same item at 50 nm).

Selecting a topographical data range (TOPO DATA):

1) Press the **MENU** Key with the Navigation Map Page displayed. The cursor flashes on the 'Map Setup' option.

2) Press the **ENT** Key. The Map Setup Menu is displayed.

3) Select the 'Map' group.

4) Press the **ENT** Key.

5) Highlight the 'TOPO DATA' range field. TOPO ranges are from 500 ft to 2000 nm.

6) To change the TOPO range setting, turn the small **FMS** Knob to display the range list.

7) Select the desired range using the small **FMS** Knob.

8) Press the **ENT** Key.

9) Press the **FMS** Knob to return to the Navigation Map Page.

In addition, the Navigation Map can display a topographic scale (located in the lower right hand side of the map) showing a scale of the terrain elevation and current elevation values.
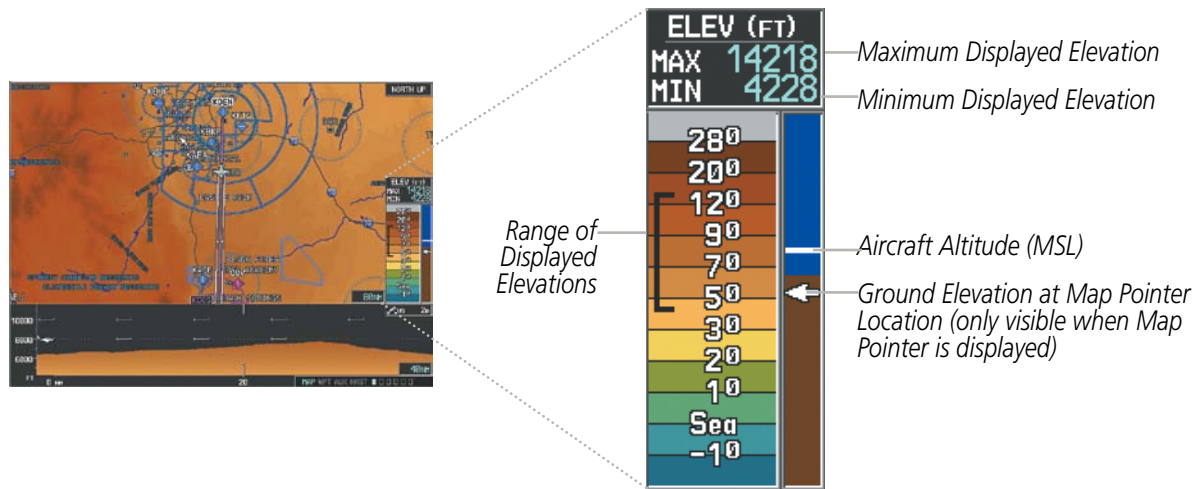
Figure 5-16 Navigation Map - TOPO SCALE

Displaying/removing the topographic scale (TOPO SCALE):

1) Press the **MENU** Key with the Navigation Map Page displayed. The cursor flashes on the 'Map Setup' option.

2) Press the **ENT** Key. The Map Setup Menu is displayed.

3) Select the 'Map' group and select the **ENT** Key.

4) Highlight the 'TOPO SCALE' field.

5) Select 'On' or 'Off'.

6) Press the **FMS** Knob to return to the Navigation Map Page.
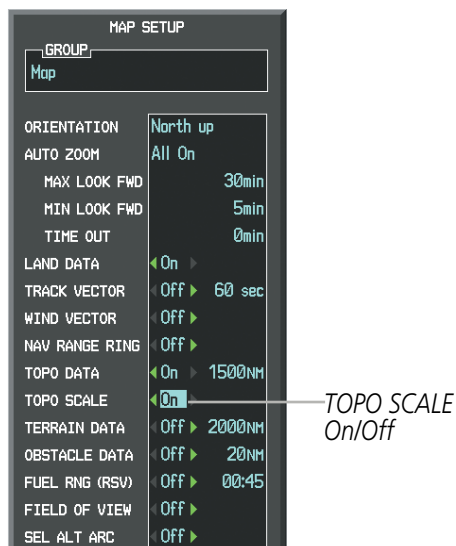
Figure 5-17 Navigation Map Setup Menu - TOPO SCALE Setup

MAP SYMBOLS

This section discusses the types of land and aviation symbols that can be displayed. Each listed type of symbol can be turned on or off, and the maximum range to display each symbol can be set. The decluttering of the symbols from the map using the **DCLTR** Softkey is also discussed.

LAND SYMBOLS

The following items are configured on the land menu:
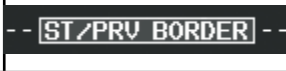
Land Symbols *(Text label size can be None, Small, Medium (Med), or Large (Lrg))*	Symbol	Default Range (nm)	Maximum Range (nm)
Latitude/Longitude (LAT/LON)		Off	2000
Highways and Roads			
Interstate Highway (FREEWAY)		300	800
International Highway (FREEWAY)		300	800
US Highway (NATIONAL HWY)		30	80
State Highway (LOCAL HWY)		15	30
Local Road (LOCAL ROAD)	N/A	8	15
Railroads (RAILROAD)		15	30
LARGE CITY (> 200,000)		800	1500
MEDIUM CITY (> 50,000)		100	200
SMALL CITY (> 5,000)		20	50
States and Provinces (STATE/PROV)		800	1500
Rivers and Lakes (RIVER/LAKE)		200	500
USER WAYPOINT		150	300

Table 5-1 Land Symbol Information

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AVIATION SYMBOLS

The following items are configured on the aviation menu:

Aviation Symbols *(Text label size can be None, Small, Medium (Med), or Large (Lrg))*	Symbol	Default Range (nm)	Maximum Range (nm)
Active Flight Plan Leg (ACTIVE FPL)		2000	2000
Non-active Flight Plan Leg (ACTIVE FPL)		2000	2000
Active Flight Plan Waypoint (ACTIVE FPL WPT)	See Airports, NAVAIDs	2000	2000
Large Airports (LARGE APT)		250	500
Medium Airports (MEDIUM APT)		150	300
Small Airports (SMALL APT)		50	100
Taxiways (SAFETAXI)	See Additional Features	3	20
Runway Extension (RWY EXTENSION)	N/A	Off	100
Intersection (INT WAYPOINT)		15	30
Non-directional Beacon (NDB WAYPOINT)		15	30
VOR (VOR WAYPOINT)		150	300
Class B Airspace/TMA (CLASS B/TMA)		200	500
Class C Airspace/TCA (CLASS C/TCA)		200	500
Class D Airspace (CLASS D)		150	300
Restricted Area (RESTRICTED)		200	500
Military Operations Area [MOA(MILITARY)]		200	500
Other/Air Defense Interdiction Zone (OTHER/ADIZ)		200	500
Temporary Flight Restriction (TFR)		500	2000

Table 5-2 Aviation Symbol Information

SYMBOL SETUP

All pages with maps can display land symbols (roads, lakes, borders, etc). Land symbols can be removed totally (turned off).

Displaying/removing all land symbols:

1) Press the **MENU** Key with the Navigation Map Page displayed. The Page Menu is displayed and the cursor flashes on the 'Map Setup' option.

2) Press the **ENT** Key. The Map Setup Group Menu is displayed and the cursor flashes on the 'Map' option.

3) Highlight the 'LAND DATA' field.

4) Select 'On' or 'Off'.

5) Press the **FMS** Knob to return to the Navigation Map Page.
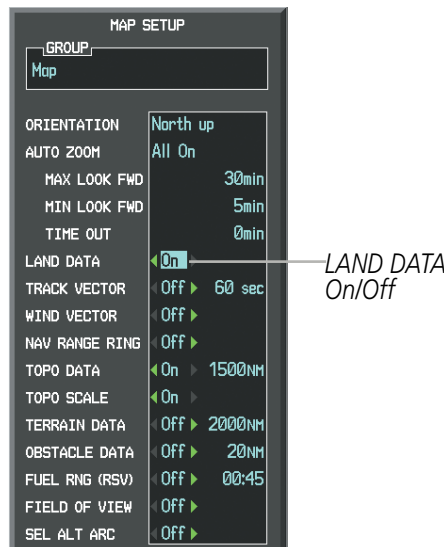
Figure 5-18 Navigation Map Setup Menu - LAND DATA Setup

The label size (TEXT) sets the size at which labels appear on the display (none, small, medium, and large). The range (RNG) sets the maximum range at which items appear on the display.

Selecting a 'Land' or 'Aviation' group item text size and range:

1) Press the **MENU** Key with the Navigation Map Page displayed. The cursor flashes on the 'Map Setup' option.

2) Press the **ENT** Key. The Map Setup Menu is displayed.

3) Select the 'Land' or 'Aviation' group.

4) Press the **ENT** Key. The cursor flashes on the first field.

5) Select the desired land option.

6) Select the desired text size.

7) Press the **ENT** Key to accept the selected size.

8) Select the desired range.

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9) Press the **ENT** Key to accept the selected range.

10) Press the **FMS** Knob to return to the Navigation Map Page.

Text Label Size
(None, Small, Med, or Lrg)

Maximum Display Range
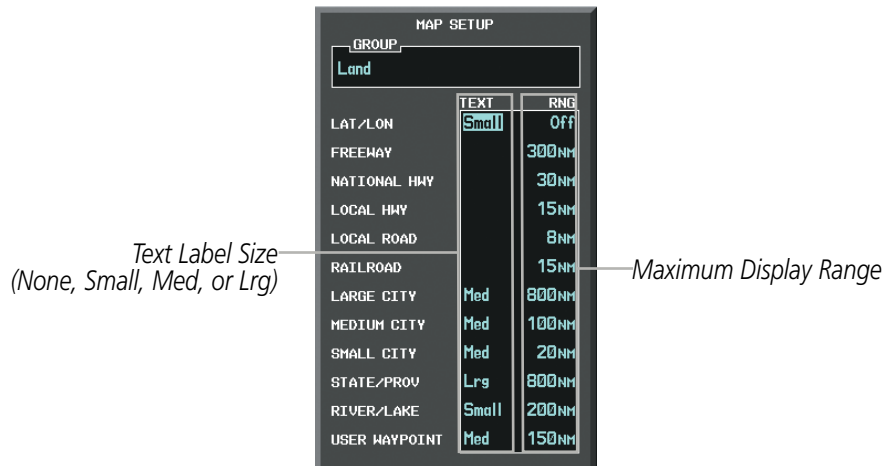
Figure 5-19 Navigation Map Setup Menu - LAND GROUP Setup

Text Label Size
(None, Small, Med, or Lrg)

Maximum Display Range
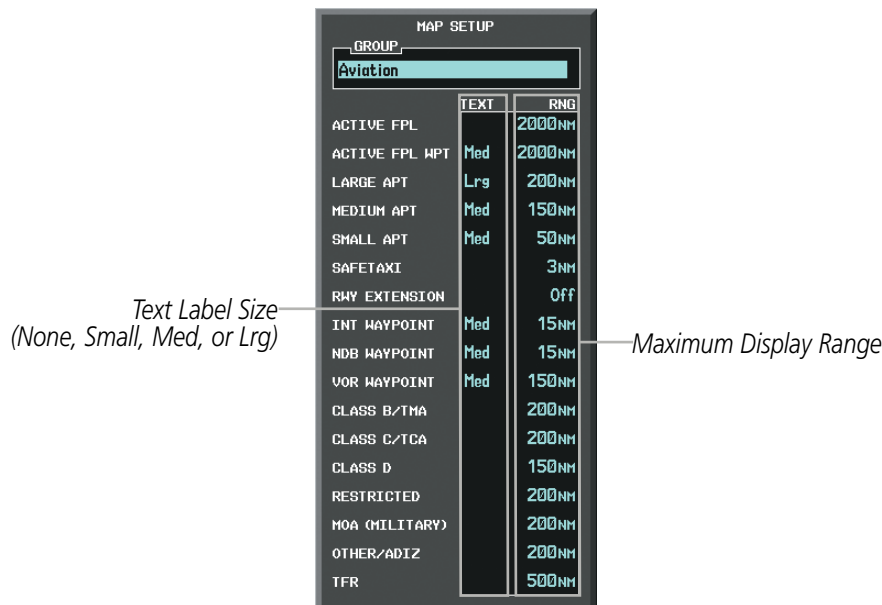
Figure 5-20 Navigation Map Setup Menu - AVIATION GROUP Setup

NOTE: *Since the PFD Inset Map is much smaller than the MFD navigation maps, items are removed on the PFD Inset Map two range levels smaller than the range selected in the Map Setup pages (e.g., a setting of 100 nm removes the item at ranges above 100 nm on MFD navigation maps, while the PFD Inset Map removes the same item at 50 nm).*

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 **DCLTR** Softkey and next to the Declutter Menu Option.

Declutter Level

Navigation Map Page Menu
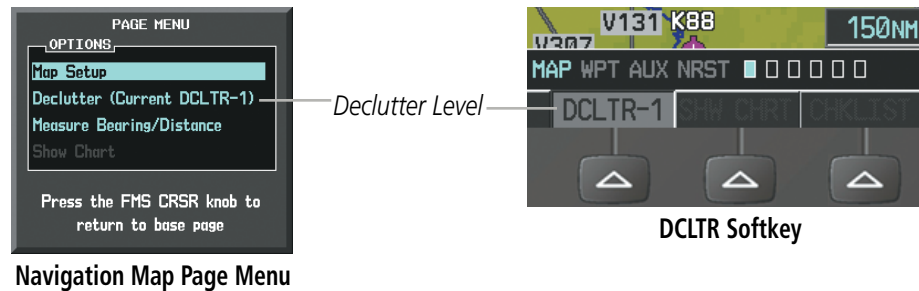
DCLTR Softkey

Figure 5-21 Navigation Map - Declutter Level Indications

Decluttering the map:

Select the **DCLTR** Softkey with the Navigation Map Page displayed. The current declutter level is shown. With each softkey selection, another level of map information is removed.

Or:

1) Press the **MENU** Key with the Navigation Map Page displayed.

2) Select 'Declutter'. The current declutter level is shown.

3) Press the **ENT** Key.

Decluttering the PFD Inset Map:

1) Press the **INSET** Softkey.

2) Select the **DCLTR** Softkey. The current declutter level is shown. With each selection, another level of map information is removed.

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Table 5-3 lists the items displayed at each declutter level. The 'X' represents map items displayed for the various levels of declutter.

Item	No Declutter	Declutter-1	Declutter-2	Declutter-3
Flight Plan Route Lines	X	X	X	X
Flight Plan Route Waypoints	X	X	X	X
Rivers/Lakes	X	X	X	X
Topography Data	X	X	X	X
International Borders	X	X	X	X
Track Vector	X	X	X	X
Navigation Range Ring	X	X	X	X
Fuel Range Ring	X	X	X	X
Terrain Data	X	X	X	X
Traffic	X	X	X	X
Airways	X			
NEXRAD	X	X	X	
XM Lightning Data	X	X	X	
Airports	X	X	X	
Runway Labels	X	X	X	
Restricted	X	X	X	
MOA (Military)	X	X	X	
User Waypoints	X	X		
Latitude/Longitude Grid	X	X		
NAVAIDs	X	X		
Class B Airspaces/TMA	X	X		
Class C Airspaces/TCA	X	X		
Class D Airspaces	X	X		
Other Airspaces/ADIZ	X	X		
TFRs	X	X		
Obstacles	X	X		
Land/Country Text	X			
Cities	X			
Roads	X			
Railroads	X			
State/Province Boundaries	X			
River/Lake Names	X			

Table 5-3 Navigation Map Items Displayed by Declutter Level

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AIRWAYS

This airways discussion is based upon the North American airway structure. The airway structure in places other than North America vary by location, etc. and are not discussed in this book. Low Altitude Airways (or Victor Airways) primarily serve smaller piston-engine, propeller-driven airplanes on shorter routes and at lower altitudes. Airways are eight nautical miles wide and start 1,200 feet above ground level (AGL) and extend up to 18,000 feet mean sea level (MSL). Low Altitude Airways are designated with a "V" before the airway number (hence the name "Victor Airways") since they run primarily between VORs.

High Altitude Airways (or Jet Routes) primarily serve airliners, jets, turboprops, and turbocharged piston aircraft operating above 18,000 feet MSL. Jet Routes start at 18,000 feet MSL and extend upward to 45,000 feet MSL (altitudes above 18,000 feet are called "flight levels" and are described as FL450 for 45,000 feet MSL). Jet Routes are designated with a "J" before the route number.

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

When airways are selected for display on the map, the airway waypoints (VORs, NDBs and Intersections) are also displayed.
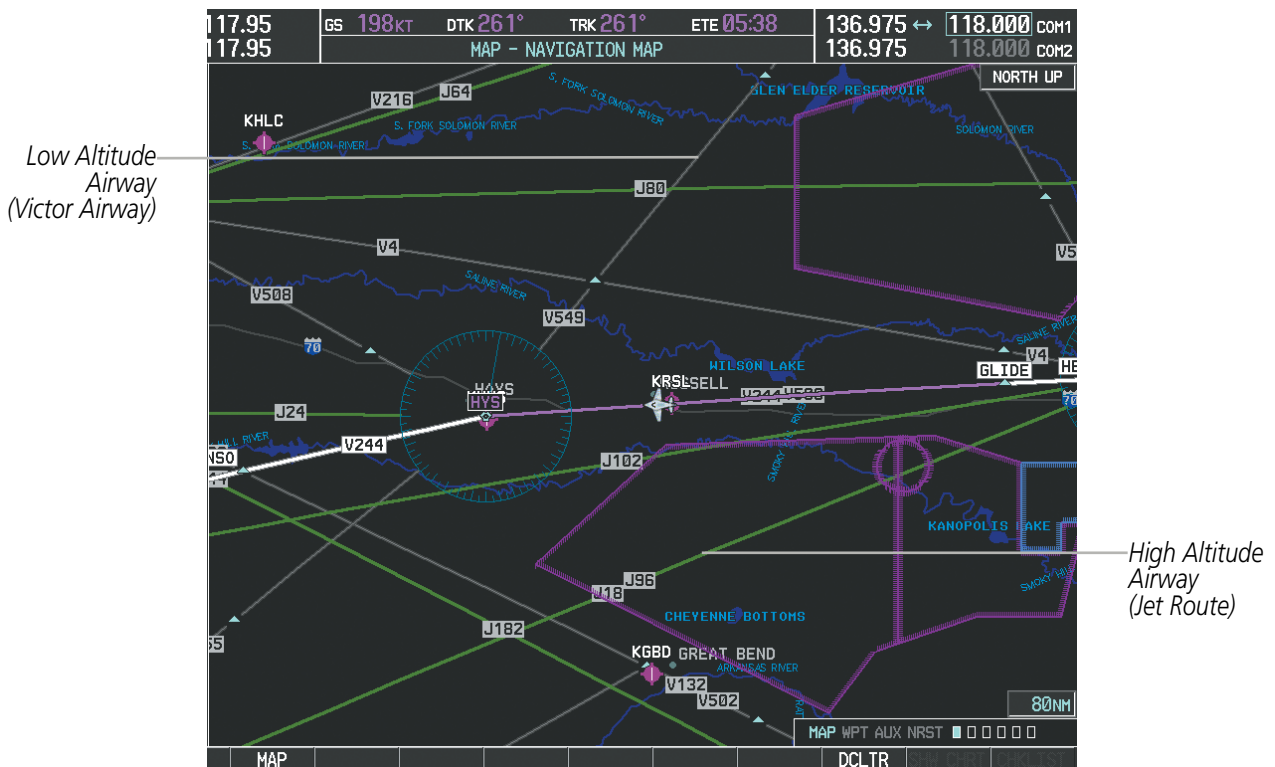
Figure 5-22 Airways on MFD Navigation Page

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Airways may be displayed on the map at the pilot's discretion using either a combination of **AIRWAYS** Softkey presses, or menu selections using the **MENU** Key from the Navigation Map Page. The Airway range can also be programmed to only display Airways on the MFD when the map range is at or below a specific number.

Displaying/removing airways:

1) Select the **MAP** Softkey.

2) Select the **AIRWAYS** Softkey. Both High and Low Altitude Airways are displayed (AIRWY ON).

3) Select the softkey again to display Low Altitude Airways only (AIRWY LO).

4) Select the softkey again to display High Altitude Airways only (AIRWY HI).

5) Select the softkey again to remove High Altitude Airways. No airways are displayed (AIRWAYS).

   Or:

1) Press the **MENU** Key with the Navigation Map Page displayed. The cursor flashes on the 'Map Setup' option.

2) Press the **ENT** Key. The Map Setup Menu 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 'AIRWAYS' field.

5) Turn the **FMS** Knob to select 'Off', 'All', 'LO Only', or 'HI Only', and press the **ENT** Key.

6) Press the **FMS** Knob to return to the Navigation Map Page.

Airway Display Selection Off, All, LO Only, HI Only

Low Altitude Airway Range

High Altitude Airway Range
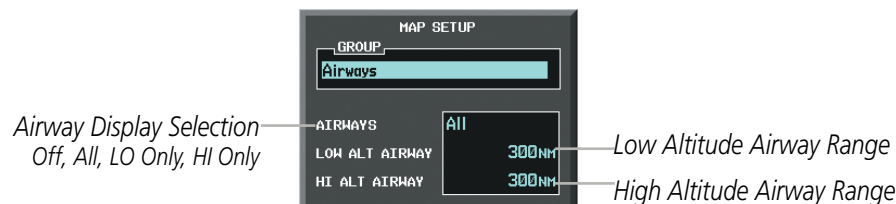
Figure 5-23 Navigation Map Setup Menu - AIRWAYS Setup

The airway range is the maximum map range on which airways are displayed.

Selecting an airway range (LOW ALT AIRWAY or HI ALT AIRWAY):

1) Press the **MENU** Key with the Navigation Map Page displayed. The cursor flashes on the 'Map Setup' option.

2) Press the **ENT** Key. The Map Setup Menu is displayed.

3) Turn the small **FMS** Knob to select the 'Airways' group and press the **ENT** Key.

4) Highlight the 'LOW ALT AIRWAY' or 'HI ALT AIRWAY' range field.

5) To change the range setting, turn the small **FMS** Knob to display the range list.

6) Select the desired range using the small **FMS** Knob.

7) Press the **ENT** Key.

8) Press the **FMS** Knob to return to the Navigation Map Page.

The following range items are configurable on the airways menu:

Airway Type	Symbol	Default Range (nm)	Maximum Range (nm)
Low Altitude Airway (LOW ALT AIRWAY)	V4	200	500
High Altitude Airway (HI ALT AIRWAY)	J24	300	500

Table 5-4 Airway Range Information

TRACK VECTOR

The Navigation Map can display a track vector that is useful in minimizing track angle error. The track vector is a solid light blue 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.
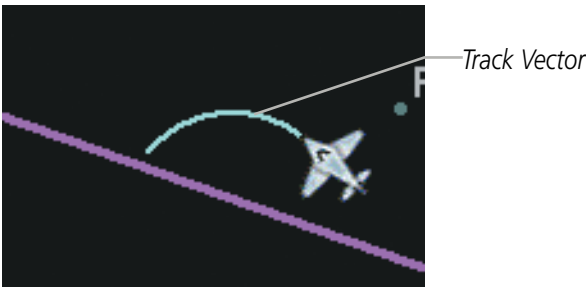
Track Vector

Figure 5-24 Navigation Map -Track Vector

Displaying/removing the track vector:

1) Press the **MENU** Key with the Navigation Map Page displayed. The cursor flashes on the 'Map Setup' option.

2) Press the **ENT** Key. The Map Setup Menu is displayed.

3) Select the 'Map' group.

4) Press the **ENT** Key.

5) Highlight the 'TRACK VECTOR' field.

6) Select 'On' or 'Off'. Press the **ENT** Key to accept the selected option. The flashing cursor highlights the look ahead time field. Use the **FMS** Knob to select the desired time. Press the **ENT** Key.

7) Press the **FMS** Knob to return to the Navigation Map Page.
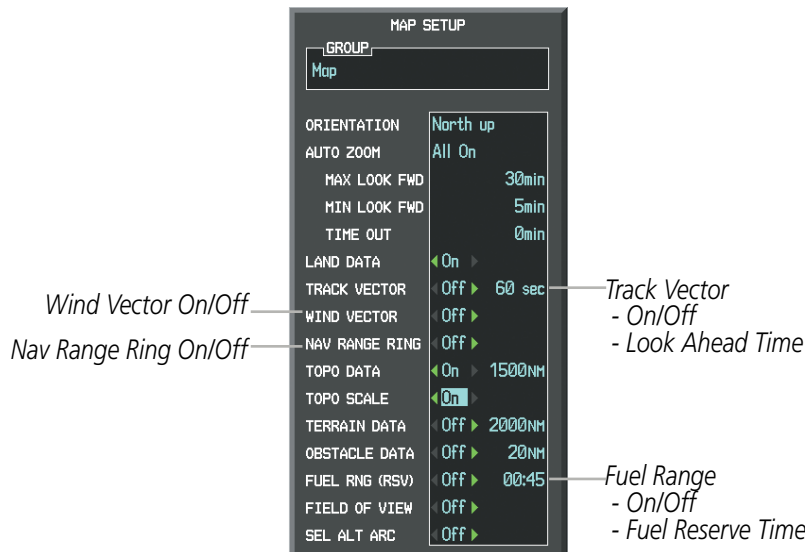
Figure 5-25 Navigation Map Setup Menu -TRACK VECTOR, WIND VECTOR, NAV RANGE RING, FUEL RANGE RING Setup

WIND VECTOR

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

Figure 5-26 Navigation Map - Wind Vector

NOTE: *The wind vector is not displayed until the aircraft is moving. It is not displayed on the Waypoint Information pages.*

Displaying/removing the wind vector:

1) Press the **MENU** Key with the Navigation Map Page displayed. The cursor flashes on the 'Map Setup' option.

2) Press the **ENT** Key. The Map Setup Menu is displayed.

3) Select the 'Map' group.

4) Press the **ENT** Key.

5) Highlight the 'WIND VECTOR' field.

6) Select 'On' or 'Off'.

7) Press the **FMS** Knob to return to the Navigation Map Page.

NAV RANGE RING

The Nav Range Ring shows the direction of travel (ground track) on a rotating compass card. The range is determined by the map range. The range is 1/4 of the map range (e.g., 37.5 nm on a 150 nm map).

Range (radius)
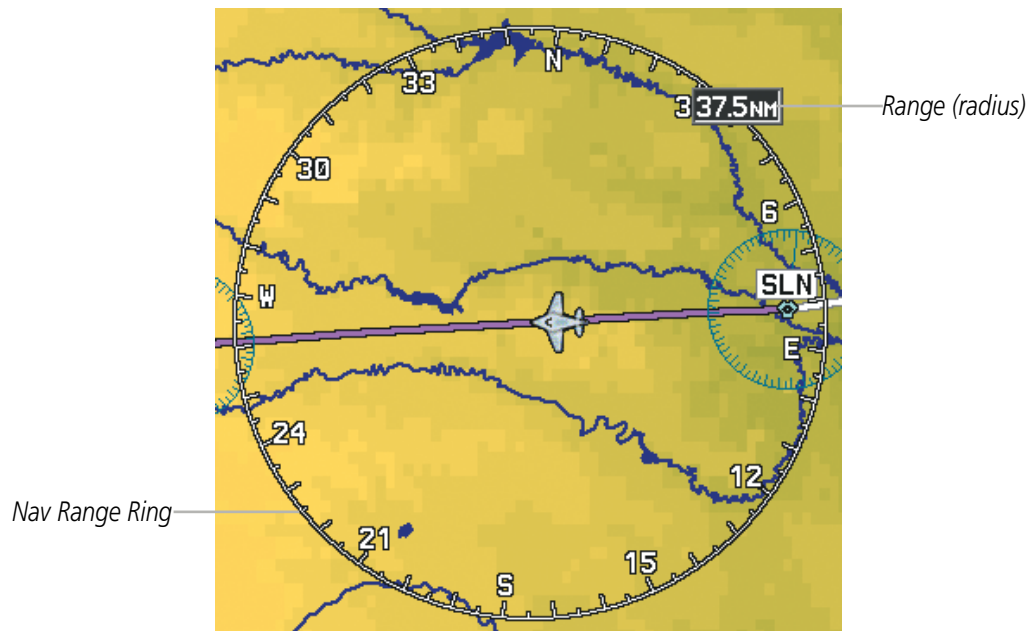
Nav Range Ring

Figure 5-27 Navigation Map - Nav Range Ring

> **NOTE:** *The Nav Range Ring is not displayed on the Waypoint Information pages, Nearest pages, or Direct-to Window map.*

Displaying/removing the Nav Range Ring:

1) Press the **MENU** Key with the Navigation Map Page displayed. The cursor flashes on the 'Map Setup' option.

2) Press the **ENT** Key. The Map Setup Menu is displayed.

3) Select the 'Map' group.

4) Press the **ENT** Key.

5) Highlight the 'NAV RANGE RING' field.

6) Select 'On' or 'Off'.

7) Press the **FMS** Knob to return to the Navigation Map Page.

> **NOTE:** *The Nav Range Ring is referenced to either magnetic or true north, based on the selection on the AUX - System Setup Page.*

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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 yellow circle.
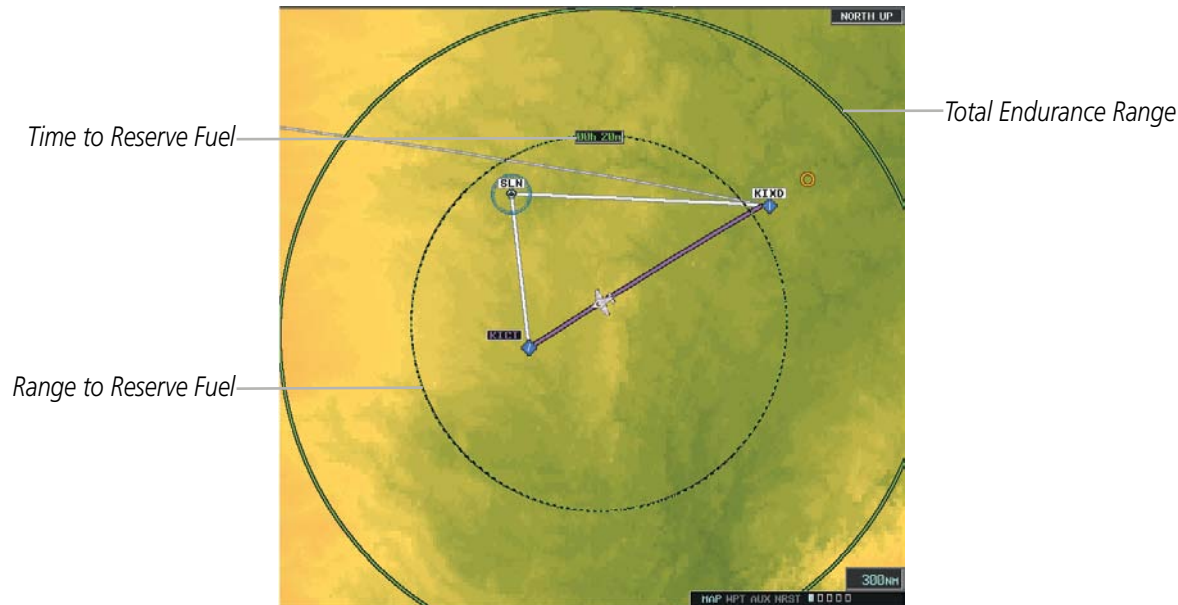
Figure 5-28 Navigation Map - Fuel Range Ring

Displaying/removing the fuel range ring and selecting a fuel range time:

1) Press the **MENU** Key with the Navigation Map Page displayed. The cursor flashes on the 'Map Setup' option.

2) Press the **ENT** Key. The Map Setup Menu is displayed.

3) Select the 'Map' group.

4) Press the **ENT** Key.

5) Highlight the 'FUEL RNG (RSV)' field.

6) Select 'On' or 'Off'.

7) Highlight the fuel reserve time field. This time should be set to the amount of flight time equal to the amount of fuel reserve desired.

8) To change the reserve fuel time, enter a time (00:00 to 23:59; hours:minutes). The default setting is 00:45 minutes.

9) Press the **ENT** Key.

10) Press the **FMS** Knob to return to the Navigation Map Page.

FIELD OF VIEW (SVS)

The map can display the boundaries of the PFD Synthetic Vision System (SVS) 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 SVS is installed on the aircraft.
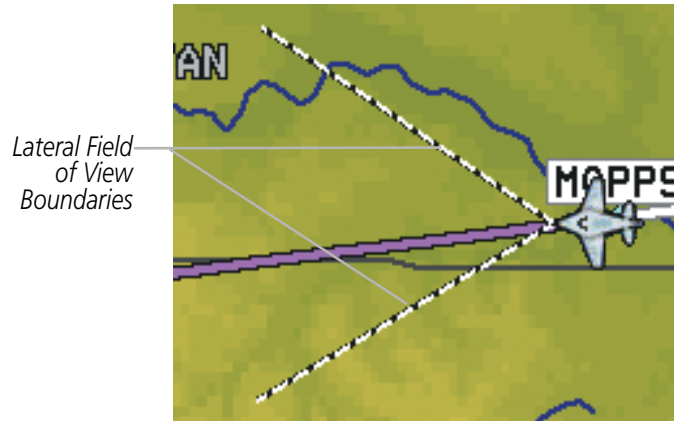
Figure 5-29 Navigation Map - Field of View

Displaying/removing the field of view:

1) Press the **MENU** Key with the Navigation Map Page displayed. The cursor flashes on the 'Map Setup' option.

2) Press the **ENT** Key. The Map Setup Menu is displayed.

3) Select the 'Map' group.

4) Press the **ENT** Key.

5) Highlight the 'FIELD OF VIEW' field.

6) Select 'On' or 'Off'.

7) Press the **FMS** Knob to return to the Navigation Map Page.

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SELECTED ALTITUDE INTERCEPT ARC

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

Range to Altitude Arc
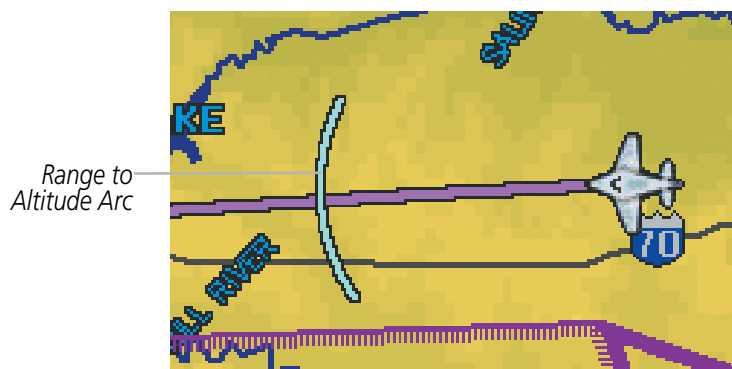
Figure 5-30 Navigation Map - Range to Altitude Arc

Displaying/removing the selected altitude intercept arc:

1) Press the **MENU** Key with the Navigation Map Page displayed. The cursor flashes on the 'Map Setup' option.

2) Press the **ENT** Key. The Map Setup Menu is displayed.

3) Select the 'Map' group.

4) Press the **ENT** Key.

5) Highlight the 'SEL ALT ARC' field.

6) Select 'On' or 'Off'.

7) Press the FMS Knob to return to the Navigation Map Page.

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 G1000. As a waypoint identifier, facility name, or location is entered, the G1000's Spell'N'Find™ feature scrolls through the database, displaying those waypoints matching the characters which have been entered to that point. A direct-to navigation leg to the selected waypoint can be initiated by pressing the **Direct-to** Key on any of the waypoint pages.

Figure 5-31 Waypoint Information Window

If duplicate entries exist for the entered facility name or location, additional entries may be viewed by continuing to turn the small **FMS** Knob during the selection process. If duplicate entries exist for an identifier, a Duplicate Waypoints Window is displayed when the **ENT** Key is pressed.

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Duplicate Waypoints

Figure 5-32 Waypoint Information Window - Duplicate Identifier

AIRPORTS

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

   The Airport Information Page is the first page in WPT group and allows the pilot to view airport information, load frequencies (COM, NAV, and lighting), review runways, and review instrument procedures that may be involved in the flight plan. See the Audio Panel and CNS Section for more information on loading frequencies (auto-tuning). After engine startup, the Airport Information Page defaults to the airport where the aircraft is located. After a flight plan has been loaded, it defaults to the destination airport. On a flight plan with multiple airports, it defaults to the airport which is the current active waypoint.

   In addition to displaying a map of the currently selected airport and surrounding area, the Airport Information Page displays airport information in three boxes labeled 'AIRPORT', 'RUNWAYS', and 'FREQUENCIES'. For airports with multiple runways, information for each runway is available. This information is viewed on the Airport Information Page by pressing the INFO softkey until **INFO-1** is displayed.

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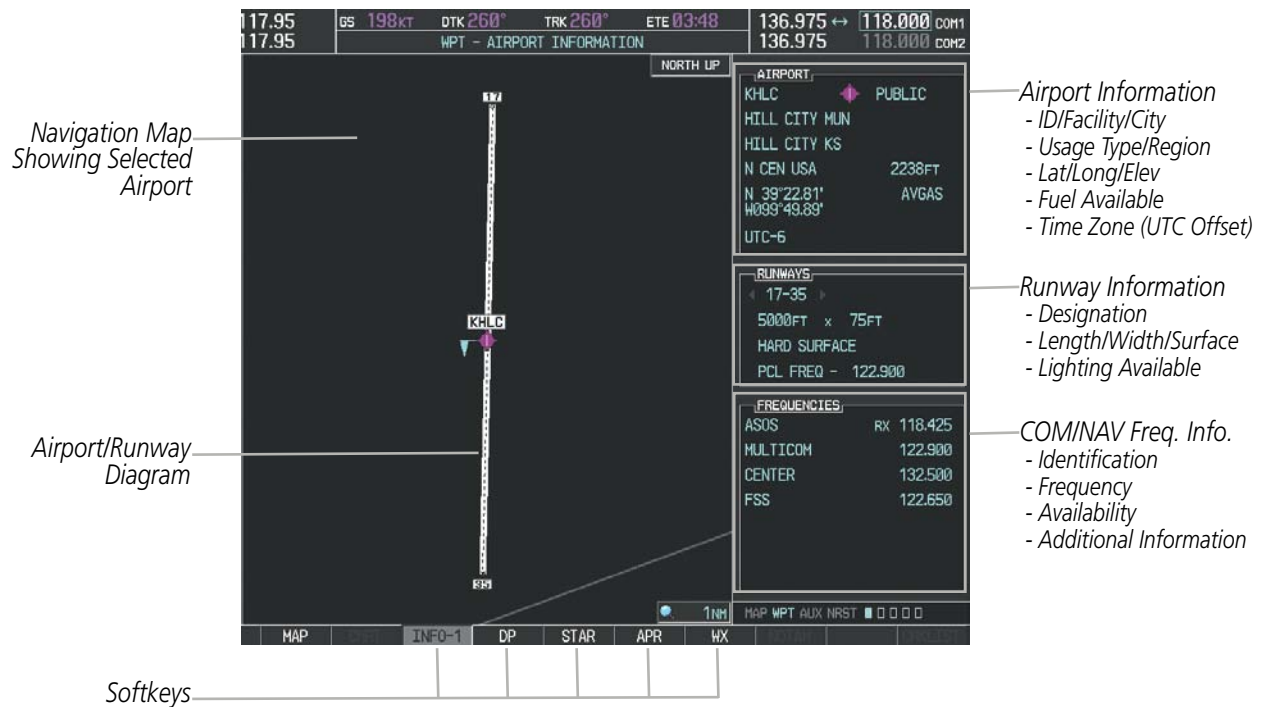
Figure 5-33 Airport Information Page

The following descriptions and abbreviations are used on the Airport Information Page:

- Usage type: Public, Military, Private, or Heliport

- Runway surface type: Hard, Turf, Sealed, Gravel, Dirt, Soft, Unknown, or Water

- Runway lighting type: No Lights, Part Time, Full Time, Unknown, or PCL Freq (for pilot-controlled lighting)

- COM Availability: TX (transmit only), RX (receive only), PT (part time), i (additional information available)
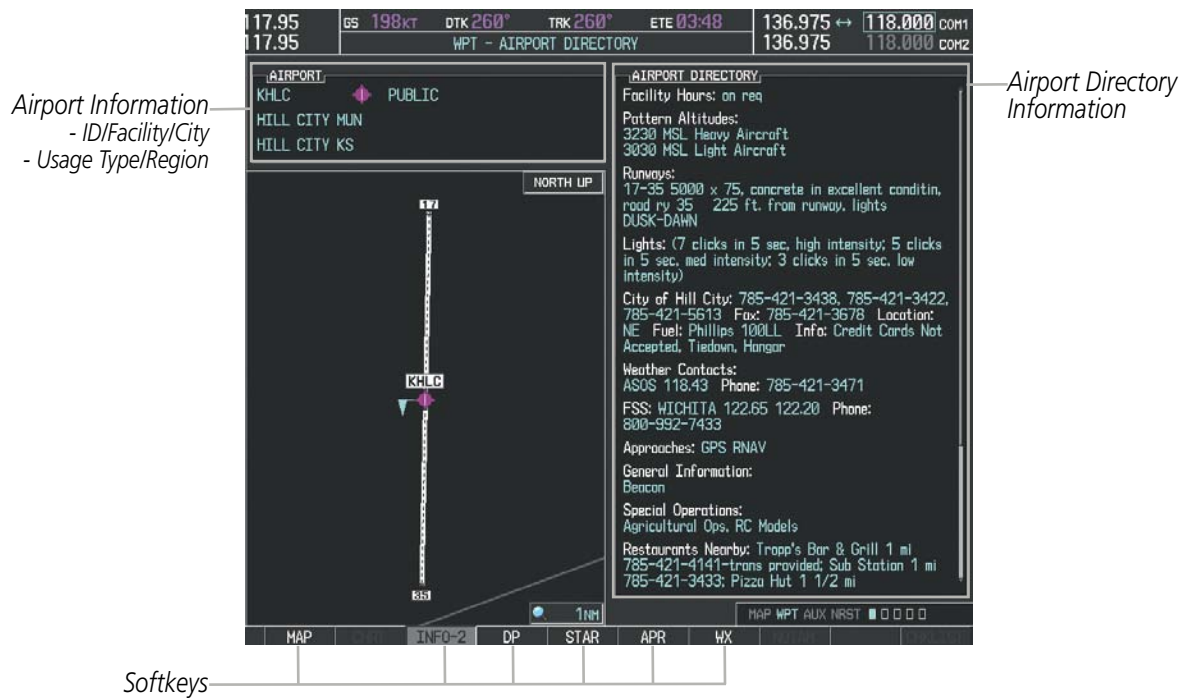
Figure 5-34 Airport Directory Page Example

The AOPA directory information is viewed on the Airport Directory Page by pressing the INFO softkey until **INFO-2** is displayed. The following are types of AOPA airport directory information shown (if available) on the Airport Directory Page:

- **Airport**: Identifier, Site Number, Name, City, State

- **Phones**: Phone/Fax Numbers

- **Hours**: Facility Hours, Light Hours, Tower Hours, Beacon Hours

- **Location**: Sectional, Magnetic Variation

- **Frequencies**: Type/Frequency

- **Transportation**: Ground Transportation Type Available

- **Approach**: Approach Facility Name, Frequency, Frequency Parameter

- **Traffic Pattern Altitudes (TPA)**: Aircraft Class/Altitude

- **Weather**: Service Type, Frequency, Phone Number

- **Flight Service Station (FSS)**: FSS Name, Phone Numbers

- **Instrument Approaches**: Published Approach, Frequency

- **NAVAIDS**: Type, Identifier, Frequency, Radial, Distance

- **Noise**: Noise Abatement Procedures

- **Charts**: Low Altitude Chart Number

- **Runway**: Headings, Length, Width, Obstructions, Surface

- **Obstructions**: General Airport Obstructions

- **Special Operations at Airport**

- **Services Available**: Category, Specific Service

- **Notes**: Airport Notes

- **Pilot Controlled Lighting**: High/Med/Low Clicks/Second

- **FBO**: Type, Frequencies, Services, Fees, Fuel, Credit Cards, Phone/Fax Numbers

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

1) From the Airport Information Page, press the **FMS** Knob.

2) Use the **FMS** Knobs and enter an identifier, facility name, or location.

3) Press the **ENT** Key.

4) Press the **FMS** Knob to remove the cursor.

Selecting a runway:

1) With the Airport Information Page displayed, press the **FMS** Knob to activate the cursor.

2) Turn the large **FMS** Knob to place the cursor in the 'RUNWAYS' Box, on the runway designator.

3) Turn the small **FMS** Knob to display the desired runway (if more than one) for the selected airport.

4) To remove the flashing cursor, press the **FMS** Knob.

Viewing a destination airport:

From the Airport Information Page press the **MENU** Key. Select 'View Destination Airport'. The Destination Airport is displayed.

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

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

Table 5-5 Airport Frequency Abbreviations

A departure, arrival, or approach can be loaded using the softkeys on the Airport Information Page. See the Procedures section for details. METARs or TAFs applicable to the selected airport can be selected for display (see the Hazard Avoidance section for details about weather).

The G1000 provides a **NRST** Softkey on the PFD, which gives the pilot quick access to nearest airport information (very useful if an immediate landing is required). The Nearest Airports Window displays a list of up to the 25 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.

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Bearing/Distance to Airport

Airport Identifier/ Type

COM Freq. Info.
- Identification
- Frequency

Approach Available

Length of Longest Runway

Additional Airports (within 200 nm)

NRST Softkey
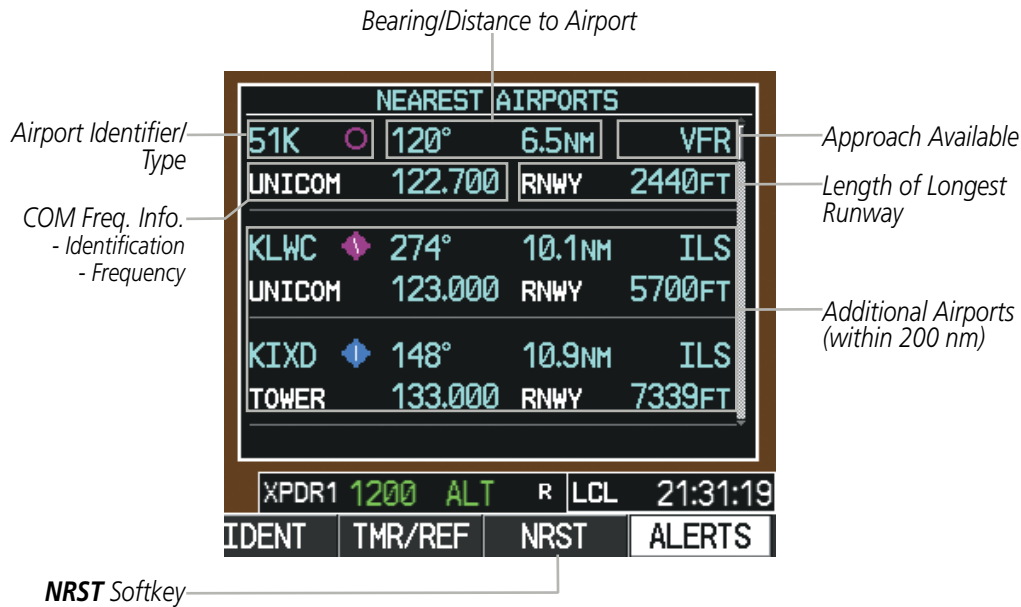
Figure 5-35 Nearest Airports Window on PFD

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.

Airport Information
- ID/Type/City
- Facility

Airport Information
- Usage/Time/Elev
- Region

Airport Information
- Lat/Long
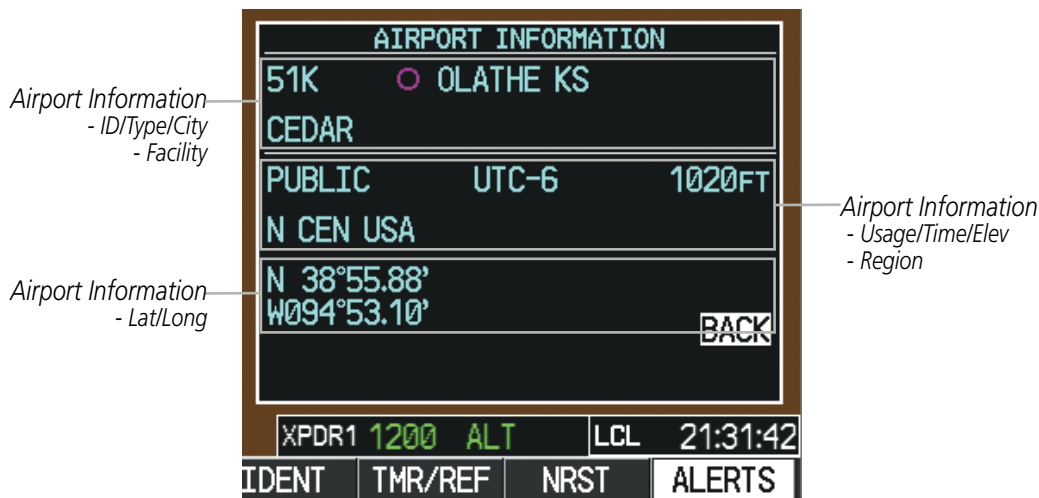
Figure 5-36 Airport Information Window on PFD

The Nearest Airports Page on the MFD is first in the group of NRST pages because of its potential use in the event of an in-flight emergency. In addition to displaying a map of the currently selected airport and surrounding area, the page displays nearest airport information in five boxes labeled 'NEAREST AIRPORTS', 'INFORMATION', 'RUNWAYS', 'FREQUENCIES', and 'APPROACHES'.

The selected airport is indicated by a white arrow, and a dashed white line is drawn on the navigation map from the aircraft position to the nearest airport. Up to five nearest airports, one runway, up to five frequencies, and up to five approaches are visible at one time. If there are more than can be shown, each list can be scrolled.

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If there are no items for display in a boxed area, text indicating that fact is displayed. The currently selected airport remains in the list until it is unselected.

Figure 5-37 Nearest Airport Page

Viewing information for a nearest airport on the PFD:

1) Press the **NRST** Softkey to display the Nearest Airports Window. Press the **FMS** Knob to activate the cursor.

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 **NRST** Softkey to close the PFD Nearest Airports Window.

Viewing information for a nearest airport on the MFD:

1) Turn the large **FMS** Knob to select the NRST page group.

2) Turn the small **FMS** Knob to select the 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 200 NM" is displayed.

3) Press the **APT** Softkey; or press the **FMS** Knob; or press the **MENU** Key, highlight 'Select Airport Window' and press the **ENT** Key. The cursor is placed in the 'NEAREST AIRPORTS' Box. The first airport in the nearest airports list is highlighted.

4) Turn the **FMS** Knob to highlight the desired airport. (Pressing the **ENT** Key also moves to the next airport.)

5) Press the **FMS** Knob to remove the flashing cursor.

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Viewing runway information for a specific airport:

1) With the Nearest Airports Page displayed, press the **RNWY** Softkey; or press the **MENU** Key, highlight 'Select Runway Window'; and press the **ENT** Key. The cursor is placed in the 'RUNWAYS' Box.

2) Turn the small **FMS** Knob to select the desired runway.

3) Press the **FMS** Knob to remove the flashing cursor.

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

The Nearest Airports Box on the System Setup Page defines the minimum runway length and surface type used when determining the 25 nearest airports to display on the MFD Nearest Airports Page. A minimum runway length and/or surface type can be entered to prevent airports with small runways or runways that are not appropriately surfaced from being displayed. Default settings are 0 feet (or meters) for runway length and "HARD/SOFT" for runway surface type.

Selecting nearest airport surface matching criteria:

1) Use the **FMS** Knob to select the System Setup Page.

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

3) Turn the large **FMS** Knob to highlight the runway surface field in the Nearest Airports Box.

4) Turn the small **FMS** Knob to select the desired runway option (ANY, HARD ONLY, HARD/SOFT, WATER).

5) Press the **ENT** Key.

6) Press the **FMS** Knob to remove the flashing cursor.

Selecting nearest airport minimum runway length matching criteria:

1) Use the **FMS** Knob to select the System Setup Page.

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

3) Turn the large **FMS** Knob to highlight the minimum length field in the Nearest Airport Box.

4) Use the **FMS** Knob to enter the minimum runway length (zero to 25,000 feet) and press the **ENT** Key.

5) Press the **FMS** Knob to remove the flashing cursor.

Figure 5-38 System Setup Page - Nearest Airport Selection Criteria

INTERSECTIONS

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

The Intersection Information Page is used to view information about intersections. In addition to displaying a map of the currently selected intersection and surrounding area, the Intersection Information Page displays intersection information in three boxes labeled 'INTERSECTION', 'INFORMATION', and 'NEAREST VOR'.

Navigation Map Showing Selected Intersection

Selected Intersection

Intersection Identifier

Intersection Info
- Region
- Lat/Long

Nearest VOR Info
- Identifier/Type (symbol)
- Radial to VOR
- Distance to VOR

Figure 5-39 Intersection Information Page

Selecting an intersection:

1) With the Intersection Information Page displayed, enter an identifier in the Intersection Box.

2) Press the **ENT** Key.

3) Press the **FMS** Knob to remove the flashing cursor.

   Or:

1) With the Nearest Intersections Page displayed, press the **FMS** Knob.

2) Press the **ENT** Key or turn either **FMS** Knob to select an identifier in the Nearest Intersection Box.

3) Press the **FMS** Knob to remove the flashing cursor.

The Nearest Intersections Page can be used to quickly find an intersection close to the flight path. In addition to displaying a map of the surrounding area, the page displays information for up to 25 nearest intersections in three boxes labeled 'NEAREST INT', 'INFORMATION', and 'REFERENCE VOR'.

The selected intersection is indicated by a white arrow. Up to eleven intersections are visible at a time. If there are more than can be shown, the list can be scrolled. If there are no items for display, text indicating that fact is displayed.

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

Figure 5-40 Nearest Intersections Page

NDBs

The NDB Information Page is used to view information about NDBs. In addition to displaying a map of the currently selected NDB and surrounding area, the page displays NDB information in four boxes labeled 'NDB', 'INFORMATION', 'FREQUENCY', and 'NEAREST AIRPORT'.

Navigation Map Showing Selected NDB

Selected NDB

NDB Identifier/Type
- Facility Name
- Nearest City

NDB Information
- Type
- Region
- Lat/Long

NDB Frequency

Nearest Airport Info
- Identifier/Type (symbol)
- Bearing/Distance to Airport

Figure 5-41 NDB Information Page

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

Selecting an NDB:

1) With the NDB Information Page displayed, enter an identifier, the name of the NDB, or the city in which it's located in the NDB Box.

2) Press the **ENT** Key.

3) Press the **FMS** Knob to remove the flashing cursor.

   Or:

1) With the Nearest NDB Page displayed, press the **FMS** Knob.

2) Press the **ENT** Key or turn either **FMS** Knob to select an identifier in the Nearest NDB Box.

3) Press the **FMS** Knob to remove the flashing cursor.

The Nearest NDB Page can be used to quickly find a NDB close to the flight path. In addition to displaying a map of the surrounding area, the page displays information for up to 25 nearest NDBs in three boxes labeled 'NEAREST NDB', 'INFORMATION', and 'FREQUENCY'.

A white arrow before the NDB identifier indicates the selected NDB. Up to eleven NDBs are visible at a time. If there are more than can be shown, each list can be scrolled. The list only includes waypoints that are within 200nm. If there are no NDBs in the list, text indicating that there are no nearest NDBs is displayed. If there are no nearest NDBs in the list, the information and frequency fields are dashed.

Navigation Map Showing Selected NDB

Nearest NDB

NDB Identifier/Symbol
- Bearing/Distance to NDB from aircraft position

NDB Information
- Facility Name/City
- Type
- Lat/Long

NDB Frequency

Figure 5-42 Nearest NDB Page

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VORs

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 auto-tune a VOR or ILS frequency. Localizer information cannot be viewed on the VOR Information Page. If a VOR station is combined with a TACAN station it is listed as a VORTAC on the VOR Information Page and if it includes only DME, it i s displayed as VOR-DME.

In addition to displaying a map of the currently selected VOR and surrounding area, the VOR Information Page displays VOR information in four boxes labeled 'VOR', 'INFORMATION', 'FREQUENCY', and 'NEAREST AIRPORT'.
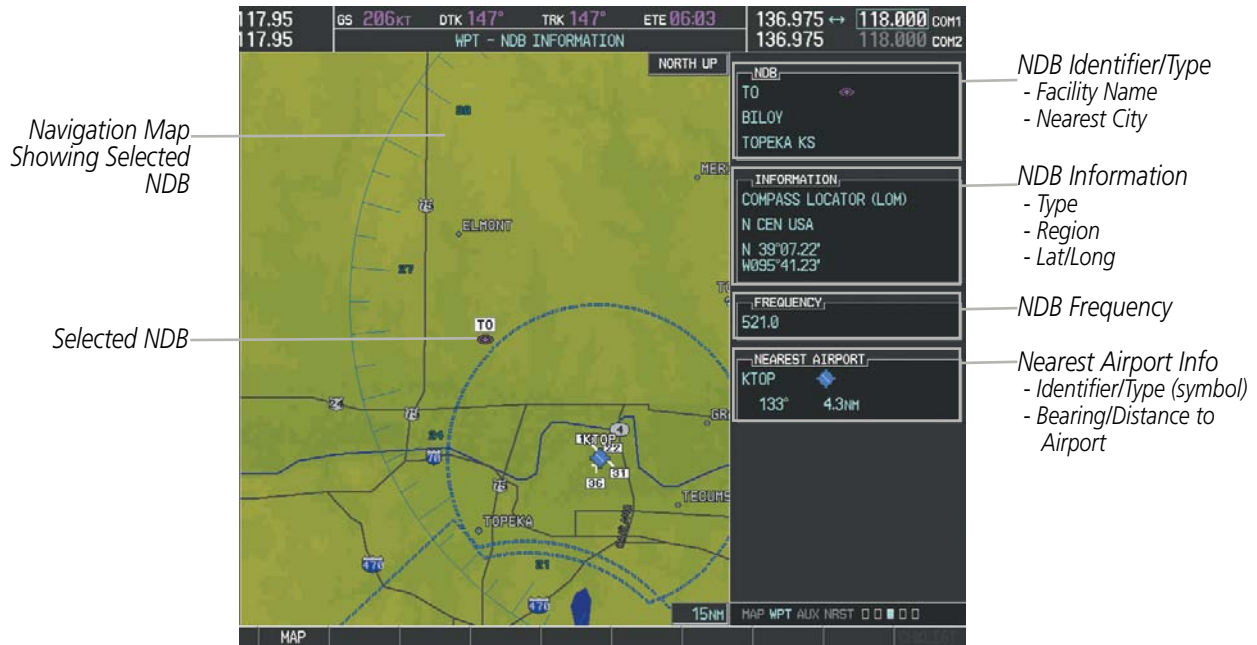

Navigation Map Showing Selected VOR

Selected VOR

VOR Identifier/Type
- Facility Name
- Nearest City

VOR Information
- Class/Magnetic Variation
- Region
- Lat/Long

VOR Frequency

Nearest Airport Info
- Identifier/Type (symbol)
- Bearing/Distance to Airport

Figure 5-43 VOR Information Page

The VOR classes used in the VOR information box are: LOW ALTITUDE, HIGH ALTITUDE, and TERMINAL.

Selecting a VOR:

1) With the VOR Information Page displayed, enter an identifier, the name of the VOR, or the city in which it's located in the VOR Box.

2) Press the **ENT** Key.

3) Press the **FMS** Knob to remove the flashing cursor.

   Or:

1) With the Nearest VOR Page displayed, press the **FMS** Knob or press the **VOR** Softkey.

2) Press the **ENT** Key or turn either **FMS** Knob to select an identifier in the Nearest VOR Box.

3) Press the **FMS** Knob to remove the flashing cursor.

   Or:

1) With the Nearest VOR Page displayed, press the **MENU** Key.

2) Highlight 'Select VOR Window', and press the **ENT** Key.

3) Press the **ENT** Key or turn either **FMS** Knob to select an identifier in the Nearest VOR Box.

4) Press the **FMS** Knob to remove the flashing cursor.

The Nearest VOR Page can be used to quickly find a VOR station close to the aircraft. Also, a NAV frequency from a selected VOR station can be loaded from the Nearest VOR Page. In addition to displaying a map of the surrounding area, the Nearest VOR Page displays information for up to 25 nearest VOR stations in three boxes labeled 'NEAREST VOR', 'INFORMATION', and 'FREQUENCY'. The list only includes waypoints that are within 200 nm.

A white arrow before the VOR identifier indicates the selected VOR. Up to eleven VORs are visible at a time. If there are more than can be shown, each list can be scrolled. If there are no VORs in the list, text indicating that there are no nearest VORs is displayed. If there are no nearest VORs in the list, the information is dashed.

Navigation Map Showing Nearest VOR

VOR Identifier/Symbol
- *Bearing/Distance to VOR from aircraft position*

VOR Information
- *Facility Name/City*
- *Class/Magnetic Variation*
- *Lat/Long*

VOR Frequency

Nearest VOR

Figure 5-44 Nearest VOR Page

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USER WAYPOINTS

The G1000 can create and store up to 1,000 user-defined waypoints. User waypoints can be created from any map page (except PFD Inset Map, AUX-Trip Planning Page, or Procedure Pages) by selecting a position on the map using the **Joystick**, or from the User Waypoint Information Page by referencing a bearing/distance from an existing waypoint, bearings from two existing waypoints, or latitude and longitude. Once a waypoint has been created, it can be renamed, deleted, or moved. Temporary user waypoints are erased upon system power down.
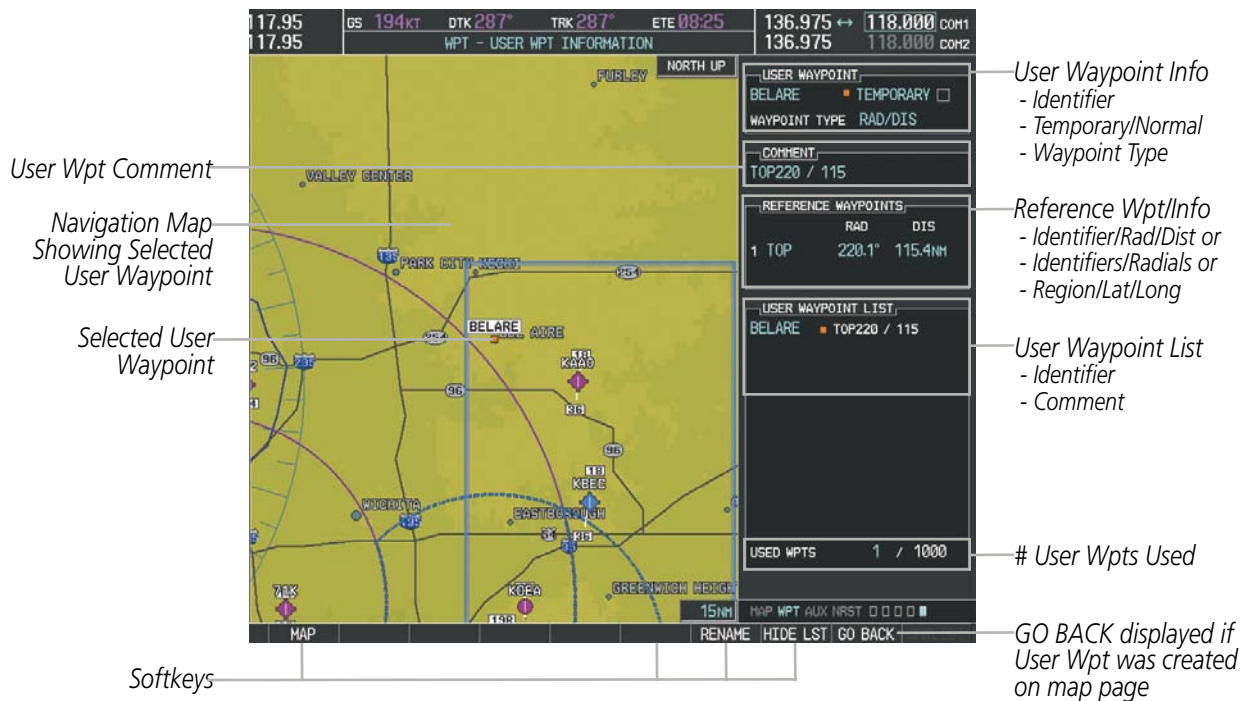
Figure 5-45 User Waypoint Information Page

Selecting a User Waypoint:

1) With the User Waypoint Information Page displayed, enter the name of the User Waypoint, or scroll to the desired waypoint in the User Waypoint List using the large **FMS** Knob.

2) Press the **ENT** Key.

3) Press the **FMS** Knob to remove the flashing cursor.

   Or:

1) With the Nearest User Waypoints Page displayed, press the **FMS** Knob.

2) Press the **ENT** Key or turn either **FMS** Knob to select an identifier in the Nearest USR Box.

3) Press the **FMS** Knob to remove the flashing cursor.

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Navigation Map Showing Selected User Waypoint

Nearest User Wpt List
  - Identifier
  - Bearing/Distance from aircraft position

User Waypoint Info
  - Comment
  - Lat/Long

Selected User Waypoint

Reference Wpt Info
  - Identifier
  - Radial/Distance

Figure 5-46 Nearest User Waypoint Page

CREATING USER WAYPOINTS

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

Creating user waypoints from the User Waypoint Information Page:

1) Select the **NEW** Softkey, **or** press the **MENU** Key and select 'Create New User Waypoint'.

2) Enter a user waypoint name (up to six characters).

3) Press the **ENT** Key. The current aircraft position is the default location of the new waypoint.

4) If desired, define the type and location of the waypoint in one of the following ways:

a) 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 window using the **FMS** Knobs.

Or:

b) 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 window using the **FMS** Knobs.

Or:

c) Select "LAT/LON" using the small **FMS** Knob, press the **ENT** Key, and enter the latitude and longitude into the INFORMATION window using the **FMS** Knobs.

5) Press the **ENT** Key to accept the new waypoint.

6) If desired, change the storage method of the waypoint to "TEMPORARY" or "NORMAL" by moving the cursor to "TEMPORARY" and selecting the **ENT** Key to check or uncheck the box.

7) Press the **FMS** Knob to remove the flashing cursor.

Or:

1) Press the **FMS** Knob to activate the cursor.

2) Enter a user waypoint name (up to six characters).

3) Press the **ENT** Key. The message 'Are you sure you want to create the new User Waypoint AAAAAA?' is displayed.

4) With 'YES' highlighted, press the **ENT** Key.

5) If desired, define the type and location of the waypoint in one of the following ways:

   a) 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 window using the **FMS** Knobs.

   Or:

   b) 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 window using the **FMS** Knobs.

   Or:

   c) Select "LAT/LON" using the small **FMS** Knob, press the **ENT** Key, and enter the latitude and longitude into the INFORMATION window using the **FMS** Knobs.

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

7) If desired, change the storage method of the waypoint to "TEMPORARY" or "NORMAL" by moving the cursor to "TEMPORARY" and selecting the **ENT** Key to check or uncheck the box.
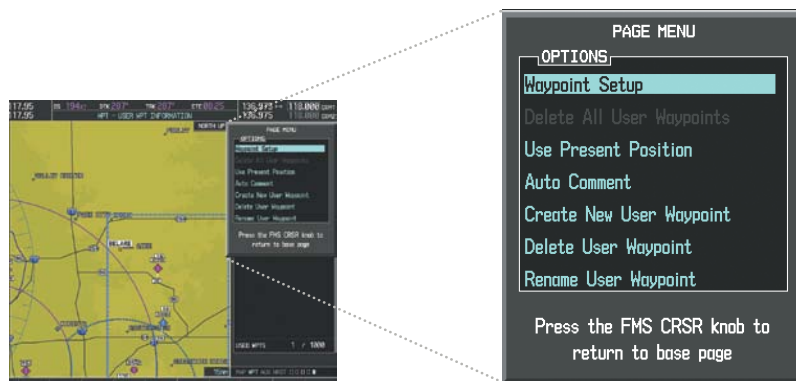
8) Press the **FMS** Knob to remove the flashing cursor.

Figure 5-47 User Waypoint Information Page Menu

Creating user waypoints from map pages:

1) Press the **Joystick** to activate the panning function and pan to the map location of the desired user waypoint.

2) Press the **ENT** Key. The User Waypoint Information Page is displayed with the captured position.

NOTE: *If the pointer has highlighted a map database feature, one of three things happens upon pressing the* **ENT** *Key: 1) information about the selected feature is displayed instead of initiating a new waypoint, 2) a menu pops up allowing a choice between 'Review Airspaces' or 'Create User Waypoint', or 3) a new waypoint is initiated with the default name being the selected map item.*

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3) Enter a user waypoint name (up to six characters).

4) Press the **ENT** Key to accept the selected name. The first reference waypoint box is highlighted.

5) If desired, define the type and location of the waypoint in one of the following ways:

a) 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 window using the **FMS** Knobs.

Or:

b) 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 window using the **FMS** Knobs.

Or:

c) Select "LAT/LON" using the small **FMS** Knob, press the **ENT** Key, and enter the latitude and longitude into the INFORMATION window using the **FMS** Knobs.

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

7) If desired, change the storage method of the waypoint to "TEMPORARY" or "NORMAL" by moving the cursor to "TEMPORARY" and selecting the **ENT** Key to check or uncheck the box.

8) Press the **FMS** Knob to remove the flashing cursor.

9) Press the **GO BACK** Softkey to return to the map page.

EDITING USER WAYPOINTS

Editing a user waypoint comment or location:

1) With the User Waypoint Information Page displayed, press the **FMS** Knob to activate the cursor.

2) Select a user waypoint in the User Waypoint List, if required, and press the **ENT** Key.

3) Move the cursor to the desired field.

4) Turn the small **FMS** Knob to make any changes.

5) Press the **ENT** Key to accept the changes.

6) Press the **FMS** Knob to remove the flashing cursor.

Renaming user waypoints:

1) Highlight a user waypoint in the User Waypoint List. Press the **RENAME** Softkey, or press the **MENU** Key and select 'Rename User Waypoint'.

2) Enter a new name.

3) Press the **ENT** Key. The message 'Do you want to rename the user waypoint AAAAAA to BBBBBB?' is displayed.

4) With 'YES' highlighted, press the **ENT** Key.

5) Press the **FMS** Knob to remove the flashing cursor.

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

1) Enter a waypoint name or select the waypoint in the User Waypoint List, then press the **ENT** Key.

2) Press the **MENU** Key.

3) Select 'Use Present Position'.

4) Press the **ENT** Key twice. The new waypoint's location is saved.

5) Press the **FMS** Knob to remove the flashing cursor.

A system generated comment for a user waypoint incorporates the reference waypoint identifier, bearing, and distance. If a system generated comment has been edited, a new comment can be generated.

Resetting the comment field to the system generated comment:

1) Enter a waypoint name or select the waypoint in the User Waypoint List, then press the **ENT** Key.

2) Press the **MENU** Key.

3) Select 'Auto Comment'.

4) Press the **ENT** Key. The generated comment is based on the reference point used to define the waypoint.

The default type of user waypoint (normal or temporary) can be changed using the user waypoint information page menu. Temporary user waypoints are automatically deleted upon the next power cycle.

Changing the user waypoint storage duration default setting:

1) With the User Waypoint Information Page displayed, press the **MENU** Key.

2) Move the cursor to select 'Waypoint Setup', and press the **ENT** Key.

3) Select 'NORMAL' or 'TEMPORARY' as desired, and press the **ENT** Key.

4) Press the **FMS** Knob to remove the flashing cursor and return to the User Waypoint Information Page.

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DELETING USER WAYPOINTS

Deleting a single user waypoint:

1) Highlight a User Waypoint in the User Waypoint List, or enter a waypoint in the User Waypoint field.

2) Press the **DELETE** Softkey or press the **CLR** Key. 'Yes' is highlighted in the confirmation window.

3) Press the **ENT** Key.

4) Press the **FMS** Knob to remove the flashing cursor.

   Or:

1) Highlight a User Waypoint in the User Waypoint List, or enter a waypoint in the User Waypoint field.

2) Press the **MENU** Key.

3) Select 'Delete User Waypoint'.

4) Press the **ENT** Key twice to confirm the selection.

5) Press the **FMS** Knob to remove the flashing cursor.

> **NOTE:** The option to 'Delete All User Waypoints' is not available while the aircraft is in flight.

Deleting all user waypoints:

1) Highlight a User Waypoint in the User Waypoint List.

2) Press the **MENU** Key.

3) Select 'Delete All User Waypoints'.

4) Press the **ENT** Key twice to confirm the selection.

5) Press the **FMS** Knob to remove the flashing cursor.

5.4 AIRSPACES

The G1000 can display the following types of airspaces: Class B/TMA, Class C/TCA, Class D, Restricted, MOA (Military), Other Airspace, Air Defense Interdiction Zone (ADIZ), and Temporary Flight Restriction (TFR).
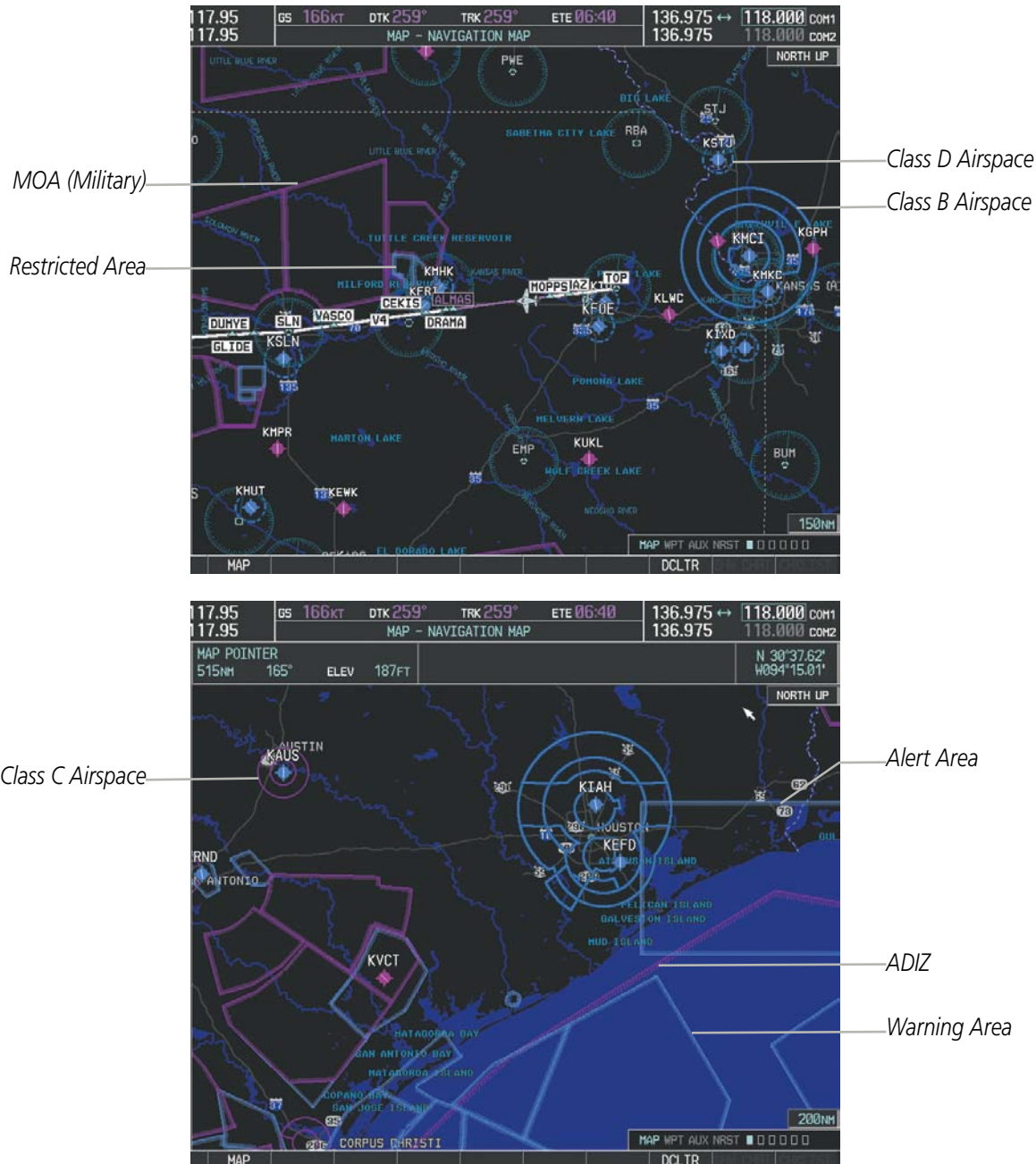

Figure 5-48 Airspaces

The Nearest Airspaces Page, Airspace Alerts Window, and Airspace Alerts on the PFD provide additional information about airspaces and the location of the aircraft in relationship to them.

The Airspace Alerts Box allows the pilot to turn the controlled/special-use airspace message alerts on or off. This does not affect the alerts listed on the Nearest Airspaces Page or the airspace boundaries depicted on the Navigation Map Page. It simply turns on/off the warning provided when the aircraft is approaching or near an airspace.

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

Changing the altitude buffer distance setting:

1) Use the **FMS** Knob to select the AUX - System Setup Page.

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

3) Turn the large **FMS** Knob to highlight the altitude buffer field in the Airspace Alerts Box.

4) Use the **FMS** Knob to enter an altitude buffer value and press the **ENT** Key.

5) Press the **FMS** Knob to remove the flashing cursor.

Turning an airspace alert on or off:

1) Use the **FMS** Knob to select the AUX - System Setup Page.

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

3) Turn the large **FMS** Knob to highlight the desired field in the Airspace Alerts Box.

4) Turn the small **FMS** Knob clockwise to turn the airspace alert ON or counterclockwise to turn the alert OFF.

5) Press the **FMS** Knob to remove the flashing cursor.

Figure 5-49 System Setup Page - Airspace Alerts

Map ranges for the airspace boundaries are selected from the Aviation Group in the Map Setup Menu. See Table 5-2 for the default and maximum ranges for each type of airspace and the symbol used to define the airspace area.

The Nearest Airspaces Page can be used to quickly find airspaces close to the flight path. In addition, a selected frequency associated with the airspace can be loaded from the Nearest Airspaces Page. In addition to displaying a map of airspace boundaries and surrounding area, the Nearest Airspaces Page displays airspace information in four boxes labeled 'AIRSPACE ALERTS', 'AIRSPACE, AGENCY', 'VERTICAL LIMITS', and 'FREQUENCIES'.
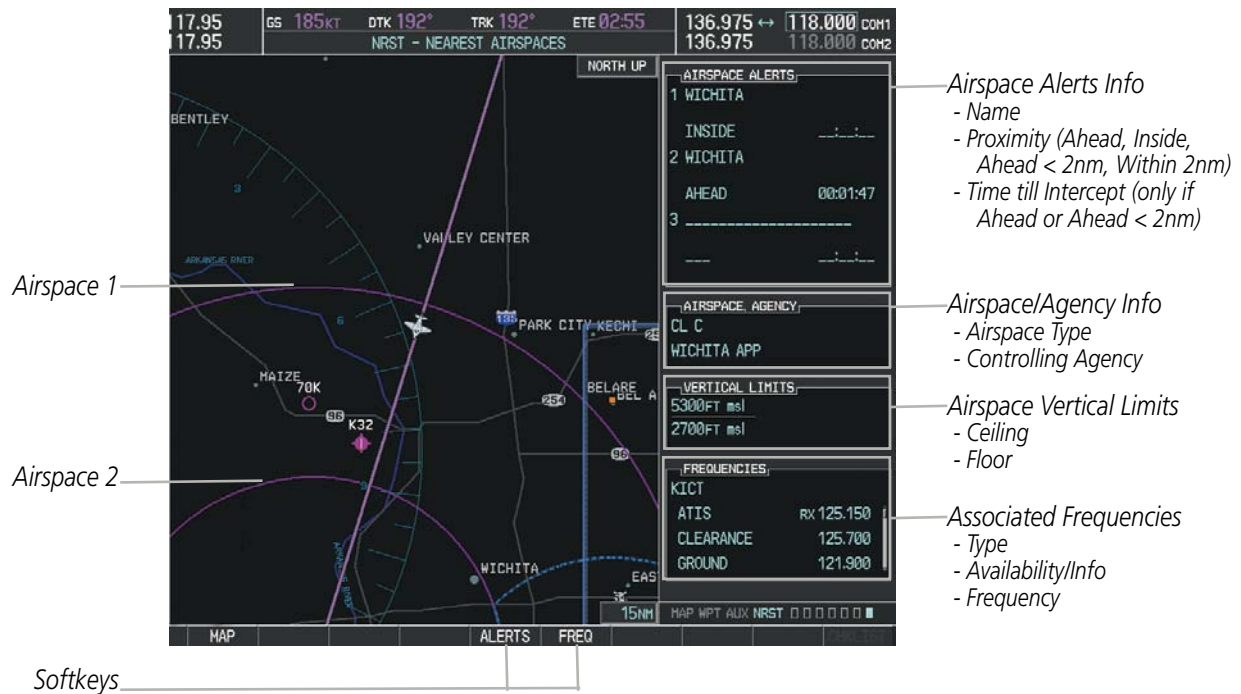
Figure 5-50 Nearest Airspaces Page

Airspace alerts and associated frequencies are shown in scrollable lists on the Nearest Airspaces Page. The **ALERTS** and **FREQ** softkeys place the cursor in the respective list. The **FREQ** Softkey is enabled only if one or more frequencies exist for a selected airspace.

Selecting and viewing an airspace alert with its associated information:

1) Select the Nearest Airspaces Page.

2) Press the **ALERTS** Softkey; or press the **FMS** Knob; or press the **MENU** Key, highlight 'Select Alerts Window', and press the **ENT** Key. The cursor is placed in the 'AIRSPACE ALERTS' Box.

3) Select the desired airspace.

4) Press the **FMS** Knob to remove the flashing cursor.

Pressing the PFD **ALERTS** Softkey displays the message window on the PFD. The following airspace alerts are displayed in the message window:

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

Table 5-6 PFD Airspace Alert Messages

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5.5 DIRECT-TO-NAVIGATION

The Direct-to method of navigation, initiated by pressing the **Direct-to** Key on either the MFD or PFD, is quicker to use than a flight plan when the desire is to navigate to a single point such as a nearby airport.

Once a direct-to is activated, the G1000 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.
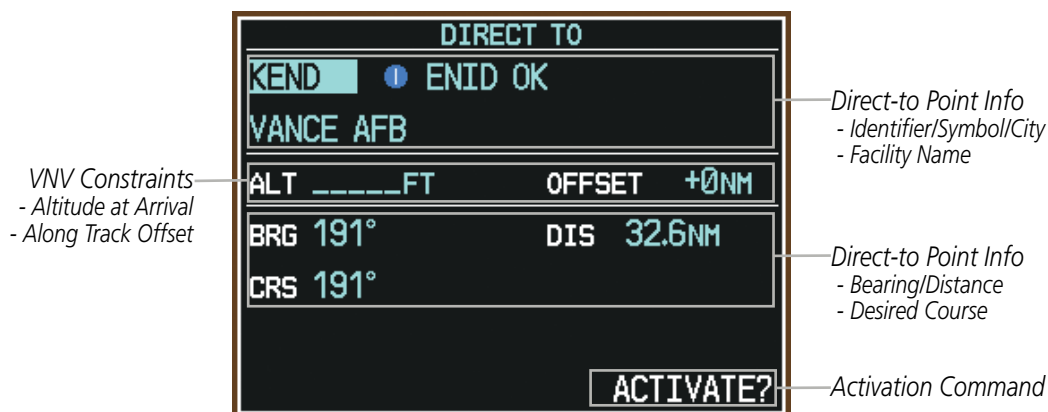

Figure 5-51 Direct-to Window - MFD

Figure 5-52 Direct-to Window - PFD

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Any waypoint can be entered as a direct-to destination from the Direct-to Window.

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

1) Press the **Direct-to** Key. The Direct-to Window is displayed (with the active flight plan wayoint as the default selection or a blank waypoint field if no flight plan is active).

2) Turn the small **FMS** Knob clockwise to begin entering a waypoint identifier (turning it counter-clockwise brings up the waypoint selection submenu - press the **CLR** Key to remove it), or turn the large **FMS** Knob to select the facility name, or city field and turn the small **FMS** Knob to begin entering a facility name or city. If duplicate entries exist for the entered facility or city name, additional entries can be viewed by turning the small **FMS** Knob during the selection process.

3) Press the **ENT** Key. The 'Activate?' field is highlighted.

4) Press the **ENT** Key to activate the direct-to.

Any waypoint contained in the active flight plan can be selected as a direct-to waypoint from the Direct-to Window, the Active Flight Plan Page, or the Active Flight Plan Window.
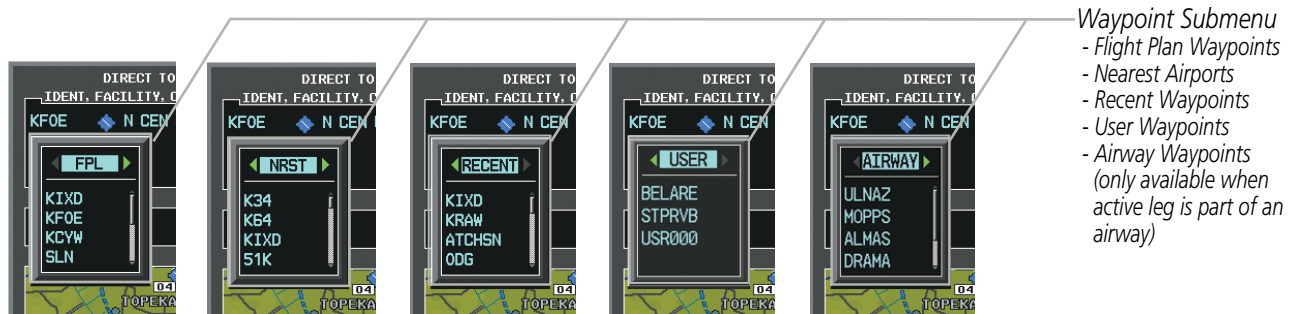

Waypoint Submenu
- Flight Plan Waypoints
- Nearest Airports
- Recent Waypoints
- User Waypoints
- Airway Waypoints
 (only available when
 active leg is part of an
 airway)

Figure 5-53 Waypoint Submenu

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

1) While navigating an active flight plan, press the **Direct-to** Key. The Direct-to Window is displayed with the active flight plan waypoint as the default selection.

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

3) Select the desired waypoint.

4) Press the **ENT** Key. The cursor is now displayed on 'ACTIVATE?'.

5) Press the **ENT** Key again to activate the direct-to.

   Or:

1) Select the Active Flight Plan Page on the MFD, or the Active Flight Plan Window on the PFD.

2) Select the desired waypoint.

3) Press the **Direct-to** Key.

4) Press the **ENT** Key. The cursor is now displayed on 'ACTIVATE?'.

5) Press the **ENT** Key again to activate the direct-to.

Any NRST, RECENT, USER, or AIRWAY waypoints can be selected as a direct-to destination in the Direct-to Window.

Selecting a NRST, RECENT, USER, or AIRWAY waypoint as a direct-to destination:

1) Press the **Direct-to** Key. The Direct-to Window is displayed (with the active flight plan destination as the default selection or a blank destination if no flight plan is active).

2) Turn the small **FMS** Knob counter-clockwise to display a list of FPL waypoints (the FPL list is populated only when navigating a flight plan, and the AIRWAY list is available only when the active leg is part of an airway).

3) Turn the small **FMS** Knob clockwise to display the NRST, RECENT, USER, or AIRWAY waypoints.

4) Turn the large **FMS** Knob clockwise to select the desired waypoint.

5) Press the **ENT** Key. The cursor is now displayed on 'ACTIVATE?'.

6) Press the **ENT** Key again to activate the direct-to.

The Direct-to Window can be displayed from any page and allows selection and activation of direct-to navigation. If the direct-to is initiated from any page except the WPT pages, the default waypoint is the active flight plan waypoint (if a flight plan is active) or a blank waypoint field. Direct-to requests on any WPT page defaults to the displayed waypoint.

Selecting any waypoint as a direct-to destination:

1) Select the page or window containing the desired waypoint type and select the desired waypoint.

2) Press the **Direct-to** Key to display the Direct-to Window with the selected waypoint as the direct-to destination.

3) Press the **ENT** Key. The cursor is now displayed on 'ACTIVATE?'.

4) Press **ENT** again to activate the direct-to.

Selecting a nearby airport as a direct-to destination:

1) Select the **NRST** Softkey on the PFD; or turn the **FMS** Knob to display the Nearest Airports Page and press the **FMS** Knob.

2) Select the desired airport (the nearest one is already selected).

3) Press the **Direct-to** Key.

4) Press the **ENT** Key. The cursor is now displayed on 'ACTIVATE?'.

5) Press the **ENT** Key again to activate the direct-to.

Direct-to destinations may also be selected by using the pointer on the navigation map pages. If no airport, NAVAID, or user waypoint exists at the desired location, a temporary waypoint named 'MAPWPT' is automatically created at the location of the map arrow.

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

1) From a navigation map page, press the **Joystick** to display the pointer.

2) Move the **Joystick** to place the pointer at the desired destination location.

3) If the pointer is placed on an existing airport, NAVAID, or user waypoint, the waypoint name is highlighted.

4) Press the **Direct-to** Key to display the Direct-to Window with the selected point entered as the direct-to destination.

5) Press the **ENT** Key. The cursor is now displayed on 'ACTIVATE?'.

6) Press the **ENT** Key again to activate the direct-to.

Cancelling a Direct-to:

1) Press the **Direct-to** Key to display the Direct-to Window.

2) Press the **MENU** Key.

3) With 'Cancel Direct-To NAV' highlighted, press the **ENT** Key. If a flight plan is still active, the G1000 resumes navigating the flight plan along the closest leg.
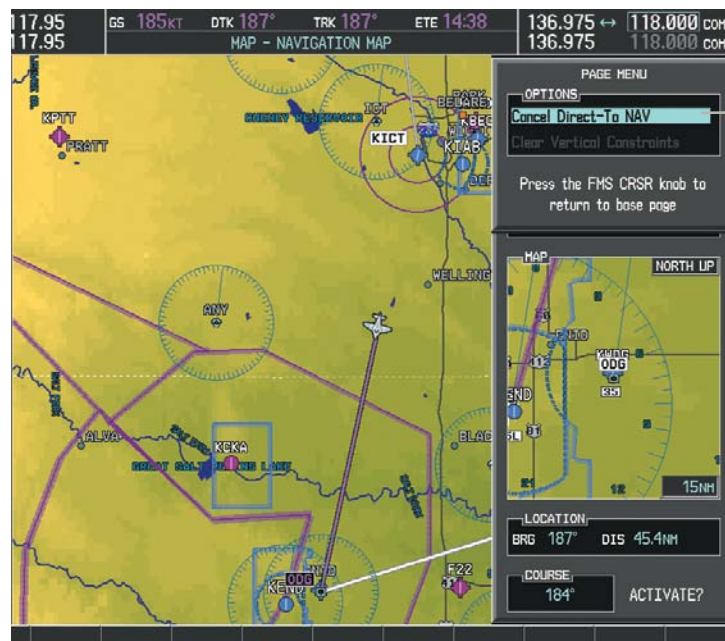
Page Menu - Cancel Direct-To Navigation

Figure 5-54 Direct-to Window - Cancelling Direct-to Navigation

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When navigating a direct-to, the G1000 sets a direct great circle course to the selected destination. The course to a destination can also be manually selected using the course field ('COURSE') on the Direct-to Window.

Selecting a manual direct-to course:

1) Press the **Direct-to** Key. The Direct-to Window is displayed with the destination field highlighted.

2) Highlight the course field.

3) Enter the desired course.

4) Press the **ENT** Key. The cursor is now displayed on 'ACTIVATE?'.

5) Press the **ENT** Key again to activate the direct-to.

Reselecting the direct course from the current position:

1) Press the **Direct-to** Key. The Direct-to Window is displayed with the destination field highlighted.

2) Press the **ENT** Key. The cursor is now displayed on 'ACTIVATE?'.

3) Press the **ENT** Key again to activate the direct-to.

A direct-to with altitude constraints creates a descent path (and provides guidance to stay on the path) from the aircraft's current altitude to the altitude of the direct-to waypoint. The altitude is reached at the waypoint, or at the specified distance along the flight path if an offset distance has been entered. All VNV altitudes prior to the direct-to destination are removed from the active flight plan upon successful activation of a direct-to destination that is part of the active flight plan. All VNV altitudes following the direct-to waypoint are retained. See the section on Vertical Navigation for more information regarding the use and purpose of VNV altitudes and offset distances.

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

1) Press the **Direct-to** Key to display the Direct-to Window.

2) Turn the large **FMS** Knob to place the cursor over the 'VNV' altitude field.

3) Enter the desired altitude.

4) Press the **ENT** Key. The option to select MSL or AGL is now displayed.

5) Turn the small **FMS** Knob to select 'MSL' or 'AGL'.

6) Press the **ENT** Key. The cursor is now flashing in the VNV offset distance field.

7) Enter the desired along-track distance before the waypoint.

8) Press the **ENT** Key. The 'Activate?' field is highlighted.

9) Press the **ENT** Key to activate.

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Removing a VNV altitude constraint:

1) Press the **Direct-to** Key to display the Direct-to Window.

2) Press the **MENU** Key.

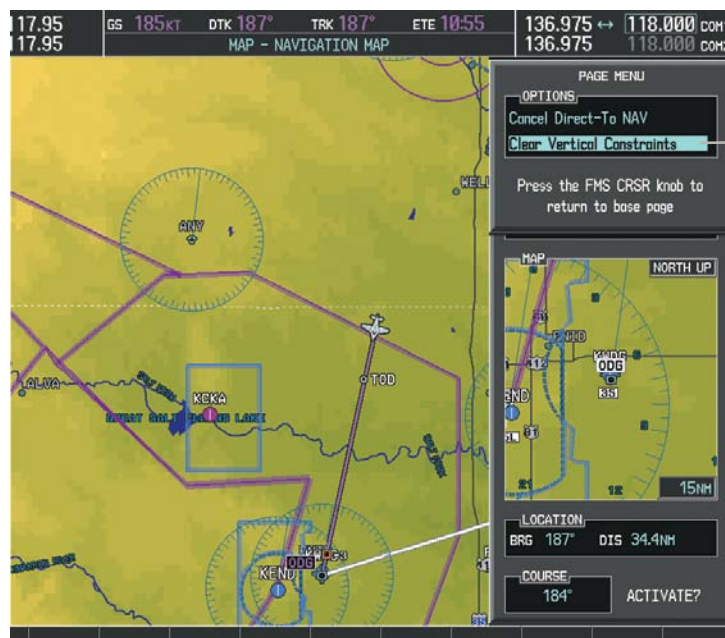3) With 'Clear Vertical Constraints' highlighted, press the **ENT** Key.

Page Menu
- Clear Vertical Navigation Constraints

Figure 5-55 Direct-to Window - Clearing Vertical Constraints

5.6 FLIGHT PLANNING

Flight planning on the G1000 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 G1000 allows flight planning information to be entered from either the MFD or PFD. The flight plan is displayed on maps using different line widths, colors, and types, based on the type of leg and the segment of the flight plan currently being flown (departure, enroute, arrival, approach, or missed approach).
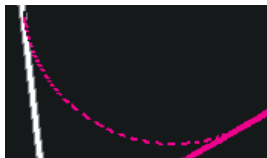
Flight Plan Leg Type	Symbol
Active non-heading Leg	
Active heading Leg	
Non-heading Leg in the current flight segment	
Heading Leg ot in the current flight segment	
Non-heading Leg not in the active flight segment	
Turn Anticipation Arc	

Table 5-7 Flight Plan Leg Symbols

Up to 99 flight plans with up to 99 waypoints each can be created and stored in memory. One flight plan can be activated at a time and becomes the active flight plan. The active flight plan is erased when the system is turned off and overwritten when another flight plan is activated. When storing flight plans with an approach, departure, or arrival, the G1000 uses the waypoint information from the current database to define the waypoints. If the database is changed or updated, the G1000 automatically updates the information if the procedure has not been modified. If an approach, departure, or arrival procedure is no longer available, the procedure is deleted from the affected stored flight plan(s), and an alert is displayed (see Miscellaneous Messages in Appendix A) advising that one or more stored flight plans need to be edited.

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

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

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The following could cause the airway update to fail:

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

FLIGHT PLAN CREATION

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

- Active Flight Plan Page on the MFD (create/modify the active flight plan)
- Active Flight Plan Window on the PFD (create/modify the active flight plan)
- Flight Plan Catalog Page on the MFD (create/modify a stored flight plan)

Active Flight Plan Leg

Turn Anticipation Arc

Non-Active, Flight Plan Leg

Active FPL Waypoint List
- *Comment*
- *Procedure Header*
- *Waypoint Identifier*
- *Airway Identifier*
- *Desired Track to Waypoint*
- *Distance to Waypoint*
- *Waypoint Altitude Constraint*

Vertical Navigation Profile
- *Active Vertical WPT Alt/ID*
- *Vertical Speed Target*
- *Flight Path Angle*
- *Vertical Speed Target*
- *Time to Top of Descent*
- *Vertical Deviation*

Figure 5-56 Active Flight Plan Page
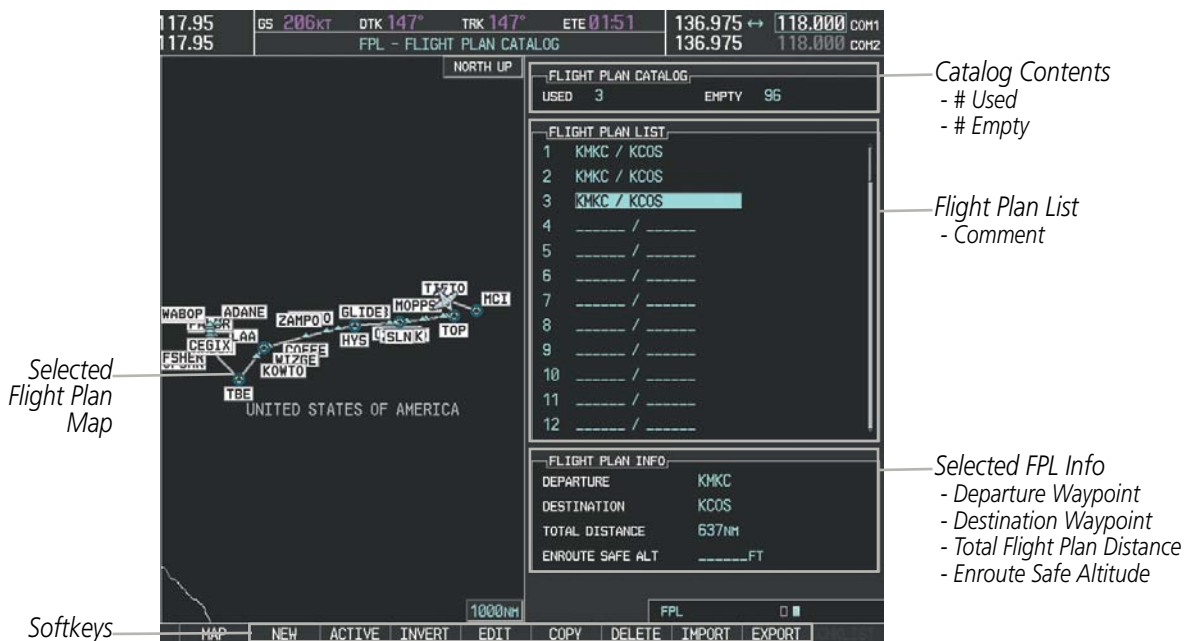
Figure 5-57 Active Flight Plan Window on PFD

Figure 5-58 Flight Plan Catalog Page

The active flight plan is listed on the active Flight Plan Page on the MFD, and in the Active Flight Plan Window on the PFD. It is the flight plan to which the G1000 is currently providing guidance, and is shown on the navigation maps. Stored flight plans are listed on the Flight Plan Catalog Page, and are available for activation (becomes the active flight plan).

Creating an active flight plan:

1) Press the **FPL** Key.

2) Press the **FMS** Knob to activate the cursor (only on MFD).

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 departure waypoint or select a waypoint from the submenu of waypoints and press the **ENT** Key. The active flight plan is modified as each waypoint is entered.

5) Repeat step numbers 3 and 4 to enter each additional flight plan waypoint.

6) When all waypoints have been entered, press the **FMS** Knob to remove the cursor.

Creating a stored flight plan:

1) Press the **FPL** Key.

2) Turn the small **FMS** Knob clockwise to display the Flight Plan Catalog Page.

3) Select the **NEW** Softkey; or press the **MENU** Key, highlight 'Create New Flight Plan', and press the **ENT** Key to display a blank flight plan for the first empty storage location.

4) Turn the small **FMS** Knob to display the Waypoint Information Window. (Turning it clockwise displays a blank Waypoint Information Window, turning it counter-clockwise displays the Waypoint Information Window with a waypoint selection submenu allowing selection of active flight plan, nearest, recent, user, or airway waypoints).

5) Enter the identifier, facility, or city name of the departure waypoint or select a waypoint from the submenu of waypoints and press the **ENT** Key.

6) Repeat step numbers 4 and 5 to enter each additional flight plan waypoint.

7) When all waypoints have been entered, press the **FMS** Knob to return to the Flight Plan Catalog Page. The new flight plan is now in the list.

Flight plans can be imported from an SD Card or exported to an SD Card from the Stored Flight Plan Page.

Importing a Flight Plan from an SD Card

1) Insert the SD card containing the flight plan in the top card slot on the MFD.

2) Press the **FPL** Key to display the Active Flight Plan Page on the MFD.

3) Turn the small **FMS** Knob to select the Flight Plan Catalog Page.

4) Press the **FMS** Knob to activate the cursor.

5) Turn either **FMS** Knob to highlight an empty or existing flight plan.

6) Press the **IMPORT** Softkey; or press the **MENU** Key, select "Import Flight Plan", and press the **ENT** Key.

   If an empty slot is selected, a list of the available flight plans on the SD card will be displayed.

   Or:

   If an existing flight plan is selected, an "Overwrite existing flight plan? OK or CANCEL" prompt is displayed. Press the **ENT** Key to choose to overwrite the selected flight plan and see the list of available flight plans on the SD card. If overwriting the existing flight plan is not desired, select "CANCEL" using the **FMS** Knob, press the **ENT** Key, select another flight plan slot, and press the **IMPORT** Softkey again.
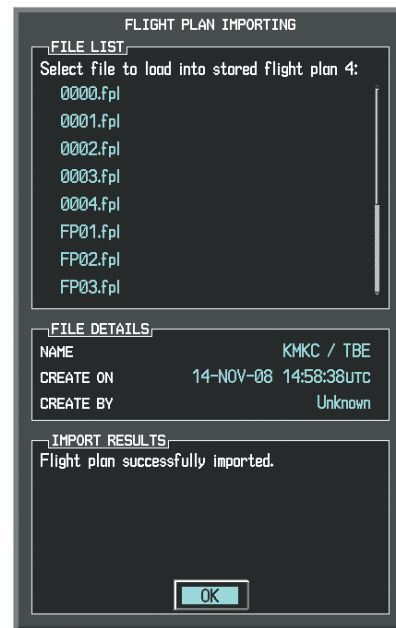
7) Turn the small **FMS** Knob to highlight the desired flight plan for importing.

8) Press the **ENT** Key to initiate the import.

9) Press the **ENT** Key again to confirm the import.
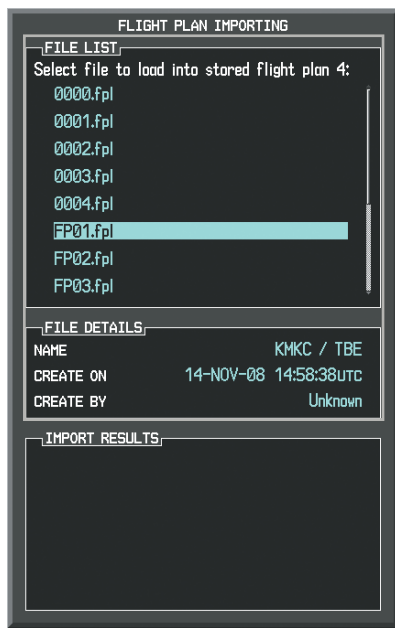
| Import/Export Softkeys | List of Flight Plans to Import & Details for the Selected File | Import Successful |

Figure 5-59 Flight Plan Import

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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 Active Flight Plan Page on the MFD.

3) Turn the small **FMS** Knob to select the Flight Plan Catalog Page.

4) Press the **FMS** Knob to activate the cursor.

5) Turn the large **FMS** Knob to highlight the flight plan to be exported.

6) Press the **EXPORT** Softkey; or press the **MENU** Key, select "Export Flight Plan".

7) If desired, change the name for the exported file by turning the large **FMS** Knob to the left to highlight the name, then use the small and large **FMS** knobs to enter the new name, and press the **ENT** Key.

8) Press the **ENT** Key to initiate the export.

9) Press the **ENT** Key to confirm the export.

NOTE: *The exported flight plan will not contain any procedures or airways.*
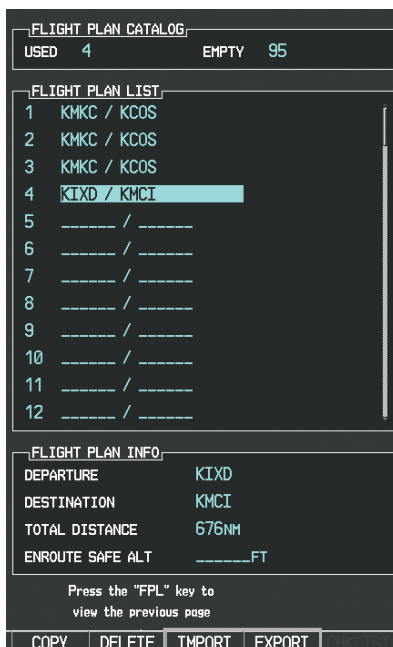
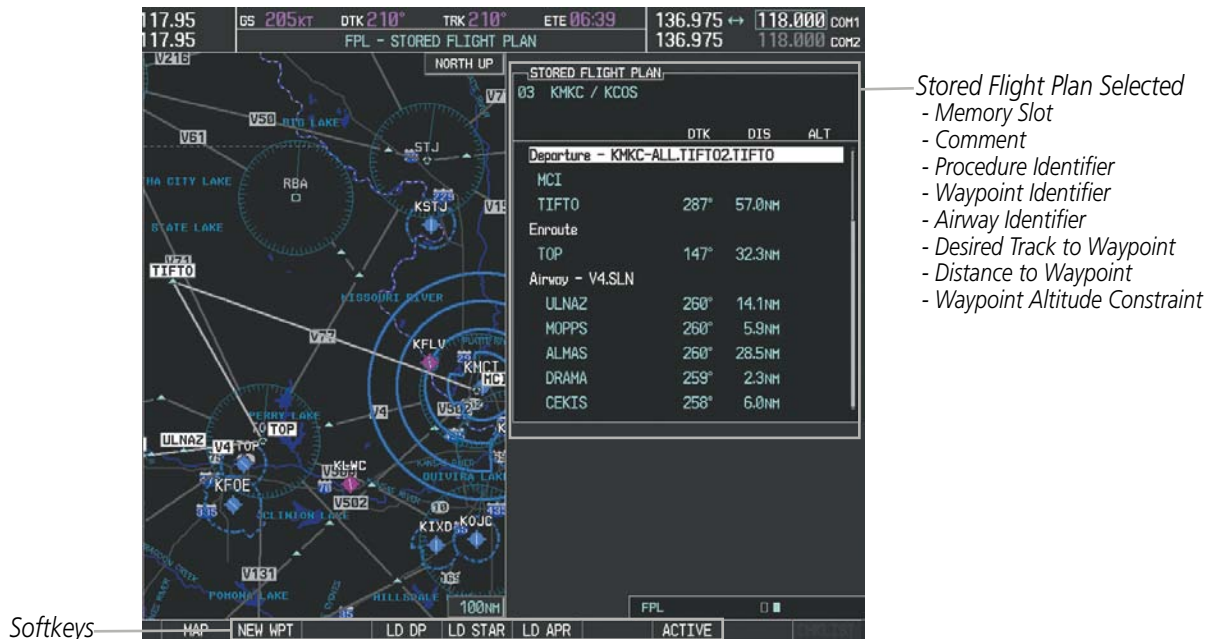| Import/Export Softkeys | Stored Flight Plan to be Exported & Exported Flight Plan Name | Export Successful |

Figure 5-60 Flight Plan Export

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ADDING WAYPOINTS TO AN EXISTING FLIGHT PLAN

Waypoints can be added to the active flight plan or any stored flight plan. Choose the flight plan, select the desired point of insertion, enter the waypoint, and it is added in front of the selected waypoint. Flight plans are limited to 99 waypoints (including waypoints within airways and procedures). If the number of waypoints in the flight plan exceeds 99, the message "Flight plan is full. Remove unnecessary waypoints." appears and the new waypoint(s) are not added to the flight plan.

Stored Flight Plan Selected
 - Memory Slot
 - Comment
 - Procedure Identifier
 - Waypoint Identifier
 - Airway Identifier
 - Desired Track to Waypoint
 - Distance to Waypoint
 - Waypoint Altitude Constraint

Softkeys

Figure 5-61 Stored Flight Plan Page

Flight Plan Full Message

Figure 5-62 Active Flight Plan Page - FPL Full

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Adding a waypoint to a stored flight plan:

1) On the Flight Plan Catalog Page, press the **FMS** Knob to activate the cursor.

2) Highlight the desired flight plan.

3) Press the **EDIT** Softkey; or press the **ENT** Key, turn the large **FMS** Knob clockwise to select "EDIT" and press the **ENT** Key. The Stored Flight Plan Page is displayed.

4) Select the point in the flight plan to add the new waypoint. The new waypoint is placed directly in front of the highlighted waypoint.

5) Turn the small **FMS** Knob to display the Waypoint Information Window. (Turning it clockwise displays a blank Waypoint Information Window, turning it counter-clockwise displays the Waypoint Information Window with a waypoint selection submenu allowing selection of active flight plan, nearest, recent, user, or airway waypoints).

6) Enter the identifier, facility, or city name of the waypoint or select a waypoint from the submenu of waypoints and press the **ENT** Key. The new waypoint now exists in the flight plan.

> **NOTE:** *If the identifier entered in the Waypoint Information Window has duplicates, a Duplicate Waypoint Window is displayed. Use the FMS Knob to select the correct waypoint.*
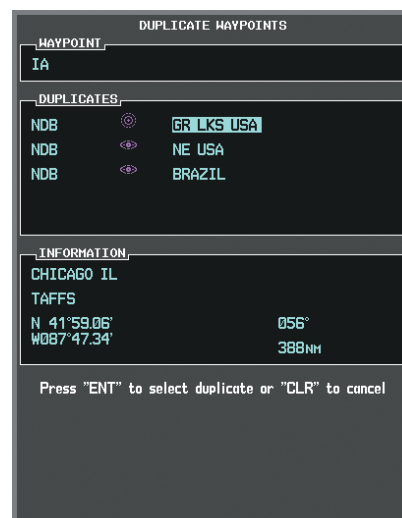

Figure 5-63 Duplicate Waypoints Window

Adding a waypoint to the active flight plan:

1) Press the **FPL** Key.

2) Press the **FMS** Knob to activate the cursor (not required on the PFD).

3) 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.

4) Turn the small **FMS** Knob to display the Waypoint Information Window. (Turning it clockwise displays a blank Waypoint Information Window, turning it counter-clockwise displays the Waypoint Information Window with a waypoint selection submenu allowing selection of active flight plan, nearest, recent, or airway waypoints).

5) Enter the identifier, facility, or city name of the waypoint or select a waypoint from the submenu of waypoints and press the **ENT** Key. The active flight plan is modified as each waypoint is entered.

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Creating and adding user waypoints to the active flight plan:

1) Press the **Joystick** to activate the panning function on the Active Flight Plan Page and pan to the map location of the desired user waypoint.

2) Select the **LD WPT** Softkey; or press the **MENU** Key, select 'Load Waypoint', and press the **ENT** Key. The user waypoint is created with a name of USRxxx (using the next available in sequence) and is added to the end of the active flight plan.

ADDING AIRWAYS TO A FLIGHT PLAN

Airways can be added to the active flight plan or any stored flight plan. Choose a flight plan (add the desired airway entry point if not already in the flight plan), select the waypoint after the desired airway entry point, select the airway, and it is added in front of the selected waypoint. An airway can only be loaded if there is a waypoint in the flight plan that is part of the desired airway and is not part of an arrival or approach procedure. The G1000 also anticipates the desired airway and exit point based on loaded flight plan waypoints.

Selected Airway

Preview of Selected Airway

Airway Entry Waypoint

Airways Available at TOP

Airway Waypoint Sequence

Figure 5-64 Select Airway Page - Selecting Airway

Adding an airway to a flight plan:

1) Press the **FPL** Key.

2) Press the **FMS** Knob to activate the cursor (not required on the PFD).

3) Turn the large **FMS** Knob to highlight the waypoint after the desired airway entry point. If this waypoint is not a valid airway entry point, a valid entry point should be entered at this time.

4) Turn the small **FMS** Knob one click clockwise and select the **LD AIRWY** Softkey, or press the **MENU** Key and select "Load Airway". The Select Airway Page is displayed. The **LD AIRWY** Softkey or the "Load Airway" menu item is available only when a valid airway entry waypoint has been chosen (the waypoint ahead of the cursor position).

5) Turn the **FMS** Knob to select the desired airway from the list, and press the **ENT** Key. Low altitude airways are shown first in the list, followed by "all" altitude airways, and then high altitude airways.

6) Turn the **FMS** Knob to select the desired airway exit point from the list, and press the **ENT** Key. 'LOAD?' is highlighted.

7) Press the **ENT** Key. The system returns to editing the flight plan with the new airway inserted.
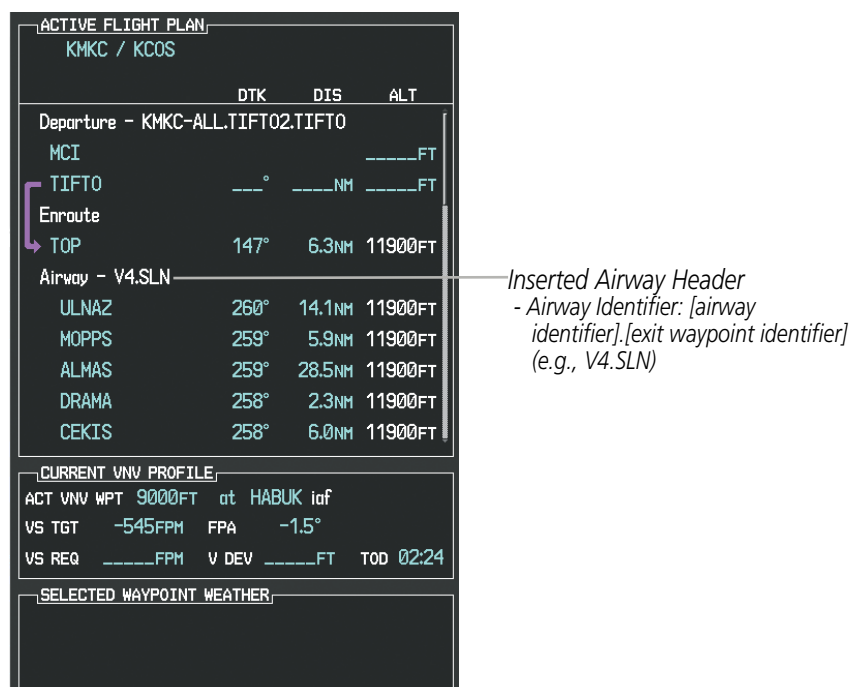

Selected Airway

Preview of Selected Airway

Selected Airway Exit Point

Airway Entry Waypoint

Selected Exit Point

Airway Exit Points Available

Figure 5-65 Select Airway Page - Selecting Exit Point

Inserted Airway Header
- Airway Identifier: [airway identifier].[exit waypoint identifier] (e.g., V4.SLN)

Figure 5-66 Active Flight Plan Page - Airway Inserted

RESTRICTIONS ON ADDING AIRWAYS

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

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

- Starting from AMANO, the airway can be flown only to LIBRO.

- Starting from SARKI, the airway can be flown only to LIBRO.

- Between NELDA and GZO, the airway can be flown in either direction.

In the US, airways that are "one-way" for specified hours of operation are not uncommon. These airways are always bidirectional in the G1000 database.

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

ADDING PROCEDURES TO A STORED FLIGHT PLAN

The G1000 allows the pilot to insert pre-defined instrument procedures from the navigation database into a flight plan. The procedures are designed to facilitate routing of traffic leaving an airport (departure), arriving at an airport (arrival), and landing at an airport (approach). See the procedures section for more details.

Figure 5-67 Stored Flight Plan Page

DEPARTURE (DP)

A Departure Procedure (DP) is loaded at the departure airport in the flight plan. Only one departure can be loaded at a time in a flight plan. The route is defined by selection of a departure, the transition waypoints, and a runway.
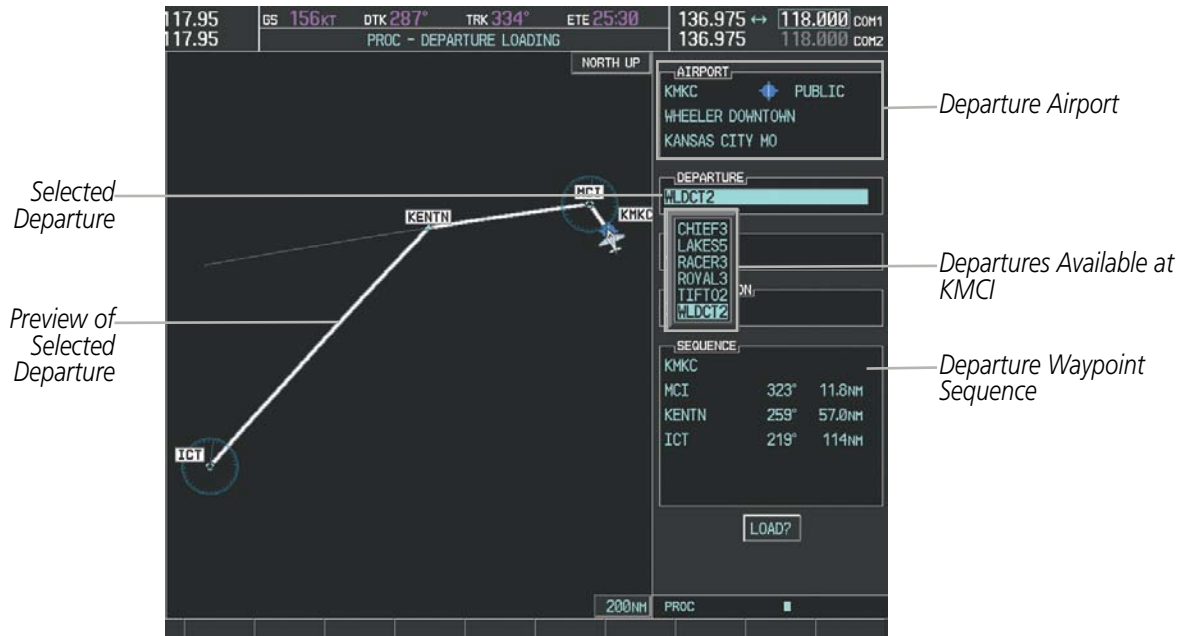

Figure 5-68 Departure Loading Page - Selecting the Departure

Loading a departure procedure into a stored flight plan:

1) Select a stored flight plan from the Flight Plan Catalog Page.

2) Select the **EDIT** Softkey; or press the **MENU** Key, select 'Edit Flight Plan', and press the **ENT** Key. The Stored Flight Plan Page is displayed.

3) Select the **LD DP** Softkey; or press the **MENU** Key, select "Load Departure", and press the **ENT** Key. The Departure Loading Page is displayed.

4) Select a departure. Press the **ENT** Key.

5) Select a runway served by the selected departure, if required. Press the **ENT** Key.

6) Select a transition for the selected departure. Press the **ENT** Key.

7) Press the **ENT** Key to load the selected departure procedure.
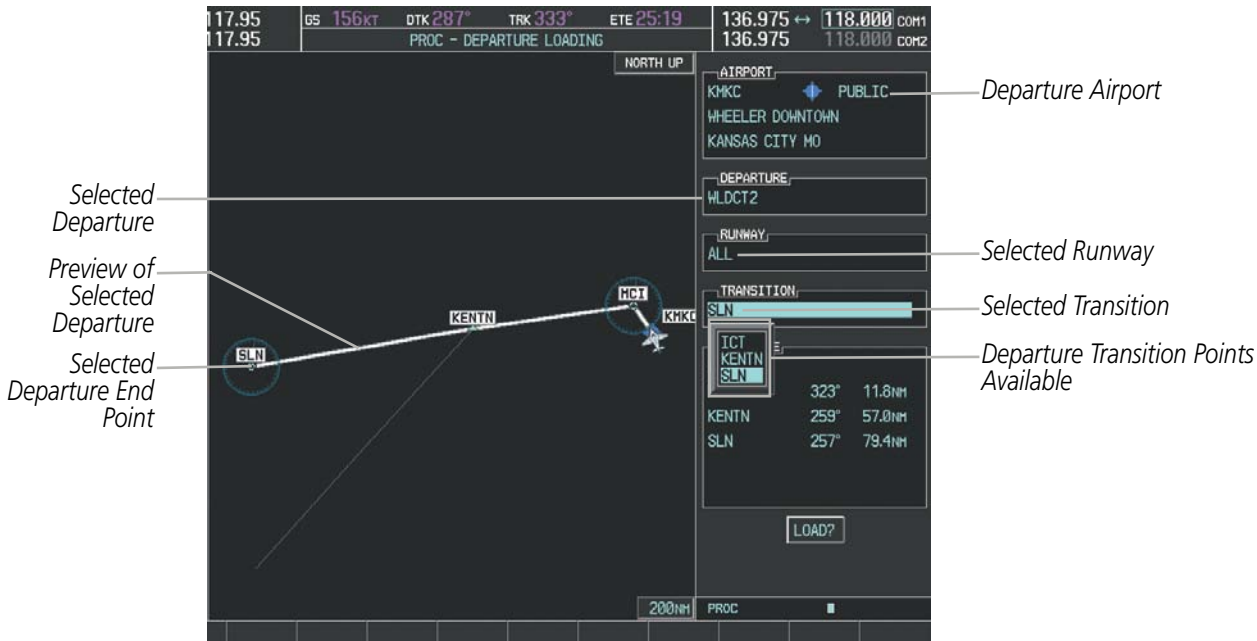
Figure 5-69 Departure Loading Page - Selecting Transition

Labels in figure:
- Departure Airport
- Selected Departure
- Preview of Selected Departure
- Selected Departure End Point
- Selected Runway
- Selected Transition
- Departure Transition Points Available
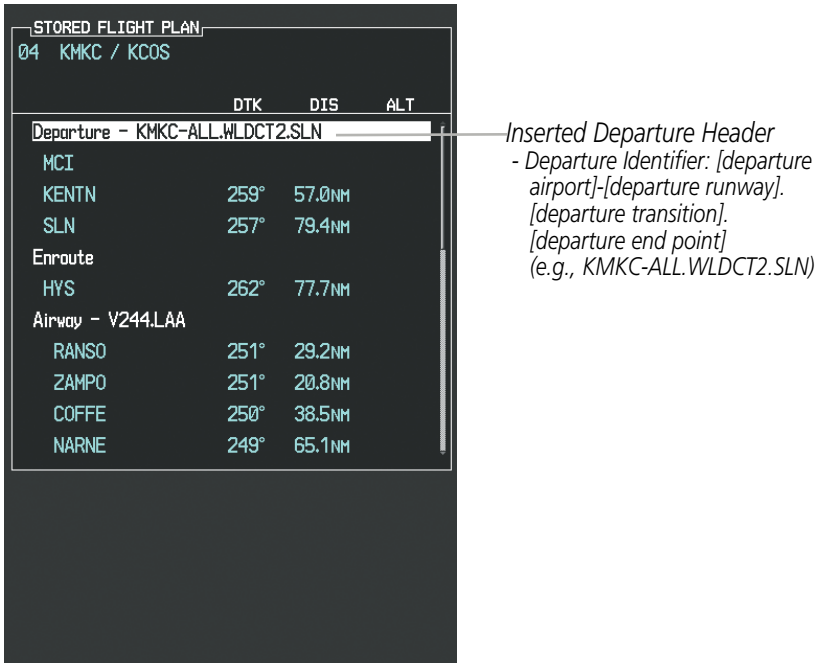
Figure 5-70 Stored Flight Plan Page - Departure Inserted

Label in figure:
- *Inserted Departure Header*
  - Departure Identifier: [departure airport]-[departure runway].[departure transition].[departure end point] (e.g., KMKC-ALL.WLDCT2.SLN)

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ARRIVAL (STAR)

A Standard Terminal Arrival (STAR) is loaded at the destination airport in the flight plan. Only one arrival can be loaded at a time in a flight plan. The route is defined by selection of an arrival, the transition waypoints, and a runway.
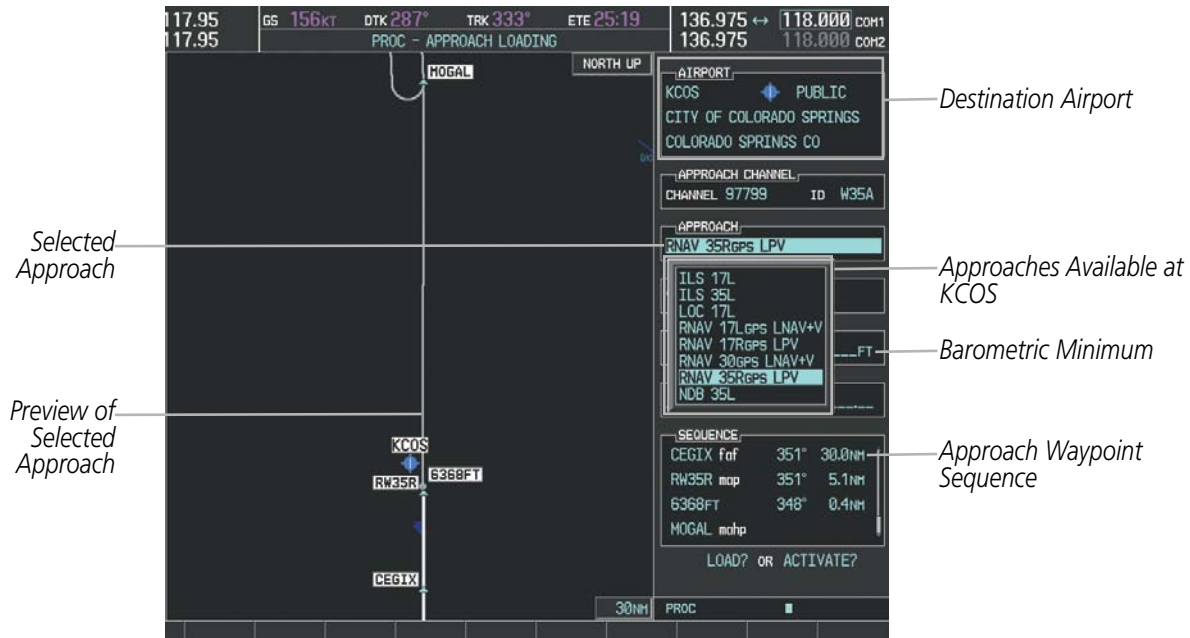

Figure 5-71 Arrival Loading Page - Selecting the Arrival

Loading an arrival procedure into a stored flight plan:

1) Select a stored flight plan from the Flight Plan Catalog Page.

2) Select the **EDIT** Softkey; or press the **MENU** Key, select 'Edit Flight Plan', and press the **ENT** Key. The Stored Flight Plan Page is displayed.

3) Select the **LD STAR** Softkey; or press the **MENU** Key, select "Load Arrival", and press the **ENT** Key. The Arrival Loading Page is displayed.

4) Select an arrival. Press the **ENT** Key.

5) Select a transition for the selected arrival. Press the **ENT** Key.

6) Select a runway served by the selected arrival, if required. Press the **ENT** Key.

7) Press the **ENT** Key to load the selected arrival procedure.

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Destination Airport

Selected Arrival

Selected Transition

Transitions Available with DBRY1

Arrival Waypoint Sequence

Preview of Selected Arrival
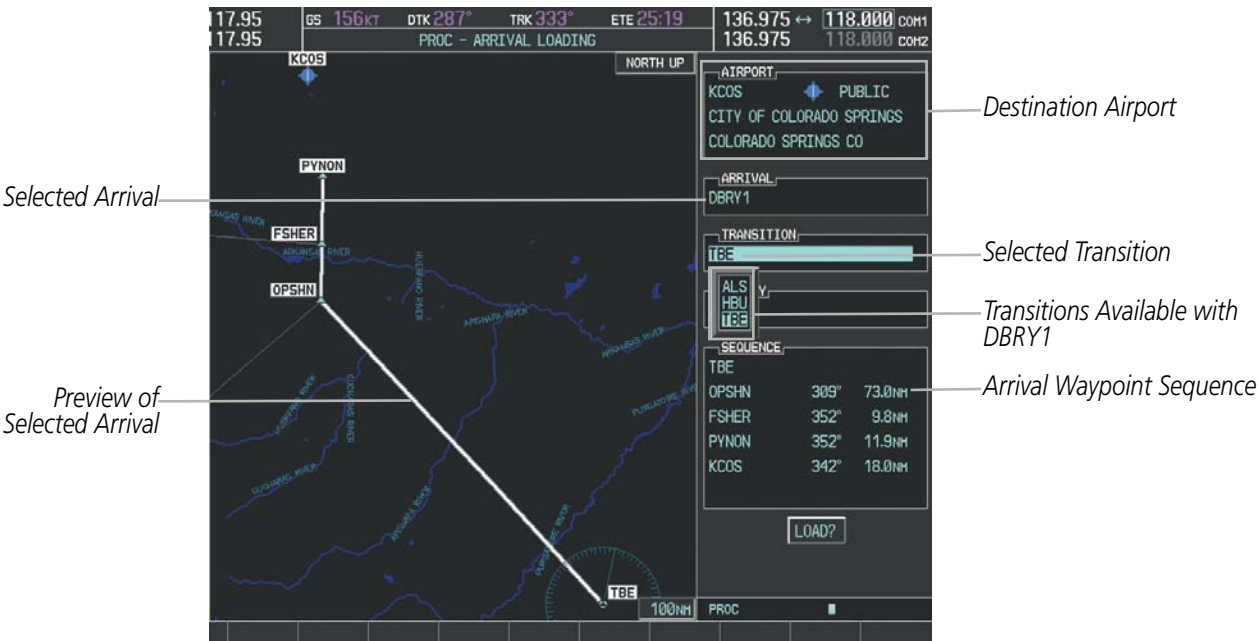
Figure 5-72 Arrival Loading Page - Selecting the Transition
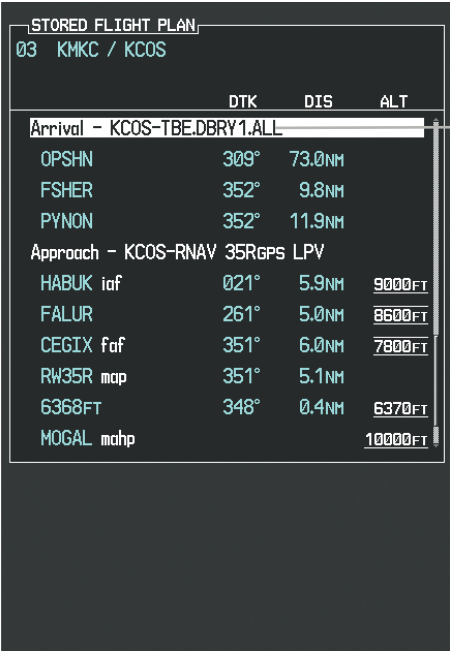
Inserted Arrival Header
- Arrival Identifier:
   [arrival airport]-[arrival transition].
   [arrival].[arrival runway]
   (e.g., KCOS-TBE.DBRY1.ALL)

Figure 5-73 Stored Flight Plan Page - Arrival Inserted

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APPROACH (APPR)

An Approach Procedure (APPR) can be loaded at any airport that has an approach available. Only one approach can be loaded at a time in a flight plan. The route for a selected approach is defined by designating transition waypoints.

Destination Airport

Selected Approach

Approaches Available at KCOS

Barometric Minimum

Preview of Selected Approach

Approach Waypoint Sequence

Figure 5-74 Approach Loading Page - Selecting the Approach

Loading an approach procedure into a stored flight plan:

1) Select a stored flight plan from the Flight Plan Catalog Page.

2) Select the **EDIT** Softkey; or press the **MENU** Key, select 'Edit Flight Plan', and press the **ENT** Key. The Stored Flight Plan Page is displayed.

3) Select the **LD APR** Softkey; or press the **MENU** Key, select "Load Approach", and press the **ENT** Key. The Approach Loading Page is displayed.

4) Select an approach. Press the **ENT** Key.

5) Select a transition for the selected approach. Press the **ENT** Key.

6) Press the **ENT** Key to load the selected approach procedure.

Destination Airport

Selected Approach

Preview of Selected Approach

Selected Transition

Barometric Minimum

Transitions Available with Selected Approach

Approach Waypoint Sequence
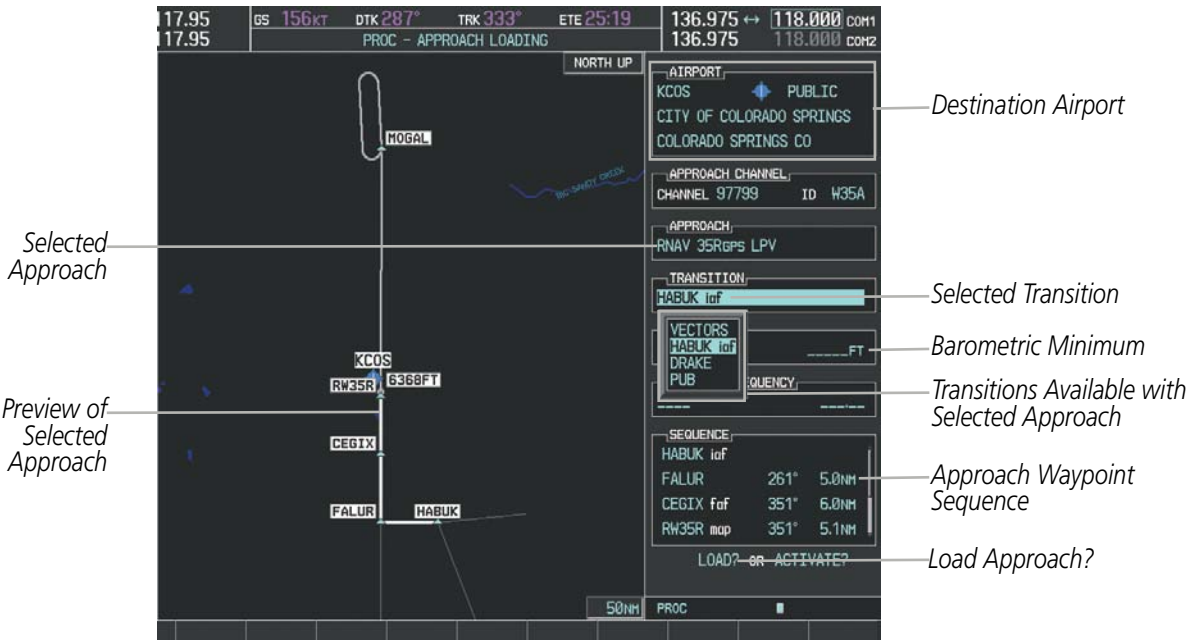
Load Approach?

Figure 5-75 Approach Loading Page - Selecting the Transition

Inserted Approach Header
- Approach Identifier: [approach airport].[runway and approach type] (e.g., KCOS-RNAV 35R$_{GPS}$ LPV)
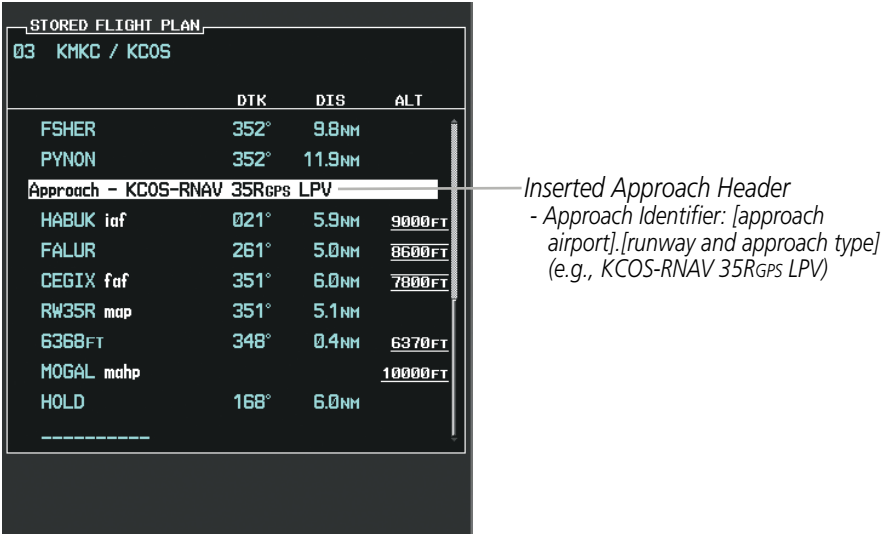
Figure 5-76 Stored Flight Plan Page - Approach Inserted

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FLIGHT PLAN STORAGE

The G1000 can store up to 99 flight plans, numbered 1 through 99. The active flight plan is erased when the G1000 is powered off or when another flight plan is activated. Details about each stored flight plan can be viewed on the Flight Plan Catalog Page and on the Stored Flight Plan Page.

Viewing information about a stored flight plan:

1) Press the **FPL** Key on the MFD to display the Active Flight Plan Page.

2) Turn the small **FMS** Knob clockwise one click to display the Flight Plan Catalog Page.

3) Press the **FMS** Knob to activate the cursor and turn the **FMS** Knob to highlight the desired flight plan.

4) The Flight Plan 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 Stored Flight Plan Page and view the waypoints in the flight plan.

6) Press the **FMS** Knob to exit the Stored Flight Plan Page.
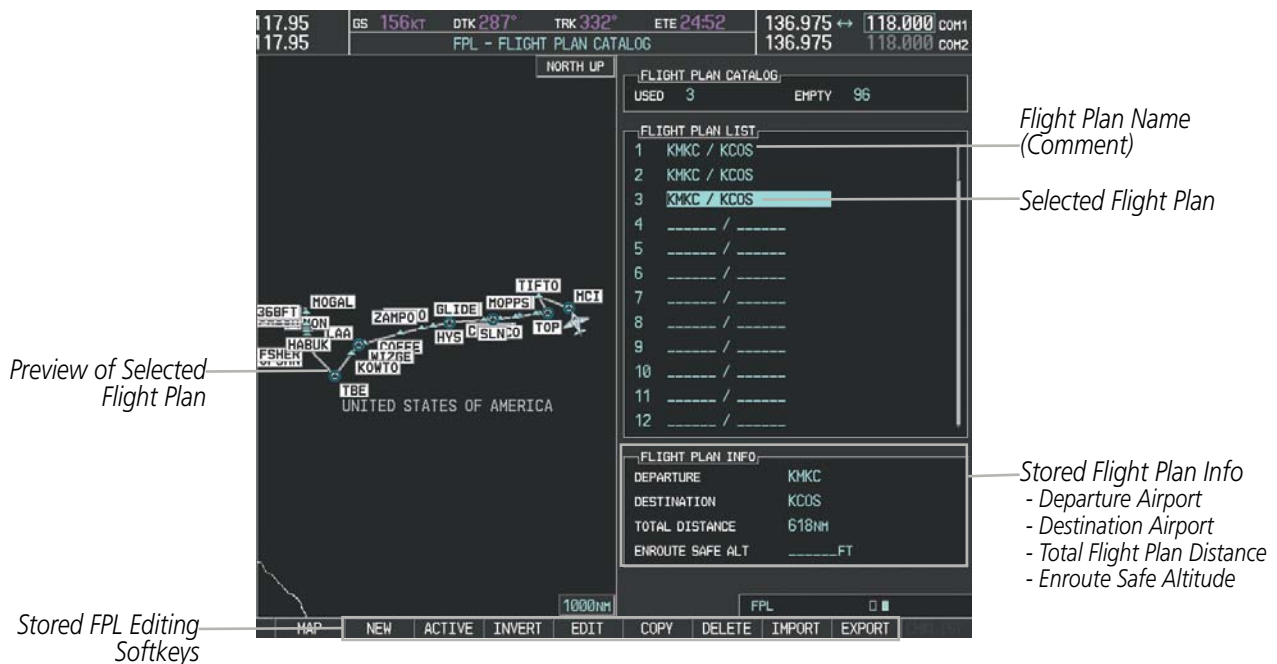
Figure 5-77 Stored Flight Plan Information

Storing an active flight plan from the Active Flight Plan Page or the Active Flight Plan Window:

1) Press the **MENU** Key.

2) Highlight 'Store Flight Plan'.

3) Press the **ENT** Key.

4) With 'OK' highlighted, press the **ENT** Key. The flight plan is stored in the next available position in the flight plan list on the Flight Plan Catalog Page.

SORT FLIGHT PLANS

The stored flight plans can be sorted alphanumerically based on the flight plan name (comment) assigned to each flight plan.

Sorting by flight plan name (comment):

1) Press the **FPL** Key and turn the small **FMS** Knob to display the Flight Plan Catalog Page.

2) Press the **MENU** Key.

3) Highlight 'Sort By Comment' and press the **ENT** Key. A confirmation window is displayed.

4) With 'OK' highlighted, press the **ENT** Key to change flight plan ordering. To cancel the request, press the **CLR** Key, or highlight 'CANCEL' and press the **ENT** Key.

ACTIVATE A FLIGHT PLAN

Activating a stored flight plan erases the active flight plan and replaces it with the flight plan being activated. Inverting a stored flight plan reverses the waypoint order, erases the active flight plan, and replaces it with the flight plan being activated (the stored flight plan is not changed).

Activating a stored flight plan on the MFD:

1) Press the **FPL** Key and turn the small **FMS** Knob to display the Flight Plan Catalog Page.

2) Press the **FMS** Knob to activate the cursor, and turn the **FMS** Knob to highlight the desired flight plan.

3) Select the **ACTIVE** Softkey; or press the **ENT** Key twice; or press the **MENU** Key, highlight 'Activate Flight Plan', and press the **ENT** Key. The 'Activate Stored Flight Plan?' window is displayed.

4) With 'OK' highlighted, select the **ENT** Key. To cancel the request, press the **CLR** Key, or highlight 'CANCEL' and press the **ENT** Key.

Inverting and activating a stored flight plan on the MFD:

1) Press the **FPL** Key and turn the small **FMS** Knob to display the Flight Plan Catalog Page.

2) Press the **FMS** Knob to activate the cursor, and turn the **FMS** Knob to highlight the desired flight plan.

3) Select the **INVERT** Softkey; or press the **MENU** Key, highlight 'Invert & Activate FPL?', and press the **ENT** Key. The 'Invert and activate stored flight plan?' window is displayed.

4) With 'OK' highlighted, press the **ENT** Key. To cancel the request, press the **CLR** Key, or highlight 'CANCEL' and press the **ENT** Key.

COPY A FLIGHT PLAN

The G1000 allows copying a flight plan into a new flight plan memory slot, allowing editing, etc., without affecting the original flight plan. This can be used to duplicate an existing stored flight plan for use in creating a modified version of the original stored flight plan.

Copying a stored flight plan on the MFD:

1) Press the **FPL** Key and turn the small **FMS** Knob to display the Flight Plan Catalog Page.

2) Press the **FMS** Knob to activate the cursor, and turn the **FMS** Knob to highlight the desired flight plan.

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3) Select the **COPY** Softkey; or press the **MENU** Key, highlight 'Copy Flight Plan', and press the **ENT** Key. The 'Copy to Flight Plan XX?' window is displayed.

4) With 'OK' highlighted, press the **ENT** Key to copy the flight plan. To cancel the request, press the **CLR** Key, or highlight 'CANCEL' and press the **ENT** Key.

DELETE A STORED FLIGHT PLAN

Individual or all stored flight plans can be deleted from the G1000 memory.

Deleting a stored flight plan:

1) Press the **FPL** Key and turn the small **FMS** Knob to display the Flight Plan Catalog Page.

2) Press the **FMS** Knob to activate the cursor, and turn the **FMS** Knob to highlight the desired flight plan.

3) Select the **DELETE** Softkey; press the **CLR** Key; or press the **MENU** Key, highlight 'Delete Flight Plan', and press the **ENT** Key. The 'Delete Flight Plan XX?' window is displayed.

4) With 'OK' highlighted, press the **ENT** Key to delete the flight plan. To cancel the request, press the **CLR** Key, or highlight 'CANCEL' and press the **ENT** Key.

> **NOTE:** *The option to delete all stored flight plans is not available while the aircraft is in flight.*

Deleting all stored flight plans:

1) Press the **FPL** Key and turn the small **FMS** Knob to display the Flight Plan Catalog Page.

2) Press the **MENU** Key.

3) Highlight 'Delete All' and press the **ENT** Key. A 'Delete all flight plans?' confirmation window is displayed.

4) With 'OK' highlighted, press the **ENT** Key to delete all flight plans. To cancel the request, press the **CLR** Key, or highlight 'CANCEL' and press the **ENT** Key.

FLIGHT PLAN EDITING

The active flight plan or any stored flight plan can be edited. The edits made to the active flight plan affect navigation as soon as they are entered.

DELETING THE ACTIVE FLIGHT PLAN

The G1000 allows deleting an active flight plan. Deleting the active flight plan suspends navigation by the G1000.

Deleting the active flight plan:

1) Press the **FPL** Key to display the Active Flight Plan Page (MFD) or the Active Flight Plan Window (PFD).

2) Press the **MENU** Key, highlight 'Delete Flight Plan', and press the **ENT** Key. The 'Delete all waypoints in flight plan?' window is displayed.

3) With 'OK' highlighted, press the **ENT** Key to delete the active flight plan. To cancel the request, press the **CLR** Key, or highlight 'CANCEL' and press the **ENT** Key.

DELETING FLIGHT PLAN ITEMS

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

Deleting an individual waypoint from the active flight plan:

1) Press the **FPL** Key to display the Active Flight Plan Page (MFD) or the Active Flight Plan Window (PFD).

2) Press the **FMS** Knob to activate the cursor (not required on the PFD) and turn the large **FMS** Knob to highlight the waypoint to be deleted.

3) Press the **CLR** Key. The 'Remove XXXXX?' window is displayed.

4) With 'OK' highlighted, press the **ENT** Key. To cancel the request, press the **CLR** Key, or highlight 'CANCEL' and press the **ENT** Key.

5) Press the **FMS** Knob to remove the flashing cursor.

Deleting an entire airway from the active flight plan:

1) Press the **FPL** Key to display the Active Flight Plan Page (MFD) or the Active Flight Plan Window (PFD).

2) Press the **FMS** Knob to activate the cursor (not required on the PFD) and turn the large **FMS** Knob to highlight the white header of the airway to be deleted.

3) Press the **CLR** Key. The 'Remove <airway name>?' window is displayed.

4) With 'OK' highlighted, press the **ENT** Key. To cancel the request, press the **CLR** Key, or highlight 'CANCEL' and press the **ENT** Key.

5) Press the **FMS** Knob to remove the flashing cursor.

Deleting an entire procedure from the active flight plan:

1) Press the **FPL** Key to display the Active Flight Plan Page (MFD) or the Active Flight Plan Window (PFD).

2) Press the **FMS** Knob to activate the cursor (not required on the PFD) and turn the large **FMS** Knob to highlight the white header of the procedure to be deleted.

3) Press the **CLR** Key. The 'Remove <procedure name> from flight plan?' window is displayed.

4) With 'OK' highlighted, press the **ENT** Key. To cancel the request, press the **CLR** Key, or highlight 'CANCEL' and press the **ENT** Key.

5) Press the **FMS** Knob to remove the flashing cursor.

Or:

1) Press the **FPL** Key to display the Active Flight Plan Page (MFD) or the Active Flight Plan Window (PFD).

2) Press the **MENU** Key to display the Page Menu and turn the **FMS** Knob to highlight 'Remove <procedure>'.

3) Press the **ENT** Key. The 'Remove <procedure name> from flight plan?' window is displayed.

4) With 'OK' highlighted, press the **ENT** Key. To cancel the request, press the **CLR** Key, or highlight 'CANCEL' and press the **ENT** Key.

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Deleting an individual waypoint from a stored flight plan:

1) Press the **FPL** Key to display the Active Flight Plan Page.

2) Turn the small **FMS** Knob clockwise one click to display the Flight Plan Catalog Page.

3) Press the **FMS** Knob to activate the cursor and turn the **FMS** Knob to highlight the flight plan to be edited.

4) Select the **EDIT** Softkey; or press the **MENU** Key, select 'Edit Flight Plan' and press the **ENT** Key. The Stored Flight Plan Page is displayed.

5) Turn the large **FMS** Knob to highlight the waypoint to be deleted.

6) Press the **CLR** Key. The 'Remove XXXXX?' window is displayed.

7) With 'OK' highlighted, press the **ENT** Key. To cancel the request, press the **CLR** Key, or highlight 'CANCEL' and press the **ENT** Key.

8) Press the **FMS** Knob to remove the flashing cursor.

Deleting an entire airway from a stored flight plan:

1) Press the **FPL** Key to display the Active Flight Plan Page.

2) Turn the small **FMS** Knob clockwise one click to display the Flight Plan Catalog Page.

3) Press the **FMS** Knob to activate the cursor and turn the **FMS** Knob to highlight the flight plan to be edited.

4) Select the **EDIT** Softkey; or press the **MENU** Key, select 'Edit Flight Plan' and press the **ENT** Key. The Stored Flight Plan Page is displayed.

5) Turn the large **FMS** Knob to highlight the white header of the airway to be deleted.

6) Press the **CLR** Key. The 'Remove <airway name>?' window is displayed.

7) With 'OK' highlighted, press the **ENT** Key. To cancel the request, press the **CLR** Key, or highlight 'CANCEL' and press the **ENT** Key.

8) Press the **FMS** Knob to remove the flashing cursor.

Deleting an entire procedure from a stored flight plan:

1) Press the **FPL** Key to display the Active Flight Plan Page.

2) Turn the small **FMS** Knob clockwise one click to display the Flight Plan Catalog Page.

3) Press the **FMS** Knob to activate the cursor and turn the **FMS** Knob to highlight the flight plan to be edited.

4) Select the **EDIT** Softkey; or press the **MENU** Key, select 'Edit Flight Plan' and press the **ENT** Key. The Stored Flight Plan Page is displayed.

5) Turn the large **FMS** Knob to highlight the white header of the procedure to be deleted.

6) Press the **CLR** Key. The 'Remove <procedure name> from flight plan?' window is displayed.

7) With 'OK' highlighted, press the **ENT** Key. To cancel the request, press the **CLR** Key, or highlight 'CANCEL' and press the **ENT** Key.

8) Press the **FMS** Knob to remove the flashing cursor.

   Or:

1) Press the **FPL** Key to display the Active Flight Plan Page.

2) Turn the small **FMS** Knob clockwise one click to display the Flight Plan Catalog Page.

3) Press the **FMS** Knob to activate the cursor and turn the **FMS** Knob to highlight the flight plan to be edited.

4) Select the **EDIT** Softkey; or press the **MENU** Key, select 'Edit Flight Plan' and press the **ENT** Key. The Stored Flight Plan Page is displayed.

5) Press the **MENU** Key to display the Page Menu and turn the **FMS** Knob to highlight 'Remove <procedure>'.

6) Press the **ENT** Key. The 'Remove <procedure name> from flight plan?' window is displayed.

7) With 'OK' highlighted, press the **ENT** Key. To cancel the request, press the **CLR** Key, or highlight 'CANCEL' and press the **ENT** Key.

8) Press the **FMS** Knob to remove the flashing cursor.

CHANGING FLIGHT PLAN COMMENTS (NAMES)

The comment field (or name) of each flight plan can be changed to something that is useful for identification and sorting.

Changing the active flight plan comment:

1) Press the **FPL** Key to display the Active Flight Plan Page.

2) Press the **FMS** Knob to activate the cursor and turn the large **FMS** Knob to highlight the comment field.

3) Use the **FMS** Knobs to edit the comment.

4) Press the **ENT** Key to accept the changes.

5) Press the **FMS** Knob to remove the flashing cursor.

Changing a stored flight plan comment:

1) Press the **FPL** Key to display the Active Flight Plan Page.

2) Turn the small **FMS** Knob clockwise one click to display the Flight Plan Catalog Page.

3) Press the **FMS** Knob to activate the cursor and turn the **FMS** Knob to highlight the flight plan to be edited.

4) Select the **EDIT** Softkey; or press the **MENU** Key, select 'Edit Flight Plan' and press the **ENT** Key. The Stored Flight Plan Page is displayed.

5) Turn the large **FMS** Knob to highlight the comment field.

6) Use the **FMS** Knobs to edit the comment.

7) Press the **ENT** Key to accept the changes.

8) Press the **FMS** Knob to remove the flashing cursor.

ALONG TRACK OFFSETS

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

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entered from 1 to 99 nm in increments of 1 nm. Entering a negative offset distance results in an along track offset waypoint inserted before the selected waypoint, whereas entering a positive offset distance results in an along track offset waypoint inserted after the selected waypoint. Multiple offset waypoints are allowed.

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

An along track offset distance cannot be modified once entered. If the along track offset distance must be changed, the existing along track offset waypoint must be deleted and a new one created with the new offset distance.
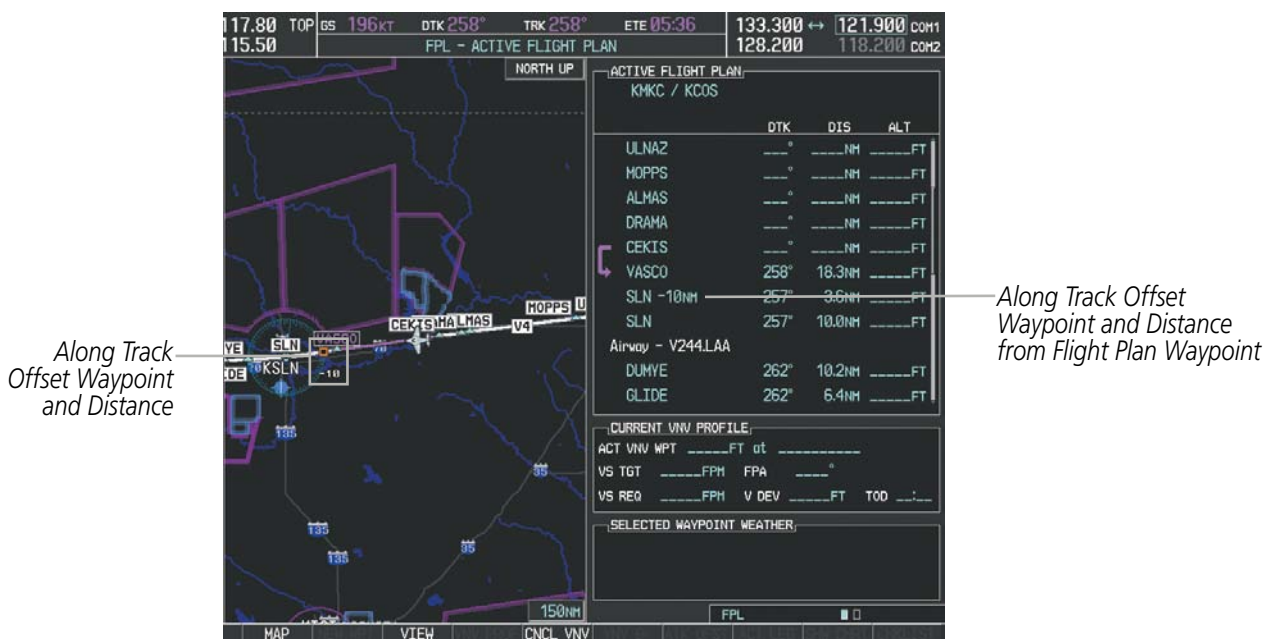
Figure 5-78 Along Track Offset

Entering an along track offset distance:

1) Press the **FPL** Key to display the Active Flight Plan Page (MFD) or the Active Flight Plan Window (PFD).

2) Press the **FMS** Knob to activate the cursor (not required on the PFD) and turn the large **FMS** Knob to highlight the waypoint for the along track offset.

3) Press the **ATK OFST** 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 99 nm (limited by leg distances).

5) Press the **ENT** Key to create the offset waypoint.

6) Turn the small **FMS** Knob to enter the desired altitude for the offset.

7) Press the **FMS** Knob to remove the flashing cursor.

PARALLEL TRACK

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

Using direct-to, loading an approach, a holding pattern, or editing and activating the flight plan automatically cancels Parallel Track. Parallel Track is also cancelled if a course change occurs greater than 120° or the parallel tracks overlap as a result of the course change.

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

Active Flight Plan prior to Parallel Track

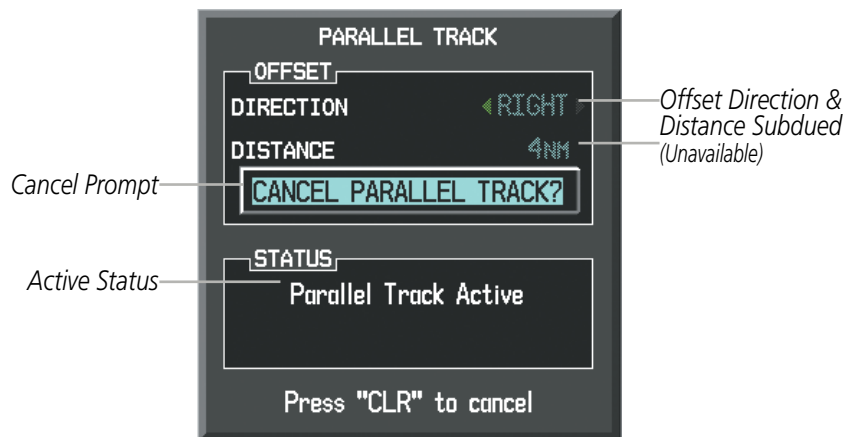*Selecting Parallel Track*
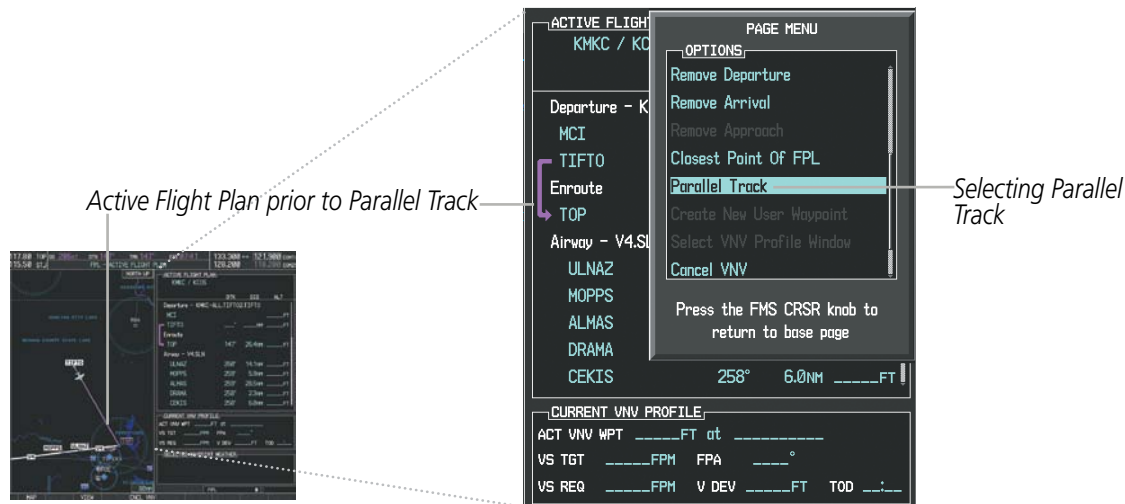
Figure 5-79 Active Flight Plan Window - Selecting Parallel Track

Activating parallel track:

1) Press the **FPL** Key to display the 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 the direction field highlighted.

3) Turn the small **FMS** Knob to select 'Left' or 'Right' and press the **ENT** Key. The 'DISTANCE' field is highlighted.

4) Turn the small **FMS** Knob to enter a distance from 1-99 nm and press the **ENT** Key. 'ACTIVATE PARALLEL TRACK' is highlighted.

5) Press the **ENT** Key to activate parallel track. Press the **FMS** Knob or the **CLR** Key to cancel the parallel track activation.
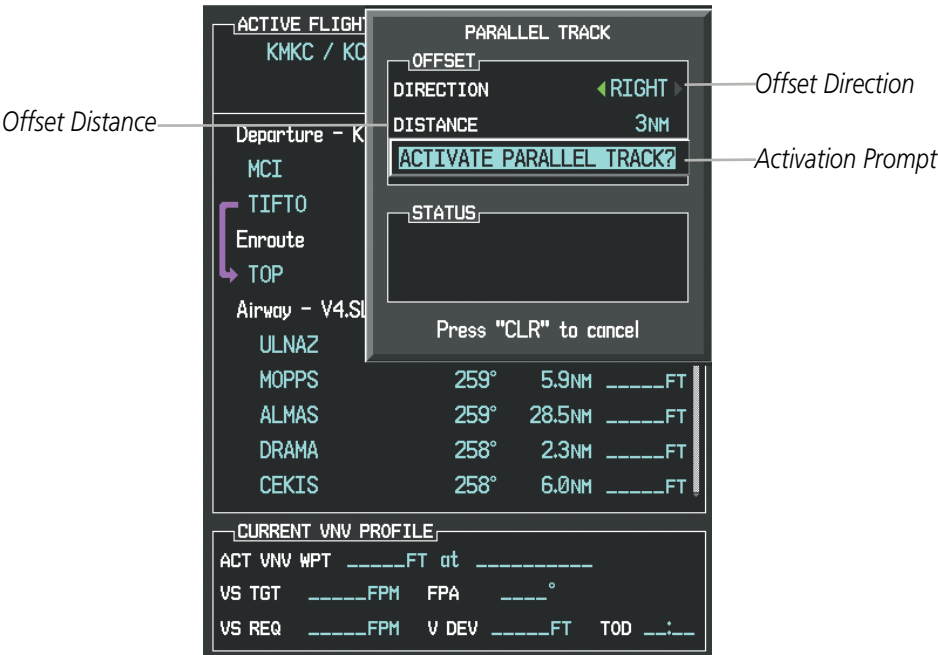
Figure 5-80 Parallel Track Window
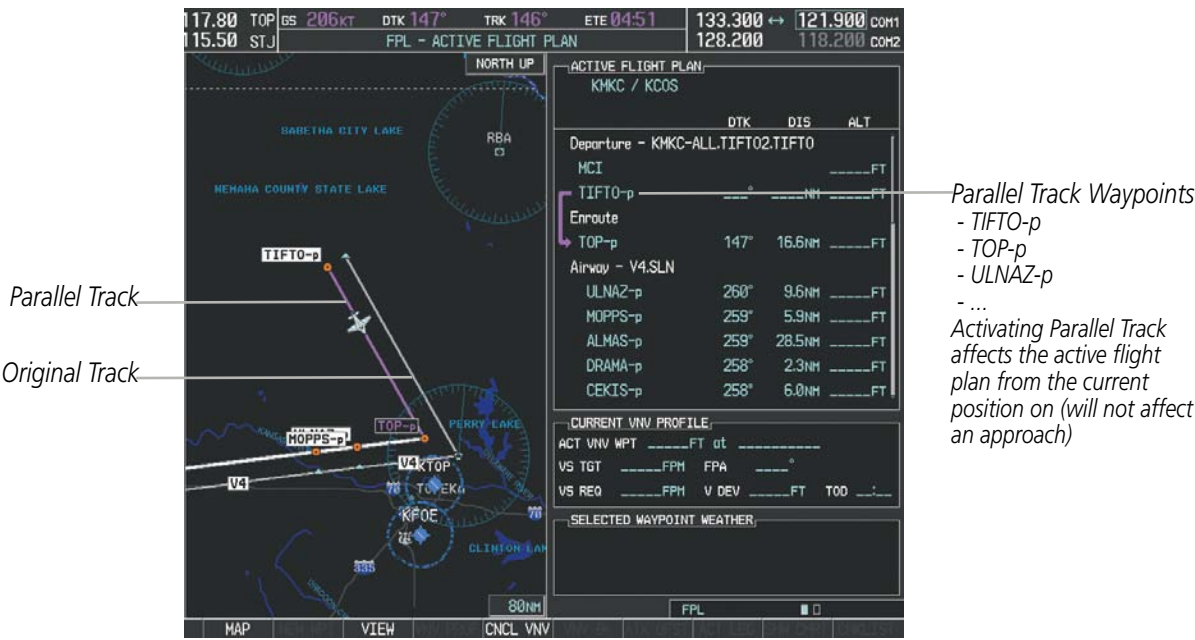
Figure 5-81 Parallel Track Active

If the parallel track proposed by the offset direction and distance is not allowed by the system, the activation prompt is displayed, but disabled. Parallel Track cannot be activated if a course is set using direct-to or if the active leg is the first leg of the departure procedure. Attempting to activate parallel track with these conditions results in the message 'Parallel Track Unavailable Invalid Route Geometry'. If an approach leg is active the status

indicates that the system is unable to activate the parallel track with the message 'Parallel Track Unavailable Approach Leg Active'. If the offset direction and distance results in an unreasonable route geometry the status indicates that the system is unable to activate the parallel track because of invalid geometry.
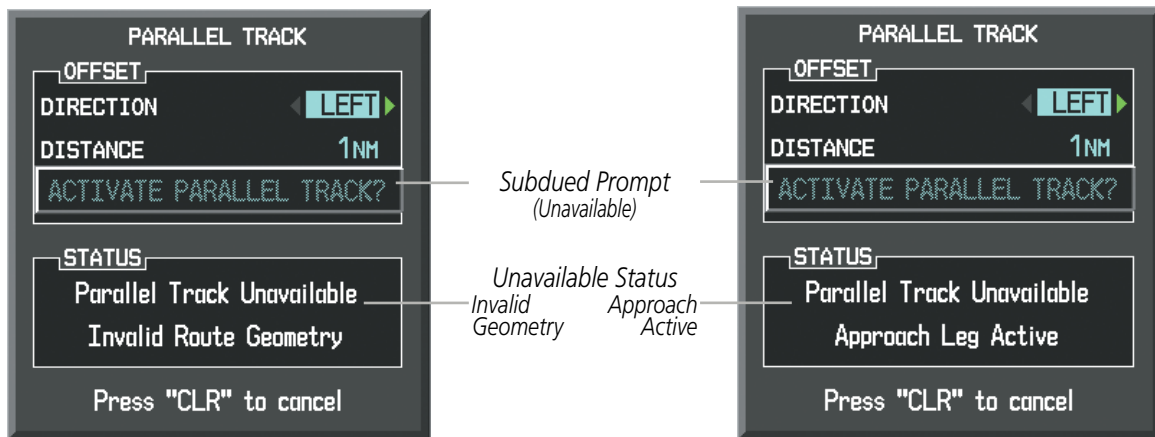
Figure 5-82 Parallel Track Unavailable

If the active leg is not a track between two fixes (TF) or a course to a fix (DF) leg, the status indicates that the system is unable to activate the parallel track because parallel track is not available for the active leg type.

Figure 5-83 Cancelling Parallel Track

Cancelling parallel track:

1) Press the **FPL** Key to display the 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.

ACTIVATING A FLIGHT PLAN LEG

The G1000 allows selection of a highlighted leg as the "active leg" (the flight plan leg which is currently used for navigation guidance).

Activating a flight plan leg:

1) Press the **FPL** Key to display the Active Flight Plan Page (MFD) or the Active Flight Plan Window (PFD).

2) Press the **FMS** Knob to activate the cursor (not required on the PFD) and turn the large **FMS** Knob to highlight the destination waypoint for the desired leg.

3) Select the **ACT LEG** Softkey (MFD only); or press the **MENU** Key, highlight 'Activate Leg', and press the **ENT** Key. A confirmation window is displayed with 'ACTIVATE' highlighted.

4) Press the **ENT** Key to activate the flight plan leg. To cancel, press the **CLR** Key, or highlight 'CANCEL' and press the **ENT** Key.

5) Press the **FMS** Knob to remove the flashing cursor.
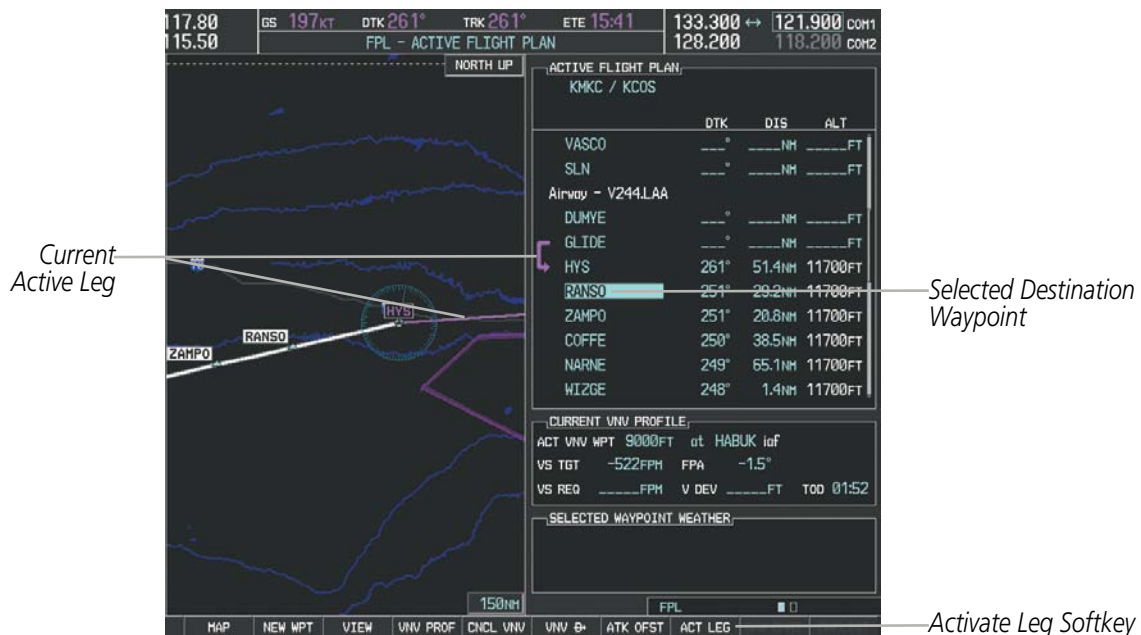
Figure 5-84 Active Flight Plan Page - Selecting the Leg Destination Waypoint

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New Active Flight Plan Leg

Confirmation Window

Figure 5-85 Active Flight Plan Page - New Active Leg

INVERTING A FLIGHT PLAN

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

Inverting the active flight plan:

1) Press the **FPL** Key to display the Active Flight Plan Page (MFD) or the Active Flight Plan Window (PFD).2) Press the **MENU** Key, highlight 'Invert Flight Plan', and press the **ENT** Key. An 'Invert Active Flight Plan?' confirmation window is displayed.

3) Select 'OK'.

4) Press the **ENT** Key to invert and activate the active flight plan. To cancel, press the **CLR** Key, or highlight 'CANCEL' and press the **ENT** Key.

Inverting and activating a stored flight plan:

1) Press the **FPL** Key and turn the small **FMS** Knob to display the Flight Plan Catalog Page.

2) Press the **FMS** Knob to activate the cursor, and turn the **FMS** Knob to highlight the desired flight plan.

3) Select 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.

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FLIGHT PLAN VIEWS

Information about flight plans can be viewed in more than one way. The active flight plan can be configured to show cumulative distance over the length of the flight plan or the distance for each leg of the flight plan; and the active flight plan can be viewed in a narrow or wide view. In the wide view, additional information is displayed: Fuel Remaining (FUEL REM), Estimated Time Enroute (ETE), Estimated Time of Arrival (ETA), and Bearing to the waypoint (BRG).

Switching between leg-to-leg waypoint distance and cumulative waypoint distance:

1) Press the **FPL** Key on the MFD to display the Active Flight Plan Page.

2) Press the **VIEW** Softkey to display the **CUM** and **LEG-LEG** 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 **BACK** Softkey to return to the top level active flight plan softkeys.

Active Flight Plan Leg to Leg Distance　　　　　　　　*Active Flight Plan Cumulative Distance*
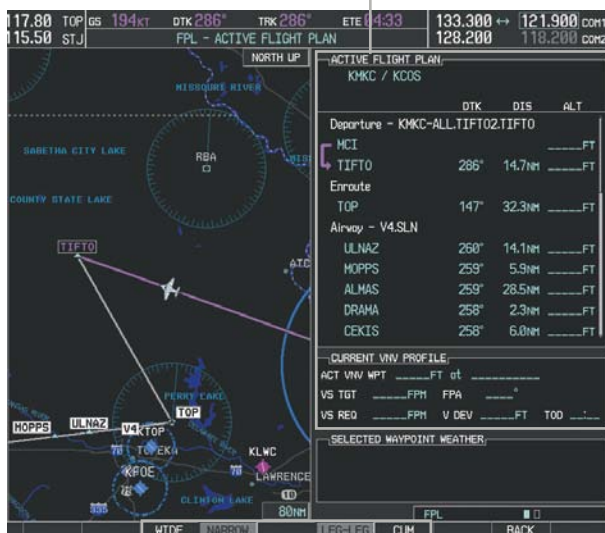
WIDE *Softkey,*　**NARROW** *Softkey,*　**LEG-LEG** *Softkey,*　**CUM** *Softkey*

Figure 5-86 Active Flight Plan - Leg to Leg vs. Cumulative Distance

Switching between wide and narrow view:

1) Press the **FPL** Key on the MFD to display the Active Flight Plan Page.

2) Press the **VIEW** Softkey to display the **WIDE** and **NARROW** Softkeys.

3) Press the **WIDE** Softkey to display the wide view, or press the **NARROW** Softkey to display the narrow view.

4) Press the **BACK** Softkey to return to the top level active flight plan softkeys.

Active Flight Plan Narrow View · *Active Flight Plan* Wide View

WIDE *Softkey,* **NARROW** *Softkey,* **LEG-LEG** *Softkey,* **CUM** *Softkey*
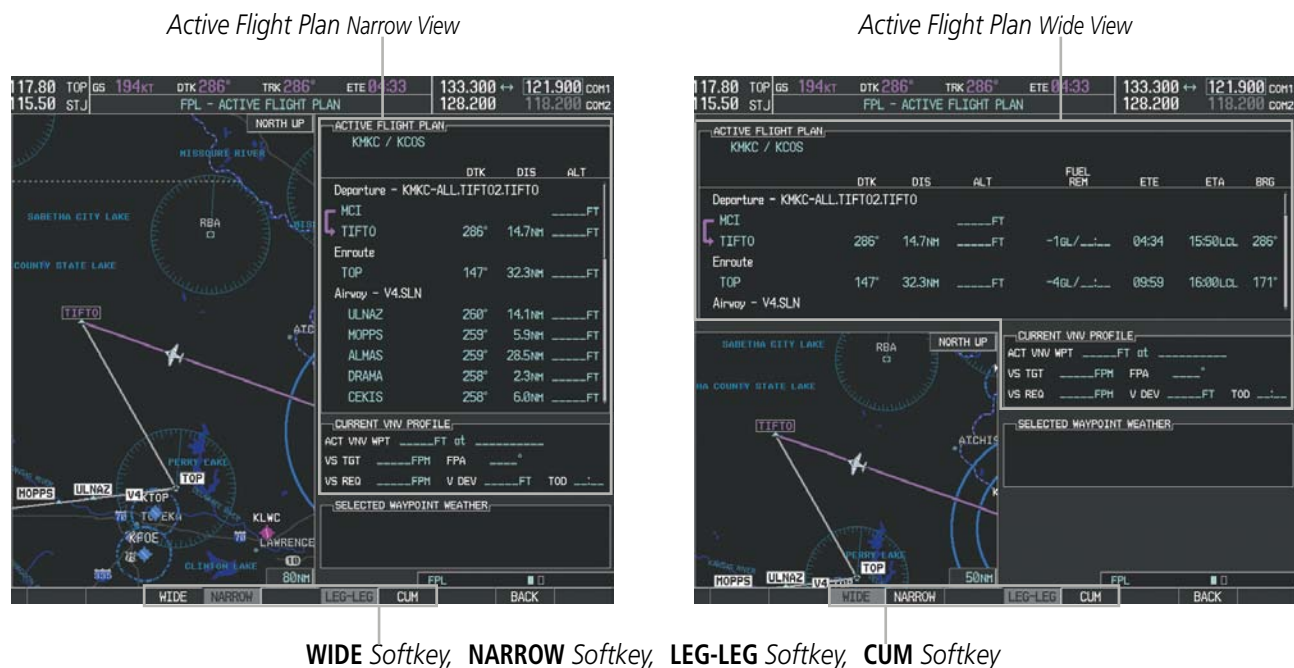
Figure 5-87 Active Flight Plan - Wide vs. Narrow View

COLLAPSING AIRWAYS

The G1000 allows airways on the active flight plan to be collapsed or expanded from the Active Flight Plan Page/Window. When airways have been collapsed, it is indicated on the airway heading.

When airways are collapsed, leg-to-leg computed values such as DIS or ETE shown for the exit waypoint reflect the total of all the legs on the airway that have been hidden in the collapsed display. The DTK value is inhibited because it is not usable in this context.

The Active Flight Plan Page always keeps the following three waypoints visible: "From" waypoint, "To" waypoint, and "Next" waypoint. To prevent one or more of these waypoints from being hidden in a collapsed airway segment, the airway segment that contains either the "To" or the "Next" waypoint is automatically expanded. When an airway is loaded, airways are automatically expanded to facilitate flight plan review.

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Figure 5-88 Expanded/Collapsed Airways

Collapsing/expanding the airways in the active flight plan:

1) Press the **FPL** Key to display the Active Flight Plan Page (MFD) or the Active Flight Plan Window (PFD).

2) Press the **MENU** Key, highlight 'Collapse Airways' or 'Expand Airways', and press the **ENT** Key. The airways are collapsed/expanded.

CLOSEST POINT OF FPL

'Closest Point of FPL' calculates the bearing and closest distance at which a flight plan passes a reference waypoint, and creates a new user waypoint along the flight plan at the location closest to a chosen reference waypoint.

Determining the closest point along the active flight plan to a selected waypoint:

1) Press the **FPL** Key to display the Active Flight Plan Page (MFD) or the Active Flight Plan Window (PFD).

2) Press the **MENU** Key, highlight 'Closest Point Of FPL", and press the **ENT** Key. A window appears with the reference waypoint field highlighted.

3) Enter the identifier of the reference waypoint and press the **ENT** Key. The G1000 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.

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5.7 VERTICAL NAVIGATION

> **NOTE:** *The G1000 supports vertical navigation for all lateral leg types except for CA, CI, FA, FM, HA, HM, PI, VA, VD, VI, VR, and VM. Vertical constraints are not retained in stored flight plans.*

The G1000 system Vertical Navigation (VNV) feature provides vertical profile guidance during the enroute and terminal phases of flight. Guidance based on specified altitudes at waypoints in the active flight plan or to a direct-to waypoint is provided. It includes vertical path guidance to a descending path, which is provided as a linear deviation from the desired path. The desired path is defined by a line joining two waypoints with specified altitudes or as a vertical angle from a specified waypoint/altitude. The vertical waypoints are integrated into the active flight plan. Both manual and autopilot-coupled guidance are supported.

ENBL VNV *Softkey*   **CNCL VNV** *Softkey*
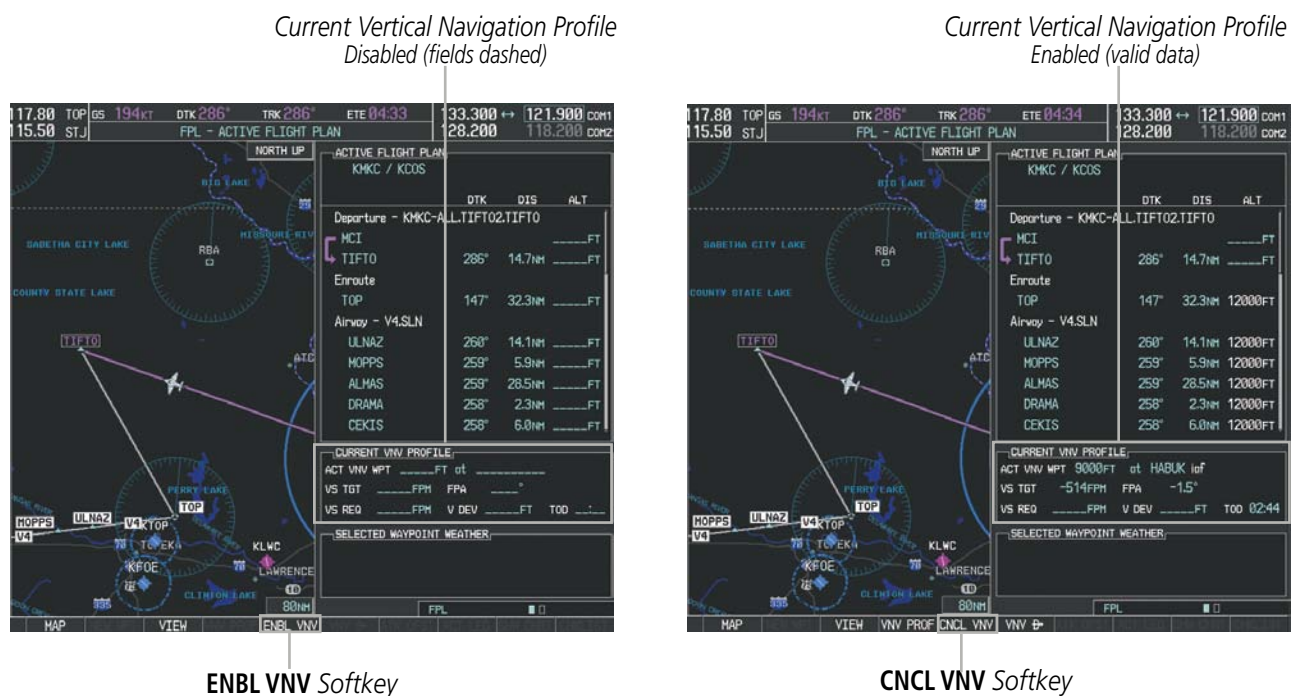
Figure 5-89 Enabling/Disabling Vertical Navigation

Enabling VNV guidance:

1) Press the **FPL** Key to display the Active Flight Plan Page on the MFD.

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 CURRENT VNV PROFILE box (defaults first waypoint in the active flight plan with an altitude enabled for vertical navigation (e.g., HABUK)).

Disabling VNV guidance:

1) Press the **FPL** Key to display the Active Flight Plan Page on the MFD.

2) Press the **CNCL VNV** Softkey; or press the **MENU** Key, highlight 'Cancel VNV', and press the **ENT** Key. Vertical navigation is disabled.

Canceling vertical navigation results in vertical deviation (V DEV), vertical speed required (VS REQ), and time to top of descent/bottom of descent (TIME TO TOD/BOD) going invalid. The Vertical Deviation Indicator (VDI) and Required Vertical Speed Indicator (RVSI) on the PFD are removed, and the V DEV, VS REQ, and TIME TO TOD items displayed in the CURRENT VNV PROFILE box are dashed. VNV remains disabled until manually enabled. Vertical guidance in reversionary mode can only be enabled for a direct-to waypoint.

The G1000 allows a vertical navigation direct-to to any waypoint in the active flight plan with an altitude constraint "designated" for vertical guidance. Selecting the **VNV Direct-to** Softkey on the Active Flight Plan Page allows the flight plan to be flown, while vertical guidance based on the altitude constraint at the VNV direct-to waypoint is provided. The altitude change begins immediately and is spread along the flight plan from current position to the vertical direct-to waypoint, not just along the leg for the direct-to waypoint. A direct-to with altitude constraint activated by pressing the **Direct-to** Key also provides vertical guidance, but would bypass flight plan waypoints between the current position in the flight plan and the direct-to waypoint. A top of descent (TOD) point is computed based on the default flight path angle; descent begins once the TOD is reached.
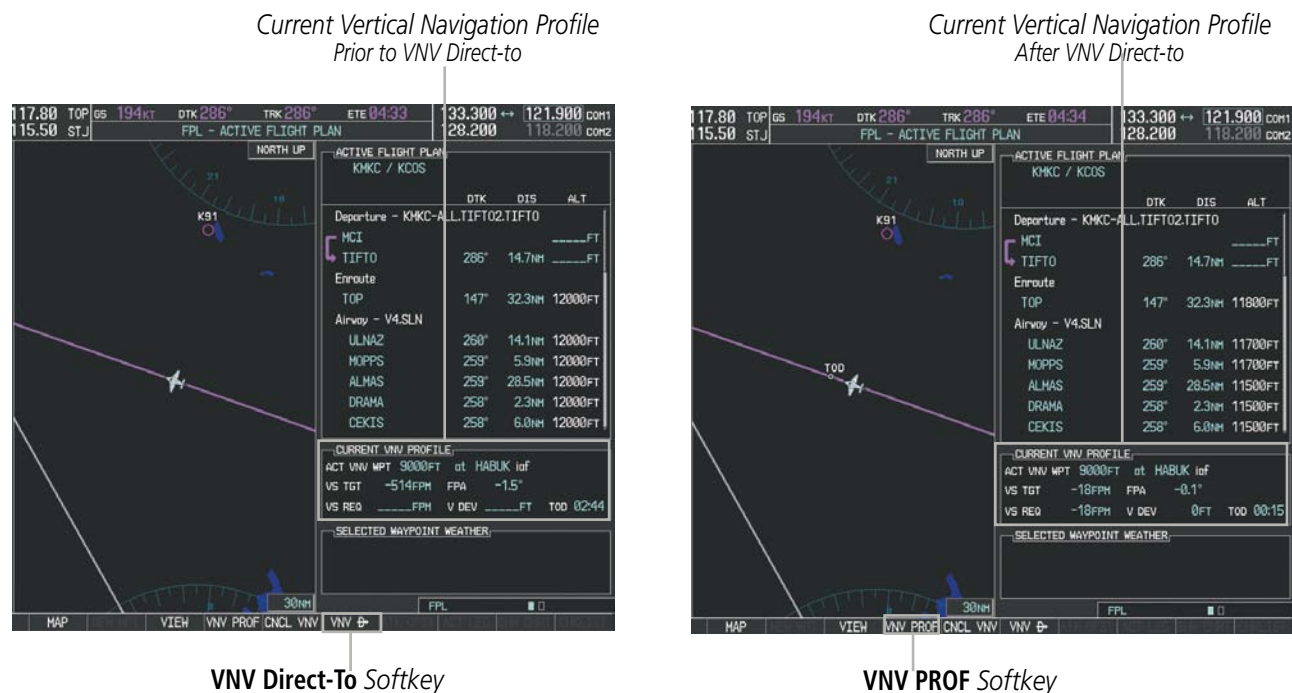
Figure 5-90 Vertical Navigation Direct-To

Activating a vertical navigation direct-to:

1) Press the **FPL** Key to display the Active Flight Plan Page on the MFD.

2) Press the **FMS** Knob to activate the cursor and turn the **FMS** Knob to highlight the desired waypoint.

> *NOTE: The selected waypoint must have a designated altitude constraint (light blue number) to be used. If not, the first waypoint in the flight plan with a designated altitude constraint is selected.*

3) Press the **VNV Direct-To** Softkey; or press the **MENU** Key, highlight 'VNV Direct-To', and press the **ENT** Key. An 'Activate vertical Direct-to to: NNNNNFT at XXXXXX?' confirmation window is displayed.

4) Press the **ENT** Key. Vertical guidance begins to the altitude constraint for the selected waypoint.

5) Press the **FMS** Knob to remove the flashing cursor.

The vertical navigation profile can be modified by directly entering a vertical speed target (VS TGT) and/or flight path angle (FPA) in the CURRENT VNV PROFILE box.

Modifying the VS TGT and FPA:

1) Press the **FPL** Key to display the Active Flight Plan Page on the MFD.

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 CURRENT VNV PROFILE box.

3) Turn the **FMS** Knobs as needed to edit the values.

4) Press the **FMS** Knob to remove the flashing cursor.

ALTITUDE CONSTRAINTS

The G1000 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. The navigation database only contains altitudes for procedures that call for "Cross at" altitudes. If the procedure states "Expect to cross at," then the altitude is not in the database. In this case the altitude may be entered manually.

5000FT
Cross AT or ABOVE 5,000 ft

2300FT
Cross AT 2,300 ft

3000FT
Cross AT or BELOW 3,000 ft

Altitude Constraint Examples

ACTIVE FLIGHT PLAN			
KIXD / KDFW			
	DTK	DIS	ALT
KARLA	221°	11.7NM	13000FT
COVIE	221°	9.0NM	12400FT
LEMYN	220°	8.0NM	9900FT
Approach – KDFW-RNAV 17Lgps LPV			
RIVET iaf	259°	18.8NM	4000FT
DRAAK	176°	3.3NM	2000FT
INWOD	176°	3.2NM	3000FT
MENOL faf	176°	3.9NM	2300FT
RW17L map	176°	5.3NM	
990FT	174°	0.8NM	990FT
POLKE			

Displayed Text Examples
Large White Text
Large Light Blue Text
Small Light Blue Text
Small Light Blue Subdued Text
Small White Text with Altitude Restriction Bar

Figure 5-91 Waypoint Altitude Constraints

	White Text	Light Blue Text	Light Blue Subdued Text
Large Text	Altitude calculated by the system estimating the altitude of the aircraft as it passes over the navigation point. This altitude is provided as a reference and is not designated to be used in determining vertical speed and deviation guidance.	Altitude has been entered manually. Altitude is designated for use in giving vertical speed and deviation guidance. Altitude does not match the published altitude in navigation database or no published altitude exists.	The system cannot use this altitude in determining vertical speed and deviation guidance because of an invalid constraint condition.
Small Text	Altitude is not designated to be used in determining vertical speed and deviation guidance. Altitude has been retrieved from the navigation database and is provided as a reference.	Altitude is designated for use in giving vertical speed and deviation guidance. Altitude has been retrieved from the navigation database or has been entered manually and matches a published altitude in the navigation database.	The system cannot use this altitude in determining vertical speed and deviation guidance because of an invalid constraint condition.

Table 5-8 Altitude Constraint Size and Color Coding

Altitudes associated with approach procedures are "auto-designated". This means the system automatically uses the altitudes loaded with the approach for giving vertical speed and deviation guidance. Note that these altitudes are displayed as blue text up to, but not including, the FAF. The FAF is always a "reference only" altitude and cannot be designated, unless the selected approach does not provide vertical guidance. In this case, the FAF altitude can be designated.

Altitudes that have been designated for use in vertical guidance can be "un-designated" using the **CLR** Key. The altitude is now displayed only as a reference. It is not used to give vertical guidance. Other displayed altitudes may change due to re-calculations or be rendered invalid as a result of manually changing an altitude to a non-designated altitude.

Designating a waypoint altitude to be used for vertical guidance:

1) Press the **FPL** Key to display the Active Flight Plan Page on the MFD.

2) Press the **FMS** Knob, and turn to highlight the desired waypoint altitude.

3) Turn the small **FMS** Knob to enter editing mode.

4) Press the **ENT** Key. The altitude is now shown in blue, indicating it is usable for vertical guidance.

Designating a procedure waypoint altitude to be used for vertical guidance:

1) Press the **FPL** Key to display the Active Flight Plan Page on the MFD.

2) Press the **FMS** Knob, and turn to highlight the desired waypoint altitude.

3) Press the **ENT** Key. The altitude is now shown in blue, indicating it is usable for vertical guidance.

Altitude constraints are displayed and entered in feet mean sea level (MSL) values to the nearest hundred. An altitude constraint in feet above ground level (AGL) format is supported for airports. When a database altitude restriction is displayed, the G1000 allows entry of a different altitude when creating a waypoint, effectively overriding the database restriction (only before the FAF). When a database altitude restriction of type "AT or ABOVE" or "AT or BELOW" is activated, the system uses the "AT" portion of the restriction to define the vertical profile.

An altitude constraint is invalid if:

- Meeting the constraint requires the aircraft to climb
- Meeting the constraint requires the maximum flight path angle or maximum vertical speed to be exceeded
- The altitude constraint results in a TOD behind the aircraft present position
- The constraint is within a leg type for which altitude constraints are not supported
- The altitude constraint is added to the FAF of an approach that provides vertical guidance (i.e., ILS or GPS SBAS approach)
- The altitude constraint is added to a waypoint past the FAF.

Entering/modifiying an altitude constraint:

1) Press the **FPL** Key to display the Active Flight Plan Page on the MFD.

2) Press the **FMS** Knob, and turn to highlight the desired waypoint altitude constraint.

3) Enter an altitude constraint value using the **FMS** Knobs. To enter altitudes as a flight level, turn the small **FMS** Knob counter-clockwise past zero or clockwise past 9 on the first character, and the system automatically changes to show units of Flight Level. Turn the large **FMS** Knob clockwise to highlight the first zero and enter the three digit flight level.

4) Press the **ENT** Key to accept the altitude constraint; if the selected waypoint is an airport, an additional choice is displayed. Turn the small **FMS** Knob to choose 'MSL' or 'AGL', and press the **ENT** Key to accept the altitude.

Altitude constraints can be modified or deleted after having been added to the flight plan. In the event an altitude constraint is deleted and the navigation database contains an altitude restriction for the lateral waypoint, the G1000 displays the altitude restriction from the database provided no predicted altitude can be provided. The G1000 also provides a way to reinstate a published altitude constraint that has been edited.

Deleting an altitude constraint provided by the navigation database:

1) Press the **FPL** Key to display the Active Flight Plan Page on the MFD.

2) Press the **FMS** Knob, and turn to highlight the desired waypoint altitude constraint.

3) Press the **CLR** Key. A 'Remove VNV altitude constraint?' confirmation window is displayed.

4) Select 'OK' and press the **ENT** Key.

Deleting an altitude constraint that has been manually entered:

1) Press the **FPL** Key to display the Active Flight Plan Page on the MFD.

2) Press the **FMS** Knob, and turn to highlight the desired waypoint altitude constraint.

3) Press the **CLR** Key. A 'Remove or Revert to published VNV altitude of nnnnnFT?' confirmation window is displayed.

4) Select 'REMOVE' and press the **ENT** Key. The manually entered altitude is deleted (it is replaced by a system calculated altitude, if available).

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

1) Press the **FPL** Key to display the Active Flight Plan Page on the MFD.

2) Press the **FMS** Knob, and turn to highlight the desired waypoint altitude constraint.

3) Press the **CLR** Key. A 'Remove or Revert to published VNV altitude of nnnnnFT?' confirmation window is displayed.

4) Select 'REVERT' and press the **ENT** Key. The altitude is changed to the navigation database value.

5) Press the **FMS** Knob to remove the flashing cursor.

Modifying a system calculated altitude constraint:

1) Press the **FPL** Key to display the Active Flight Plan Page on the MFD.

2) Press the **FMS** Knob, and turn to highlight the desired waypoint altitude constraint.

3) Press the **CLR** Key. An 'Edit or Revert to published VNV altitude of nnnnnFT?' confirmation window is displayed.

4) Select 'EDIT' and press the **ENT** Key.

5) Edit the value using the **FMS** Knobs, and press the **ENT** Key.

6) Press the **FMS** Knob to remove the flashing cursor.

5.8 PROCEDURES

The G1000 can access the whole range of instrument procedures available. Departures (DPs), arrivals (STARs), and non-precision and precision approaches (APPRs) are stored within the database and can be loaded using the Procedures **(PROC)** Key.

The selected procedure for the departure or arrival airport is added to the active flight plan. No waypoints are required to be in the active flight plan to load procedures; however, if the departure and arrival airport are already loaded, the procedure loading window defaults to the appropriate airport, saving some time selecting the correct airport on the Procedure Loading Page. Whenever an approach is selected, the choice to either "load" or "activate" is given. "Loading" adds the approach to the end of the flight plan without immediately using it for navigation guidance. This allows continued navigation via the intermediate waypoints in the original flight plan, but keeps the procedure available on the Active Flight Plan Page for quick activation when needed. "Activating" also adds the procedure to the end of the flight plan but immediately begins to provide guidance to the first waypoint in the approach.

DEPARTURES

A Departure Procedure (DP) is loaded at the departure airport in the flight plan. Only one departure can be loaded at a time in a flight plan. If a departure is loaded when another departure is already in the active flight plan, the new departure replaces the previous departure. The route is defined by selection of a departure, the transition waypoints, and a runway.

LOADING A DEPARTURE INTO THE ACTIVE FLIGHT PLAN

Loading a departure into the active flight plan using the PROC Key:

1) Press the **PROC** Key. The Procedures Window is displayed.

2) Highlight 'SELECT DEPARTURE'.

3) Press the **ENT** Key. The 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.

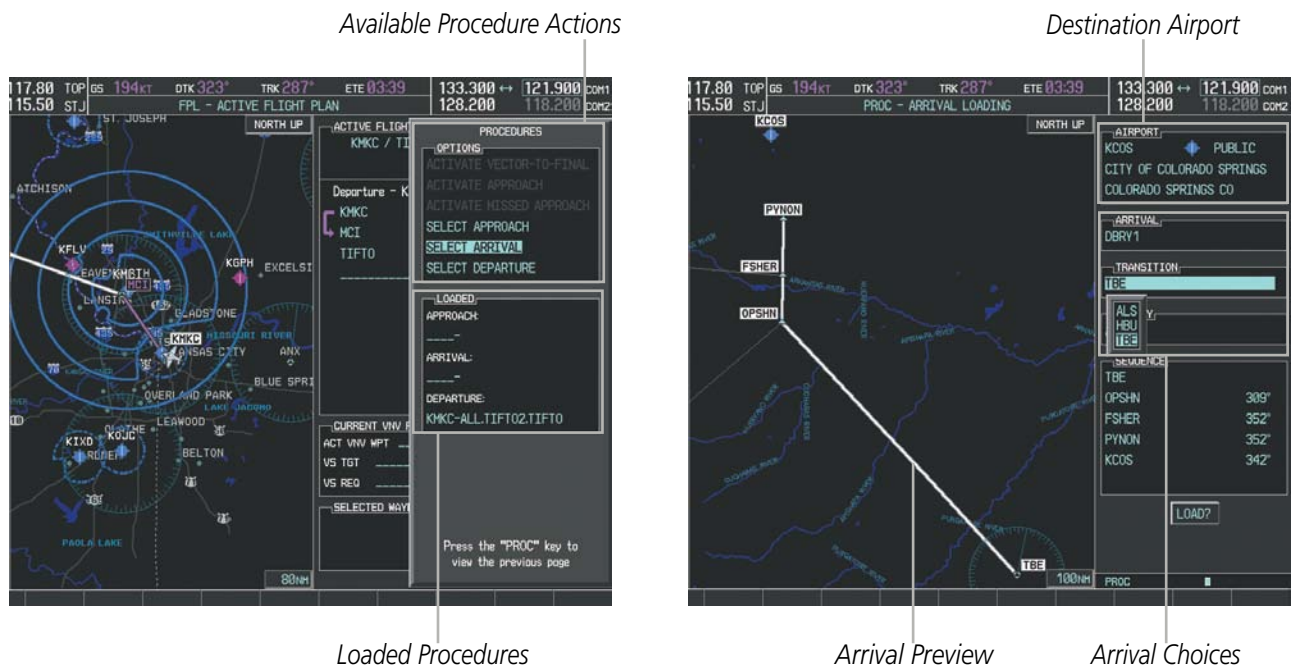8) Press the **ENT** Key to load the departure procedure.

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Departure Airport

Loaded Procedures

Departure Preview

Departure Choices
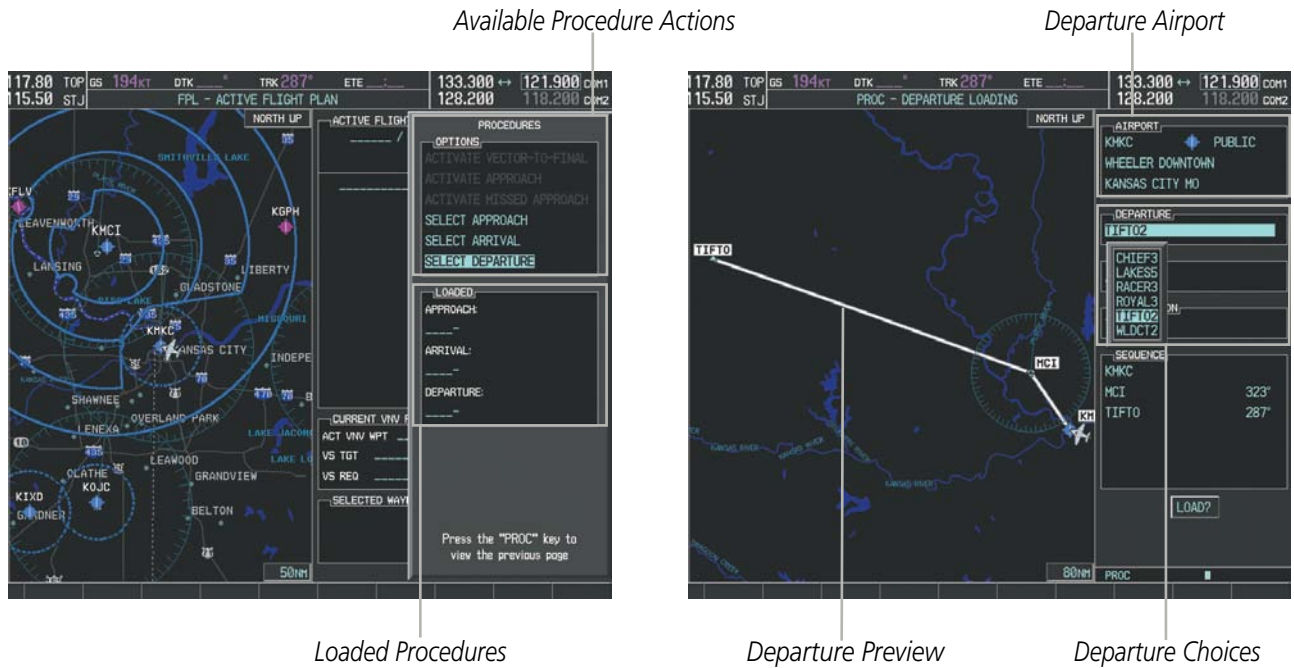
Figure 5-92 Departure Selection

Selected Departure

Loaded Departure

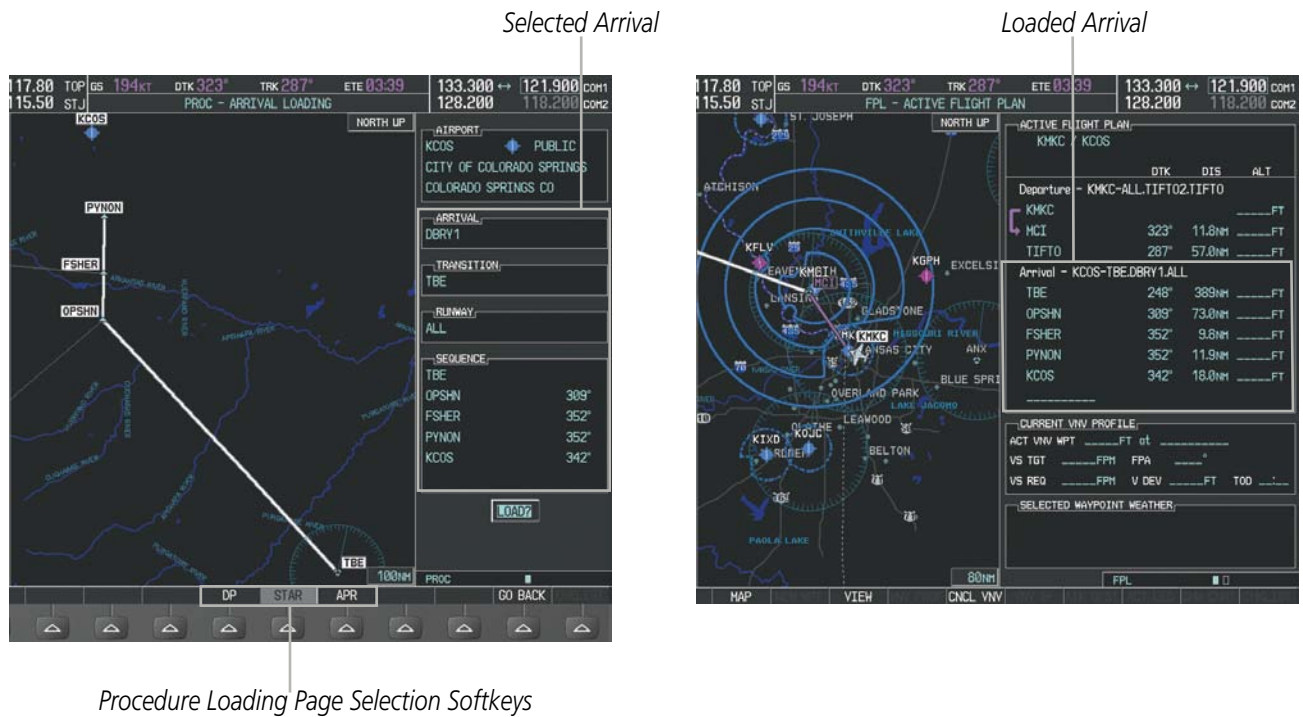*Procedure Loading Page Selection Softkeys*
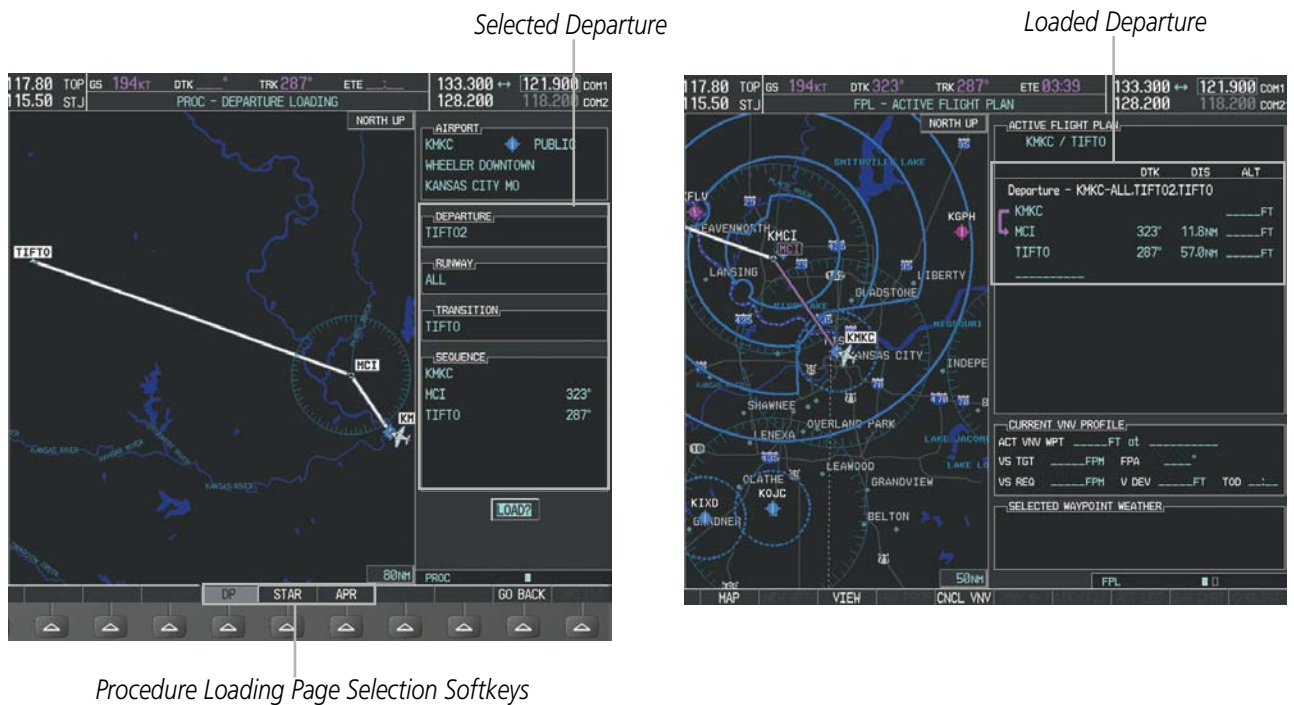
Figure 5-93 Departure Loading

Viewing available departures at an airport:

1) From the Airport Information Page (first page in the WPT group), select the **DP** Softkey. The Departure Information Page is displayed, defaulting to the airport displayed on the Airport information Page.

2) To select another airport, press the **FMS** Knob to activate the cursor, enter an identifier/facility name/city, and press the **ENT** Key.

3) Turn the large **FMS** Knob to highlight the Departure. The departure is previewed on the map.

4) 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.

5) 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.

6) 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.

7) Select the **INFO-x** Softkey to return to the Airport Information Page.

REMOVING A DEPARTURE FROM THE ACTIVE FLIGHT PLAN

When plans change while flying IFR, departures can be easily removed from the Active Flight Plan.

Removing a departure procedure from the active flight plan:

1) Press the **FPL** Key to display the Active Flight Plan Page (MFD) or the Active Flight Plan Window (PFD).

2) Press the **MENU** Key, and highlight 'Remove Departure'.

3) Press the **ENT** Key. A confirmation window is displayed listing the departure procedure.

4) With 'OK' highlighted, press the **ENT** Key. To cancel the removal request, highlight 'CANCEL' and press the **ENT** Key.

Or:

1) Press the **FPL** Key to display the Active Flight Plan Page (MFD) or the Active Flight Plan Window (PFD).

2) Press the **FMS** Knob, and turn to highlight the departure header in the active flight plan.

3) Press the **CLR** Key. A confirmation window is displayed listing the departure procedure.

4) With 'OK' highlighted, press the **ENT** Key. To cancel the removal request, highlight 'CANCEL' and press the **ENT** Key.

5) Press the **FMS** Knob to remove the flashing cursor.

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ARRIVALS

A Standard Terminal Arrival (STAR) can be loaded at any airport that has one available. Only one arrival can be loaded at a time in a flight plan. If an arrival is loaded when another arrival is already in the active flight plan, the new arrival replaces the previous arrival. The route is defined by selection of an arrival, the transition waypoints, and a runway.

LOADING AN ARRIVAL INTO THE ACTIVE FLIGHT PLAN

Loading an arrival into the active flight plan using the PROC Key:

1) Press the **PROC** Key. The Procedures Window is displayed.

2) Highlight 'SELECT ARRIVAL'.

3) Press the **ENT** Key. The 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.

Available Procedure Actions   *Destination Airport*

Loaded Procedures   *Arrival Preview*   *Arrival Choices*

Figure 5-94 Arrival Selection

Selected Arrival   *Loaded Arrival*

Procedure Loading Page Selection Softkeys

Figure 5-95 Arrival Loading

Viewing available arrivals at an airport:

1) From the Airport Information Page (first page in the WPT group), select the **STAR** Softkey. The Arrival Information Page is displayed, defaulting to the airport displayed on the Airport Information Page.

2) To select another airport, press the **FMS** Knob to activate the cursor, enter an identifier/facility name/city, and press the **ENT** Key.

3) Turn the large **FMS** Knob to highlight the Arrival. The arrival is previewed on the map.

4) 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. The arrival is previewed on the map.

5) 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.

6) 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.

7) Select the **INFO-x** Softkey to return to the Airport Information Page.

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REMOVING AN ARRIVAL FROM THE ACTIVE FLIGHT PLAN

When plans change while flying IFR, arrivals can be easily removed from the Active Flight Plan.

Removing an arrival from the active flight plan:

1) Press the **FPL** Key to display the Active Flight Plan Page (MFD) or the Active Flight Plan Window (PFD).

2) Press the **MENU** Key, and highlight 'Remove Arrival'.

3) Press the **ENT** Key. A confirmation window is displayed listing the arrival procedure.

4) With 'OK' highlighted, press the **ENT** Key. To cancel the removal request, highlight 'CANCEL' and press the **ENT** Key.

Or:

1) Press the **FPL** Key to display the Active Flight Plan Page (MFD) or the Active Flight Plan Window (PFD).

2) Press the **FMS** Knob, and turn to highlight the arrival header in the active flight plan.

3) Press the **CLR** Key. A confirmation window is displayed listing the arrival procedure.

4) With 'OK' highlighted, press the **ENT** Key. To cancel the removal request, highlight 'CANCEL' and press the **ENT** Key.

5) Press the **FMS** Knob to remove the flashing cursor.

APPROACHES

> **NOTE:** *If certain GPS parameters (SBAS, RAIM, etc.) are not available, some published approach procedures for the desired airport may not be displayed in the list of available approaches.*

An Approach Procedure (APPR) can be loaded at any airport that has one available, and provides guidance for non-precision and precision approaches to airports with published instrument approach procedures. Only one approach can be loaded at a time in a flight plan. If an approach is loaded when another approach is already in the active flight plan, the new approach replaces the previous approach. The route is defined by selection of an approach and the transition waypoints.

Whenever an approach is selected, the choice to either "load" or "activate" is given. "Loading" adds the approach to the end of the flight plan without immediately using it for navigation guidance. This allows continued navigation via the intermediate waypoints in the original flight plan, but keeps the procedure available on the Active Flight Plan Page for quick activation when needed. "Activating" also adds the procedure to the end of the flight plan but immediately begins to provide guidance to the first waypoint in the approach.

When selecting an approach, a "GPS" designation to the right of the procedure name indicates the procedure can be flown using the GPS receiver. Some procedures do not have this designation, meaning the GPS receiver can be used for supplemental navigation guidance only. If the GPS receiver cannot be used for primary guidance, the appropriate navigation receiver must be used for the selected approach (e.g., VOR or ILS). The final course segment of ILS approaches, for example, must be flown by tuning the NAV receiver to the proper frequency and selecting that NAV receiver on the CDI.

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The G1000 SBAS GPS allows for flying LNAV, LNAV/VNAV, and LPV approaches according to the published chart. LNAV+V is a standard LNAV approach with advisory vertical guidance provided for assistance in maintaining a constant vertical glidepath similar to an ILS glideslope on approach. This guidance is displayed on the G1000 PFD in the same location as the ILS glideslope using a magenta diamond. In all cases where LNAV+V is indicated by the system during an approach, LNAV minima are used. The active approach type is annunciated on the HSI as shown in the following table:
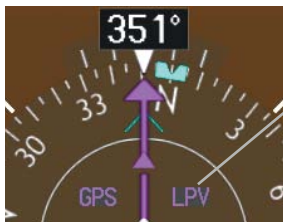
HSI Annunciation	Description	Example on HSI
LNAV	GPS approach using published LNAV minima	
LNAV+V	GPS approach using published LNAV minima. Advisory vertical guidance is provided	
L/VNAV	GPS approach using published LNAV/VNAV minima	
LPV	GPS approach using published LPV minima	

Table 5-9 Approach Types

LOADING AN APPROACH INTO THE ACTIVE FLIGHT PLAN

Loading an approach into the active flight plan using the PROC Key:

1) Press the **PROC** Key. The Procedures Window is displayed.

2) Highlight 'SELECT APPROACH', and press the **ENT** Key. The Approach Loading Page is displayed.

3) Use the **FMS** Knob to select an airport and press the **ENT** Key.

4) Select an approach from the list and press the **ENT** Key.

5) Select a transition (if required) and press the **ENT** Key.

6) Barometric Minimums

   a) To set 'MINIMUMS', turn the small **FMS** Knob to select 'BARO', and press the **ENT** Key. Turn the small **FMS** Knob to select the altitude, and press the **ENT** Key.

   Or:

   b) To skip setting minimums, press the **ENT** Key.

7) Press the **ENT** Key with 'LOAD?' highlighted to load the approach procedure; or turn the large **FMS** Knob to highlight 'ACTIVATE' and press the **ENT** Key to load and activate the approach procedure.

> **NOTE:** When GPS is not approved for the selected final approach course, the message 'NOT APPROVED FOR GPS' is displayed. GPS provides guidance to the approach, but the HSI must to be switched to a NAV receiver to fly the final course of the approach.

Available Procedure Actions *Destination Airport*

Loaded Procedures *Approach Preview* *Approach Choices*
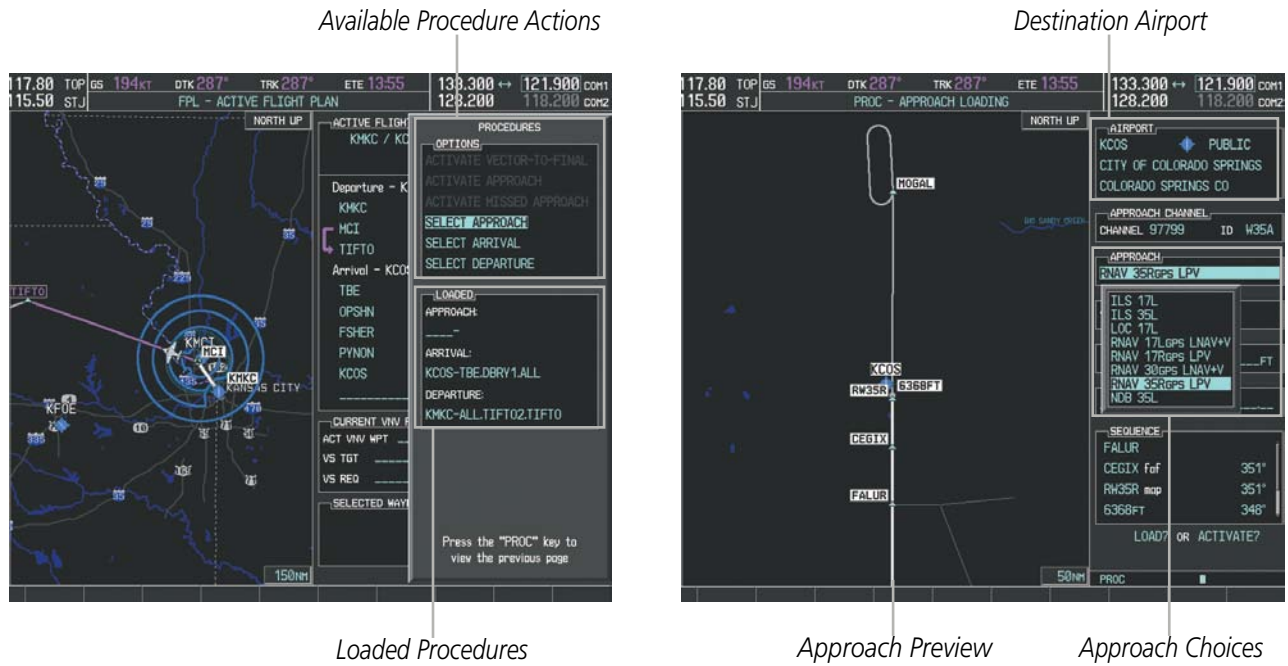
Figure 5-96 Approach Selection

Selected Approach *Loaded Approach*

Procedure Loading Page Selection Softkeys *LOAD or ACTIVATE? Annunciation*

Figure 5-97 Approach Loading

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Viewing available approaches at an airport:

1) From the Airport Information Page (first page in the WPT group), select the **APR** Softkey. The Approach Information Page is displayed, defaulting to the airport displayed on the Airport information Page.

2) To select another airport, press the **FMS** Knob to activate the cursor, enter an identifier/facility name/city, and press the **ENT** Key.

3) Press the **FMS** Knob, then turn the large **FMS** Knob to highlight the Approach. The approach is previewed on the map.

4) Turn the small **FMS** Knob to view the available approaches. Press the **ENT** Key to select the approach. The cursor moves to the Transition box. The approach is previewed on the map.

5) Turn the small **FMS** Knob to view the available transitions. Press the **ENT** Key to select the transition. The cursor moves to the Minimums box. The approach is previewed on the map.

6) Turn the small **FMS** Knob to select BARO minimums on or off. Press the **ENT** Key.

   a) When minimums are selected on, the cursor moves to the minimum altitude field . Use the small FMS Knob to select the altitude. Press the **ENT** Key. The cursor moves to the Sequence box. The approach is previewed on the map.

   Or:

   b) When minimums are selected off, the cursor moves to the Sequence box. The approach is previewed on the map.

7) Press the INFO-x Softkey to return to the Airport Information Page.

Loading an approach into the active flight plan from the Nearest Airport Page:

1) Select the Nearest Airports Page.

2) Press the **FMS** Knob, then turn the large **FMS** Knob to highlight the desired nearest airport. The airport is previewed on the map.

3) 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 Approach Loading Page is displayed with the transitions field highlighted.

6) Turn the **FMS** Knob to highlight the desired transition, and press the **ENT** Key.

7) Barometric Minimums

   a) To set 'MINIMUMS', turn the small **FMS** Knob to select 'BARO', and press the **ENT** Key. Turn the small **FMS** Knob to select the altitude, and press the **ENT** Key. The 'LOAD?' field is highlighted.

   Or:

   b) To skip setting minimums, press the **ENT** Key. The 'LOAD?' field is highlighted.

8) Press the **ENT** Key with 'LOAD?' highlighted to load the approach procedure; or turn the large **FMS** Knob to highlight 'ACTIVATE' and press the **ENT** Key to load and activate the approach procedure. The system continues navigating the current flight plan until the approach is activated. When GPS is not approved for the selected final approach course, the message 'NOT APPROVED FOR GPS' is displayed. GPS provides guidance to the approach, but the HSI must to be switched to a NAV receiver to fly the final course of the approach.

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ACTIVATING AN APPROACH

A previously loaded approach can be activated from the Procedures Window.

Activating a previously loaded approach:

1) Press the **PROC** Key. The Procedures Window is displayed with 'Activate Approach' highlighted.

2) Press the **ENT** Key to activate the approach.

In many cases, it may be easiest to "load" the full approach while still some distance away, enroute to the destination airport. Later, if vectored to final, use the steps above to select 'Activate Vector-To-Final' — which makes the inbound course to the FAF waypoint active.

Activating a previously loaded approach with vectors to final:

1) Press the **PROC** Key to display the Procedures Window.

2) Highlight 'ACTIVATE VECTOR-TO-FINAL' and press the **ENT** Key.

Loading and activating an approach using the MENU Key:

1) From the Approach Loading Page, press the **MENU** Key. The page menu is displayed with 'Load & Activate Approach' highlighted.

2) Press the **ENT** Key. When GPS is not approved for the selected final approach course, the message 'NOT APPROVED FOR GPS' is displayed. GPS provides guidance to the approach, but the HSI must to be switched to a NAV receiver to fly the final course of the approach.

REMOVING AN APPROACH FROM THE ACTIVE FLIGHT PLAN

When plans change while flying IFR, approaches can be easily removed from the Active Flight Plan.

Removing an approach from the active flight plan:

1) Press the **FPL** Key to display the Active Flight Plan Page (MFD) or the Active Flight Plan Window (PFD).

2) Press the **MENU** Key, and highlight 'Remove Approach'.

3) Press the **ENT** Key. A confirmation window is displayed listing the approach procedure.

4) With 'OK' highlighted, press the **ENT** Key. To cancel the removal, highlight 'CANCEL' and press the **ENT** Key.

    Or:

1) Press the **FPL** Key to display the Active Flight Plan Page (MFD) or the Active Flight Plan Window (PFD).

2) Press the **FMS** Knob, and turn to highlight the approach header in the active flight plan.

3) Press the **CLR** Key. A confirmation window is displayed listing the approach procedure.

4) With 'OK' highlighted, press the **ENT** Key. To cancel the removal, highlight 'CANCEL' and press the **ENT** Key.

5) Press the **FMS** Knob to remove the flashing cursor.

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MISSED APPROACH

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.
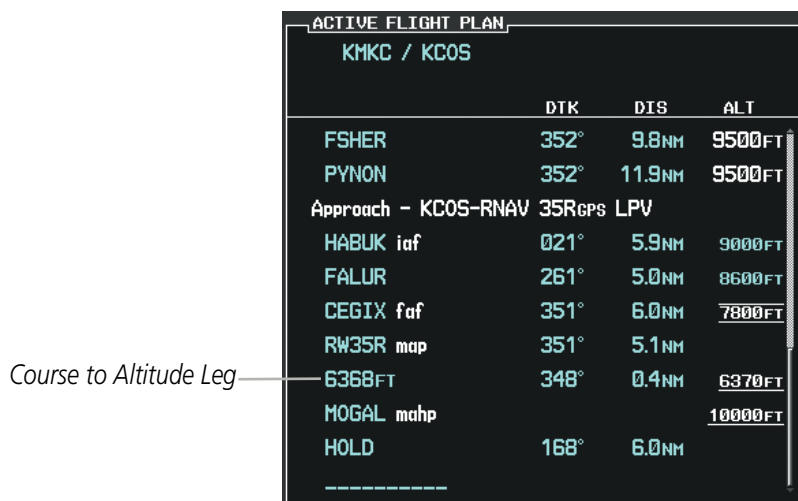
Or:

1) Press the **PROC** Key.

2) Turn the **FMS** Knob to highlight 'ACTIVATE MISSED APPROACH'.

3) Press the **ENT** Key. The aircraft automatically sequences to the MAHP.

COURSE TO ALTITUDE

In this missed approach procedure, the altitude immediately following the MAP (in this case '6368ft') is not part of the published procedure. It is simply a Course to Altitude (CA) leg which guides the aircraft along the runway centerline until the altitude required to safely make the first turn toward the MAHP is exceeded. This altitude is provided by Jeppesen, and may be below, equal to, or above the published minimums for this approach. In this case, if the aircraft altitude is below the specified altitude (6,368 feet) after crossing the MAP, a direct-to is established to provide a course on runway heading until an altitude of 6,368 feet is reached. After reaching 6,368 feet, a direct-to is established to the published MAHP (in this case MOGAL). If the aircraft altitude is above the specified altitude after crossing the MAP, a direct-to is established to the published fix (MOGAL) to begin the missed approach procedure.

In some missed approach procedures this Course to Altitude leg may be part of the published procedure. For example, a procedure may dictate a climb to 5,500 feet, then turn left and proceed to the Missed Approach Hold Point (MAHP). In this case, the altitude would appear in the list of waypoints as '5500ft'. Again, if the aircraft altitude is lower than the prescribed altitude, a direct-to is established on a Course to Altitude leg when the missed approach procedure is activated.

Course to Altitude Leg ———

ACTIVE FLIGHT PLAN			
KMKC / KCOS			
	DTK	DIS	ALT
FSHER	352°	9.8NM	9500FT
PYNON	352°	11.9NM	9500FT
Approach – KCOS-RNAV 35RGPS LPV			
HABUK iaf	021°	5.9NM	9000FT
FALUR	261°	5.0NM	8600FT
CEGIX faf	351°	6.0NM	7800FT
RW35R map	351°	5.1NM	
6368FT	348°	0.4NM	6370FT
MOGAL mahp			10000FT
HOLD	168°	6.0NM	

Figure 5-98 Course to Altitude

5.9 TRIP PLANNING

The G1000 allows the pilot to view trip planning information, fuel information, and other information for a specified flight plan or flight plan leg based on automatic data, or based on manually entered data. Weight planning is also available, based on manually entered fuel data and the active flight plan (to estimate remaining fuel).

TRIP PLANNING

All of the input of data needed for calculation and viewing of the statistics is done on the Trip Planning Page located in the AUX Page Group.
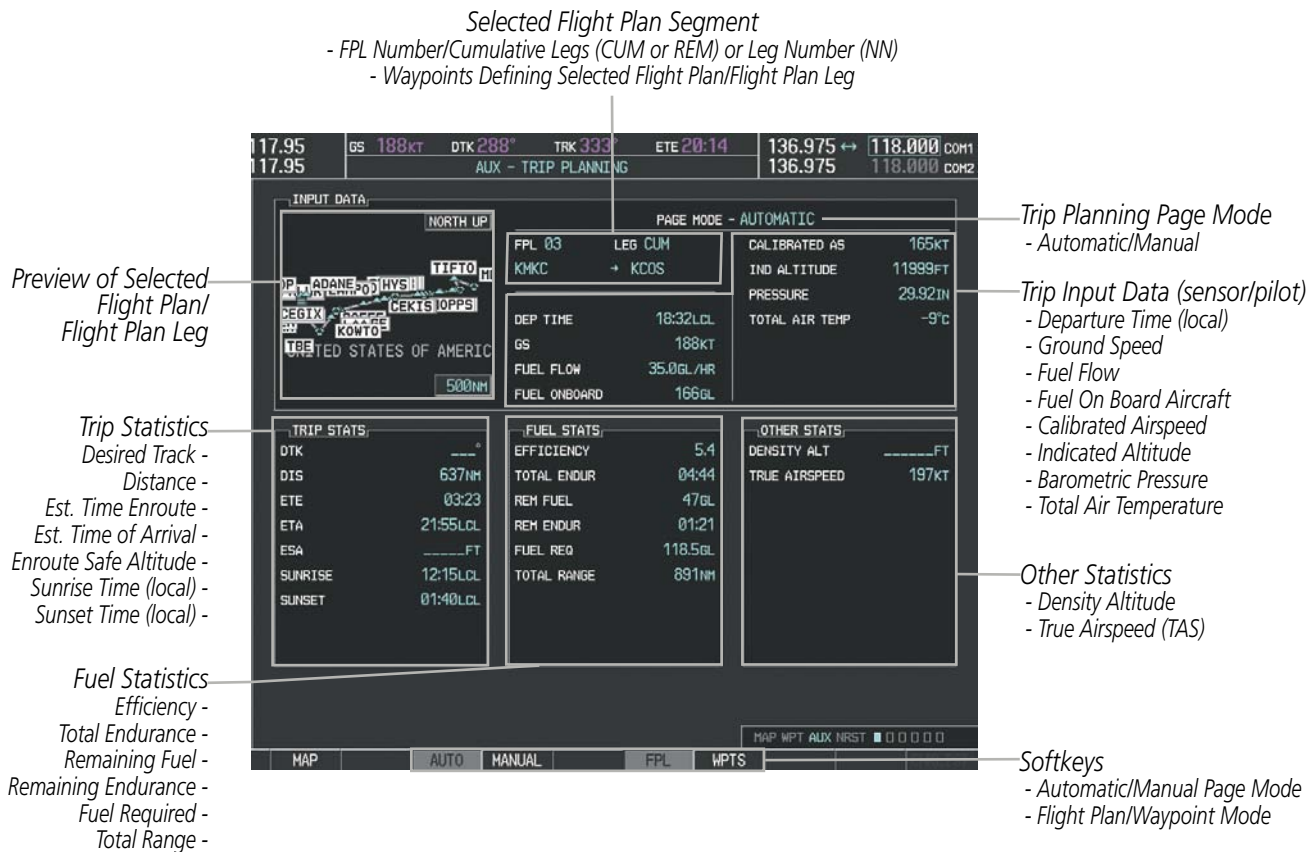
Figure 5-99 Trip Planning Page

The trip planning inputs are based on sensor inputs (automatic page mode) or on pilot inputs (manual page mode). Some additional explanation of the sources for some of the inputs is as follows:

- Departure time (DEP 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 (CALIBRATED AS) - The primary source is from the air data system, and the secondary source of information is GPS ground speed.

- Indicated altitude (IND ALTITUDE) - The primary source is the barometric altitude, and the secondary source of information is GPS altitude.

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TRIP STATISTICS

The trip statistics are calculated based on the selected starting and ending waypoints and the trip planning inputs.

In flight plan mode (FPL) with a stored flight plan selected (NN), and the entire flight plan (CUM) selected, the waypoints are the starting and ending waypoints of the selected flight plan.

In flight plan mode (FPL) with a stored flight plan selected (NN), and a specific leg (NN) selected, the waypoints are the endpoints of the selected leg.

In flight plan mode (FPL) with the active flight plan selected (00), and the remaining flight plan (REM) selected, the 'from' waypoint is the present position of the aircraft and the 'to' waypoint is the endpoint of the active flight plan.

In flight plan mode (FPL) with the active flight plan selected (00), and a specific leg (NN) selected, the 'from' waypoint is the current aircraft position and the 'to' waypoint is the endpoint of the selected leg.

In waypoint (WPTS) mode these are manually selected waypoints (if there is an active flight plan, these default to the endpoints of the active leg).

Some of the calculated trip statistics are dashed when the selected leg of the active flight plan has already been flown.

- Desired Track (DTK) - DTK is shown as nnn° and is the desired track between the selected waypoints. It is dashed unless only a single leg is selected.

- Distance (DIS) - The distance is shown in tenths of units up to 99.9, and in whole units up to 9999.

- Estimated time enroute (ETE) - ETE is shown as hours:minutes until less than an hour, then it is shown as minutes:seconds.

- Estimated time of arrival (ETA) -   ETA is shown as hours:minutes 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 and are the local time at the destination.

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FUEL STATISTICS

The fuel statistics are calculated based on the selected starting and ending waypoints and the trip planning inputs. Some of the calculated trip statistics are dashed when the selected leg of the active flight plan has already been flown.

- Fuel efficiency (EFFICIENCY) - This value is calculated by dividing the current ground speed by the current fuel flow.

- Time of fuel endurance (TOTAL ENDUR) - This time is shown as hours:minutes. This value is obtained by dividing the amount of fuel on board by the current fuel flow.

- Fuel on board upon reaching end of selected leg (REM FUEL) - This value is calculated by taking the amount of fuel onboard and subtracting the fuel required to reach the end of the selected leg.

- Fuel endurance remaining at end of selected leg (REM ENDUR) - This value is calculated by taking the time of fuel endurance and subtracting the estimated time enroute to the end of the selected leg.

- Fuel required for trip (FUEL REQ) - This value is calculated by multiplying the time to go by the fuel flow.

- Total range at entered fuel flow (TOTAL RANGE) - This value is calculated by multiplying the time of fuel endurance by the ground speed.

OTHER STATISTICS

These statistics are calculated based on the system sensor inputs or the manual trip planning inputs.

- Density altitude (DENSITY ALT)
- True airspeed (TRUE AIRSPEED)

The pilot may select automatic (AUTO) or manual (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).

Selected Flight Plan NN -
00 is Active FPL
01-99 are Stored FPLs

FPL 03   LEG CUM

KMKC   → KCOS

Starting and Ending Waypoint of
Selected Flight Plan Segment

Selected Leg(s)
Stored Flight Plan
- CUM: Beginning to End of FPL
- NN: Beginning to End of Selected Leg
Active Flight Plan
- REM: Pres. Pos. to End of FPL
- NN: Pres. Pos. to End of Selected Leg
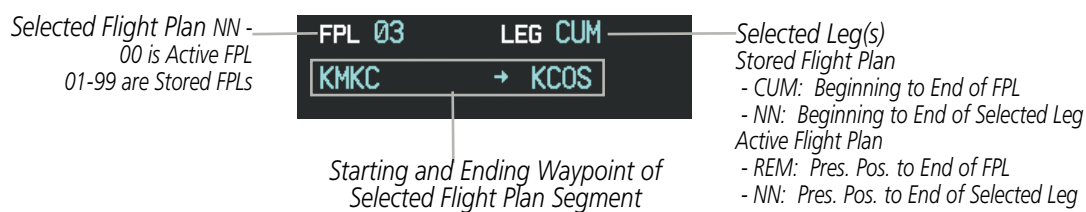
Figure 5-100 Trip Planning Page - Flight Plan Mode

Selected Flight Plan
Not Available

FPL 05   LEG CUM

TOP   → HYS

Selected Leg(s)
Not Available

Selected Starting and Ending Waypoints
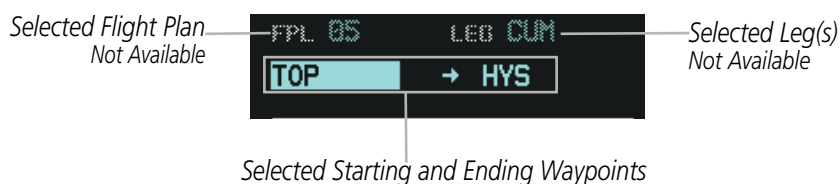
Figure 5-101 Trip Planning Page - Waypoint Mode

Selecting automatic or manual page mode:

Select 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:

Select 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) Press the **FMS** Knob to activate the cursor in the flight plan number 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 Inset Map also displays the selected data.

Selecting waypoints for waypoint mode:

1) Select 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 'Set WPT to Present Position' if that is what is desired), and press the **ENT** Key. The cursor moves to the second waypoint field.

3) Turn the **FMS** knobs to select the desired waypoint, and press the **ENT** Key. The statistics for the selected leg are displayed.

In manual page mode, the other eight trip input data fields must be entered by the pilot, in addition to flight plan and leg selection.

Entering manual data for trip statistics calculations:

1) Select the **MANUAL** Softkey or select 'Manual Mode' from the Page Menu, and press the **ENT** Key. The cursor may now be positioned in any field in the top right two boxes.

2) Turn the **FMS** Knobs to move the cursor onto the DEP 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.

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5.10 RAIM PREDICTION

RAIM (Receiver Autonomous Integrity Monitoring) is a GPS receiver function that performs a consistency check on all tracked satellites. RAIM ensures that the available satellite geometry allows the receiver to calculate a position within a specified RAIM protection limit (2.0 nm for oceanic, 2.0 nm for 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. RAIM prediction must be initiated manually if there is concern over SBAS coverage at the destination or some other reason that compromises navigation precision. If RAIM is not predicted to be available for the final approach course, the approach does not become active. If RAIM is not available when crossing the FAF, the missed approach procedure must be flown.

RAIM PREDICTION Box
- Prediction Waypoint
- Arrival Time
- Arrival Date
- RAIM Status

RAIM *Softkey*
(displays RAIM PREDICTION)

SBAS *Softkey*
(displays SBAS Selection)
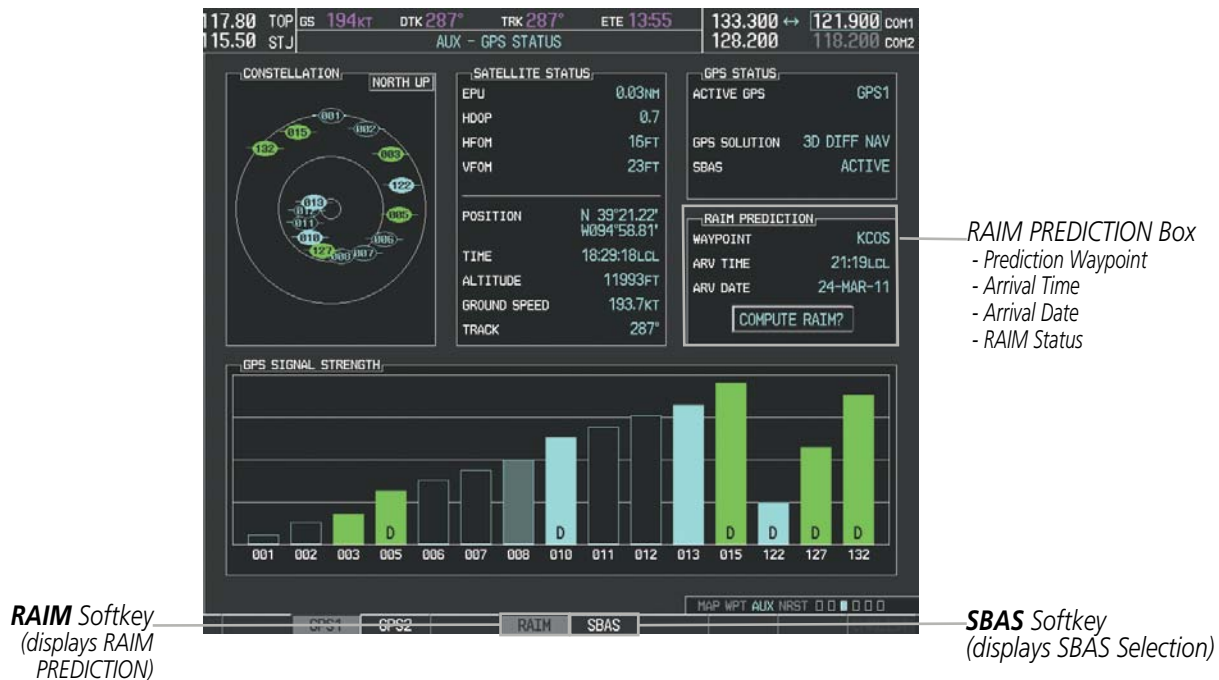
Figure 5-102 RAIM Prediction

Predicting RAIM availability at a selected waypoint:

1) Select the AUX-GPS Status Page.

2) Press the **FMS** Knob. The RAIM Prediction 'WAYPOINT' field is highlighted.

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 departure waypoint; or select a waypoint from the submenu of waypoints and press the **ENT** Key to accept the waypoint entry.

5) Turn the FMS Knobs to enter an arrival time and press the **ENT** Key.

6) Turn the FMS Knobs to enter an arrival date and press the **ENT** Key.

7) Press the **ENT** Key with 'COMPUTE RAIM?' highlighted to begin the computation.

Predicting RAIM availability at the aircraft present position:

1) Select the AUX-GPS Status Page.

2) Press the **FMS** Knob. The RAIM Prediction 'WAYPOINT' field is highlighted.

3) Press the **MENU** Key, highlight 'Set WPT to Present Position', and press the **ENT** Key.

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

5) Turn the FMS Knobs to enter an arrival time and press the **ENT** Key.

6) Turn the FMS Knobs to enter an arrival date and press the **ENT** Key.

7) Press the **ENT** Key with 'COMPUTE RAIM?' highlighted to begin the computation.

Status of the RAIM computation for the selected waypoint, time, and date is displayed at the bottom of the RAIM PREDICTION Box as follows:

• 'COMPUTE RAIM?' - RAIM has not been computed.

• 'COMPUTING AVAILABILITY' - RAIM calculation is in progress.

• 'RAIM AVAILABLE' - RAIM is predicted to be available.

• 'RAIM NOT AVAILABLE' - RAIM is predicted to be unavailable.

The Satellite Based Augmentation System (SBAS) provides increased navigation accuracy when available. SBAS can be enabled or disabled manually on the GPS Status Page.

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SBAS Status

SBAS SELECTION Box
- EGNOS Enable/Disable
- MSAS Enable/Disable
- WAAS Enable/Disable

RAIM Softkey
(displays RAIM PREDICTION)

SBAS Softkey
(displays SBAS Selection)
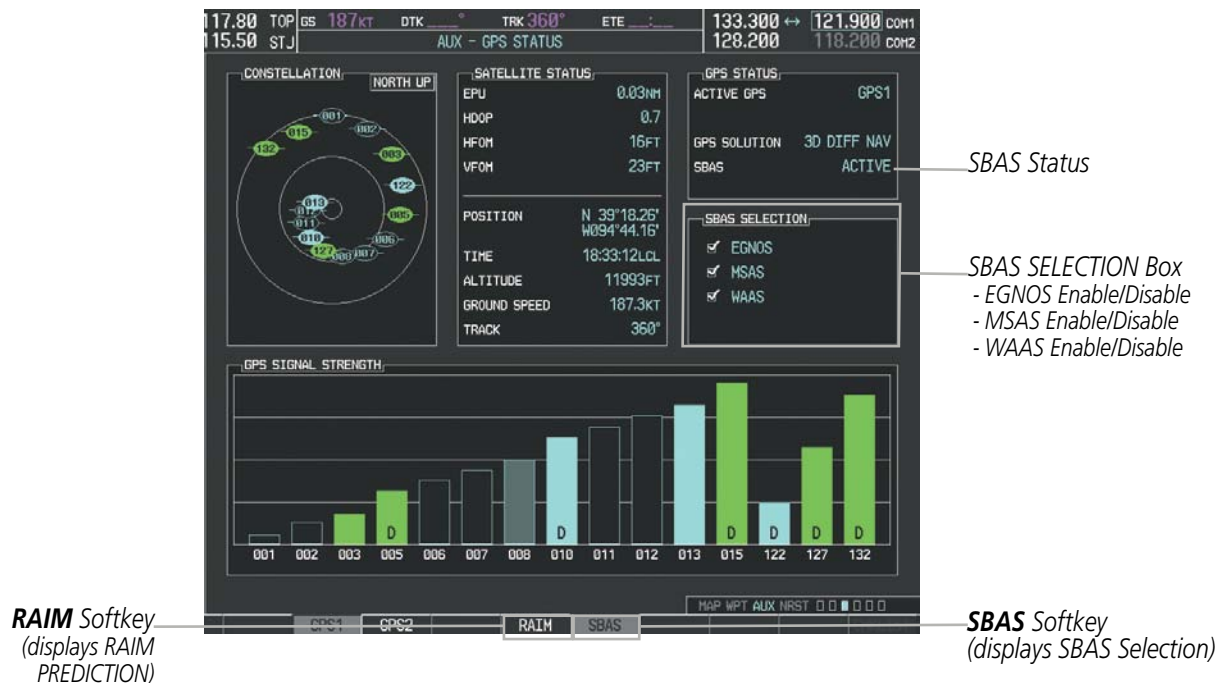
Figure 5-103 SBAS Display - Active

Enabling/Disabling SBAS:

1) Select the AUX-GPS Status Page.

2) Press the **SBAS** Softkey.

3) Press the **FMS** Knob, and turn the large FMS Knob to highlight 'EGNOS', 'MSAS' or 'WAAS'.

4) Press the **ENT** Key to disable SBAS. Press the **ENT** Key again to enable SBAS.

SBAS Status

SBAS SELECTION Box
- EGNOS Enable/Disable
- MSAS Enable/Disable
- WAAS Enable/Disable

RAIM Softkey
(displays RAIM PREDICTION)

SBAS Softkey
(displays SBAS Selection)

Figure 5-104 SBAS Display - Disabled

5.11 NAVIGATING A FLIGHT PLAN

The following discussion is an example of navigating a flight plan with the SBAS capable GPS system while the G1000 provides vertical guidance through descents. A lateral flight plan (LNAV) would be navigated in much the same way, but would not include vertical guidance when the final approach course is active.

NOTE: *The following example flight plan is for instructional purposes only. All database information depicted should be considered not current.*

The example is a flight plan from KMKC to KCOS filed using the TIFTO2 departure, various Victor Airways, and the DBRY1 arrival with the transition at TBE. The flight plan includes an enroute altitude of 12,000 feet, an LPV (WAAS) approach selected for runway 35R, and a missed approach executed at the Missed Approach Point (MAP). A few enroute changes are demonstrated.

1) Prior to departure, the TIFTO2 departure, the airways, and the DBRY1 arrival at KCOS are loaded. See the Procedures section for loading departures and arrivals. Note the magenta arrow in Figure 5-105 indicating the active departure leg.

   After takeoff, ATC assigns a heading of 240º.

2) Figure 5-105 shows the aircraft on the assigned heading of 240º. 'TERM' (Terminal) is the current CDI flight phase displayed on the HSI indicating 1.0 nm CDI scaling.
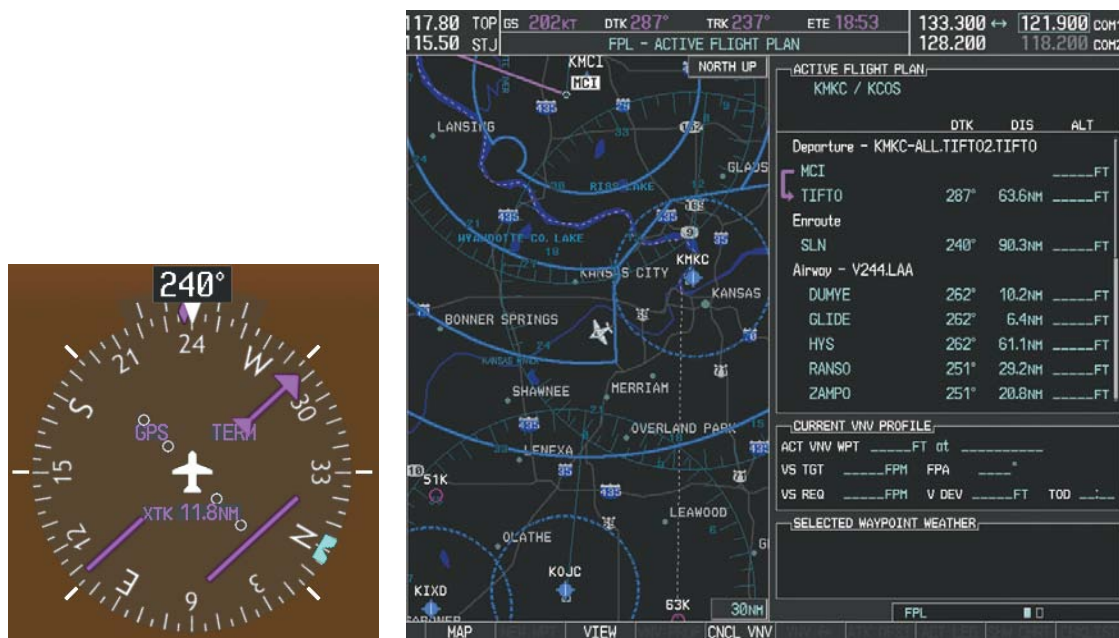
Figure 5-105 Assigned Heading of 240º

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3) ATC now assigns routing to join V4. A heading of 290º is assigned to intercept V4.   The aircraft turns to heading 290° as seen in Figure 5-106.
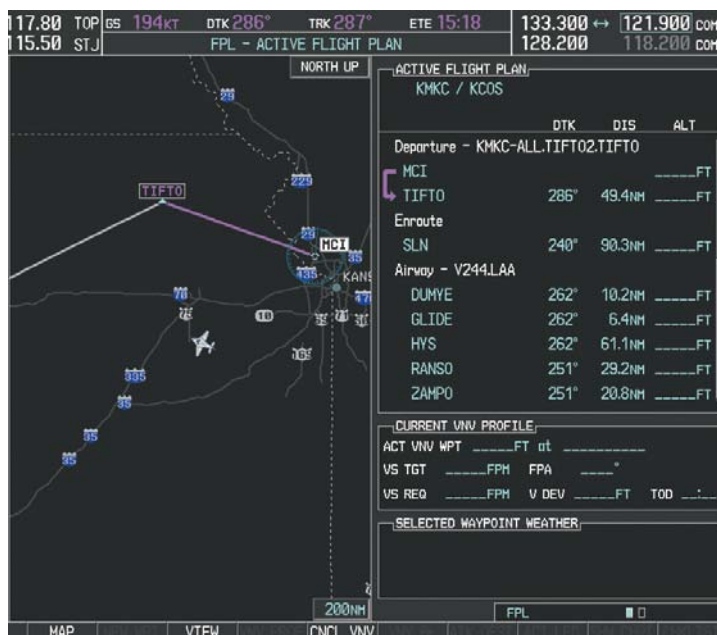
Figure 5-106 Assigned Heading of 290º

4) Enter V4 into the flight plan.

  a) Press the **FMS** Knob to activate the cursor.

b) The desired entry point for V4 (TOP) must be entered. Turn the large **FMS** Knob to highlight the desired flight plan insertion point (SLN) as shown in Figure 5-107. When the V4 entry point (TOP) is inserted, it is placed immediately above the highlighted waypoint (SLN).

Figure 5-107 Begin Adding V4 to the Flight Plan

c) Turn the small **FMS** Knob to display the Waypoint Information Window. Enter the desired entry point for V4, Topeka VOR (TOP), as shown in Figure 5-108.

Figure 5-108 Entering V4 Entry Point

d) Press the **ENT** Key. TOP is inserted into the flight plan as in Figure 5-109.
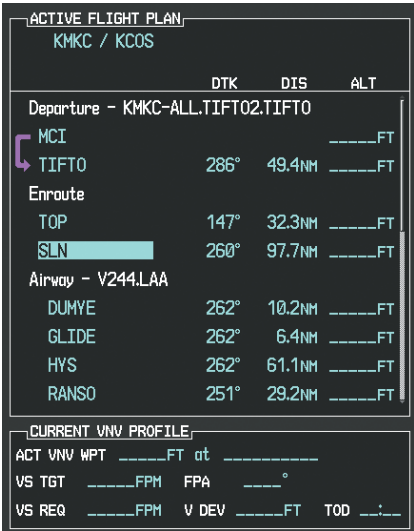
Figure 5-109 TOP Inserted into the Flight Plan

e) With SLN still highlighted as in Figure 5-109, turn the small **FMS** Knob clockwise. The Waypoint Information Page is displayed and the **LD AIRWY** Softkey is now available.

f) Select the **LD AIRWY** Softkey to display the list of available airways for TOP as seen in Figure 5-110.

Figure 5-110 List of Available Airways for TOP

g) Turn either **FMS** Knob to highlight V4 in the list as seen in Figure 5-110.

h) Press the **ENT** Key. The list of available exits for V4 is now displayed as in Figure 5-111.

Figure 5-111 List of Available Exits for V4

i) If necessary, turn either **FMS** Knob to select the desired exit. In this case Salina VOR (SLN) is selected as in Figure 5-111.

j) Press the **ENT** Key. The selected airway and exit are displayed, and the prompt "LOAD?" highlighted as in Figure 5-112.
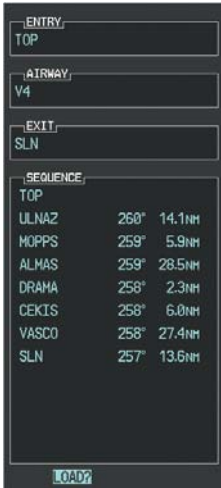
Figure 5-112 Ready to Load V4

k) Press the **ENT** Key.

l) V4 is now loaded into the flight plan as shown in Figure 5-113.
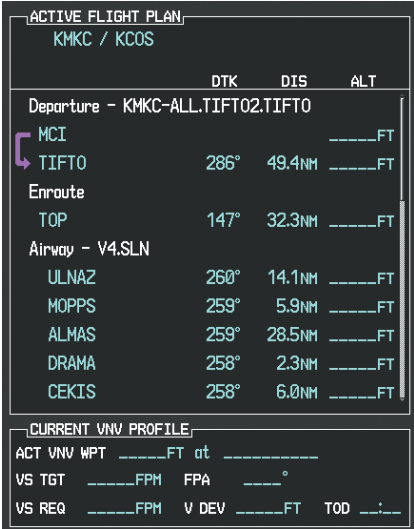
Figure 5-113 V4 is Loaded in the Flight Plan

5) Making V4 the active leg of the flight plan.

a) Press the **FMS** Knob to activate the cursor.

b) Turn the large **FMS** Knob to highlight SLN. The TO waypoint of the leg is selected in order to activate the leg.

c) Select the **ACT LEG** Softkey. The confirmation window is now displayed as in Figure 5-114. Note the TOP to SLN leg is actually part of V4.
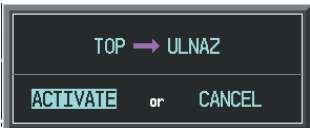
Figure 5-114 Comfirm Active Leg

d) Verify the displayed leg is the desired leg and press the **ENT** Key. Note in Figure 5-115, the magenta arrow in the flight plan window and magenta line on the map indicating V4 is now the active flight plan leg. Note the phase of flight remained in Terminal (TERM) mode up to this point because a departure leg was active. Since a leg after the departure is now active, the current CDI flight phase is ENR (Enroute) and CDI scaling has changed to 2.0 nm.
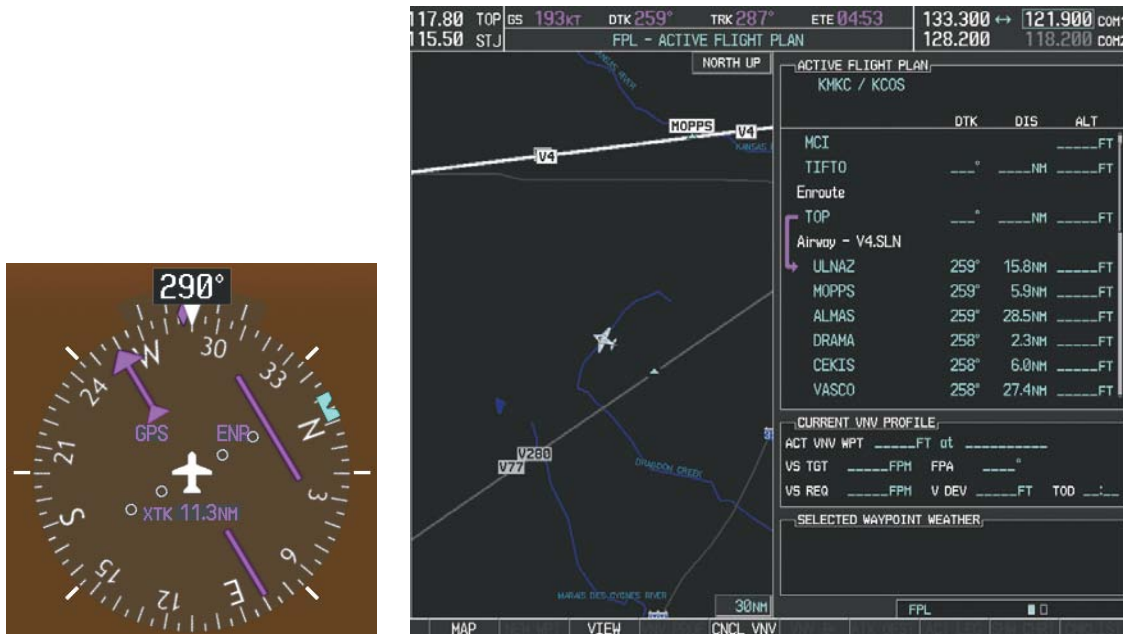
Figure 5-115 V4 Now Active Leg

6) The aircraft continues on heading 290º. When crosstrack distance is less than 2.0 nm, the XTK disappears from the HSI and the CDI is positioned on the last dot indicating a 2.0 nm distance from the centerline of the next course.

7) As the CDI approaches center, the aircraft turns onto the active leg as seen in Figure 5-116.

Figure 5-116 Turn on to Active Leg

8) At SLN, Victor Airway 244 (V244) is intercepted. Turn prompts are displayed in the PFD Navigation Status Box as seen in Figure 5-117.
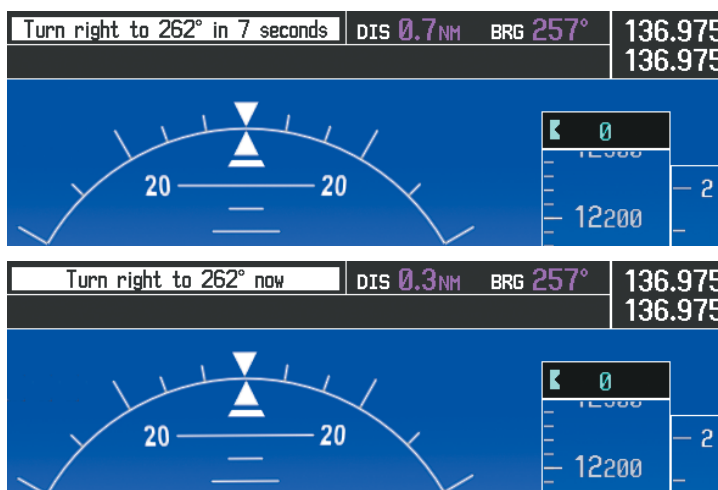
Figure 5-117 Turn to Intercept V244

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9) As seen in Figure 5-118, V244 is now the active flight plan leg.

Figure 5-118 V244 Now Active Leg

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10) At Lamar VOR (LAA) V263 is intercepted. See Figure 5-119.

Figure 5-118 HYS to LAA Leg Active

11) ATC grants clearance to proceed direct to the OPSHN intersection to begin the arrival procedure. ATC advises to expect an altitude of 10,000 feet at OPSHN.

  a) Press the **FMS** Knob to activate the cursor.

  b) Turn the large **FMS** Knob to select OPSHN in the flight plan list.

  c) Press the **Direct-to** ( ) Key. The Direct-to Window is now displayed as shown in Figure 5-120.
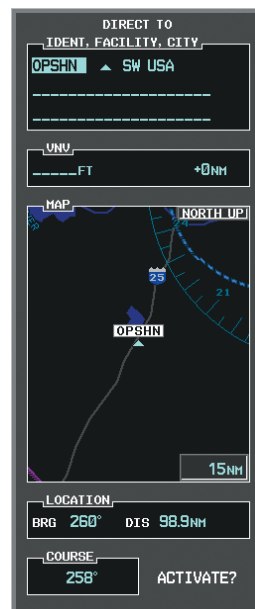
Figure 5-120 Direct To OPSHN

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d) Turn the large **FMS** Knob to place the cursor in the VNV altitude field as shown in Figure 5-121.
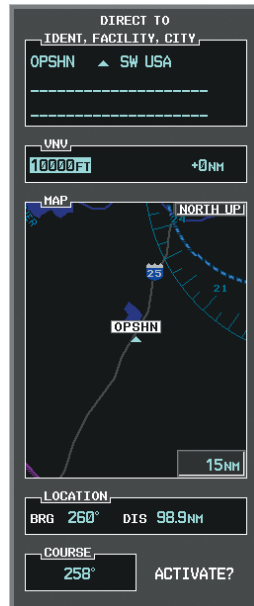
Figure 5-121 Enter VNV Altitude

e) An altitude of 10,000 feet is entered as requested by ATC.

f) Press the **ENT** Key. The cursor is now displayed in the VNV offset field as shown in Figure 5-122.
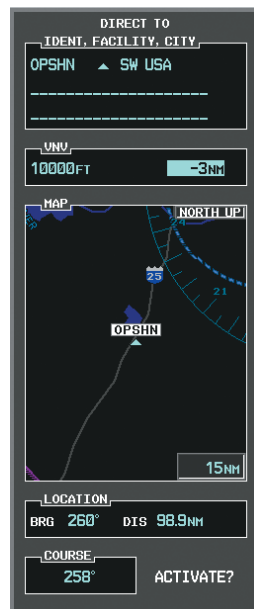
Figure 5-122 Enter VNV Offset Distance

g) Enter the offset, or distance from the waypoint at which to reach the selected altitude. In this case, three miles prior to OPSHN is entered. In other words, the G1000 gives vertical guidance so the aircraft arrives at an altitude of 10,000 feet three miles prior to OPSHN.

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h) Press the **ENT** Key twice to activate the direct-to. Note, in Figure 5-123, the magenta arrow indicating the direct-to OPSHN after the offset waypoint for OPSHN. The preceding offset waypoint indicates the offset distance and altitude that were previously entered. The remaining waypoints in the loaded arrival procedure have no database specified altitudes, therefore, dashes are displayed. Keep the CDI centered and maintain a track along the magenta line to OPSHN.

Note the Direct-to waypoint is within the loaded arrival procedure, therefore, phase of flight scaling for the CDI changes to Terminal Mode and is annunciated by displaying 'TERM' on the HSI.

> **NOTE:** *If the loaded arrival procedure has waypoints with altitude constraints retrieved from the database to be used as is, the altitude must be manually accepted by placing the cursor over the desired altitude, then pressing the ENT Key. The altitude is now displayed as light blue meaning it is used by the system to determine vertical speed and deviation guidance.*

Figure 5-123 Direct-to Active

12) The aircraft is proceeding to OPSHN. The expected approach is the RNAV LPV approach to runway 35R, so it is selected.

a) Press the **PROC** Key to display the Procedures Window.

b) 'SELECT APPROACH' should be highlighted as shown in Figure 5-124.

Figure 5-124 Procedures Window

c) Press the **ENT** Key. A list of available approaches for the destination airport is displayed as in Figure 5-125.

Figure 5-125 List of Available Approaches

d) Turn either **FMS** Knob to select the LPV approach for 35R as shown in Figure 5-125.

GARMIN.

e) Press the **ENT** Key. A list of available transitions for the selected approach is displayed as in Figure 5-126.

Figure 5-126 List of Available Transitions

f) Turn either **FMS** Knob to select the desired transition. In this case, the Initial Approach Fix (IAF) at HABUK is used.

g) Press the **ENT** Key.

h) Barometric Minimums

To set 'MINIMUMS', turn the small **FMS** Knob to select 'BARO', and press the **ENT** Key. Turn the small **FMS** Knob to select the altitude, and press the **ENT** Key.

Or:

To skip setting minimums, press the **ENT** Key.
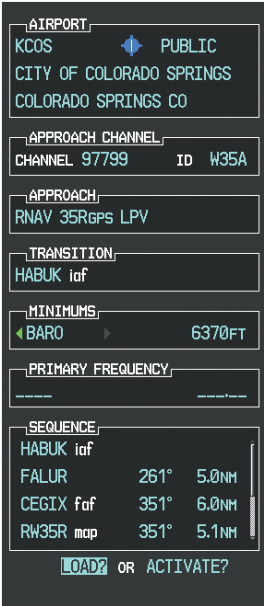
Figure 5-127 Barometric Minimums Set

i) With 'LOAD?' highlighted, again press the **ENT** Key. The selected approach is added to the flight plan as seen in Figure 5-128.
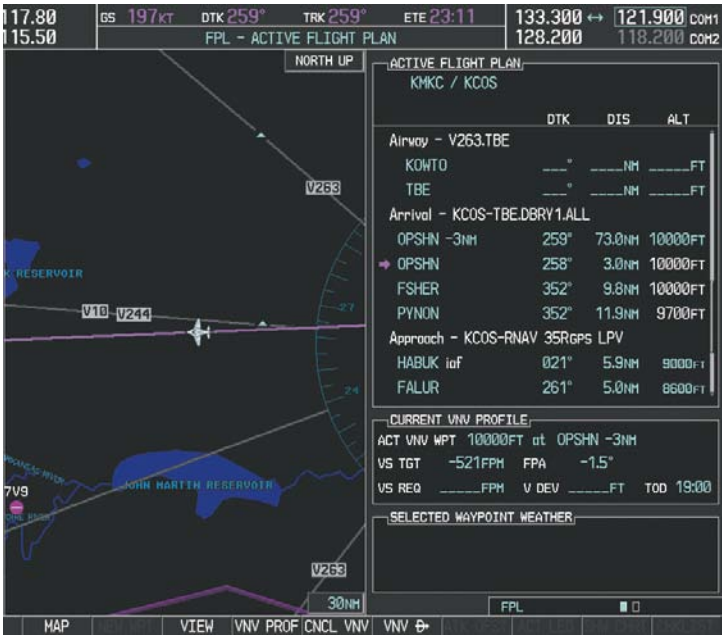
Figure 5-128 Loaded Approach

13) Note the altitude constraints associated with each of the approach waypoints as seen in Figure 5-129. These altitudes are loaded from the database and are displayed as light blue text, indicating these values are "designated" for use in computing vertical deviation guidance.

Note: To no longer use the displayed altitude for calculating vertical deviation guidance, perform the following:

  a) Press the **FMS** Knob to activate the cursor.

  b) Turn the small **FMS** Knob to highlight the desired altitude.

  c) Press the **CLR** Key.

  d) Press the **FMS** Knob to deactivate the cursor.

  After making the altitude "non-designated", it is displayed as white text.

Altitude constraint values associated with the Final Approach Fix (FAF) and waypoints beyond the FAF cannot be designated for vertical guidance. These altitude values are always displayed as white text, as in Figure 5-129. Vertical guidance from the FAF and on to the Missed Approach Point (MAP) is given using the WAAS GPS altitude source, therefore, the displayed altitude values are for reference only.

Figure 5-129 Vertical Guidance is Active to the FAF

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14) As the aircraft approaches OPSHN, it may be desirable to adjust the speed, or steepness of the upcoming descent. The default Flight Path Angle (FPA) is -3.0 degrees and a required vertical speed is computed to maintain the -3.0 FPA. To change the vertical flight path, perform the following steps.

a) Select the **VNV PROF** Softkey to place the cursor in the target vertical speed field (VS TGT) as shown in Figure 5-130.

b) At this point, the descent vertical speed can be selected, or the FPA can be selected. Turn the large **FMS** Knob to select the desired selection field, then turn the small **FMS** Knob to enter the desired value.

Note the information now displayed in the 'CURRENT VNV PROFILE' box. Also, note the offset waypoint (orange box) and gray circle are now displayed on the map. The gray circle marks the Top of Descent (TOD). In this example, vertical guidance is provided at the TOD that results in a -3.0 degree FPA descent to an altitude of 10,000 feet upon reaching the offset waypoint.
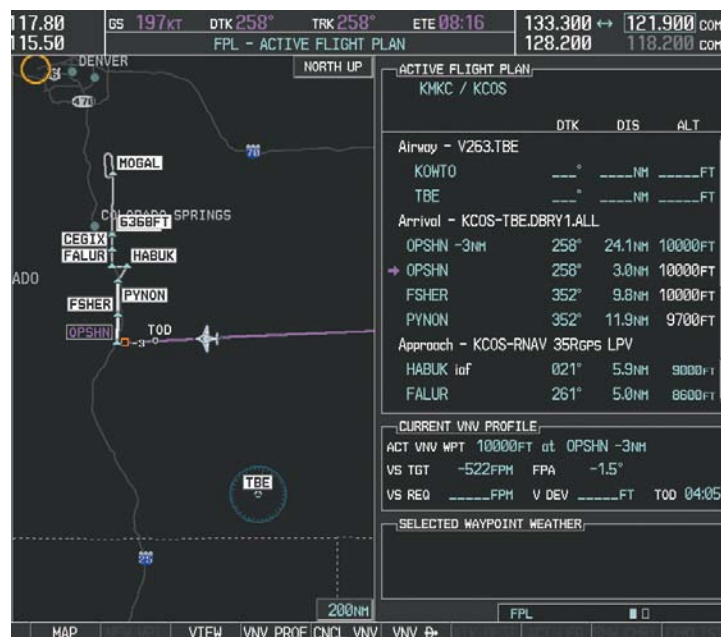
Figure 5-130 Adjusting the Descent

c) Press the **ENT** Key.

15) As seen in Figure 5-131, the aircraft is approaching TOD. Note the target vertical speed required to reach the selected altitude. The Vertical Deviation Indicator (VDI) and the Required Vertical Speed Indicator (RVSI) are now displayed on the PFD as shown in Figure 5-132. When the aircraft is within one minute of the TOD, it is annunciated as shown in Figure 5-132, and an aural alert 'Vertical track' will be heard.
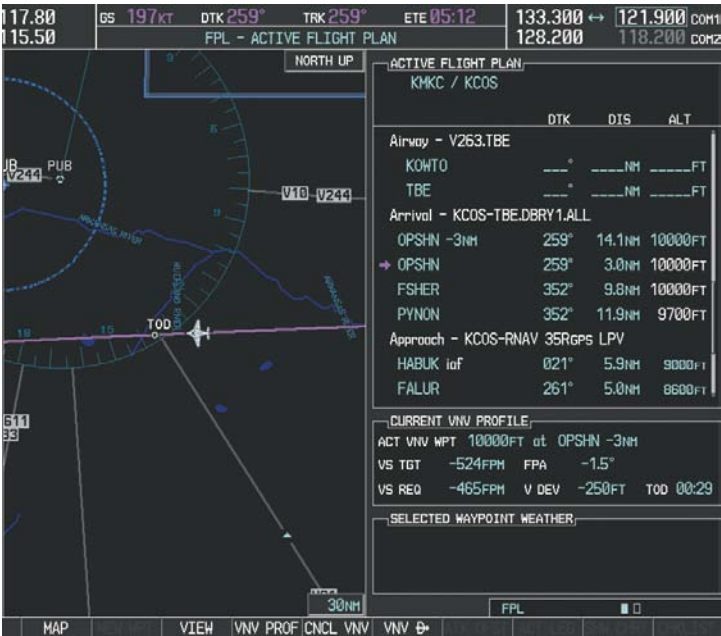
Figure 5-131 Approaching Top of Descent (TOD)
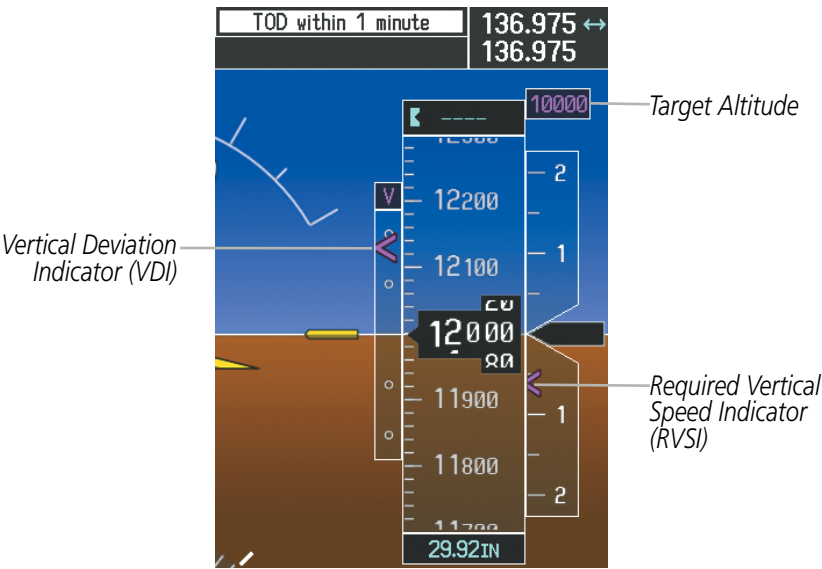
Figure 5-132 VDI & RVSI Upon Reaching Top of Descent (TOD)

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16) Upon reaching TOD, a descent vertical speed is established by placing the VSI pointer in line with the RVSI as shown in Figure 5-133.

Keep Vertical Deviation Indicator Centered

Align Actual Vertical Speed with Required Vertical Speed
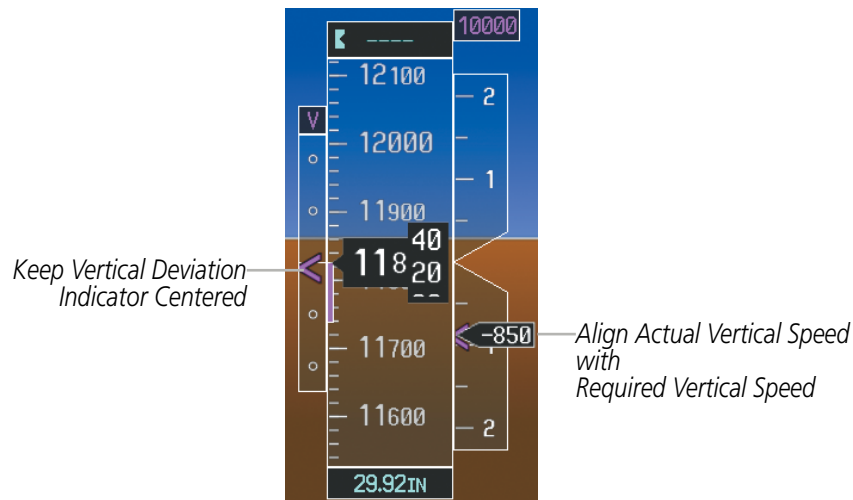
Figure 5-133 VDI & RVSI Showing Correctly Established Descent

17) When the aircraft is one minute from the bottom of descent (BOD) it is annunciated as shown in Figure 5-134. Upon reaching the offset waypoint for OPSHN, the aircraft is at 10,000 feet.
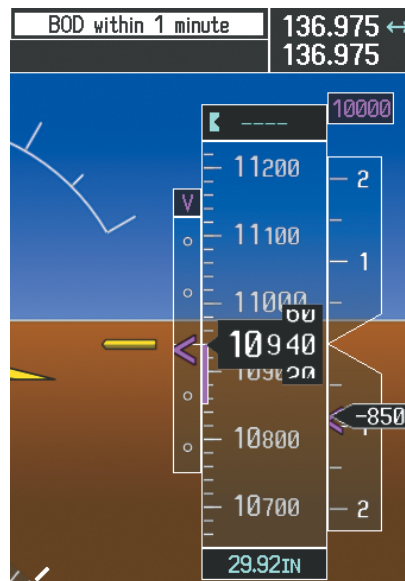
Figure 5-134 Approaching Bottom of Descent (BOD) at OPSHN Offset Waypoint

18) The aircraft is approaching OPSHN. The upcoming turn and next heading are annunciated at the top left of the PFD as seen in Figure 5-135. Initiate the turn and maneuver the aircraft on a track through the turn radius to intercept the magenta line for the OPSHN to FSHER leg and center the CDI.
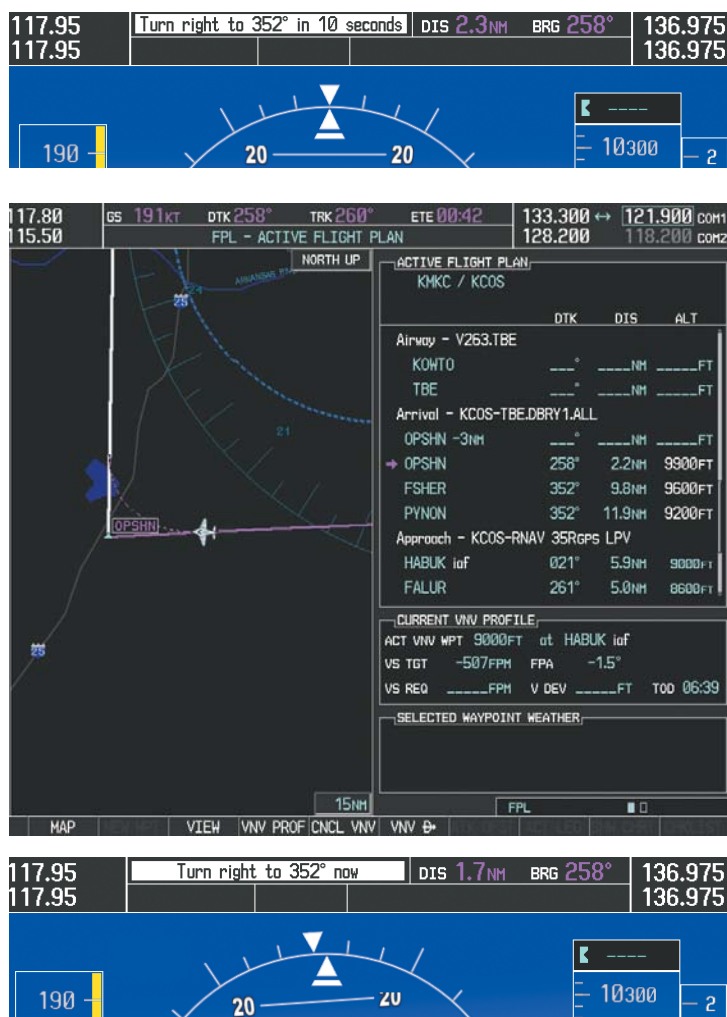
Figure 5-135 Turn to intercept OPSHN to FSHER Leg

19) After passing OPSHN, the next leg of the arrival turns magenta as shown in Figure 5-136. The magenta arrow in the flight plan list now indicates the OPSHN to FSHER leg of the arrival procedure is now active.

Figure 5-136 Tracking the OPSHN to FSHER Leg

20) The flight continues through the arrival procedure to PYNON (see Figure 5-137). At a point 31 nm from the destination airport, the phase of flight scaling for the CDI changes to Terminal Mode and is annunciated by displaying 'TERM' on the HSI.

A descent to HABUK is in the next leg. Note the TOD point on the map. Annunciations for the upcoming turn and descent, as well as the VDI and RVSI, appear on the PFD as the flight progresses.

Figure 5-137 Approaching PYNON

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21) Upon passing PYNON the approach procedure automatically becomes active. The approach may be activated at any point to proceed directly to the IAF. In this example, the aircraft has progressed through the final waypoint of the arrival and the flight plan has automatically sequenced to the IAF as the active leg, activating the approach procedure (see Figure 5-138).

Figure 5-138 Approach is Now Active

Note: To manually activate the approach procedure, perform the following steps:

a) Press the **PROC** Key.

b) Turn the large **FMS** Knob to highlight 'ACTIVATE APPROACH' as shown in Figure 5-139.

c) Press the **ENT** Key to activate the approach.
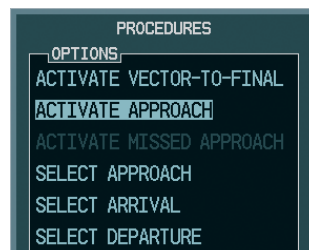
Figure 5-139 Manually Activate Approach

22) The IAF is the next waypoint. At the TOD, establish a descent vertical speed as previously discussed in Step 16. The aircraft altitude is 9,000 feet upon reaching HABUK.
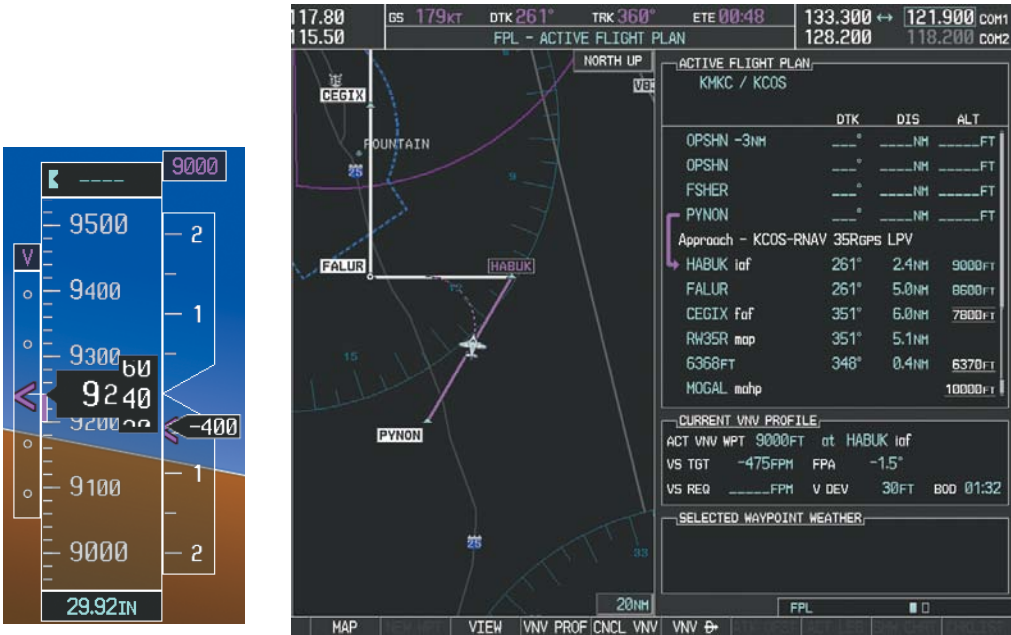
Figure 5-140 Descending Turn to the Initial Approach Fix (IAF)

23) After crossing FALUR the next waypoint is the FAF. The flight phase changes to LPV on the HSI indicating the current phase of flight is in Approach Mode and the approach type is LPV. CDI scaling changes accordingly and is used much like a localizer when flying an ILS approach. The RVSI is no longer displayed and the VDI changes to the Glidepath Indicator (as shown in Figure 5-141) when the final approach course becomes active.
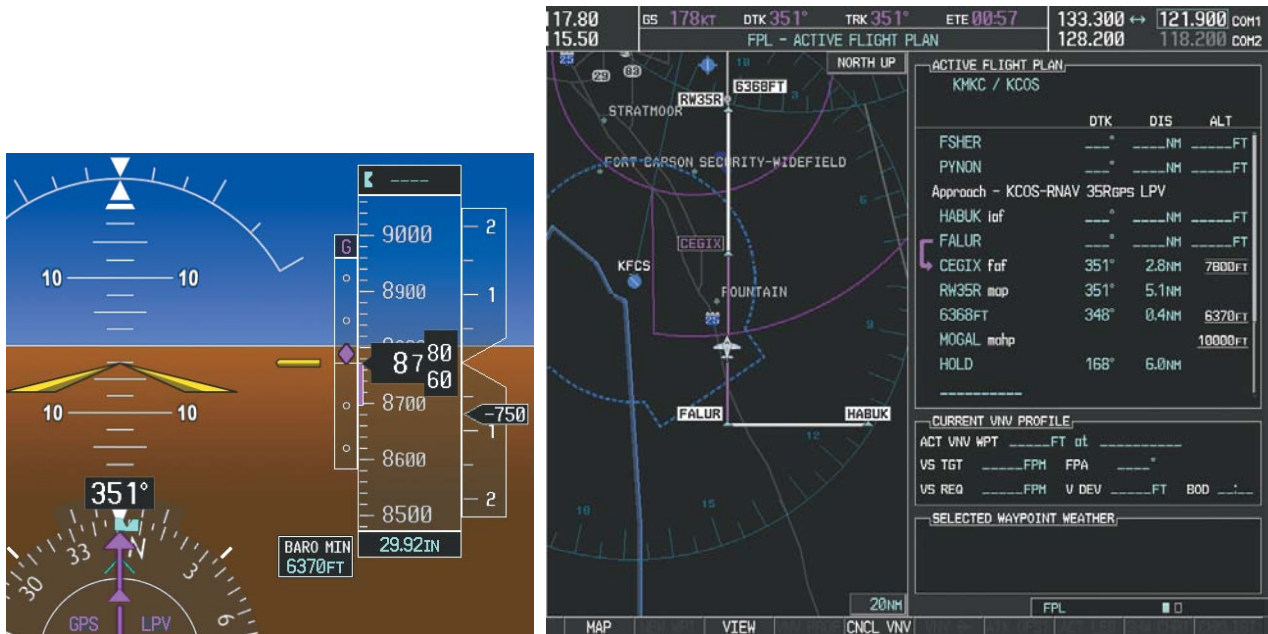
Figure 5-141 Descending to the FAF

The descent continues through the FAF (CEGIX) using the Glidepath Indicator, as one would use a glideslope indicator, to obtain an altitude "AT" 7,800 feet at the FAF. Note the altitude restriction lines over and under (At) the altitude in the 'ALT' field in Figure 5-141.

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24) After crossing CEGIX, the aircraft continues following the glidepath to maintain the descent to "AT or ABOVE" 6,370 feet at the Missed Approach Point (MAP) (RW35R) as seen in Figure 5-142.

Figure 5-142 Descending to the Missed Approach Point

In this missed approach procedure, the altitude immediately following the MAP (in this case '6368ft') is not part of the published procedure. It is simply a Course to Altitude (CA) leg which guides the aircraft along the runway centerline until the altitude required to safely make the first turn toward the MAHP is exceeded. This altitude is provided by Jeppesen, and may be below, equal to, or above the published minimums for this approach. In this case, if the aircraft altitude is below the specified altitude (6,368 feet) after crossing the MAP, a direct-to is established to provide a course on runway heading until an altitude of 6,368 feet is reached. After reaching 6,368 feet, a direct-to is established to the published MAHP (in this case MOGAL). If the aircraft altitude is above the specified altitude after crossing the MAP, a direct-to is established to the published fix (MOGAL) to begin the missed approach procedure.

In some missed approach procedures this Course to Altitude leg may be part of the published procedure. For example, a procedure may dictate a climb to 5,500 feet, then turn left and proceed to the Missed Approach Hold Point (MAHP). In this case, the altitude would appear in the list of waypoints as '5500ft'. Again, if the aircraft altitude is lower than the prescribed altitude, a direct-to is established on a Course to Altitude leg when the missed approach procedure is activated.

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25) Upon reaching the MAP, it is decided to execute a missed approach. Automatic waypoint sequencing is suspended past the MAP. Press the Go Around Button, or press the **SUSP** Softkey on the PFD, to resume automatic waypoint sequencing through the missed approach procedure.

A direct-to is initiated to MOGAL, which is the Missed Approach Hold Point (MAHP) as seen in Figure 5-143. The aircraft is climbing to 10,000 feet. The CDI flight phase now changes from LPV to MAPR as seen on the HSI.

Figure 5-143 Missed Approach Active

26) The aircraft continues climbing to "AT or ABOVE" 10,000 feet at MOGAL. A holding pattern is established at the MAHP (MOGAL) as shown in Figure 5-144.

Figure 5-144 Establishing the Holding Pattern

27) The aircraft maintains 10,000 feet while following the magenta line through the hold as in Figure 5-145.
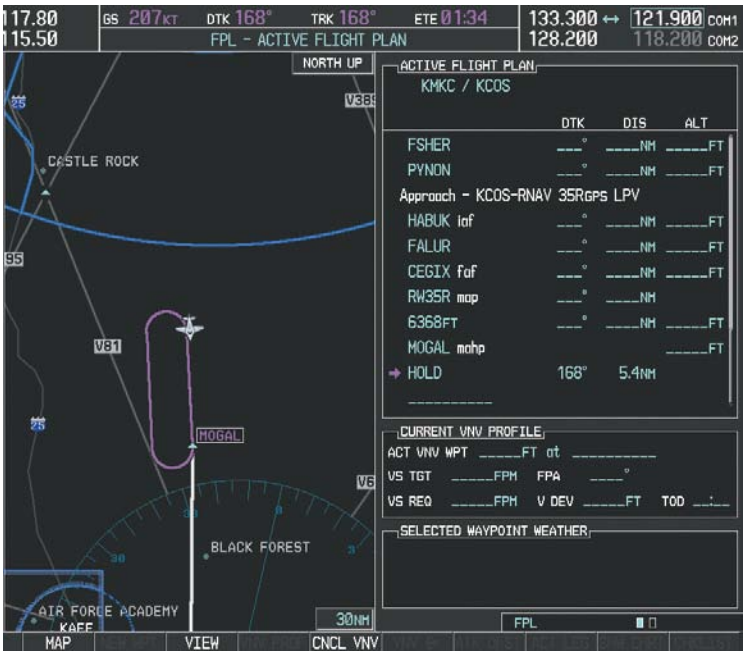
Figure 5-145 Hold Established

5.12 ABNORMAL OPERATION

This section discusses the Dead Reckoning mode of operation and the subsequent indications.

> **NOTE:** *Dead Reckoning Mode only functions in Enroute (ENR) or Oceanic (OCN) phase of flight. In all other phases, an invalid GPS solution produces a "NO GPS POSITION" annunciation on the map and the G1000 stops using GPS.*

While in Enroute or Oceanic phase of flight, if the G1000 detects an invalid GPS solution or is unable to calculate a GPS position, the system automatically reverts to Dead Reckoning (DR) Mode. In DR Mode, the G1000 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 G1000 in DR Mode may become increasingly unreliable and must not be used as a sole means of navigation. If while in DR Mode airspeed and/or heading data is also lost or not available, the DR function may not be capable of accurately tracking estimated position and, consequently, the system may display a path that is different than the actual movement of the aircraft. Estimated position information displayed by the G1000 through DR while there is no heading and/or airspeed data available should not be used for navigation.

DR Mode is inherently less accurate than the standard GPS/SBAS Mode due to the lack of satellite measurements needed to determine a position. Changes in wind speed and/or wind direction compounds 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 G1000 by the appearance of the letters 'DR' superimposed in yellow over the 'own aircraft' symbol as shown in Figure 5-146. In addition, 'DR' is prominently displayed in yellow on the HSI slightly above and to the right of the aircraft symbol on the CDI as shown in Figure 5-146. The CDI deviation bar remains, but is removed from the display after 20 minutes in DR Mode. The autopilot will remain coupled in DR mode as long as the deviation info is available (20 min.) 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 GPS-derived data is computed based upon an estimated position and is displayed as yellow text on the display to denote degraded navigation source information as shown in Figure 5-146.

Also, while the G1000 is in DR Mode, TAWS is disabled. Additionally, the accuracy of all nearest information (airports, airspaces, and waypoints) is questionable. Finally, airspace alerts continue to function, but with degraded accuracy.
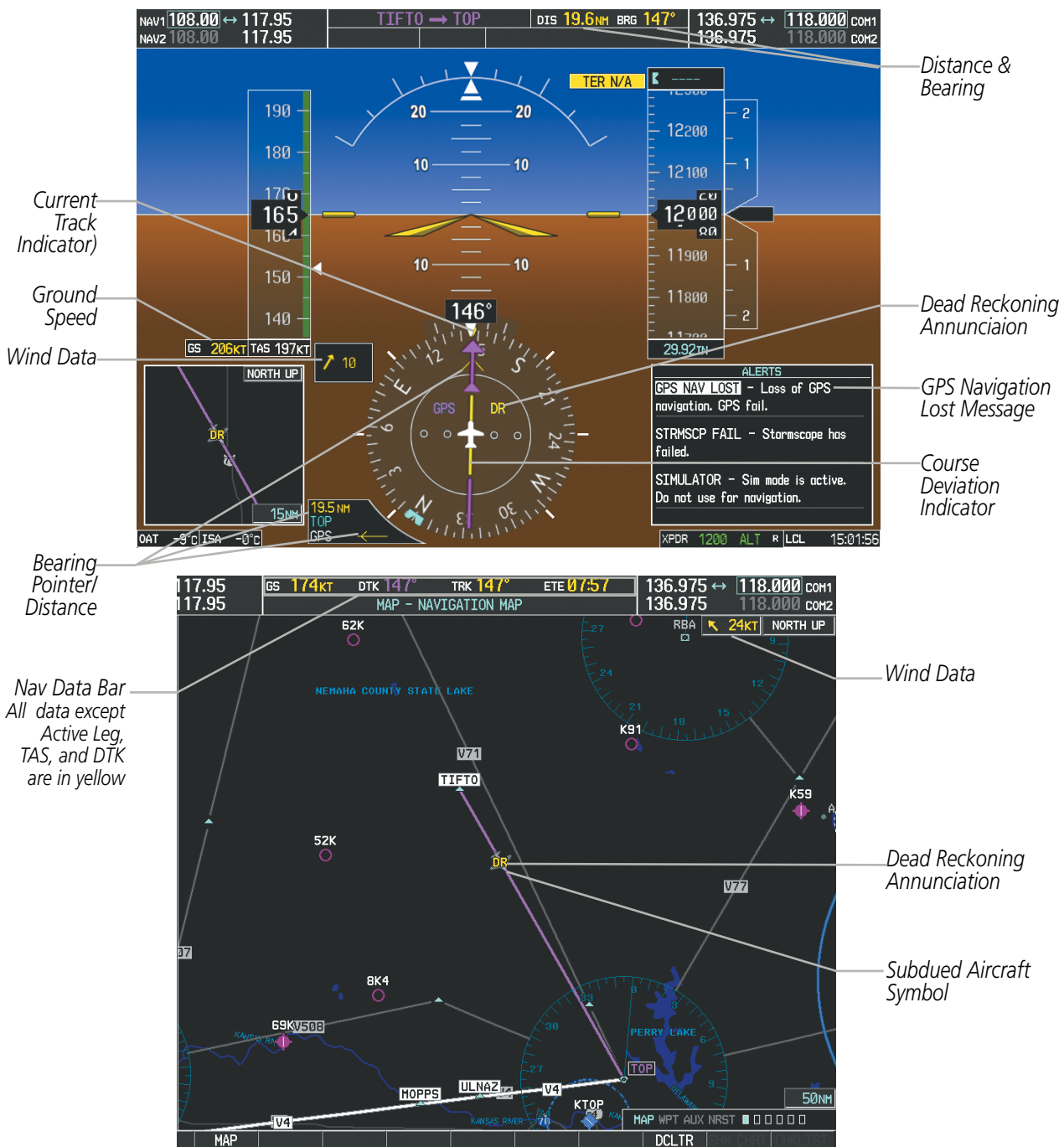
Figure 5-146 Dead Reckoning Mode - GPS Derived Data Shown in Yellow

NOTE: *The Inset Map is removed from the PFD any time aircraft pitch is greater than +30° or less than −20°, or when a 65° bank angle is reached.*

SECTION 6 HAZARD AVOIDANCE

The G1000 hazard avoidance features are designed to provide advisory information with regard to potential hazards to flight safety associated with weather, terrain, and air traffic.

This section is divided into the following groups:

Weather

- Garmin GDL 69A XM WX Satellite Weather

- Garmin GWX 68 Airborne Color Weather Radar

- L-3 STORMSCOPE® WX-500 Series II Weather Mapping Sensor (Optional)

Terrain Avoidance

- Terrain Awareness and Warning System - Class B (TAWS-B)

Traffic

- Traffic Information Service (TIS)

- Garmin GTS 820 Traffic Advisory System (TAS) (Optional)

- L-3 SKYWATCH® (SKY497) Traffic Advisory System (TAS) (If installed)

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6.1 XM WX SATELLITE WEATHER

> **NOTE:** *XM WX Satellite Weather data provides information for avoiding hazardous weather. Do not use XM WX information to penetrate hazardous weather.*

XM WX Satellite Weather is provided through the GDL 69/69A, a remote-mounted data link satellite receiver. Received graphical weather information and associated text is displayed on the Multi Function Display (MFD) and the Primary Flight Display (PFD) Inset Map. The GDL 69A can also receive SiriusXM Satellite Radio entertainment services. Weather data and entertainment programming operate in the S-band frequency range to provide continuous reception capabilities at any altitude throughout North America.

Services are subscription-based. For more information on specific service packages, visit www.siriusxm.com.

ACTIVATING SERVICES

Before XM WX Satellite Weather can be used, the service must be activated. Service is activated by providing SiriusXM with coded IDs unique to the installed GDL 69A. SiriusXM Satellite Radio (audio) and XM WX Satellite Weather (data) services each have coded IDs. The Data and Audio Radio IDs must be provided to SiriusXM to activate the weather service and entertainment subscriptions, respectively. These IDs are located on:

- The label on the back of the Data Link Receiver

- The XM Information Page on the MFD (Figure 6-1)

- The SiriusXM Satellite Radio Activation Instructions included with the unit (available at www.garmin.com, P/N 190-00355-04)

Contact the installer if the Audio and Data Radio IDs cannot be located.

SiriusXM uses the coded IDs to send an activation signal that allows the system to display weather data and/or entertainment programming provided through the GDL 69A.

Activating XM WX Satellite Weather and SiriusXM Satellite Radio services:

1) Contact SiriusXM using the the customer service phone number listed on the website. Follow the instructions provided by SiriusXM customer service.

2) Select the XM Radio page in the Auxiliary Page Group.

3) Press the **INFO** Softkey to display the XM Information Page.

4) Verify the desired services are activated.

5) Press the **LOCK** Softkey.

6) Turn the large **FMS** Knob to highlight 'YES'.

7) To complete activation, press the **ENT** Key.

Data Radio ID (for XM WX Satellite Weather)

Audio Radio ID (for SiriusXM Satellite Radio)

Weather Products (Available Products for Service Class Indicated in Green)

Select to Display XM Information page

Select to Lock Subscription Information
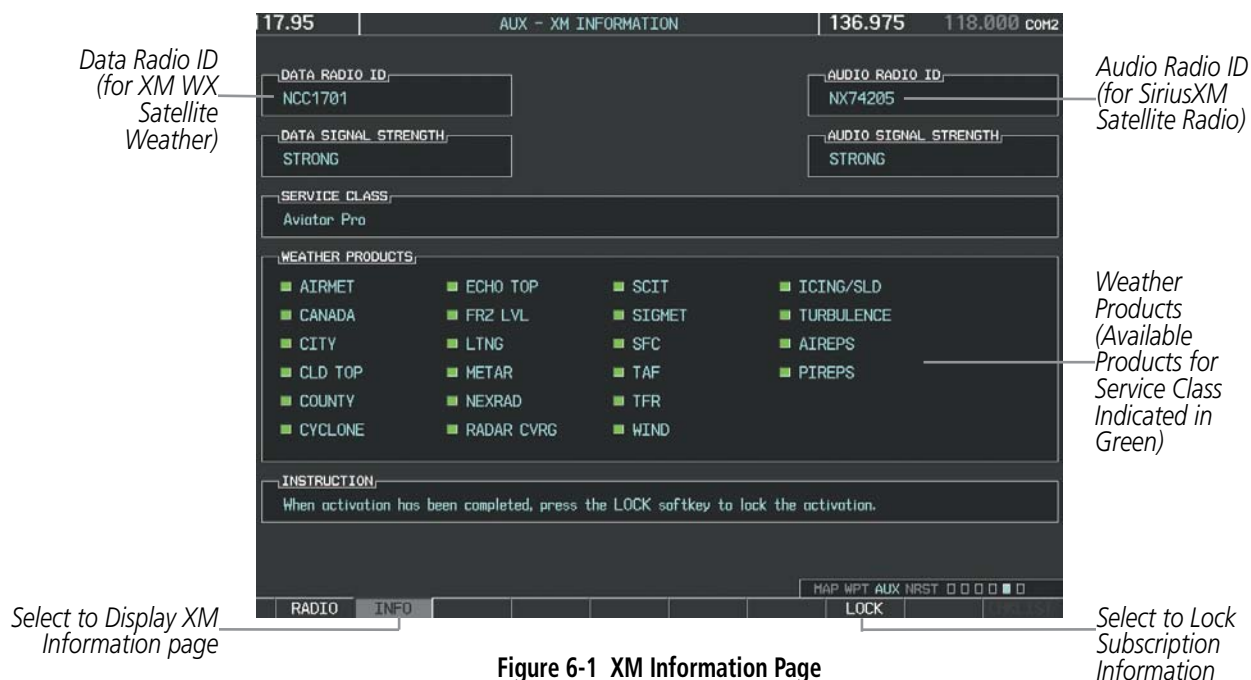
Figure 6-1 XM Information Page

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USING XM WX SATELLITE WEATHER PRODUCTS

The principal map for viewing XM WX data is the XM Weather Data Link Page in the Map Page Group. This is the only G1000 map display capable of showing information for all available XM WX products.

Viewing the XM Weather Data Link Page:

1) Turn the large **FMS** Knob to select the Map Page Group.

2) Turn the small **FMS** Knob to select the XM Weather Data Link Page.
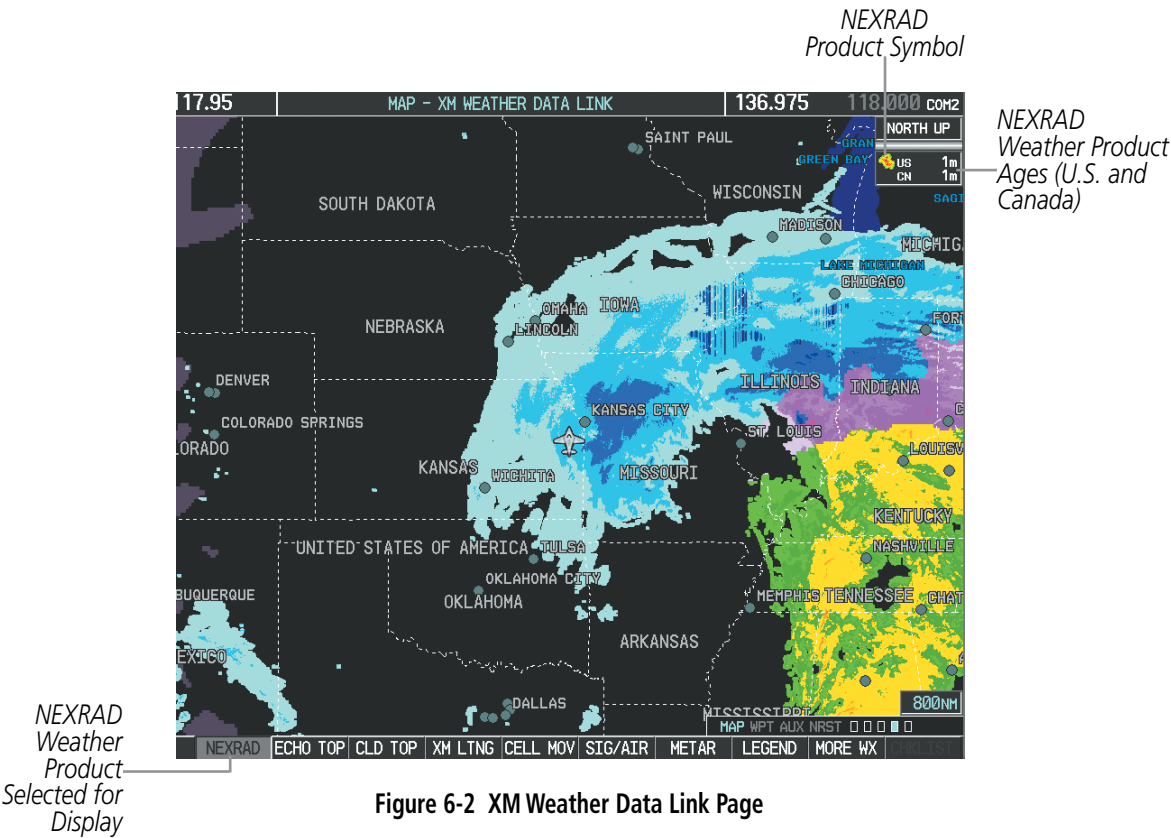
Figure 6-2 XM Weather Data Link Page

When a weather product is active on the XM Weather Data Link Page or the Navigation Map Page, the age of the data is displayed on the screen next to its product symbol (Figure 6-2). The age of the product is based on the time difference between when the data was assembled on the ground and the current GPS time. Weather products are refreshed at specific intervals (defined in the **Refresh Rate** column in Table 6-1).

If for any reason, a weather product is not refreshed within its defined **Expiration Time** interval (see Table 6-1), the data is considered expired and is removed from the display, and the system shows dashes instead of a product age. This ensures the displayed data is consistent with what is currently being provided by XM WX services. If more than half of the expiration time has elapsed, the color of the product age displayed changes to yellow. If a weather product is unavailable, the system displays 'N/A' instead of a product age.

Table 6-1 shows the weather product symbols, the expiration time and the refresh rate. The refresh rate represents the interval at which XM WX services provides new signals that may or may not contain new weather data. It does not represent the rate at which weather data is updated or new content is received by the Data Link Receiver. SiriusXM and its data suppliers control the weather product update intervals, and are are subject to change.

Weather Product	Symbol	Expiration Time (Minutes)	Refresh Rate (Minutes)
NEXRAD		30	5 (U.S.) 10 (Canada)
Cloud Top (CLD TOP)		60	15
Echo Top (ECHO TOP)		30	7.5
XM Lightning (LTNG)		30	5
Cell Movement (CELL MOV)		30	1.25
SIGMETs/AIRMETs (SIG/AIR)		60	12
METARs		90	12
City Forecast (CITY)		90	12
Surface Analysis (SFC)		60	12
Freezing Levels (FRZ LVL)		60	12
Winds Aloft (WIND)		60	12
County Warnings (COUNTY)		60	5
Cyclone Warnings (CYCLONE)		60	12
Icing Potential (CIP and SLD) (ICNG)		90	22
Pilot Weather Report (PIREPs)		90	12
Air Report (AIREPs)		90	12
Turbulence (TURB)		180	12
Radar Coverage	No product image	30	5
TFRs	No product image	60	12
TAFs	No product image	60	12

Table 6-1 Weather Product Symbols and Data Timing

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Table 6-2 shows which XM WX products can be displayed (indicated with a '+' symbol) on specific maps.

XM WX Satellite Weather Product	PFD Inset Map	Navigation Map Page	XM Weather Data Link Page	Weather Information Page	AUX - Trip Planning Page	Nearest Page Group	Flight Plan Pages
NEXRAD	+	+	+		+	+	+
Cloud Top (CLD TOP)			+				
Echo Top (ECHO TOP)			+				
XM Lightning (LTNG)	+	+	+		+	+	+
Cell Movement (CELL MOV)	+	+	+		+	+	+
SIGMETs/AIRMETs (SIG/AIR)			+				
METARs	+	+	+	+	+	+	+
City Forecast (CITY)			+				
Surface Analysis (SFC)			+				
Freezing Levels (FRZ LVL)			+				
Winds Aloft (WIND)		+*	+				
County Warnings (COUNTY)			+				
Cyclone Warnings (CYCLONE)			+				
Icing Potential (ICNG)			+				
PIREPs			+	+			
AIREPs			+	+			
Turbulence (TURB)			+				
Radar Coverage		+	+				
TFRs	+	+	+	+	+	+	+
TAFs			+	+			

* WInds Aloft data available in Profile View on Navigation Map Page.
Table 6-2 Weather Product Display Maps

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Softkeys control the display of weather information on most MFD pages and the PFD Inset Map (Figure 6-3 shows the weather product softkeys for the XM Weather Data Link Page). When a weather product is selected for display, the corresponding softkey label changes to gray to indicate the product is enabled.
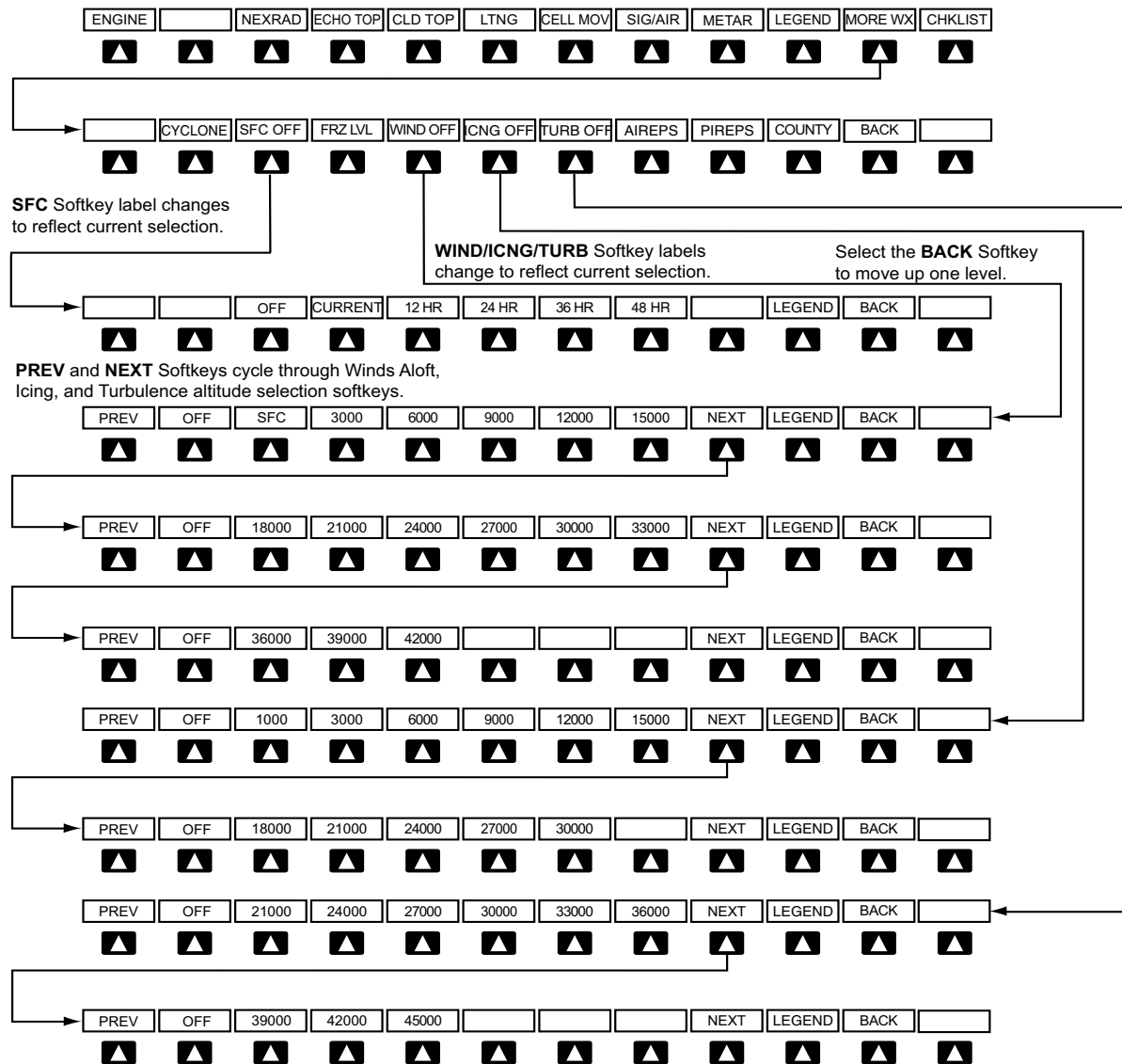
Figure 6-3 Weather Data Link Weather Product Softkeys

The setup menus for the Navigation Map Page and the XM 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 menus also provide a means in addition to the softkeys for enabling/disabling display of weather products.

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Setting up and customizing the XM Weather Data Link Page:

1) Select the XM Weather Data Link Page.

2) Press the **MENU** Key.

3) With 'Weather Setup' highlighted, press the **ENT** Key (Figure 6-4).

4) Turn the small **FMS** Knob to select 'PRODUCT GROUP 1' or 'PRODUCT GROUP 2', and press the **ENT** Key (Figure 6-5).

5) Turn the large **FMS** Knob or press the **ENT** Key to scroll through product selections.

6) Turn the small **FMS** Knob to scroll through options for each product (ON/OFF, range settings, etc.).

7) Press the **ENT** Key to select an option.

8) Press the **FMS** Knob or **CLR** Key to return to the XM Weather Data Link Page with the changed settings.
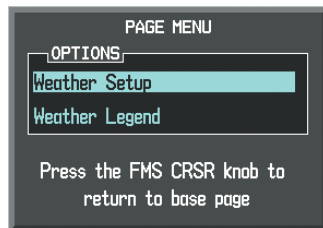
Figure 6-4 XM Weather Data Link Page Menu
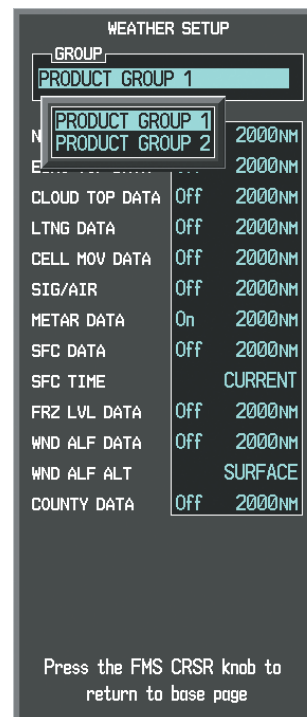
Figure 6-5 XM Weather Data Link Page Setup Menu

Restoring default XM Weather Data Link Page settings:

1) Select the XM Weather Data Link Page.

2) Press the **MENU** Key.

3) With 'Weather Setup' highlighted, 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.

Maps besides the XM Weather Data Link Page use settings based on those selected for the Navigation Map Page.

Setting up and customizing weather data for the Navigation Map Page:

1) Select the Navigation Map Page.

2) Press the **MENU** Key.

3) With 'Map Setup' highlighted, press the **ENT** Key (Figure 6-6).

4) Turn the small **FMS** Knob to select the 'Weather' Group and press the **ENT** Key (Figure 6-7).

5) Turn the large **FMS** Knob or press the **ENT** Key to scroll through product selections (Figure 6-8).

6) Turn the small **FMS** Knob to scroll through options for each product (ON/OFF, range settings).

7) Press the **ENT** Key to select an option.

8) Press the **FMS** Knob or **CLR** Key to return to the Navigation Map Page with the changed settings.

Figure 6-6 Navigation Map Page Menu

Figure 6-7 Navigation Map Page Setup Menu
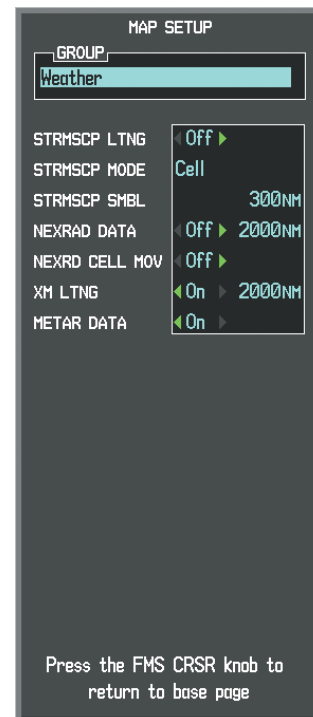
Figure 6-8 Navigation Map Page Setup Menu, Weather Group

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Each active weather product has an associated legend which can be displayed on the XM Weather Data Link Page.

Viewing legends for displayed weather products

1) Select the XM 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 Legend Window, press the **LEGEND** Softkey, the **ENT** or the **CLR** Key, or press the **FMS** Knob.

Additional information about the following can be displayed by panning over the display on the map:

- Echo Tops
- Cell Movement
- SIGMETs
- AIRMETs
- METARs

- County Warnings
- TFRs
- AIREPs
- PIREPs

The map panning feature is enabled by pressing the **RANGE** Knob. The map range is adjusted by turning the **RANGE** Knob. If the map range is adjusted while panning is enabled, the map is re-centered on the Map Pointer.
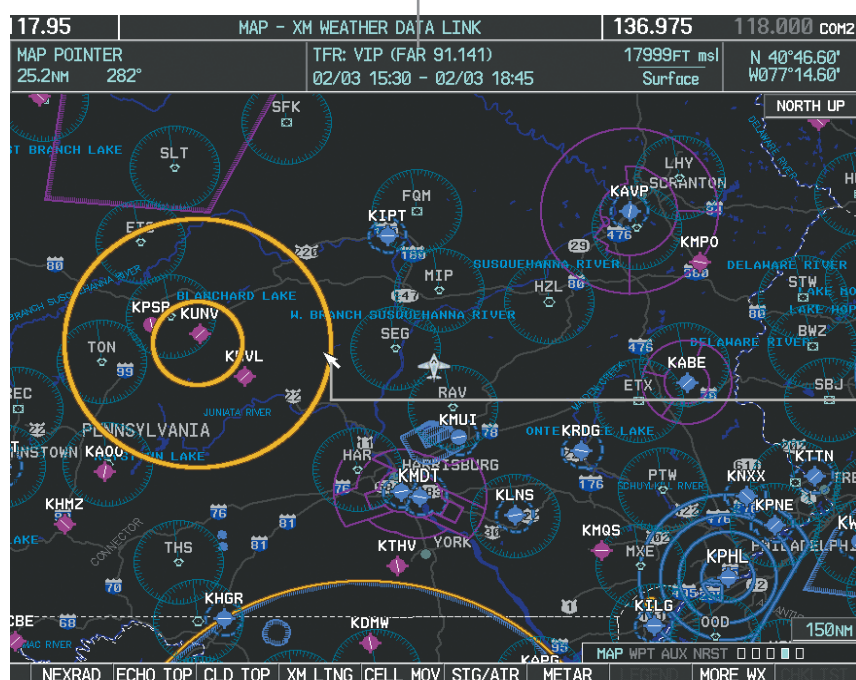
Figure 6-9 Panning on the XM Weather Data Link Page

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NEXRAD

> **NOTE:** *NEXRAD data cannot be displayed at the same time as terrain, echo tops, turbulence, or icing data.*

WSR-88D, or NEXRAD (NEXt-generation RADar), is a network of 158 high-resolution Doppler radar systems that are operated by the National Weather Service (NWS). NEXRAD data provides centralized meteorological information for the continental United States and selected overseas locations. The maximum range of a single NEXRAD radar site is 250 nm. In addition to a wide array of services, the NEXRAD network provides important information about severe weather and air traffic safety.

NEXRAD data is not real-time. The lapsed time between collection, processing, and dissemination of NEXRAD images can be significant and may not reflect the current radar synopsis. Due to the inherent delays and the relative age of the data, it should be used for long-range planning purposes only. Never use NEXRAD data or any radar data to penetrate hazardous weather. Rather, use it in an early-warning capacity of pre-departure and enroute evaluation.

No Radar Coverage
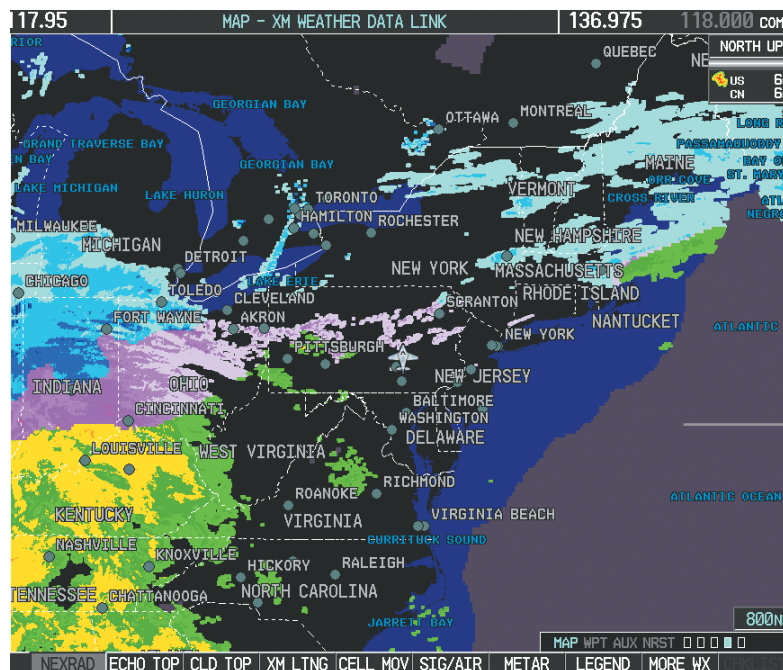
Figure 6-10 NEXRAD Data on the XM Weather Data Link Page

NEXRAD data can be displayed on the following maps:

- PFD Inset Map
- Navigation Map Page
- XM Weather Data Link Page
- Airport Information Page
- Trip Planning Page
- Nearest Pages
- Flight Plan Pages

Displaying NEXRAD weather information:

1) Press the **MAP** Softkey (for the PFD Inset Map, press the **INSET** Softkey). This step is not necessary on the XM Weather Data Link Page.

2) Press the **NEXRAD** Softkey.

Composite data from all the NEXRAD radar sites in the United States is shown. 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 XM Weather Data Link Page. For the NEXRAD legend (Figure 6-11), press the **LEGEND** Softkey when NEXRAD is selected for display.
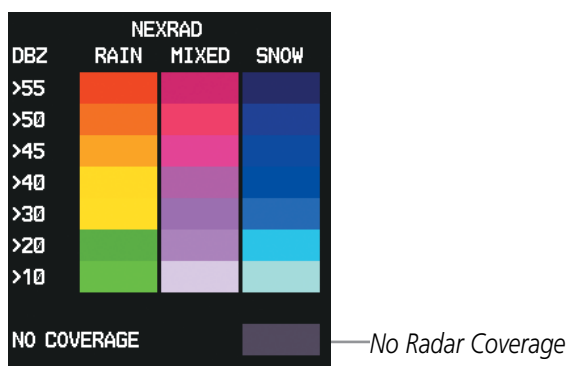
Figure 6-11 NEXRAD Data with Legend

The display of 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 a gray shade of purple.

REFLECTIVITY

Reflectivity is the amount of transmitted power returned to the radar receiver. Colors on the NEXRAD display are directly correlative to the level of detected reflectivity. Reflectivity as it relates to hazardous weather can be very complex.

The role of radar is essentially to detect moisture in the atmosphere. Simply put, certain types of weather reflect radar better than others. The intensity of a radar reflection is not necessarily an indication of the weather hazard level. For instance, wet hail returns a strong radar reflection, while dry hail does not. Both wet and dry hail can be extremely hazardous.

The different NEXRAD echo intensities are measured in decibels (dB) relative to reflectivity (Z). NEXRAD measures the radar reflectivity ratio, or the energy reflected *back to* the radar receiver (designated by the letter Z). The value of Z increases as the returned signal strength increases.

NEXRAD LIMITATIONS

NEXRAD radar images may have certain limitations:

- NEXRAD base reflectivity does not provide sufficient information to determine cloud layers or precipitation characteristics (wet hail vs. rain). For example, it is not possible to distinguish between wet snow, wet hail, and rain.

- NEXRAD base reflectivity is sampled at the minimum antenna elevation angle. An individual NEXRAD site cannot depict high altitude storms at close ranges. It has no information about storms directly over the site.

- When zoomed in to a range of 30 nm, each square block on the display represents an area of four square kilometers. The intensity level reflected by each square represents the *highest* level of NEXRAD data sampled within the area (Figure 6-12).
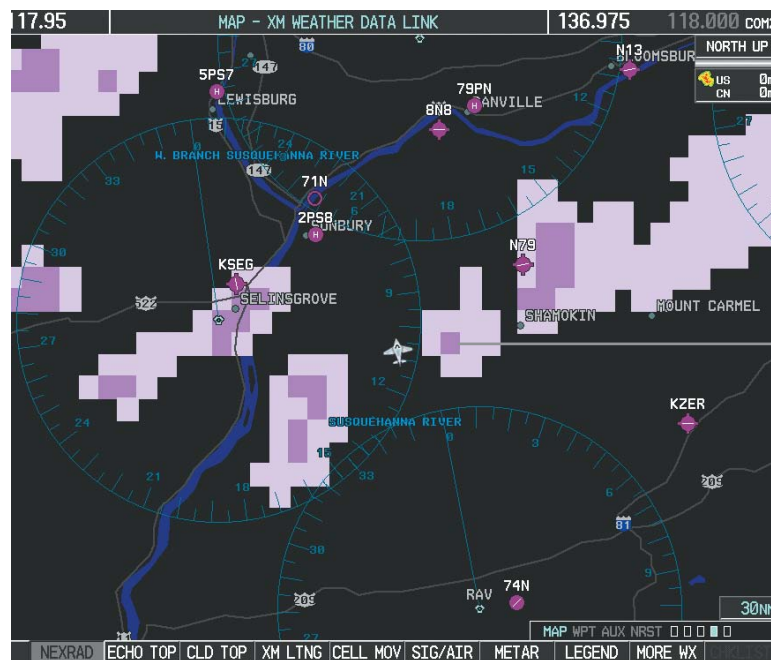
Figure 6-12 NEXRAD Data - Zoomed

The following may cause abnormalities in displayed NEXRAD radar images:

- Ground clutter
- Strobes and spurious radar data
- Sun strobes (when the radar antenna points directly at the sun)
- Interference from buildings or mountains, which may cause shadows
- Metallic dust from military aircraft, which can cause alterations in radar scans

NEXRAD LIMITATIONS (CANADA)

- Radar coverage extends to 55ºN.
- Any precipitation displayed between 52ºN and 55ºN is displayed as mixed precipitation.
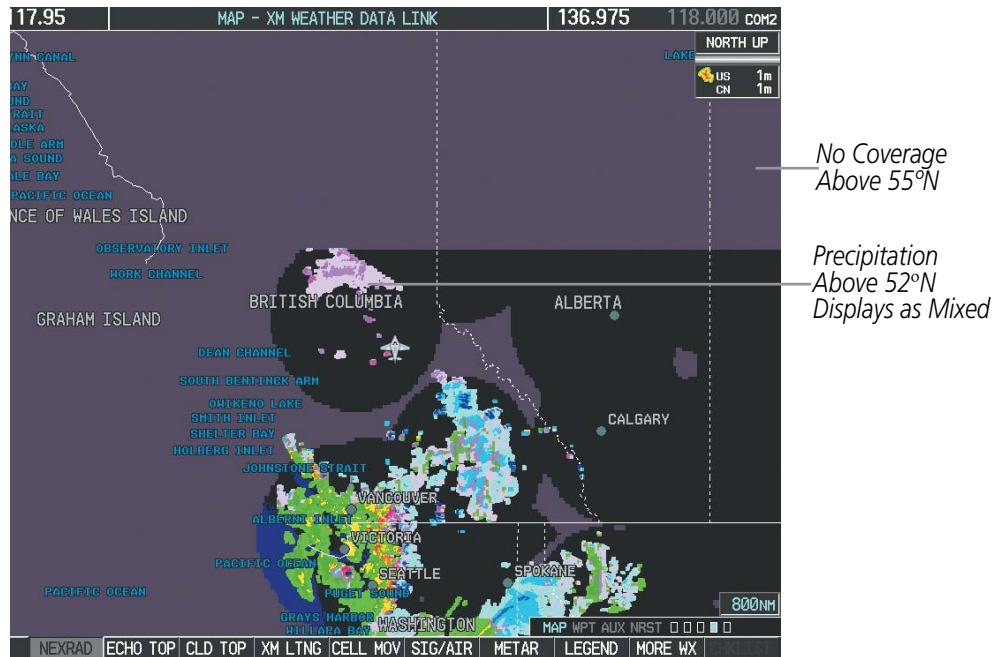
Figure 6-13 NEXRAD Data - Canada

ECHO TOPS

> **NOTE:** *Echo Tops cannot be displayed at the same time as Cloud Tops or NEXRAD data.*

Echo Tops data (Figure 6-14) shows the location, elevation, and direction of the highest radar echo. The highest radar echo does not indicate the top of a storm or clouds; rather it indicates the highest altitude at which precipitation is detected. Information is derived from NEXRAD data.
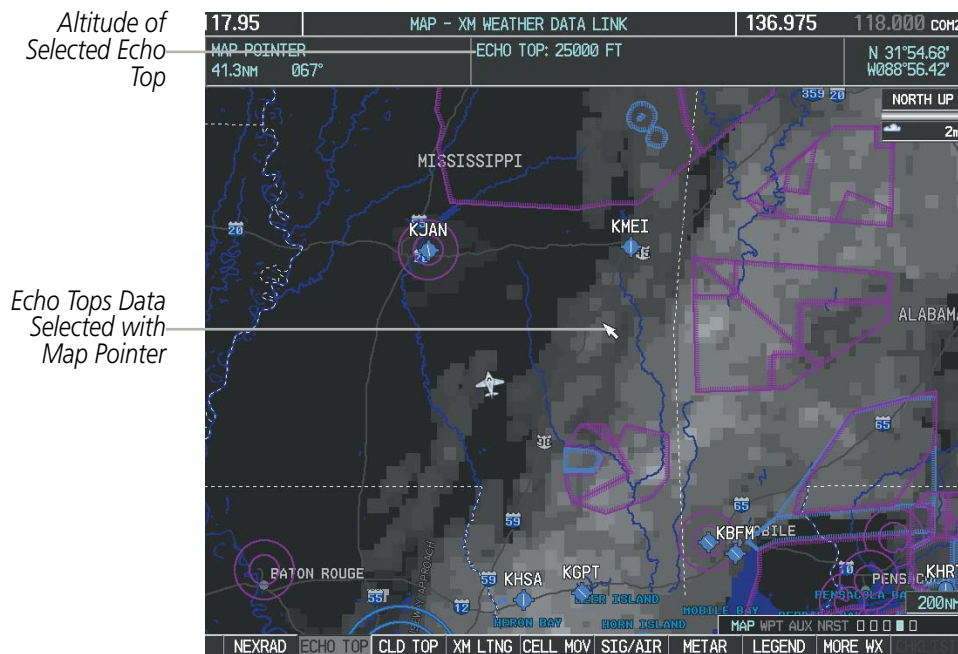
Figure 6-14 Echo Tops Data

Displaying Echo Tops information:

1) Select the XM Weather Data Link Page.

2) Press the **ECHO TOP** Softkey.

To display the Echo Tops legend (Figure 6-15), press the **LEGEND** Softkey when Echo Tops is selected for display. 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.
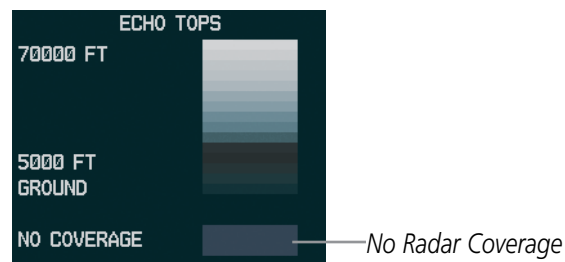
Figure 6-15 Echo Tops Legend

The display of 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 a gray shade of purple.

CLOUD TOPS

NOTE: *Cloud Tops and Echo Tops cannot be displayed at the same time.*

Cloud Tops data (Figure 6-16) depicts cloud top altitudes as determined from satellite imagery.
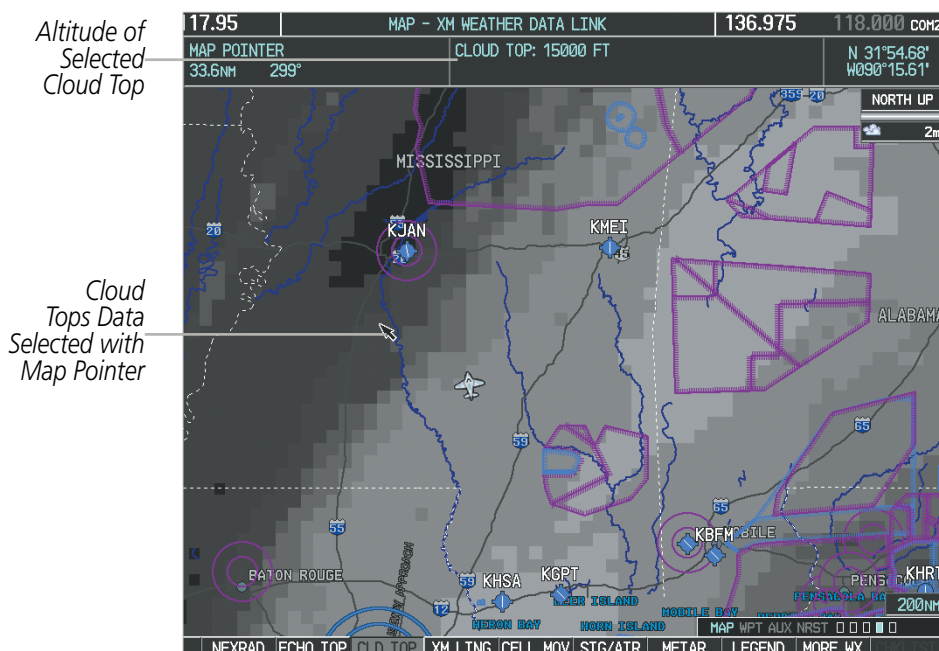
Figure 6-16 Cloud Tops Data

Displaying Cloud Tops information:

1) Select the XM Weather Data Link Page.

2) Press the **CLD TOP** Softkey.

To display the Cloud Tops legend (Figure 6-17), press the **LEGEND** Softkey when Cloud Tops is selected for display.   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.
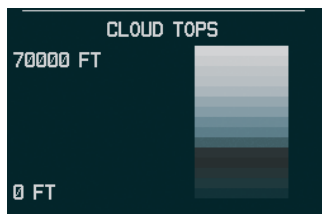
Figure 6-17 Cloud Tops Legend

XM LIGHTNING

> **NOTE:** *Optional L-3 STORMSCOPE® WX-500 Lightning and GDL 69/69A XM WX Satellite Weather Lightning cannot be displayed at the same time.*

XM Lightning data (Figure 6-18) 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.
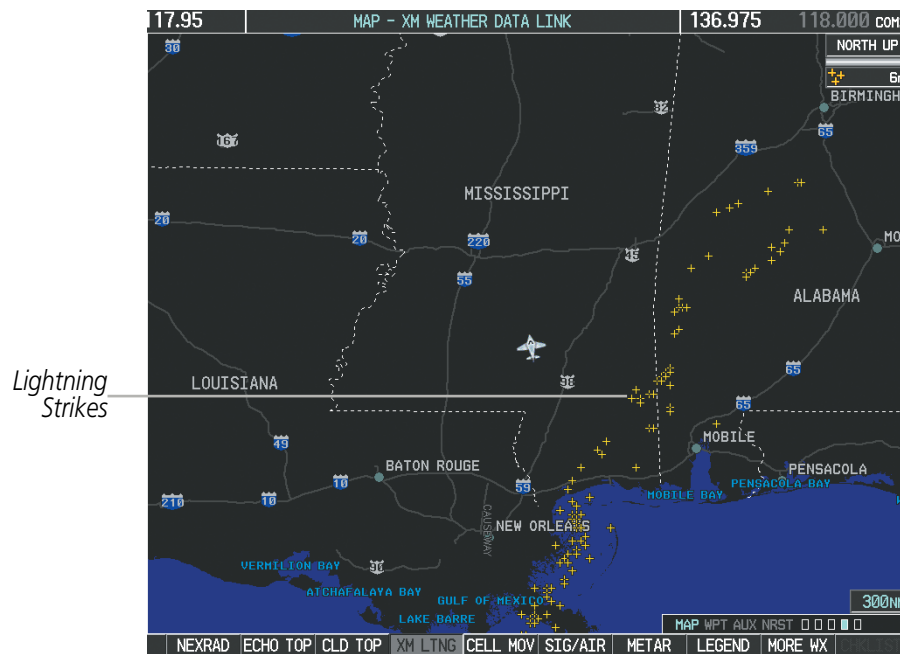
Figure 6-18 XM Lightning Data

XM Lightning data displays on the following maps:

- PFD Inset Map
- Navigation Map Page
- XM Weather Data Link Page
- Trip Planning Page
- Nearest Pages
- Flight Plan Pages

Displaying XM Lightning information:

1) Press the **MAP** Softkey (for the PFD Inset Map, press the **INSET** Softkey). This step is not necessary on the XM Weather Data Link Page.

2) Press the **XM LTNG** Softkey.

To display the XM Lightning legend on the XM Weather Data Link Page (Figure 6-19), press the **LEGEND** Softkey when XM Lightning is selected for display.
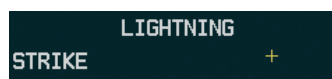
Figure 6-19 Lightning Legend

CELL MOVEMENT

Cell Movement data (Figure 6-20) 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.
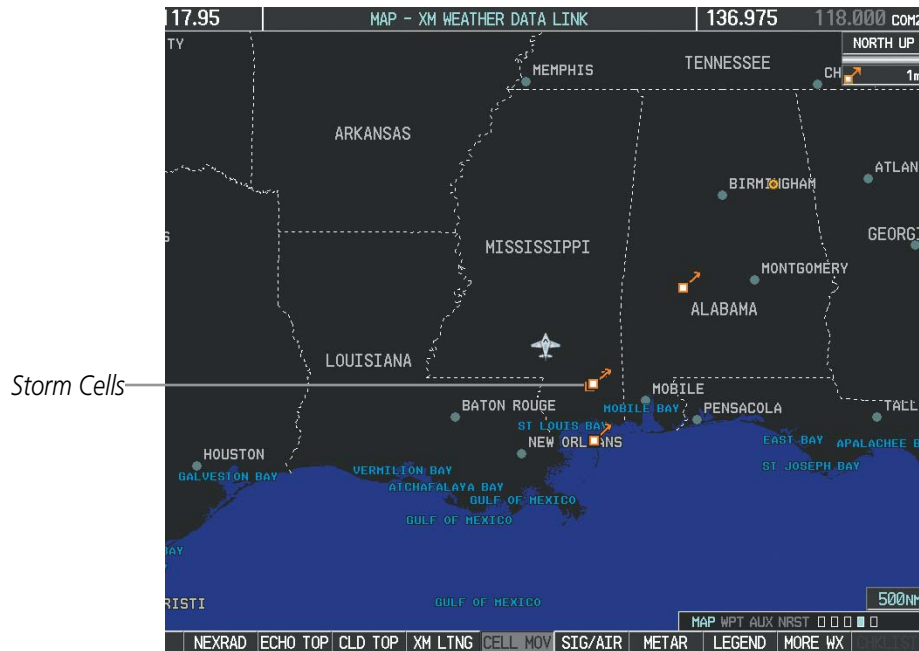
Figure 6-20 Cell Movement Data

On most applicable maps, Cell Movement data is selected for display along with NEXRAD. On the XM Weather Data Link Page, Cell Movement data can be selected independently. Cell Movement data can be displayed on the following maps:

- PFD Inset Map
- Navigation Map Page
- XM Weather Data Link Page
- Trip Planning Page
- Nearest Pages
- Flight Plan Pages

Displaying Cell Movement information:

1) Press the **MAP** Softkey (for the PFD Inset Map, press the **INSET** Softkey). This step is not necessary on the XM Weather Data Link Page.

2) Press the **NEXRAD** Softkey (**CEL MOV** Softkey on the XM Weather Data Link Page). For Cell Movement to be displayed on maps other than the XM Weather Data Link Page, Cell Movement must be turned on in the Navigation Map Setup Menu (see "Setting up and customizing weather data for the Navigation Map Page").

To display the Cell Movement legend on the XM Weather Data Link Page, (Figure 6-21), press the **LEGEND** Softkey when Cell Movement is selected for display.
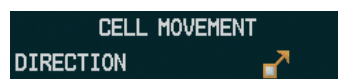
Figure 6-21 Cell Movement Legend

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SIGMETS AND AIRMETS

SIGMETs (SIGnificant METeorological Information) and AIRMETs (AIRmen's METeorological Information) are broadcast for potentially hazardous weather. A Convective SIGMET is issued for hazardous convective weather. A localized SIGMET is a significant weather condition occurring at a localized geographical position.
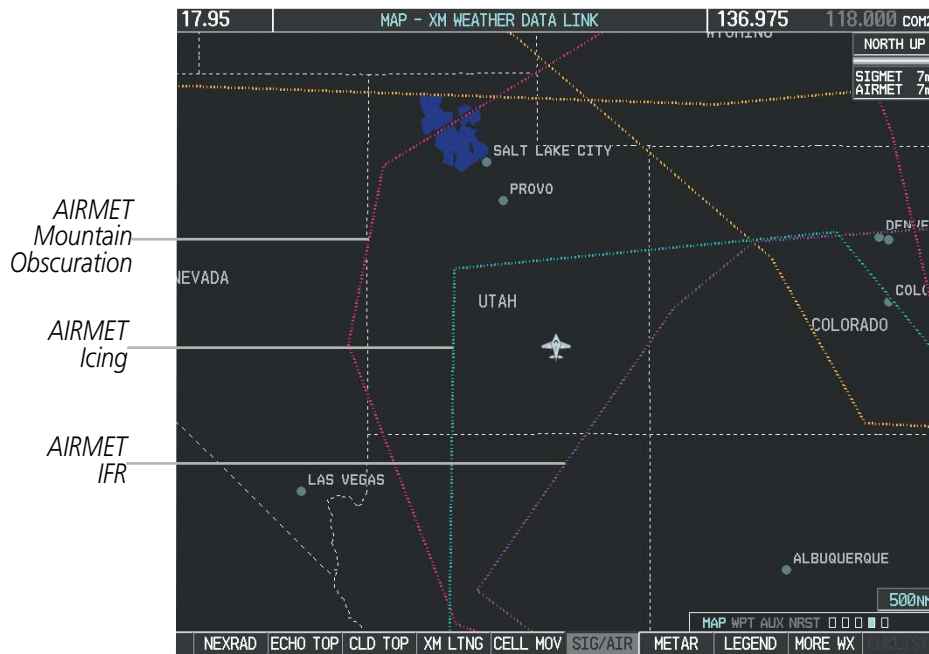
Figure 6-22 SIGMET/AIRMET Data

Displaying SIGMETs and AIRMETs:

1) Select the XM Weather Data Link Page.

2) Press the **SIG/AIR** Softkey.

3) To view the text of the SIGMET or AIRMET, press the **RANGE** Knob and move the Map Pointer over the icon.

4) Press the **ENT** key. Figure 6-23 shows sample SIGMET text.

To display the SIGMET and AIRMET legend (Figure 6-24), press the **LEGEND** Softkey when SIGMETs and AIRMETs are selected for display.
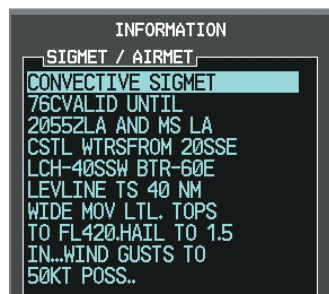
Figure 6-23 Sample SIGMET Text

Figure 6-24 SIGMET/AIRMET Legend

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METARS AND TAFS

✓ **NOTE:** *Atmospheric pressure as reported for METARs is given in hectopascals (hPa), except for in the United States, where it is reported in inches of mercury (in Hg). Temperatures are reported in Celsius.*

✓ **NOTE:** *METAR information is only displayed within the installed navigation database service area.*

METARs (METeorological Aerodrome Reports) typically contain information about the temperature, dewpoint, wind, precipitation, cloud cover, cloud heights, visibility, and barometric pressure at an airport or observation station. They can also contain information on precipitation amounts, lightning, and other critical data. METARs reflect hourly observations; non-routine updates include the code "SPECI" in the report. METARs are shown as colored flags at airports that provide them.
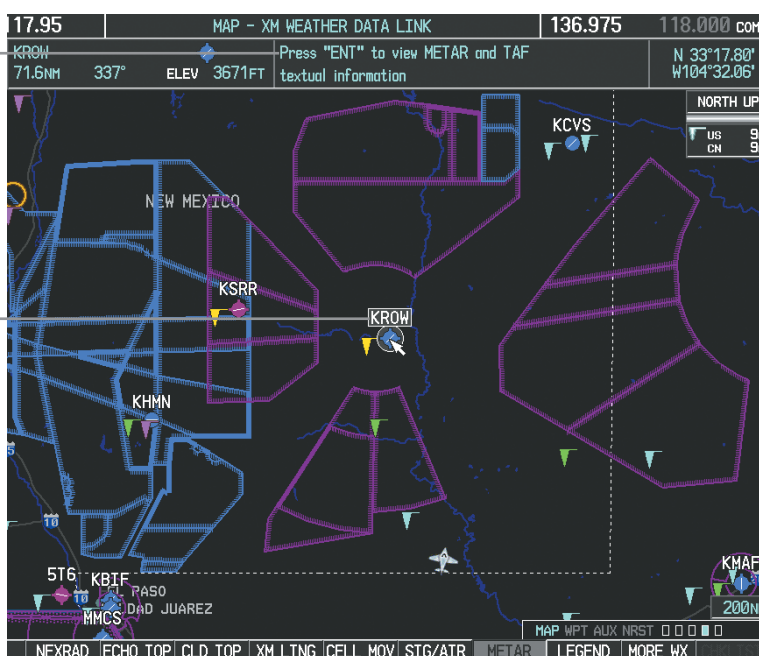
Figure 6-25 METAR Flags on the XM Weather Data Link Page

TAFs (Terminal Aerodrome Forecasts) are weather predictions for specific airports typically within a 24-hour period, and may span up to 36 hours. TAFs may 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, then as raw text. TAF information is displayed only in its raw form when it is available.

Displaying METAR and TAF text:

1) On the XM Weather Data Link Page, press the **METAR** Softkey.

2) Press the **RANGE** Knob 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.

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5) Press the **FMS** Knob or the **CLR** Key to return to the XM Weather Data Link Page.

   Or:

1) Select the Weather Information Page.

   a) Turn the large **FMS** Knob to select the Waypoint Page Group.

   b) Press the **WX** Softkey to select the Weather Information Page.

2) Press the **FMS** Knob to display the cursor.

3) Use the **FMS** Knob to enter the desired airport and press the **ENT** Key.

4) Use the **FMS** Knob or the **ENT** Key to scroll through the METAR and TAF text. Note the METAR text must be completely scrolled through before scrolling through the TAF text.
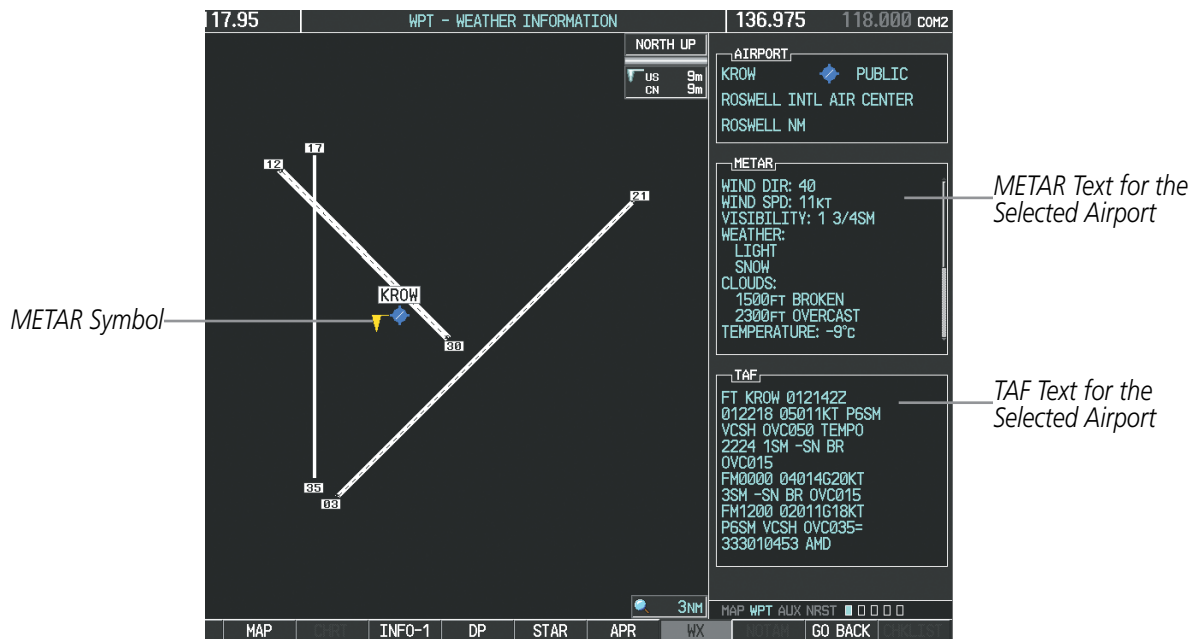
Figure 6-26 METAR and TAF Text on the Weather Information Page

Raw METAR text is also accessible while panning the map cursor over a METAR flag on any map page on which a METAR is displayed. The METAR text is shown in a box near the METAR flag.

In addition, METAR flags and their associated text are displayed on the Active Flight Plan Page on the MFD. A METAR flag is shown next to waypoint(s) in the flight plan with an available METAR.

Displaying raw METAR text on the Active Flight Plan Page:

1) Select the Active Flight Plan Page on the MFD.

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

3) Turn the large **FMS** Knob to highlight the desired waypoint. The METAR text will appear in the 'SELECTED WAYPOINT WEATHER' window below.

4) When finished, press the **FMS** Knob to remove the cursor or press the **FPL** Key to exit the Active Flight Plan Page.

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To display the METAR legend on the XM Weather Data Link Page (Figure 6-27), press the **LEGEND** Softkey when METARs are selected for display.

The METAR flag color is determined by the information in the METAR text. A gray METAR flag is displayed when the METAR text does not contain adequate information.

Figure 6-27 METAR Legend

SURFACE ANALYSIS AND CITY FORECAST

NOTE: *Surface Analysis and City Forecast data are displayed only within the installed Aviation Database service area.*

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.
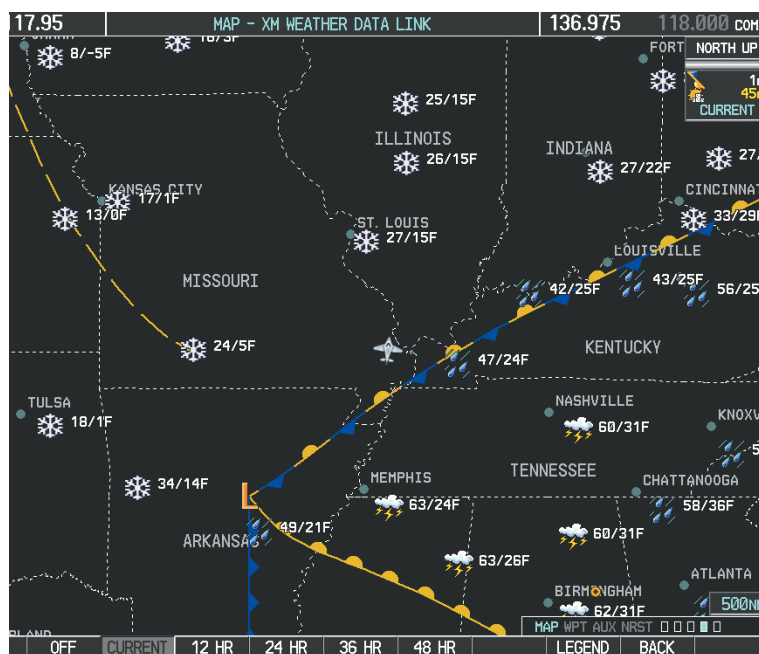
Figure 6-28 Current Surface Analysis Data

Displaying Surface Analysis and City Forecast information:

1) Select the XM Weather Data Link Page.

2) Press the **MORE WX** Softkey.

3) Press the **SFC** Softkey.

4) Select the desired forecast time: **CURRENT**, **12 HR**, **24 HR**, **36 HR**, or **48 HR**. The **SFC** Softkey label changes to reflect the forecast time selected.

To display the Surface Analysis and City Forecast legend (Figure 6-29), press the **LEGEND** Softkey when Surface Analysis and City Forecast are selected to be displayed.
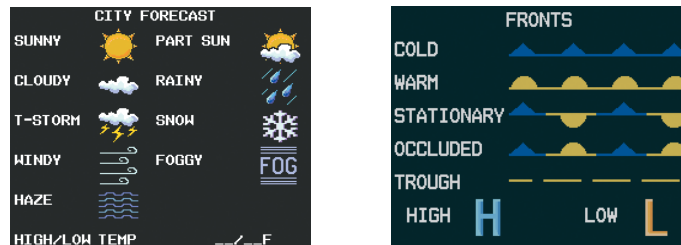
Figure 6-29 Surface Analysis Legend

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FREEZING LEVELS

Freezing Level data shows the color-coded contour lines for the altitude and location at which the first isotherm is found (Figure 6-30). 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 at the next update.
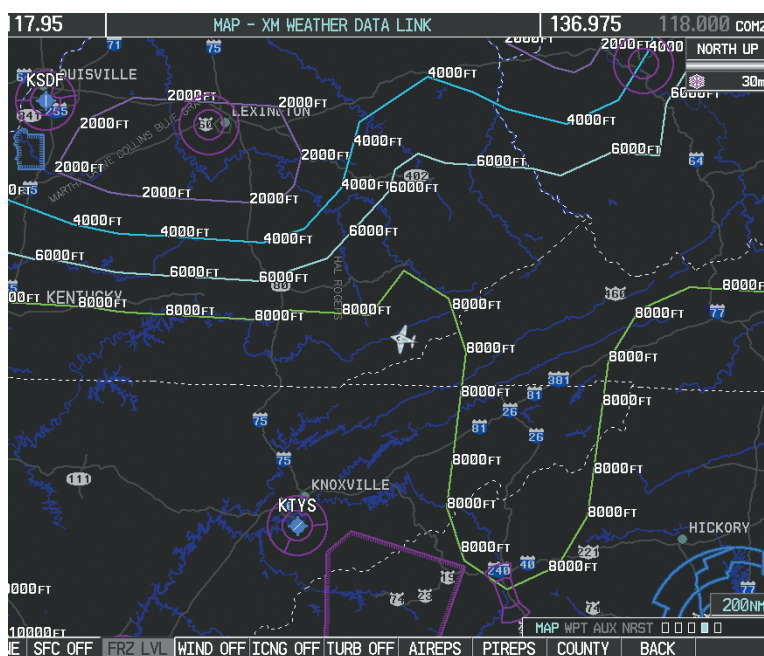
Figure 6-30 Freezing Level Data

Displaying Freezing Level information:

1) Select the XM Weather Data Link Page.

2) Press the **MORE WX** Softkey.

3) Press the **FRZ LVL** Softkey.

To display the Freezing Level legend (Figure 6-31), press the **LEGEND** Softkey when Freezing Level data is selected to be displayed.

Figure 6-31 Freezing Level Legend

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WINDS ALOFT

Winds Aloft data (Figure 6-32) shows the forecasted wind speed and direction at the surface and at selected altitudes. Altitude can be displayed in 3,000-foot increments up to 42,000 feet MSL.

Displaying Winds Aloft data:

1) Select the XM Weather Data Link Page.

2) Press the **MORE WX** Softkey.

3) Press the **WIND** Softkey.

4) Select 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 6-32 Winds Aloft Data at 12,000 Feet

To display the Winds Aloft legend (Figure 6-33), press the **LEGEND** Softkey when Winds Aloft is selected for display.
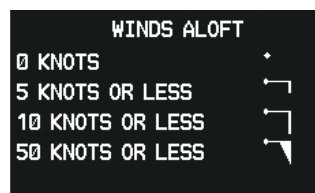
Figure 6-33 Winds Aloft Data with Legend

Headwind and tailwind components aloft are available inside the Profile View on the Navigation Map Page (Figure 6-34). The displayed components are relative to current aircraft altitude and track, but not to aircraft speed.
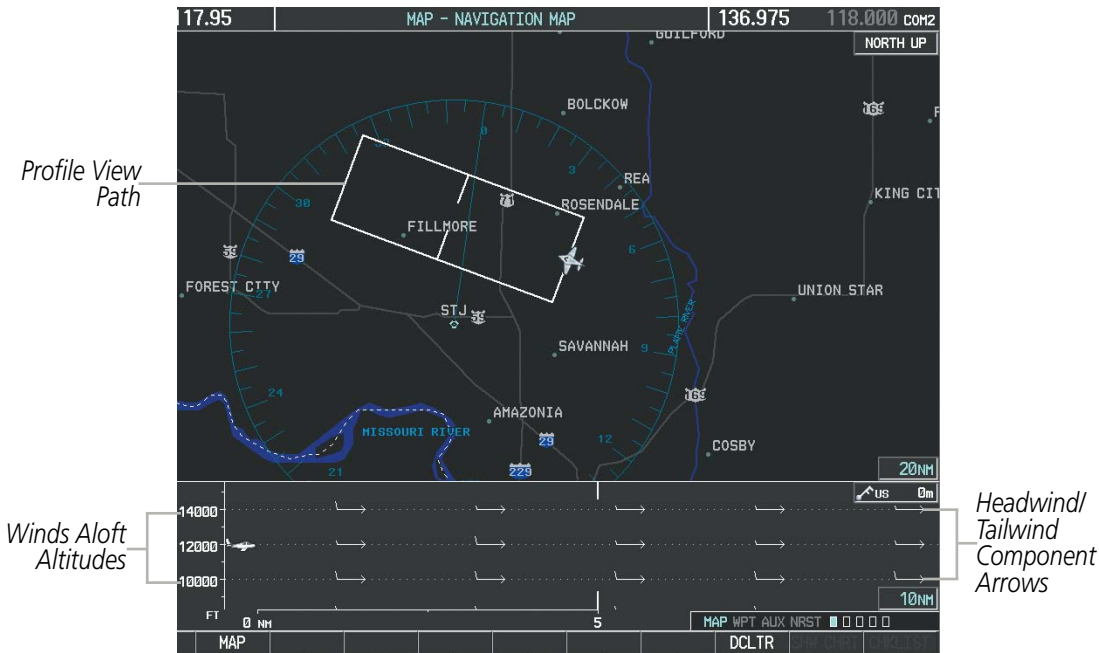
Figure 6-34 Winds Aloft Data Inside Profile View (Navigation Map Page)

Arrows pointing to the left indicate headwind components; tailwind component arrows point to the right, as shown in Table 6-3.

Headwind Symbol	Tailwind Symbol	Headwind/Tailwind Component
None	None	Less than 5 knots
		5 knots
		10 knots
		50 knots

Table 6-3 Profile View Headwind/Tailwind Component Symbols

Showing/Hiding Profile View:

1) Select the Navigation Map Page.

2) Press the **MAP** Softkey.

3) Press the **PROFILE** Softkey.

Or:

1) Press the **MENU** Key.

2) Turn the large FMS Knob to highlight 'Show Profile View' or 'Hide Profile View' (choice dependent on current state) and press the **ENT** Key.

Winds Aloft data inside the Profile View is enabled by default when the Profile View is displayed on the Navigation Map Page. This behavior can be changed on the Navigation Map Page.

Enabling/disabling Wind Data in Profile View:

1) Select the Navigation Map Page.

2) Press the **MENU** Key.

3) With Map Setup highlighted, press the **ENT** Key (Figure 6-35).

4) Turn the small **FMS** Knob to select the Profile Group and press the **ENT** Key (Figure 6-36).

5) Turn the large **FMS** Knob to select 'Profile Winds' (Figure 6-37).

6) Turn the small **FMS** Knob to select 'On' or 'Off'.

7) Press the **FMS** Knob or **CLR** Key to return to the Navigation Map Page with the changed settings.
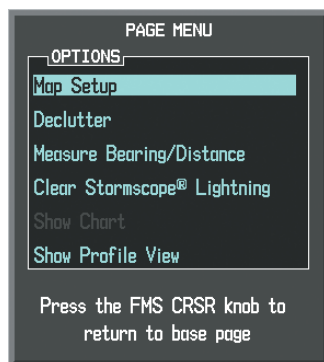
Figure 6-35 Navigation Map Page Menu

Figure 6-36 Navigation Map Page Setup Menu

Figure 6-37 Navigation Map Page Setup Menu, Weather Group

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ICING (CIP & SLD)

NOTE: *Icing data cannot be displayed at the same time as NEXRAD data. When NEXRAD data is selected, icing data is removed.*

Current Icing Product (CIP) data (Figure 6-38) 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 XM Weather Data Link Page.

2) Press the **MORE WX** Softkey.

3) Press the **ICNG** Softkey.

4) Select 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 reflect the altitude selected.
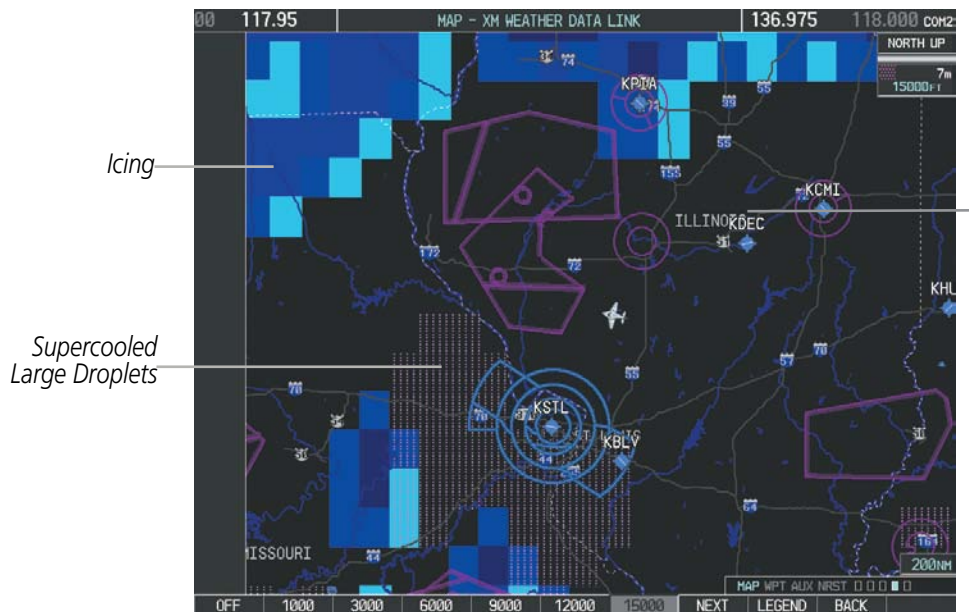
Figure 6-38 Icing Data at 15,000 Feet

To display the Icing Potential legend (Figure 6-39), press the **LEGEND** Softkey when Icing is selected for display.
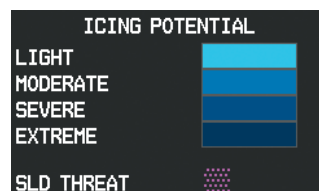
Figure 6-39 Icing Potential Legend

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TURBULENCE

> **NOTE:** *Turbulence data cannot be displayed at the same time as NEXRAD data. When NEXRAD data is selected, turbulence data is removed.*

Turbulence data (Figure 6-40) identifies the potential for erratic movement of high-altitude air mass associated winds. Turbulence is classified as light, moderate, severe or extreme, at altitudes between 21,000 and 45,000 feet. Turbulence data is intended to supplement AIRMETs and SIGMETs.

Displaying Turbulence data:

1) Select the XM Weather Data Link Page.

2) Press the **MORE WX** Softkey.

3) Press the **TURB** Softkey.

4) Select the desired altitude level: 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 reflect the altitude selected.
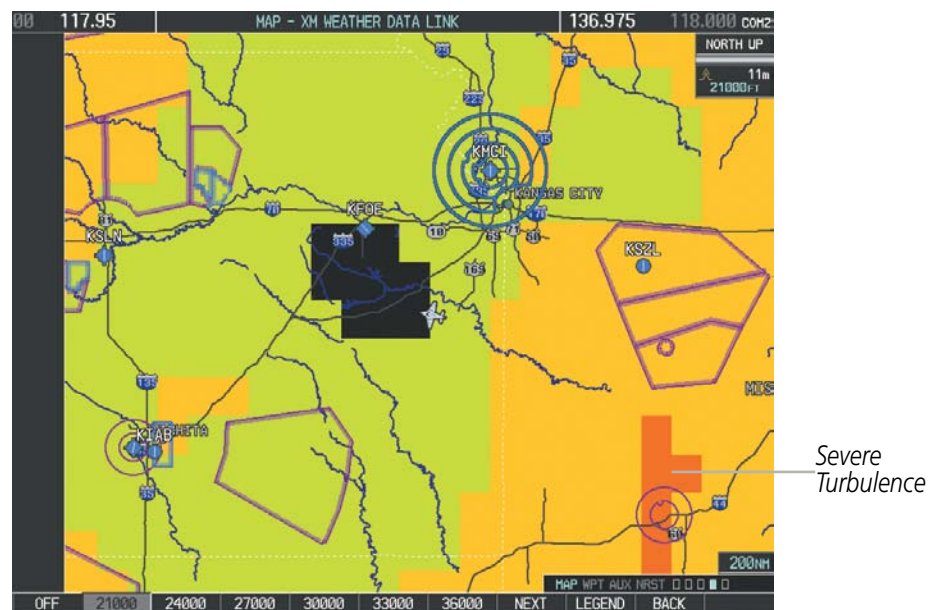
Severe Turbulence

Figure 6-40 Turbulence Data at 21,000 Feet

To display the Turbulence legend (Figure 6-41), press the **LEGEND** Softkey when Turbulence is selected for display.
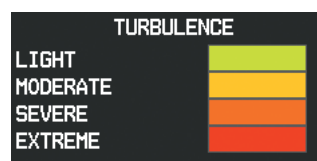
Figure 6-41 Turbulence Legend

PIREPS AND AIREPS

Pilot Weather Reports (PIREPs) (Figure 6-42) provide timely weather information for a particular route of flight. 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).

Air Reports or AIREPs are similar to PIREPs, but used almost exclusively by commercial airlines.
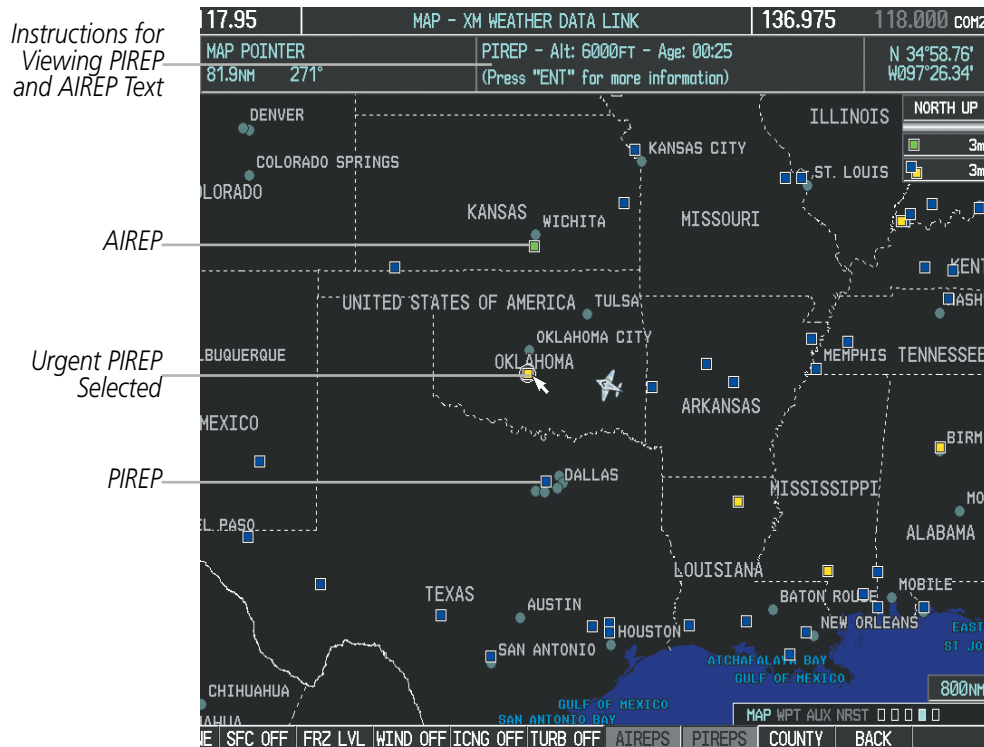
Figure 6-42 AIREPs and PIREPs on the XM Weather Data Link Page

Displaying PIREP and AIREP text:

1) Select the XM Weather Data Link Page.

2) Press the **MORE WX** Softkey.

3) Press the **AIREPS** or **PIREPS** Softkey.

4) Press the **RANGE** Knob 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, then as raw text.

6) Use the **FMS** Knob or the **ENT** Key to scroll through the PIREP or AIREP text.

7) Press the **FMS** Knob or the **CLR** Key to return to the XM Weather Data Link Page.

Decoded PIREP Text
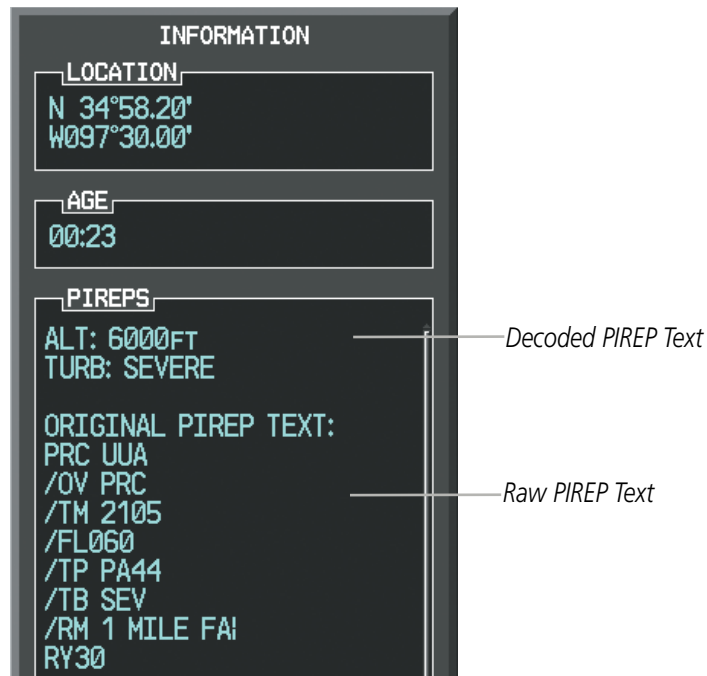
Raw PIREP Text

Figure 6-43 PIREP Text on the XM Weather Data Link Page

To display the PIREP or AIREP legend (Figure 6-44), press the **LEGEND** Softkey when PIREPs or AIREPs are selected for display.

The PIREP color is determined by the type (routine or urgent).

Figure 6-44 AIREPs & PIREPs Legend

COUNTY WARNINGS

County data (Figure 6-45) provides specific public awareness and protection weather warnings from the National Weather Service (NWS). This can include information on severe thunderstorms, tornadoes, and flood conditions.
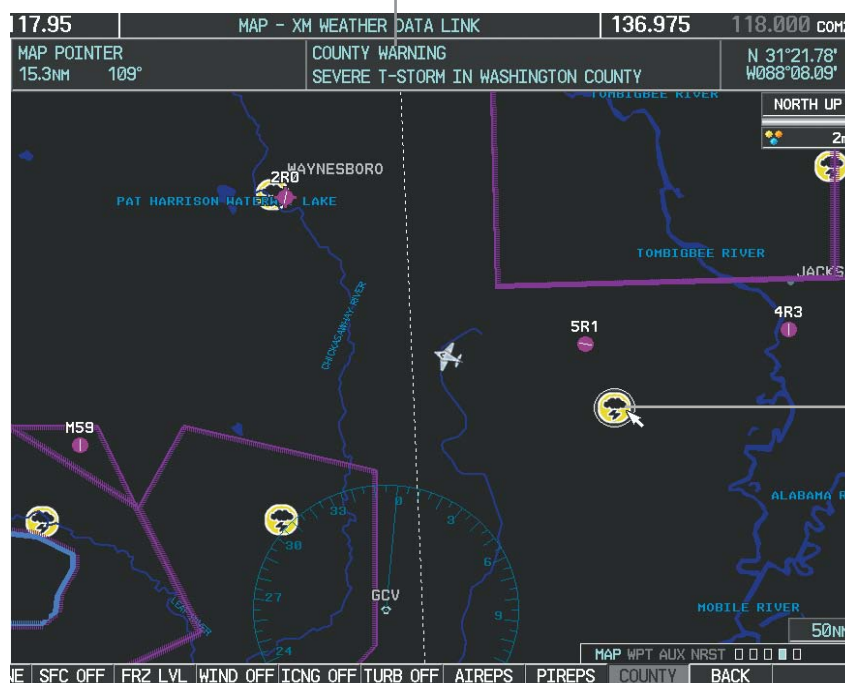
Additional Information on Warning Selected with Map Pointer

Flood Warning Selected with Map Pointer

Figure 6-45 County Warnings

Displaying County Warning information:

1) Select the XM Weather Data Link Page.

2) Press the **MORE WX** Softkey.

3) Press the **COUNTY** Softkey.

To display the County Warnings legend (Figure 6-46), press the **LEGEND** Softkey when County Warnings are selected to be displayed.
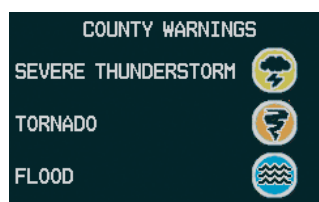
Figure 6-46 County Warnings Legend

CYCLONE

The Cyclone weather product (Figure 6-47) shows the current location of cyclones (hurricanes), tropical storms, and their projected tracks.
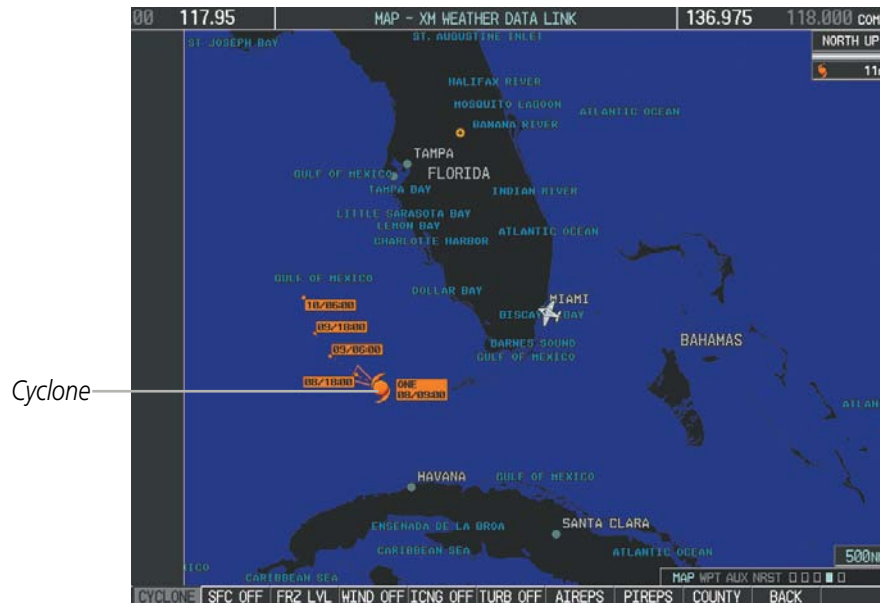
Figure 6-47 Cyclone Data on the Weather Data Link Display

Displaying cyclone (hurricane) track information:

1) Select the XM Weather Data Link Page.

2) Press the **MORE WX** Softkey.

3) Press the **CYCLONE** Softkey.

To display the Cyclone legend (Figure 6-48), press the **LEGEND** Softkey when Cyclones are selected to be displayed.
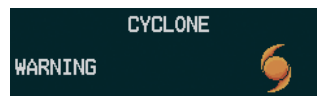
Figure 6-48 Cyclone Legend

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6.2 AIRBORNE COLOR WEATHER RADAR

SYSTEM DESCRIPTION

The Garmin GWX 68 Airborne Color Weather Radar is a four-color digital pulsed radar with 6.5 kilowatts of output power. It combines excellent range and adjustable scanning profiles with a high-definition target display. The pulse width is four microseconds (μs) on all ranges except the 2.5 nm range. The GWX 68 uses a one μs pulse width at this range to reduce the targets smearing together on the display for better target definition at close range.

The Beechcraft G58 uses a 12-inch phased array antenna that is fully stabilized to accommodate 30º of pitch and roll.

To focus radar scanning on specific areas, Sector Scanning offers pilot-adjustable horizontal scan angles of 20º, 40º, 60º, or 90º. A vertical scanning function helps to analyze storm tops, gradients, and cell buildup activity at various altitudes.

Radar features include:

- 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.

PRINCIPLES OF PULSED AIRBORNE WEATHER RADAR

The term RADAR is an acronym for RAdio Detecting And Ranging. Pulsed radar locates targets by transmitting a microwave pulse beam that, upon encountering a target, is reflected back to the radar receiver as a return echo. The microwave pulses are focused and radiated by the antenna, with the most intense energy in the center of the beam and decreasing intensity near the edge. The same antenna is used for both transmitting and receiving. The returned signal is then processed and displayed on the G1000 MFD.

Radar detection is a two-way process that requires 12.36 μs for the transmitted microwave pulses to travel out and back for each nautical mile of target range. It takes 123.6 μs for a transmitted pulse to make the round trip if a target is ten nautical miles away.

Airborne weather radar should be used to avoid severe weather, not for penetrating severe weather. The decision to fly into an area of radar targets depends on target intensity, spacing between the targets, aircraft capabilities, and pilot experience. Pulse type weather radar detects only precipitation, not clouds or turbulence. The display may indicate clear areas between intense returns, but this does not necessarily mean it is safe to fly between them. Only Doppler radar can detect turbulence.

Airborne weather radar has other capabilities beyond weather detection. It also has the ability to detect and provide distance to cities, mountains, coastlines, rivers, lakes, and oceans.

NEXRAD AND AIRBORNE WEATHER RADAR

Both Airborne Weather Radar and NEXRAD measure weather reflectivity in decibels (dB). A decibel is a logarithmic expression of the ratio of two quantities. Airborne Weather Radar measures the ratio of power against the gain of the antenna, while NEXRAD measures the energy reflected back to the radar, or the radar reflectivity ratio.

Both systems use colors to identify the different echo intensities, but the colors are not interchangeable. Airborne color radar values used by Garmin Airborne Color Weather Radar should not be confused with NEXRAD radar values.

ANTENNA BEAM ILLUMINATION

The radar beam is much like the beam of a spotlight. The further the beam travels, the wider it becomes. The radar is only capable of seeing what is inside the boundaries of the beam. The figure below depicts a radar beam's characteristics. The figure illustrates vertical dimensions of the radar beam, although the same holds true for the horizontal dimensions. In other words, the beam is as wide as it is tall. Note that it is possible to miss areas of precipitation on the radar display because of the antenna tilt setting. With the antenna tilt set to zero in this illustration, the beam overshoots the precipitation at 15 nautical miles.
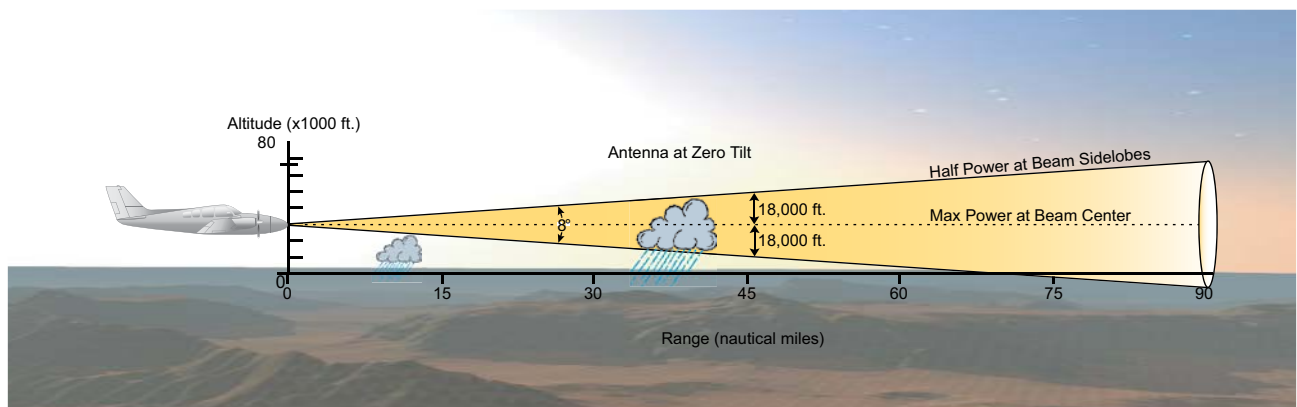
Figure 6-49 Radar Beam from a 10 inch Antenna

The curvature of the earth can also be a factor in missing areas of precipitation, especially at range settings of 150 nautical miles or more. Here the beam overshoots the precipitation at less than 320 nautical miles.
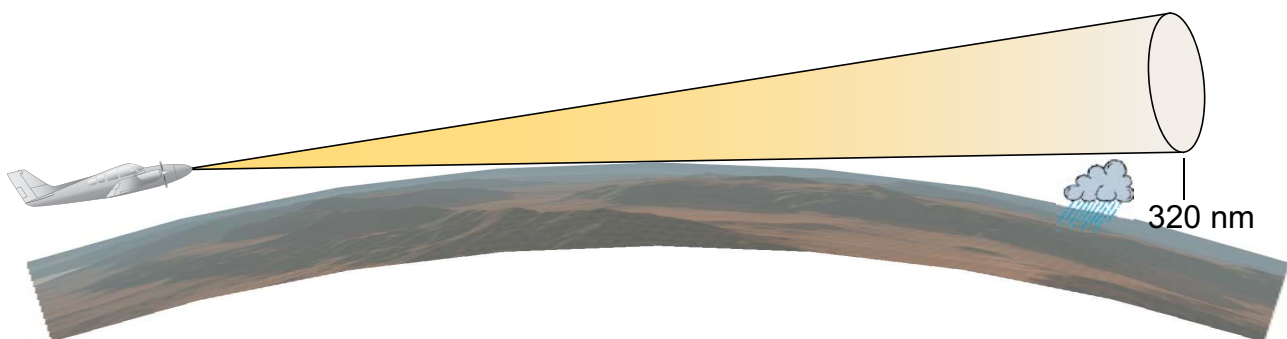
Figure 6-50 Radar Beam in Relation to the Curvature of the Earth

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RADAR SIGNAL ATTENUATION

The phenomenon of radar signal attenuation affects the operation of weather radar. When the radar signal is transmitted, it is progressively absorbed and scattered, making the signal weaker. This weakening, or attenuation, is caused by two primary sources, distance and precipitation.

Attenuation because of distance is due to the fact that the radar energy leaving the antenna is inversely proportional to the square of the distance. The reflected radar energy from a target 40 miles away that fills the radar beam is one fourth the energy reflected from an equivalent target 20 miles away. This would appear to the operator that the storm is gaining intensity as the aircraft gets closer. Internal signal processing within the GWX 68 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 GWX 68 Weather Radar system can help in identifying these shadowed areas. Areas in question appear as shadowed or gray on the radar display. Proper use of the antenna tilt control can also help detect radar shadows.

Attenuation can also be due to poor maintenance or degradation of the radome. Even the smallest amount of wear and scratching, pitting, and pinholes on the radome surface can cause damage and system inefficiency.

RADAR SIGNAL REFLECTIVITY

PRECIPITATION

Precipitation or objects more dense than water, such as the surface of the earth or solid structures, are detected by the weather radar. The weather radar does not detect clouds, thunderstorms, or turbulence directly. It detects precipitation associated with clouds, thunderstorms, and turbulence. The best radar signal reflectors are raindrops, wet snow, or wet hail. The larger the raindrop, the better the reflectivity. The size of the precipitation droplet is the most important factor in radar reflectivity. Because large drops in a small concentrated area are characteristic of a severe thunderstorm, the radar displays the storm as a strong return. Ice crystals, dry snow, and dry hail have low levels of reflectivity as shown in the illustration, and often not displayed by the radar. Additionally, a cloud that contains only small raindrops, such as fog or drizzle, does not reflect enough radar energy to produce a measurable target return.
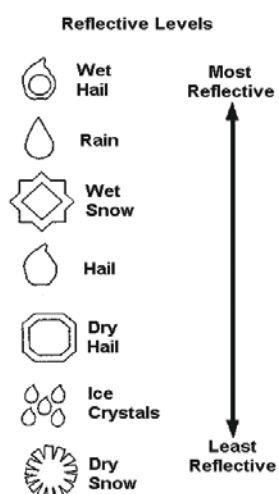
Figure 6-51 Precipitation Type and Reflectivity

GROUND RETURNS

The intensity of ground target returns depends upon the angle at which the radar beam strikes the ground target (Angle of Incidence) and the reflective properties of that target. The gain can be adjusted so shorelines, rivers, lakes, and cities are well-defined. Increasing the gain too much causes the display to fill in between targets, thus obscuring some landmarks.

Cities normally provide a strong return signal. While large buildings and structures provide good returns, small buildings can be shadowed from the radar beam by the taller buildings. As the aircraft approaches and shorter ranges are selected, details become more noticeable as the highly reflective regular lines and edges of the city become more defined.

Bodies of water such as lakes, rivers, and oceans are not good reflectors and normally do not provide good returns. The energy is reflected in a forward scatter angle with inadequate energy being returned. They can appear as dark areas on the display. However, rough or choppy water is a better reflector and provides stronger returns from the downwind sides of the waves.

Mountains also provide strong return signals to the antenna, but also block the areas behind. However, over mountainous terrain, the radar beam can be reflected back and forth in the mountain passes or off canyon walls, using up all or most of the radar energy. In this case, no return signal is received from this area, causing the display to show a dark spot which could indicate a pass where no pass exists.

ANGLE OF INCIDENCE

The angle at which the radar beam strikes the target is called the Angle of Incidence. The figure illustrates the incident angle ('A'). This directly affects the detectable range, the area of illumination, and the intensity of the displayed target returns. A large incident angle gives the radar system a smaller detectable range and lower display intensity due to minimized reflection of the radar energy.
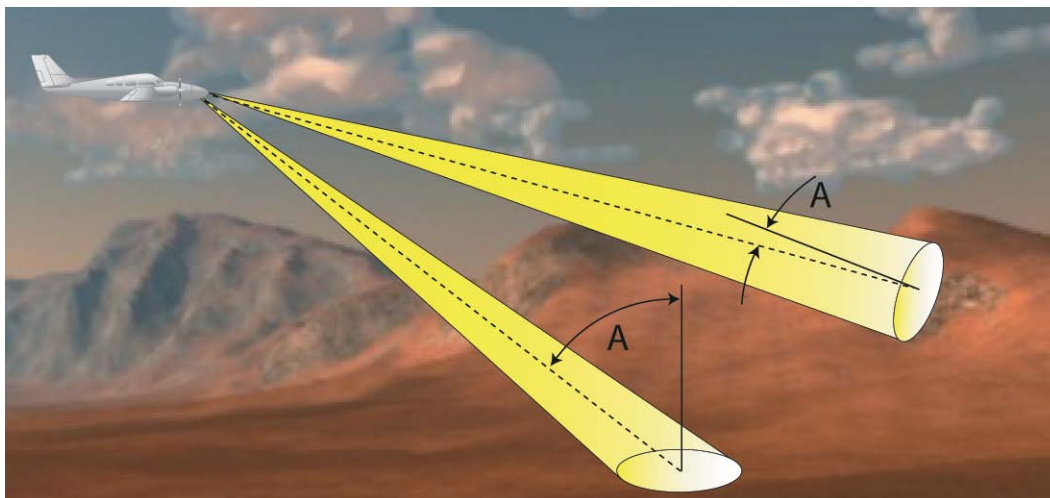
Figure 6-52 Angle of Incidence

A smaller incident angle gives the radar a larger detectable range of operation and the target display shows a higher intensity. Since more radar energy is reflected back to the antenna with a low incident angle, the resulting detectable range is increased for mountainous terrain.

SAFE OPERATING DISTANCE

The following information establishes a minimum safe distance from the antenna for personnel near operating weather radar. The minimum safe distance is based on the FCC's exposure limit at 9.3 to 9.5 GHz for general population/uncontrolled environments, which is 1 mW/cm2. See Advisory Circular 20-68B for more information on safe distance determination.

MAXIMUM PERMISSIBLE EXPOSURE LEVEL (MPEL)

The zone in which the radiation level exceeds the US Government standard of 1 mW/cm2 is the semicircular area of at least 11 feet from the 12-inch antenna. All personnel must remain outside of this zone. With a scanning or rotating beam, the averaged power density at the MPEL boundary is significantly reduced.

MPEL
Boundary

11' for 12"
antenna
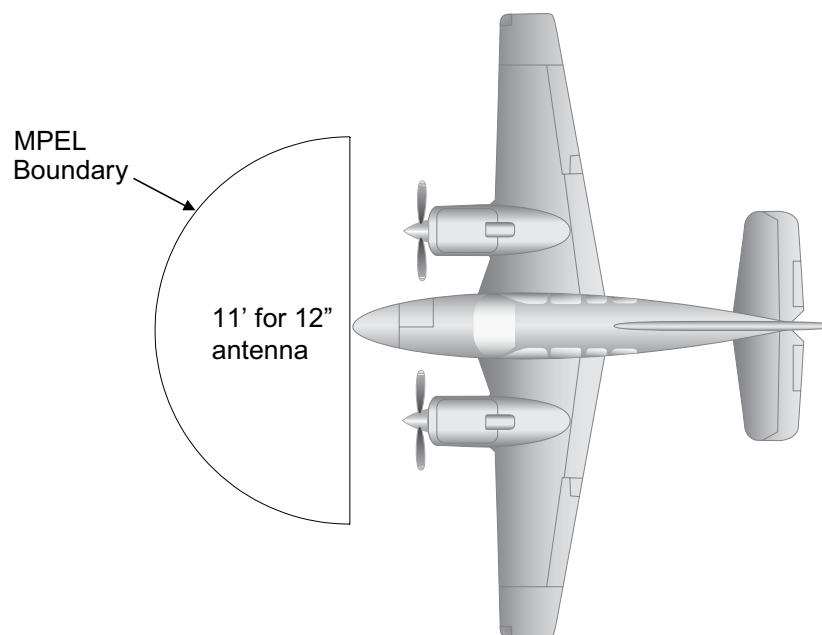
Figure 6-53 MPEL Boundary

BASIC ANTENNA TILT SETUP

The following discussion is a simple method for setting up the weather radar antenna tilt for most situations. It is not to be considered an all encompassing setup that works in all situations, but this method does provide good overall parameters for the monitoring of threats. Ultimately, it is desired to have the antenna tilted so that the bottom of the radar beam is four degrees below parallel with the ground. The following example explains one way of achieving this.

With the aircraft flying level, adjust the antenna tilt so ground returns are displayed at a distance that equals the aircraft's current altitude (AGL) divided by 1,000. For example, if the aircraft is at 14,000 feet, adjust the tilt so the front edge of ground returns are displayed at 14 nautical miles. Note this antenna tilt angle setting. Now, raise the antenna tilt 6 degrees above this setting. The bottom of the radar beam is now angled down 4° from parallel with the ground.

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PRACTICAL APPLICATION USING THE BASIC TILT SETUP

With the antenna tilt set as previously described, any displayed target return should be scrutinized when flying at altitudes between 2,000 and 30,000 feet AGL. If the displayed target advances on the screen to within 5 nautical miles of the aircraft, avoid it. This may be either weather or ground returns that are 2,000 feet or less below the aircraft. Raising the antenna tilt 4 degrees can help separate ground returns from weather returns in relatively flat terrain. This aligns the bottom of the radar beam parallel with the ground. Return the antenna tilt to the previous setting after a few sweeps.

If the aircraft is above 29,000 feet, be cautious of any target return that gets to within 30 nautical miles. This is likely a thunderstorm that has a top high enough that the aircraft cannot fly over it safely.

If the aircraft altitude is 15,000 feet or lower, setting the displayed range to 60 miles may be more helpful. Closely monitor anything that enters the display.

Also, after setting up the antenna tilt angle as described previously, ground returns can be monitored for possible threats. The relationship between antenna tilt angle, altitude, and distance is one degree of tilt equals 100 feet of altitude for every one nautical mile.
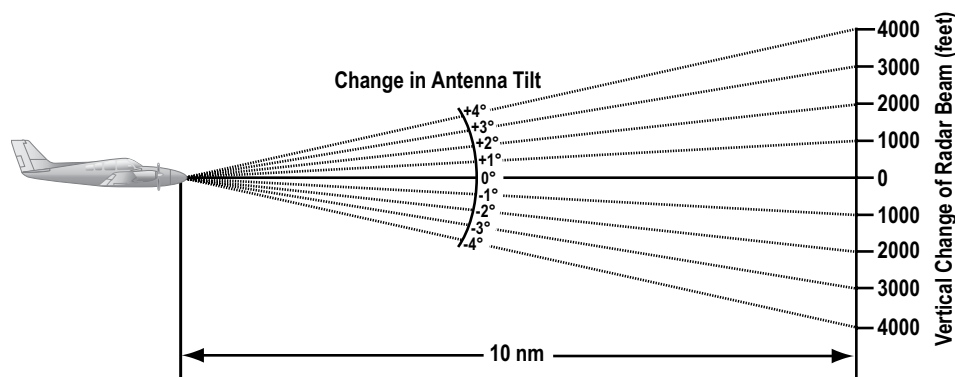
Figure 6-54 Vertical Change in Radar Beam per Nautical Mile

Therefore, with the antenna tilt set so that the bottom of the beam is four degrees below parallel with the ground, a target return at 10 nm is approximately 4,000 feet below the aircraft; at 20 nm, 8,000 feet; at 50 nm, 20,000 feet. In other words, at this tilt setting, a ground return (such as a mountain peak) being displayed at 10 nm would have a maximum distance below the aircraft of 4,000 feet. A ground target return being displayed at 5 nm would have a maximum distance below the aircraft of 2,000 feet.

This setup provides a good starting point for practical use of the GWX 68. There are many other factors to consider in order to become proficient at using weather radar in all situations.

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 Table 6-4.

Weather Mode Color	Intensity	Approximate Precipitation Rate (in/hr.)
Black	< 23 dBZ	< .01.
Green	23 dBZ to < 32 dBZ	.01 - 0.1.
Yellow	32 dBZ to < 41 dBZ	0.1 - 0.5
Red	41 dBZ to < 50 dBZ	0.5 - 2
Magenta	50 dBZ and greater	> 2

Table 6-4 Precipitation Intensity Levels

THUNDERSTORMS

Updrafts and downdrafts in thunderstorms carry water through the cloud. The more severe the drafts, the greater the number and size of the precipitation droplets. With this in mind, the following interpretations can be made from what is displayed on the weather radar. Avoid these areas by an extra wide margin.

- In areas where the displayed target intensity is red or magenta (indicating large amounts of precipitation), the turbulence is considered severe.

- Areas that show steep color gradients (intense color changes) over thin bands or short distances suggest irregular rainfall rate and strong turbulence.

- Areas that show red or magenta are associated with hail or turbulence, as well as heavy precipitation. Vertical scanning and antenna tilt management may be necessary to identify areas of maximum intensity.

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Along squall lines (multiple cells or clusters of cells in a line) individual cells may be in different stages of development. Areas between closely spaced, intense targets may contain developing clouds not having enough moisture to produce a return. However, these areas could have strong updrafts or downdrafts. Targets showing wide areas of green are generally precipitation without severe turbulence.

Irregularities in the target return may also indicate turbulence, appearing as hooks, fingers, or scalloped edges. These irregularities may be present in green areas with no yellow, red, or magenta areas and should be treated as highly dangerous areas. Avoid these areas as if they are red or magenta.

Squall Line

Steep Gradient　　　*Hook or Finger*　　　*Scalloped Edge*
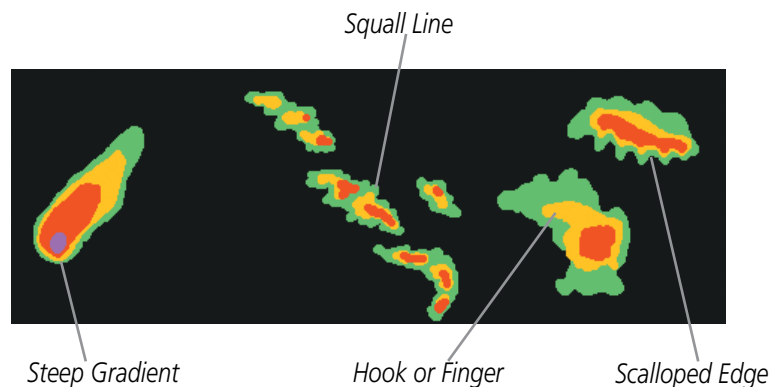
Figure 6-55 Cell Irregularities

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.
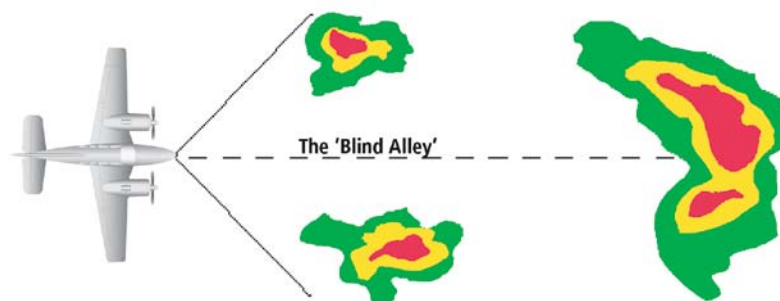
The 'Blind Alley'

Figure 6-56 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.
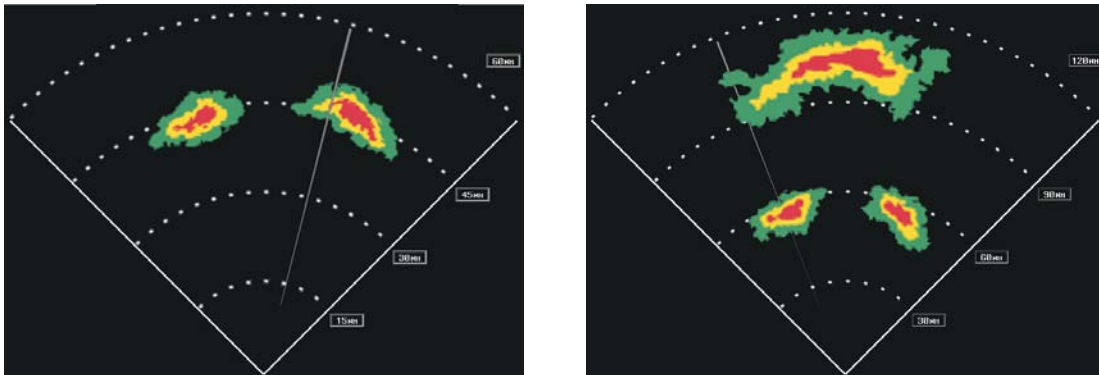
The Blind Alley at Close Range   *The Large Storm Behind*

Figure 6-57 The Blind Alley

TORNADOES

There are no conclusive radar target return characteristics which identify a tornado. However, tornadoes may be present if the following characteristics are observed:

• A narrow, finger-like portion extends and in a short time curls into a hook and closes on itself.

• A hook, which may be in the general shape of the numeral 6 (9 in the southern hemisphere), especially if bright and projecting from the southwest quadrant (northeast quadrant in the southern hemisphere) of a major thunderstorm.

• V-shaped notches.

• Doughnut shapes.

These shapes do not always indicate tornadoes, and tornado returns are not limited to these characteristics. Confirmed radar observations of tornadoes most often have not shown shapes different from those of a normal thunderstorm display.

HAIL

Hail results from updrafts carrying water high enough to freeze. Therefore, the higher the top of a thunderstorm, the greater the probability that it contains hail. Vertically scanning the target return can give the radar top of a thunderstorm that contains hail. Radar top is the top of a storm cell as detected by radar. It is not the actual top, or true top of the storm. The actual top of a storm cell is seen with the eyes in clear air and may be much higher than the radar top. The actual top does not indicate the top of the hazardous area.

Hail can fall below the minimum reflectivity threshold for radar detection. It can have a film of water on its surface, making its reflective characteristics similar to a very large water droplet. Because of this film of water, and because hail stones usually are larger than water droplets, thunderstorms with large amounts of wet hail return stronger signals than those with rain. Some hail shafts are extremely narrow (100 yards or less) and make poor radar targets. In the upper regions of a cell where ice particles are dry (no liquid coating), target returns are less intense.

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Hail shafts are associated with the same radar target return characteristics as tornados. U-shaped cloud edges three to seven miles across can also indicate hail. These target returns appear quite suddenly along any edge of the cell outline. They also change in intensity and shape in a matter of seconds, making vigilant monitoring essential.

OPERATION IN WEATHER MODE

⚠ **WARNING:** *Begin transmitting only when it is safe to do so. When transmitting while the aircraft is on the ground, no personnel or objects should be within 11 feet of the antenna.*

⚠ **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.*

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.
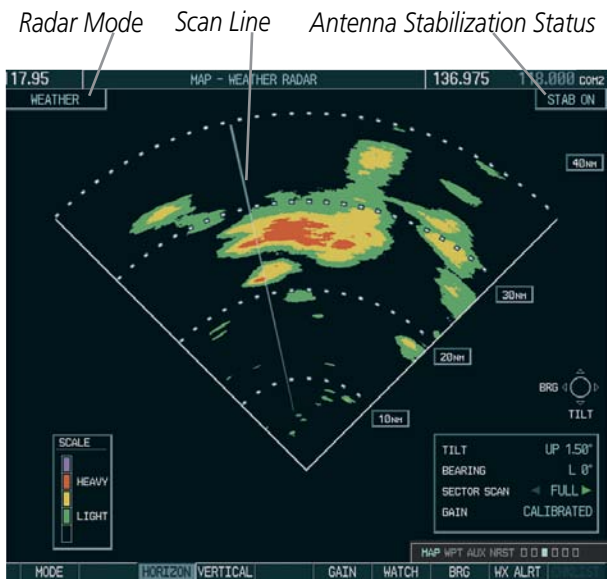
Figure 6-58 Horizontal Scan Display

Displaying weather on the Weather Radar Page:

1) Select the Weather Radar Page in the Map Page Group with the **FMS** Knob.

2) Press the **MODE** Softkey.

3) While on the ground, press the **STANDBY** Softkey. A one-minute warm-up period is initiated (countdown is displayed on the screen). After the warm-up is complete, the radar enters the Standby Mode.

a) Press the **WEATHER** Softkey. A confirmation window is displayed.

```
           CAUTION:
   Activating radar on ground.
   Read and follow all safety
    precautions.  Continue
       activating radar?


     YES     or     NO
```
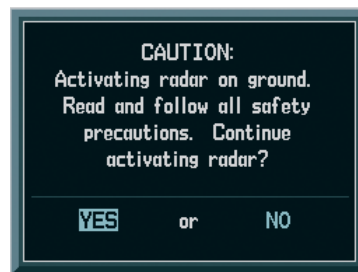
Figure 6-59 Confirming Activating Radar

b) Turn the small **FMS** Knob to highlight YES and press the **ENT** Key to continue radar activation.

Or:

If the aircraft is airborne, press the **WEATHER** Softkey. A one-minute warm-up period is initiated (countdown is displayed on the screen). After the warm-up is complete, the radar begins transmitting.

4) Turn the **RANGE** Knob to select the desired map range.

5) The horizontal scan is initially displayed (Figure 6-58). If desired, press the **VERTICAL** Softkey to change to vertical scanning.

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Vertically scanning a storm cell:

> **NOTE:** *Vertical scanning of a storm cell should be done with the aircraft wings level to avoid constant adjustment of the Bearing Line.*

1) While in the Horizontal Scan view, 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.
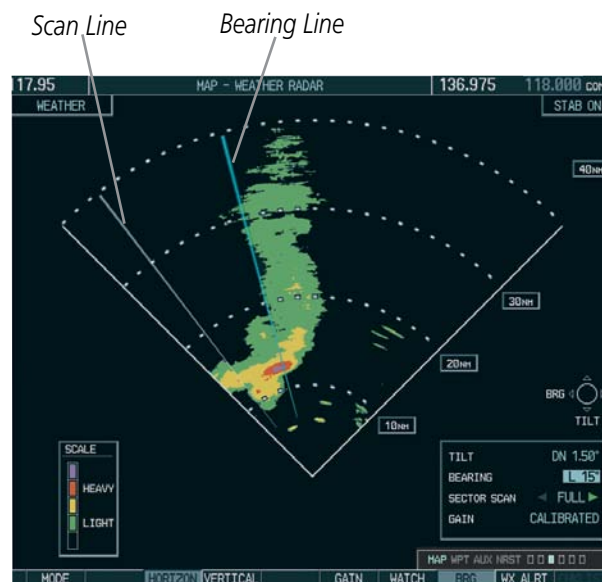
Figure 6-60 Bearing Line on Horizontal Scan

4) Press the **VERTICAL** Softkey. A vertical scan of the selected area is displayed (Figure 6-61).

5) The small **FMS** Knob may be used to move the scanned bearing line a few degrees right or left.

6) Turn the **RANGE** Knob 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 **HORIZON** Softkey to return to the Horizontal Scan view and repeat the previous steps.

The **RANGE** Knob can also be used to adjust bearing from left to right.
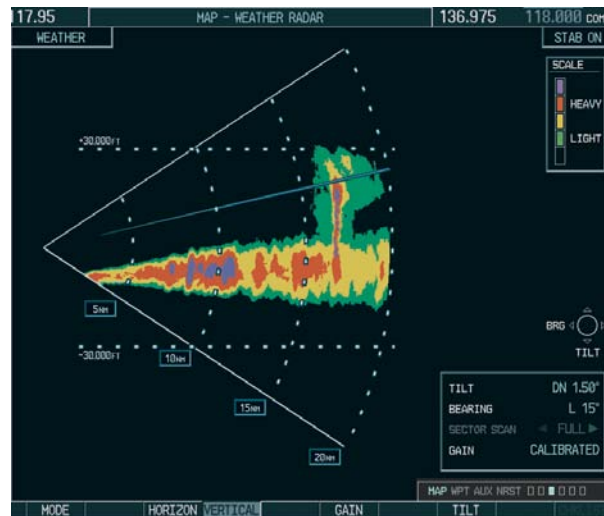
Figure 6-61 Vertical Scan Display

ADJUSTING ANTENNA TILT ANGLE

In order to make an accurate interpretation of a storm cell, the radar beam should be pointed at the wet part of the weather cell to record the proper rainfall intensity (color level). The ideal aiming point is just below the freezing level of the storm. The best way to find this point is to use the Vertical Scan feature. The antenna tilt angle can be centered on the strongest return area in the vertical scan to get a more accurate view of the coverage and intensity of the target in the horizontal scan.

Adjusting antenna tilt on the Horizontal Scan display:

1) Press the **FMS** Knob to activate the cursor in the TILT field.

2) Turn the small **FMS** Knob to select the desired antenna tilt angle.

3) Press the **ENT** Key.

4) Press the **FMS** Knob to remove the cursor.

The **RANGE** Knob 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 selected again.

The **RANGE** Knob can also be used to adjust tilt.

Tilt Line

Scan Line
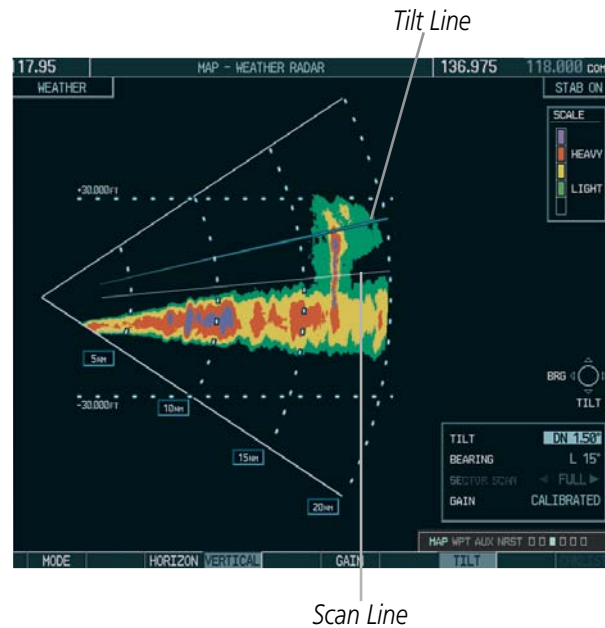
Figure 6-62 Adjusting Tilt on Vertical Scan Display

Adjusting Gain

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

1) Press the **GAIN** Softkey to activate the cursor in the GAIN field.

2) Turn the small **FMS** Knob to adjust the gain for the desirable level. The gain setting is visible in the GAIN field as a movable horizontal bar in a flashing box. The line pointer is a reference depicting the calibrated position.

3) Press the **FMS** Knob to remove the cursor.

4) Press the **GAIN** Softkey again to recalibrate the gain. CALIBRATED is displayed in the GAIN field.
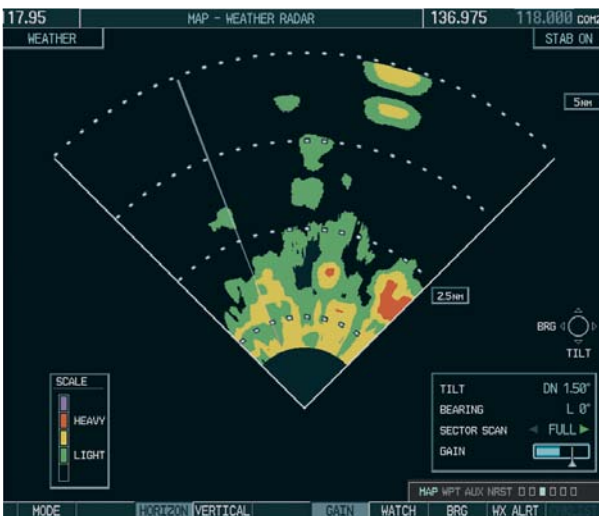
Manual Gain Set Below Calibrated
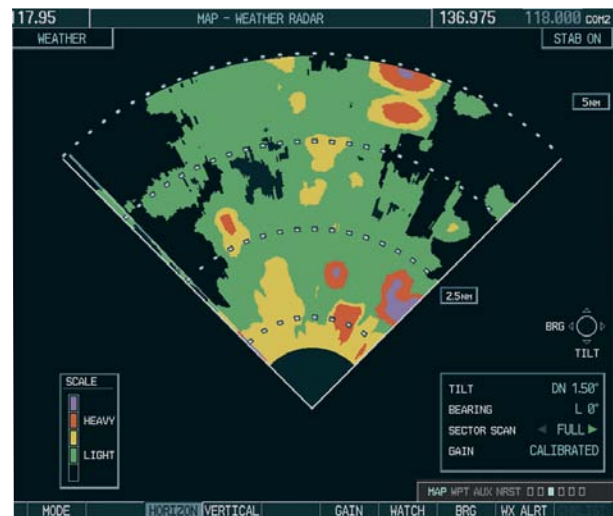
Calibrated Gain

Figure 6-63 Gain Calibration

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Sector Scan

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.
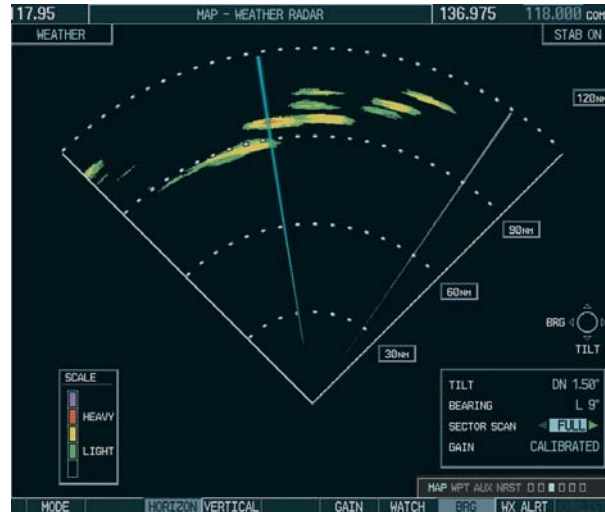
Figure 6-64 Selecting Sector Scan Position

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 select FULL, 60˚, 40˚, or 20˚ 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 0º.

Figure 6-65 40° Sector Scan

Antenna Stabilization

1) To activate or deactivate the antenna stabilization, press the **MODE** Softkey.

2) Press the **STAB ON** Softkey to activate antenna stabilization or press the **STAB OFF** Softkey to deactivate. The current stabilization condition is shown in the upper right of the weather radar display.

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 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.

To activate or deactivate the WATCH™ feature, press the **WATCH** Softkey.

Displayed intensity is questionable. Potentially stronger than displayed.

Areas of Attenuated Signal
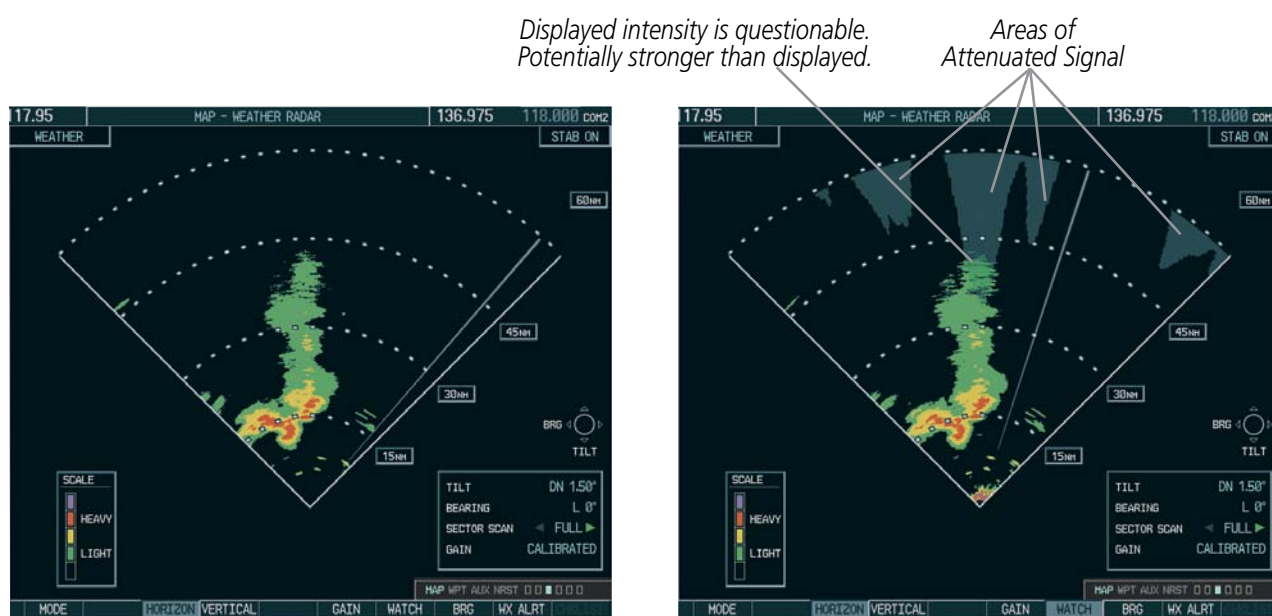
Horizontal Scan Without WATCH™

Horizontal Scan With WATCH™

Figure 6-66 Horizontal Scan Without and With WATCH™

WEATHER ALERT

The Weather Alert feature indicates the presence of heavy precipitation between the ranges of 80 and 320 nm regardless of the currently displayed range. Weather Alert targets appear as red bands along the outer range ring at the approximate azimuth of the detected returns.

If a Weather Alert is detected within ±10° of the aircraft heading, an alert is displayed on the PFD in the Messages Window.

If the antenna tilt is adjusted too low, a weather alert can be generated by ground returns. To avoid unwanted weather alerts, deselect the **WX ALRT** Softkey..
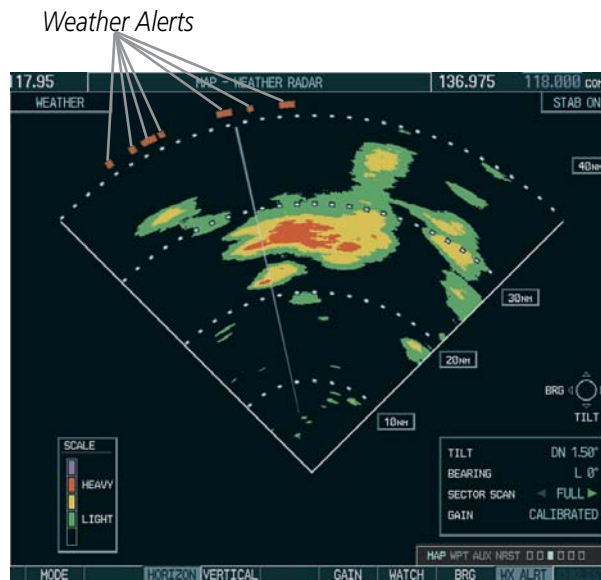
Figure 6-67 Weather Alert Indications

To activate or deactivate Weather Alerts, press the **WX ALRT** Softkey. Activating and deactivating enables or inhibits the alert on the PFD.
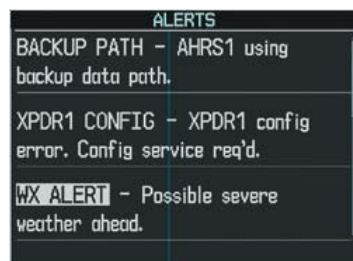
Figure 6-68 Weather Alert on PFD

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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** controls help improve contrast so that specific ground targets can be recognized more easily. As previously discussed, the type and orientation of the target in relation to the aircraft affects the intensity displayed.

When the weather radar system is in either the Weather or Ground Map mode, the system automatically switches to Standby mode upon landing.

Ground Map Mode Color	Intensity
Black	0 dB
Light blue	> 0 dB to < 9 dB
Yellow	9 dB to < 18 dB
Magenta	18 dB to < 27 dB
Blue	27 dB and greater

Table 6-5 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.

SYSTEM STATUS

The radar mode is annunciated in the upper left corner of the Weather Radar Page. Additional information may be displayed in the center of the Weather Radar Page as a banner annunciation.

Radar Mode	Radar Mode Annunciation Box	Center Banner Annunciation
Standby	STANDBY	STANDBY
Standby (During Warm-Up)	STANDBY	WARM-UP XX (XX indicates number of seconds remaining in warm-up)
Weather	WEATHER	None
Ground Mapping	GROUND MAPPING	None
Off	OFF	OFF
Radar Failed*	FAIL	RADAR FAIL

See Table 6-8 for additional failure annunciations

Table 6-6 Radar Modes on the Weather Radar Page

The system displays the status of the radar antenna stabilization feature in the upper right corner of the Weather Radar Page.

Radar Antenna Stabilization Status	Description
STAB ON	Antenna stabilization is selected on.
STAB OFF	Antenna stabilization is selected off.
STAB INOP	The radar is not receiving pitch and roll information. The antenna stabilization feature is inoperative.

Table 6-7 Antenna Stabilization Annunciations on the Weather Radar Page

If the unit fails, an annunciation as to the cause of the failure is shown as a banner in the center of the Weather Radar Page.

Weather Radar Page Center Banner Annunciation	Description
BAD CONFIG	The radar configuration is invalid. The radar should be serviced.
RDR FAULT	The radar unit is reporting a fault. The radar should be serviced.
RADAR FAIL	The system is not receiving valid data from the radar unit. The system should be serviced.

Table 6-8 Abnormal Radar Status Annunciations on the Weather Radar Page

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6.3 WX-500 STORMSCOPE

> **NOTE:** *The optional L-3 STORMSCOPE® WX-500 Lightning system is not intended for hazardous thunderstorm penetration. Weather information on the G1000 MFD is approved for weather avoidance only. Refer to the WX-500 User's Guide for a detailed description of Stormscope operation.*

> **NOTE:** *Stormscope lightning data and GDL 69/69A XM WX Satellite Weather Lightning data cannot be displayed at the same time. When Stormscope data is displayed, XM WX lightning data is removed.*

The following pages can display Stormscope data:

- Stormscope Page
- Navigation Map
- AUX - Trip Planning Page
- Nearest Pages

To display Stormscope data on the Navigation Map, AUX - Trip Planning Page, or any of the Nearest Pages, press the **MAP** Softkey, then press the **STRMSCP** Softkey. These pages can also display cell or strike data using the yellow lightning strike symbology shown in Table 6-9.

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 6-9 Lightning Age and Symbols

SETTING UP STORMSCOPE ON THE NAVIGATION MAP

Setting up Stormscope options on the Navigation Map:

1) On the Navigation Map Page, press the **MENU** Key.

2) With 'Map Setup' selected (Figure 6-69), 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 (Figure 6-70).

5) When an item is highlighted, turn the small **FMS** Knob to select the option.

6) Press the **ENT** Key.

7) Press the **FMS** Knob to return to the Navigation Map Page (Figure 6-71).

The following options are available (Figure 6-70):

- **STRMSCP LTNG** – Turns the display of Stormscope data on or off.

- **STRMSCP 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.

- **STRMSCP SMBL** – Selects the range at which Stormscope data displays. Stormscope data is removed when a map range greater than the STRMSCP SMBL value is selected.
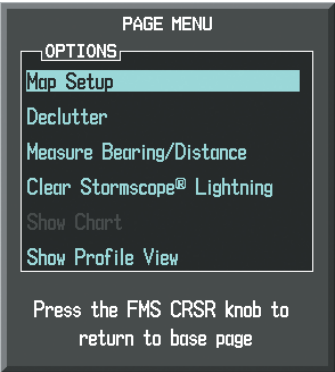
PAGE MENU

OPTIONS

Map Setup
Declutter
Measure Bearing/Distance
Clear Stormscope® Lightning
Show Chart
Show Profile View

Press the FMS CRSR knob to return to base page

Figure 6-69 Navigation Map Page Menu

MAP SETUP

GROUP
Weather

STRMSCP LTNG	◀ Off ▶	
STRMSCP MODE	Cell	
STRMSCP SMBL		300NM
NEXRAD DATA	◀ Off ▶	2000NM
NEXRD CELL MOV	◀ Off ▶	
XM LTNG	◀ On ▶	2000NM
METAR DATA	◀ On ▶	

Press the FMS CRSR knob to return to base page
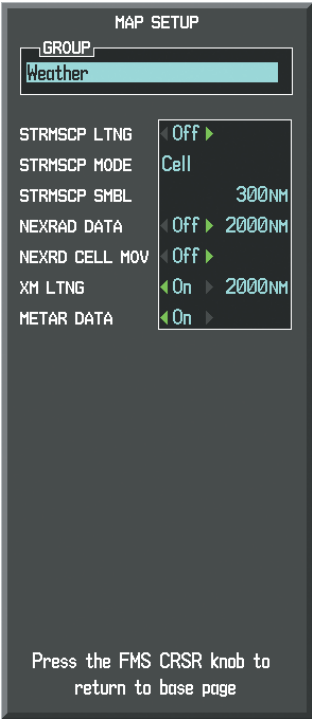
Figure 6-70 Map Setup Menu

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CELL AND STRIKE MODE ON THE NAVIGATION MAP

On the Navigation Map, cell mode identifies cells of lightning activity (Figure 6-71). 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 Setup' selected, press the **ENT** Key.

3) Select the 'Weather' group.

4) Press the **ENT** Key. The cursor flashes on 'STRMSCP LTNG'.

5) Turn the **large FMS** Knob to select 'STRMSCP MODE'.

6) Turn the **small FMS** Knob to change between 'CELL' and 'STRIKE' options. When an item is selected, press the **ENT** Key.

7) Press the **FMS** knob to return to the Navigation Map Page.
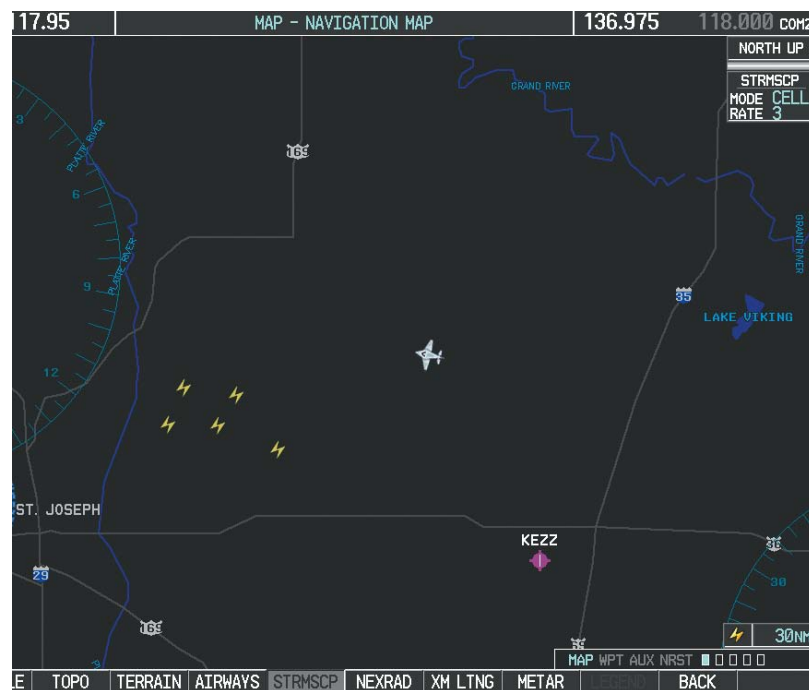
Figure 6-71 Navigation Map Page with Stormscope Lightning Data Enabled

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If heading input is lost, strikes and/or cells must be cleared manually after the execution of each turn (Figure 6-72). This is to ensure 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) Select 'Clear Stormscope® Lightning'.

3) Press the **ENT** Key.

Figure 6-72 Navigation Map Page Options Menu

ZOOM RANGE ON THE NAVIGATION MAP

Stormscope lightning data can be displayed up to 800 nm zoom range (in North up mode) on the Navigation Map Page. **However, in the track up mode at the 500 nm range, a portion of Stormscope lightning data can be behind the aircraft and therefore not visible on the Navigation Map**. Since the range for Stormscope data is 400 nm diameter total (200 nm in front and 200 nm behind), the 500 nm range in North up mode shows all the data.

At a map range of less than 25 nm, Stormscope lightning data is not displayed, but can still be present. The presence of Stormscope lightning data is indicated by the annunciation 'LTNG < 25 nm' in the upper right corner (Figure 6-73).
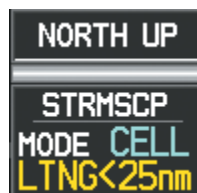
Figure 6-73 Lightning Display Range Annunciation

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The maximum zoom range can also be set on the Navigation Map.

Selecting a Stormscope range on the Navigation Map:

1) Press the **MENU** Key.

2) Select 'MAP SETUP'.

3) Select the 'Weather' group.

4) Press the **ENT** Key.

5) Turn the **large FMS** Knob to select 'STRMSCP SMBL'.

6) Turn the **small FMS** Knob to select the maximum display range.

7) Press the **ENT** Key.

8) Press the **FMS** Knob to return to the Navigation Map Page.

To change the display range on the Navigation Map Page, turn the **RANGE** Knob clockwise to zoom out or counter-clockwise to zoom in.

SELECTING THE STORMSCOPE PAGE

The Map - Stormscope Page is the principal page for viewing Stormscope lightning data. Lightning data 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) To change the map range, turn the **RANGE** Knob clockwise to zoom out or counter-clockwise to zoom in.
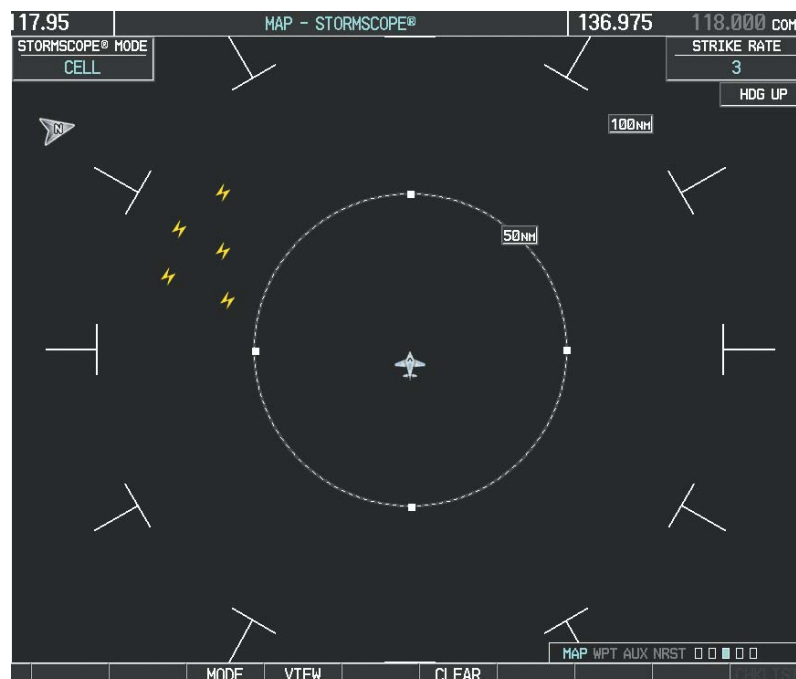
Figure 6-74 Stormscope Page

Changing between 'cell' and 'strike' mode on the Stormscope Page:

1) Select the Stormscope Page.

2) Press the **MODE** Softkey. The **CELL** and **STRIKE** softkeys are displayed.

3) Press the **CELL** Softkey to display 'CELL' data or press the **STRIKE** Softkey to display 'STRIKE' data. 'CELL' or 'STRIKE' is displayed in the mode box in the upper left corner of the Stormscope Page.

4) Press the **BACK** Softkey to return to the main Stormscope page.

Changing the viewing mode between 360˚ and 120˚ on the Stormscope Page:

1) Select the Stormscope Page.

2) Press the **VIEW** Softkey. The **360** and **ARC** softkeys are displayed. Press the **360** Softkey to display a 360˚ viewing area or press the **ARC** Softkey to display a 120˚ viewing area.

3) Press the **BACK** Softkey to return to the main Stormscope page.

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6.4 TAWS-B

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

✓ **NOTE:** *The data contained in the TAWS databases comes from government agencies. Garmin accurately processes and cross-validates the data but cannot guarantee the accuracy and completeness of the data.*

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

TAWS-B (Terrain Awareness and Warning System - Class B) increases situational awareness and aids in reducing controlled flight into terrain (CFIT). TAWS-B provides visual and aural annunciations when terrain and obstacles are within the given altitude threshold from the aircraft. The displayed alerts and warnings are advisory in nature only.

TAWS-B satisfies TSO-C151b Class B requirements for certification.

TAWS-B requires the following to operate properly:

- A valid terrain/obstacle/airport terrain database
- A valid 3-D GPS position solution

TAWS-B uses terrain and obstacle information supplied by government sources. Terrain information is based on terrain elevation information in a database that may contain inaccuracies. Individual obstructions may be shown if available in the database. The data undergoes verification by Garmin to confirm accuracy of the content, per TSO-C151b. However, the displayed information should never be understood as being all-inclusive and data may be inaccurate.

TAWS-B uses information provided from the GPS receiver to provide a horizontal position and altitude. GPS altitude is derived from satellite measurements. GPS altitude is converted to a mean sea level (MSL)-based altitude (GPS-MSL altitude) and is used to determine TAWS-B alerts. GPS-MSL altitude accuracy is affected by factors such as satellite geometry, but it is not subject to variations in pressure and temperature that normally affect pressure altitude devices. GPS-MSL altitude does not require local altimeter settings to determine MSL altitude. Therefore, GPS altitude provides a highly accurate and reliable MSL altitude source to calculate terrain and obstacle alerts.

The terrain and obstacle databases used by TAWS-B are referenced to mean sea level (MSL). Using the GPS position and GPS-MSL altitude, TAWS-B displays a 2-D picture of the surrounding terrain and obstacles relative to the position and altitude of the aircraft. Furthermore, the GPS position and GPS-MSL altitude are used to calculate and "predict" the aircraft's flight path in relation to the surrounding terrain and obstacles. In this manner, TAWS-B can provide advanced alerts of predicted dangerous terrain 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

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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 GPS-MSL altitude. This variation results in the aircraft's true altitude differing from the baro-corrected altitude.

DISPLAYING TAWS-B DATA

TAWS-B uses yellow (caution) and red (warning) to depict terrain and obstacles (with heights greater than 200 feet above ground level, AGL) alerts relative to aircraft altitude. Colors are adjusted automatically as the aircraft altitude changes. The colors and symbols in Figure 6-75 and Tables 6-10 and 6-11 are used to represent terrain, obstacles, and potential impact points, respectively.
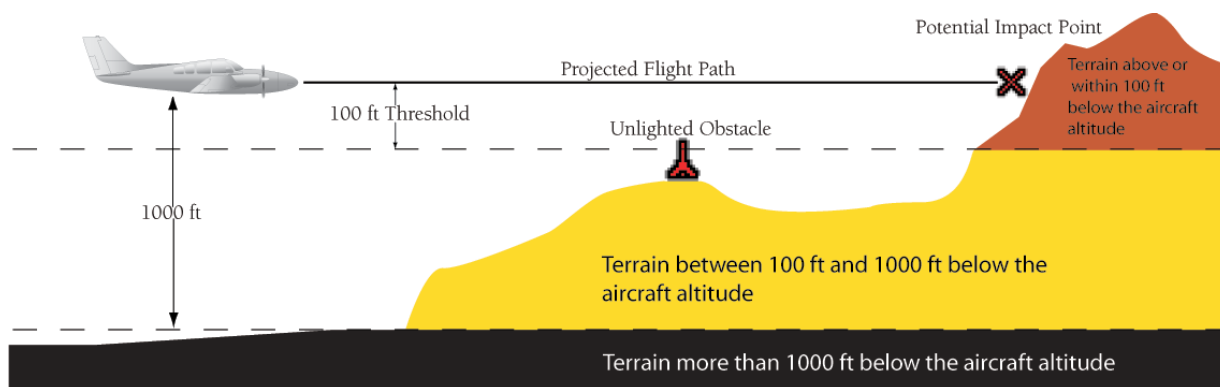
Figure 6-75 Terrain Altitude/Color Correlation for TAWS-B

Unlighted Obstacle		Lighted Obstacle		Obstacle Location
< 1000' AGL	> 1000' AGL	< 1000' AGL	> 1000' AGL	
🔺	🔺	✳	✳	Red obstacle is above or within 100 ft below the aircraft altitude
🔺	🔺	✳	✳	Yellow obstacle is between 100 ft and 1000 ft below the aircraft altitude

Table 6-10 TAWS-B Obstacle Colors and Symbology

Potential Impact Point Symbol	Alert Type	Example Annunciation
✖	Warning	PULL UP
✖	Caution	TERRAIN

Table 6-11 TAWS-B Potential Impact Point Symbols with Alert Types

TAWS-B information can be displayed on the following maps:

- PFD Inset Map
- Navigation Map Page
- TAWS-B Page
- Trip Planning Page
- Flight Plan Pages

Displaying terrain and obstacle information (maps other than the TAWS-B Page):

1) Press the **MAP** Softkey (for the PFD Inset Map, press the **INSET** Softkey).

2) Press the **TERRAIN** Softkey to display terrain and obstacle data.

When TAWS-B is selected on maps other than the TAWS-B Page, an icon to indicate the feature is enabled for display and a legend for TAWS-B terrain colors are shown (Figure 6-82).

The Navigation Map Page Setup Menu provides a means in addition to the softkey for enabling/disabling display of terrain and obstacles. The setup menu also controls the map range settings above which terrain and obstacle data are decluttered from the display. If a map range larger than the map range setting is selected, the data is removed from the map. For terrain data, the enable/disable function applies only to the MFD, while the range setting also affects the PFD Inset Map.

Terrain data can be selected for display independently of obstacle data; however, obstacles for which 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 TAWS-B Page use settings based on those selected for the Navigation Map Page. The maximum display ranges for obstacles on each map are dependent on the range setting made for the Navigation Map. If the maximum range for obstacle display on the Navigation Map is adjusted to below 20 nm, the highest obstacle display range settings on the other applicable maps are also adjusted proportionally.

Customizing terrain and obstacle display on the Navigation Map Page:

1) Select the Navigation Map Page.

2) Press the **MENU** Key.

3) With 'Map Setup' highlighted, press the **ENT** Key (Figure 6-76).

4) Turn the small **FMS** Knob to select the 'Map' Group and press the **ENT** Key (Figure 6-77).

5) Turn the large **FMS** Knob or press the **ENT** Key to scroll through product selections (Figure 6-78).

- TERRAIN DATA – Turns the display of terrain data on or off and sets maximum range at which terrain is shown

- OBSTACLE DATA – Turns the display of obstacle data on or off and sets maximum range at which obstacles are shown

6) Turn the small **FMS** Knob to scroll through options for each product (ON/OFF, range settings).

7) Press the **ENT** Key to select an option.

8) Press the **FMS** Knob or **CLR** Key to return to the Navigation Map Page with the changed settings.
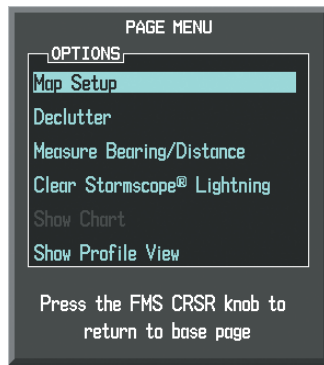
Figure 6-76 Navigation Map Page Menu
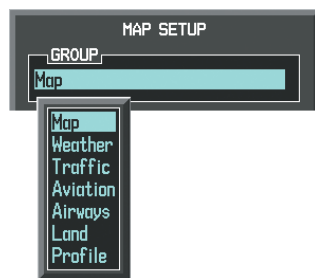
Figure 6-77 Navigation Map Page Setup Menu
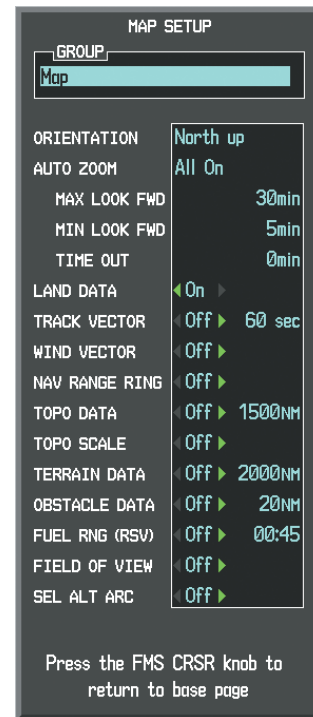
Figure 6-78 Navigation Map Page Setup Menu, Map Group

TAWS-B PAGE

The Map - TAWS-B Page is the principal map display for showing terrain, obstacle, and potential impact point data in relation to the aircraft's current altitude, without clutter from the basemap. Aviation data (airports, VORs, and other NAVAIDs) can be displayed for reference. If an obstacle and the projected flight path of the aircraft intersect, the display automatically zooms in to the closest potential point of impact on the TAWS-B Page.

Aircraft orientation on this map is always heading up unless there is no valid heading. Two views are available relative to the position of the aircraft: the 360° default display and the radar-like ARC (120°) display. Map range is adjustable with the **RANGE** Knob from 1 to 200 nm, as indicated by the map range rings (or arcs).

Displaying the TAWS-B Page:

1) Turn the large **FMS** Knob to select the Map Page Group.

2) Turn the small **FMS** Knob to select the TAWS-B Page.

Changing the TAWS-B Page view:

1) Press the **VIEW** Softkey.

2) Press the **360** or **ARC** Softkey to select the desired view.

   Or:

1) Press the **MENU** Key.

2) Select 'View Arc' or 'View 360°' (choice dependent on current state) and press the **ENT** Key to change the view

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Showing/hiding aviation information on the TAWS-B Page:

1) Press the **MENU** Key.

2) Select 'Show Aviation Data' or 'Hide Aviation Data' (choice dependent on current state) and press the **ENT** Key.
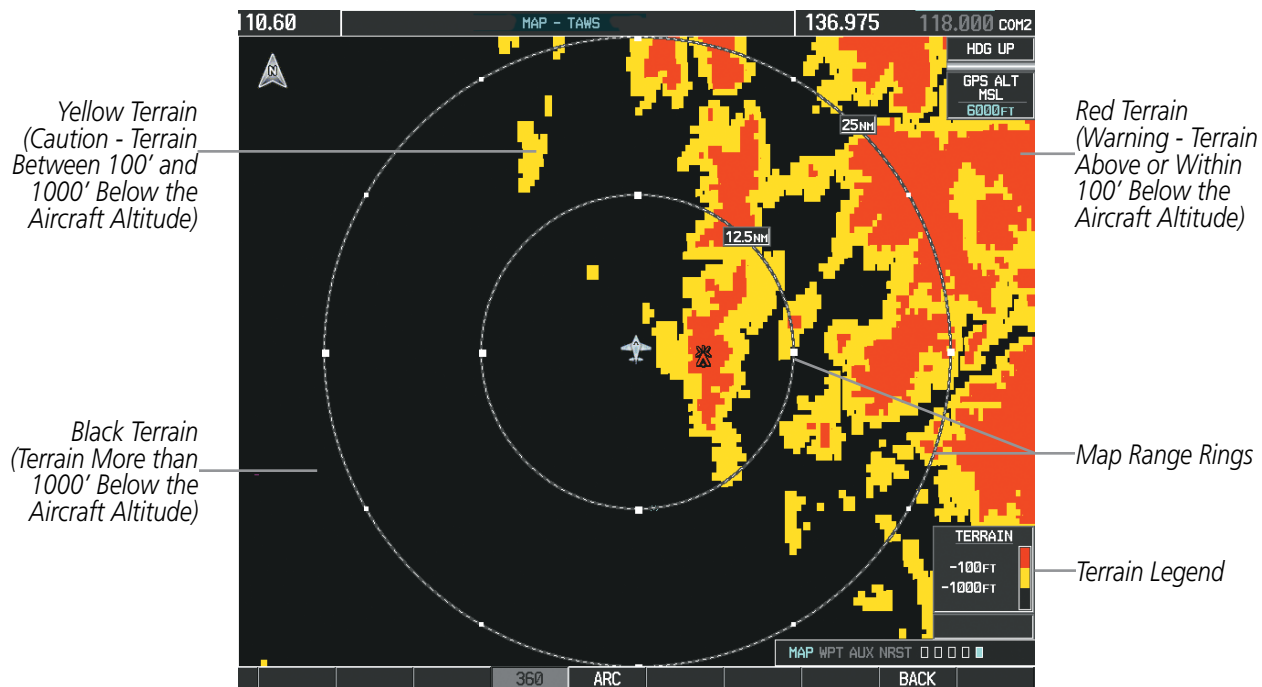
Figure 6-79 TAWS-B Page
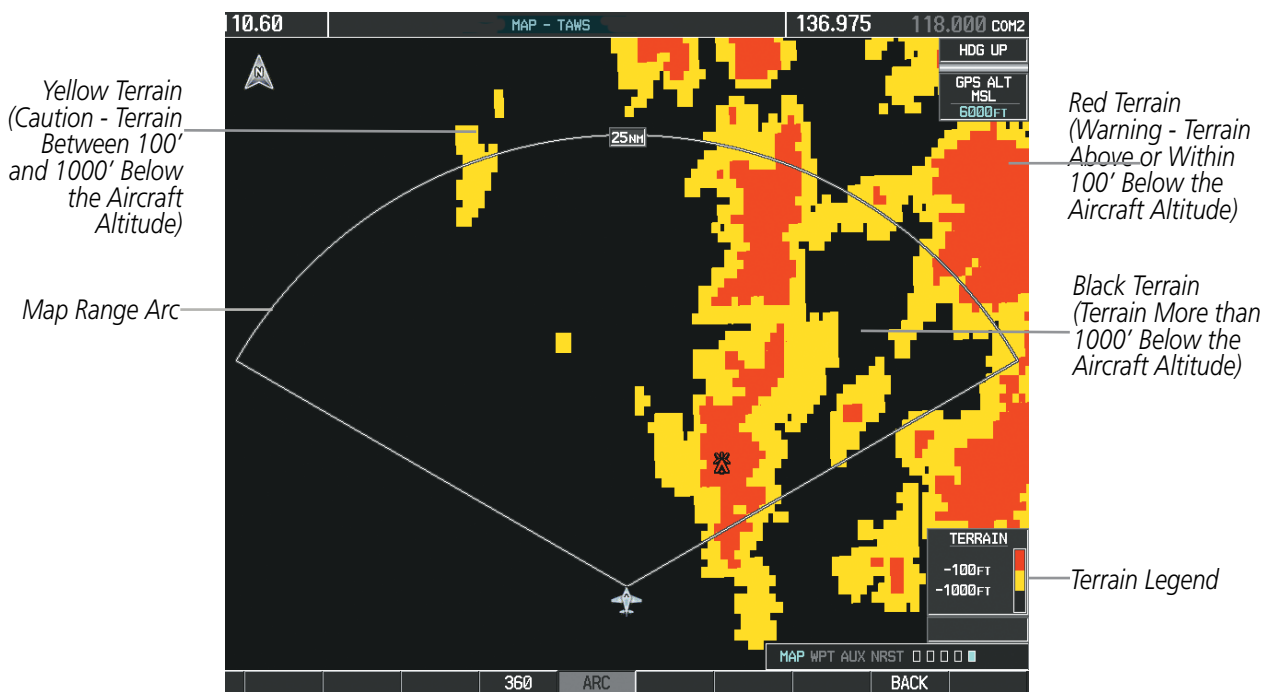
Figure 6-80 TAWS-B Page (ARC View)

TAWS-B ALERTS

Alerts are issued when flight conditions meet parameters that are set within TAWS-B software algorithms. TAWS-B alerts typically employ a CAUTION or a WARNING alert severity level, or both. When an alert is issued, visual annunciations are displayed and aural alerts are simultaneously issued. Table 6-12 shows TAWS-B alert types with corresponding annunciations and aural messages.

When an alert is issued, annunciations appear on the PFD and MFD. The TAWS-B Alert Annunciation is shown to the upper left of the Altimeter on the PFD and below the Terrain Legend on the MFD (shown when terrain display is enabled). If the TAWS-B 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 TAWS-B Page)

PFD Alert Annunciation
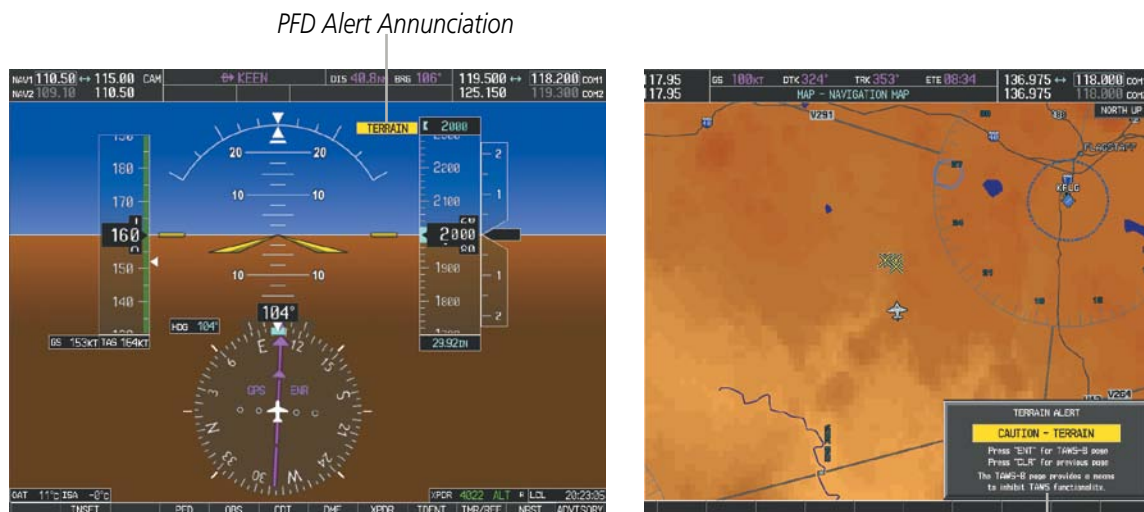
Figure 6-81 TAWS-B Alert Annunciations

MFD Pop-up Alert

Terrain Display Enabled
Terrain Legend
Alert Annunciation
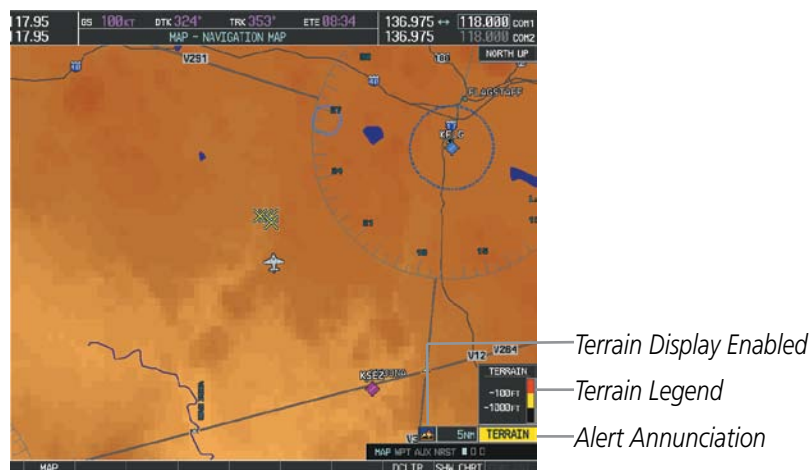
Figure 6-82 Navigation Map Page
(After TAWS-B Pop-up Alert Acknowledgment)

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Alert Type	PFD/MFD** Alert Annunciation	MFD Pop-Up Alert (except TAWS-B Page)	Aural Message
Excessive Descent Rate Warning (EDR)	PULL UP	PULL-UP	"Pull Up"
Reduced Required Terrain Clearance Warning (RTC)	PULL UP	TERRAIN – PULL-UP * or TERRAIN AHEAD – PULL-UP	"Terrain, Terrain; Pull Up, Pull Up"* or "Terrain Ahead, Pull Up; Terrain Ahead, Pull Up"
Imminent Terrain Impact Warning (ITI)	PULL UP	TERRAIN – PULL-UP or TERRAIN AHEAD – PULL-UP *	"Terrain, Terrain; Pull Up, Pull Up" or "Terrain Ahead, Pull Up; Terrain Ahead, Pull Up"*
Reduced Required Obstacle Clearance Warning (ROC)	PULL UP	OBSTACLE – PULL-UP * or OBSTACLE AHEAD – PULL-UP	"Obstacle, Obstacle; Pull Up, Pull Up"* or "Obstacle Ahead, Pull Up; Obstacle Ahead, Pull Up"
Imminent Obstacle Impact Warning (IOI)	PULL UP	OBSTACLE – PULL-UP or OBSTACLE AHEAD – PULL-UP *	"Obstacle, Obstacle; Pull Up, Pull Up" or "Obstacle Ahead, Pull Up; Obstacle Ahead, Pull Up"*
Reduced Required Terrain Clearance Caution (RTC)	TERRAIN	CAUTION – TERRAIN * or TERRAIN AHEAD	"Caution, Terrain; Caution, Terrain"* or "Terrain Ahead; Terrain Ahead"
Imminent Terrain Impact Caution (ITI)	TERRAIN	CAUTION – TERRAIN or TERRAIN AHEAD *	"Caution, Terrain; Caution, Terrain" or "Terrain Ahead; Terrain Ahead"*
Reduced Required Obstacle Clearance Caution (ROC)	TERRAIN	CAUTION – OBSTACLE or OBSTACLE AHEAD *	"Caution, Obstacle; Caution, Obstacle" or "Obstacle Ahead; Obstacle Ahead"*
Imminent Obstacle Impact Caution (IOI)	TERRAIN	CAUTION – OBSTACLE * or TOO LOW – TERRAIN	"Caution, Obstacle; Caution, Obstacle"* or "Obstacle Ahead; Obstacle Ahead"
Premature Descent Alert Caution (PDA)	TERRAIN	TOO LOW – TERRAIN	"Too Low, Terrain"
Altitude Callout "500"	None	None	"Five-Hundred"
Excessive Descent Rate Caution (EDR)	TERRAIN	SINK RATE	"Sink Rate"
Negative Climb Rate Caution (NCR)	TERRAIN	DON'T SINK * or TOO LOW – TERRAIN	"Don't Sink"* or "Too Low, Terrain"

Alerts with multiple messages are configurable at installation and are installation-dependent. Alerts for the default configuration when more than one option is available are indicated with asterisks.
*** Annunciation is displayed on the MFD when terrain display is enabled.*

Table 6-12 TAWS-B Alerts Summary

EXCESSIVE DESCENT RATE ALERT

The purpose of the **Excessive Descent Rate (EDR)** alert is to provide suitable notification when the aircraft is determined to be closing (descending) upon terrain at an excessive speed. Figure 6-83 shows the parameters for the alert as defined by TSO-C151b.
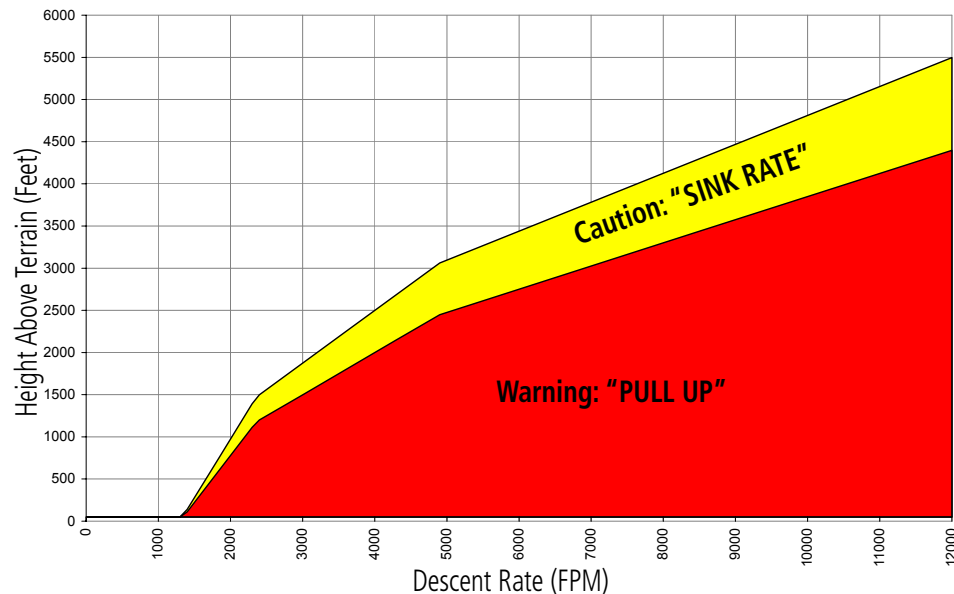

Figure 6-83 Excessive Descent Rate Alert Criteria

FORWARD LOOKING TERRAIN AVOIDANCE

Reduced Required Terrain Clearance (RTC) and **Reduced Required Obstacle Clearance (ROC)** alerts are issued when the aircraft flight path is above terrain, yet is projected to come within the minimum clearance values in Figure 6-84. When an RTC alert is issued, a potential impact point is displayed on the TAWS-B Page.

Imminent Terrain Impact (ITI) and **Imminent Obstacle Impact (IOI)** alerts are issued when the aircraft is below the elevation of a terrain or obstacle cell in the aircraft's projected path. ITI and IOI alerts are accompanied by a potential impact point displayed on the TAWS-B Page. The alert is annunciated when the projected vertical flight path is calculated to come within minimum clearance altitudes in Figure 6-84.

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Required Terrain Clearance
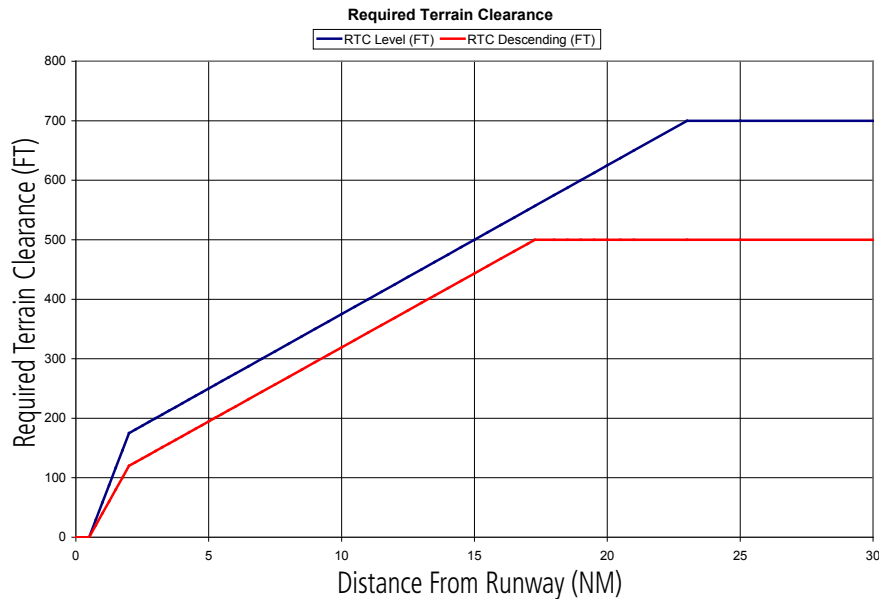
Figure 6-84 FLTA Alert Minimum Terrain and Obstacle Clearance Values

FLTA alerts are automatically inhibited when the aircraft is less than 200 feet above the destination runway elevation while within 0.5 nm of the approach runway or the aircraft is between runway ends

PREMATURE DESCENT ALERTING

A **Premature Descent Alert (PDA)** is issued when the system detects the aircraft is significantly below the normal approach path to a runway (Figure 6-85).

PDA alerting begins when the aircraft is below 700 feet AGL within 15 nm of the destination airport and ends when the aircraft is 0.5 nm from the runway threshold.
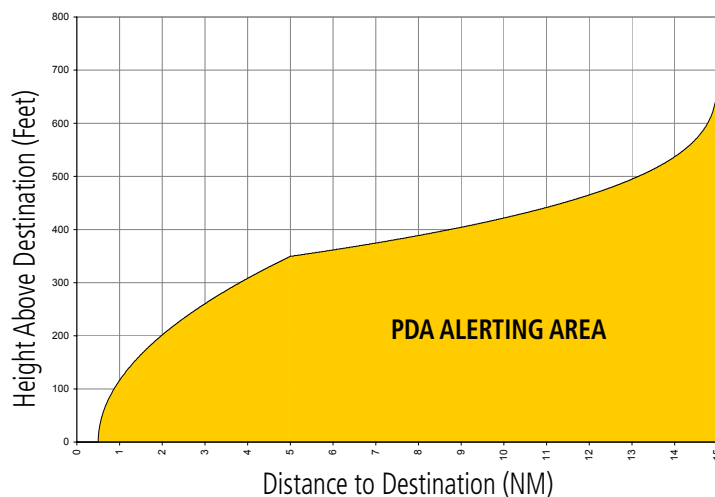
Figure 6-85 PDA Alerting Threshold

PDA and FLTA aural and visual alerts can be manually inhibited. Discretion should be used when inhibiting TAWS-B and the system should be enabled when appropriate. When TAWS-B is inhibited, the alert annunciation 'TAWS INH' is shown on the PFD, and on MFD pages when terrain is displayed (Figure 6-86).

```
┌──────────┐
│ TAWS INH │
└──────────┘
```

**Figure 6-86 TAWS-B Alerting Disabled
(TAWS Inhibited) Annunciation**

Inhibiting/enabling TAWS-B alerting:

1) Select the TAWS-B Page.

2) Press the **INHIBIT** Softkey to inhibit or enable TAWS (choice dependent on current state).

Or:

a) Press the **MENU** Key.

b) Select 'Inhibit TAWS' or 'Enable TAWS' (choice dependent on current state) and press the **ENT** Key.

If TAWS-B alerts are inhibited when the Final Approach Fix is the active waypoint in a GPS WAAS approach, a 'LOW ALT' annunciation may appear on the PFD next to the Altimeter if the current aircraft altitude is at least 164 feet below the prescribed altitude at the Final Approach Fix. See the Flight Instruments Section for details.

FIVE-HUNDRED AURAL ALERT

The purpose of the aural alert message **"Five-hundred"** is to provide an advisory alert of when the aircraft descends to within 500 feet above the terrain or runway threshold. When the aircraft is within 5 nm of an airport, the **"Five Hundred"** aural alert is based on the nearest runway threshold elevation. When the aircraft is more than 5 nm of the nearest airport, the **"Five Hundred"** aural alert is based on the height above terrain. There are no display annunciations or pop-up alerts that accompany the aural message.

NEGATIVE CLIMB RATE AFTER TAKEOFF ALERT (NCR)

The **Negative Climb Rate (NCR) After Takeoff** alert (also referred to as "Altitude Loss After Takeoff") provides alerts when the system determines the aircraft is losing altitude (closing upon terrain) after takeoff. The aural message "Don't Sink" is given for NCR alerts, accompanied by an annunciation and a pop-up terrain alert on the display. NCR alerting is only active when departing from an airport and when the following conditions are met:

• Height above the terrain is less than 700 feet

• Distance from the departure airport is 2 nm or less

• Heading change from the departure heading is less than 110 degrees

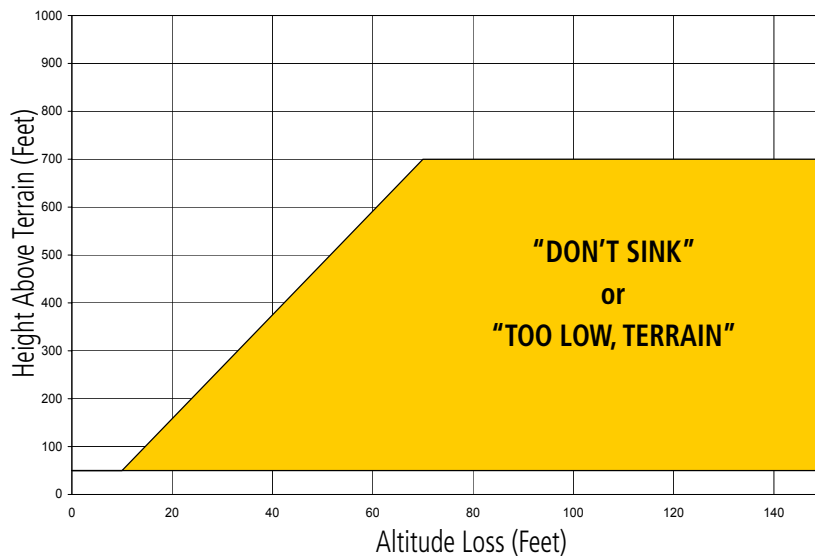Figures 6-72 and 6-73 show the NCR alerting parameters as defined by TSO-C151b.

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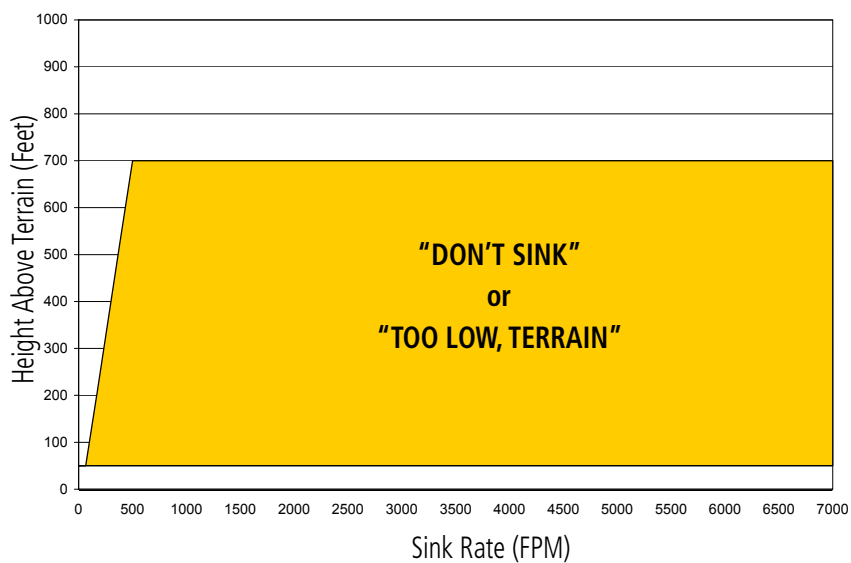**Figure 6-87 Negative Climb Rate (NCR) Altitude Loss**

Figure 6-88 Negative Climb Rate (NCR) Sink Rate

SYSTEM STATUS

During power-up, TAWS-B conducts a self-test of its aural and visual annunciations. The system test can also be manually initiated. An aural alert is issued at test completion. TAWS-B System Testing is disabled when ground speed exceeds 30 knots.

Manually testing the TAWS-B System:

1) Select the TAWS-B Page.

2) Press the **MENU** Key (Figure 6-89).

3) Select 'Test TAWS System' and press the **ENT** Key to confirm the selection.
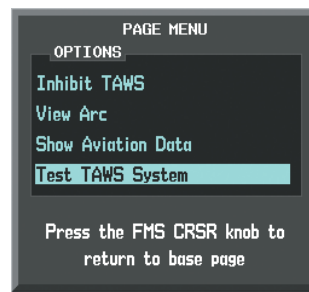
Figure 6-89 TAWS-B Page Menu

TAWS-B continually monitors several system-critical items such as database validity, hardware status, and GPS status. If the terrain/obstacle database is not available, the aural message *"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' is generated in the annunciation window and on the TAWS-B Page. The aural message *"TAWS Not Available"* is generated. When the GPS signal integrity returns and the aircraft is within the database coverage area, the aural message "TAWS Available" is generated

Alert Type	PFD/MFD* Alert Annunciation	TAWS-B Page Center Banner Annunciation	Aural Message
System Test in progress	TAWS TEST	**TAWS TEST**	None
System Test pass	None	None	"TAWS System Test Test OK"
TAWS-B FLTA Alerting Inhibited	TAWS INH	None	None
No GPS position	TAWS N/A	**NO GPS POSITION**	"TAWS Not Available"
Excessively degraded GPS signal; or Out of database coverage area	TAWS N/A	None	"TAWS Not Available"
TAWS-B System Test Fail; Terrain or Obstacle database unavailable or invalid; Invalid software configuration; or System audio fault	TAWS FAIL	**TAWS FAIL**	"TAWS System Failure"
MFD Terrain or Obstacle database unavailable or invalid. TAWS operating with PFD Terrain or Obstacle databases	None	**TERRAIN DATABASE FAILURE**	None

† *Annunciation is shown on TAWS-B Page and the Navigation Map Page when Terrain is enabled.*
* "TAWS Available" will be heard when sufficient GPS signal is received, or Terrain database coverage area re-entered.

Table 6-13 TAWS-B System Status Annunciations

6.5 PROFILE VIEW TERRAIN

The system offers a Profile View of terrain and obstacles relative to the aircraft's current flight path and altitude on the Navigation Map Page of the MFD. Profile View does not provide terrain or obstacle caution or warning annunciations or voice alerts, nor does it display potential impact points inside the Profile View.   The colors and symbols in Figure 6-90 and Table 6-14 are used to represent terrain and obstacles.
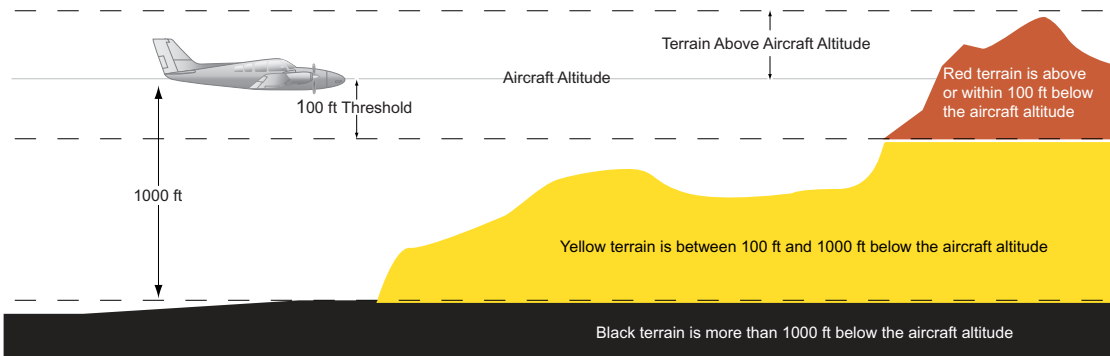
Figure 6-90 Terrain Altitude/Color Correlation for Profile View Terrain

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

Table 6-14 Profile View Terrain/Obstacle Colors and Symbology

Accessing Profile View:

1) Select the Navigation Map Page.

2) Press the **MAP** Softkey.

3) Press the **PROFILE** Softkey to enable or disable Profile View.

Or:

1) Press the **MENU** Key.

2) Select 'Show Profile View' or 'Hide Profile View' (choice dependent on current state) and press the **ENT** Key.

Enabling/Disabling Profile View Terrain on the Navigation Map (when Profile View is enabled):

1) Select the Navigation Map Page.

2) Press the **MAP** Softkey.

3) Press the **TERRAIN** Softkey.

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PROFILE VIEW DISPLAY

When the Profile View is enabled, it is displayed in a window below the Navigation Map. Altitude is shown along a vertical scale, with an aircraft icon positioned at the current altitude. Distance is represented horizontally along the bottom of the Profile View, and increases from left (present position) to right.

When the Navigation Map range is adjusted with the **RANGE** Knob, the horizontal distance of the Profile View is adjusted proportionately to be 1/2 of the Navigation Map range distance down to 1 nm, at which point Profile View is no longer available ('PROFILE NOT AVAILABLE' is displayed). When Navigation Map range is adjusted to remove altitude-correlated colored terrain data (as shown in the Terrain Legend) or obstacles from the Navigation Map, these items are also removed from the Profile View; only an outline of the terrain will be displayed in black in the Profile View window. Refer to the TAWS-B section for more information about displaying terrain or obstacles on the Navigation Map Page.
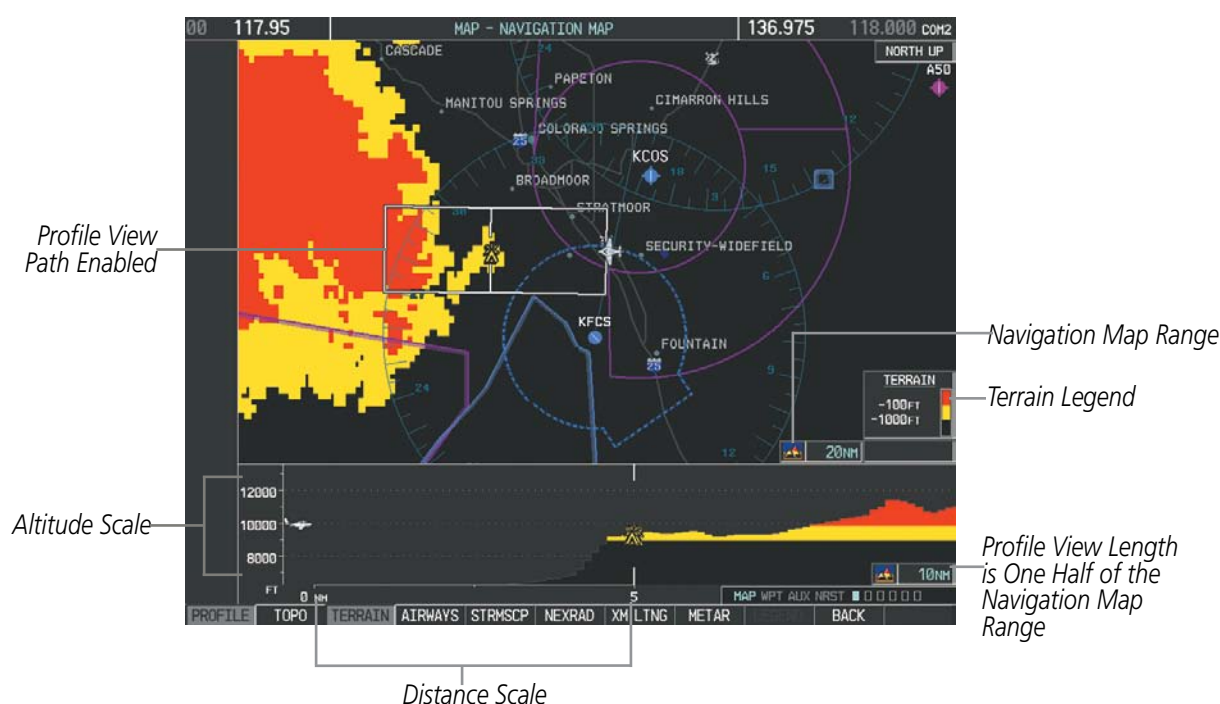
Figure 6-91 Profile View on Navigation Map with Terrain Display Enabled

The Profile View is based on the current aircraft track (or heading if track is unavailable) and shows the *highest* known terrain or obstacles within a predetermined width from the present aircraft position to the end of the profile range. The width of the Profile View (Table 6-15) is determined by the phase of flight, as annunciated on the HSI. Refer to the Flight Instruments section for more information about flight phases.

Flight Phase	Total Profile View Width
Approach	0.6 nm
Departure	0.6 nm
Terminal	2.0 nm
Enroute	4.0 nm
Oceanic	4.0 nm

Table 6-15 Profile View Width Scale

PROFILE PATH

The Profile Path displays the horizontal and lateral boundaries of the Profile View. The path is shown as a white rectangle on the Navigation Map Page (Figure 6-91) and is only available when Profile View is enabled. White range markers both edges of the Profile Path rectangle match the range markers along the distance scale inside the Profile View display window whenever the profile range is at least 4 nm (or 7.5 km if configured for metric units).

The Profile Path rectangle may be configured on or off, and the Navigation Map range at which the Profile Path is removed from map display can be changed.

Customizing the Profile Path display on the Navigation Map Page:

1) Select the Navigation Map Page.

2) Press the **MENU** Key.

3) With 'Map Setup' highlighted, press the **ENT** Key (Figure 6-92).

4) Turn the small **FMS** Knob to select the 'Profile' Group and press the **ENT** Key (Figure 6-93).

5) Turn the large **FMS** Knob or press the **ENT** Key to scroll through product selections (Figure 6-94).

   • PROFILE PATH – Turns the display of the Profile Path on or off and sets maximum map range at which the Profile Path is shown

6) Turn the small **FMS** Knob to scroll through options (ON/OFF, range settings).

7) Press the **ENT** Key to select an option.

8) Press the **FMS** Knob or **CLR** Key to return to the Navigation Map Page with the changed settings.

Figure 6-92 Navigation Map Page Menu
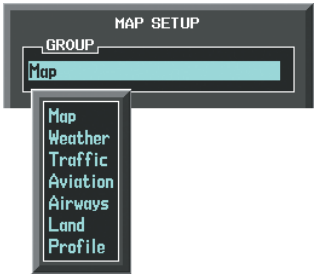
Figure 6-93 Navigation Map Page Setup Menu

Figure 6-94 Navigation Map Page Setup Menu, Profile Group

6.6 TRAFFIC INFORMATION SERVICE (TIS)

> ⚠ **WARNING:** *The Traffic Information Service (TIS) is intended for advisory use only. TIS is intended to help the pilot locate traffic visually. It is the responsibility of the pilot to see and maneuver to avoid traffic.*

> ✓ **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) and TIS. Aircraft without altitude reporting capability are shown without altitude separation data or climb descent indication.*

> ✓ **NOTE:** *TIS is disabled if a Traffic Advisory System (TAS) 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 5 seconds. The G1000 displays up to eight traffic targets within a 7.5-nm radius, from 3000 feet below to 3500 feet above the requesting aircraft. Traffic is displayed using the symbols shown in Table 6-16.

TIS Symbol	Description
◈	Non-Threat Traffic
🟡	Traffic Advisory (TA)
🟡	Traffic Advisory Off Scale

Table 6-16 TIS Traffic Symbols

Traffic Advisories (TA) alert the crew to intruding aircraft. When traffic meets the advisory criteria for the TA, a solid yellow circle symbol is generated. A TA which is detected but is outside the range of the map on which traffic is displayed are indicated with a message in the lower left corner of the map.

TIS also provides a vector line showing the direction in which the traffic is moving, to the nearest 45°. Traffic information for which TIS is unable to determine the bearing (non-bearing traffic) is displayed in the center of the Traffic Map Page (Figure 6-99) 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.

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DISPLAYING TRAFFIC DATA

Traffic information can be displayed on the following maps (when TIS is operating):

- PFD Inset Map
- Navigation Map Page
- Traffic Map Page
- Trip Planning Page
- Nearest Pages
- Active Flight Plan Page

Displaying traffic information (maps other than the Traffic Map Page):

1) Press the **MAP** Softkey (for the PFD Inset Map, press the **INSET** Softkey).

2) Press the **TRAFFIC** Softkey. Traffic is now displayed on the map.

When traffic is selected on maps other than the Traffic Map Page, an icon is shown to indicate the feature is enabled for display.

Traffic Advisory

Traffic Display Status Icon

Traffic Advisory Off-Scale

Figure 6-95 TIS Traffic on the Navigation Map Page

The Navigation Map Page Setup Menu provides a means in addition to the softkey for enabling/disabling display of traffic. The setup menu also controls the map range settings above which traffic data (symbols and labels) are decluttered from the display. If a map range larger than the map range setting is selected, the data is removed from the map. Maps besides the Traffic Map Page use settings based on those selected for the Navigation Map Page.

Customizing traffic display on the Navigation Map Page:

1) Select the Navigation Map Page.

2) Press the **MENU** Key.

3) With 'Map Setup' highlighted, press the **ENT** Key (Figure 6-96).

4) Turn the small **FMS** Knob to select the 'Traffic' Group and press the **ENT** Key (Figure 6-97).

5) Turn the large **FMS** Knob or press the **ENT** Key to scroll through product selections (Figure 6-98).

- 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 Traffic Alerts and Proximity Advisories

   - TA ONLY - Displays Traffic Alerts only

- TRAFFIC SMBL – Selects the maximum range at which traffic symbols are shown

- TRAFFIC LBL – Selects the maximum range at which traffic labels are shown (with the option to turn off)

6) Turn the small **FMS** Knob to scroll through options for each product (ON/OFF, range settings, etc.).

7) Press the **ENT** Key to select an option.

8) Press the **FMS** Knob or **CLR** Key to return to the Navigation Map Page with the changed settings.

Figure 6-96 Navigation Map Page Menu

Figure 6-97 Navigation Map Page Setup Menu
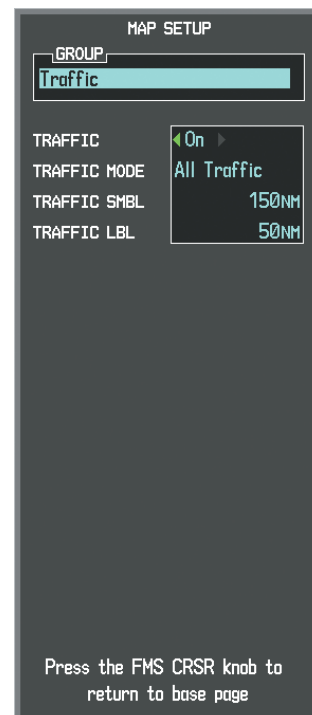
Figure 6-98 Navigation Map Page Setup Menu, Traffic Group

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TRAFFIC MAP PAGE

The Map - Traffic Map Page is the principal map display for showing 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 **RANGE** Knob from 2 to 12 nm, as indicated by the map range rings.

The traffic mode is annunciated in the upper left corner of the Traffic Map Page. When the aircraft is on the ground, TIS automatically enters Standby Mode. Once the aircraft is airborne, TIS switches from Standby to Operating Mode and the G1000 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 Traffic Map Page.
>
> 3) Confirm TIS is in Operating Mode:
>
>   Press the **OPERATE** Softkey to begin displaying traffic.
>
>   **Or**:
>
>   a) Press the **MENU** Key.
>
>   b) Select 'Operate Mode' (shown if TIS is in Standby Mode) and press the **ENT** Key.
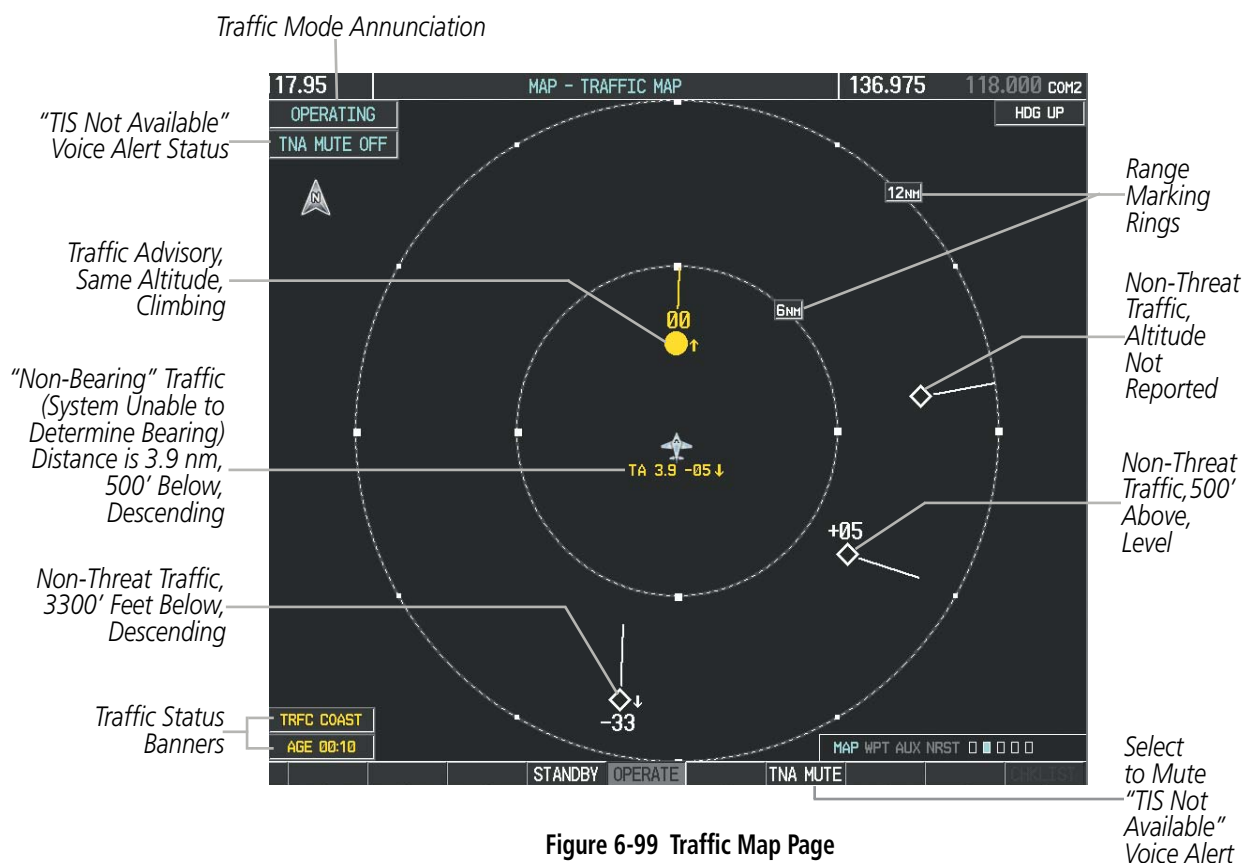
Figure 6-99 Traffic Map Page

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TIS ALERTS

When the number of TAs on the Traffic Map Page increases from one scan to the next, the following occur:

- A single **"Traffic"** voice alert is generated.
- A 'TRAFFIC' Annunciation appears to the top left of the Attitude Indicator on the PFD, flashing for 5 seconds and remaining displayed until no TAs are detected in the area.
- The PFD Inset 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.
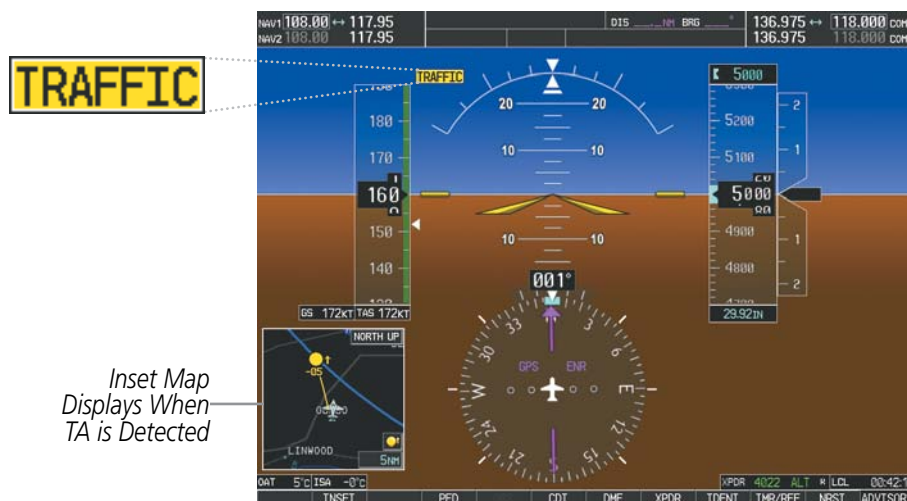
Figure 6-100 Traffic Annunciation (PFD)

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 left corner of the Traffic Map Page.

Muting the "TIS Not Available" voice alert:

1) Select the 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 G1000 performs an automatic test of TIS during power-up. If TIS passes the test, TIS enters Standby Mode (on the ground) or Operating Mode (in the air). If TIS fails the power up test, an annunciation is shown in the center of the Traffic Map Page.

Traffic Map Page Annunciation	Description
NO DATA	Data is not being received from the transponder*
DATA FAILED	Data is being received from the transponder, but a failure is detected in the data stream*
FAILED	The transponder has failed*
UNAVAILABLE	TIS is unavailable or out of range

* Contact a service center or Garmin dealer for corrective action

Table 6-17 TIS Failure Annunciations

Figure 6-101 TIS Power-up Test Failure

The traffic mode is annunciated in the upper left corner of the Traffic Map Page. When the aircraft is on the ground, TIS automatically enters Standby Mode. 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.

Mode	Traffic Mode Annunciation (Traffic Map Page)	Traffic Display Enabled Icon (Other Maps)
TIS Operating	**OPERATING**	
TIS Standby	**STANDBY** (also shown in white in center of page)	
TIS Failed*	**FAIL**	

* See Table 6-19 for additional failure annunciations

Table 6-18 TIS Modes

Switching between TIS modes:

1) Select the Traffic Map Page.

2) Press the **STANDBY** or **OPERATE** Softkey to switch between modes. The mode is displayed in the upper left 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.

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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 (Table 6-19).

Traffic Status Banner Annunciation	Description
TA OFF SCALE	A Traffic Advisory is outside the selected display range* Annunciation is removed when traffic comes within the selected display range
TA X.X ± XX ↕	System cannot determine bearing of Traffic Advisory** Annunciation indicates distance in nm, altitude separation in hundreds of feet, and altitude trend arrow (climbing/descending)
AGE MM:SS	Appears if traffic data is not refreshed within 6 seconds If after another 6 seconds data is not received, traffic is removed from the display The quality of displayed traffic information is reduced as the age increases
TRFC COAST	The displayed data is not current (6 to 12 seconds since last message) The quality of displayed traffic information is reduced when this message is displayed
TRFC RMVD	Traffic is removed because it is too old for coasting (12 to 60 seconds since last message) Traffic may exist within the selected display range, but it is not displayed
TRFC FAIL	Traffic data has failed
NO TRFC DATA	Traffic has not been detected
TRFC UNAVAIL	The traffic service is unavailable or out of range

Shown as symbol on Traffic Map Page
**Shown in center of Traffic Map Page*

Table 6-19 TIS Traffic Status Annunciations

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6.7 GARMIN GTS 820 TRAFFIC

⚠️ **WARNING:** *The GTS 820 Traffic Advisory System (TAS) is intended for advisory use only to aid the pilot in visually acquiring traffic. No avoidance maneuvers should be based solely upon TAS traffic information. It is the responsibility of the pilot in command to see and maneuver to avoid traffic.*

✅ **NOTE:** *Pilots should be aware of TAS system limitations. TAS systems require transponders of other aircraft to respond to system interrogations. If the transponders do not respond to interrogations due 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:** *TIS is disabled when a TAS is installed.*

The Garmin GTS 820 is a Traffic Advisory System (TAS), if installed. The GTS 820 enhances flight crew situational awareness by displaying traffic information for transponder-equipped aircraft. The GTS 820 also provides visual and aural traffic alerts including voice announcements to assist in visually acquiring traffic.

The GTS 820 is capable of tracking up to 45 intruding aircraft equipped with Mode A or C transponders, and up to 30 intruders 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.

THEORY OF OPERATION

When the system is in Operating Mode, the TAS unit interrogates the transponders of intruding aircraft while monitoring transponder replies. The system uses this information to derive the distance, relative bearing, and if reported, the altitude and vertical trend for each aircraft within its surveillance range.

The system then calculates a closure rate to each intruder based on the projected Closest Point of Approach (CPA). If the closure rate meets the threat criteria for a Traffic Advisory (TA), visual and aural alerting is provided.

TAS SURVEILLANCE VOLUME AND SYMBOLOGY

The GTS 820 TAS monitors the airspace within ±10,000 feet of own altitude, and up to 40 nm in the forward direction. TAS range is somewhat reduced to the sides and aft of own aircraft due to the directional interrogation signal patterns. The system displays TAS-detected traffic using the symbology shown in Table 6-20.

In addition, if a 1090 MHz extended squitter transponder is installed, and the GTS 820 detects airborne traffic providing 1090 MHz Automatic Dependent Surveillance - Broadcast (ADS-B) information, the system will display the TAS traffic using the ADS-B symbology shown in Table 6-21.

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NOTE: *Do not confuse this functionality with full ADS-B capability, which can provide traffic information from ADS-B Ground-Based Transceivers (GBTs) and ADS-B traffic outside of the TAS surveillance volume. This system is limited to displaying ADS-B information from suitably equipped airborne aircraft within the TAS surveillance volume.*

TAS Symbol	Description
◈	Non-Threat Traffic
◇	Proximity Advisory (PA)
⬤	Traffic Advisory (TA)
◕	Traffic Advisory Off Scale

Table 6-20 TAS Symbol Description

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.
▷	Non-threat traffic with ADS-B directional information. Points in the direction of the intruder aircraft track.
⊃	Traffic with ADS-B directional information, but positional accuracy is degraded. Points in the direction of the aircraft track.

Table 6-21 TAS Traffic with ADS-B Symbology

A Traffic Advisory (TA), displayed as a yellow circle or triangle, alerts the crew to a potentially hazardous intruding aircraft, if the closing rate, distance, and vertical separation meet TA criteria. A Traffic Advisory that is beyond the selected display range (off scale) is indicated by a half TA symbol at the edge of the screen at the relative bearing of the intruder.

A Proximity Advisory (PA), displayed as a solid white diamond or triangle, indicates the intruding aircraft is within ±1200 feet and is within a 6 nm range, but is still not considered a TA threat.

A Non-threat Advisory, shown as an open white diamond or triangle, is displayed for traffic beyond 6 nm that is neither a TA or PA.

A solid white rounded arrow indicates either a PA or Non-Threat traffic with ADS-B directional information, but the position of the traffic is shown with degraded accuracy.

Relative altitude, when available, is displayed above or below the corresponding intruder symbol in hundreds of feet (Figure 6-102). When this altitude is above own aircraft, it is preceded by a '+' symbol; a minus sign '-' indicates traffic is below own aircraft.

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A vertical trend arrow to the right of the intruder symbol (Figure 6-102) indicates climbing or descending traffic with an upward or downward-pointing arrow respectively.

+12 — *Relative Altitude*

◇ ↑ — *Vertical trend arrow*
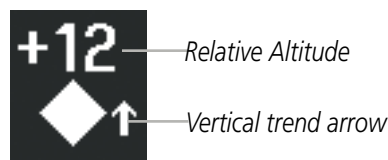
Figure 6-102 Intruder Altitude and Vertical Trend Arrow

+12 — *Vector Line indicates intruder aircraft track*

▷ ↑

Figure 6-103 Intruder Traffic with ADS-B Directional Information and Track

If the intruding aircraft is providing ADS-B track information, this is displayed as a vector line extending beyond the traffic symbol in the direction of the track (Figure 6-103).

The GTS 820 automatically suppresses the display of aircraft on the ground operating with Mode S transponders.

TA ALERTING CONDITIONS

The GTS 820 automatically adjusts its TA sensitivity level to reduce the likelihood of nuisance TA alerting during flight phases likely to be near airports. Level A (less) TA sensitivity is used when the aircraft's landing gear is extended. In all other conditions, Level B (greater) TA sensitivity is used to assess TA threats.

Sensitivity Level	Intruder Altitude Available	TA Alerting Conditions
A	Yes	Intruder closing rate provides less than 20 seconds of vertical and horizontal separation. Or: Intruder closing rate provides less than 20 seconds of horizontal separation and vertical separation is within 600 feet. Or: Intruder range is within 0.2 nm and vertical separation is within 600 feet.
A	No	Intruder closing rate provides less than 15 seconds of separation.
B	Yes	Intruder closing rate provides less than 30 seconds of vertical and horizontal separation. Or: Intruder closing rate provides less than 30 seconds of horizontal separation and vertical separation is within 800 feet. Or: Intruder range is within 0.55 nm and vertical separation is within 800 feet.
B	No	Intruder range is less than 20 seconds.

Table 6-22 TA Sensitivity Level and TA Alerting Criteria

TAS ALERTS

> **NOTE:** *Aural traffic alerts do not occur when the landing gear is extended. Only visual traffic annunciations are issued under this condition.*

When the GTS 820 detects a new TA, the following occur:

- A single **"Traffic!"** voice alert is generated, followed by additional voice information about the bearing, relative altitude, and approximate distance from the intruder that triggered the TA (Table 6-23). The announcement "**Traffic! 12 o'clock, high, four miles**," would indicate the traffic is in front of own aircraft, above own altitude, and approximately four nautical miles away.

- A TRAFFIC Annunciation appears at the top right of the airspeed on the PFD, flashing for five seconds and remains displayed until no TAs are detected in the area (Figure 6-104).

- The PFD Inset Map is automatically displayed with TA traffic.

If the bearing of TA traffic cannot be determined (Figures 6-86 and 6-89), a yellow text banner will be displayed in the center of the Traffic Map Page and in the lower-left of the PFD inset map instead of a TA symbol. The text will indicate "TA" followed by the distance, relative altitude, and vertical trend arrow for the TA traffic, if known.

A TA will be displayed for at least eight seconds, even if the condition(s) that initially triggered the TA are no longer present.

Inset Map Displays When TA is Detected

Figure 6-104 Traffic Annunciation (PFD)

Bearing	Relative Altitude	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 6-23 TA Descriptive Voice Announcements

SYSTEM TEST

NOTE: *GTS 820 traffic surveillance is not available during the system test. Use caution when performing a system test during flight.*

The GTS 820 provides a system test mode to verify the TAS system is operating normally. The test takes ten seconds to complete. When the system test is initiated, a test pattern of traffic symbols is displayed on the Traffic Map Page (Figure 6-105). If the system test passes, the aural announcement **"TAS System Test Passed"** is heard, otherwise the system announces **"TAS System Test Failed."** When the system test is complete, the GTS 820 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 Traffic Map Page.

3) Turn the **Range** knob to set the range to 2/6 nm to allow for proper test pattern display.

4) Press the **TEST** Softkey.

Or:

1) Press the **MENU** Key and turn the small **FMS** knob to select 'Test Mode'.

2) Press the **ENT** Key.
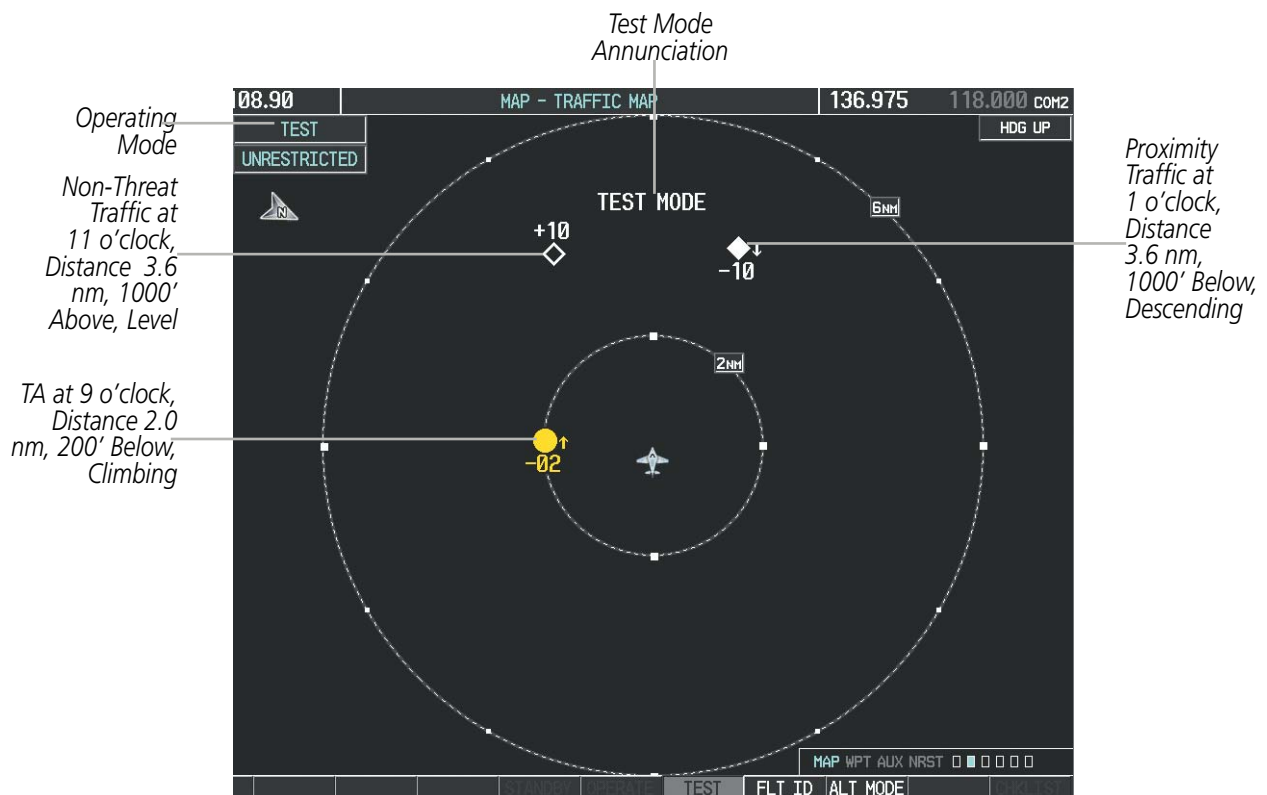
Figure 6-105   System Test in Progress with Test Pattern

OPERATION

> **NOTE:** *The GTS 820 automatically transitions from **STANDBY** to **OPERATE** mode eight seconds after takeoff. The unit also automatically transitions from **OPERATE** to **STANDBY** mode 24 seconds after landing.*

After power-up, the GTS 820 is in Standby Mode. The GTS 820 must be in Operating Mode for traffic to be displayed and for TAs to be issued.

Pressing the **OPERATE** Softkey allows the GTS 820 to switch from Standby Mode to Operating Mode as necessary. Pressing the **STANDBY** Softkey forces the unit into Standby Mode.

Switching from operating mode to standby mode:

On the Traffic Page, select the **STANDBY** Softkey

Or:

1) Press the **MENU** Key and turn the small **FMS** knob to select 'Standby Mode'.

2) Press the **ENT** Key.

Switching from standby mode to operating mode:

On the Traffic Page, select the **OPERATE** Softkey

Or:

1) Press the **MENU** Key and turn the small **FMS** knob to select 'Operate Mode'.

2) Press the **ENT** Key. The GTS 820 switches from Standby Mode to Operating Mode as necessary.

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TRAFFIC MAP PAGE

The Map - Traffic Map Page is the principal map page for showing surrounding TAS 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 **RANGE** Knob from 2 to 40 nm, as indicated by the map range rings.

The traffic mode and altitude display mode are annunciated in the upper left corner of the page.
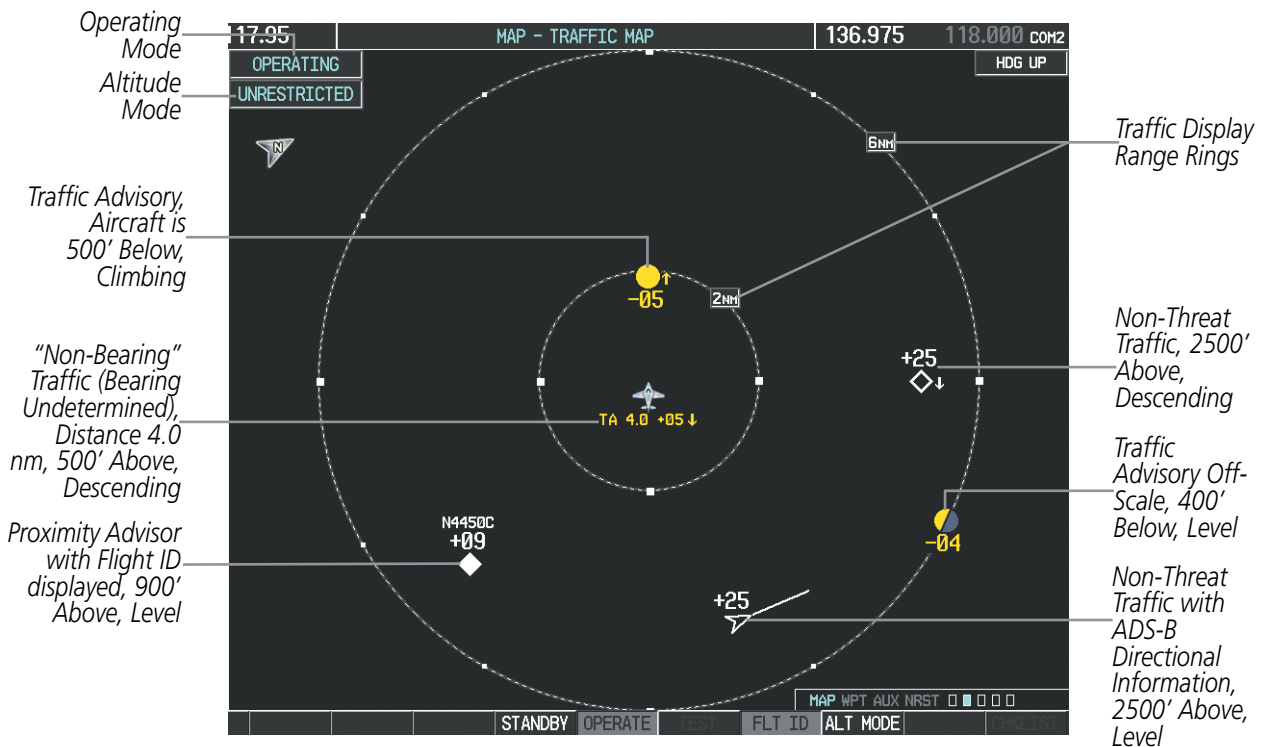
Figure 6-106 Traffic Map Page

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 Traffic Map Page.

3) Press the **OPERATE** Softkey to begin displaying traffic. 'OPERATING' is displayed in the Traffic mode field.

4) Press the **STANDBY** Softkey to place the system in the Standby mode. 'STANDBY' is displayed in the Traffic mode field.

5) Turn the **RANGE** Knob clockwise to display a larger area or counter-clockwise to display a smaller area.

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ALTITUDE DISPLAY

The pilot can select the volume of airspace in which non-threat and proximity traffic is displayed. TAs occurring outside of these limits will always be shown.

Changing the altitude range:

1) On the Traffic Map Page, press the **ALT MODE** Softkey.

2) Press one of the following Softkeys:

   • **ABOVE:** Displays 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 non-threat and proximity traffic from 2700 feet above the aircraft to 2700 feet below the aircraft. Typically used during enroute phase of flight.

   • **BELOW:** Displays non-threat and proximity traffic from 2700 feet above the aircraft to 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 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 step 2 above):

   • ABOVE

   • NORMAL

   • BELOW

   • UNRESTRICTED

3) Press the **ENT** Key.

TRAFFIC MAP PAGE DISPLAY RANGE

The display range on the Traffic Map Page can be changed at any time. Map range is adjustable with the **RANGE** Knob from 2 to 40 nm, as indicated by the map range rings.

Changing the display range on the Traffic Map Page:

1) Turn the **RANGE** Knob.

2) The following range options are available:

   • 2 nm

   • 2 and 6 nm

   • 6 and 12 nm

   • 12 and 24 nm

   • 24 and 40 nm

Flight ID Display

The Flight IDs of other aircraft (when available) can be enabled for display on the Traffic Map Page (Figure 6-107). When a flight ID is received, it will appear above or below the corresponding traffic symbol on the Traffic Map Page when this option is enabled.
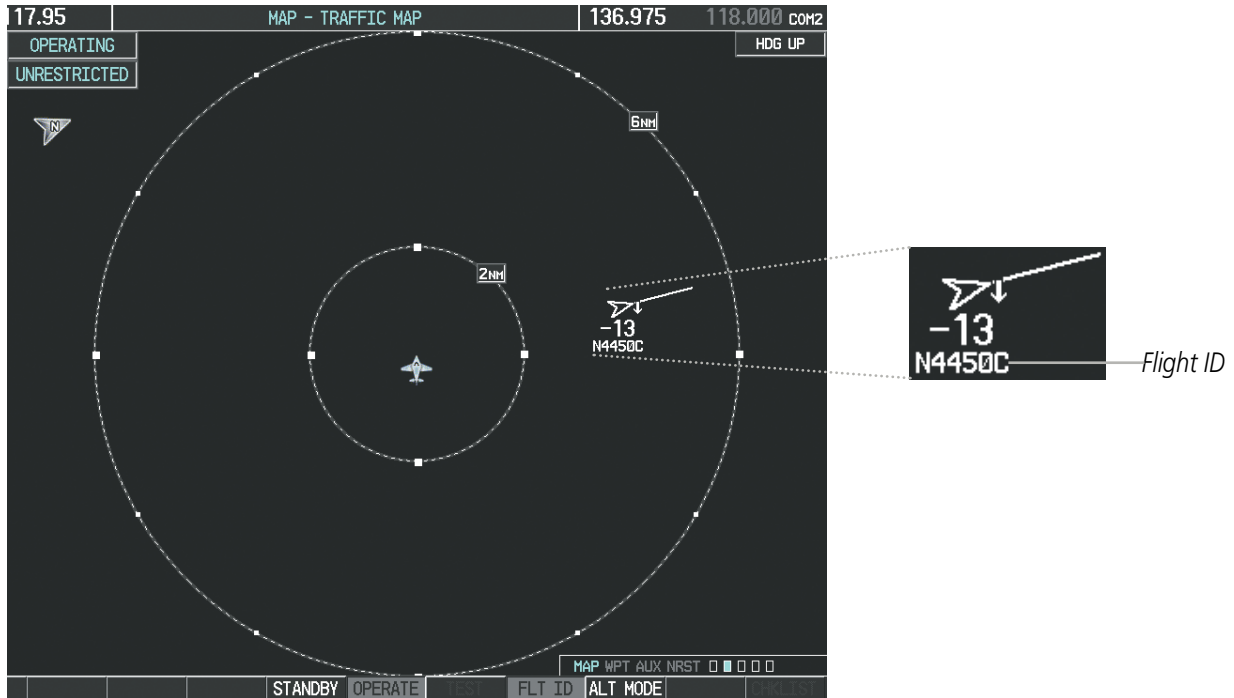
Figure 6-107 Traffic Map Page with Flight IDs Enabled

Enabling/Disabling Flight ID Display:

On the Traffic Map Page, press the **FLT ID** Softkey.

Or:

1) Press the **MENU** Key.

2) Turn the small **FMS** Knob to select 'Show Flight IDs' or 'Hide Flight IDs' (choice dependent on current state) (Figure 6-108).

3) Press the **ENT** Key.
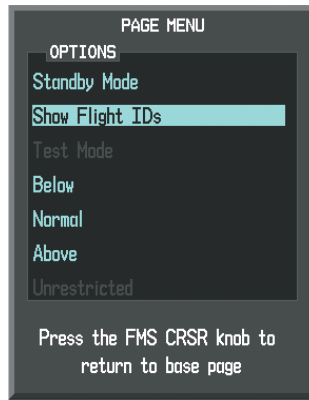
Figure 6-108 Traffic Map Page Menu

ADDITIONAL TRAFFIC DISPLAYS

Traffic information can be displayed on the following maps on the MFD when the unit is operating:

- Navigation Map Page
- Traffic Map Page
- Trip Planning Page
- Nearest Pages
- Active Flight Plan Page
- System Pages

Traffic information can also be displayed on the PFD when the Synthetic Vision System (SVS) option is installed and enabled. See the Additional Features Section for details.

Displaying traffic information (MFD maps other than the Traffic Map Page):

1) Press the **MAP** Softkey.

2) Press the **TRAFFIC** Softkey. Traffic is now displayed on the map.

When traffic is selected on maps other than the Traffic Map Page, a traffic status icon is shown to indicate traffic is enabled for display (Figure 6-109).

Displaying traffic on the Navigation Map

1) Ensure the TAS system is operating. With the Navigation Map displayed, select the **MAP** Softkey.

2) Press the **TRAFFIC** Softkey. Traffic is now displayed on the map as shown in the figure.
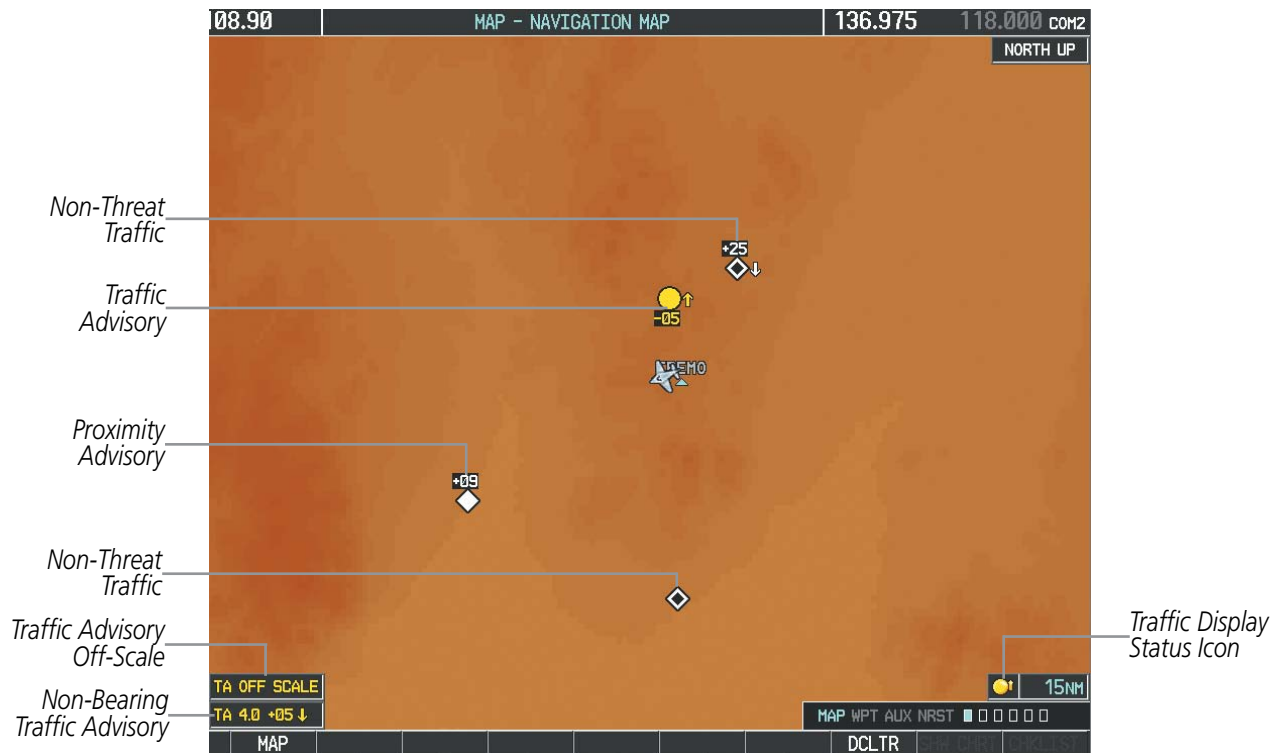
Figure 6-109 TAS Traffic on Navigation Map

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Customizing the traffic display on the Navigation Map Page:

1) Select the Navigation Map Page.

2) Press the **MENU** Key.

3) With Map Setup highlighted, press the **ENT** Key (Figure 6-110).

4) Turn the small **FMS** Knob to select the Traffic Group and press the **ENT** Key (Figure 6-111).

5) Turn the large **FMS** Knob or press the **ENT** Key to scroll through the selections (Figure 6-112).

   • 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 Traffic Advisories and Proximity Advisories

      - TA ONLY - Displays Traffic Advisories only

   • TRAFFIC SMBL – Selects the maximum range at which traffic symbols are shown

   • TRAFFIC LBL – 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 (ON/OFF, range settings, etc.).

7) Press the **ENT** Key to select an option.

8) Press the **FMS** Knob or **CLR** Key to return to the Navigation Map Page.

Figure 6-110 Navigation Map Page Menu

Figure 6-111 Navigation Map Page Setup Menu
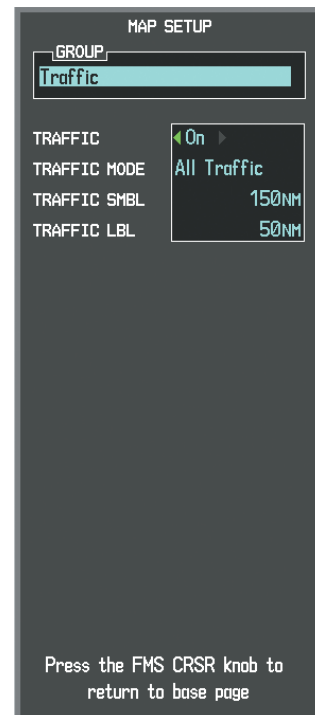
Figure 6-112 Navigation Map Page Setup Menu, Traffic Group

The Navigation Map Page Setup Menu also controls the display of traffic. The setup menu controls the map range settings. Traffic data symbols and labels can be decluttered from the display. If a map range larger than the map range setting is selected, the data is removed from the map. Maps besides the Traffic Map Page use settings based on those selected for the Navigation Map Page.

Traffic information can also be displayed on the PFD Inset Map by pressing the **INSET** Softkey. A traffic map will appear in heading up orientation. Traffic information can also be overlaid with navigation, topographic and optional XM WX Satellite Weather data.

Displaying traffic information (PFD Inset Map):

1) Press the **INSET** Softkey.

2) Press the **TRAFFIC** Softkey to display traffic data on the inset map (TRFC-1).

3) Press the softkey again to display the traffic-only inset (TRFC-2).

4) Press the softkey again to remove traffic data.

SYSTEM STATUS

The traffic mode is annunciated in the upper left corner of the Traffic Map Page.

Mode	Traffic Mode Annunciation (Traffic Map Page)	Traffic Display Status Icon (Other Maps)
TAS System Test Initiated	**TEST** (also shown in white in center of page)	
TAS Operating	**OPERATING**	
TAS Standby	**STANDBY** (also shown in white in center of page)	
TAS Failed*	**FAIL**	

* See Table 6-25 for additional failure annunciations

Table 6-24 TAS Modes

If the traffic unit fails, an annunciation as to the cause of the failure is shown in the center of the Traffic Map Page. During a failure condition, the Operating Mode cannot be selected.

Traffic Map Page 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 6-25 TAS Failure Annunciations

The annunciations to indicate the status of traffic information appear in a banner at the lower left corner of maps on which traffic can be displayed.

Traffic Status Banner Annunciation	Description
TA OFF SCALE	A Traffic Advisory is outside the selected display range*. Annunciation is removed when traffic comes within the selected display range.
TA X.X ± XX ↕	System cannot determine bearing of Traffic Advisory**. Annunciation indicates distance in nm, altitude separation in hundreds of feet, and altitude trend arrow (climbing/descending).
TRFC FAIL	TAS unit has failed (unit is self-reporting a failure or sending incorrectly formatted data)
NO TRFC DATA	Data is not being received from the TAS unit

*Shown as symbol on Traffic Map Page
**Shown in center of Traffic Map Page

Table 6-26 TAS Traffic Status Annunciations

6.8 L-3 SKYWATCH TRAFFIC

NOTE: *TIS is disabled when a Traffic Advisory System (TAS) is installed.*

NOTE: Refer to the L-3 SKYWATCH® (SKY497) Pilot's Guide for a detailed discussion of the SKY497 TAS System.

TAS SYMBOLOGY

The L-3 SKYWATCH TAS (if installed) is designed to help in detection and avoidance of other aircraft. TAS uses an on-board interrogator-processor and the Mode S transponder for the air-to-air traffic data link. Traffic is displayed the symbols shown in Table 6-27.

TAS Symbol	Description
◈	Non-Threat Traffic
◇	Proximity Advisory (PA)
⬤	Traffic Advisory (TA)
◐	Traffic Advisory Off Scale

Table 6-27 TAS Symbol Description

A Non-threat Advisory, shown as an open white diamond, indicates that an intruding aircraft is at greater than ±1200 feet relative altitude or the distance is beyond 5 nm.

A Proximity Advisory indicates the intruding aircraft is within ±1200 feet and is within 5 nm range, but is still not considered a threat.

A Traffic Advisory (TA) alerts the crew to a potentially hazardous intruding aircraft. Closing rate, distance, and vertical separation meet TA criteria. A Traffic Advisory that is beyond the selected display range is indicated by a half TA symbol at the edge of the screen at the relative bearing of the intruder.

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OPERATION

The unit must be in operating mode for traffic to be displayed. The ability to switch from standby to operating mode on the ground is especially useful for scanning the airspace around the airport before takeoff.

Switching from standby mode to operating mode:

1) On the Traffic Page, press the **OPERATE** Softkey or press the **MENU** Key and turn the small **FMS** knob to select Operating Mode.

2) If using the FMS menu, press the **ENT** Key to place the SKY497 in the operating mode.

3) To switch to Standby Mode from the Traffic Page, press the **STANDBY** Softkey.

Traffic System Test

1) Set the map range to 2/6 nm to allow for full test pattern display.

2) Press the **STANDBY** Softkey.

3) Press the **TEST** Softkey.

4) System test takes approximately eight seconds to complete. When completed successfully, traffic symbols display and a voice alert "Traffic Advisory System Test Passed" is heard. If the system test fails, the system reverts to Standby Mode and a voice alert "Traffic Advisory System Test Failed" is heard.

DISPLAYING TRAFFIC DATA

Traffic information can be displayed on the following maps when the traffic unit is operating:

- PFD Inset Map
- Navigation Map Page
- Traffic Map Page
- Trip Planning Page
- Nearest Pages
- Active Flight Plan Page

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 Traffic Map Page.

3) Press the **ALT MODE** Softkey to change the altitude volume.

4) Press the **STANDBY** Softkey to place the system in the Standby mode. 'STANDBY' is displayed in the Traffic mode field.

5) Turn the **RANGE** Knob clockwise to display a larger area or counter-clockwise to display a smaller area.

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Figure 6-113 Traffic Map Page

The Traffic Map Page is the principal map page for showing surrounding TAS 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 **RANGE** Knob from 2 to 40 nm, as indicated by the map range rings.

The traffic mode and altitude display mode are annunciated in the upper left corner.

Displaying traffic information (maps other than the Traffic Map Page):

1) Press the **MAP** Softkey (for the PFD Inset Map, press the **INSET** Softkey).

2) Press the **TRAFFIC** Softkey. Traffic is now displayed on the map.

When traffic is selected on maps other than the Traffic Map Page, a traffic status icon is shown to indicate TAS is enabled for display (Figure 6-114).

Displaying traffic on the Navigation Map

1) Ensure the TAS system is operating. With the Navigation Map displayed, press the **MAP** Softkey.

2) Press the **TRAFFIC** Softkey. Traffic is now displayed on the map as shown in the figure.
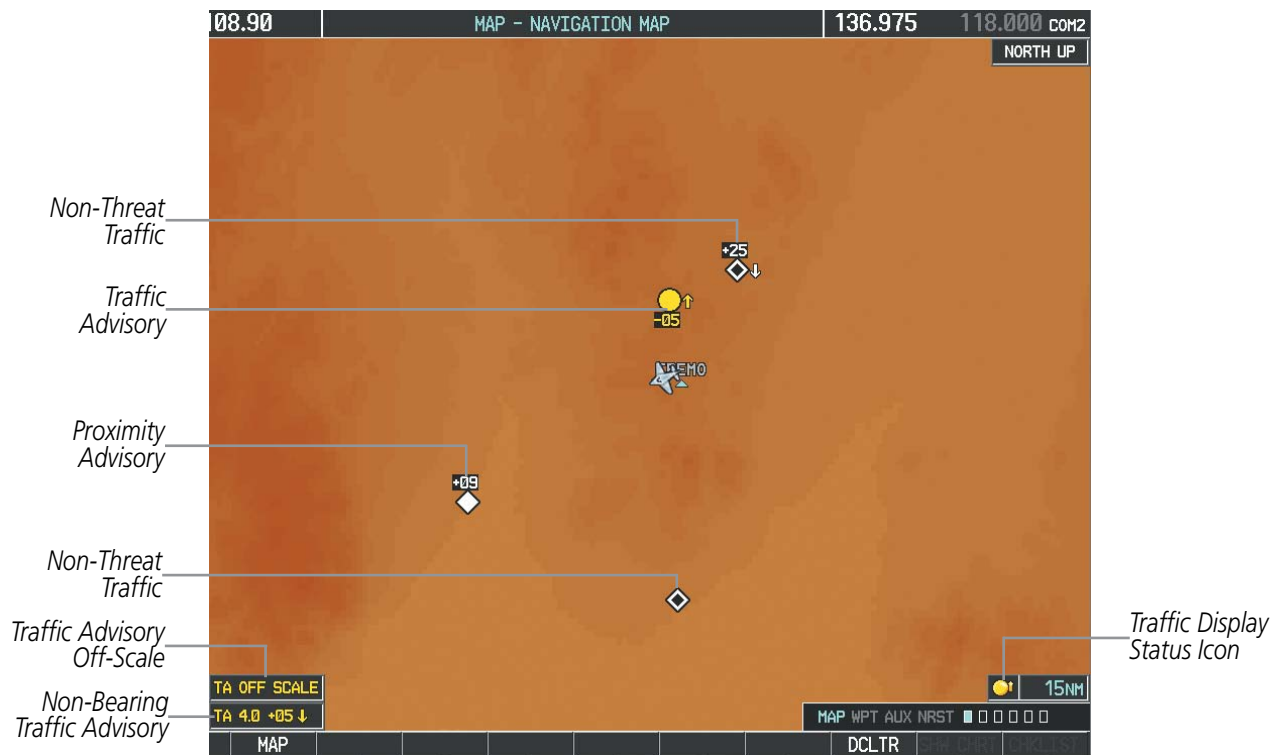
Figure 6-114 TAS Traffic on Navigation Map

The Navigation Map Page Setup Menu also controls the display of traffic. The setup menu controls the map range settings. Traffic data symbols and labels can be decluttered from the display. If a map range larger than the map range setting is selected, the data is removed from the map. Maps besides the Traffic Map Page use settings based on those selected for the Navigation Map Page.

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ALTITUDE DISPLAY

Changing the altitude display mode:

1) On the Traffic Page, press the **ALT MODE** Softkey.

2) Press one of the following Softkeys:

   - **BELOW**

   - **NORMAL**

   - **ABOVE**

   - **UNREST** (unrestricted)

3) To return to the Traffic Page, press the **BACK** Softkey.

   Or:

1) Press the **MENU** Key.

2) Turn the small **FMS** Knob to select one of the following:

   - BELOW

   - NORMAL

   - ABOVE

   - UNREST (unrestricted)

3) Press the **ENT** Softkey.

TRAFFIC MAP PAGE DISPLAY RANGE

The display range on the Traffic Map Page can be changed at any time. Map range is adjustable with the **RANGE** Knob from 2 to 40 nm, as indicated by the map range rings.

Changing the display range on the Traffic Page:

1) Turn the **RANGE** Knob.

2) The following range options are available:

   - 2 nm

   - 2 and 6 nm

   - 6 and 12 nm

Customizing the traffic display on the Navigation Map Page:

1) Select the Navigation Map Page.

2) Press the **MENU** Key.

3) With Map Setup highlighted, press the **ENT** Key (Figure 6-115).

4) Turn the small **FMS** Knob to select the Traffic Group and press the **ENT** Key (Figure 6-116).

5) Turn the large **FMS** Knob or press the **ENT** Key to scroll through the selections (Figure 6-117).

- 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 Traffic Alerts and Proximity Advisories

    - TA ONLY - Displays Traffic Alerts only

- TRAFFIC SMBL – Selects the maximum range at which traffic symbols are shown

- TRAFFIC LBL – 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 (ON/OFF, range settings, etc.).

7) Press the **ENT** Key to select an option.

8) Press the **FMS** Knob or **CLR** Key to return to the Navigation Map Page.

Figure 6-115 Navigation Map Page Menu

Figure 6-116 Navigation Map Page Setup Menu
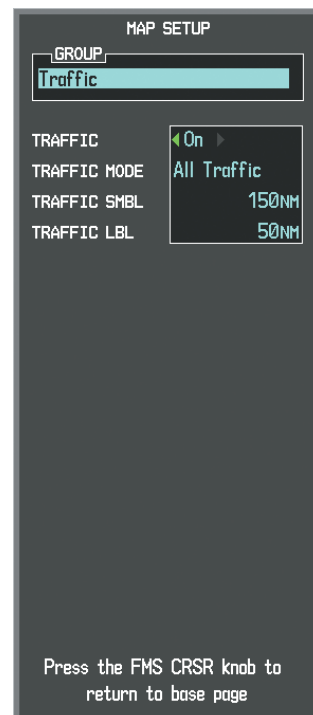
Figure 6-117 Navigation Map Page Setup Menu, Traffic Group

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TAS ALERTS

> **NOTE:** *Refer to the SKY497 documentation for information on alerts generated by the TAS equipment.*

When the number of TAs on the Traffic Map Page increases from one scan to the next, the following occur on the PFD:

- A TRAFFIC Annunciation appears at the top right of the airspeed on the PFD, flashing for 5 seconds and remaining displayed until no TAs are detected in the area.

- The PFD Inset Map is automatically displayed with TA traffic

Inset Map Displays When TA is Detected

Figure 6-118 Traffic Annunciation (PFD)

SYSTEM STATUS

The traffic mode is annunciated in the upper left corner of the Traffic Map Page.

Mode	Traffic Mode Annunciation (Traffic Map Page)	Traffic Display Enabled Icon (Other Maps)
TAS Self-test Initiated	**TEST** (also shown in white in center of page)	
TAS Operating	**OPERATING**	
TAS Standby	**STANDBY** (also shown in white in center of page)	
TAS Failed*	**FAIL**	

* See Table 6-29 for additional failure annunciations

Table 6-28 TAS Modes

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If the unit fails, an annunciation as to the cause of the failure is shown in the center of the Traffic Map Page.

Traffic Map Page 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 6-29 TAS Failure Annunciations

The annunciations to indicate the status of traffic information appear in a banner at the lower left corner of maps on which traffic can be displayed.

Traffic Status Banner Annunciation	Description
TA OFF SCALE	A Traffic Advisory is outside the selected display range* Annunciation is removed when traffic comes within the selected display range
TA X.X ± XX ↕	System cannot determine bearing of Traffic Advisory** Annunciation indicates distance in nm, altitude separation in hundreds of feet, and altitude trend arrow (climbing/descending)
TRFC FAIL	TAS unit has failed (unit is self-reporting a failure or sending incorrectly formatted data)
NO TRFC DATA	Data is not being received from the TAS unit

*Shown as symbol on Traffic Map Page
**Shown in center of Traffic Map Page

Table 6-30 TAS Traffic Status Annunciations

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SECTION 7 AUTOMATIC FLIGHT CONTROL SYSTEM

7.1 AFCS OVERVIEW

> **NOTE:** *The approved Pilot's Operating Handbook (POH) and FAA Approved Airplane Flight Manual (AFM) always supersedes this Pilot's Guide.*

> **NOTE:** *A failure of the primary (#1) GIA 63W Integrated Avionics Unit (IAU) results in loss of the flight director. Any IAU failure results in loss of the autopilot and manual electric trim.*

The GFC 700 is a digital Automatic Flight Control System (AFCS), fully integrated within the System avionics architecture. The System Overview section provides a block diagram to support this system description. GFC 700 AFCS functionality in the Beechcraft G58 is distributed across the following Line Replaceable Units (LRUs):

- GDU 1040 Primary Flight Display (PFD)
- GDU 1043/1045 Multi-Function Display (MFD)
- GIA 63W Integrated Avionics Units (2)
- GSA 81 AFCS Servo (4)
- GSM 85 Servo Mounts (4)

The GFC 700 AFCS can be divided into these main operating functions:

- **Flight Director (FD)** — Flight director operation takes place within the primary (#1) GIA 63W. Flight director commands are displayed on the PFD. The flight director provides:
    - Command Bars showing pitch/roll guidance
    - Vertical/lateral mode selection and processing
    - Autopilot communication
- **Autopilot (AP)** — Autopilot operation occurs within the pitch, roll, and pitch trim servos. It also provides servo monitoring and automatic flight control in response to flight director steering commands, Attitude and Heading Reference System (AHRS) attitude and rate information, and airspeed.
- **Yaw Damper (YD)** — The yaw servo is self-monitoring and provides Dutch roll damping and turn coordination in response to yaw rate, roll angle, lateral acceleration, and airspeed.
- **Manual Electric Pitch Trim (MEPT)** — The pitch trim servo provides manual electric pitch trim capability when the autopilot is not engaged.

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AFCS CONTROLS ON THE MFD

The following dedicated AFCS keys are located on the bezel of the MFD:

①	**AP Key**	Engages/disengages the autopilot
②	**FD Key**	Activates/deactivates the flight director only
		Pressing once turns on the flight director in the default vertical and lateral modes. Pressing again deactivates the flight director and removes the Command Bars. If the autopilot is engaged, the key is disabled.
③	**NAV Key**	Selects/deselects Navigation Mode
④	**ALT Key**	Selects/deselects Altitude Hold Mode
⑤	**VS Key**	Selects/deselects Vertical Speed Mode
⑥	**FLC Key**	Selects/deselects Flight Level Change Mode
⑦	**YD Key**	Engages/disengages the yaw damper
⑧	**HDG Key**	Selects/deselects Heading Select Mode
⑨	**APR Key**	Selects/deselects Approach Mode
⑩	**VNV Key**	Selects/deselects Vertical Path Tracking Mode for Vertical Navigation flight control
	(If equipped)	
⑪	**NOSE UP/ NOSE DN Keys**	Control the mode reference in Pitch Hold, Vertical Speed and Flight Level Change modes

GDU 1043   *GDU 1045*
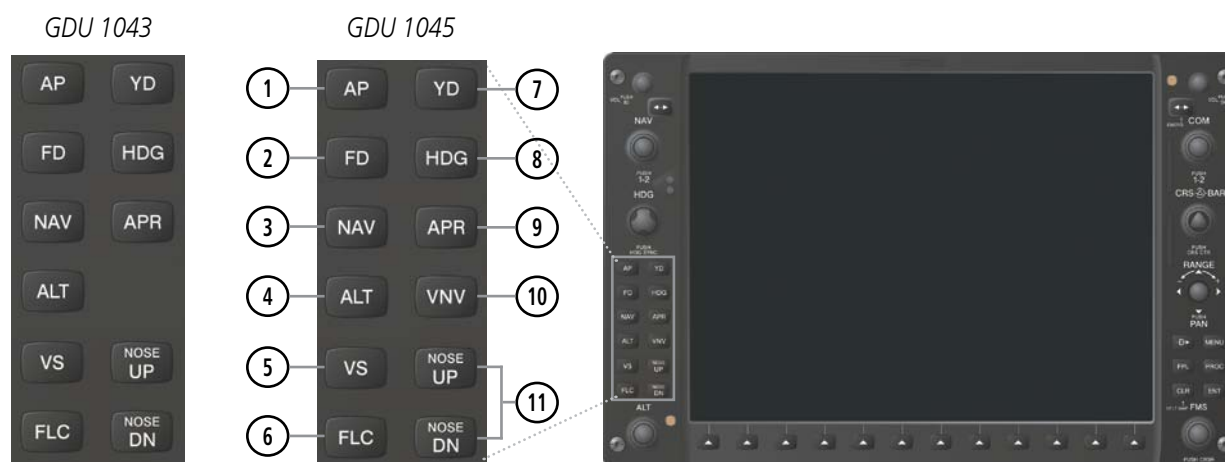
Figure 7-1 Dedicated MFD AFCS Controls

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ADDITIONAL AFCS CONTROLS

The following controls used for the AFCS are located in the cockpit separately from the MFD:

AP DISC/TRIM INT Switch (Autopilot Disconnect/Trim Interrupt)	Disengages the autopilot and yaw damper and interrupts pitch trim operation
	An **AP DISC/TRIM INT** Switch is red and is located on the pilot's control.
	This switch may be used to acknowledge an autopilot disconnect alert and mute the associated aural tone.
CWS Switch (Control Wheel Steering)	While pressed, allows manual control of the aircraft while the autopilot is engaged and synchronizes the flight director's Command Bars with the current aircraft pitch (if not in a Vertical Navigation, Glideslope, or Glidepath Mode) and roll (if in Roll Hold Mode)
	A **CWS** Switch is located on the pilot's control wheel.
	Upon release of the **CWS** Switch, the flight director may establish new pitch and roll references, depending on the current vertical and lateral modes. CWS operation details are discussed in the respective mode sections of this manual.
GA Switch (Go Around)	Disengages the autopilot and selects flight director Go Around Mode
	If an approach procedure is loaded this switch also activates the missed approach when the selected navigation source is GPS or when the navigation source is VOR/LOC and a valid frequency has been tuned.
	The **GA** Switch is located on the throttle.
MEPT Switch (Manual Electric Pitch Trim)	Used to command manual electric pitch trim
	An **MEPT** Switch is located on the pilot's control wheel.
	This composite switch is split into left and right sides. The left switch is the ARM contact and the right switch controls the DN (forward) and UP (rearward) contacts. Pushing the **MEPT** ARM Switch disengages the autopilot, if currently engaged, but does not affect yaw damper operation. The **MEPT** ARM Switch may be used to acknowledge an autopilot disconnect alert and mute the associated aural tone.
	Manual trim commands are generated only when both sides of the switch are operated simultaneously. If either side of the switch is active separately for more than three seconds, MEPT function is disabled and 'PTRM' is displayed as the AFCS Status Annunciation on the PFD. The function remains disabled until both sides of the switch are inactivated.

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7.2 FLIGHT DIRECTOR OPERATION

The flight director function provides pitch and roll commands to the AFCS and displays them on the PFD. With the flight director active, the aircraft can be hand-flown to follow the path shown by the Command Bars. Maximum commanded pitch (–15°, +20°) and roll (25°) angles, vertical acceleration, and roll rate are limited to values established during AFCS certification. The flight director also provides commands to the autopilot.

ACTIVATING THE FLIGHT DIRECTOR

An initial press of a key listed in Table 7-1 (when the flight director is not active) activates the flight director in the listed modes. The flight director may be turned off and the Command Bars removed from the display by pressing the **FD** Key again. The **FD** Key is disabled when the autopilot is engaged.

Control Pressed	Modes Selected			
	Lateral		Vertical	
FD Key	Roll Hold (default)	ROL	Pitch Hold (default)	PIT
AP Key	Roll Hold (default)	ROL	Pitch Hold (default)	PIT
CWS Switch	Roll Hold (default)	ROL	Pitch Hold (default)	PIT
GA Switch	Go Around	GA	Go Around	GA
ALT Key	Roll Hold (default)	ROL	Altitude Hold	ALT
VS Key	Roll Hold (default)	ROL	Vertical Speed	VS
VNV Key (If equipped)	Roll Hold (default)	ROL	Vertical Path Tracking*	VPTH
NAV Key	Navigation**	GPS VOR LOC BC	Pitch Hold (default)	PIT
APR Key	Approach**	GPS VOR LOC	Pitch Hold (default)	PIT
HDG Key	Heading Select	HDG	Pitch Hold (default)	PIT

*Valid VNV flight plan must be entered before **VNV** Key press activates flight director.

The selected navigation receiver must have a valid VOR or LOC signal or active GPS course before **NAV or **APR** Key press activates flight director.

Table 7-1 Flight Director Activation

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AFCS STATUS BOX

Flight director mode annunciations are displayed on the PFD when the flight director is active. Flight director selection and autopilot and yaw damper statuses are shown in the center of the AFCS Status Box. Lateral flight director modes are displayed on the left and vertical on the right. Armed modes are displayed in white and active in green.

AFCS Status Box
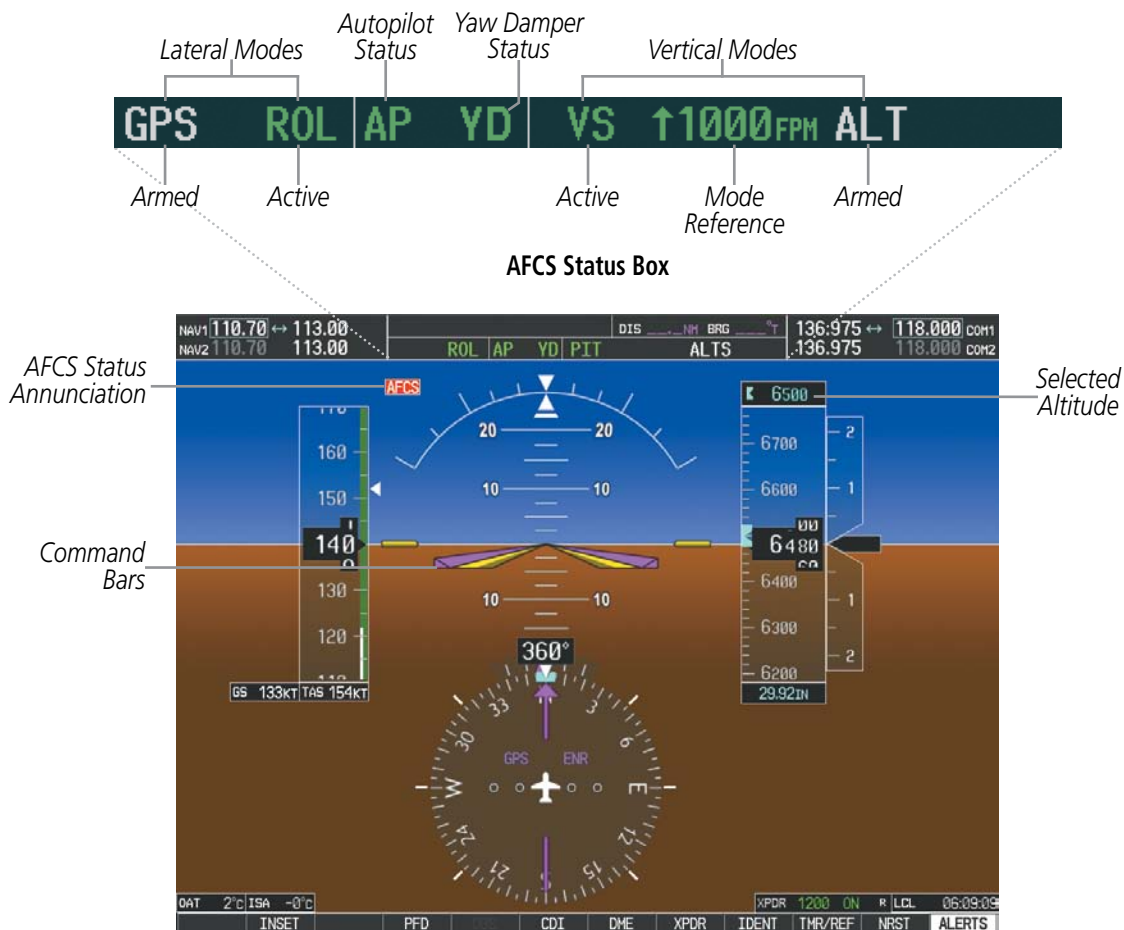
Figure 7-2 PFD AFCS Display

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FLIGHT DIRECTOR MODES

Flight director modes are normally selected independently for the pitch and roll axes. Unless otherwise specified, all mode keys are alternate action (i.e., press on, press off). In the absence of specific mode selection, the flight director reverts to the default pitch and/or roll modes.

Armed modes are annunciated in white and active in green in the AFCS Status Box. Under normal operation, when the control for the active flight director mode is pressed, the flight director reverts to the default mode(s) for the axis(es). Automatic transition from armed to active mode is indicated by the white armed mode annunciation moving to the green active mode field and flashing for 10 seconds.

If the information required to compute a flight director mode becomes invalid or unavailable, the flight director automatically reverts to the default mode for that axis. A flashing yellow mode annunciation and annunciator light indicate loss of sensor (ADC) or navigation data (VOR, LOC, GPS, VNV, SBAS) required to compute commands. When such a loss occurs, the system automatically begins to roll the wings level (enters Roll Hold Mode) or maintain the pitch angle (enters Pitch Hold Mode), depending on the affected axis. The flashing annunciation stops when the affected mode key is pressed or another mode for the axis is selected. If after 10 seconds no action is taken, the flashing annunciation stops.

Figure 7-3 Loss of VOR Signal

The flight director is automatically disabled if the attitude information required to compute the default flight director modes becomes invalid or unavailable.

COMMAND BARS

Upon activation of the flight director, Command Bars are displayed in magenta on the PFD as a single cue. The Command Bars do not override the Aircraft Symbol. The Command Bars move together vertically to indicate pitch commands and bank left or right to indicate roll commands.
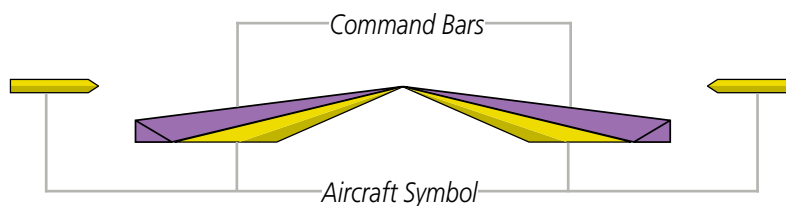
Figure 7-4 Command Bars

If the attitude information being sent to the flight director becomes invalid or unavailable, the Command Bars are removed from the display. The flight director Command Bars also disappear if the pitch exceeds +30°/-20° or bank exceeds 65°.

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7.3 VERTICAL MODES

Table 7-2 lists the vertical modes with their corresponding controls and annunciations. The mode reference is displayed next to the active mode annunciation for Altitude Hold, Vertical Speed, and Flight Level Change modes. The **NOSE UP/NOSE DN** Keys can be used to change the vertical mode reference while operating under Pitch Hold, Vertical Speed, or Flight Level Change Mode. Increments of change and acceptable ranges of values for each of these references using the **NOSE UP/NOSE DN** Keys are also listed in the table.

Vertical Mode	Description	Control	Annunciation	Reference Range	Reference Change Increment
Pitch Hold	Holds the current aircraft pitch attitude; may be used to climb/descend to the Selected Altitude	(default)	PIT	-15° to +20°	0.5°
Selected Altitude Capture	Captures the Selected Altitude	*	ALTS		
Altitude Hold	Holds the current Altitude Reference	**ALT** Key	ALT nnnnn FT		
Vertical Speed	Maintains the current aircraft vertical speed; may be used to climb/descend to the Selected Altitude	**VS** Key	VS nnnn FPM	-2000 to +1500 fpm	100 fpm
Flight Level Change, IAS Hold	Maintains the current aircraft airspeed in IAS while the aircraft is climbing/descending to the Selected Altitude	**FLC** Key	FLC nnn KT	90 to 210 kt	1 kt
Vertical Path Tracking (If equipped)	Captures and tracks descent legs of an active vertical profile	**VNV** Key	VPTH		
VNV Target Altitude Capture	Captures the Vertical Navigation (VNV) Target Altitude	**	ALTV		
Glidepath	Captures and tracks the SBAS glidepath on approach	**APR** Key	GP		
Glideslope	Captures and tracks the ILS glideslope on approach		GS		
Go Around	Disengages the autopilot and commands a constant pitch angle and wings level in the air	**GA** Switch	GA	7°	

* *ALTS armed automatically when PIT, VS, FLC, or GA active, and under VPTH when Selected Altitude is to be captured instead of VNV Target Altitude*

** *ALTV armed automatically under VPTH when VNV Target Altitude is to be captured instead of Selected Altitude*

Table 7-2 Flight Director Vertical Modes

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PITCH HOLD MODE (PIT)

When the flight director is activated (the **FD** Key is pressed), Pitch Hold Mode is selected by default. Pitch Hold Mode is indicated as the active vertical mode by the green 'PIT' annunciation. This mode may be used for climb or descent to the Selected Altitude (shown above the Altimeter), since Selected Altitude Capture Mode is automatically armed when Pitch Hold Mode is activated.

In Pitch Hold Mode, the flight director maintains a constant pitch attitude, the pitch reference. The pitch reference is set to the aircraft pitch attitude at the moment of mode selection. If the aircraft pitch attitude exceeds the flight director pitch command limitations, the flight director commands a pitch angle equal to the nose-up/down limit.

CHANGING THE PITCH REFERENCE

When operating in Pitch Hold Mode, the pitch reference can be adjusted by:

• Using the **NOSE UP/NOSE DN** Keys

• Pressing the **CWS** Switch, hand-flying the aircraft to establish a new pitch reference, then releasing the **CWS** Switch

Pitch Hold Mode Active

Selected Altitude Capture Mode Armed

Selected Altitude

Command Bars Maintain Desired Pitch Reference
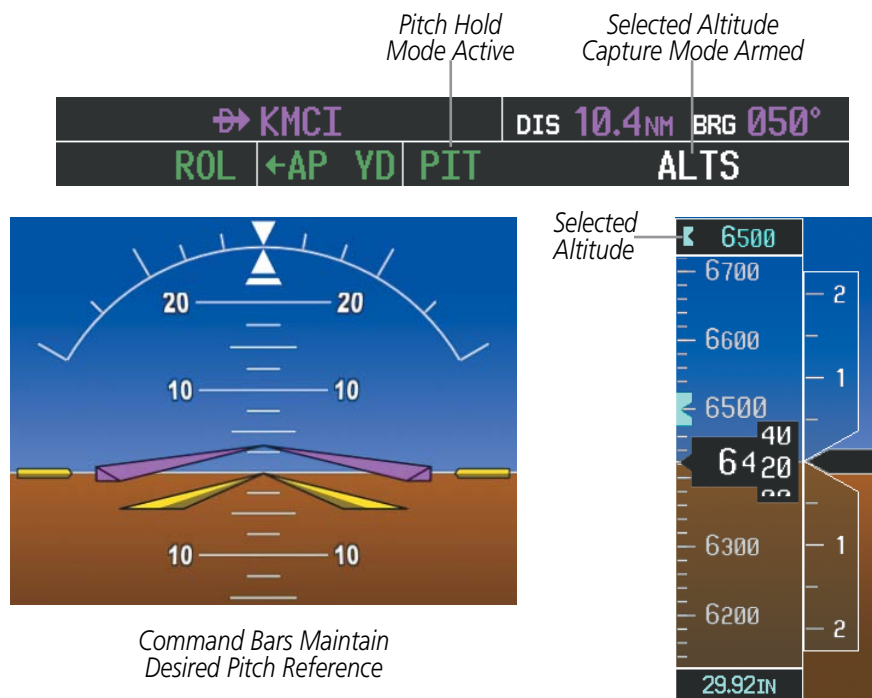
Figure 7-5 Pitch Hold Mode

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SELECTED ALTITUDE CAPTURE MODE (ALTS)

Selected Altitude Capture Mode is automatically armed with activation of the following modes:

- Pitch Hold
- Vertical Speed
- Flight Level Change

- Go Around
- Vertical Path Tracking (if the Selected Altitude is to be captured instead of the VNV Target Altitude)

The white 'ALTS' annunciation indicates Selected Altitude Capture Mode is armed (see Figure 7-6 for example). The **ALT** Knob is used to set the Selected Altitude (shown above the Altimeter) until Selected Altitude Capture Mode becomes active.

As the aircraft nears the Selected Altitude, the flight director automatically transitions to Selected Altitude Capture Mode with Altitude Hold Mode armed (Figure 7-6). This automatic transition is indicated by the green 'ALTS' annunciation flashing for up to 10 seconds and the appearance of the white 'ALT' annunciation. The Selected Altitude is shown as the Altitude Reference beside the 'ALTS' annunciation.

At 50 feet from the Selected Altitude, the flight director automatically transitions from Selected Altitude Capture to Altitude Hold Mode and holds the Selected Altitude (shown as the Altitude Reference). As Altitude Hold Mode becomes active, the white 'ALT' annunciation moves to the active vertical mode field and flashes green for 10 seconds to indicate the automatic transition.

*Altitude Reference
(in this case, equal to
Selected Altitude)*

| GPS | AP | ALTS 10000ᶠᵀ ALT |

Flash up to 10 sec, Indicating Automatic Transition

| GPS | AP | ALT 10000ᶠᵀ |
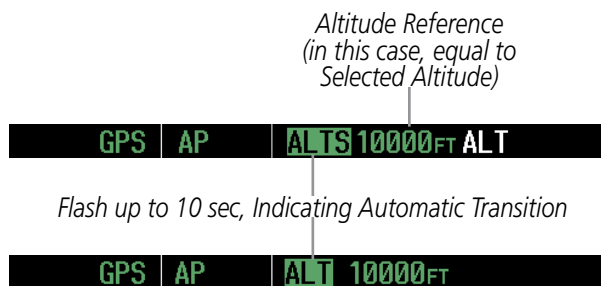
Figure 7-6 Automatic Mode Transitions During Altitude Capture

CHANGING THE SELECTED ALTITUDE

> **NOTE:** Pressing the **CWS** Switch while in Selected Altitude Capture Mode does not cancel the mode.

Use of the **ALT** Knob to change the Selected Altitude while Selected Altitude Capture Mode is active causes the flight director to revert to Pitch Hold Mode with Selected Altitude Capture Mode armed for the new Selected Altitude.

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ALTITUDE HOLD MODE (ALT)

Altitude Hold Mode can be activated by pressing the **ALT** Key; the flight director maintains the current aircraft altitude (to the nearest 10 feet) as the Altitude Reference. The flight director's Altitude Reference, shown in the AFCS Status Box, is independent of the Selected Altitude, displayed above the Altimeter. Altitude Hold Mode active is indicated by a green 'ALT' annunciation in the AFCS Status Box.

Altitude Hold Mode is automatically armed when the flight director is in Selected Altitude Capture Mode (see Figure 7-7). Selected Altitude Capture Mode automatically transitions to Altitude Hold Mode when the altitude error is less than 50 feet. In this case, the Selected Altitude becomes the flight director's Altitude Reference.

CHANGING THE ALTITUDE REFERENCE

NOTE: *Turning the **ALT** Knob while in Altitude Hold Mode changes the Selected Altitude, but not the flight director's Altitude Reference, and does not cancel the mode.*

The Altitude Reference (shown in the AFCS Status Box) may be changed by:

- Using the **NOSE UP/NOSE DN** Keys

- Pressing the **CWS** Switch, hand-flying the aircraft to attain a new Altitude Reference, then releasing the **CWS** Switch at the desired altitude (the new altitude is now the Altitude Reference)

Altitude Hold
Mode Active

Altitude
Reference

Selected
Altitude

Selected
Altitude
Bug

Command Bars Hold Pitch Attitude
to Maintain Altitude Reference
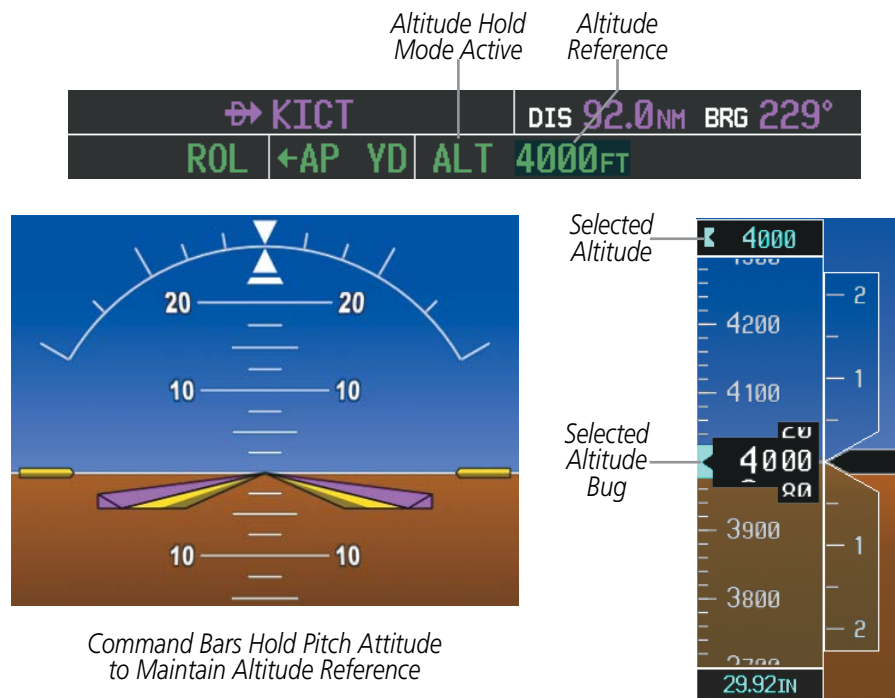
Figure 7-7 Altitude Hold Mode

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VERTICAL SPEED MODE (VS)

In Vertical Speed Mode, the flight director acquires and maintains a Vertical Speed Reference. Current aircraft vertical speed (to the nearest 100 fpm) becomes the Vertical Speed Reference at the moment of Vertical Speed Mode activation. This mode may be used for climb or descent to the Selected Altitude (shown above the Altimeter) since Selected Altitude Capture Mode is automatically armed when Vertical Speed Mode is selected.

When Vertical Speed Mode is activated by pressing the **VS** Key, 'VS' is annunciated in green in the AFCS Status Box along with the Vertical Speed Reference. The Vertical Speed Reference is also displayed above the Vertical Speed Indicator. A Vertical Speed Reference Bug corresponding to the Vertical Speed Reference is shown on the indicator.

CHANGING THE VERTICAL SPEED REFERENCE

The Vertical Speed Reference (shown both in the AFCS Status Box and above the Vertical Speed Indicator) may be changed by:

• Using the **NOSE UP/NOSE DN** Keys

• Pressing the **CWS** Switch, hand-flying the aircraft to attain a new Vertical Speed Reference, then releasing the **CWS** Switch

NOTE: If the Selected Altitude is reached during CWS maneuvering, the Altitude Reference is not changed. To adjust the Altitude Reference in this case, the **CWS** Switch must be pressed again after the Selected Altitude is reached.
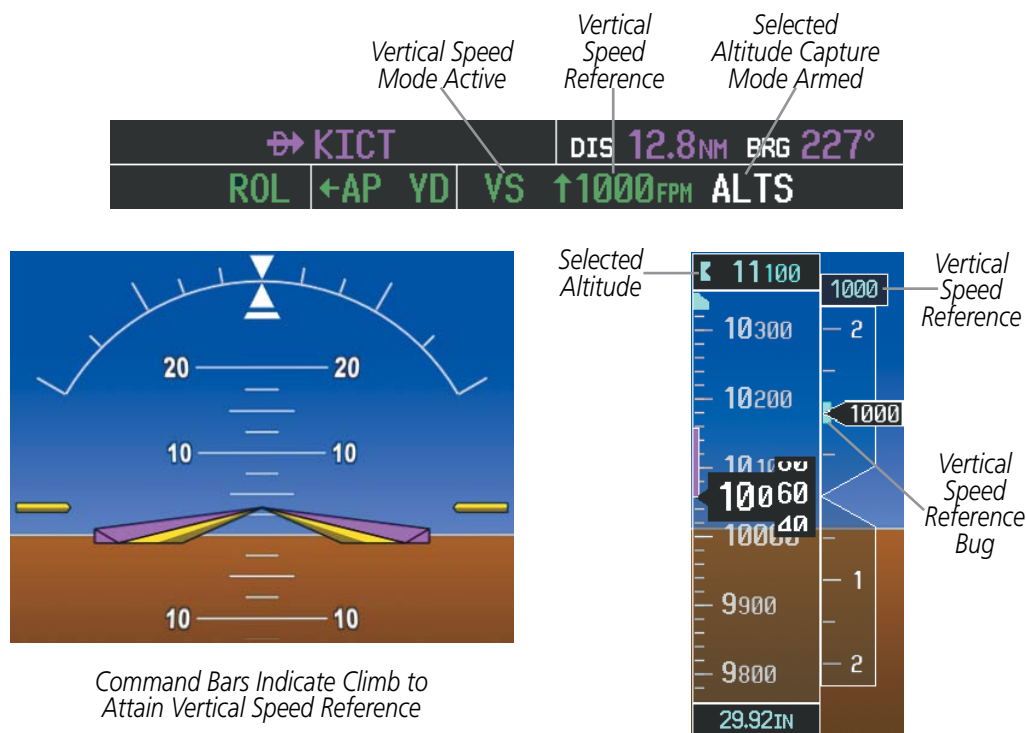
Figure 7-8 Vertical Speed Hold Mode

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FLIGHT LEVEL CHANGE MODE (FLC)

> **NOTE:** *The Selected Altitude should be set before selecting Flight Level Change Mode.*

Flight Level Change Mode is selected by pressing the **FLC** Key. This mode acquires and maintains the Airspeed Reference (IAS) while climbing or descending to the Selected Altitude (shown above the Altimeter). When Flight Level Change Mode is active, the flight director continuously monitors Selected Altitude, airspeed and altitude.

The Airspeed Reference is set to the current airspeed upon mode activation. Flight Level Change Mode is indicated by a green 'FLC' annunciation beside the Airspeed Reference in the AFCS Status Box. The Airspeed Reference is also displayed directly above the Airspeed Indicator, along with a bug corresponding to the Airspeed Reference along the tape.

Engine power must be adjusted to allow the autopilot to fly the aircraft at a pitch attitude corresponding to the desired flight profile (climb or descent) while maintaining the Airspeed Reference. The flight director maintains the current altitude until either engine power or the Airspeed Reference are adjusted and does not allow the aircraft to climb or descend away from the Selected Altitude.

CHANGING THE AIRSPEED REFERENCE

The Airspeed Reference (shown in both the AFCS Status Box and above the Airspeed Indicator) may be adjusted by:

- Using the **NOSE UP/NOSE DN** Keys

- Pressing the **CWS** Switch, hand-flying the aircraft to attain a new Airspeed Reference, then releasing the **CWS** Switch

> **NOTE:** *If the Selected Altitude is reached during CWS maneuvering, the Airspeed Reference is not changed. To adjust the Airspeed Reference in this case, the **CWS** Switch must be pressed again after the Selected Altitude is reached.*

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Flight Level Change Mode Active

Airspeed Reference

Selected Altitude Capture Mode Armed

Airspeed Reference

Airspeed Reference Bug

Command Bars Indicate Climb to attain Selected Altitude
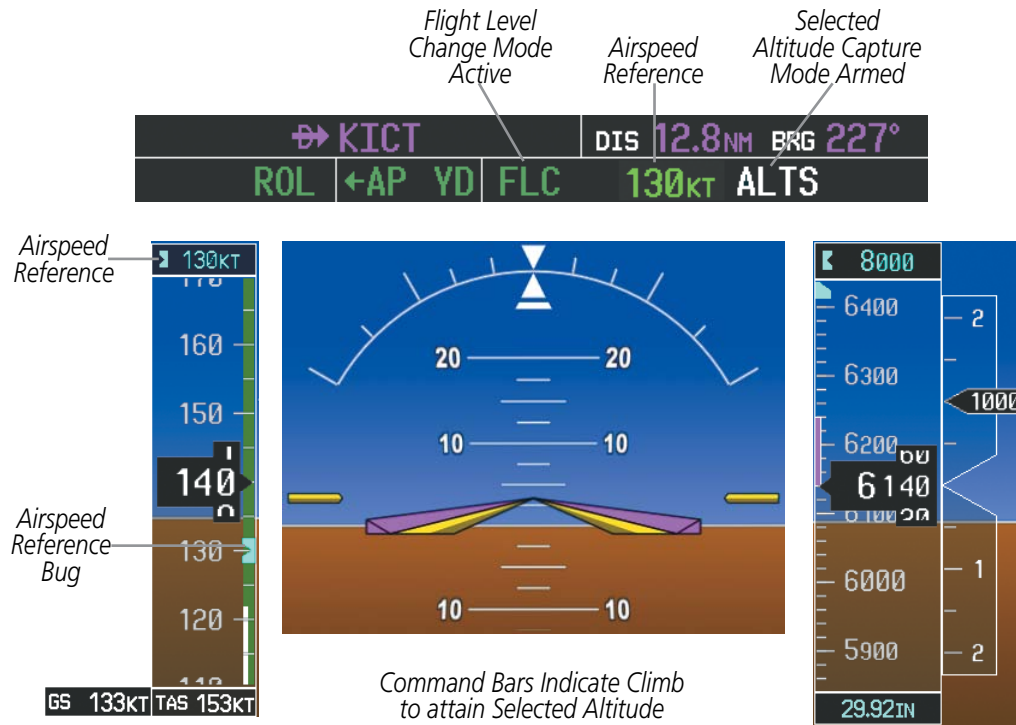
Figure 7-9 Flight Level Change Mode (IAS)

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VERTICAL NAVIGATION MODES (VPTH, ALTV)

> **NOTE:** *VNV is disabled when parallel track or Dead Reckoning Mode is active.*

> **NOTE:** *The Selected Altitude takes precedence over any other vertical constraints.*

Vertical Navigation (VNV) flight control is available for enroute/terminal cruise and descent operations any time that VNV flight planning is available. Refer to the Flight Management Section for more information on VNV flight plans. Conditions for availability include, but are not limited to:

- The selected navigation source is GPS.
- A VNV flight plan (with at least one altitude-constrained waypoint) or vertical direct-to is active.
- VNV is enabled (**VNV ENBL** Softkey pressed on the MFD).
- Crosstrack error is valid and within certain limits.
- Desired/actual track are valid or track angle error is within certain limits.
- The VNV Target Altitude of the active waypoint is no more than 250 ft above the current aircraft altitude.

The flight director may be armed for VNV at any time, but no target altitudes are captured during a climb. The Command Bars provide vertical profile guidance based on specified altitudes (entered manually or loaded from the database) at waypoints in the active flight plan or vertical direct-to. The appropriate VNV flight control modes are sequenced by the flight director to follow the path defined by the vertical profile. Upon reaching the last waypoint in the VNV flight plan, the flight director transitions to Altitude Hold Mode and cancels any armed VNV modes.

VERTICAL PATH TRACKING MODE (VPTH)

> **NOTE:** *Vertical Path Tracking Mode is only applicable to aircraft equipped with a **VNV** Key.*

> **NOTE:** *If another vertical mode key is pressed while Vertical Path Tracking Mode is selected, Vertical Path Tracking Mode reverts to armed.*

> **NOTE:** *Pressing the **CWS** Switch while Vertical Path Tracking Mode is active does not cancel the mode. The autopilot guides the aircraft back to the descent path upon release of the **CWS** Switch.*

When a vertical profile (VNV flight plan) is active and the **VNV** Key is pressed, Vertical Path Tracking Mode is armed in preparation for descent path capture. 'VPTH' (or '/V' when Glidepath or Glideslope Mode is concurrently armed) is annunciated in white in addition to previously armed modes. If applicable, the appropriate altitude capture mode is armed for capture of the next VNV Target Altitude (ALTV) or the Selected Altitude (ALTS), whichever is greater.

GPS | ALT 13000FT **VPTH**

GPS | FLC 170KT **ALTS GP/V**
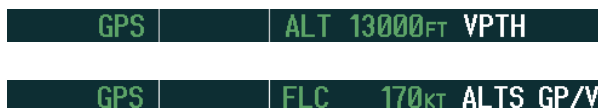
Figure 7-10 Vertical Path Tracking Armed Annunciations

Prior to descent path interception, the Selected Altitude must be set below the current aircraft altitude by at least 75 feet. For the flight director to transition from Altitude Hold to Vertical Path Tracking Mode, acknowledgment is required within five minutes of descent path interception by:

- Pressing the **VNV** Key
- Adjusting the Selected Altitude

If acknowledgment is not received within one minute of descent path interception, the white 'VPTH' annunciation starts to flash. Flashing continues until acknowledged or the descent path is intercepted. If the descent is not confirmed by the time of interception, Vertical Path Tracking Mode remains armed and the descent is not captured.

In conjunction with the "TOD [top of descent] within 1 minute" annunciation in the PFD Navigation Status Box and the "Vertical track" voice message, VNV indications (VNV Target Altitude, vertical deviation, and vertical speed required) appear on the PFD in magenta (Figure 7-11).
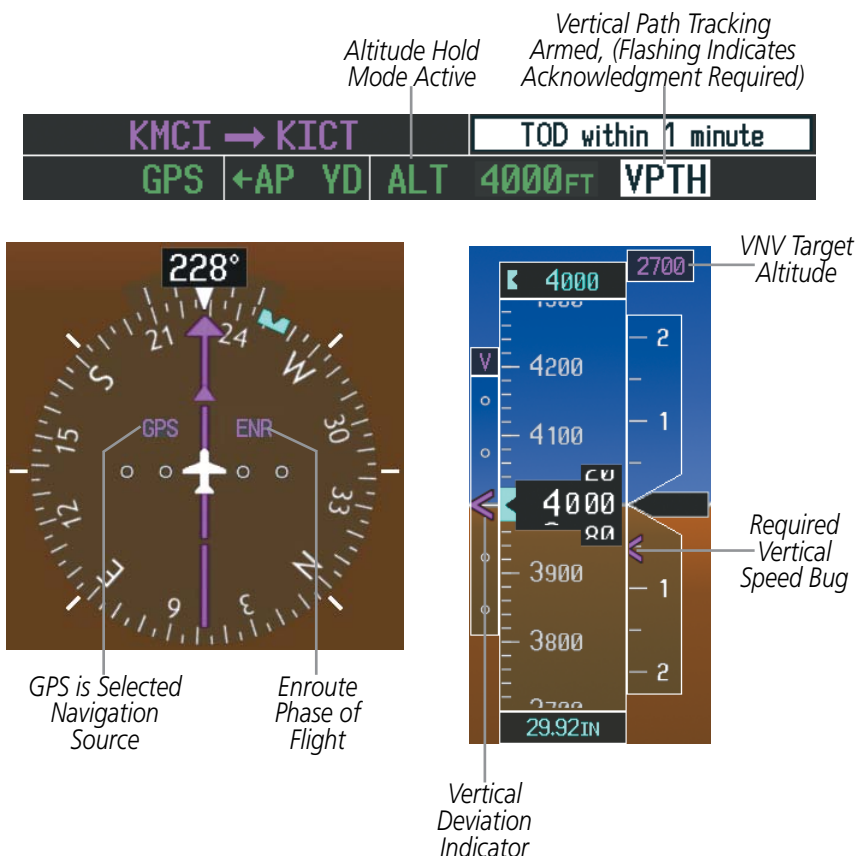
Figure 7-11 Vertical Path Capture

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When a descent leg is captured (i.e., vertical deviation becomes valid), Vertical Path Tracking becomes active and tracks the descent profile (Figure 7-12). An altitude capture mode ('ALTS' or 'ALTV') is armed as appropriate.
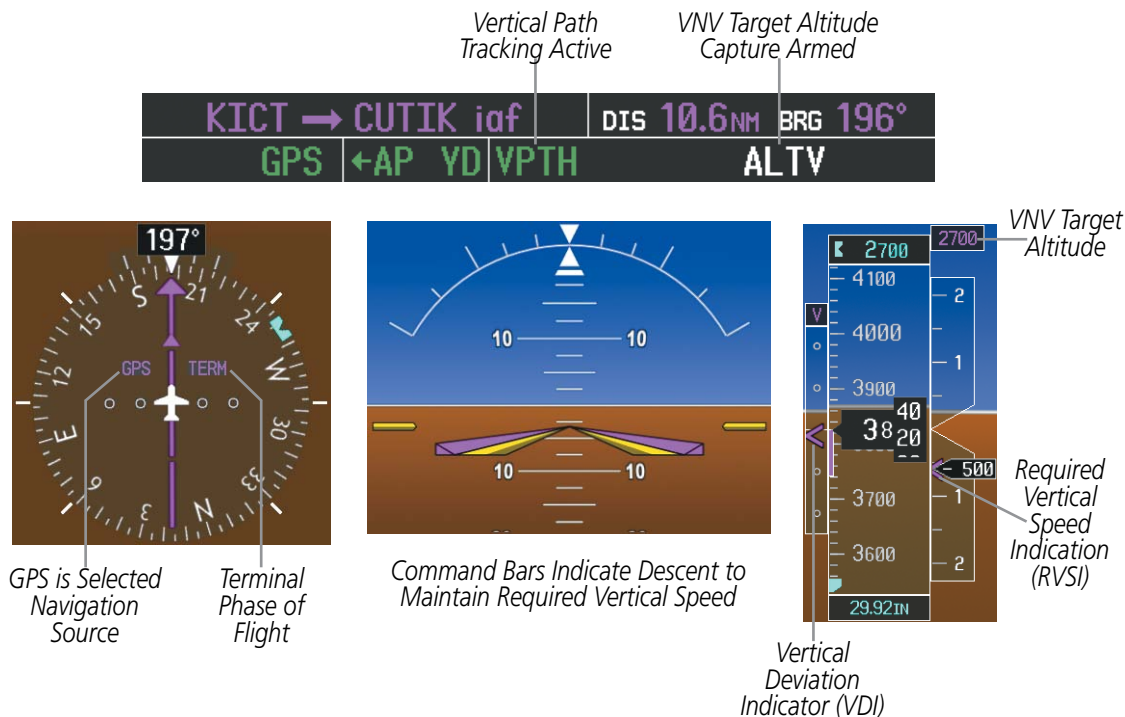
Figure 7-12 Vertical Path Tracking Mode

If the altimeter barometric setting is adjusted while Vertical Path Tracking is active, the flight director increases/decreases the descent rate by up to 500 fpm to re-establish the aircraft on the descent path (without commanding a climb). Adjusting the altimeter barometric setting creates discontinuities in VNV vertical deviation, moving the descent path. For large adjustments, it may take several minutes for the aircraft to re-establish on the descent path. If the change is made while nearing a waypoint with a VNV Target Altitude, the aircraft may not re-establish on the descent path in time to meet the vertical constraint.

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AUTOMATIC REVERSION TO PITCH HOLD MODE

Several situations can occur while Vertical Path Tracking Mode is active which cause the flight director to revert to Pitch Hold Mode:

• Vertical deviation exceeds 200 feet during an overspeed condition.

• Vertical deviation experiences a discontinuity that both exceeds 200 feet in magnitude and results in the vertical deviation exceeding 200 feet in magnitude. Such discontinuities are usually caused by flight plan changes that affect the vertical profile.

• Vertical deviation becomes invalid (the Vertical Deviation Indicator is removed from the PFD).

• A display enters Reversionary Mode (this does not apply to an active vertical direct-to).

Unless VNV is disabled, Vertical Path Tracking Mode and the appropriate altitude capture mode become armed following the reversion to Pitch Hold Mode to allow for possible profile recapture.

NON-PATH DESCENTS

Pitch Hold, Vertical Speed, and Flight Level Change modes can also be used to fly non-path descents while VNV flight control is selected. If the **VS** or **FLC** Key is pressed while Vertical Path Tracking Mode is selected, Vertical Path Tracking Mode reverts to armed along with the appropriate altitude capture mode to allow profile re-capture.

| GPS | | FLC | 170ᴋᴛ ALTS ᐯPTH |

Figure 7-13 Flight Level Change VNV Non-Path Descent

To prevent immediate profile re-capture, the following must be satisfied:

• At least 10 seconds have passed since the non-path transition was initiated

• Vertical deviation from the profile has exceeded 250 feet, but is now less than 200 feet

Pressing the **VNV** Key twice re-arms Vertical Path Tracking for immediate profile re-capture.

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VNV TARGET ALTITUDE CAPTURE MODE (ALTV)

> **NOTE:** *VNV Target Altitude Capture Mode is only applicable to aircraft equipped with a **VNV** Key.*

> **NOTE:** *Armed VNV Target Altitude and Selected Altitude capture modes are mutually exclusive. However, Selected Altitude Capture Mode is armed implicitly (not annunciated) whenever VNV Target Altitude Capture Mode is armed.*

VNV Target Altitude Capture is analogous to Selected Altitude Capture Mode and is armed automatically after the **VNV** Key is pressed and the next VNV Target Altitude is to be intercepted before the Selected Altitude. The annunciation 'ALTV' indicates that the VNV Target Altitude is to be captured. VNV Target Altitudes are shown in the active flight plan or vertical direct-to, and can be entered manually or loaded from a database (see the Flight Management Section for details). At the same time as "TOD within 1 minute" is annunciated in the Navigation Status Box, the active VNV Target Altitude is displayed above the Vertical Speed Indicator (see Figure 7-11).

As the aircraft nears the VNV Target Altitude, the flight director automatically transitions to VNV Target Altitude Capture Mode with Altitude Hold Mode armed. This automatic transition is indicated by the green 'ALTV' annunciation flashing for up to 10 seconds and the appearance of the white 'ALT' annunciation. The VNV Target Altitude is shown as the Altitude Reference beside the 'ALTV' annunciation and remains displayed above the Vertical Speed Indicator. The Required Vertical Speed Indication (RVSI) is removed once VNV Target Altitude Capture Mode becomes active.

At 50 feet from the VNV Target Altitude, the flight director automatically transitions from VNV Target Altitude Capture to Altitude Hold Mode and tracks the level leg. As Altitude Hold Mode becomes active, the white 'ALT' annunciation moves to the active vertical mode field and flashes green for 10 seconds to indicate the automatic transition. The flight director automatically arms Vertical Path Tracking, allowing upcoming descent legs to be captured and subsequently tracked.

Altitude Reference (In This Case, Equal To VNV Altitude Target)

| GPS | | ALTV 10000FT | ALT | VPTH |

Flash up to 10 sec, Indicating Automatic Transition

| GPS | | ALT 10000FT | VPTH |
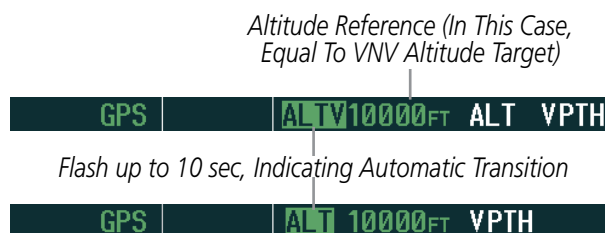
Figure 7-14 Automatic Mode Transitions During Altitude Capture

CHANGING THE VNV TARGET ALTITUDE

> **NOTE:** *Pressing the **CWS** Switch while in VNV Target Altitude Capture Mode does not cancel the mode.*

Changing the current VNV Target Altitude while VNV Target Altitude Capture Mode is active causes the flight director to revert to Pitch Hold Mode. Vertical Path Tracking and the appropriate altitude capture mode are armed in preparation to capture the new VNV Target Altitude or the Selected Altitude, depending on which altitude is to be intercepted first.

VNV target altitudes can be changed while editing the active flight plan (see the Flight Management Section for details).

GLIDEPATH MODE (GP) (SBAS ONLY)

> ✓ **NOTE:** *Pressing the **CWS** Switch while Glidepath Mode is active does not cancel the mode. The autopilot guides the aircraft back to the glidepath upon release of the **CWS** Switch.*

Glidepath Mode is available only when SBAS is available. Glidepath Mode is used to track the SBAS-based glidepath (Figure 7-15). When Glidepath Mode is armed, 'GP' is annunciated in white in the AFCS Status Box.

Selecting Glidepath Mode (SBAS Only):

1) Ensure a GPS approach with vertical guidance or vertical descent angle (LPV, LNAV/VNAV, LNAV +V) is loaded into the active flight plan. The active waypoint must be part of the flight plan (cannot be a direct-to a waypoint not in the flight plan).

2) Ensure that GPS is the selected navigation source (use the **CDI** Softkey to cycle through navigation sources if necessary).

3) Press the **APR** Key.

> ✓ **NOTE:** *Some RNAV (GPS) approaches provide a vertical descent angle as an aid in flying a stabilized approach. These approaches are NOT considered Approaches with Vertical Guidance (APV). Approaches that are annunciated on the HSI as LNAV or LNAV+V are considered Nonprecision Approaches (NPA) and are flown to an MDA even though vertical glidepath (GP) information may be provided.*

> ⚠ **WARNING:** *When flying an LNAV approach (with vertical descent angle) with the autopilot coupled, the aircraft will not level off at the MDA even if the MDA is set in the altitude preselect.*

Upon reaching the glidepath, the flight director transitions to Glidepath Mode and begins to capture and track the glidepath.

GPS | AP YD | VPTH   ALTS GP

Figure 7-15 Glidepath Mode Armed

Once the following conditions have been met, the glidepath can be captured:

• The active waypoint is at or after the final approach fix (FAF).

• Vertical deviation is valid.

• The CDI is at less than full-scale deviation

• Automatic sequencing of waypoints has not been suspended (no 'SUSP' annunciation on the HSI)

GPS Approach
Mode Active

Glidepath
Mode Active

JETUX faf → RW01L map │ DIS 2.3NM BRG 015°

GPS │←AP YD│ GP

GPS is Selected
Navigation
Source

LNAV/VNAV
Approach
Active

Command Bars Indicate
Descent on Glidepath

Glidepath
Indicator
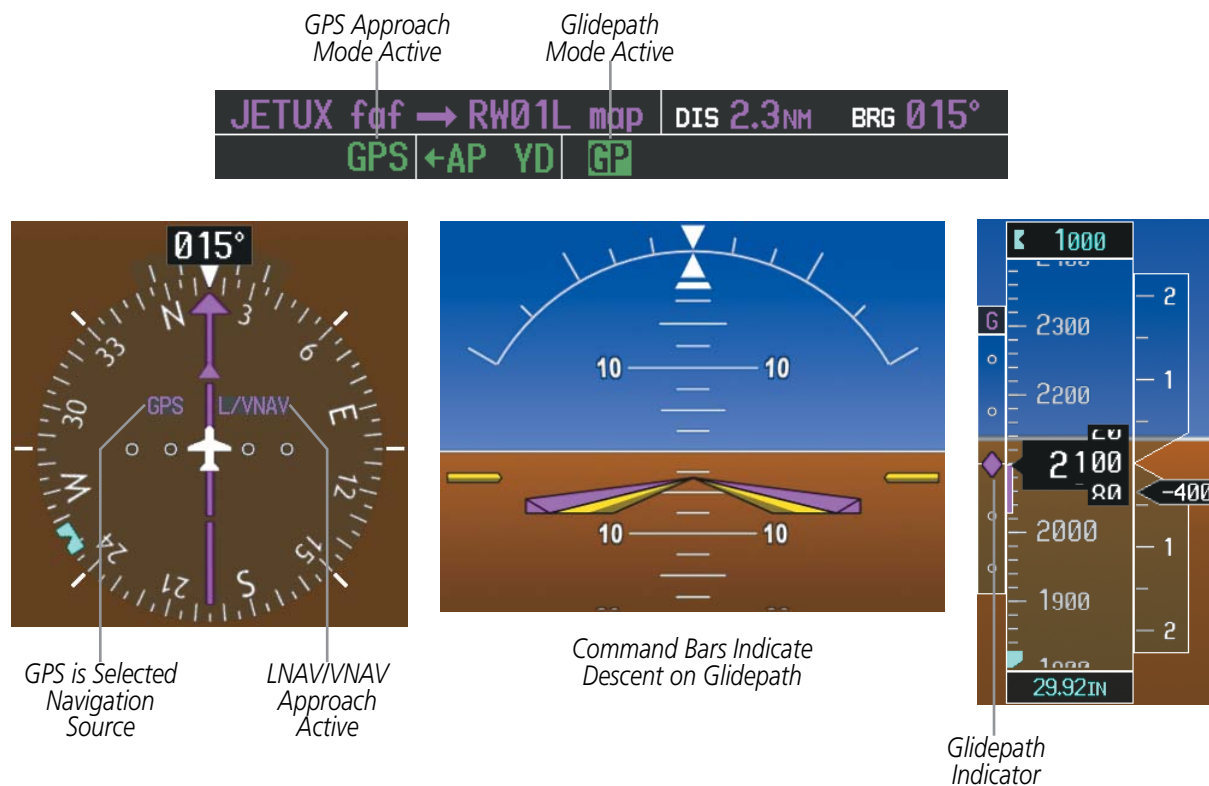
Figure 7-16 Glidepath Mode

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GLIDESLOPE MODE (GS)

✓ **NOTE:** *Pressing the **CWS** Switch while Glideslope Mode is active does not cancel the mode. The autopilot guides the aircraft back to the glideslope upon release of the **CWS** Switch.*

Glideslope Mode is available for LOC/ILS approaches to capture and track the glideslope. When Glideslope Mode is armed (annunciated as 'GS' in white), LOC Approach Mode is armed as the lateral flight director mode.

Selecting Glideslope Mode:

1) Ensure a valid localizer frequency is tuned.

2) Ensure that LOC is the selected navigation source (use the **CDI** Softkey to cycle through navigation sources if necessary).

3) Press the **APR** Key.

   Or:

1) Ensure that GPS is the selected navigation source (use the **CDI** Softkey to cycle through navigation sources if necessary).

2) Ensure a LOC/ILS approach is loaded into the active flight plan.

3) Ensure the corresponding LOC frequency is tuned.

4) Press the **APR** Key.

| LOC | HDG | AP YD | ALT | 9000FT | GS |

Figure 7-17 Glideslope Mode Armed

Once LOC is the navigation source, the localizer and glideslope can be captured. Upon reaching the glideslope, the flight director transitions to Glideslope Mode and begins to capture and track the glideslope.

Active ILS Frequency Tuned

Approach Mode Active

Glideslope Mode Active

NAV2 (localizer) is Selected Navigation Source

Command Bars Indicate Descent on Localizer/Glideslope Path

Glideslope Indicator
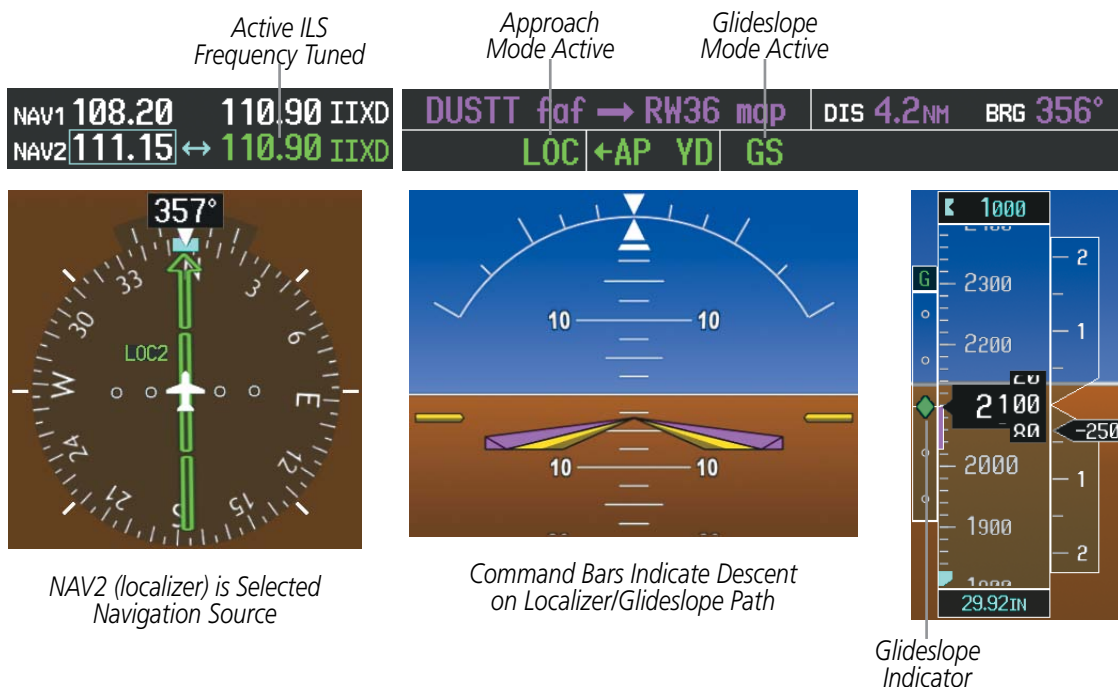
Figure 7-18 Glideslope Mode

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GO AROUND MODE (GA)

Pressing the **GA** Switch while in the air activates the flight director in a wings-level, pitch-up attitude, allowing the execution of a missed approach or a go around. Go Around Mode disengages the autopilot and arms Selected Altitude Capture Mode automatically. Subsequent autopilot engagement is allowed. Attempts to modify the aircraft attitude (i.e., with the **NOSE UP/NOSE DN** Keys or **CWS** Switch) result in reversion to Pitch and Roll Hold modes.

Go Around Mode Active

Autopilot Disconnect Annunciation
Flashes Yellow for 5 seconds
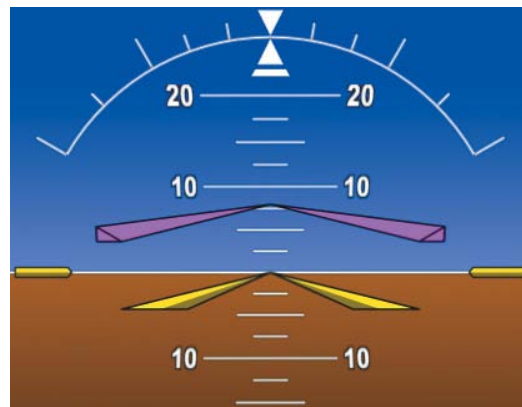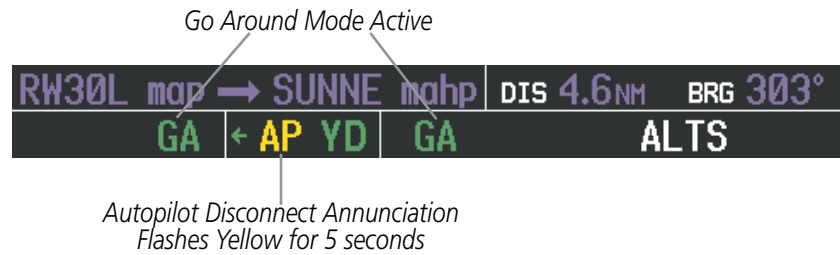
Command Bars Indicate Climb

Figure 7-19 Go Around Mode

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7.4 LATERAL MODES

The following table relates each GFC 700 lateral mode to its respective control and annunciation. Refer to the vertical modes section for information regarding Go Around Mode.

Lateral Mode	Description	Control	Annunciation	Maximum Roll Command Limit
Roll Hold	Holds the current aircraft roll attitude or rolls the wings level, depending on the commanded bank angle	(default)	ROL	25°
Heading Select	Captures and tracks the Selected Heading	**HDG** Key	HDG	25°
Navigation, GPS	Captures and tracks the selected navigation source (GPS, VOR, LOC)	**NAV** Key	GPS	25°
Navigation, VOR Enroute Capture/Track			VOR	25° Capture 10° Track
Navigation, LOC Capture/Track (No Glideslope)			LOC	25° Capture 10° Track
Navigation, Backcourse Capture/Track	Captures and tracks a localizer signal for backcourse approaches		BC	25° Capture 10° Track
Approach, GPS	Captures and tracks the selected navigation source (GPS, VOR, LOC)	**APR** Key	GPS	25°
Approach, VOR Capture/Track			VAPP	25° Capture 10° Track
Approach, LOC Capture/Track (Glideslope Mode automatically armed)			LOC	25° Capture 10° Track
Go Around	Disengages the autopilot and commands a constant pitch angle and wings level in the air	**GA** Switch	GA	Wings Level

The GFC 700 limits turn rate to 3 degrees per second (standard rate turn).

Table 7-3 Flight Director Lateral Modes

The **CWS** Switch does not change lateral references for Heading Select, Navigation, Backcourse, or Approach Mode. The autopilot guides the aircraft back to the Selected Heading/Course upon release of the **CWS** Switch.

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ROLL HOLD MODE (ROL)

> **NOTE:** *If Roll Hold Mode is activated as a result of a mode reversion, the flight director rolls the wings level.*

When the flight director is activated or switched, Roll Hold Mode is selected by default. This mode is annunciated as 'ROL' in the AFCS Status Box. The current aircraft bank angle is held, subject to the bank angle condition.

| ROL | | PIT | ALTS |

Figure 7-20 Roll Hold Mode Annunciation

Bank Angle	Flight Director Response
< 6°	Rolls wings level
6 to 25°	Maintains current aircraft roll attitude
25° to 45°	Limits bank to 25°

Table 7-4 Roll Hold Mode Responses

CHANGING THE ROLL REFERENCE

The roll reference can be changed by pressing the **CWS** Switch, establishing the desired bank angle, then releasing the **CWS** Switch.

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HEADING SELECT MODE (HDG)

Heading Select Mode is activated by pressing the **HDG** Key. Heading Select Mode acquires and maintains the Selected Heading. The Selected Heading is shown by a light blue bug on the HSI and in the box to the upper left of the HSI.

CHANGING THE SELECTED HEADING

> **NOTE:** *Pressing the **HDG** Knob synchronizes the Selected Heading to the current heading.*

The Selected Heading is adjusted using the **HDG** Knob. Pressing the **CWS** Switch and hand-flying the aircraft does not change the Selected Heading. The autopilot guides the aircraft back to the Selected Heading upon release of the **CWS** Switch.

Turns are commanded in the same direction as Selected Heading Bug movement, even if the bug is turned more than 180° from the present heading (e.g., a 270° turn to the right). However, Selected Heading changes of more than 330° at a time result in turn reversals.

Figure 7-21 Heading Select Mode

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NAVIGATION MODES (GPS, VOR, LOC, BC)

> **NOTE:** *The selected navigation receiver must have a valid VOR or LOC signal or active GPS course for the flight director to enter Navigation Mode.*

> **NOTE:** *When intercepting a flight plan leg, the flight director gives commands to capture the active leg at approximately a 45° angle to the track between the waypoints defining the active leg. The flight director does not give commands to fly to the starting waypoint of the active leg.*

> **NOTE:** *When making a backcourse approach, set the Selected Course to the localizer front course.*

Pressing the **NAV** Key selects Navigation Mode. Navigation Mode acquires and tracks the selected navigation source (GPS, VOR, LOC). The flight director follows GPS roll steering commands when GPS is the selected navigation source. When the navigation source is VOR or LOC, the flight director creates roll steering commands from the Selected Course and deviation. Navigation Mode can also be used to fly non-precision GPS and LOC approaches where vertical guidance is not required.

Backcourse Mode is selected when the localizer front course is greater than 105° from the aircraft heading. Backcourse Mode captures and tracks a localizer signal in the backcourse direction. The annunciation "BC" in the AFCS Status Box indicates Backcourse Mode.

If the Course Deviation Indicator (CDI) shows greater than one dot when the **NAV** Key is pressed, the selected mode is armed. If the CDI shows less than one dot, Navigation Mode is automatically captured when the **NAV** Key is pressed. The armed annunciation appears in white to the left of the active lateral mode.

GPS	ROL		PIT	ALTS

Figure 7-22 GPS Navigation Mode Armed

When the CDI has automatically switched from GPS to LOC during a LOC/ILS approach, GPS Navigation Mode remains active, providing GPS steering guidance until the localizer signal is captured. LOC Navigation Mode is armed automatically when the navigation source switch takes place if the **APR** Key is not pressed prior to the automatic source switch.

If Navigation Mode is active and either of the following occur, the flight director reverts to Roll Hold Mode (wings rolled level):

- Different VOR tuned while in VOR Navigation Mode (VOR Navigation Mode reverts to armed)

- Navigation source manually switched (with the **CDI** Softkey)

- During a LOC/ILS approach, the FAF is crossed while in GPS Navigation Mode after the automatic navigation source switch from GPS to LOC

CHANGING THE SELECTED COURSE

If the navigation source is VOR or localizer, or OBS Mode has been enabled when using GPS, the Selected Course is controlled using the **CRS** Knob.

Pressing the **CWS** Switch and hand-flying the aircraft does not change the Selected Course while in Navigation Mode. The autopilot guides the aircraft back to the Selected Course (or GPS flight plan) when the **CWS** Switch is released.

GPS Navigation Mode Active   *Pitch Hold Mode Active*

GPS is Selected Navigation Source   *Selected Course*

Command Bars Indicate Left Turn to Track GPS Course and Climb to Intercept Selected Altitude

Figure 7-23 Navigation Mode

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APPROACH MODES (GPS, VAPP, LOC)

> **NOTE:** *The selected navigation receiver must have a valid VOR or LOC signal or active GPS course for the flight director to enter Approach Mode.*

Approach Mode is activated when the **APR** Key is pressed. Approach Mode acquires and tracks the selected navigation source (GPS, VOR, or LOC), depending on loaded approach. This mode uses the selected navigation receiver deviation and desired course inputs to fly the approach. Pressing the **APR** Key when the CDI is greater than one dot arms the selected approach mode (annunciated in white to the left of the active lateral mode). If the CDI is less the 1 dot, the LOC is automatically captured when the **APR** Key is pressed.

VOR Approach Mode (VAPP) provides greater sensitivity for signal tracking than VOR Navigation Mode.

Selecting VOR Approach Mode:

1) Ensure a valid VOR frequency is tuned

2) Ensure that VOR is the selected navigation source (use the **CDI** Softkey to cycle through navigation sources if necessary).

3) Press the **APR** Key.

When GPS Approach Mode is armed, Glidepath Mode is also armed.

Selecting GPS Approach Mode:

1) Ensure a GPS approach is loaded into the active flight plan. The active waypoint must be part of the flight plan (cannot be a direct-to a waypoint not in the flight plan).

2) Ensure that GPS is the selected navigation source (use the **CDI** Softkey to cycle through navigation sources if necessary).

3) Press the **APR** Key.

```
GPS   HDG        PIT       ALTS  GP
```

Figure 7-24 GPS Approach Mode Armed

LOC Approach Mode allows the autopilot to fly a LOC/ILS approach with a glideslope. When LOC Approach Mode is armed, Glideslope Mode is also armed automatically. LOC captures are inhibited if the difference between aircraft heading and localizer course exceeds 105°.

Selecting LOC Approach Mode:

1) Ensure a valid localizer frequency is tuned.

2) Ensure that LOC is the selected navigation source (use the **CDI** Softkey to cycle through navigation sources if necessary).

3) Press the **APR** Key.

   Or:

1) Ensure that GPS is the selected navigation source (use the **CDI** Softkey to cycle through navigation sources if necessary).

2) Ensure a LOC/ILS approach is loaded into the active flight plan.

3) Ensure the corresponding LOC frequency is tuned.

4) Press the **APR** Key.

If the following occurs, the flight director reverts to Roll Hold Mode (wings rolled level):

• Approach Mode is active and a Vectors-To-Final is activated

• Approach Mode is active and Navigation source is manually switched

• During a LOC/ILS approach, GPS Navigation Mode is active and the FAF is crossed after the automatic navigation source switch from GPS to LOC

CHANGING THE SELECTED COURSE

If the navigation source is VOR or localizer, or OBS Mode has been enabled when using GPS, the Selected Course is controlled using the **CRS** Knob.

Pressing the **CWS** Switch and hand-flying the aircraft does not change the Selected Course while in Approach Mode. The autopilot guides the aircraft back to the Selected Course (or GPS flight plan) when the **CWS** Switch is released.

BACKCOURSE MODE (BC)

NOTE: *When making a backcourse approach, set the Selected Course to the localizer front course.*

Backcourse Mode captures and tracks a localizer signal in the backcourse direction. The flight director creates roll steering commands from the Selected Course and deviation when in Backcourse Mode.

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Backcourse Mode Active   *Pitch Hold Mode Active*
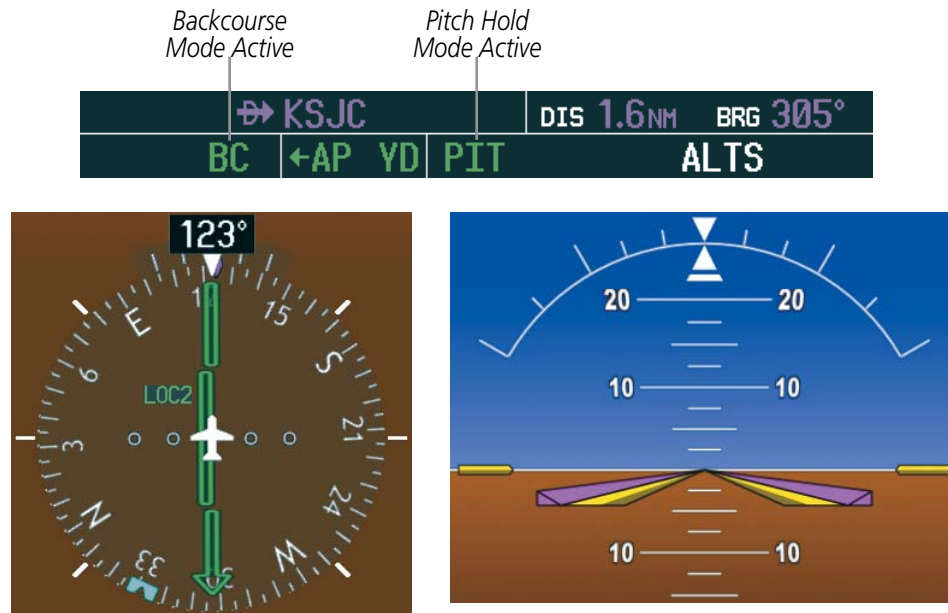
LOC2 is Selected Navigation Source   *Command Bars Hold Pitch Attitude*

Figure 7-25 Backcourse Mode

CHANGING THE SELECTED COURSE

If the navigation source is VOR or localizer or OBS Mode has been enabled when using GPS, the Selected Course is controlled using the **CRS** Knob corresponding to the selected flight director (**CRS1** for the pilot side, **CRS2** for the copilot side).

Pressing the **CWS** Button and hand-flying the aircraft does not reset any reference data while in Backcourse Mode. The autopilot guides the aircraft back to the Selected Course when the **CWS** Button is released.

INTERCEPTING AND FLYING A DME ARC

The AFCS will intercept and track a DME arc that is part of the active flight plan provided that GPS Navigation Mode is engaged, GPS is the active navigation source on the CDI, and the DME arc segment is the active flight plan leg. It is important to note that automatic navigation of DME arcs is based on GPS. Thus, even if the APR key is pressed and LOC or VOR Approach Mode is armed prior to reaching the Initial Approach Fix (IAF), Approach Mode will not activate until the arc segment is completed.

If the pilot decides to intercept the arc at a location other than the published IAF (i.e. ATC provides vectors to intercept the arc) and subsequently selects Heading Mode or Roll Mode, the AFCS will not automatically intercept or track the arc unless the pilot activates the arc leg of the flight plan and arms GPS Navigation Mode. The AFCS will not intercept and fly a DME arc before reaching an IAF that defines the beginning of the arc segment. Likewise, if at any point while established on the DME arc the pilot deselects GPS Navigation Mode, the AFCS will no longer track the arc.

7.5 AUTOPILOT AND YAW DAMPER OPERATION

> **NOTE:** *Refer to the POH/AFM for specific instructions regarding emergency procedures.*

The Beechcraft G58 autopilot and yaw damper operate the flight control surface servos to provide automatic flight control. The autopilot controls the aircraft pitch and roll attitudes following commands received from the flight director. Pitch autotrim provides trim commands to the pitch trim servo to relieve any sustained effort required by the pitch servo. Autopilot operation is independent of the yaw damper.

The yaw damper reduces Dutch roll tendencies and coordinates turns. It can operate independently of the autopilot and may be used during normal hand-flight maneuvers. Yaw rate commands are limited to 6 deg/sec by the yaw damper.

FLIGHT CONTROL

Pitch and roll commands are provided to the servos based on the active flight director modes. Yaw damping is provided by the yaw servo. Servo motor control limits the maximum servo speed and torque. The servo mounts are equipped with slip-clutches set to certain values. This allows the servos to be overridden in case of an emergency.

PITCH AXIS AND TRIM

The autopilot pitch axis uses pitch rate to stabilize the aircraft pitch attitude during flight director maneuvers. Flight director pitch commands are rate and attitude-limited, combined with pitch damper control, and sent to the pitch servo motor. The pitch servo measures the output effort (torque) and provides this signal to the pitch trim servo. The pitch trim servo commands the motor to reduce the average pitch servo effort.

When the autopilot is not engaged, the pitch trim servo may be used to provide manual electric pitch trim (MEPT). This allows the aircraft to be trimmed using a control wheel switch rather than the trim wheel. Manual trim commands are generated only when both halves of the **MEPT** Switch are operated simultaneously. Trim speeds are scheduled with airspeed to provide more consistent response.

ROLL AXIS

The autopilot roll axis uses roll rate to stabilize aircraft roll attitude during flight director maneuvers. The flight director roll commands are rate- and attitude-limited, combined with roll damper control, and sent to the roll servo motor.

YAW AXIS

The yaw damper uses yaw rate and roll attitude to dampen the aircraft's natural Dutch roll response. It also uses lateral acceleration to coordinate turns.

GARMIN.

ENGAGEMENT

> **NOTE:** *Autopilot engagement/disengagement is not equivalent to servo engagement/disengagement. Use the **CWS** Switch to disengage the pitch and roll servos while the autopilot remains active.*

When the **AP** Key is pressed, the autopilot, yaw damper, and flight director (if not already active) are activated. The flight director engages in Pitch and Roll Hold Modes when initially activated. When the **YD** Key is pressed, the system engages the yaw damper independently of the autopilot (if not already engaged). Autopilot and yaw damper status are displayed in the center of the AFCS Status Box. Engagement is indicated by green 'AP' and 'YD' annunciations, respectively.

Autopilot   Yaw Damper
Engaged   Engaged

```
         ROL │ AP YD│ PIT       ALTS
```

Figure 7-26 Autopilot and Yaw Damper Engaged

CONTROL WHEEL STEERING

During autopilot operation, the aircraft may be hand-flown without disengaging the autopilot. Pressing and holding the **CWS** Switch disengages the pitch and roll servos from the flight control surfaces and allows the aircraft to be hand-flown. At the same time, the flight director is synchronized to the aircraft attitude during the maneuver. CWS activity has no effect on yaw damper engagement.

The 'AP' annunciation is temporarily replaced by 'CWS' in white for the duration of CWS maneuvers.

Control Wheel Steering

```
         ROL │ CWS YD│ PIT       ALTS
```

Figure 7-27 CWS Annunciation

In most scenarios, releasing the **CWS** Switch reengages the autopilot with a new reference. Refer to flight director mode descriptions for specific CWS behavior in each mode.

DISENGAGEMENT

The autopilot is manually disengaged by pushing the **AP DISC/TRIM INT** Switch, **AP** Key on the MFD, **GA** Switch, or **MEPT** ARM Switch. Manual autopilot disengagement is indicated by a five-second flashing yellow 'AP' annunciation and a three-second autopilot disconnect aural alert.

Figure 7-28 Manual Autopilot Disengagement

Pushing the **AP DISC/TRIM INT** Switch or **YD** Key disengages both the yaw damper and the autopilot. When the yaw damper and autopilot are manually disengaged, both the 'AP' and 'YD' annunciation turn yellow and flash for 5 seconds and a three-second autopilot disconnect aural alert is generated.

Figure 7-29 Yaw Damper Disengagement

After manual disengagement, the autopilot disconnect aural alert may be cancelled by pushing the **MEPT** ARM or **AP DISC/TRIM INT** Switch (**AP DISC/TRIM INT** Switch also cancels the flashing 'AP' annunciation).

Automatic autopilot disengagement is indicated by a flashing red and white 'AP' annunciation and by the autopilot disconnect aural alert, which continue until acknowledged by pushing the **AP DISC/TRIM INT** or **MEPT** ARM Switch. Automatic autopilot disengagement occurs due to:

- System failure
- Invalid sensor data

- Inability to compute default flight director modes (FD also disengages automatically)

Yaw damper disengagement is indicated by a five-second flashing yellow 'YD' annunciation. Automatic yaw damper disengagement occurs when autopilot disengagement is caused by failure in a parameter also affecting the yaw damper. This means the yaw damper can remain operational in some cases where the autopilot automatically disengages. A localized failure in the yaw damper system or invalid sensor data also cause yaw damper disengagement.

Figure 7-30 Automatic Autopilot and Yaw Damper Disengagement

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7.6 EXAMPLE FLIGHT PLAN

> **NOTE:** *The following example flight plan and diagrams (not to be used for navigation) in this section are for instructional purposes only and should be considered not current. Numbered portions of accompanying diagrams correspond to numbered procedure steps.*

This scenario-based set of procedures (based on the example flight plan found in the Flight Management Section) shows various GFC 700 AFCS modes used during a flight. In this scenario, the aircraft departs Charles B. Wheeler Downtown Airport (KMKC), enroute to Colorado Springs Airport (KCOS). After departure, the aircraft climbs to 12,000 ft and airway V4 is intercepted, following ATC vectors.

Airway V4 is flown to Salina VOR (SLN) using VOR navigation, then airway V244 is flown using GPS Navigation. The ILS approach for runway 35L and LPV (WAAS) approach for runway 35R are shown and a missed approach is executed.
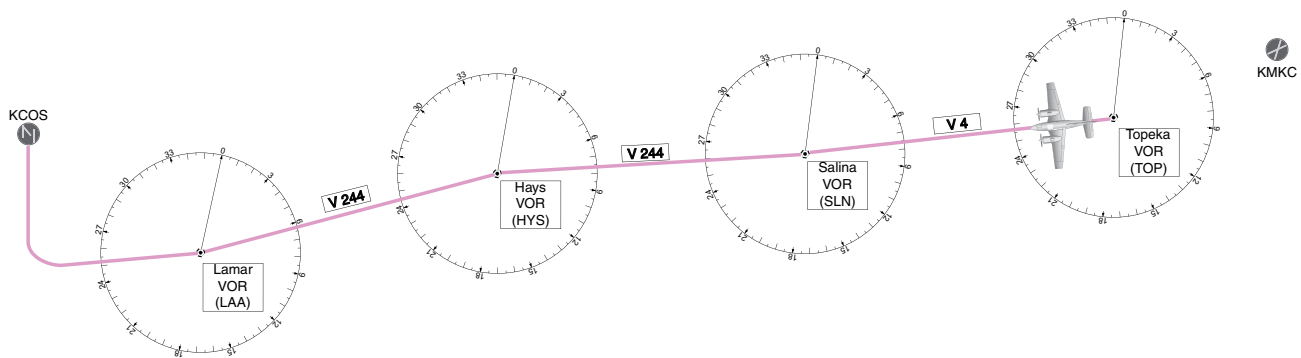
Figure 7-31 Flight Plan Overview

DEPARTURE

Climbing to the Selected Altitude and flying an assigned heading:

1) Before takeoff set the Selected Altitude to 12,000 feet using the **ALT** Knob.

2) In this example, Vertical Speed Mode is used to capture the Selected Altitude (Pitch Hold, Vertical Speed, or Flight Level Change Mode may be used).

  a) Press the **VS** Key to activate Vertical Speed Mode.

```
ROL          VS  ↑1000FPM ALTS
```

The Vertical Speed Reference may be adjusted after Vertical Speed Mode is selected using the **NOSE UP/ NOSE DN** Keys or pushing the **CWS** Switch while hand-flying the aircraft to establish a new Vertical Speed Reference.

  b) Press the **AP** Key to engage the autopilot in a climb using Vertical Speed Mode.

```
ROL  AP YD VS  ↑1000FPM ALTS
```

3) Use the **HDG** Knob to set the Selected Heading, complying with ATC vectors to intercept Airway V4.

Press the **HDG** Key to activate Heading Select Mode while the autopilot is engaged in the climb. The autopilot follows the Selected Heading Bug on the HSI and turns the aircraft to the desired heading.

```
HDG  AP YD VS  ↑1000FPM ALTS
```

4) As the aircraft nears the Selected Altitude, the flight director transitions to Selected Altitude Capture Mode, indicated by the green 'ALTS' annunciation flashing for up to 10 seconds.

```
HDG  AP YD ALTS 12000FT ALT
```

At 50 feet from the Selected Altitude, the green 'ALT' annunciation flashes for up to 10 seconds; the autopilot transitions to Altitude Hold Mode and levels the aircraft.

```
HDG  AP YD ALT 12000FT
```

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Figure 7-32 Departure

Garmin G1000 Pilot's Guide for the Beechcraft G58
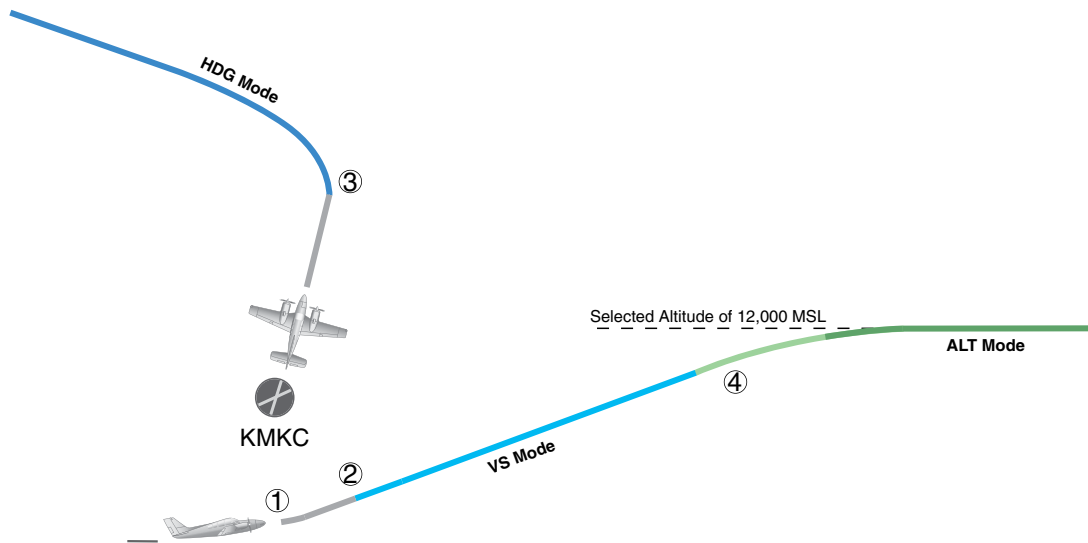
INTERCEPTING A VOR RADIAL

During climb-out, the autopilot continues to fly the aircraft in Heading Select Mode. Airway V4 to Salina VOR (SLN) should now be intercepted. Since the enroute flight plan waypoints correspond to VORs, flight director Navigation Mode using either VOR or GPS as the navigation source may be used. In this scenario, VOR Navigation Mode is used for navigation to the first VOR waypoint in the flight plan.

Intercepting a VOR radial:

1) Arm VOR Navigation Mode:

   a) Tune the VOR frequency.

   b) Press the **CDI** Softkey to set the navigation source to VOR.

   c) Use the **CRS** Knob to set the Selected Course to the desired value, 255°. Note that at this point, the flight director is still in Heading Select Mode and the autopilot continues to fly the Selected Heading, 290°.

   d) Press the **NAV** Key. This arms VOR Navigation Mode and the white 'VOR' annunciation appears to the left of the active lateral mode.

2) As the aircraft nears the Selected Course, the flight director transitions from Heading Select to VOR Navigation Mode and the 'VOR' annunciation flashes green. The autopilot begins turning to intercept the Selected Course.

3) The autopilot continues the turn until the aircraft is established on the Selected Course.
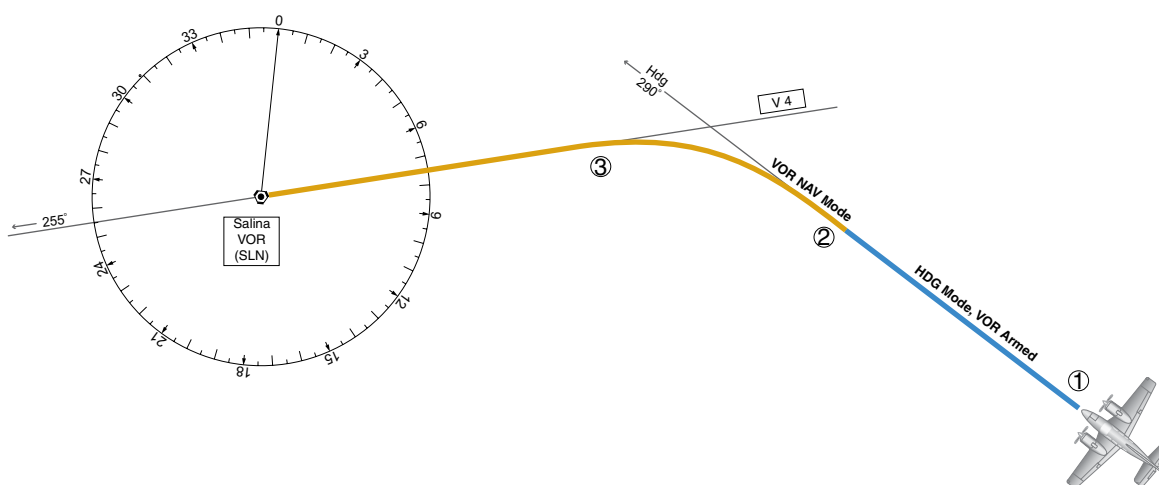
Figure 7-33 Intercepting a VOR Radial

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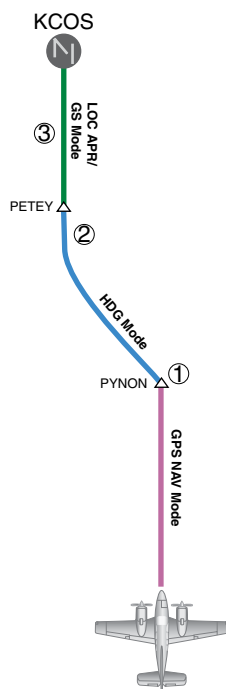
FLYING A FLIGHT PLAN/GPS COURSE

> **NOTE:** *Changing the navigation source cancels Navigation Mode and causes the flight director to revert back to Roll Hold Mode (wings rolled level).*

As the aircraft closes on Salina VOR, GPS is used to navigate the next leg, airway V244. The aircraft is currently tracking inbound on Airway V4.

Flying a GPS flight plan:

1) Transition from VOR to GPS Navigation Mode:

  a) Press the **CDI** Softkey until GPS is the selected navigation source.

  b) Press the **NAV** Key to activate GPS Navigation Mode. The autopilot guides the aircraft along the active flight plan leg.

```
GPS  |  AP YD  |  ALT  12000FT
```

2) Following the flight plan, the autopilot continues to steer the aircraft under GPS guidance. Note that in GPS Navigation Mode, course changes defined by the flight plan are automatically made without pilot action required.
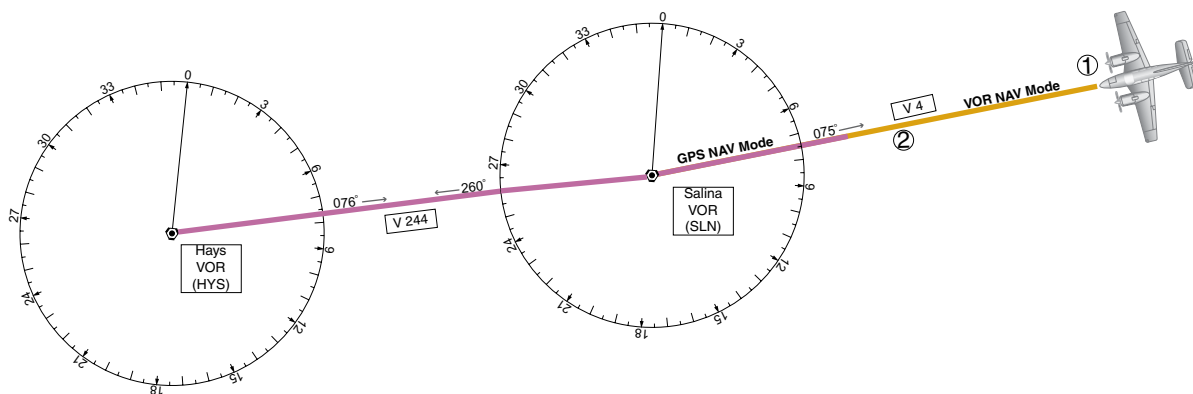
Figure 7-34 Transition to GPS Flight Plan

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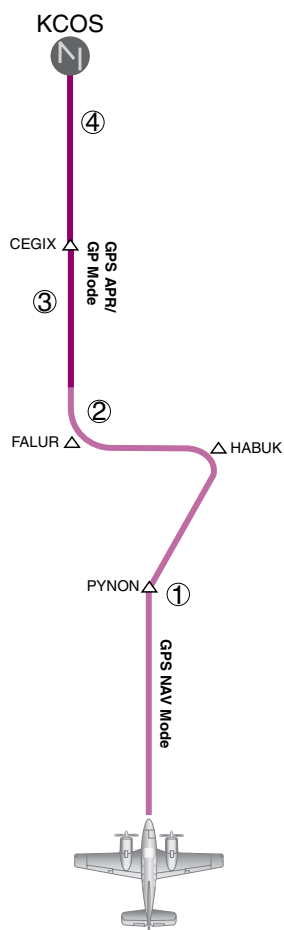## DESCENT

While flying the arrival procedure, the aircraft is cleared for descent in preparation for the approach to KCOS. Three methods are presented for descent:

- Flight Level Change descent – Flight Level Change Mode can be used to descend to the Selected Altitude at a constant airspeed. This descent method does not account for flight plan waypoint altitude constraints.

- Vertical Path Tracking descent – Vertical Path Tracking Mode is used to follow the vertical descent path defined in the GPS flight plan. Altitude constraints correspond to waypoints in the flight plan. Before VNV flight control can provide vertical profile guidance, a VNV flight plan must be entered and enabled.

- Non-path descent in a VNV scenario – A VNV flight plan is entered and enabled, however Pitch Hold, Vertical Speed, or Flight Level Change Mode can be used to descend to the VNV Target Altitude prior to reaching the planned TOD. Flight Level Change Mode is used in the example.

Flight Level Change descent:

1) Select Flight Level Change Mode:

a) Using the **ALT** Knob, set the Selected Altitude to 10,000 feet.

b) Press the **FLC** Key to activate Flight Level Change Mode. The annunciation 'FLC' appears next to the Airspeed Reference, which defaults to the current aircraft airspeed. Selected Altitude Capture Mode is armed automatically.

GPS	AP YD	FLC	170ᴋᴛ	ALTS

2) Use the **NOSE UP/NOSE DN** Keys or push the **CWS** Switch while hand-flying the aircraft to adjust the commanded airspeed while maintaining the same power, or reduce power to allow descent in Flight Level Change Mode while the autopilot maintains the current airspeed.

3) As the aircraft nears the Selected Altitude, the flight director transitions to Selected Altitude Capture Mode, indicated by the green 'ALTS' annunciation flashing for up to 10 seconds.

GPS	AP YD	ALTS	10000ꜰᴛ	ALT

The green 'ALT' annunciation flashes for up to 10 seconds upon reaching 50 feet from the Selected Altitude; the autopilot transitions to Altitude Hold Mode and levels the aircraft.

GPS	AP YD	ALT	10000ꜰᴛ
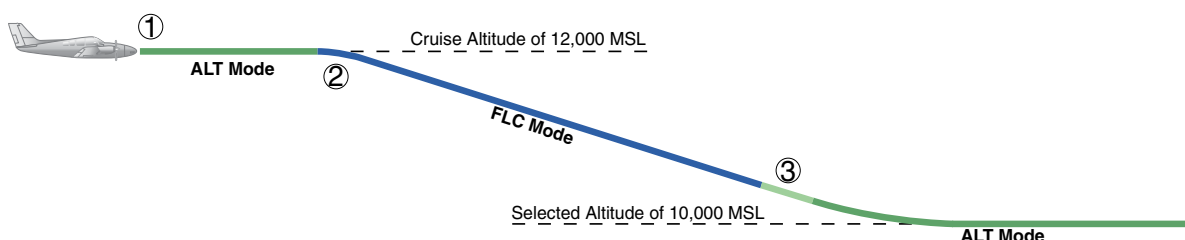
Figure 7-35 FLC Descent

Vertical Path Tracking descent to VNV Target Altitude:

1) Select VNV flight control:

a) Press the **VNV** Key to arm Vertical Path Tracking Mode. The white annunciation 'VPTH' appears.

GPS | AP YD | ALT 12000FT **VPTH**

b) Using the **ALT** Knob, set the Selected Altitude below the flight plan's VNV Target Altitude of 10,000 feet.

If the Selected Altitude is not at least 75 ft below the VNV Target Altitude, the flight director captures the Selected Altitude rather than the VNV Target Altitude once Vertical Path Tracking Mode becomes active (ALTS is armed rather than ALTV).

c) If Vertical Path Tracking Mode is armed more than 5 minutes prior to descent path capture, acknowledgment is required for the flight director to transition from Altitude Hold to Vertical Path Tracking Mode. To proceed with descent path capture if the white 'VPTH' annunciation begins flashing, do one of the following

- Press the **VNV** Key
- Turn the **ALT** Knob to adjust the Selected Altitude

If the descent is not confirmed by the time of interception, Vertical Path Tracking Mode remains armed and the descent is not captured.

2) When the top of descent (TOD) is reached, the flight director transitions to Vertical Path Tracking Mode and begins the descent to the VNV Target Altitude. Intention to capture the VNV Target Altitude is indicated by the white 'ALTV' annunciation.

GPS | AP YD | VPTH **ALTV**

3) As the aircraft nears the VNV Target Altitude, the flight director transitions to VNV Target Altitude Capture Mode, indicated by the green 'ALTV' annunciation flashing for up to 10 seconds.

GPS | AP YD | ALTV 10000FT **ALT**

The green 'ALT' annunciation flashes for up to 10 seconds upon reaching 50 feet from the VNV Target Altitude; the autopilot transitions to Altitude Hold Mode and levels the aircraft at the vertical waypoint.

GPS | AP YD | ALT 10000FT
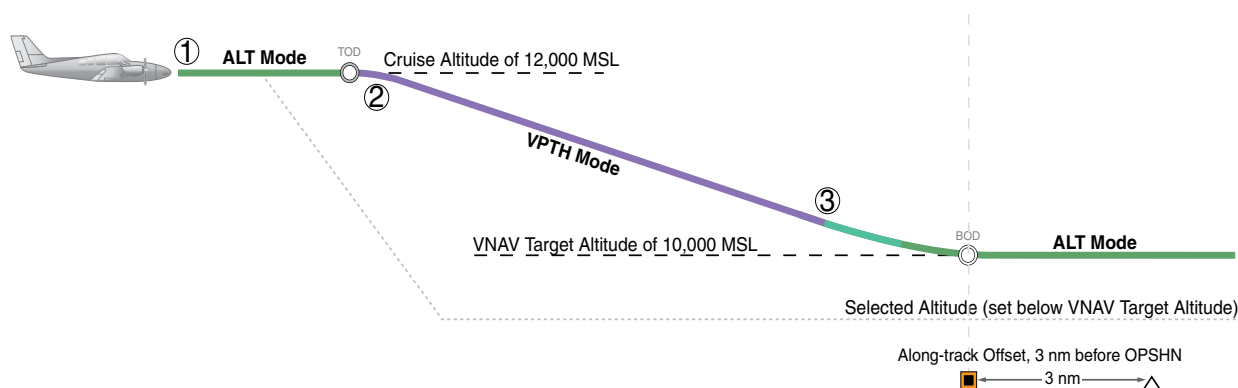
Figure 7-36 VPTH Descent

Non-path descent using Flight Level Change Mode:

1) Using Flight Level Change Mode, command a non-path descent to an intermediate altitude above the next VNV flight plan altitude.

   a) Using the **ALT** Knob, set the Selected Altitude below the current aircraft altitude to an altitude (in this case, 9,400 feet) at which to level off between VNV flight plan altitudes.

   b) Press the **FLC** Key before the planned TOD during an altitude hold while VPTH is armed. The Airspeed Reference defaults to the current aircraft airspeed. Vertical Path Tracking and Selected Altitude Capture Mode are armed automatically.

   GPS | AP YD | FLC   184ᴋᴛ **ALTS ⱽPTH**

2) Reduce power to allow descent in Flight Level Change Mode. The autopilot maintains the Airspeed Reference.

3) As the aircraft nears the Selected Altitude, the flight director transitions to Selected Altitude Capture Mode, indicated by the green 'ALTS' annunciation flashing for up to 10 seconds.

   GPS | AP YD | ALTS 9400ꜰᴛ **ALT   ⱽPTH**

   The green 'ALT' annunciation flashes for up to 10 seconds upon reaching 50 feet from the Selected Altitude; the autopilot transitions to Altitude Hold Mode and levels the aircraft. After leveling off reset Selected Altitude at or below 9,000 ft.

   GPS | AP YD | ALT   9400ꜰᴛ   **ⱽPTH**

4) When the next TOD is reached, Vertical Path Tracking becomes active (may require acknowledgment to allow descent path capture).

   GPS | AP YD | VPTH   **ALTV**

5) As the aircraft nears the VNV Target Altitude, the flight director transitions to VNV Target Altitude Capture Mode, indicated by the green 'ALTV' annunciation flashing for up to 10 seconds.

   GPS | AP YD | ALTV 9000ꜰᴛ **ALT**

   The green 'ALT' annunciation flashes for up to 10 seconds upon reaching 50 feet from the VNV Target Altitude; the autopilot transitions to Altitude Hold Mode and levels the aircraft at the vertical waypoint.

   GPS | AP YD | ALT   9000ꜰᴛ

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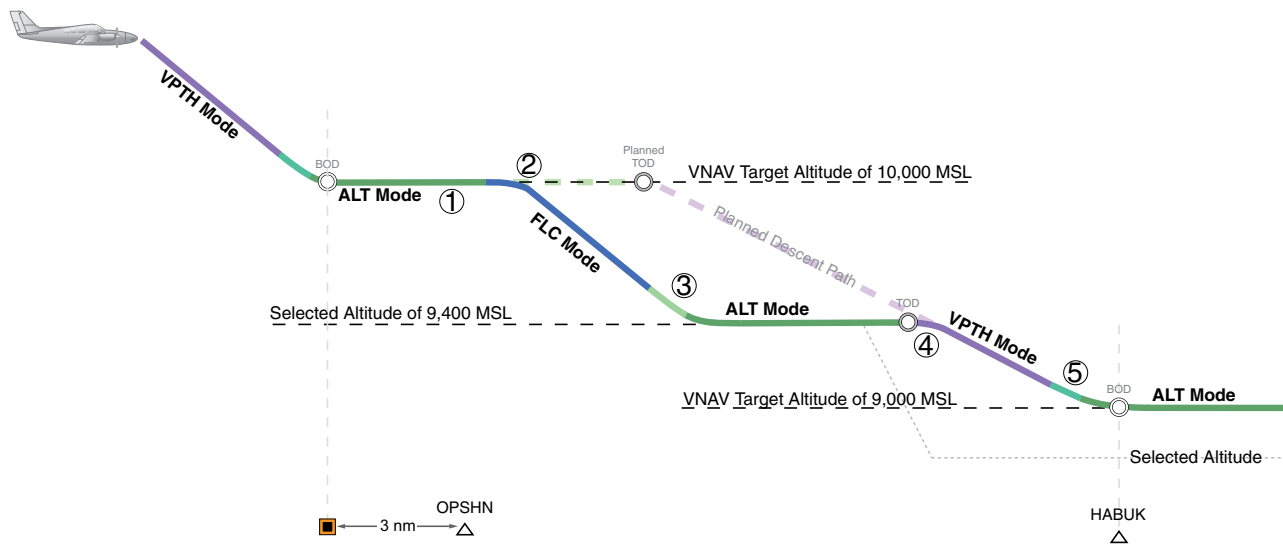
Figure 7-37 Non-path Descent

APPROACH

Flying an ILS approach:

1) Transition from GPS Navigation Mode to Heading Select Mode.

   a) Select the Runway 35L ILS approach for KCOS and select 'VECTORS' for the transition. Load and activate the approach into the flight plan.

   b) Use the **HDG** Knob to set the Selected Heading after getting vectors from ATC.

   c) Press the **HDG** Key. The autopilot turns the aircraft to the desired heading.

   d) Use Heading Select Mode to comply with ATC vectors as requested.

   HDG | AP YD | ALT 9000FT

2) Arm LOC Approach and Glideslope modes.

   a) Ensure the appropriate localizer frequency is tuned.

   b) Press the **APR** Key when cleared for approach to arm Approach and Glideslope modes. 'LOC' and 'GS' appear in white as armed mode annunciations.

   LOC HDG | AP YD | ALT 9000FT GS

   c) The navigation source automatically switches to LOC. After this switch occurs, the localizer signal can be captured and the flight director determines when to begin the turn to intercept the final approach course. The flight director now provides guidance to the missed approach point.

3) There are two options available at this point, as the autopilot flies the ILS approach:

   • Push the **AP DISC/TRIM INT** Switch at the decision height and land the aircraft.
   • Use the **GA** Switch to execute a missed approach.

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Figure 7-38 ILS Approach to KCOS

Flying a RNAV GPS approach with vertical guidance (SBAS Only):

1) Arm flight director modes for a RNAV GPS approach with vertical guidance:

    a) Make sure the navigation source is set to GPS (use **CDI** Softkey to change navigation source).

    b) Select the Runway 35R LPV approach for KCOS. Load and activate the approach into the flight plan.

2) Press the **APR** Key once clearance for approach has been received. GPS Approach Mode is activated and Glidepath Mode is armed.

3) Once the glidepath is captured, Glidepath Mode becomes active. The flight director now provides guidance to the missed approach point.

4) There are two options available at this point, as the autopilot flies the approach:

    • Push the **AP DISC/TRIM INT** Switch at the decision height and land the aircraft.

    • Use the **GA** Switch to execute a missed approach.

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Figure 7-39 LPV Approach to KCOS

GO AROUND/MISSED APPROACH

NOTE: As a result of calculations performed by the system while flying the holding pattern, the display may re-size automatically and the aircraft may not precisely track the holding pattern as depicted on the PFD and MFD.

Flying a missed approach:

1) Push the **GA** Switch at the Decision height and apply go-around power to execute a missed approach. The flight director Command Bars establish a nose-up climb to follow. If flying an ILS or LOC approach the CDI also switches to GPS as the navigation source.

   Note that when the **GA** Switch is pushed, the missed approach is activated and the autopilot disconnects, indicated by the 'AP' annunciation flashing yellow for 5 seconds and the autopilot disconnect aural alert.

Flashes 5 sec

GA	AP YD	GA	ALTS

2) Start the climb to the prescribed altitude in the published Missed Approach Procedure (in this case, 10,000 ft).

   a) Press the **AP** Key to re-engage the autopilot.

   b) Press the **NAV** Key to have the autopilot fly to the hold.

GPS	AP YD	PIT	ALTS

3) Use the **ALT** Knob to set a Selected Altitude to hold.

   To hold the current airspeed during the climb, press the **FLC** Key.

GPS	AP YD	FLC	120ᴋᴛ ALTS

   As the aircraft nears the Selected Altitude, the flight director transitions to Selected Altitude Capture Mode, indicated by the green 'ALTS' annunciation flashing for up to 10 seconds.

GPS	AP YD	ALTS 10000ғᴛ ALT

   The green 'ALT' annunciation flashes for up to 10 seconds upon reaching 50 feet from the Selected Altitude; the autopilot transitions to Altitude Hold Mode and levels the aircraft.

GPS	AP YD	ALT 10000ғᴛ

4) The autopilot flies the holding pattern after the missed approach is activated. Annunciations are displayed in the Navigation Status Box, above the AFCS Status Box.

6.0ɴᴍ ⟳ MOGAL	DIS 2.2ɴᴍ BRG 149°
GPS	AP YD	ALT 10000ғᴛ

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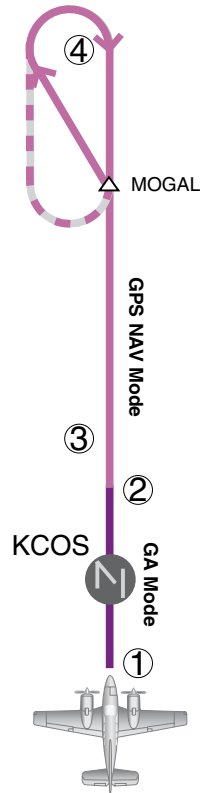
Figure 7-40 Go Around/Missed Approach

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7.7 AFCS ANNUNCIATIONS AND ALERTS

AFCS STATUS ALERTS

The annunciations in Table 7-5 (listed in order of increasing priority) can appear on the PFD above the Airspeed and Attitude indicators. Only one annunciation may occur at a time, and messages are prioritized by criticality.

AFCS Status Annunciation

Figure 7-41 AFCS Status Annunciation

Alert Condition	Annunciation	Description
Rudder Mistrim Right	RUD→	Yaw servo providing sustained force in the indicated direction
Rudder Mistrim Left	←RUD	
Aileron Mistrim Right	AIL→	Roll servo providing sustained force in the indicated direction
Aileron Mistrim Left	←AIL	
Elevator Mistrim Down	↓ELE	Pitch servo providing sustained force in the indicated direction
Elevator Mistrim Up	↑ELE	
Pitch Trim Failure (or stuck **MEPT** Switch)	PTRM	If AP engaged, take control of the aircraft and disengage AP If AP disengaged, move **MEPT** switches separately to unstick
Yaw Damper Failure	YAW	YD control failure; AP also inoperative
Roll Failure	ROLL	Roll axis control failure; AP inoperative
Pitch Failure	PTCH	Pitch axis control failure; AP inoperative
System Failure	AFCS	AP and MEPT are unavailable; FD may still be available
Preflight Test	PFT	Performing preflight system test; aural alert sounds at completion Do not press the **AP DISC/TRIM INT** Switch during servo power-up and preflight system tests as this may cause the preflight system test to fail or never to start (if servos fail their power-up tests). Power must be cycled to the servos to remedy the situation.
	PFT	Preflight system test failed; aural alert sounds at failure

Table 7-5 AFCS Status Alerts

OVERSPEED PROTECTION

✓ **NOTE:** *Overspeed protection is not active in ALT, GS or GP Modes.*

While Pitch Hold, Vertical Speed, Flight Level Change, Vertical Path Tracking, or an altitude capture mode is active, airspeed is monitored by the flight director. Pitch commands are not changed until overspeed protection becomes active. Overspeed protection is provided in situations where the flight director cannot acquire and maintain the mode reference for the selected vertical mode without exceeding the certified maximum autopilot airspeed.

When an autopilot overspeed condition occurs, the Airspeed Reference appears in a box above the Airspeed Indicator, flashing a yellow 'MAXSPD' annunciation. Engine power should be reduced and/or the pitch reference adjusted to slow the aircraft. The annunciation disappears when the overspeed condition is resolved.

Figure 7-42 Overspeed Annunciation

SECTION 8 ADDITIONAL FEATURES

> **NOTE:** *With the availability of SafeTaxi®, ChartView, or FliteCharts®, it may be necessary to carry another source of charts on-board the aircraft.*

Additional features of the system include the following:

- Synthetic Vision System (SVS)
- SafeTaxi® diagrams
- ChartView and FliteCharts® electronic charts
- AOPA's Airport Directory
- SiriusXM Satellite Radio entertainment
- Scheduler
- Flight Data Logging

The optional Synthetic Vision System (SVS) provides a three-dimensional forward view of terrain features on the PFD. SVS imagery shows the pilot's view of relevant features in relation to the aircraft attitude, as well as the flight path pertaining to the active flight plan.

SafeTaxi diagrams provide detailed taxiway, runway, and ramp information at more than 700 airports in the United States. By decreasing range on an airport that has a SafeTaxi diagram available, a close up view of the airport layout can be seen.

The optional ChartView and FliteCharts provide on-board electronic terminal procedures charts. Electronic charts offer the convenience of rapid access to essential information. Either ChartView or FliteCharts may be configured in the system, but not both.

AOPA's Airport Directory offers detailed information for a selected airport, such as available services, hours of operation, and lodging options.

The optional SiriusXM Satellite Radio entertainment audio feature of the GDL 69A Data Link Receiver handles more than 170 channels of music, news, and sports. SiriusXM Satellite Radio offers more entertainment choices and longer range coverage than commercial broadcast stations.

The Scheduler feature can be used to enter and display short term or long term reminder messages such as Switch fuel tanks, Change oil, or Altimeter-Transponder Check in the Messages Window on the PFD.

The Flight Data Logging feature automatically stores critical flight and engine data on an SD data card. Approximately 1,000 flight hours can be recorded for each 1GB of available space on the card.

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8.1 SYNTHETIC VISION SYSTEM (SVS) (OPTIONAL)

⚠️ **WARNING:** *Use appropriate primary systems for navigation, and for terrain, obstacle, and traffic avoidance. SVS 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.*

The optional Synthetic Vision System (SVS) is a visual enhancement to the G1000 Integrated Flight Deck. SVS depicts a forward-looking attitude display of the topography immediately in front of the aircraft. The field of view is 30 degrees to the left and 35 degrees to the right. SVS information is shown on the Primary Flight Display (PFD), or on the Multifunction Display (MFD) in Reversionary Mode (Figure 8-83). The depicted imagery is derived from the aircraft attitude, heading, GPS three-dimensional position, and a nine arc-second database of terrain, obstacles, and other relevant features. The terrain data resolution of nine arc-seconds, meaning that the terrain elevation contours are stored in squares measuring nine arc-seconds on each side, is required for the operation of SVS. Loss of any of the required data, including temporary loss of the GPS signal, will cause SVS to be disabled until the required data is restored.

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

The Terrain Awareness and Warning System (TAWS) is integrated within SVS to provide visual and auditory alerts to indicate the presence of terrain and obstacle threats relevant to the projected flight path. Terrain alerts are displayed in red and yellow shading on the PFD.

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

The following SVS enhancements appear on the PFD:

- Pathways
- Flight Path Marker
- Horizon Heading Marks
- Traffic Display

- Airport Signs
- Runway Display
- Terrain Alerting
- Obstacle Alerting

Figure 8-1 Synthetic Vision Imagery

SVS OPERATION

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

SVS functions are displayed on three levels of softkeys. The **PFD** Softkey leads into the PFD function Softkeys, including synthetic vision. Pressing the **SYN VIS** Softkey displays the SVS feature softkeys. The softkeys are labeled **PATHWAY**, **SYN TERR**, **HRZN HDG**, and **APTSIGNS**. The **BACK** Softkey returns to the previous level of softkeys. Synthetic Terrain must be active before any other SVS feature may be activated.

HRZN HDG, **APTSIGNS**, and **PATHWAY** Softkeys are only available when the **SYN TERR** Softkey is activated (gray with black characters). After activating the **SYN TERR** Softkey, the **HRZN HDG**, **APTSIGNS**, and **PATHWAY** 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 **SYN TERR, HRZN HDG**, **APTSIGNS**, and **PATHWAY** softkeys is remembered by the system.

• **PATHWAY** Softkey enables display of rectangular boxes that represent course guidance.

• **SYN TERR** Softkey enables synthetic terrain depiction.

• **HRZN HDG** Softkey enables horizon heading marks and digits.

• **APTSIGNS** Softkey enables airport signposts.

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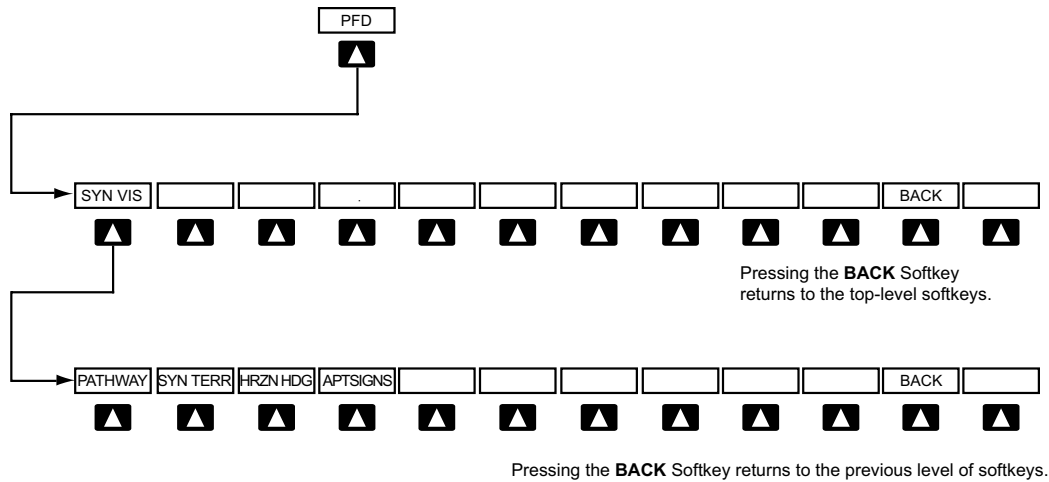
Figure 8-2 SVS Softkeys

Activating and deactivating SVS:

1) Press the **PFD** Softkey.

2) Press the **SYN VIS** Softkey.

3) Press the **SYN TERR** Softkey. The SVS display will cycle on or off with the **SYN TERR** Softkey.

Activating and deactivating Pathways:

1) Press the **PFD** Softkey.

2) Press the **SYN VIS** Softkey.

3) Press the **PATHWAY** Softkey. The Pathway feature will cycle on or off with the **PATHWAY** Softkey.

Activating and deactivating Horizon Headings:

1) Press the **PFD** Softkey.

2) Press the **SYN VIS** Softkey.

3) Press the **HRZN HDG** Softkey. The horizon heading display will cycle on or off with the **HRZN HDG** Softkey.

Activating and deactivating Airport Signs:

1) Press the **PFD** Softkey.

2) Press the **SYN VIS** Softkey.

3) Press the **APTSIGNS** Softkey. Display of airport signs will cycle on or off with the **APTSIGNS** Softkey.

SVS FEATURES

Figure 8-3 SVS on the Primary Flight Display

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

PATHWAYS

Pathways provide a three-dimensional perspective view of the selected route of flight shown as colored rectangular boxes representing the horizontal and vertical flight path of the active flight plan. The box size represents 700 feet wide by 200 feet tall during enroute, oceanic, and terminal flight phases. During an approach, the box width is 700 feet or one half full scale deviation on the HSI, whichever is less. The height is 200 feet or one half full scale deviation on the VDI, whichever is less. The altitude at which the pathway boxes are displayed is determined by the higher of either the selected altitude or the VNAV altitude programmed for the active leg in the flight plan (Figure 8-4).

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 Inset map or MFD map indicating an inactive leg.

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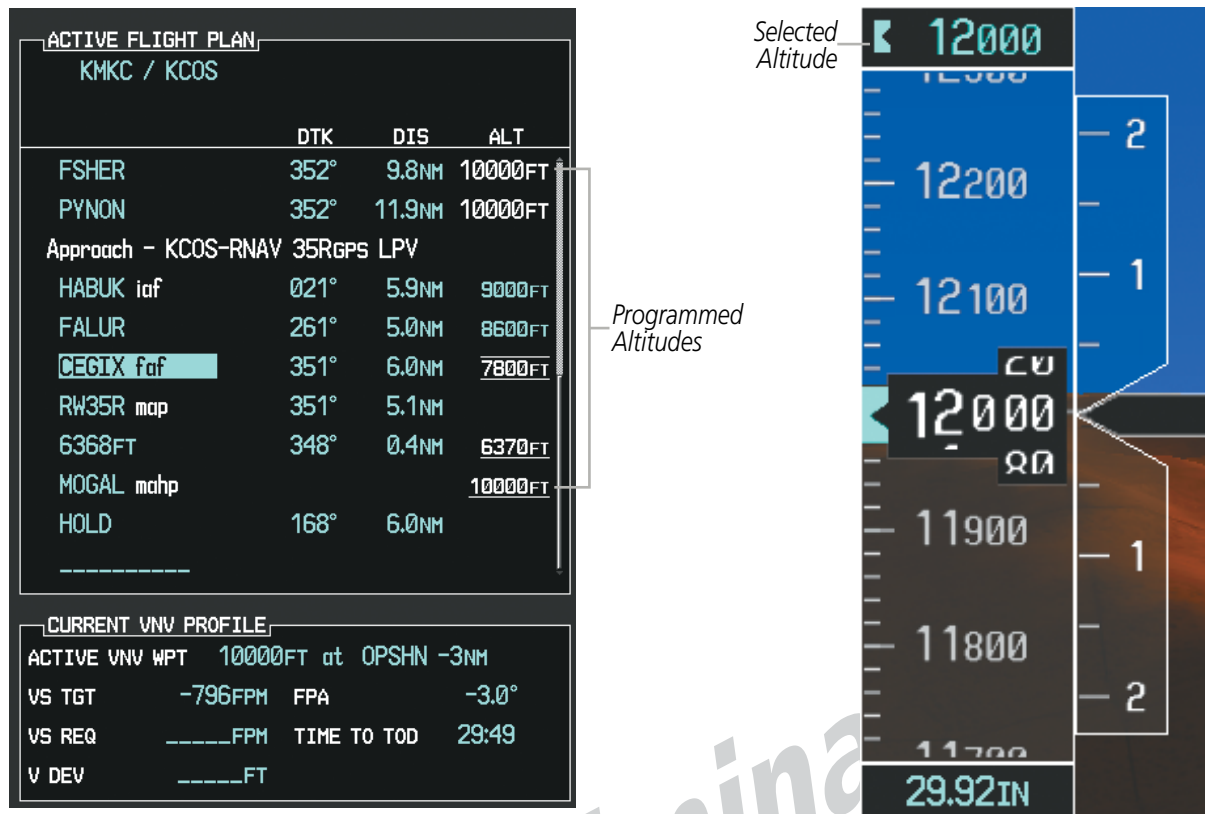
Figure 8-4 Programmed and Selected Altitude

Pathways provide supplemental glidepath information on an active ILS, LPV, LNAV/VNAV, and some LNAV approaches. Pathways are intended as an aid to situational awareness and should not be used independent of the CDI, VDI, glide path indicator, and glide slope 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 SVS field of view, pathways will not be visible until the aircraft has turned toward this leg. While approaching the center of the active leg and prescribed altitude, the number of pathway boxes decreases to a minimum of four.

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

Descent and Approach

Pathways are shown descending only for a programmed descent (Figures 8-5, 8-6). When the flight plan includes programmed descent segments, pathways are displayed along the descent path provided that the selected altitude is lower than the programmed altitude.

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

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

VOR, LOC BC, 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.
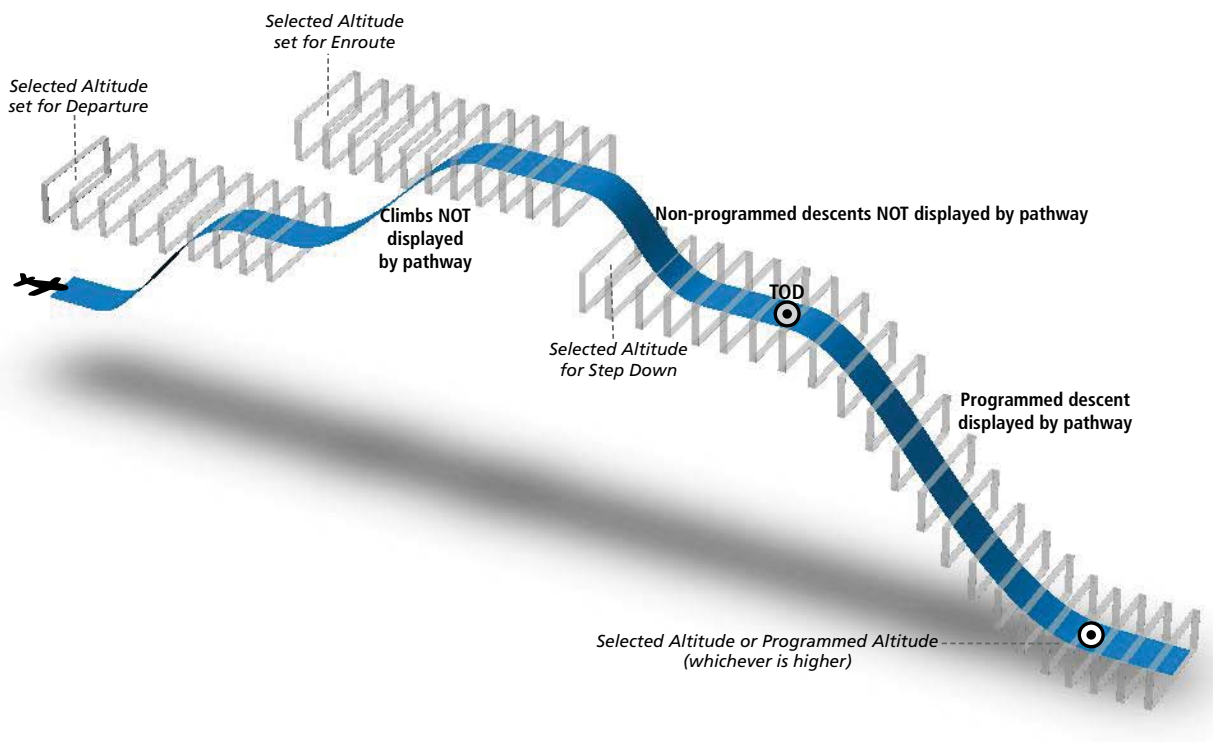
Figure 8-5 SVS Pathways, Enroute and Descent

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.
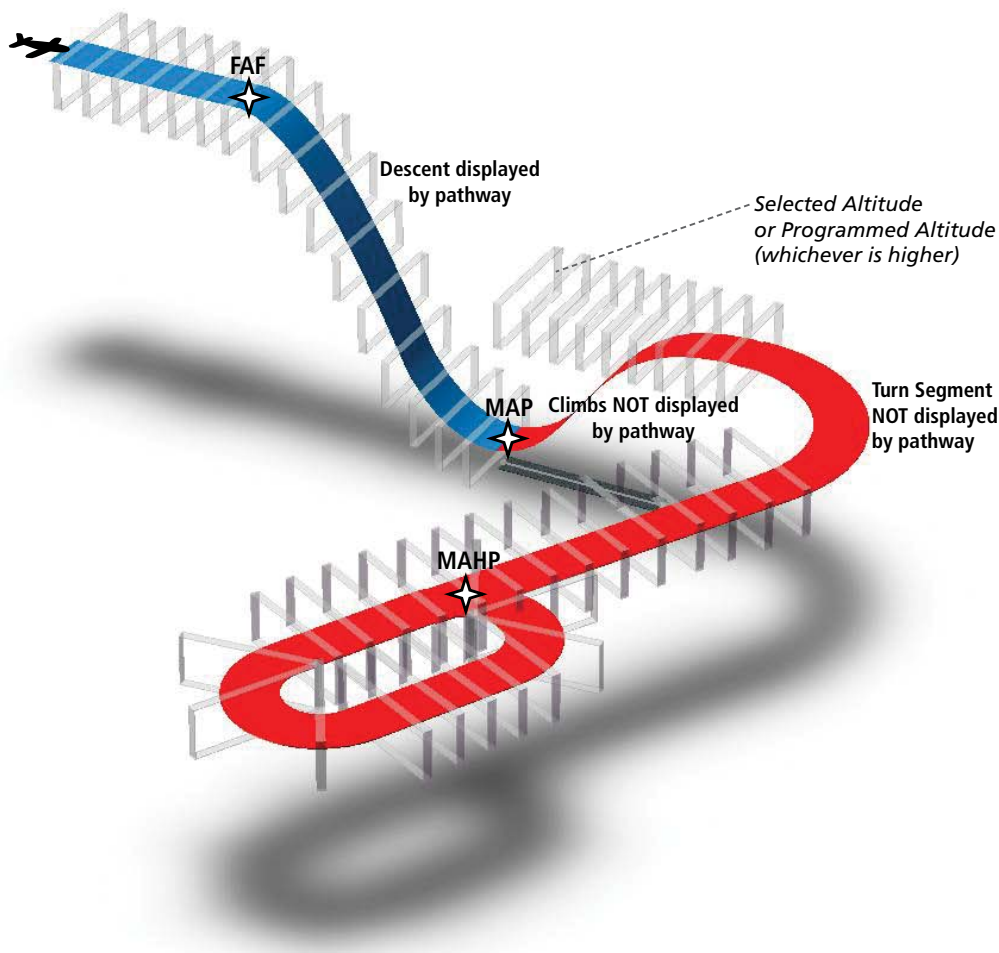
Figure 8-6 SVS Pathways, Approach, Missed Approach, and Holding

FLIGHT PATH MARKER

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

The FPM is always available 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 altitudes and direction when navigating a flight plan. When on course and altitude the FPM is aligned inside the pathway boxes as shown (Figure 8-7).

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 8-7 Flight Path Marker and Pathways

ZERO PITCH LINE

The Zero Pitch Line is drawn completely across the display and represents the aircraft attitude with respect to the horizon. 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 **HRZN HDG** Softkey.

TRAFFIC

⚠ **WARNING:** *Intruder aircraft at or below 500 ft. AGL may not appear on the SVS 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 SVS display. Traffic symbols and coloring are consistent with that used for traffic displayed in the Inset map or MFD traffic page. If the traffic altitude is unknown, the traffic will not be displayed on the SVS display. For more details refer to the traffic system discussion in the Hazard Avoidance section.

AIRPORT SIGNS

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

Figure 8-8 Airport Signs

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RUNWAYS

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

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

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

Figure 8-9 Airport Runways

TAWS ALERTING

Terrain alerting on the synthetic terrain display is triggered by Forward-looking Terrain Avoidance (FLTA) alerts, and corresponds to the red and yellow X symbols on the Inset Map and MFD map displays. For more detailed information regarding TAWS, refer to the Hazard Avoidance Section.

In some instances, a terrain or obstacle alert may be issued with no conflict shading displayed on the synthetic terrain. In these cases, the conflict is outside the SVS field of view to the left or right of the aircraft.
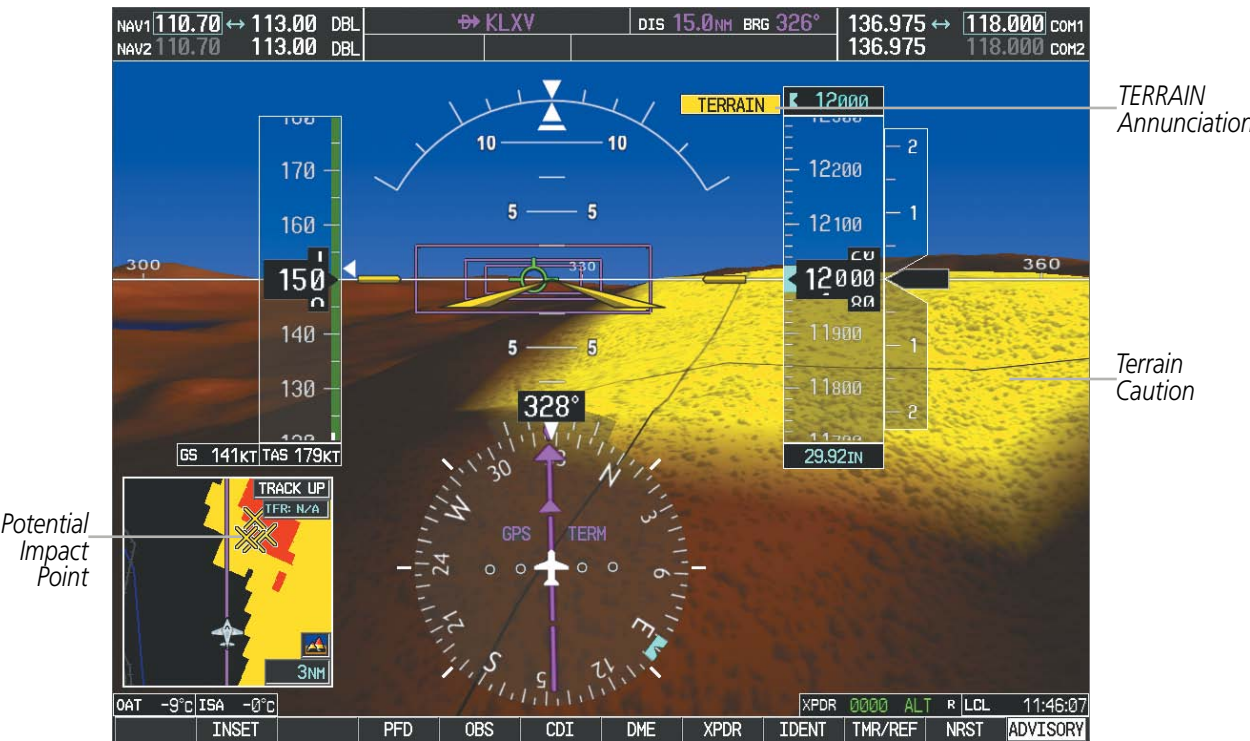
Figure 8-10 Terrain Alert

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

Figure 8-11 Obstacle

FIELD OF VIEW

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

Configuring field of view:

1) While viewing the Navigation Map Page, press the **MENU** Key to display the PAGE MENU.

2) Turn the large **FMS** Knob to highlight Map Setup and press the **ENT** Key.
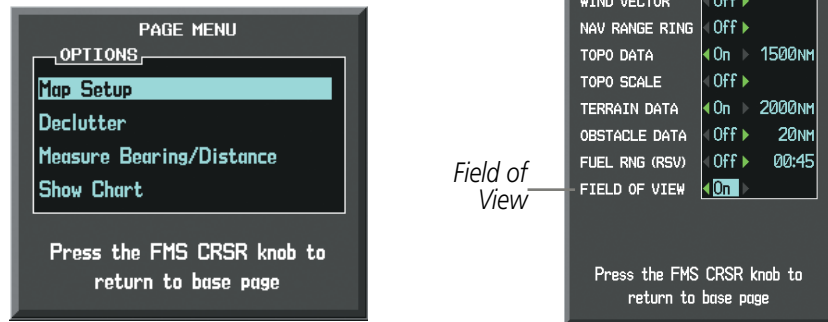
Navigation Map Page OPTIONS Menu   *Map Setup Menu, Map Group, Field of View Option*

Figure 8-12 Option Menus

3) Turn the **FMS** Knob to select the Map Group and press the **ENT** Key.

4) Turn the large **FMS** Knob to scroll through the Map Group options to FIELD OF VIEW.

5) Turn the small **FMS** Knob to select On or Off.

6) Press the **FMS** Knob to return to the Navigation Map Page.

The following figure compares the PFD forward looking depiction with the MFD plan view and FIELD OF VIEW turned on.

SVS View on the PFD   *Field of View on the MFD*
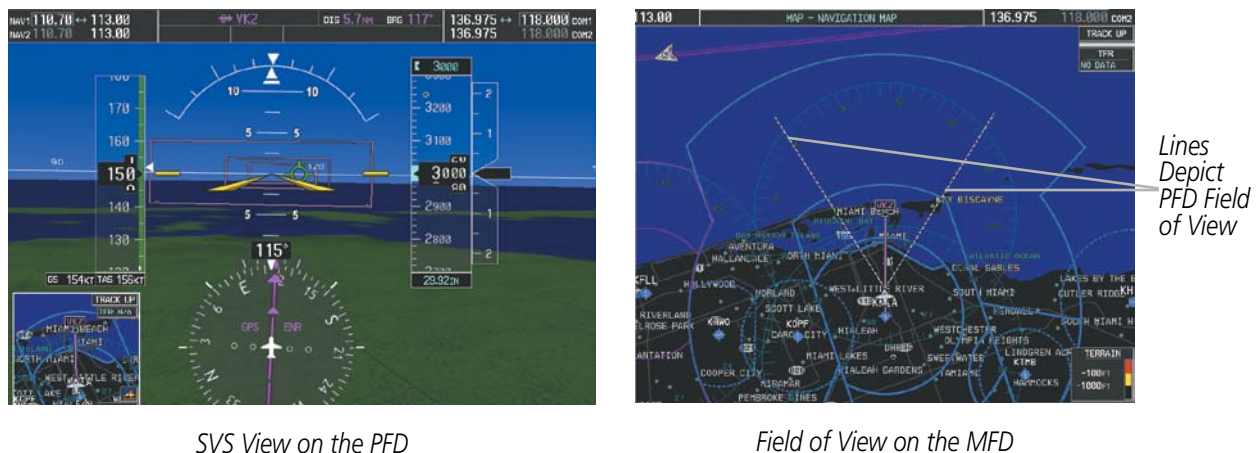
Figure 8-13 PFD and MFD Field of View Comparison

8.2 SAFETAXI

SafeTaxi is an enhanced feature that gives greater map detail when viewing airports at close range. The maximum map ranges for enhanced detail are pilot configurable. When viewing at ranges close enough to show the airport detail, the map reveals taxiways with identifying letters/numbers, airport Hot Spots, and airport landmarks including ramps, buildings, control towers, and other prominent features. Resolution is greater at lower map ranges. When the MFD display is within the SafeTaxi ranges, the airplane symbol on the airport provides enhanced position awareness.

Designated Hot Spots are recognized at airports with many intersecting taxiways and runways, and/or complex ramp areas. Airport Hot Spots are outlined to caution pilots of areas on an airport surface where positional awareness confusion or runway incursions happen most often. Hot Spots are defined with a magenta circle or outline around the region of possible confusion.

Any map page that displays the navigation view can also show the SafeTaxi airport layout within the maximum configured range. The following is a list of pages where the SafeTaxi feature can be seen:

- Navigation Map Page
- Inset Map (PFD)
- Weather Datalink Page
- Airport Information Page
- Intersection Information Page
- NDB Information Page

- VOR Information Page
- User Waypoint Information Page
- Trip Planning Page
- Nearest Pages
- Active and Stored Flight Plan Pages

During ground operations the aircraft's position is displayed in reference to taxiways, runways, and airport features. In the example shown, the aircraft is on taxiway Bravo approaching the High Alert Intersection boundary on KSFO airport. Airport Hot Spots are outlined in magenta. When panning over the airport, features such as runway holding lines and taxiways are shown at the cursor.

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GARMIN.

Figure 8-14 SafeTaxi Depiction on the Navigation Map Page

The **DCLTR** Softkey (declutter) label advances to DCLTR-1, DCLTR -2, and DCLTR-3 each time the softkey is pressed for easy recognition of decluttering level. Pressing the **DCLTR** Softkey removes the taxiway markings and airport feature labels. Pressing the **DCLTR-1** Softkey removes VOR station ID, the VOR symbol, and intersection names if within the airport plan view. Pressing the **DCLTR-2** Softkey removes the airport runway layout, unless the airport in view is part of an active route structure. Pressing the **DCLTR-3** Softkey cycles back to the original map detail. Refer to Map Declutter Levels in the Flight Management Section.

Configuring SafeTaxi range:

1) While viewing the Navigation Map Page, press the **MENU** Key to display the PAGE MENU.

2) Turn the large **FMS** Knob to highlight the Map Setup Menu Option and press the **ENT** Key.
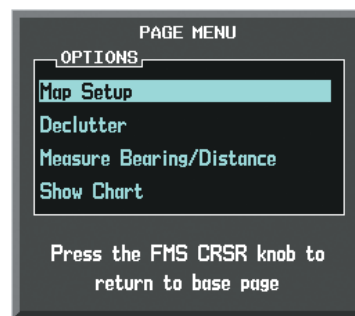
Figure 8-15 Navigation Map PAGE MENU, Map Setup Option

3) Turn the **FMS** Knob to select the Aviation Group and press the **ENT** Key.

4) Turn the large **FMS** Knob to scroll through the Aviation Group options to SAFETAXI.

5) Turn the small **FMS** Knob to display the range of distances.

6) Turn either **FMS** Knob to select the desired distance for maximum SafeTaxi display range.

7) Press the **ENT** Key to complete the selection.

8) Press the **FMS** Knob to return to the Navigation Map Page.
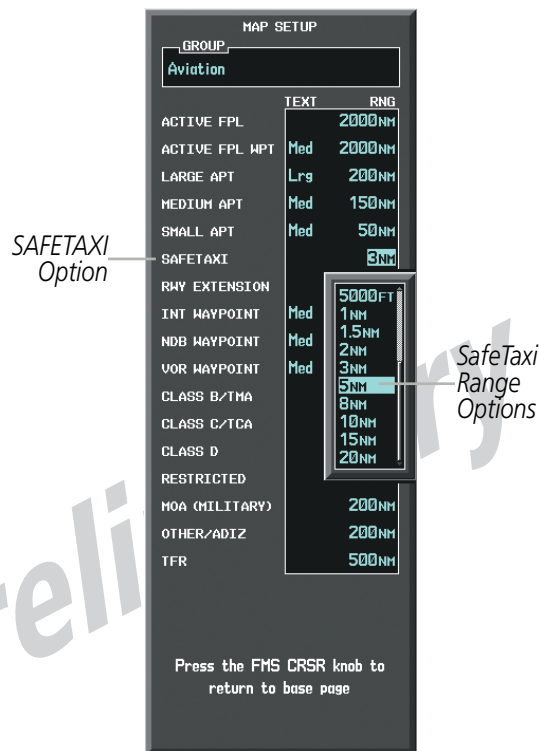
Figure 8-16 MAP SETUP Menu, Aviation Group, SAFETAXI Range Options

SafeTaxi database is revised every 56 days. SafeTaxi is always available for use after the expiration date. When turning on the system, the Power-up Page indicates whether the databases are current, out of date, or not available.
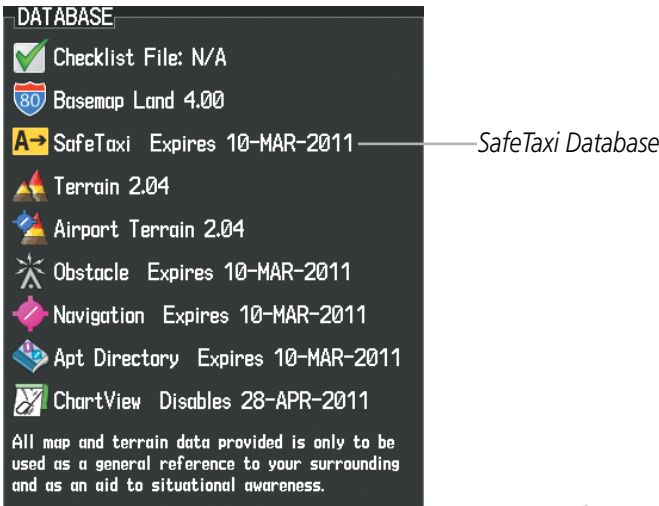
SafeTaxi Database

Figure 8-17 Power-up Page, SafeTaxi Database

Power-up Page Display	Definition
SafeTaxi Expires 10-MAR-2011	Normal operation. SafeTaxi database is valid and within current cycle.
SafeTaxi Expires 10-MAR-2011	SafeTaxi database has expired.
SafeTaxi: N/A	Database card contains no SafeTaxi data.

Table 8-1 SafeTaxi Annunciation Definitions

The SafeTaxi Region, Version, Cycle, Effective date and Expires date of the database cycle can also be found on the AUX - System Status page, as seen in Figure 8-18.

Press the **MFD1 DB** Softkey to place the cursor in the DATABASE window. Scroll through the listed information by turning the **FMS** Knob or pressing the **ENT** Key until the SafeTaxi database information is shown.

The SafeTaxi database cycle number shown in the figure, 11S1, is deciphered as follows:

11 – Indicates the year 2011

S – Indicates the data is for SafeTaxi

1 – Indicates the first issue of the SafeTaxi database for the year

The SafeTaxi EFFECTIVE date 13–JAN–11 is the beginning date for the current database cycle.   SafeTaxi EXPIRES date 10–MAR–11 is the revision date for the next database cycle.

Figure 8-18 AUX – System Status Page, SafeTaxi Current Information

SafeTaxi information appears in blue and yellow text. The EFFECTIVE date appears in blue when data is current and in yellow when the current date is before the effective date. The EXPIRES date appears in blue when data is current and in yellow when expired (Figures 8-18 and 8-19). NOT AVAILABLE appears in blue in the REGION field if SafeTaxi data is not available on the database card (Figure 8-19). An expired SafeTaxi database is not disabled and will continue to function indefinitely.

Press the **MFD1 DB** Softkey a second time. The softkey label will change to **PFD1 DB**. The DATABASE window will now be displaying database information for PFD1. As before, scroll through the listed information by turning the **FMS** Knob or pressing the **ENT** Key until the SafeTaxi database information is shown.

Refer to Updating Garmin Databases in Appendix B for instructions on revising the SafeTaxi database.

Figure 8-19 illustrates possible SafeTaxi database conditions that may appear on the AUX - System Status Page. The EFFECTIVE date is the beginning date for this database cycle. If the present date is before the effective date, the EFFECTIVE date appears in yellow and the EXPIRES date appears in blue. The EXPIRES date is the revision date for the next database cycle. NOT AVAILABLE indicates that SafeTaxi is not available on the database card or no database card is inserted.

Current Date is before Effective Date   *SafeTaxi Database has Expired*   *SafeTaxi Database Not Installed*

Figure 8-19 AUX – System Status Page, SafeTaxi Database Status

8.3 CHARTVIEW

ChartView resembles the paper version of Jeppesen terminal procedures charts. The charts are displayed in full color with high-resolution. The MFD depiction shows the aircraft position on the moving map in the plan view of approach charts and on airport diagrams. Airport Hot Spots are outlined in magenta.

The ChartView database subscription is available from Jeppesen, Inc. Available data includes:

- Arrivals (STAR)
- Departure Procedures (DP)
- Approaches
- Airport Diagrams
- NOTAMs

CHARTVIEW SOFTKEYS

ChartView functions are displayed on three levels of softkeys. While on the Navigation Map Page, Nearest Airports Page, or Flight Plan Page, pressing the **SHW CHRT** Softkey displays the available terminal chart and advances to the chart selection level of softkeys: **CHRT OPT**, **CHRT**, **INFO-1, INFO-2**, **DP**, **STAR**, **APR**, **WX**, **NOTAM**, and **GO BACK**. The chart selection softkeys shown below appear on the Airport Information Page.

Pressing the **GO BACK** Softkey reverts to the top level softkeys and previous page.

Pressing the **CHRT OPT** Softkey advances to the next level of softkeys: **ALL**, **HEADER**, **PLAN**, **PROFILE**, **MINIMUMS**, **FIT WDTH**, **FULL SCN**, and **BACK**.

While viewing the **CHRT OPT** Softkeys, after 45 seconds of softkey inactivity, the system reverts to the chart selection softkeys.
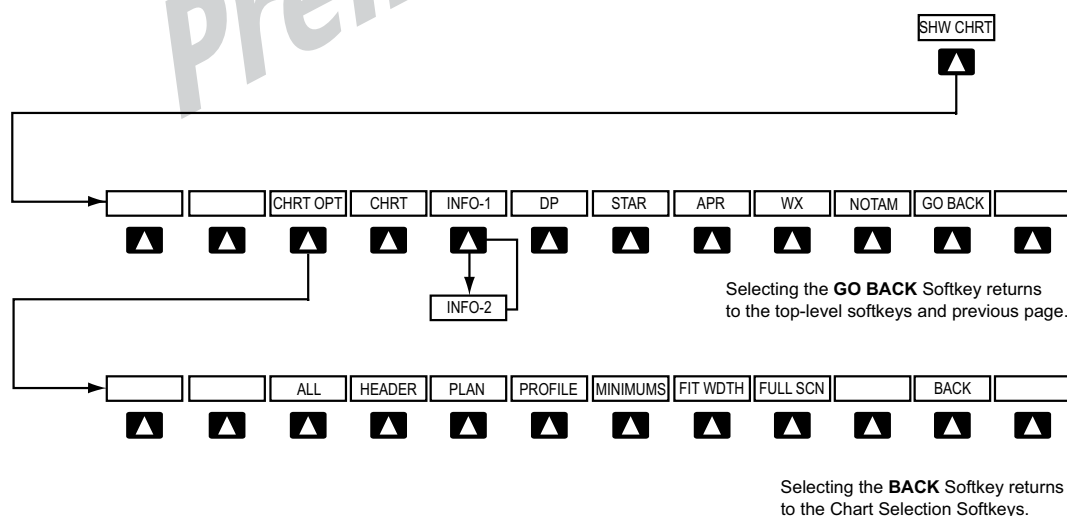
Figure 8-20 ChartView SHW CHRT, Chart Selection, and Chart Option Softkeys

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TERMINAL PROCEDURES CHARTS

Selecting Terminal Procedures Charts:

While viewing the Navigation Map Page, Nearest Airport Page, or Flight Plan Page, press the **SHW CHRT** Softkey.

Or:

1) Press the **MENU** Key to display the PAGE MENU.

2) Turn the large **FMS** Knob to scroll through the OPTIONS Menu to Show Chart.

3) Press the **ENT** Key to display the chart.

Navigation Map Page OPTIONS Menu   *Waypoint Airport Information Page OPTIONS Menu*

Figure 8-21 Option Menus

When no terminal procedure chart is available for the nearest airport or the selected airport, the banner CHART NOT AVAILABLE appears on the screen. The CHART NOT AVAILABLE banner does not refer to the Jeppesen subscription, but rather the availability of a particular airport chart selection or procedure for a selected airport.

CHART NOT AVAILABLE

Figure 8-22 Chart Not Available Banner

If there is a problem in rendering the data (such as a data error or a failure of an individual chart), the banner UNABLE TO DISPLAY CHART is then displayed.

UNABLE TO DISPLAY CHART

Figure 8-23 Unable To Display Chart Banner

When a chart is not available by pressing the **SHW CHRT** Softkey or selecting a Page Menu Option, charts may be obtained for other airports from the WPT Pages or Flight Plan Pages.

If a chart is available for the destination airport, or the airport selected in the active flight plan, the chart appears on the screen. When no flight plan is active, or when not flying to a direct-to destination, pressing the **SHW CHRT** Softkey displays the chart for the nearest airport, if available.

The chart shown is one associated with the WPT – Airport Information page. Usually this is the airport runway diagram. Where no runway diagram exists, but Take Off Minimums or Alternate Minimums are available, that page appears. If Airport Information pages are unavailable, the Approach Chart for the airport is shown.

Selecting a chart:

1) While viewing the Navigation Map Page, Flight Plan Page, or Nearest Airports Page, press the **SHW CHRT** Softkey. The airport diagram or approach chart is displayed on the Airport Information Page.

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

3) Turn the large **FMS** Knob to select either the Airport Identifier Box or the Approach Box. (Press the **APR** Softkey if the Approach Box is not currently shown).

4) Turn the small and large **FMS** Knob to enter the desired airport identifier.

5) Press the **ENT** Key to complete the airport selection.

6) Turn the large **FMS** Knob to select the Approach Box.

7) Turn the small **FMS** Knob to show the approach chart selection choices.

8) Turn either **FMS** Knob to scroll through the available charts.

9) Press the **ENT** Key to complete the chart selection.

Figure 8-24 Approach Information Page, Chart Selection

While the APPROACH Box is selected using the **FMS** Knob, the G1000 softkeys are blank. Once the desired chart is selected, the chart scale can be changed and the chart page can be scrolled using the **Joystick**. Pressing the **Joystick** centers the chart on the screen.

The aircraft symbol is shown on the chart only if the chart is to scale and the aircraft position is within the boundaries of the chart. The aircraft symbol is not displayed when the Aircraft Not Shown Icon appears (Figure 8-28). If the Chart Scale Box displays a banner NOT TO SCALE, the aircraft symbol is not shown. The Aircraft Not Shown Icon may appear at certain times, even if the chart is displayed to scale.

Pressing the **CHRT** Softkey switches between the ChartView diagram and the associated map in the WPT page group. In the example shown, the **CHRT** Softkey switches between the Colorado Springs, CO (KCOS) Airport Diagram and the navigation map on the WPT – Airport Information page.

*Press **CHRT** Softkey to Switch Between ChartView and WPT - Airport Information Page*
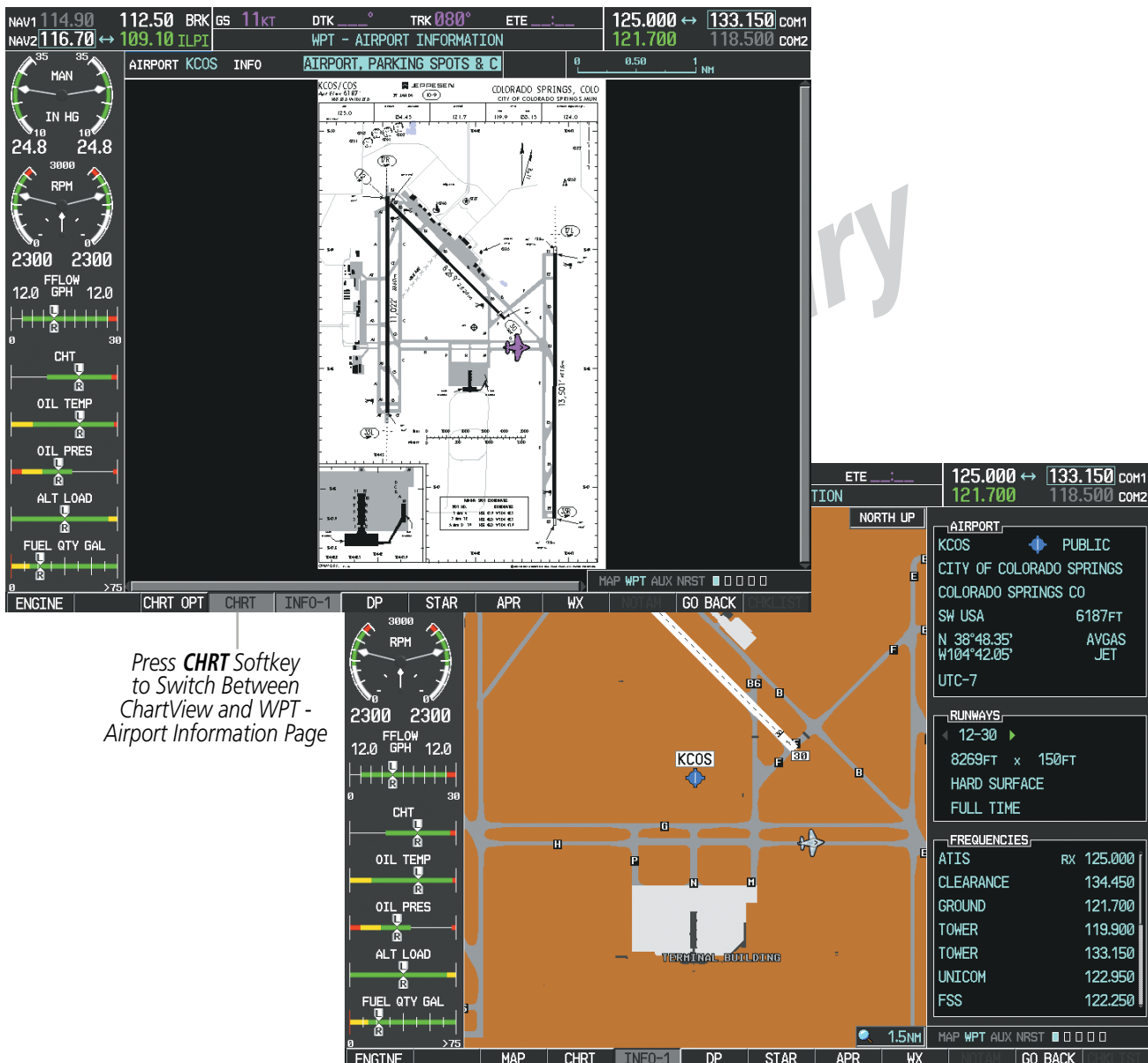
Figure 8-25 CHRT Softkey, Airport Information Page

Pressing the **INFO-1** or **INFO-2** Softkey returns to the airport diagram when the view is on a different chart. If the displayed chart is the airport diagram, the **INFO-1** or **INFO-2** Softkey has no effect.

The aircraft position is shown in magenta on the ChartView diagrams when the location of the aircraft is within the chart boundaries. In the example shown, the aircraft is taxiing on Taxiway Alpha on the Charlotte, NC (KCLT) airport.

Another source for additional airport information is from the INFO Box above the chart for certain airports. This information source is not related to the **INFO-1** or **INFO-2** Softkey. When the INFO Box is selected using the **FMS** Knob, the G1000 softkeys are blank. The Charlotte, NC airport has five additional charts offering information; the Airport Diagram, Take-off Minimums, Class B Airspace, Airline Parking Gate Coordinates, and Airline Parking Gate Location. (The numbers in parentheses after the chart name are Jeppesen designators.)

Figure 8-26 Airport Information Page, INFO View, Full Screen Width

In the example shown in Figure 8-26, the Class B Chart is selected. Pressing the **ENT** Key displays the Charlotte Class B Airspace Chart (Figure 8-27).
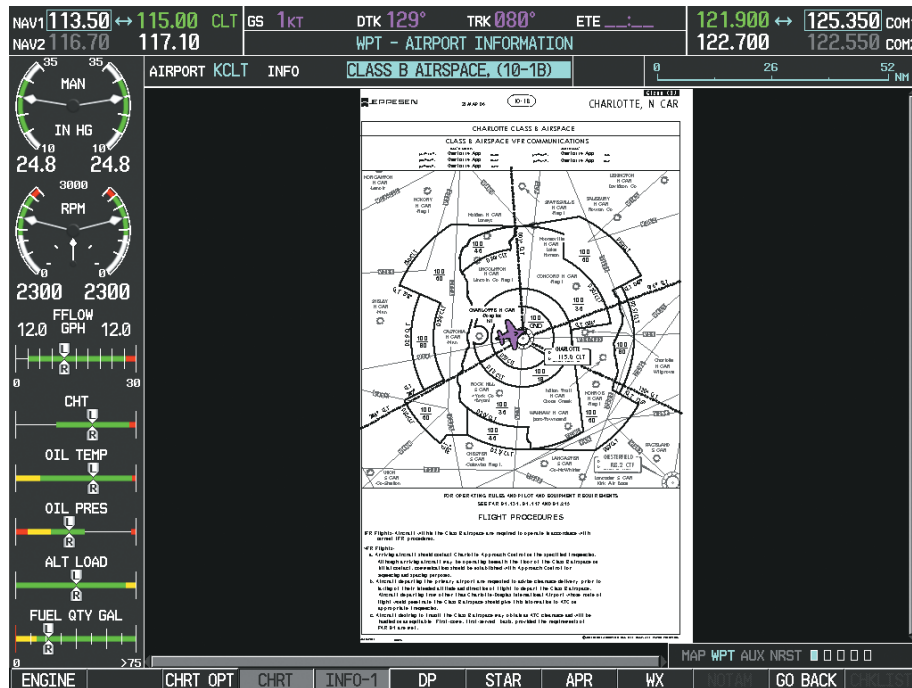
Figure 8-27 Airport Information Page, Class B Chart Selected from INFO View

Pressing the **DP** Softkey displays the Departure Procedure Chart if available.

Chart Not To Scale

Aircraft Not Shown Icon
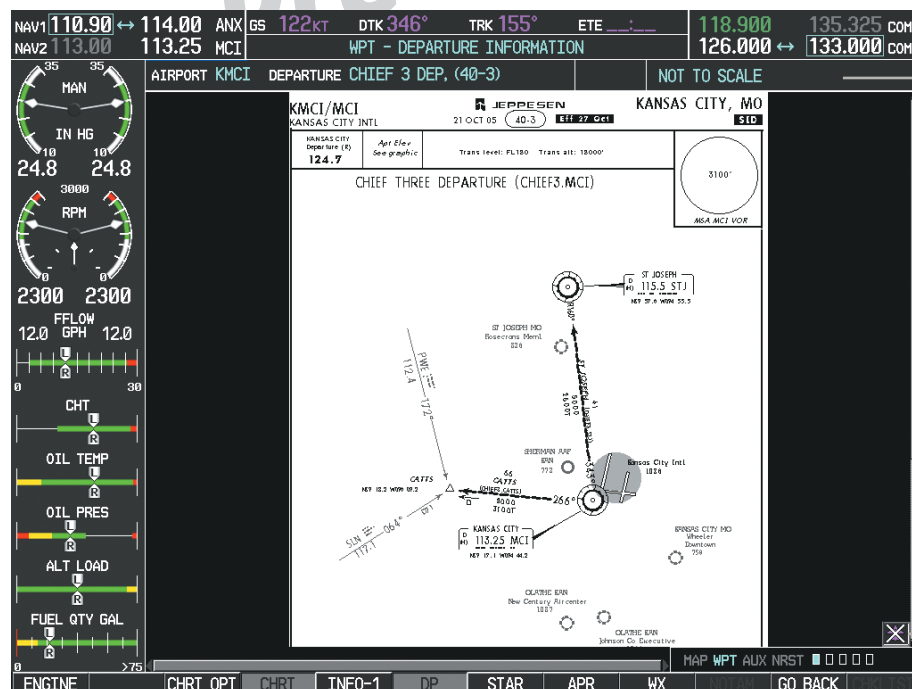
Figure 8-28 Departure Information Page

Pressing the **STAR** Softkey displays the Standard Terminal Arrival Chart if available.

Chart Not To Scale

*Change Range and Scroll Through the Chart With the **Joystick***

Aircraft Not Shown Icon
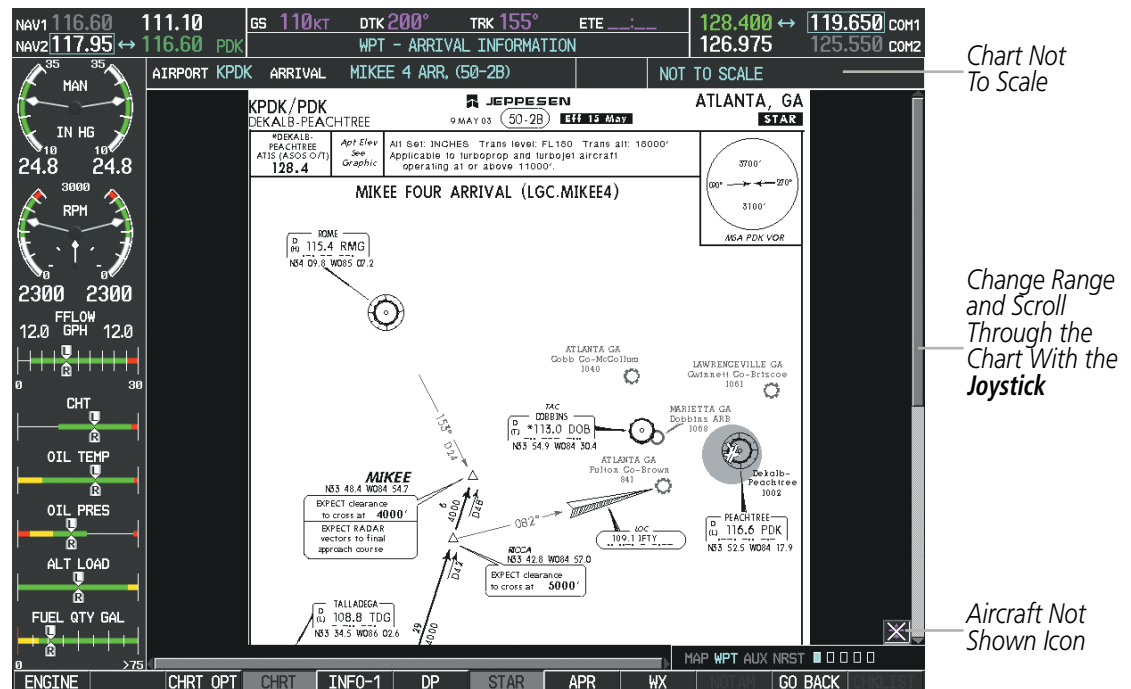
Figure 8-29 Arrival Information Page

Pressing the **APR** Softkey displays the approach chart for the airport if available.
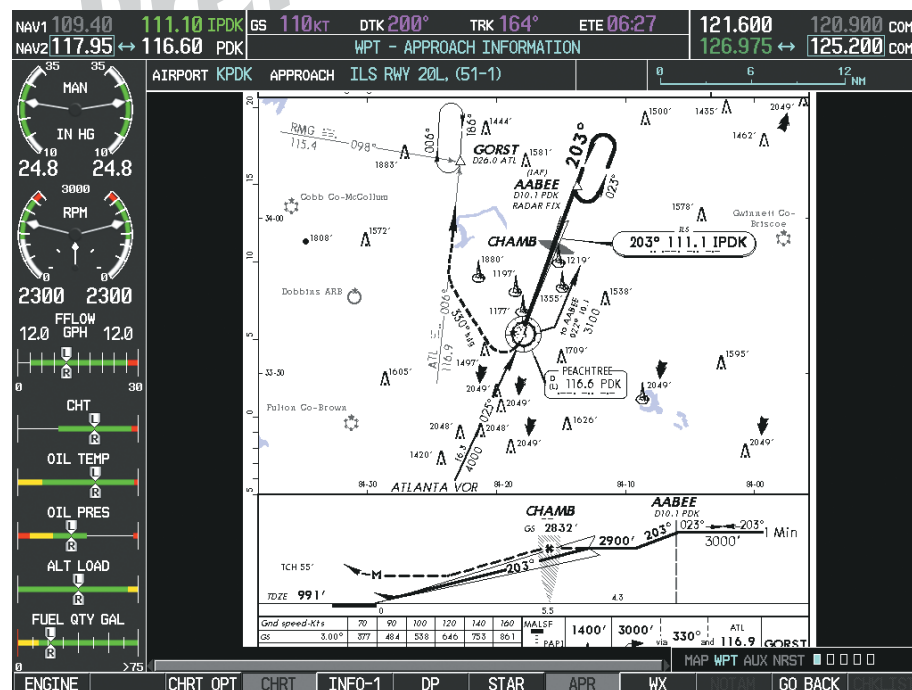
Figure 8-30 Approach Information Page

Pressing the **WX** Softkey shows the airport weather frequency information, and includes weather data such as METAR and TAF from the XM Data Link Receiver, when available. Weather information is available only when an XM Data Link Receiver is installed and the XM WX Satellite Weather subscription is current.
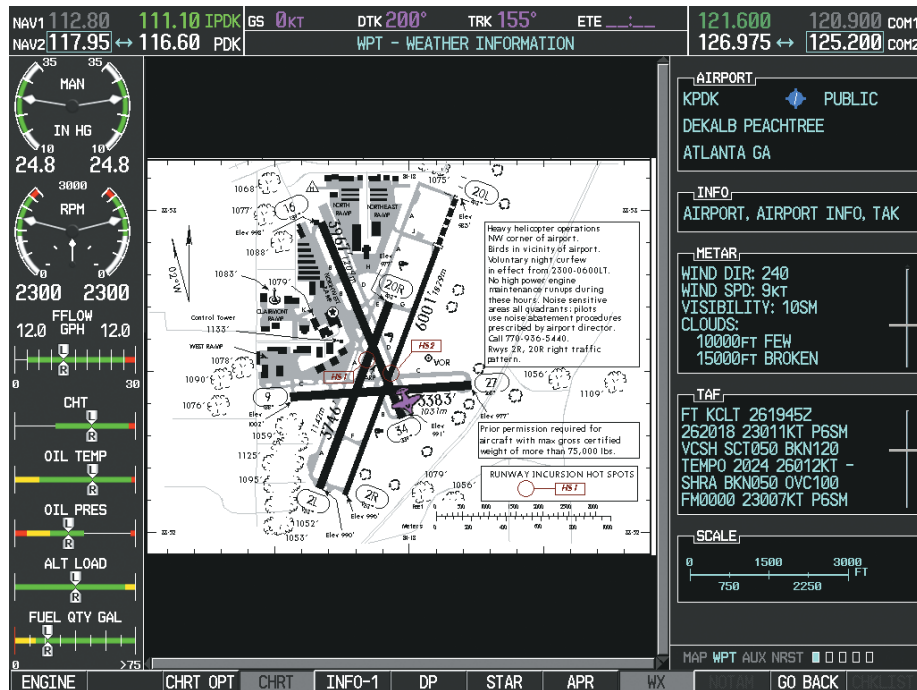
Figure 8-31 Weather Information Page

> **NOTE:** *A subdued softkey label indicates the function is disabled.*

Recent NOTAMS applicable to the current ChartView cycle are included in the ChartView database. Pressing the **NOTAM** Softkey shows the local NOTAM information for selected airports, when available. When NOTAMS are not available, the **NOTAM** Softkey label appears subdued and is disabled as shown in Figure 8-31. The **NOTAM** Softkey may appear on the Airport Information Page and all of the chart page selections.
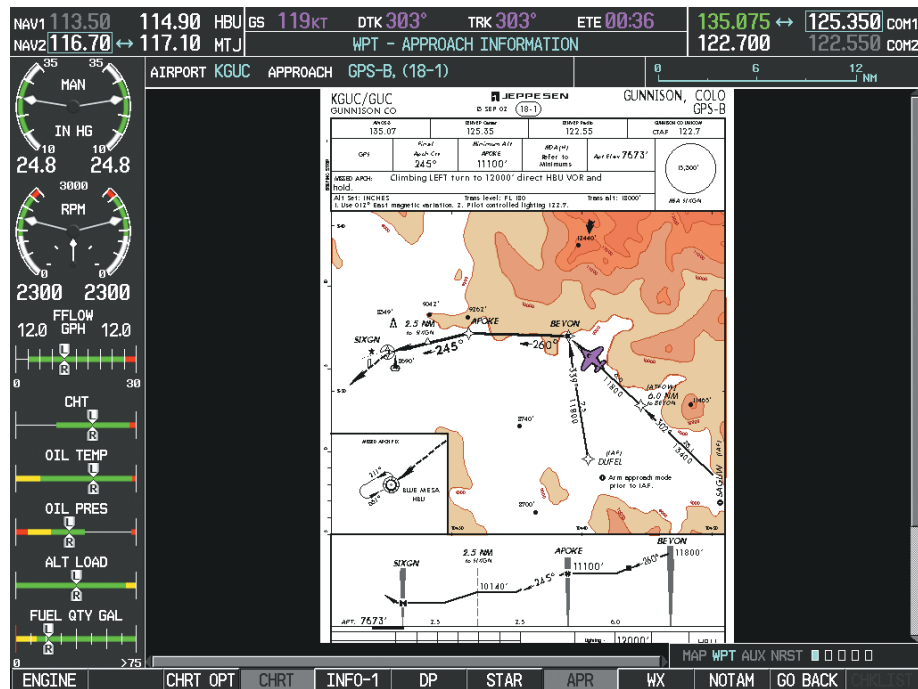
NOTAM Softkey Appears for Selected Airports

Figure 8-32 NOTAM Softkey Highlighted
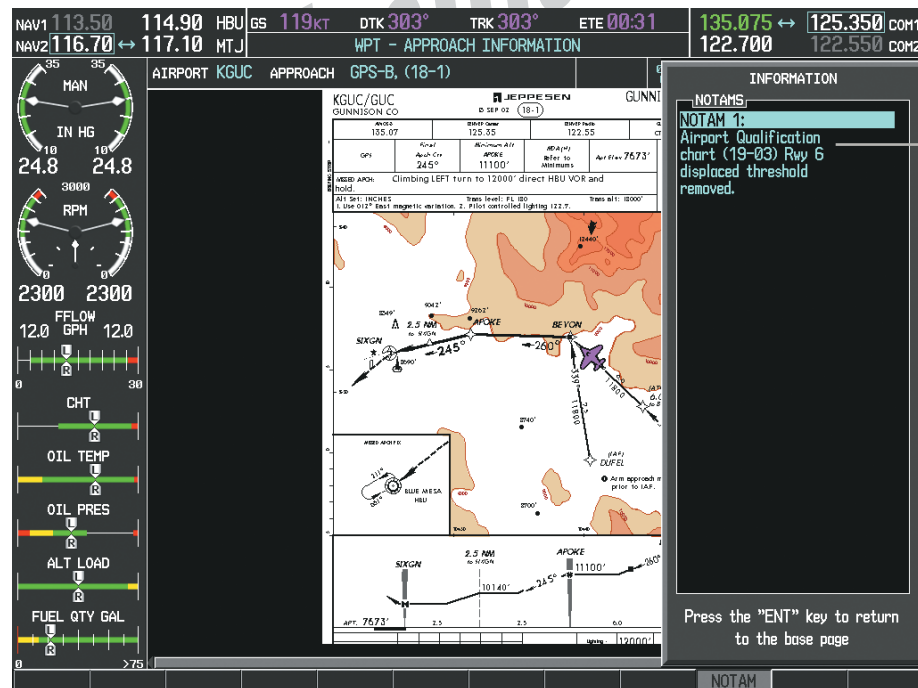
Local NOTAM on This Airport

NOTAM Softkey Selected

Figure 8-33 Airport Information Page, Local NOTAMs

Pressing the **NOTAM** Softkey again removes the NOTAMS information.

Pressing the **GO BACK** Softkey reverts to the previous page (Navigation Map Page, Nearest Pages, or Flight Plan Page).

CHART OPTIONS

Pressing the **CHRT OPT** Softkey displays the next level of softkeys, the chart options level (Figure 8-20).

Pressing the **ALL** Softkey shows the complete approach chart on the screen.

Complete Chart Shown

Figure 8-34 Approach Information Page, ALL View

Pressing the **HEADER** Softkey shows the header view (approach chart briefing strip) on the screen.
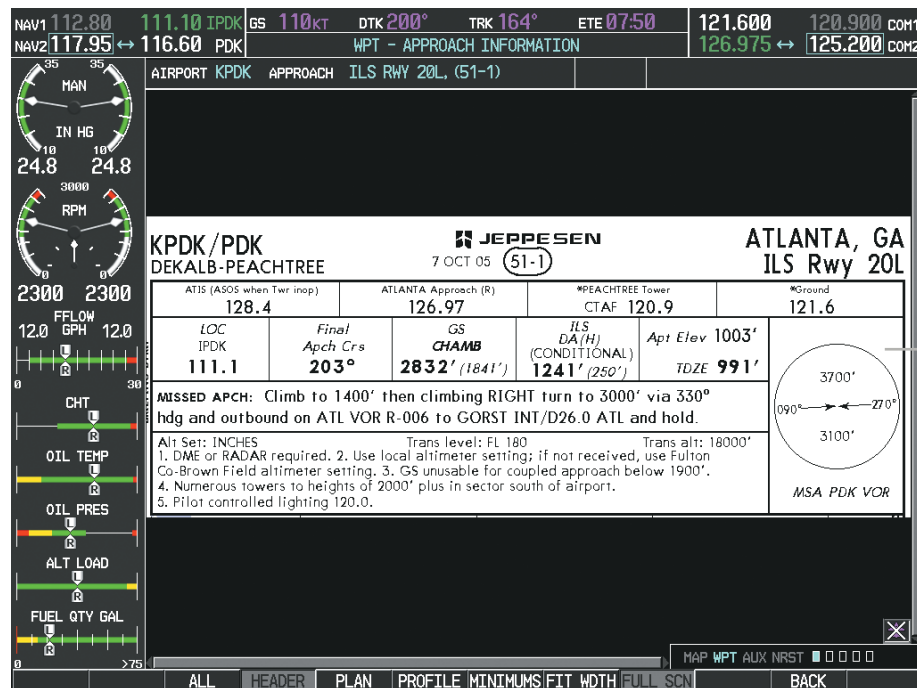
Approach Chart Briefing Strip

Figure 8-35 Approach Information Page, Header View

Pressing the **PLAN** Softkey shows the approach chart two dimensional plan view.
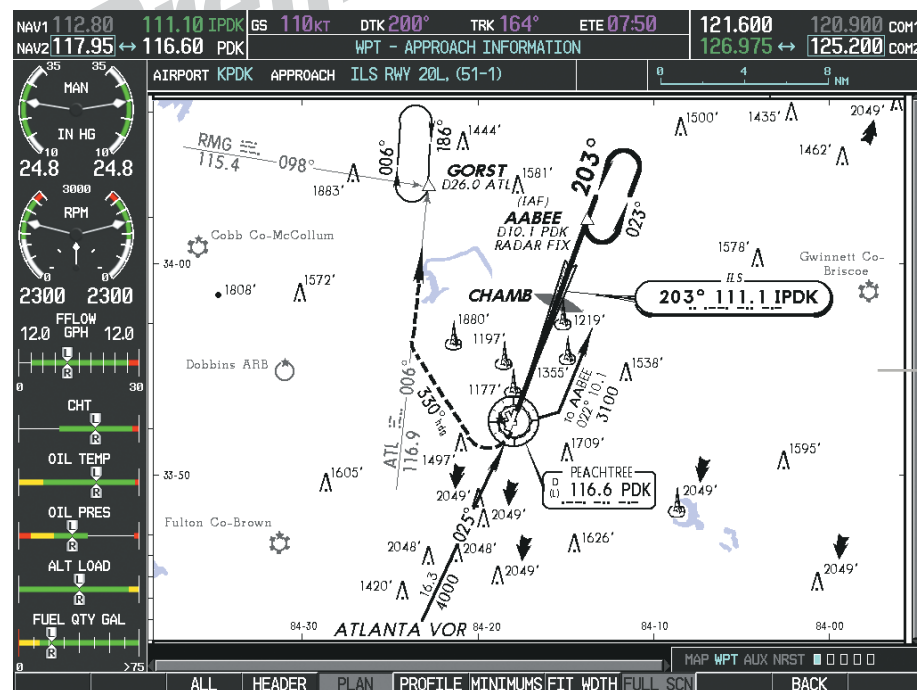
Approach Chart Plan View

Figure 8-36 Approach Information Page, Plan View

Pressing the **PROFILE** Softkey displays the approach chart descent profile strip.
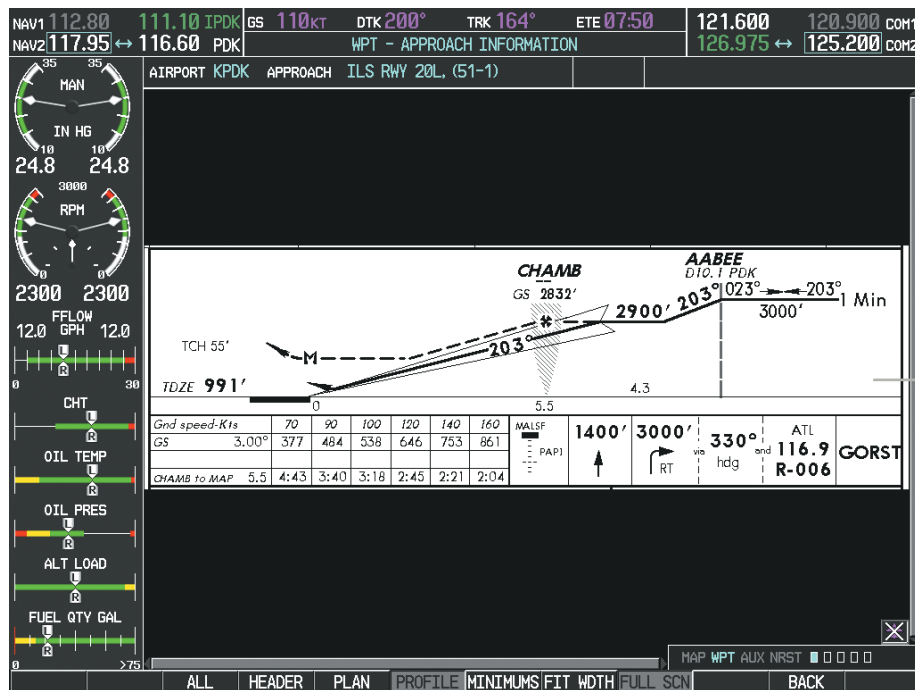
Approach
Chart Descent
Profile Strip

Figure 8-37 Approach Information Page, Profile View, Full Screen Width

Pressing the **MINIMUMS** Softkey displays the minimum descent altitude/visibility strip at the bottom of the approach chart.
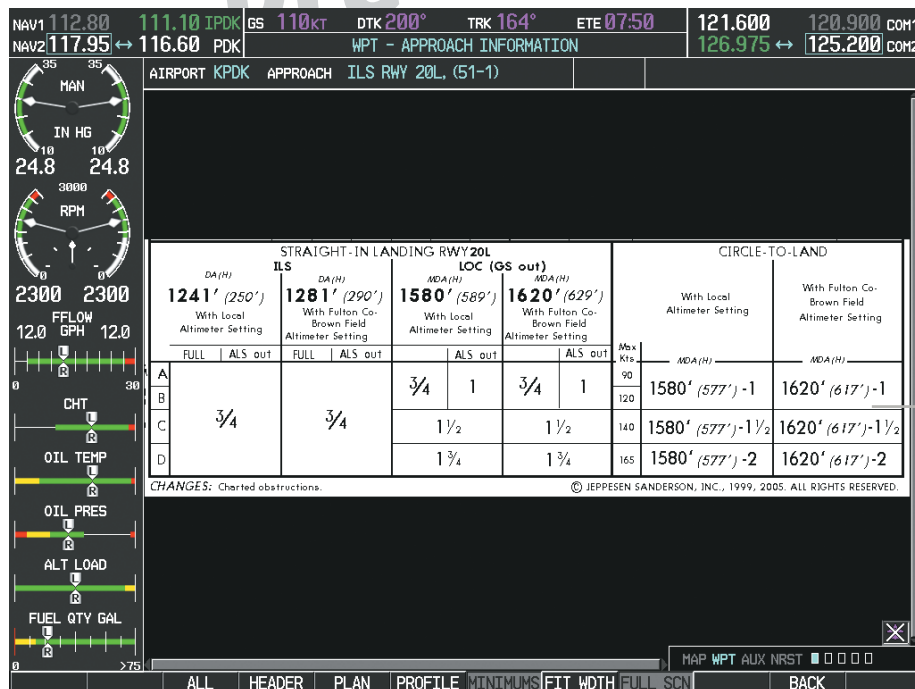
Minimum
Descent
Altitude/
Visibility Strip

Figure 8-38 Approach Information Page, Minimums View, Full Screen Width

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If the chart scale has been adjusted to view a small area of the chart, pressing the **FIT WIDTH** Softkey changes the chart size to fit the available screen width.
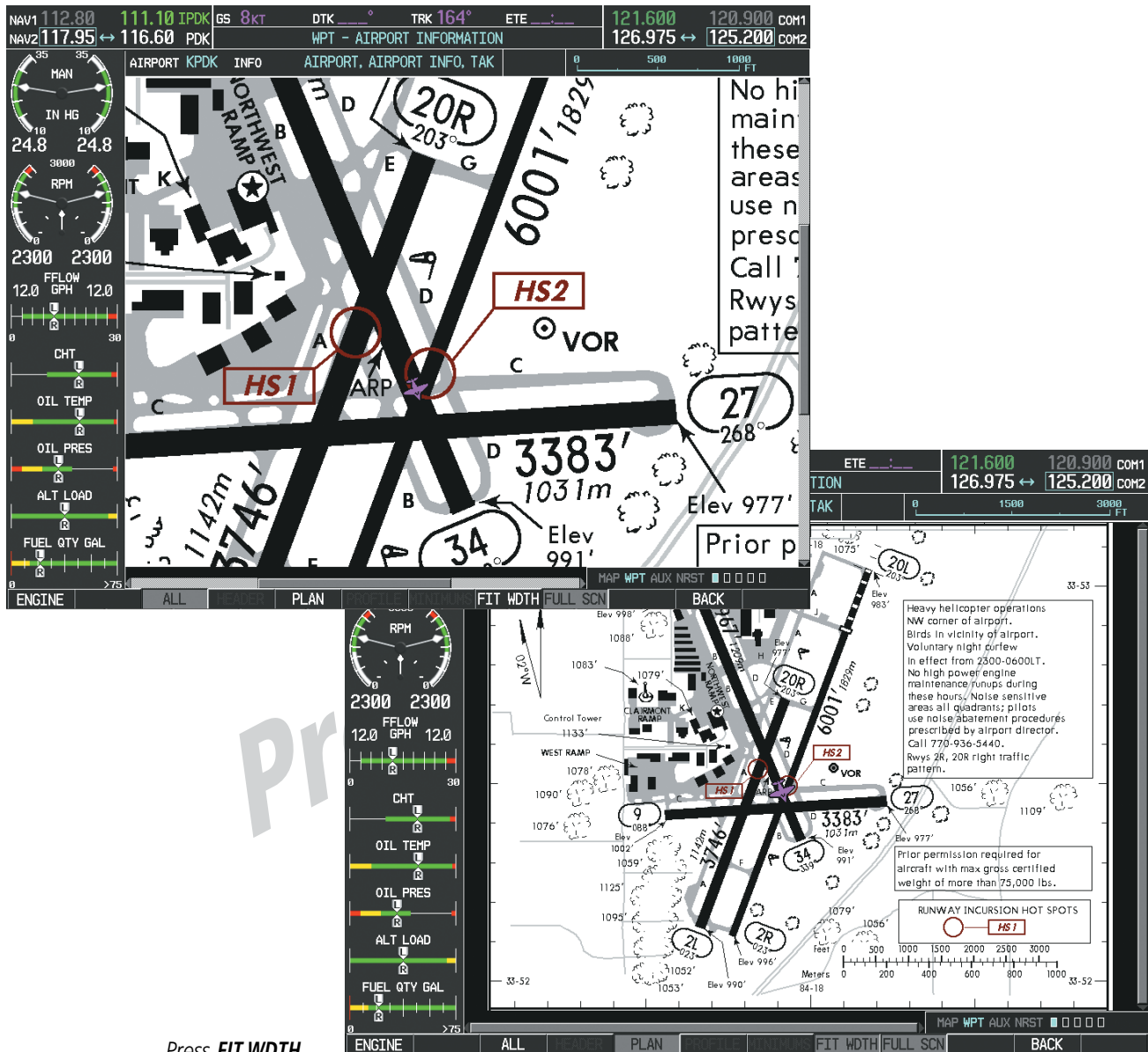
*Press **FIT WDTH** Softkey to Show Full Chart Width*

Figure 8-39 Airport Information Page, FIT WDTH Softkey Selected

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Pressing the **FULL SCN** Softkey alternates between removing and replacing the data window to the right.

Selecting Additional Information:

1) While viewing the Airport Taxi Diagram, press the **FULL SCN** Softkey to display the information windows (AIRPORT, INFO).

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

3) Turn the large **FMS** Knob to highlight the AIRPORT, INFO, RUNWAYS, or FREQUENCIES Box (INFO Box shown).

4) Turn the small **FMS** Knob to select the INFO Box choices. If multiple choices are available, scroll to the desired choice with the large **FMS** Knob and press the **ENT** Key to complete the selection.

5) Press the **FMS** Knob again to deactivate the cursor.

Available Information

Press FULL SCN Softkey to Switch Between Full Screen and Chart With Info Window
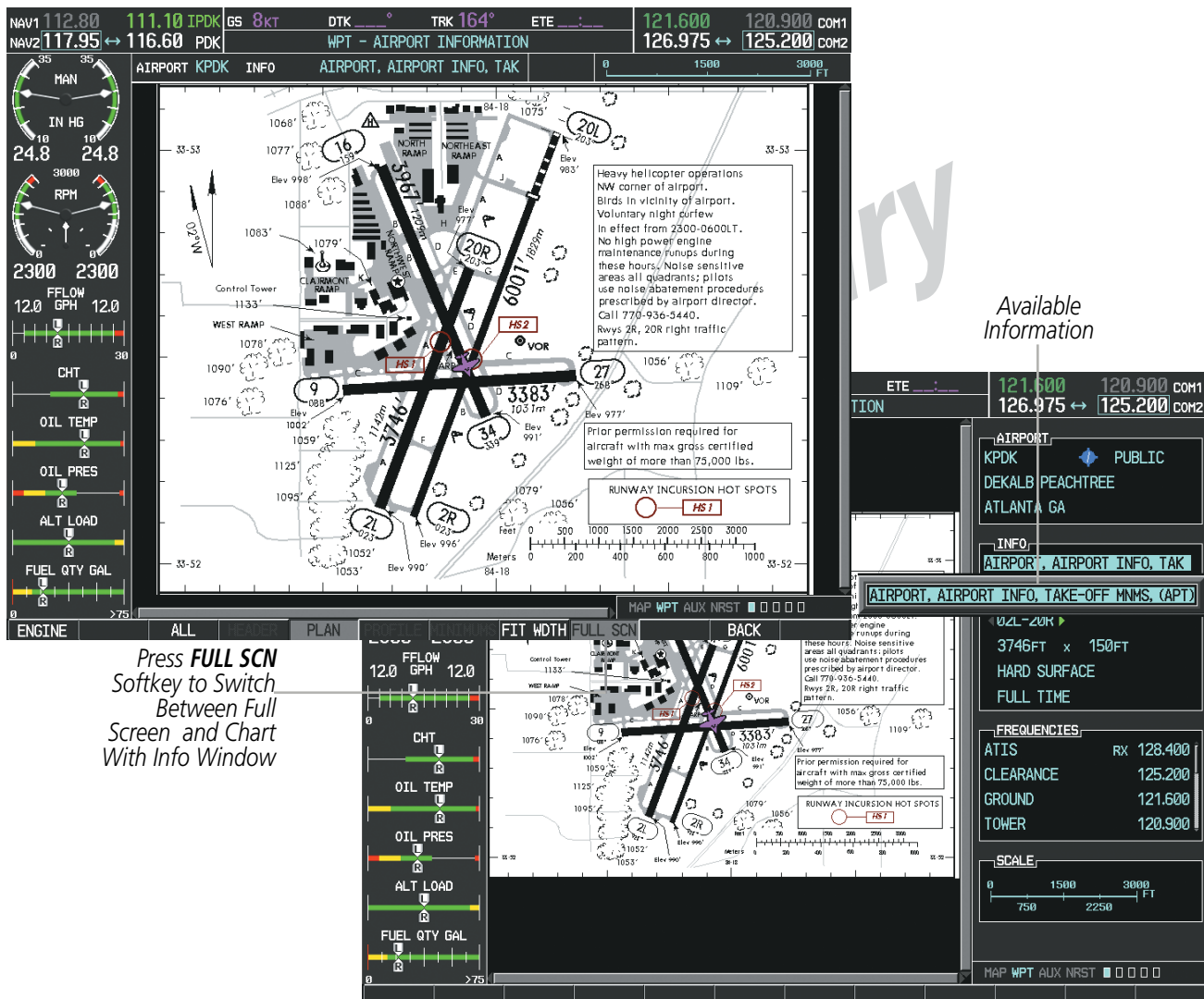
Figure 8-40 Airport Information Page, Full Screen and Info Window

Pressing the **BACK** Softkey, or waiting for 45 seconds reverts to the chart selection softkeys.

The full screen view can also be selected by using the page menu option.

Selecting full screen On or Off:

1) While viewing a terminal chart press the **MENU** Key to display the Page Menu OPTIONS.

2) Turn the large **FMS** Knob to highlight the Chart Setup Menu Option and press the **ENT** Key.

3) Turn the large **FMS** Knob to move between the FULL SCREEN and COLOR SCHEME Options.

4) Turn the small **FMS** Knob to choose between the On and Off Full Screen Options.
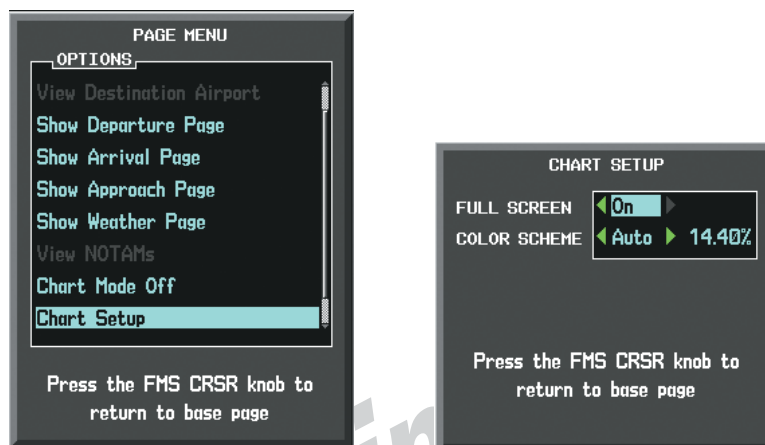
Chart Setup Option   *Full Screen On/Off Selection*

Figure 8-41 Page Menus

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DAY/NIGHT VIEW

ChartView can be displayed on a white or black background for day or night viewing. The Day View offers a better presentation in a bright environment. The Night View gives a better presentation for viewing in a dark environment. When the CHART SETUP Box is selected the G1000 softkeys are blank.

Selecting Day, Night, or Automatic View:

1) While viewing a terminal chart press the **MENU** Key to display the Page Menu OPTIONS.

2) Turn the large **FMS** Knob to highlight the Chart Setup Menu Option and press the **ENT** Key.
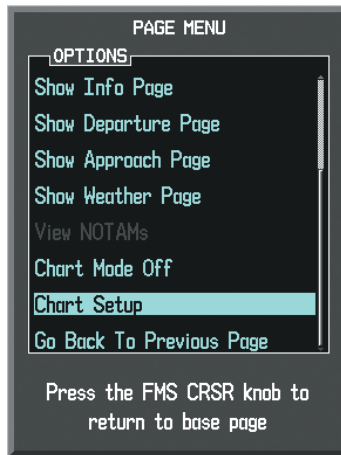
Figure 8-42 Waypoint Information Page, OPTIONS Menu

3) Turn the large **FMS** Knob to move to the COLOR SCHEME Option (Figure 8-43).

4) Turn the small **FMS** Knob to choose between Day, Auto, and Night Options.

5) If Auto Mode is selected, turn the large **FMS** Knob to select the percentage field. Use the small **FMS** Knob to change the percentage value. The percentage value is the day/night crossover point based on the percentage of backlighting intensity. For example, if the value is set to 15%, the day/night display changes when the display backlight reaches 15% of full brightness.

The display must be changed in order for the new setting to become active. This may be accomplished by selecting another page or changing the display range.

6) Press the **FMS** Knob when finished to remove the Chart Setup Menu.

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Figure 8-43 Arrival Information Page, Day View
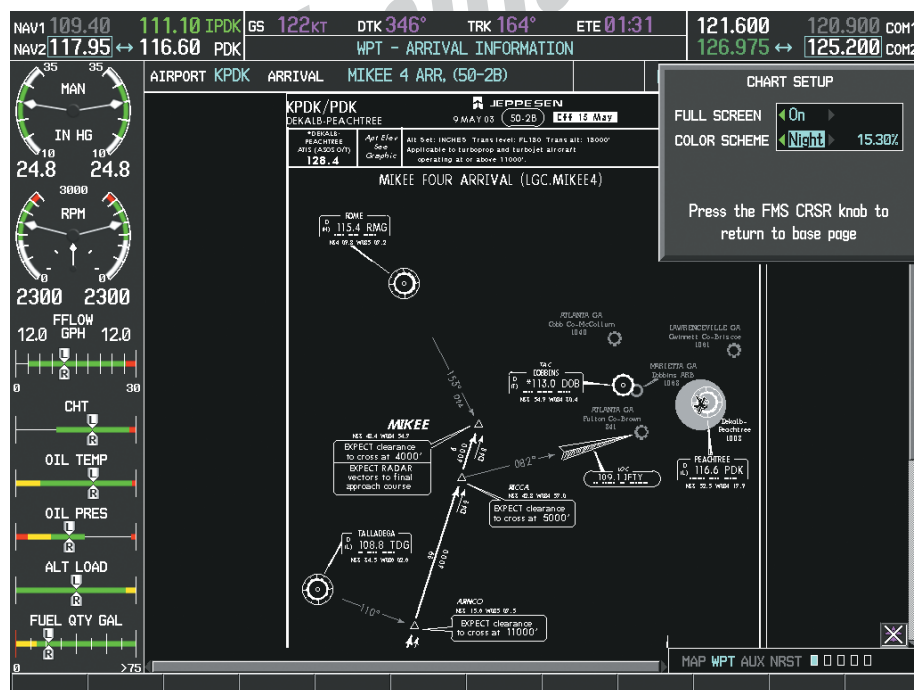
Figure 8-44 Arrival Information Page, Night View

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CHARTVIEW CYCLE NUMBER AND EXPIRATION DATE

ChartView database is revised every 14 days. Charts are still viewable during a period that extends from the cycle expiration date to the disables date. ChartView is disabled 70 days after the expiration date and is no longer available for viewing. When turning on the system, the Power-up Page displays the current status of the ChartView database. See the table below for the various ChartView Power-up Page displays and the definition of each.
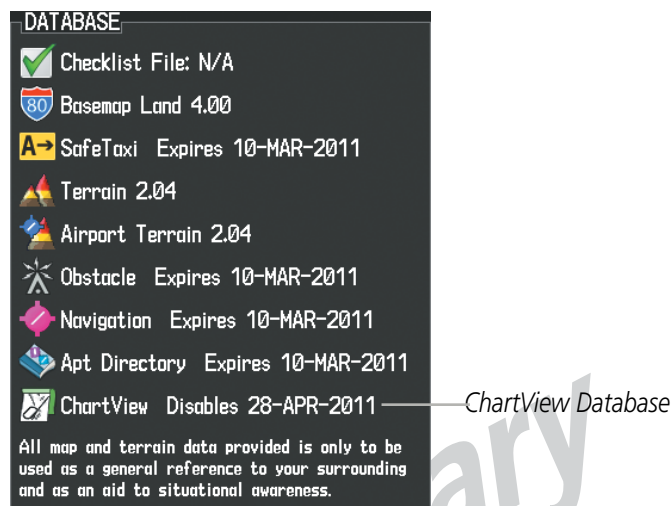
Figure 8-45 Power-up Page, ChartView Database

Power-up Page Display	Definition
	Blank Line. system is not configured for ChartView. Contact a Garmin-authorized service center for configuration.
Chart Data: N/A	System is configured for ChartView but no chart database is installed. Contact Jeppesen for a ChartView database.
ChartView Disables 28-APR-2011	Normal operation. ChartView database is valid and within current cycle.
Chart data update available.	ChartView database is within 1 week after expiration date. A new cycle is available for update.
Chart data is out of date!	ChartView database is beyond 1 week after expiration date, but still within the 70 day viewing period.
Chart data is disabled.	ChartView database has timed out. Database is beyond 70 days after expiration date. ChartView database is no longer available for viewing.
Verify chart database cycle.	System time is not available. GPS satellite data is unknown or the system has not yet locked onto satellites. Check database cycle number for effectivity.
Verifying Chart data	System is verifying chart database when new cycle is installed for the first time.
Chart Data is Corrupt!	After verifying, chart database is found to be corrupt. ChartView is not available.

Table 8-2 ChartView Power-up Page Annunciations and Definitions

The ChartView time critical information can also be found on the AUX - System Status page. The database CYCLE number, EXPIRES, and DISABLES dates of the ChartView subscription appear in either blue or yellow text. When the ChartView EXPIRES date is reached, ChartView becomes inoperative 70 days later. This is shown as the DISABLES date. When the DISABLES date is reached, charts are no longer available for viewing. The **SHW CHRT** Softkey label then appears subdued and is disabled until a revised issue of ChartView is installed.

> **NOTE:** *A subdued softkey label indicates the function is disabled.*

Press the **MFD1 DB** Softkey to place the cursor in the DATABASE window. Scroll through the listed information by turning the **FMS** Knob or pressing the **ENT** Key until the ChartView database information is shown.

The ChartView database cycle number shown in the figure, 1103, is deciphered as follows:

11 – Indicates the year 2011

03 – Indicates the third issue of the ChartView database for the year

The EXPIRES date 17–FEB–11 is the date that this database should be replaced with the next issue.

The DISABLES date 28–APR–11 is the date that this database becomes inoperative.
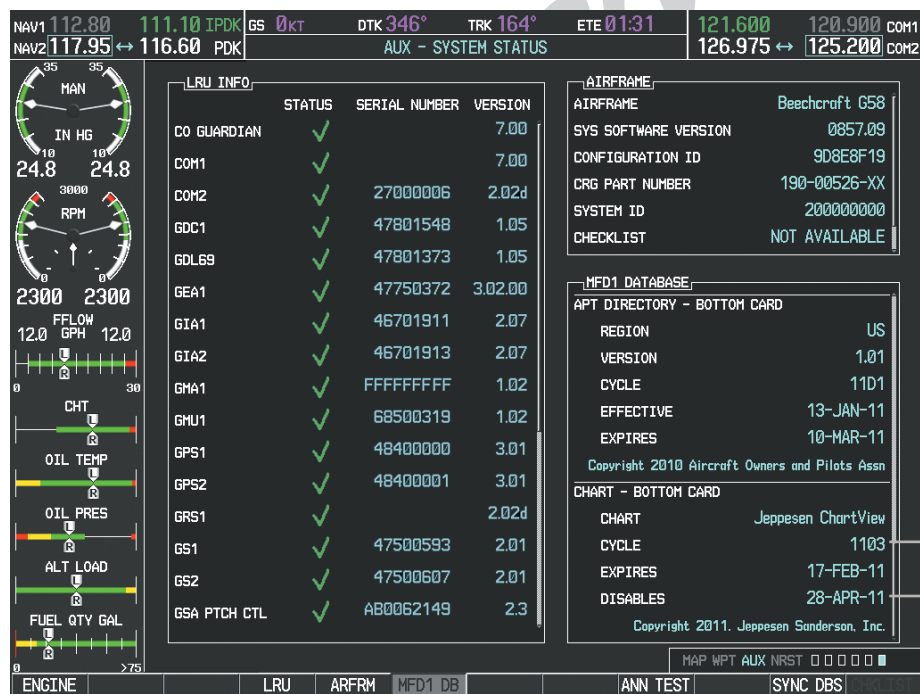
ChartView Data

DBASE Softkey Selected

Figure 8-46 AUX – System Status Page, ChartView Current and Available

The ChartView database is obtained directly from Jeppesen. Refer to Updating Jeppesen Databases in Appendix B for instructions on revising the ChartView database.

Other possible AUX - System Status page conditions are shown in Figure 8-47. The EXPIRES date, in yellow, is the revision date for the next database cycle. The DISABLES date, in yellow, is the date that this database cycle is no longer viewable. CYCLE NOT AVAILABLE in blue, indicates no ChartView data is available on the database card or no database card is inserted.

MFD1 DATABASE		MFD1 DATABASE		MFD1 DATABASE	
APT DIRECTORY - BOTTOM CARD		APT DIRECTORY - BOTTOM CARD		REGION	US
REGION	US	REGION	US	VERSION	1.01
VERSION	1.01	VERSION	1.01	CYCLE	11D1
CYCLE	11D1	CYCLE	11D1	EFFECTIVE	13-JAN-11
EFFECTIVE	13-JAN-11	EFFECTIVE	13-JAN-11	EXPIRES	10-MAR-11
EXPIRES	10-MAR-11	EXPIRES	10-MAR-11	Copyright 2010 Aircraft Owners and Pilots Assn	
Copyright 2010 Aircraft Owners and Pilots Assn		Copyright 2010 Aircraft Owners and Pilots Assn		CHART - UNKNOWN	
CHART - BOTTOM CARD		CHART - BOTTOM CARD		CHART	Jeppesen ChartView
CHART	Jeppesen ChartView	CHART	Jeppesen ChartView	REGION	NOT AVAILABLE
CYCLE	1103	CYCLE	1103	CYCLE	NOT AVAILABLE
EXPIRES	17-FEB-11	EXPIRES	17-FEB-11	EFFECTIVE	__-___-__
DISABLES	28-APR-11	DISABLES	28-APR-11	EXPIRES	__-___-__
Copyright 2011. Jeppesen Sanderson, Inc.		Copyright 2011. Jeppesen Sanderson, Inc.		DISABLES	__-___-__

ChartView has Expired, but is not Disabled   *ChartView Database is Disabled*   *ChartView Database is Not Available*

Figure 8-47 AUX – System Status Page, ChartView Database Status

8.4 FLITECHARTS

FliteCharts resemble the paper version of AeroNav Services terminal procedures charts. The charts are displayed with high-resolution and in color for applicable charts. FliteCharts database subscription is available from Garmin. Available data includes:

- Arrivals (STAR)
- Departure Procedures (DP)
- Approaches
- Airport Diagrams

FLITECHARTS SOFTKEYS

FliteCharts functions are displayed on three levels of softkeys. While on the Navigation Map Page, Nearest Airports Page, or Flight Plan Page, pressing the **SHW CHRT** Softkey displays the available terminal chart and advances to the chart selection level of softkeys: **CHRT OPT**, **CHRT**, **INFO-1**, **INFO-2**, **DP**, **STAR**, **APR**, **WX**, and **GO BACK**. The chart selection softkeys appear on the Airport Information Page.

Pressing the **GO BACK** Softkey reverts to the top level softkeys and previous page.

Pressing the **CHRT OPT** Softkey displays the available terminal chart and advances to the next level of softkeys: **ALL**, **FIT WDTH**, **FULL SCN**, and **BACK**.

While viewing the **CHRT OPT** Softkeys, after 45 seconds of softkey inactivity, the system reverts to the chart selection softkeys.

NOTAMs are not available with FliteCharts. The NOTAM Softkey label appears subdued and is disabled.
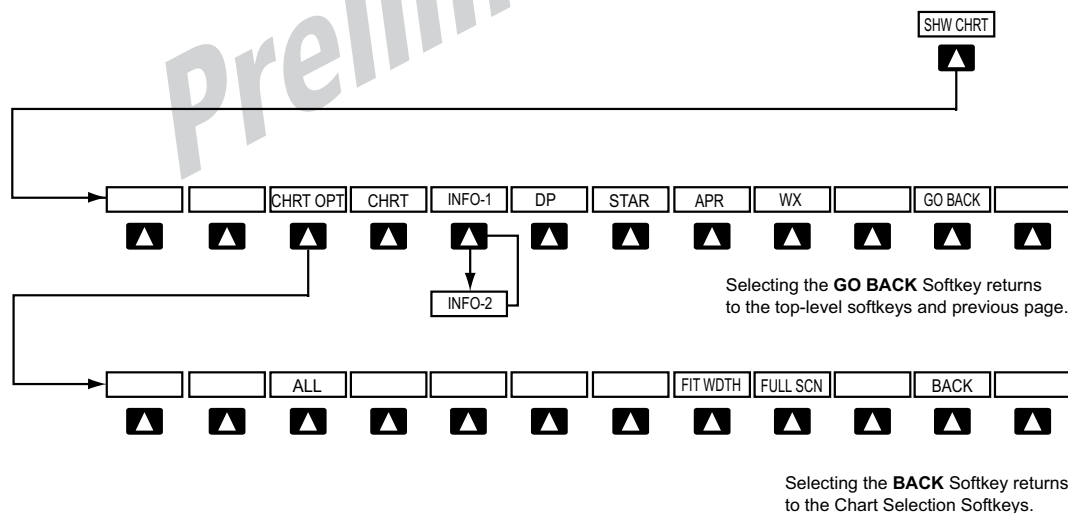
Figure 8-48 FliteCharts SHW CHRT, Chart Selection, and Chart Option Softkeys

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TERMINAL PROCEDURES CHARTS

Selecting Terminal Procedures Charts:

While viewing the Navigation Map Page, Nearest Airport Page, or Flight Plan Page, press the **SHW CHRT** Softkey.

Or:

1) Press the **MENU** Key to display the PAGE MENU.

2) Turn the large **FMS** Knob to scroll through the OPTIONS Menu to Show Chart.

3) Press the **ENT** Key to display the chart.

Navigation Map Page OPTIONS Menu   *Waypoint Airport Information Page OPTIONS Menu*

Figure 8-49 Option Menus

When no terminal procedure chart is available, the banner CHART NOT AVAILABLE appears on the screen. The CHART NOT AVAILABLE banner does not refer to the FliteCharts subscription, but rather the availability of a particular airport chart selection or procedure for a selected airport.

Figure 8-50 Chart Not Available Banner

If there is a problem in rendering the data (such as a data error or a failure of an individual chart), the banner UNABLE TO DISPLAY CHART is then displayed.

Figure 8-51 Unable To Display Chart Banner

When a chart is not available by pressing the **SHW CHRT** Softkey or selecting a Page Menu Option, charts may be obtained for other airports from the WPT Pages or Flight Plan Pages.

If a chart is available for the destination airport, or the airport selected in the active flight plan, the chart appears on the screen. When no flight plan is active, or when not flying to a direct-to destination, pressing the **SHW CHRT** Softkey displays the chart for the nearest airport, if available.

The chart shown is one associated with the WPT – Airport Information page. Usually this is the airport runway diagram. Where no runway diagram exists, but Take Off Minimums or Alternate Minimums are available, that page appears. If Airport Information pages are unavailable, the Approach Chart for the airport is shown.

Selecting a chart:

1) While viewing the Navigation Map Page, Flight Plan Page, or Nearest Airports Page, press the **SHW CHRT** Softkey. The airport diagram or approach chart is displayed on the Airport Information Page.

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

3) Turn the large **FMS** Knob to select either the Airport Identifier Box or the Approach Box. (Press the **APR** Softkey if the Approach Box is not currently shown).

4) Turn the small and large **FMS** Knob to enter the desired airport identifier.

5) Press the **ENT** Key to complete the airport selection.

6) Turn the large **FMS** Knob to select the Approach Box.

7) Turn the small **FMS** Knob to show the approach chart selection choices.

8) Turn either **FMS** Knob to scroll through the available charts.

9) Press the **ENT** Key to complete the chart selection.

Figure 8-52 Approach Information Page, Chart Selection

While the APPROACH Box is selected using the **FMS** Knob, the G1000 softkeys are blank. Once the desired chart is selected, the chart scale can be changed and the chart can be panned using the **Joystick**. Pressing the **Joystick** centers the chart on the screen.

The aircraft symbol is not shown on FliteCharts. The Chart Scale Box displays a banner NOT TO SCALE, and the Aircraft Not Shown Icon is displayed in the lower right corner of the screen.

Pressing the **CHRT** Softkey alternates between the FliteCharts diagram and the associated map in the WPT page group. In the example shown, the **CHRT** Softkey switches between the Charlotte, NC (KCLT) Airport Diagram and the navigation map on the WPT – Airport Information page.

*Press **CHRT** Softkey to Switch Between FliteCharts and Navigation Map Page*
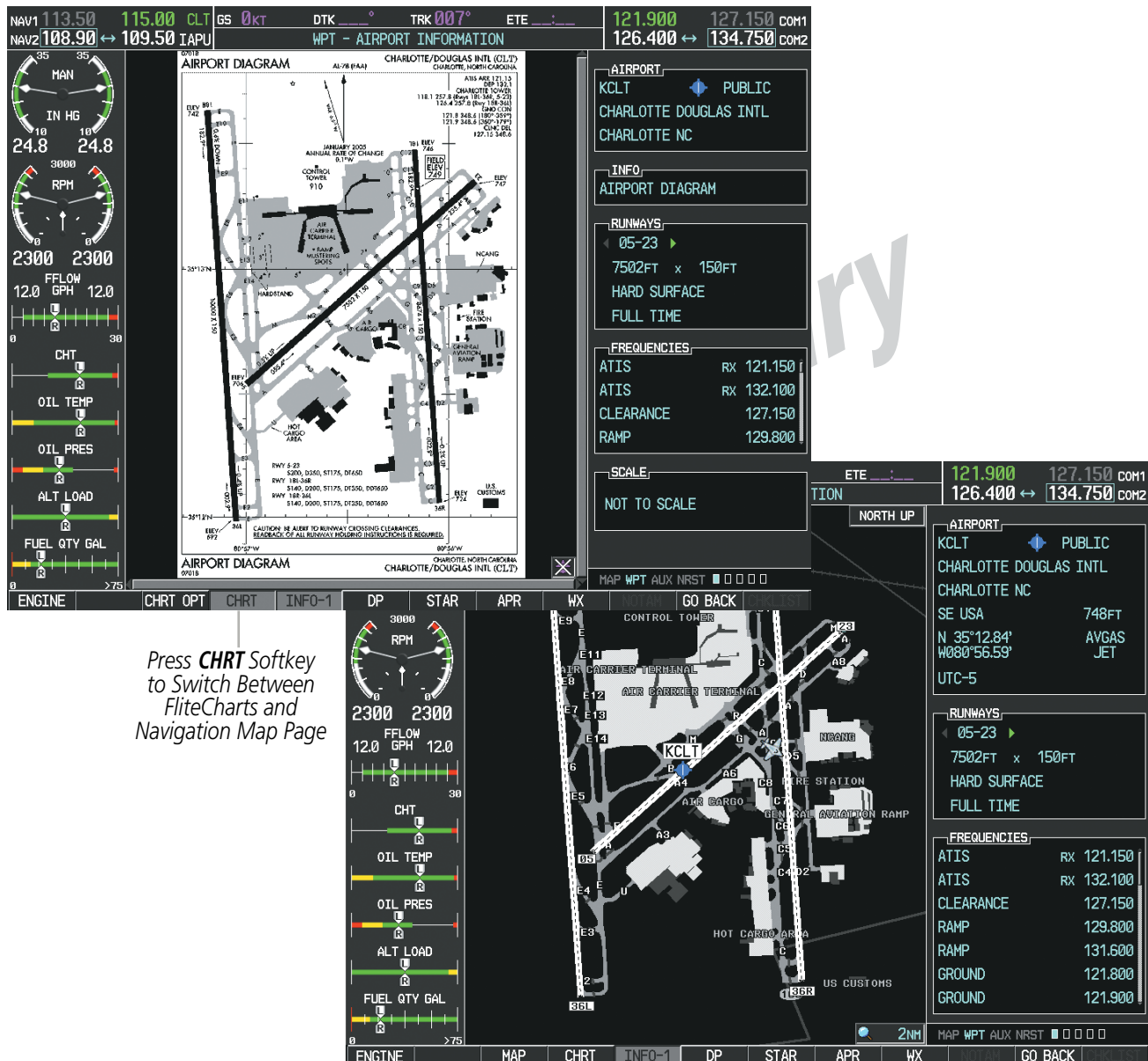
Figure 8-53 CHRT Softkey, Airport Information Page

Pressing the **INFO-1** or **INFO-2** Softkey returns to the airport diagram when the view is on a different chart. If the displayed chart is the airport diagram, the **INFO-1** or **INFO-2** Softkey has no effect.

Another source for additional airport information is from the INFO Box above the chart (Figure 8-52) or to the right of the chart (Figure 8-54) for certain airports. This information source is not related to the **INFO-1** or **INFO-2** Softkey. When the INFO Box is selected using the **FMS** Knob, the G1000 softkeys are blank. The Charlotte, NC airport has three additional charts offering information; the Airport Diagram, Alternate Minimums, and Take-off Minimums.
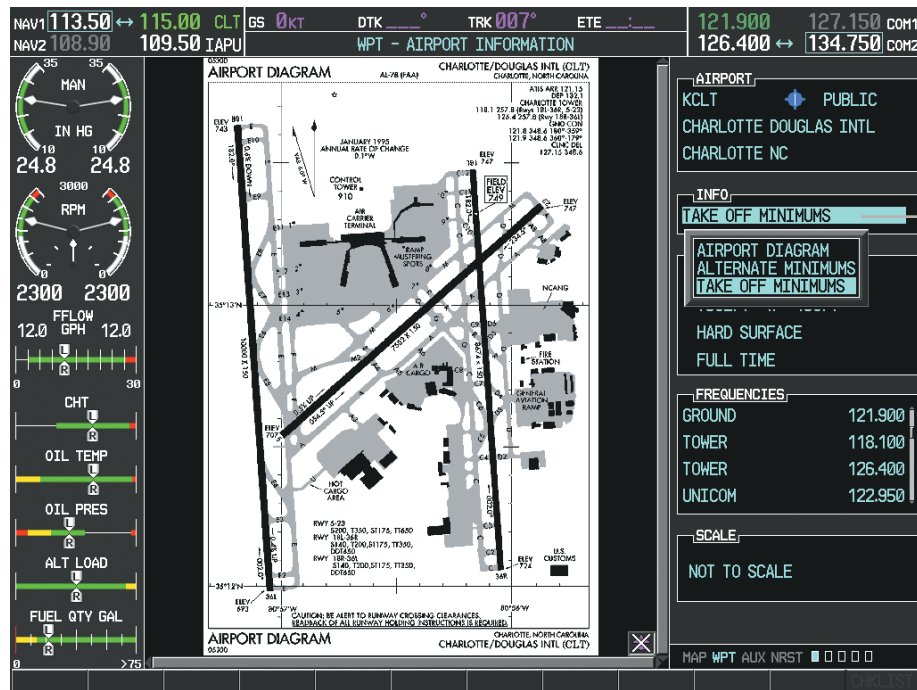
Figure 8-54 Airport Information Page, INFO View with Airport Information

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In the example shown in Figure 8-54, TAKE OFF MINIMUMS is selected. Pressing the **ENT** Key displays the Take-off Minimums and Departure Procedures Chart (Figure 8-55).
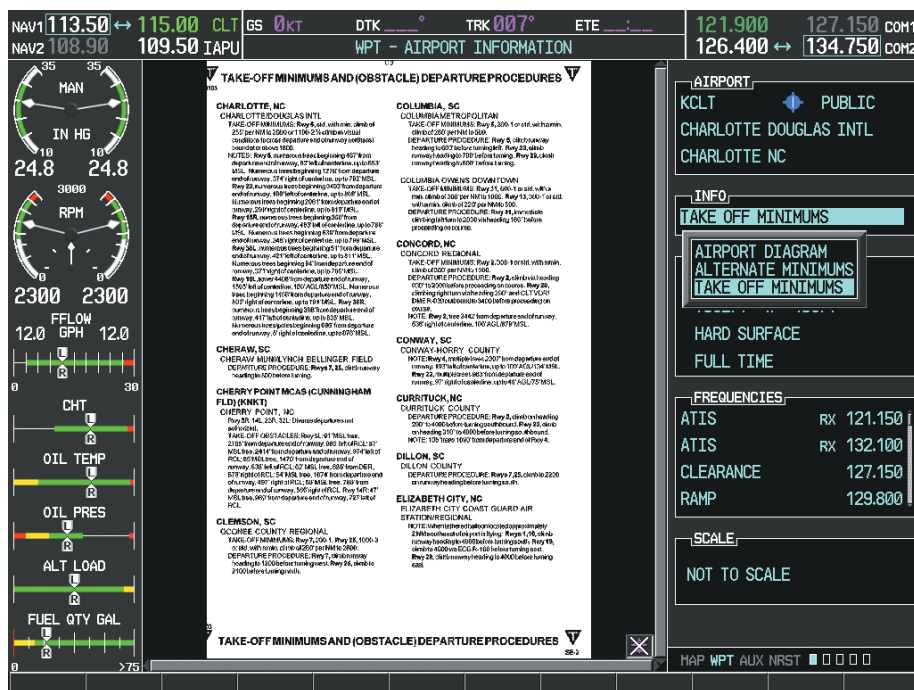
Figure 8-55 Airport Information Page, TAKE OFF MINIMUMS Selected from INFO View

Pressing the **DP** Softkey displays the Departure Procedure Chart if available.
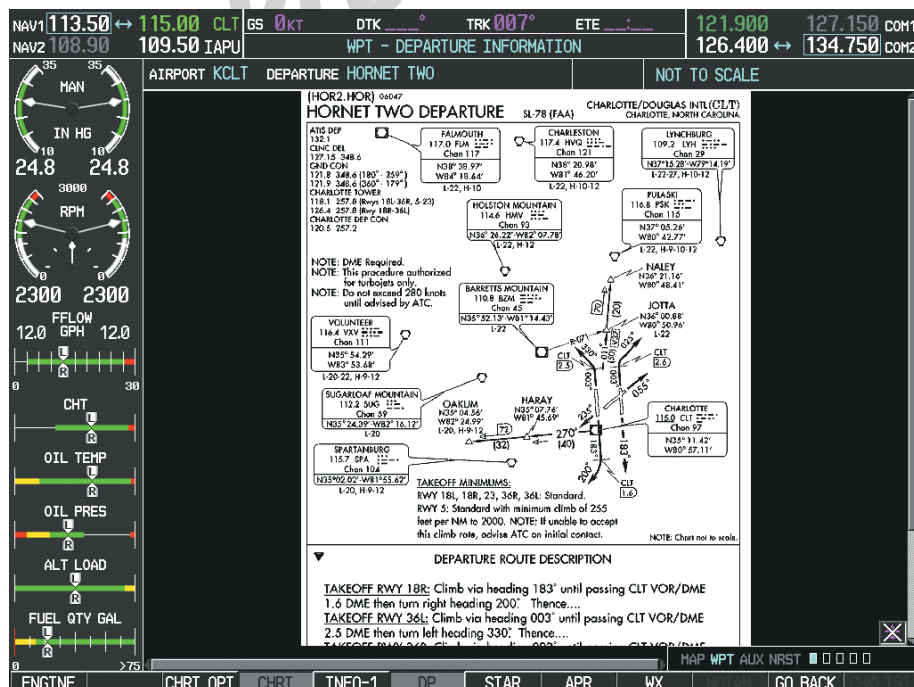
Figure 8-56 Departure Information Page

Pressing the **STAR** Softkey displays the Standard Terminal Arrival Chart if available.
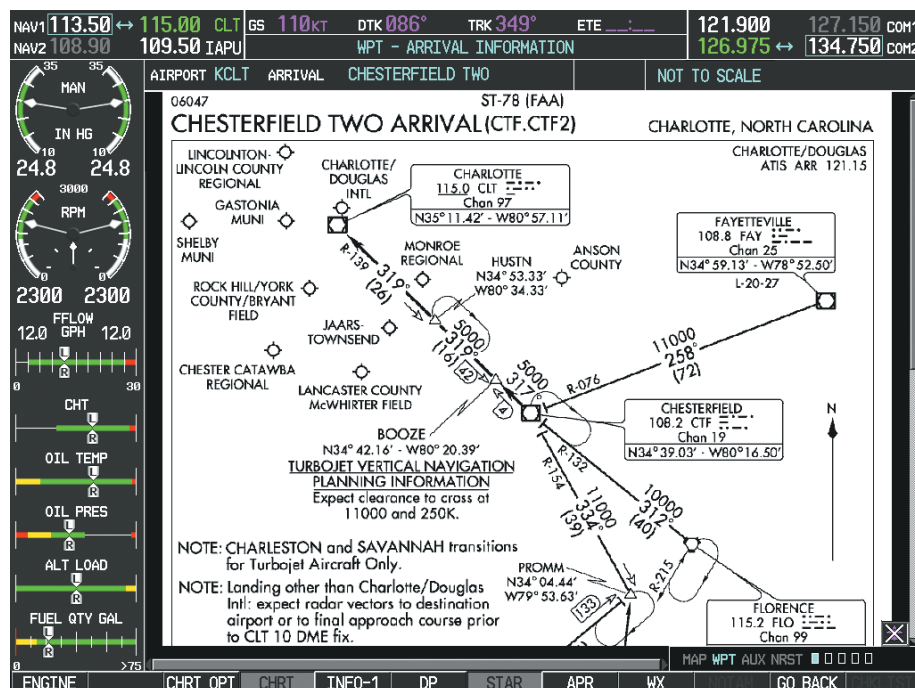
Figure 8-57 Arrival Information Page

Pressing the **APR** Softkey displays the approach chart for the airport if available.
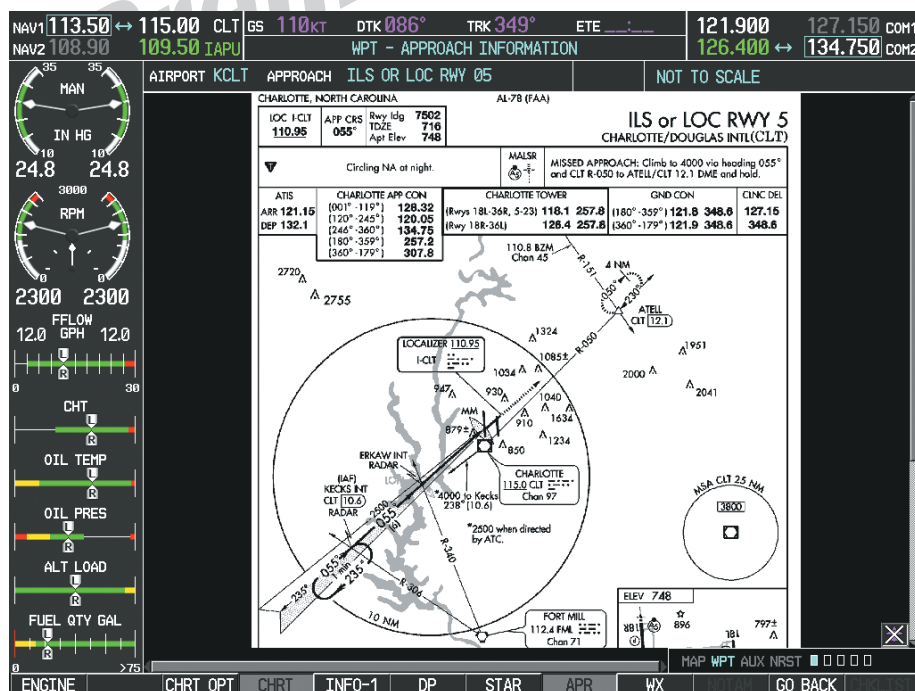
Figure 8-58 Approach Information Page

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Pressing the **WX** Softkey shows the airport weather frequency information, when available, and includes weather data such as METAR and TAF from the XM Data Link Receiver. Weather information is available only when an XM Data Link Receiver is installed and the XM WX Satellite Weather subscription is current.

Selecting Additional Information:

1) While viewing the Airport Taxi Diagram, press the **WX** Softkey to display the information windows (AIRPORT, INFO).

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

3) Turn the large **FMS** Knob to highlight the INFO Box.

4) Turn the small **FMS** Knob to select the INFO Box choices. When the INFO Box is selected the G1000 softkeys are blank. If multiple choices are available, scroll to the desired choice with the large **FMS** Knob and press the **ENT** Key to complete the selection.

5) Press the **FMS** Knob again to deactivate the cursor.
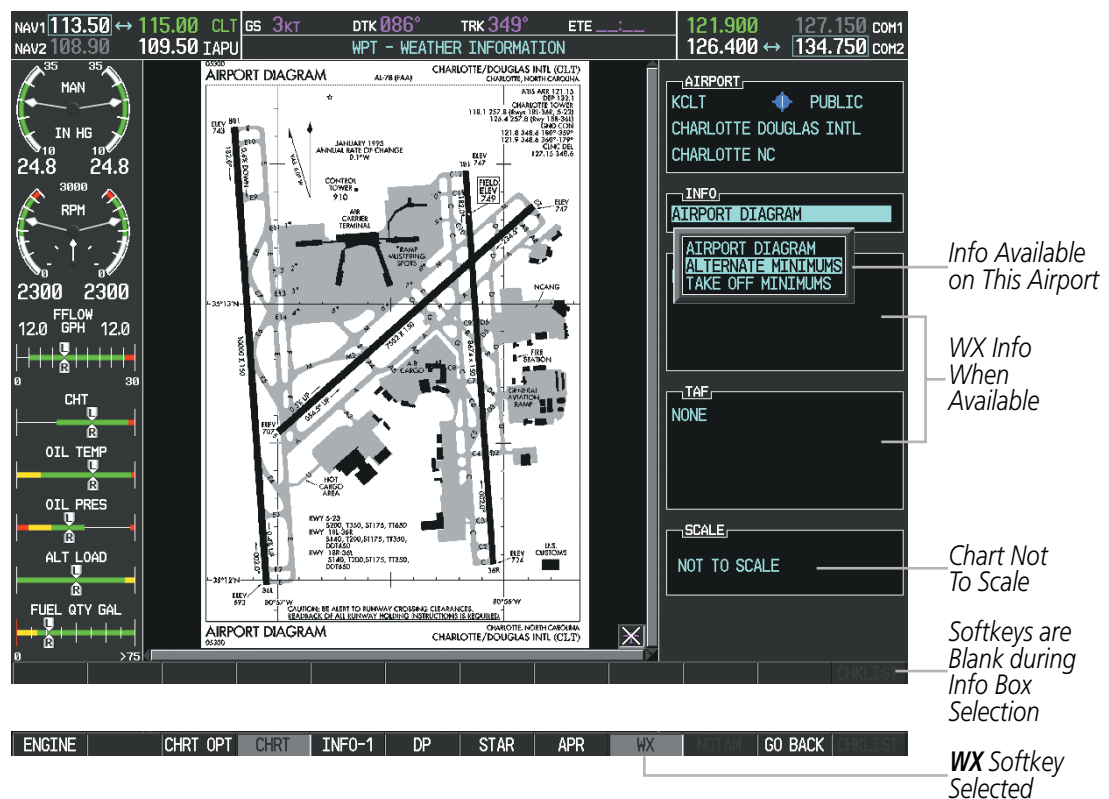
Figure 8-59 Weather Information Page, WX Softkey Selected

Pressing the **GO BACK** Softkey reverts to the previous page (Navigation Map Page or Flight Plan Page).

CHART OPTIONS

Pressing the **CHRT OPT** Softkey displays the next level of softkeys, the chart options level (Figure 8-48).

Pressing the **ALL** Softkey shows the complete chart on the screen.
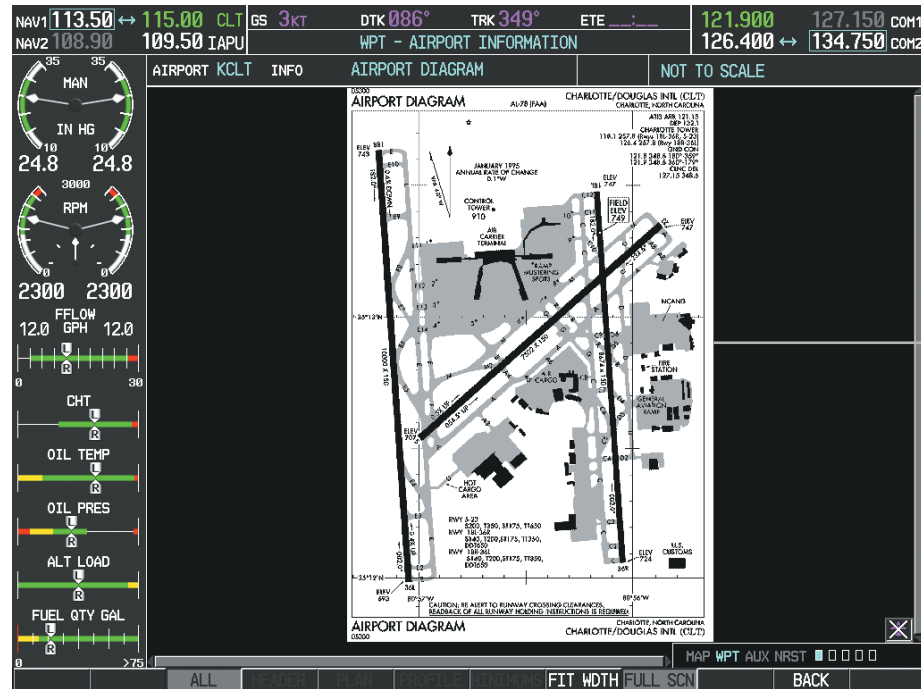
Complete Chart Shown

Figure 8-60 Airport Information Page, ALL View Selected

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Pressing the **FIT WIDTH** Softkey fits the width of the chart in the display viewing area. In the example shown, the chart at close range is replaced with the full width chart.
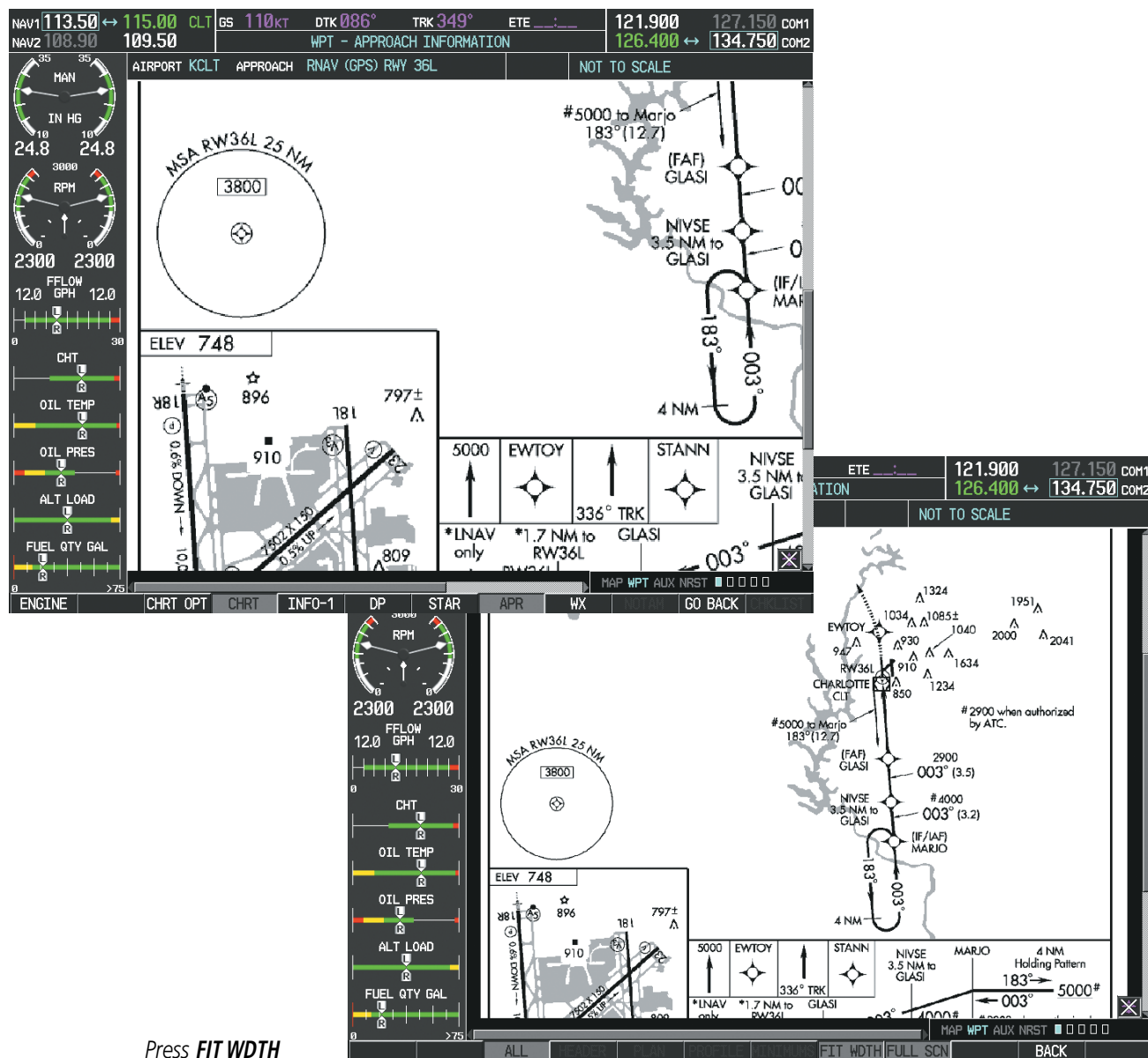
Press FIT WDTH Softkey to Show Full Chart Width

Figure 8-61 Approach Information Page, FIT WDTH Softkey Selected

Pressing the **FULL SCN** Softkey alternates between removing and replacing the data window to the right.

Press FULL SCN Softkey to Switch Between Chart on Full Screen and Chart with Info Window

Figure 8-62 Airport Information Page, Full Screen and Info Window

Pressing the **BACK** Softkey, or waiting for 45 seconds reverts to the chart selection softkeys.

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The full screen view can also be selected by using the page menu option.

Selecting full screen On or Off:

1) While viewing a terminal chart press the **MENU** Key to display the Page Menu OPTIONS.

2) Turn the large **FMS** Knob to highlight the Chart Setup Menu Option and press the **ENT** Key.

3) Turn the large **FMS** Knob to move between the FULL SCREEN and COLOR SCHEME Options.

4) Turn the small **FMS** Knob to choose between the On and Off Full Screen Options.

Chart Setup Option   *Full Screen On/Off Selection*

Figure 8-63 Page Menus

DAY/NIGHT VIEW

FliteCharts can be displayed on a white or black background for day or night viewing. The Day View offers a better presentation in a bright environment. The Night View gives a better presentation for viewing in a dark environment. When the CHART SETUP Box is selected the G1000 softkeys are blank.

Selecting Day, Night, or Automatic View:

1) While viewing a terminal chart press the **MENU** Key to display the Page Menu OPTIONS.

2) Turn the large **FMS** Knob to highlight the Chart Setup Menu Option and press the **ENT** Key.
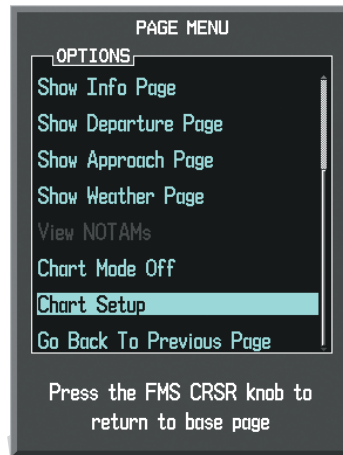
Figure 8-64 Waypoint Information Page, OPTIONS Menu

3) Turn the large **FMS** Knob to move to the COLOR SCHEME Option (Figure 8-65).

4) Turn the small **FMS** Knob to choose between Day, Auto, and Night Options.

5) If Auto Mode is selected, turn the large **FMS** Knob to select the percentage field. Use the small **FMS** Knob to change the percentage value. The percentage value is the day/night crossover point based on the percentage of backlighting intensity. For example, if the value is set to 15%, the day/night display changes when the display backlight reaches 15% of full brightness.

The display must be changed in order for the new setting to become active. This may be accomplished by selecting another page or changing the display range.

6) Press the **FMS** Knob when finished to remove the Chart Setup Menu.

Figure 8-65 Approach Information Page, Day View
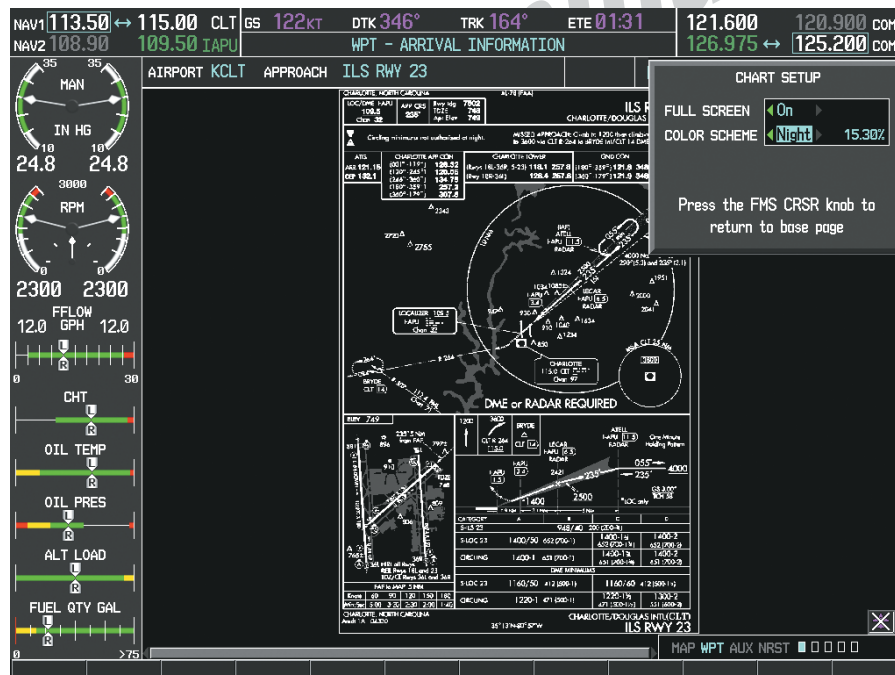
Figure 8-66 Approach Information Page, Night View

FLITECHARTS CYCLE NUMBER AND EXPIRATION DATE

FliteCharts data is revised every 28 days. Charts are still viewable during a period that extends from the cycle expiration date to the disables date. FliteCharts are disabled 180 days after the expiration date and are no longer available for viewing upon reaching the disables date. When turning on the system, the Power-up Page displays the current status of the FliteCharts database. See the table below for the various FliteCharts Power-up Page displays and the definition of each.
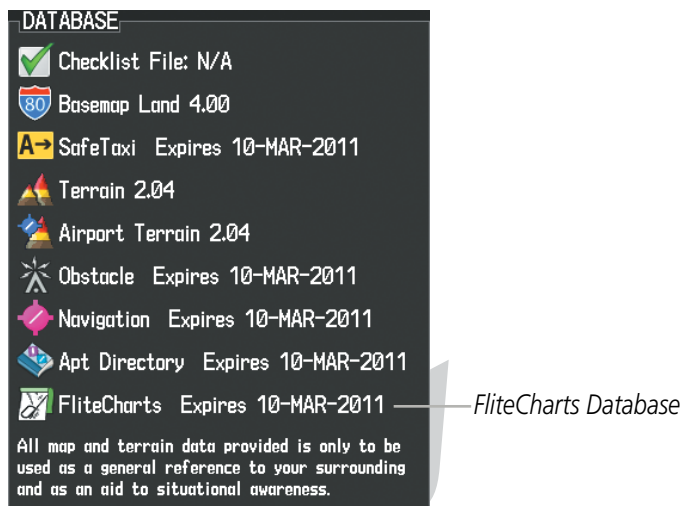
Figure 8-67 Power-up Page, FliteCharts Database

Power-up Page Display	Definition
	Blank Line. system is not configured for FliteCharts. Contact a Garmin-authorized service center for configuration.
Chart Data: N/A	System is configured for FliteCharts but no chart database is installed. Refer to Updating Garmin Databases in Appendix B for the FliteCharts database
FliteCharts Expires 10-MAR-2011	Normal operation. FliteCharts database is valid and within current cycle.
Chart data is out of date!	FliteCharts database is beyond the expiration date, but still within the 180 day viewing period.
Chart data is disabled.	FliteCharts database has timed out. Database is beyond 180 days after expiration date. FliteCharts database is no longer available for viewing.

Table 8-3 FliteCharts Power-up Page Annunciations and Definitions

Other possible AUX - System Status page conditions are shown in Figure 8-68. 'FliteCharts Expires' plus a date in white, indicates the chart database is current. 'Chart data is out of date!' in yellow, indicates charts are still viewable, but approaching the disable date.

When the 180 day grace period has expired, 'Chart data is disabled.' in yellow indicates that the FliteCharts database has expired and is no longer viewable. 'Chart Data: N/A' appears in white if no FliteCharts data is available on the database card or no database card is inserted.

FliteCharts time critical information can also be found on the AUX - System Status page. The FliteCharts database REGION, CYCLE number, EFFECTIVE, EXPIRES, and DISABLES dates of the subscription appear in either blue or yellow text. Dates shown in blue are current data. Dates shown in yellow indicate the data is not within the current subscription period.

FliteCharts becomes inoperative 180 days after the FliteCharts EXPIRES date is reached, and is no longer available for viewing. This date is shown as the DISABLES date. After the disable date the **SHW CHRT** Softkey label appears subdued and is unavailable until a revised issue of FliteCharts is installed.

> **NOTE:** *A subdued softkey label indicates the function is disabled.*

Press the **MFD1 DB** Softkey to place the cursor in the DATABASE window. Scroll through the listed information by turning the **FMS** Knob or pressing the **ENT** Key until the FliteCharts database information is shown.

The FliteCharts database cycle number shown in the figure, 1102, is deciphered as follows:

11 – Indicates the year 2011

02 – Indicates the second issue of the FliteCharts database for the year

The FliteCharts EFFECTIVE date 10–FEB–11 is the first date that this database is current.

The FliteCharts EXPIRES date 10–MAR–11 is the last date that this database is current.

The DISABLES date 06–SEP–11 is the date that this database becomes inoperative.
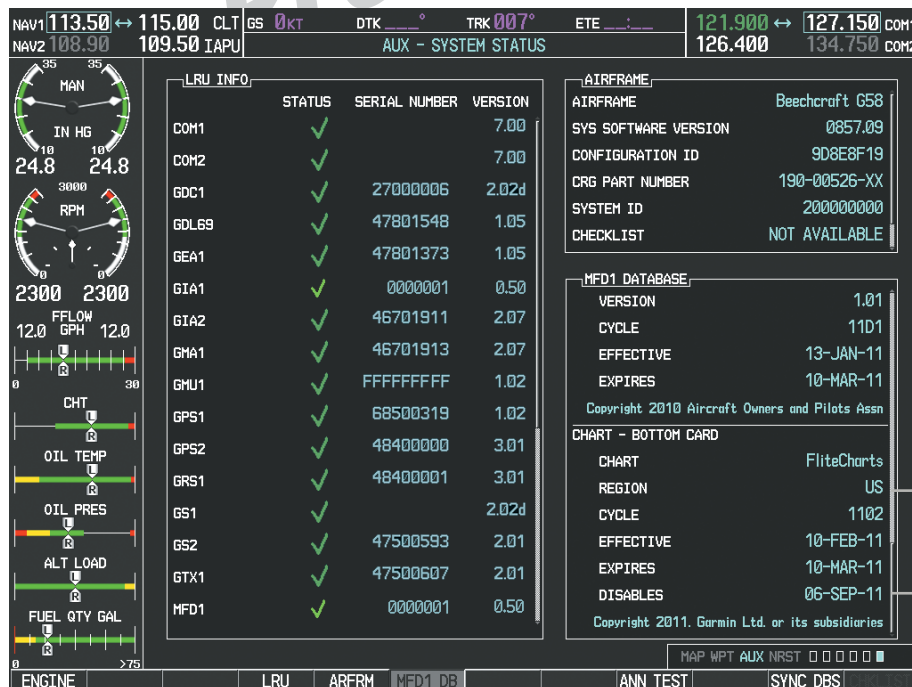
Figure 8-68 AUX – System Status Page, FliteCharts Current and Available

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The FliteCharts database is provided from Garmin. Refer to Updating Garmin Databases in Appendix B for instructions on revising the FliteCharts database.

The other four possible AUX - System Status page conditions are shown here. The EFFECTIVE date, in yellow, indicates the current date preceeds the date the FliteCharts database becomes effective. The EXPIRES date, in yellow, is the revision date for the next database cycle. The DISABLES date, in yellow, is the date that this database cycle is no longer viewable. NOT AVAILABLE in blue, indicate the FliteCharts database is not available on the database card or no database card is inserted.

Current Date is Before Effective Date   *FliteCharts Expired, but is not Disabled*   *FliteCharts Database is Disabled*

FliteCharts Database is Not Available
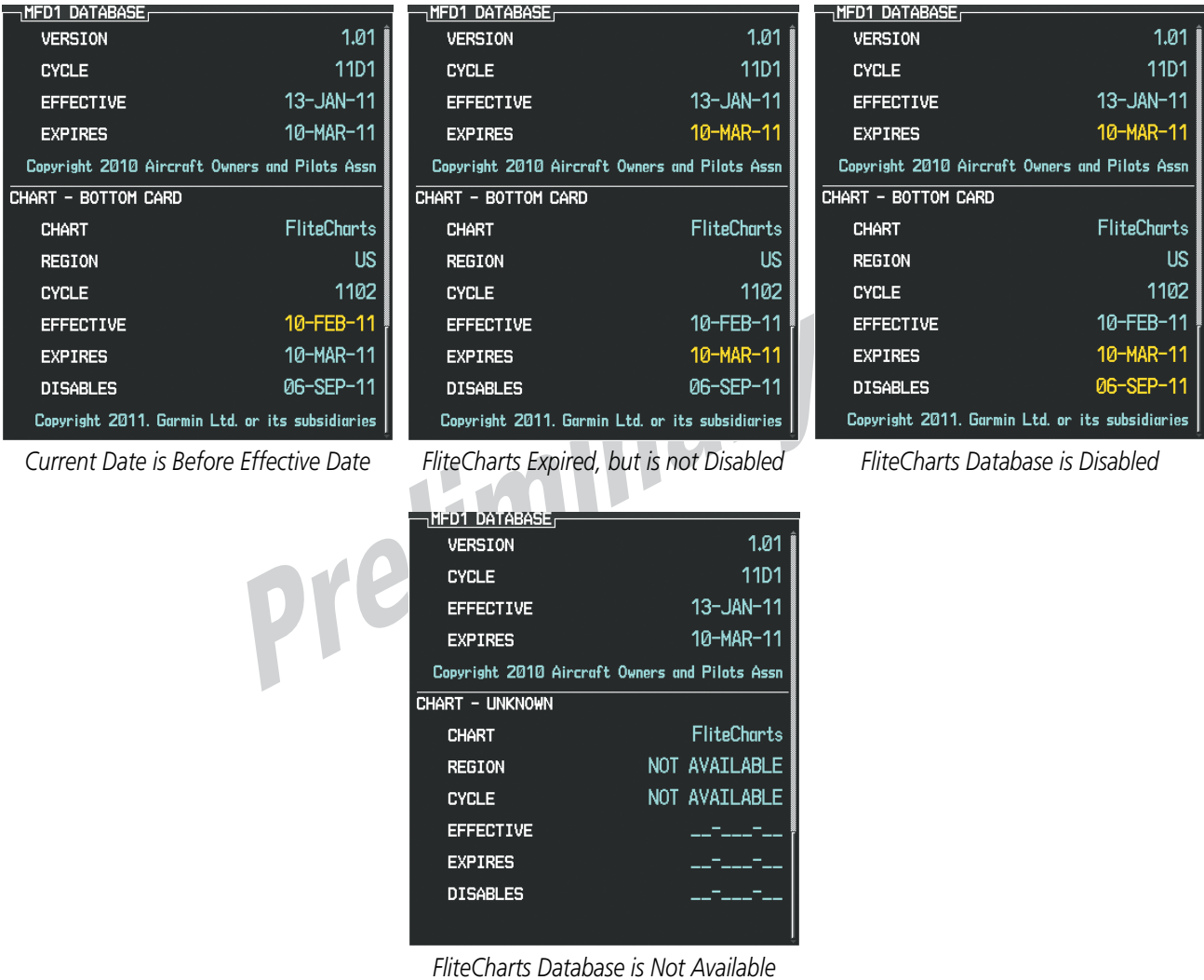
Figure 8-69 AUX – System Status Page, FliteCharts Datbase Status

8.5 AOPA AIRPORT DIRECTORY

The Aircraft Owners and Pilots Association (AOPA) Airport Directory database offers detailed information regarding services, hours of operation, lodging options, and more. This information is viewed on the Airport Directory Page as shown in Figure 8-70.

Selecting the Airport Directory Page:

1) Turn the large **FMS** Knob to select the 'WPT' page group.

2) Turn the small **FMS** Knob to select the AIRPORT INFORMATION Page. Initially, information for the airport closest to the aircraft's present position is displayed.

3) If necessary, select the INFO softkey until **INFO-2** is displayed.

Figure 8-70 AOPA Information on the Airport Information Page

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AOPA DATABASE CYCLE NUMBER AND REVISION

The AOPA Airport Directory database is revised four times per year. Check fly.garmin.com for the current database. The Airport Directory is always available for use after the expiration date. When turning on the system, the Power-up Page indicates whether the databases are current, out of date, or not available.
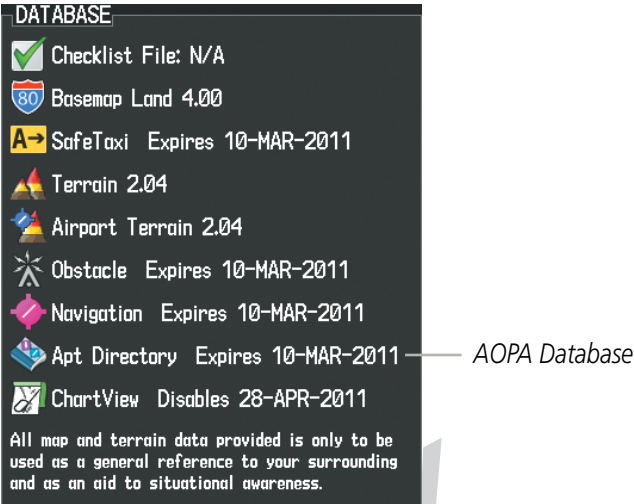
Figure 8-71 Power-up Page, Airport Directory Database

Power-up Page Display	Definition
Apt Directory Expires 10-MAR-2011	Normal operation. AOPA Airport Directory database is valid and within current cycle.
Apt Directory Expires 10-MAR-2011	AOPA Airport Directory database has expired.
Apt Directory N/A	Database card contains no AOPA Airport Directory data.

Table 8-4 Airport Directory Annunciation Definitions

The Airport Directory Region, Version, Cycle, Effective date and Expires date of the database cycle can also be found on the AUX - System Status page, as seen in Figure 8-72.

Press the **MFD1 DB** Softkey to place the cursor in the DATABASE window. Scroll through the listed information by turning the **FMS** Knob or pressing the **ENT** Key until the Airport Directory database information is shown.

The Airport Directory database cycle number shown in the figure, 11D1, is deciphered as follows:

11 – Indicates the year 2011

D – Indicates the data is for Airport Directory

1 – Indicates the first issue of the Airport Directory database for the year

The Airport Directory EFFECTIVE date 13–JAN–11 is the beginning date for the current database cycle. The Airport Directory EXPIRES date 10–MAR–11 is the revision date for the next database cycle.
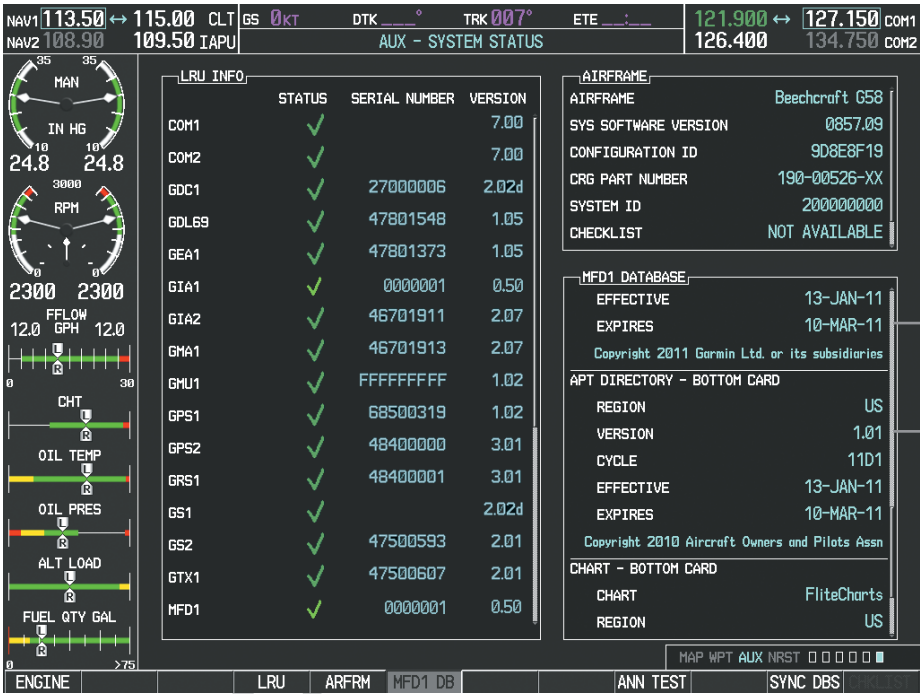
Figure 8-72 AUX – System Status Page, Airport Directory Current Information

Airport Directory information appears in blue and yellow text. The EFFECTIVE date appears in blue when data is current and in yellow when the current date is before the effective date. The EXPIRES date appears in blue when data is current and in yellow when expired (Table 8-4). NOT AVAILABLE appears in blue in the REGION field if Airport Directory data is not available on the database card. An expired Airport Directory database is not disabled and will continue to function indefinitely.

8.6 SIRIUSXM SATELLITE RADIO ENTERTAINMENT

> **NOTE:** Refer to the Hazard Avoidance Section for information about XM WX Satellite Weather products.

The optional SiriusXM Satellite Radio entertainment feature of the GDL 69A Data Link Receiver is available for the pilot's and passengers' enjoyment. The GDL 69A can receive SiriusXM Satellite Radio entertainment services at any altitude throughout the Continental U.S. Entertainment audio is not available on the GDL 69 Data Link Receiver.

SiriusXM Satellite Radio offers a variety of radio programming over long distances without having to constantly search for new stations. Based on signals from satellites, coverage far exceeds land-based transmissions. SiriusXM Satellite Radio services are subscription-based. For more information on specific service packages, visit www.siriusxm.com.

ACTIVATING SIRIUSXM SATELLITE RADIO SERVICES

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

It is not required to activate both the entertainment and weather service subscriptions with the GDL 69A. Either or both services can be activated. SiriusXM Satellite Radio uses one or both of the coded IDs to send an activation signal that, when received by the GDL 69A, allows it to play entertainment programming.

These IDs are located:

• On the label on the back of the Data Link Receiver

• On the XM Information Page on the MFD (Figure 8-73)

• On the XM Satellite Radio Activation Instructions included with the unit (available at www.garmin.com, P/N 190-00355-04)

Contact the installer if the Data Radio ID and the Audio Radio ID cannot be located.

> **NOTE:** The **LOCK** Softkey on the XM Information Page (Auxiliary Page Group) is used to save GDL 69A activation data when the SiriusXM services are initially set up. It is not used during normal SiriusXM Radio operation, but there should be no adverse effects if inadvertently pressed during flight. Refer to the GDL 69/69A XM Satellite Radio Activation Instructions (190-00355-04, Rev H or later) for further information.

Activating the SiriusXM Satellite Radio services:

1) Contact SiriusXM Satellite Radio. Follow the instructions provided by SiriusXM Satellite Radio services.

2) Select the Auxiliary Page Group.

3) Select the next to last page in the AUX Page Group.

4) Press the **INFO** Softkey to display the XM Information Page.

5) Verify that the desired services are activated.

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6) Press the **LOCK** Softkey.

7) Turn the large **FMS** Knob to highlight YES.

8) To complete activation, press the **ENT** Key.

Figure 8-73 XM Information Page

If XM WX Satellite Weather services have not been activated, all the weather product boxes are blank on the XM Information Page and a yellow Activation Required message is displayed in the center of the Weather Data Link Page (Map Page Group). The Service Class refers to the groupings of weather products available for subscription.

USING SIRIUSXM SATELLITE RADIO

The XM Radio Page provides information and control of the audio entertainment features of the SiriusXM Satellite Radio.

Selecting the XM Radio Page:

1) Turn the large **FMS** Knob to select the Auxiliary Page Group.

2) Turn the small **FMS** Knob to select the displayed AUX - XM Information Page.

3) Press the **RADIO** Softkey to show the XM Radio Page where audio entertainment is controlled.

Figure 8-74 XM Radio Page

ACTIVE CHANNEL AND CHANNEL LIST

The Active Channel Box on the XM Radio Page displays the currently selected channel that the SiriusXM Radio is using.

The Channels List Box of the XM Radio Page shows a list of the available channels for the selected category. Channels can be stepped through one at a time or may be selected directly by channel number.

Selecting a channel from the channel list:

1) While on the XM Radio Page, press the **CHNL** Softkey.

2) Press the **CH +** Softkey to go up through the list in the Channel Box, or move down the list with the **CH –** Softkey.

   Or:

1) Press the **FMS** Knob to highlight the channel list and turn the large **FMS** Knob to scroll through the channels.

2) Press the **ENT** Key to activate the selected channel.

Selecting a channel directly:

1) While on the XM Radio Page, press the **CHNL** Softkey.

2) Press the **DIR CH** Softkey. The channel number in the Active Channel Box is highlighted.

3) Press the numbered softkeys located on the bottom of the display to directly select the desired channel number.

4) Press the **ENT** Key to activate the selected channel.

CATEGORY

The Category Box of the XM Radio Page displays the currently selected category of audio. Categories of channels such as jazz, rock, or news can be selected to list the available channels for a type of music or other contents. One of the optional categories is PRESETS to view channels that have been programmed.

Selecting a category:

1) Press the **CATGRY** Softkey on the XM Radio Page.

2) Press the **CAT +** and **CAT -** Softkeys to cycle through the categories.

Or:

Turn the small **FMS** Knob to display the Categories list. Highlight the desired category with the small **FMS** Knob and press the **ENT** Key. Selecting All Categories places all channels in the list.

Figure 8-75 Categories List

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PRESETS

Up to 15 channels from any category can be assigned a preset number. The preset channels are selected by pressing the **PRESETS** and **MORE** Softkeys. Then the preset channel can be selected directly and added to the channel list for the Presets category.

Setting a preset channel number:

1) On the XM Radio Page, while listening to an Active Channel that is wanted for a preset, press the **PRESETS** Softkey to access the first five preset channels (**PS1 - PS5**).

2) Press the **MORE** Softkey to access the next five channels (**PS6 – PS10**), and again to access the last five channels (**PS11 – PS15**). Pressing the **MORE** Softkey repeatedly cycles through the preset channels.

3) Press any one of the (**PS1 - PS15**) softkeys to assign a number to the active channel.

4) Press the **SET** Softkey on the desired channel number to save the channel as a preset.

*Press **PRESETS** to Access the Preset Channels Softkeys*

*Press **SET** to Save Each Preset Channel*

*Press **MORE** to Cycle Through the Preset Channels*
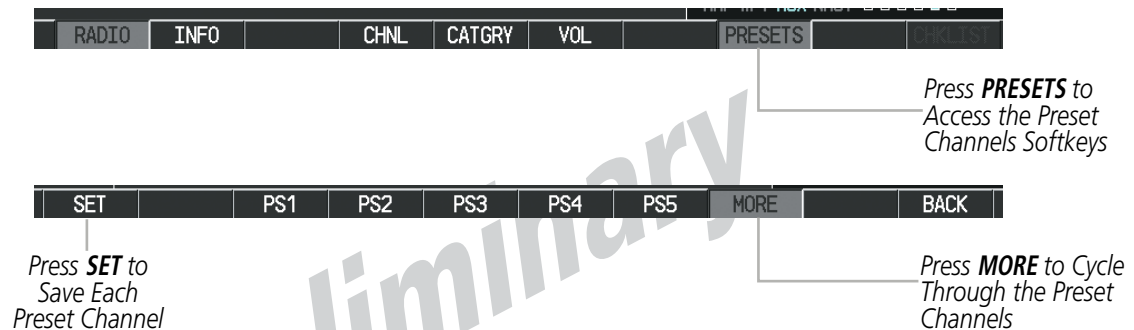
Figure 8-76 Accessing and Selecting XM Preset Channels

Pressing the **BACK** Softkey, or waiting during 45 seconds of softkey inactivity, returns the system to the top level softkeys.

VOLUME

Radio volume is shown as a percentage of full volume. Volume level is controlled by pressing the **VOL** Softkey, which brings up the **MUTE** Softkey and the volume increase and decrease softkeys.

Adjusting the volume:

1) With the XM Radio Page displayed, press the **VOL** Softkey.

2) Press the **VOL –** Softkey to reduce volume or press the **VOL +** Softkey to increase volume. (Once the **VOL** Softkey is pressed, the volume can also be adjusted using the small **FMS** Knob.)

3) Press the **MUTE** Softkey to mute the audio. Press the **MUTE** Softkey again to unmute the audio.
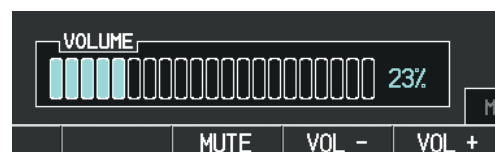
Figure 8-77 Volume Control

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AUTOMATIC AUDIO MUTING

SiriusXM Radio audio is muted automatically when the aircraft groundspeed exceeds approximately 30 knots and the airspeed is less than approximately 80 knots. The audio is not unmuted automatically. The audio must be manually unmuted once the aircraft is airborne and outside the applicable speed range. Automatic Audio Muting has been implemented to meet regulatory requirements that the aural stall warning be heard.

When the aircraft is operating within the automute airspeed range, the **MUTE** Softkey and the volume softkeys are subdued, and the Unmute selection of the Page Menu is unavailable, preventing the audio from being unmuted at this time.

Audio availability conforms to the following three states:

- Audio is available on the ground until the aircraft exceeds 30 knots

- Audio is automatically muted (not available) from Airborne Status up to 80 knots airspeed

- Audio is available when airspeed is over 80 knots

> **Unmuting SiriusXM audio:**
>
> 1) With the XM Radio Page displayed, press the **VOL** Softkey.
>
> 2) Press the **MUTE** Softkey to restore (unmute) SiriusXM Audio.

*Pressing the **MUTE** Softkey When Airborne Unmutes XM Audio*
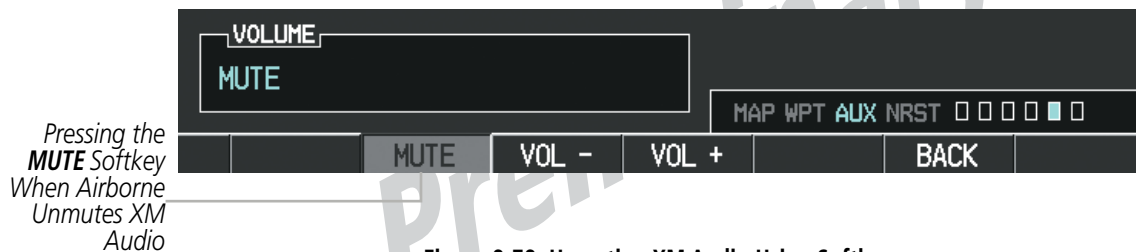
Figure 8-78 Unmuting XM Audio Using Softkeys

> **Or**:
>
> 1) While on either the XM – Radio Page or the XM – Information Page, press the **MENU** Key to display the PAGE MENU.
>
> 2) Turn the large **FMS** Knob to select the Unmute option.
>
> 3) Press the **ENT** Key to restore (unmute) SiriusXM Audio.
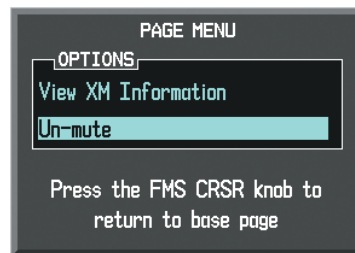
Figure 8-79 Unmuting XM Audio with the Page Menu

8.7 SCHEDULER

The Scheduler feature can be used to enter and display reminder messages (e.g., Change oil, Switch fuel tanks, or Altimeter-Transponder Check) 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, all messages are retained until deleted, and message timer countdown is resumed.
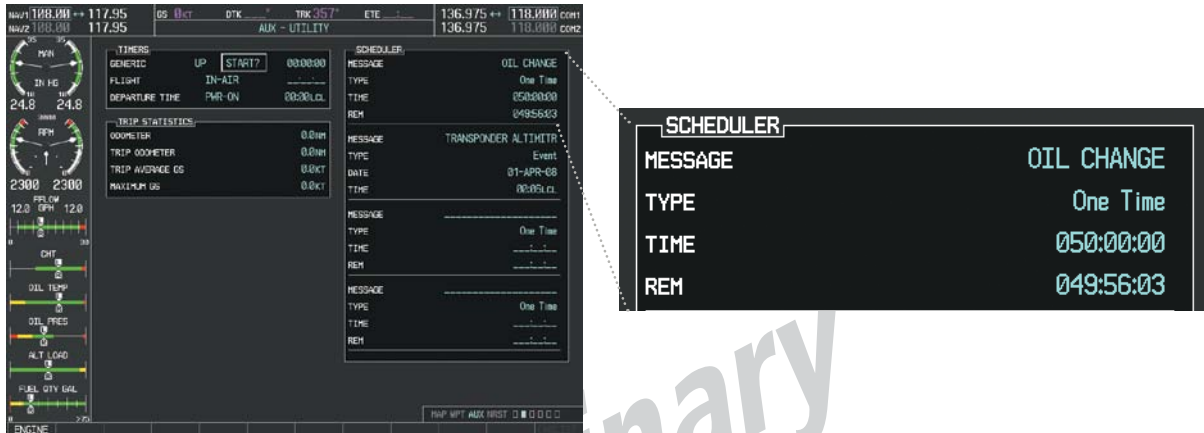
Figure 8-80 Scheduler (Utility Page)

Entering a scheduler message:

1) Select the AUX - Utility Page.

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

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

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

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

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

   • Event—Message issued at the specified date/time

   • One-time—Message issued when the message timer reaches zero (default setting)

   • Periodic—Message issued each time the message timer reaches zero

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

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

9) For event-based messages:

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

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

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

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

Deleting a scheduler message:

1) Select the AUX - Utility Page.

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

3) Turn the large **FMS** Knob to highlight the name field of the scheduler message to be deleted.

4) Press the **CLR** Key to clear the message text. If the **CLR** Key is pressed again, the message is restored.

5) Press the **ENT** Key while the message line is cleared to clear the message time.

Scheduler messages appear in the Alerts Window on the PFD. When a scheduler message is waiting, the **ALERTS** Softkey label changes to ADVISORY. Pressing the **ADVISORY** Softkey opens the Alerts Window and acknowledges the scheduler message. The softkey label reverts to ALERTS when pressed, the Alerts Window is removed from the display, and the scheduler message is deleted from the message queue.

Figure 8-81 PFD Alerts Window

8.8 FLIGHT DATA LOGGING

NOTE: *Some aircraft installations may not provide all aircraft/engine data capable of being logged by the system.*

The Flight Data Logging feature will automatically store critical flight and engine data on an SD data card (up to 16GB) inserted into the top card slot of the MFD. Approximately 1,000 flight hours can be recorded for each 1GB of available space on the card.

Data is written to the SD card once each second while the MFD is powered on. All flight data logged on a specific date is stored in a file named in a format which includes the date, time, and nearest airport identifier. The file is created automatically each time the G1000 system is powered on, provided an SD card has been inserted.

The status of the Flight Data Logging feature can be viewed on the AUX-UTILITY Page. If no SD card has been inserted, "NO CARD" is displayed. When data is being written to the SD card, "LOGGING DATA" is displayed.

The .csv file may be viewed with Microsoft Excel**®** or other spreadsheet applications.

The following is a list of data parameters the G1000 system is capable of logging for the Beechcraft G58 aircraft.

- Date
- Time
- GPS altitude (MSL)
- GPS altitude (WGS84 datum)
- Baro-Corrected altitude (feet)
- Baro Correction (in/Hg)
- Indicated airspeed (kts)
- Vertical speed (fpm)
- GPS vertical speed (fpm)
- OAT (degrees C)
- True airspeed (knots)
- Pitch Attitude Angle (degrees)
- Roll Attitude Angle (degrees)
- Lateral and Vertical G Force (g)
- Ground Speed (kts)
- Ground Track (degrees magnetic)
- Latitude (degrees; geodetic; +North)

- Longitude (degrees; geodetic; +East)
- Magnetic Heading (degrees)
- HSI source
- Selected course
- Com1/Com2 frequency
- Nav1/Nav2 frequency
- CDI deflection
- VDI/GP/GS deflection
- Wind Direction (degrees)
- Wind Speed (knots)
- Active Waypoint Identifier
- Distance to next waypoint (nm)
- Bearing to next waypoint (degrees)
- Magnetic variation (degrees)
- Autopilot On/Off
- AFCS roll/pitch modes
- AFCS roll/pitch commands

- GPS fix
- GPS horizontal alert limit
- GPS vertical alert limit
- SBAS GPS horizontal protection level
- SBAS GPS vertical protection level
- Fuel Qty (right & left)(gals)
- Fuel Flow (gph)
- Fuel Pressure (psi)
- Voltage 1 and/or 2
- Amps 1 and/or 2
- Engine RPM
- Oil Pressure (psi)
- Oil Temperature (deg. F)
- Manifold Pressure (in. Hg)
- CHT
- EGT

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The file containing the recorded data will appear in the format shown in Figure 8-82. This file can be imported into most computer spreadsheet applications.

Local Date
YYMMDD

Local 24hr Time
HHMMSS

Nearest Airport
(A blank will be
inserted if no
airport is found)

log_110210_104506_KIXD.csv
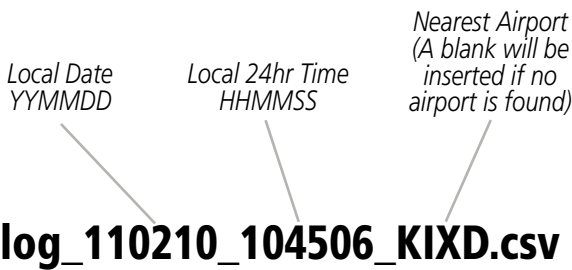
Figure 8-82 Log File Format

Data logging status can be monitored on the AUX-UTILITY Page.

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8.9 ABNORMAL OPERATION

SVS TROUBLESHOOTING

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

SVS becomes disabled without the following data resources:

- Attitude data
- Heading data
- GPS position data
- 9 Arc-second 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.

REVERSIONARY MODE

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

Figure 8-83 SVS Reversionary Mode

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UNUSUAL ATTITUDES

Unusual attitudes are displayed with red chevrons overlaid on the display indicating the direction to fly to correct the unusual attitude condition. The display shows either a brown or blue colored bar at the top or bottom of the screen to represent earth or sky. This is intended to prevent losing sight of the horizon during extreme pitch attitudes.

Figure 8-80 Unusual Attitude Display

The blue colored bar is also displayed when terrain gradient is great enough to completely fill the display.

Figure 8-84 Blue Sky Bar with Full Display Terrain

GDL 69/69A DATA LINK RECEIVER TROUBLESHOOTING
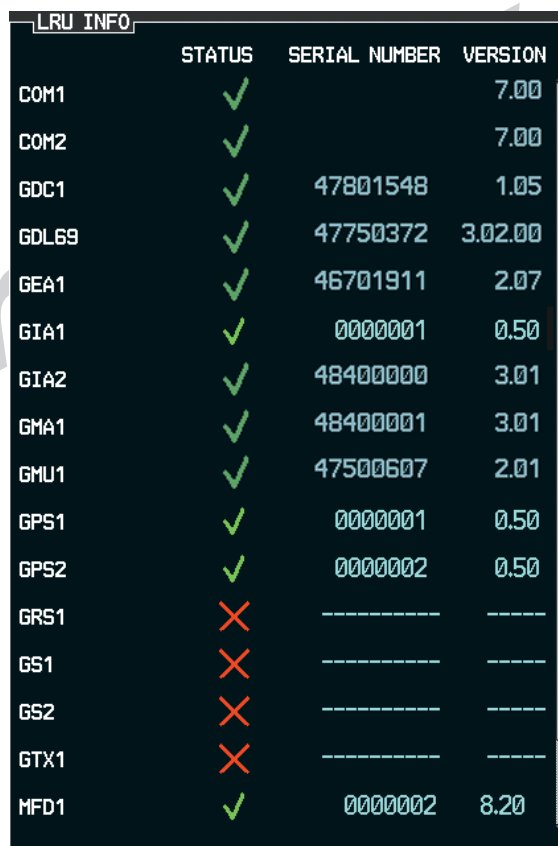
Some quick troubleshooting steps listed below can be performed to find the possible cause of a failure.

• Ensure the owner/operator of the aircraft in which the Data Link Receiver is installed has subscribed to SiriusXM

• Ensure the XM subscription has been activated

• Perform a quick check of the circuit breakers to ensure that power is applied to the Data Link Receiver

For troubleshooting purposes, check the LRU Information Box on the AUX - System Status Page for Data Link Receiver (GDL 69/69A) status, serial number, and software version number. If a failure has been detected in the GDL 69/69A the status is marked with a red X.

Selecting the System Status Page:

1) Turn the large **FMS** Knob to select the AUX Page Group.

2) Turn the small **FMS** Knob to select the System Status Page (the last page in the AUX Page Group).

LRU INFO	STATUS	SERIAL NUMBER	VERSION
COM1	✓		7.00
COM2	✓		7.00
GDC1	✓	47801548	1.05
GDL69	✓	47750372	3.02.00
GEA1	✓	46701911	2.07
GIA1	✓	0000001	0.50
GIA2	✓	48400000	3.01
GMA1	✓	48400001	3.01
GMU1	✓	47500607	2.01
GPS1	✓	0000001	0.50
GPS2	✓	0000002	0.50
GRS1	✗	-----------	------
GS1	✗	-----------	------
GS2	✗	-----------	------
GTX1	✗	-----------	------
MFD1	✓	0000002	8.20

Figure 8-85 LRU Information Window on System Status Page

If a failure still exists, the following messages may provide insight as to the possible problem:

Message	Message Location	Description
CHECK ANTENNA	XM Radio Page - active channel field	Data Link Receiver antenna error; service required
UPDATING	XM Radio Page - active channel field	Data Link Receiver updating encryption code
NO SIGNAL	XM Radio Page - active channel field Weather Datalink Page - center of page	Loss of signal; signal strength too low for receiver
LOADING	XM Radio Page - active channel field	Acquiring channel audio or information
OFF AIR	XM Radio Page - active channel field	Channel not in service
---	XM Radio Page - active channel field	Missing channel information
WEATHER DATA LINK FAILURE	Weather Datalink Page - center of page	No communication from Data Link Receiver within last 5 minutes
ACTIVATION REQUIRED	Weather Datalink Page - center of page	SiriusXM subscription is not activated

Table 8-5 GDL 69/69A Data Link Receiver Error Messages

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ANNUNCIATIONS AND ALERTS

> **NOTE:** The Pilot's Operating Handbook and FAA Approved Airplane Flight Manual (AFM/POH) supersedes information found in this document.

The G1000 Alerting System conveys alerts using the following:

- **Alerts Window:** The Alerts Window displays text messages for up to 64 prioritized alert messages. Pressing the **ALERTS** Softkey displays the Alerts Window. Pressing the **ALERTS** Softkey a second time removes the Alerts Window from the display. When the Alerts Window is displayed, the **FMS** Knob can be used to scroll through the alert message list.

- **Softkey Annunciation:** During certain alerts, the **ALERTS** Softkey may appear as a flashing annunciation to accompany an alert. The **ALERTS** Softkey assumes a new label consistent with the alert level (WARNING, CAUTION, or ADVISORY). By selecting the softkey when flashing an annunciation, the alert is acknowledged. The softkey label then returns to **ALERTS**. If alerts are still present, the **ALERTS** label is displayed in white with black text. Selecting the **ALERTS** Softkey a second time views the alert text messages.

- **System Annunciations:** Typically, a large red 'X' appears over instruments whose information is supplied by a failed Line Replaceable Unit (LRU). See the G1000 System Annunciations Section for more information.
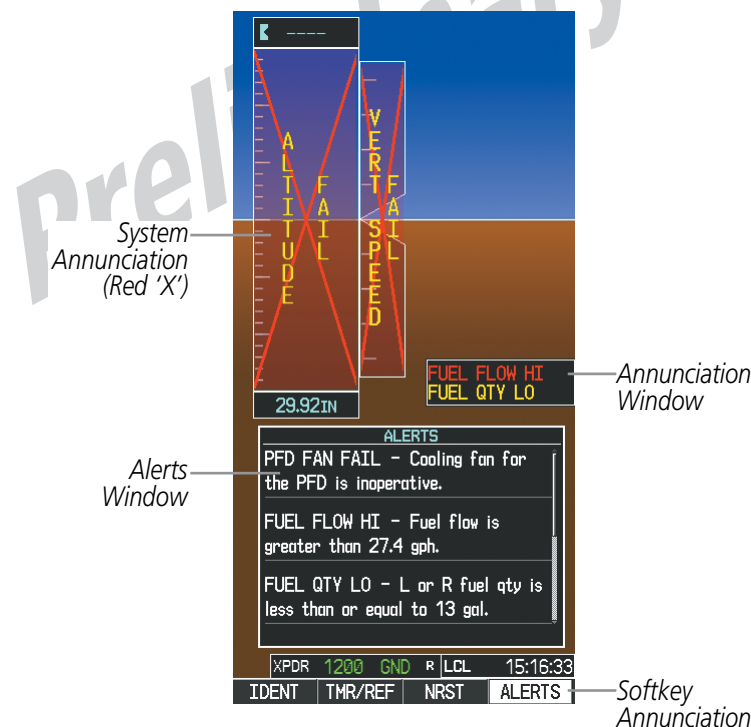
Figure A-1 G1000 Alerting System

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- **Audio Alerting System:** The G1000 System issues audio alert tones when specific system conditions are met. See the Alert Level Definitions Section for more information. The annunciation tone may be tested from the AUX - System Status Page.

> **Testing the system annunciation tone:**
>
> **1)** Use the **FMS** Knob to select the AUX - System Status Page.
>
> **2)** Press the **ANN TEST** Softkey.
>
> **Or**:
>
> **a)** Press the **MENU** Key.
>
> **b)** Highlight 'Enable Annunciator Test Mode' and press the **ENT** Key.

Press to Test Annunciation Tone

Figure A-2 System Status Page, Annunciation Tone Testing

ALERT LEVEL DEFINITIONS

The G1000 Alerting System, as installed in Beechcraft G58 aircraft, uses three alert levels.

- **WARNING:** This level of alert requires immediate attention.

Warning alert text is accompanied by a continuous chime and a flashing 'WARNING' Softkey annunciation (see Figure A-3). Pressing the **WARNING** Softkey acknowledges the presence of the warning alert and stops the aural chime.

- **CAUTION:** This level of alert indicates the existence of abnormal conditions on the aircraft that may require intervention.

Caution alert text is accompanied by a single chime and a flashing 'CAUTION' Softkey annunciation (see Figure A-3). Pressing the **CAUTION** Softkey acknowledges the presence of the caution alert.

- **ANNUNCIATION OR MESSAGE ADVISORY:** This level of alert provides general information.

An annunciation alert is accompanied by a flashing 'ADVISORY' Softkey annunciation (see Figure A-3). Pressing the **ADVISORY** Softkey acknowledges the presence of the annunciation alert.

Message advisory alerts issue a flashing 'ADVISORY' Softkey annunciation (see Figure A-3). Pressing the **ADVISORY** Softkey acknowledges the presence of the message advisory alert and displays the alert text message in the Alerts Window.

WARNING   CAUTION   ADVISORY

Figure A-3 Softkey Annunciation (ALERTS Softkey Labels)

AIRCRAFT ALERTS

The following alerts are configured specifically for the Beechcraft G58. Red annunciation window text signifies warnings and yellow, cautions, and white, annunciation advisories. See the AFM/POH for recommended pilot actions.

WARNING ANNUNCIATION

Annunciation Text	Alerts Window Message	Audio Alert
GEAR UP	Gear up with power below 13in Hg or flaps down.	Continuous Tone (received through the G1000 audio from another source)
L ALT INOP	Left alternator offline.	Repeating Tone
R ALT INOP	Right alternator offline.	Repeating Tone
L-R ALT INOP	Right and Left alternators offline.	Repeating Tone
FUEL FLOW HI	L or R fuel flow is greater than 27.4 gph.	Repeating Tone
FUEL QTY LO	L or R fuel qty is at zero.	Repeating Tone
CHT HI	L or R CHT is greater than 238 deg C.	Repeating Tone
OIL TEMP HI	L or R oil temp is greater than 116 deg C.	Repeating Tone
OIL PRESS HI	L or R oil press is greater than 100 psi.	Repeating Tone
OIL PRESS LO	L or R oil press is less than 10 psi.	Repeating Tone

CAUTION ANNUNCIATION

Annunciation Text	Alerts Window Message	Audio Alert
L START ENGD	Left starter relay has power applied.	Single Chime
R START ENGD	Right starter relay has power applied.	Single Chime
LBUS VOLT HI	Left bus voltage greater than 30 VDC.	Single Chime
RBUS VOLT HI	Right bus voltage greater than 30 VDC.	Single Chime
LBUS VOLT LO	Left bus voltage less than 24 V.	Single Chime
RBUS VOLT LO	Right bus voltage less than 24 V.	Single Chime
AFT DOOR	Aft door not latched.	Single Chime
L AIR PUMP	Press Low — Ops in icing conditions not approved.	Single Chime
R AIR PUMP	Press Low — Ops in icing conditions not approved.	Single Chime
OIL PRESS LO	L or R oil press is between 30 and 10 psi.	Single Chime
FUEL QTY LO	L or R fuel qty is less than or equal to 13 gal.	Single Chime
ALT LOAD	L or R alternator load exceeds 100 amps.	Single Chime

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ADVISORY ANNUNCIATION

Annunciation Text	Alerts Window Message	Audio Alert
BUSES TIED	Right Bus is tied to Left Bus.	None

ALERT MESSAGE

Alerts Window Message	Audio Alert/Voice Message
PFD FAN FAIL – The cooling fan for the PFD is inoperative.	None
MFD FAN FAIL – The cooling fan for the MFD is inoperative.	None
AVN FAN FAIL – The cooling fan for remote avionics is inoperative.	None

VOICE ALERTS

The following audio alerts are announced by the system using a voice of male or female gender (see the AUX - System Setup Page to change the audio alert voice for TIS; the GTS 820 gender is set at installation). Terrain Awareness and Warning System voice alerts are also generated (refer to the TAWS Alerts section).

Voice Alert	Alert Trigger
"Minimums, minimums"	The aircraft has descended below the preset barometric minimum descent altitude.
"Vertical track"	The aircraft is one minute from Top of Descent. Issued only when vertical navigation is enabled.
"Traffic"	Played when a Traffic Advisory (TA) is issued with the TIS system or the optional GTS 820 TAS system. See the Hazard Avoidance section for additional details on GTS 820 voice alerts.
"TIS Not Available"	The aircraft is outside the Traffic Information Service (TIS) coverage area.
"Traffic, Traffic"	Played when a Traffic Advisory (TA) is issued with the optional SKY 497 TAS system. See the Skywatch SKY 497 PG for additional details on SKY 497 voice alerts.
"Traffic Advisory System Test Passed" "TAS System Test Passed"	Played when the optional traffic system passes a pilot-initiated self test. - SKY 497 TAS - GTS 820 TAS
"Traffic Advisory System Test Failed" "TAS System Test Fail"	Played when the optional traffic system fails a pilot-initiated self test. - SKY 497 TAS - GTS 820 TAS
"One o'clock" through "Twelve o'clock" or "No Bearing"	Intruder bearing (GTS 820 only)
"High", "Low", "Same Altitude" (if within 200 feet of own altitude), or "Altitude not available"	Intruder relative altitude (GTS 820 only)
"Less than one mile", "One Mile" through "Ten Miles", or "More than ten miles"	Intruder distance (GTS 820 only)

G1000 SYSTEM ANNUNCIATIONS

When a new message is issued, the **ALERTS** Softkey flashes to alert the flight crew of a new message. It continues to flash until acknowledged by pressing the softkey. Active messages are displayed in white text. Messages that have become inactive change to gray text. The **ALERTS** Softkey flashes if the state of a displayed message changes or a new message is displayed. The inactive messages can be removed from the Message Window by pressing the flashing **ALERTS** Softkey.

The G1000 System Messages convey messages to the flight crew regarding problems with the G1000 system. Typically, a large red 'X' appears in a window when a related LRU fails or detects invalid data.

When an LRU or an LRU function fails, a large red 'X' is typically displayed on windows associated with the failed data. The following section describes various system annunciations. Refer to the AFM/POH for additional information regarding pilot responses to these annunciations.

> **NOTE:** *Upon power-up of the G1000 system, certain windows remain invalid as G1000 equipment begins to initialize. All windows should be operational within one minute of power-up. Should any window continue to remain flagged, the G1000 system should be serviced by a Garmin-authorized repair facility.*
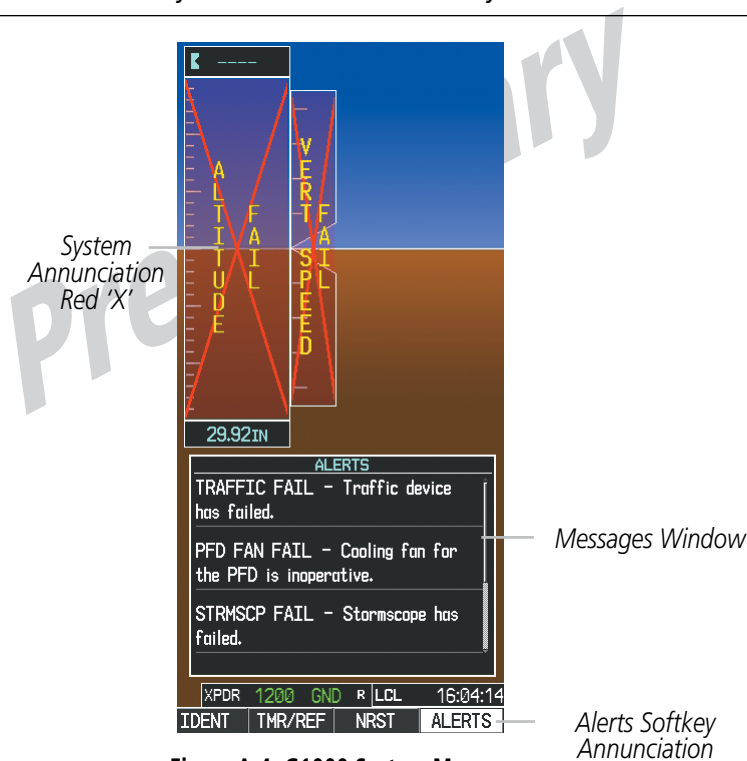
Figure A-4 G1000 System Messages
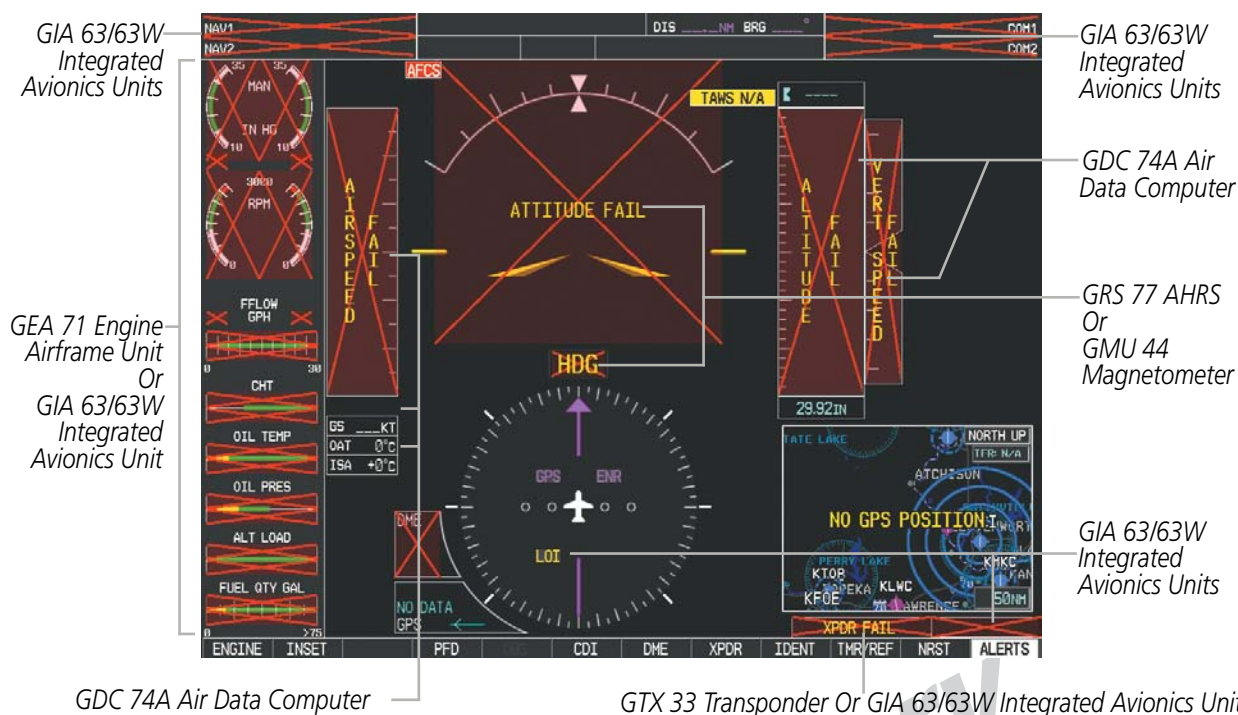
Figure A-5 G1000 System Failure Annunciations

> **NOTE:** *Upon power-up, certain windows remain invalid as G1000 equipment begins to initialize. All windows should be operational within one minute of power-up. If any window continues to remain flagged, the G1000 System should be serviced by a Garmin-authorized repair facility.*

System Annunciation	Comment
	Attitude and Heading Reference System is aligning.
	Display system is not receiving attitude information from the AHRS.
	Display system is not receiving airspeed input from air data computer.
	Display system is not receiving valid heading input from AHRS.
	Display system is not receiving altitude input from the air data computer.
	Display system is not receiving vertical speed input from the air data computer.
	Display system is not receiving valid transponder information.
	GPS information is either not present or is invalid for navigation use. Note that AHRS utilizes GPS inputs during normal operation. AHRS operation may be degraded if GPS signals are not present (see AFM/POH).
Other Various Red X Indications	A red 'X' through any other display field (such as engine instrumentation display) indicates that the field is not receiving valid data.

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G1000 SYSTEM MESSAGE ADVISORIES

This section describes various G1000 system message advisories. Certain messages are issued due to an LRU or an LRU function failure. Such messages are normally accompanied by a corresponding red 'X' annunciation as shown previously in the G1000 System Annunciation section.

> **NOTE:** *This Section provides information regarding G1000 message advisories that may be displayed by the system. Knowledge of the aircraft, systems, flight conditions, and other existing operational priorities must be considered when responding to a message. Always use sound pilot judgment. The AFM/POH takes precedence over any conflicting guidance found in this section.*

MFD & PFD MESSAGE ADVISORIES

Message	Comments
DATA LOST – Pilot stored data was lost. Recheck settings.	The pilot profile data was lost. System reverts to default pilot profile and settings. The pilot may reconfigure the MFD & PFD with preferred settings, if desired.
XTALK ERROR – A flight display crosstalk error has occurred.	The MFD and PFD are not communicating with each other. The G1000 system should be serviced.
PFD1 SERVICE – PFD1 needs service. Return unit for repair.	The PFD and/or MFD self-test has detected a problem. The G1000 system should be serviced.
MFD1 SERVICE – MFD1 needs service. Return unit for repair.	
MANIFEST – PFD1 software mismatch. Communication halted.	The PFD and/or MFD has incorrect software installed. The G1000 system should be serviced.
MANIFEST – MFD1 software mismatch. Communication halted.	
PFD1 CONFIG – PFD1 configuration error. Config service req'd.	The PFD configuration settings do not match backup configuration memory. The G1000 system should be serviced.
MFD1 CONFIG – MFD1 configuration error. Config service req'd.	The MFD configuration settings do not match backup configuration memory. The G1000 system should be serviced.
SW MISMATCH – GDU software version mismatch. Xtalk is off.	The MFD and PFD have different software versions installed. The G1000 system should be serviced.
PFD1 COOLING – PFD1 has poor cooling. Reducing power usage.	The PFD and/or MFD is overheating and is reducing power consumption by dimming the display. If problem persists, the G1000 system should be serviced.
MFD1 COOLING – MFD1 has poor cooling. Reducing power usage.	
PFD1 KEYSTK – PFD1 [key name] Key is stuck.	A key is stuck on the PFD and/or MFD bezel. Attempt to free the stuck key by pressing it several times. The G1000 system should be serviced if the problem persists.
MFD1 KEYSTK – MFD1 [key name] Key is stuck.	
CNFG MODULE – PFD1 configuration module is inoperative.	The PFD1 configuration module backup memory has failed. The G1000 system should be serviced.
PFD1 VOLTAGE – PFD1 has low voltage. Reducing power usage.	The PFD1 voltage is low. The G1000 system should be serviced.
MFD1 VOLTAGE – MFD1 has low voltage. Reducing power usage.	The MFD voltage is low. The G1000 system should be serviced.

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DATABASE MESSAGE ADVISORIES

Message	Comments
MFD1 DB ERR – MFD1 navigation database error exists.	The MFD and/or PFD detected a failure in the navigation database. Attempt to reload the navigation database. If problem persists, the G1000 system should be serviced.
PFD1 DB ERR – PFD1 navigation database error exists.	
MFD1 DB ERR – MFD1 basemap database error exists.	The MFD and/or PFD detected a failure in the basemap database. The G1000 system should be serviced.
PFD1 DB ERR – PFD1 basemap database error exists.	
MFD1 DB ERR – MFD1 terrain database error exists.	The MFD and/or PFD detected a failure in the terrain database. Ensure that the terrain card is properly inserted in display. Replace terrain card. If problem persists, the G1000 system should be serviced.
PFD1 DB ERR – PFD1 terrain database error exists.	
MFD1 DB ERR – MFD1 obstacle database error exists.	The MFD and/or PFD detected a failure in the obstacle database. Ensure that the data card is properly inserted. Replace data card. If problem persists, the G1000 system should be serviced.
PFD1 DB ERR – PFD1 obstacle database error exists.	
MFD1 DB ERR – MFD1 airport terrain database error exists.	The MFD and/or PFD detected a failure in the airport terrain database. Ensure that the data card is properly inserted. Replace data card. If problem persists, the G1000 system should be serviced.
PFD1 DB ERR – PFD1 airport terrain database error exists.	
MFD1 DB ERR – MFD1 Safe Taxi database error exists.	The MFD and/or PFD detected a failure in the Safe Taxi database. Ensure that the data card is properly inserted. Replace data card. If problem persists, the G1000 system should be serviced.
PFD1 DB ERR – PFD1 Safe Taxi database error exists.	
MFD1 DB ERR – MFD1 Chartview database error exists.	The MFD and/or PFD detected a failure in the Chartview database (optional feature). Ensure that the data card is properly inserted. Replace data card. If problem persists, the G1000 system should be serviced.
MFD1 DB ERR – MFD1 FliteCharts database error exists.	The MFD and/or PFD detected a failure in the FliteCharts database (optional feature). Ensure that the data card is properly inserted. Replace data card. If problem persists, the G1000 system should be serviced.
MFD1 DB ERR – MFD1 terrain database missing.	The terrain database is present on another LRU, but is missing on the specified LRU. Ensure that the terrain card is properly inserted in the specified display. Replace terrain card. If problem persists, the G1000 system should be serviced.
PFD1 DB ERR – PFD1 terrain database missing.	
MFD1 DB ERR – MFD1 obstacle database missing.	The obstacle database is present on another LRU, but is missing on the specified LRU. Ensure that the terrain card is properly inserted in the specified display. Replace terrain card. If problem persists, the G1000 system should be serviced.
PFD1 DB ERR – PFD1 obstacle database missing.	
MFD1 DB ERR – MFD1 airport terrain database missing.	The airport terrain database is present on another LRU, but is missing on the specified LRU. Ensure that the terrain card is properly inserted in the specified display. Replace terrain card. If problem persists, the G1000 system should be serviced.
PFD1 DB ERR – PFD1 airport terrain database missing.	

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Message	Comments
DB MISMATCH – Navigation database mismatch. Xtalk is off.	The PFD and MFD have different navigation database versions or regions installed. Crossfill is off. Check the AUX-SYSTEM STATUS Page to determine versions or regions. Also, check the AUX-SYSTEM STATUS Page for a database synchronization function not completed. After synchronization is complete, power must be turned off, then on.
DB MISMATCH – Standby Navigation database mismatch.	The PFD and MFD have different standby navigation database versions or regions installed. Check the AUX-SYSTEM STATUS Page to determine versions or regions. Also, check the AUX-SYSTEM STATUS Page for a database synchronization function not completed. After synchronization is complete, power must be turned off, then on.
DB MISMATCH – Terrain database mismatch.	The PFD and MFD have different terrain database versions or regions installed. Check the AUX-SYSTEM STATUS Page to determine versions or regions. Also, check the AUX-SYSTEM STATUS Page for a database synchronization function not completed. After synchronization is complete, power must be turned off, then on.
DB MISMATCH – Obstacle database mismatch.	The PFD and MFD have different obstacle database versions or regions installed. Check the AUX-SYSTEM STATUS Page to determine versions or regions. Also, check the AUX-SYSTEM STATUS Page for a database synchronization function not completed. After synchronization is complete, power must be turned off, then on.
DB MISMATCH – Airport Terrain database mismatch.	The PFD and MFD have different airport terrain database versions or regions installed. Check the AUX-SYSTEM STATUS Page to determine versions or regions. Also, check the AUX-SYSTEM STATUS Page for a database synchronization function not completed. After synchronization is complete, power must be turned off, then on.

GMA 1347 MESSAGE ADVISORIES

Message	Comments
GMA1 FAIL – GMA1 is inoperative.	The audio panel self-test has detected a failure. The audio panel is unavailable. The G1000 system should be serviced.
GMA1 CONFIG – GMA1 configuration error. Config service req'd.	The audio panel configuration settings do not match backup configuration memory. The G1000 system should be serviced.
MANIFEST – GMA1 software mismatch. Communication halted.	The audio panel has incorrect software installed. The G1000 system should be serviced.
GMA1 SERVICE – GMA1 needs service. Return unit for repair.	The audio panel self-test has detected a problem in the unit. Certain audio functions may still be available, and the audio panel may still be usable. The G1000 system should be serviced when possible.

GIA 63W MESSAGE ADVISORIES

Message	Comments
GIA1 CONFIG – GIA1 config error. Config service req'd.	The GIA1 and/or GIA2 configuration settings do not match backup configuration memory. The G1000 system should be serviced.
GIA2 CONFIG – GIA2 config error. Config service req'd.	
GIA1 CONFIG – GIA1 audio config error. Config service req'd.	The GIA1 and/or GIA2 have an error in the audio configuration. The G1000 system should be serviced.
GIA2 CONFIG – GIA2 audio config error. Config service req'd.	

Message	Comments
GIA1 COOLING – GIA1 temperature too low.	The GIA1 and/or GIA2 temperature is too low to operate correctly. Allow units to warm up to operating temperature.
GIA2 COOLING – GIA2 temperature too low.	
GIA1 COOLING – GIA1 over temperature.	The GIA1 and/or GIA2 temperature is too high. If problem persists, the G1000 system should be serviced.
GIA2 COOLING – GIA2 over temperature.	
GIA1 SERVICE – GIA1 needs service. Return the unit for repair.	The GIA1 and/or GIA2 self-test has detected a problem in the unit. The G1000 system should be serviced.
GIA2 SERVICE – GIA2 needs service. Return the unit for repair.	
HW MISMATCH – GIA hardware mismatch. GIA1 communication halted.	A GIA mismatch has been detected, where only one is SBAS capable. The G1000 system should be serviced.
HW MISMATCH – GIA hardware mismatch. GIA2 communication halted.	
MANIFEST – GIA1 software mismatch, communication halted.	The GIA1 and/or GIA 2 has incorrect software installed. The G1000 system should be serviced.
MANIFEST – GIA2 software mismatch, communication halted.	
MANIFEST – GFC software mismatch, communication halted.	Incorrect servo software is installed, or gain settings are incorrect.
MANIFEST – COM1 software mismatch, communication halted.	COM1 and/or COM2 software mismatch. The system should be serviced.
MANIFEST – COM2 software mismatch, communication halted.	
MANIFEST – NAV1 software mismatch, communication halted.	NAV1 and/or NAV2 software mismatch. The system should be serviced.
MANIFEST – NAV2 software mismatch, communication halted.	
COM1 CONFIG – COM1 config error. Config service req'd.	COM1 and/or COM2 configuration settings do not match backup configuration memory. The system should be serviced.
COM2 CONFIG – COM2 config error. Config service req'd.	
COM1 TEMP – COM1 over temp. Reducing transmitter power.	The system has detected an over temperature condition in COM1 and/or COM2. The transmitter operates at reduced power. If the problem persists, the G1000 system should be serviced.
COM2 TEMP – COM2 over temp. Reducing transmitter power.	
COM1 SERVICE – COM1 needs service. Return unit for repair.	The system has detected a failure in COM1 and/or COM2. COM1 and/or COM2 may still be usable. The G1000 system should be serviced when possible.
COM2 SERVICE – COM2 needs service. Return unit for repair.	

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Message	Comments
COM1 PTT – COM1 push-to-talk key is stuck.	The COM1 and/or COM2 external push-to-talk switch is stuck in the enable (or "pressed") position. Press the PTT switch again to cycle its operation. If the problem persists, the G1000 system should be serviced.
COM2 PTT – COM2 push-to-talk key is stuck.	
COM1 RMT XFR – COM1 remote transfer key is stuck.	The COM1 and/or COM2 transfer switch is stuck in the enabled (or "pressed") position. Press the transfer switch again to cycle its operation. If the problem persists, the G1000 system should be serviced.
COM2 RMT XFR – COM2 remote transfer key is stuck.	
LOI – GPS integrity lost. Crosscheck with other NAVS.	GPS integrity is insufficient for the current phase of flight.
GPS NAV LOST – Loss of GPS navigation. Insufficient satellites.	Loss of GPS navigation due to insufficient satellites.
GPS NAV LOST – Loss of GPS navigation. Position error.	Loss of GPS navigation due to position error.
GPS NAV LOST – Loss of GPS navigation. GPS fail.	Loss of GPS navigation due to GPS failure.
ABORT APR – Loss of GPS navigation. Abort approach.	Abort approach due to loss of GPS navigation.
APR DWNGRADE – Approach downgraded.	Vertical guidance generated by SBAS is unavailable, use LNAV only minimums.
TRUE APR – True north approach. Change HDG refereence to TRUE.	Displayed after passing the first waypoint of a true north approach when the nav angle is set to 'AUTO'.
GPS1 SERVICE – GPS1 needs service. Return unit for repair.	A failure has been detected in the GPS1 and/or GPS2 receiver. The receiver may still be available. The G1000 system should be serviced.
GPS2 SERVICE – GPS2 needs service. Return unit for repair.	
NAV1 SERVICE – NAV1 needs service. Return unit for repair.	A failure has been detected in the NAV1 and/or NAV2 receiver. The receiver may still be available. The G1000 system should be serviced.
NAV2 SERVICE – NAV2 needs service. Return unit for repair.	
NAV1 RMT XFR – NAV1 remote transfer key is stuck.	The remote NAV1 and/or NAV2 transfer switch is stuck in the enabled (or "pressed") state. Press the transfer switch again to cycle its operation. If the problem persists, the G1000 system should be serviced.
NAV2 RMT XFR – NAV2 remote transfer key is stuck.	
G/S1 FAIL – G/S1 is inoperative.	A failure has been detected in glideslope receiver 1 and/or receiver 2. The G1000 system should be serviced.
G/S2 FAIL – G/S2 is inoperative.	
G/S1 SERVICE – G/S1 needs service. Return unit for repair.	A failure has been detected in glideslope receiver 1 and/or receiver 2. The receiver may still be available. The G1000 system should be serviced when possible.
G/S2 SERVICE – G/S2 needs service. Return unit for repair.	

GEA 71 MESSAGE ADVISORIES

Message	Comments
GEA1 CONFIG – GEA1 config error. Config service req'd.	The GEA1 configuration settings do not match those of backup configuration memory. The G1000 system should be serviced.
MANIFEST – GEA1 software mismatch, communication halted.	The #1 GEA 71 has incorrect software installed. The G1000 system should be serviced.

GTX 33 MESSAGE ADVISORIES

Message	Comments
XPDR1 CONFIG – XPDR1 config error. Config service req'd.	The transponder configuration settings do not match those of backup configuration memory. The G1000 system should be serviced.
MANIFEST – GTX1 software mismatch, communication halted.	The transponder has incorrect software installed. The G1000 system should be serviced.
XPDR1 SRVC – XPDR1 needs service. Return unit for repair.	The #1 transponder should be serviced when possible.
XPDR1 FAIL – XPDR1 is inoperative.	There is no communication with the #1 transponder.

GRS 77 MESSAGE ADVISORIES

Message	Comments
AHRS1 TAS – AHRS1 not receiving airspeed.	The #1 AHRS is not receiving true airspeed from the air data computer. The AHRS relies on GPS information to augment the lack of airspeed. The G1000 system should be serviced.
AHRS1 GPS – AHRS1 using backup GPS source.	The #1 AHRS is using the backup GPS path. Primary GPS path has failed. The G1000 system should be serviced when possible.
AHRS1 GPS – AHRS1 not receiving any GPS information.	The #1 AHRS is not receiving any or any useful GPS information. Check AFMS limitations. The G1000 system should be serviced.
AHRS1 GPS – AHRS1 not receiving backup GPS information.	The #1 AHRS is not receiving backup GPS information. The G1000 system should be serviced.
AHRS1 GPS – AHRS1 operating exclusively in no-GPS mode.	The #1 AHRS is operating exclusively in no-GPS mode. The G1000 system should be serviced.
AHRS1 SRVC – AHRS1 Magnetic-field model needs update.	The #1 AHRS earth magnetic field model is out of date. Update magnetic field model when practical.
GEO LIMITS – AHRS1 too far North/South, no magnetic compass.	The aircraft is outside geographical limits for approved AHRS operation. Heading is flagged as invalid.
MANIFEST – GRS1 software mismatch, communication halted.	The #1 AHRS has incorrect software installed. The G1000 system should be serviced.

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GMU 44 MESSAGE ADVISORIES

Message	Comments
HDG FAULT – AHRS1 magnetometer fault has occurred.	A fault has occurred in the #1 GMU 44. Heading is flagged as invalid. The AHRS uses GPS for backup mode operation. The G1000 system should be serviced.
MANIFEST – GMU1 software mismatch, communication halted.	The GMU 44 has incorrect software installed. The G1000 system should be serviced.

GDL 69A MESSAGE ADVISORIES

Message	Comments
GDL69 CONFIG – GDL 69 config error. Config service req'd.	GDL 69 configuration settings do not match those of backup configuration memory. The G1000 system should be serviced.
GDL69 FAIL – GDL 69 has failed.	A failure has been detected in the GDL 69. The receiver is unavailable. The G1000 system should be serviced
MANIFEST – GDL software mismatch, communication halted.	The GDL 69 has incorrect software installed. The G1000 system should be serviced.

GDC 74A MESSAGE ADVISORIES

Message	Comments
MANIFEST – GDC1 software mismatch, communication halted.	The GDC 74A has incorrect software installed. The G1000 system should be serviced.

GWX 68 MESSAGE ADVISORIES

Message	Comments
GWX CONFIG – GWX config error. Config service req'd.	GWX 68 configuration settings do not match those of the GDU configuration. The G1000 system should be serviced.
GWX FAIL – GWX is inoperative.	The GDU is not recieving status packet from the GWX 68 or the GWX 68 is reporting a fault. The GWX 68 radar system should be serviced.
GWX SERVICE – Needs service. Return unit for repair.	A failure has been detected in the GWX 68. The GWX 68 may still be usable.
WX ALERT – Possible severe weather ahead.	The GWX 68 indicates severe weather within ±10 degrees of the aircraft heading at a range of 80 to 320 nm.
MANIFEST – GWX software mismatch, communication halted.	The GWX 68 has incorrect software installed. The G1000 system should be serviced.

GTS 820 TRAFFIC ADVISORY SYSTEM

Message Advisory	Comments
GTS CONFIG – GTS Config error. Config service req'd.	The GTS and GDU have different copies of the GTS configuration, or the Mode S address is invalid The G1000 system should be serviced.
MANIFEST – GTS software mismatch, communication halted.	The GTS has incorrect software installed. The G1000 system should be serviced.

MISCELLANEOUS MESSAGE ADVISORIES

Message	Comments
FPL WPT LOCK – Flight plan waypoint is locked.	Upon power-up, the G1000 system detects that a stored flight plan waypoint is locked. This occurs when an navigation database update eliminates an obsolete waypoint. The flight plan cannot find the specified waypoint and flags this message. This can also occur with user waypoints in a flight plan that is deleted. Remove the waypoint from the flight plan if it no longer exists in any database, or update the waypoint name/identifier to reflect the new information.
FPL WPT MOVE – Flight plan waypoint moved.	The system has detected that a waypoint coordinate has changed due to a new navigation database update. Verify that stored flight plans contain correct waypoint locations.
TIMER EXPIRD – Timer has expired.	The system notifies the pilot that the timer has expired.
DB CHANGE – Database changed. Verify user modified procedures.	This occurs when a stored flight plan contains a procedure that is no longer consistent with the navigation database. This alert is issued only after an navigation database update. Verify that the user-modified procedures in stored flight plans are correct and up to date.
DB CHANGE – Database changed. Verify stored airways.	This occurs when a stored flight plan contains an airway that is no longer consistent with the navigation database. This alert is issued only after an navigation database update. Verify use of airways in stored flight plans and reload airways as needed.
FPL TRUNC – Flight plan has been truncated.	This occurs when a newly installed navigation database eliminates an obsolete approach or arrival used by a stored flight plan. The obsolete procedure is removed from the flight plan. Update flight plan with current arrival or approach.
LOCKED FPL – Cannot navigate locked flight plan.	This occurs when the pilot attempts to activate a stored flight plan that contains locked waypoint. Remove locked waypoint from flight plan. Update flight plan with current waypoint.
WPT ARRIVAL – Arriving at waypoint -[xxxx]	Arriving at waypoint [xxxx], where [xxxx] is the waypoint name.
STEEP TURN – Steep turn ahead.	A steep turn is 15 seconds ahead. Prepare to turn.
INSIDE ARSPC – Inside airspace.	The aircraft is inside the airspace.
ARSPC AHEAD – Airspace ahead less than 10 minutes.	Special use airspace is ahead of aircraft. The aircraft will penetrate the special use 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.
APPR INACTV – Approach is not active.	The system notifies the pilot that the loaded approach is not active. Activate approach when required.
SLCT FREQ – Select appropriate frequency for approach.	The system notifies the pilot to load the approach frequency for the appropriate NAV receiver. Select the correct frequency for the approach.
SLCT NAV – Select NAV on CDI for approach.	The system notifies the pilot to set the CDI to the correct NAV receiver. Set the CDI to the correct NAV receiver.
PTK FAIL – Parallel track unavailable: bad geometry.	Bad parallel track geometry.

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Message	Comments
PTK FAIL – Parallel track unavailable: invalid leg type.	Invalid leg type for parallel offset.
PTK FAIL – Parallel track unavailable: past IAF.	IAF waypoint for parallel offset has been passed.
UNABLE V WPT – Can't reach current vertical waypoint.	The current vertical waypoint can not be reached within the maximum flight path angle and vertical speed constraints. The system automatically transitions to the next vertical waypoint.
VNV – Unavailable. Unsupported leg type in flight plan.	The lateral flight plan contains a procedure turn, vector, or other unsupported leg type prior to the active vertical waypoint. This prevents vertical guidance to the active vertical waypoint.
VNV – Unavailable. Excessive crosstrack error.	The current crosstrack exceeds the limit, causing vertical deviation to go invalid.
VNV – Unavailable. Excessive track angle error.	The current track angle error exceeds the limit, causing the vertical deviation to go invalid.
VNV – Unavailable. Parallel course selected.	A parallel course has been selected, causing the vertical deviation to go invalid.
NO WGS84 WPT – Non WGS 84 waypoint for navigation -[xxxx]	The position of the selected waypoint [xxxxx] is not calculated based on the WGS84 map reference datum and may be positioned in error as displayed. Do not use GPS to navigate to the selected non-WGS84 waypoint.
TRAFFIC FAIL – Traffic device has failed.	The G1000 is no longer receiving data from the traffic system. The traffic device should be serviced.
STRMSCP FAIL – Stormscope has failed.	Stormscope has failed. The G1000 system should be serviced.
FAILED PATH – A data path has failed.	A data path connected to the GDU or the GIA 63/W has failed.
SCHEDULER [#] – <message>.	Message criteria entered by the user.
MAG VAR WARN – Large magnetic variance. Verify all course angles.	The GDU's internal model cannot determine the exact magnetic variance for geographic locations near the magnetic poles. Displayed magnetic course angles may differ from the actual magnetic heading by more than 2°.
SVS – SVS DISABLED: Out of available terrain region.	Synthetic Vision is disabled because the aircraft is not within the boundaries of the installed terrain database.
SVS – SVS DISABLED: Terrain DB resolution too low.	Synthetic Vision is disabled because a terrain database of sufficient resolution (9 arc-second or better) is not currently installed.
CHECK CRS – Database course for LOC1 / [LOC ID] is [CRS]°.	Selected course for LOC1 differs from published localizer course by more than 10 degrees.
CHECK CRS – Database course for LOC2 / [LOC ID] is [CRS]°.	Selected course for LOC2 differs from published localizer course by more than 10 degrees.
[PFD1 or MFD1] CARD 1 REM – Card 1 was removed. Reinsert card.	The SD card was removed from the top card slot of the PFD or MFD. The SD card needs to be reinserted.
[PFD1 or MFD1] CARD 2 REM – Card 2 was removed. Reinsert card.	The SD card was removed from the bottom card slot of the PFD or MFD. The SD card needs to be reinserted.
[PFD1 or MFD1] CARD 1 ERR – Card 1 is invalid.	The SD card in the top card slot of the PFD or MFD contains invalid data.
[PFD1 or MFD1] CARD 2 ERR – Card 2 is invalid.	The SD card in the bottom card slot of the PFD or MFD contains invalid data.

FLIGHT PLAN IMPORT/EXPORT MESSAGES

In some circumstances, some messages may appear in conjunction with others.

Flight Plan Import/Export Results	Description
'Flight plan successfully imported.'	A flight plan file stored on the SD card was successfully imported as a stored flight plan.
'File contained user waypoints only. User waypoints imported successfully. No stored flight plan data was modified.'	The file stored on the SD card did not contain a flight plan, only user waypoints. These waypoints have been saved to the system user waypoints. No flight plans stored in the system have been modified.
'No flight plan files found to import.'	The SD card contains no flight plan data.
'Flight plan import failed.'	Flight plan data was not successfully imported from the SD card.
'Flight plan partially imported.'	Some flight plan waypoints were successfully imported from the SD card, however others had errors and were not imported. A partial stored flight plan now exists in the system.
'File contained user waypoints only.'	The file stored on the SD card did not contain a flight plan, only user waypoints. One or more of these waypoints did not import successfully.
'Too many points. Flight plan truncated.'	The flight plan on the SD card contains more waypoints than the system can support. The flight plan was imported with as many waypoints as possible.
'Some waypoints not loaded. Waypoints locked.'	The flight plan on the SD card contains one or more waypoints that the system cannot find in the navigation database. The flight plan has been imported, but must be edited within the system before it can be activated for use.
'User waypoint database full. Not all loaded.'	The flight plan file on the SD card contains user waypoints. The quantity of stored user waypoints has exceeded system capacity, therefore not all the user waypoints on the SD card have been imported. Any flight plan user waypoints that were not imported are locked in the flight plan. The flight plan must be edited within the system before it can be activated for use.
'One or more user waypoints renamed.'	One or more imported user waypoints were renamed when imported due to naming conflicts with waypoints already existing in the system.
'Flight plan successfully exported.'	The stored flight plan was successfully exported to the SD card.
'Flight plan export failed.'	The stored flight plan was not successfully exported to the SD card. The SD card may not have sufficient available memory or the card may have been removed prematurely.

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System Status Field
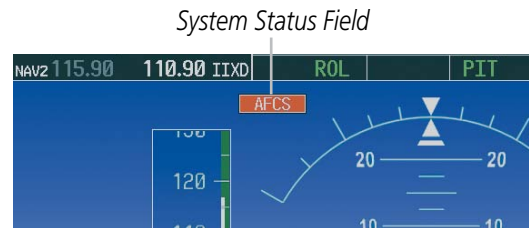
Figure A-6 AFCS System Status Field

The following alert annunciations appear in the AFCS System Status field on the PFD.

Condition	Annunciation	Description
Pitch Failure	PTCH	Pitch axis control failure. AP is inoperative.
Roll Failure	ROLL	Roll axis control failure. AP is inoperative.
Yaw Damper Failure	YAW	Yaw Damper control failure.
MET Switch Stuck, or Pitch Trim Axis Control Failure	PTRM	If annunciated when AP is engaged, take control of the aircraft and disengage the autopilot. If annunciated when AP is not engaged, move each half of the MET switch separately to check if a stuck switch is causing the annunciation.
System Failure	AFCS	AP and MET are unavailable. FD may still be available.
Elevator Mistrim Up	↑ELE	A condition has developed causing the pitch servo to provide a sustained force. Be prepared to apply nose up control wheel force upon autopilot disconnect.
Elevator Mistrim Down	↓ELE	A condition has developed causing the pitch servo to provide a sustained force. Be prepared to apply nose down control wheel force upon autopilot disconnect.
Aileron Mistrim Left	←AIL	A condition has developed causing the roll servo to provide a sustained left force. Ensure the slip/skid indicator is centered and observe any maximum fuel imbalance limits.
Aileron Mistrim Right	AIL→	A condition has developed causing the roll servo to provide a sustained right force. Ensure the slip/skid indicator is centered and observe any maximum fuel imbalance limits.
Rudder Mistrim Left	←RUD	A condition has developed causing the yaw servo to provide a sustained force. Ensure the slip/skid indicator is centered and observe any maximum fuel imbalance limits.
Rudder Mistrim Right	RUD→	A condition has developed causing the yaw servo to provide a sustained force. Ensure the slip/skid indicator is centered and observe any maximum fuel imbalance limits.
Preflight Test	PFT	Performing preflight system test. Upon completion of the test, the aural alert is heard.
	PFT	Preflight system test has failed.

> **NOTE:** *Do not press the* **AP/YD DISC TRIM INTRPT** *switch during servo power-up and preflight system tests as this may cause the preflight system test to fail or never to start (if servos fail their power-up tests). Power must be cycled to the servos to remedy the situation.*

TAWS-B ALERTS

Annunciations appear on the PFD and the MFD. Pop-up alerts appear only on the MFD.

Alert Type	PFD/MFD* Alert Annunciation	MFD Pop-Up Alert (except TAWS-B Page)	Aural Message
Excessive Descent Rate Warning (EDR)	PULL UP	PULL-UP	"Pull Up"
Reduced Required Terrain Clearance Warning (RTC)	PULL UP	TERRAIN-PULL-UP or TERRAIN AHEAD-PULL-UP	"Terrain, Terrain; Pull Up, Pull Up" or "Terrain Ahead, Pull Up; Terrain Ahead, Pull Up"
Imminent Terrain Impact Warning (ITI)	PULL UP	TERRAIN AHEAD-PULL-UP or TERRAIN-PULL-UP	"Terrain Ahead, Pull Up; Terrain Ahead, Pull Up" or "Terrain, Terrain; Pull Up, Pull Up"
Reduced Required Obstacle Clearance Warning (ROC)	PULL UP	OBSTACLE-PULL-UP or OBSTACLE AHEAD-PULL-UP	"Obstacle, Obstacle; Pull Up, Pull Up" or "Obstacle Ahead, Pull Up; Obstacle Ahead, Pull Up"
Imminent Obstacle Impact Warning (IOI)	PULL UP	OBSTACLE AHEAD-PULL-UP or OBSTACLE-PULL-UP	"Obstacle Ahead, Pull Up; Obstacle Ahead, Pull Up" or "Obstacle, Obstacle; Pull Up, Pull Up"
Reduced Required Terrain Clearance Caution (RTC)	TERRAIN	CAUTION-TERRAIN or TERRAIN AHEAD	"Caution, Terrain; Caution, Terrain" or "Terrain Ahead; Terrain Ahead"
Imminent Terrain Impact Caution (ITI)	TERRAIN	TERRAIN AHEAD or CAUTION-TERRAIN	"Terrain Ahead; Terrain Ahead" or "Caution, Terrain; Caution, Terrain"
Reduced Required Obstacle Clearance Caution (ROC)	TERRAIN	CAUTION-OBSTACLE or OBSTACLE AHEAD	"Caution, Obstacle; Caution, Obstacle" or "Obstacle Ahead; Obstacle Ahead"
Imminent Obstacle Impact Caution (IOI)	TERRAIN	OBSTACLE AHEAD or CAUTION-OBSTACLE	"Obstacle Ahead; Obstacle Ahead" or "Caution, Obstacle; Caution, Obstacle"
Premature Descent Alert Caution (PDA)	TERRAIN	TOO LOW-TERRAIN	"Too Low, Terrain"
Altitude Callout "500"	None	None	"Five-Hundred"
Excessive Descent Rate Caution (EDR)	TERRAIN	SINK RATE	"Sink Rate"
Negative Climb Rate Caution (NCR)	TERRAIN	DON'T SINK or TOO LOW-TERRAIN	"Don't Sink" or "Too Low, Terrain"

* Annunciation is shown on the TAWS-B Page and the Navigation Map Page when Terrain is enabled.

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TAWS-B SYSTEM STATUS ANNUNCIATIONS

Alert Type	PFD/MFD* Alert Annunciation	TAWS-B Page Center Banner Annunciation	Aural Message
System Test in progress	TAWS TEST	TAWS TEST	None
System Test pass	None	None	"TAWS System Test OK"
TAWS-B FLTA Alerting Inhibited	TAWS INH	None	None
No GPS position	TAWS N/A	NO GPS POSITION	"TAWS Not Available"†
Excessively degraded GPS signal; or Out of database coverage area	TAWS N/A	None	"TAWS Not Available"†
TAWS-B System Test Fail; Terrain or Obstacle database unavailable or invalid; Invalid software configuration; or System audio fault	TAWS FAIL	TAWS FAIL	"TAWS System Failure"
MFD Terrain or Obstacle database unavailable or invalid, TAWS-B operating with PFD Terrain or Obstacle databases	None	TERRAIN DATABASE FAILURE	None

Annunciation is shown on the TAWS-B Page and the Navigation Map Page when Terrain is enabled.

† *"TAWS Available" (in-flight only) when sufficient GPS signal received, or terrain database coverage re-entered.*

DATABASE MANAGEMENT

The system uses Secure Digital (SD) cards to load and store various types of data. For basic flight operations, SD cards are required for database storage as well as Jeppesen navigation and Jeppesen ChartView database updates. Not all SD cards are compatible with the G1000. Use only SD cards supplied by Garmin or the aircraft manufacturer.

GARMIN DATABASES

The following databases are stored on Supplemental Data Cards provided by Garmin:

- Expanded basemap
- Airport terrain
- SafeTaxi
- Airport Directory (AOPA)
- Terrain
- Obstacle
- FliteCharts

After subscribing to the desired database product updates, a personal computer is used to copy these updated databases to the Supplemental Data Card which will reside in the bottom card slot of the MFD (this is also the card that contains the FliteCharts or ChartView database). This allows taking all applicable databases to the airplane on one card and using the G1000 system to update the remaining display Supplemental Data Cards. Figure B-1 illustrates the correct location of the Supplemental Data Cards and their respective databases. Since these databases are not stored internally in the displays, these Supplemental Data Cards must remain in the bottom card slot of each display.

PFD

MFD

Expanded Basemap
Terrain
Airport Terrain
Obstacle
SafeTaxi
Airport Directory (AOPA)
SD Card

Expanded Basemap
Terrain
Airport Terrain
Obstacle
SafeTaxi
Airport Directory (AOPA)
FliteCharts or ChartView
SD Card
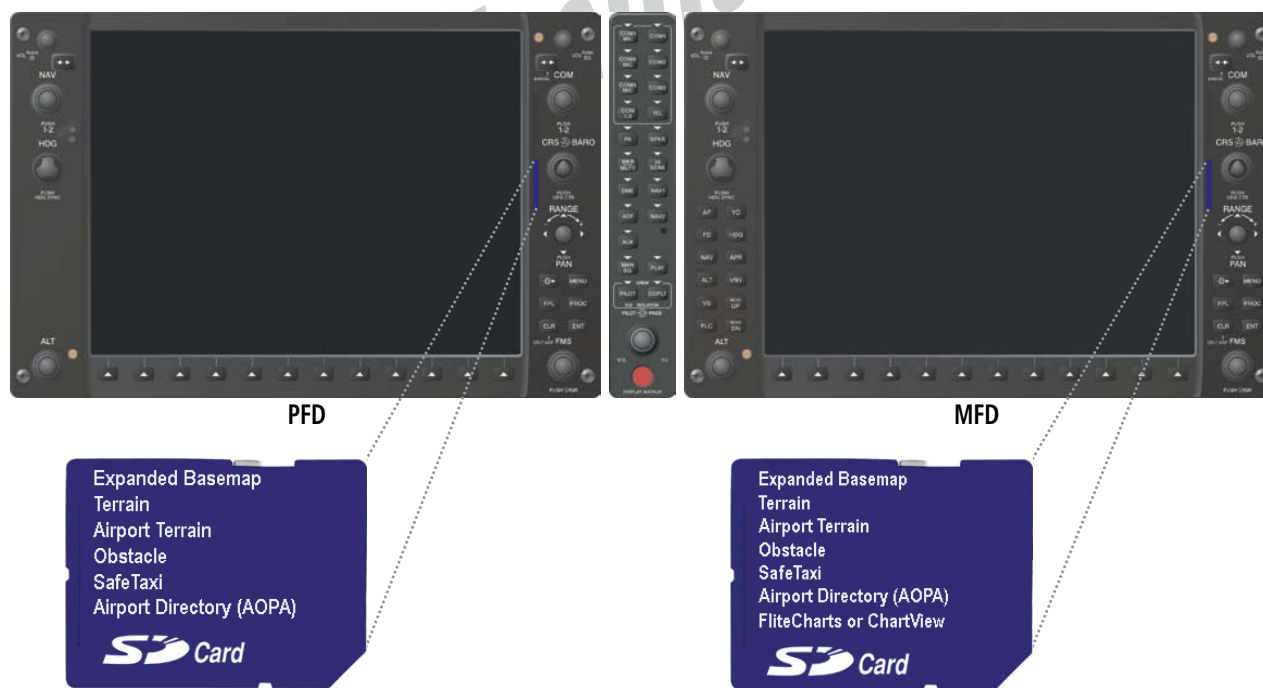
Figure B-1 Correct Database Locations

The basemap database contains data for the topography and land features, such as rivers, lakes, and towns. It is updated only periodically, with no set schedule. There is no expiration date.

The terrain database contains the terrain mapping data. The airport terrain database contains increased resolution terrain data around airports. These databases are updated periodically and have no expiration date.

The obstacle database contains data for obstacles, such as towers, that pose a potential hazard to aircraft. Obstacles 200 feet and higher are included in the obstacle database. It is very important to note that not all obstacles are necessarily charted and therefore may not be contained in the obstacle database. This database is updated on a 56-day cycle.

> **NOTE:** *The data contained in the terrain and obstacle databases comes from government agencies. Garmin accurately processes and cross-validates the data, but cannot guarantee the accuracy and completeness of the data.*

The AOPA Airport Directory provides data on airports and heliports throughout the U.S., and offers detailed information for over 5,300 U. S. airports, along with the names and phone numbers of thousands of FBOs. This database is updated four times per year.

The SafeTaxi database contains detailed airport diagrams for selected airports. These diagrams aid in following ground control instructions by accurately displaying the aircraft position on the map in relation to taxiways, ramps, runways, terminals, and services. This database is updated on a 56-day cycle.

The FliteCharts database contains procedure charts for the United States only. This database is updated on a 28-day cycle. If not updated within 180 days of the expiration date, FliteCharts will no longer function.

OBTAINING GARMIN DATABASE UPDATES

The Garmin database updates can be obtained by following the instructions detailed in the 'Aviation Databases' section of the Garmin website (fly.garmin.com). Once the updated files have been downloaded from the website, a PC equipped with an appropriate SD card reader is used to unpack and copy the new databases onto the appropriate Supplemental Data Card. Equipment required to perform the update is as follows:

- Windows-compatible PC computer (Windows 2000 or XP recommended)
- SD Card Reader: SanDisk SDDR-93, SanDisk SDDR-99, Verbatim #96504, or equivalent
- Updated database obtained from the Garmin website
- Existing Supplemental Database SD Card (010-00330-41, -42, or -43) from the MFD. The supplemental data card from the MFD should be used because all databases (except the active navigation database) are required to reside on this card.

JEPPESEN DATABASES

The Jeppesen navigation database is updated on a 28-day cycle. The ChartView database is updated on a 14-day cycle. If the ChartView database is not updated within 70 days of the expiration date, ChartView will no longer function. Both of these databases are provided directly from Jeppesen.

> **NOTE:** *The Jeppesen aviation navigation database is now referred to as the 'navigation database'. Previously this database had been referred to as the 'aviation database'.*

The ChartView database should be copied to the Supplemental Data Card which will reside in the bottom card slot on the MFD. The navigation database is be loaded from the Jeppesen or user supplied SD data card. Contact Jeppesen (www.jeppesen.com) for subscription and update information.

AUTOMATIC DATABASE SYNCHRONIZATION

The automatic database synchronization feature automatically transfers the Garmin databases from a single SD card residing in the bottom card slot of the MFD to the SD card in the bottom card slot of each PFD to ensure that all databases are synchronized. During power-up, the system compares all copies of each applicable database. If similar databases do not match, the most recent valid database is automatically copied to each card that does not already contain that database.

The following databases are checked and synchronized: Basemap, Safetaxi, Airport Terrain, Obstacle, Airport Directory (AOPA), and Terrain. This feature applies only to databases that are stored on the SD card that resides in the bottom card slot of each display. This feature does not apply to the active navigation database which is stored in internal memory in each display, or to the charts databases (FliteCharts and ChartView) which are only required to reside on the SD card in the bottom card slot of the MFD. The typical procedure would be to copy new databases to the MFD card, then synchronize the data to each PFD. Perform this procedure only when the aircraft is on the ground.

> ✓ **NOTE:** *The terrain database may take as long as 100 minutes to synchronize using this method. Therefore the user may want to transfer the data using a PC, or connect the system to a ground power source while performing the database synchronization.*

The **SYNC DBS** Softkey (Figure B-2) on the AUX–System Status Page allows control of the automatic database synchronization feature. When database synchronization is enabled, the **SYNC DBS** Softkey is displayed as black text on gray background. When database synchronization is disabled, the softkey is displayed as white text on black background. If the **SYNC DBS** Softkey is selected while a database synchronization is in progress, the current synchronization process will be canceled.

SYNC DBS	SYNC DBS
Enabled	*Disabled*

Figure B-2 SYNC DBS Softkey

The synchronization progress may be monitored on the AUX-System Status Page in the Sync Status section of the Database Window (Figure B-4). This window shows the synchronization status of each applicable database, including the percent complete, time remaining, and to which displays the databases are being copied. The Sync Status section is only present when synchronization is occurring or has occurred on the current power-up. When the synchronization is complete, the status is listed as 'Complete', followed by the displays to which the databases were copied. The database cycle numbers should be checked for each database on each display after synchronization to verify the display contains the proper database version.

The Display Database Selection Softkey (Figure B-3) is used to place the cursor in the Database Window. Upon first press of the Display Database Selection Softkey, the softkey will change to a selected state (black text on gray background) and the cursor will appear in the Database Window. At this point the user can scroll through all databases in the Database Window to view status information. If the Display Database Selection Softkey is selected repeatedly, the softkey will switch between PFD1 and MFD1. Database status information in the Database Window will reflect the database of the PFD or MFD.

MFD1 DB	MFD1 DB	PFD1 DB
Unselected	*MFD1 DB Selected*	*PFD1 DB Selected*

Figure B-3 Display Database Selection Softkey

If an error occurs during synchronization, an error message will be displayed, followed by the affected display in the Sync Status section of the Database Window (Figure B-4). If synchronization completes on one display, but an error occurs on another, the error message will be displayed with the affected diaplays listed after it. When an error message (Table B-1) is displayed, the problem must be corrected before synchronization can be completed. A power cycle is required to restart synchronization when 'Card Full' or 'Err' is shown.
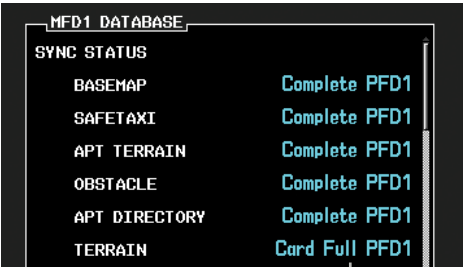
'Card Full' Message

Figure B-4 Synchronization Error Message

Error Message	Description
Canceled	An active synchronization has been canceled using the **SYNC DBS** Softkey
Card Full	SD card does not contain sufficient memory
Err	Displayed for all other errors that may cause the synchronization process to be halted
Timeout	System timed-out prior to the database transfer completing

Table B-1 Database Synchronization Error Messages

LOADING UPDATED DATABASES

In some cases it may be necessary to obtain an unlock code from Garmin in order to make the database product functional. It may also be necessary to have the system configured by a Garmin authorized service facility in order to use some database features.

Loading the Garmin database updates:

1) With system power OFF, remove the MFD database card from the bottom card slot of the MFD.

2) Update the Garmin databases on the MFD card.

3) Insert the MFD database card into the bottom card slot of the MFD.

4) Apply power to the system, check that the databases are initialized and displayed on the power-up screen (Figure B-5). When updating the terrain and FliteCharts databases, a 'Verifying' message may be seen. If this message is present, wait for the system to finish loading before proceeding to step 5.
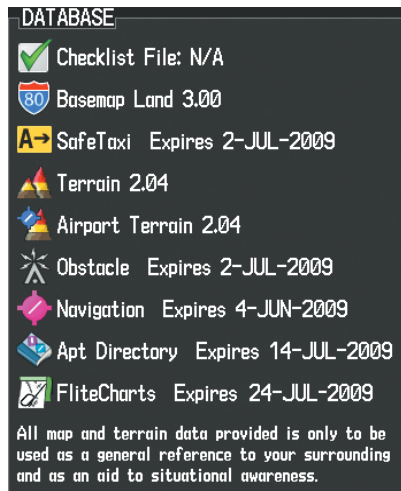
Figure B-5 Database Information on the Power-up Screen

5) Acknowledge the Power-up Page agreement by pressing the **ENT** Key or the right most softkey.

6) Turn the large **FMS** Knob to select the AUX Page group on the MFD.

7) Turn the small **FMS** Knob to select the System Status Page.

8) Make sure the **SYNC DBS** Softkey is in the enabled state (Figure B-2).

9) Monitor the Sync Status in the Database Window. Wait for all databases to complete synching, indicated by 'Complete' being displayed as seen in Figure B-4.

10) Remove and reapply power to the system.

11) Turn the large **FMS** Knob to select the AUX Page group on the MFD.

12) Turn the small **FMS** Knob to select the System Status Page.

13) Press the Display Database Selection Softkey to show database information for each display (**MFD1 DB**, **PFD1 DB**). Verify the correct database cycle information is shown for each database for each display.

Canceling an automatic database synchronization:

1) While synchronization is in progress, press the **SYNC DBS** Softkey to disable (Figure B-2) automatic database synchronization.

2) Acknowledge the cancelation by pressing the **ENT** Key.

Loading the Jeppesen navigation database:

NOTE: Loading the Jeppesen navigation database prior to its effective date will result in the expiration date on the power-up screen and the effective date on the AUX-System Status Page being displayed in yellow.

1) Copy the new navigation database to an SD card obtained from Garmin, or the aircraft manufacturer.

2) With the G1000 system OFF, insert the SD card containing the new navigation database version into the top card slot of the MFD (label of SD card facing left).

3) Turn the G1000 system ON. A prompt similar to Figure B-6 is displayed:

```
DO YOU WANT TO UPDATE THE ACTIVE NAVIGATION DATABASE?
SELECTING YES WILL OVERWRITE THE ACTIVE NAVIGATION DATABASE.
              FROM              TO
REGION:      WORLDWIDE         WORLDWIDE
CYCLE:       0912              0913
EFFECTIVE:   19-NOV-2009       17-DEC-2009
EXPIRES:     17-DEC-2009       14-JAN-2010

NO WILL BE ASSUMED IN 28 SECONDS.
```

Figure B-6 Navigation Database Load Prompt

4) Press the **YES** Softkey to update the navigation database in the MFD.

5) After the update completes, the display starts in normal mode.

6) Turn the G1000 system OFF and remove the SD card from the top card slot.

7) Repeat steps 2 through 6 for the PFD.

8) Apply power to the system and press the **ENT** Key to acknowledge the startup screen.

9) Turn the large **FMS** Knob to select the AUX Page group on the MFD.

10) Turn the small **FMS** Knob to select the System Status Page.

11) Select the Display Database Selection Softkey to show navigation database information for each display (**MFD1 DB** and **PFD1 DB**) as seen for the MFD in Figure B-7.

```
MFD1 DATABASE
NAVIGATION - INTERNAL
     REGION              WORLDWIDE
     CYCLE                    0913
     EFFECTIVE            17-DEC-09
     EXPIRES             14-JAN-10
        Copyright 2009. Jeppesen Sanderson, Inc.
BASEMAP - BOTTOM CARD
     REGION              WORLDWIDE
     VERSION                  3.00
        GARMIN LTD. AND ITS SUBSIDIARIES 2008
SAFETAXI - BOTTOM CARD
     REGION                     US
     VERSION                  2.25
```

Figure B-7 Check Database Cycle Number (MFD shown)

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MAGNETIC FIELD VARIATION DATABASE UPDATE

A copy of the current magnetic field variation database (MV DB) is included with the navigation database. At startup, the system compares this version of the MV DB with that presently being used by the AHRS (GRS). If the system determines the MV DB needs to be updated, a prompt is displayed on the Navigation Map Page.
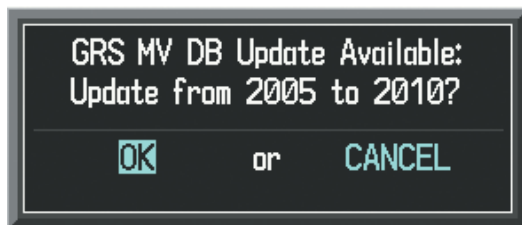
Figure B-8 GRS Magnetic Field Variation Database Update Prompt

Loading the magnetic field variation database update:

1) With 'OK' highlighted, as shown in figure B-8, press the **ENT** Key on the MFD. A progress monitor is displayed as shown in Figure B-9.

Figure B-9 Uploading Database to GRS

2) When the upload is complete, the system is ready for use.

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GLOSSARY

ACC	accuracy		AUX	auxiliary
ACT, ACTV	active, activate		AWOS	Automated Weather Observing System
ADC	air data computer			
ADF	Automatic Direction Finder		B ALT	barometric altitude
ADI	Attitude Direction Indicator		BARO	barometric setting
AF	Arc to fix		BATT	battery
AFCS	Automatic Flight Control System		BC	backcourse
AFM	Airplane Flight Manual		Bearing	The compass direction from the present position to a destination waypoint.
AFMS	Airplane Flight Manual Supplement			
AFRM	airframe		BFO	beat frequency oscillator
AGL	Above Ground Level		BKSP	backspace
AHRS	Attitude and Heading Reference System		BRG	bearing
AIM	Airman's Information Manual			
AIRMET	Airman's Meteorological Information		C	center runway
ALRT	alert		°C	degrees Celsius
ALT	altitude		CA	Course to Altitude
ALT, ALTN	alternator		CALC	calculator
AMPS	amperes		Calibrated Airspeed	Indicated airspeed corrected for installation and instrument errors.
ANNUNC	annunciation			
ANT	antenna		CD	Course to DME distance
AP	autopilot		CDI	Course Deviation Indicator
AP DISC	autopilot disconnect		CDU	Control Display Unit
APR	approach		CF	Course to Fix
APT	airport, aerodrome		CHT	Cylinder Head Temperature
ARINC	Aeronautical Radio Incorporated		CHKLIST	checklist
ARSPC	airspace		CHNL	channel
ARTCC	Air Route Traffic Control Center		CI	Course to Intercept
ARV	arrival		CLD	cloud
AS	airspeed		CLR	clear
ASB	Aviation Support Branch		cm	centimeter
ASOS	Automated Surface Observing System		CNS	Communication, Navigation, & Surveillance
ATC	Air Traffic Control			
ATCRBS	ATC Radar Beacon System		CO	carbon monoxide
ATIS	Automatic Terminal Information Service		COM	communication radio
ATK	along-track		CONFIG	configuration
AUTOSEQ	automatic sequence		COOL	coolant
			COPLT	co-pilot

Course	The line between two points to be followed by the aircraft.		DH	decision height
Course to Steer	The recommended direction to steer in order to reduce course error or stay on course. Provides the most efficient heading to get back to the desired course and proceed along the flight plan.		Dilution of Precision	A measure of GPS satellite geometry quality on a scale of one to ten (lower numbers equal better geometry, where higher numbers equal poorer geometry).
CR	Course to Radial		DIR	direction
CRG	Cockpit Reference Guide		DIS	distance
CRNT	current		Distance	The 'great circle' distance from the present position to a destination waypoint.
Crosstrack Error	The distance the aircraft is off a desired course in either direction, left or right.		DME	Distance Measuring Equipment
CRS	course		DOP	Dilution of Precision
CRS	Course to Steer		DP	Departure Procedure
CRSR	cursor		DPRT	departure
CTA	Control Area		DR	dead reckoning
CTRL	control		DSBL	disabled
Cumulative	The total of all legs in a flight plan.		DTK	Desired Track
CVR	Cockpit Voice Recorder		E	empty, east
CVRG	coverage		ECU	Engine Control Unit
CWS	control wheel steering		Efficiency	A measure of fuel consumption, expressed in distance per unit of fuel.
CYL	cylinder		EGT	Exhaust Gas Temperature
			EIS	Engine Indication System
D ALT	density altitude		ELEV	elevation
DB, DBASE	database		ELEV	elevator
dBZ	decibels 'Z' (radar return)		EMERGCY	emergency
DCLTR, DECLTR	declutter		EMI	Electromagnetic Interference
DEC FUEL	decrease fuel		ENDUR	endurance
deg	degree		Endurance	Flight endurance, or total possible flight time based on available fuel on board.
DEIC, DEICE	de-icing			
DEP	departure		ENG	engine
Desired Track	The desired course between the active "from" and "to" waypoints.		ENGD	engaged
			ENR	enroute
DEST	destination		Enroute Safe Altitude	The recommended minimum altitude within ten miles left or right of the desired course on an active flight plan or direct-to.
DF	Direct to Fix			
DFLT	default			
DGRD	degrade			

ENT	enter		FPL	flight plan
EPE	Estimated Position Error		fpm	feet per minute
EPU	Estimated Position Uncertainty		FREQ	frequency
ERR	error		FRZ	freezing
ESA	Enroute Safe Altitude		FSS	Flight Service Station
Estimated Position Error	A measure of horizontal GPS position error derived by satellite geometry conditions and other factors.		ft	foot/feet
			Fuel Flow	The fuel flow rate, expressed in units of fuel per hour.
Estimated Time of Arrival	The estimated time at which the aircraft should reach the destination waypoint, based upon current speed and track.		Fuel On Board	The total amount of usable fuel on board the aircraft.
Estimated Time Enroute	The estimated time it takes to reach the destination waypoint from the present position, based upon current ground speed.		G/S, GS	glideslope
			GA	go-around
			gal, gl	gallon(s)
ETA	Estimated Time of Arrival		GBOX	gearbox
ETE	Estimated Time Enroute		GDC	Garmin Air Data Computer
EXPIRD	expired		GDL	Garmin Satellite Data Link
			GDU	Garmin Display Unit
ºF	degrees Fahrenheit		GEA	Garmin Engine/Airframe Unit
FA	Course From Fix to Altitude		GEO	geographic
FAA	Federal Aviation Administration		GFC	Garmin Flight Control
FADEC	Full Authority Digital Engine Control		GIA	Garmin Integrated Avionics Unit
FAF	Final Approach Fix		GLS	Global Navigation Satellite Landing System
FAIL	failure		GMA	Garmin Audio Panel System
FC	Course From Fix to Distance		GMT	Greenwich Mean Time
FCC	Federal Communication Commission		GMU	Garmin Magnetometer Unit
FCST	forecast		GND	ground
FD	Course From Fix to DME Distance		gph	gallons per hour
FD	flight director		GPS	Global Positioning System
FDE	Fault Detection and Exclusion		Grid MORA	Grid Minimum Off-Route Altitude; one degree latitude by one degree longitude in size and clears the highest elevation reference point in the grid by 1000 feet for all areas of the grid
FFLOW	fuel flow			
FIS-B	Flight Information Services-Broadcast			
FISDL	Flight Information Service Data Link			
FL	flight level			
FLC	Flight Level Change		Groundspeed	The velocity that the aircraft is travelling relative to a ground position.
FM	Course From Fix to Manual Termination		Ground Track	see Track
FMS	Flight Management System		GRS	Garmin Reference System
FOB	Fuel On Board		GS	Ground speed

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GTS	Garmin Traffic System		ILS	Instrument Landing System
GTX	Garmin Transponder		IMC	Instrument Meteorological Conditions
			in	inch
HA	Hold Terminating at Altitude		INACTV	inactive
HDG	heading		INC FUEL	increase fuel
Heading	The direction an aircraft is pointed, based upon indications from a magnetic compass or a properly set directional gyro.		IND	indicated
			Indicated	Information provided by properly calibrated and set instrumentation on the aircraft panel.
HF	Hold Terminating at Fix		INFO	information
HFOM	Horizontal Figure of Merit		in HG	inches of mercury
Hg	mercury		INT	intersection(s)
HI	high		INTEG	integrity (RAIM unavailable)
HI SENS	High Sensitivity		IrDA, IRDA	Infrared Data Association
HM	Hold with Manual Termination			
Horizontal Figure of Merit	A measure of the uncertainty in the aircraft's horizontal position.		KEYSTK	key stuck
			kg	kilogram
			kHz	kilohertz
hPa	hectopascal		km	kilometer
HPL	Horizontal Protection Level		kt	knot
hr	hour			
HSDB	High-Speed Data Bus		L	left, left runway
HSI	Horizontal Situation Indicator		LAT	latitude
HT	heat		LBL	label
HUL	Horizontal Uncertainty Level		lb	pound
Hz	Hertz		LCD	Liquid Crystal Display
			LCL	local
I	Inner Marker		LED	Light Emitting Diode
IAF	Initial Approach Fix		Left Over Fuel On Board	The amount of fuel remaining on board after the completion of one or more legs of a flight plan or direct-to.
IAT	Indicated Air Temperature			
IAU	Integrated Avionics Unit			
ICAO	International Civil Aviation Organization		Left Over Fuel Reserve	The amount of flight time remaining, based on the amount of fuel on board after the completion of one or more legs of a flight plan or direct-to, and a known consumption rate.
ICS	Intercom System			
ID	Identification/Morse Code Identifier			
IDENT, IDNT	identification			
IF	Initial Fix		Leg	The portion of a flight plan between two waypoints.
IFR	Instrument Flight Rules			
IG	Imperial gallon		LIFR	Low Instrument Flight Rules
			LNAV	Lateral Navigation

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LO	low	MSA	Minimum Safe Altitude
LOC	localizer	MSG	message
LOI	loss of integrity (GPS)	MSL	Mean Sea Level
LON	longitude	MT	meter
LPV	Localizer Performance with Vertical guidance	mV	millivolt(s)
LRU	Line Replaceable Unit	MVFR	Marginal Visual Flight Rules
LT	left		
LTNG	lightning	N	north
LVL	level	NAV	navigation
		NAVAID	NAVigation AID
M	Middle Marker	NDB	Non-directional Beacon
m	meter	NEXRAD	Next Generation Radar
MAG	Magnetic	nm	nautical mile(s)
MAG VAR	Magnetic Variation	NoPT	No Procedure Turn Required (Procdeure shall not be executed without ATC clearance)
MAHP	Missed Approach Hold Point		
MAN IN	manifold pressure (inches Hg)	NRST	nearest
MAN SQ	Manual Squelch		
MAP	Missed Approach Point	O	Outer Marker
MASQ	Master Avionics Squelch	OAT	Outside Air Temperature
MAX	maximum	OBS	Omni Bearing Selector
MAXSPD	maximum speed (overspeed)	OFST	offset
MDA	barometric minimum descent altitude	OXY	oxygen
MET	manual electric trim		
METAR	Meteorological Aviation Routine	P ALT	pressure altitude
MEPT	manual electric pitch trim	PA	Passenger Address
MFD	Multi Function Display	PA	Proximity Advisory
MGRS	Military Grid Reference System	PASS	passenger(s)
MHz	megahertz	PC	personal computer
MIC	microphone	PFD	Primary Flight Display
MIN	minimum	PI	Procedure Turn to Course Intercept
Minimum Safe Altitude	Uses Grid MORAs to determine a safe altitude within ten miles of the aircraft present position.	PIT, PTCH	pitch
		POSN	position
		PPM	parts per million
MKR	marker beacon	P. POS	Present Position
MOA	Military Operations Area	PRES, PRESS	pressure
MOV	movement	PROC	procedure(s), procedure turn
mpm	meters per minute	psi	pounds per square inch

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PTK	parallel track
PTT	Push-to-Talk
PWR	power
QTY	quantity
R	right, right runway
RAD	radial
RAIM	Receiver Autonomous Integrity Monitoring
RAM	random access memory
REF	reference
REM	remaining (fuel remaining above Reserve)
REQ	required
RES	reserve (fuel reserve entered by pilot)
REV	reverse, revision, revise
RF	Constant Radius Turn to Fix
RMI	Radio Magnetic Indicator
RMT	remote
RNG	range
RNWY	runway
ROL	roll
ROM	read only memory
rpm	revolutions per minute
RST FUEL	reset fuel
RSV	reserve (fuel reserve entered by pilot)
RT	right
RVRSNRY	reversionary
RX	receive
S	south
SA	Selective Availability
SAT	Static Air Temperature
SBAS	Satellite-Based Augmentation System
SCIT	Storm Cell Identification and Tracking
SD	Secure Digital

sec	second(s)
SEL, SLCT	select
SFC	surface
SIAP	Standard Instrument Approach Procedures
SID	Standard Instrument Departure
SIGMET	Significant Meteorological Information
Sim	simulator
SLP/SKD	slip/skid
SMBL	symbol
SPD	speed
SPI	Special Position Identification
SPKR	speaker
SQ	squelch
SRVC, SVC	service
STAL	stall
STAR	Standard Terminal Arrival Route
STATS	statistics
STBY	standby
STD	standard
STRMSCP	Stormscope
SUA	Special Use Airspace
SUSP	suspend
SW	software
SYS	system
SVS	Synthetic Vision System
T	true
TA	Traffic Advisory
TACAN	Tactical Air Navigation System
TAF	Terminal Aerodrome Forecast
TAS	True Airspeed
TAS	Traffic Advisory System, true airspeed
TAT	Total Air Temperature
TAWS	Terrain Awareness and Warning System
TCA	Terminal Control Area
TCAS	Traffic Collision Avoidance System
TEL	telephone

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TEMP	temperature		Vertical Speed Required	The vertical speed necessary to descend/climb from a current position and altitude to a defined target position and altitude, based upon current groundspeed.
TERM	terminal			
TF	Track Between Two Fixes			
TFR	Temporary Flight Restriction			
T HDG	True Heading		VFOM	Vertical Figure of Merit
TIS	Traffic Information System		VFR	Visual Flight Rules
TIT	Turbine Inlet Temperature		VHF	Very High Frequency
TKE	Track Angle Error		VI	Heading Vector to Intercept
TMA	Terminal Maneuvering Area		VLOC	VOR/Localizer Receiver
TMR/REF	Timer/Reference		VM	Heading Vector to Manual Termination
Topo	topographic		VMC	Visual Meteorological Conditions
Track	Direction of aircraft movement relative to a ground position; also 'Ground Track'		VNAV, VNV	vertical navigation
			VOL	volume
			VOR	VHF Omni-directional Range
Track Angle Error	The angle difference between the desired track and the current track.		VORTAC	very high frequency omnidirectional range station and tactical air navigation
TRG	target			
TRK	track		VPL	Vertical Protection Level
TRSA	Terminal Radar Service Area		VPROF	VNV profile, vertical profile
TRUNC	truncated		VPTH	VNV path, vertical path
TTL	total		VR	Heading Vector to Radial
TURN	procedure turn		VS	vertical speed
TX	transmit		VSI	Vertical Speed Indicator
			VSR	Vertical Speed Required
			VTF	vector to final
UNAVAIL	unavailable			
USR	user			
UTC	Coordinated Universal Time		W	watt(s), west
UTM/UPS	Universal Transverse Mercator / Universal Polar Stereographic Grid		WAAS	Wide Area Augmentation System
			WARN	warning (GPS position error)
			WGS-84	World Geodetic System - 1984
V, Vspeed	velocity (airspeed)		WPT	waypoint(s)
VA	Heading Vector to Altitude		WW	world wide
VAPP	VOR approach		WX	weather
VAR	variation			
VD	Heading Vector to DME Distance		XFER, XFR	transfer
Vdc	volts, direct current		XPDR	transponder
VERT	vertical		XTALK	cross-talk
Vertical Figure of Merit	A measure of the uncertainty in the aircraft's vertical position.		XTK	cross-track

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FREQUENTLY ASKED QUESTIONS

If a particular aspect of G1000 operational capability is not addressed by these commonly asked questions or in the index, contact Garmin (see the copyright page or back cover for contact information) or a Garmin-authorized dealer. Garmin is dedicated to supporting its products and customers.

WHAT IS SBAS?

The Satellite Based Augmentation System (SBAS) uses a system of ground stations to correct any GPS signal errors. These ground stations correct for errors caused by ionospheric disturbances, timing, and satellite orbit errors. It also provides vital integrity information regarding the health of each GPS satellite. The signal correction is then broadcast through geostationary satellites. This correction information can then be received by any SBAS-enabled GPS receiver.

SBAS is designed to provide the additional accuracy, availability, and integrity necessary to enable users to rely on GPS for all phases of flight.

There are several SBAS systems serving different parts of the world. The Wide Area Augmentation System (WAAS) is currently available in the United States, including Alaska and Hawaii. The European Geostationary Navigation Overlay Service (EGNOS) offers coverage of Europe, parts of the middle east and northern Africa. The Multi-functional Satellite Augmentation System (MSAS) covers mainly Japan and parts of northern Australia.

HOW DOES SBAS AFFECT APPROACH OPERATIONS?

Both LNAV/VNAV and LPV approaches use the accuracy of SBAS to include vertical (glide path) guidance capability. The additional accuracy and vertical guidance capability allows improved instrument approaches to an expanded number of airports throughout the U.S.

The implementation of LPV approaches further improves precision approach capabilities. LPV approaches are designed to make full use of the improved GPS signal from the SBAS. This approach combines the LNAV/VNAV vertical accuracy with lateral guidance similar to the typical Instrument Landing System (ILS). LPV approaches allow lower approach minimums.

WHAT IS RAIM AND HOW DOES IT AFFECT APPROACH OPERATIONS?

RAIM is an acronym for Receiver Autonomous Integrity Monitoring. RAIM is a GPS receiver function that performs the following functions:

- Monitors and verifies integrity and geometry of tracked GPS satellites

- Notifies the pilot when satellite conditions do not provide the necessary coverage to support a certain phase of flight

- Predicts satellite coverage of a destination area to determine whether the number of available satellites is sufficient to satisfy requirements

> **NOTE:** If RAIM is not predicted to be available for the final approach course, the approach does not become active, as indicated by the "RAIM not available from FAF to MAP" message and the LOI annunciation flagging on the HSI.

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For RAIM to work correctly, the GPS receiver must track at least five satellites. A minimum of six satellites is required to allow RAIM to eliminate a single corrupt satellite from the navigation solution.

RAIM ensures that satellite geometry allows for a navigation solution calculation within a specified protection limit (2.0 nm for oceanic and en route, 1.0 nm for terminal, and 0.3 nm for non-precision approaches). The G1000 System monitors RAIM and issues an alert message when RAIM is not available (see Appendix A). Without RAIM, GPS position accuracy cannot be monitored. If RAIM is not available when crossing the FAF, the pilot must fly the missed approach procedure.

WHY ARE THERE NOT ANY APPROACHES AVAILABLE FOR A FLIGHT PLAN?

Approaches are available for the final destination airport in a flight plan or as a direct-to (keep in mind that some VOR/VORTAC identifiers are similar to airport identifiers). If a destination airport does not have a published approach, the G1000 indicates "NONE" for the available procedures.

WHAT HAPPENS WHEN AN APPROACH IS SELECTED? CAN A FLIGHT PLAN WITH AN APPROACH, A DEPARTURE, OR AN ARRIVAL BE STORED?

When an approach, departure, or arrival is loaded into the active flight plan, a set of approach, departure, or arrival waypoints is inserted into the flight plan, along with a header line showing the title of the selected instrument procedure. The original en route portion of the flight plan remains active, unless the instrument procedure is activated. This may be done either when the procedure is loaded or at a later time.

Flight plans can also be stored with an approach, a departure, or an arrival. Note that the active flight plan is erased when the system is turned off. Also, the active flight plan is overwritten when another flight plan is activated. When storing flight plans with an approach, a departure, or an arrival, the G1000 uses the waypoint information from the current database to define the waypoints. If the database is changed or updated, the G1000 System automatically updates the information, provided the procedure has not been modified. Should an approach, departure, or arrival procedure no longer be available, the flight plan becomes locked until the procedure is deleted from the flight plan.

CAN "SLANT GOLF" ("/G") BE FILED USING THE G1000?

"/G" may be filed for a flight plan. The G1000 System meets the requirements of TSO-C145a Class 3 and ETSO-C145 Class 3 installations. GPS approaches are not to be flown with an expired database. See the approved AFM/POH as well as the Aeronautical Information Manual (AIM) for more information.

WHAT DOES THE OBS SOFTKEY DO?

The **OBS** Softkey is used to select manual sequencing of waypoints. Activating OBS mode sets the current active-to waypoint as the primary navigation reference and prevents the system from sequencing to the next waypoint in a flight plan. When OBS mode is cancelled, automatic waypoint sequencing is continued, and the G1000 automatically activates the next waypoint in the flight plan once the aircraft has crossed the present active waypoint.

Normal (OBS not activated)	OBS
• Automatic sequencing of waypoints	• Manual sequencing - 'holds' on selected waypoint
• Manual course change on HSI not possible	• Manually select course to waypoint from HSI
• Always navigates 'TO' the active waypoint	• Indicates 'TO' or 'FROM' waypoint
• Must be in this mode for final approach course	• Cannot be set for final approach course or published holding patterns

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When OBS mode is active, the G1000 allows the pilot to set a desired course to/from a waypoint using the **CRS/BARO** Knob and HSI (much like a VOR).

The most common application for using the **OBS** Softkey is the missed approach. The G1000 suspends automatic waypoint sequencing (indicated by a 'SUSP' annunciation placed on the HSI) when the missed approach point (MAP) is crossed. This prevents the G1000 from automatically sequencing to the missed approach holding point (MAHP). During this time, the **OBS** Softkey designation changes to **SUSP**. Pressing the **SUSP** Softkey reactivates automatic waypoint sequencing. The **OBS** Softkey then resumes its normal functionality.

WHY DOES THE G1000 NOT AUTOMATICALLY SEQUENCE TO THE NEXT WAYPOINT?

The G1000 only sequences flight plan waypoints when automatic sequencing is enabled (i.e., no "OBS" or 'SUSP' annunciation). For automatic sequencing to occur, the aircraft must also cross the "bisector" of the turn being navigated. The bisector is a line passing through the waypoint common to two flight plan legs at an equal angle from each leg.

HOW CAN A WAYPOINT BE SKIPPED IN AN APPROACH, A DEPARTURE, OR AN ARRIVAL?

The G1000 allows the pilot to manually select any approach, departure, or arrival leg as the active leg of the flight plan. This procedure is performed on the MFD from the Active Flight Plan Page by highlighting the desired waypoint and selecting the **ACT LEG** Softkey then the **ENT** Key to approve the selection. The GPS then provides navigation along the selected flight plan leg.

WHEN DOES TURN ANTICIPATION BEGIN?

The G1000 smooths adjacent leg transitions based on a normal 15° bank angle (with the ability to roll up to 30°) and provides three pilot cues for turn anticipation:

- A waypoint alert ('Next DTK ###° in # seconds' or 'Next HDG ###° in # seconds') appears on the PFD 10 seconds before the turn point and flashes as it counts down to zero.

- A flashing turn advisory ('Turn [right/left] to ###° in # seconds') appears on the PFD 10 seconds before the turn and flashes as it counts down to zero. 'Turn [right/left] to ###° now' or 'Next [DTK/HDG] to ###° now' is displayed when the pilot is to begin the turn and the HSI (GPS mode) automatically sequences to the next DTK or HDG value.

- The To/From indicator on the HSI flips momentarily to indicate that the midpoint of the turn has been crossed.

WHEN DOES THE CDI SCALE CHANGE?

Once a departure is activated, the G1000 Course Deviation Indicator (CDI) full scale deflection is set to 0.3 nm. The CDI scale changes to 1.0 nm (terminal mode) then ramps up to 2.0 nm (enroute mode) at 30 nm from the departure airport. When 31 nm from the destination, the CDI scale smoothly transition from 2.0 nm back to 1.0 nm (terminal mode). At 2.0 nm before the FAF during an active approach, the CDI scale transitions down further based on the type of approach activated (LNAV, LNAV/VNAV, LPV). When a missed approach is activated, the CDI is set to 0.3 nm. See the Flight Instruments Section for more details on CDI scaling.

WHY DOES THE HSI NOT RESPOND LIKE A VOR WHEN OBS MODE IS ACTIVE?

Unlike a VOR, the CDI scale used on GPS equipment is based on the crosstrack distance to the desired course, not on the angular relationship to the destination. Therefore, the CDI deflection on the GPS is constant regardless of the distance to the destination and does not become less sensitive when further away from the destination.

WHAT IS THE CORRECT MISSED APPROACH PROCEDURE? HOW IS THE MISSED APPROACH HOLDING POINT SELECTED?

To comply with TSO specifications, the G1000 does not automatically sequence past the MAP. The first waypoint in the missed approach procedure becomes the active waypoint when the **SUSP** Softkey is selected *after* crossing the MAP. All published missed approach procedures must be followed, as indicated on the approach plate.

To execute the missed approach procedure prior to the MAP (not recommended), select the Active Flight Plan Page and use the **ACT LEG** Softkey to activate the missed approach portion of the procedure.

AFTER A MISSED APPROACH, HOW CAN THE SAME APPROACH BE RE-SELECTED? HOW CAN A NEW APPROACH BE ACTIVATED?

> **NOTE:** *Do not attempt to reactivate the current approach prior to crossing the missed approach point (MAP). If an attempt to do so is made, an alert message "Are you sure you want to discontinue the current approach?" appears. The G1000 directs the pilot back to the transition waypoint and does not take into consideration any missed approach procedures, if the current approach is reactivated.*

After flying the missed approach procedure, the pilot may reactivate the same approach for another attempt by pressing the **PROC** Key. Once the clearance is given for another attempt, activate the approach by highlighting 'ACTIVATE APPROACH' using the large **FMS** Knob and pressing the **ENT** Key. The G1000 provides navigation along the desired course to the waypoint and rejoins the approach in sequence from that point.

To activate a new approach for the same airport, select the new procedure by pressing the **PROC** Key. Choose 'SELECT APPROACH', select the desired approach from the list shown, and press the **ENT** Key. Select the desired transition, then activate the approach using the **ENT** Key.

To activate a new approach to a different airport, press the **Direct-to** Key and select the desired airport using the **FMS** Knobs. Press the **ENT** Key to accept the selected airport, then follow the steps in the preceding paragraph to select an approach for the new airport.

MAP SYMBOLS

NOTE: Refer to the Flight Management Section for the topography legend and the Hazard Avoidance Section for XM Weather Product legends.

AIRPORT

Item	Symbol
Unknown Airport	
Non-towered, Non-serviced Airport	
Towered, Non-serviced Airport	
Non-towered, Serviced Airport	
Towered, Serviced Airport	
Restricted (Private) Airport	
Heliport	

NAVAIDS

Item	Symbol
Intersection	
LOM (compass locator at outer marker)	
NDB (non-directional radio beacon)	
VOR	
VOR/DME	
VOR/ILS	
VORTAC	
TACAN	

LINE SYMBOLS

Item	Symbol
ICAO Control Area Class B Airspace	
Mode C Tower Area	
Warning Area Prohibited Area Alert Area Restricted Area Caution Area Training Area Danger Area Unknown Area	
Class C Terminal Radar Service Area Mode C Area	
Military Operations Area (MOA)	
State or Province Border	- - ST/PRV BORDER - -
International Border	INTL BORDER
Road	
Railroad	
Latitude/Longitude	

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MISCELLANEOUS

Item	Symbol
ARTCC Frequency or FSS Frequency	
Default Map Pointer	
Elevation Pointer	
Wind Vector	
Measuring Pointer	
Overzoom Indicator	
Terrain Proximity or TAWS Enabled	
Traffic Enabled	
User Waypoint	
Vertical Navigation Along Track Waypoint	
Parallel Track Waypoint	
Unanchored Flight Path Waypoint	
Top of Descent (TOD)	
Bottom of Descent (BOD)	
Navigating using Dead Reckoning	

STORMSCOPE LIGHTNING STRIKES

Item	Symbol
Lightning Strike (0-6 sec ago)	
Lightning Strike (6-20 sec ago)	
Lightning Strike (20-60 sec ago)	
Lightning Strike (60-120 sec ago)	

TRAFFIC

Item	Symbol
Non-threat Traffic (hollow diamond)	
Proximity Advisory	
Traffic Advisory, Out of Range	
Traffic Advisory	

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TERRAIN AVOIDANCE COLORS AND SYMBOLS

Terrain Color	Terrain Location
Red (WARNING)	Terrain above, or within 100 ft below the aircraft altitude
Yellow (CAUTION)	Terrain between 100 ft and 1000 ft below the aircraft altitude
Black	Terrain more than 1000 ft below the aircraft altitude
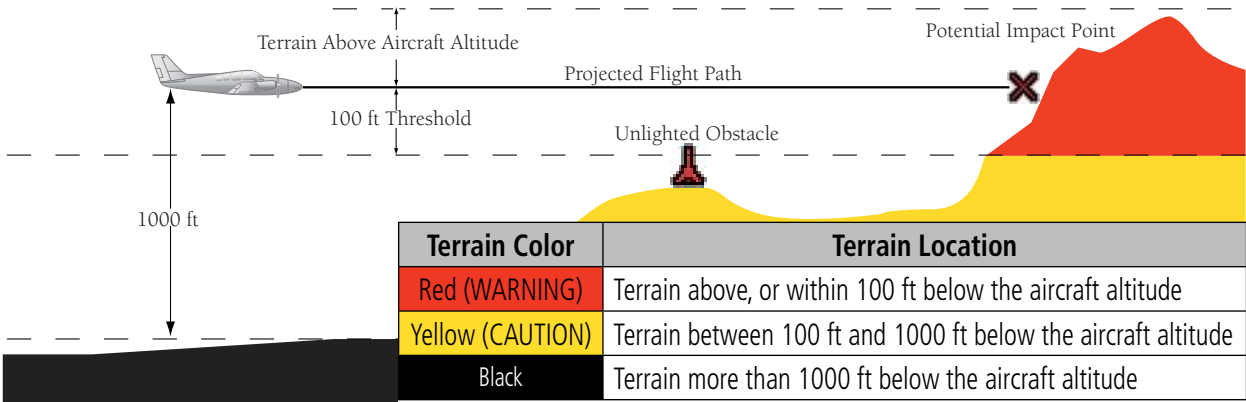
Figure E-1 TAWS Color Chart
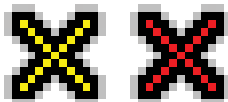
Figure E-2 TAWS Potential Impact Points

Height	Unlighted Obstacle		Lighted Obstacle		Obstacle Color	Obstacle Location
	< 1000 ft AGL	> 1000 ft AGL	< 1000 ft AGL	> 1000 ft AGL		
Obstacle Symbol	(red symbol)	(red symbol)	(red symbol)	(red symbol)	Red (WARNING)	Obstacle within 100 ft of or above aircraft altitude
	(yellow symbol)	(yellow symbol)	(yellow symbol)	(yellow symbol)	Yellow (CAUTION)	Obstacle within 1000 ft of aircraft altitude
	(gray symbol)	(gray symbol)	(gray symbol)	(gray symbol)	Gray	Obstacle more than 1000 ft below aircraft altitude

Obstacle Symbols and Colors

HAZARD AVOIDANCE FEATURES

This table identifies the symbols displayed in the lower right corner of PFD or MFD maps to indicate which hazard avoidance features are activated for display.

Feature	Symbol
Terrain Proximity/TAWS display enabled	
Traffic display enabled	
NEXRAD display enabled	
Cloud Top display enabled	
Echo Top display enabled	
XM Lightning display enabled	
Cell Movement display enabled	
SIGMETs/AIRMETs display enabled	
METARs display enabled	

Feature	Symbol
City Forecast display enabled	
Surface Analysis display enabled	
Freezing Levels display enabled	
Winds Aloft display enabled	
County Warnings display enabled	
Cyclone Warnings display enabled	
Icing Potential (CIP and SLD) (ICNG)	
Pilot Weather Report (PIREPs)	
Air Report (AIREPs)	
Turbulence (TURB)	
Loss of hazard avoidance feature, (a white X is shown over the symbol to indicate not available; e.g., traffic)	

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