GARMIN™

G1000® Integrated Flight Deck
Pilot's Guide

Cessna
Citation Mustang

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WARNING: Navigation and terrain separation must NOT be predicated upon the use of the terrain function. The G1000 Terrain Proximity 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 Proximity feature is only to be used as an aid for terrain avoidance and is not certified for use in applications requiring a certified terrain awareness system. 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 74B 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WARNING: Do not use outdated database information.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 Pilots using any outdated database do so entirely at their own risk.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 the G1000 Multi Function Display 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: XM Weather should not be used for hazardous weather penetration. Weather information provided by the GDL 69 is approved only for weather avoidance, not penetration.

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: The Garmin G1000, as installed in the Cessna Citation Mustang 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: For safety reasons, G1000 operational procedures must be learned on the ground.

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 Cessna Citation Mustang 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."*

CAUTION: *The GDU 1040A PFDs and GDU 1500 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: *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. 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: *This product, its packaging, and its components contain chemicals known to the State of California to cause cancer, birth defects, or reproductive harm. This notice is being provided in accordance with California's Proposition 65. If you have any questions or would like additional information, please refer to our web site at www.garmin.com/prop65.*

NOTE: *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: *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.*

Record of Revisions				
Part Number	**Revision**	**Date**	**Page Range**	**Description**
190-00494-00	A B	October, 2006 November, 2006	i through I-6 4-7, 4-16, 4-34 5-108 through 5-126 7-33 through 7-45	Production release Added 'SQ' and 'RX' annunciations. Added transponder code entry using the FMS Knob. Added flying an example flight plan to the GPS Navigation section. Udated AFCS examples to be consistent with the example flight plan in GPS Navigation section.
190-00494-01	A B	February, 2007 May, 2007	i through I-6 i through I-6	Added GDU 8.00 parameters and made various corrections. Added KHF 1050 HF and KTA 870 TAS Reformatted GPS Navigation Section Corrected various clerical errors

SECTION 1 SYSTEM OVERVIEW

1.1 SYSTEM DESCRIPTION

This section provides an overview of the G1000 Integrated Flight Deck as installed in the Cessna Citation Mustang. 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 1040A** Primary Flight Display (PFD)
- **GDU 1500** Multi Function Display (MFD)
- **GIA 63W** Integrated Avionics Unit
- **GDC 74B** Air Data Computer (ADC)
- **GEA 71** Engine/Airframe Unit
- **GRS 77** Attitude and Heading Reference System (AHRS)
- **GMU 44** Magnetometer
- **GMA 1347D** Dual Audio System with Integrated Marker Beacon Receiver

- **GTX 33/33D** Mode S Transponder
- **GDL 69A** Satellite Data Link Receiver
- **GWX 68** Weather Radar
- **GCU 475** MFD Control Unit
- **GMC 710** AFCS Control Unit
- **GTP 59** Outside Air Temperature (OAT) Probe
- **GA 56A** and **GA 57** GPS/WAAS Antennas
- **GSA 80** and **GSA 81** AFCS Servos
- **GSM 85A** Servo Gearboxes

A top-level G1000 system block diagram is shown in Figure 1-1 (it does not include the GA 56A, GA 57, or GSM 85A).

The following equipment is also connected to the G1000 system and interfaces with the GIA 63Ws:

- **Becker RA 3502 –** A remotely mounted ADF receiver that operates in the 190.0 kHz to 1799.5 kHz frequency band with 0.5 kHz channel spacing.

- **Honeywell KN 63 –** A remotely mounted 200-channel, 100-watt, all-solid-state digital DME transceiver that provides distance information to the G1000 system.

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

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

1.2 LINE REPLACEABLE UNITS (LRU)

- **GDU 1040A** (2) – Each unit is configured as a PFD that features a 10.4-inch LCD with 1024 x 768 resolution. The unit installed on the left/pilot side is designated as PFD1, and the one installed on the right/copilot side is designated as PFD2. These units communicate with each other, the MFD, and with the on-side GIA 63W Integrated Avionics Unit through a High-Speed Data Bus (HSDB) connection.

- **GDU 1500** (1) – Features a 15-inch LCD with 1024 x 768 resolution and is configured as an MFD. This unit is linked to both PFDs via HSDB connection.

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

- **GDC 74B** (2) – Processes data from the pitot/static system as well as the OAT probe. This unit provides pressure altitude, airspeed, vertical speed and OAT information to the G1000 system, and it communicates with the on-side GIA 63W, on-side GDU 1040A and on-side GRS 77, using an ARINC 429 digital interface (it also interfaces directly with the on-side GTP 59). The GDC 74B is designed to operate in Reduced Vertical Separation Minimum (RVSM) airspace.

- **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** (2) – Provides aircraft attitude and heading information via ARINC 429 to both the on-side GDU 1040A and the on-side GIA 63W. The GRS 77 contains advanced sensors (including accelerometers and rate sensors) and interfaces with the on-side GMU 44 to obtain magnetic field information, with the GDC 74B to obtain air data, and with both GIA 63Ws to obtain GPS information. AHRS modes of operation are discussed later in this document.

- **GMU 44** (2) – Measures local magnetic field. Data is sent to the GRS 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.

- **GMA 1347D** (2) – Integrates NAV/COM digital audio, intercom system and marker beacon controls, and is installed in dual configuration on the outboard side of PFD1 and PFD2. This unit also enables the manual control of the display reversionary mode (red **DISPLAY BACKUP** button) and communicates with the on-side GIA 63W, using an RS-232 digital interface.

- **GTX 33** (1) **and GTX 33D** (1 or 2) – Solid-state transponders that provide Modes A, C and S capability. Transponder #1 (XPDR1) is a GTX 33D, which includes Mode S with diversity. Either the GTX 33 or GTX 33D may be installed as Transponder #2 (XPDR2). Both transponders can be controlled from either PFD, and only one transponder can be active at a time. Each transponder communicates with the on-side GIA 63W 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.

- **GCU 475** (1) – Provides the Flight Management System (FMS) controls for the MFD through an RS-232 digital interface.

- **GMC 710** (1) – Provides the controls for the GFC 700 AFCS through an RS-232 digital interface allowing communication with both PFDs.

- **GTP 59** (2) – Provides Outside Air Temperature (OAT) data to the on-side GDC 74B.

- **GSA 80** (2), **GSA 81** (2), and **GSM 85A** (4) – The GSA 80 servos are used for the automatic control of roll and yaw, while the GSA 81 servos are used for the automatic control of pitch and pitch trim. These units interface with each GIA 63W.

  The GSM 85A servo gearbox is responsible for transferring the output torque of the GSA 80/81 servo actuator to the mechanical flight-control surface linkage.

- **GA 56A** (1) and **GA 57** (1) – The GA 56A is a through-mount GPS/WAAS antenna. The GA 57 is a through-mount GPS/WAAS antenna with XM/Data Link.

GA 56A GA 57
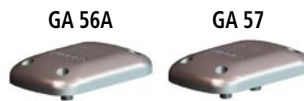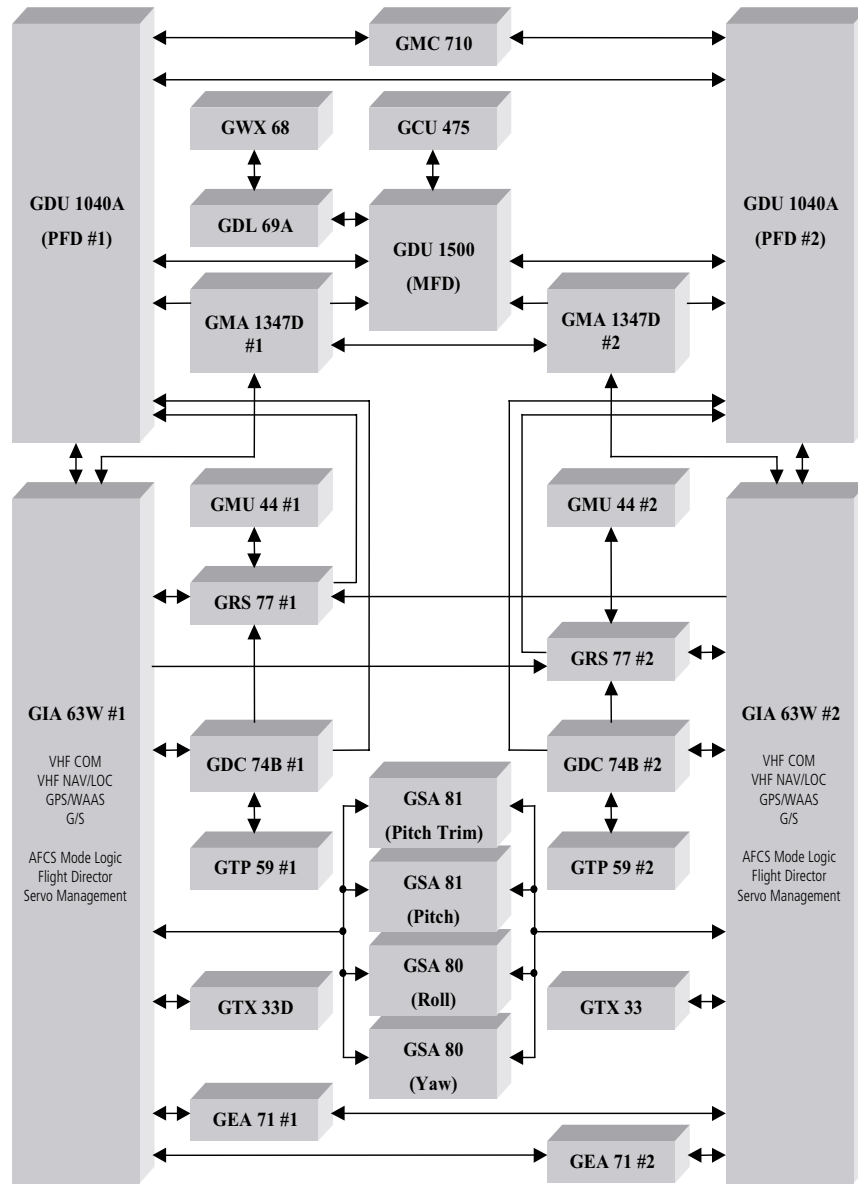
Figure 1-1 G1000 System (LRU Configuration)

1.3 G1000 CONTROLS

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

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

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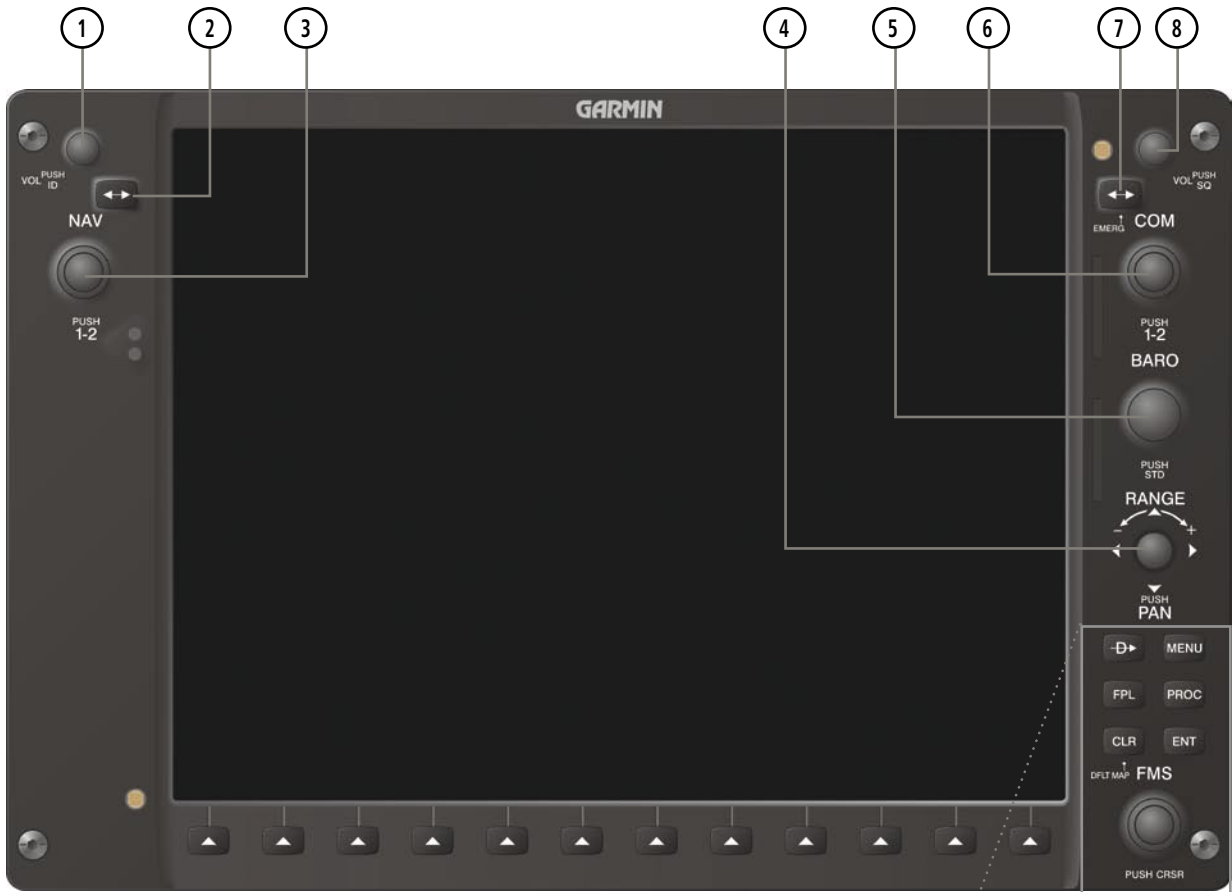
Figure 1-2 PFD Controls
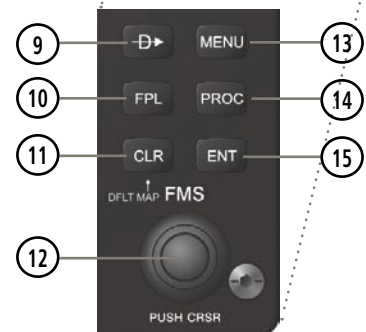
The following list provides an overview of the controls located on the PFD bezel (see Figure 1-2).

(1) **NAV VOL/ID Knob** – Controls NAV audio volume level. Press to toggle the Morse code identifier audio ON and OFF. Volume level is shown in the NAV frequency field as a percentage.

(2) **NAV Frequency Transfer Key** – Toggles the standby and active NAV frequencies.

(3) **Dual NAV Knob** – Tunes the standby frequencies for the NAV receiver (large knob for MHz; small knob for kHz). Press to switch the tuning box (cyan box) between NAV1 and NAV2.

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

(5) **BARO Knob** – Sets the altimeter barometric pressure. Press to enter standard pressure (29.92).

(6) **Dual COM Knob** – Tunes the standby frequencies for the COM transceiver (large knob for MHz; small knob for kHz). Press to switch the tuning box (cyan box) between COM1 and COM2.

(7) **COM Frequency Transfer Key** – Toggles the standby and active COM frequencies. Press and hold this key for two seconds to tune the emergency frequency (121.5 MHz) automatically into the active frequency field.

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

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

(10) **FPL Key** – Displays the active Flight Plan Page for creating and editing the active flight plan.

(11) **CLR Key** – Erases information, cancels entries, or removes page menus.

(12) **Dual FMS Knob** – Flight Management System Knob. Press the **FMS** Knob to turn the selection cursor ON and OFF. When the cursor is ON, data may be entered in the applicable window by turning the small and large knobs. The large knob moves the cursor on the page, while the small knob selects individual characters for the highlighted cursor location.

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

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

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

CONTROLS ASSOCIATED WITH THE MFD

The controls for the MFD (GDU 1500) are located on both the MFD bezel and the MFD Control Unit (GCU 475). The bottom portion of the MFD bezel features 12 softkeys that are designed to perform various functions depending upon the specific page being displayed. These softkeys are discussed throughout the Pilot's Guide documentation.

The following list provides an overview of the controls located on the MFD Control Unit (see Figure 1-3):
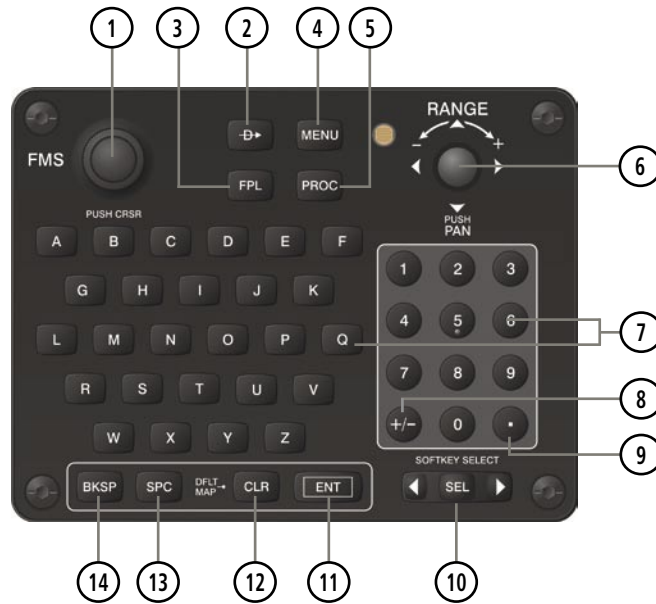
Figure 1-3 MFD Control Unit (GCU 475)

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

② **Direct-to Key (-D→)** – Allows the user to enter a destination waypoint and establish a direct course to the selected destination (the destination is either specified by the identifier, chosen from the active route, or taken from the map pointer position).

③ **FPL Key** – Displays the active Flight Plan Page for creating and editing the active flight plan, or for accessing stored flight plans.

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

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

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

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

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

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

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

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

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

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

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

AFCS CONTROLS

> **NOTE:** With the exception of the **FD** and **SPD** Keys, if a key is selected, its respective annunciator is illuminated.
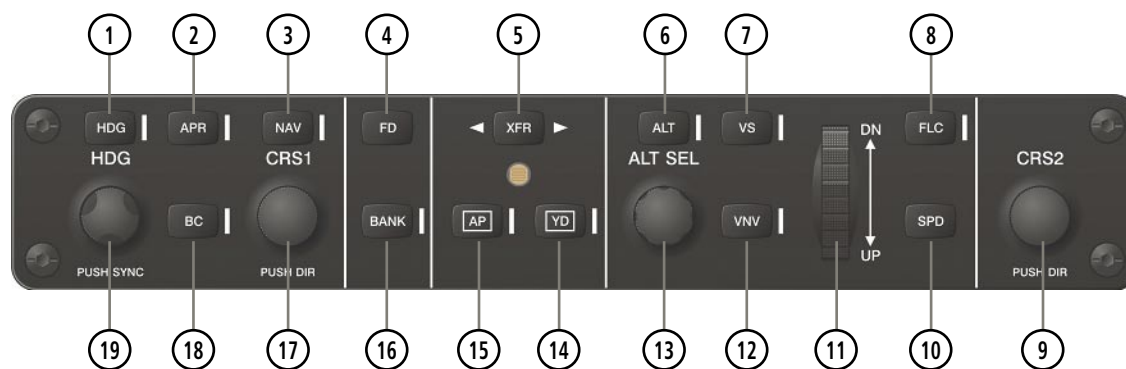
Figure 1-4 AFCS Control Unit (GMC 710)

The GFC 700 AFCS is mainly controlled through the GMC 710 AFCS Control Unit. The AFCS Control Unit consists of the following controls:

① **HDG Key** – Selects/deselects Heading Select Mode.

② **APR Key** – Selects/deselects Approach Mode.

③ **NAV Key** – Selects/deselects Navigation Mode.

(4) **FD Key** – Activates/deactivates the flight director in the default pitch and roll modes. If the autopilot is engaged, the **FD** Key is disabled.

(5) **XFR Key** – Switches the autopilot between the pilot-side and the copilot-side flight directors. This selection also selects which air data computer is communicating with the active transponder and which PFD triggers the altitude alert. Upon power-up, the pilot-side FD is selected.

(6) **ALT Key** – Selects/deselects Altitude Hold Mode.

(7) **VS Key** – Selects/deselects Vertical Speed Mode.

(8) **FLC Key** – Selects/deselects Flight Level Change Mode.

(9) **CRS2 Knob** – Sets the copilot-selected course on the HSI of PFD2 when the VOR1, VOR2, or OBS/SUSP mode is selected. Pressing this knob centers the CDI on the currently selected VOR. The copilot-selected course provides course reference to the copilot-side flight director when operating in Navigation and Approach modes.

(10) **SPD Key** – Switches the Flight Level Change mode reference speed between IAS and MACH number.

(11) **NOSE UP/DN Wheel** – Controls the active mode reference for the Pitch, Vertical Speed, and Flight Level Change modes.

(12) **VNV Key** – Selects/deselects Vertical Navigation mode.

(13) **ALT SEL Knob** – Sets the selected altitude in the Selected Altitude Box. 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.

(14) **YD Key** – Engages/disengages the yaw damper.

(15) **AP Key** – Engages/disengages the autopilot.

(16) **BANK Key** – Selects/deselects Low Bank Mode.

(17) **CRS1 Knob** – Sets the pilot-selected course on the HSI of PFD1 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.

(18) **BC Key** – Selects/deselects Back Course Mode.

(19) **HDG Knob** – Sets the selected heading on the HSI. When operating in Heading Select mode, this knob provides the heading reference to the flight director.

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
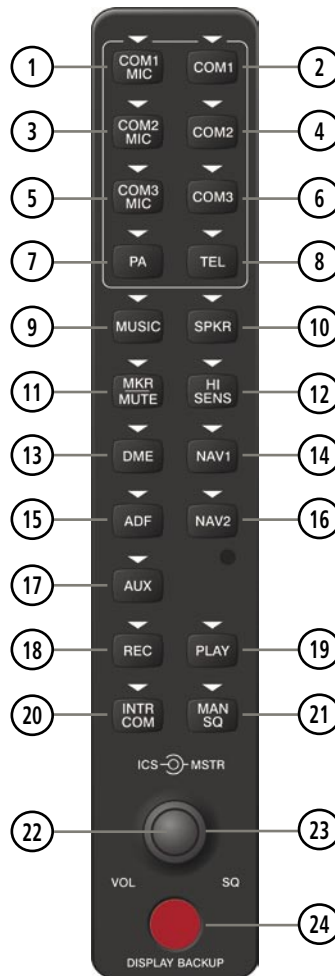
Figure 1-5 Audio Panel Controls (GMA 1347D)

> **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 receiver audio 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 is simultaneously selected when this key is pressed allowing received audio from the #2 COM receiver to be heard. COM2 can be deselected by pressing the **COM2** Key, or COM1 can be added by pressing the **COM1** Key.

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

⑤ **COM3 MIC** – Selects the KHF 1050 transmitter for transmitting (if installed). COM3 is simultaneously selected when this key is pressed allowing received audio from the HF receiver to be heard. COM3 can be deselected by pressing the **COM3** Key, or COM1/COM2 can be added by pressing the **COM1/COM2** Key.

⑥ **COM3** – When selected, audio from the HF receiver (if installed) can be heard.

⑦ **PA** – Selects the passenger address system. The selected COM transmitter is deselected when the **PA** Key is pressed.

⑧ **TEL** – Not used on the Cessna Citation Mustang.

⑨ **MUSIC** – Not used on the Cessna Citation Mustang.

⑩ **SPKR** – Pressing this key selects and deselects the corresponding cockpit speaker. COM and NAV receiver audio will be heard on the speaker.

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

⑫ **HI SENS** – Press to increase Marker Beacon Receiver sensitivity. Press again to return to normal.

⑬ **DME** – Pressing turns DME audio on or off.

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

⑮ **ADF** – Pressing turns on or off the audio from the ADF receiver.

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

⑰ **AUX** – Not used on the Cessna Citation Mustang.

⑱ **REC** – Press to start the recording up to 2.5 minutes of COM receiver audio. When no audio is being received, nothing is recorded. Press again to stop recording.

⑲ **PLAY** – Press once to play the last recorded audio. Press again to stop playing. Press twice quickly while audio is playing and the previous block of recorded audio will be played. Each subsequent two presses will skip back to the previously recorded block.

⑳ **INTR COM** – Pressing selects the pilot/copilot intercom on both audio panels. Press again to deselect the intercom.

㉑ **MAN SQ** – Press to enable manual squelch for the intercom. When active, press the **ICS** Knob to illuminate 'SQ'. Turn the **ICS** Knob to adjust squelch.

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

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

㉔ **Reversionary Mode Button** – Pressing manually selects Reversionary Mode.

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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 1040A and GDU 1500 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.

PFD   MFD
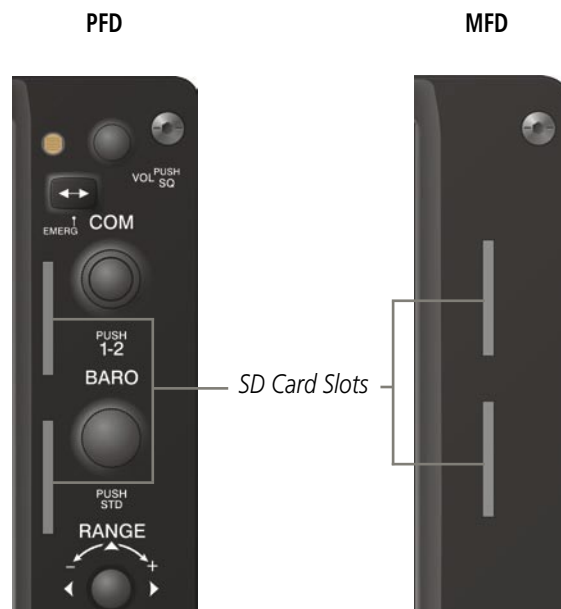
SD Card Slots

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 Airplane Flight Manual (AFM) 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
- Obstacle database name and version

- Terrain database name and version
- Aviation database name, version, and effective dates
- 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 Auxiliary (AUX) Weight Planning Page.

Figure 1-7 PFD Initialization
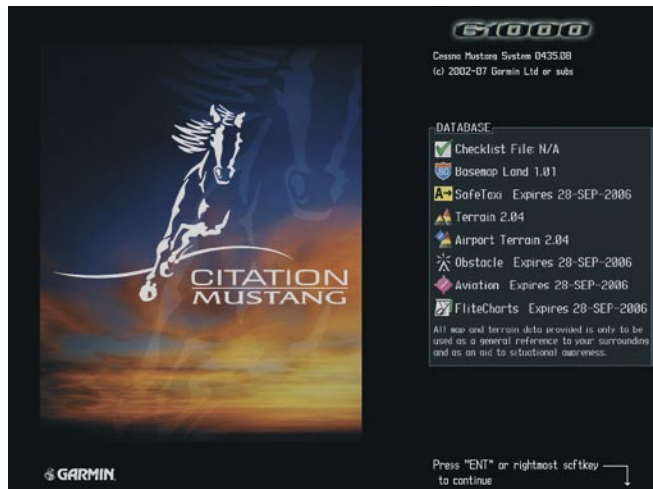
Figure 1-8 MFD Power-up Page

1.6 SYSTEM OPERATION

The displays are connected together via a single Ethernet bus, thus allowing for high-speed communication. As shown in Figure 1-1, each GIA 63W is connected to the on-side PFD. 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 and Crew Alerting System (EICAS).

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

PFD1   MFD   PFD2
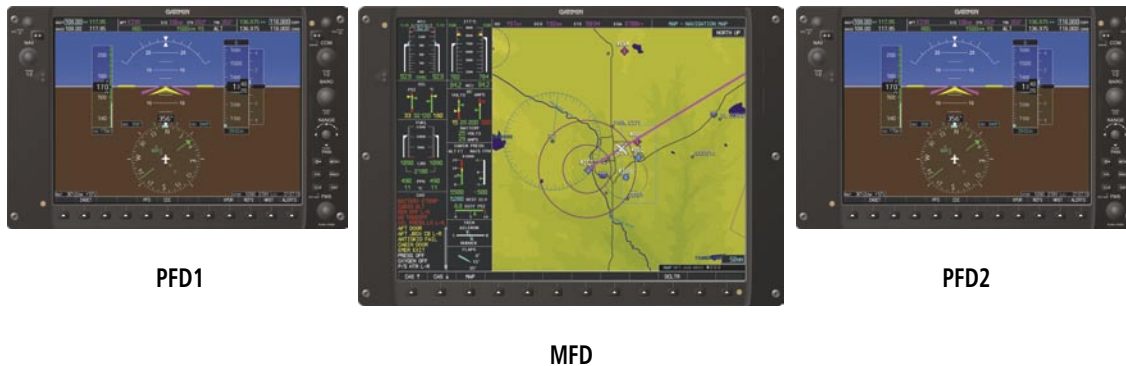
Figure 1-9 Normal Operation

REVERSIONARY MODE

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

Reversionary mode is a mode of operation in which all important flight information is presented identically on at least one of the remaining displays (see Figure 1-10). Transition to reversionary mode should be straightforward for the pilot, for flight parameters are presented in the same format as in normal mode.

Figure 1-10 Reversionary Mode (Manual)

Reversionary mode can be activated manually by pressing the dedicated **DISPLAY BACKUP** button at the bottom of the audio panel (see Figure 1-11 and refer to the Audio Panel section for further details). Pressing this button again deactivates reversionary mode.

*Pressing the **DISPLAY BACKUP** button activates/ deactivates reversionary mode for both the on-side PFD and the MFD.*
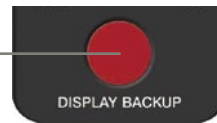
Figure 1-11 DISPLAY BACKUP Button

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

• **PFD1** – By pressing the **DISPLAY BACKUP** button on the left audio panel.

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

• **PFD2** – By pressing the **DISPLAY BACKUP** button on the right audio panel.

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

Figure 1-12 Inoperative Input (NAV1 Shown)

AHRS OPERATION

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

NOTE: *Aggressive maneuvering in any of the three reversionary modes listed in Table 1-1 can 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.
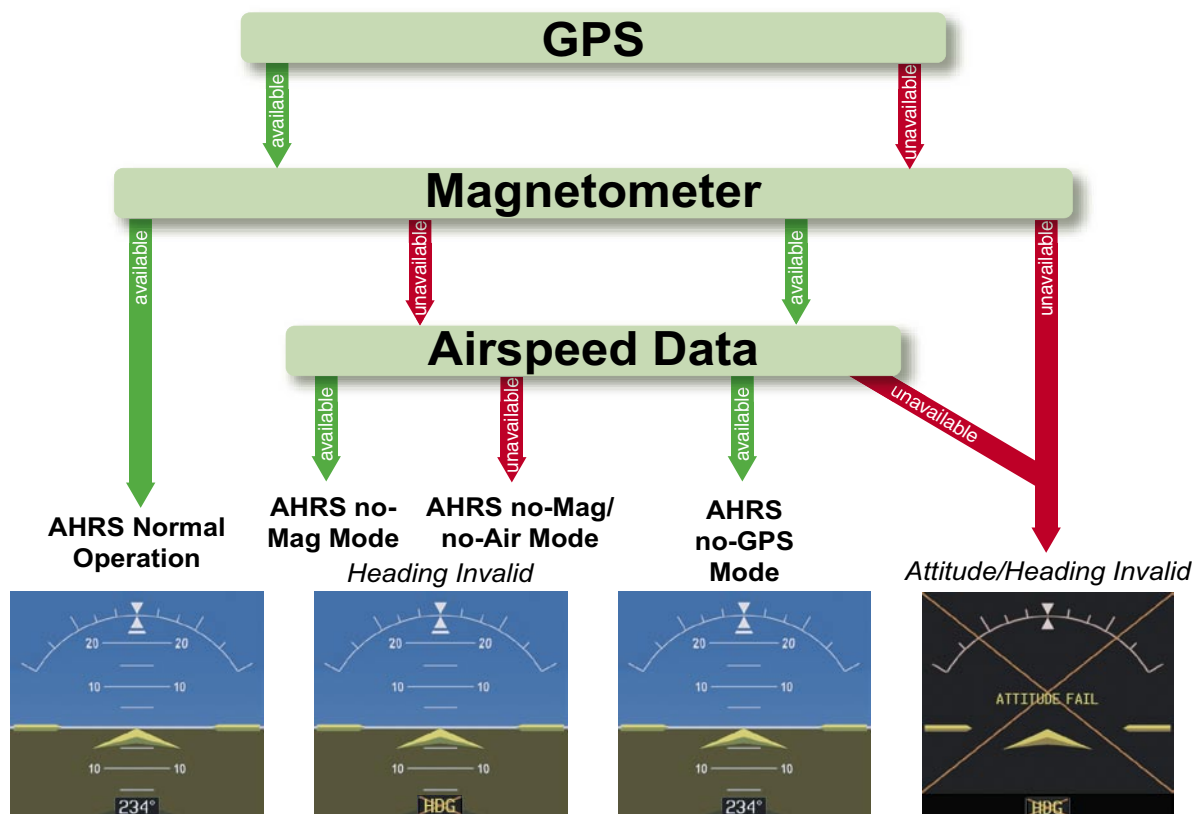
Figure 1-13 AHRS Operation

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.

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 Airplane Flight Manual (AFM) 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.
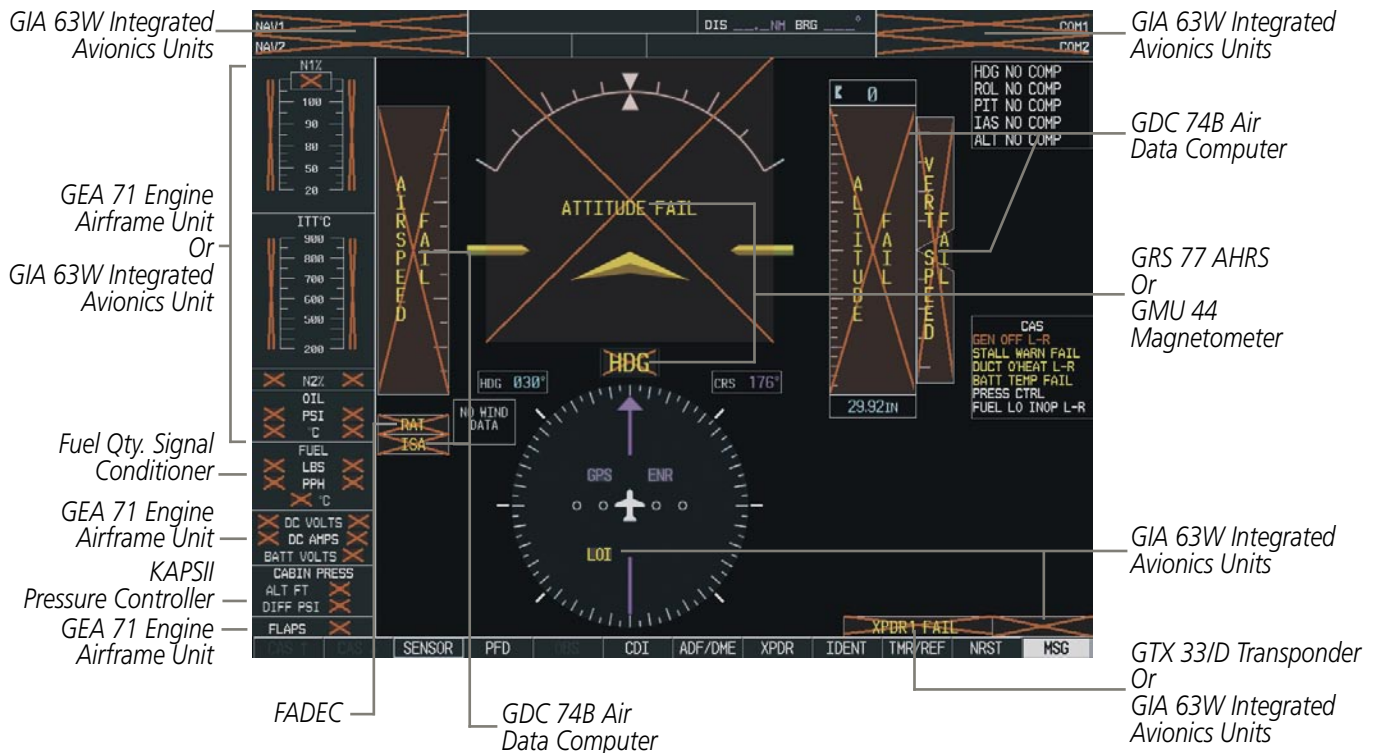
Figure 1-14 G1000 System Failure Annunciations

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)

Another means of selecting softkeys on the MFD is by using the MFD Control Unit:

Selecting a softkey using the MFD Control Unit

1)   Move the softkey selection box to the desired softkey using the arrows of the **SEL** Key.

2)   Press the center of the **SEL** Key to select the desired softkey.

PFD SOFTKEYS

The **CDI**, **IDENT**, **TMR/REF**, **NRST,** and **MSG** 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 **MSG** Softkey will be black on white.

The PFD softkeys provide control over flight management functions, including GPS, NAV, terrain, traffic, and lightning (optional). Each softkey sublevel has a **BACK** Softkey which can be pressed to return to the previous level. The **MSG** 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
	TOPO	Displays topographical data (e.g., coastlines, terrain, rivers, lakes) and elevation scale on Inset Map
	TERRAIN	Displays terrain information on Inset Map
	NEXRAD	Displays NEXRAD weather and coverage information on Inset Map (optional feature)
	XM LTNG	Displays XM lightning information on Inset Map (optional feature)

SENSOR			Displays softkeys for selecting the #1 and #2 AHRS and Air Data Computers
	ADC1		Selects the #1 Air Data Computer
	ADC2		Selects the #2 Air Data Computer
	AHRS1		Selects the #1 AHRS
	AHRS2		Selects the #2 AHRS
PFD			Displays second-level softkeys for additional PFD configurations
	FD FRMT		Displays the softkeys for selecting the two flight director formats
		SNGL CUE	Selects the single cue flight director format
		X POINTR	Selects the cross pointer flight director format
	DFLTS		Resets PFD to default settings, including changing units to standard
	WIND		Displays softkeys to select wind data parameters
		OPTN 1	Longitudinal and lateral components
		OPTN 2	Total direction and speed
		OPTN 3	Total direction with head and crosswind speed components
		OFF	Information not displayed
	BRG1		Cycles the Bearing 1 Information Window through NAV1, GPS/waypoint identifier and GPS-derived distance information, and ADF/frequency.
	BRG2		Cycles the Bearing 2 Information Window through NAV2 or GPS waypoint identifier and GPS-derived distance information, and ADF/frequency.
	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
ADF/DME			Displays the ADF/DME Tuning Window, allowing tuning of the ADF, ADF Mode selection, ADF volume control, and selection of the DME
XPDR			Displays transponder mode selection softkeys
	XPDR1		Selects the #1 transponder as active
	XPDR2		Selects the #2 transponder as active
	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

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
MSG	Displays Messages Window
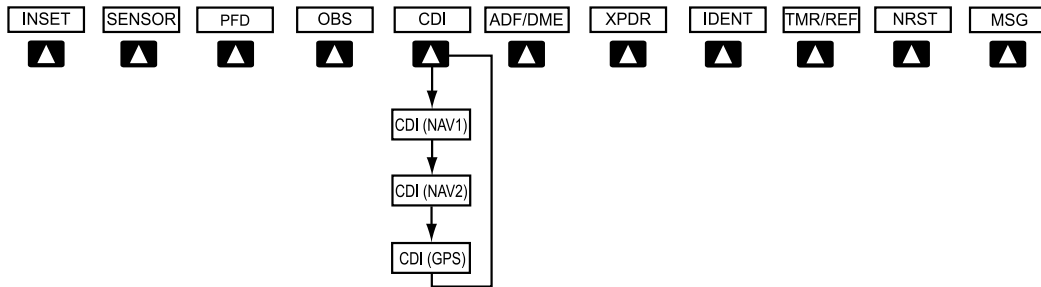
Figure 1-16 Top Level PFD Softkeys
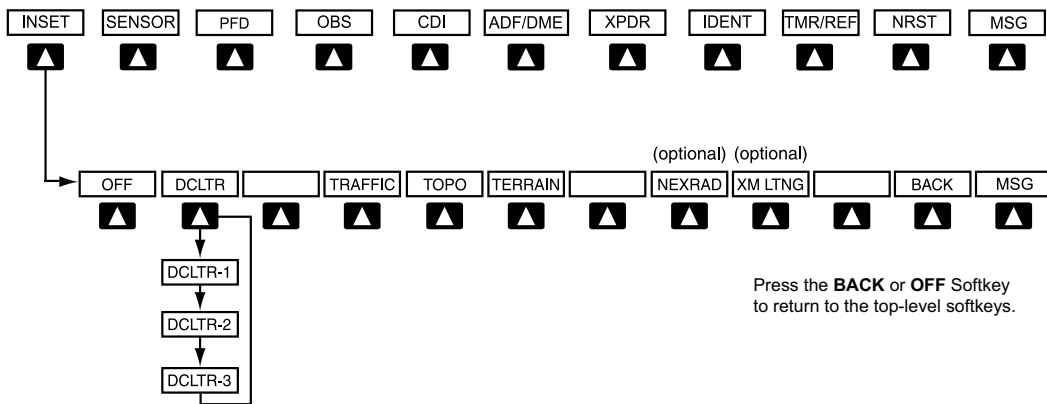
Figure 1-17 INSET Softkeys

INSET	SENSOR	PFD	OBS	CDI	ADF/DME	XPDR	IDENT	TMR/REF	NRST	MSG

ADC1	ADC2		AHRS1	AHRS2				BACK	MSG
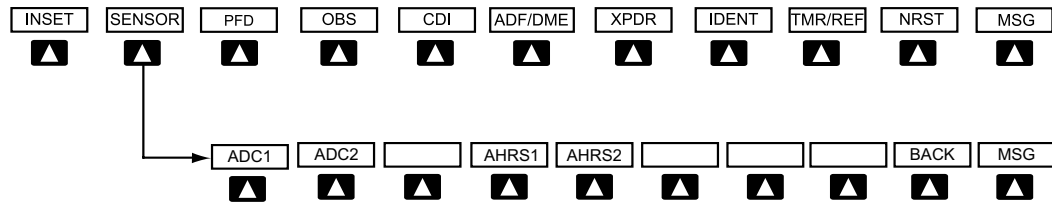
Press the **BACK** Softkey to
return to the top level softkeys.

Figure 1-18 SENSOR Softkeys

INSET	SENSOR	PFD	OBS	CDI	ADF/DME	XPDR	IDENT	TMR/REF	NRST	MSG

FD FRMT	DFLTS	WIND	DME	BRG1			BRG2	ALT UNIT	STD BARO	BACK	MSG

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

BRG1 (NAV1)
BRG1 (GPS)
BRG2 (ADF)
BRG1 (OFF)

Select the **STD BARO** or
BACK Softkey to return to
the top-level softkeys

					METERS		IN	HPA		BACK	MSG

		OPTN1	OPTN2	OPTN3		OFF				BACK	MSG

	SNGL CUE	X POINTR								BACK	MSG
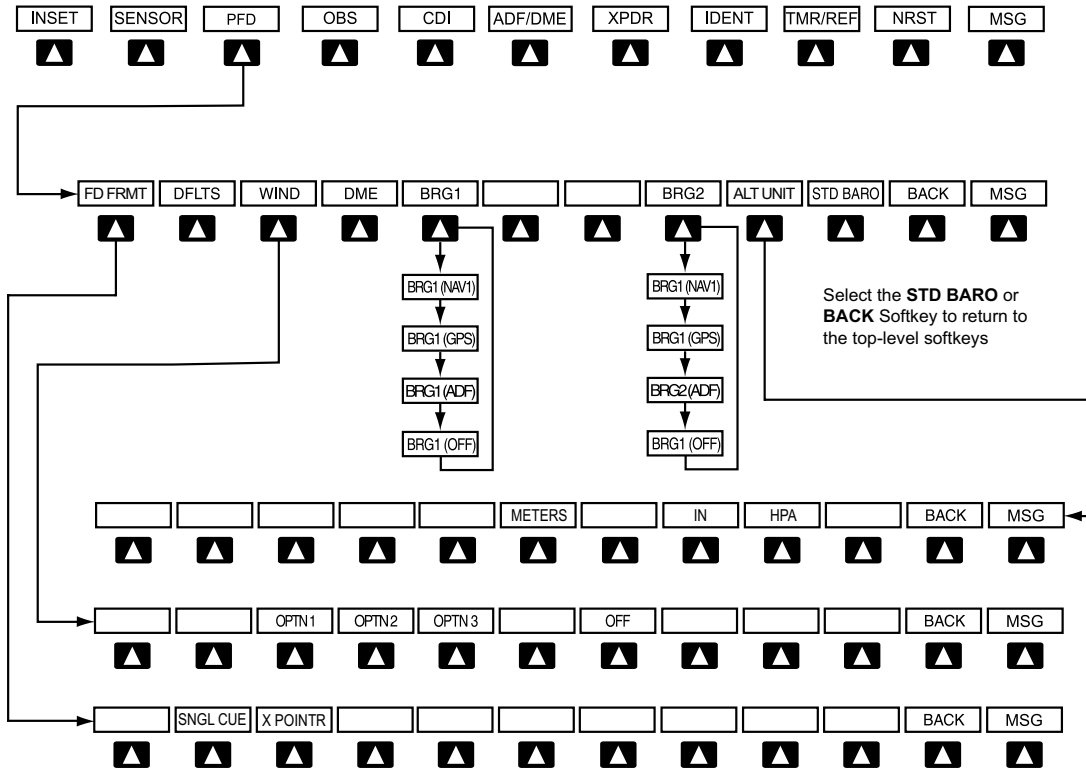
Figure 1-19 PFD Configuration Softkeys
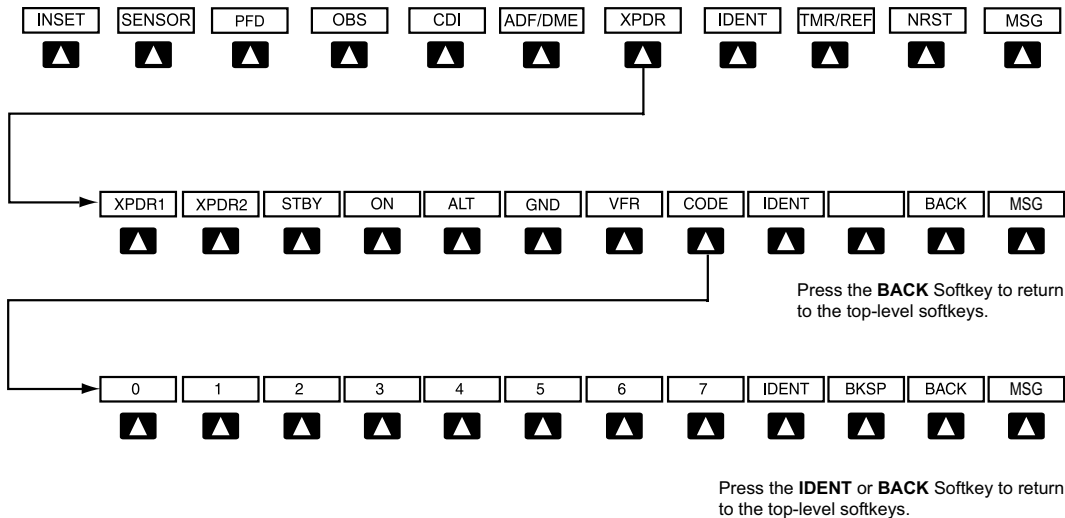
Figure 1-20 XPDR Softkeys

MFD SOFTKEYS

CAS ↑	Scroll up (enabled only when a sufficient number of items are displayed in the Crew Alerting System Display to warrant scrolling)
CAS ↓	Scroll down (enabled only when a sufficient number of items are displayed in the Crew Alerting System Display to warrant scrolling)
MAP	Enables second-level Navigation Map softkeys

	TRAFFIC	Displays traffic information 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 dependant 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

	NEXRAD	Displays NEXRAD weather and coverage information on Navigation Map (optional feature)
	XM LTNG	Displays XM lightning information on Navigation Map (optional feature)
	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
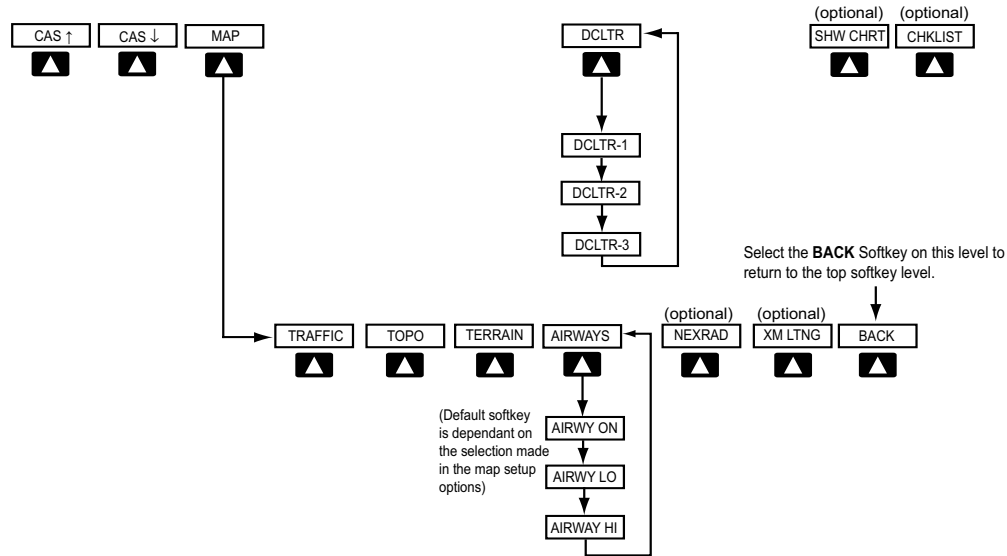
Figure 1-21 MFD Softkeys

GPS RECEIVER OPERATION

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

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

These GPS sensor annunciations are most often seen after system power-up when one GPS receiver has acquired satellites before the other, or one of the GPS receivers has not yet acquired a WAAS signal. While the aircraft is on the ground, the WAAS 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 WAAS 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.

Viewing GPS receiver status information

1) Use the large **FMS** Knob on the MFD 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.
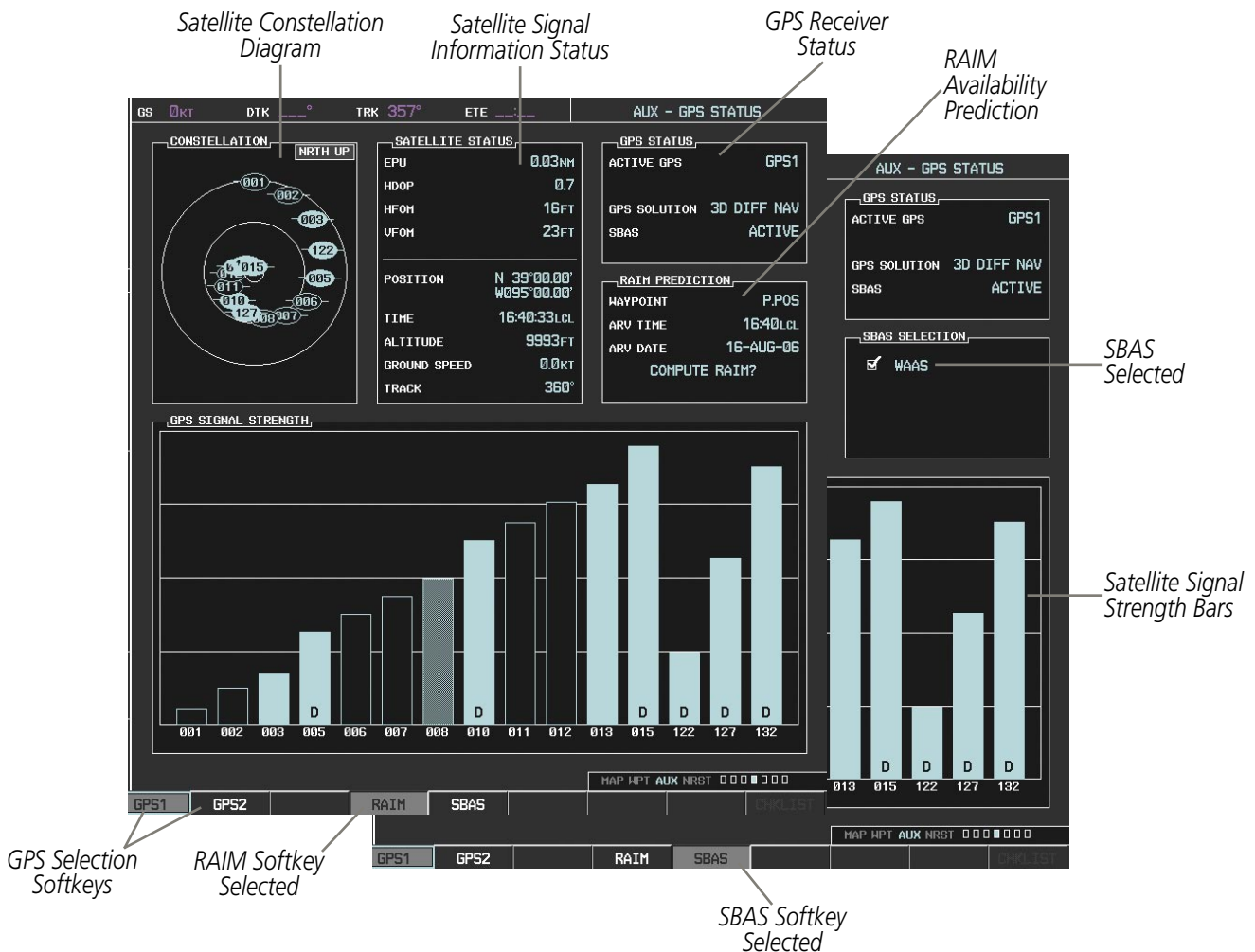
Figure 1-22 GPS Status Page (RAIM or SBAS Selected)

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 navigational GPS solution, 3D NAV is indicated as the solution until the 3D differential fix has finished acquisition. SBAS (Satellite-Based Augmentation System) will indicate INACTIVE. When acquisition is complete, the solution status will indicate 3D DIFF NAV and SBAS will indicate ACTIVE.

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

In most cases performing a RAIM prediction will not be necessary. However, in some cases, the selected approach may be outside the WAAS 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

1) Select the GPS Status Page.

2) If necessary, select 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) Use the large **FMS** Knob to scroll to the Most Recent Waypoints List.

    b) Use the small FMS Knob to highlight the desired waypoint in the list and press the **ENT** Key. The G1000 automatically fills in the identifier, facility, and city fields with the information for the selected waypoint.

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

        Or:

    a) To use the present position, press the **MENU** Key.

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

    c) 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

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

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

Disabling WAAS

1) Select the GPS Status Page.

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

3) Press the **FMS** Knob. 'WAAS' is highlighted.

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

5) Press the **FMS** Knob to remove the cursor.

• GPS Satellite Signal Strengths

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

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

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

1.7 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.
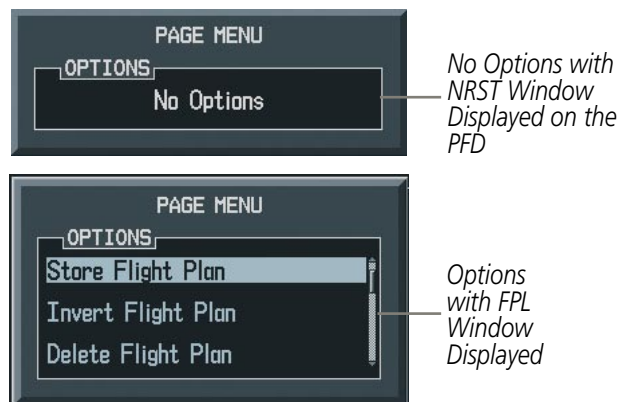
Figure 1-23 Page Menu Examples

GARMIN.

MFD PAGE GROUPS

> ✓ **NOTE:** Refer to the GPS Navigation, Hazard Avoidance, and Additional Features sections for details on specific pages.

The page group and active page title box are displayed in the upper right of the screen.

Page Group   *Active Page Title*

MAP – NAVIGATION MAP
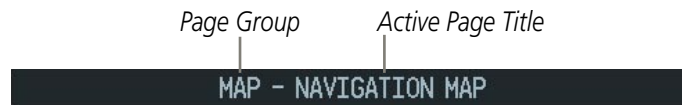
Figure 1-24 Page Title Box

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.

Page Groups   *Pages in Current Group*

MAP WPT AUX NRST ▉ ☐ ☐ ☐ ☐

Selected Page
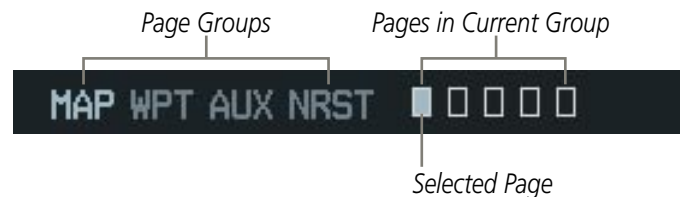
Figure 1-25 Page Group Icons

The MFD displays information in four main page groups; specific pages within each group can vary depending on the configuration of optional equipment.

Selecting a page using the **FMS** Knob

1) Turn the large **FMS** Knob 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 Information and XM Information pages) which are selected first from within a main page group with the **FMS** Knobs, then with the appropriate softkey at the bottom of the page. In this case, the page remains set to the selected screen until a different screen softkey is pressed.

Map Pages (MAP)

Navigation Map

Traffic Map

Weather Radar

Weather Data Link (*service optional*)

Terrain Proximity or TAWS
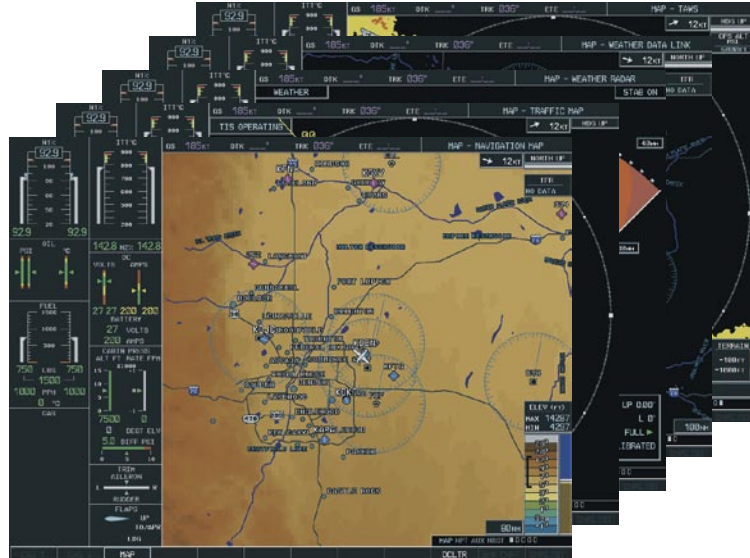
Figure 1-26 Map Pages

Waypoint Pages (WPT)

Airport Information pages

- Airport Information (**INFO** Softkey)

- Departure Information (**DP** Softkey)

- Arrival Information (**STAR** Softkey)

- Approach Information (**APR** Softkey)

- Weather Information (**WX** Softkey)

Intersection Information

NDB Information

VOR Information

User Waypoint Information

Airport Information Pages
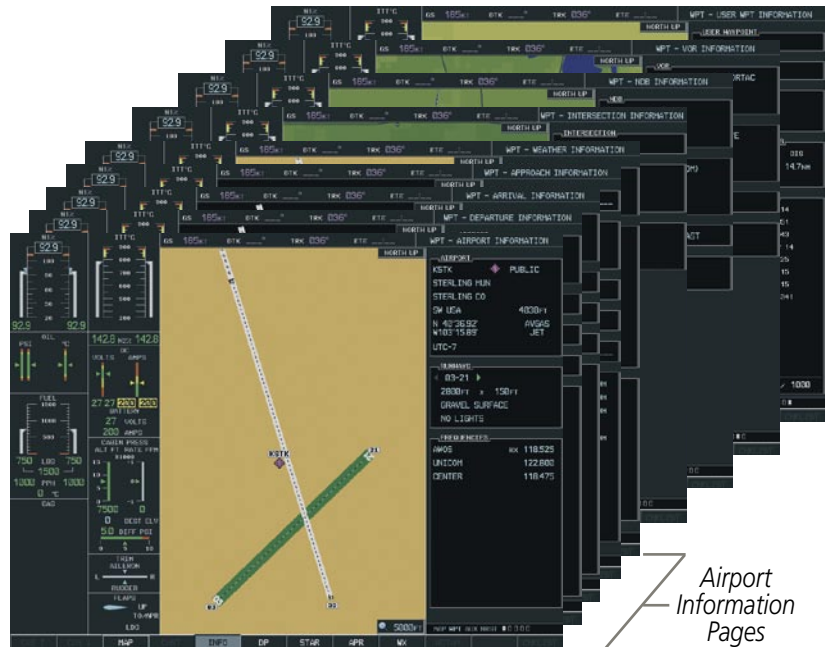
Figure 1-27 Waypoint Pages

Auxiliary Pages (AUX)

Weight Planning

Trip Planning

Utility

GPS Status

System Setup

XM Satellite pages

- XM Information (**INFO** Softkey)

- XM Radio (**RADIO** Softkey)

System Status

XM Satellite Pages

Figure 1-28 Auxiliary Pages

Nearest Pages (NRST)

Nearest Airports

Nearest Intersections

Nearest NDB

Nearest VOR

Nearest User Waypoints

Nearest Frequencies

Nearest Airspaces

Figure 1-29 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 bezel key. In some instances, softkeys may be used to access the Procedure Pages.

The Flight Plan Pages are accessed using the **FPL** Key on the MFD. 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

or

Stored Flight Plan (**NEW** Softkey)

Narrow and Wide View

Figure 1-30 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 1-31 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 5 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

The System Setup Page allows management of the following system parameters:

- Time display format (local or UTC)
- Displayed measurement units
- Airspace alerts
- Audio alert voice
- MFD Data Bar (Navigation Status Box) fields

- GPS Course Deviation Indicator (CDI) range
- COM transceiver channel spacing
- Displayed nearest airports
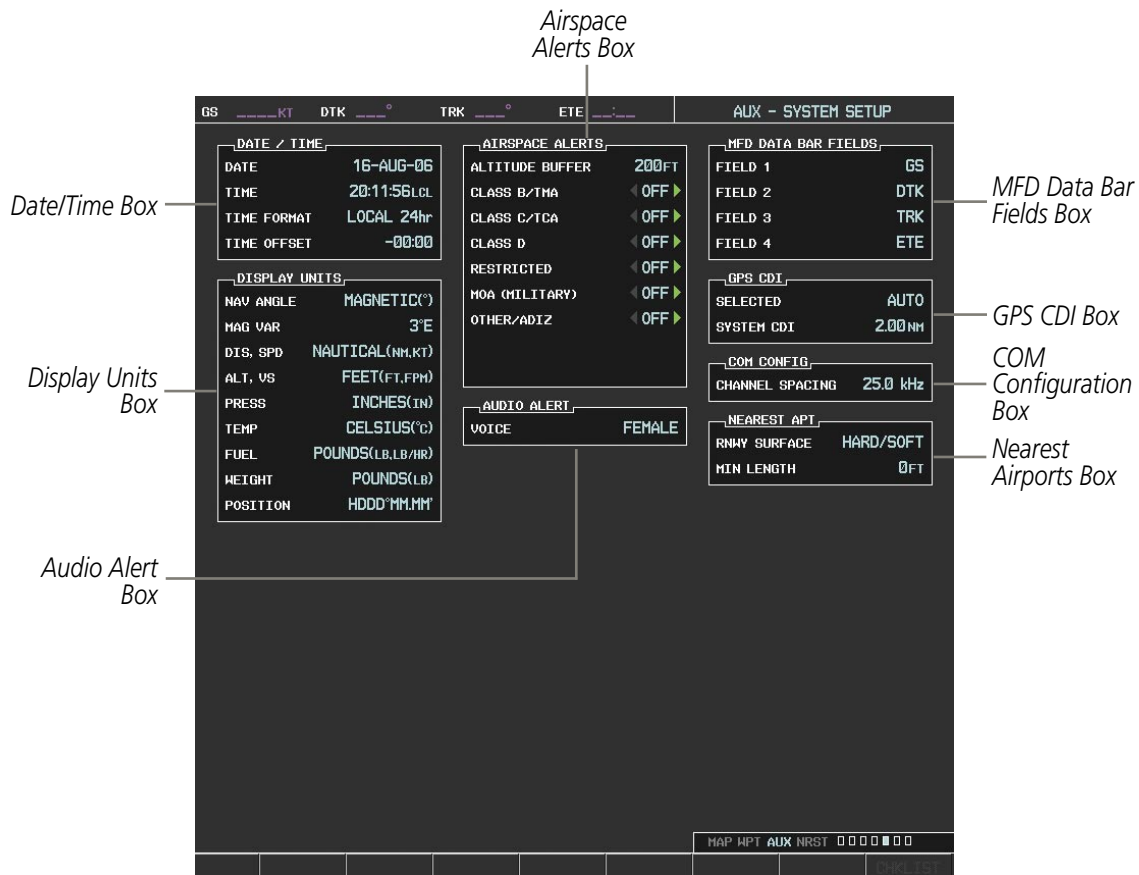
Figure 1-32 System Setup Page

DATE/TIME

The Date/Time Box on the System Setup Page displays the current date and time and allows the pilot to set the time format (local 12-hr, local 24-hr, or UTC) and offset. The time offset is used to define current local time. UTC (also called GMT or Zulu) date and time are calculated directly from the GPS satellites signals

and cannot be changed. When using a local time format, designate the offset by adding or subtracting the desired number of hours.

Setting the system time format

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 time format field in the Date/Time Box.

3) Turn the small **FMS** Knob to select the desired system time format (local 12hr, local 24hr, UTC) and press the **ENT** Key.

Setting the current time offset

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 time offset field in the Date/Time Box.

3) Enter the time offset and press the **ENT** Key.

DISPLAY UNITS

The Display Units Box on the System Setup Page shows the configured units of measure used for each category and the system parameters they affect. The NAV ANGLE is pilot selectable. The units of measure for the other categories are preset at the factory. To change units of measure in any of these categories, contact a Garmin authorized service center.

- Nav angle (magnetic, true)

    When set to 'MAGNETIC', magnetic variation is figured into the displayed value. When 'TRUE' is selected, no magnetic variation is calculated and a 'T' is displayed next to the value.

    Affects the BRG field in the PFD Navigation Status Box.

    Affects Current Heading, Selected Heading, and Selected Course boxes on the PFD.

    Affects the BRG, DTK, TKE, TRK, and XTK fields in the MFD Navigation Status Box.

- Distance and speed (metric, nautical)

    Affects the DIS field in the PFD Navigation Status Box and the range setting of the Inset Map.

    Affects all distance and speed displays on the MFD with the exception of the displayed wind speed displayed on the Navigation Map Page. Wind speed is affected on the Trip Planning Page.

- Altitude and vertical speed (feet, meters)

    Affects all altitude and elevation displays on the MFD, with the exception of VNV altitudes on the Active Flight Plan Page.

- Barometric pressure (inches of mercury, hectopascals)

    Affects the altimeter setting on the PFD and the pressure display on the Trip Planning Page.

- Temperature (Celsius, Fahrenheit)

    Affects all temperature displays on the PFD.

    Affects the temperature display on the Trip Planning Page. Does not affect the EICAS displays.

- Fuel and fuel flow (pounds, kilograms)

   Affects fuel and fuel flow displayed on the Trip Planning Page.

- Weight (pounds, kilograms)

   Affects aircraft weights on the Weight Planning Page.

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

   Affects all position displays.

Changing the NAV ANGLE 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 NAV ANGLE field in the Display Units Box.

3) Turn the small **FMS** Knob to select 'MAGNETIC' or 'TRUE'.

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

Airspace Alerts

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 MFD Navigation Map Page. It simply turns on/off the warning provided when the aircraft is approaching or near an airspace.

Alerts for the following airspaces can be turned on/off in the Airspace Alerts Box:

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

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 will not be 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) 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 altitude buffer field in the Airspace Alerts Box.

3) Turn the **FMS** Knobs to enter an altitude buffer value and press the **ENT** Key.

Turn an airspace alert on or off

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 Airspace Alerts Box.

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

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.

MFD Data Bar Fields

The MFD Data Bar Fields Box on the System Setup Page displays the current configuration of the MFD Navigation Status Box. By default, the Navigation Status Bar is set to display ground speed (GS), distance to next waypoint (DIS), estimated time enroute (ETE), and enroute safe altitude (ESA).

Changing the information shown in an MFD Navigation Status Bar field

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 number in the MFD Data Bar Fields Box.

3) Turn the small **FMS** Knob to display and scroll through the data options list and press the **ENT** Key when the desired data selection is highlighted.

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

- Bearing (BRG)
- Distance (DIS)
- Desired Track (DTK)
- En Route Safe Altitude (ESA)
- Estimated Time of Arrival (ETA)
- Estimated Time En Route (ETE)
- Ground Speed (GS)

- Minimum Safe Altitude (MSA)
- True Air Speed (TAS)
- Track Angle Error (TKE)
- Track (TRK)
- Vertical Speed Required (VSR)
- Crosstrack Error (XTK)

GPS CDI

The GPS CDI Box on the System Setup Page allows the pilot to define the range for the on-screen course deviation indicator (CDI). The range values represent full range deflection for the CDI to either side. The default setting is 'AUTO'. At this setting, leaving the departure airport the CDI range is set to 1.0 nm and gradually ramps up to 2 nm beyond 30 nm from the departure airport. The CDI range is set to 2.0 nautical miles during the en route phase of flight. Within 30 nm of the destination airport, the CDI range gradually ramps down to 1.0 nm (terminal area). During approach operations, the CDI range ramps down even further to 0.3 nm. This transition normally occurs within 2.0 nm of the final approach fix (FAF).

If a lower CDI range setting is selected (i.e., 1.0 or 0.3 nm), the higher range settings are not selected during any phase of flight. For example, if 1.0 nm is selected, the G1000 uses this for en route and terminal phases and ramps down to 0.3 nm during an approach. Note that the Receiver Autonomous Integrity Monitoring (RAIM) protection limits follow the selected CDI range and corresponding flight phases.

The GPS CDI Box on the System Setup Page displays the following:

• Selected CDI range (auto, 2 nm, 1 nm, 0.3 nm)

• Current system CDI range (2 nm, 1 nm, 0.3 nm)

Changing the CDI range

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 selected field in the GPS CDI Box.

3) Turn the small **FMS** Knob to display and scroll through the range list and press the **ENT** Key when the desired selection is highlighted.

COM CONFIGURATION

✓ *NOTE: 8.33 kHz VHF communication frequency channel spacing is not required for use in the United States. Select the 25.0 kHz channel spacing option for use in the United States.*

The COM Configuration Box on the System Setup Page allows the pilot to select 8.33 kHz or 25.0 kHz COM frequency channel spacing.

Changing COM channel spacing

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 channel spacing field in the COM Configuration Box.

3) Turn the small **FMS** Knob to select the desired spacing and press the **ENT** Key.

NEAREST AIRPORTS

The Nearest Airports Box on the System Setup Page defines the minimum runway length and surface type used when determining the nine 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 of appropriate surface from being displayed. Default settings are zero feet (or meters) for runway length and "any" for runway surface type.

Selecting the nearest airport surface matching criteria (any, hard only, hard/soft, water)

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 runway surface field in the Nearest Airports Box.

3) Turn the small **FMS** Knob to display and scroll through the runway options (any, hard only, hard/soft, water) and press the **ENT** Key when the desired selection is highlighted.

Selecting the nearest airport minimum runway length matching criteria

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 minimum length field in the Nearest Airport Box.

3) Turn the **FMS** Knobs to enter the minimum runway length (zero to 99,999 feet) and press the **ENT** Key.

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 Cessna service center or Garmin dealer informed.
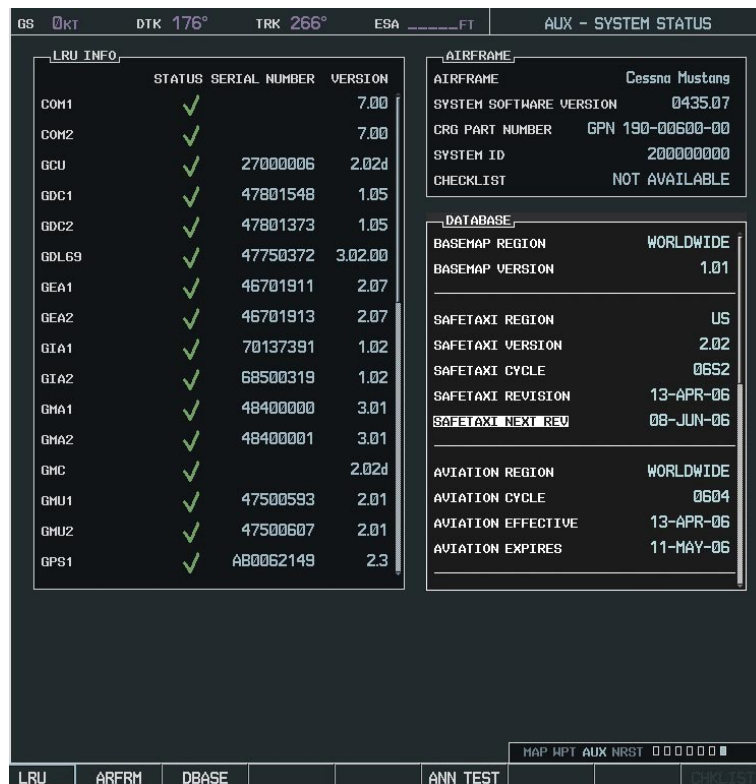
Figure 1-33 Example System Status Page

The **LRU**, **ARFRM**, and **DBASE** Softkeys on the System Status Page select the list (LRU Info, Airframe, or Database) through which the **FMS** Knob can be used to scroll if all the information cannot appear on the screen.

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

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 1-34 Utility Page

TIMERS

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

Setting the generic timer

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

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

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

4) If a desired starting time is desired:

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

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

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

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

7) To reset the timer, press the **ENT** Key with 'RESET?' highlighted. The field changes back to 'START?' and the digits are reset.

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

Setting the flight timer starting criterion

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

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

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

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

Resetting the flight timer

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

2) Press the **MENU** Key.

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

The 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.

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

2) 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.

1.8 DISPLAY BACKLIGHTING

The G1000 display and control backlighting can be adjusted either automatically or manually. Backlighting intensity ranges from 0.22% to 100% on the PFDs and 0.80% to 100.00% on the MFD.

AUTOMATIC ADJUSTMENT

The existing instrument panel dimmer bus normally controls the PFD and MFD backlighting as well as the PFD and MFD bezels, MFD Control Unit, AFCS Control Unit and audio panel key annunciator lighting. When the dimmer bus is not used by the G1000 system, photocell technology automatically controls backlighting adjustments. Photocell calibration curves are pre-configured to optimize display appearance through a broad range of cockpit lighting conditions.

MANUAL ADJUSTMENT

NOTE: The avionics dimming knob may also be used to adjust backlighting. Refer to the AFM for details.

NOTE: In normal mode, backlighting can only be adjusted from PFD1 or PFD2. In reversionary mode, it can also be adjusted from the MFD.

NOTE: No other window can be displayed on the PFD while the PFD Setup Menu Window is displayed.

Backlighting may also be adjusted manually for all of the displays and the associated bezels. The audio panel key backlighting is directly tied to the on-side PFD key backlighting setting.

Adjust display backlighting manually

1) Press the **MENU** Key on the PFD to display the PFD Setup Menu Window. 'AUTO' becomes highlighted to the right of 'PFD1 DSPL'.

Figure 1-35 Manual Display Backlighting Adjustment

2) Turn the small **FMS** Knob to display the selection box. Turn the **FMS** Knob to select 'MANUAL', then press the **ENT** Key. The intensity value becomes highlighted.

3) Turn the small **FMS** Knob to select the desired backlighting, then press the **ENT** Key.

4) Turn the large **FMS** Knob to highlight 'AUTO' to the right of 'MFD DSPL' or 'PFD2 DSPL', respectively, and repeat steps 2 and 3.

5) Press the **CLR** or **MENU** Key to remove the PFD Setup Menu Window from the display.

Adjust key backlighting manually

1) Press the **MENU** Key on the PFD to display the PFD Setup Menu Window. 'AUTO' becomes highlighted to the right of 'PFD1 DSPL'.
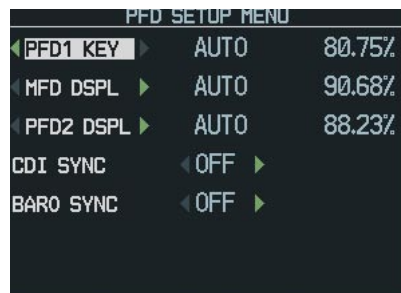
Figure 1-36 Manual Key Lighting Adjustment

2) Turn the large **FMS** Knob to highlight 'PFD1 DSPL'. Turn the small **FMS** Knob in the direction of the green arrowhead to display 'PFD1 KEY'.

3) Turn the large **FMS** Knob to highlight 'AUTO' and turn the small **FMS** Knob to display the selection box.

4) Turn the **FMS** Knob to select 'MANUAL', then press the **ENT** Key. The intensity value becomes highlighted.

5) Turn the small **FMS** Knob to select the desired backlighting, then press the **ENT** Key.

6) Turn the large **FMS** Knob to highlight 'MFD DSPL' or 'PFD2 DSPL' and turn the small **FMS** Knob in the direction of the green arrowhead to display 'MFD KEY' or 'PFD2 KEY', respectively.

7) Repeat steps 3 to 5.

8) Press the **CLR** or **MENU** Key to remove the PFD Setup Menu Window from the display.

SECTION 2 FLIGHT INSTRUMENTS

> ⚠ **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 flight director modes.*

Increased situational awareness is provided by replacing the traditional instruments on the panel with two easy-to-scan Primary Flight Displays (PFDs) that feature large horizons, airspeed, attitude, altitude, vertical speed, and course deviation information. In addition to the flight instruments, navigation, communication, terrain, traffic, and weather information are also presented on the PFDs and explained in other sections of this Pilot's Guide.

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

- Airspeed Indicator, showing
  - Airspeed awareness ranges
  - Mach number
  - Reference flags
- Attitude Indicator with slip/skid indication
- Altimeter, showing
  - Barometric setting
  - Selected Altitude

- Vertical Deviation, Glideslope, and Glidepath Indicators
- Vertical Speed Indicator (VSI)
- Horizontal Situation Indicator, showing
  - Turn Rate Indicator
  - Bearing pointers and information windows
  - DME Information Window

- Course Deviation Indicator (CDI)
- Ram air temperature (RAT)
- ISA temperature deviation
- Wind data
- Vertical Navigation indications

The PFDs also display various alerts and annunciations.

Figure 2-1 Primary Flight Display (Default)
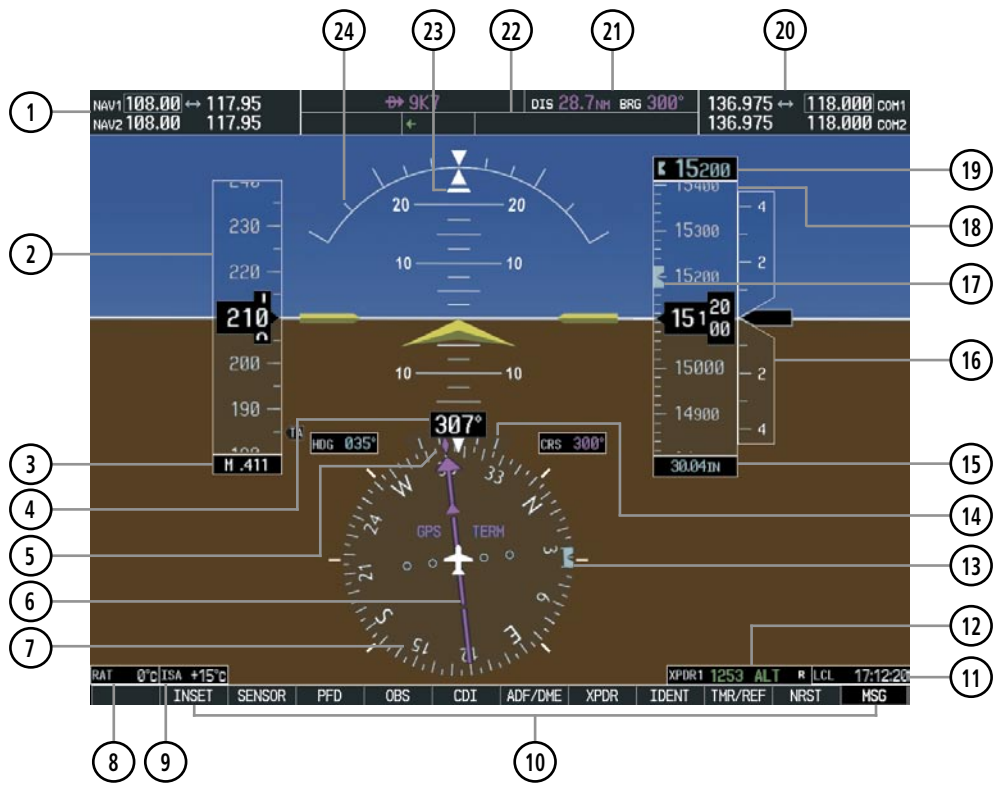
1	NAV Frequency Box	13	Selected Heading Bug
2	Airspeed Indicator	14	Turn Rate Indicator
3	Mach Number	15	Barometric Altimeter Setting
4	Current Heading	16	Vertical Speed Indicator (VSI)
5	Current Track Bug	17	Selected Altitude Bug
6	Course Deviation Indicator (CDI)	18	Altimeter
7	Horizontal Situation Indicator (HSI)	19	Selected Altitude
8	Ram Air Temperature (RAT)	20	COM Frequency Box
9	ISA Temperature Deviation	21	Navigation Status Box
10	Softkeys	22	AFCS Status Box
11	System Time	23	Slip/Skid Indicator
12	Transponder Status Box	24	Attitude Indicator

Figure 2-2 Primary Flight Display (Additional Information)

1	Traffic Annunciation	
2	Flap Speed Reference	
3	Selected Heading	
4	Wind Data	
5	Inset Map	
6	DME Information Window	
7	Bearing Information Windows	
8	Timer/References Window	

9	Minimum Descent Altitude/Decision Height
10	Selected Course
11	Required Vertical Speed
12	Current Vertical Speed
13	Vertical Deviation Indicator (VDI)
14	Comparator Window
15	VNV Target Altitude
16	AFCS Status Annunciation

2.1 FLIGHT INSTRUMENTS

AIRSPEED INDICATOR

✓ **NOTE:** *Refer to the Airplane Flight Manual (AFM) for speed criteria and Vspeed values.*

✓ **NOTE:** V_{REF} *cannot be set above the indicated value for* V_{APR}.

The Airspeed Indicator displays airspeed on a rolling number gauge using a moving tape. The numeric labels and major tick marks on the moving tape are marked 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 the high airspeed limit, at which point it turns red along with the Mach number readout.

The Mach number is displayed below the Airspeed Indicator (see Figure 2-1) for airspeeds at or above Mach 0.4 or at altitudes exceeding 27,120 feet. The color of the readout corresponds to the color of the actual airspeed pointer.
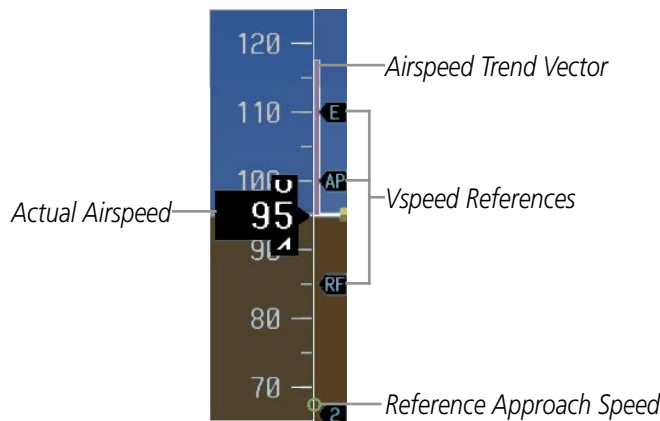
Figure 2-3 Airspeed Indicator

**Figure 2-4 Red Pointer
Showing Overspeed**

Speeds above the maximum operating speed, V_{MO} or M_{MO} depending on aircraft altitude, appear in the high speed awareness range, represented on the airspeed tape by red/white "barber pole" coloration. An aural overspeed warning tone is generated if the airspeed exceeds the high airspeed limit.

A red low speed awareness range extends up to the low speed awareness velocity, V_{LSA}. An aural stall warning is generated if the airspeed falls below V_{LSA}. An open green circle on the airspeed tape represents $1.3V_{S1}$ when takeoff vspeeds are turned off.

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 the airspeed will be reached in 6 seconds if the current rate of acceleration is maintained. If the trend vector crosses V_{MO}/M_{MO}, the text of the actual airspeed readout and the Mach readout changes to yellow. 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.

Flap extension maximum speed references (for takeoff/approach, TA, and landing, LD, conditions) are displayed as flags (Figure 2-5) to the right of the Airspeed Indicator for altitudes below 18,000 feet. These flags cannot be turned off or modified.

Vspeeds can be changed and their flags along the right of the airspeed scale turned on/off. By default, all Vspeed values are reset and all flags turned off when power is cycled.

Figure 2-5 Flap Speed References

	Vspeed	Flag
Takeoff	V_1	1
	V_R	R
	V_2	2
	V_{ENR}	E
Landing	V_{APR}	AP
	V_{REF}	RF

Table 2-1 Vspeed Flag Labels

Vspeeds are categorized as either takeoff or landing. Takeoff Vspeed flags are automatically turned off when airspeed reaches 160 knots. The order in which the categories are displayed is determined by whether the aircraft is on the ground or in the air. If the aircraft is on the ground, the takeoff Vspeeds are displayed at the top of the Vspeed list (Figure 2-6). If the aircraft is in the air, the landing Vspeeds are displayed at the top.

Changing Vspeeds and turning 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.
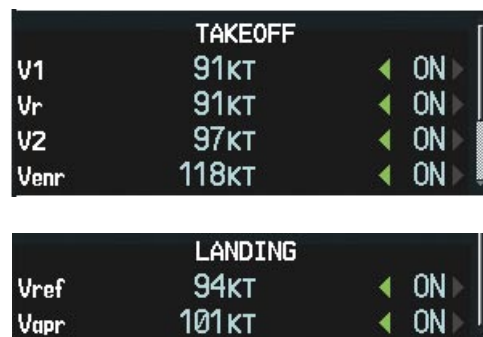
**Figure 2-6 Takeoff and Landing Vspeeds
(Timer/References Window)**

Vspeed flags can be turned on or off and values restored all at once or by category (takeoff and landing).

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.
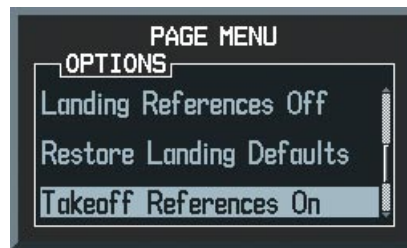
**Figure 2-7 Page Menu
(Timer/References Window)**

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, roll, and slip/skid information.

1. Roll Pointer
2. Roll Scale
3. Horizon Line
4. Aircraft Symbol (Formatted for Single-cue Command Bars)
5. Land Representation
6. Pitch Scale
7. Slip/Skid Indicator
8. Sky Representation
9. Roll Scale Zero
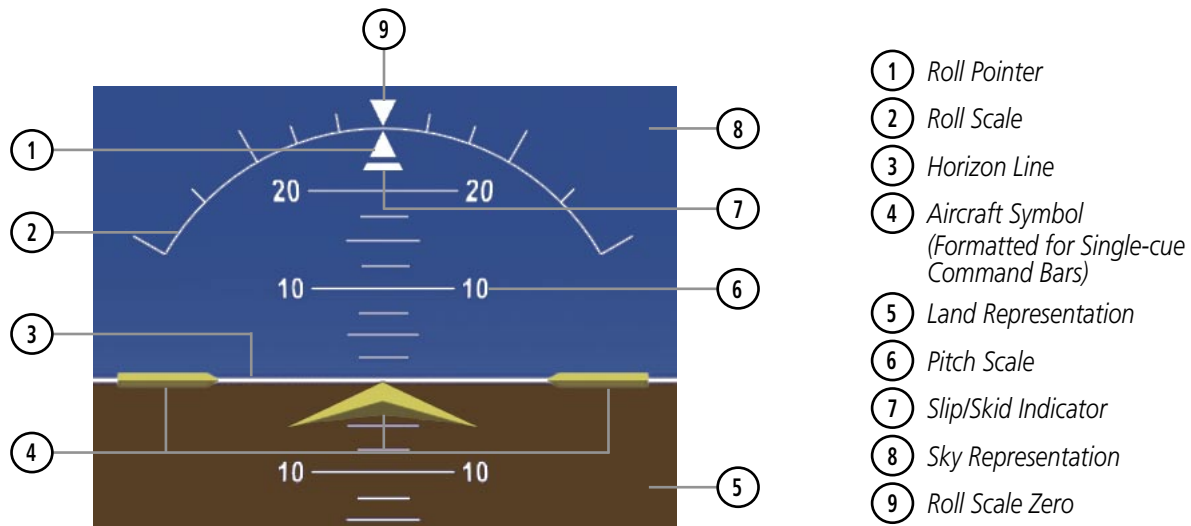
Figure 2-8 Attitude Indicator

The yellow symbolic aircraft on the Attitude Indicator changes appearance based on selection of AFCS flight director Command Bar format (see the AFCS Section for details). Both PFDs show the same Command Bar format and Aircraft Symbol. Command Bar format may only be changed while on the ground. When the single-cue Command Bar format is selected, the Aircraft Symbol appears as in Figure 2-8. The Aircraft Symbol for the cross-pointer format Command Bars is shown in Figure 2-9.

Changing Command Bar and Aircraft Symbol format:

1) Press the **PFD** Softkey.

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

3) Press the **SNGL CUE** Softkey to display Command Bars as a single cue (Aircraft Symbol in Figure 2-8).

   OR:

   Press the **X POINTR** Softkey to display Command Bars as a cross pointer (Aircraft Symbol in Figure 2-9).

Figure 2-9 Aircraft Symbol for Cross-pointer Command Bars

The horizon line is part of the pitch scale. Above and below the horizon line, major pitch marks and numeric labels are shown for every 10°, up to 80°. Minor pitch marks are shown for intervening 5° increments, up to 25° below and 45° above the horizon line. Between 20° below to 20° above the horizon line, minor pitch marks occur every 2.5°.

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

The Slip/Skid Indicator is the bar beneath the roll pointer. The indicator 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. One bar displacement is equal to one ball displacement on a traditional Slip/Skid Indicator.

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.

A magenta Altitude Trend Vector extends up or down the left of the altitude tape, the end resting at the approximate altitude to be reached in 6 seconds at the current vertical speed. The trend vector is not shown if altitude remains constant or if data needed for calculation is not available due to a system failure.
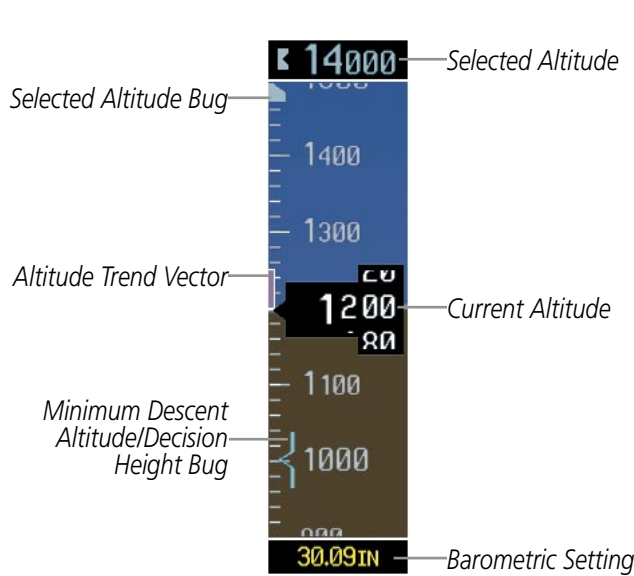
Figure 2-11 Altimeter

Figure 2-12 Altimeter (Metric Units)

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. The metric value, when selected, is displayed in a separate box above the Selected Altitude. See the AFCS Section for more information on the Selected Altitude.

Setting the Selected Altitude:

Turn the **ALT SEL** Knob to set the Selected Altitude in 100-ft increments (increments reduce to 10 feet for approach) up to the aircraft's service ceiling.

If a value has been set for the minimum descent altitude/decision height (MDA/DH), this altitude is also made available for the Selected Altitude setting (when between 100-ft increments).

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 (see Figure 2-12).

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

The barometric pressure setting is displayed below the Altimeter in inches of mercury (in Hg) or hectopascals (hPa) 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):

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

OR:

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 twice to return to the top-level softkeys.

If the barometric altimeter settings differ between PFDs by more than 0.02 in Hg, the readouts turn yellow (Figure 2-13). The settings can be synchronized from the PFD Setup Menu. Once the settings are synchronized (BARO SYNC turned on), they remain synchronized for the entire flight.

Synchronizing the altimeter barometric pressure settings:

1) Press the **MENU** Key to display the PFD Setup Menu.

2) Turn the large **FMS** Knob to highlight the 'Baro Sync' ON/OFF field.

3) Turn the small **FMS** Knob clockwise to ON or counterclockwise to OFF.

4) Press the **MENU** Key to remove the window.
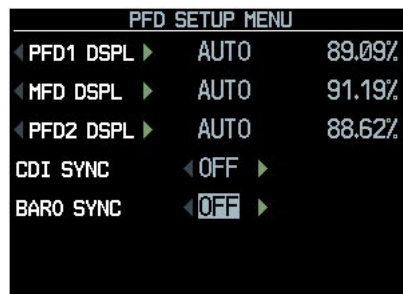
Figure 2-13 BARO SYNC (PFD Setup Menu)

VERTICAL SPEED INDICATOR (VSI)

The Vertical Speed Indicator (VSI; Figure 2-14) displays the aircraft vertical speed with numeric labels and tick marks at 2000 and 4000 fpm in each direction on the non-moving tape. Minor tick marks are at intervals of 1000 fpm. The current vertical speed is displayed in the pointer, which also points to that speed on the non-moving tape. Digits appear in the pointer when the climb or descent rate is greater than 100 fpm. If the rate of ascent/descent exceeds 4000 fpm, the pointer appears at the corresponding edge of the tape and the rate appears inside the pointer.

A magenta chevron bug is displayed as the Required Vertical Speed Indication (RVSI; Figure 2-14) for reaching a VNV Target Altitude once the "TOD [Top of Descent] within 1 minute" alert has been generated. See the GPS Navigation and AFCS sections for details on VNV features, and refer to Section 2.2, Supplemental Flight Data, for more information about VNV indications on the PFD.

VERTICAL DEVIATION, GLIDESLOPE, & GLIDEPATH INDICATORS

The Vertical Deviation Indicator (VDI; Figure 2-14) 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. The VDI is removed from the display if vertical deviation becomes invalid. See the GPS Navigation and AFCS sections for details on VNV features, and refer to Section 2.2, Supplemental Flight Data, for more information about VNV indications on the PFD.

The Glideslope Indicator (Figure 2-15) appears to the left of the Altimeter whenever an ILS frequency is tuned in the active NAV field. A green diamond acts as the Glideslope Indicator, like a glideslope needle on a conventional indicator. 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 WAAS vertical guidance (LNAV+V, LNAV/VNAV, 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 2-16) appears as a magenta diamond. If the approach type downgrades past the final approach fix (FAF), "NO GP" is annunciated.

Full-scale deflection (two dots) is 1000 feet.
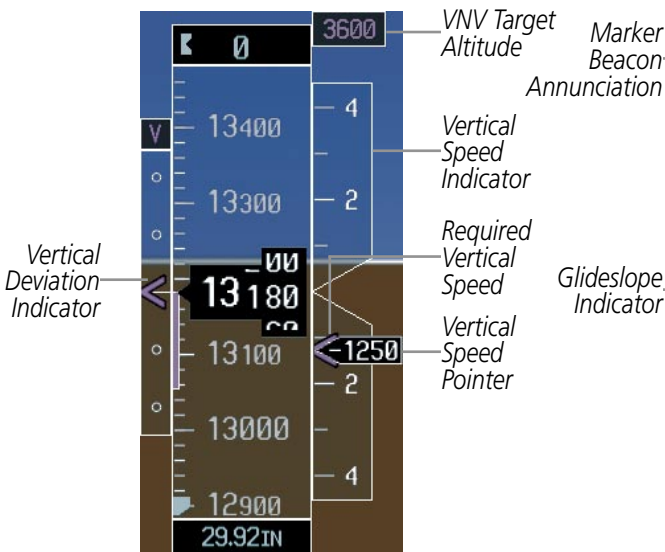
Figure 2-14 Vertical Speed and Deviation Indicators (VSI and VDI)
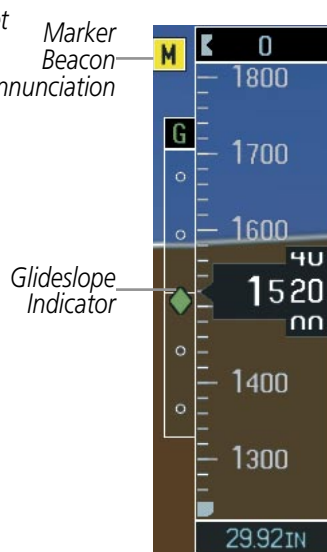
Figure 2-15 Glideslope Indicator
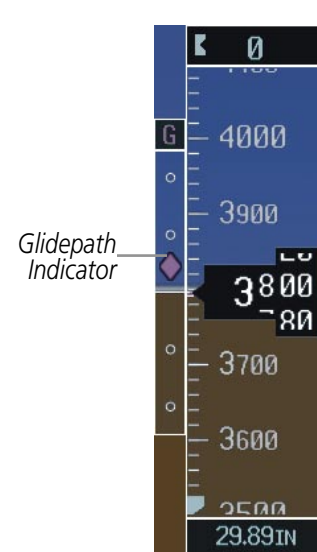
Figure 2-16 Glidepath Indicator

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. The HSI presents heading, turn rate, course deviation, bearing, and navigation source information in a 360° compass-rose format.

The HSI contains a Course Deviation Indicator (CDI) with a course pointer arrow, a To/From arrow, 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	Selected Heading	10	Course Pointer
3	Current Track Bug	11	Heading Bug
4	Lateral Deviation Scale	12	Flight Phase
5	Navigation Source	13	Selected Course
6	Aircraft Symbol	14	Turn Rate/Heading Trend Vector
7	Course Deviation Indicator (CDI)	15	Current Heading
8	Rotating Compass Rose	16	Lubber Line
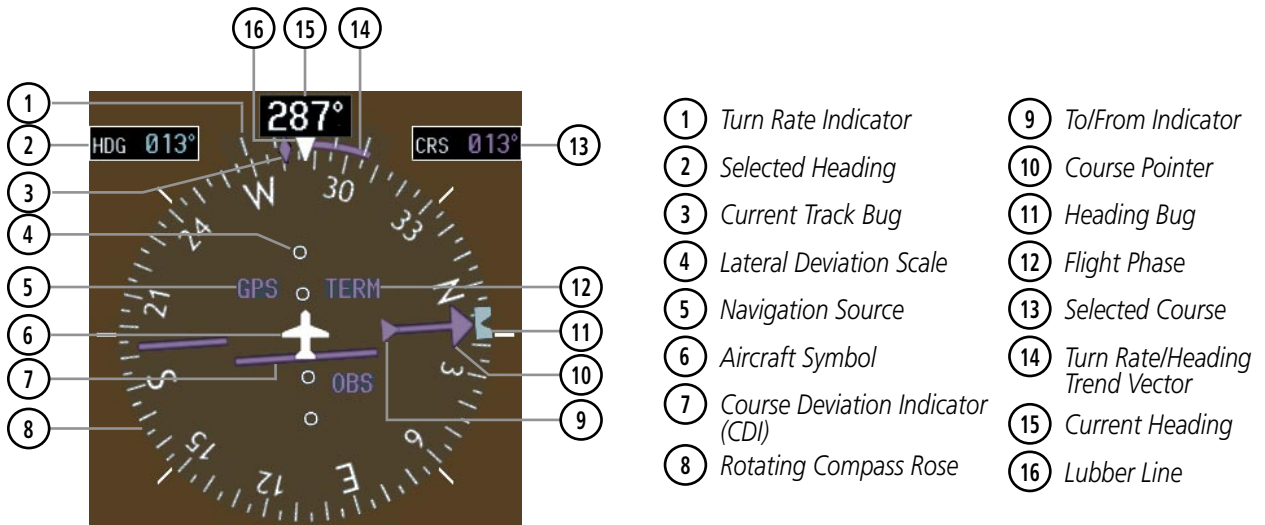
Figure 2-17 Horizontal Situation Indicator (HSI)

A digital reading of the current heading appears on top of the HSI. The current track is represented on the HSI by a magenta diamond bug. To the upper left of the HSI, the Selected Heading is shown in light blue; the light blue bug on the compass rose corresponds to the Selected Heading. The Selected Course is shown to the upper right of the HSI. The color of the Selected Course corresponds to the selected navigation source: magenta for GPS or green for NAV (VOR, LOC).

Figure 2-18 Heading and Course Indications

Adjusting the Selected Heading:

Turn the **HDG** Knob to set the Selected Heading on both PFDs.

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

Adjusting the Selected Course:

Turn the **CRS** Knob to set the Selected Course (for each PFD).

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).

The heading displayed on the HSI and all other navigation angles (track, heading, course, bearing) are magnetic when the NAV ANGLE is set to 'Magnetic' on the AUX - System Setup Page. When 'True' is selected, all navigation angles and the HSI display a 'T' next to the angle value (Figure 2-19). When an approach referenced to true north has been loaded into the flight plan, the system generates a message alerting the pilot to switch the NAV 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.
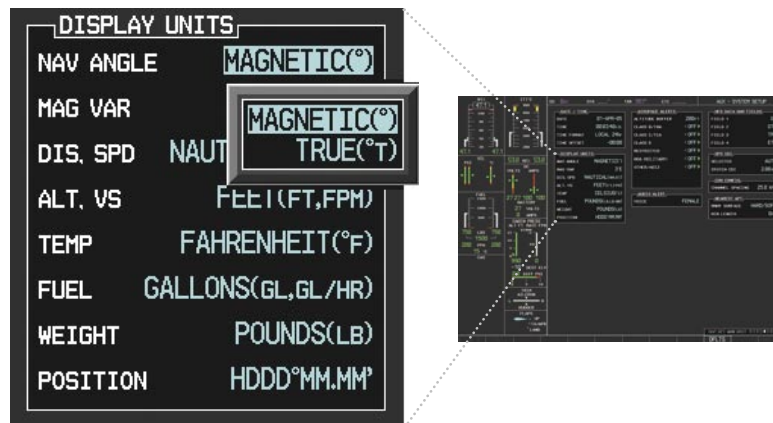
**Figure 2-20 System Setup Page,
Navigation Angle Settings**

TURN RATE INDICATOR

The Turn Rate Indicator is located directly above the rotating compass card. Tick marks to the left and right of the lubber line denote half-standard and standard turn rates. A magenta Turn Rate Trend Vector shows the current turn rate. The end of the trend vector gives the heading predicted in 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).

Figure 2-21 Turn Rate Indicator and Trend Vector

BEARING POINTERS AND INFORMATION WINDOWS

> **NOTE:** Refer to the Audio Panel and CNS Section for information on tuning the radios.

Two bearing pointers and associated information can be displayed on the HSI for NAV, GPS, and ADF 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).
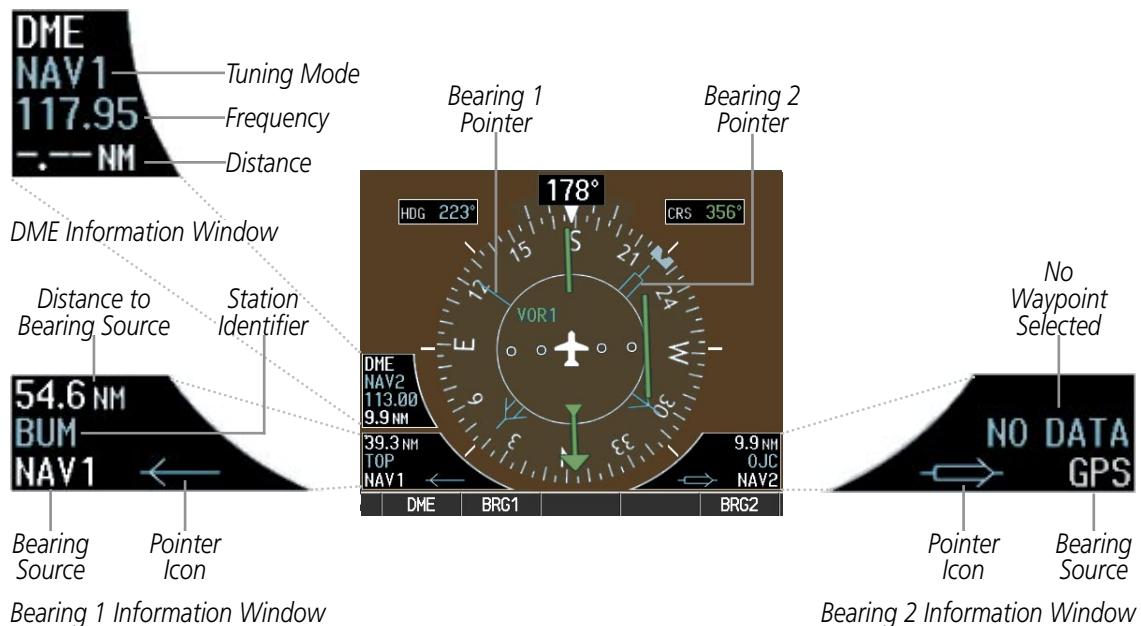
Figure 2-22 HSI with Bearing and DME Information

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, ADF)

• Pointer icon (single line for BRG1, double line for BRG2)

• Frequency (NAV, ADF)

• 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, 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.

Under the following conditions, the bearing pointer is removed from the HSI and "NO DATA" is displayed in the information window:

• 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) Press the **BRG** Softkey a third time to change the bearing source to ADF.

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

DME INFORMATION WINDOW

> **NOTE:** *Refer to the Audio Panel and CNS Section for information on tuning the radios.*

The DME Information Window (labeled 'DME'; see Figure 2-22) is displayed above the BRG1 Information Window and shows the tuning mode (NAV1, NAV2, or HOLD), frequency, and actual DME distance. When a signal is invalid, the distance is replaced by "–.– – NM".

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.

COURSE DEVIATION INDICATOR (CDI)

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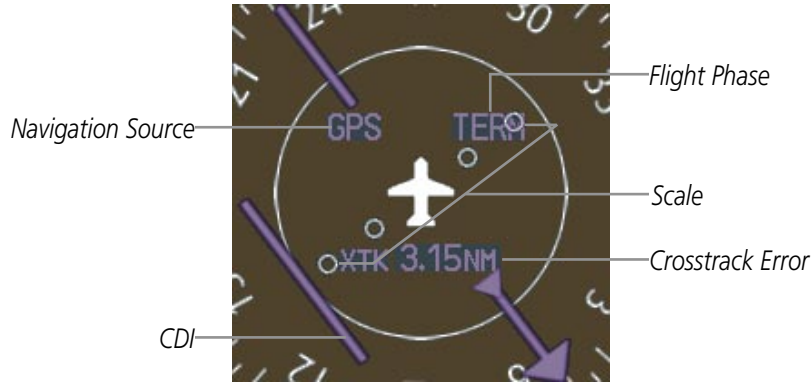
Figure 2-23 Course Deviation Indicator

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 Selected Course readout also follows these color indications.
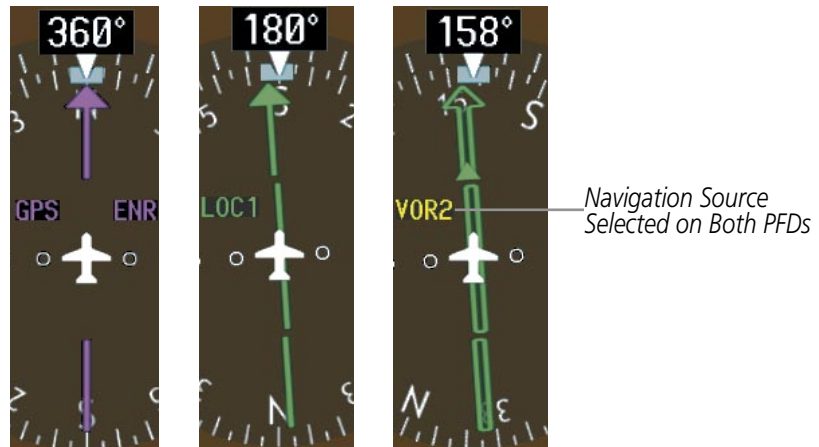
Figure 2-24 Navigation Sources

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*
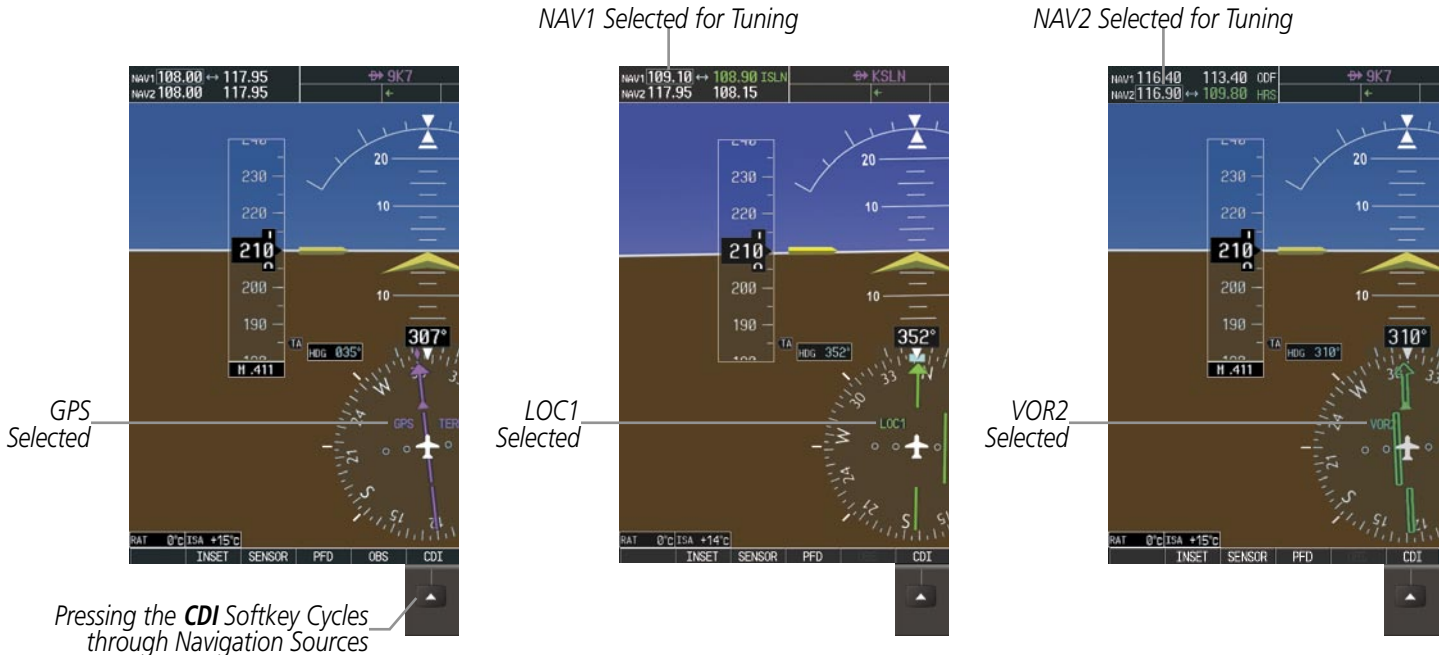
Figure 2-25 Selecting a Navigation Source

The CDI has the same angular limits as a mechanical CDI when coupled to a VOR or localizer (LOC). When coupled to GPS, the full scale limits for the CDI are defined by a GPS-derived distance. If the CDI exceeds the maximum deviation on the scale (two dots) while coupled to GPS, the crosstrack error (XTK) is displayed below the white aircraft symbol.

If the same VOR/LOC navigation source is selected on both PFDs, the navigation source annunciation turns yellow on both displays (unless synchronized). Once the CDIs are synchronized (CDI SYNC turned on), they remain synchronized for the entire flight. Synchronization is not reset (turned off) until the power is cycled.

Synchronizing the CDIs:

1) Press the **MENU** Key to display the PFD Setup Menu.

2) Turn the large **FMS** Knob to highlight the 'CDI Sync' ON/OFF field.

3) Turn the small **FMS** Knob clockwise to ON or counterclockwise to OFF.

4) Press the **MENU** Key again to remove the menu.
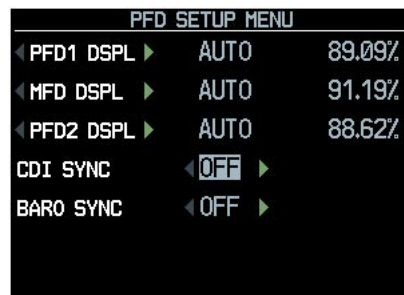
Figure 2-26 PFD Setup Menu – CDI Sync

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 leg, the FAF is less than 15 nm away, and the aircraft is moving toward the FAF

- A valid localizer frequency has been tuned

- The GPS CDI deviation is less than 1.2 times full-scale deflection

GPS steering guidance is still provided after the HSI 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 (see the GPS Navigation Section) also causes the HSI to switch to LOC navigation source; GPS steering guidance is not provided after this switch.

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. 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 2-27).

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 2-27 System Setup Page,
GPS CDI Settings**

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. Receiver Autonomous Integrity Monitoring (RAIM) protection limits follow the selected CDI scale and corresponding flight phases.

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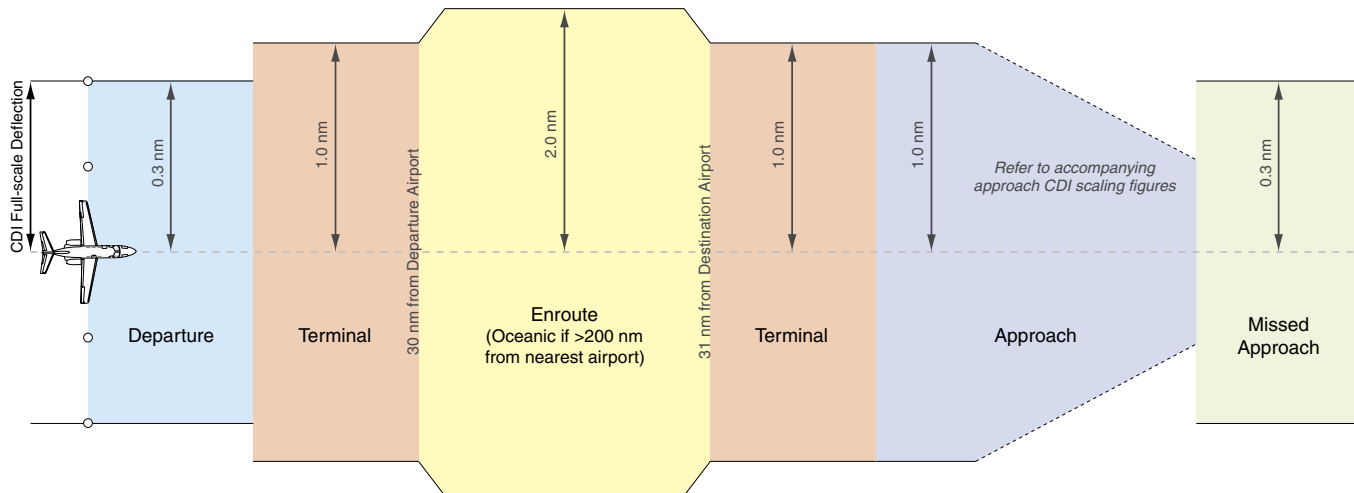
Figure 2-28 Automatic CDI Scaling

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

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

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

  - If the next leg in the departure procedure is not a CA, CD, CF, CI, CR, DF, FA, FC, FD, FM, IF, or TF leg

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

- Thirty nautical miles from the departure airport (or at the last departure waypoint if farther than 30 nm from the departure airport), the system automatically selects the ***enroute*** phase of flight and changes the CDI scaling to 2.0 nm over a distance of 1.0 nm.

- 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; if a transition back to enroute flight occurs, the CDI scale increases back to 2.0 in the same manner.

- During ***approach***, the CDI scale ramps down even further (see Table 2-2). This transition normally occurs within 2.0 nm of the final approach fix (FAF). The CDI switches to approach scaling automatically once any portion of the approach procedure becomes active or if Vectors-To-Final (VTF) are selected.

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

  - If the active waypoint is part of the missed approach procedure, the active leg and the preceding missed approach legs must be aligned within 3° of the final approach segment course and the aircraft position must be prior to the turn initiation point.
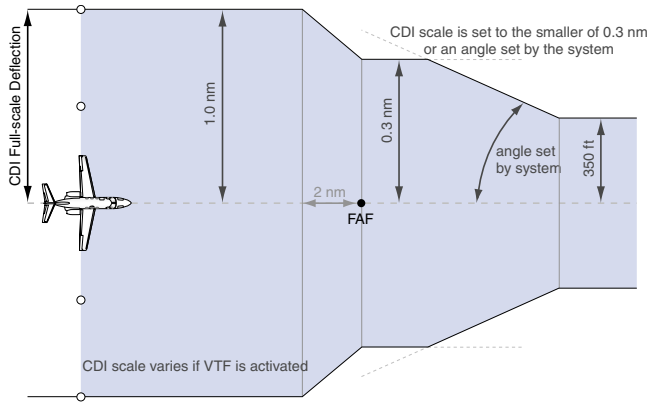
Figure 2-29 Typical LNAV and LNAV+V Approach CDI Scaling
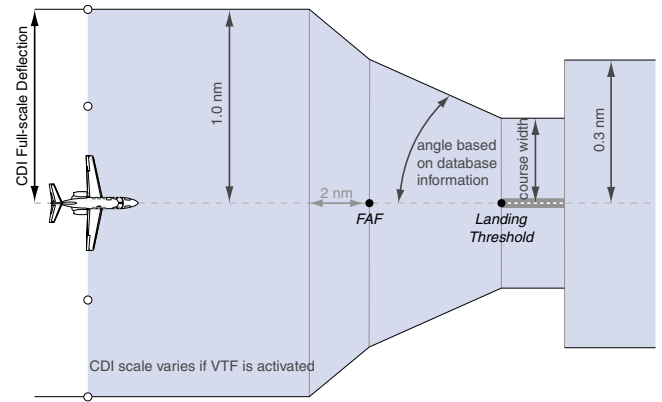
Figure 2-30 Typical LNAV/VNAV and LPV Approach CDI Scaling

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

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 2-29)
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 2-30)
Approach (LPV)	LPV	
Missed Approach	MAPR	0.3 nm

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

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.

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.
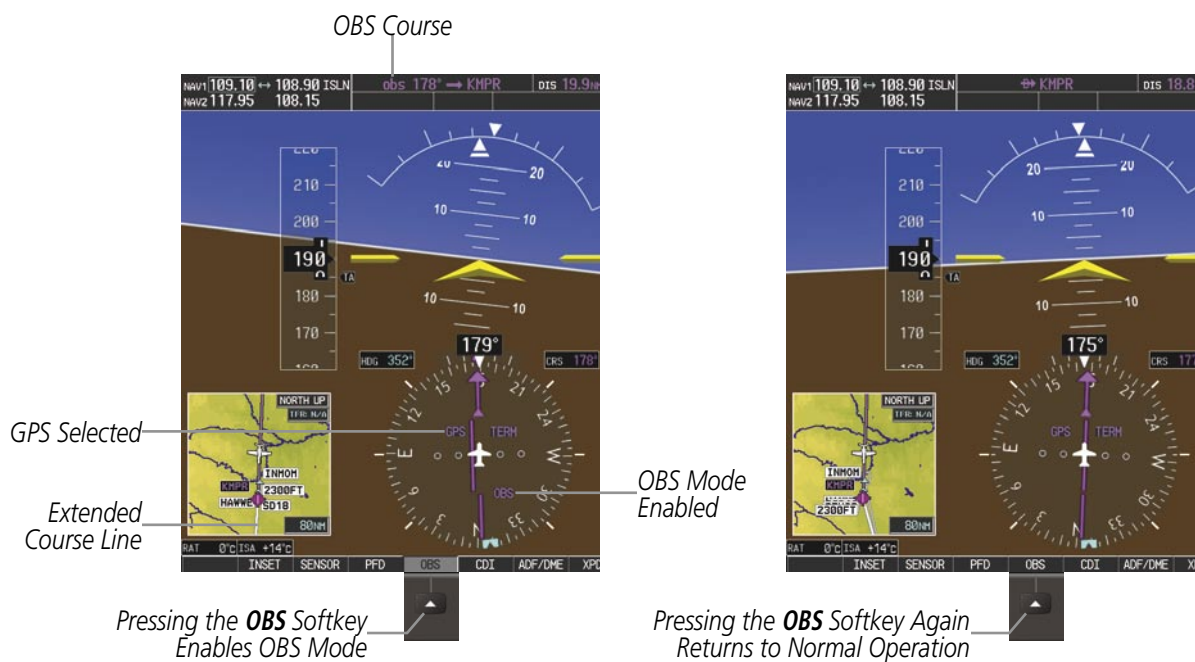
Figure 2-31 Omni-bearing Selector (OBS) Mode

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

1) Press the **OBS** Softkey to select OBS Mode.

2) Turn a **CRS** Knob to select the desired course to/from the waypoint. Press a **CRS** Knob to synchronize the Selected Course with the bearing to the next waypoint.

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

As the aircraft crosses the missed approach point (MAP), automatic approach waypoint sequencing is suspended. 'SUSP' appears on the HSI (to the lower right of the aircraft symbol) in place of 'OBS' and the **OBS** Softkey label changes to **SUSP**.

SUSP Annunciation

*Pressing the **SUSP** Softkey Suspends Automatic Waypoint Sequencing*
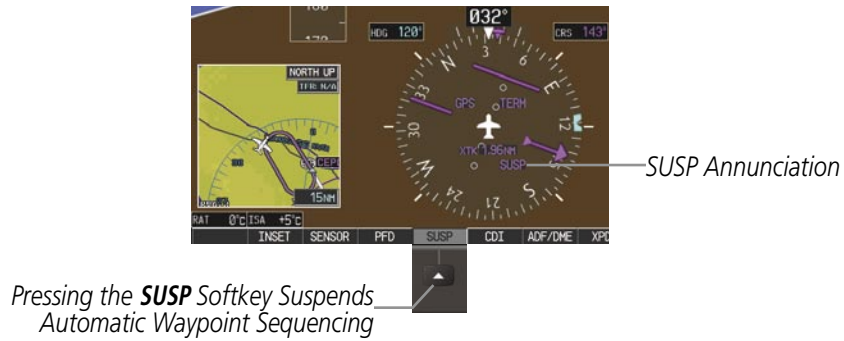
Figure 2-32 Suspending Automatic Waypoint Sequencing

2.2 SUPPLEMENTAL FLIGHT DATA

> **NOTE:** *Pressing 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 Ram Air Temperature (RAT) and deviation from International Standard Atmosphere (ISA) temperature are displayed in the lower left of the PFD under normal conditions, or underneath the Airspeed Indicator in reversionary display mode. Both are displayed in degrees Celsius (°C).

Normal Display   *Reversionary Mode*

Figure 2-33 Ram Air Temperature and ISA Temperature Deviation

WIND DATA

Wind direction and speed (relative to the aircraft) 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".

Option 1　　　*Option 2*

Option 3　　　*No Data*

Figure 2-34 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/tail and crosswind components

  • **OPTN 2**: Wind direction with respect to heading and speed

  • **OPTN 3**: Wind direction with respect the heading and head (H)/tail (T) and crosswind (X) speed components

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, RSVI, VDI) appear on the PFD in conjunction with the "TOD within 1 minute" message (Figure 2-35) and "Vertical track" voice alert. See the GPS Navigation and AFCS sections for details on VNV features. VNV indications are removed from the PFD according to the criteria listed in Table 2-3.

Figure 2-35 Vertical Navigation Indications (PFD)

Criteria	VNV Indication Removed		
	Required Vertical Speed (RSVI)	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 pressed on MFD)	X	X	X
Distance to active waypoint cannot be computed due to unsupported flight plan leg type (see GPS Navigation 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

* If the flight director has been engaged to fly a VNV flight plan, the VNV Target Altitude being held remains displayed while on level flight plan legs.

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 the EICAS Section for information on the Crew Alerting System (CAS) and to Appendix A for more information on alerts and annunciations.

SYSTEM ALERTING

The System Messages Window conveys messages to the flight crew regarding problems with the G1000 System. When a new message is issued, the **MSG** Softkey flashes to alert the flight crew. It continues to flash until pressed, which opens the System Messages Window and acknowledges the message(s) which initiated the flashing. When the window is open, messages for which the trigger conditions no longer exist turn gray. Messages generated while the window is open are not automatically displayed, but cause the **MSG** Softkey to begin flashing again. Pressing the **MSG** Softkey while the System Messages Window is open closes the window, unless the **MSG** Softkey is flashing.

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

Reversionary sensor selection is annunciated in a window on the right side of the PFD. These annunciations reflect reversionary sensors selected on one or both PFDs. Pressing the **SENSOR** Softkey accesses the **ADC1**, **ADC2**, **AHRS1**, and **AHRS2** softkeys. These softkeys allow switching of the sensors being viewed on each PFD. With certain types of sensor failures, the G1000 may make some sensor selections automatically. The GPS sensor cannot be switched manually.
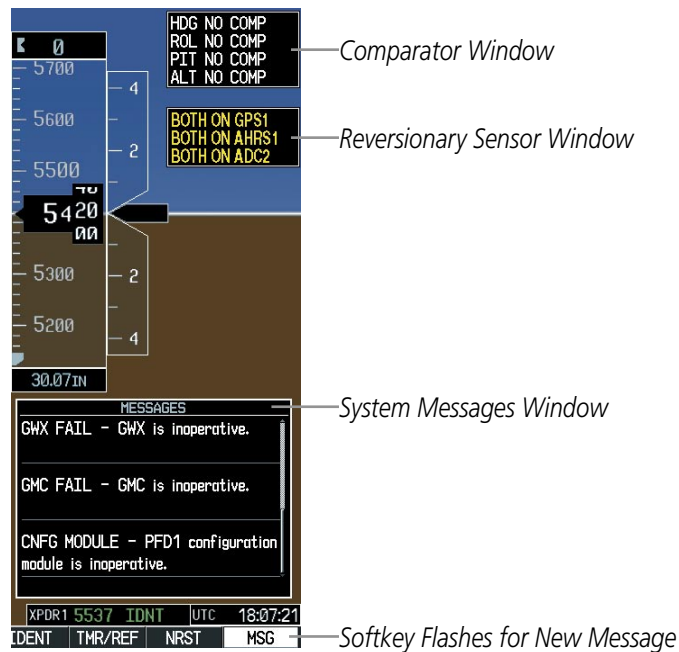
Figure 2-36 G1000 Alerting System

MARKER BEACON ANNUNCIATIONS

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

Outer Marker   *Middle Marker*   *Inner Marker*

Altimeter
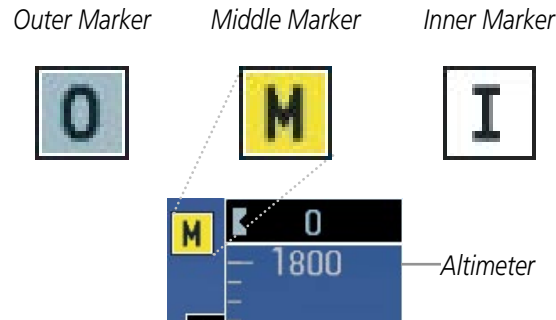
Figure 2-37 Marker Beacon Annunciations

TRAFFIC ANNUNCIATION

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

• The PFD Inset Map is enabled, displaying traffic

• A flashing black-on-yellow 'TRAFFIC' annunciation (Figure 2-38) appears to the top left of the Attitude Indicator for 5 seconds and remains displayed until no TAs are detected in the area

• A single "TRAFFIC" aural alert is generated

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

TAWS ANNUNCIATIONS

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

Figure 2-38 Traffic and Example TAWS Annunciations

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. 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 alert the pilot when approaching the MDA or 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.

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.
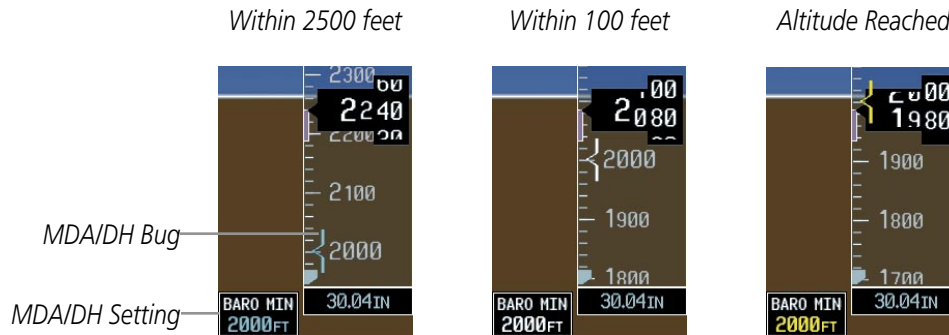
Figure 2-39 Minimum Descent Altitude/Decision Height Alerting Visual Annunciations

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

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 2-40).

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 2-40 Minimum Descent Altitude/Decision Height Setting (Timer/References Window)

ALTITUDE ALERTING

The Altitude Alerting function provides visual and audio alerts when approaching the Selected Altitude. Whenever the Selected Altitude is changed, Altitude Alerting is reset. Altitude Alerting is based on the altitude information shown on the PFD selected with the **XFR** Key on the AFCS Control Unit. Altitude Alerting is independent of the AFCS.

Pilot-side PFD Selected

ROL ← PIT ALTS

Copilot-side PFD Selected

ROL → PIT ALTS
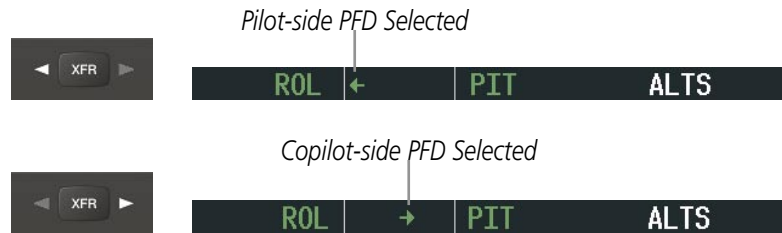
Figure 2-41 PFD Selection Indications

The following occur when approaching the Selected Altitude:

• Upon passing through 1000 feet of the Selected Altitude, the Selected Altitude Box changes to black text on a light blue background, flashes for 5 seconds, and an aural tone is generated.

• When the aircraft passes within 200 feet of the Selected Altitude, the Selected Altitude changes to light blue text on a black background and flashes for 5 seconds.

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

Within 1000 feet   *Within 200 feet*   *Deviation of ±200 feet*

4000   4000   4000

Figure 2-42 Altitude Alerting Visual Annunciations

LOW ALTITUDE ANNUNCIATION

NOTE: *This annunciation is only shown if TAWS is inhibited.*

When the Final Approach Fix (FAF) is the active waypoint in a GPS WAAS 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.

LOW ALT

5000
9700
—*Altimeter*

Figure 2-43 Low Altitude on GPS WAAS Approach

2.4 ABNORMAL OPERATIONS

ABNORMAL GPS CONDITIONS

The annunciations listed in Table 2-3 can appear on the HSI when abnormal GPS conditions occur; see Figure 2-44 for examples. Refer to the GPS Navigation 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
WARN	Lower left of aircraft symbol	Warning–RAIM function detects excessive GPS position errors
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 2-3 Abnormal GPS Conditions Annunciated on HSI

Figure 2-44 Example HSI Annunciations

Dead Reckoning Mode causes the CDI to be removed from the display (when GPS is the selected navigation source) and the following items on the PFD to be shown in yellow:

• Current Track Bug

• Wind Data (calculated based on GPS information)

• Distances in the Bearing Information windows

• GPS bearing pointers

These items should be verified when operating in Dead Reckoning Mode.

UNUSUAL ATTITUDES

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

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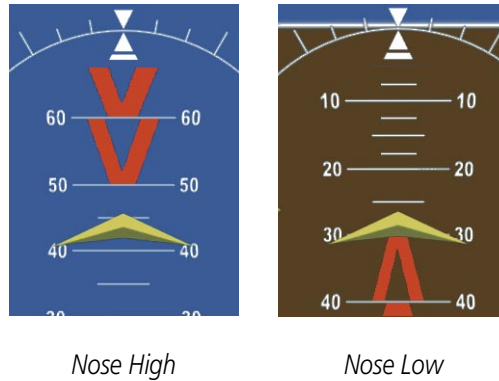
Figure 2-45 Pitch Attitude Warnings

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
- Temperatures
- DME Information Window
- Wind data
- Selected Heading Box
- Selected Course Box
- Transponder Status Box

- System Time
- PFD Setup Menu
- Windows displayed in the lower right corner of the PFD:
    – Timer/References
    – Nearest Airports
    – Flight Plan
    – Messages
    – Procedures
    – ADF/DME Tuning

- Minimum Descent Altitude/ Decision Height readout
- Vertical Deviation, Glideslope, and Glidepath Indicators
- Altimeter Barometric Setting
- Selected Altitude
- VNV Target Altitude

SECTION 3 ENGINE INDICATION AND CREW ALERTING SYSTEM (EICAS)

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

The Cessna Citation Mustang's Engine Indication and Crew Alerting System (EICAS) offers improved flight operations and reduces crew workload by automatically monitoring critical system parameters and providing system alerts during all phases of flight. In combination with the EICAS, aural alerts, additional avionics messages, and master indicators are used to inform the crew of aberrant flight conditions. The EICAS is also designed to provide an improved level of maintenance data for the ground crew.

The EICAS can be divided into two major functions:

• The **Engine Indication System** (EIS) displays electrical, fuel, engine, pressurization, and flight control information.

• The **Crew Alerting System** (CAS) displays advisories, cautions, and warnings to communicate conditions, statuses, and system failures. CAS messages are grouped by level of importance and color-coded based on urgency in the CAS pane in the lower left of the EICAS Display.

EICAS information is normally displayed on the left side of the Multi Function Display (MFD).
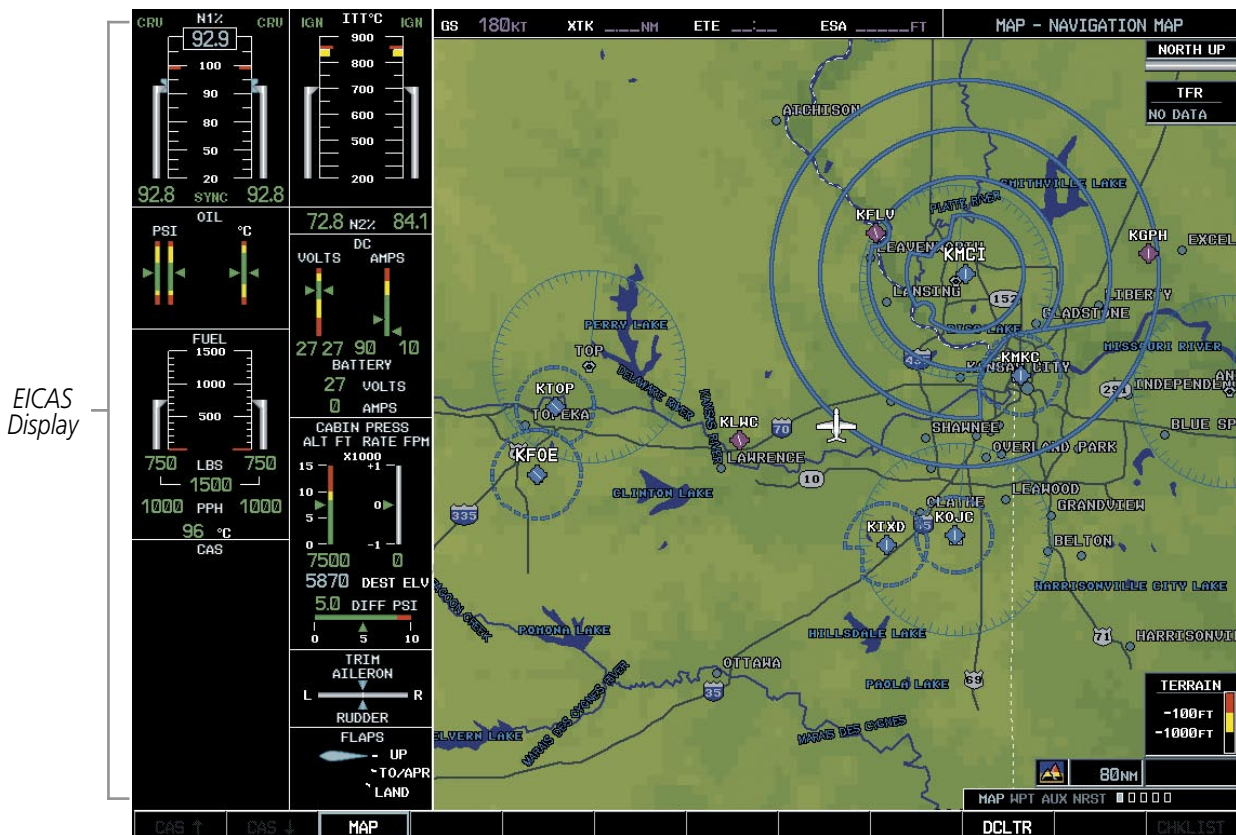
Figure 3-1 Multi Function Display (Normal Mode)

In the event of a display failure, depending on the failed display(s), the remaining display(s) may be re-configured to present Primary Flight Display (PFD) symbology together with EICAS information (refer to the System Overview for more information about reversionary mode).

In reversionary mode, the data is pared down to a single column on any display. The N1, N2, and ITT indicators are presented in the same way, but all other parameters are shown as readouts only. The following are not shown:

- Total fuel
- Cabin altitude rate
- Destination elevation
- Battery current
- Aileron and rudder trim

The CAS is moved to a window on the right side of the display. CAS messages are treated in the same way as they are during normal display. Messages are prioritized by criticality.

Figure 3-2 Reversionary Mode

3.1 ENGINE INDICATION SYSTEM (EIS)
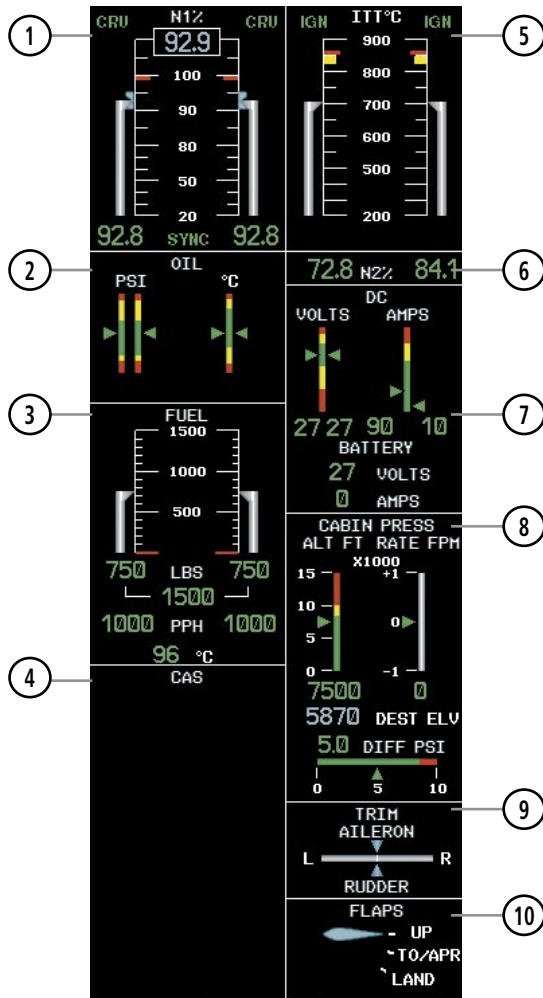
Figure 3-3 EICAS Display (Normal Mode)
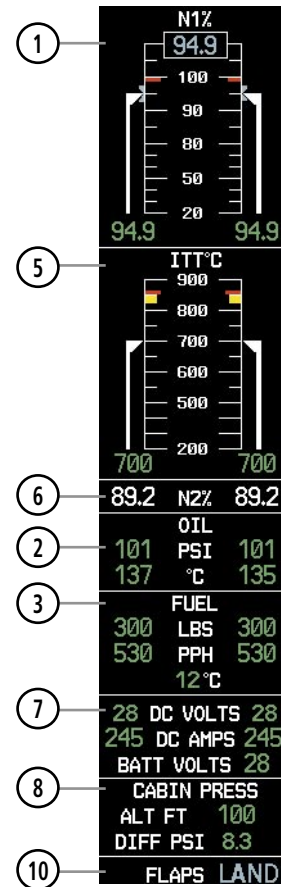
Figure 3-4 EIS Display (Reversionary Mode)

① *Engine Fan Rotation Speed*	⑥ *Engine High Pressure Turbine Rotation Speed*
② *Oil Pressure and Temperature*	⑦ *Electrical Display*
③ *Fuel Display*	⑧ *Pressurization Display*
④ *CAS Display (refer to Section 3.2)*	⑨ *Trim Indicator*
⑤ *Interstage Turbine Temperature*	⑩ *Flap Indicator*

EIS information is presented using horizontal and vertical bar indicators and digital readouts. Green ranges on the instrument scales indicate normal ranges of operation; yellow and red bands indicate caution and warning, respectively. During normal operating conditions, an instrument's pointer appears in white or green and readout text is green. Refer to each instrument description for additional details on display behavior.

When an unsafe operating condition occurs, the pointer and readout color change to indicate a caution (yellow) or warning (red). If the time limit for an unsafe condition is exceeded, the color of the sliders, pointers, and digits may change to denote an increase in priority level, even if the parameter is still within in the lower priority condition range. If sensor data for a parameter becomes invalid or unavailable, a red "X" is displayed across the indicator and/or readout.
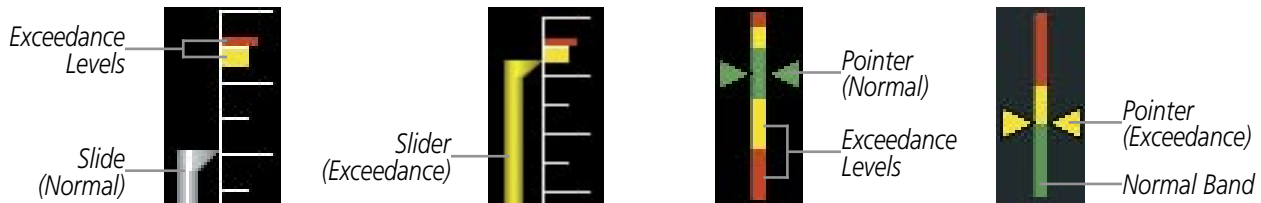
Figure 3-5 Indicators and Exceedance Levels

ENGINE STAGE ROTATION SPEEDS (N1 AND N2)

The N1 display (Figure 3-6) indicates the engine fan rotation speeds while the N2 readouts show the engine high pressure turbine rotation speeds. Both are shown as percentages. The N1 and N2 displays are shown in the same format in reversionary mode.

The N1 display ranges from 20 to 110% of maximum rotational speed. Values and limits are obtained from the Full Authority Digital Engine Controller (FADEC). When the N1 values of the engines are synchronized, 'SYNC' appears in green between the readouts below the scale. If N1 drops below 20%, the sliders are removed from the scale while the readouts remain displayed below.

An N1 target based on the indicated Thrust Mode is shown for each engine by a bug along the scale. The readout in the box at the top of the scale is the minimum N1 target value for both engines. When the Thrust Lever Angle (TLA) position corresponds to the indicated Thrust Mode (Table 3-1), the indication is shown in green; otherwise, the indication appears in white.

Figure 3-6 N1 Display
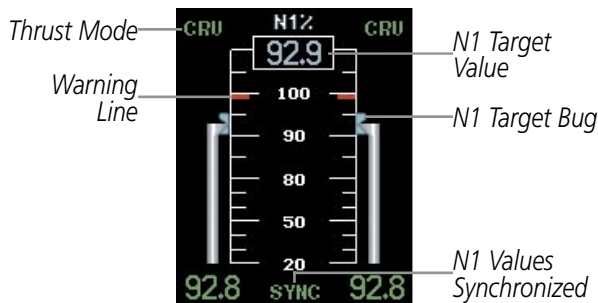
Indication	Thrust Mode
CRU	Cruise
CLB	Max Climb
T/O	Takeoff

Table 3-1 Thrust Modes

The N2 readouts are located beneath the ITT display. At engine start, the readouts appear in white. Once normal operating conditions are reached, the readouts change to green.

OIL PRESSURE AND TEMPERATURE

The oil pressure and temperature for each engine are shown below the N1 display under normal display operating conditions. Oil pressure is shown in pounds per square inch (psi) and temperature in degrees Celsius (°C). When oil pressure and temperature are in the normal operating range, no readout is provided. When an abnormal operating condition occurs, the readouts appear in the corresponding color. In reversionary mode, only the readouts are shown.

FUEL DISPLAY

The fuel display is located beneath the oil indicators and shows the fuel quantity in pounds (lb) and fuel flow in pounds per hour (pph) for each engine, the total fuel quantity, and the fuel tank temperature in °C. Fuel information is provided primarily by the Fuel Quantity Signal Conditioner (FQSC), which has a fuel quantity processor for each tank. Fuel display can also be configured for display in metric units.

Fuel quantity for each tank is normally shown along a slider scale with readouts below for each tank and the total. The fuel flow readout for each engine is shown below the fuel quantity and the fuel temperature is displayed under this. Only readouts are given in reversionary mode and total fuel quantity is not shown.
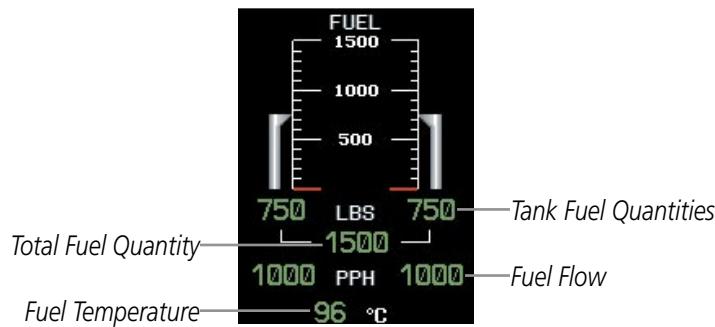
Figure 3-7 Fuel Display (Normal Mode)

INTERSTAGE TURBINE TEMPERATURE

Interstage Turbine Temperatures (ITT) are displayed along a slider scale in °C. ITT values and limits are obtained from the FADEC. ITT is shown in the same format in display reversionary mode. During normal operations, the sliders appear in white and no readout is shown. Readouts are provided for each engine below the scale during engine start, for values below 200°C, or for caution and warning values. When the respective engine ignitors are on, 'IGN' appears in green text at the top of the ITT scales.
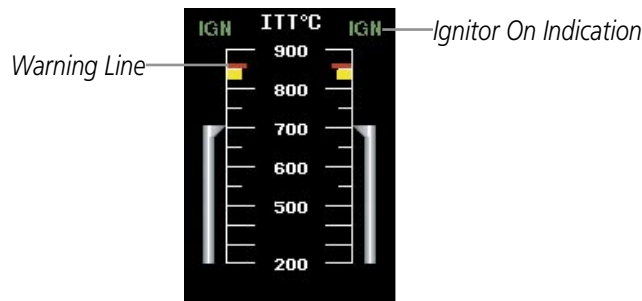
Figure 3-8 Interstage Turbine Temperature Display

ELECTRICAL DISPLAY

Voltage and current for the direct current (DC) generators and battery are obtained directly from the electrical system buses. Generator voltages and currents are normally shown along color-coded scales, with readouts below. Battery voltage and current are displayed as readouts. In reversionary mode, battery current is not shown.
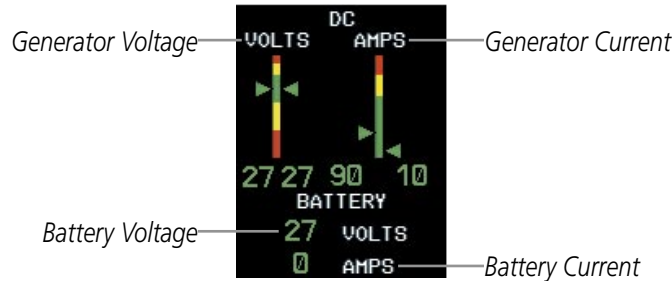
Figure 3-9 Electrical Display (Normal Mode)

PRESSURIZATION DISPLAY

Cabin pressurization information (cabin altitude and rate of change, destination elevation, differential cabin pressure) is shown beneath the electrical display. Only cabin altitude and the pressure differential readouts are displayed in reversionary mode.

Cabin altitude is shown on a color-coded scale labeled in 5,000-ft increments with a readout (in feet) below (unless on the ground). The cabin altitude scale and corresponding "CABIN ALT" CAS messages shift up to higher altitude when in high altitude pressurization mode. High altitude mode is active whenever both the following are true:

- The takeoff or destination elevation is above 8,000 feet

- The aircraft altitude is less than 24,500 feet

- The pressurization system has verified the conditions

Cabin altitude change rate is displayed on a scale in terms of 1,000-fpm increments with a readout (in fpm) below. Cabin pressure differential (DIFF PSI), in pounds per square inch (psi), is indicated on a color-coded scale with a readout.
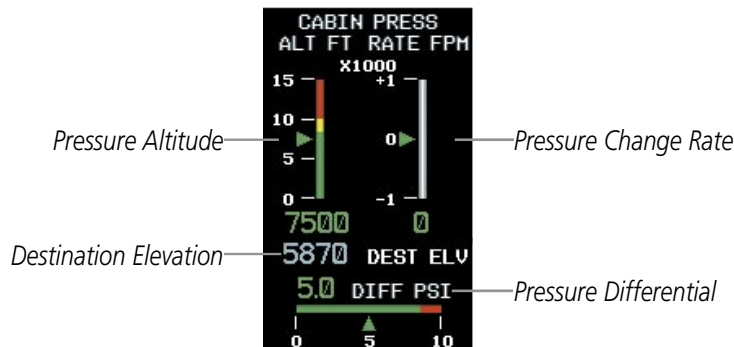
Figure 3-10 Cabin Pressure Display (Normal Mode)

The destination elevation (from -1,000 to 14,000 feet) entered in the PFD Timer/References Window (Figure 3-11) is displayed below the cabin altitude readings. This value is retained by the G1000 on power-down.

Setting the destination elevation:

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

2) Turn the large **FMS** Knob to highlight the 'DEST ELV' field.

3) Use the small **FMS** Knob to enter the destination elevation (in 10-ft increments from -1,000 to 14,000 feet).

4) To remove the window, press the **CLR** Key or the **TMR/REF** Softkey.

Timer/References Window

Figure 3-11 Primary Flight Display

TRIM AND FLAP INDICATORS

Lateral trim indications are shown along a slide bar scale beneath the pressurization display in normal display mode. Aileron trim is displayed at the top of the scale and rudder trim is displayed at the bottom. The trim display is not present in reversionary mode.

Flap deflection is normally displayed beneath the trim indications using a rotating pointer. Flap positions for takeoff/approach, landing, and up positions are labeled. In reversionary mode, a digital readout of the flap position (UP, TO/APR, LAND) is provided.

Figure 3-12 Trim and Flap Indications (Normal Mode)

3.2 CREW ALERTING SYSTEM (CAS)

> **NOTE:** *Aural alerts associated with abnormal conditions and advisories are managed through the Audio Panels. Refer to the Audio Panel and CNS Section for more information.*

> **NOTE:** *If there is a mismatch between databases or software on the PFDs, CAS is inoperative.*

The Crew Alerting System (CAS) Display is located in the lower left corner of the EICAS Display (on the MFD) under normal display conditions. Up to 14 messages can be displayed; when more than 14 messages accumulate, the scrolling **CAS** softkeys become available.

When CAS messages are present while in reversionary mode, the CAS Window appears on the display along with the flight instruments and EIS. The window size increases to fit up to 14 CAS messages; if more than 14 messages are generated, the messages can be scrolled through using the **CAS** softkeys (two left-most softkeys).

CAS Display

Normal Mode

CAS Window

Reversionary Mode
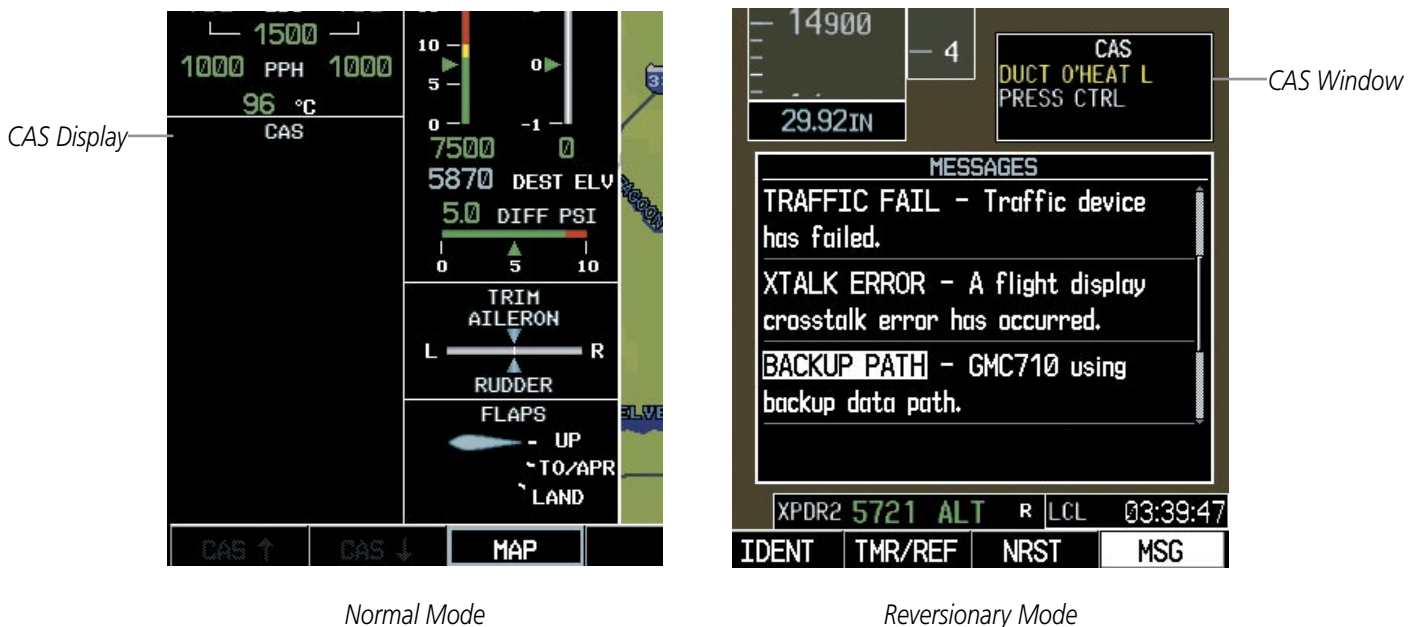
Figure 3-13 CAS Messages

CAS MESSAGES AND PRIORITIZATION

> **NOTE:** *Information on CAS messages in this pilot's guide is always superseded by the AFM.*

CAS messages are grouped by criticality (warning, caution, advisory) and sorted by order of appearance (most recent messages on top). The color of the message is based on its urgency and on required action:

- **Warning** (red) – Immediate crew awareness and action required; Master Warning triggered

- **Caution** (yellow) – Immediate crew awareness and possible future corrective action required; Master Caution triggered

- **Advisory** (white) – Crew awareness required and subsequent action may be required

Warning	Caution	Advisory	Description	GROUND	ESI	TOPI	AIR	LOPI	ESDI	EMER
	AFT DOOR		Tailcone baggage door not fully secured							X
	AFT JBOX CB L-R*		Start control circuit breaker (located in aft j-box) tripped							X
	AFT JBOX LMT L-R*		Current limiter blown (located in aft j-box)							X
	ANTISKID FAIL		Antiskid Control Unit cannot perform anti-skid functions							X
BATTERY O'TEMP	BATTERY O'TEMP		NiCad battery (optional) overheated							
	BATT TEMP FAIL		Battery temperature sensor failure			X		X		
CABIN ALT	CABIN ALT	CABIN ALT	Cabin altitude potentially unsafe	X		X		X		
	CABIN DOOR		Cabin door not fully secured							X
	CHECK DOORS		Door monitor not properly tested or has failed			X	X	X		X
	DUCT O'HEAT L-R*		Duct temperature too high or sensor disconnected					X		X
	ENG A/I COLD L-R*	ENG A/I COLD L-R*	Engine anti-ice system on and inlet temperature cold						X	X
	ENG CTRL SYS L-R*		FADEC has a fault that requires maintenance							
ENGINE FAIL L-R*			An engine has failed							
	F/W SHUTOFF L-R*		Fuel firewall shutoff valve fully closed							X
	FLAPS FAIL		A flap system failure has occurred							X
	FUEL BOOST L-R*	FUEL BOOST L-R*	Electric fuel boost pump on / Caution when pump is operating in abnormal conditions							X
	FUEL FLTR BP L-R*		Engine fuel filter impending bypass switch closed							X
		FUEL LO INOP L-R*	Fuel low level function failure			X		X		
	FUEL LVL LO L-R*		Fuel level in tank is too low							X
	FUEL PRES LO L-R*		Fuel pressure too low						X	X
		FUEL TRANSFER	Fuel transfer valve open							X
GEN OFF L-R	GEN OFF L-R*		One or both electrical generators offline							
	HYD PRESS LO**		Hydraulic system pressure too low			X				X
	HYD PUMP ON		Hydraulic pump running too long					X		X
	NOSE DOOR L-R*		One or both nose baggage doors not fully secured							X
		NO TIRE SPINDOWN	Antiskid control spindown function not working					X		X
OIL PRESS LO L-R*			Oil pressure less than redline low limit		X				X	X
	OXYGEN OFF		Oxygen supply off			X		X		X
	P/S HTR L-R*		No current detected to pitot static heater							X
	PRESS CTRL	PRESS CTRL	Pressure controller loss of integrity			X		X		X
		PRESS OFF	Air source selector switch in off or fresh air position					X		X
		SPD BRK EXTEND	Speed brakes extended							X
	STALL WARN FAIL		Failure detected in stall warning system		X	X		X		X
		STALL WARN HI	Stall warning system on ice-contaminated schedule		X					X
	STALL WARN HTR		No power delivered to stall warning vane heater		X					X
		SURFACE DE-ICE	De-ice boots inflating/deflating as designed							X
	T2 HTR FAIL L-R*		T2 probe heater failure			X		X		X
TAIL CONE BLD LK			Tailcone temp high, possible bleed air leak			X		X		X
	TAIL DE-ICE FAIL		De-ice system not operating normally							X
	W/S A/I FAIL L-R*	W/S A/I FAIL L-R*	Loss of power to windshield heater							X
	W/S O'HEAT L-R*	W/S O'HEAT L-R*	Windshield anti-ice power on and temperature too high							X
	WING DE-ICE FAIL		De-ice system operating abnormally							X
	WOW MISCOMPARE		Gear on-ground inputs do not agree			X		X		X

Only affected side (L, R, or L-R) displayed in CAS message; noted CAS messages display L-R as an example.

** *The "HYD PRESS LO" message cannot be acknowledged using the Master Caution Indicator if the aircraft is on the ground. Both Master Caution annunciators remain on and the message continues to flash until the issue is corrected.*

Table 3-2 Color-Coded CAS Messages

Any CAS messages that come up when the system is first powered on are considered already acknowledged. They do not flash or trigger the Master Warning or Master Caution. CAS messages listed in Table 3-2 are shown in the acknowledged state (text corresponding to criticality on a black background).

Since red and yellow CAS messages indicate the immediate or future need for corrective action, two momentary buttons are located above each PFD for CAS message acknowledgment: Master Warning and Master Caution.

When a new red CAS warning message appears, it flashes in conjunction with the Master Warning Indicator. Pressing a Master Warning Indicator acknowledges all flashing red messages, extinguishes the master warning lights, and stops the message flashing. Messages are displayed until the issue is corrected and a Master Warning Indicator has been pressed.

When a new yellow caution message appears on the CAS display, it flashes and triggers the Master Caution Indicator to come on, but not to flash. Pressing a Master Caution Indicator acknowledges all flashing yellow messages, extinguishes the master caution lights, and stops the message flashing. Messages are displayed until the issue is corrected.

Master Caution and Warning Indicators

PFD1 *PFD2*

MFD

Figure 3-14 Panel Layout

A CAS message does not appear more than once at a given time (unless the CAS is being tested). If signals are received that justify multiple priorities for a certain message, the message is displayed for the higher priority condition. When graduating to a higher priority, the message flashes and requires new acknowledgment. When degrading to a lower priority condition, the message moves to the top of the appropriate grouping, but does not require new acknowledgment.

Red warning messages cannot be scrolled through and remain at the top of the CAS display. The scroll bar changes color to yellow if more caution messages exist than can be displayed at once or if caution messages have been scrolled off the display. The scroll bar remains in the selected position for 45 seconds or until a new caution message is generated, at which point the scroll bar returns to the top of the display.

CAS DISPLAY INHIBITS

Inhibits prevent certain CAS messages from being displayed during the following conditions:

- Aircraft on ground (GROUND)
- Emergency bus power (EMER)
- Engine start (Engine Start Inhibit, ESI)
- Takeoff (TOPI)

- Aircraft in air (AIR)
- Landing (LOPI)
- Engine shutdown (Engine Shutdown Inhibit, ESDI)

Inhibits affecting each CAS message are indicated with an "X" under the corresponding inhibit column in Table 3-2. Alerts affected by an inhibit are not displayed while the inhibit is enabled. If an alert is displayed prior to the activation of an inhibit affecting it, the alert continues to be displayed normally until the condition causing the alert ceases to exist.

Takeoff and Landing Operation Phase inhibits (TOPI and LOPI) are implemented to reduce flight crew workload and distractions during takeoff and landing. The following tables list the criteria which must be met to activate or deactivate TOPI or LOPI; only one criterion must be met for activation or deactivation to occur.

Activation	Deactivation
Transitions from on-ground to in-air	Airborne > 25 sec
IAS transitions > 50 knots (on either PFD)	IAS > 40 knots (on either PFD)
	IAS invalid (on both PFDs)
	Pressure altitude > 400 ft above field elevation*
	TOPI active > 90 sec

Pressure altitude captured when the aircraft transitions from on-ground to in-air

Table 3-3 Takeoff Operation Phase Inhibit (TOPI) Activation/Deactivation Criteria

Activation	Deactivation
Transitions from in-air to on-ground	On-ground > 25 sec
	IAS < 40 knots (on either PFD)
	IAS invalid (on both PFDs)
GPS altitude transitions < 400 ft above field elevation*	GPS altitude > 600 ft above field elevation*
	LOPI active > 90 sec

Stored in terrain database

Table 3-4 Landing Operation Phase Inhibit (LOPI) Activation/Deactivation Criteria

In order to prevent nuisance messages in the event of a dual generator failure, most messages are inhibited when the emergency bus is powering the aircraft. Failure of a bus or processor also triggers an inhibit to prevent invalid data from triggering a message. Most messages are not generated based upon invalid data; however, there may be exceptions.

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SECTION 4 AUDIO PANEL AND CNS

4.1 OVERVIEW

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

CNS operation in the Cessna Citation Mustang is performed by the following Line Replaceable Units (LRUs):

- GDU 1040A Primary Flight Displays (PFDs) (2)
- GDU 1500 Multifunction Display (MFD)
- GIA 63W Integrated Avionics Units (2)
- GMA 1347D Audio Panels (2)
- GTX 33/33D Mode S Transponders (2)
- GCU 475 MFD Control Unit

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

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

The Mode S Transponders are controlled with softkeys and the **FMS** Knob located on the 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 a reply status (Figure 4-1).

AUDIO PANEL VOLUME CONTROL

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

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

PFD CONTROLS AND FREQUENCY DISPLAY

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

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

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

③ **NAV Knob** – Tunes the standby frequencies for the NAV receiver (large knob for MHz; small knob for kHz). Press to move the 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 **ADF/DME Tuning Window** – Displays ADF frequencies, volume setting, and modes, and DME tuning selection. Display by selecting **ADF/DME** Softkey.

⑩ **ENT Key** – Validates or confirms an ADF frequency or ADF/DME mode and Auto-tune selection.

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

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

AUDIO PANEL CONTROLS
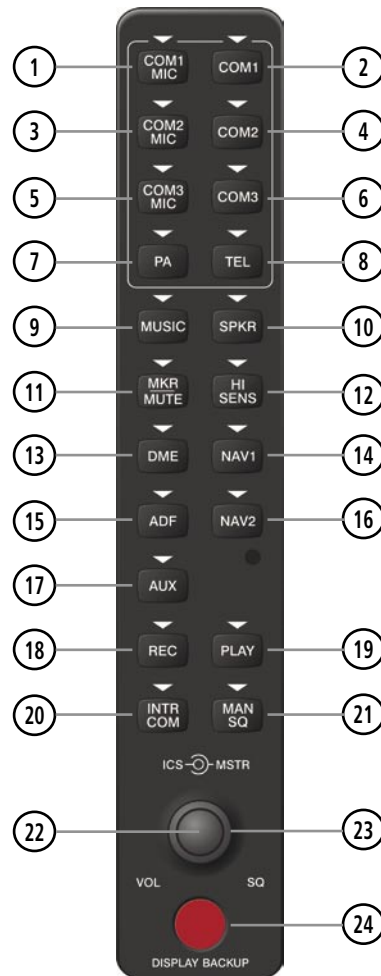
Figure 4-2 Audio Panel Controls (GMA 1347D)

> **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** – Selects the optional #3 transmitter (HF) for transmitting. COM3 receive is simultaneously selected when this key is pressed allowing received audio from the #3 COM receiver to be heard.

(6) **COM3** – When selected, audio from the optional #3 COM receiver (HF) can be heard.

(7) **PA** – Selects the passenger address system. The selected COM transmitter is deselected when the **PA** Key is pressed.

(8) **TEL** – Not used in the Cessna Citation Mustang.

(9) **MUSIC** – Not used in the Cessna Citation Mustang.

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

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

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

(13) **DME** – Turns DME audio on or off.

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

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

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

(17) **AUX** – Not used in the Cessna Citation Mustang.

(18) **REC** – Press to enable the recording of up to 2.5 minutes of COM receiver audio. When no audio is being received, nothing is recorded. Press again to stop recording.

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

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

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

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

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

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

4.2 COM OPERATION

COM TRANSCEIVER SELECTION AND ACTIVATION

> ✓ **NOTE:** *During PA Mode, the COM MIC Annunciator is extinguished and the COM active frequency color changes to white, indicating that neither COM transmitter is active.*

> ✓ **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.

An active COM frequency displayed in green indicates that the COM transceiver is selected on the Audio Panel (**COM1 MIC** or **COM2 MIC** Key). Both active COM frequencies appearing in white indicate that no COM radio is selected for transmitting (**PA** Key is selected on the Audio Panel). Frequencies in the standby fields are also displayed in white.
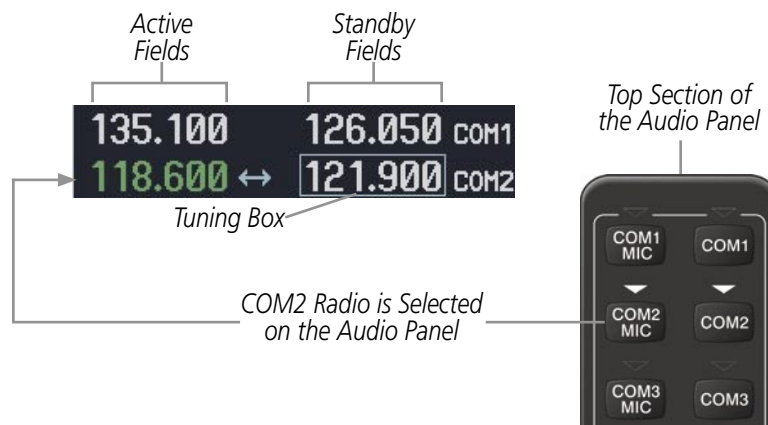
Figure 4-3 Selecting a COM Radio for Transmit

COM3 is reserved for the optional HF radio. The active HF frequency is not shown on the G1000.

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.
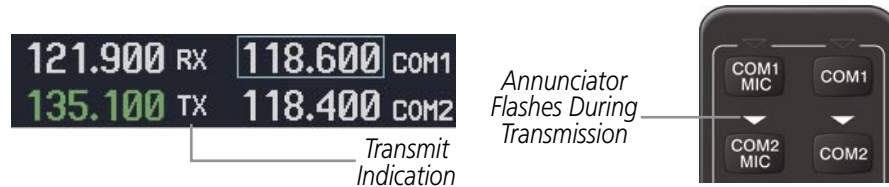
Figure 4-4 COM Radio Transmit and Receive Indications

When the same COM radio is selected on both Audio Panels, the pilot has transmit priority on COM1, the copilot has transmit priority on COM2.

COM TRANSCEIVER MANUAL TUNING

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

Manually tuning a COM frequency:

1) Turn the **COM** Knob to tune the desired frequency 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.

Figure 4-5 COM Frequency Tuning

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*
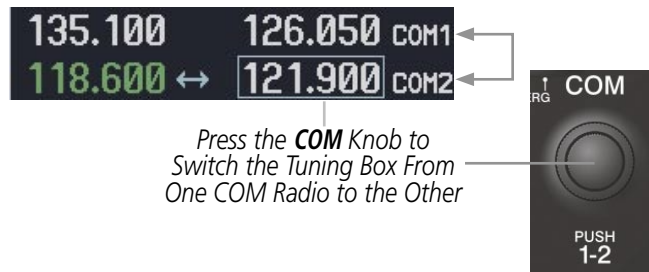
Figure 4-6 Switching COM Tuning Boxes

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

AUTO-TUNING THE COM FREQUENCY

COM frequencies can be automatically tuned from the following:

- Nearest Airports Window (PFD)
- WPT – Airport Information Page
- NRST – Nearest Airports Page

- NRST – Nearest Frequencies Page (ARTCC, FSS, WX)
- NRST – Nearest Airspaces Page

AUTO-TUNING FROM THE PFD

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

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

1) Select the **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.

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

Figure 4-8 Nearest Airports Window (PFD)

AUTO-TUNING FROM THE MFD

Frequencies can be automatically loaded into the COM Frequency Box from pages in the NRST or WPT page group by highlighting the frequency and pressing the **ENT** Key (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 on the MFD control unit or selecting 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 on either PFD to transfer the frequency to the COM Active Frequency Field.

*Turn the **FMS** Knob to Scroll Through a List of Frequencies.*

*Press the **ENT** Key to Load a Highlighted Frequency into the COM Standby Frequency Box.*
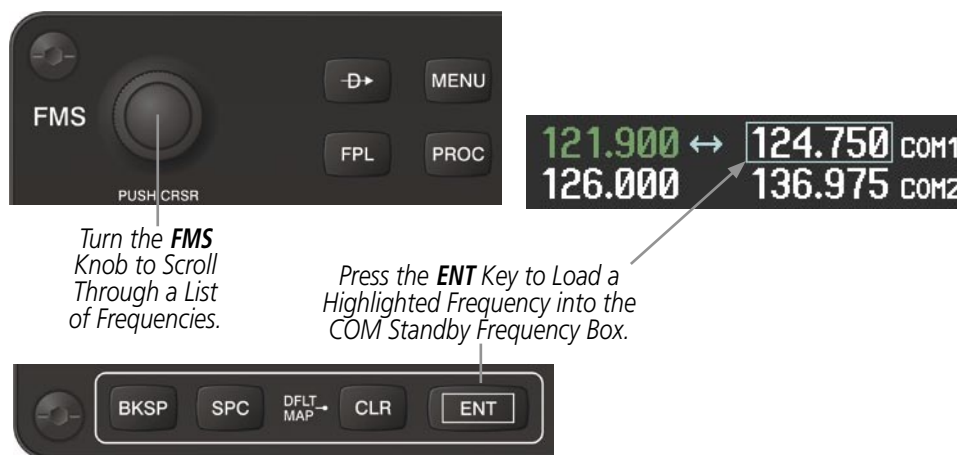
Figure 4-9 Frequency Auto-Tuning from the MFD

OR:

5) Press the **MENU** Key on the MFD control unit (Figure 4-9) to display the page menu (Figure 4-10).

6) Turn the large **FMS** Knob to scroll through the menu options.

7) Press the **ENT** Key to place the cursor on the desired selection.

8) Scroll through the frequency selections with the **FMS** Knob or the **ENT** Key.

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

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

PAGE MENU
OPTIONS
Select Airport Window
Select Runway Window
Select Frequency Window
Select Approach Window
Load Approach
Show Chart

Press the FMS CRSR knob to
return to base page

Nearest Airports Menu

PAGE MENU
OPTIONS
Select ARTCC Window
Select FSS Window
Select WX Window

Press the FMS CRSR knob to
return to base page

Nearest Frequencies Menu

PAGE MENU
OPTIONS
Select Alerts Window
Select Frequency Window

Press the FMS CRSR knob to
return to base page

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.

Selected Airport Identifier and Information

Runway Information

*Press **ENT** Key to load frequency into PFD1 COM Standby Field. Cursor then advances to the next frequency.*

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

Figure 4-11 WPT – Airport Information Page

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

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

*Press the COM **VOL/SQ** Knob to turn off Automatic Squelch. Press again to restore Automatic Squelch.*

Squelch Indication

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.
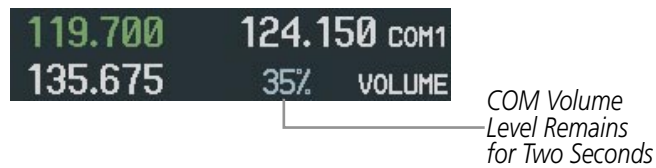

COM Volume Level Remains for Two Seconds

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

While cycling through the **CDI** Softkey selections, the 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.
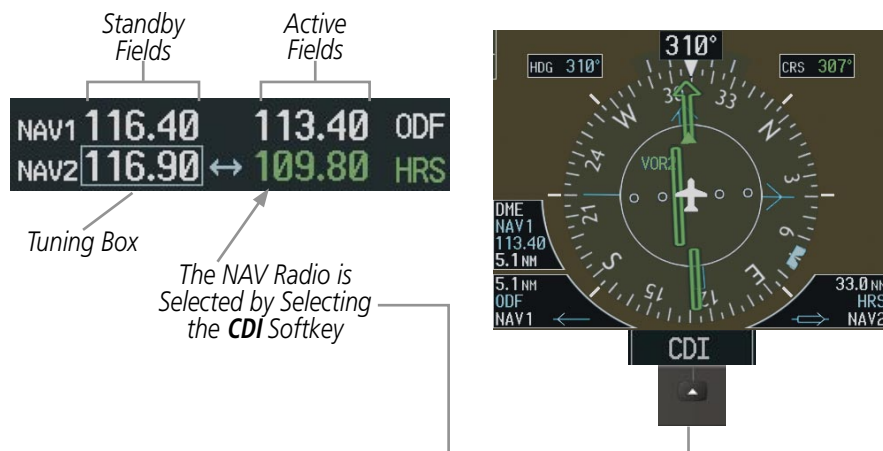

Figure 4-17 Selecting a NAV Radio for Navigation

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

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

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 PFDs.

Manually tuning a NAV frequency:

1) Turn the **NAV** Knob to tune the desired frequency in the NAV Tuning Box.

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

3) Adjust the volume level with the 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*
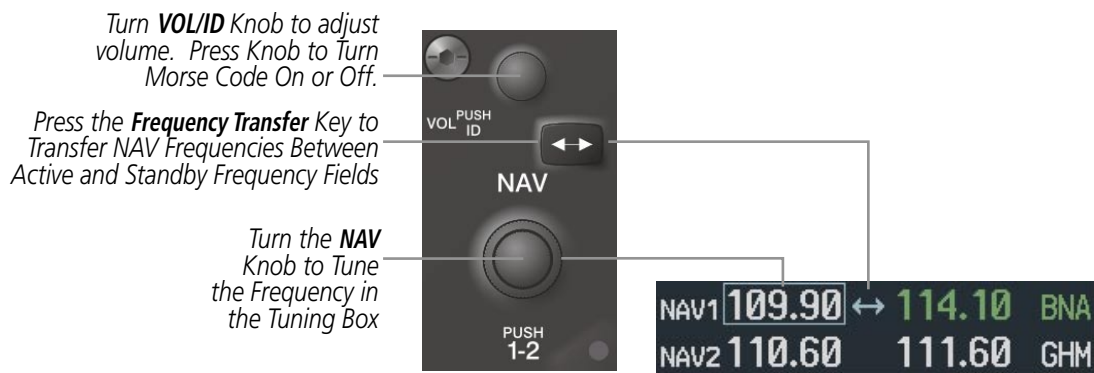

Figure 4-19 NAV Frequency Tuning

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.
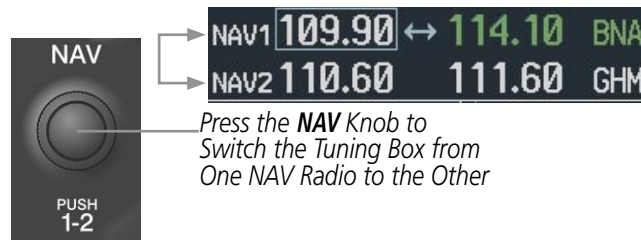

*Press the **NAV** Knob to Switch the Tuning Box from One NAV Radio to the Other*

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 with the small **NAV** Knob and press 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 Level

AUTO-TUNING THE NAV FREQUENCY

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 Boxes by highlighting the frequency and pressing the **ENT** Key (Figures 4-23, 4-24, and 4-25).

Auto-tuning a NAV frequency:

1) From any page that the NAV frequency can be auto-tuned, activate the cursor by pressing the **FMS** Knob on the MFD control unit or selecting the appropriate softkey.

2) Turn the **FMS** Knob to place the cursor on the desired NAV identifier.

3) Select the **FREQ** Softkey to place the cursor on the NAV frequency (Figure 4-25) when on the NRST pages.

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.

*Turn the **FMS** Knob to Scroll Through a List of Frequencies.*

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

Figure 4-23 NAV Frequency Auto-Tuning from the MFD

OR:

6) When on the NRST pages, press the **MENU** Key on the MFD control unit to display the page menu.

7) Turn the large **FMS** Knob to scroll through the menu options.

8) Press the **ENT** Key to place the cursor in the desired window.

9) Scroll through the frequency selections with the **FMS** Knob or the **ENT** Key.

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

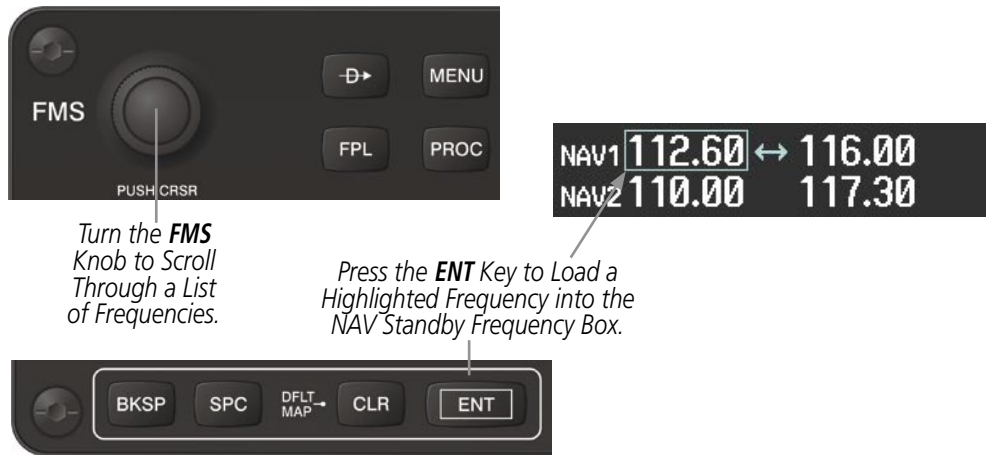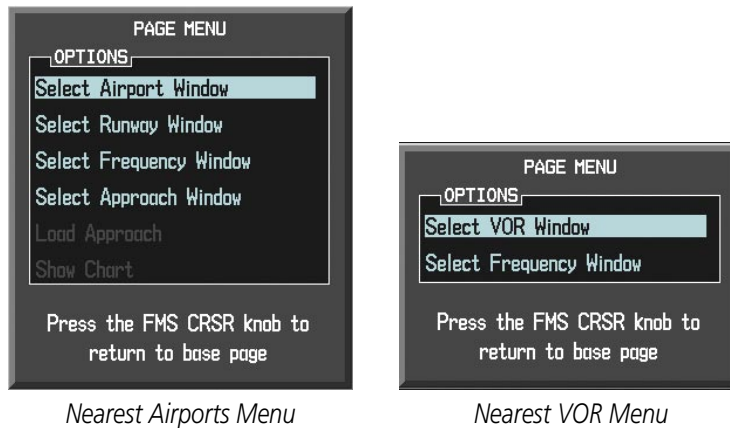11) Press the **Frequency Transfer** Key to transfer the frequency to the NAV Active Frequency Field.

Nearest Airports Menu   *Nearest VOR 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.
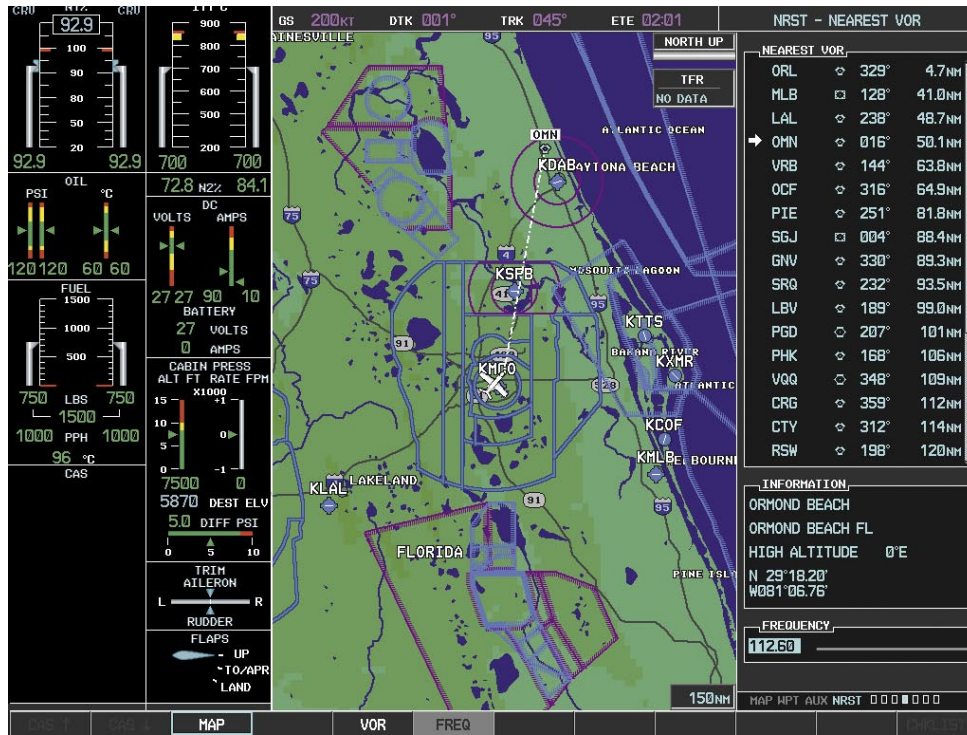
*Press the **ENT** Key to Load the Frequency into the NAV Standby Field.*

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

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

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

GARMIN.

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.
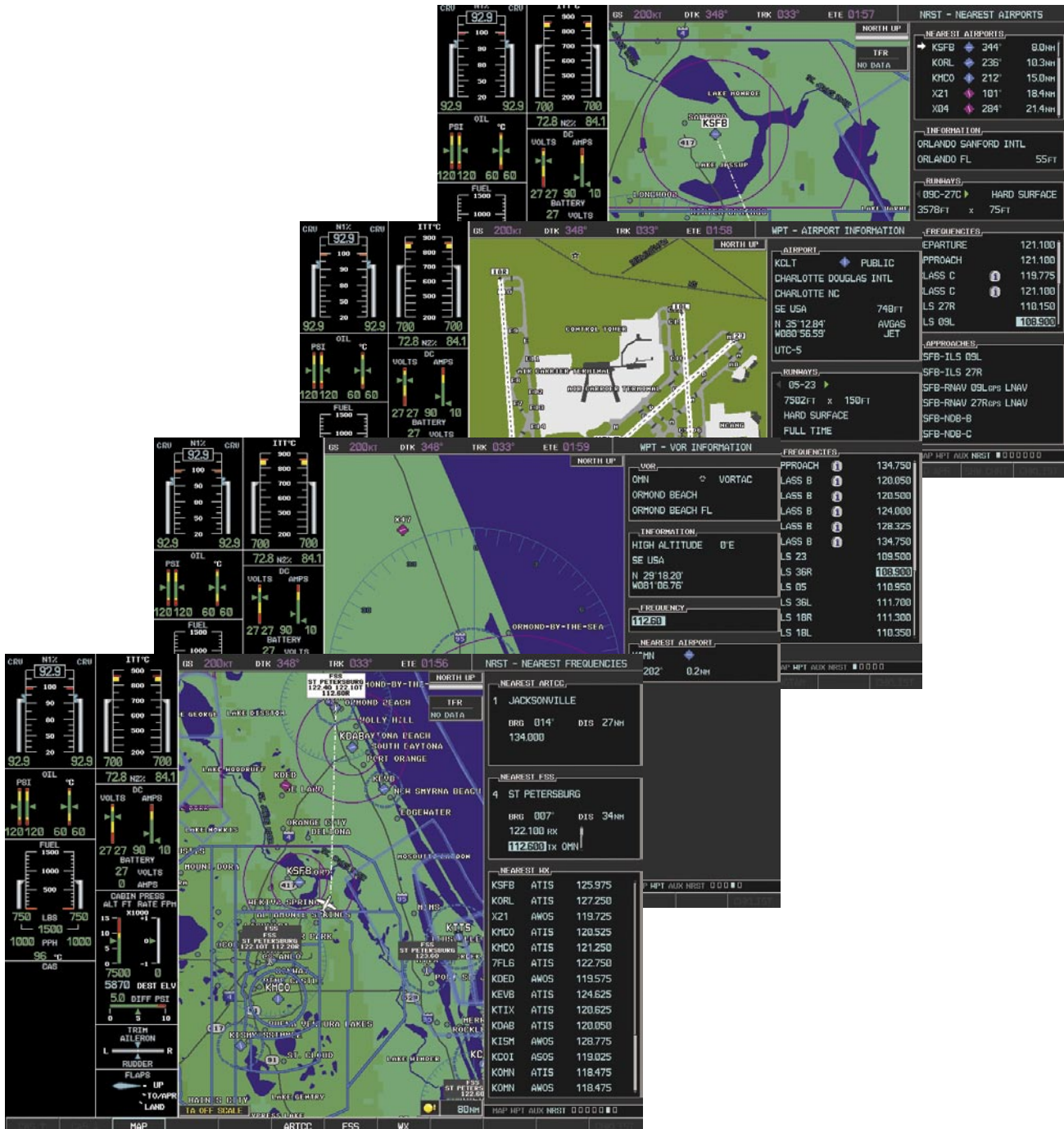

Figure 4-26 NRST – Nearest Frequencies, WPT – VOR Information, WPT – Airport Information, and NRST – Nearest Airports Pages

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 in GPS Mode, the system switches to NAV Mode as the final approach course is intercepted (within 15 nm of the FAF). See the GPS Navigation Section for details.*

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

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

- If the current CDI navigation source is GPS, the approach frequency is transferred to the NAV1 or NAV2 active frequency fields. The frequency that was previously in the NAV1 or NAV2 active frequency fields are transferred to standby.

- If the current CDI navigation source is GPS, and if the approach frequency is already loaded into the NAV1 or NAV2 standby frequency field, the standby frequency is transferred to active.

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

MARKER BEACON RECEIVER

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

The marker beacon receiver is used as part of 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.
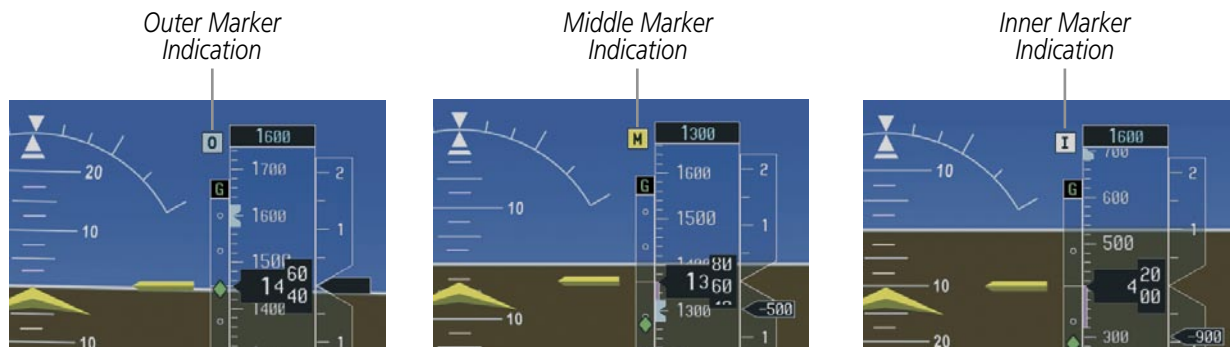
Outer Marker Indication   Middle Marker Indication   Inner Marker Indication

Figure 4-27 Marker Beacon Annunciations on the PFD

Figure 4-28 Marker Beacon Keys

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

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

ADF/DME TUNING

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

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

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

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

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

• Active and standby ADF frequencies

• ADF receiver mode

• ADF receiver volume

• DME tuning mode (DME transceiver pairing)

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

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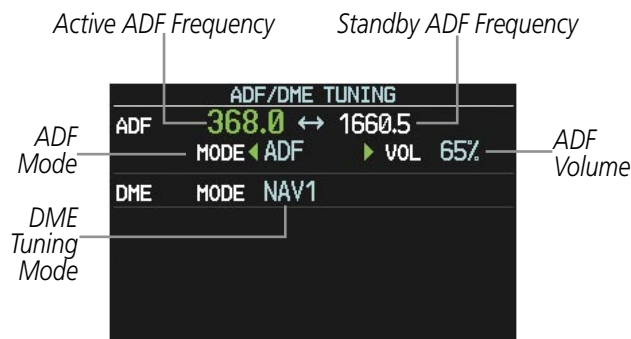

Figure 4-29 ADF/DME Tuning Window

ADF TUNING

ADF frequencies in the 190.0-kHz to 1799.5-kHz range are entered in the standby ADF frequency field of the ADF/DME Tuning Window. The G1000 System does not tune the ADF emergency frequency, 2182.0-kHz.

Tuning an ADF frequency:

1) Select the **ADF/DME** Softkey to display the ADF/DME Tuning Window.

2) Turn the large **FMS** Knob to place the selection cursor over the standby ADF frequency field.

3) Turn the small **FMS** Knob to begin data entry and change each digit.

4) Turn the large **FMS** Knob to move the cursor to the next digit position.

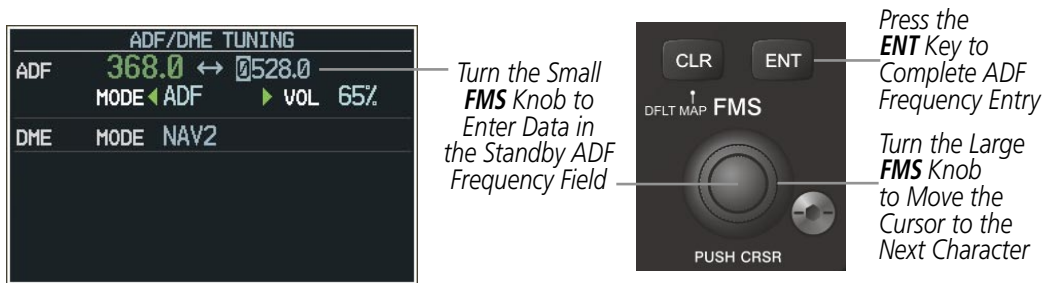5) Press the **ENT** Key to complete data entry for the standby frequency.

Turn the Small FMS Knob to Enter Data in the Standby ADF Frequency Field

Press the ENT Key to Complete ADF Frequency Entry

Turn the Large FMS Knob to Move the Cursor to the Next Character

Figure 4-30 Entering ADF Standby Frequencies

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

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

Transferring the active and standby ADF frequencies:

1) Turn the large **FMS** Knob to place the selection cursor over the standby ADF frequency field.

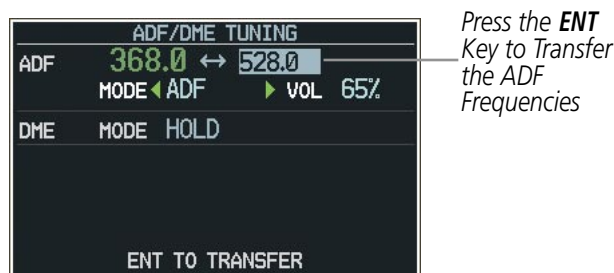2) Press the **ENT** Key to complete the frequency transfer.

Press the ENT Key to Transfer the ADF Frequencies

Figure 4-31 Transferring ADF Frequencies

SELECTING ADF RECEIVER MODE

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

- ANT (Antenna) – The ADF bearing pointer parks on the HSI at 90 degrees. Best mode for listening to NDB audio.

- ADF (Automatic Direction Finder) – The ADF pointer points to the relative bearing of the NDB station.

- ADF/BFO (ADF/Beat Frequency Oscillator) – The ADF pointer points to the relative bearing of the NDB station and an audible tone confirms signal reception. This mode allows identification of the interrupted carrier beacon stations used in various parts of the world.

- ANT/BFO (Antenna/Beat Frequency Oscillator) – The ADF bearing pointer parks on the HSI at 90 degrees while an audible tone is provided when a signal is received. This mode also allows identification of the interrupted carrier beacon stations and confirms signal reception.

Selecting an ADF receiver mode:

1) Turn the large **FMS** Knob to place the selection cursor over the ADF mode field.

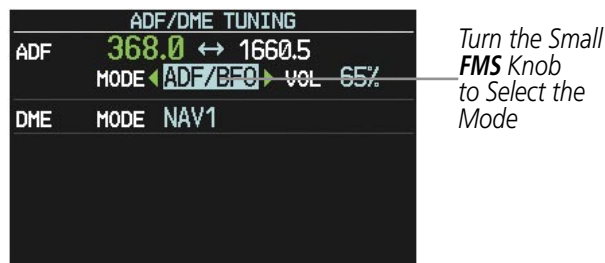2) Turn the small **FMS** Knob to select the desired ADF receiver mode.

Figure 4-32 Selecting ADF Receiver Mode

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

Adjusting ADF receiver volume:

1) Turn the large **FMS** Knob to place the selection cursor over the ADF volume field.

2) Turn the small **FMS** Knob to adjust volume as desired.

Figure 4-33 Adjusting ADF Receiver Volume

DME TUNING

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

Figure 4-34 ADF/DME Tuning Window, DME Modes

The following DME transceiver pairing can be selected:

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

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

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

Selecting DME transceiver pairing:

1) Select the **ADF/DME** Softkey to display the ADF/DME Tuning Window.

2) Turn the small **FMS** Knob to select the DME tuning mode.

3) Press the **ENT** Key to complete the selection.

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

4.4 GTX 33/33D MODE S TRANSPONDERS

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

- Level-2 reply data link capability (used to exchange information between aircraft and ATC facilities)

- Surveillance identifier capability

- Flight ID (Flight Identification) reporting – The Mode S Transponder reports aircraft identification as either the aircraft registration or a unique Flight ID.

- Altitude reporting

- Airborne status determination

- Transponder capability reporting

- Mode S Enhanced Surveillance (EHS) requirements

- 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.

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 selected, the Mode Selection softkeys appear: **STBY**, **ON**, **ALT**, **VFR**, **CODE**, **IDENT**, **BACK**.

When the **CODE** Softkey is selected, 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. Selecting the numbered softkeys in sequence enters the transponder code. If an error is made, selecting the **BKSP** Softkey moves the code selection cursor to the previous digit. Selecting the **BKSP** Softkey again moves the cursor to the next previous digit.

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

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

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

After 45 seconds of transponder control inactivity, the system reverts back to the top-level softkeys.
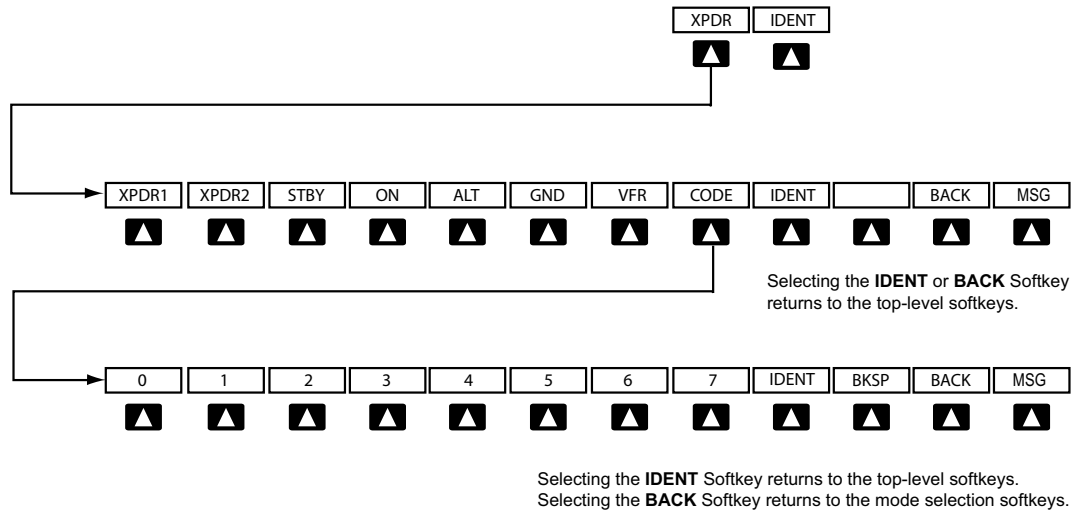
Figure 4-35 Transponder Softkeys (PFD)

Selecting and activating Transponder 1 or Transponder 2:

1) Select the **XPDR** Softkey to display the Transponder Mode Selection Softkeys.

2) Select the **XPDR1** or **XPDR2** Softkey to select and activate the other transponder.

When turning on the G1000 for use, the system activates Transponder 1 as the default unit, regardless of which transponder was active prior to shutdown. When switching between Transponder 1 and Transponder 2, the code and mode remain the same. If a new code is entered in the active transponder, switching transponders does not bring back the previous code.

TRANSPONDER MODE SELECTION

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

Selecting a transponder mode:

1) Select the **XPDR** Softkey to display the Transponder Mode Selection Softkeys.

2) Select 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 selecting 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 selecting the **GND** Softkey.
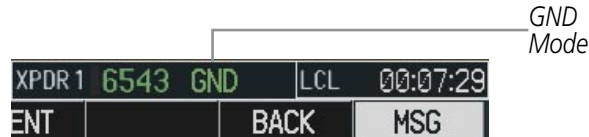
GND
Mode

XPDR 1 6543 GND | LCL 00:07:29
ENT | BACK | MSG

Figure 4-36 Ground Mode

STANDBY MODE (MANUAL)

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

Standby Mode can be selected at any time by selecting 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 1 6543 STBY | LCL 00:10:39
ENT | BACK | MSG

Figure 4-37 Standby Mode

MANUAL ON MODE

ON Mode can be selected at any time by selecting 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 1 1200 ON R | LCL 00:12:25
ENT | BACK | MSG

Figure 4-38 ON Mode

ALTITUDE MODE (AUTOMATIC OR MANUAL)

Altitude Mode is automatically selected when the aircraft becomes airborne. Altitude Mode may also be selected manually by selecting 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 4-39 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 4-40 Reply Indication

ENTERING A TRANSPONDER CODE

Entering a transponder code with softkeys:

1) Select the **XPDR** Softkey to display the Transponder Mode Selection Softkeys.

2) Select the **CODE** Softkey to display the Transponder Code Selection Softkeys, for digit entry.

3) Select the digit softkeys to enter the code in the code field. When entering the code, the next softkey in sequence must be selected within 10 seconds, or the entry is cancelled and restored to the previous code. Selecting 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.
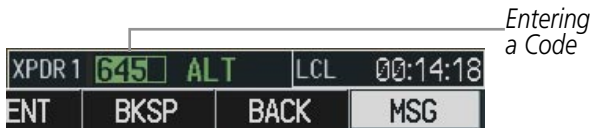
Entering a Code

Figure 4-41 Entering a Code with Softkeys

Entering a transponder code with the PFD FMS Knob:

1) Select the **XPDR** and the **CODE** Softkeys as in the previous procedure to enable code entry.

2) Turn the small **FMS** Knob to enter the first two code digits.

3) Turn the large **FMS** Knob to move the cursor to the next code field.

4) Enter the last two code digits with the small **FMS** Knob.

5) Press the **ENT** Key to complete code digit entry.

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

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 4-42 Entering a Code with the FMS Knob

VFR CODE

The VFR code can be entered either manually or by selecting the **XPDR** Softkey, then the **VFR** Softkey. When the **VFR** Softkey is selected, the pre-programmed VFR code is automatically displayed in the code field of the Transponder Data Box. Selecting 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 4-43 VFR Code

IDENT FUNCTION

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

Selecting the **IDENT** Softkey sends an ID indication to Air Traffic Control (ATC). The ID return distinguishes one transponder from all the others on the air traffic controller's radar screen. The **IDENT** Softkey appears on all levels of transponder softkeys. When the **IDENT** Softkey is selected, 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 selected while in Mode or Code Selection, the system reverts to the top-level softkeys.

Figure 4-44 IDENT Softkey and Indication

FLIGHT ID REPORTING

The flight crew must enter the Flight ID before flight operation. The number is entered 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. If configuration is set to "SAME AS TAIL" the aircraft tail number will always be displayed.

Entering a Flight ID:

1) Select 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. The word "updating" appears until the new entry is completed.

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.
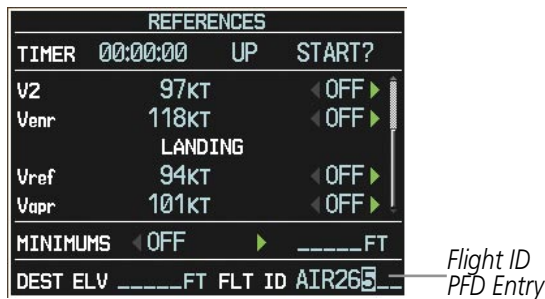

Figure 4-45 Timer/References Window, Entering Flight ID

4.5 ADDITIONAL AUDIO PANEL FUNCTIONS

POWER-UP

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

MONO/STEREO HEADSETS

Stereo headsets are recommended for use in this aircraft.

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

SPEAKER

✓ **NOTE:** *When the oxygen mask switch on the instrument panel is selected, each pilot's microphone audio is heard on the cross-side speaker. The on-side speaker is also enabled and cannot be deselected.*

Each Audio Panel is connected to a separate flight deck speaker for listening to all of the radios. Each **SPKR** Key controls the on-side speaker unless oxygen masks are in use. During oxygen mask use the on-side speaker is always enabled.

Pressing the **SPKR** Key selects and deselects the speaker. Except for oxygen mask use, speaker audio is muted when the PTT Key is pressed.
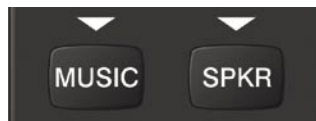

Figure 4-46 Speaker Key

UNMUTED INPUTS

Stall, overspeed, and aural gear alerts are heard on the headset and speaker always, even when the speaker is off.

All other alerts are always present on the headset and are on the speaker when the SPKR is selected. These warnings and the aircraft radios are not heard on the passenger headphones.

INTERCOM

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

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

During manual squelch operation, pressing the **ICS** Knob toggles between volume and squelch adjustment, lighting the associated annunciator beneath the knob. When the MAN SQ annunciator is lit, the **ICS** Knob controls both volume and squelch. When the MAN SQ annunciator is extinguished, the **ICS** Knob controls only volume.
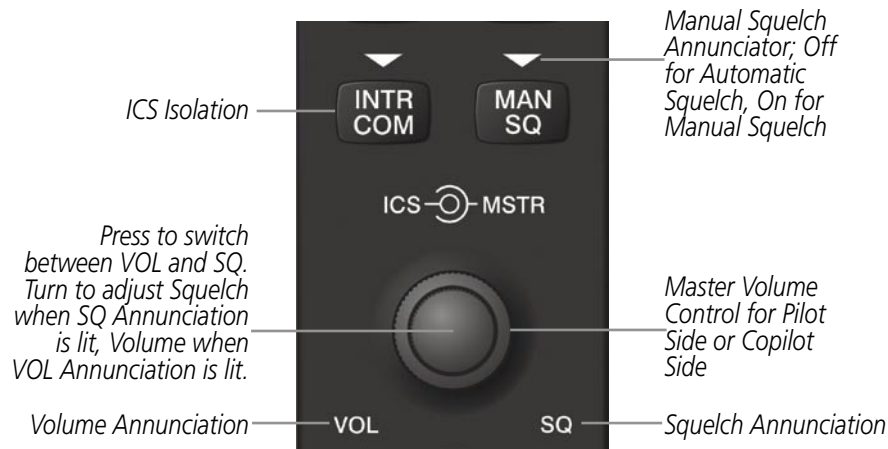

ICS Isolation

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

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

Master Volume Control for Pilot Side or Copilot Side

Volume Annunciation

Squelch Annunciation

Figure 4-47 Intercom Controls

PASSENGER ADDRESS (PA) SYSTEM

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

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

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

PA Key is Selected on the Audio Panel
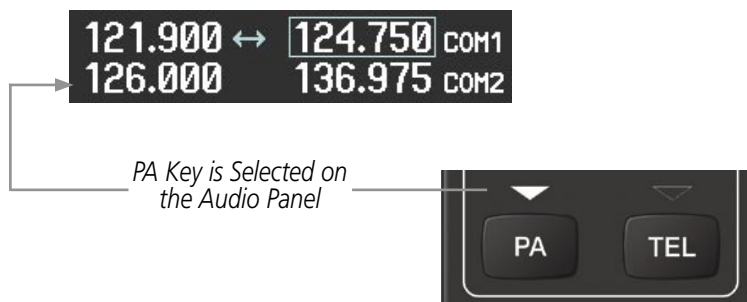
Figure 4-48 PA Key Selected for Cabin Announcements

SIMULTANEOUS COM OPERATION

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

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

CLEARANCE RECORDER AND PLAYER

The Audio Panels contain 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.

Pressing the **REC** Key enables recording of audio from the COM radio selected for transmission. Quiet periods between COM reception are not recorded.

The **PLAY** Key controls the play function. The PLAY annunciator indicates when play is in progress. The PLAY annunciator turns off after playback is finished.

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

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

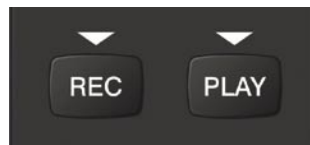Powering off the unit automatically clears all recorded blocks.

Figure 4-49 Record and Playback Key

4.6 AUDIO PANELS PREFLIGHT PROCEDURE

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

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

After powering up the G1000 system the following steps will aid the flight crew in maximizing the use of the Audio Panels as well as prevent flight crew induced issues. These preflight procedures should be performed each time a flight crew boards the aircraft to insure awareness of all audio levels in the Audio Panels and radios.

Figure 4-50 Audio Panel Controls

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

Setting the Audio Panels during preflight:

1) Verify that the **INTR COM** Key is selected.

2) Verify that the MAN SQ Annunciator is extinguished.

3) Turn the **MSTR** Knob (Master Volume Control) on both Audio Panels clockwise two full turns. This will set the headset audio level to max volume (least amount of attenuation).

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

5) Adjust the **ICS** volume Knob on each Audio Panel to the desired intercom level.

Once this procedure has been completed, the master volume controls on both Audio Panels may now be adjusted. The flight crew can change settings, keeping in mind the notes above.
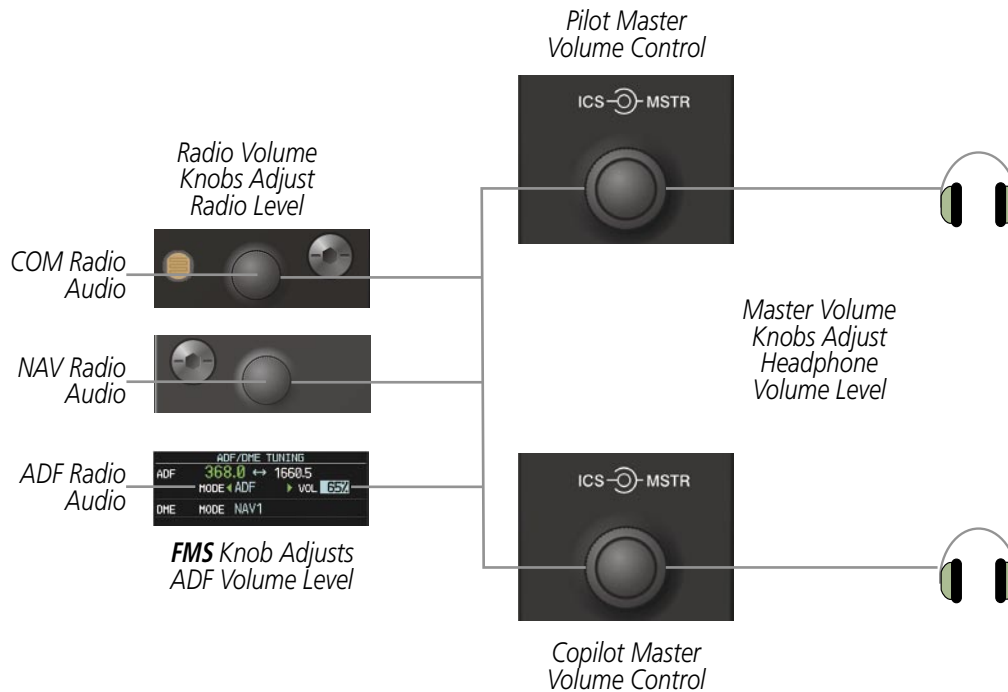
Figure 4-51 Radio and Headphone Volume Controls

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 crew of a stuck microphone.

The **COM1 MIC** or **COM2 MIC** Key Annunciator on the Audio Panel flashes as long as the PTT Key remains stuck.
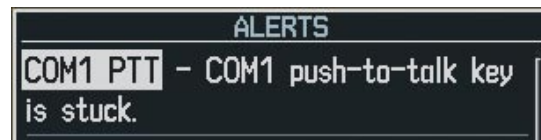
Figure 4-52 Stuck Microphone Alert

COM TUNING FAILURE

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

Figure 4-53 COM Tuning Failure

AUDIO PANEL FAIL-SAFE OPERATION

If there is a failure of both Audio Panels, a fail-safe circuit connects the pilot's headset and microphone directly to the COM1 transceiver and the copilot's headset directly to the COM2 transceiver. Audio will not be available on the speakers.

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

REVERSIONARY MODE

The red **DISPLAY BACKUP** Button selects the Reversionary Mode. Reversionary Mode operation displays flight and engine information on both the PFD and MFD, in case of display failure.

The pilot side controls the pilot side PFD (PFD1) and the MFD. The copilot side controls the copilot side PFD (PFD2) and the MFD.

See the System Overview Section for more information.

Figure 4-54 Reversionary Mode Button

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SECTION 5 GPS NAVIGATION

5.1 INTRODUCTION

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

The most prominent part of the G1000 are the three full color displays: two outside Primary Flight Displays (PFD) and an inside 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 GPS navigation functions are discussed later in this section.

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

Navigation mode indicates which sensor is providing the course data (e.g., GPS, VOR) and the flight plan phase (e.g., 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 can be 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, lake, 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.
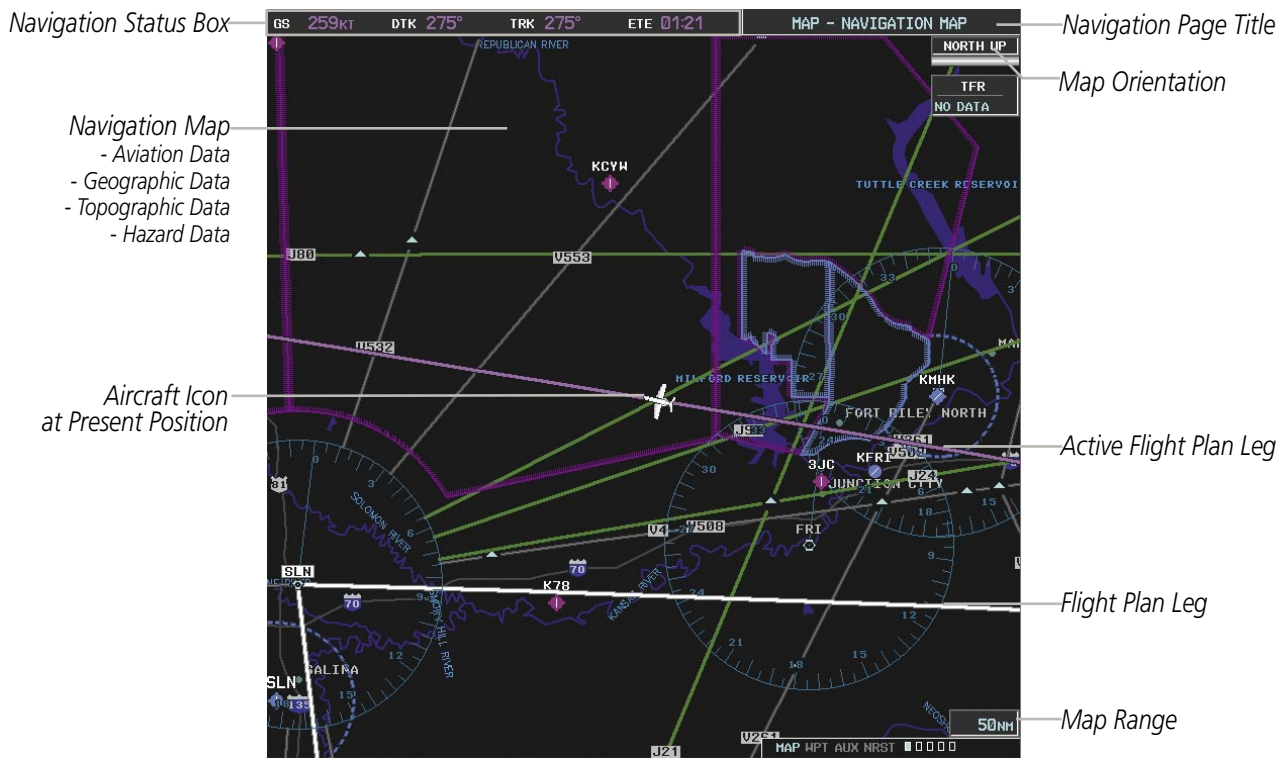
Navigation Status Box

Navigation Mode

Inset Map

Location of:
- Direct To Window
- Flight Plan Window
- Procedures Window
- Nearest Airports Window

Figure 5-1 GPS Navigation Information on the PFD

Navigation Status Box

Navigation Map
- Aviation Data
- Geographic Data
- Topographic Data
- Hazard Data

Navigation Page Title

Map Orientation

Aircraft Icon
at Present Position

Active Flight Plan Leg

Flight Plan Leg

Map Range

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 symbol]	Active Leg
![Direct-to symbol]	Direct-to
![Right Procedure Turn symbol]	Right Procedure Turn
![Left Procedure Turn symbol]	Left Procedure Turn
![Right Holding Pattern symbol]	Right Holding Pattern
![Left Holding Pattern symbol]	Left Holding Pattern
vtf	Vector to Final
![Right DME Arc symbol]	Right DME Arc
![Left DME Arc symbol]	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)
- Enroute Safe Altitude (ESA)
- Estimated Time of Arrival (ETA)
- Estimated Time Enroute (ETE)
- Ground Speed (GS)
- Minimum Safe Altitude (MSA)
- True Air Speed (TAS)
- Track Angle Error (TKE)
- Track (TRK)
- Vertical Speed Required (VSR)
- Crosstrack Error (XTK)

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 any field to its default setting.

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
- Flight plan legs
- User waypoints
- Track vector
- Topography scale
- Topography data

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

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

- Flight Plan Pages (FPL)
- Direct-to Window
- PFD 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.
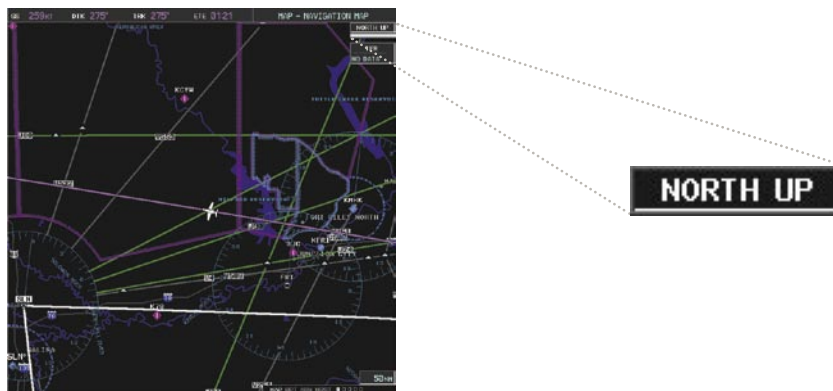
Figure 5-3 Map Orientation

- 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.

> ✓ **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
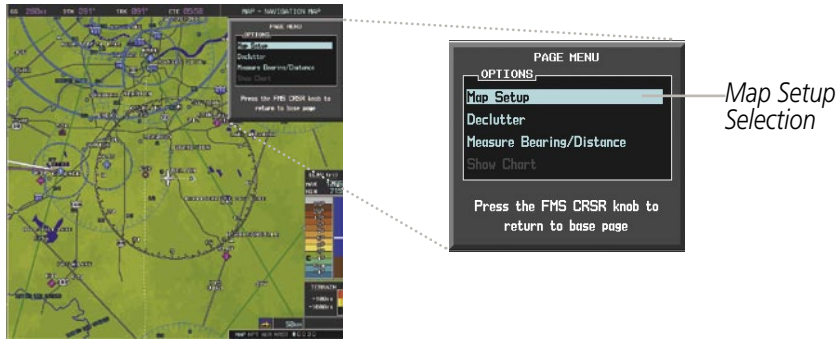
Figure 5-4 Navigation Map Page Menu Window

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
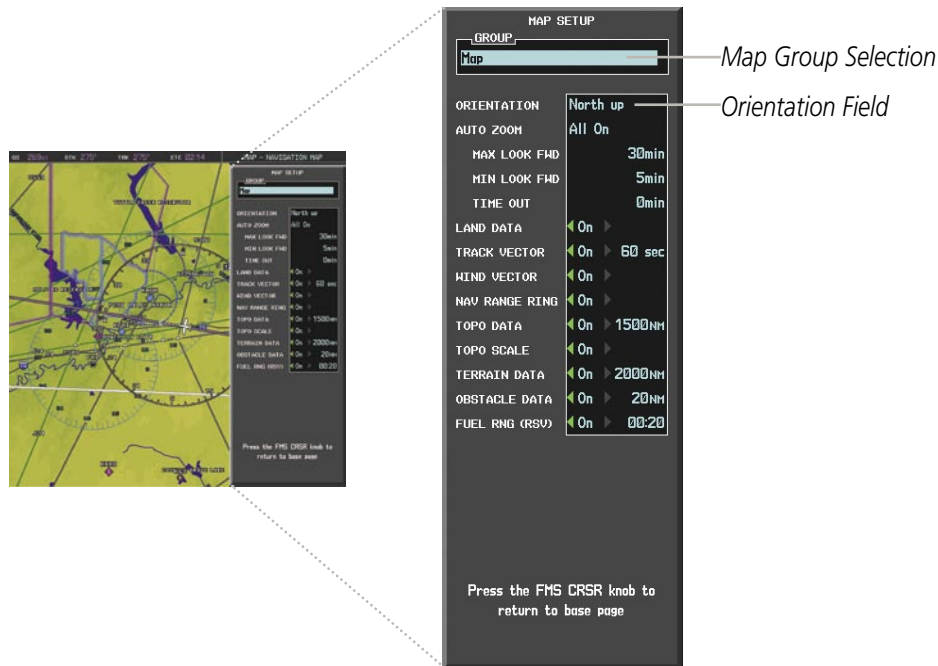
Orientation Field

Figure 5-6 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.

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 zoomed 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 zoom in (-, decreasing), or clockwise to zoom out (+, increasing).

Range Overzoom

Figure 5-7 Map Range

AUTO ZOOM

Auto zoom allows the G1000 to zoom (in or out) the map displays to the smallest range clearly showing the active waypoint. Auto zoom can be overridden by adjusting the range with the Joystick. The manual range selection 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 PFD and MFD. Control of the ranges at which the auto zoom occurs is done by setting the minimum and maximum 'look forward' times (set on the Map 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 zoom out 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 zoom in 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 zoom in and out 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 this 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).

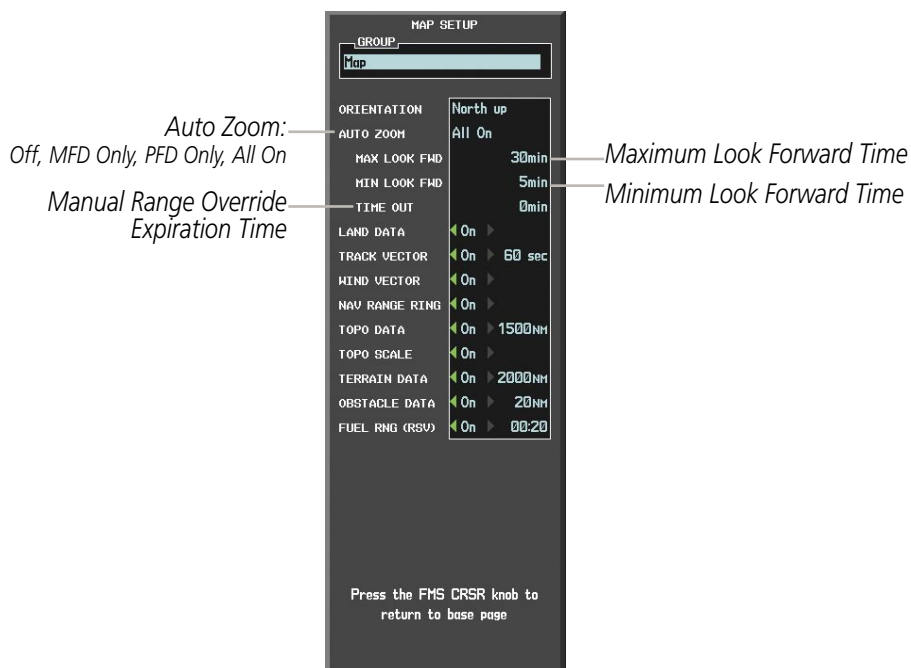- When the minimum 'look forward' time is set to zero, the lower limit becomes 1.5 nm.

Auto Zoom:
Off, MFD Only, PFD Only, All On

Manual Range Override
Expiration Time

Maximum Look Forward Time
Minimum Look Forward Time

Figure 5-8 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-99 minutes) and 'MAX LOOK FWD' (zero to 999 minutes).

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

MAP PANNING

Map panning allows the pilot to:

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

When the panning function is selected by 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 5-9 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). This feature applies to everything displayed on the map except route lines. 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 5-10 Navigation Map - Map Pointer on Point of Interest

When the Map Pointer crosses an airspace boundary, the boundary is highlighted and airspace information is shown 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 5-11 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 **CLR** or **ENT** Key to exit the Waypoint Information Page.
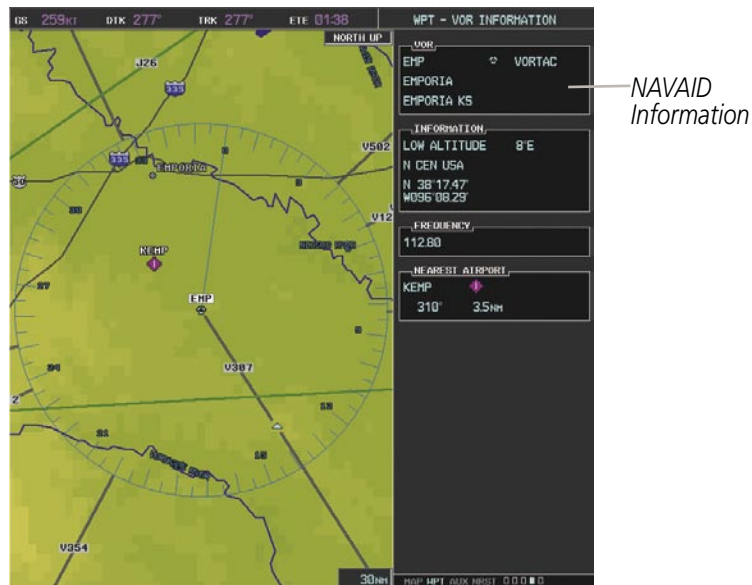
Figure 5-12 Navigation Map - Information Window - NAVAID

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 Airspace?' 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 5-13 Navigation Map - Information Window - Airspace

MEASURING BEARING AND DISTANCE

The pilot can measure the bearing and distance between any two points on the Navigation Map. As an example, the measuring of bearing and distance could be useful to help create a route to avoid a TFR.

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
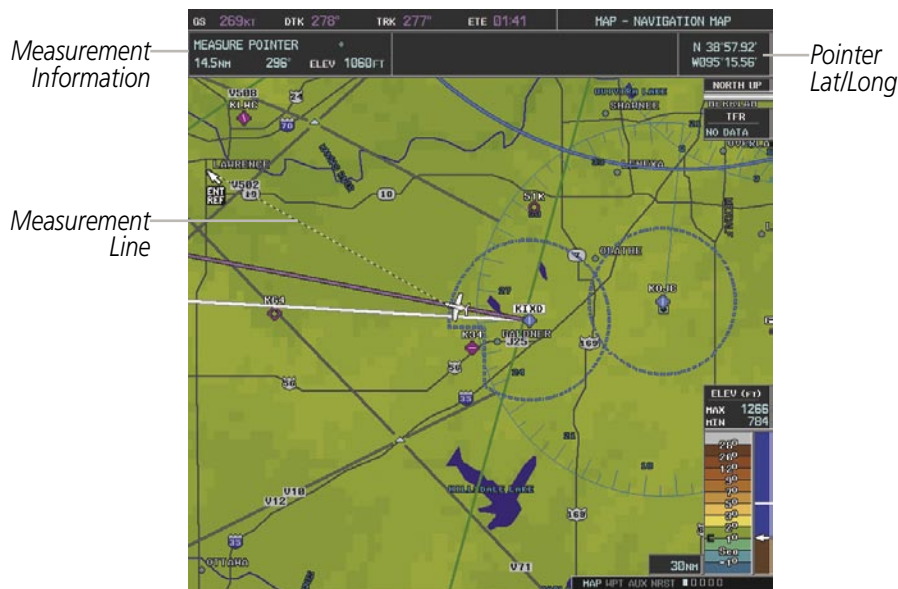
Figure 5-14 Navigation Map - Measuring Bearing and Distance

TOPOGRAPHY

All navigation maps can display various shades of topography colors representing land elevation, similar to aviation sectional charts. Topographic data can be displayed or removed as described in the following procedures.
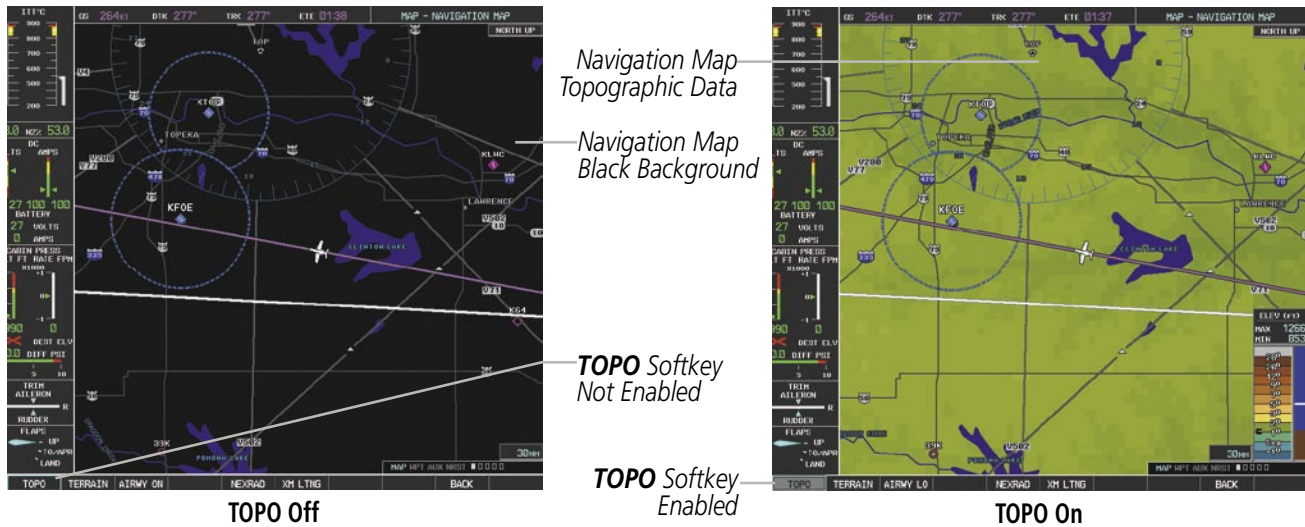
Figure 5-15 Navigation Map - Topographic Data

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.
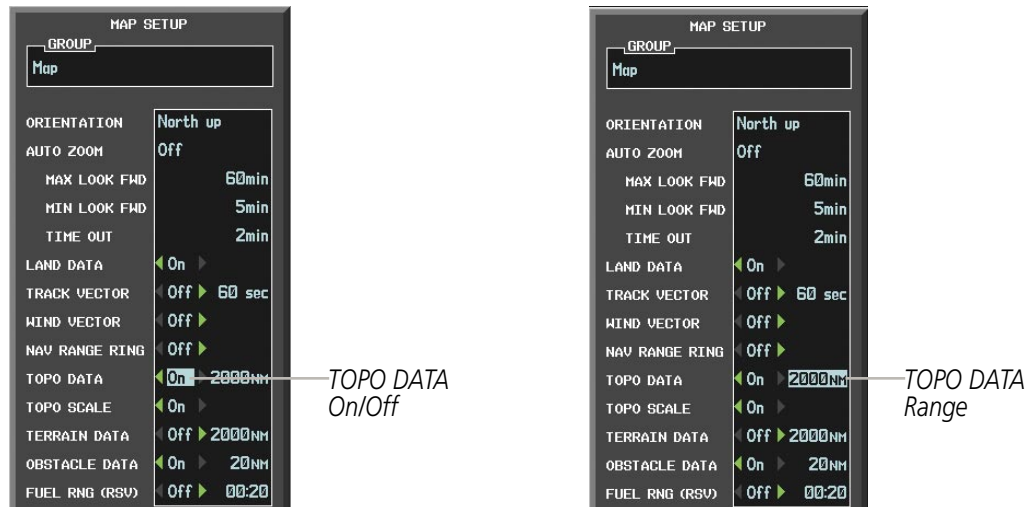
Figure 5-16 Navigation Map Setup Menu - TOPO DATA Setup

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 as shown following.

Maximum Displayed Elevation

Minimum Displayed Elevation

Aircraft Altitude (MSL)

Range of Displayed Elevations

Ground Elevation at Pointer Location (only visible when Pointer is displayed)
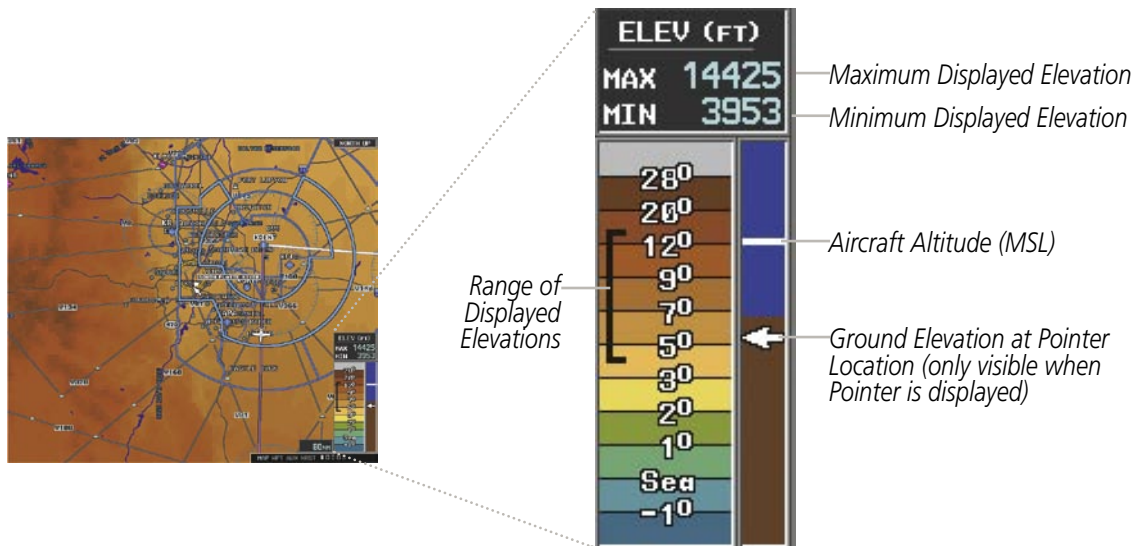
Figure 5-17 Navigation Map - TOPO SCALE

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.

TOPO SCALE On/Off
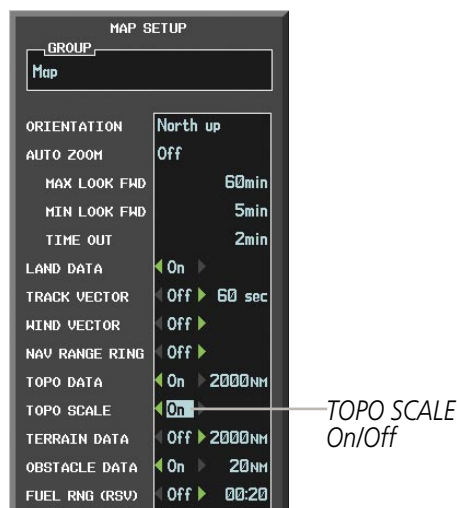
Figure 5-18 Navigation Map Setup Menu - TOPO SCALE Setup

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)	ST/PRV BORDER	800	1500
Rivers and Lakes (RIVER/LAKE)		200	500
USER WAYPOINT		150	300

Table 5-1 Land Symbol Information

AVIATION SYMBOLS

The following items are configured on the aviation menu:
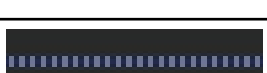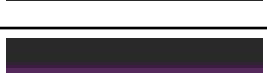
Aviation Symbols *(Text label size can be None, Small, Medium (Med), or Large (Lrg)*	Symbol	Default Range (nm)	Maximum Range (nm)
Active Flight Plan Leg (ACTIVE FPL)		2000	2000
Non-active Flight Plan Leg (ACTIVE FPL)		2000	2000
Active Flight Plan Waypoint (ACTIVE FPL WPT)	See Airports, NAVAIDs	2000	2000
Large Airports (LARGE APT)		250	500
Medium Airports (MEDIUM APT)		150	300
Small Airports (SMALL APT)		50	100
Taxiways (SAFETAXI)	See Section 8	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.
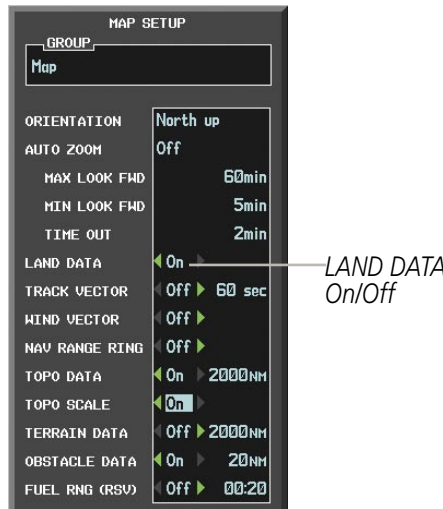
Figure 5-19 Navigation Map Setup Menu - TOPO SCALE Setup

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.

6) Select the desired range.

7) Press the **ENT** Key to accept the selected range.

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

*Text Label Size
(Off, Small Med, or Lrg)*

Maximum Display Range
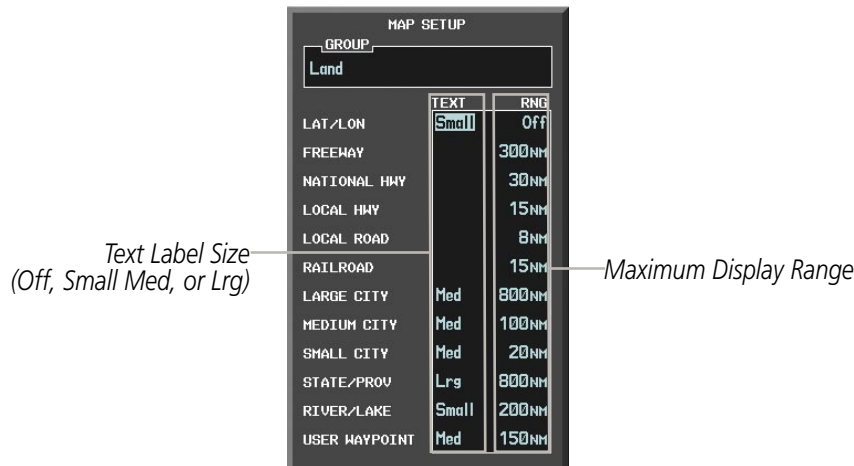
Figure 5-20 Navigation Map Setup Menu - LAND GROUP Setup

*Text Label Size
(Off, Small Med, or Lrg)*

Maximum Display Range
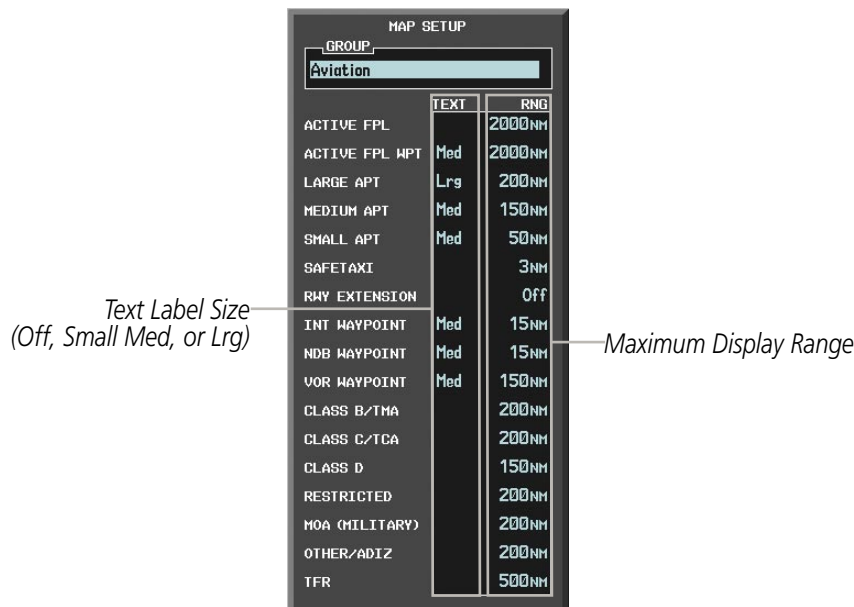
Figure 5-21 Navigation Map Setup Menu - AVIATION GROUP Setup

> **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.

Navigation Map Page Menu

Declutter Level
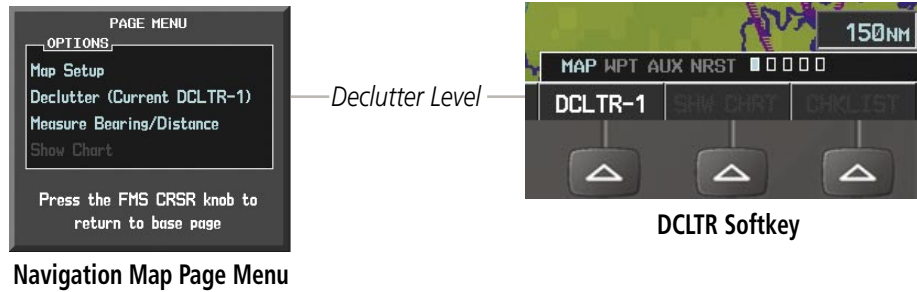
DCLTR Softkey

Figure 5-22 Navigation Map - Declutter Level Indications

Decluttering the map:

1) 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.

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
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		
Airways	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

AIRWAYS

Airways are designated Low Altitude Airways and High Altitude Airways. 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.
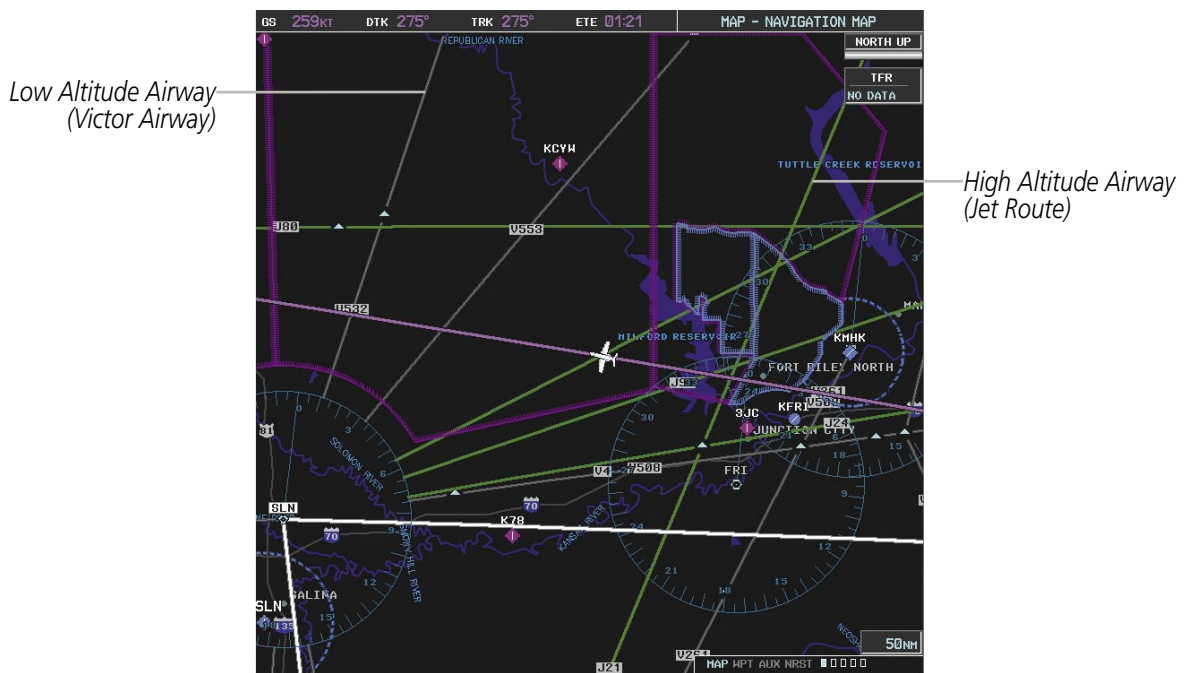

Figure 5-23 Airways on MFD Navigation Page

Displaying/removing airways:

1) Select the **MAP** Softkey.

2) Select the **AIRWAYS** Softkey. Both High and Low Altitude Airways are displayed.

3) Select the **AIRWY ON** Softkey to display the Low Altitude Airways only.

4) Select the **AIRWY LO** Softkey to display the High Altitude Airways only.

5) Select the **AIRWY HI** Softkey to remove the High Altitude Airways. No airways are displayed.

    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.
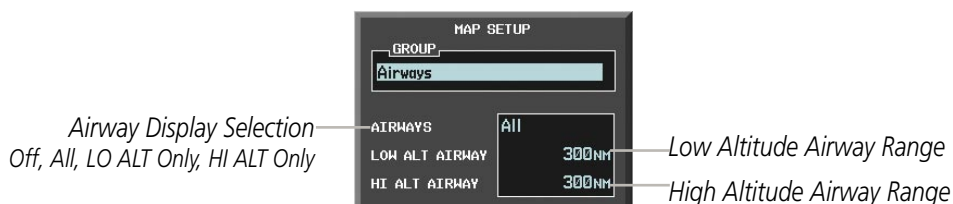
Figure 5-24 Navigation Map Setup Menu - AIRWAYS Setup

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) Select the 'Airway' group.

4) Press the **ENT** Key.

5) Highlight the 'LOW ALT AIRWAY' or 'HI ALT AIRWAY' range field.

6) To change the 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.

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 dashed light blue line segment with an arrowhead attached to the end, extended to a predicted location along the current aircraft track. 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 arrowhead is continuously pointing to the predicted aircraft location.

Track Vector

Figure 5-25 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.
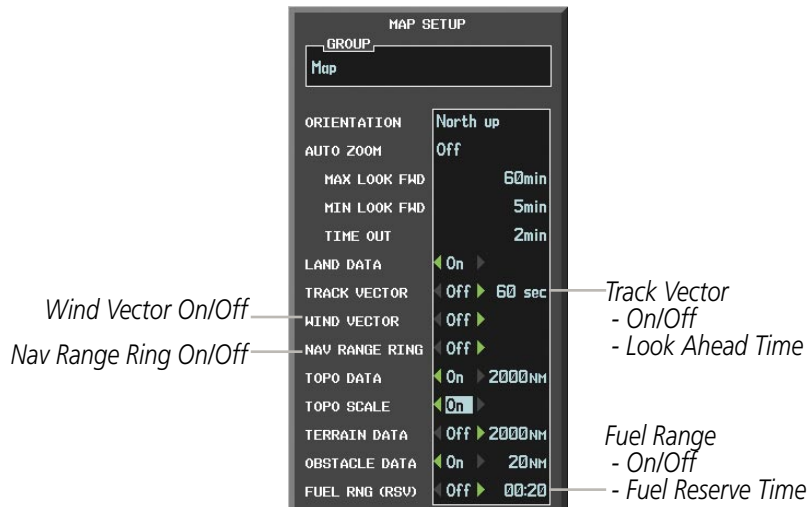
Figure 5-26 Navigation Map Setup Menu -TRACK VECTOR, WIND VECTOR, NAV RANGE RING, FUEL RANGE RING Setup

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 5-27 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)
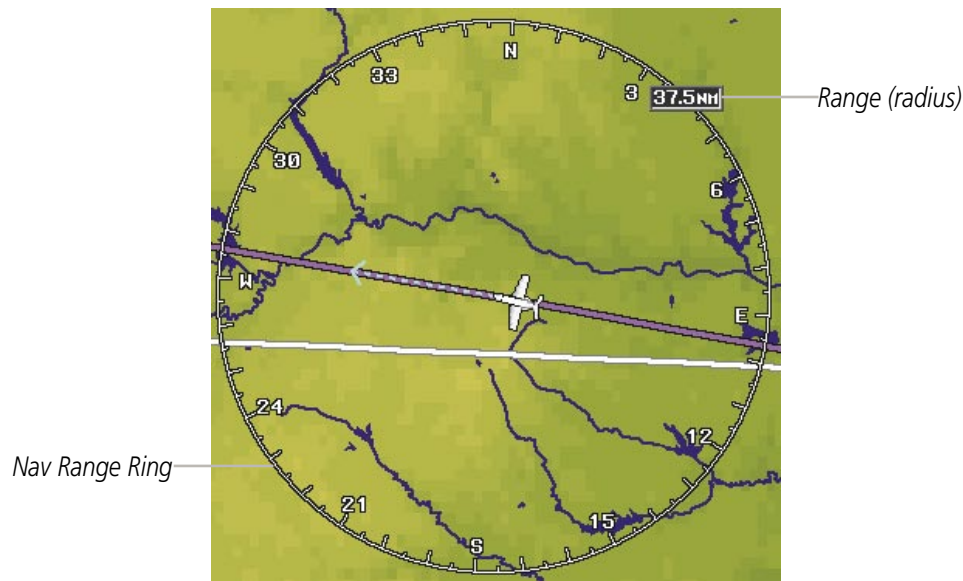
Nav Range Ring

Figure 5-28 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.*

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. For more details, see the EICAS section.
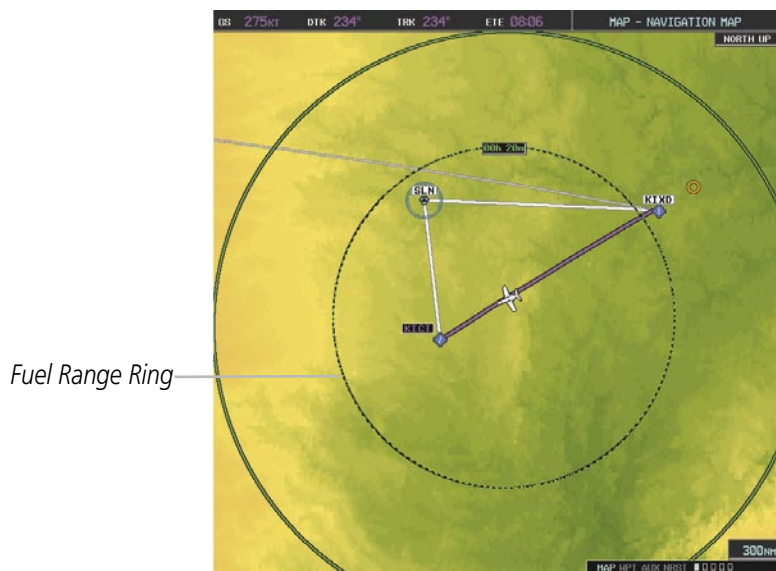
Fuel Range Ring

Figure 5-29 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.

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 entered from various Waypoint Information (WPT), Nearest (NRST) pages, and the Nearest Airports Window (on PFD). This auto-tuning feature simplifies frequency entry over manual tuning. Refer to the CNS and Audio Panel 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 5-30 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.

Identifier with Duplicates

Duplicate Waypoints

Duplicate Message

Figure 5-31 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.
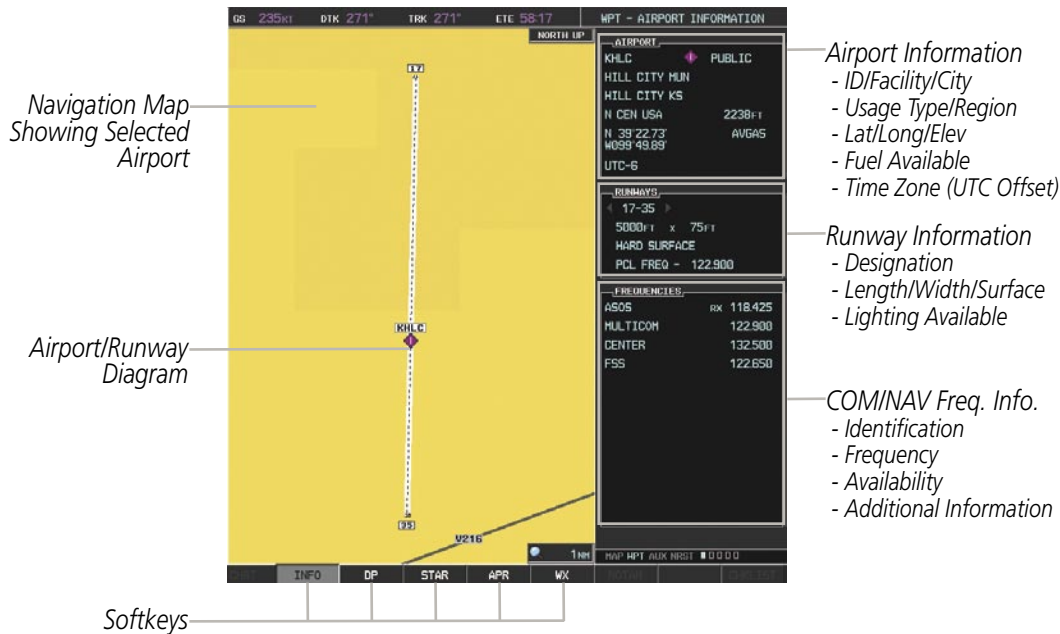
Figure 5-32 Airport Information Page

The following descriptions and abbreviations are used on the Airport Information Page:

• Usage type: Public, Military, or Private

• 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)

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.

View 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 need to land is required). The Nearest Airports Window displays a list of 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.
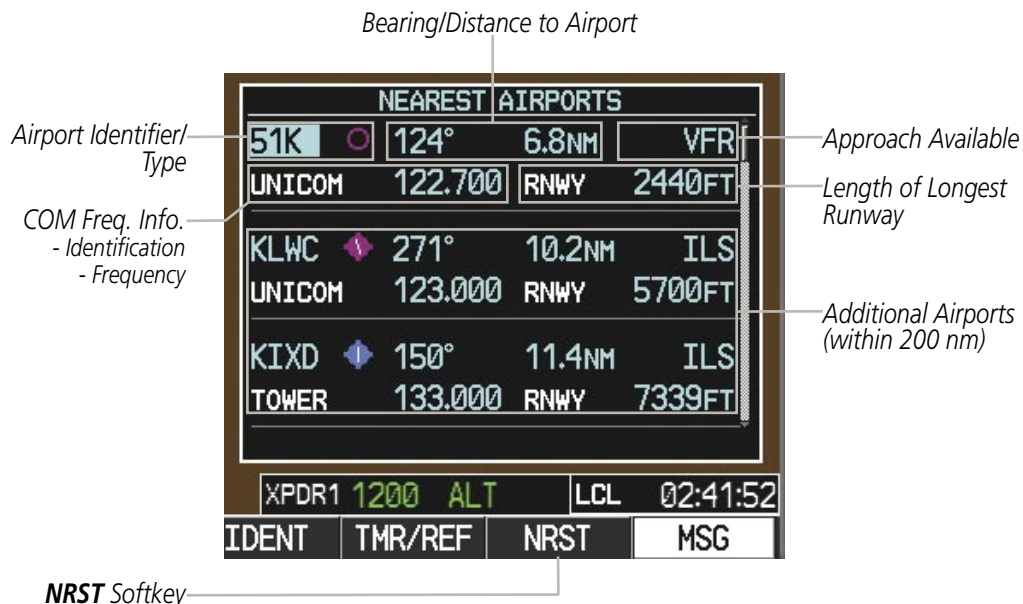
Figure 5-33 Nearest Airports Window on PFD

The PFD Airport Information Window displays the following information:

Airport Information
- ID/Type/City
- Facility

Airport Information
- Lat/Long

Airport Information
- Usage/Time/Elev
- Region

Figure 5-34 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 an arrow. Up to five nearest airports, one runway, up to three frequencies, and up to three approaches are visible at one time. If there are more than can be shown, each list can be scrolled. If there are no items for display in a boxed area, text indicating that fact is displayed. The currently selected airport remains in the list until it is unselected.

Navigation Map
Showing Nearest
Airport

Nearest Airports
- ID/Type
- Bearing/Distance

Airport Information
- Facility/City/Elevation

Runway Information
- Designation/Surface
- Length/Width

COM/NAV Freq. Info.
- Identification
- Frequency

Approaches Available

Nearest Airport

Softkeys

Figure 5-35 Nearest Airport Page

Viewing information for a nearest airport on the PFD:

1) Press the **NRST** Softkey to display the Nearest Airports Window.

2) Highlight the airport identifier with the **FMS** Knob and press the **ENT** Key to display the Airport Information Window.

3) To return to the Nearest Airports Window press the **ENT** Key (with the cursor on 'BACK') or press the **CLR** Key. The cursor is now on the next airport in the nearest airports list. (Repeatedly pressing the **ENT** Key moves through the airport list, alternating between the Nearest Airports Window and the Airport Information Window.)

4) Press the **CLR** Key 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 to place the cursor 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.

OR:

1) With the Nearest Airports Page displayed, press the **MENU** Key.

2) Select the option 'Select Airport Window' and press the **ENT** Key. The cursor is placed in the 'NEAREST AIRPORTS' Box.

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

4) Press the **FMS** Knob to remove the flashing cursor.

Viewing runway information for a specific airport:

1) With the Nearest Airports Page displayed, press the **RNWY** Softkey to place the cursor in the 'RUNWAYS' Box.

2) Select the desired runway.

3) Press the **FMS** Knob to remove the flashing cursor.

OR:

1) With the Nearest Airports Page displayed, press the **MENU** Key.

2) Select the option 'Select Runway Window' and press the **ENT** Key. The cursor is placed in the 'RUNWAYS' Box.

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

4) 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 "ANY" 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).

5) Press the **ENT** Key.

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.

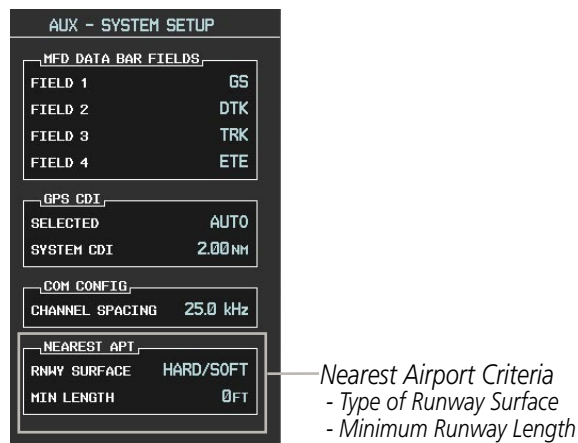4) Use the **FMS** Knob to enter the minimum runway length (zero to 25,000 feet) and press the **ENT** Key.

Figure 5-36 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'.
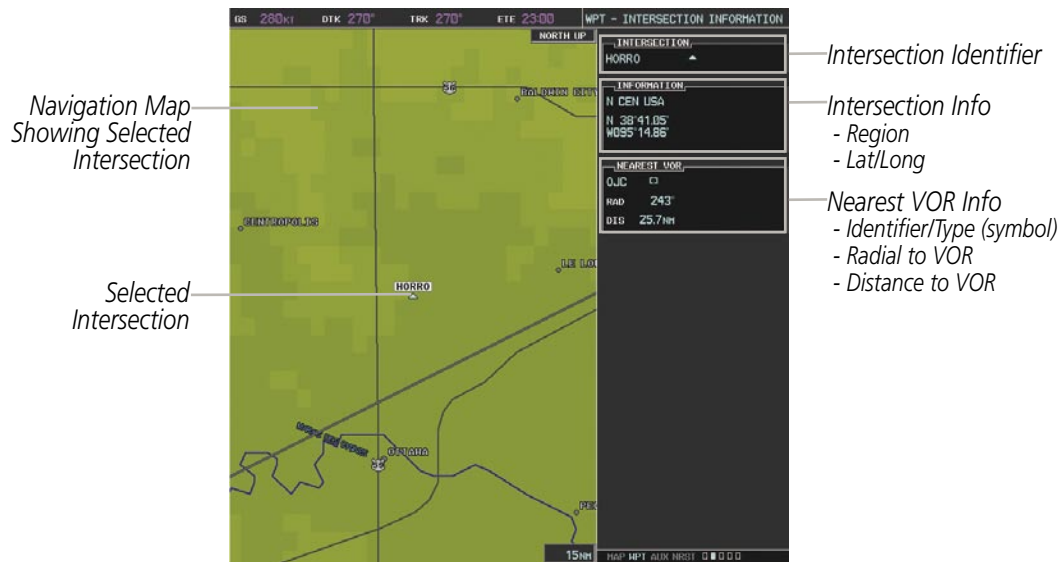

Navigation Map Showing Selected Intersection

Selected Intersection

Intersection Identifier

Intersection Info
  - Region
  - Lat/Long

Nearest VOR Info
  - Identifier/Type (symbol)
  - Radial to VOR
  - Distance to VOR

Figure 5-37 Intersection Information Page

Select 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 an 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.*

Navigation Map
Showing Nearest
Intersection

Nearest Intersection

Intersection Information
- Identifier/Symbol
- Bearing/Distance to
  intersection from
  aircraft position

Intersection Lat/Long

Nearest VOR Info
- Identifier/Type (symbol)
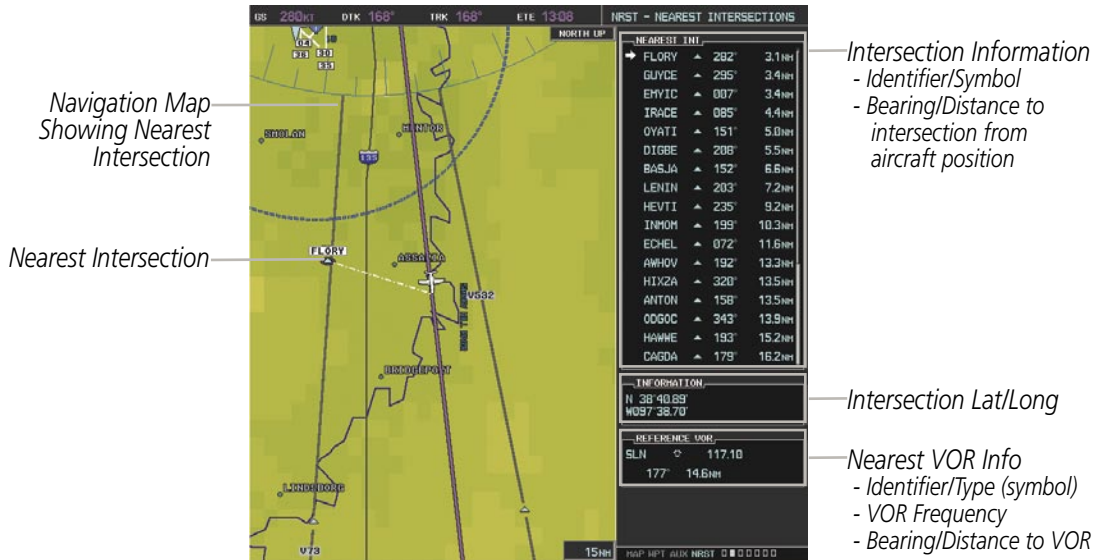- VOR Frequency
- Bearing/Distance to VOR

Figure 5-38 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 5-39 NDB Information Page

GARMIN.

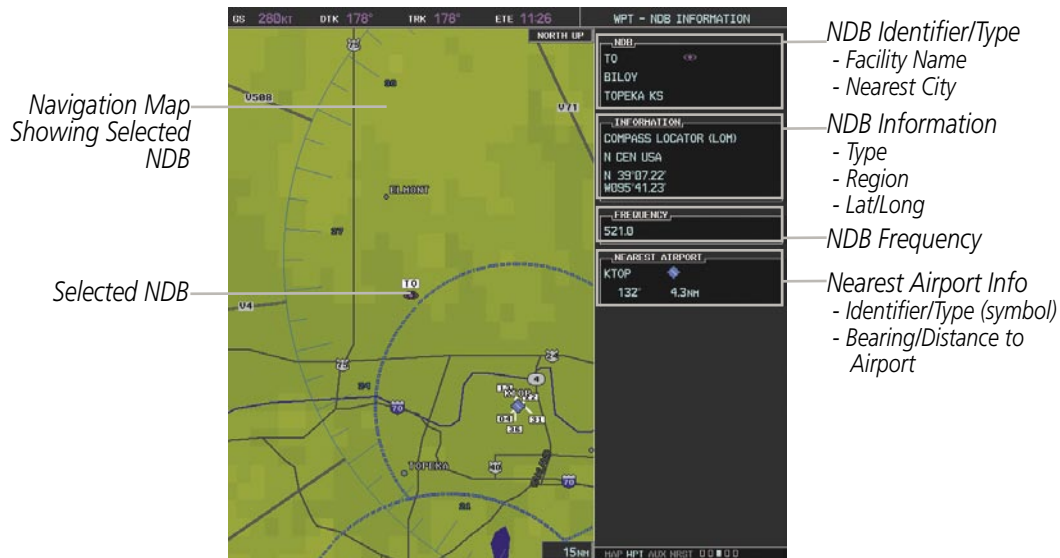
NOTE: *Compass locator (LOM): a low power, low or medium frequency radio beacon installed in conjunction with the instrument landing system. When LOM is used, the locator is at the Outer Marker; when LMM is used, the locator is at the Middle Marker.*

Select 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, 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.

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'.

An 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.
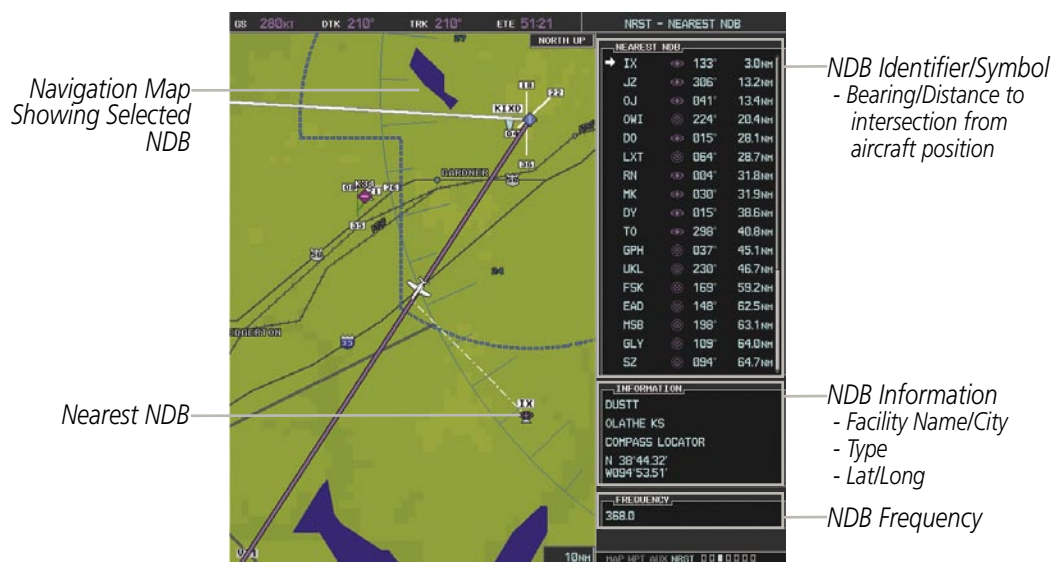

Navigation Map Showing Selected NDB

Nearest NDB

NDB Identifier/Symbol
- Bearing/Distance to intersection from aircraft position

NDB Information
- Facility Name/City
- Type
- Lat/Long

NDB Frequency

Figure 5-40 Nearest NDB Page

VORs

The VOR Information Page can be used to view information about VOR and ILS signals (since ILS signals stations can be received on a VOR 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'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'.

Figure 5-41 VOR Information Page

The VOR classes used in the VOR information box are: LOW ALTITUDE, HIGH ALTITUDE, and TERMINAL

Select a VOR:

1) With the VOR Information Page or the Nearest VOR 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 **MENU** Key.

2) Highlight 'SELECT VOR WINDOW', and press the **ENT** Key.

3) Enter an identifier, the name of the VOR, or the city in which it's located in the VOR Box.

4) Press the **ENT** Key.

5) 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 flight path. In addition, 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.

An 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.
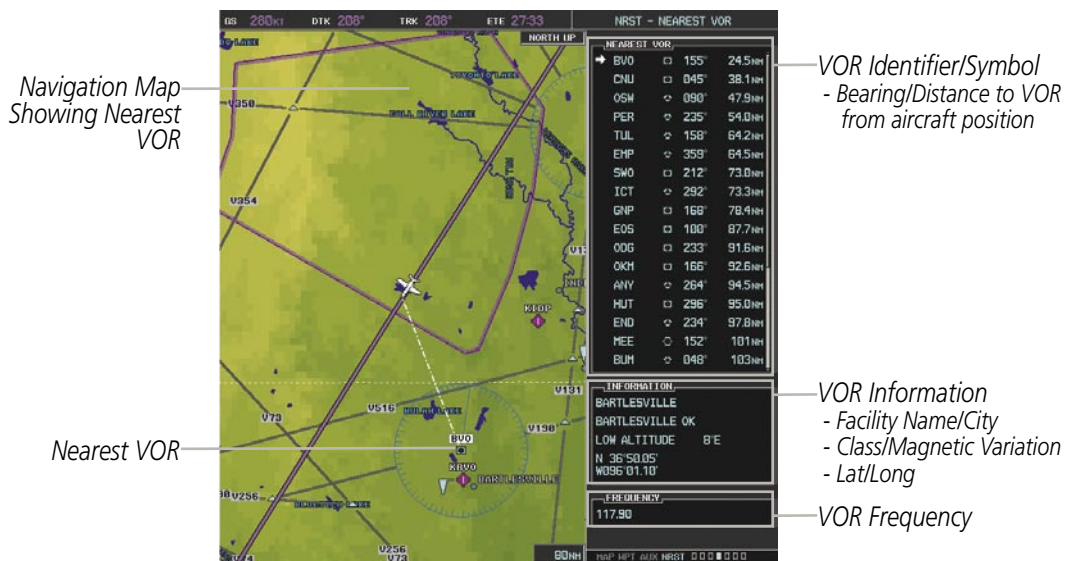

Navigation Map Showing Nearest VOR

Nearest VOR

VOR Identifier/Symbol
- Bearing/Distance to VOR from aircraft position

VOR Information
- Facility Name/City
- Class/Magnetic Variation
- Lat/Long

VOR Frequency

Figure 5-42 Nearest VOR Page

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, or from the User Waypoint Information Page by referencing a bearing/distance from an existing waypoint or bearing from two existing waypoints. Once a waypoint has been created, it can be renamed, deleted, or moved.
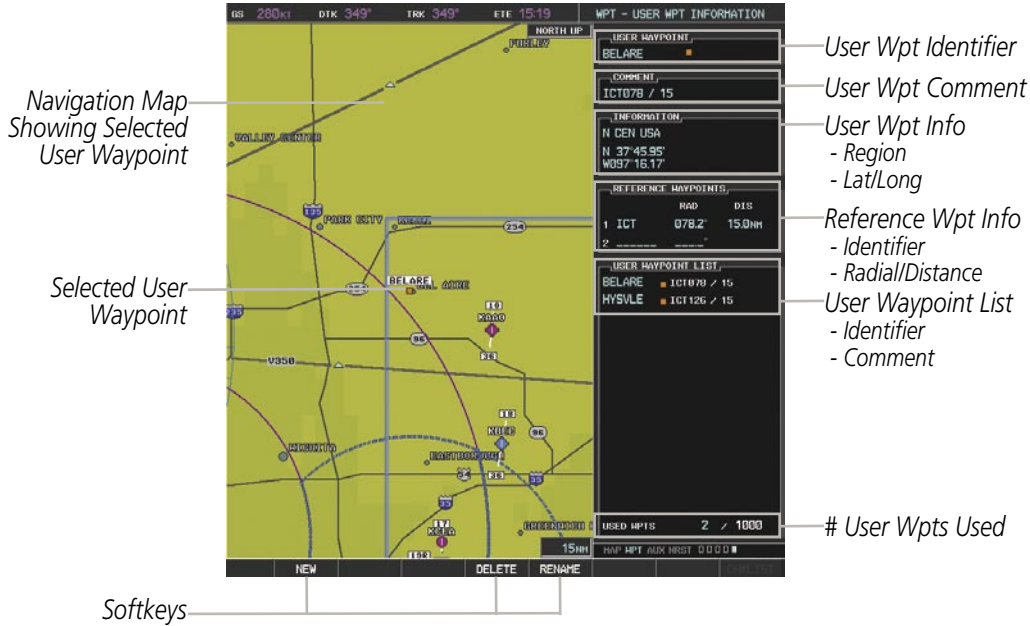

Navigation Map Showing Selected User Waypoint

Selected User Waypoint

Softkeys

User Wpt Identifier

User Wpt Comment

User Wpt Info
- Region
- Lat/Long

Reference Wpt Info
- Identifier
- Radial/Distance

User Waypoint List
- Identifier
- Comment

User Wpts Used

Figure 5-43 User Waypoint Information Page

Navigation Map Showing Selected User Waypoint

Selected User Waypoint

Nearest User Wpt List
- Identifier
- Bearing/Distance from aircraft position

User Waypoint Info
- Comment
- Lat/Long

Reference Wpt Info
- Identifier
- Radial/Distance

Figure 5-44 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) Press 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, highlight the Information Box and enter the latitude and longitude for the waypoint **or** highlight the Reference Waypoints Box to enter a bearing and distance from another waypoint or the bearing from two other waypoints to define the new waypoint location.

Figure 5-45 User Waypoint Information Page Menu

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) Highlight the Information Box and enter the latitude and longitude for the waypoint **or** highlight the Reference Waypoints Box to enter a bearing and distance from another waypoint or the bearing from two other waypoints to define the new waypoint location.

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

7) Press the **FMS** Knob to remove the flashing cursor.

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.*

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, highlight the Information Box and enter the latitude and longitude for the waypoint or highlight the Reference Waypoints Box to enter a bearing and distance from another waypoint or the bearing from two other waypoints to define the new waypoint location.

6) Press the **FMS** Knob to remove the flashing cursor.

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) Move the cursor to the desired field.

3) Turn the small **FMS** Knob to make any changes.

4) Press the **ENT** Key to accept the changes.

5) 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.

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.

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).
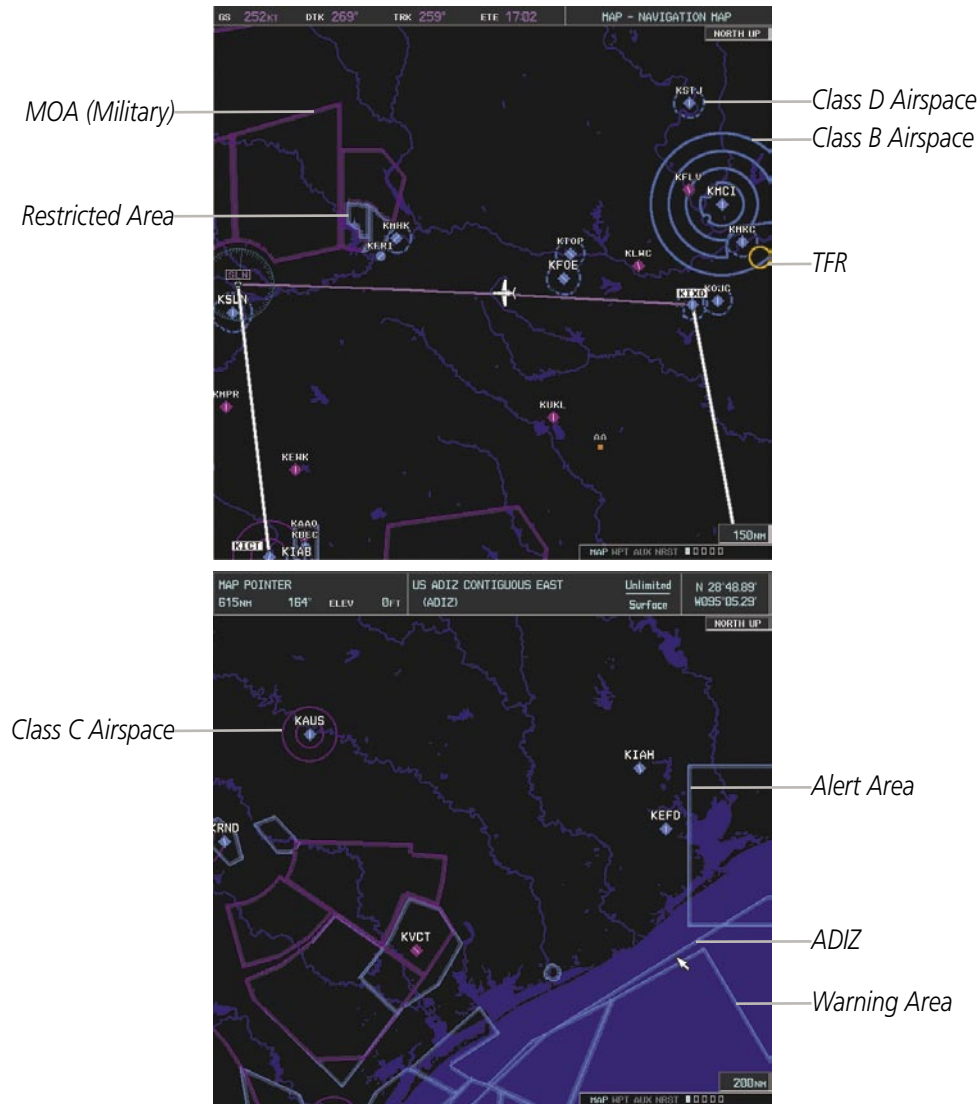

Figure 5-46 Airspaces

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.

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.

Airspace Alerts Box
- Airspace Altitude Buffer
- Alert On/Off
  (Default Settings Shown)

DFLTS *Softkey*

Figure 5-47 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'.
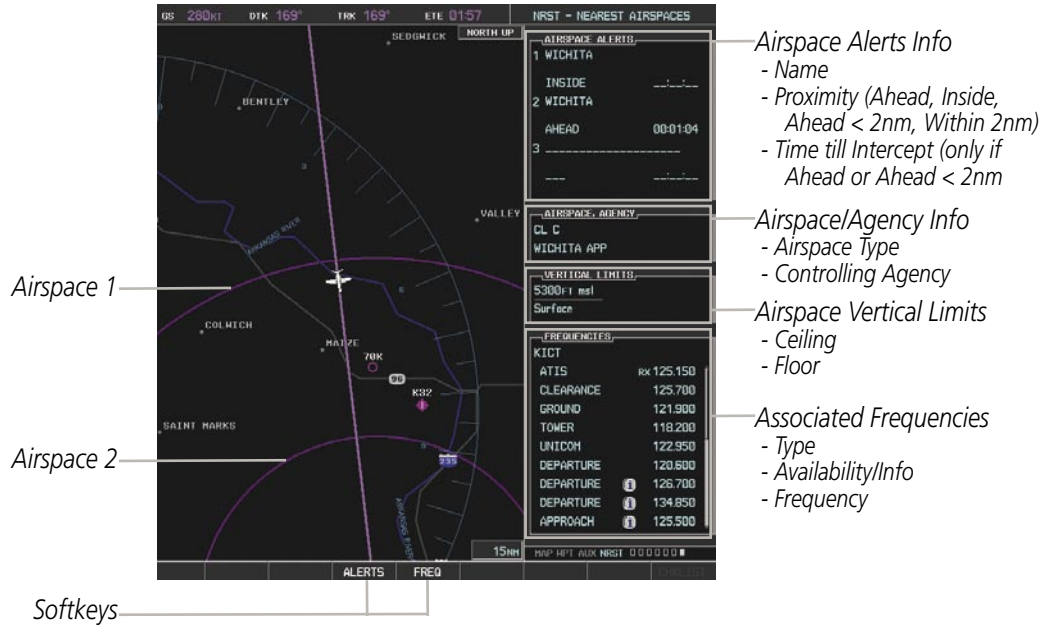

Figure 5-48 Nearest Airspaces Page

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 Airspace Page.

2) Press the **ALERTS** Softkey or press the **FMS** Knob to place the cursor in the 'AIRSPACE ALERTS' box .

3) Select the desired airspace.

4) Press the **FMS** Knob to remove the flashing cursor.

OR:

1) With the Nearest Airspace Page displayed, press the **MENU** Key.

2) Highlight 'Select Alerts Window'.

3) Press the **ENT** Key. The cursor is placed in the 'AIRSPACE ALERTS' Box.

4) Select the desired airspace.

5) Press the **FMS** Knob to remove the flashing cursor.

The following airspace alerts are displayed in the message window on the PFD:

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.

Displaying alerts on the PFD:

Press the MSG Softkey.

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 (when part of a flight plan) 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 5-49 Direct-to Window - MFD
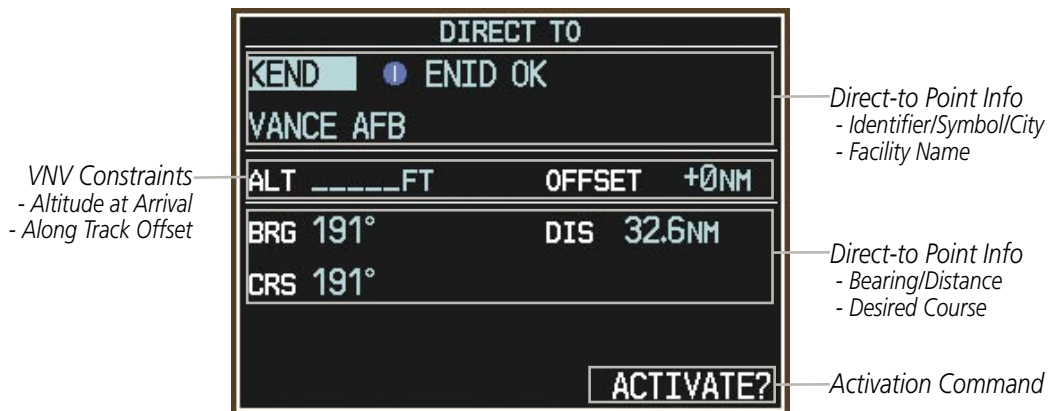
Figure 50 Direct-to Window - PFD

Any waypoint can be entered as a direct-to destination from the Direct-to Window.

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

1) Press the **Direct-to** Key. The Direct-to Window is displayed (with the active flight plan waypoint as the default selection or a blank waypoint field if no flight plan is active).

2) Turn the small **FMS** Knob clockwise to begin entering a waypoint identifier (turning it counter-clockwise brings up the waypoint selection submenu - press the **CLR** Key to remove it), or turn the large **FMS** Knob to select the facility name, or city field and turn the small **FMS** Knob to begin entering a facility name or city. If duplicate entries exist for the entered facility or city name, additional entries can be viewed by turning the small **FMS** Knob during the selection process.

3) Press the **ENT** Key. The 'Activate?' field is highlighted.

4) Press the **ENT** Key to activate the direct-to.

Any waypoint contained in the active flight plan can be selected as a direct-to waypoint from the Direct-to Window, the Active Flight Plan Page, or the Active Flight Plan Window.

Waypoint Submenu
- Flight Plan Waypoints
- Nearest Waypoints
- Recent Waypoints
- Airway Waypoints

Figure 5-51 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 **ENT** 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 or RECENT waypoints can be selected as a direct-to destination from the Direct-to Window.

Selecting a NRST or RECENT waypoint as a direct-to destination:

1) Press the **Direct-to** Key. The Direct-to Window is displayed (with the active flight plan destination as the default selection or a blank destination if no flight plan is active).

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

3) Turn the small **FMS** Knob clockwise to display the NRST or RECENT 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.

2) Select the desired airport (the nearest one is already selected).

3) Press the **Direct-to** Key.

4) Press the **ENT** Key. The cursor is now displayed on 'ACTIVATE?'.

5) Press the **ENT** Key again to activate the direct-to.

Direct-to destinations may also be selected by using the pointer on the navigation map pages. If no airport, NAVAID, or user waypoint exists at the desired location, a temporary waypoint named 'MAPWPT' is automatically created at the location of the map arrow.

Selecting a waypoint as a direct-to destination using the pointer:

1) From 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.
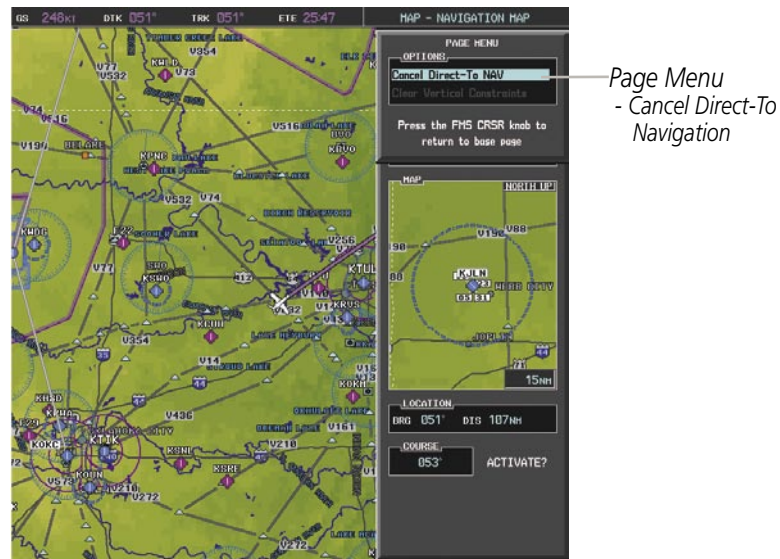

Figure 5-52 Direct-to Window - Cancelling Direct-to Navigation

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 (when part of a flight plan) 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 the direct-to. 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 distance along-track before (-) or after (+) the offset waypoint.

8) Press the **ENT** Key. The 'Activate?' field is highlighted.

9) Press the **ENT** Key to activate.

Removing a VNV altitude constraint:

1) Press the **Direct-to** Key to display the Direct-to Window.

2) Press the **MENU** Key.

3) With 'Clear Vertical Constraints' highlighted, press the **ENT** Key.

*Page Menu
- Clear Vertical Navigation Constraints*
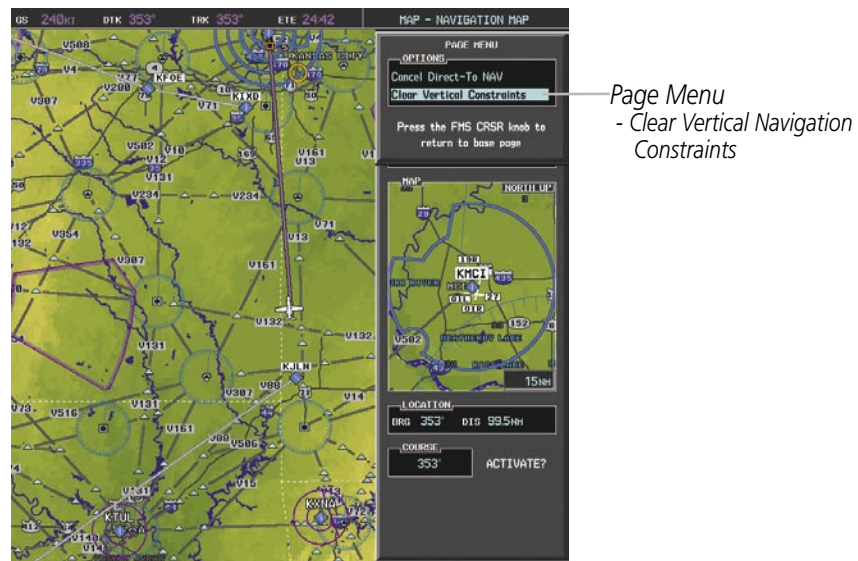
Figure 5-53 Direct-to Window - Clearing Vertical Constraints

5.6 FLIGHT PLANNING

Flight planning on the G1000 consists of building a flight plan by entering waypoints one at a time, adding waypoint along airways, and inserting departures, airways, arrivals, or approaches as needed. The G1000 allows flight planning to take place 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).
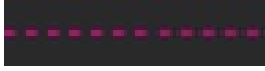
Flight Plan Leg Type	Symbol
Active non-heading Leg	
Active heading Leg	
Non-heading Leg in the current flight segment	
Heading Leg not in the current flight segment	
Non-heading leg not in the active flight segment	
Turn Anticipation Arc	

Table 5-5 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 flight plan and an alert is displayed.

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 re-loads 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 is removed from the flight plan.

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 places 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)
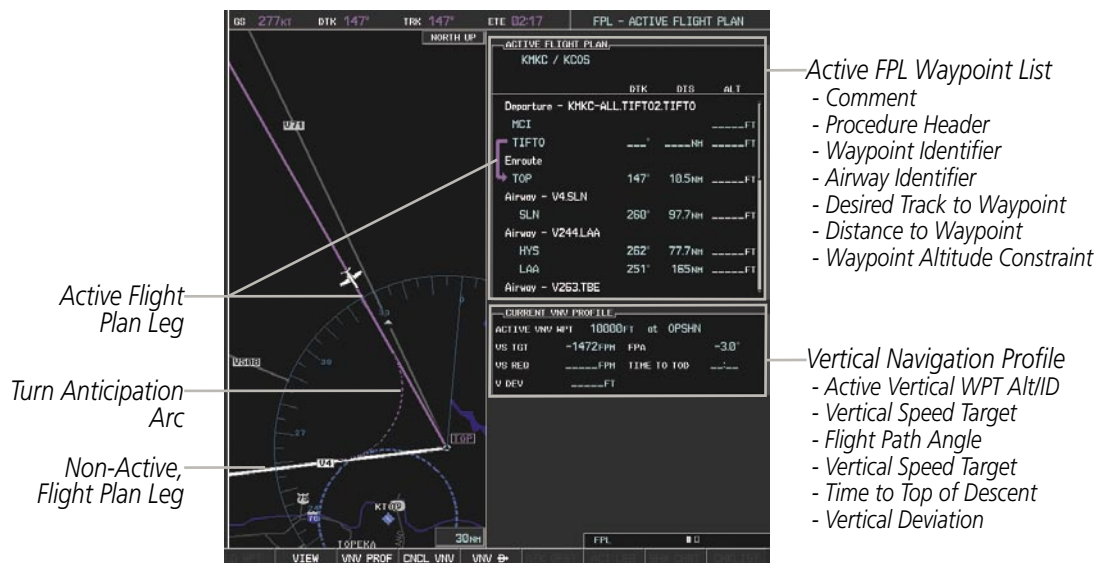
Figure 5-54 Active Flight Plan Page
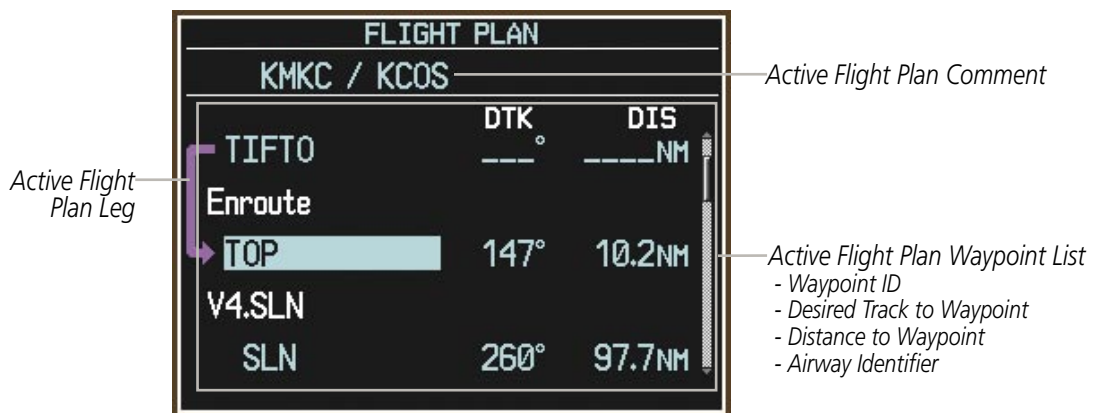
Figure 5-55 Active Flight Plan Window on PFD

Figure 5-56 Flight Plan Catalog Page

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, 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 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, 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.

OR:

1) Press the **FPL** Key.

2) Turn the small **FMS** Knob clockwise to display the Flight Plan Catalog Page.

3) Press the **MENU** Key.

4) Highlight 'Create New Flight Plan'.

5) Press the **ENT** Key to display a blank flight plan for the first empty storage location.

6) 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).

7) 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.

8) Repeat step numbers 6 and 7 to enter each additional flight plan waypoint.

9) 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.

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
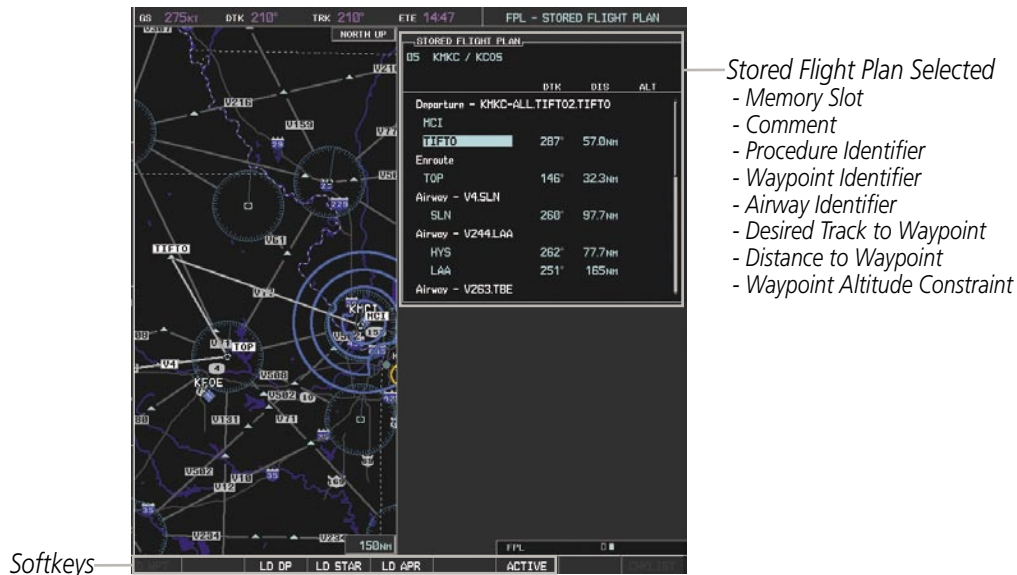
Figure 5-57 Stored Flight Plan Page

Flight Plan Full Message

Figure 5-58 Active Flight Plan Page - FPL Full

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) Enter the identifier, facility, or city of the new waypoint.

6) 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 will be displayed. Use the FMS Knob to select the correct waypoint.*

Figure 5-59 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 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.

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.
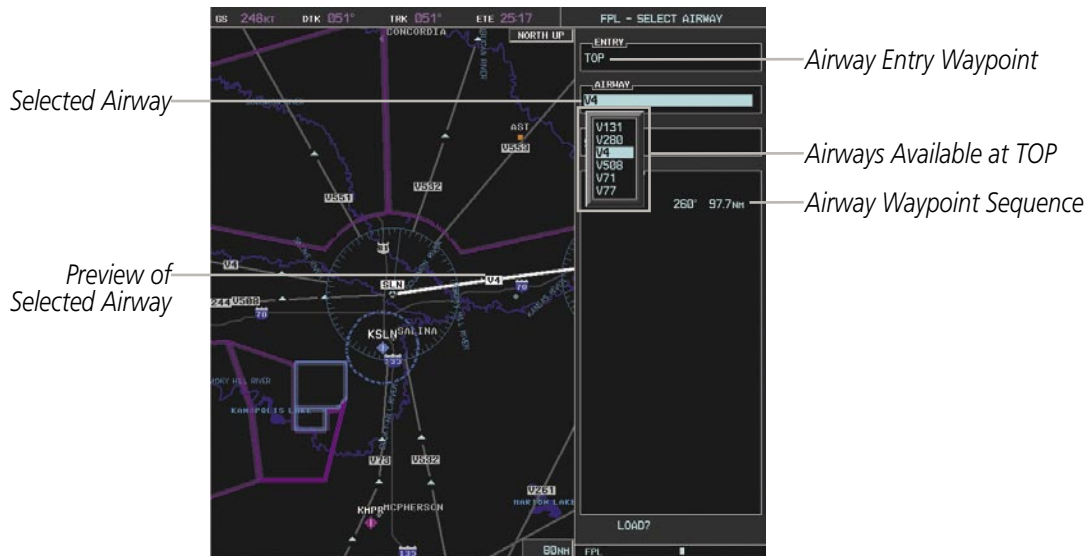
Figure 5-60 Select Airway Page - Selecting Airway

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.

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 an acceptable 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.

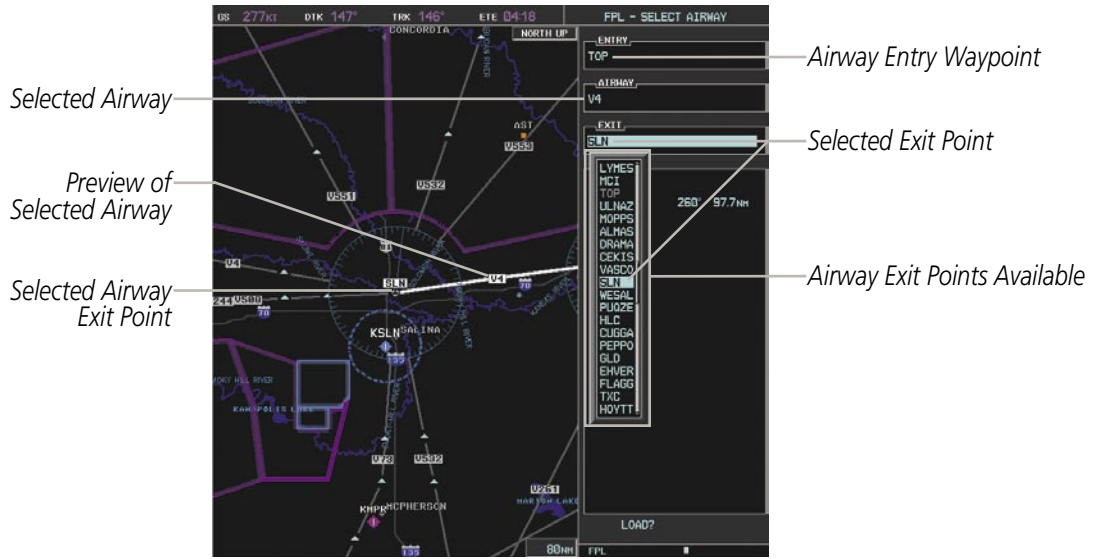7) Press the **ENT** Key. The system returns to editing the flight plan with the new airway inserted.

Airway Entry Waypoint

Selected Airway

Preview of
Selected Airway

Selected Airway
Exit Point

Selected Exit Point

Airway Exit Points Available

Figure 5-61 Select Airway Page - Selecting Exit Point

Inserted Airway Header
- Airway Identifier: [airway
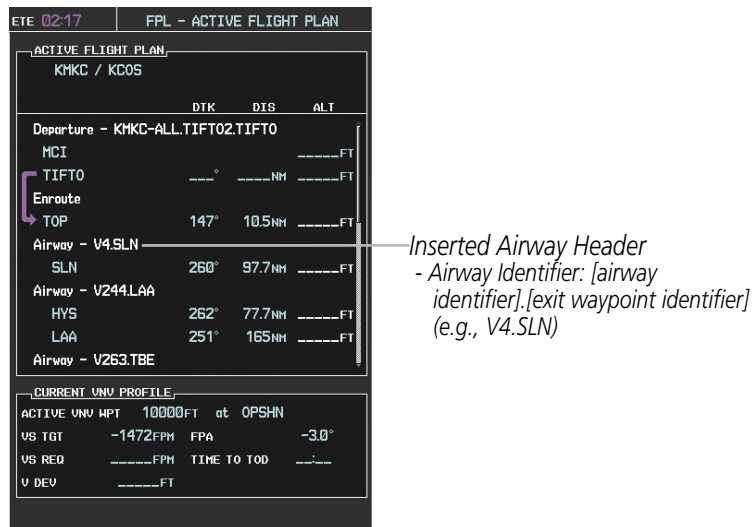 identifier].[exit waypoint identifier]
  (e.g., V4.SLN)

Figure 5-62 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.
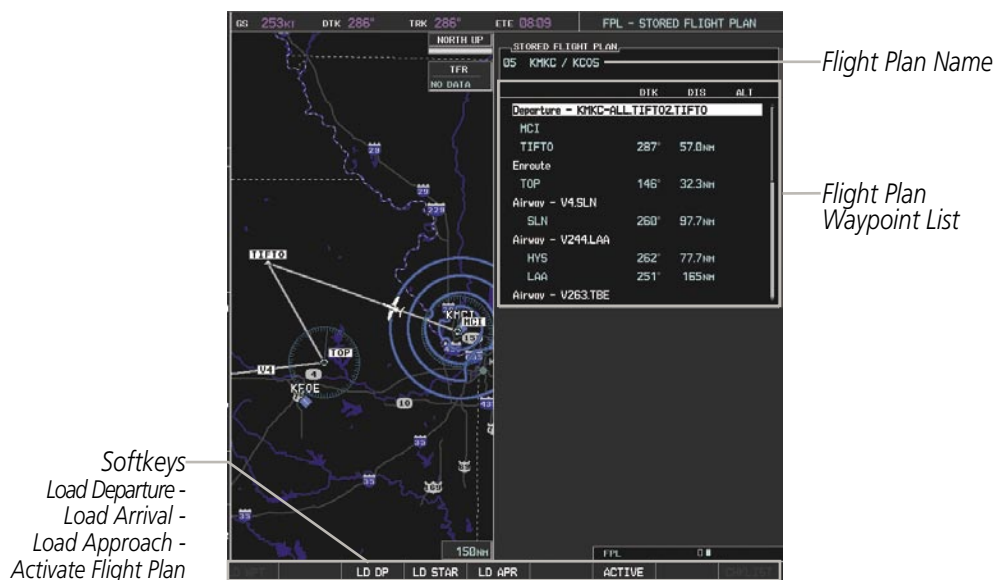
Figure 5-63 Stored Flight Plan Page

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.
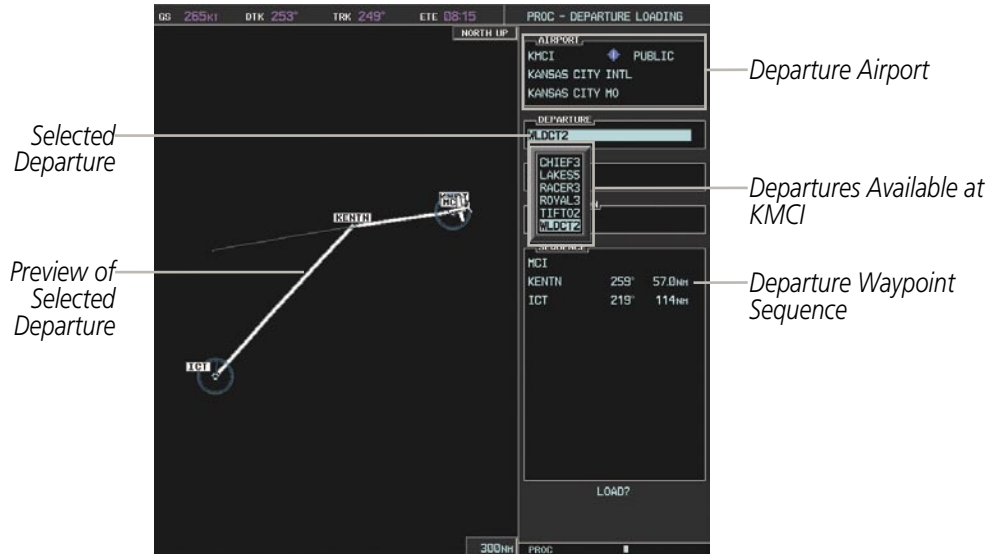

Selected Departure

Preview of Selected Departure

Departure Airport

Departures Available at KMCI

Departure Waypoint Sequence

Figure 5-64 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 transition for the selected departure. Press the **ENT** Key.

6) Select a runway served by the selected departure, if required. Press the **ENT** Key.

7) Press the **ENT** Key to load the selected departure procedure.
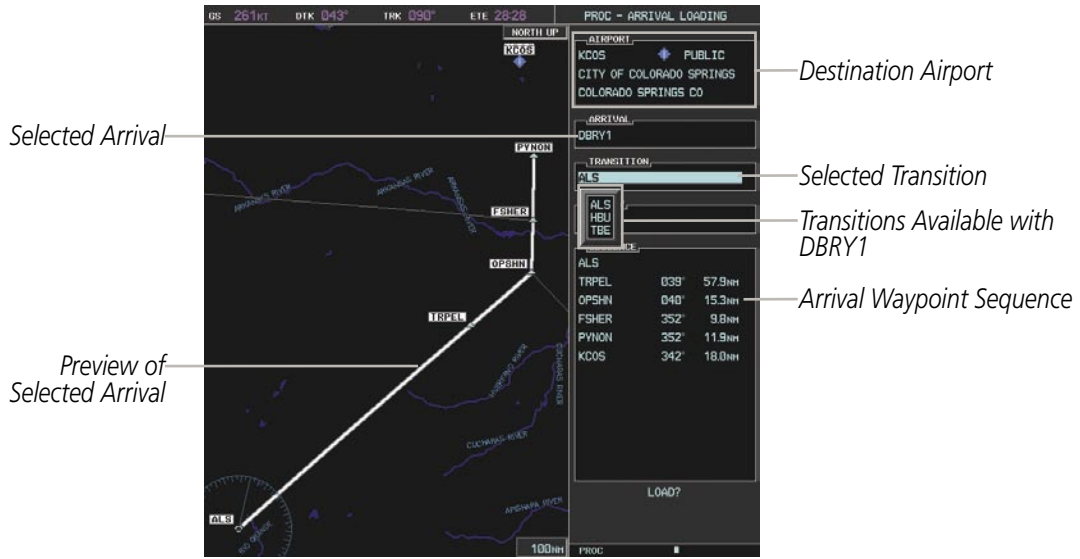
Departure Airport

Selected
Departure

Selected Runway

Preview of
Selected
Departure

Selected Transition

Departure Transition
Points Available

Departure Transition
Points Available

Selected
Departure End
Point
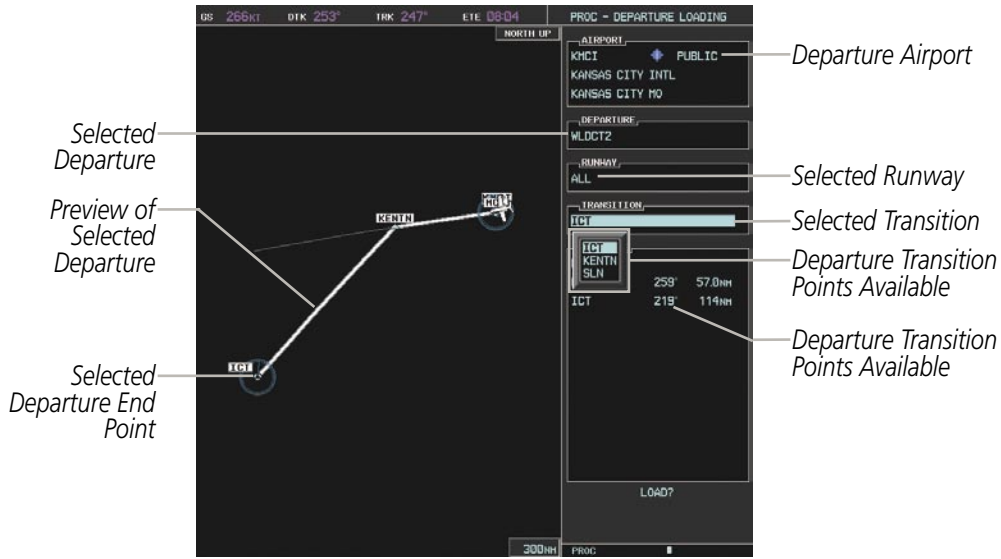
Figure 5-65 Departure Loading Page - Selecting Transition

Inserted Departure Header
- Departure Identifier: [departure
  airport]-[departure runway].
  [departure transition].
  [departure end point]
  (e.g., KMKC-ALL.TIFTO2.TIFTO)
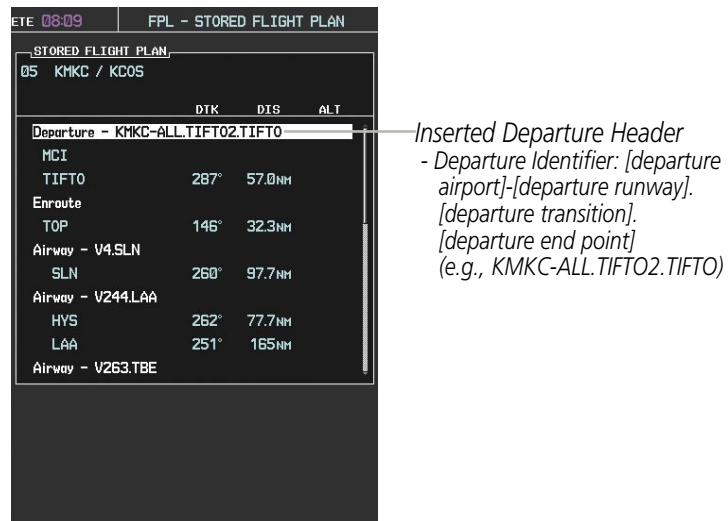
Figure 5-66 Stored Flight Plan Page - Departure Inserted

ARRIVAL (STAR)

A Standard Terminal Arrival (STAR) is loaded at the destination airport in the flight plan. Only one arrival can be loaded at a time in a flight plan. The route is defined by selection of an arrival, the transition waypoints, and a runway.
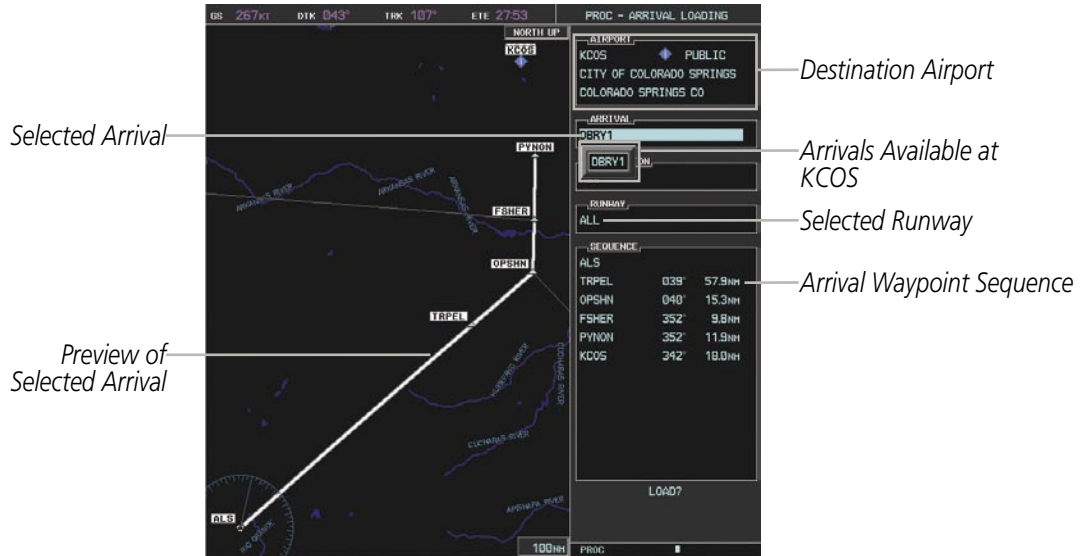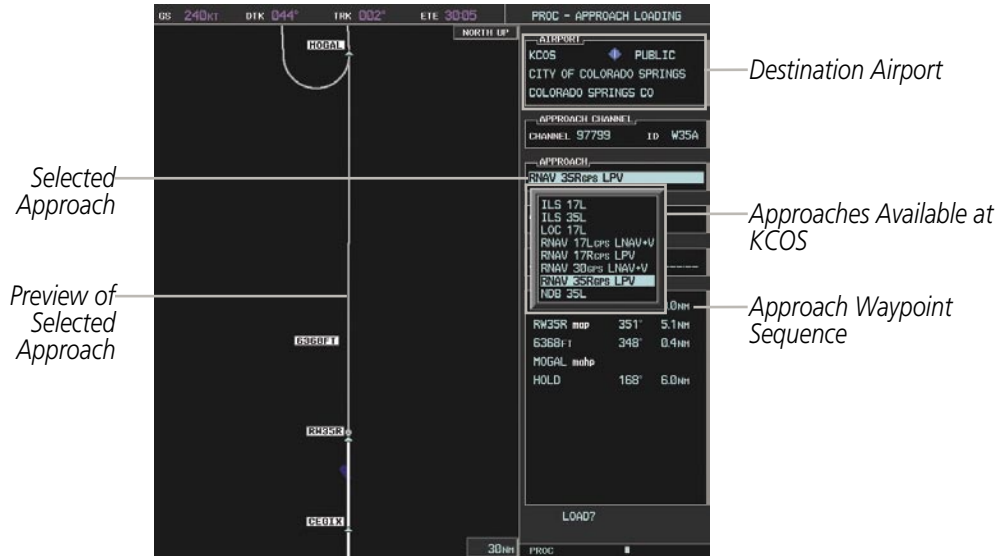

Figure 5-67 Arrival Loading Page - Selecting the Arrival

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.

Destination Airport

Selected Arrival

Selected Transition

Transitions Available with DBRY1

Arrival Waypoint Sequence

Preview of Selected Arrival

Figure 5-68 Arrival Loading Page - Selecting the Transition

Inserted Arrival Header
- Arrival Identifier:
   [arrival airport]-[arrival transition].
   [arrival].[arrival runway]
   (e.g., KCOS-ALS.DBRY1.ALL)
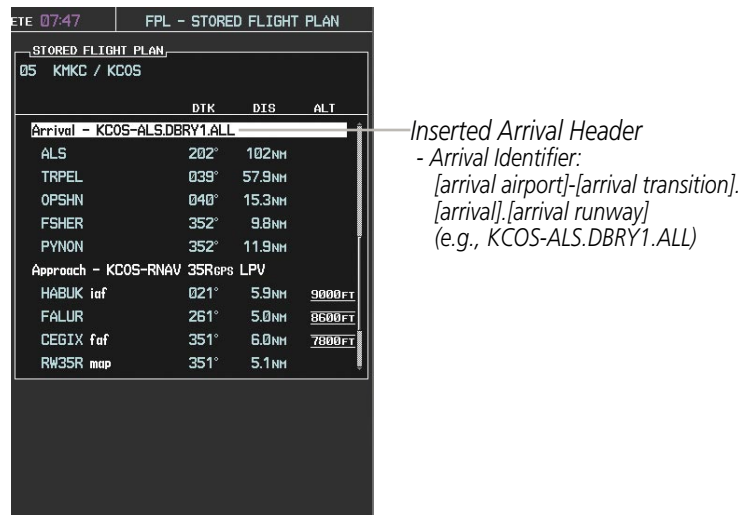
Figure 5-69 Stored Flight Plan Page - Arrival Inserted

APPROACH (APPR)

An Approach Procedure (APPR) is loaded at the destination airport in the flight plan and provides precision or non-precision guidance. Only one approach can be loaded at a time in a flight plan. The route is defined by selection of an approach and the transition waypoints.

Destination Airport

Selected Approach

Approaches Available at KCOS

Preview of Selected Approach

Approach Waypoint Sequence

Figure 5-70 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 arrival. Press the **ENT** Key.

6) Press the **ENT** Key to load the selected approval procedure.

Destination Airport

Selected Approach

Selected Transition

Transitions Available with Selected Approach

Preview of Selected Approach

Approach Waypoint Sequence
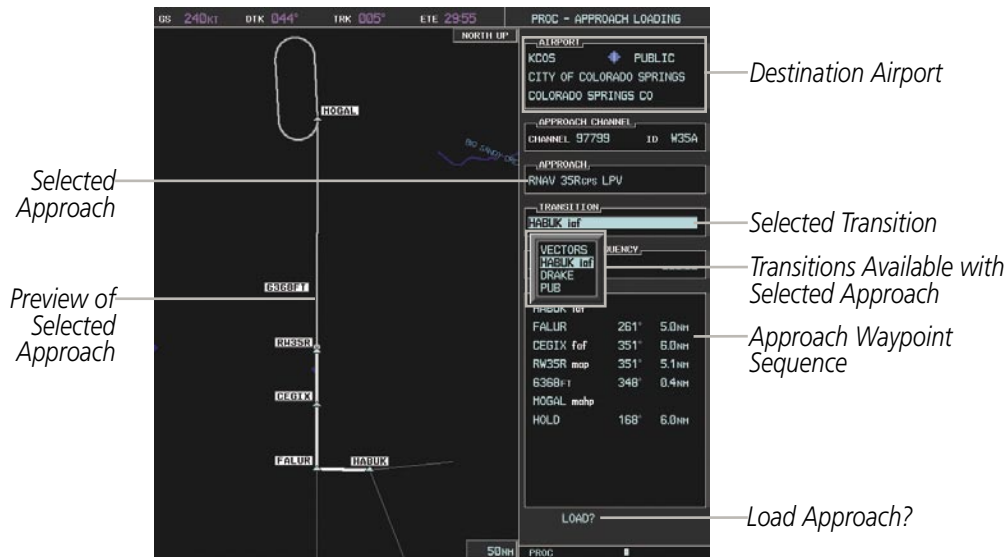
Load Approach?

Figure 5-71 Approach Loading Page - Selecting the Transition

Inserted Approach Header - Approach Identifier: [approach airport].[runway and approach type]
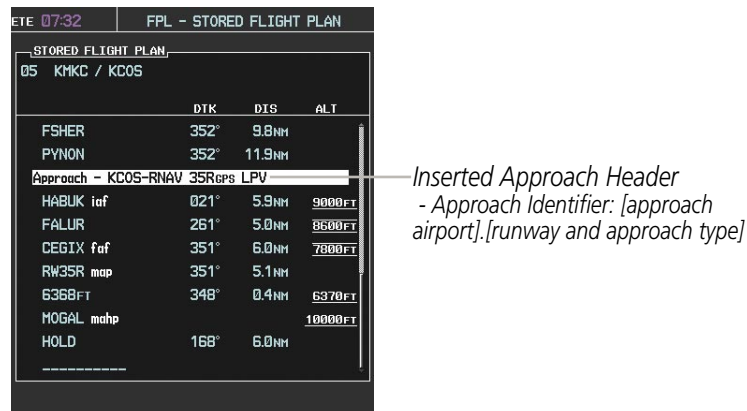
Figure 5-72 Stored Flight Plan Page - Approach Inserted

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.
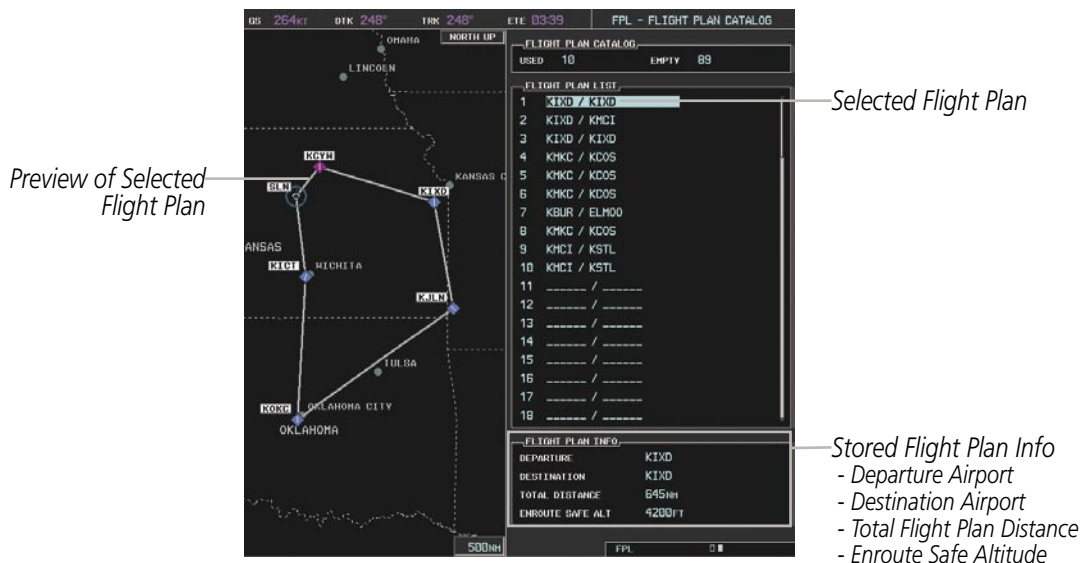
Figure 5-73 Stored Flight Plan Information

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 comment (flight plan name):

1) Press the **FPL** Key and turn the small **FMS** Knob to display the Flight Plan Catalog Page.

2) Press the **MENU** Key.

2) Highlight 'Sort By Comment' and press the **ENT** Key. A confirmation window is displayed.

3) 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 and activates it.

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 **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.

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.

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.

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.

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.

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.

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.

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.

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.

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.

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.

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.

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.

ALONG TRACK OFFSETS

A waypoint having an "along track offset" distance from an existing waypoint can be entered into a flight plan. Along track offset waypoints lie along the path of the existing flight plan, and can be used to make the system reach a specified altitude before or after reaching the specified flight plan waypoint. Offset distances can be entered from 1 to 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.
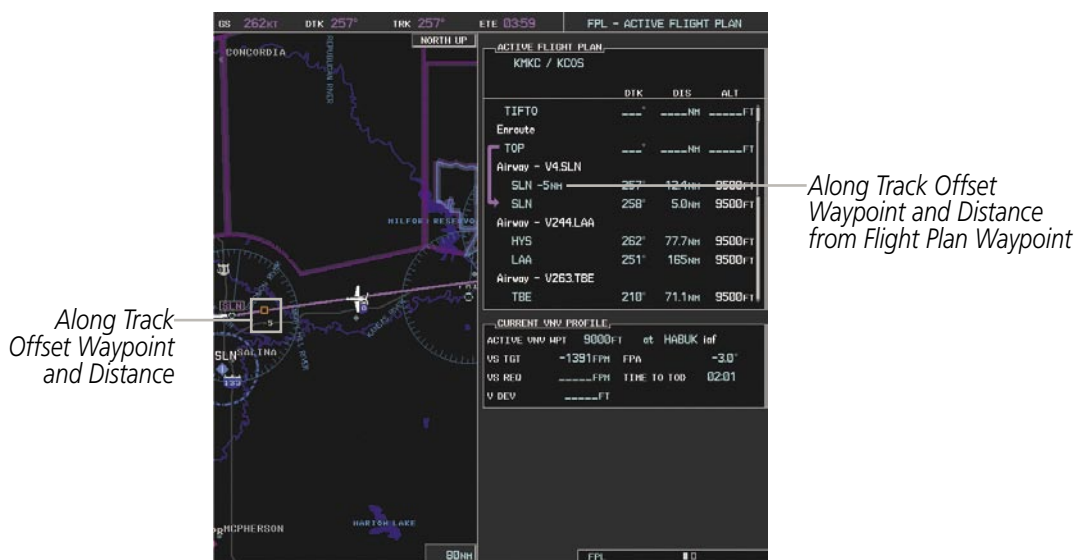
Figure 5-74 Along Track Offset

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.

5) Press the **ENT** Key to create the offset waypoint.

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.*
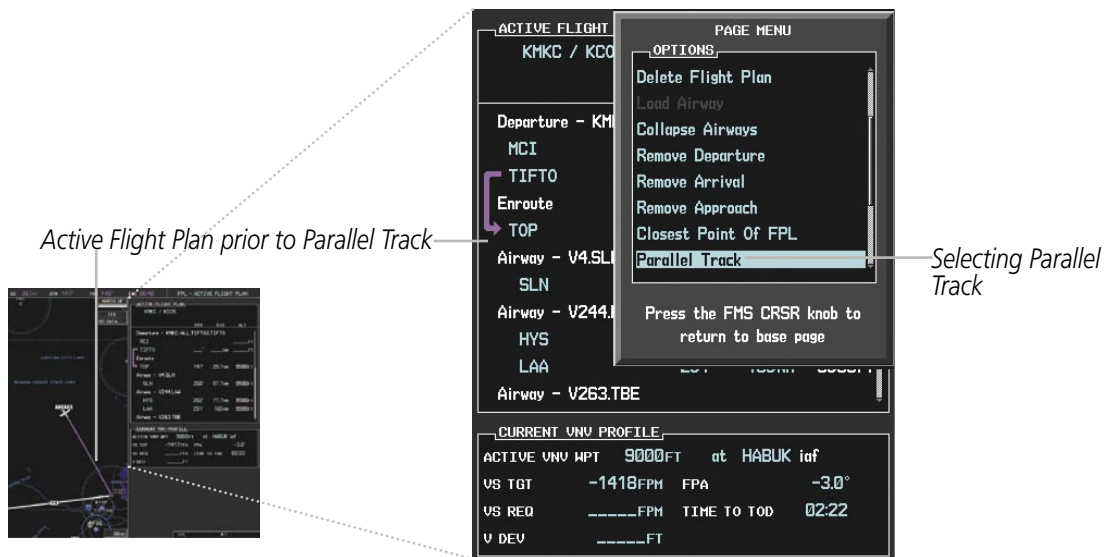
Figure 5-75 Active Flight Plan Window - Selecting Parallel Track

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 **EN**T 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.
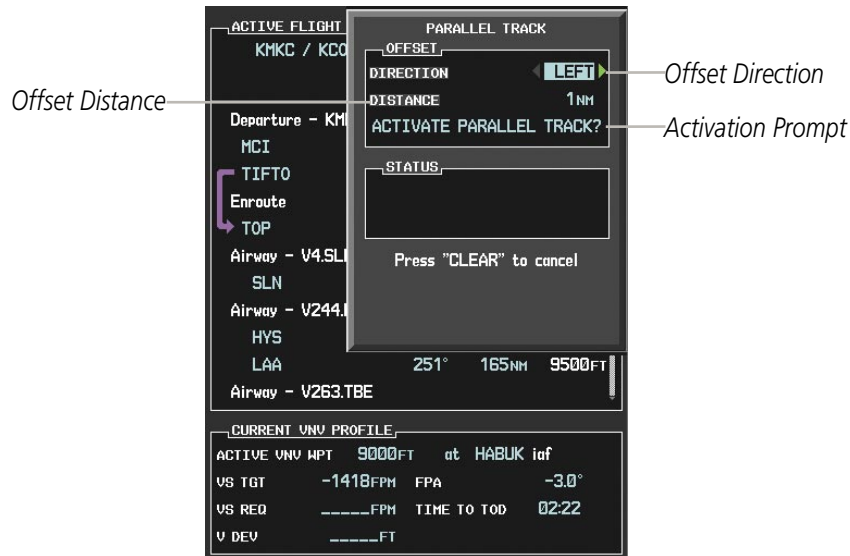
Figure 5-76 Parallel Track Window
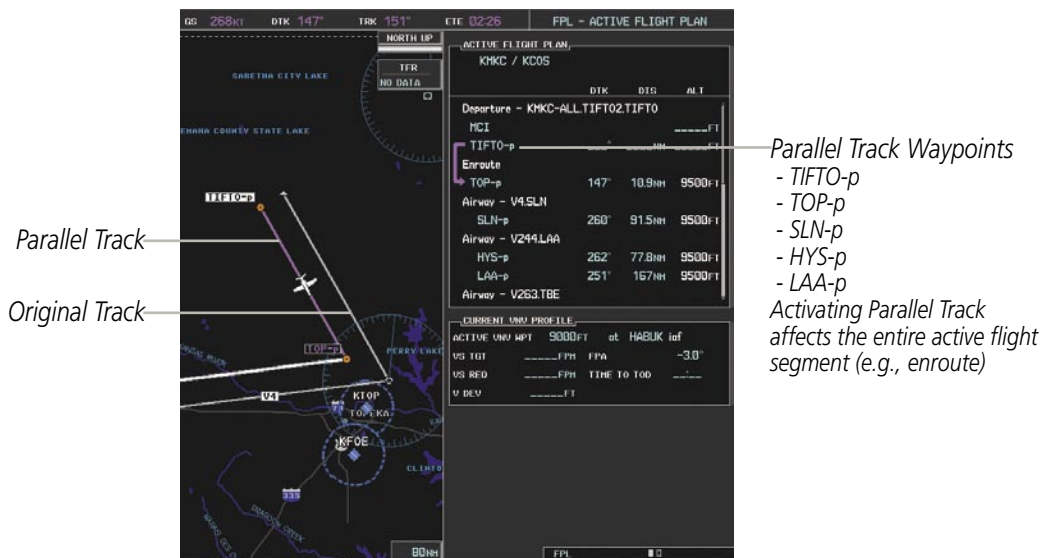
Figure 5-77 Parallel Track Active

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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.
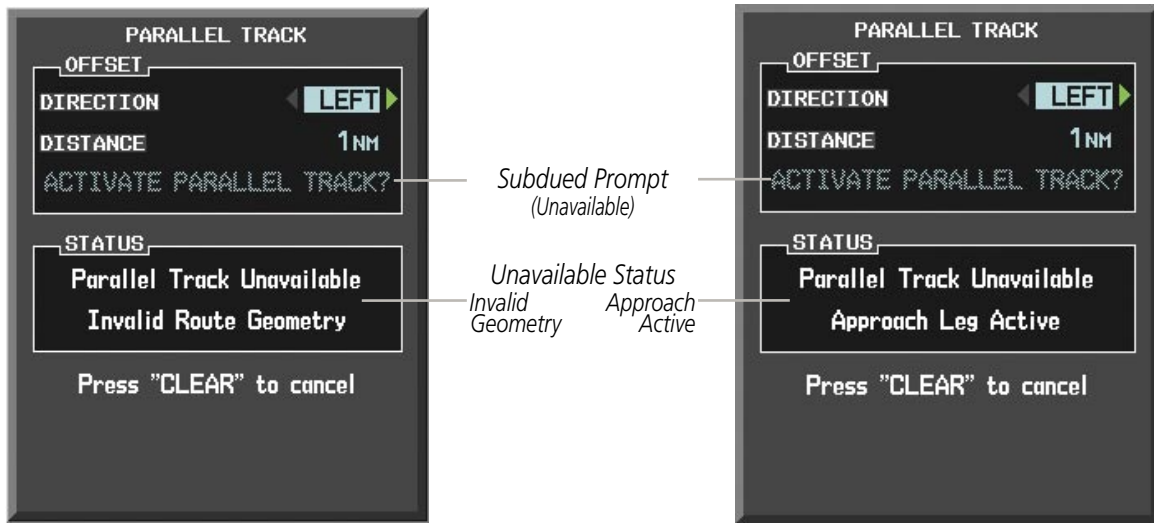
Figure 5-78 Parallel Track Unavailable

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 5-79 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.
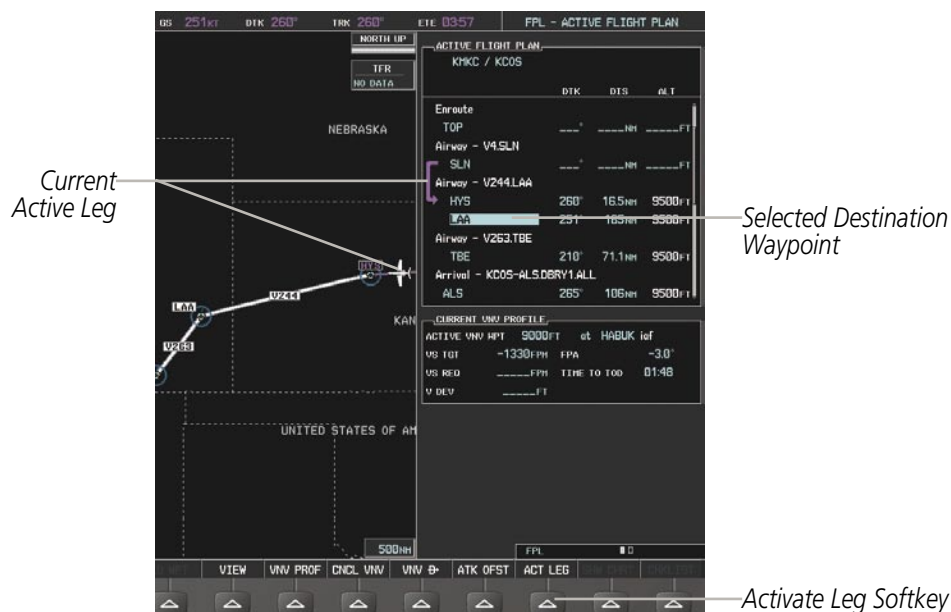
Figure 5-80 Active Flight Plan Page - Selecting the Leg Destination Waypoint

Confirmation Window

New Active Flight Plan Leg
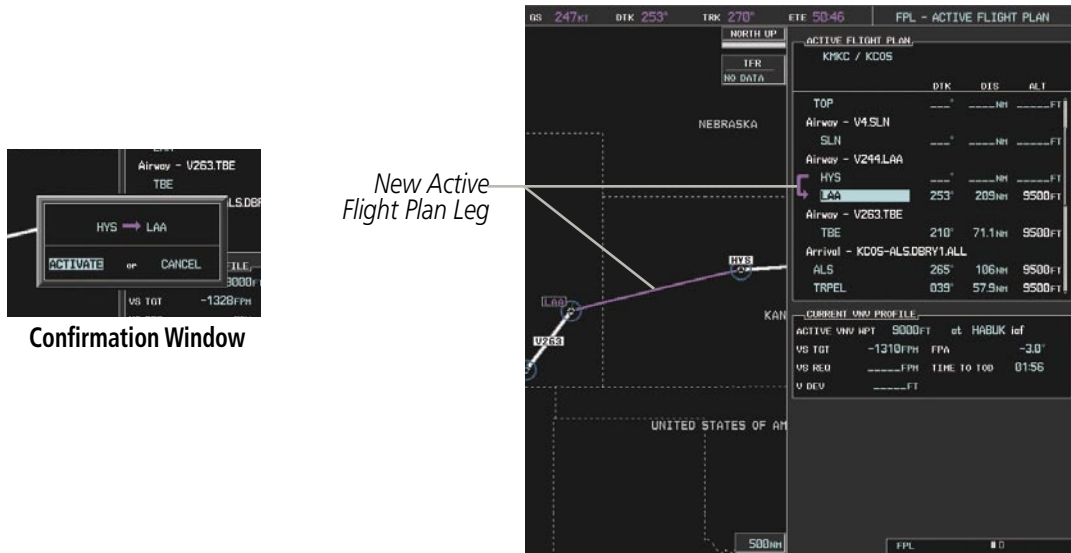
Figure 5-81 Active Flight Plan Page - New Active Leg

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 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 flight plan to be inverted.

4) Select the **INVERT** Softkey; or press the **MENU** Key, select 'Invert & Activate Flight Plan' and press the **ENT** Key. An 'Invert and activate stored flight plan?' confirmation window is displayed.

5) Select 'OK'.

6) Press the **ENT** Key to invert and activate the stored flight plan. To cancel, press the **CLR** Key, or highlight 'CANCEL' and press the **ENT** Key.

FLIGHT PLAN VIEWS

Information about flight plans can be viewed in more than one way. The active flight plan can be configured to show cumulative distance over the length of the flight plan or the distance for each leg of the flight plan; and the active flight plan can be viewed in a narrow or wide view. In the wide view, additional information is displayed: Fuel Remaining (FUEL REM), Estimated Time Enroute (ETE), Estimated Time of Arrival (ETA), and Bearing to the waypoint (BRG).

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.
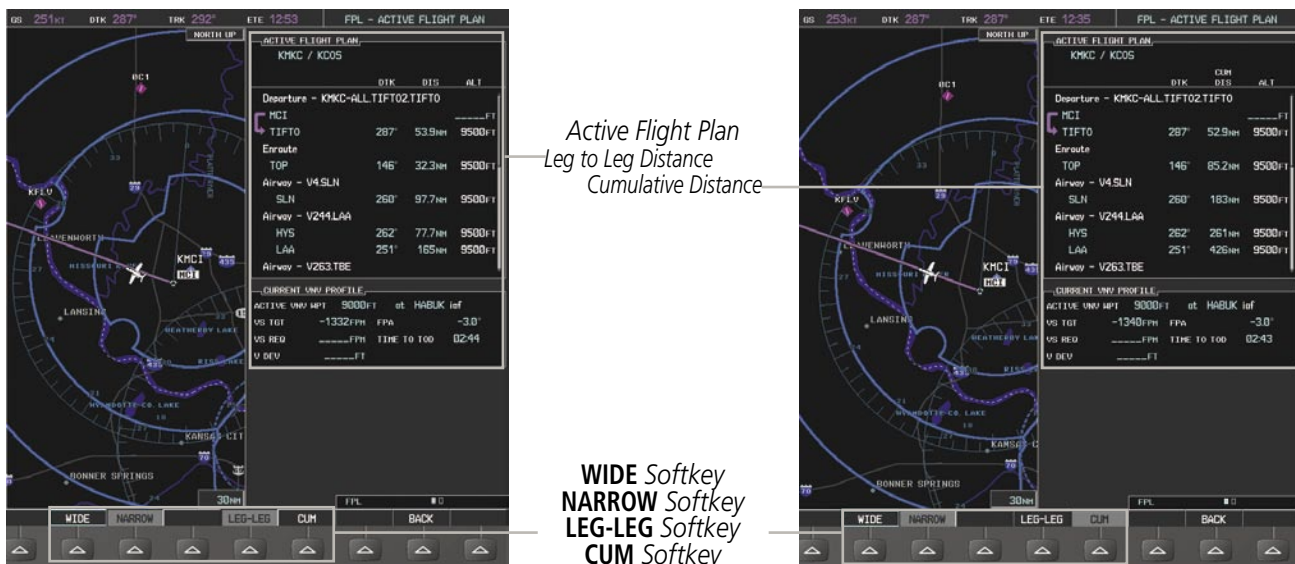
Figure 5-82 Active Flight Plan - Leg to Leg vs. Cumulative Distance

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
Wide View

WIDE *Softkey*
NARROW *Softkey*
LEG-LEG *Softkey*
CUM *Softkey*

Figure 5-83 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 reflects the total of all the legs on the airway that have been hidden in the collapsed display. The DTK value is inhibited because it is not usable in this context.

The Active Flight Plan Page always keeps the following three waypoints visible: "From" waypoint, "To" waypoint, and the "Next" waypoint. To prevent one or more of these waypoints from being hidden in a collapsed airway segment, the airway segment that contains either the "To" or the "Next" waypoint is automatically expanded. When an airway is loaded, airways are automatically expanded to facilitate flight plan review.

Q3.FEPOT Airway
Collapsed View
Expanded View
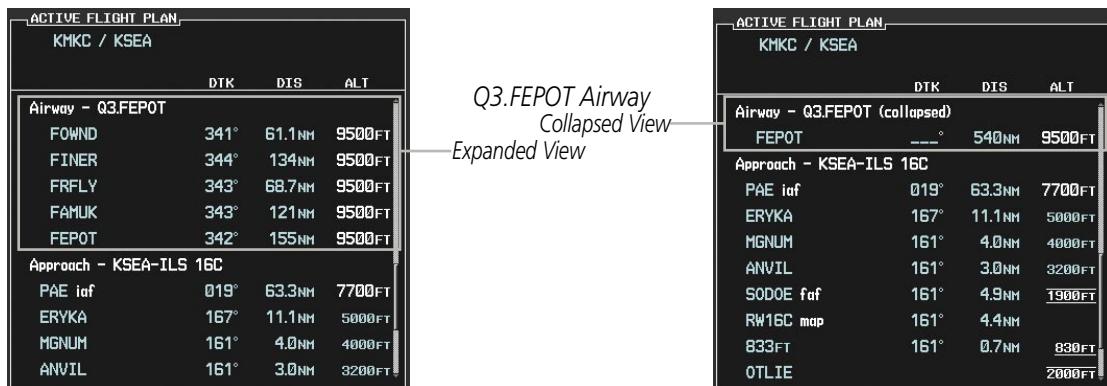
Figure 5-84 Expanded/Collapsed Airways

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.

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 teminal phases of flight. Guidance based on specified altitudes at waypoints in the active flight plan or to a direct-to waypoint is provided. It includes vertical path guidance to a descending path, which is provided as a linear deviation from the desired path. The desired path is defined by a line joining two waypoints with specified altitudes or as a vertical angle from a specified waypoint/altitude. The vertical waypoints are integrated into the active flight plan Both manual and autopilot-coupled guidance are supported.
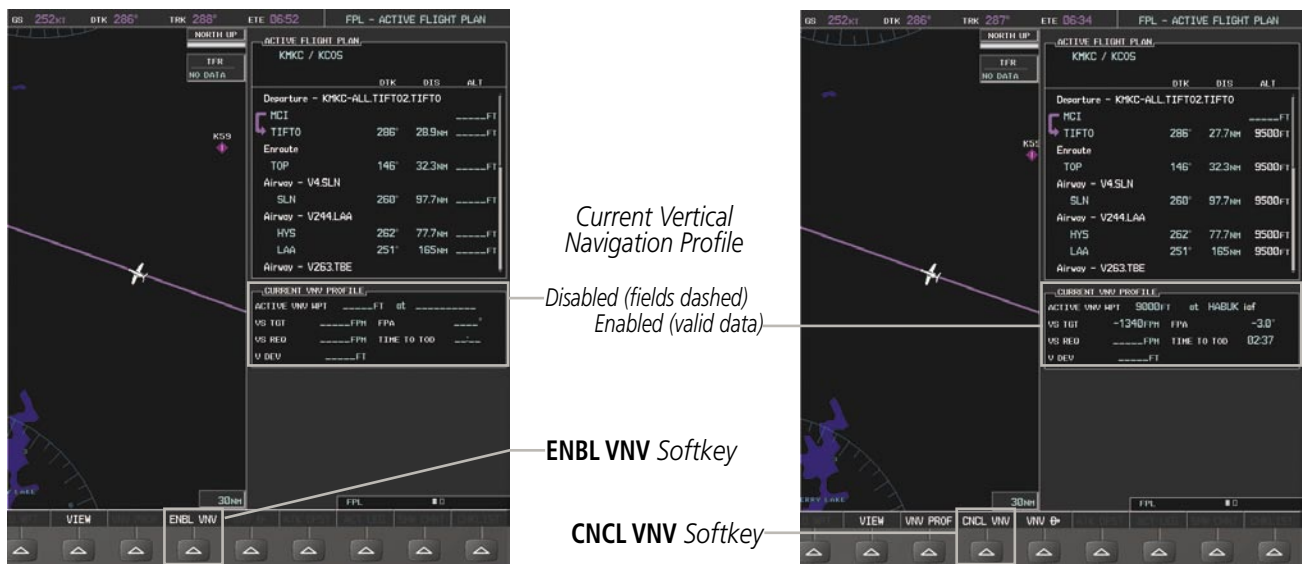
Figure 5-85 Enabling/Disabling Vertical Navigation

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 Vertical Speed Required Indication (VSRI) 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.

Current Vertical Navigation Profile

Prior to VNV Direct-to
After VNV Direct-to

VNV Direct-To *Softkey*

VNV PROF *Softkey*
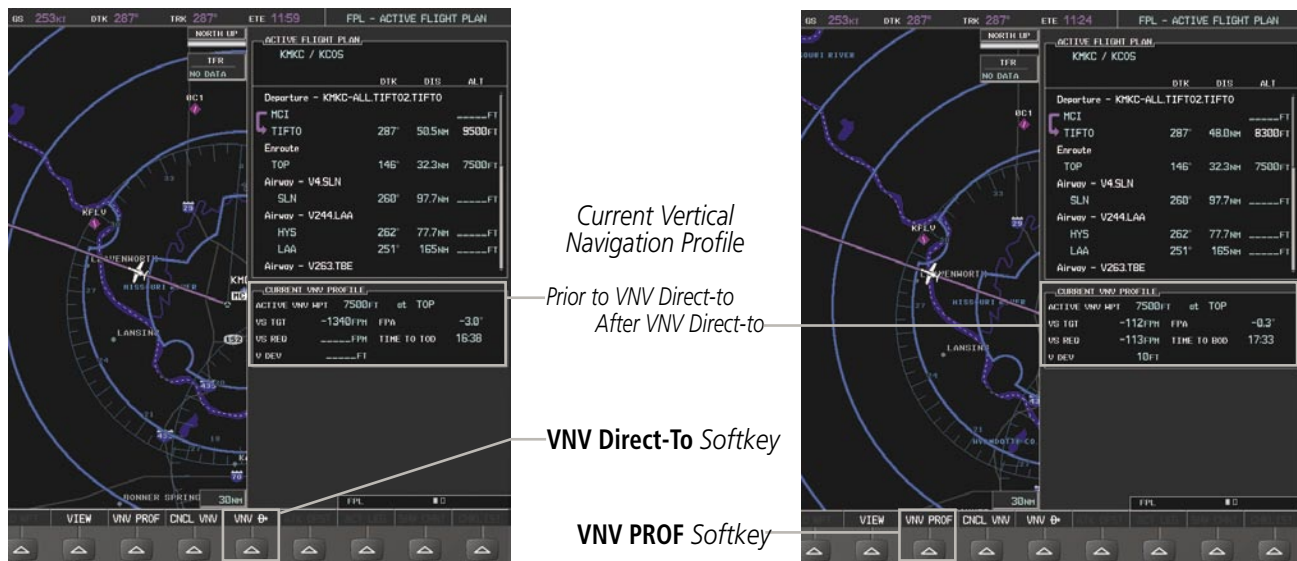
Figure 5-86 Vertical Navigation Direct-To

Activating a vertical navigation direct-to:

1) Press the **FPL** Key to display the Active Flight Plan Page on the MFD.

2) Press the **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.

3) Press the **ENT** Key. Vertical guidance begins to the altitude constraint for the selected waypoint.

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 without having to scroll all the way through past the end of the active flight plan.

3) Turn the **FMS** Knobs as needed to edit the values.

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.
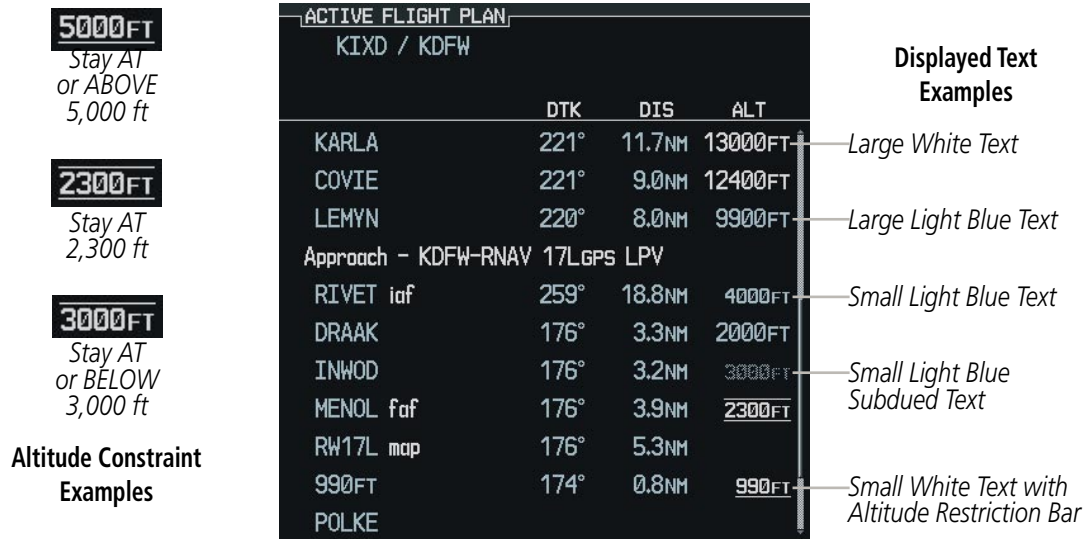
Figure 5-87 Waypoint Altitude Constraints

	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 5-6 Altitude Constraint Size and Color Coding

Altitudes associated with arrival and approach procedures are "auto-designated". This means the system automatically uses the altitudes loaded with the arrival or 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". 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 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 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 hundredth. 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 WAAS 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 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.

Deleting an altitude constraint:

1) Press the **FPL** Key to display the Active Flight Plan Page on the MFD.

2) Press the **FMS** Knob and 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.

GARMIN.

5.8 PROCEDURES

The G1000 can access the whole range of instrument procedures available. Departures (DPs), arrivals (STARs), and non-precision and precision approaches (APPR) 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) Select a departure from the list and press the **ENT** Key.

6) Select a runway (if required) and press the **ENT** Key.

7) Select a transition (if required) and press the **ENT** Key. 'LOAD?' is highlighted.
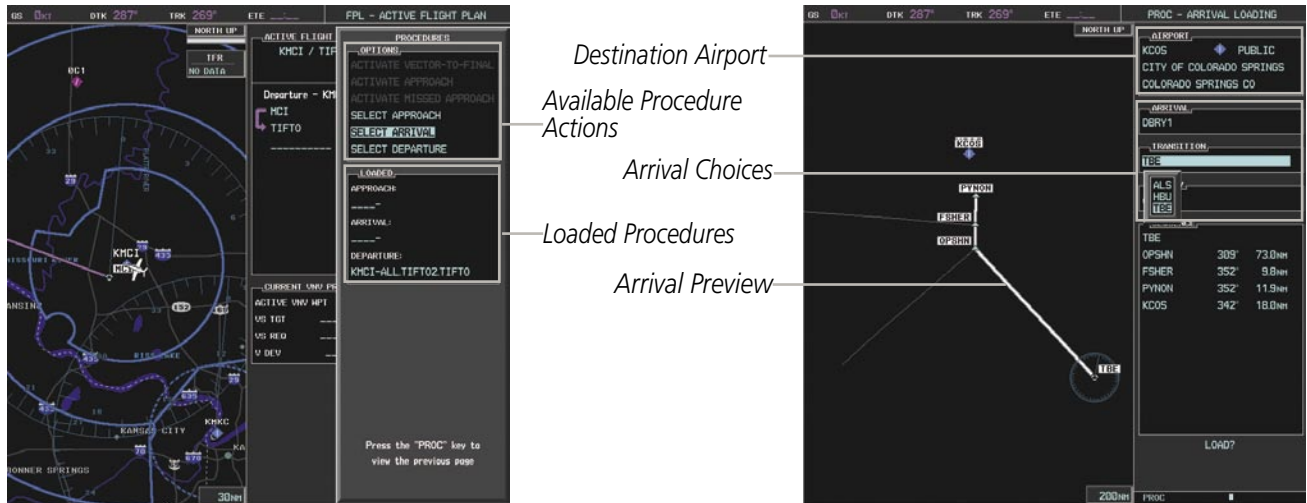
8) Press the **ENT** Key to load the departure procedure.

Figure 5-88 Departure Selection

Figure 5-89 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) Press the **FMS** Knob, then 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. 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** 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 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.

ARRIVALS

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. 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) 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.

Destination Airport

Available Procedure Actions

Arrival Choices

Loaded Procedures

Arrival Preview

Figure 5-90 Arrival Selection

Selected Arrival

Loaded Arrival

Procedure Loading Page Selection Softkeys

Figure 5-91 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) Press the **FMS** Knob, then 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** Softkey to return to the Airport Information Page.

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 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.

APPROACHES

> **NOTE:** If certain GPS parameters (WAAS, 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) is loaded at the destination airport in the flight plan 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.

The G1000 WAAS 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 5-6 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) Select an approach from the list and press the **ENT** Key.

4) Select a transition (if required) and press the **ENT** Key.

5) Press the **ENT** Key with 'LOAD?' highlighted to load the arrival 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.

Destination Airport

Available Procedure Actions

Approach Choices

Loaded Procedures

Approach Preview
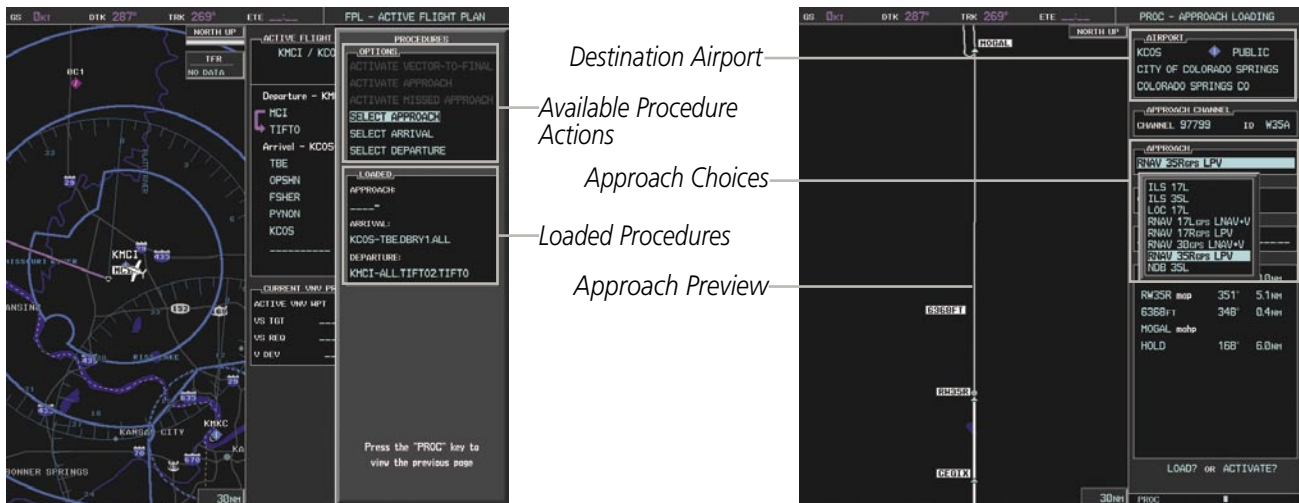
Figure 5-92 Approach Selection

Selected Approach

Loaded Approach

LOAD or ACTIVATE? Annunciation

Procedure Loading Page Selection Softkeys
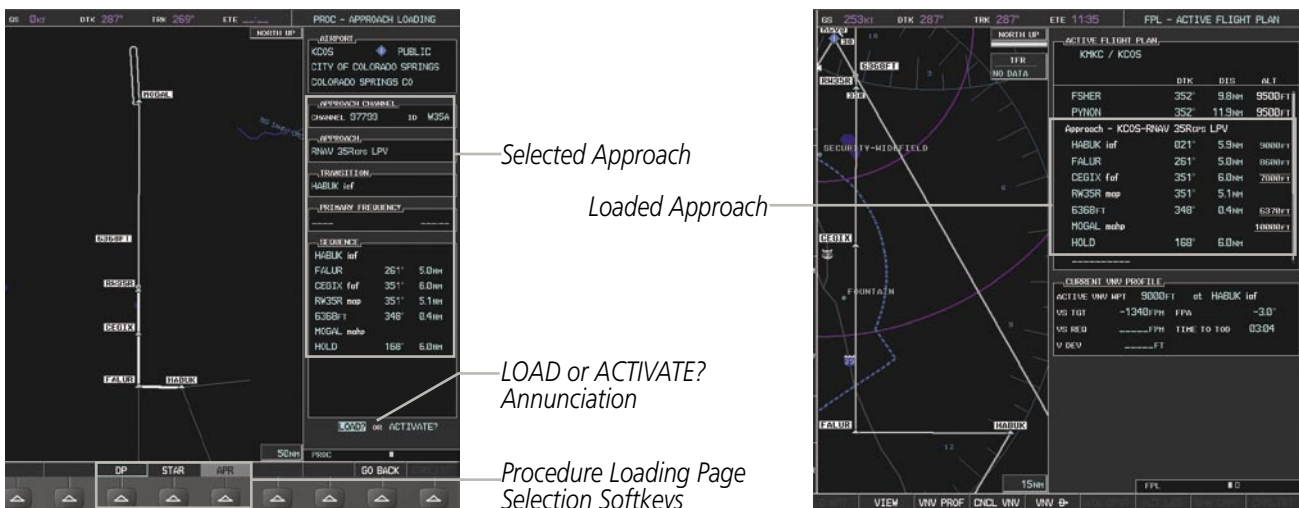
Figure 5-93 Approach Loading

Viewing available approaches at an airport:

1) From the Airport Information Page (first page in the WPT group), select the **APR** 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) 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 Runway box. The approach 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. The approach 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 approach is previewed on the map.

7) Select the **INFO** 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) Select the **APR** Softkey; or press the **MENU** Key, highlight 'Select Approach Window', and press the **ENT** Key.

4) Turn the **FMS** Knob to highlight the desired approach.

5) Select the **LD APR** Softkey; or press the **MENU** Key, highlight 'Load Approach', and press the **ENT** Key. The Approach Loading Page is displayed with the transitions field highlighted.

6) Turn the **FMS** Knob to highlight the desired transition.

7) Press the **ENT** Key. The 'LOAD?' field is highlighted.

8) Press the **ENT** Key with 'LOAD?' highlighted to load the arrival procedure; or turn the large **FMS** Knob to highlight 'ACTIVATE' and press the **ENT** Key to load and activate the approach procedure. The G1000 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.

ACTIVATING AN APPROACH

A previously loaded approach can be activated from the Procedures Window.

Activating a previously loaded approach:

1) Press the **PROC** Key. The Procedures Window is displayed with 'Activate Approach' highlighted.

2) Press the **ENT** Key to activate the approach.

In many cases, it may be easiest to "load" the full approach while still some distance away, enroute to the destination airport. Later, if vectored to final, use the steps below to select 'Activate Vector-To-Final' — which makes the inbound course to the FAF waypoint active.

Activating a previously loaded approach with vectors to final:

1) Press the **PROC** Key to display the Procedures Window.

2) Highlight 'ACTIVATE VECTOR-TO-FINAL' and press the **ENT** Key.

Loading and activating an approach using the MENU Key:

1) From the 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 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.

MISSED APPROACH

Activating a missed approach in the active flight plan:

1) Press the **PROC** Key.

2) Turn the **FMS** Knob to highlight 'ACTIVATE MISSED APPROACH'.

3) Press the **ENT** Key. The aircraft automatically sequences to the MAHP.

COURSE TO FIX

In a missed approach procedure, the fix immediately following the MAP (in this case '6368FT') is not part of the published procedure. It is simply a fix that defines a leg which guides the aircraft along the runway centerline until the required altitude to make the first turn on the missed approach is exceeded. 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 this fix until an altitude of 6,368 feet reached. After reaching 6,368 feet, a direct-to is established to the published fix (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. The altitude constraint value defaults to 400 feet AGL when the fix is not part of the published procedure.

In some missed approach procedures this altitude fix may be part of the published procedure. If the aircraft altitude is lower than this prescribed altitude, a direct-to is established to this fix when the missed approach procedure is activated.

Course to Fix Waypoint —

Figure 5-94 Course to Fix

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 fuel sensor 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.

Selected Flight Plan Segment
- FPL Number/Cumulative Legs (CUM or REM) or Leg Number (NN)
- Waypoints Defining Selected Flight Plan/Flight Plan Leg

Trip Planning Page Mode
- Automatic/Manual

Preview of Selected
Flight Plan/
Flight Plan Leg

Trip Input Data (sensor/pilot)
- Departure Time (local)
- Ground Speed
- Fuel Flow
- Fuel On Board Aircraft
- Calibrated Airspeed
- Indicated Altitude
- Barometric Pressure
- Total Air Temperature

Trip Statistics
Desired Track -
Distance -
Est. Time Enroute -
Est. Time of Arrival -
Enroute Safe Altitude -
Sunrise Time (local) -
Sunset Time (local -

Other Statistics
- Density Altitude
- True Airspeed (TAS)
- Wind Direction/Speed
- Head Wind Speed

Fuel Statistics
Desired Track -
Distance -
Est. Time Enroute -
Est. Time of Arrival -
Enroute Safe Altitude -
Sunrise Time (local) -
Sunset Time (local -

Softkeys
- Automatic/Manual Page Mode
- Flight Plan/Waypoint Mode

Figure 5-95 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.

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 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 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.

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 for trip.

- Fuel endurance remaining at end of selected leg (REM ENDUR) - This value is calculated by subtracting the time of fuel endurance by the amount of time to go.

- 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)

- Wind direction (WIND DIRECTION) - Not shown in manual page mode.

- Wind speed (WIND SPEED) - Not shown in manual page mode.

- Head wind (HEAD WIND) - Not shown in manual page mode. The wind is shown as a tail wind value if appropriate

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

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
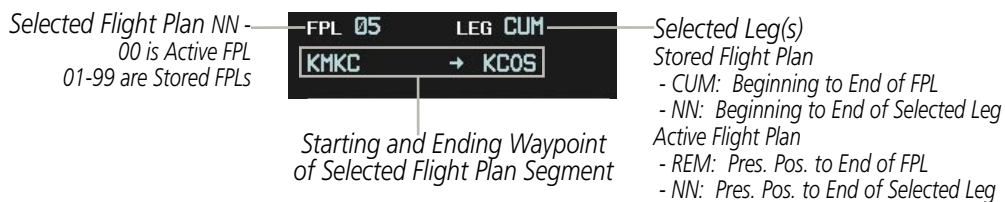
Figure 5-96 Trip Planning Page - Flight Plan Mode

Selected Flight Plan
Not Available

Selected Leg(s)
Not Available

Selected Starting and Ending Waypoints
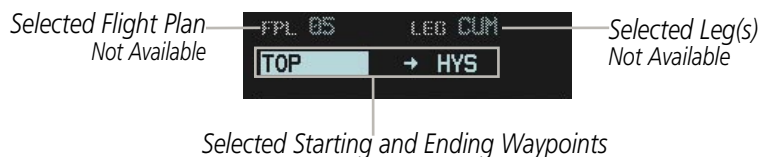
Figure 5-97 Trip Planning Page - Waypoint Mode

Selecting automatic or manual page mode:

1) 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:

1) 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 Trip Planning Page 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.

WEIGHT PLANNING

> ⚠️ **NOTE:** All weight planning page data fields displays data rounded to the nearest 10 pounds or 5 kilograms.

A/C Payload Calculator
Basic Empty Weight Entry -
Pilot and Stores Weight Entry -
Basic Operating Weight Calculation -
Passenger(s) Weight Entry -
Cargo Weight Entry -
Zero Fuel Weight Calculation -

Fuel Weight Calculator
- Zero Fuel Weight Calculation
- Fuel on Board Entry (or sync)
- Aircraft Weight Calculation
- Estimated Landing Weight Calculation
- Estimated Landing Fuel Calculation
- Fuel Reserve Entry
- Excess Fuel Calculation

Empty Weight Softkey
(selects Basic Empty Weight)

Fuel On Board Sync Softkey
(sets FOB to sensor actual)

Figure 5-98 Weight Planning Page

Entering basic empty weight:

1) Select the **EMPTY WT** Softkey; or press the **MENU** Key, highlight 'Set Basic Empty Weight', and press the **ENT** Key to select the BASIC EMPTY WEIGHT field.

2) Turn the small **FMS** Knob to enter the basic empty weight.

3) Press the **ENT** Key to confirm the entry.

Entering a pilot and stores weight:

1) Press the **FMS** Knob to activate the cursor and highlight the 'PILOT AND STORES' field.

2) Turn the small **FMS** Knob to enter the pilot and stores weight.

3) Press the **ENT** Key to confirm the entry.

The basic operating weight is calculated by adding the basic empty weight and the pilot and stores weight.

Entering the number of passengers:

1) Press the **FMS** Knob to activate the cursor and highlight the 'PASSENGERS #' field.

2) Turn the small **FMS** Knob to enter the number of passengers.

3) Press the **ENT** Key to confirm the entry.

Entering the average passenger weight:

1) Press the **FMS** Knob to activate the cursor and highlight the passenger weight field.

2) Turn the small **FMS** Knob to enter the average passenger weight.

3) Press the **ENT** Key to confirm the entry.

The total weight of passengers is calculated by multiplying the number of passengers by the average passenger weight.

Entering the cargo weight:

1) Press the **FMS** Knob to activate the cursor and highlight the 'CARGO' field.

2) Turn the small **FMS** Knob to enter the cargo weight.

3) Press the **ENT** Key to confirm the entry.

The 'ZERO FUEL WEIGHT' is calculated by adding the basic empty, pilot and stores, passenger, and cargo weights.

Entering a fuel on board weight:

1) Press the **FMS** Knob to activate the cursor and highlight the 'FUEL ON BOARD' field.

2) Turn the small **FMS** Knob to enter the fuel on board.

3) Press the **ENT** Key to confirm the entry.

Synchronizing the fuel on board with the actual measured fuel on board:

Select the **FOB SYNC** Softkey; or press the **MENU** Softkey, highlight 'Synchronize Fuel on Board', and press the **ENT** Key. The actual measured fuel on board is displayed in the fuel on board field.

When the aircraft is in the air and a destination waypoint has been entered, the fuel calculations can be completed.

• Estimated landing weight = zero fuel weight + estimated landing fuel weight.

• Estimated landing fuel weight = fuel on board weight - (fuel flow x ETE)

• Excess fuel weight = estimated landing fuel weight - fuel reserves weight

If the aircraft is on the ground or a destination waypoint has not been entered, the following fields display invalid values consisting of six dashes:

• Estimated landing weight

• Estimated landing fuel weight

• Excess fuel weight

WEIGHT CAUTION AND WARNING CONDITIONS

If the zero fuel weight is greater than the maximum allowable zero fuel weight, then the zero fuel weight is displayed in amber.

If the aircraft weight is greater than the maximum allowable takeoff weight, then the aircraft weight is displayed in amber.

If the estimated landing weight is greater than the maximum allowable landing weight, then the estimated landing weight is displayed in amber.

If the estimated landing fuel weight is positive, but less than or equal to the fuel reserves weight, the following values are displayed in amber:

• Estimated fuel at landing weight

• Excess fuel weight

If the estimated landing fuel weight is zero or negative, then the following values are displayed in red:

• Estimated fuel at landing weight

• Excess fuel weight

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 (4.0 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 WAAS 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)
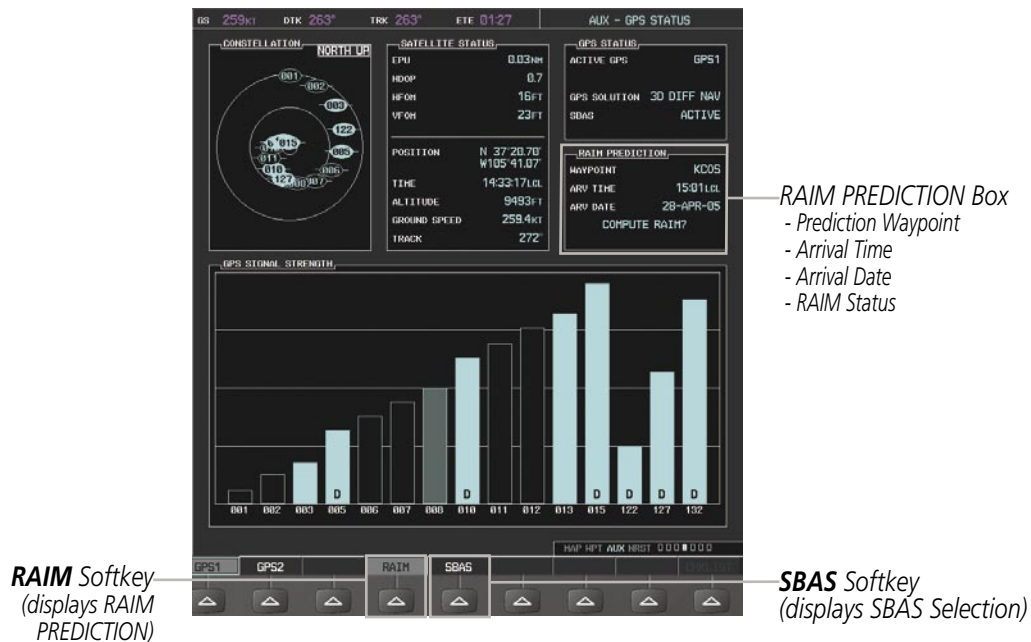
Figure 5-99 RAIM Prediction

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, 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.
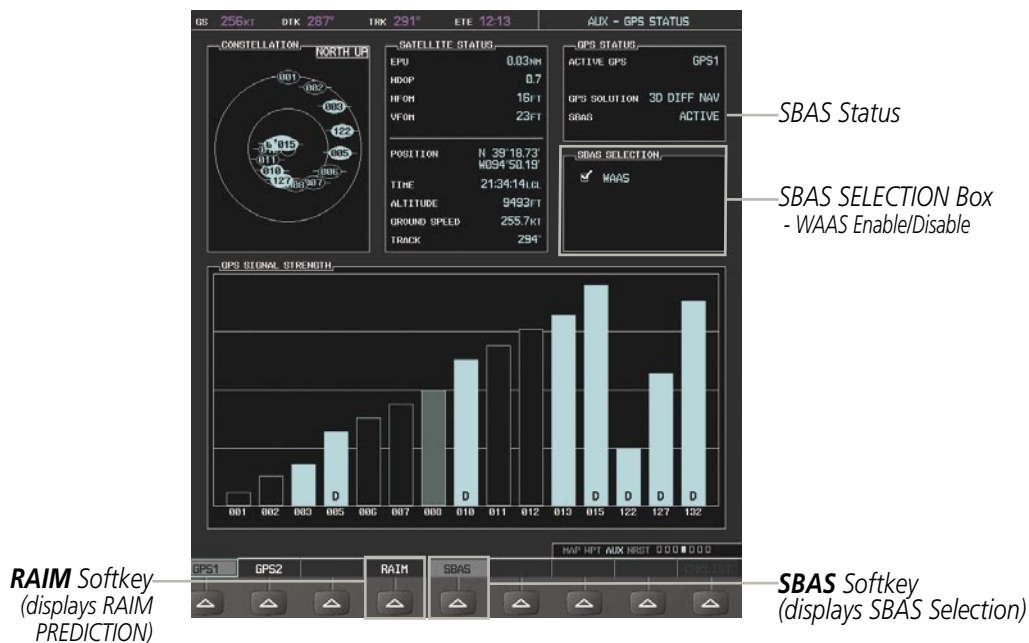
Figure 5-100 SBAS Display - Active

Enabling/Disabling SBAS:

1) Select the AUX-GPS Status Page.

2) Press the **FMS** Knob. The SBAS SELECTION 'WAAS' field is highlighted.

3) Press the **ENT** Key to disable SBAS. Press the **ENT** Key again to enable SBAS.

SBAS Status

*SBAS SELECTION Box
- WAAS Enable/Disable*

RAIM *Softkey
(displays RAIM
PREDICTION)*

SBAS *Softkey
(displays SBAS Selection)*
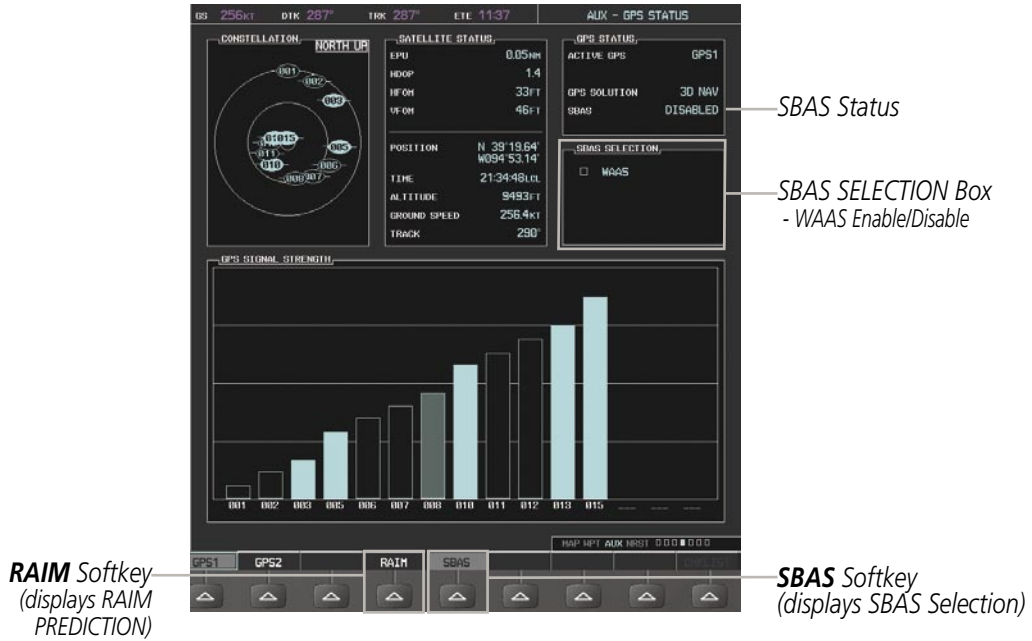
Figure 5-101 SBAS Display - Disabled

5.11 NAVIGATING A FLIGHT PLAN

The following discussion is an example of navigating a flight plan with the WAAS 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.

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 5-102 indicating the active departure leg.

After takeoff, ATC assigns a heading of 240º.

2) Figure 5-102 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.
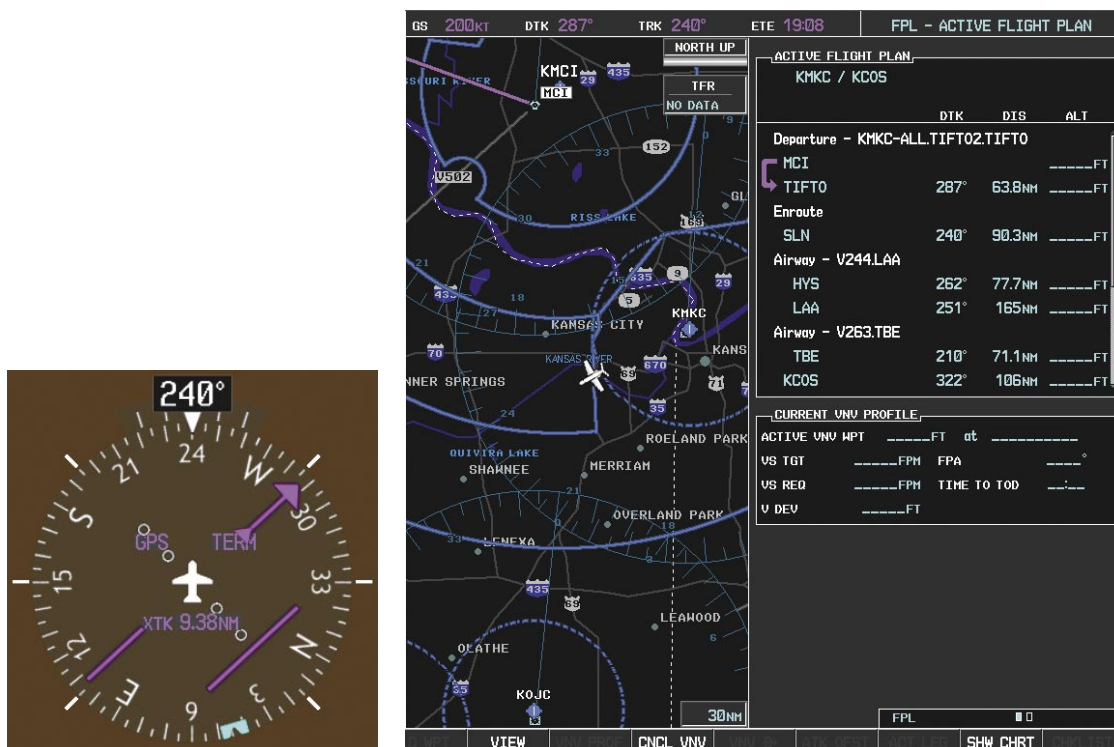
Figure 5-102 Assigned Heading of 240º

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 5-103. Note the current CDI flight phase is now ENR (Enroute). When the aircraft reached 30 nm from the departure point, the flight phase changed from TERM to ENR on the HSI and CDI scaling changed to 2.0 nm.
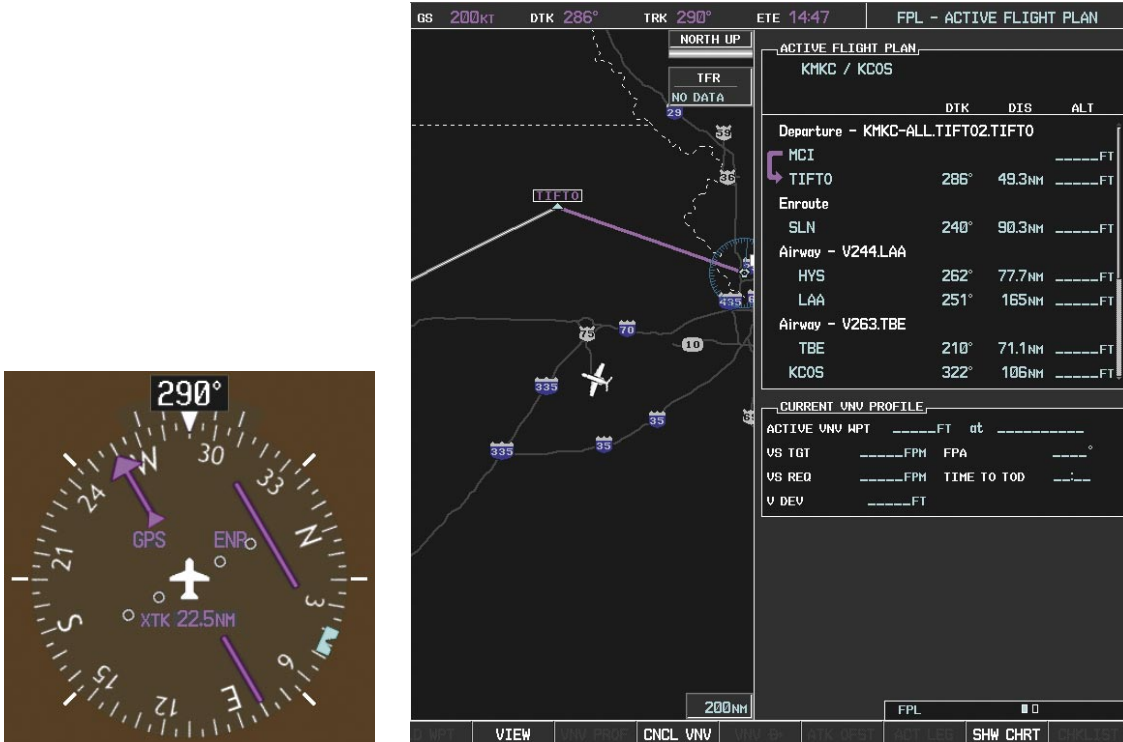
Figure 5-103 Assigned Heading of 290º

4) Enter V4 into the flight plan.

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

b) Turn the large **FMS** Knob to highlight the desired entry point as shown in Figure 5-104. When the V4 entry point is inserted, it is placed immediately above the highlighted waypoint (SLN).

Figure 5-104 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 5-105.

Figure 5-105 Entering V4 Entry Point

d) Press the **ENT** Key. TOP is inserted into the flight plan as in Figure 5-106.

Figure 5-106 TOP Inserted into the Flight Plan

e) With SLN still highlighted as in Figure 5-106, 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 5-107.

Figure 5-107 List of Available Airways for TOP

g) Turn either **FMS** Knob to highlight V4 in the list as seen in Figure 5-107.

h) Press the **ENT** Key. The list of available exits for V4 is now displayed as in Figure 5-108.
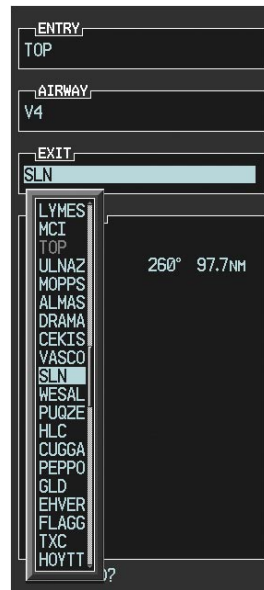
Figure 5-108 List of Available Exits for V4

i) If necessary, turn either **FMS** Knob to select the desired exit. In this case Salina VOR (SLN) is selected as in Figure 5-108.

j) Press the **ENT** Key. The selected airway and exit are displayed, and the prompt "LOAD?" highlighted as in Figure 5-109.
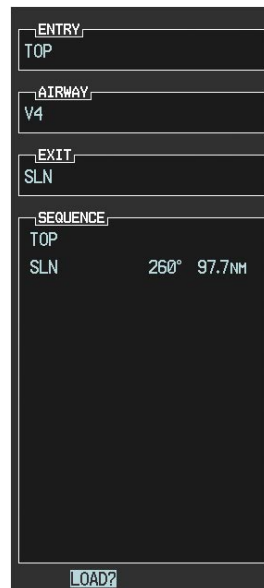
Figure 5-109 Ready to Load V4

k) Press the **ENT** Key.

l) V4 is now loaded into the flight plan as shown in Figure 5-110.
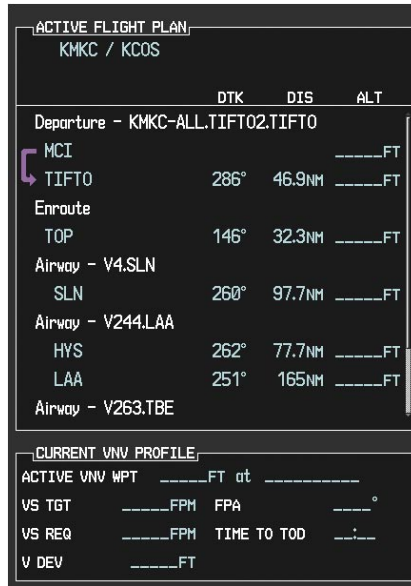
Figure 5-110 V4 is Loaded in the Flight Plan

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 5-111. Note the TOP to SLN leg is actually part of V4.

Figure 5-111 Comfirm Active Leg

d) Verify the displayed leg is the desired leg and press the **ENT** Key. Note in Figure 5-112, the magenta arrow in the flight plan window and magenta line on the map indicating V4 is now the active flight plan leg.
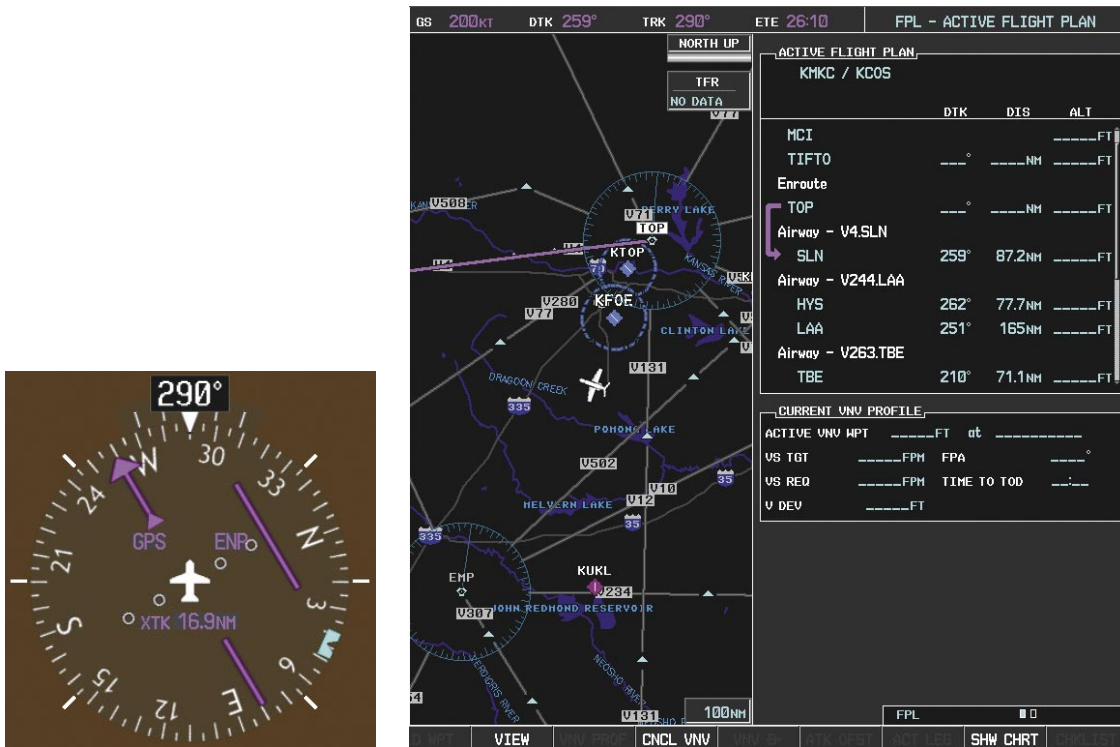
Figure 5-112 V4 Now Active Leg

6) The aircraft continues on heading 290°. When 2.0 nm from the intercept, 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 5-113.
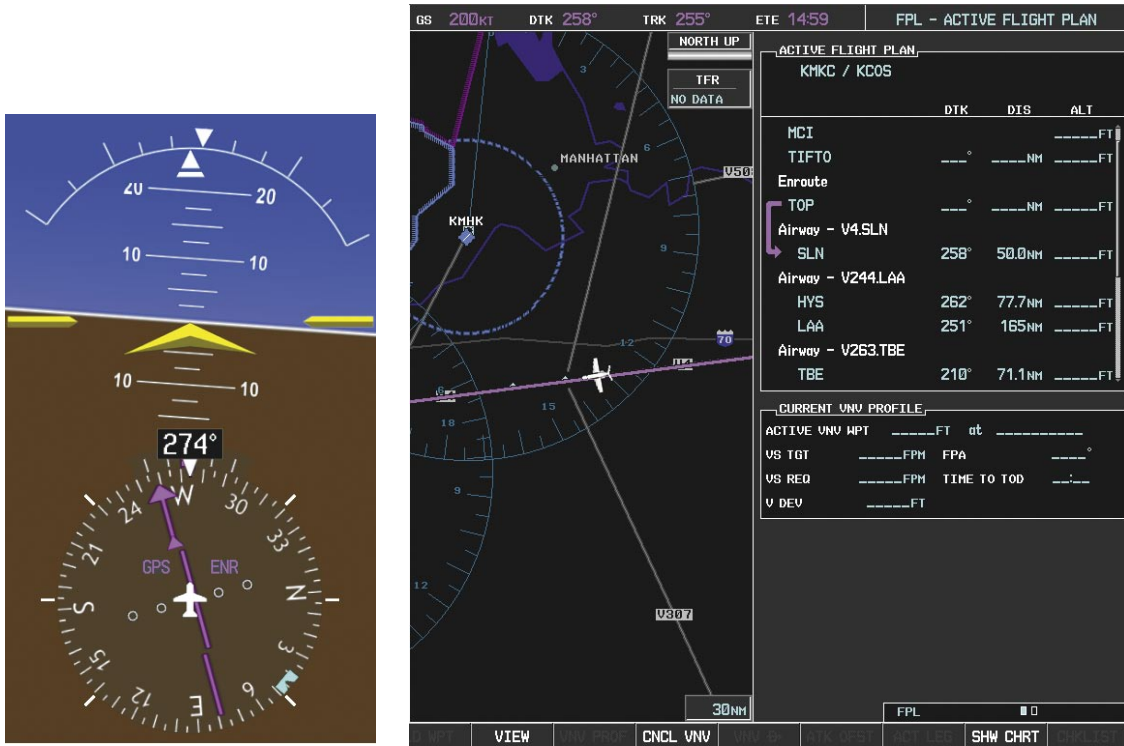
Figure 5-113 Turn on to Active Leg

8) At SLN, Victor Airway 244 (V244) is intercepted. Turn prompts are displayed in the PFD Navigation Status Box as seen in Figure 5-114.
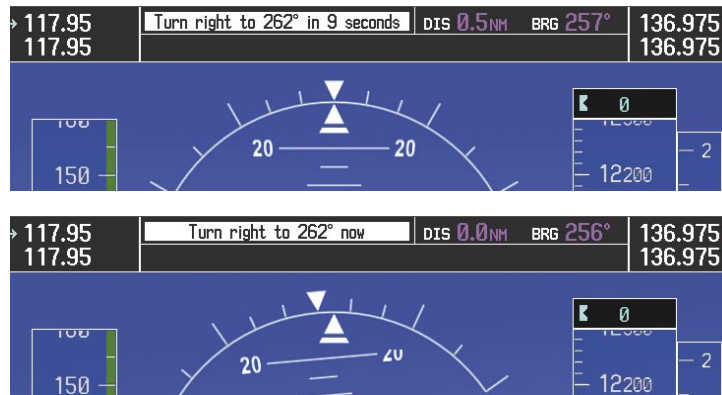
Figure 5-114 Turn to Intercept V244

9) As seen in Figure 5-115, V244 is now the active flight plan leg.
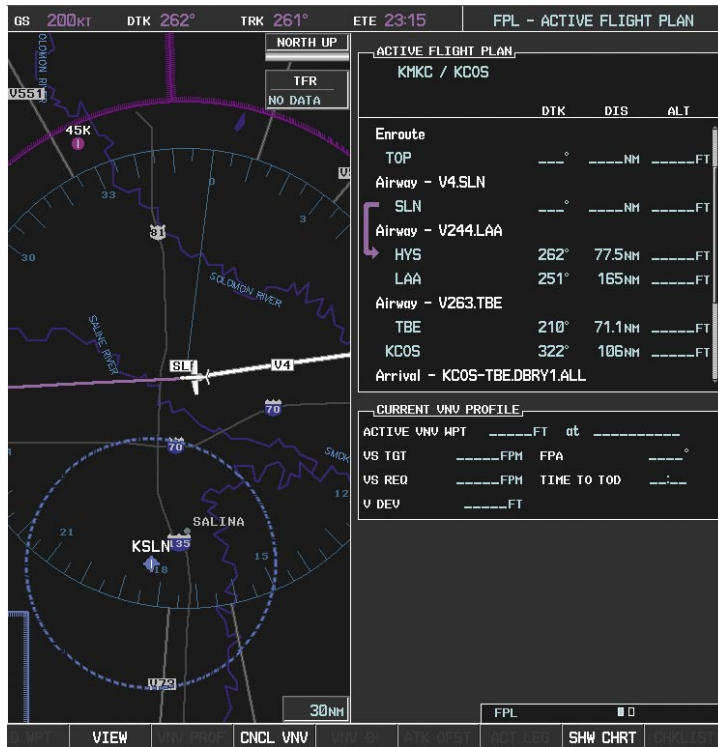
Figure 5-115 V244 Now Active Leg

10) At Lamar VOR (LAA) V263 is intercepted. See Figure 5-116.
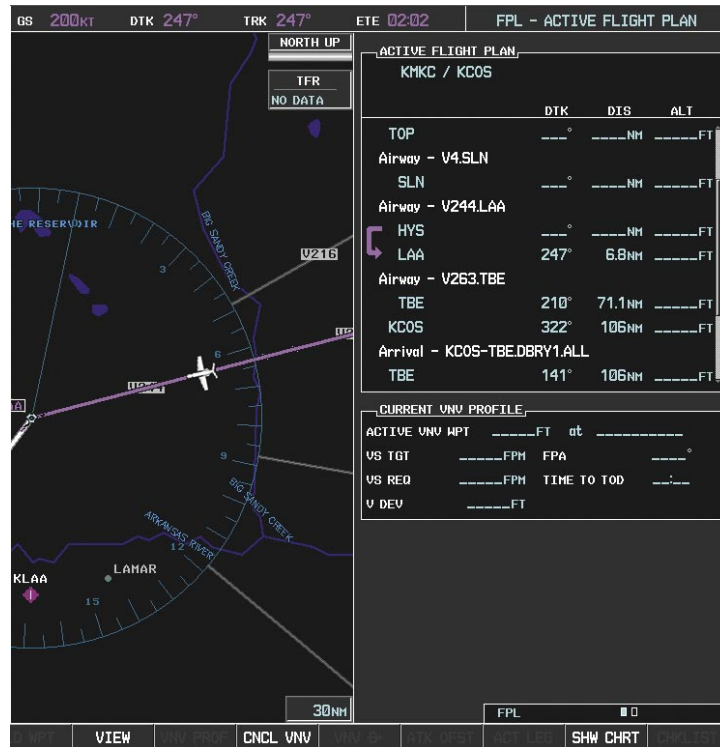
Figure 5-116 HYS to LAA Leg Active

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 5-117.

Figure 5-117 Direct To OPSHN

d) Turn the large **FMS** Knob to place the cursor in the VNV altitude field as shown in Figure 5-118.

Figure 5-118 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 5-119.

Figure 5-119 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.

h) Press the **ENT** Key twice to activate the direct-to. Note, in Figure 5-120, 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.

Figure 5-120 Direct-to Active

12) While proceeding to OPSHN, the preferred approach is the LPV approach to runway 35R and is selected.

a) Press the **PROC** Key to display the Procedures Window.

b) 'SELECT APPROACH' should be highlighted as shown in Figure 5-121.
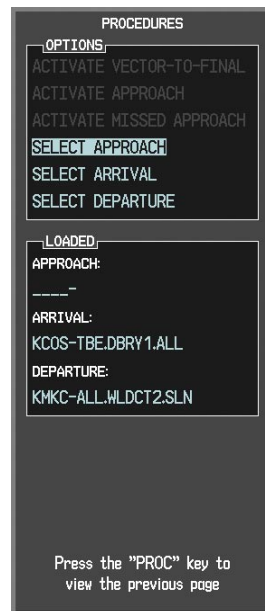
Figure 5-121 Proceudures Window

c) Press the **ENT** Key. A list of available approaches for the destination airport is displayed as in Figure 5-122.
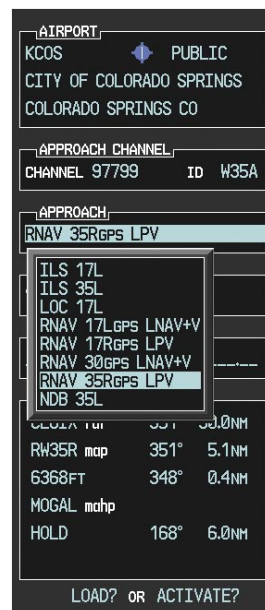
Figure 5-122 List of Available Approaches

d) Turn either **FMS** Knob to select the LPV approach for 35R as shown in Figure 5-122.

e) Press the **ENT** Key. A list of available transitions for the selected approach is displayed as in Figure 5-123.
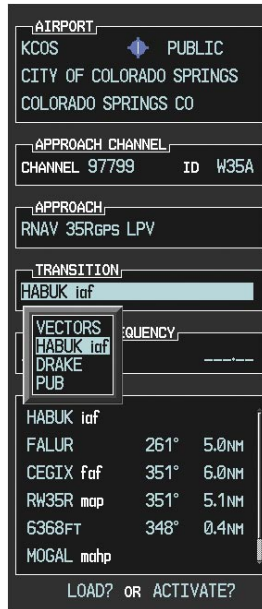
Figure 5-123 List of Available Transitions

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) With 'LOAD?' highlighted, again press the **ENT** Key. The selected approach is added to the flight plan as seen in Figure 5-124.
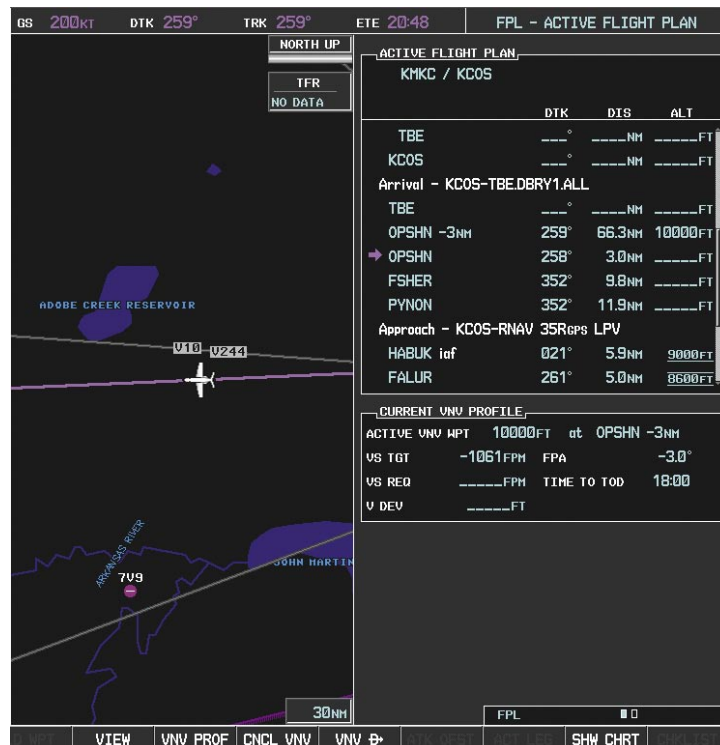
Figure 5-124 Loaded Approach

13) Note the altitude constraints associated with each of the approach waypoints as seen in Figure 5-125. 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 5-125. Vertical guidance to 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 5-125 Vertical Guidance is Active to the FAF

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 5-126.

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 5-126 Adjusting the Descent

c) Press the **ENT** Key.

15) As seen in Figure 5-127, the aircraft is approaching TOD. Note the target vertical speed required to reached 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 5-128.
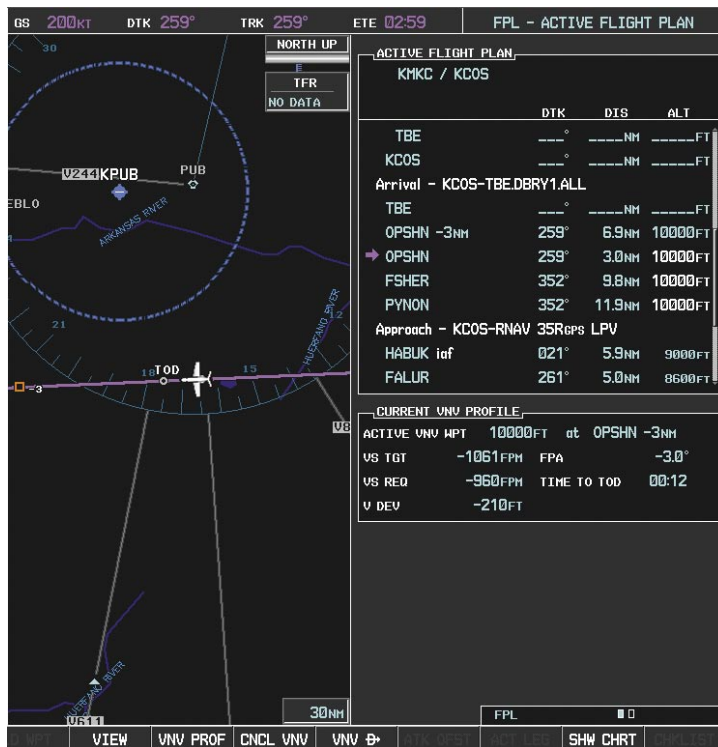
Figure 5-127 Approaching Top of Descent (TOD)
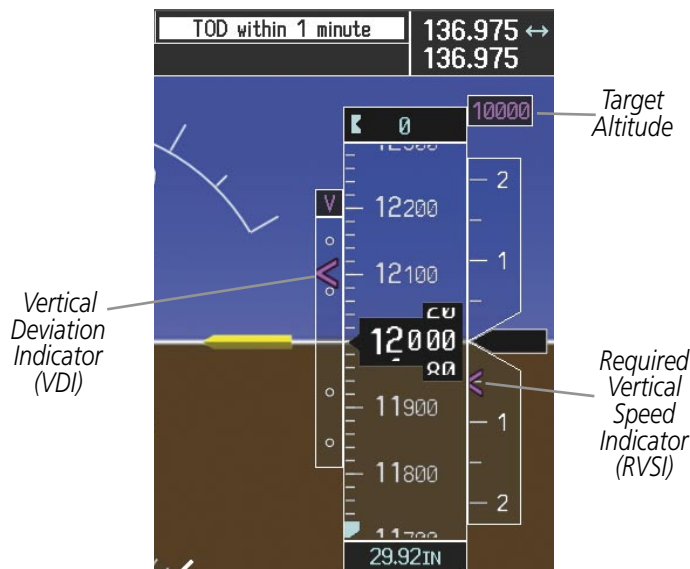
Figure 5-128 VDI & RVSI Upon Reaching Top of Descent (TOD)

16) Upon reaching TOD, a descent vertical speed is established which places the VSI pointer in line with the RVSI as shown in Figure 5-129.

Keep Vertical Deviation Pointer Centered

Align Actual Vertical Speed with Required Vertical Speed
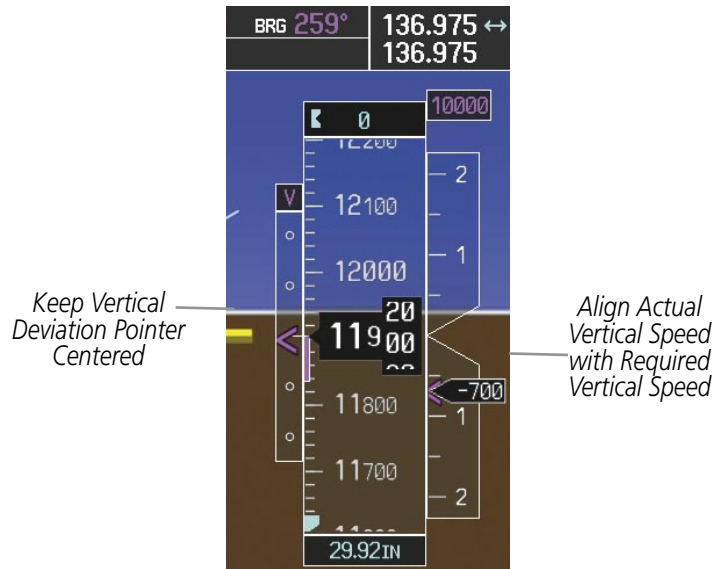
Figure 5-129 VDI & RVSI Showing Correctly Established Descent

17) When the aircraft is one minute from the bottom of descent (BOD) it is annunciated as shown in Figure 5-130. Upon reaching the offset waypoint for OPSHN, the aircraft is at 10,000 feet.

**Figure 5-130 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 5-131. 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.
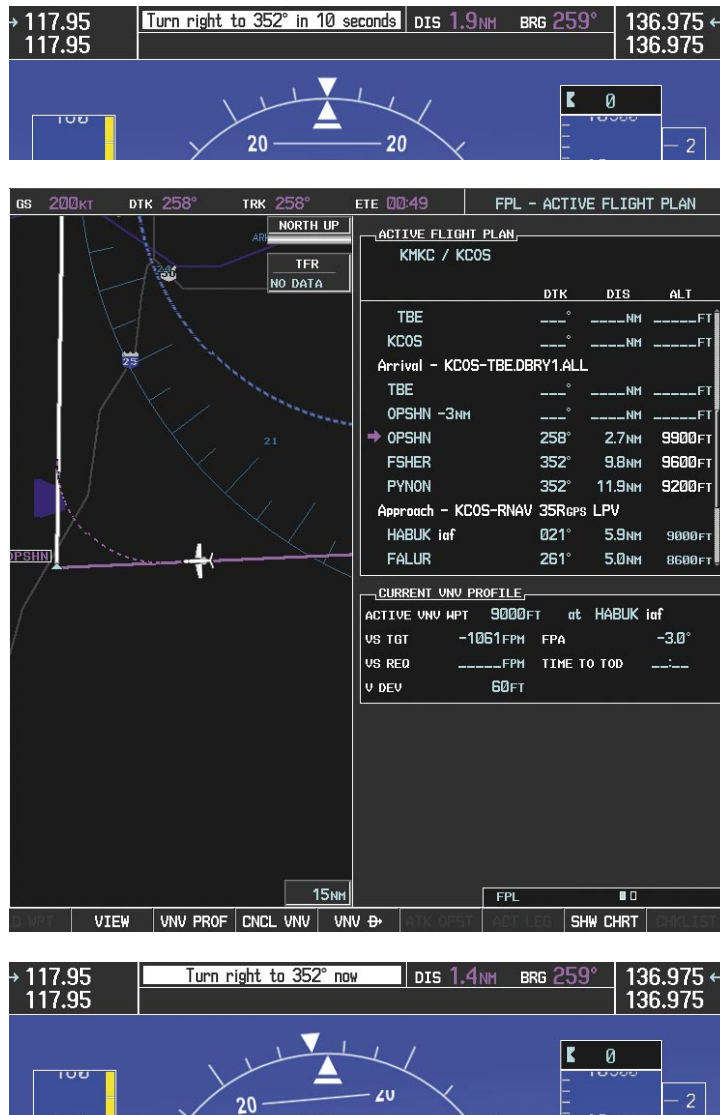
Figure 5-131 Turn to intercept OPSHN to FSHER Leg

19) After passing OPSHN, the next leg of the arrival turns magenta as shown in Figure 5-132. The magenta arrow in the flight plan list now indicates the OPSHN to FSHER leg of the arrival procedure is now active.
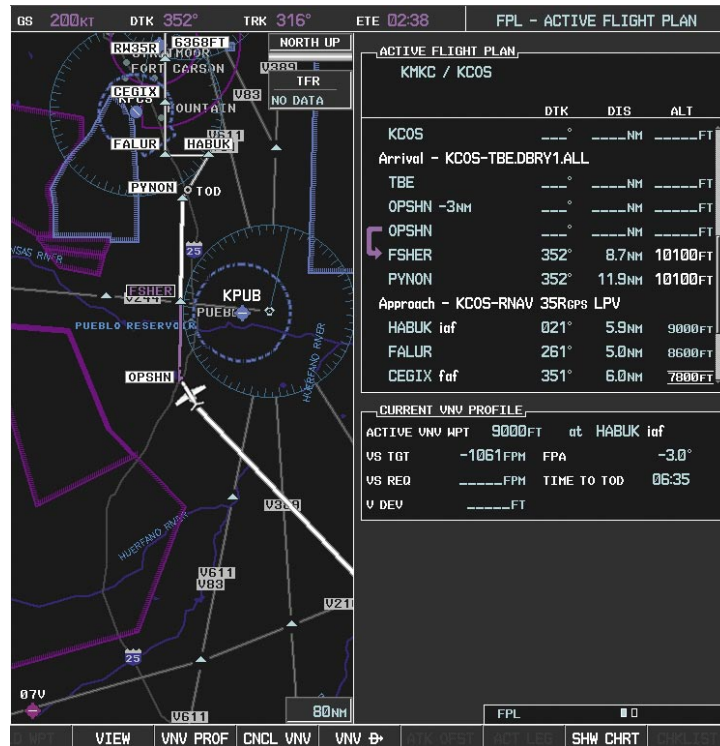
Figure 5-132 Tracking the OPSHN to FSHER Leg

20) The flight continues through the arrival procedure to PYNON (see Figure 5-133). 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.
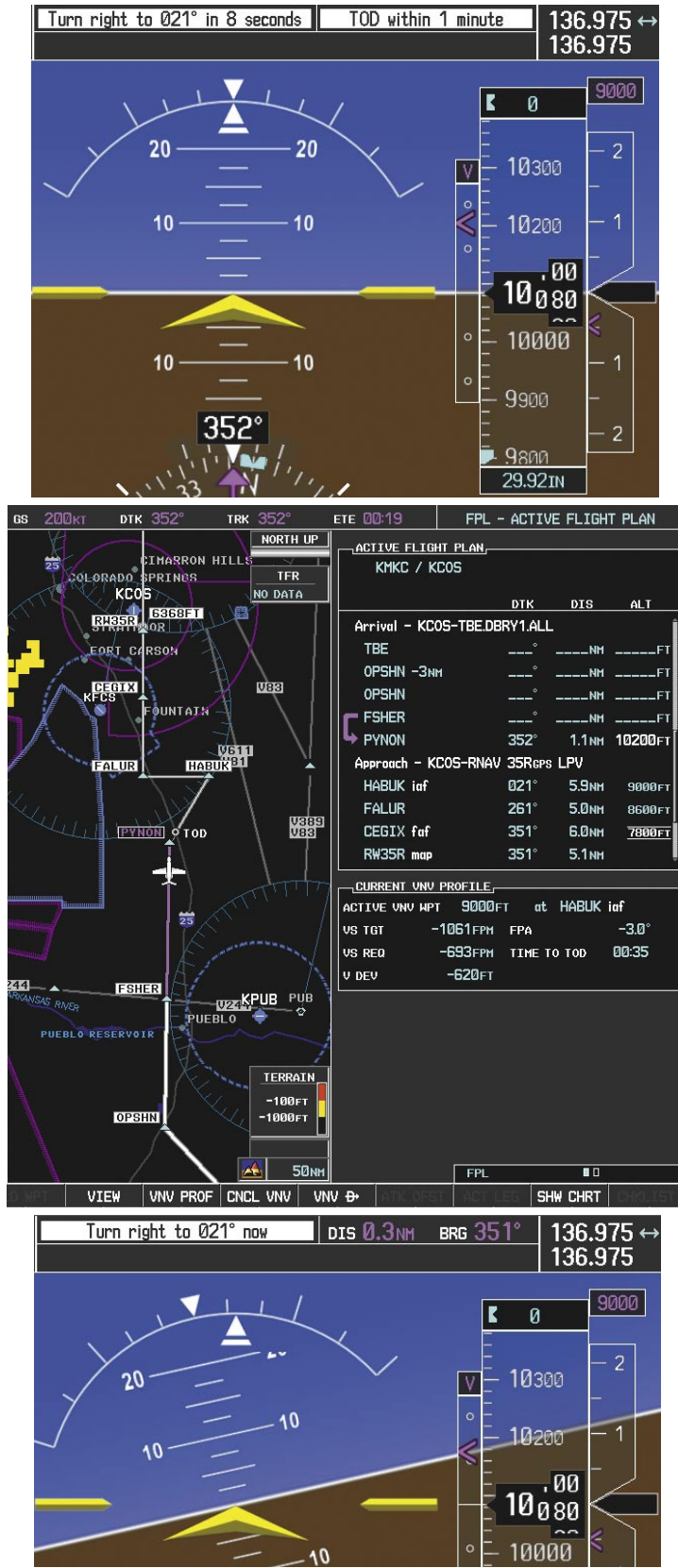
Figure 5-133 Approaching PYNON

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 5-134).
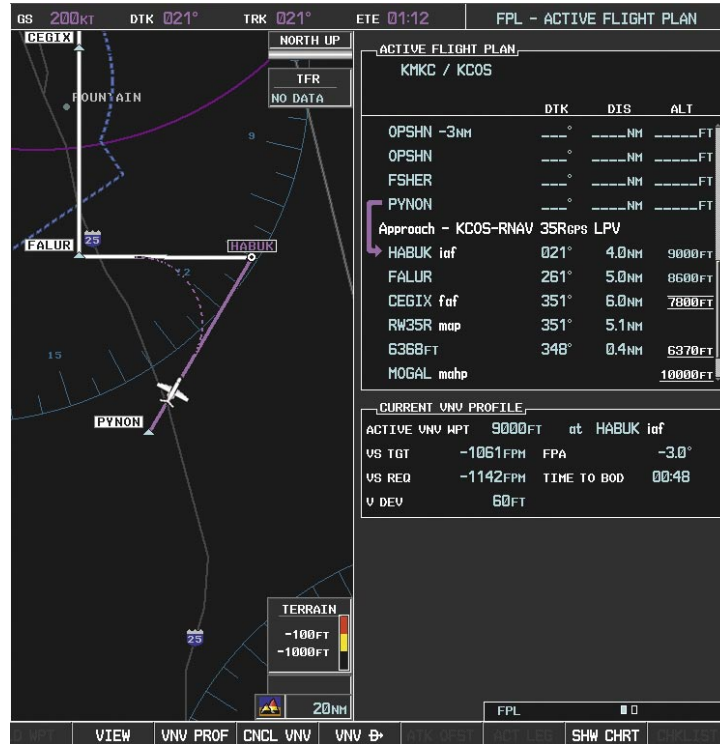
Figure 5-134 Approach is Now Active

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 5-135.

   c) Press the **ENT** Key to activate the approach.
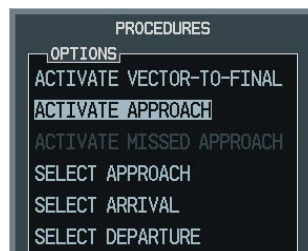
Figure 5-135 Manually Activate Approach

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.
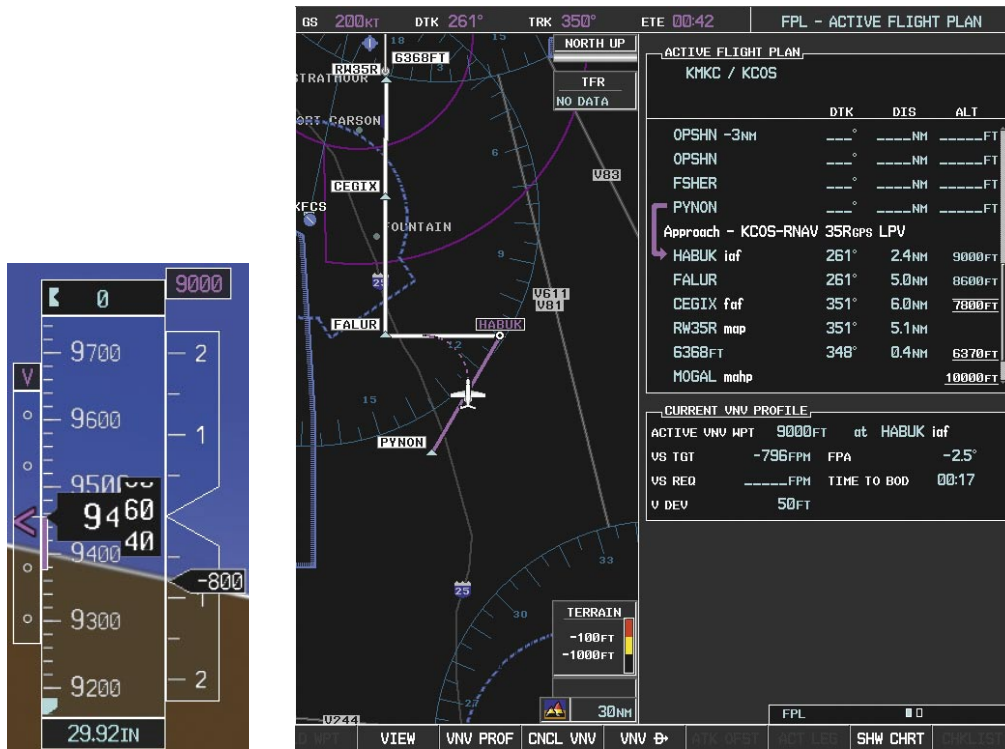
Figure 5-136 Descending Turn to the Initial Approach Fix (IAF)

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 5-137) when the final approach course becomes active.
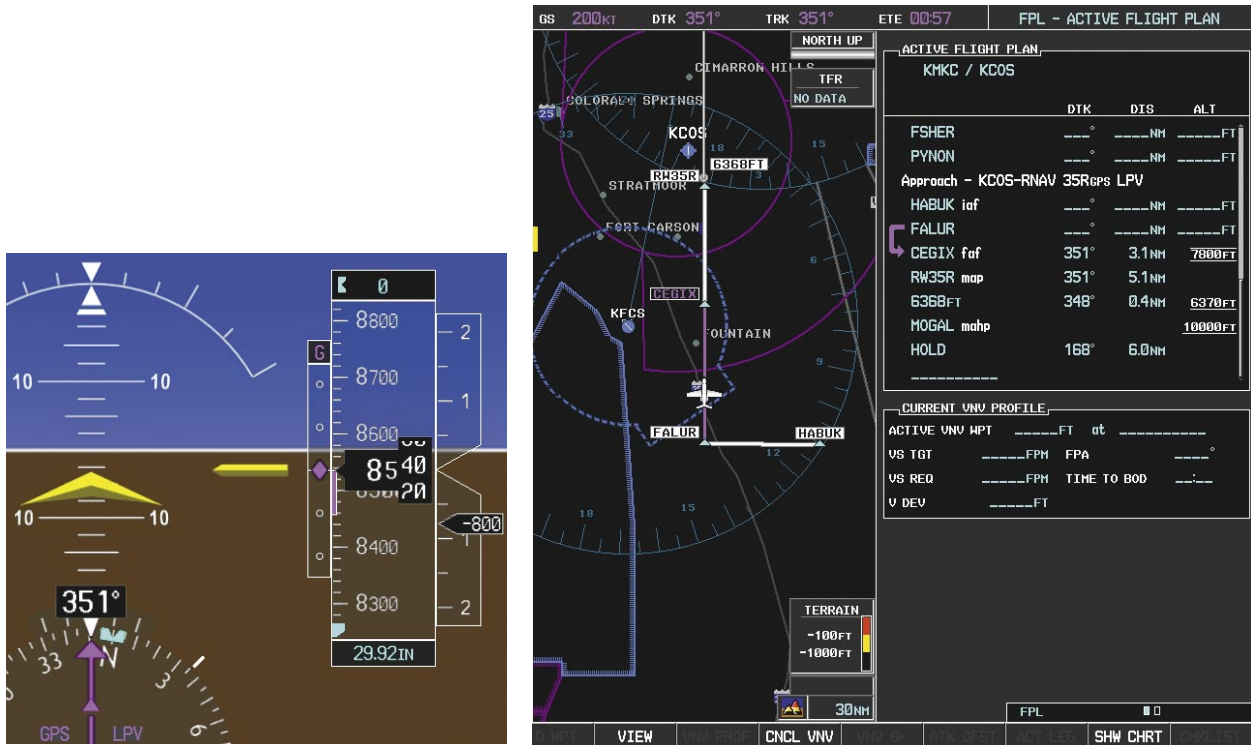
Figure 5-137 Descending to the FAF

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 5-137.

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 5-138.
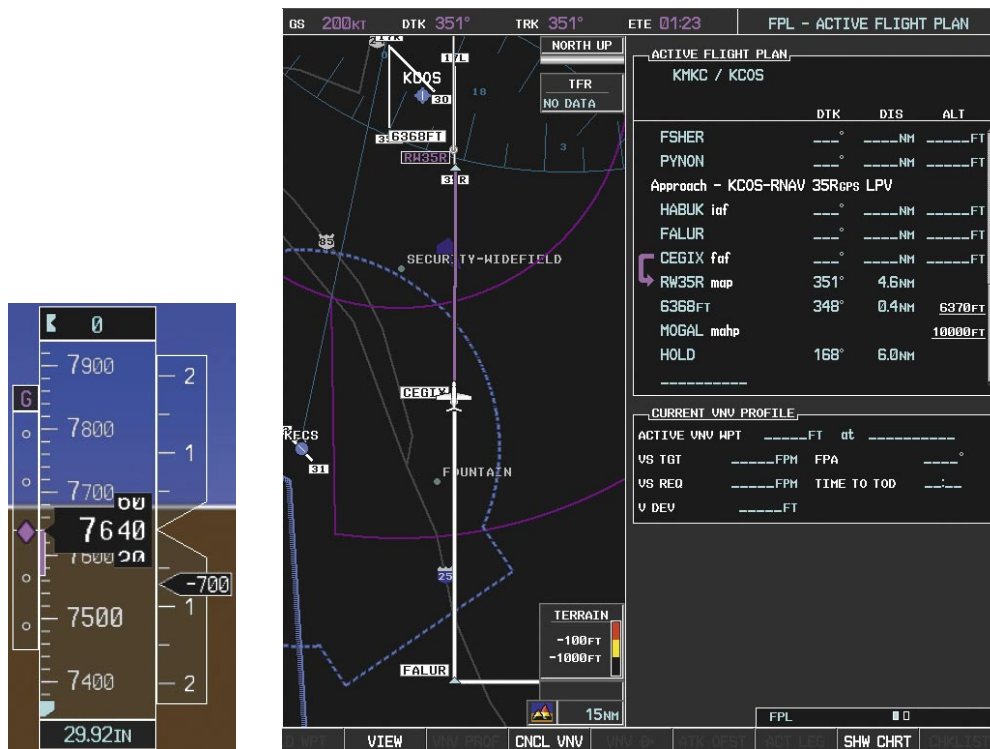
Figure 5-138 Descending to the Missed Approach Point

In this missed approach procedure, the fix immediately following the MAP (in this case '6368FT') is not part of the published procedure. It is simply a fix that defines a leg which guides the aircraft along the runway centerline until the required altitude to make the first turn on the missed approach is exceeded. 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 this fix until an altitude of 6,368 feet reached. After reaching 6,368 feet, a direct-to is established to the published fix (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. The altitude constraint value defaults to 400 feet AGL when the fix is not part of the published procedure.

In some missed approach procedures this altitude fix may be part of the published procedure. For example, the procedure dictates a climb to 5,500 feet, then turn left and proceed to the Missed Approach Hold Point (MAHP). In this case, the altitude fix would be labeled '5500FT'. Again, if the aircraft altitude is lower than this prescribed altitude, a direct-to is established to this fix when the missed approach procedure is activated.

25) Upon reaching the MAP, it is decided to execute a missed approach. Automatic waypoint sequencing is suspended past the MAP. Select 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 5-139. The aircraft is climbing to 10,000 feet. The CDI flight phase now changes from LPV to MAPR as seen on the HSI.
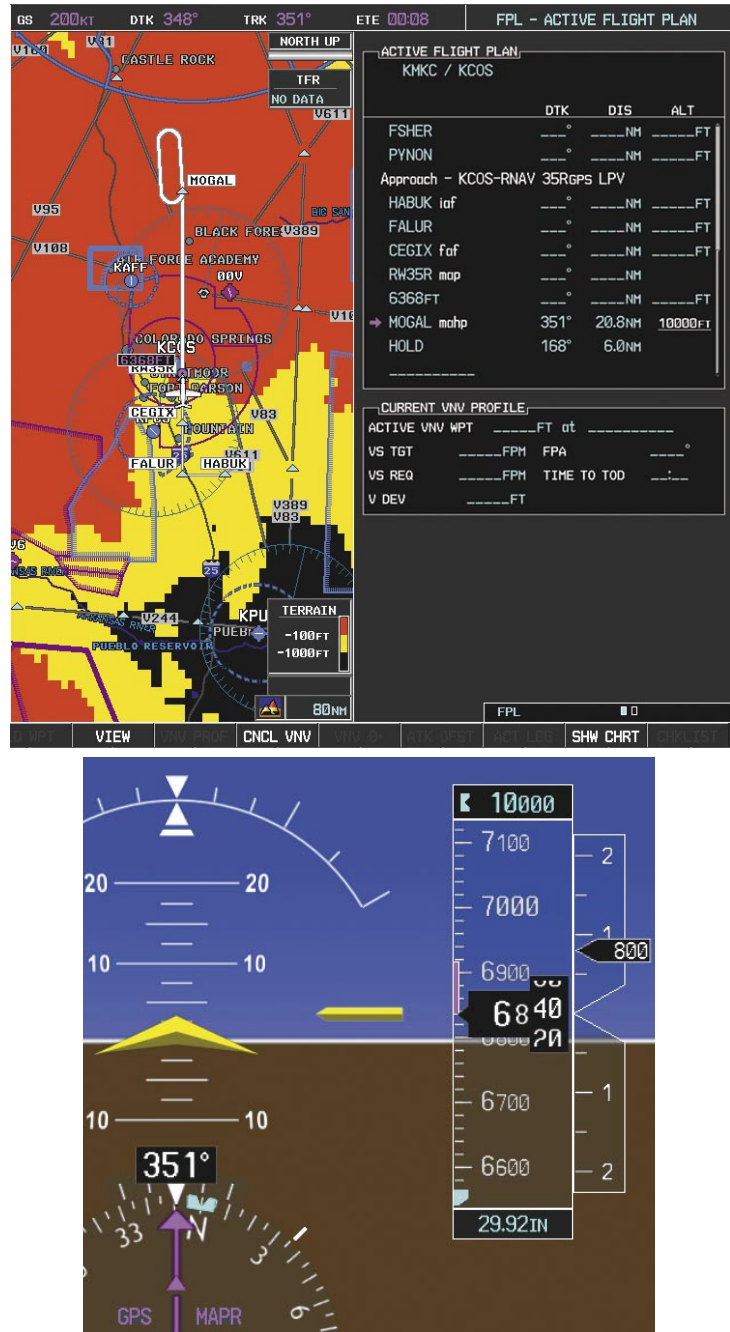

Figure 5-139 Missed Approach Active

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 5-140.

Figure 5-140 Establishing the Holding Pattern

27) The aircraft maintains 10,000 feet while following the magenta line through the hold as in Figure 5-141.
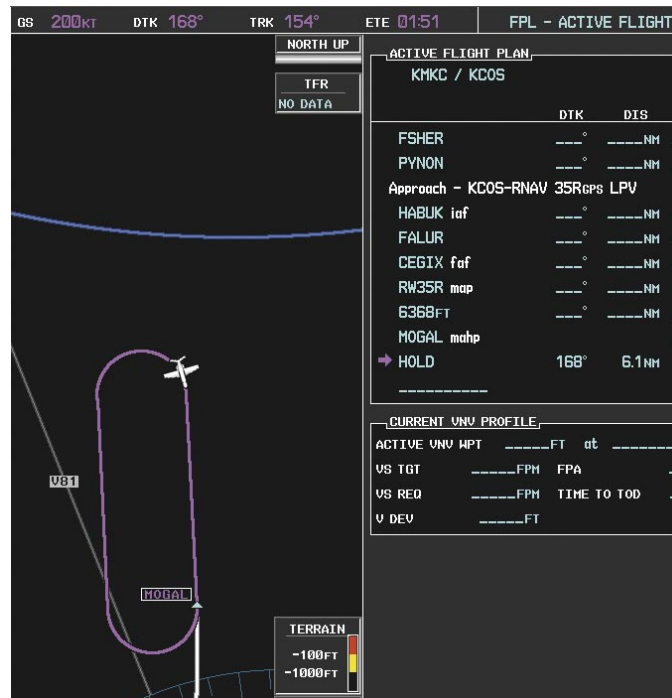
Figure 5-141 Hold Established

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/WAAS 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 5-140. 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 5-142. Also, the CDI deviation bar is removed from the display. Lastly, but at the same time, a 'GPS NAV LOST' alert message appears on the PFD. Normal navigation using GPS/WAAS 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 5-142.

Also, while the G1000 is in DR Mode, the autopilot does not couple to GPS, and both TAWS and Terrain Proximity are disabled. Additionally, the accuracy of all nearest information (airports, airspaces, and waypoints) is questionable. Finally, airspace alerts continue to function, but with degraded accuracy.
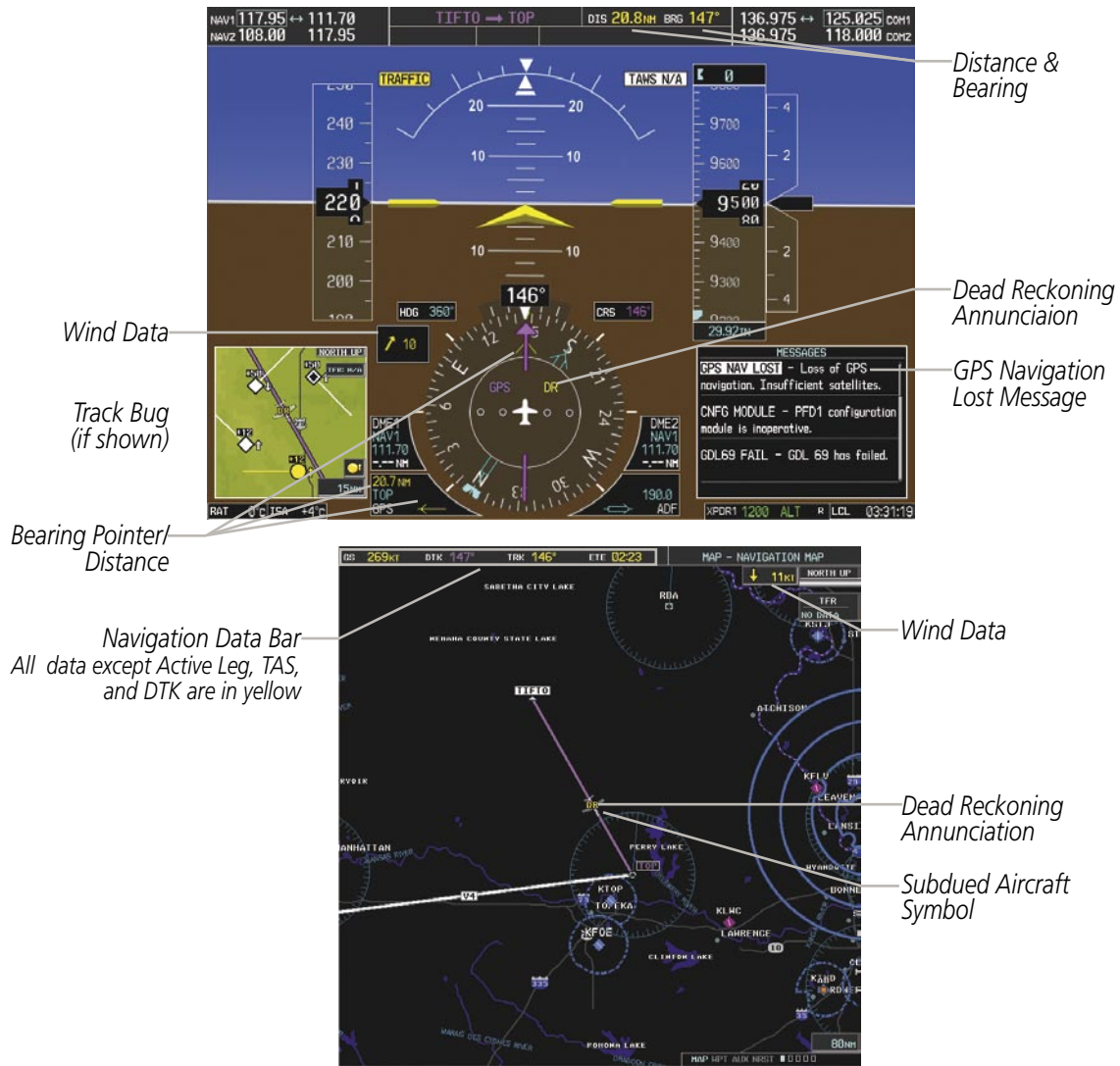
Figure 5-142 Dead Reckoning Mode - GPS Derived Data Shown in Yellow

> **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 of potential hazards to flight safety associated with weather, terrain, and air traffic.

This section is divided into the following groups:

Weather

- GDL 69/69A XM® Satellite Weather
- GWX 68 Airborne Color Weather Radar

Terrain Avoidance

- TAWS (Terrain Awareness Warning System - TSO-C151b certified)

Traffic

- TIS (Traffic Information Service)
- Honeywell® KTA 870 TAS (Traffic Alert System)

Determine what type of traffic system is installed by looking at the traffic page softkeys.

TIS Softkeys

| | | STANDBY | OPERATE | | TNA MUTE | | | CHKLIST |

TAS Softkeys

| | | STANDBY | OPERATE | TEST | | ALT MODE | | CHKLIST |

Figure 6-1 Traffic Softkeys

6.1 XM SATELLITE WEATHER (OPTIONAL)

> **NOTE:** *XM Satellite Weather data provides information for avoiding hazardous weather. It is not meant for use to penetrate hazardous weather.*

XM Satellite Weather is provided through the GDL 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 XM Satellite Radio® entertainment services. Both weather data and entertainment programming operate in the S-band frequency range to provide continuous reception capabilities at any altitude throughout North America.

XM Satellite Radio services are subscription-based. For more information on specific service packages, visit www.xmradio.com. Refer to the Additional Features Section for information about XM Radio Entertainment.

ACTIVATING XM SATELLITE SERVICES

Before XM Satellite Weather can be used, the service must be activated. Service is activated by providing XM Satellite Radio with coded IDs unique to the installed GDL 69A. XM Satellite Radio and XM Satellite Weather services each have coded IDs. The Audio and Data Radio IDs must be provided to XM Satellite Radio 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

• 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 Audio and Data Radio IDs cannot be located.

XM Satellite Radio uses the coded IDs to send an activation signal that allows the G1000 to display weather data and/or entertainment programming provided through the GDL 69A.

Activating the XM Satellite Weather and XM Satellite Radio Services:

1) Contact XM Satellite Radio by email (address listed on their website, www.xmradio.com) or by the customer service phone number listed on the website. Follow the instructions provided by XM Satellite Radio services.

2) Select the next-to-last page in the AUX page group.

3) Select the **INFO** Softkey to display the XM Information Page.

4) Verify that the desired services are activated.

5) Select the **LOCK** Softkey to lock subscription information.

6) Turn the large **FMS** Knob to highlight YES.

7) To complete activation, press the **ENT** Key.

Data Radio ID (for XM Weather)

Weather Products (Available Products for Service Class Indicated in Green)

Select **INFO** Softkey to Display XM Information page

Audio Radio ID (for XM Satellite Radio)

Select **LOCK** Softkey to Lock Subscription Information

Figure 6-2 XM Information Page

USING XM SATELLITE WEATHER PRODUCTS

The primary map for viewing XM Weather data is the Weather Data Link Page in the Map Page Group. This is the only G1000 map display capable of showing information for all available XM weather products.

Viewing the 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 Weather Data Link Page.

NEXRAD Weather Product Age and Legend

NEXRAD Weather Product Display Enabled

Figure 6-3 Weather Data Link Page

When a weather product is active on the Weather Data Link Page or the Navigation Map Page, the age of the data is displayed on the screen. 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 the 30-, 60-, or 90-minute Expiration Time intervals, the data is considered expired and is removed from the display. This ensures that the displayed data is consistent with what is currently being broadcast by XM Satellite Radio services. If more than half of the expiration time has elapsed, the color of the product age displayed changes to yellow.

This table shows the weather product symbols, the expiration time and the refresh rate. The refresh rate represents the interval at which XM Satellite Radio broadcasts 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. Weather data is refreshed at intervals that are defined and controlled by XM Satellite Radio and its data vendors.

Weather Product	Symbol	Expiration Time (Minutes)	Refresh Rate (Minutes)
NEXRAD		30	5
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
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

This table shows which XM products can be displayed (indicated with a '+' symbol) on specific maps.

Weather Product	PFD Inset Map	Navigation Map Page	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)			+				
Radar Coverage		+	+				
TFRs	+	+	+	+	+	+	+
TAFs			+	+			

Table 6-2 Weather Product Display Maps

WEATHER SOFTKEYS ON THE WEATHER DATA LINK PAGE

Softkeys control the display of weather information on most MFD pages and the PFD Inset Map (The figure shows the weather product softkeys for the 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. Unavailable weather products have subdued softkey labels (softkeys are disabled from selection).
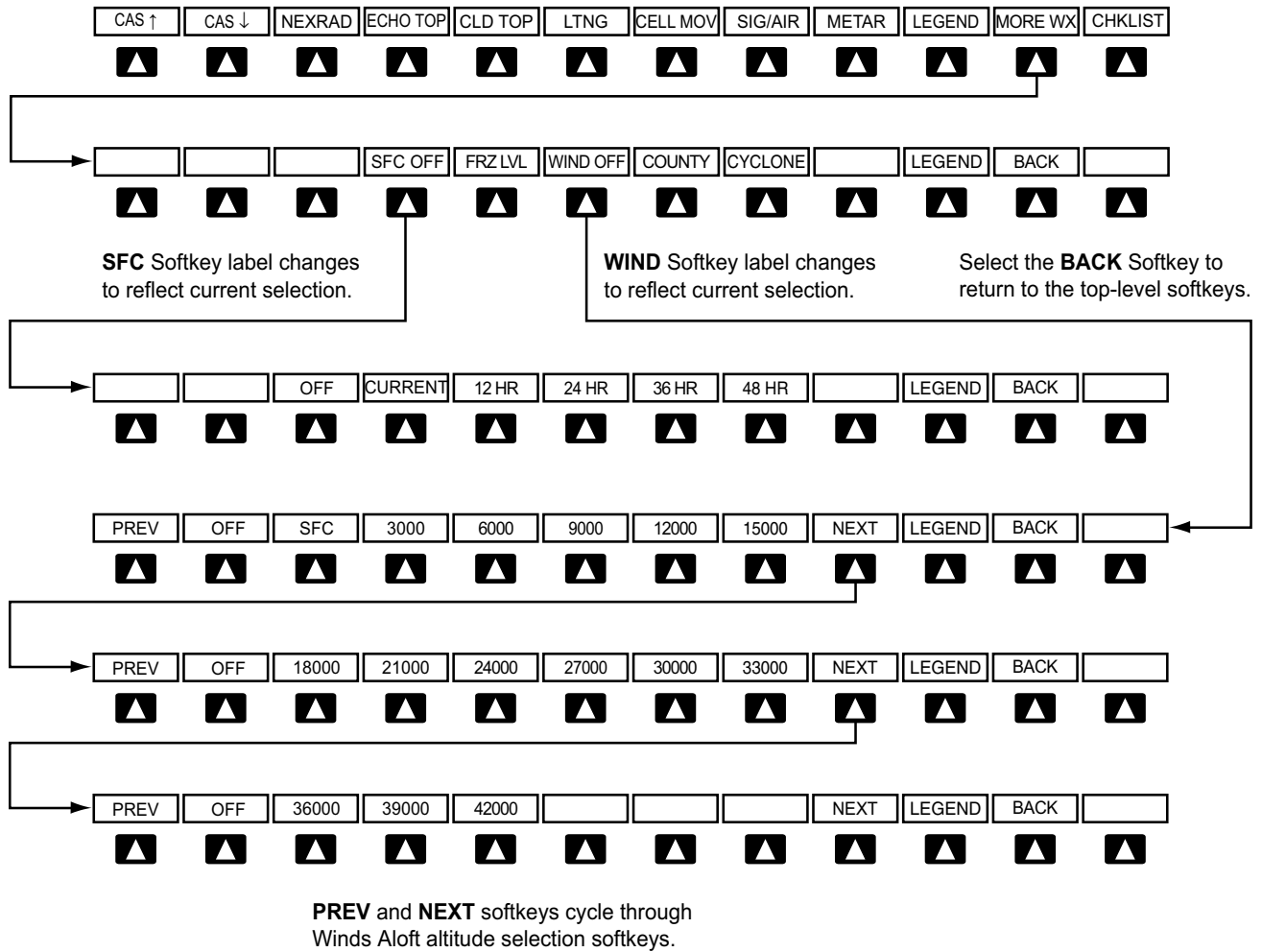
Figure 6-4 Weather Softkeys

The setup menus for the Navigation Map Page and the Weather Data Link Page control the map range settings above which weather products data are decluttered from the display. If a map range larger than the weather product map range setting is selected, the weather product data is removed from the map. The menus also provide a means in addition to the softkeys for enabling/disabling display of weather products.

Setting up and customizing the Weather Data Link Page:

1) Select the Weather Data Link Page.

2) Press the **MENU** Key.

3) With 'Weather Setup' highlighted, press the **ENT** Key (Figure 6-5).

4) Turn the large **FMS** Knob or press the **ENT** Key to scroll though product selections (Figure 6-6).

5) Turn the small **FMS** Knob to scroll though options for each product (ON/OFF, range settings, etc.).

6) Press the **ENT** Key to select an option.

7) Press the **FMS** Knob or **CLR** Key to return to the Weather Data Link Page with the changed settings.

DATA LINK SETUP		
NEXRAD DATA	Off	2000NM
ECHO TOP DATA	Off	2000NM
CLOUD TOP DATA	Off	2000NM
LTNG DATA	Off	2000NM
CELL MOV DATA	Off	2000NM
SIG/AIR	Off	2000NM
METAR DATA	Off	2000NM
SFC DATA	Off	2000NM
SFC TIME		CURRENT
FRZ LVL DATA	Off	2000NM
WND ALF DATA	Off	2000NM
WND ALF ALT		SURFACE
COUNTY DATA	Off	2000NM
CYCLONE DATA	Off	2000NM

Press the FMS CRSR knob to return to base page

PAGE MENU
OPTIONS
Weather Setup
Weather Legend

Press the FMS CRSR knob to return to base page

Figure 6-5 Weather Data Link Page Menu   **Figure 6-6 Weather Data Link Page Setup Menu**
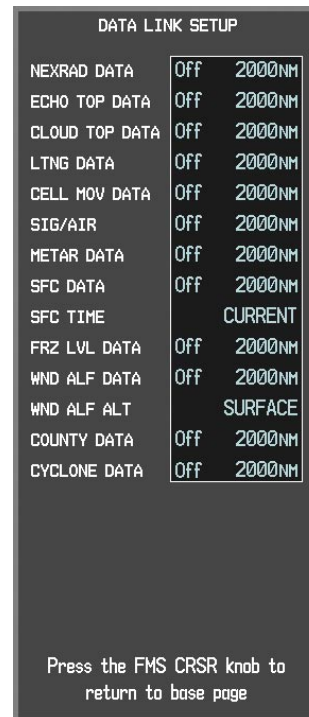
Restoring default Weather Data Link Page settings:

1) Select the 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 other than the 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 6-7).

4) Turn the small **FMS** Knob to select the 'Weather' Group and press the **ENT** Key (Figure 6-8).

5) Turn the large **FMS** Knob or press the **ENT** Key to scroll though product selections (Figure 6-9).

6) Turn the small **FMS** Knob to scroll though 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 6-7 Navigation Map Page Menu

Figure 6-8 Navigation Map Page Setup Menu
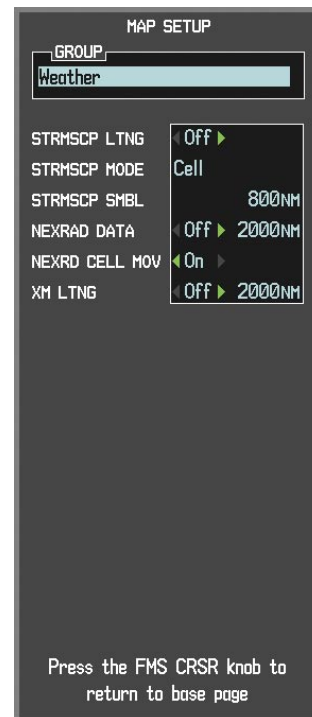
Figure 6-9 Navigation Map Page Setup Menu, Weather Group

Each active weather product has an associated legend which can be displayed on the Weather Data Link Page. Weather product legends are not interchangeable.

Viewing legends for displayed weather products

1) Select the Weather Data Link Page.

2) Select 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, select 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
- METARs
- Cell Movement
- County Warnings
- SIGMETs
- TFRs
- AIRMETs

The map panning feature is enabled by pressing the **Joystick**. The map range is adjusted by turning the **Joystick**. If the map range is adjusted while panning is enabled, the map is re-centered on the Map Pointer.

Additional Information on Weather Feature Selected with Map Pointer

Tornado Warning Selected With Map Pointer
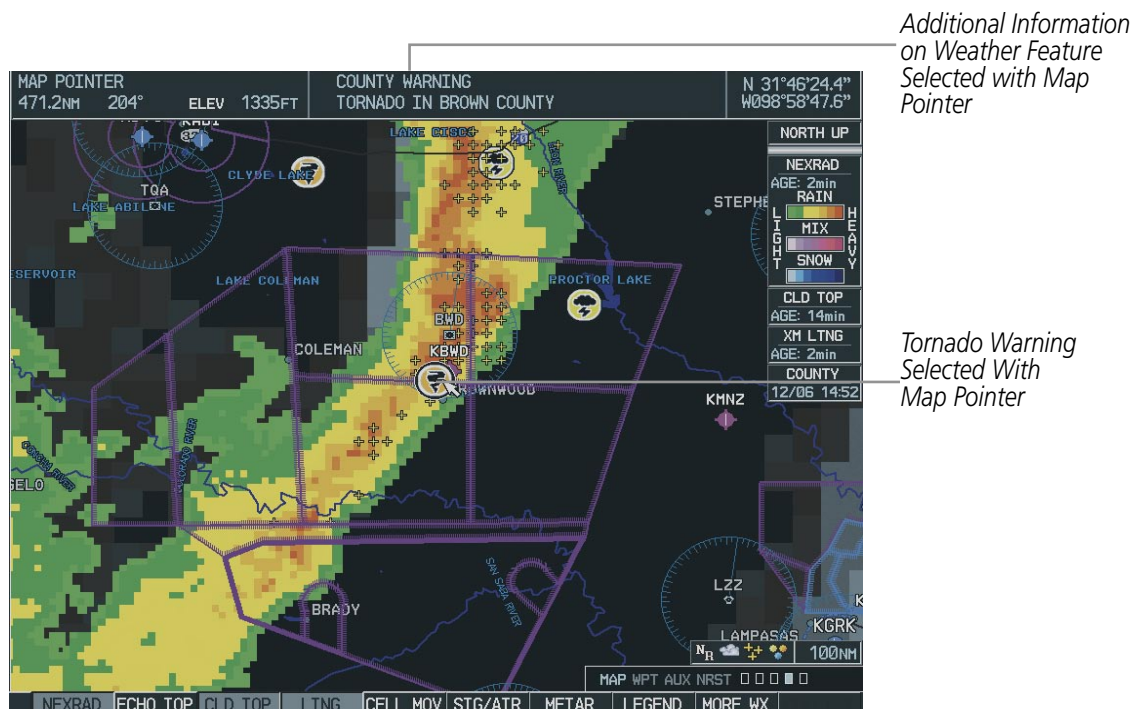
Figure 6-10 Panning on the Weather Data Link Page

NEXRAD

> **NOTE:** *NEXRAD cannot be displayed at the same time as map topography and/or terrain.*

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 for 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.
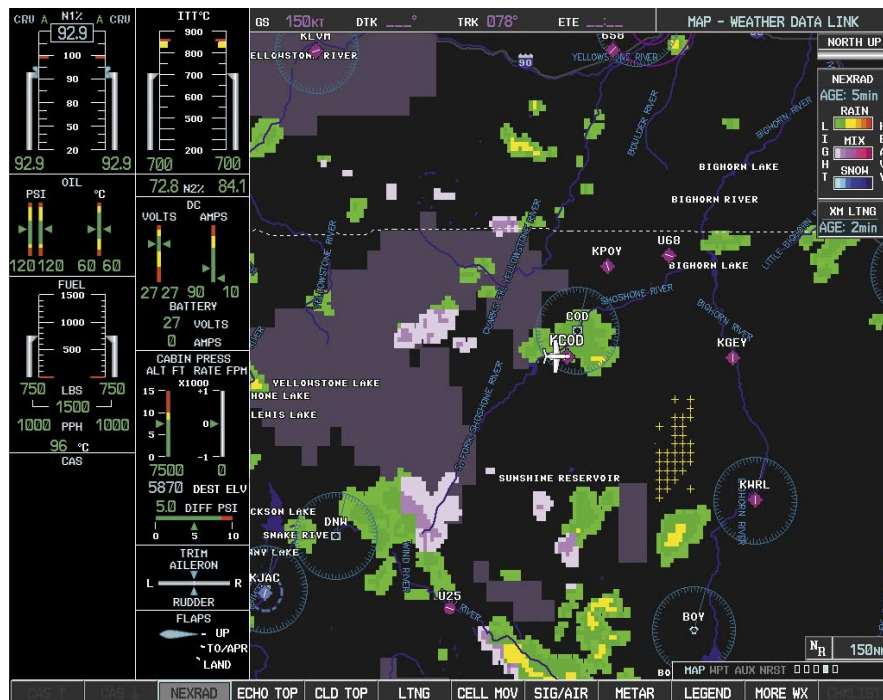
Figure 6-11 NEXRAD Data on the Weather Data Link Page

NEXRAD data can be displayed on the following maps:

- PFD Inset Map
- Navigation Map Page
- Weather Data Link Page
- Airport Information Page

- Trip Planning Page
- Nearest Pages
- Flight Plan Pages

Displaying NEXRAD weather information:

1) Select the **MAP** Softkey (for the PFD Inset Map, select the **INSET** Softkey). This step is not necessary on the Weather Data Link Page.

2) Select 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 Weather Data Link Page. For the NEXRAD legend, select the **LEGEND** Softkey when NEXRAD is selected for display.
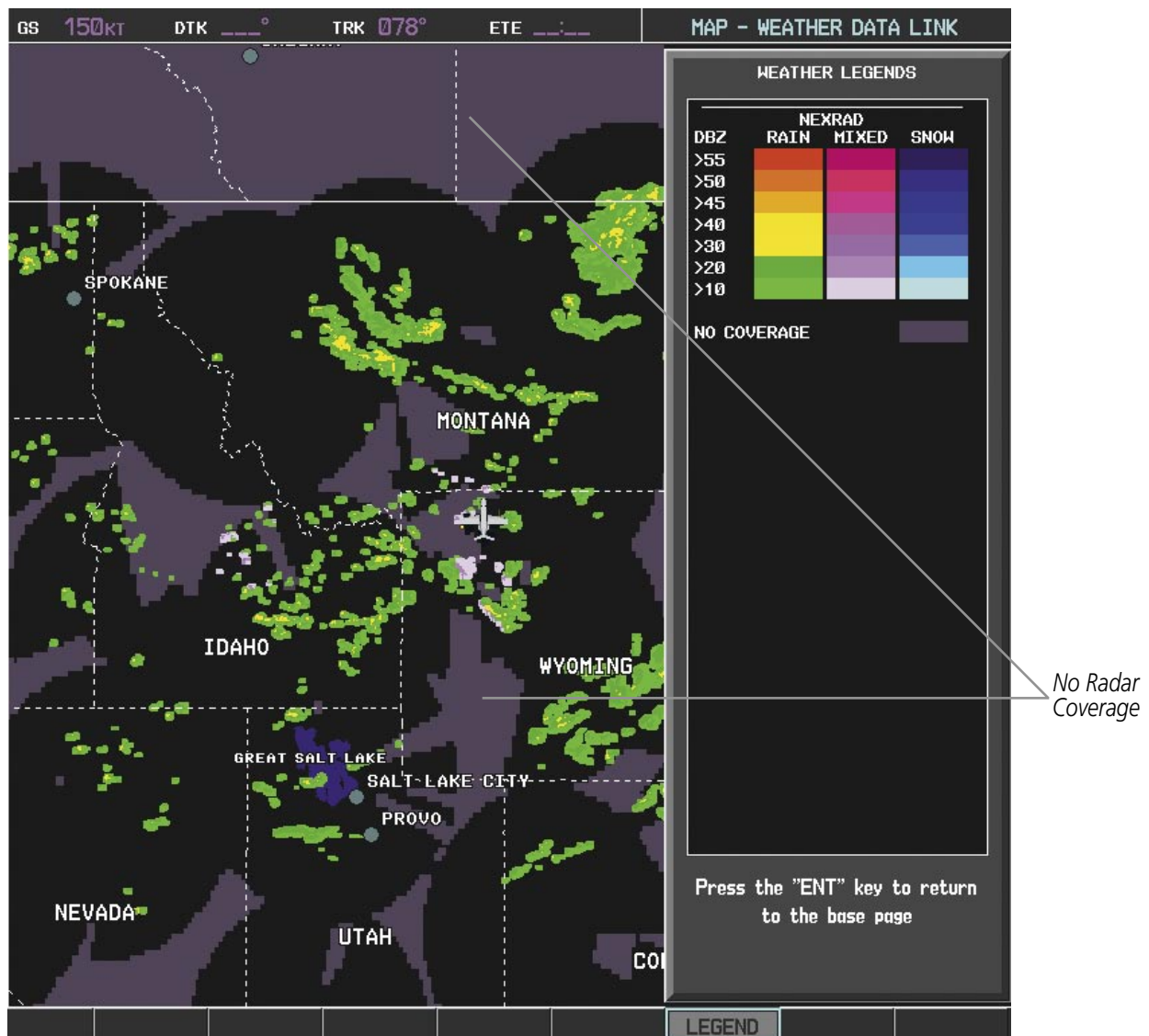
Figure 6-12 NEXRAD Data with Legend

The display of radar coverage is always active when NEXRAD is selected. The display indicates the currently available NEXRAD radar coverage areas. Information is unavailable or is not being collected in areas where the shading is grayish-purple in color. This means that the radar capability exists in the grayish-purple areas, but that it is not active or is off-line.

REFLECTIVITY

Reflectivity is the amount of transmitted power returned to the radar receiver. Colors on the NEXRAD display directly correlate to the level of detected reflectivity. Reflectivity as it relates to hazardous weather can be very complex.

The role of radar is essentially to detect moisture in the atmosphere. Simply put, certain types of weather reflect radar better than others. The intensity of a radar reflection is not necessarily an indication of the weather hazard level. For instance, wet hail returns a strong radar reflection, while dry hail does not. Both wet and dry hail can be extremely hazardous.

The different 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.

Each block covers an Area of 4 sq. km
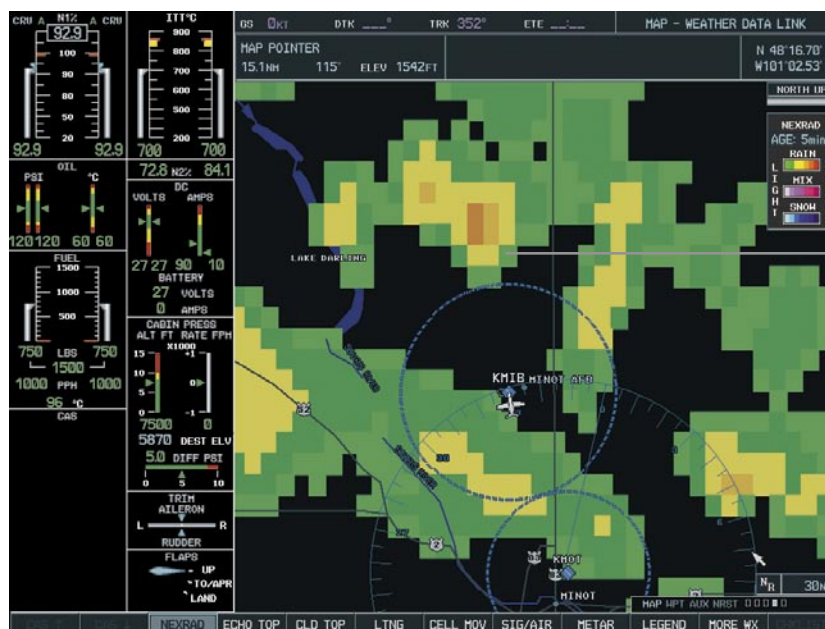
Figure 6-13 NEXRAD Data - Zoomed

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

ECHO TOPS

NOTE: *Display of Echo Tops is mutually exclusive with Cloud Tops and NEXRAD.*

Echo Tops data 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.
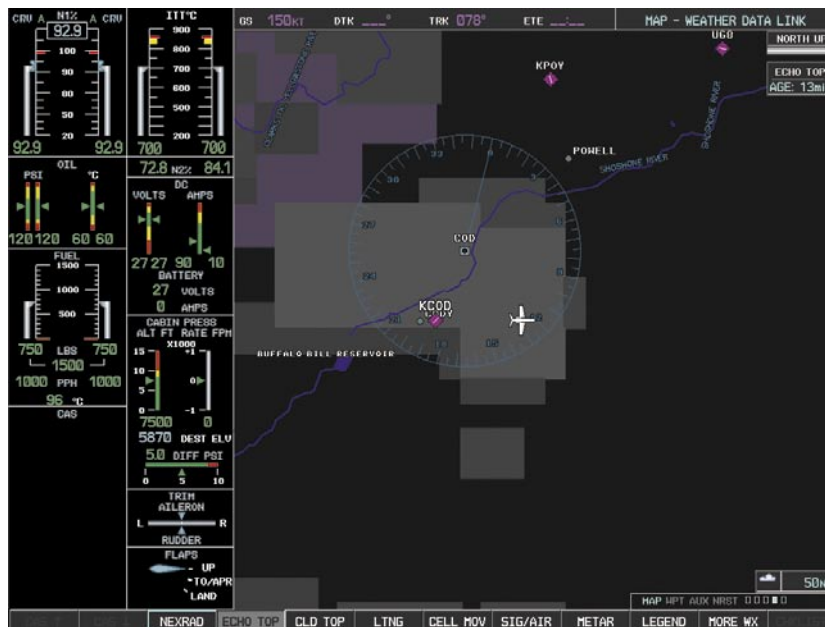
Figure 6-14 Echo Tops Data

Displaying Echo Tops information:

1) Select the Weather Data Link Page.

2) Select the **ECHO TOPS** Softkey.

To display the Echo Tops legend, select 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.
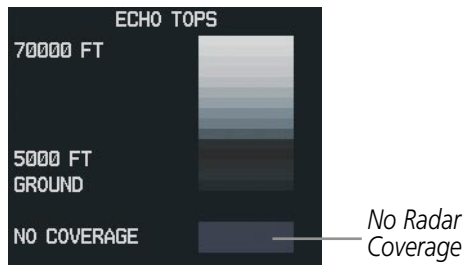

No Radar Coverage

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 grayish-purple. Radar capability exists in these areas, but it is not active or is off-line.

CLOUD TOPS

> **NOTE:** *Cloud Tops and Echo Tops cannot be displayed at the same time.*

Cloud Tops data depicts cloud top altitudes as determined from satellite imagery.
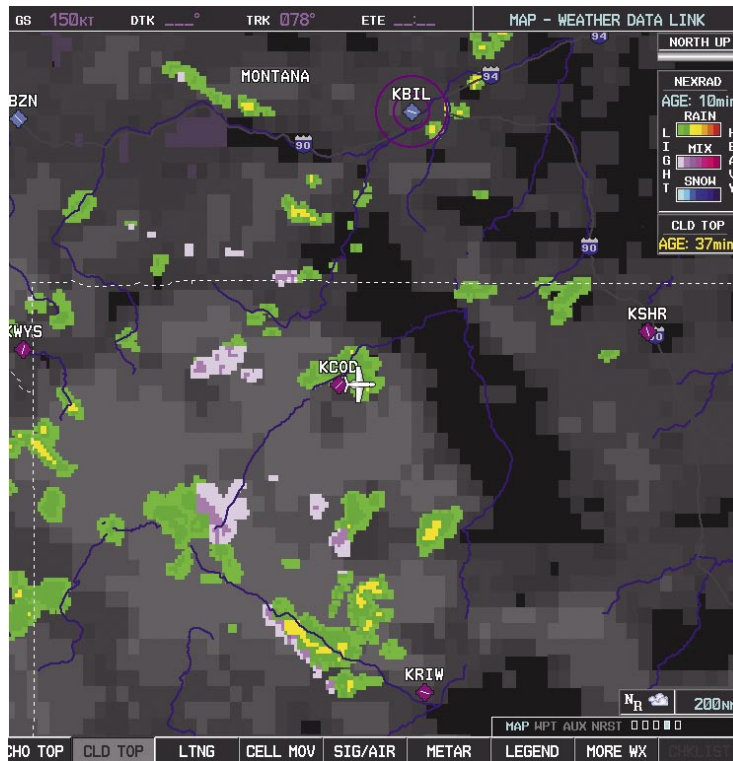
Figure 6-16 Cloud Tops Data

Displaying Cloud Tops information:

1) Select the Weather Data Link Page.

2) Select the **CLOUD TOPS** Softkey.

To display the Cloud Tops legend, select 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.
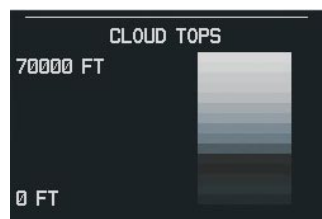
Figure 6-17 Cloud Tops Legend

XM LIGHTNING

Lightning data 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.

Lightning Strikes
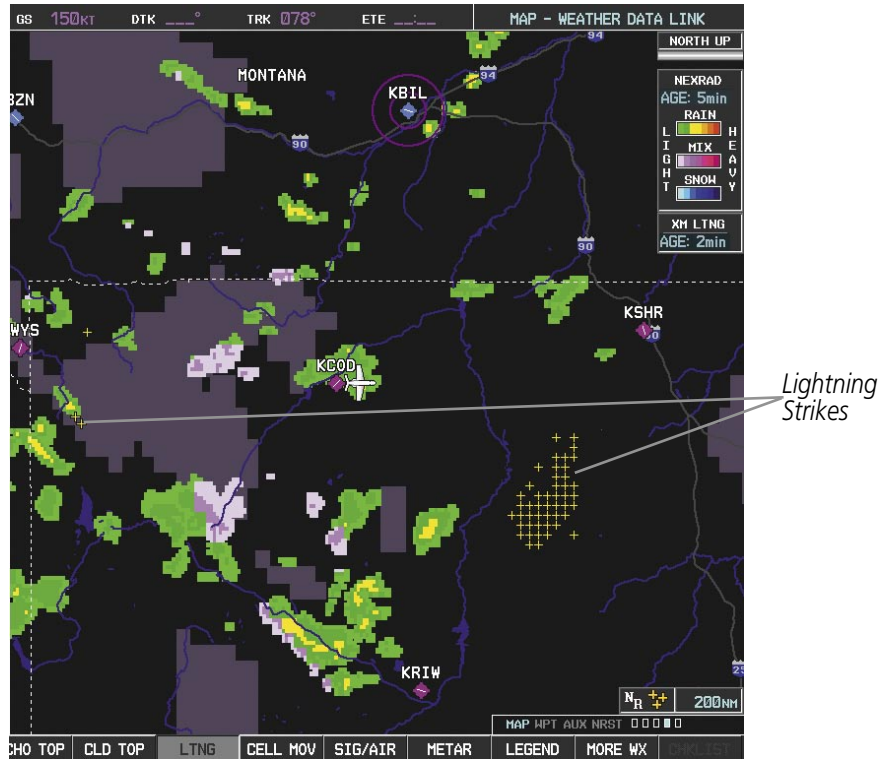
Figure 6-18 Lightning Data

XM Lightning data displays on the following maps:

- PFD Inset Map
- Navigation Map Page
- Weather Data Link Page
- Trip Planning Page
- Nearest Pages
- Flight Plan Pages

Displaying XM Lightning information:

1) Select the **MAP** Softkey (for the PFD Inset Map, select the **INSET** Softkey). This step is not necessary on the Weather Data Link Page.

2) Select the **XM LTNG** Softkey (LTNG Softkey on the Weather Data Link Page).

To display the XM Lightning legend on the Weather Data Link Page, select the **LEGEND** Softkey when XM Lightning is selected for display.
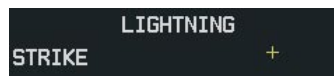
Figure 6-19 Lightning Legend

CELL MOVEMENT

Cell Movement data 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.
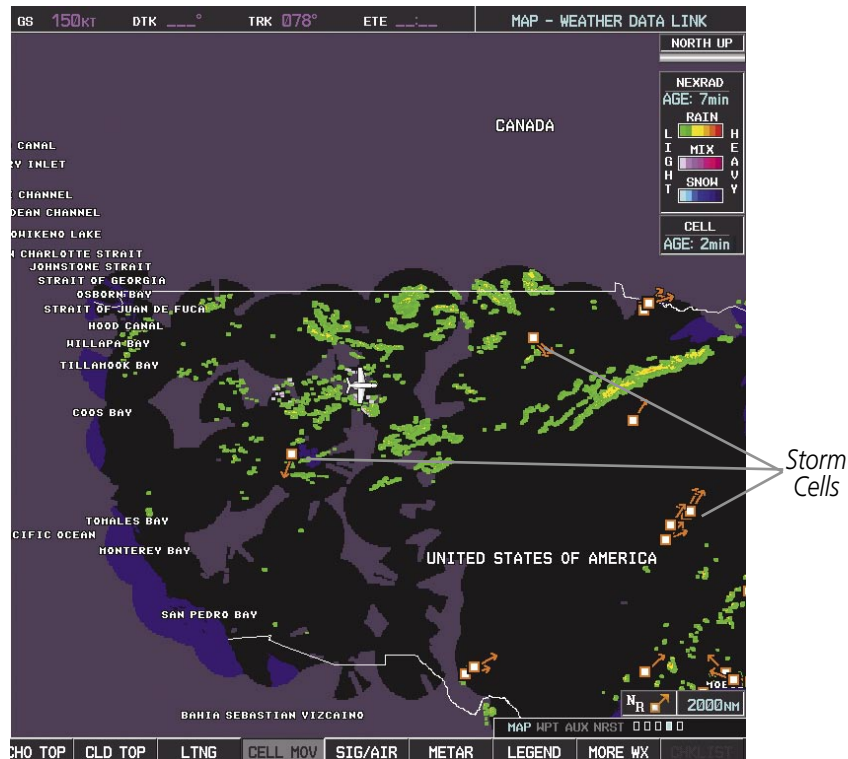
Figure 6-20 Cell Movement Data

On most applicable maps, Cell Movement data is selected for display along with NEXRAD. On the 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
- AUX - Trip Planning Page
- Nearest Pages

Displaying Cell Movement information:

1) Select the **MAP** Softkey (for the PFD Inset Map, select the **INSET** Softkey). This step is not necessary on the Weather Data Link Page.

2) Select the **NEXRAD** Softkey (**CEL MOV** Softkey on the Weather Data Link Page). For Cell Movement to be displayed on maps other than the Weather Data Link Page, Cell Movement must be turned on in the Navigation Map Setup Menu (see "Setting Up XM Satellite Weather").

To display the Cell Movement legend on the Weather Data Link Page, select the **LEGEND** Softkey when Cell Movement is selected for display.

Figure 6-21 Cell Movement Legend

SIGMETS AND AIRMETS

SIGMETs (SIGnificant METeorological Information) and AIRMETs (AIRmen's METeorological Information) are broadcast for potentially hazardous weather considered of extreme importance to all aircraft. A Convective SIGMET is issued for hazardous convective weather. A localized SIGMET is a significant weather condition occurring at a localized geographical position.
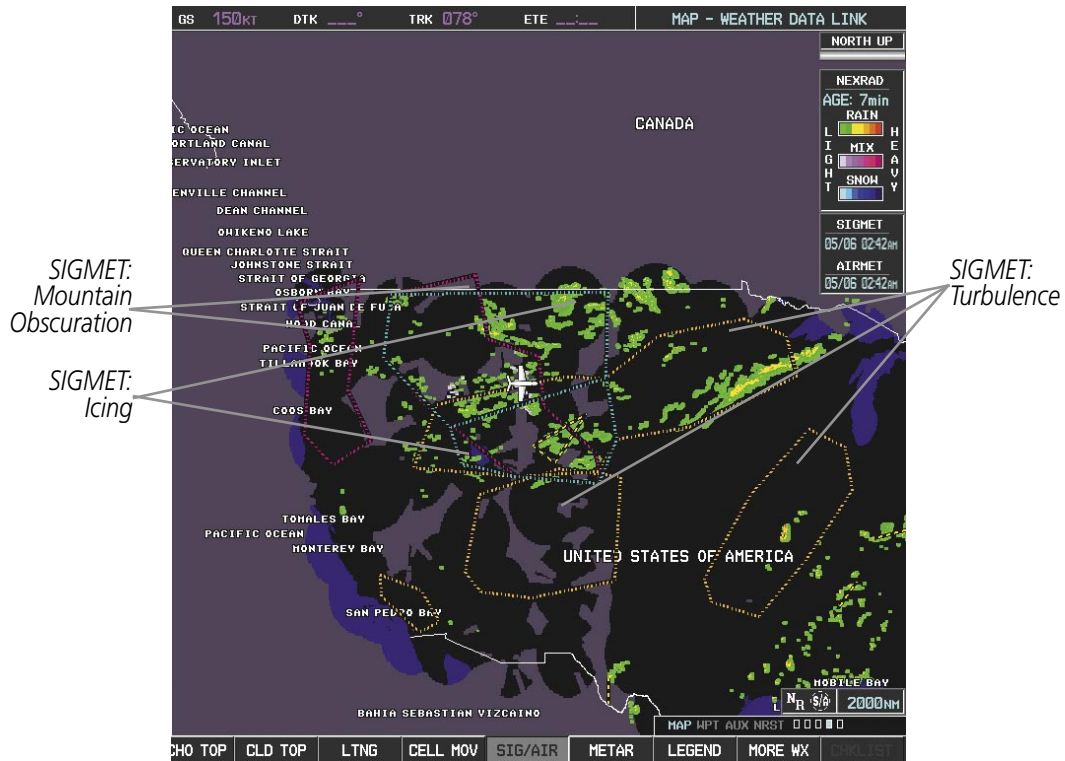
Figure 6-22 SIGMET/AIRMET Data

Displaying SIGMETs and AIRMETs:

1) Select the Weather Data Link Page.

2) Select the **SIG/AIR** Softkey.

3) To view the text of the SIGMET or AIRMET, press the **Joystick** and move the Map Pointer over the icon.

4) Press the **ENT** key. Figure 6-22 shows a sample of SIGMET text.

To display the SIGMET and AIRMET legend, select the **LEGEND** Softkey when SIGMETs and AIRMETs are selected for display.

Sample SIGMET Text

SIGMET/AIRMET Legend

Figure 6-23 SIGMET/AIRMET Text and Legend

METARS AND TAFS

✓ **NOTE:** *Atmospheric pressure as reported for METARs is given in hectopascals (hPa), except 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 aviation database service area.*

METAR (METeorological Aerodrome Report) is the standard format for pre-flight weather briefings. METARs are updated hourly and are considered current. METARs typically contain information about the temperature, dewpoint, wind, precipitation, cloud cover, cloud heights, visibility, and barometric pressure. They can also contain information on precipitation amounts, lightning, and other critical data. METARs are shown as colored flags at airports that provide them.

Instructions for Viewing METAR and TAF Text

Selected Airport

Figure 6-24 METAR Flags on the Weather Data Link Page

TAF (Terminal Aerodrome Report) is the standard format for 24-hour weather forecasts. TAFs may contain some METAR data, but generally cover a smaller area. It typically forecasts significant weather changes, temporary changes, probable changes, and expected changes in weather conditions.

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.

Displaying METAR and TAF text:

1) On the Weather Data Link Page, select the **METAR** Softkey.

2) Press the **Joystick** and pan to the desired airport.

3) Press the **ENT** Key. The Weather Information Page is shown with METAR and TAF text.

4) Use the **FMS** Knob or the **ENT** Key to scroll through the METAR and TAF text. METAR text must be completely scrolled through before scrolling through the TAF text.

5) Press the **FMS** Knob or the **CLR** Key to return to the Weather Data Link Page.

OR:

1) Select the Weather Information Page.

a) Select the first rectangular page in the Waypoint Page Group.

b) Select the **WX** Softkey to select the Weather Information Page.

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

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

4) Use the **FMS** Knob or the **ENT** Key to scroll through the METAR and TAF text. Note that the METAR text must be completely scrolled through before scrolling through the TAF text.
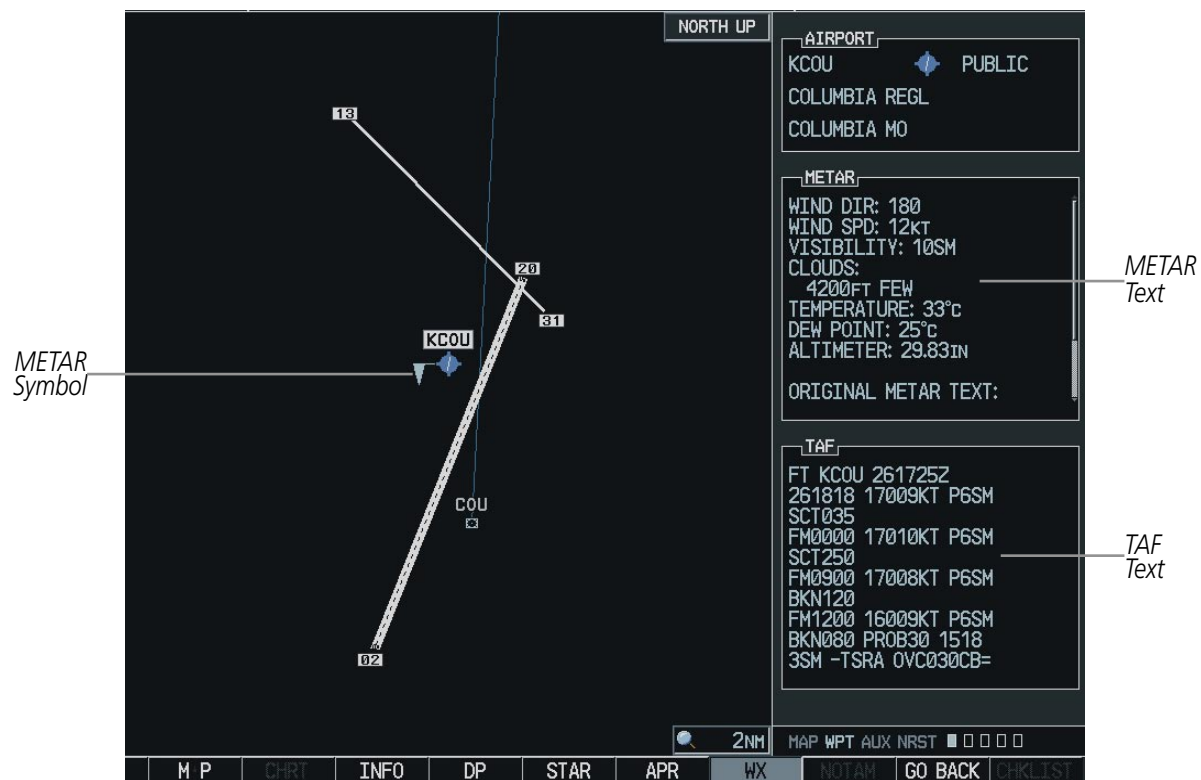
Figure 6-25 METAR with Text

To display the METAR legend on the Weather Data Link Page, select the **LEGEND** Softkey when METARs are selected for display.
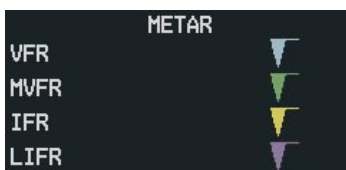
Figure 6-26 METAR Legend

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 6-27 Surface Analysis Data - 36-Hour

Displaying Surface Analysis and City Forecast information:

1) Select the Weather Data Link Page.

2) Select the **MORE WX** Softkey.

3) Select the **SFC** Softkey.

4) Select the 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, select the **LEGEND** Softkey when Surface Analysis and City Forecast are selected for display.
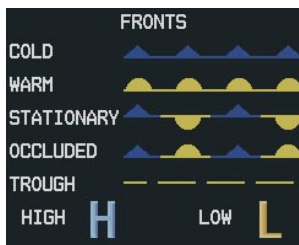
Figure 6-28 Surface Analysis Legend

FREEZING LEVEL

Freezing Level data shows the color-coded contour lines for the altitude and location at which the first isotherm is found. When no data is displayed for a given altitude, the data for that altitude has not been received, or is out of date and has been removed from the display. New data appears at the next update.
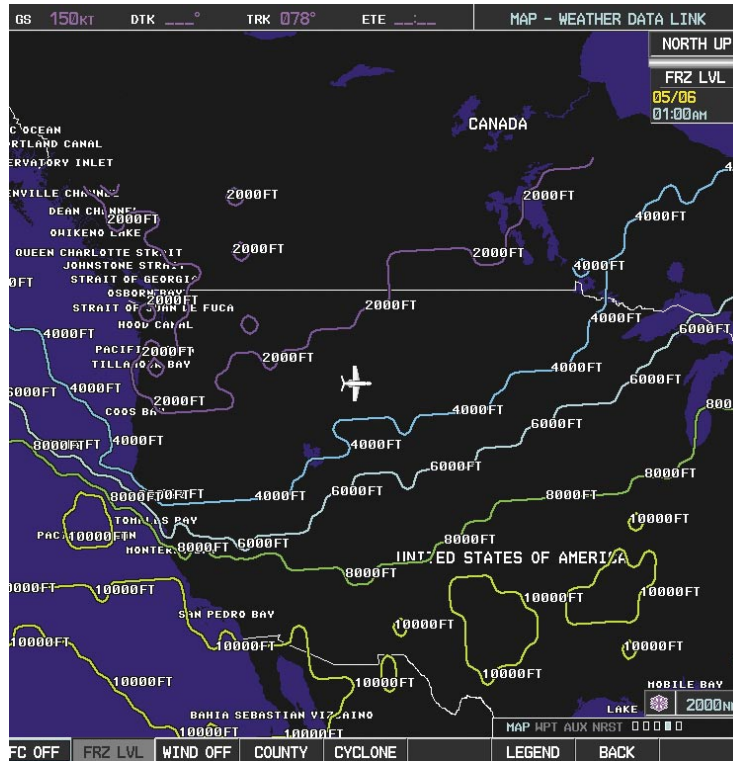
Figure 6-29 Freeze Level Data

Displaying Freezing Level information:

1) Select the Weather Data Link Page.

2) Select the **MORE WX** Softkey.

3) Select the **FRZ LVL** Softkey.

To display the Freezing Level legend, select the **LEGEND** Softkey when Freezing Level data is selected to be displayed.

Figure 6-30 Freezing Level Legend

WINDS ALOFT

Winds Aloft data shows the forecasted wind speed and direction at the surface and at selected altitudes. Altitude can be displayed in 3000-foot increments up to 42,000 feet MSL.

Displaying Winds Aloft data:

1) Select the Weather Data Link Page.

2) Select the **MORE WX** Softkey.

3) Select the **WIND** Softkey.

4) Select the desired altitude level: SFC (surface) up to 42,000 feet. Select the **NEXT** or **PREV** Softkey to cycle through the altitude softkeys. The **WIND** Softkey label changes to reflect the altitude selected.

Figure 6-31 Winds Aloft at 27,000 Feet

To display the Winds Aloft legend, select the **LEGEND** Softkey when Winds Aloft is selected for display.
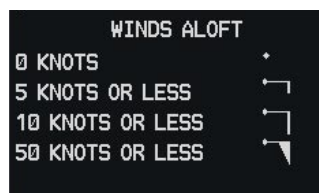
Figure 6-32 Winds Aloft Data with Legend

COUNTY WARNINGS

County data provides specific public awareness and protection weather warnings from the National Weather Service (NWS). This can include information on fires, tornadoes, severe thunderstorms, flood conditions, and other natural disasters.
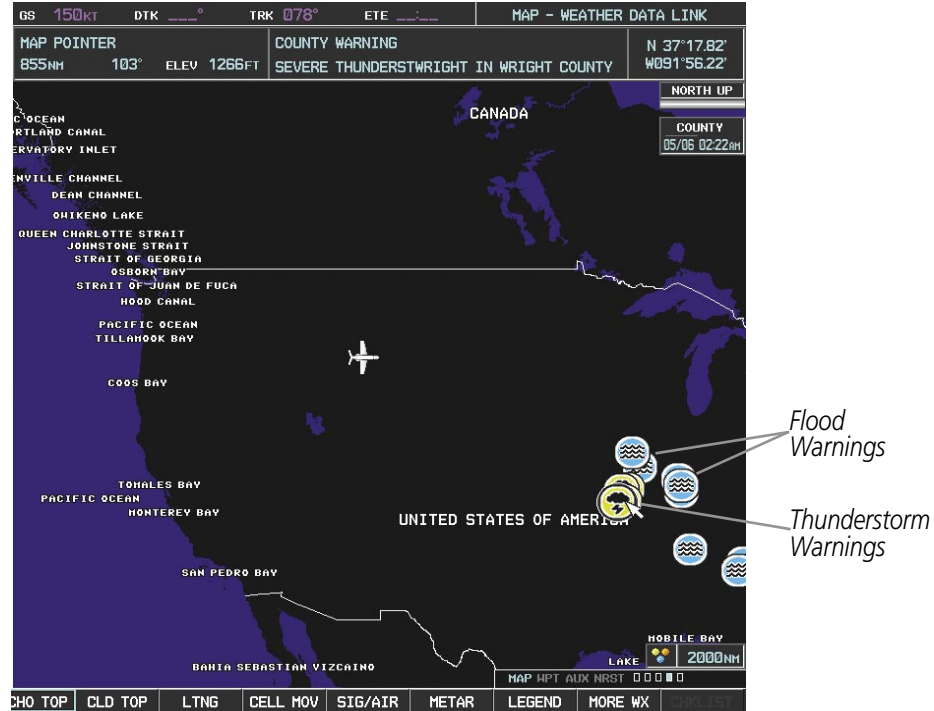
Figure 6-33 County Flood and Thunderstorm Warnings

Displaying County Warning information:

1) Select the Weather Data Link Page.

2) Select the **MORE WX** Softkey.

3) Select the **COUNTY** Softkey.

To display the County Warnings legend, select the **LEGEND** Softkey when County Warnings are selected to be displayed.

Figure 6-34 County Warnings Legend

CYCLONE

The Cyclone weather product shows the current location of cyclones (hurricanes) and their projected tracks.
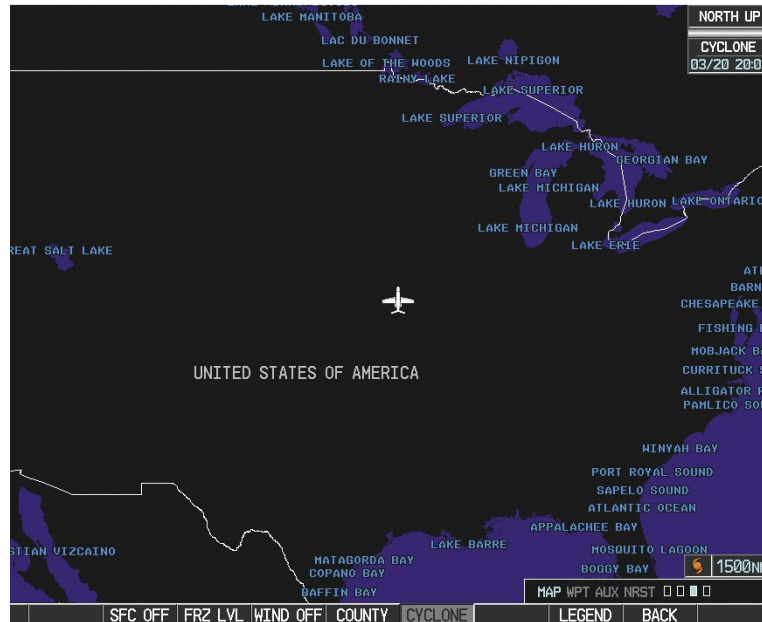
Figure 6-35 Cyclone Data Selected for Display

Displaying cyclone (hurricane) track information:

1) Select the Weather Data Link Page.

2) Select the **MORE WX** Softkey.

3) Select the **CYCLONE** Softkey.

To display the Cyclone legend, select the **LEGEND** Softkey when Cyclones are selected to be displayed.
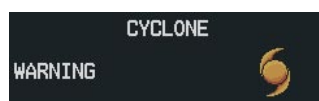
Figure 6-36 Cyclone Legend

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 Cessna Mustang 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 Control (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 farther 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 will be 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.
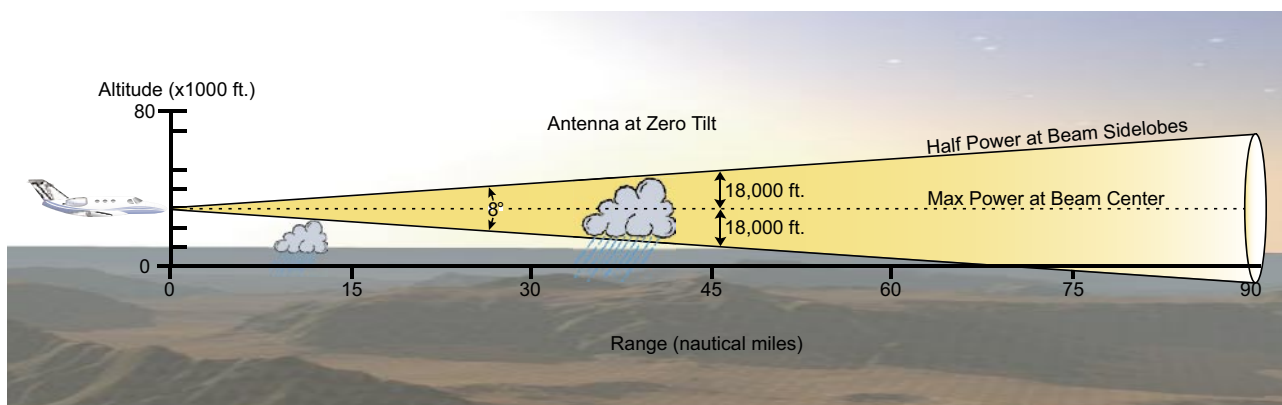
Figure 6-37 Radar Beam from a 12 inch Antenna

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.
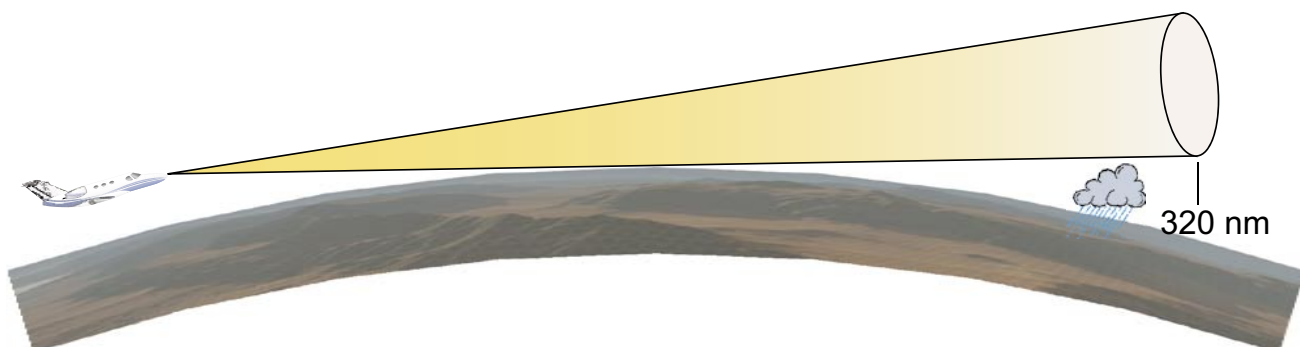
Figure 6-38 Radar Beam in Relation to the Curvature of the Earth

RADAR SIGNAL ATTENUATION

The phenomenon of radar signal attenuation affects the operation of weather radar. When the radar signal is transmitted, it is progressively absorbed and scattered, making the signal weaker. This weakening, or attenuation, is caused by two primary sources, distance and precipitation.

Attenuation because of distance is due to the fact that the radar energy leaving the antenna is inversely proportional to the square of the distance. The reflected radar energy from a target 40 miles away that fills the radar beam will be 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 circuitry within the GWX 68 system will compensate 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 area of no precipitation. If the signal has been fully attenuated, the radar will display 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 will appear as shadowed or gray area 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 tear, 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, will be detected by the weather radar. The weather radar will 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, dry snow, and dry hail have low levels of reflectivity as shown in the illustration, and often will not be displayed by the radar. Additionally, a cloud that contains only small raindrops, such as fog or drizzle, will not reflect enough radar energy to produce a measurable target return.

Reflective Levels

Wet Hail — Most Reflective

Rain

Hail

Ice Crystals

Wet Snow

Dry Hail

Dry Snow — Least Reflective
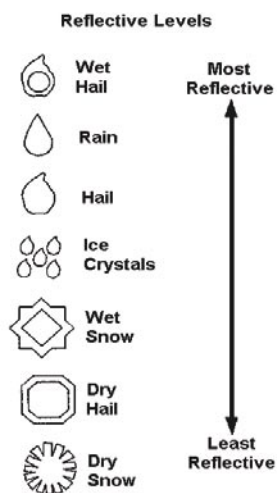
Figure 6-39 Precipitation Type and Reflectivity

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 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 will provide 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.
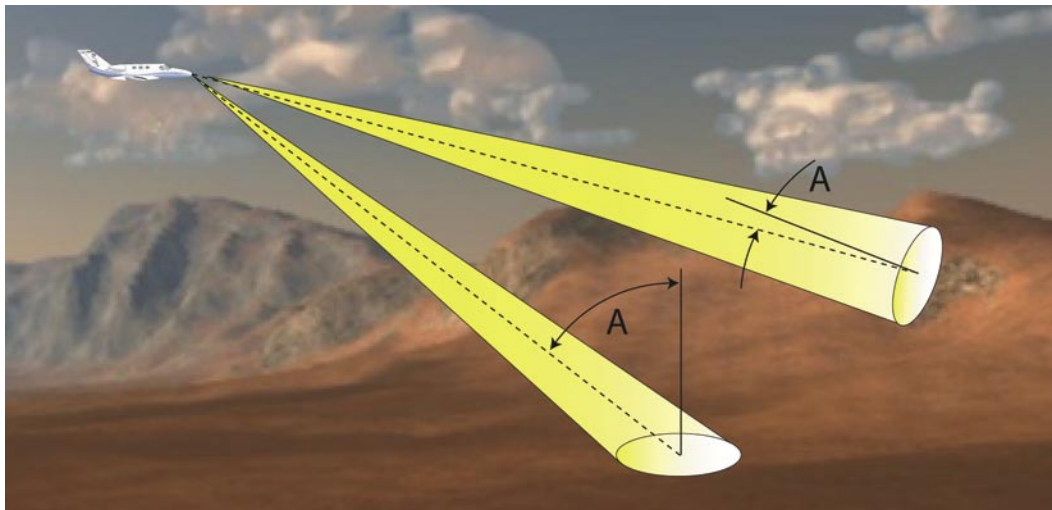
Figure 6-40 Angle of Incidence

A smaller incident angle gives the radar a larger detectable range of operation and the target display will show 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-foot 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
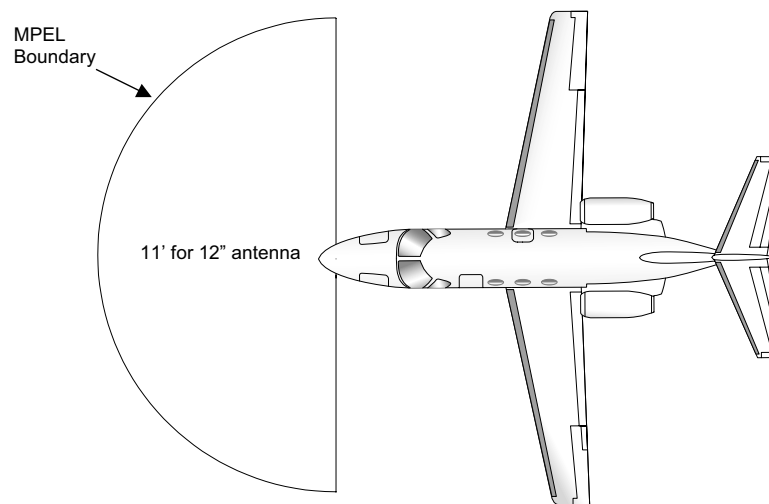
Figure 6-41 MPEL Boundary

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 will work in all situations, but this method does provide good overall parameters for the monitoring of threats. Ultimately, it is desired to have the antenna tilted so that the bottom of the radar beam is four degrees below parallel with the ground. The following example explains one way of achieving this.

With the aircraft flying level, adjust the antenna tilt so ground returns are displayed at a distance that equals the aircraft's current altitude (AGL) divided by 1,000. For example, if the aircraft is at 14,000 feet, adjust the tilt so the front edge of ground returns are displayed at 14 nautical miles. Note this antenna tilt angle setting. Now, raise the antenna tilt 6 degrees above this setting. The bottom of the radar beam is now angled down 4° from parallel with the ground.

PRACTICAL APPLICATION USING THE BASIC TILT SETUP

With the antenna tilt set as previously described, any displayed target return should be scrutinized when flying at altitudes between 2,000 and 30,000 feet AGL. If the displayed target advances on the 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 will place 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.
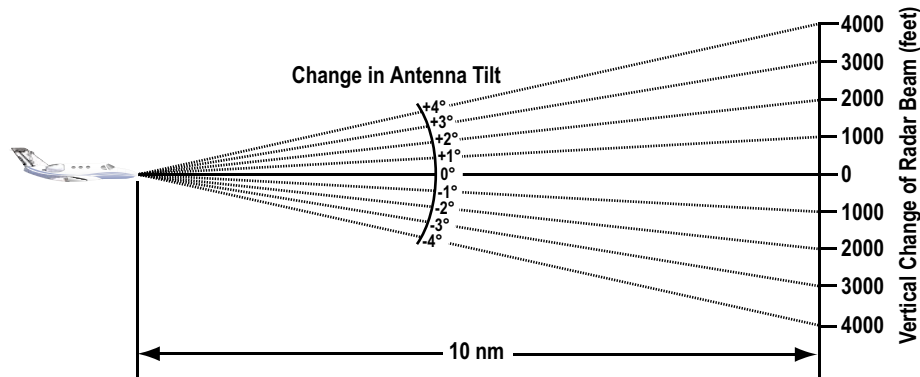
Figure 6-42 Vertical Change in Radar Beam per Nautical Mile

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. If that ground target return moves to 5 nm, maximum distance below the aircraft will be 2,000 feet.

This setup will provide 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 the table.

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 6-3 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.

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 were red or magenta areas.
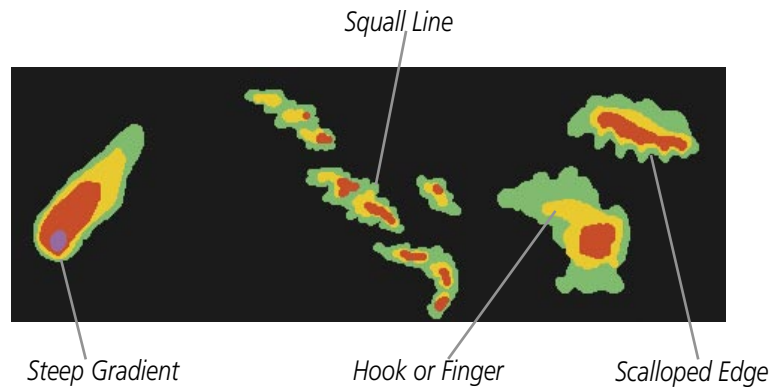
Figure 6-43 Cell Irregularities

Thunderstorm development is rapid. A course may become blocked within a short time. When displaying shorter ranges, periodically select a longer range to see if problems are developing further out. That can help prevent getting trapped in a blind alley or an area that is closed at one end by convective weather.
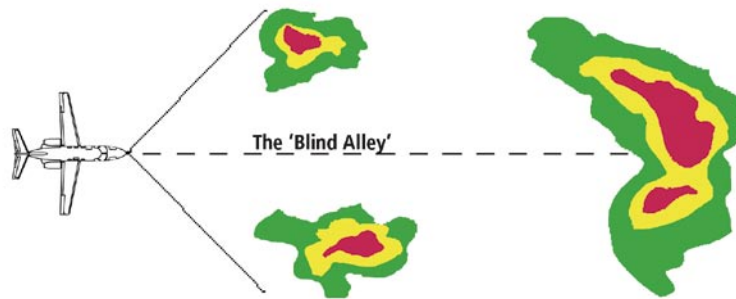
Figure 6-44 The Blind Alley - Horizontal Scan

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.
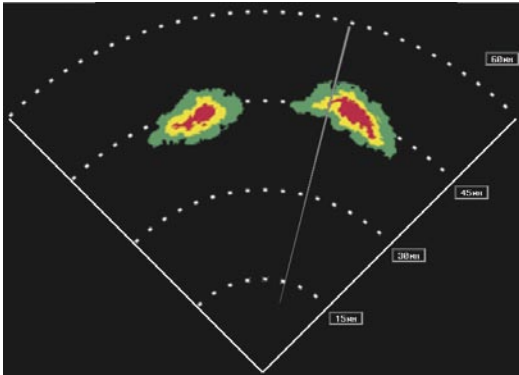
The Blind Alley at Close Range   *The Large Storm Behind*
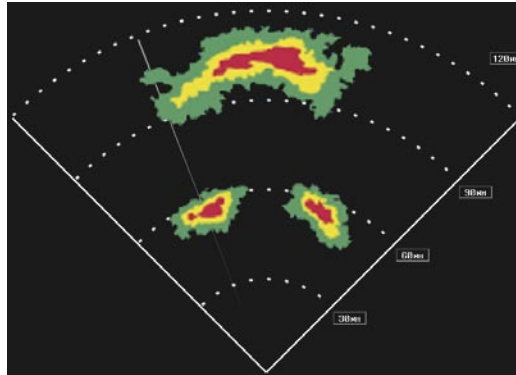
Figure 6-45 The Blind Alley

TORNADOES

There are no conclusive radar target return characteristics which will 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, especially if bright and projecting from the southwest quadrant (northeast quadrant in the southern hemisphere) of a major thunderstorm.

- V-shaped notches.

- Doughnut shapes.

These shapes do not always indicate tornadoes, and tornado returns are not limited to these characteristics. Confirmed radar observations of tornadoes most often have not shown shapes different from those of a normal thunderstorm display.

HAIL

Hail results from updrafts carrying water high enough to freeze. Therefore, the higher the top of a thunderstorm, the greater the probability that it contains hail. Vertically scanning the target return can give the radar top of a thunderstorm that contains hail. Radar top is the top of a storm cell as detected by radar. It is not the actual top, or true top of the storm. The actual top of a storm cell is seen with the eyes in clear air and may be much higher than the radar top. The actual top does not indicate the top of the hazardous area.

Hail can fall below the minimum reflectivity threshold for radar detection. It can have a film of water on its surface, making its reflective characteristics similar to a very large water droplet. Because of this film of water, and because hail stones usually are larger than water droplets, thunderstorms with large amounts of wet hail return stronger signals than those with rain. Some hail shafts are extremely narrow (100 yards or less) and make poor radar targets. In the upper regions of a cell where ice particles are dry (no liquid coating), target returns are less intense.

Hail shafts are associated with the same radar target return characteristics as tornados. U-shaped cloud edges three to seven miles across can also indicate hail. These target returns appear quite suddenly along any edge of the cell outline. They also change in intensity and shape in a matter of seconds, making vigilant monitoring essential.

OPERATION IN WEATHER MODE

⚠ **WARNING:** *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.
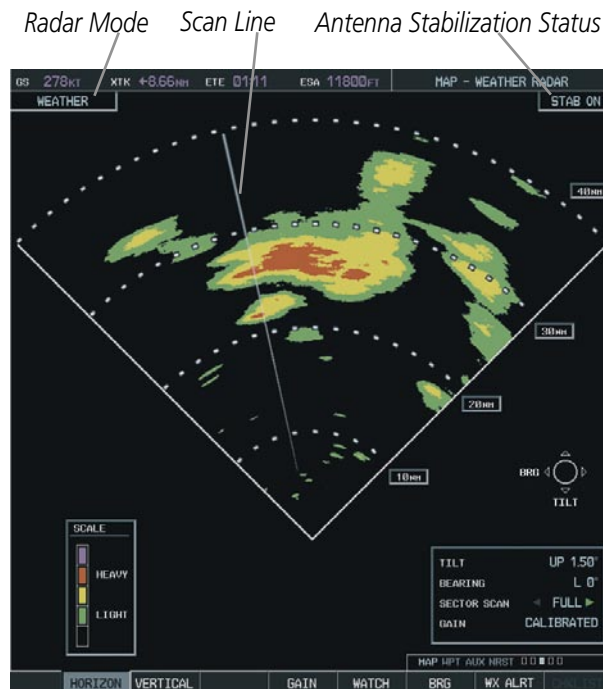
Figure 6-46 Horizontal Scan Display

Displaying weather on the Weather Radar Page:

1) Select the Map Page Group.

2) Select the Weather Radar Page.

3) Select the **MODE** Softkey.

4) To select Weather Mapping Mode:

    a) While on the ground, select 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.

    b) When the aircraft is airborne, select the **WEATHER** Softkey.

    OR:

    a) While on the ground, select the **WEATHER** Softkey. A confirmation window is displayed.

Figure 6-47 Confirming Activating Radar

    b) Turn the small **FMS** Knob to highlight YES and press the **ENT** Key to continue radar activation.

    OR:

    c) If the aircraft is airborne, select 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.

5) Turn the **Joystick** to select the desired map range.

6) The horizontal scan is initially displayed (Figure 6-46). If desired, select the **VERTICAL** Softkey to change to vertical scanning.

Vertically scanning a storm cell:

> **NOTE:** *Vertical scanning of a storm cell should be done with the aircraft wings level to avoid constant adjustment of the Bearing Line.*

1) While in the Horizontal Scan view, select the **BRG** Softkey. This places the cursor in the BEARING field and displays the Bearing Line.

   If the Bearing Line is not displayed, press the **MENU** Key and turn the large **FMS** Knob to select Show Bearing Line. Press the **ENT** Key.

2) Turn the small **FMS** Knob to place the Bearing Line on the desired storm cell or other area to be vertically scanned.
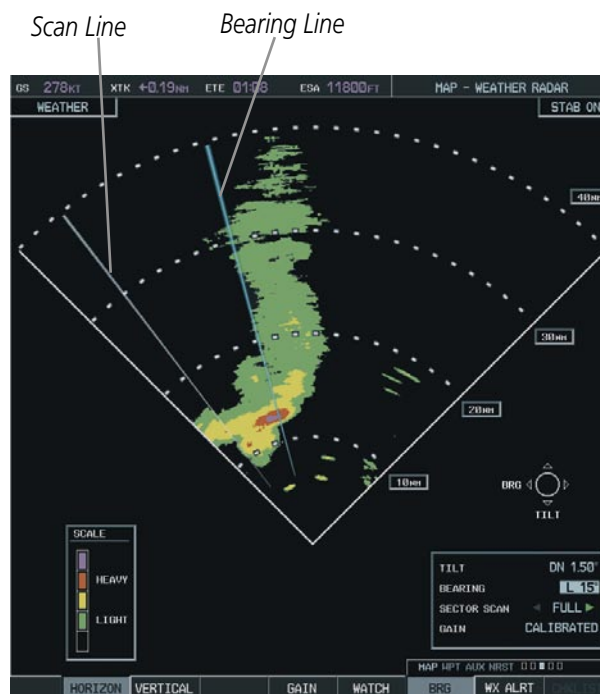
Figure 6-48 Bearing Line on Horizontal Scan

3) Select the **VERTICAL** Softkey. A vertical slice of the selected area will now be displayed (Figure 6-49).

4) The small **FMS** Knob may be used to move the scanned slice a few degrees right or left.

5) Turn the **Joystick** to adjust the range.

6) Press the **FMS** Knob to remove the cursor.

7) To select a new area to be vertically scanned, select the **HORIZON** Softkey to return to the Horizontal Scan view and repeat the previous steps.

The **Joystick** can also be used to adjust bearing from left to right.
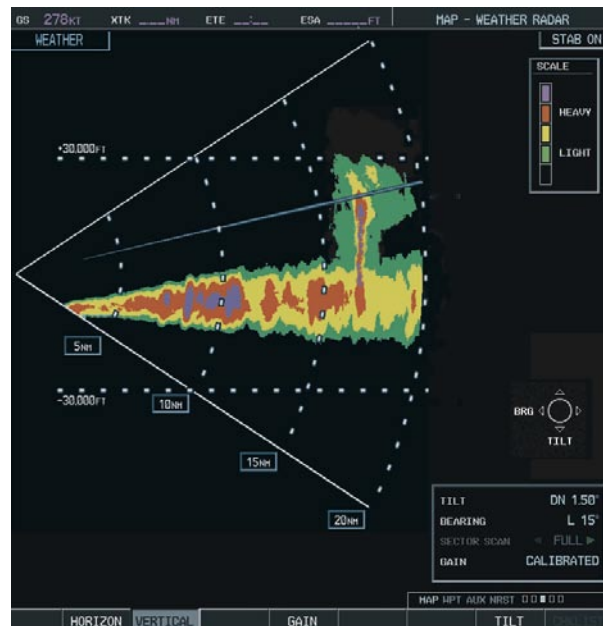
Figure 6-49 Vertical Scan Display

ADJUSTING ANTENNA TILT ANGLE

In order to make an accurate interpretation of a storm cell, the radar beam should be pointed at the wet part of the weather cell to record the proper rainfall intensity (color level). The ideal aiming point is just below the freezing level of the storm. The best way to find this point is to use the Vertical Scan feature. The antenna tilt angle can be centered on the strongest return area in the vertical scan to get a more accurate view of the coverage and intensity of the target in the horizontal scan.

Adjusting antenna tilt on the Horizontal Scan display:

1) Press the **FMS** Knob to activate the cursor in the TILT field.

2) Turn the small **FMS** Knob to select the desired antenna tilt angle.

3) Press the **ENT** Key.

4) Press the **FMS** Knob to remove the cursor.

The **Joystick** can also be used to adjust tilt up and down.

Adjusting antenna tilt on the Vertical Scan display:

1) Select the **TILT** Softkey to activate the cursor in the TILT field and display the Tilt Line.

    If the Tilt Line is not displayed, press the **MENU** Key and turn the large **FMS** Knob to select Show Tilt Line. Press the **ENT** Key.

2) Turn the small **FMS** Knob to adjust the antenna tilt angle. The selected tilt angle will be implemented when Horizontal Scan is again selected.

The **Joystick** can also be used to adjust tilt.
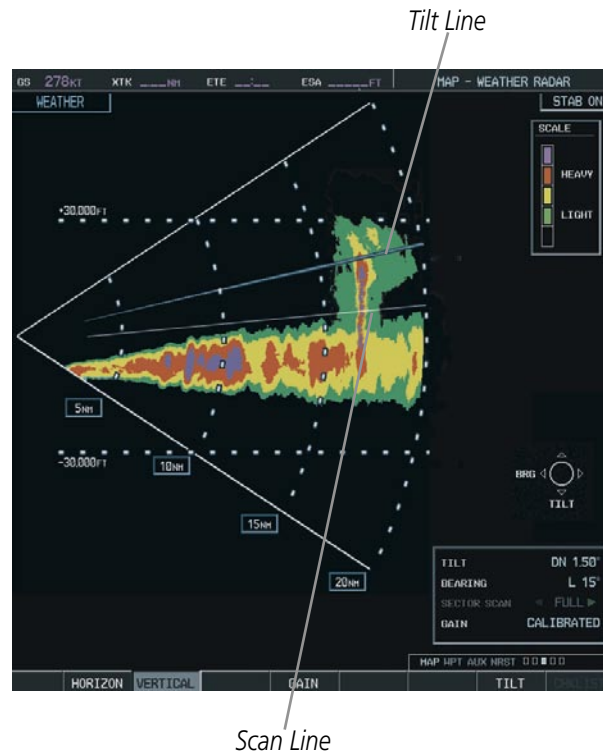
Figure 6-50 Adjusting Tilt on Vertical Scan Display

ADJUSTING GAIN

⚠️ **WARNING:** *Changing the gain in weather mode will cause precipitation intensity to be displayed as a color not representative of the true intensity. Remember to return the gain setting to Calibrated for viewing the actual intensity of precipitation.*

1) Select the **GAIN** Softkey to activate the cursor in the GAIN field.

2) Turn the small **FMS** Knob to adjust the gain for the desirable level. The gain setting is visible in the GAIN field as a movable horizontal bar in a flashing box. The line pointer is a reference depicting the calibrated position.

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

4) Select the **GAIN** Softkey again to recalibrate the gain. CALIBRATED will be displayed in the GAIN field.
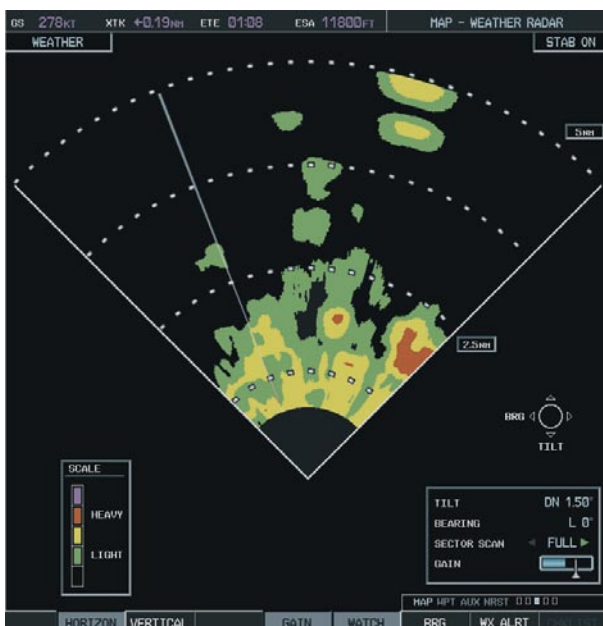
Manual Gain Set Below Calibrated   *Calibrated Gain*
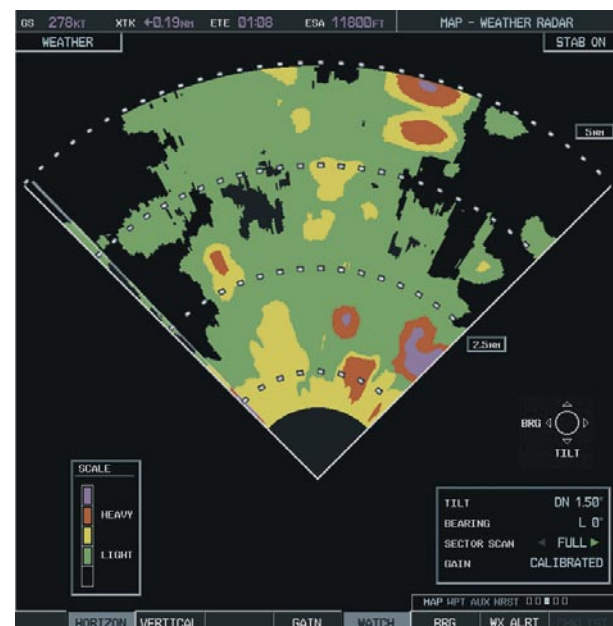
Figure 6-51 Gain Calibration

SECTOR SCAN

1) While in horizontal scan mode, select the **BRG** Softkey to display the Bearing Line and place the cursor in the BEARING field.

   If the Bearing Line is not displayed, press the **MENU** Key and turn the large **FMS** Knob to select Show Bearing Line. Press the **ENT** Key.

Figure 6-52 Selecting Sector Scan Position

2) Turn the small **FMS** Knob to place the Bearing Line in the desired position. The location of the Bearing Line will become the center point of the Sector Scan.

3) Turn the large **FMS** Knob to place the cursor in the SECTOR SCAN field.

4) Turn the small **FMS** Knob to select FULL, 60˚, 40˚, or 20˚ scan.

5) If desired, readjust the Bearing Line as discussed previously to change the center of the Sector Scan.

6) Select the **BRG** Softkey again to remove the Bearing Line and cursor. The bearing reference will also be reset to 0º.

Figure 6-53 40° Sector Scan

ANTENNA STABILIZATION

1) To activate or deactivate the antenna stabilization, select the **MODE** Softkey.

2) Select the **STAB ON** Softkey to activate antenna stabilization or select 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 will also attenuate 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, select the **WATCH** Softkey.

Displayed intensity is questionable. Potentially stronger than displayed.

Areas of Attenuated Signal
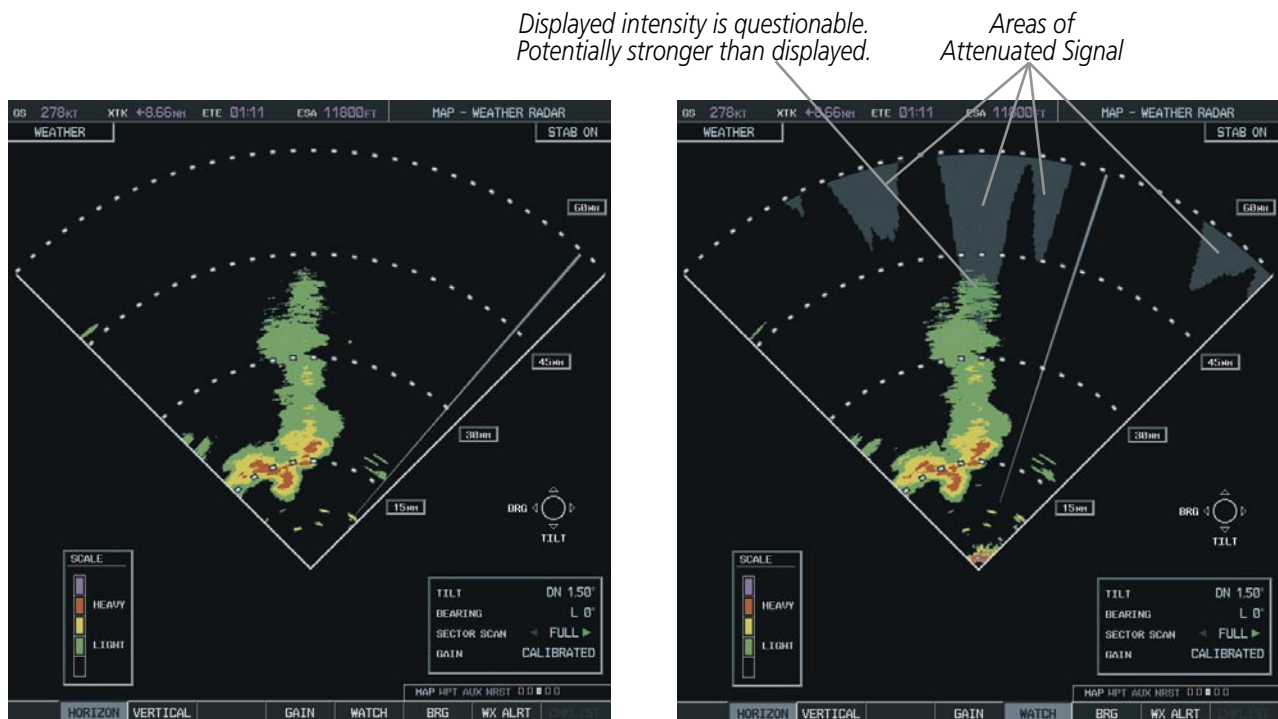
Horizontal Scan Without WATCH™

Horizontal Scan With WATCH™

Figure 6-54 Horizontal Scan Without and With WATCH™

WEATHER ALERT

This feature may be used to indicate the presence of heavy precipitation beyond the currently displayed range and 80 to 320 nm from the aircraft's present position. 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 will be 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 this issue, set the display range to less than 80 nm in the terminal area. Weather alerts can also be deactivated in the terminal area.
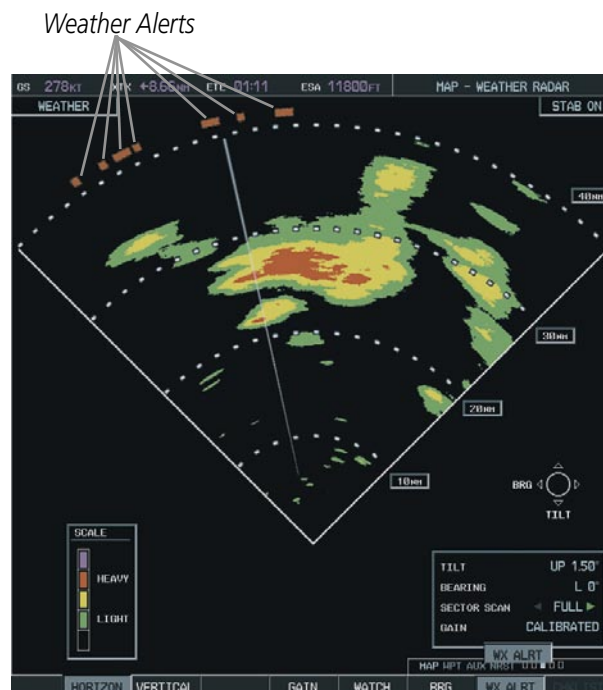
Figure 6-55 Weather Alert Indications

To activate or deactivate Weather Alerts, select the **WX ALRT** Softkey. Activating and deactivating will also enable or inhibit the alert on the PFD.
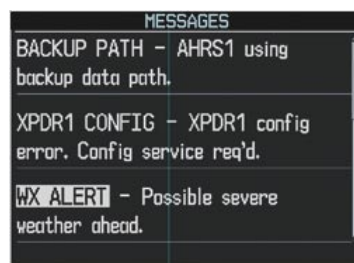
Figure 6-56 Weather Alert on PFD

GROUND MAPPING AND INTERPRETATION

A secondary use of the weather radar system is for the presentation of terrain. This can be a useful tool for verifying aircraft position. A picture of the ground is represented much like a topographical map that can be used as a supplement to the navigation map on the MFD.

Ground Map mode uses a different gain range than Weather mode. Different colors are also used to represent the intensity levels. The displayed intensity of ground target returns are defined in the table below. Use of the **GAIN** and **TILT** controls will 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 the either the Weather or Ground Map mode, the system automatically switches to Standby mode when the aircraft is on the ground.

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 6-4 Ground Target Return Intensity Levels

Operation in Ground Map Mode

1) Select the **MODE** Softkey.

2) Select the **GROUND** Softkey to place the radar in Ground Map mode.

3) Select the **BACK** Softkey.

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

5) Turn the large **FMS** Knob to place the cursor in the TILT field.

6) Adjust the antenna tilt angle by turning the small **FMS** Knob to display ground returns at the desired distance.

7) Press the **FMS** Knob to remove the cursor.

6.3 TERRAIN AWARENESS & WARNING SYSTEM (TAWS)

> **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.*

The Terrain Awareness and Warning System (TAWS) is an optional feature to increase situational awareness and aid in reducing controlled flight into terrain (CFIT). TAWS 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.

Terrain information should be used as an aid to situational awareness. Never use this information for navigation or to maneuver to avoid obstacles.

TAWS satisfies TSO-C151b Class B requirements for certification. Class B TAWS is required for all Part 91 aircraft operations with six or more passenger seats and for Part 135 turbine aircraft operations with six to nine passenger seats (FAR Parts 91.223, 135.154).

TAWS requires the following to operate properly:

• A valid terrain/obstacle/airport terrain database

• A valid 3-D GPS position solution

TAWS 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 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 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 are referenced to mean sea level (MSL). Using the GPS position and GPS-MSL altitude, TAWS 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 can provide advanced alerts of predicted dangerous terrain conditions.

Baro-corrected altitude (or indicated altitude) is derived by adjusting the altimeter setting for local atmospheric conditions. The most accurate baro-corrected altitude can be achieved by frequently updating the altimeter setting to the nearest reporting station along the flight path. However, because actual atmosphere 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 DATA

TAWS 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 shown in the figure and table below are used to represent terrain, obstacles, and potential impact points.
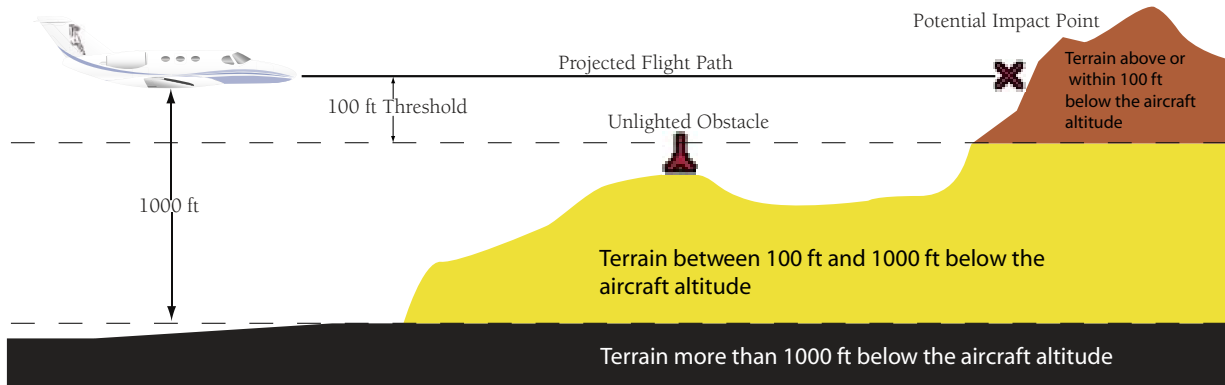

Figure 6-57 Terrain Altitude/Color Correlation for TAWS

Unlighted Obstacle		Lighted Obstacle		Potential Impact Points	Obstacle Location
< 1000' AGL	> 1000' AGL	< 1000' AGL	> 1000' AGL		
▲	⅄	✻	✳	✖	WARNING: Red obstacle is above or within 100' below current aircraft altitude
▲	⅄	✻	✳	✖	CAUTION: Yellow obstacle is between 100' and 1000' below current aircraft altitude

Table 6-5 TAWS Obstacle Colors and Symbology

TAWS information can be displayed on the following maps:

- PFD Inset Map
- Navigation Map Page
- TAWS Page
- Trip Planning Page
- Flight Plan Pages

Displaying terrain and obstacle information (maps other than the TAWS Page):

1) Select the **MAP** Softkey (for the PFD Inset Map, select the **INSET** Softkey).

2) Select the **TERRAIN** Softkey to display terrain and obstacle data.

When TAWS is selected on maps other than the TAWS Page, an icon to indicate the feature is enabled for display and a legend for TAWS terrain colors is shown.

The Navigation Map Page Setup Menu provides a means in addition to the softkey for enabling/disabling display of terrain and obstacles. The setup menu also controls the map range settings above which terrain and obstacle data are decluttered from the display. If a map range larger than the map range setting is selected, the data is removed from the map.

Terrain 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 other than the TAWS 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 6-58).

4) Turn the small **FMS** Knob to select the 'Map' Group and press the **ENT** Key (Figure 6-59).

5) Turn the large **FMS** Knob or press the **ENT** Key to scroll though product selections (Figure 6-60).

   • 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 though 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.
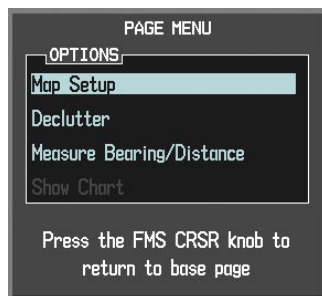
Figure 6-58 Navigation Map Page Menu

Figure 6-59 Navigation Map Page Setup Menu

Figure 6-60 Navigation Map Page Setup Menu, Map Group

TAWS PAGE

The TAWS Page is specialized to show 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 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 **Joystick** from 1 to 200 nm, as indicated by the map range rings (or arcs).

Displaying the TAWS Page:

1) Turn the large **FMS** Knob to select the Map Page Group.

2) Turn the small **FMS** Knob to select the last rectangular page icon.

3) To change the view,

   a) Select the **VIEW** Softkey.

   b) Select the **360** or **ARC** Softkey to select the desired view.

   OR:

   a) Press the **MENU** Key.

   b) Select 'View 120°' or 'View 360°' (choice dependent on current state) and press the **ENT** Key to change the view.

Showing/hiding aviation information on the TAWS 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.

Red Terrain
(Warning - Terrain
Above or Within
100' Below the
Aircraft Altitude)

Yellow Terrain
(Caution - Terrain
Between 100' and
1000' Below the
Aircraft Altitude)

Black Terrain (No
Danger - Terrain
More than
1000' Below the
Aircraft Altitude)

Map Range

Terrain Legend
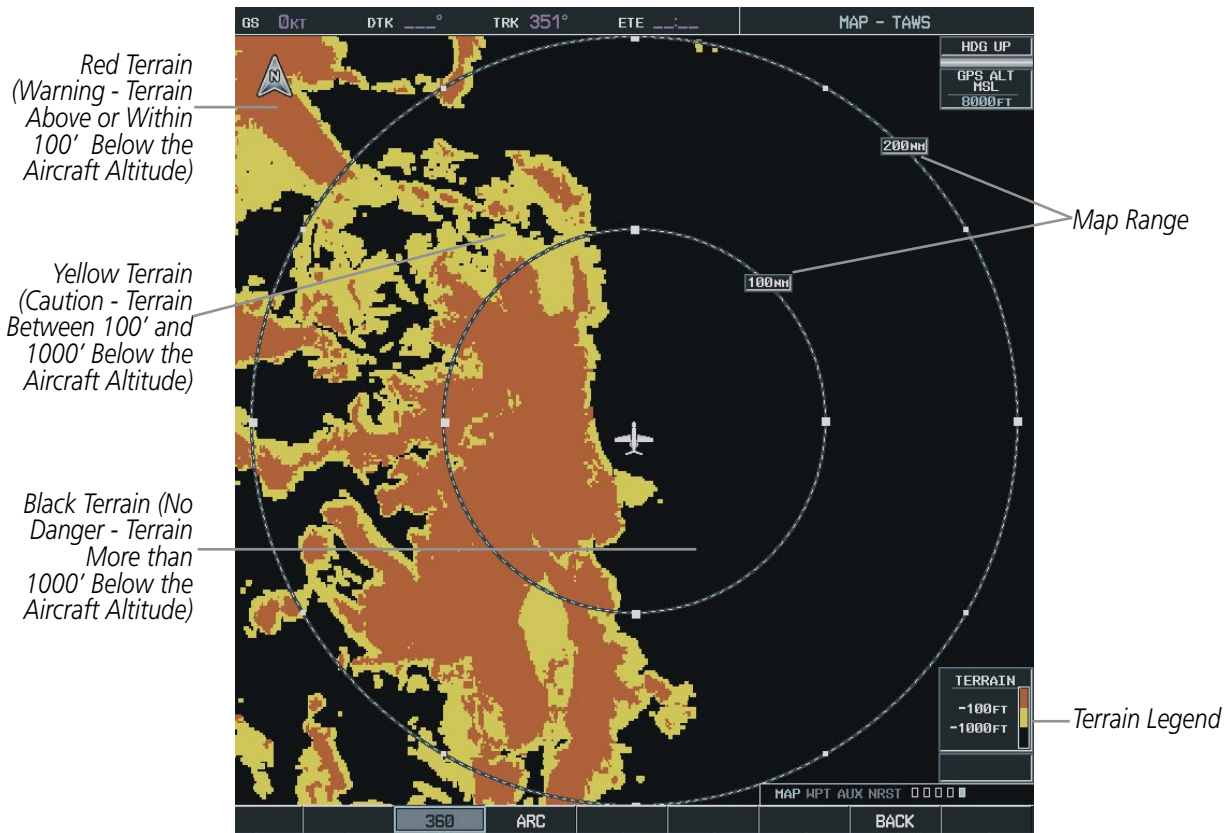
Figure 6-61 TAWS Page, 360° View

Map Range

Red Terrain
(Warning - Terrain
Above or Within
100' Below the
Aircraft Altitude)

Yellow Terrain
(Caution - Terrain
Between 100' and
1000' Below the
Aircraft Altitude)

Black Terrain
(Terrain More
than 1000'
Below the
Aircraft Altitude)

Terrain Legend
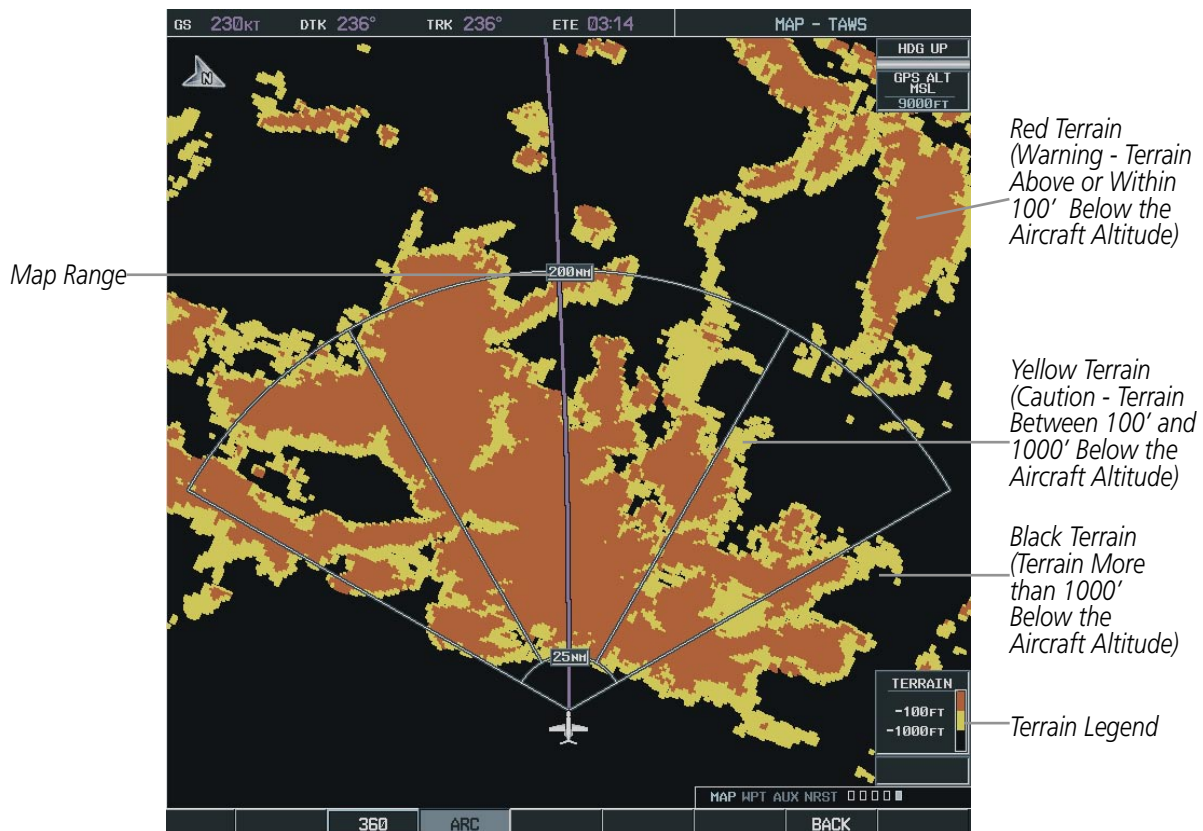
Figure 6-62 TAWS Page (ARC View)

TAWS ALERTS

Alerts are issued when flight conditions meet parameters that are set within TAWS software algorithms. TAWS 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 6-6 shows TAWS alert types with corresponding annunciations and aural messages.

When an alert is issued, annunciations appear on the PFD and MFD. The TAWS Alert Annunciation is shown to the upper left of the Altimeter on the PFD and below the Terrain Legend on the MFD. If the TAWS 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 Page)

Figure 6-63 Alert Annunciation on the PFD

Figure 6-64 Alert Pop-up on the MFD
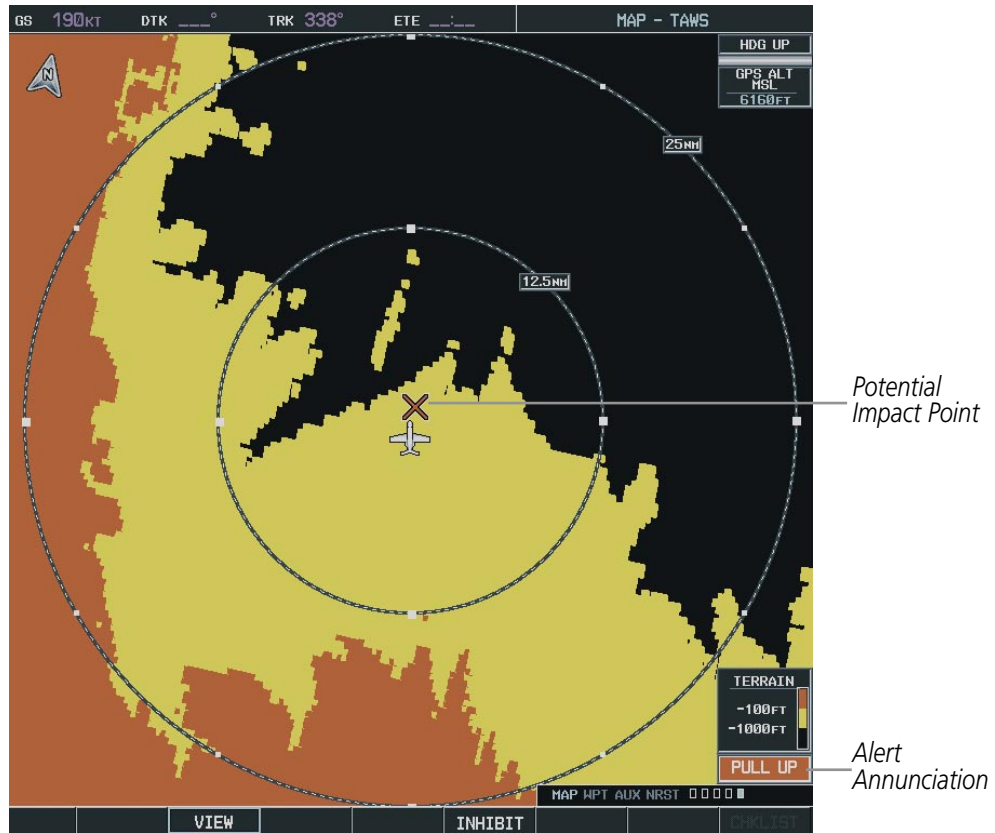
Figure 6-65 TAWS PULL UP Alert Annunciation on the MFD

TAWS INHIBIT

PDA and FLTA aural and visual alerts can be manually inhibited. Use caution when inhibiting TAWS as the system should be enabled when appropriate. When TAWS is inhibited, the alert annunciation 'TAWS INHB' is shown on the PFD and MFD.

TAWS INHB

Figure 6-66 TAWS Alerting Disabled
(TAWS Inhibited) Annunciation

Inhibiting/enabling TAWS alerting:

1) Select the TAWS Page.

2) Press the **MENU** Key.

3) Select Inhibit TAWS or Enable TAWS, depending on the current state, and press the **ENT** Key.

   OR:

   Select the **INHIBIT** Softkey to inhibit TAWS.

If TAWS alerts are inhibited when the Final Approach Fix is the active waypoint during 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.

Alert Type	PFD/MFD Alert Annunciation	MFD Pop-Up Alert	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"

Alerts with multiple messages are configurable at installation and are installation-dependent. Alerts for the default configuration are indicated with asterisks.

Table 6-6 TAWS 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. The following figure shows the parameters for the alert as defined by TSO-C151b.
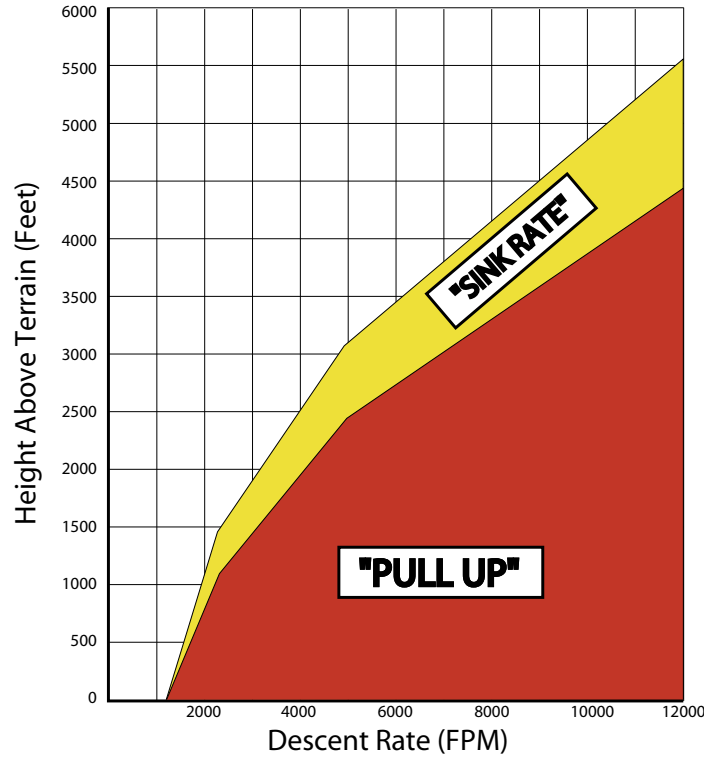
Figure 6-67 Excessive Descent Rate Alert Criteria

FORWARD LOOKING TERRAIN AVOIDANCE

The Forward Looking Terrain Avoidance (FLTA) alert is used by TAWS and is composed of:

• REDUCED REQUIRED TERRAIN CLEARANCE AND REDUCED REQUIRED OBSTACLE CLEARANCE

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. When an RTC alert is issued, a potential impact point is displayed on the TAWS Page.

• IMMINENT TERRAIN IMPACT AND IMMINENT OBSTACLE IMPACT

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 Page. The alert is annunciated when the projected vertical flight path is calculated to come within minimum clearance altitudes in the table.

Flight Phase	Minimum Clearance Altitude (ft)	
	Level Flight	**Descending**
Enroute	700	500
Terminal	350	300
Approach	150	100
Departure	100	100

Table 6-7 FLTA Alert Minimum Terrain and Obstacle Clearance Values

During final approach, FLTA alerts are automatically inhibited when the aircraft is below 200 feet AGL while within 0.5 nm of the approach runway or below 125 feet AGL while within 1.0 nm of the runway threshold.

PREMATURE DESCENT ALERTING

A Premature Descent Alert (PDA) is issued when the system detects that the aircraft is significantly below the normal approach path to a runway.

PDA alerting begins when the aircraft is within 15 nm of the destination airport and ends when the aircraft is either 0.5 nm from the runway threshold OR is at an altitude of 125 feet AGL while within 1.0 nm of the threshold. During the final descent, algorithms will set a threshold for alerting based on speed, distance, and other parameters.
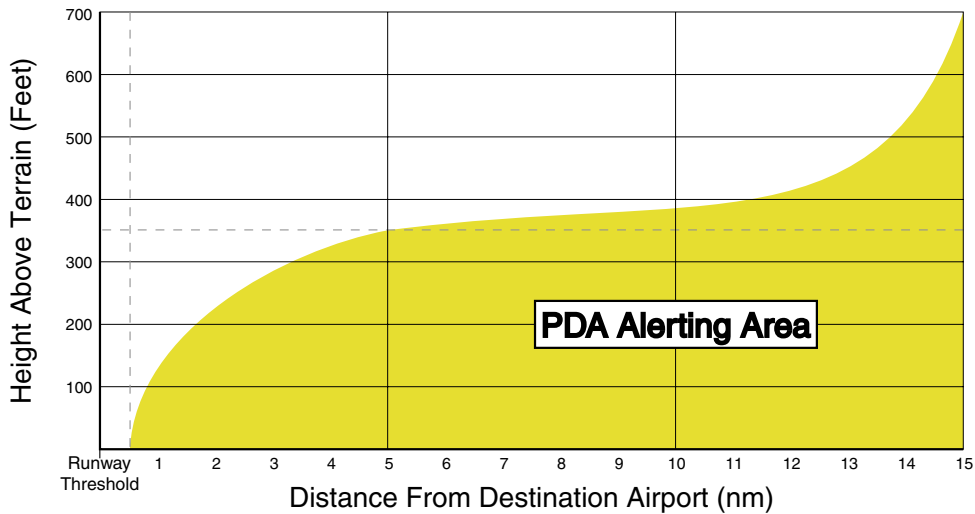
Figure 6-68 PDA Alerting Threshold

FIVE-HUNDRED AURAL ALERT

The purpose of the aural alert message "Five-hundred" is to provide an advisory alert to the pilot that the aircraft is 500 feet above terrain. When the aircraft descends within 500 feet of terrain, the aural message "five-hundred" is generated. 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

The figure below shows the NCR alerting parameters as defined by TSO-C151b.
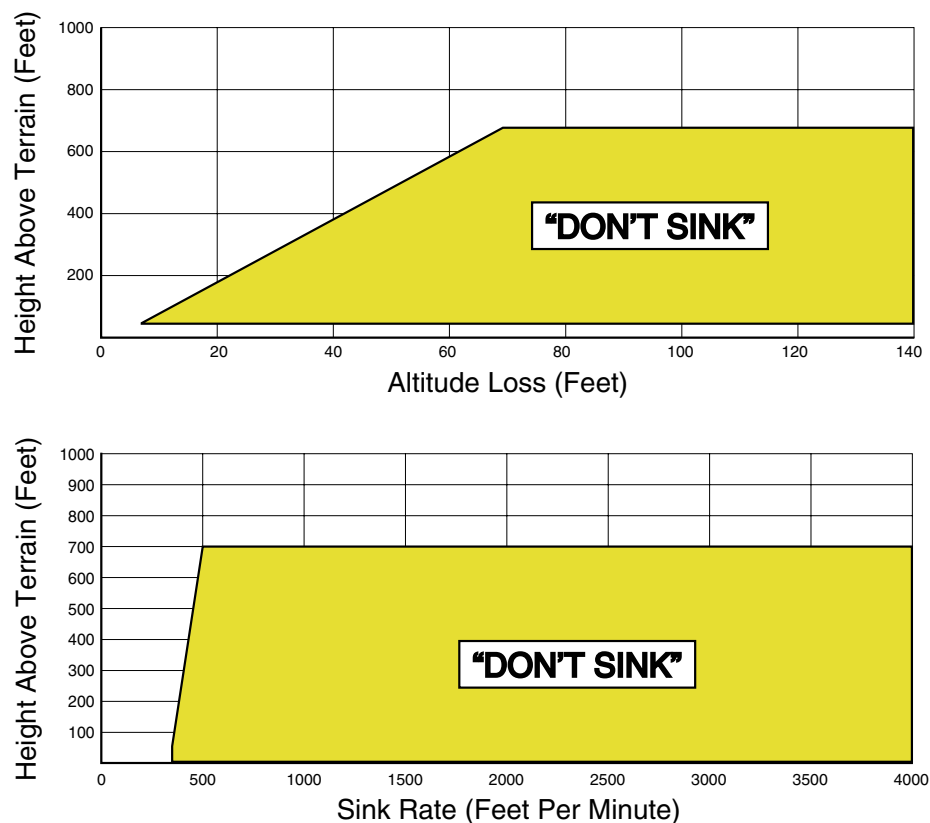
Figure 6-69 Negative Climb Rate (NCR) Alert Criteria

SYSTEM STATUS

During G1000 power-up, TAWS 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 System Testing is disabled when ground speed exceeds 30 knots.

Alert Type	PFD/MFD Alert Annunciation	TAWS Page Annunciation	Aural Message
System Test in Progress	TAWS TEST	TAWS TEST	None
System Test Pass	None	None	"TAWS System Test OK"
TAWS System Test Fail	TAWS FAIL	TAWS FAIL	"TAWS System Failure"

Table 6-8 TAWS System Test Status Annunciations

Manually testing the TAWS System:

1) Select the TAWS Page.

2) Press the **MENU** Key.

3) Select 'Test TAWS' and press the **ENT** Key to confirm the selection.

Figure 6-70 TAWS Page Menu

TAWS 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 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 Page. The aural message "TAWS Not Available" is generated. When the GPS signal is re-established and the aircraft is within the database coverage area, the aural message "TAWS Available" is generated.

Alert Type	PFD/MFD Alert Annunciation	TAWS Page Annunciation	Aural Message
No GPS position Excessively degraded GPS signal	TAWS N/A	NO GPS POSITION	"TAWS Not Available"
GPS signal re-established	None	None	"TAWS Available"

Table 6-9 TAWS Status Annunciations

6.4 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 when a Traffic Advisory System (TAS) is installed.*

The type of traffic systems that is installed is determined by the traffic page softkeys.

TIS Softkeys

| | | STANDBY | OPERATE | | TNA MUTE | | | CHKLIST |

Figure 6-71 TIS Traffic Softkeys

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 according to TCAS symbology using four different symbols.

TIS Symbol	Description
◆	Non-Threat Traffic
◇	Proximity Advisory (PA)
●	Traffic Advisory (TA)
◑	Traffic Advisory Off Scale

Table 6-10 TIS Traffic Symbols

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 that the intruding aircraft is within ±1200 feet and is within 5nm 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.

TIS also provides a vector line showing the direction in which the traffic is moving, to the nearest 45°. Traffic information for which TIS is unable to determine the bearing (non-bearing traffic) is displayed in the center of the Traffic Map Page or in a banner at the lower left corner of maps other than the Traffic Map Page on which traffic can be displayed.

The altitude difference between the requesting aircraft and other intruder aircraft is displayed above/below the traffic symbol in hundreds of feet. If the other aircraft is above the requesting aircraft, the altitude separation appears above the traffic symbol; if below, the altitude separation appears below. Altitude trend is displayed as an up/down arrow (for speeds greater than 500 fpm in either direction) to the right of the target symbol. Traffic symbols for aircraft without altitude reporting capability appear without altitude separation or climb/descent information.

DISPLAYING TRAFFIC DATA

Traffic information can be displayed on the following maps (when TIS is operating):

- PFD Inset Map
- Navigation Map Page
- Traffic Map Page
- VOR Information Page
- Trip Planning Page
- Nearest Pages
- Active Flight Plan Page

Displaying traffic information (maps other than the Traffic Map Page):

1) Select the **MAP** Softkey (select the **INSET** Softkey for the PFD Inset Map).

2) Select the **TRAFFIC** Softkey to display traffic.

When traffic is selected on maps other than the Traffic Map Page, the traffic icon is shown to indicate the feature is enabled for display.
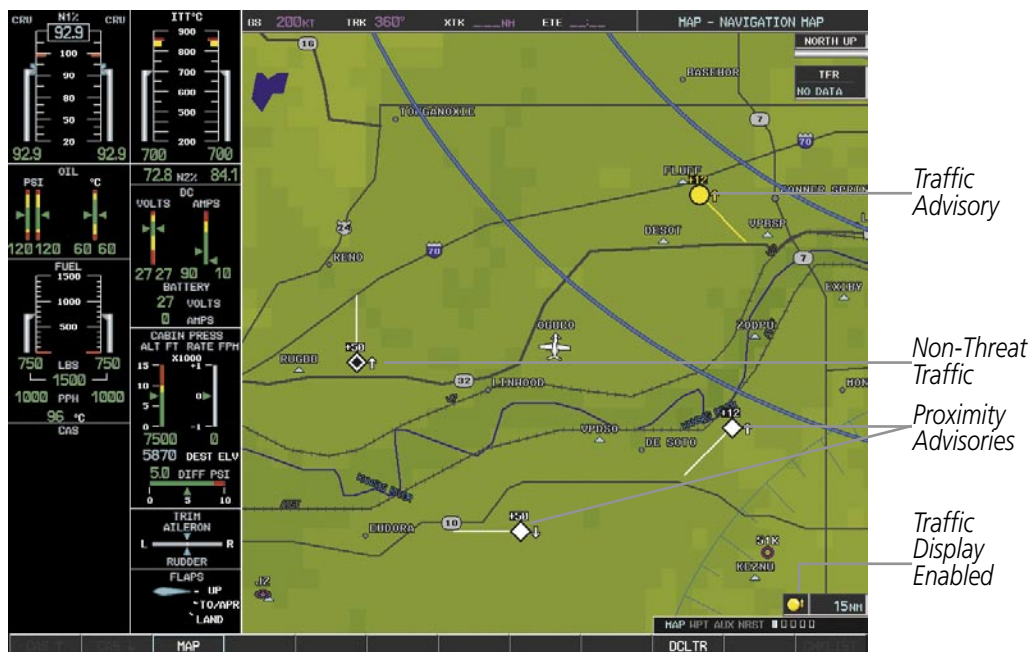
Figure 6-72 TIS Traffic on the Navigation Map Page

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 other than 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 6-73).

4) Turn the small **FMS** Knob to select the 'Traffic' Group and press the **ENT** Key (Figure 6-74).

5) Turn the large **FMS** Knob or press the **ENT** Key to scroll though product selections (Figure 6-75).

   • 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 though 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.
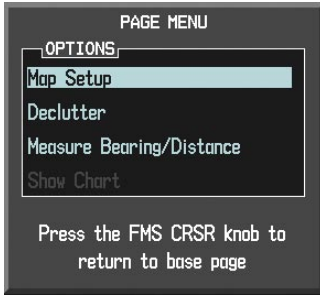
Figure 6-73 Navigation Map Page Menu

Figure 6-74 Navigation Map Page Setup Menu

Figure 6-75 Navigation Map Page Setup Menu, Traffic Group

TRAFFIC MAP PAGE

The Traffic Map Page is specialized to show surrounding TIS traffic data in relation to the aircraft's current position and altitude, without clutter from the basemap. Aircraft orientation on this map is always heading up unless there is no valid heading. Map range is adjustable with the **Joystick** from 2 to 12 nm, as indicated by the map range rings.
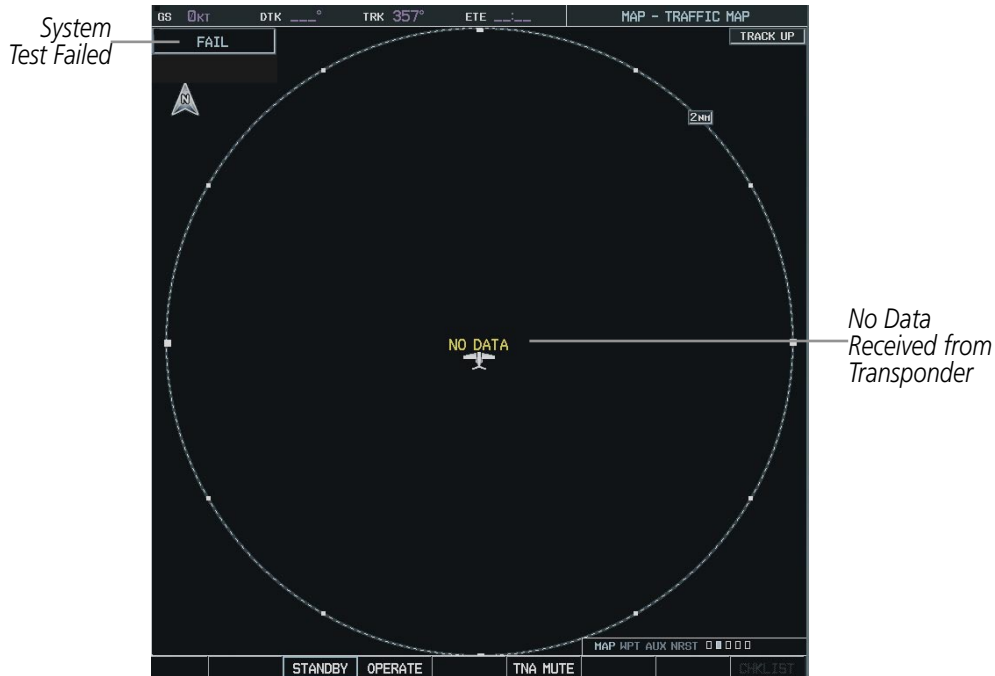
The traffic mode is annunciated in the upper left corner of the Traffic Map Page. When the aircraft is on the ground, TIS automatically enters Standby Mode. Once the aircraft is airborne, TIS switches from Standby to Operating Mode and the G1000 begins to display traffic information. Refer to the System 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:

   Select 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.
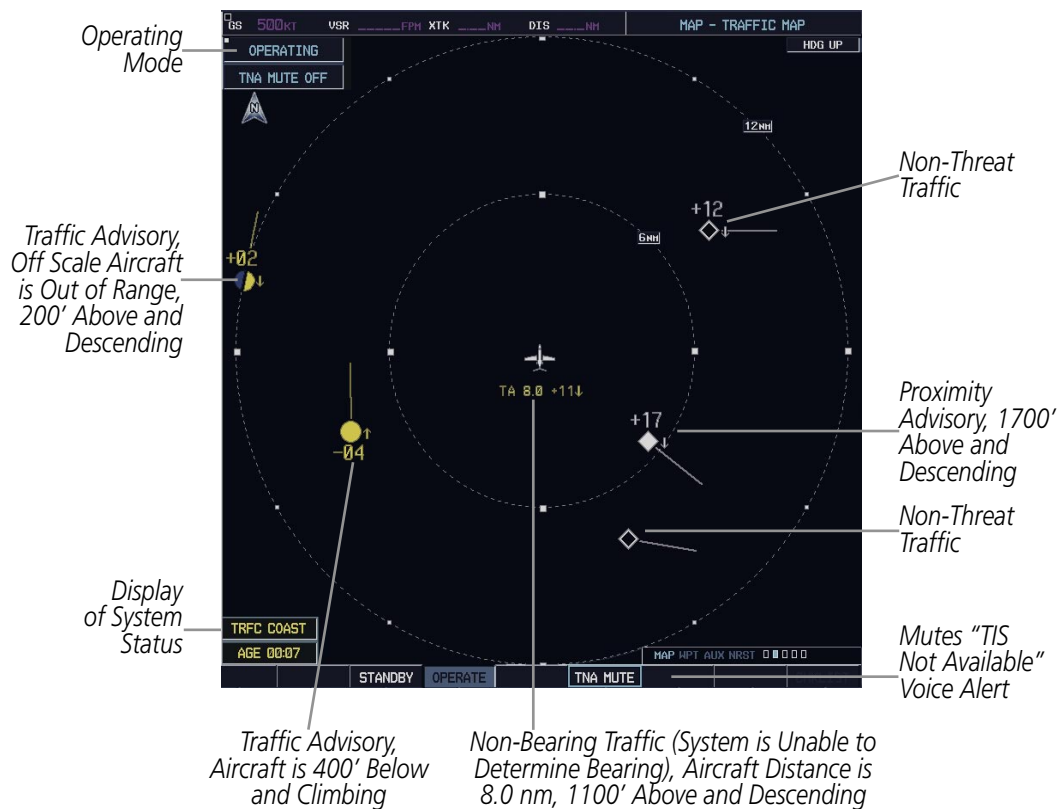
Figure 6-76 Traffic Map Page - Advisories

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.

Inset Map Displays When TA is Detected
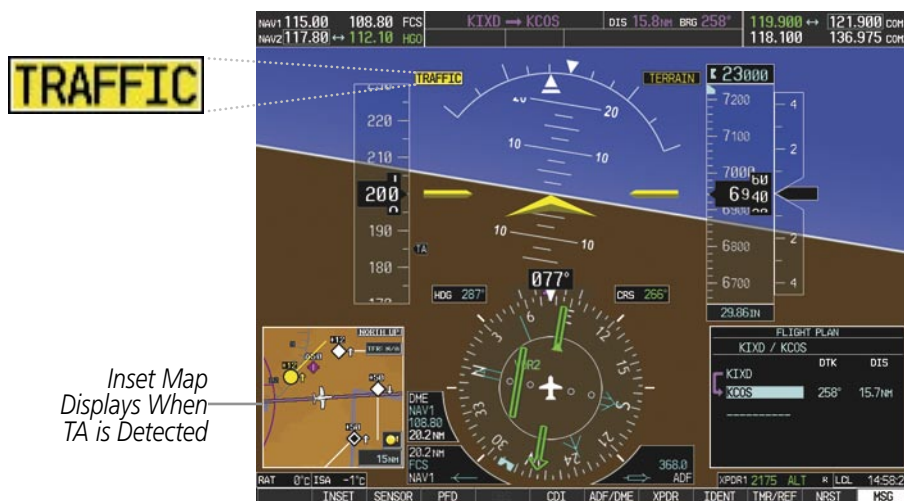
Figure 6-77 Traffic Annunciation (PFD)

A "Traffic 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 "Traffic 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 "Traffic Not Available" voice alert:

1) Select the Traffic Map Page.

2) Select 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 6-11 TIS Failure Annunciations

System Test Failed

No Data Received from Transponder

Figure 6-78 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 when 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 6-13 for additional failure annunciations

Table 6-12 TIS Modes

Switching between TIS modes:

1) Select the Traffic Map Page.

2) Select 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' (if airborne or on the ground) and press the **ENT** Key.

The annunciations 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)
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 (12 to 60 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 6-13 TIS Traffic Status Annunciations

6.5 HONEYWELL KTA 870 TAS SYSTEM (OPTIONAL)

> ✓ **NOTE:** *TIS is disabled when Traffic Advisory System (TAS) is installed.*

Refer to the Honeywell KTA 870 Pilot's Guide for a detailed discussion of the KTA 870 TAS System.

The type of traffic systems that is installed is determined by the traffic page softkeys.

TAS Softkeys

| | | STANDBY | OPERATE | TEST | | ALT MODE | | CHKLIST |

Figure 6-79 TAS Traffic Softkeys

TAS SYMBOLOGY

Traffic Advisory System (TAS) 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 according to TCAS symbology using four different symbols.

TAS Symbol	Description
◈	Non-Threat Traffic
◇	Proximity Advisory (PA)
●	Traffic Advisory (TA)
◐	Traffic Advisory Off Scale

Table 6-14 KTA 870 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 that the intruding aircraft is within ±1200 feet and is within 5nm 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.

PILOT-INITIATED SELF TEST

NOTE: *A pilot initiated self test can only be performed when the system is in standby or failed mode.*

Performing a pilot-initiated self test:

1) On the Traffic Page, select the **TEST** Softkey.

2) Set the range to 2/6 nm.

3) Select the **STANDBY** Softkey.

3) Select the **TEST** Softkey again.

4) The pilot-initiated test will take approximately eight seconds to complete. When completed successfully, traffic symbols display as shown.

Figure 6-80 KTA 870 Self Test OK Display

When the KTA 870 successfully completes the test, the aural message, "TAS SYSTEM OK" is generated. The unit switches to OPERATE mode at the completion of the test.

If a failure is detected during the test, the aural message "TAS SYSTEM FAIL" is generated. The unit then reverts to STANDBY mode.

When the system is in the STANDBY mode, select the **OPERATE** Softkey to begin tracking intruder aircraft.

OPERATING MODES

The unit must be in operating mode for traffic to be displayed. The ability to switch out of standby into operating mode on the ground is especially useful for scanning the airspace around the airport before takeoff.

Switching to operating mode from standby mode:

1) On the Traffic Page, select the **OPERATE** Softkey or press the **MENU** Key and turn the small **FMS** knob to select 'Operating Mode'.

2) If 'Operating Mode' is selected from the FMS menu, press the **ENT** Key to confirm and place the KTA 870 in operating mode.

3) To switch to Standby Mode from the Traffic Page, select the **STANDBY** Softkey.

ALTITUDE DISPLAY MODE

Changing the altitude display mode:

1) On the Traffic Page, select the **ALT MODE** Softkey.

2) Press one of the following softkeys:

   - BELOW
   - NORMAL
   - ABOVE
   - UNREST

3) To return to the Traffic Page, select the **BACK** Softkey.

   OR:

4) Press the **MENU** Key and turn the small **FMS** Knob to select one of the following:

   - BELOW
   - NORMAL
   - ABOVE
   - UNREST

5) Select the **ENT** Softkey.

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 second rectangular page icon.

3) Select the **OPERATE** Softkey to begin displaying traffic. 'TAS OPERATING' is displayed in the Traffic mode field.

4) Select the **ALT MODE** Softkey to change the altitude volume. Select the desired altitude volume by selecting the **BELOW**, **NORMAL**, **ABOVE**, or **UNREST** (unrestricted) Softkey. The selection is displayed in the Altitude mode field.

5) Select the **STANDBY** Softkey to place the system in the Standby mode. 'TAS STANDBY' displays in the Traffic mode field.

6) Turn the **Joystick** clockwise to display a larger area or counter-clockwise to display a smaller area.

TRAFFIC MAP PAGE DISPLAY RANGE

The pilot can change the display range on the Traffic Map Page at any time.

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
- 12 and 24 nm
- 24 and 40 nm

Operating Mode
Altitude Mode
Off Scale Traffic
Traffic Advisory, Aircraft is 400' Below, Climbing
"Non-Bearing" Traffic (Bearing Undetermined), Distance 8.0 nm, 1100' Above, Descending
Proximity Traffic, 1000' Above, Descending

Figure 6-81 KTA 870 Traffic Map Page

Displaying traffic on the Navigation Map

1) Ensure the KTA 870 system is operating. With the Navigation Map displayed, select the **MAP** Softkey.

2) Select the **TRAFFIC** Softkey. Traffic now displays on the map as shown in the figure.

Traffic Advisory
Proximity Traffic
Non-Threat Traffic
TA Off Scale Banner
Non-Bearing Traffic Advisories

Figure 6-82 KTA 870 TAS Traffic on Navigation Map

SECTION 7 AUTOMATIC FLIGHT CONTROL SYSTEM

7.1 AFCS OVERVIEW

> **NOTE:** *The approved Airplane Flight Manual (AFM) always supersedes this Pilot's Guide.*

The GFC 700 is a digital Automatic Flight Control System (AFCS), fully integrated within the G1000 System avionics architecture. The System Overview section provides a block diagram to support this system description. GFC 700 AFCS functionality in the Cessna Citation Mustang is distributed across the following Line Replaceable Units (LRUs):

- GDU 1040A Primary Flight Displays (PFDs) (2)
- GMC 710 AFCS Control Unit
- GIA 63W Integrated Avionics Units (IAUs) (2)
- GSA 80 AFCS Servos (2)
- GSA 81 AFCS Servos (2)
- GSM 85A Servo Gearboxes (4)

The GFC 700 AFCS can be divided into these main operating functions:

- **Flight Director (FD)** — The Cessna Citation Mustang has two flight directors, each operating within an IAU and referred to as pilot-side and copilot-side. Commands for the selected flight director are displayed on both PFDs.

  The flight director provides:

    – Command Bars showing pitch/roll guidance

    – Vertical/lateral mode selection and processing

    – Autopilot communication

- **Autopilot (AP)** — Autopilot operation occurs within the pitch, roll, and pitch trim servos. It also provides servo monitoring and automatic flight control in response to flight director steering commands, Attitude and Heading Reference System (AHRS) attitude and rate information, and airspeed.

- **Yaw Damper (YD)** — The yaw servo is self-monitoring and provides Dutch roll damping and turn coordination in response to yaw rate, roll angle, lateral acceleration, and airspeed.

- **Manual Electric Pitch Trim (MEPT)** — The pitch trim servo provides manual electric pitch trim capability when the autopilot is not engaged.

AFCS CONTROL UNIT

The AFCS Control Unit is positioned above the MFD, and has the following controls:

①	**HDG Key**	Selects/deselects Heading Select Mode
②	**APR Key**	Selects/deselects Approach Mode
③	**NAV Key**	Selects/deselects Navigation Mode
④	**FD Key**	Activates/deactivates the flight director only
		Pressing once turns on the selected flight director in the default vertical and lateral modes. Pressing again deactivates the flight director and removes the Command Bars. If the autopilot is engaged, the key is disabled.
⑤	**XFR Key**	Transfers between the active flight director and standby flight director
⑥	**ALT Key**	Selects/deselects Altitude Hold Mode
⑦	**VS Key**	Selects/deselects Vertical Speed Mode
⑧	**FLC Key**	Selects/deselects Flight Level Change Mode
⑨ ⑰	**CRS Knobs**	Adjust the Selected Course (while in VOR, LOC, or OBS Mode) in 1° increments on the Horizontal Situation Indicator (HSI) of the corresponding PFD
		Press to re-center the Course Deviation Indicator (CDI) and return course pointer directly TO the bearing of the active waypoint/station
⑩	**SPD Key**	Toggles Airspeed Reference between IAS and Mach for Flight Level Change Mode
⑪	**NOSE UP/DN Wheel**	Adjusts the reference in Pitch Hold, Vertical Speed, and Flight Level Change modes (see Table 7-1 for change increments in each mode)
⑫	**VNV Key**	Selects/deselects Vertical Path Tracking Mode for Vertical Navigation flight control
⑬	**ALT SEL Knob**	Controls the Selected Altitude in 100-ft increments (a finer resolution of 10 feet is available under approach conditions)
⑭	**YD Key**	Engages/disengages the yaw damper
⑮	**AP Key**	Engages/disengages the autopilot
⑯	**BANK Key**	Manually selects/deselects Low Bank Mode
⑱	**BC Key**	Selects/deselects Backcourse Mode
⑲	**HDG Knob**	Adjusts the Selected Heading and bug in 1° increments on the HSI (both PFDs)
		Press to synchronize the Selected Heading to the current heading on the pilot-side PFD
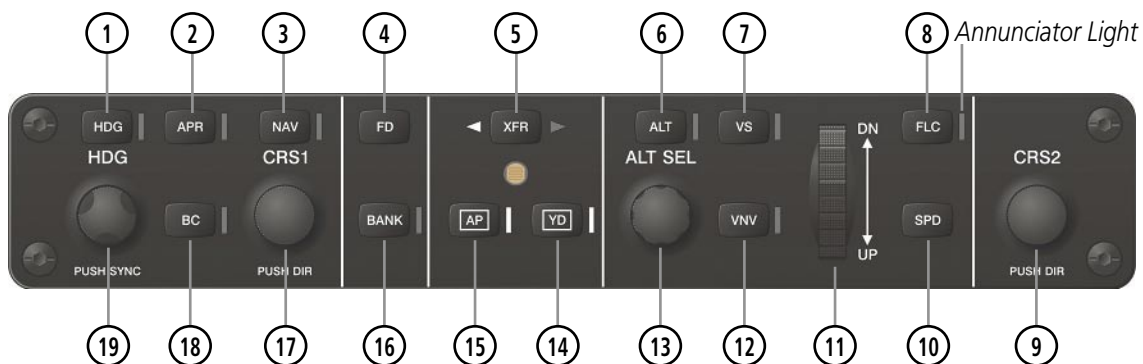
Figure 7-1 GMC 710 AFCS Control Unit

ADDITIONAL AFCS CONTROLS

The following AFCS controls are located separately from the AFCS Control Unit:

AP DISC Switch (Autopilot Disconnect)
Disengages the autopilot, yaw damper, and flight director and interrupts pitch trim operation

An **AP DISC** Switch is located on each control wheel.

This switch may be used to acknowledge an autopilot disconnect alert and mute the associated aural tone.

CWS Button (Control Wheel Steering)
While pressed, allows manual control of the aircraft while the autopilot is engaged and synchronizes the flight director's Command Bars with the current aircraft pitch (if not in a Vertical Navigation, Glideslope, or Glidepath Mode) and roll (if in Roll Hold Mode)

A **CWS** Button is located on each control wheel.

Upon release of the **CWS** Button, the flight director may establish new pitch and roll references, depending on the current vertical and lateral modes. CWS operation details are discussed in the respective mode sections of this manual.

GA Switch (Go Around)
Disengages the autopilot and selects flight director Takeoff (on ground) or Go Around (in air) Mode

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 each control wheel.

This composite switch is split into left and right sides. The left switch is the ARM contact and the right switch controls the DN (forward) and UP (rearward) contacts. Pushing the **MEPT** ARM Switch disengages the autopilot, if currently engaged, but does not affect yaw damper operation. The **MEPT** ARM Switch may be used to acknowledge an autopilot disconnect alert and mute the associated aural tone.

Manual trim commands are generated only when both sides of the switch are operated simultaneously. If either side of the switch is active separately for more than three seconds, MEPT function is disabled and 'PTRM' is displayed as the AFCS Status Annunciation on the PFDs. The function remains disabled until both sides of the switch are inactivated.

7.2 FLIGHT DIRECTOR OPERATION

The flight director function provides pitch and roll commands to the AFCS and displays them on the PFDs. With the flight director active, the aircraft can be hand-flown to follow the path shown by the Command Bars. Maximum commanded pitch (±20°) and roll (Table 7-3) 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 pilot-side flight director in the listed modes. The flight director may be turned off and the Command Bars removed from the displays by pressing the **FD** Key again. The **FD** Key is disabled when the autopilot is engaged.

Control Pressed	Modes Selected			
	Lateral		Vertical	
FD Key	Roll Hold (default)	ROL	Pitch Hold (default)	PIT
AP Key	Roll Hold (default)	ROL	Pitch Hold (default)	PIT
CWS Button	Roll Hold (default)	ROL	Pitch Hold (default)	PIT
GA Switch	Takeoff (on ground)	TO	Takeoff (on ground)	TO
	Go Around (in air)	GA	Go Around (in air)	GA
ALT Key	Roll Hold (default)	ROL	Altitude Hold	ALT
VS Key	Roll Hold (default)	ROL	Vertical Speed	VS
VNV Key	Roll Hold (default)	ROL	Vertical Path Tracking*	VPTH
NAV Key	Navigation**	GPS VOR LOC	Pitch Hold (default)	PIT
BC Key	Backcourse***	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.

***The selected navigation receiver must have a valid LOC signal before **BC** Key press activates flight director.

Table 7-1 Flight Director Activation

AFCS STATUS BOX

Flight director mode annunciations are displayed on the PFDs when the flight director is active. Flight director selection and autopilot and yaw damper statuses are shown in the center of the AFCS Status Box. Lateral flight director modes are displayed on the left and vertical on the right. Armed modes are displayed in white and active in green.

AFCS Status Box
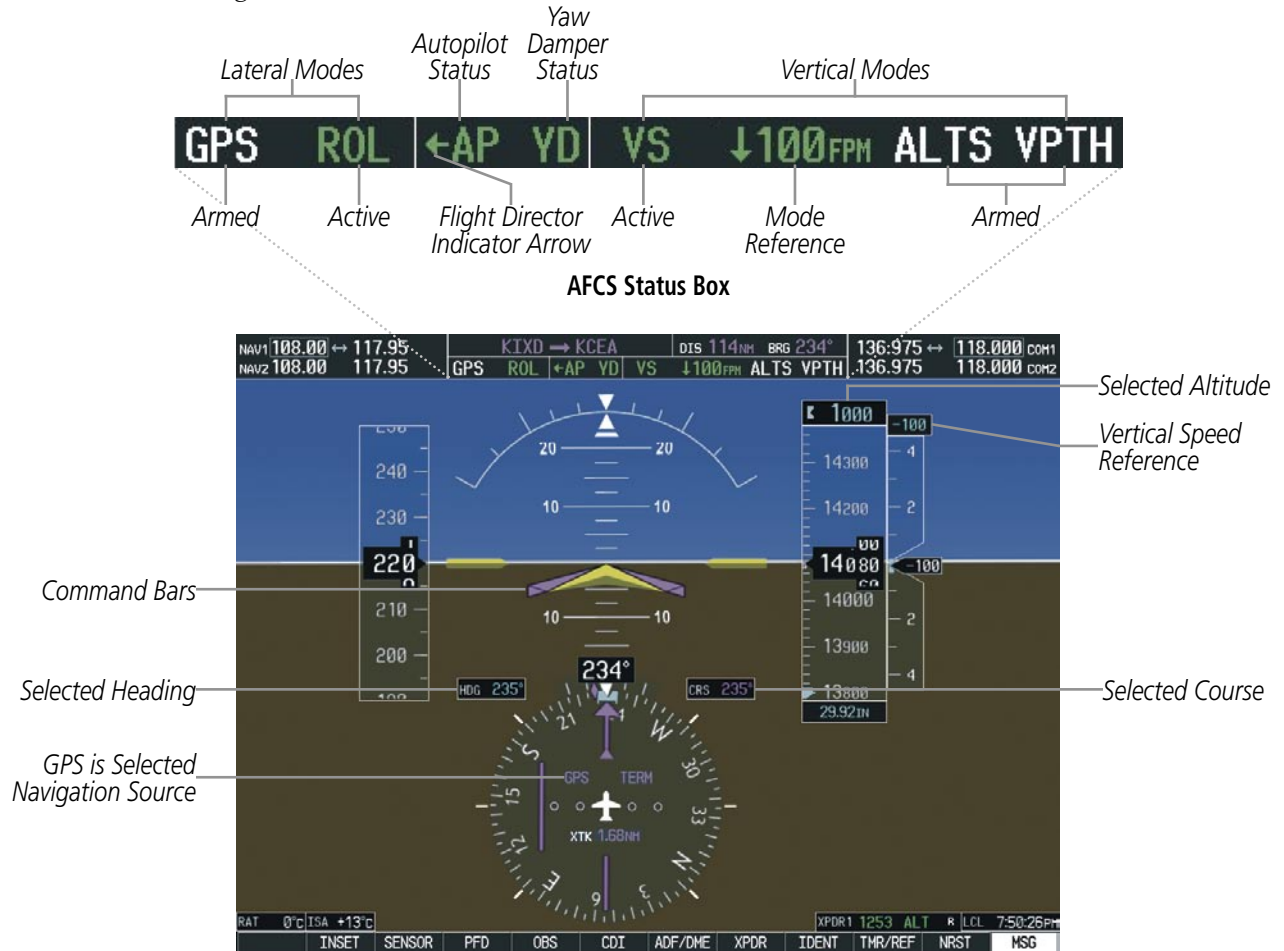
Figure 7-2 PFD AFCS Display

FLIGHT DIRECTOR MODES

Flight director modes are normally selected independently for the pitch and roll axes. Unless otherwise specified, all mode keys are alternate action (i.e., press on, press off). In the absence of specific mode selection, the flight director reverts to the default pitch and/or roll modes(s). Mode keys on the AFCS controller are accompanied by annunciator lights (Figure 7-1) which are illuminated when their respective modes are armed or active.

Armed modes are annunciated in white and active in green in the AFCS Status Box. Under normal operation, when the control for the active flight director mode is pressed, the flight director reverts to the default mode(s) for the axis(es). Automatic transition from armed to active mode is indicated by the white armed mode annunciation moving to the green active mode field and flashing for 10 seconds.

If the information required to compute a flight director mode becomes invalid or unavailable, the flight director automatically reverts to the default mode for that axis. A flashing yellow mode annunciation and annunciator light indicate loss of sensor (AHRS, ADC, IAU) or navigation data (VOR, LOC, GPS, VNV, WAAS) 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.
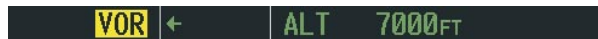
Figure 7-3 Loss of VOR Signal

The flight director is automatically disabled if the attitude information required to compute the default flight director modes becomes invalid or unavailable.

SWITCHING FLIGHT DIRECTORS

The GFC 700 in the Cessna Citation Mustang has two flight directors, each operating within an IAU. Only one flight director is active (selected) at a time. Flight directors may be switched by pressing the **XFR** Key. Both PFDs display the selected flight director, indicated by an arrow pointing toward either the pilot or copilot side, in the center of the AFCS Status Box. The annunciator light arrow for the selected flight director is also illuminated beside the **XFR** Key. When the flight directors are switched, the vertical and lateral modes revert to default.

Pilot-side Flight Director Selected

Copilot-side Flight Director Selected
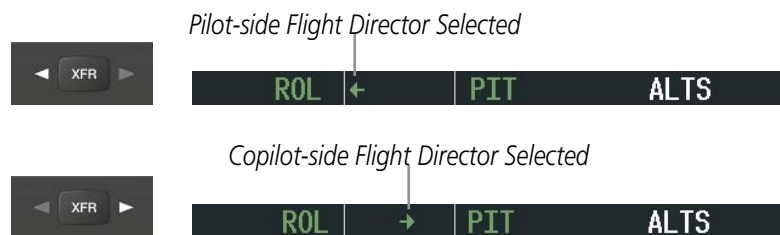
Figure 7-4 Flight Director Selection Indications

COMMAND BARS

Upon activation of the flight director, Command Bars are displayed in magenta on the PFDs as single cues or cross pointers. The Aircraft Symbol (in yellow) changes to accommodate the Command Bar format; the Command Bars do not override the Aircraft Symbol. The single-cue Command Bars (Figure 7-5) move together vertically to indicate pitch commands and bank left or right to indicate roll commands. Command Bars displayed as a cross pointer (Figure 7-6) move independently to indicate pitch (horizontal bar) and roll (vertical bar) commands. Both PFDs show the same Command Bar format. Command Bar format may only be changed while on the ground.
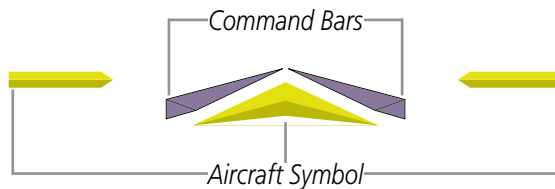
Figure 7-5 Single-cue Command Bars
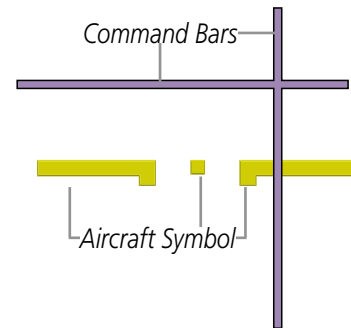
Figure 7-6 Cross-pointer Command Bars

Changing Command Bar format:

1) Press the **PFD** Softkey.

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

3) Press the **SNGL CUE** Softkey to display Command Bars as a single cue.

    OR:

    Press the **X POINTR** Softkey to display Command Bars as a cross pointer.

If the attitude information being sent to the flight director becomes invalid or unavailable, the Command Bars are removed from the display. The flight director Command Bars also disappear if the pitch exceeds +30°/-20° or bank exceeds 65°.

7.3 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/DN** Wheel can be used to change the vertical mode reference while operating under Pitch Hold, Vertical Speed, or Flight Level Change Mode. Increments of change and acceptable ranges of values for each of these references using the **NOSE UP/DN** Wheel are also listed in the table.

Vertical Mode	Description	Control	Annunciation	Reference Range	Reference Change Increment
Pitch Hold	Holds the current aircraft pitch attitude; may be used to climb/descend to the Selected Altitude	(default)	PIT	-20° 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	-5000 to +5000 fpm	100 fpm
Flight Level Change, IAS Hold	Maintains the current aircraft airspeed (in IAS or Mach) while the aircraft is climbing/descending to the Selected Altitude	**FLC** Key	FLC nnn KT	80 to 250 kt	1 kt
Flight Level Change, Mach Hold			FLC M .nnn	M 0.40 to 0.63	M 0.01
Vertical Path Tracking	Captures and tracks descent legs of an active vertical profile	**VNV** Key	VPTH		
VNV Target Altitude Capture	Captures the Vertical Navigation (VNV) Target Altitude	**	ALTV		
Glidepath	Captures and tracks the WAAS glidepath on approach	**APR** Key	GP		
Glideslope	Captures and tracks the ILS glideslope on approach		GS		
Takeoff	Disengages the autopilot and commands a constant pitch angle and wings level on the ground in preparation for takeoff	**GA** Switch	TO	10°	
Go Around	Disengages the autopilot and commands a constant pitch angle and wings level in the air		GA	8°	

*   *ALTS armed automatically when PIT, VS, FLC, TO, or GA active, and under VPTH when Selected Altitude is to be captured instead of VNV Target Altitude*

** *ALTV armed automatically under VPTH when VNV Target Altitude is to be captured instead of Selected Altitude*

Table 7-2 Flight Director Vertical Modes

PITCH HOLD MODE (PIT)

When the flight director is activated (the **FD** Key is pressed) or switched (the **XFR** Key is pressed), Pitch Hold Mode is selected by default. Pitch Hold Mode is indicated as the active vertical mode by the 'PIT' annunciation. This mode may be used for climb or descent to the Selected Altitude (shown above the Altimeter), since Selected Altitude Capture Mode is automatically armed when Pitch Hold Mode is activated.

In Pitch Hold Mode, the flight director maintains a constant pitch attitude, the pitch reference. The pitch reference is set to the aircraft pitch attitude at the moment of mode selection. If the aircraft pitch attitude exceeds the flight director pitch command limitations, the flight director commands a pitch angle equal to the nose-up/down limit.

CHANGING THE PITCH REFERENCE

When operating in Pitch Hold Mode, the pitch reference can be adjusted by:

• Using the **NOSE UP/DN** Wheel

• Pressing the **CWS** Button, hand-flying the aircraft to establish a new pitch reference, then releasing the **CWS** Button

Figure 7-7 Pitch Hold Mode

SELECTED ALTITUDE CAPTURE MODE (ALTS)

Selected Altitude Capture Mode is automatically armed with activation of the following modes:

- Pitch Hold
- Vertical Speed
- Flight Level Change

- 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 7-7 for example). The **ALT SEL** Knob is used to set the Selected Altitude (shown above the Altimeter) until Selected Altitude Capture Mode becomes active.

As the aircraft nears the Selected Altitude, the flight director automatically transitions to Selected Altitude Capture Mode with Altitude Hold Mode armed (Figure 7-8). 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)

HDG ←AP YD **ALTS** 12000FT**ALT**

Flash up to 10 sec, Indicating Automatic Transition

HDG ←AP YD **ALT** 12000FT
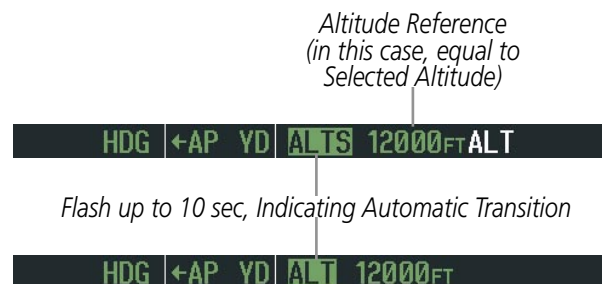
Figure 7-8 Automatic Mode Transitions During Altitude Capture

CHANGING THE SELECTED ALTITUDE

> **NOTE:** *Pressing the **CWS** Button while in Selected Altitude Capture Mode does not cancel the mode.*

Use of the **ALT SEL** Knob to change the Selected Altitude while Selected Altitude Capture Mode is active causes the flight director to revert to Pitch Hold Mode with Selected Altitude Capture Mode armed for the new Selected Altitude.

ALTITUDE HOLD MODE (ALT)

Altitude Hold Mode can be activated by pressing the **ALT** Key; the flight director maintains the current aircraft altitude (to the nearest 10 feet) as the Altitude Reference. The flight director's Altitude Reference, shown in the AFCS Status Box, is independent of the Selected Altitude, displayed above the Altimeter. Altitude Hold Mode active is indicated by a green 'ALT' annunciation in the AFCS Status Box.

Altitude Hold Mode is automatically armed when the flight director is in Selected Altitude Capture Mode (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 SEL** Knob while in Altitude Hold Mode changes the Selected Altitude, but not the flight director's Altitude Reference, and does not cancel the mode.*

With the **CWS** Button depressed, the aircraft can be hand-flown to a new Altitude Reference. When the **CWS** Button is released at the desired altitude, the new altitude is established as the Altitude Reference.

If the Selected Altitude is reached during CWS maneuvering, the Altitude Reference is not changed. To adjust the Altitude Reference in this case, the **CWS** Button must be pressed again after the Selected Altitude is reached.

Figure 7-9 Altitude Hold Mode

VERTICAL SPEED MODE (VS)

In Vertical Speed Mode, the flight director acquires and maintains a Vertical Speed Reference. Current aircraft vertical speed (to the nearest 100 fpm) becomes the Vertical Speed Reference at the moment of Vertical Speed Mode activation. This mode may be used for climb or descent to the Selected Altitude (shown above the Altimeter) since Selected Altitude Capture Mode is automatically armed when Vertical Speed Mode is selected.

When Vertical Speed Mode is activated by pressing the **VS** Key, 'VS' is annunciated in green in the AFCS Status Box along with the Vertical Speed Reference. The Vertical Speed Reference is also displayed above the Vertical Speed Indicator. A Vertical Speed Reference Bug corresponding to the Vertical Speed Reference is shown on the indicator.

CHANGING THE VERTICAL SPEED REFERENCE

The Vertical Speed Reference (shown both in the AFCS Status Box and above the Vertical Speed Indicator) may be changed by:

- Using the **NOSE UP/DN** Wheel

- Pressing the **CWS** Button, hand-flying the aircraft to attain a new Vertical Speed Reference, then releasing the **CWS** Button

Figure 7-10 Vertical Speed Hold Mode

FLIGHT LEVEL CHANGE MODE (FLC)

> **NOTE:** *The Selected Altitude should be set before selecting Flight Level Change Mode.*

Flight Level Change Mode is selected by pressing the **FLC** Key. This mode acquires and maintains the Airspeed Reference (in IAS or Mach) 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, Mach, 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.

Figure 7-11 Flight Level Change Mode (IAS)

CHANGING THE AIRSPEED REFERENCE

The Airspeed Reference (shown in both the AFCS Status Box and above the Airspeed Indicator) may be adjusted by:

• Using the **NOSE UP/DN** Wheel

• Pressing the **CWS** Button, hand-flying the aircraft to attain a new Airspeed Reference, then releasing the **CWS** Button

During climb, the Airspeed Reference units automatically change from IAS to Mach when either the altitude or the airspeed listed in Table 7-3 are attained. For descent, the units switch back at the specified altitude or airspeed. The system determines aircraft climb or descent by the relationship between the current and Selected altitudes.

	Airspeed Reference Units		Unit Type Changes At:	
	Default Units	**Change To:**	**Altitude**	**Airspeed**
Climb	IAS	Mach	> 31,500 ft	> M 0.48
Descent	Mach	IAS	< 27,000 ft	< 249 kt

Table 7-3 FLC Mode Unit Changes

Airspeed Reference units can be manually toggled between IAS and Mach units using the **SPD** Key. When the FLC Airspeed Reference is displayed in Mach, the Airspeed Reference Bug is displayed on the Airspeed Indicator at the IAS corresponding to the selected Mach target speed and the current Mach number is shown below the Airspeed Indicator.

Figure 7-12 Flight Level Change Mode (Mach)

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 GPS Navigation Section for more information on VNV flight plans. Conditions for availability include, but are not limited to:

- The selected navigation source is GPS.
- A VNV flight plan (with at least one altitude-constrained waypoint) or direct-to (with vertical constraint) 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 direct-to (with vertical constraint). The appropriate VNV flight control modes are sequenced by the flight director to follow the path defined by the vertical profile. Upon reaching the last waypoint in the VNV flight plan, the flight director transitions to Altitude Hold Mode and cancels any armed VNV modes.

VERTICAL PATH TRACKING MODE (VPTH)

> **NOTE:** *If another vertical mode key is pressed while Vertical Path Tracking Mode is selected, Vertical Path Tracking Mode reverts to armed.*

> **NOTE:** *Pressing the **CWS** Button while Vertical Path Tracking Mode is active does not cancel the mode. The autopilot guides the aircraft back to the descent path upon release of the **CWS** Button.*

When a vertical profile (VNV flight plan) is active and the **VNV** Key is pressed, Vertical Path Tracking Mode is armed in preparation for descent path capture. 'VPTH' (or '/V' when Glidepath or Glideslope Mode is concurrently armed) is annunciated in white in addition to previously armed modes. If applicable, the appropriate altitude capture mode is armed for capture of the next VNV Target Altitude (ALTV) or the Selected Altitude (ALTS), whichever is greater.

| GPS | ← | ALT 23000FT **VPTH** |

| GPS | ← | FLC 170KT **ALTS GP/V** |
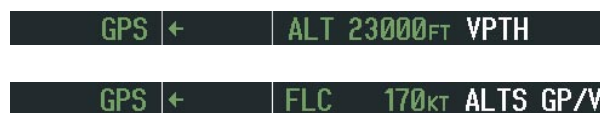
Figure 7-13 Vertical Path Tracking Armed Annunciations

Prior to descent path interception, the Selected Altitude must be set below the current aircraft altitude by at least 75 feet. For the flight director to transition from Altitude Hold to Vertical Path Tracking Mode, acknowledgment is required within 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 and the **VNV** Key annunciator light start to flash. Flashing continues until acknowledged or the descent path is intercepted. If the descent is not confirmed by the time of interception, Vertical Path Tracking Mode remains armed and the descent is not captured.

In conjunction with the "TOD [top of descent] within 1 minute" annunciation in the PFD Navigation Status Box and the "Vertical track" voice message, VNV indications (VNV Target Altitude, vertical deviation, and vertical speed required) appear on the PFDs in magenta (Figure 7-14).

Figure 7-14 Vertical Path Capture

When a descent leg is captured (i.e., vertical deviation becomes valid), Vertical Path Tracking becomes active and tracks the descent profile (Figure 7-15). An altitude capture mode ('ALTS' or 'ALTV') is armed as appropriate.

Figure 7-15 Vertical Path Tracking Mode

If the altimeter barometric setting is adjusted while Vertical Path Tracking is active, the flight director increases/decreases the descent rate by up to 500 fpm to re-establish the aircraft on the descent path (without commanding a climb). Adjusting the altimeter barometric setting creates discontinuities in VNV vertical deviation, moving the descent path. For large adjustments, it may take several minutes for the aircraft to re-establish on the descent path. If the change is made while nearing a waypoint with a VNV Target Altitude, the aircraft may not re-establish on the descent path in time to meet the vertical constraint.

Automatic Reversion to Pitch Hold Mode

Several situations can occur while Vertical Path Tracking Mode is active which cause the flight director to revert to Pitch Hold Mode:

• Vertical deviation exceeds 200 feet during an overspeed condition.

• Vertical deviation experiences a discontinuity that both exceeds 200 feet in magnitude and results in the vertical deviation exceeding 200 feet in magnitude. Such discontinuities are usually caused by flight plan changes that affect the vertical profile.

• Vertical deviation becomes invalid (the Vertical Deviation Indicator is removed from the PFD).

• A display enters Reversionary Mode (this does not apply to an active direct-to with vertical constraint).

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 220ĸᴛ **ALTS VPTH**

Figure 7-16 Flight Level Change VNV Non-Path Descent

To prevent immediate profile re-capture, the following must be satisfied:

• At least 10 seconds have passed since the non-path transition was initiated

• Vertical deviation from the profile has exceeded 250 feet, but is now less than 200 feet

Pressing the **VNV** Key twice re-arms Vertical Path Tracking for immediate profile re-capture.

VNV TARGET ALTITUDE CAPTURE MODE (ALTV)

> **NOTE:** *Armed VNV Target Altitude and Selected Altitude capture modes are mutually exclusive. However, Selected Altitude Capture Mode is armed implicitly (not annunciated) whenever VNV Target Altitude Capture Mode is armed.*

VNV Target Altitude Capture is analogous to Selected Altitude Capture Mode and is armed automatically after the **VNV** Key is pressed and the next VNV Target Altitude is to be intercepted before the Selected Altitude. The annunciation 'ALTV' indicates that the VNV Target Altitude is to be captured. VNV Target Altitudes are shown in the active flight plan or direct-to (with vertical constraint), and can be entered manually or loaded from a database (see the GPS Navigation Section for details). At the same time as "TOD within 1 minute" is annunciated in the Navigation Status Box, the active VNV Target Altitude is displayed above the Vertical Speed Indicator (see Figure 7-14).

As the aircraft nears the VNV Target Altitude, the flight director automatically transitions to VNV Target Altitude Capture Mode with Altitude Hold Mode armed. This automatic transition is indicated by the green 'ALTV' annunciation flashing for up to 10 seconds and the appearance of the white 'ALT' annunciation. The VNV Target Altitude is shown as the Altitude Reference beside the 'ALTV' annunciation and remains displayed above the Vertical Speed Indicator. The Required Vertical Speed Indication (RSVI) is removed once VNV Target Altitude Capture Mode becomes active.

At 50 feet from the VNV Target Altitude, the flight director automatically transitions from VNV Target Altitude Capture to Altitude Hold Mode and tracks the level leg. As Altitude Hold Mode becomes active, the white 'ALT' annunciation moves to the active vertical mode field and flashes green for 10 seconds to indicate the automatic transition. The flight director automatically arms Vertical Path Tracking, allowing upcoming descent legs to be captured and subsequently tracked.

Altitude Reference (In This Case, Equal To VNV Altitude Target)

```
GPS  ←        ALTV 10000 FT  ALT  VPTH
```

Flash up to 10 sec, Indicating Automatic Transition

```
GPS  ←        ALT  10000 FT  VPTH
```
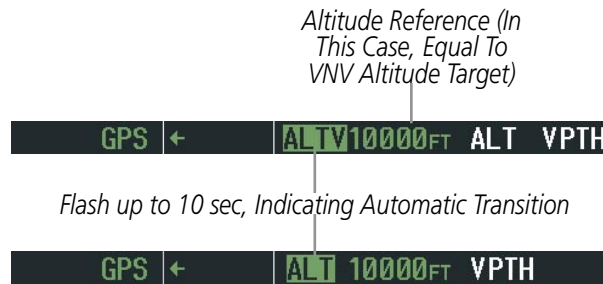
Figure 7-17 Automatic Mode Transitions During Altitude Capture

CHANGING THE VNV TARGET ALTITUDE

> **NOTE:** *Pressing the **CWS** Button while in VNV Target Altitude Capture Mode does not cancel the mode.*

Changing the current VNV Target Altitude while VNV Target Altitude Capture Mode is active causes the flight director to revert to Pitch Hold Mode. Vertical Path Tracking and the appropriate altitude capture mode are armed in preparation to capture the new VNV Target Altitude or the Selected Altitude, depending on which altitude is to be intercepted first.

VNV target altitudes can be changed while editing the active flight plan (see the GPS Navigation Section for details).

GLIDEPATH MODE (GP)

> **NOTE:** Pressing the **CWS** Button while Glidepath Mode is active does not cancel the mode. The autopilot guides the aircraft back to the glidepath upon release of the **CWS** Button.

Glidepath Mode is used to track the WAAS-based glidepath. When Glidepath Mode is armed, 'GP' is annunciated in white in the AFCS Status Box.

Selecting Glidepath Mode:

1) Ensure a GPS approach is loaded into the active flight plan. The active waypoint must be part of the flight plan (cannot be a direct-to a waypoint not in the flight plan).

2) Ensure that GPS is the selected navigation source (use the **CDI** Softkey to cycle through navigation sources if necessary).

3) Press the **APR** Key.

Upon reaching the glidepath, the flight director transitions to Glidepath Mode and begins to capture and track the glidepath.

Figure 7-18 Glidepath Mode Armed

Once the following conditions have been met, the glidepath can be captured:

- The active waypoint is at or after the final approach fix (FAF).

- Vertical deviation is valid.

- The CDI is at less than full-scale deviation

- Automatic sequencing of waypoints has not been suspended (no 'SUSP' annunciation on the HSI)

Figure 7-19 Glidepath Mode

GLIDESLOPE MODE (GS)

> **NOTE:** Pressing the **CWS** Button while Glideslope Mode is active does not cancel the mode. The autopilot guides the aircraft back to the glideslope upon release of the **CWS** Button.

Glideslope Mode is available for LOC/ILS approaches to capture and track the glideslope. When Glideslope Mode is armed (annunciated as 'GS' in white), LOC Approach Mode is armed as the lateral flight director mode.

Selecting Glideslope Mode:

1) Ensure a valid localizer frequency is tuned.

2) Ensure that LOC is the selected navigation source (use the **CDI** Softkey to cycle through navigation sources if necessary).

3) Press the **APR** Key.

OR:

1) Ensure that GPS is the selected navigation source (use the **CDI** Softkey to cycle through navigation sources if necessary).

2) Ensure a LOC/ILS approach is loaded into the active flight plan.

3) Ensure the corresponding LOC frequency is tuned.

4) Press the **APR** Key.

Figure 7-20 Glideslope Mode Armed

Once LOC is the navigation source, the localizer and glideslope can be captured. Upon reaching the glideslope, the flight director transitions to Glideslope Mode and begins to capture and track the glideslope.

Figure 7-21 Glideslope Mode

TAKEOFF (TO) AND GO AROUND (GA) MODES

Go Around and Takeoff modes are coupled pitch and roll modes and are annunciated as both the vertical and lateral modes when active. In these modes, the flight director commands a constant set pitch attitude and keeps the wings level. The **GA** Switch is used to select both modes. The mode entered by the flight director depends on whether the aircraft is on the ground.

Takeoff Mode provides an attitude reference during rotation and takeoff. This mode can be selected only while on the ground by pushing the **GA** Switch. The flight director Command Bars assume a wings-level, pitch-up attitude.

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/DN** Wheel or **CWS** Button) result in reversion to Pitch and Roll Hold modes.

Figure 7-22 Go Around Mode

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 and Takeoff modes.

Lateral Mode	Description	Control	Annunciation	Maximum Roll Command Limit
Roll Hold	Holds the current aircraft roll attitude or rolls the wings level, depending on the commanded bank angle	(default)	ROL	30°
Low Bank	Limits the maximum commanded roll angle	**BANK** Key	*	18°
Heading Select	Captures and tracks the Selected Heading	**HDG** Key	HDG	30°
Navigation, GPS Arm/Capture/Track	Captures and tracks the selected navigation source (GPS, VOR, LOC)	**NAV** Key	GPS	30°
Navigation, VOR Enroute Arm/Capture/Track			VOR	30°
Navigation, LOC Arm/Capture/Track (No Glideslope)			LOC	25°
Backcourse Arm/Capture/Track	Captures and tracks a localizer signal for backcourse approaches	**BC** Key	BC	25°
Approach, GPS Arm/Capture/Track	Captures and tracks the selected navigation source (GPS, VOR, LOC)	**APR** Key	GPS	30°
Approach, VOR Arm/Capture/Track			VAPP	25°
Approach, ILS Arm/Capture/Track (Glideslope Mode automatically armed)			LOC	25°
Takeoff	Disengages the autopilot and commands a constant pitch angle and wings level on the ground in preparation for takeoff	**GA** Switch	TO	Wings Level
Go Around	Disengages the autopilot and commands a constant pitch angle and wings level in the air		GA	Wings Level

* No annunciation appears in the AFCS Status Box. The acceptable bank angle range is indicated in green along the Roll Scale of the Attitude Indicator.

Table 7-4 Flight Director Lateral Modes

The **CWS** Button does not change lateral references for Heading Select, Navigation, Backcourse, or Approach Mode. The autopilot guides the aircraft back to the Selected Heading/Course upon release of the **CWS** Button.

ROLL HOLD MODE (ROL)

NOTE: *If Roll Hold Mode is activated as a result of a mode reversion, the flight director rolls the wings level.*

When the flight director is activated or switched, Roll Hold Mode is selected by default. This mode is annunciated as 'ROL' in the AFCS Status Box. The current aircraft bank angle is held, subject to the bank angle condition.

```
ROL  ←      PIT        ALTS
```

Figure 7-23 Roll Hold Mode Annunciation

Bank Angle	Flight Director Response
< 6°	Rolls wings level
6 to 30°	Maintains current aircraft roll attitude
> 30°	Limits bank to 30°

Table 7-5 Roll Hold Mode Responses

CHANGING THE ROLL REFERENCE

The roll reference can be changed by pressing the **CWS** Button, establishing the desired bank angle, then releasing the **CWS** Button.

LOW BANK MODE

When in Low Bank Mode, the flight director limits the maximum commanded roll angle to 18°. Low bank arc limits are displayed in green along the Roll Scale.

Low Bank Mode can be manually selected/deselected by pressing the **BANK** Key while in Heading Select or Navigation Modes (GPS and VOR). Low Bank Mode is activated automatically above 29,850 feet. The flight director deactivates Low Bank Mode when descending through 29,650 feet. The annunciator light next to the **BANK** Key illuminates while Low Bank Mode is selected.

Figure 7-24 Low Bank Mode Limits

HEADING SELECT MODE (HDG)

Heading Select Mode is activated by pressing the **HDG** Key. Heading Select Mode acquires and maintains the Selected Heading. The Selected Heading is shown by a light blue bug on the HSI and in the box to the upper left of the HSI.

Changing the Selected Heading

> ✓ **NOTE:** *Pressing the **HDG** Knob synchronizes the Selected Heading to the current heading.*

The Selected Heading is adjusted using the **HDG** Knob on either PFD. Pressing the **CWS** Button and hand-flying the aircraft does not change the Selected Heading. The autopilot guides the aircraft back to the Selected Heading upon release of the **CWS** Button.

Turns are commanded in the same direction as Selected Heading Bug movement, even if the bug is turned more than 180° from the present heading (e.g., a 270° turn to the right). However, Selected Heading changes of more than 330° at a time result in turn reversals.

Figure 7-25 Heading Select Mode

NAVIGATION MODE (GPS, VOR, LOC)

> **NOTE:** *The selected navigation receiver must have a valid VOR or LOC signal or active GPS course for the flight director to enter Navigation Mode.*

Pressing the **NAV** Key selects Navigation Mode. Navigation Mode acquires and tracks the selected navigation source (GPS, VOR, LOC). The flight director follows GPS roll steering commands when GPS is the selected navigation source. When the navigation source is VOR or LOC, the flight director creates roll steering commands from the Selected Course and deviation. Navigation Mode can also be used to fly non-precision GPS and LOC approaches where vertical guidance is not required.

If the Course Deviation Indicator (CDI) shows greater than one dot when the **NAV** Key is pressed, the selected mode is armed. The armed annunciation appears in white to the left of the active lateral mode. For cases where the projected course is offset a large distance from the present course for turn anticipation, GPS Navigation Mode can be activated with crosstrack error up to 10 nm.

GPS	ROL	←		PIT		ALTS

Figure 7-26 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)

• FAF crossed while in GPS Navigation Mode after the automatic navigation source switch from GPS to LOC

CHANGING THE SELECTED COURSE

If the navigation source is VOR or localizer or OBS Mode has been enabled when using GPS, the Selected Course is controlled using the **CRS** Knob corresponding to the selected flight director (**CRS1** for the pilot side, **CRS2** for the copilot side).

Pressing the **CWS** Button and hand-flying the aircraft does not change the Selected Course while in Navigation Mode. The autopilot guides the aircraft back to the Selected Course (or GPS flight plan) when the **CWS** Button is released.

Figure 7-27 Navigation Mode

APPROACH MODE (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).

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. If GPS Approach Mode is selected while in GPS Navigation Mode, capture can occur with crosstrack error of up to 2 nm.

Selecting GPS Approach Mode:

1) Ensure a GPS approach is loaded into the active flight plan. The active waypoint must be part of the flight plan (cannot be a direct-to a waypoint not in the flight plan).

2) Ensure that GPS is the selected navigation source (use the **CDI** Softkey to cycle through navigation sources if necessary).

3) Press the **APR** Key.

Figure 7-28 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

• GPS Navigation Mode is active and the FAF is crossed after the automatic navigation source switch from GPS to LOC

CHANGING THE SELECTED COURSE

If the navigation source is VOR or localizer or OBS Mode has been enabled when using GPS, the Selected Course is controlled using the **CRS** Knob corresponding to the selected flight director (**CRS1** for the pilot side, **CRS2** for the copilot side).

Pressing the **CWS** Button and hand-flying the aircraft does not change the Selected Course while in Approach Mode. The autopilot guides the aircraft back to the Selected Course (or GPS flight plan) when the **CWS** Button is released.

BACKCOURSE MODE (BC)

NOTE: *When making a backcourse approach, set the Selected Course to the localizer front course.*

Backcourse Mode captures and tracks a localizer signal in the backcourse direction. The mode may be selected by pressing the **BC** Key. Backcourse Mode is armed if the CDI is greater than one dot when the mode is selected. The flight director creates roll steering commands from the Selected Course and deviation when in Backcourse Mode.

Backcourse Mode Active   Pitch Hold Mode Active

LOC2 is Selected Navigation Source

Figure 7-29 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.

7.5 AUTOPILOT AND YAW DAMPER OPERATION

> **NOTE:** *Refer to the AFM for specific instructions regarding emergency procedures.*

The Cessna Citation Mustang's 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 not independent of the yaw damper for the Cessna Citation Mustang.

The yaw damper reduces Dutch roll tendencies and coordinates turns. It can operate independently of the autopilot and may be used during normal hand-flight maneuvers. Yaw rate commands are limited to 6 deg/sec by the yaw damper.

FLIGHT CONTROL

Pitch and roll commands are provided to the servos based on the active flight director modes. Yaw damping is provided by the yaw servo. Servo motor control limits the maximum servo speed and torque. The servo gearboxes are equipped with slip-clutches set to certain values. This allows the servos to be overridden in case of an emergency.

PITCH AXIS AND TRIM

The autopilot pitch axis uses pitch rate to stabilize the aircraft pitch attitude during upsets and flight director maneuvers. Flight director pitch commands are rate- and attitude-limited, combined with pitch damper control, and sent to the pitch servo motor. The pitch servo measures the output effort (torque) and provides this signal to the pitch trim 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 upsets and flight director maneuvers. The flight director roll commands are rate- and attitude-limited, combined with roll damper control, and sent to the roll servo motor.

YAW AXIS

The yaw damper uses yaw rate and roll attitude to dampen the aircraft's natural Dutch roll response. It also uses lateral acceleration to coordinate turns. Yaw damper operation is independent of autopilot engagement.

ENGAGEMENT

> **NOTE:** Autopilot engagement/disengagement is not equivalent to servo engagement/disengagement. Use the **CWS** Button to disengage the pitch and roll servos while the autopilot remains active.

> **NOTE:** The autopilot cannot be engaged if the yaw damper has failed.

When the **AP** Key is pressed, the autopilot, yaw damper, and flight director (if not already active) are activated and the annunciator lights on the AFCS controller for the autopilot and yaw damper are illuminated. The flight director engages in Pitch and Roll Hold Modes when initially activated.

Autopilot   Yaw Damper
Engaged   Engaged

ROL |←AP YD| PIT   ALTS

Figure 7-30 Autopilot and Yaw Damper Engaged

When the **YD** Key is pressed, the system engages the yaw damper independently of the autopilot and the yaw damper annunciator light is illuminated.

Autopilot and yaw damper status are displayed in the center of the AFCS Status Box. Engagement is indicated by green 'AP' and 'YD' annunciations, respectively.

CONTROL WHEEL STEERING

During autopilot operation, the aircraft may be hand-flown without disengaging the autopilot. Pressing and holding the **CWS** Button disengages the pitch and roll servos from the flight control surfaces and allows the aircraft to be hand-flown. At the same time, the flight director is synchronized to the aircraft attitude during the maneuver. CWS activity has no effect on yaw damper engagement.

The 'AP' annunciation is temporarily replaced by 'CWS' in white for the duration of CWS maneuvers.

Control Wheel

ROL |←CWS YD| PIT   ALTS

Figure 7-31 CWS Annunciation

In most scenarios, releasing the **CWS** Button reengages the autopilot with a new reference. Refer to flight director mode descriptions for specific CWS behavior in each mode.

DISENGAGEMENT

The autopilot is manually disengaged by pushing the **AP** Key on the AFCS Control Unit, the **GA** Switch, or the **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 7-32 Manual Autopilot Disengagement

Pushing the **AP DISC** 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 7-33 Yaw Damper Disengagement

After manual disengagement, the autopilot disconnect aural alert may be cancelled by pushing the **MEPT** ARM or **AP DISC** Switch (**AP DISC** 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** or **MEPT** ARM Switch. Automatic autopilot disengagement occurs due to:

- System failure
- Invalid sensor data
- Yaw damper failure while both are engaged

- Stall warning (YD also disengages)
- Inability to compute default flight director modes (FD also disengages automatically)

Yaw damper disengagement is indicated by a five-second flashing yellow 'YD' annunciation. Automatic yaw damper disengagement occurs when autopilot disengagement is caused by failure in a parameter also affecting the yaw damper. This means the yaw damper can remain operational in some cases where the autopilot automatically disengages. A localized failure in the yaw damper system or invalid sensor data also cause yaw damper disengagement.
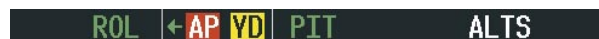
Figure 7-34 Automatic Autopilot and Yaw Damper Disengagement

7.6 EXAMPLE FLIGHT PLAN

> **NOTE:** *The diagrams in this section are for instructional purposes only and should not be used for navigation. 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 GPS Navigation 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 a GPS flight plan. The ILS approach for runway 35L and LPV (WAAS) approach for runway 35R are shown and a missed approach is executed.
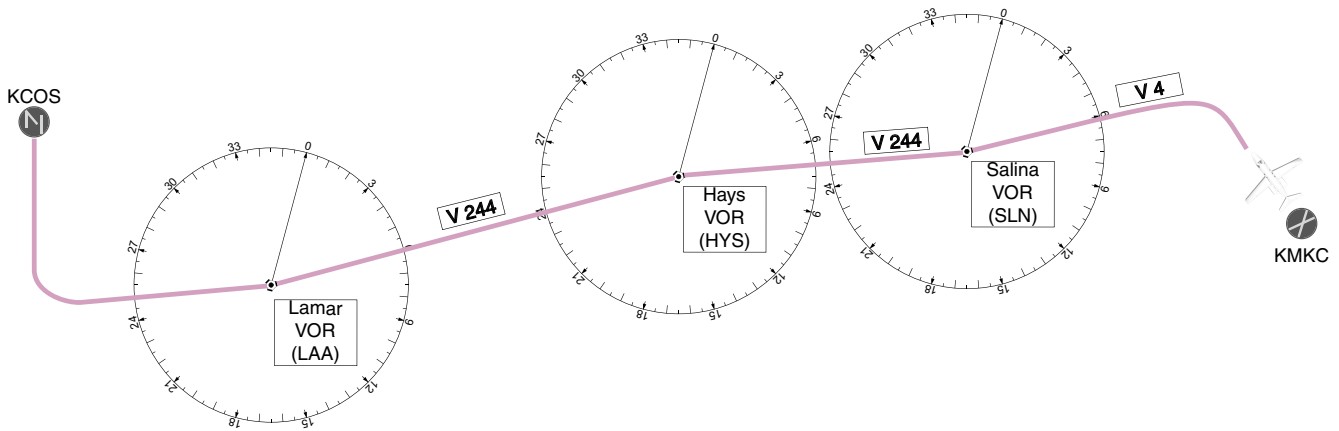
Figure 7-35 Flight Plan Overview

DEPARTURE

Climbing to the Selected Altitude and flying an assigned heading:

1) Before takeoff:

  a) Use the **ALT SEL** Knob to set the Selected Altitude to 12,000 feet.

  b) Push the **GA** Switch to activate Takeoff Mode. The flight director Command Bars establish a pitch up attitude to follow.

```
    TO    ←        TO
```

  c) Press the **AP** Key to engage the autopilot in a climb, holding the pitch angle commanded in Takeoff Mode and wings level.

```
   ROL  ←AP YD PIT        ALTS
```

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) Adjust the aircraft's vertical speed to the desired 1,000 fpm.

  b) Press the **VS** Key to activate Vertical Speed and Roll Hold modes and arm Selected Altitude Capture Mode.

  The Vertical Speed Reference may be adjusted after Vertical Speed Mode is selected using the **NOSE UP/DN** Wheel or pushing the **CWS** Button while hand-flying the aircraft to establish a new Vertical Speed Reference.

```
   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
```

HDG Mode

TO Mode

③

KMKC

① ② TO Mode

VS Mode

Selected Altitude of 12,000 MSL

④

ALT Mode
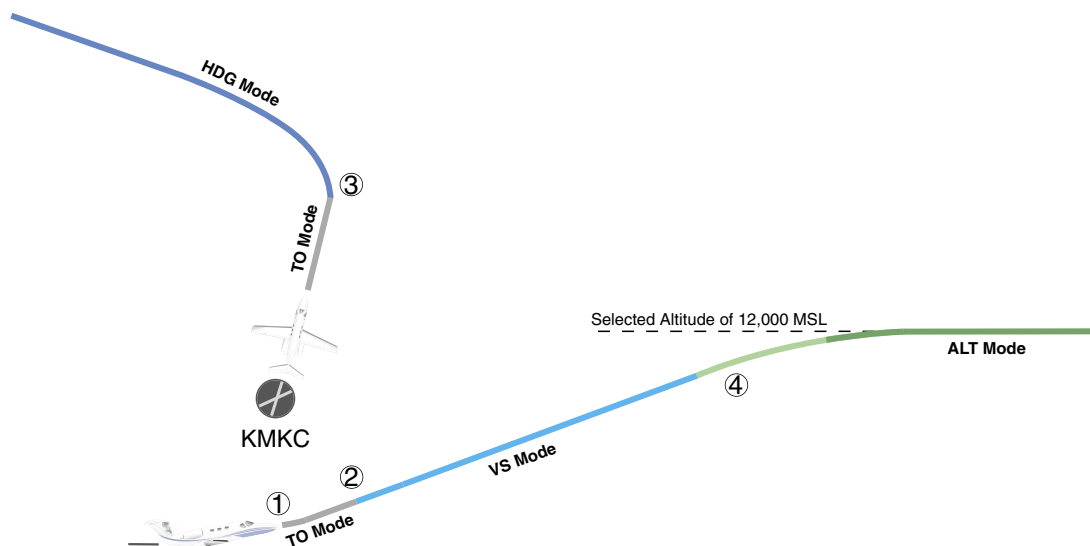
Figure 7-36 Departure

INTERCEPTING A VOR RADIAL

During climb-out, the autopilot continues to fly the aircraft in Heading Select Mode. Airway V4 to Salina VOR (SLN) should now be intercepted. Since the enroute flight plan waypoints correspond to VORs, flight director Navigation Mode using either VOR or 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 th**e CDI** Softkey to set the navigation source to VOR.

c) Use the **CRS1** or **CRS2** Knob to set the Selected Course to the desired value, 290°. Note that at this point, the flight director is still in Heading Select Mode and the autopilot continues to fly the Selected Heading, 240°.

d) Press the **NAV** Key. This arms VOR Navigation Mode and the white 'VOR' annunciation appears to the left of the active lateral mode.

VOR   HDG ← AP YD | ALT 12000FT

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.

VOR ← AP YD | ALT 12000FT

3) The autopilot continues the turn until the aircraft is established on the Selected Course.
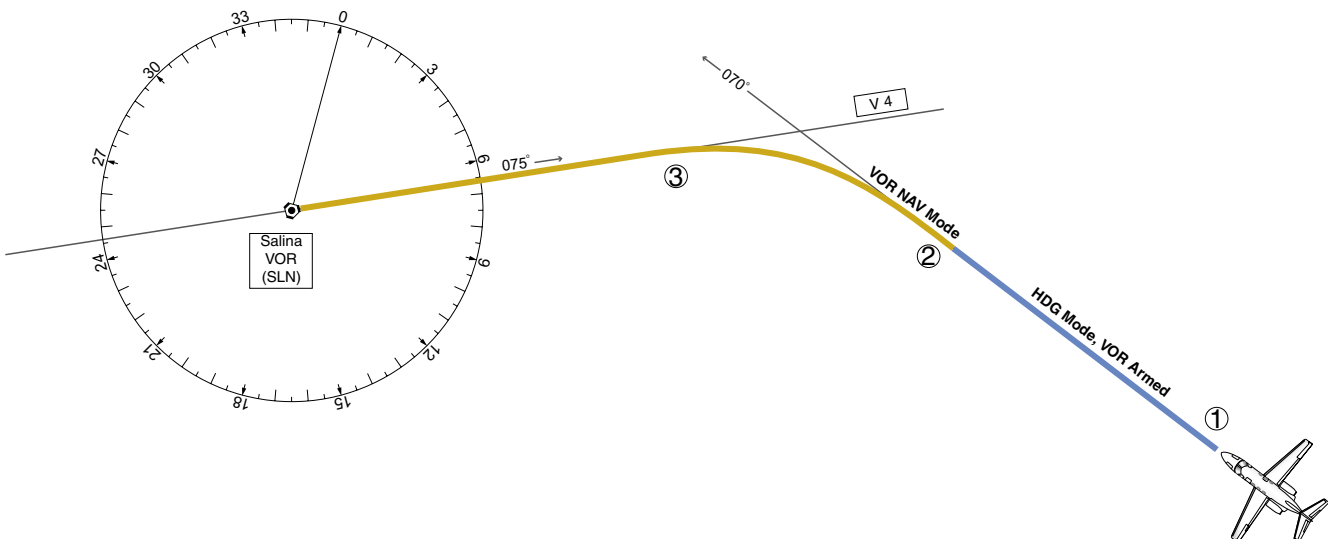
Figure 7-37 Intercepting a VOR Radial

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) Enter Salina VOR (SLN) into the GPS flight plan.

2) Transition from VOR to GPS Navigation Mode:

a) Press the **CDI** Softkey until GPS is the selected navigation source. Due to VOR signal loss, VOR Navigation Mode is cancelled. The 'VOR' annunciation flashes yellow.

*Flashes up to 10 sec, Transitions to Roll Hold Mode Unless **NAV** Key is Pressed*

b) Press the **NAV** Key to activate GPS Navigation Mode. The autopilot guides the aircraft along the active flight plan leg.

If the **NAV** Key is not pressed within 10 seconds of VOR signal loss, the flight director reverts to Roll Hold Mode (wings rolled level).

3) 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.
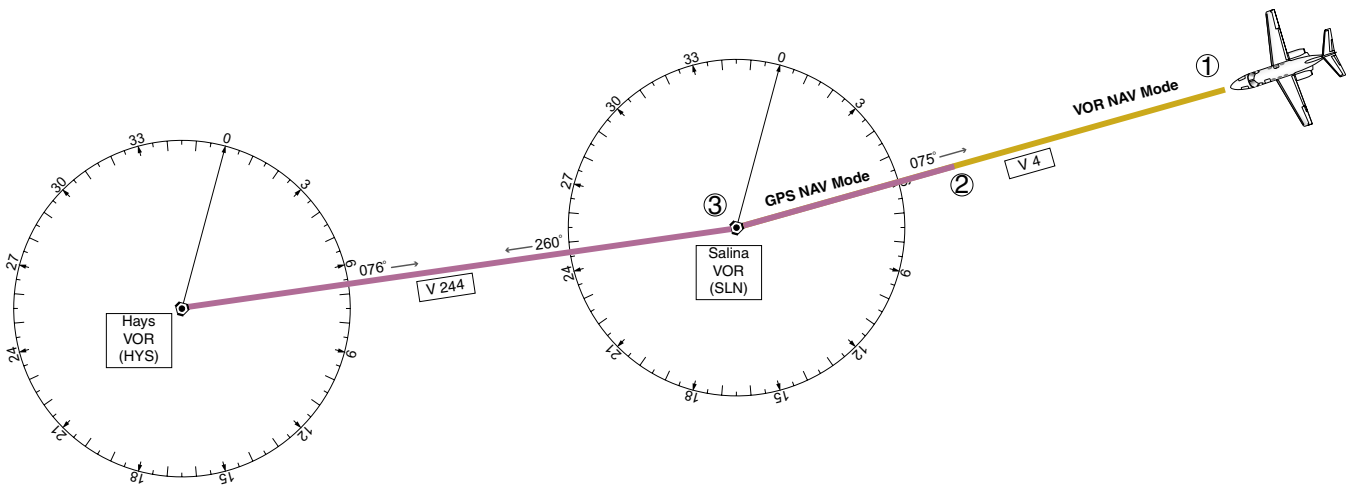
Figure 7-38 Transition to GPS Flight Plan

DESCENT

While flying the arrival procedure, the aircraft is cleared for descent in preparation for the approach to KCOS. Three methods are presented for descent:

- Flight Level Change descent – Flight Level Change Mode can be used to descend to the Selected Altitude at a constant airspeed. This descent method does not account for flight plan waypoint altitude constraints.

- Vertical Path Tracking descent – Vertical Path Tracking Mode is used to follow the vertical descent path defined in the 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 – While the flight director is following VNV guidance for descent, 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 SEL** 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.

    c) Press the **SPD** Key to display the Airspeed Reference in Mach.

2) Use the **NOSE UP/DN** Wheel or push the **CWS** Button while hand-flying the aircraft to adjust the commanded airspeed while maintaining the same power, or reduce power to allow descent in Flight Level Change Mode while the autopilot maintains the current airspeed.

3) As the aircraft nears the Selected Altitude, the flight director transitions to Selected Altitude Capture Mode, indicated by the green 'ALTS' annunciation flashing for up to 10 seconds.

The green 'ALT' annunciation flashes for up to 10 seconds upon reaching 50 feet from the Selected Altitude; the autopilot transitions to Altitude Hold Mode and levels the aircraft.
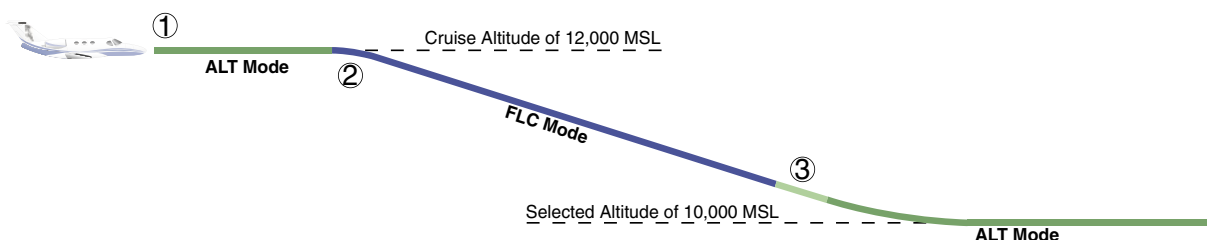
Figure 7-39 FLC Descent

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 SEL** Knob, set the Selected Altitude at least 75 feet below the flight plan's VNV Target Altitude of 10,000 feet.

   If the Selected Altitude is not adequately adjusted below the VNV Target Altitude, the flight director will command descent to the Selected Altitude rather than the VNV Target Altitude once Vertical Path Tracking Mode becomes active (ALTS will be 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 SEL** 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
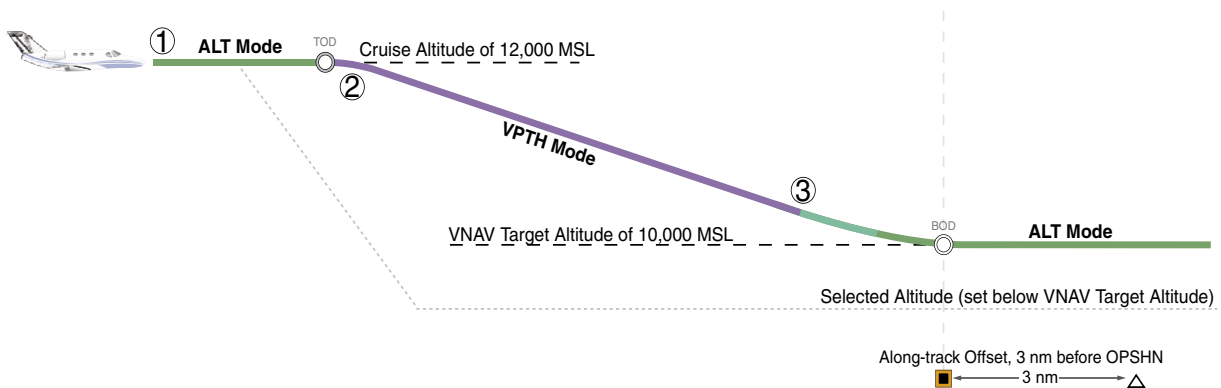
Figure 7-40 VPTH Descent

Non-path descent using Flight Level Change Mode:

1) Command a non-path descent using Flight Level Change Mode:

   a) Using the **ALT SEL** 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   184KT **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 9400FT **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.

   GPS ←AP YD | ALT   9400FT   **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 9000FT **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   9000FT
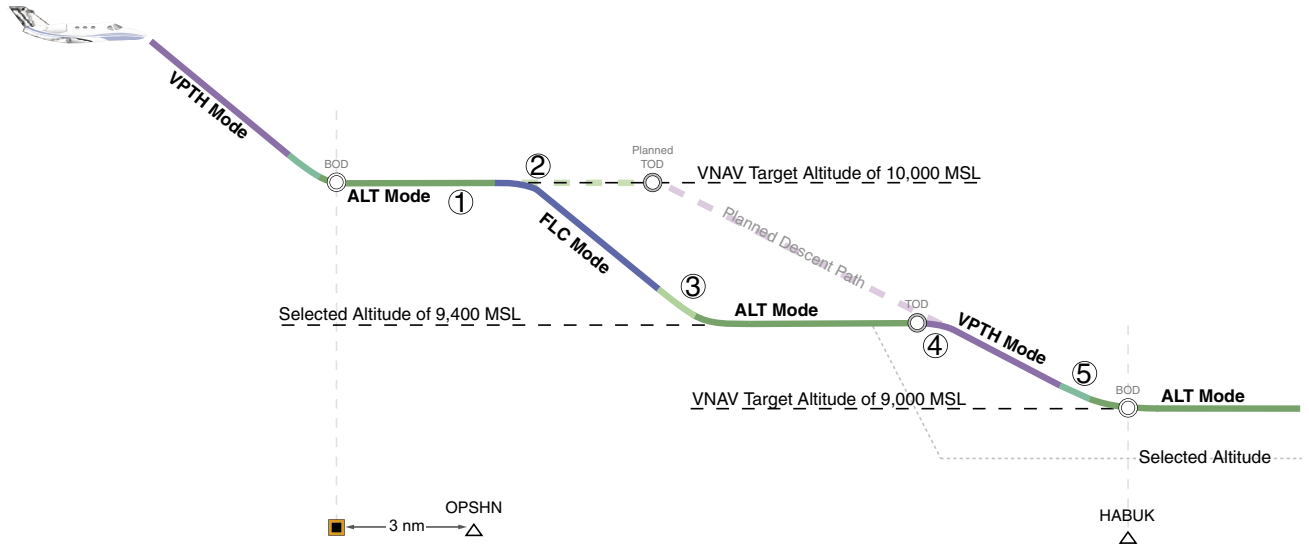
Figure 7-41 Non-path Descent

APPROACH

Flying an ILS approach:

1) Transition from GPS Navigation Mode to Heading Select Mode.

a) Load the Runway 35L ILS approach for KCOS into the flight plan and select 'VECTORS' for the transition.

b) Use the **HDG** Knob to set the Selected Heading after getting vectors from ATC.

c) Press the **HDG** Key. The autopilot turns the aircraft to the desired heading.

d) Use Heading Select Mode to comply with ATC vectors as requested.

2) Arm LOC Approach and Glideslope modes.

a) Ensure the appropriate localizer frequency is tuned.

b) Press the **APR** Key when cleared for approach to arm Approach and Glideslope modes. 'LOC' and 'GS' appear in white as armed mode annunciations.

c) The navigation source automatically switches to LOC. After this switch occurs, the localizer signal can be captured and the autopilot and flight director determine when to begin the turn to intercept the final approach course.

3) There are two options available at this point, as the autopilot flies the ILS approach:

- Push the **AP DISC** Switch at the decision height and land the aircraft.
- Use the **GA** Switch to execute a missed approach.
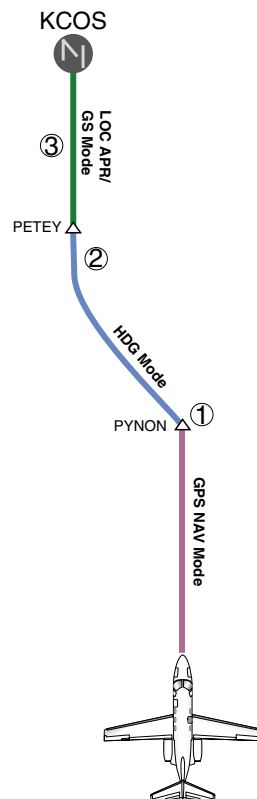
Figure 7-42 ILS Approach to KCOS

Flying a WAAS precision approach:

1) Arm flight director modes for a precision approach:

  a) Make sure the navigation source is set to GPS (use **CDI** Softkey to change navigation source).

  b) Load the Runway 35R LPV approach for KCOS into the flight plan.

2) Press the **APR** Key once clearance for approach has been acquired. GPS Approach Mode is activated and Glidepath Mode is armed.

3) Once the glidepath is captured, Glidepath Mode becomes active.

4) There are two options available at this point, as the autopilot flies the approach:

  • Push the **AP DISC** Switch at the decision height and land the aircraft.

  • Use the **GA** Switch to execute a missed approach.
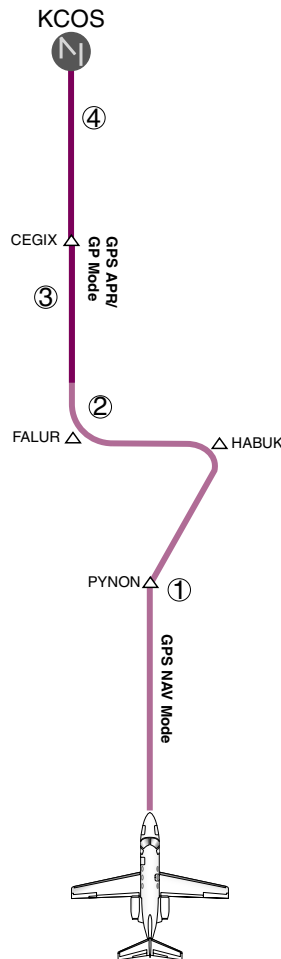
Figure 7-43 LPV Approach to KCOS

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.*

Flying a missed approach:

1) Push the **GA** Switch at the Decision height and apply full power to execute a missed approach. The flight director Command Bars establish a nose-up climb to follow.

   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.

   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 **CDI** Softkey to select GPS as the navigation source.

   c) Press the **NAV** Key to have the autopilot fly to the hold.

   GPS   ←AP YD PIT   ALTS

3) Use the **ALT SEL** Knob to set a Selected Altitude to hold.

   To hold the current airspeed during the climb, press the **FLC** Key.

   GPS   ←AP YD FLC   100kt 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 10000ft 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 10000ft

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.

   6.0nm ⟳ MOGAL   DIS 2.2nm BRG 149°
   GPS   ←AP YD ALT 10000ft
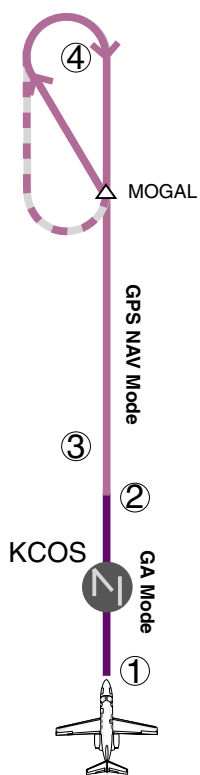
Figure 7-44 Go Around/Missed Approach

7.7 AFCS ANNUNCIATIONS AND ALERTS

AFCS STATUS ALERTS

The annunciations in Table 7-6 (listed in order of increasing priority) can appear on the PFDs above the Airspeed and Attitude indicators. Only one annunciation may occur at a time, and messages are prioritized by criticality.

AFCS Status Annunciation
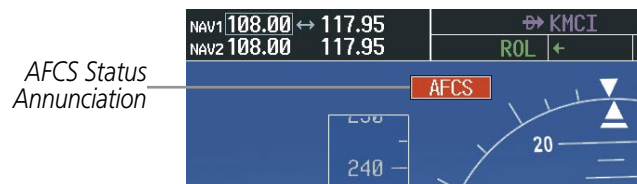
Figure 7-45 AFCS Status Annunciation

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
Emergency Descent Mode	EDM	AP engaged when aircraft altitude above 30,000 ft and cabin pressurization is lost Selected Heading set 90° left of current heading; Selected Altitude set to 15000 ft
Preflight Test	PFT	Performing preflight system test; aural alert sounds at completion Do not press the **AP DISC** Switch during servo power-up and preflight system tests as this may cause the preflight system test to fail or never to start (if servos fail their power-up tests). Power must be cycled to the servos to remedy the situation.
	PFT	Preflight system test failed; aural alert sounds at failure

Table 7-6 AFCS Status Alerts

OVERSPEED PROTECTION

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 and pitch commands are limited for overspeed protection. 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 7-46 Overspeed Annunciation

EMERGENCY DESCENT MODE (EDM)

The Cessna Citation Mustang is equipped with an Emergency Descent Mode (EDM), available during high-altitude flight while the autopilot is engaged. EDM is automatically activated when cabin pressurization is lost at altitudes above 30,000 feet MSL. Throttles should be reduced to idle and speed brakes extended to achieve a maximum rate of decent. EDM is annunciated as the AFCS Status Annunciation and the following AFCS modes are selected:

• Flight Level Change Mode with the Selected Altitude set to 15,000 feet

• Heading Select Mode with the Selected Heading set to 90° left of the current heading

Figure 7-47 Emergency Descent Mode

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SECTION 8 ADDITIONAL FEATURES

> **NOTE:** *The availability of SafeTaxi, ChartView, or FliteCharts in electronic form does not preclude the requirement to carry paper charts aboard the aircraft. See AC 120-76A for more information.*

Additional features of the G1000 include the following:

- SafeTaxi™ diagrams
- ChartView and FliteCharts™ electronic charts
- XM Radio entertainment for the passengers
- Scheduler

SafeTaxi diagrams provide detailed taxiway, runway, and ramp information at more than 700 airports in the United States. By zooming in 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.

The optional XM Radio entertainment audio feature of the GDL 69A Data Link Receiver offers more than 170 channels of music, news, and sports. XM Radio offers more entertainment choices and longer range coverage than commercial broadcast stations.

8.1 SAFETAXI

SafeTaxi is an enhanced feature that gives greater map detail when zooming in on airports at close range. The maximum map ranges for enhanced detail are configurable by the flight crew. When zoomed in close enough to show the airport detail, the map reveals runways with numbers, taxiways with identifying letters/numbers, and airport landmarks including ramps, buildings, control towers, and other prominent features. Resolution is greater at lower map ranges. When the aircraft location is within the screen boundary, including within SafeTaxi ranges, an airplane symbol is shown on any of the navigation map views for enhanced position awareness.

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 in Figure 8-1, the aircraft is on taxiway Juliet approaching runway 20 Left.

Figure 8-1 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 selected for easy recognition of decluttering level. Selecting the **DCLTR** Softkey removes the taxiway markings and airport identification labels. Selecting the **DCLTR-1** Softkey removes VOR station ID, the VOR symbol, and intersection names if within the airport plan view. Selecting the **DCLTR-2** Softkey removes the airport runway layout, unless the airport in view is part of an active route structure. Selecting the **DCLTR-3** Softkey cycles back to the original map detail. Refer to Map Declutter Levels in the GPS Navigation 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 8-2 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.
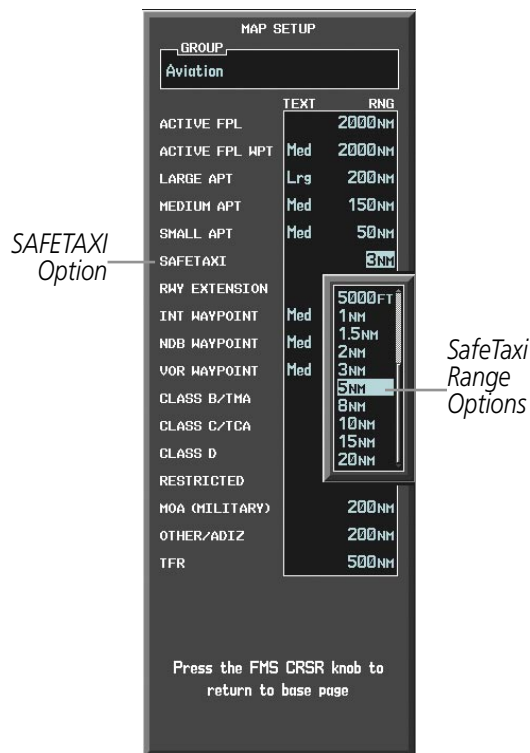
Figure 8-3 MAP SETUP Menu, Aviation Group, SAFETAXI Range Options

SAFETAXI CYCLE NUMBER AND REVISION

SafeTaxi database is revised every 56 days. SafeTaxi is always available for use after the expiration date. When turning on the G1000, the Power-up Page indicates whether the databases are current, out of date, or not available. The Power-up Page shows the SafeTaxi database is current when the 'SafeTaxi Expires' date is shown in white. When the SafeTaxi cycle has expired, the 'SafeTaxi Expires' date appears in yellow. The message 'SafeTaxi: N/A' appears in white if no SafeTaxi data is available on the database card (Figure 8-4).

SafeTaxi Database is Current

SafeTaxi Database has Expired

SafeTaxi Database Not Available

Figure 8-4 Power-up Page, SafeTaxi Database

The SafeTaxi Region, Version, Cycle, Effective date and Expires date of the database cycle can also be found on the AUX - System Status page. SafeTaxi information appears in blue and yellow text. The 'EXPIRES' date appears in blue when data is current and in yellow when expired (Figures 8-5 and 8-6). SafeTaxi 'REGION NOT AVAILABLE' appears in blue if SafeTaxi data is not available on the database card (Figure 8-6). Expired SafeTaxi data is never disabled.

Select the **DBASE** Softkey for scrolling through the database information. Scroll through the database with the **FMS** knob or **ENT** Key.

The SafeTaxi database cycle number shown in Figure 8-5, '06S2' is broken down as follows:

06 – Indicates the year 2006

S – Indicates the data is for SafeTaxi

2 – Indicates the second issue of the SafeTaxi database for the year

The SafeTaxi 'EFFECTIVE' date '13–APR–06' is the beginning date for the current database cycle.   SafeTaxi 'EXPIRES' date '08–JUN–06' is the revision date for the next database cycle.
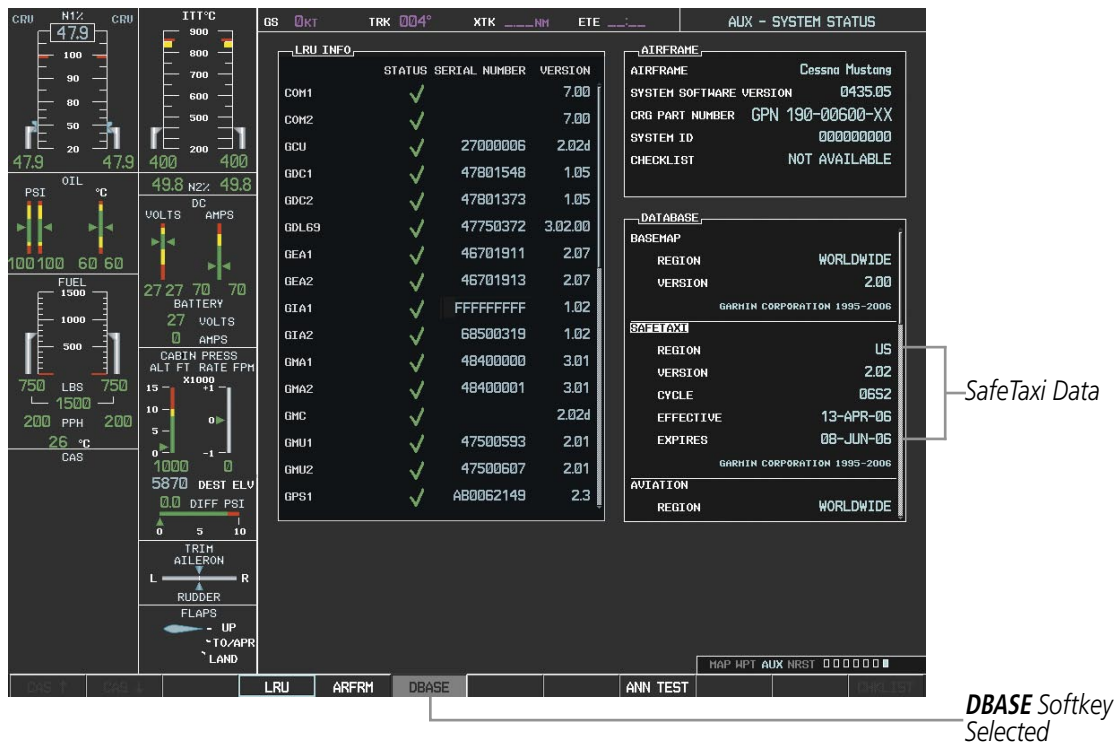
Figure 8-5 AUX – System Status Page, SafeTaxi Current Information

The SafeTaxi database is provided by Garmin. Refer to Updating Garmin Databases in Appendix B for instructions on revising the SafeTaxi database.

The other two possible AUX - System Status page conditions are shown in Figure 8-6. The 'EFFECTIVE' date is the beginning date for this database cycle. '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.

SafeTaxi Database has Expired   *SafeTaxi Database Not Installed*

Figure 8-6 AUX – System Status Page, SafeTaxi Expired, SafeTaxi Not Available

8.2 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.

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, Flight Plan Page, or Nearest Airports Page, selecting the **SHW CHRT** Softkey displays the available terminal chart and advances to the chart selection level of softkeys: **CHRT OPT**, **CHRT**, **INFO**, **DP**, **STAR**, **APR**, **WX**, **NOTAM**, and **GO BACK**. The chart selection softkeys (Figure 8-7) appear on the Airport Information Page.

Selecting the **GO BACK** Softkey reverts to the top level softkeys and previous page.

Selecting 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.
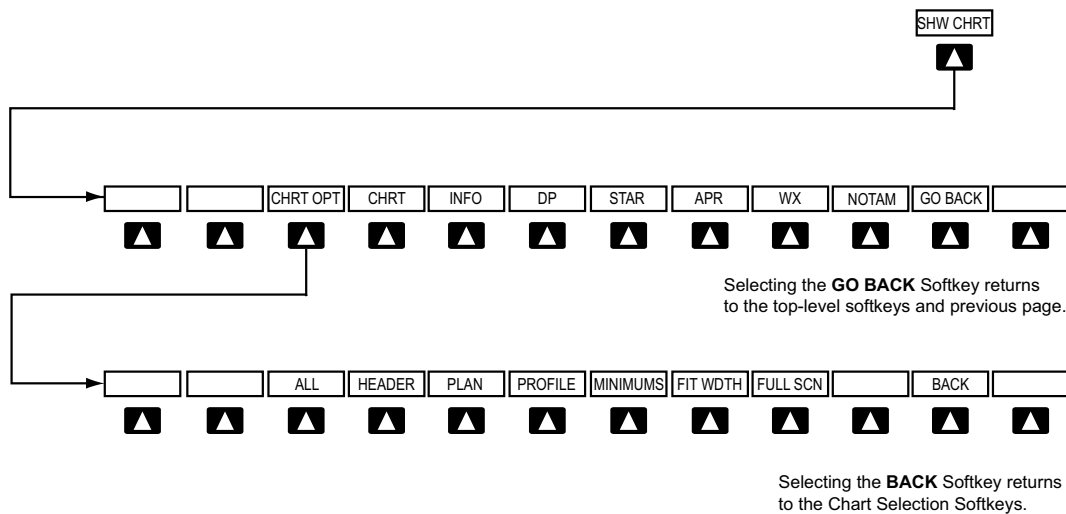
Figure 8-7 ChartView SHW CHRT, Chart Selection, and Chart Option Softkeys

TERMINAL PROCEDURES CHARTS

Selecting Terminal Procedures Charts:

1) While viewing the Navigation Map Page, Nearest Airport Page, or Flight Plan Page, select 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.

Figure 8-8 Navigation Map Page OPTIONS Menu

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 Jeppesen subscription, but rather the availability of a particular airport chart selection or procedure for a selected airport.

Figure 8-9 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 8-10 Unable To Display Chart Banner

When a chart is not available from the Navigation Map Page by selecting the **SHW CHRT** Softkey or selecting a Page Menu Option, charts may be obtained from the WPT Pages or Flight Plan Pages.

Figure 8-11 Waypoint Information Page OPTIONS Menu

If a chart is available for the destination airport, or the airport selected in the flight plan, it appears on the screen. When no flight plan is active, or when not flying to a direct-to destination, selecting the **SHW CHRT** Softkey displays the chart for the nearest airport, if available.

The chart shown will be 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 will appear. If Airport Information pages are unavailable, the Approach Chart for the airport is shown.

GARMIN™

Selecting a chart:

1) While viewing the Navigation Map Page, Flight Plan Page, or Nearest Airports Page, select the **SHW CHRT** Softkey. The airport diagram or approach chart will be 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.

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 8-12 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 8-16). If the Chart Scale Box displays a banner 'CHART NOT TO SCALE', the aircraft symbol will not be shown. The Aircraft Not Shown Icon may appear at certain times, even if the chart is displayed to scale.

Selecting 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 DeKalb Peachtree (KPDK) Airport Diagram and the navigation map on the WPT – Airport Information page.
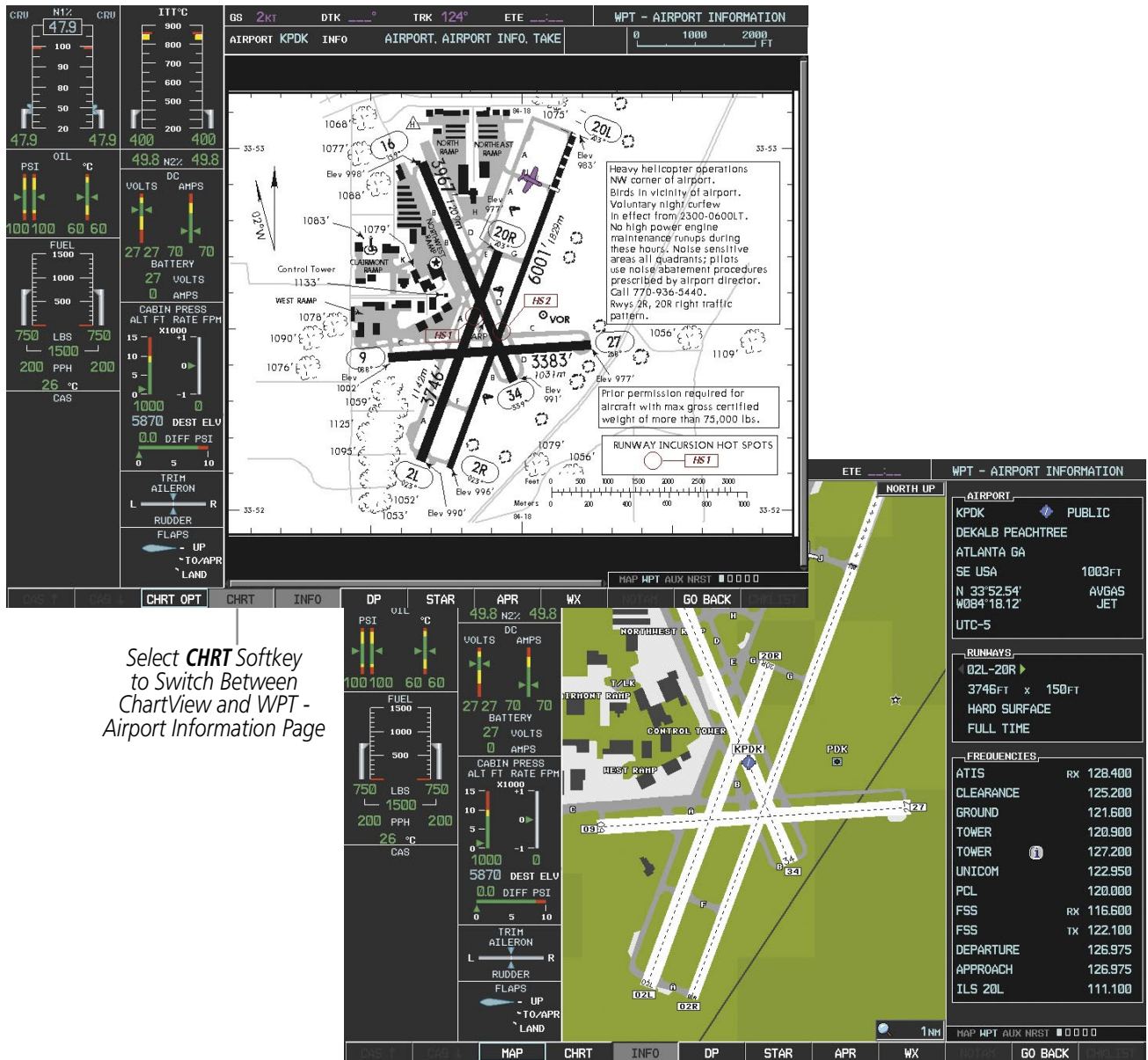
*Select **CHRT** Softkey to Switch Between ChartView and WPT - Airport Information Page*

Figure 8-13 CHRT Softkey, Airport Information Page

Selecting the **INFO** Softkey returns to the airport diagram when the view is on a different chart. If the displayed chart is the airport diagram, the **INFO** Softkey will have 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** 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 8-14 Airport Information Page, INFO View, Full Screen Width

In the example shown in Figure 8-14, the Class B Chart is selected. Pressing the **ENT** Key displays the Charlotte Class B Airspace Chart (Figure 8-15).
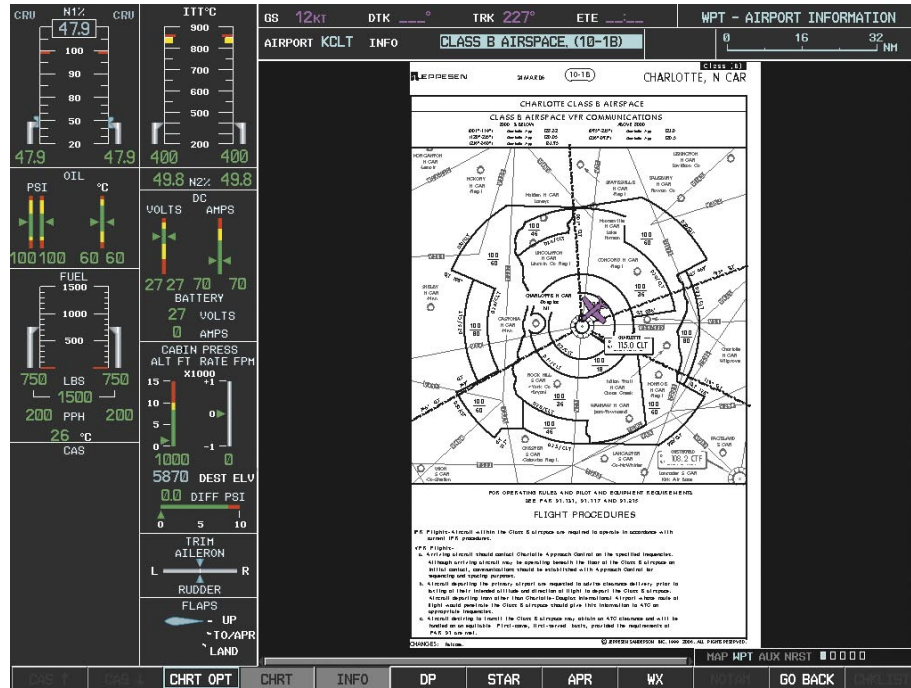
Figure 8-15 Airport Information Page, Class B Chart Selected from INFO View

Selecting the **DP** Softkey displays the Departure Procedure Chart if available.

Chart Not To Scale

Aircraft Not Shown Icon
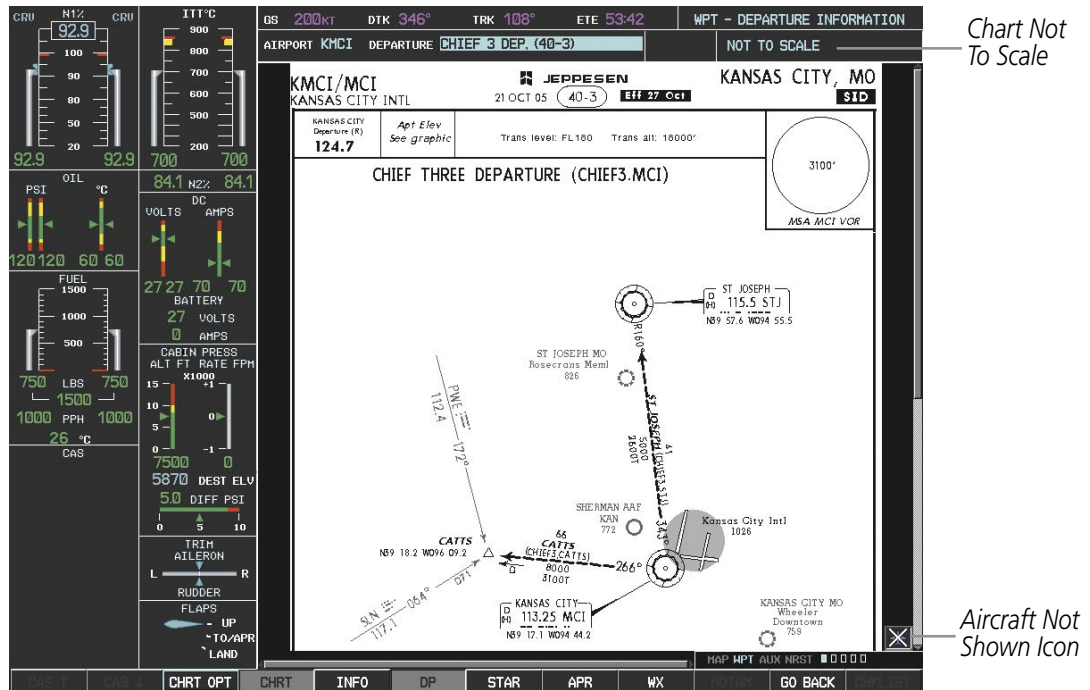
Figure 8-16 Departure Information Page

Selecting the **STAR** Softkey displays the Standard Terminal Arrival Chart if available.

Chart Not To Scale

*Zoom and Scroll Through the Chart With the **Joystick***

Aircraft Not Shown Icon
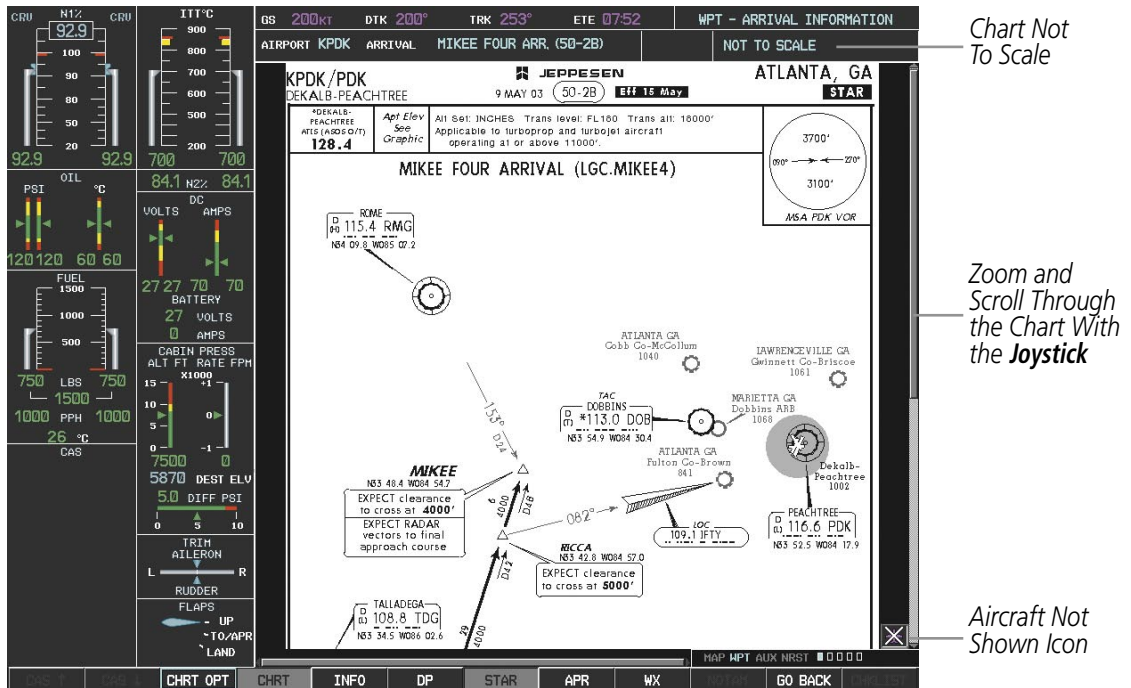
Figure 8-17 Arrival Information Page

Selecting the **APR** Softkey displays the approach chart for the airport if available.
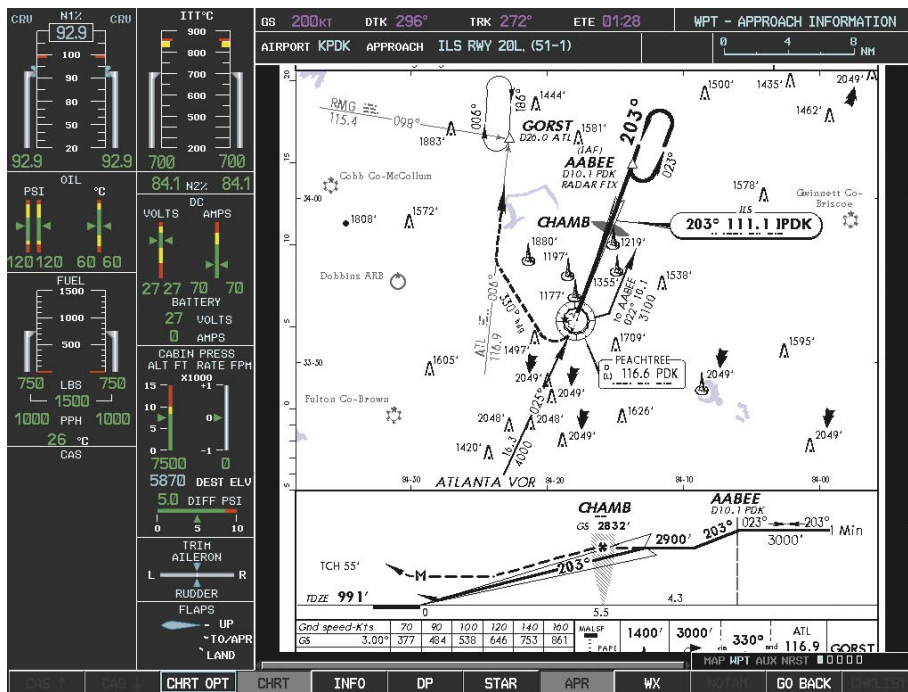
Figure 8-18 Approach Information Page

Selecting 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 Weather subscription is current.

WX Info When Available

WX Softkey Selected

Figure 8-19 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. Selecting 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 8-19. The **NOTAM** Softkey may appear on the Airport Information Page and all of the chart page selections.
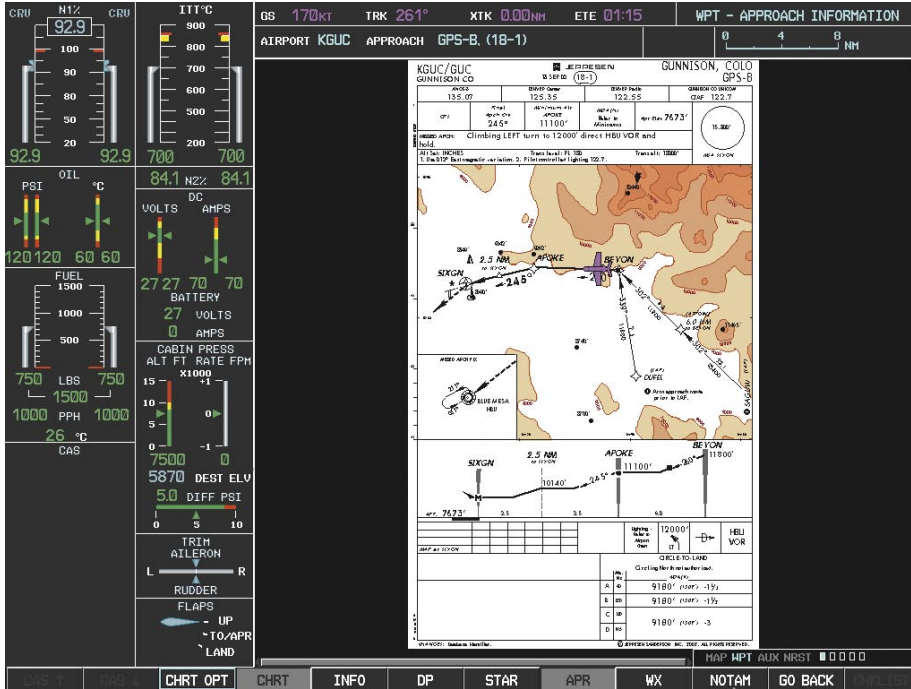
NOTAM Softkey Appears for Selected Airports

Figure 8-20 NOTAM Softkey Highlighted

Local NOTAM on This Airport

NOTAM Softkey Selected
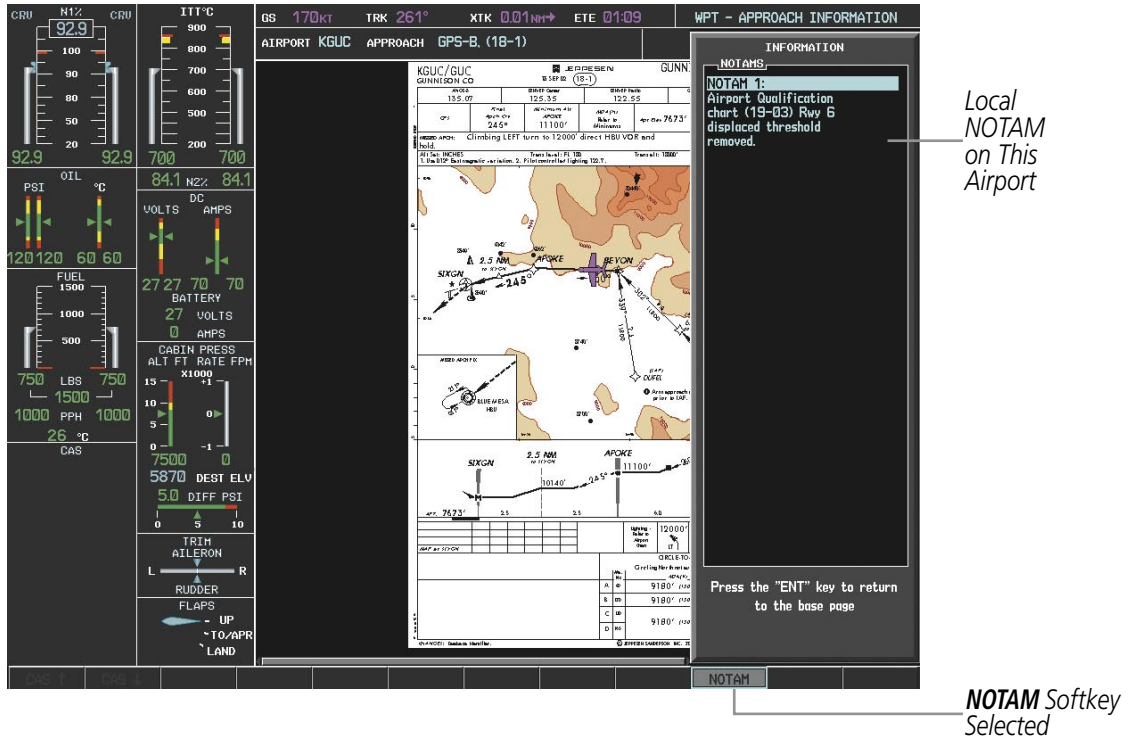
Figure 8-21 Airport Information Page, Local NOTAMs

Selecting the **NOTAM** Softkey again removes the NOTAMS information.

Selecting the **GO BACK** Softkey reverts to the previous page (Navigation Map Page, Nearest Pages, or Flight Plan Page).

CHART OPTIONS

Selecting the **CHRT OPT** Softkey displays the next level of softkeys, the chart options level (Figure 8-7).

Selecting the **ALL** Softkey shows the entire approach chart on the screen. By selecting the **ALL** Softkey from another view, the approach chart is shown in its entirety.

Entire Chart Shown
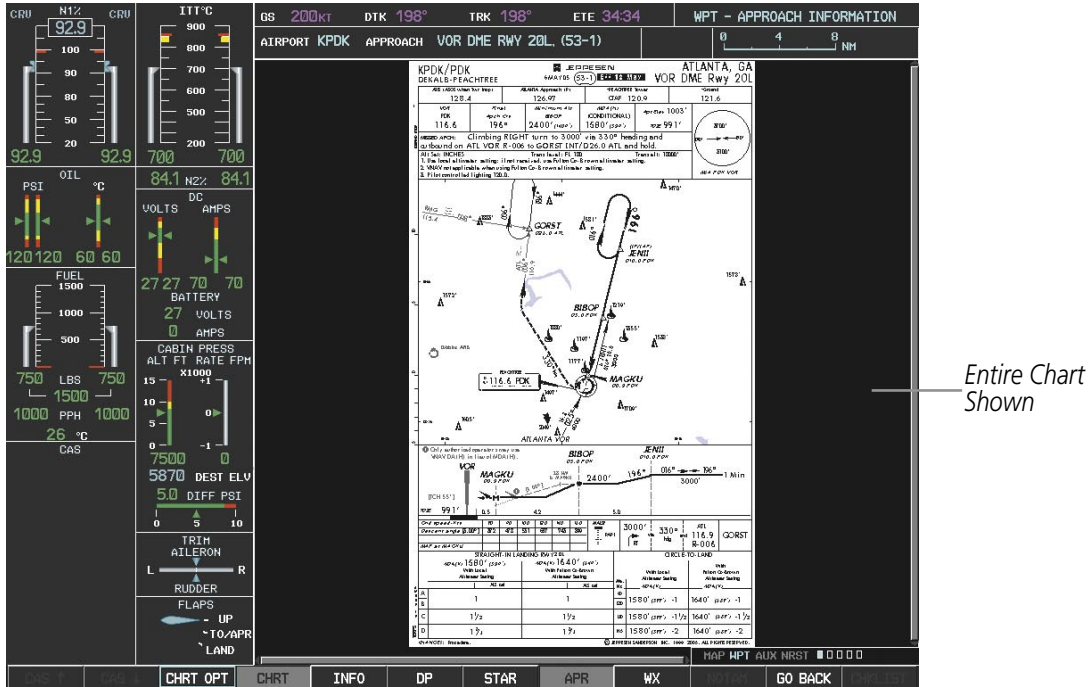
Figure 8-22 Approach Information Page, ALL View

Selecting the **HEADER** Softkey shows the header view (approach chart briefing strip) on the screen.
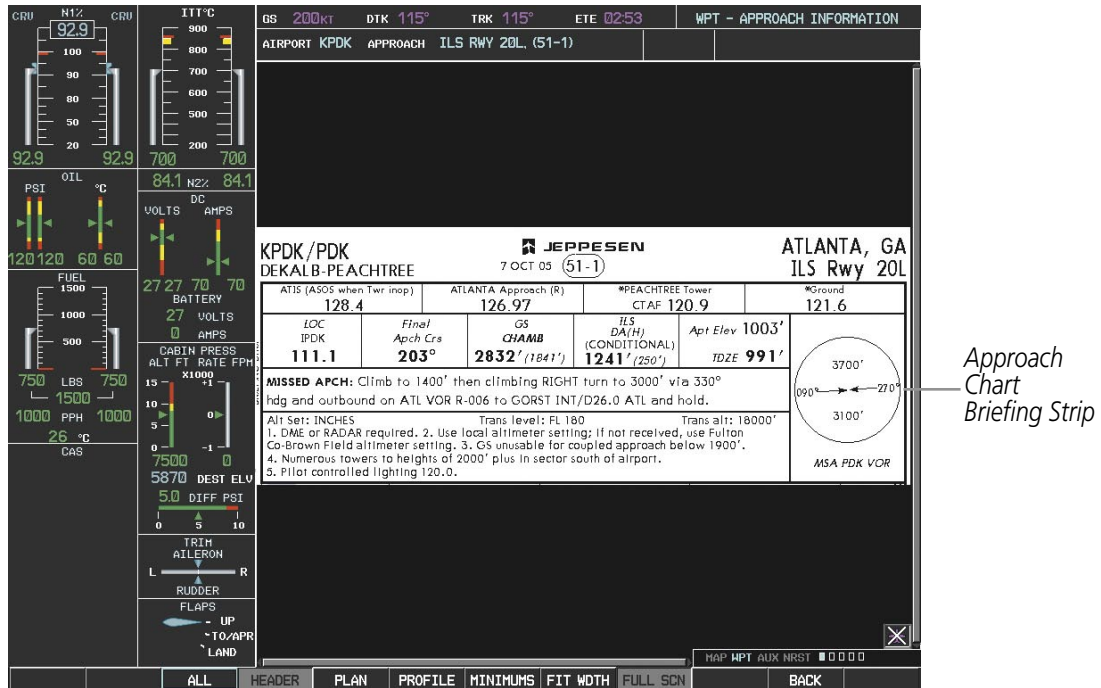
Figure 8-23 Approach Information Page, Header View

Selecting the **PLAN** Softkey shows the approach chart two dimensional plan view.
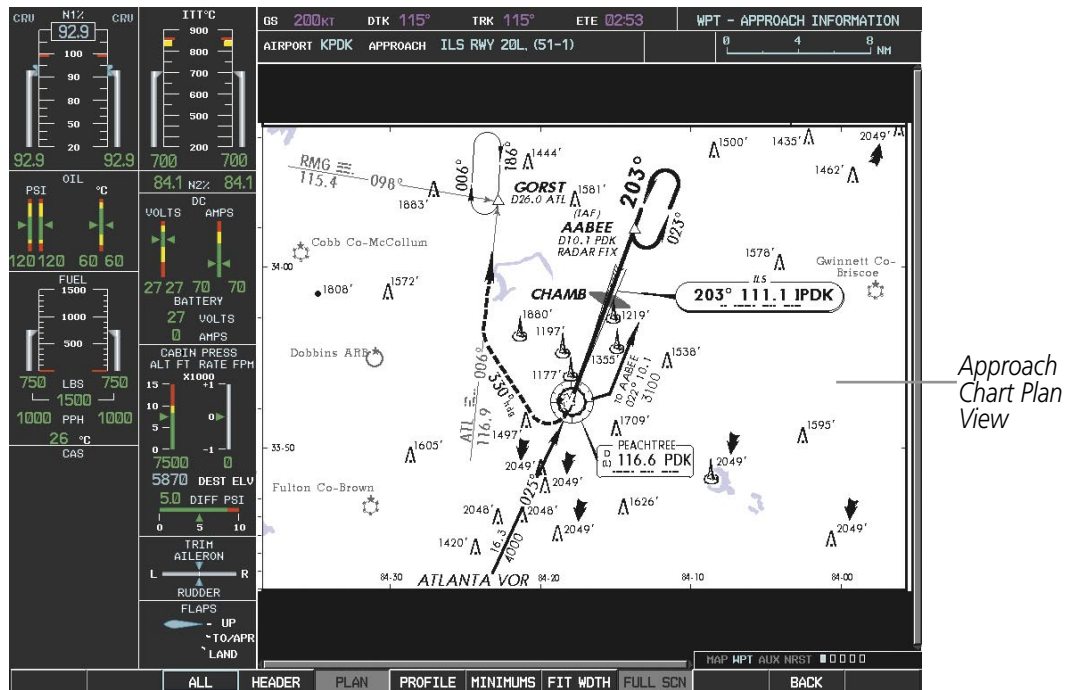
Figure 8-24 Approach Information Page, Plan View

Selecting the **PROFILE** Softkey displays the approach chart descent profile strip.
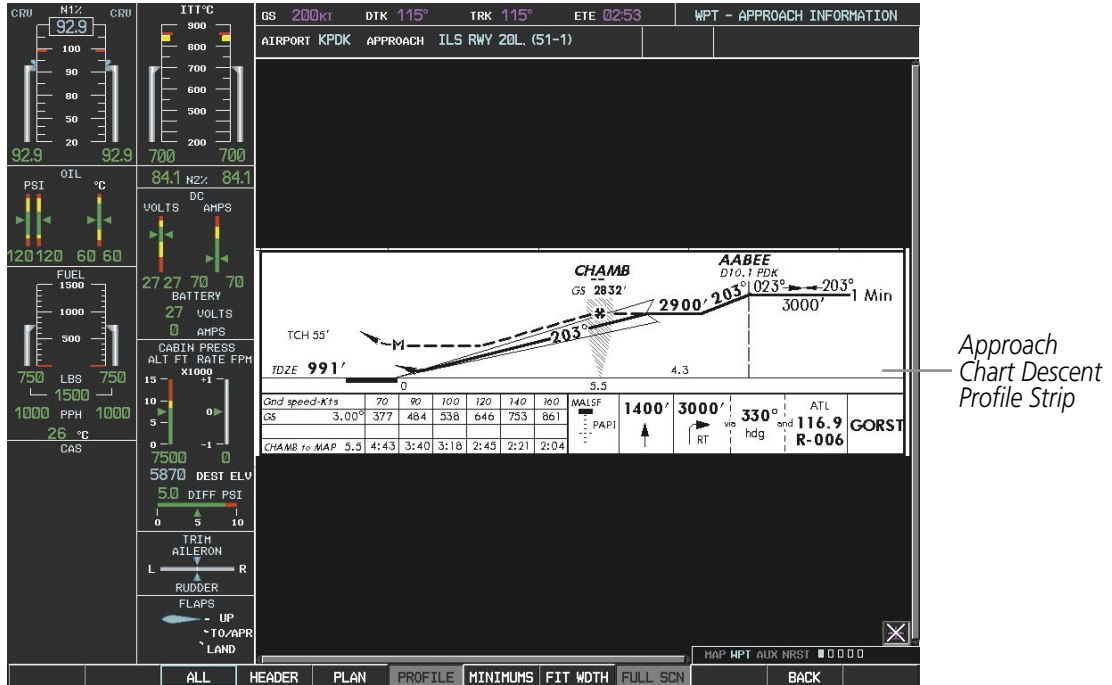
Figure 8-25 Approach Information Page, Profile View, Full Screen Width

Selecting the **MINIMUMS** Softkey displays the minimum descent altitude/visibility strip at the bottom of the approach chart.
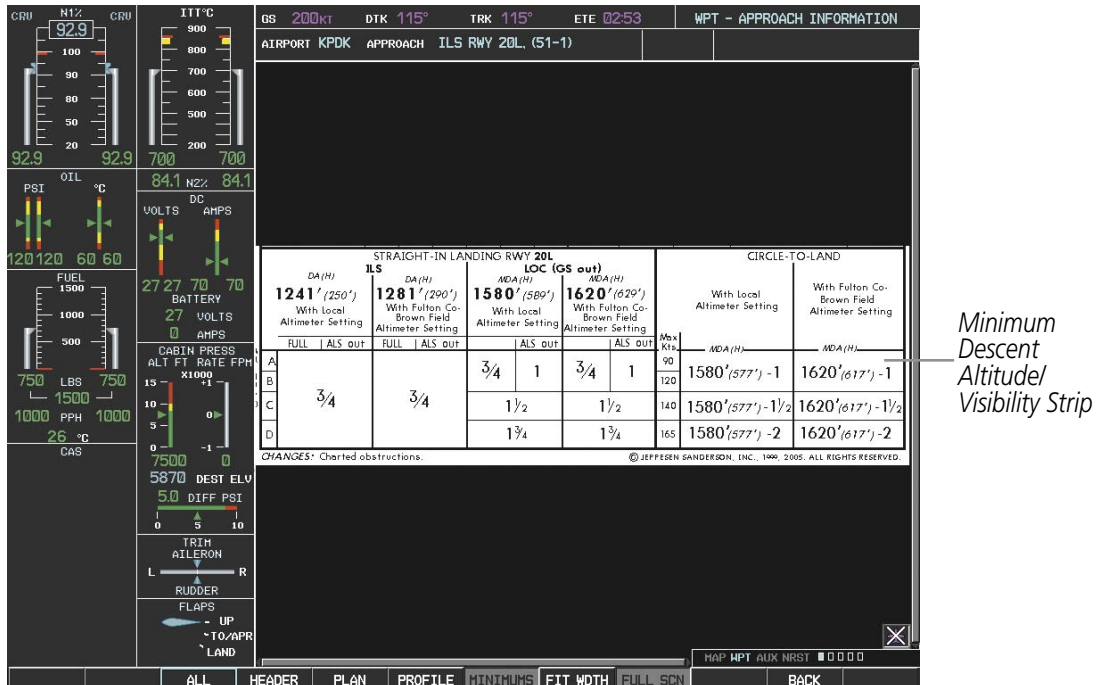
Figure 8-26 Approach Information Page, Minimums View, Full Screen Width

If the chart scale has been adjusted to view a small area of the chart, selecting the **FIT WIDTH** Softkey changes the chart size to fit the available screen width.

*Select **FIT WDTH** Softkey to Show Full Chart Width*

Figure 8-27 Airport Information Page, FIT WDTH Softkey Selected

Selecting 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, select 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, 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

*Select **FULL SCN** Softkey to Switch Between Full Screen Chart and Chart with Info Window*
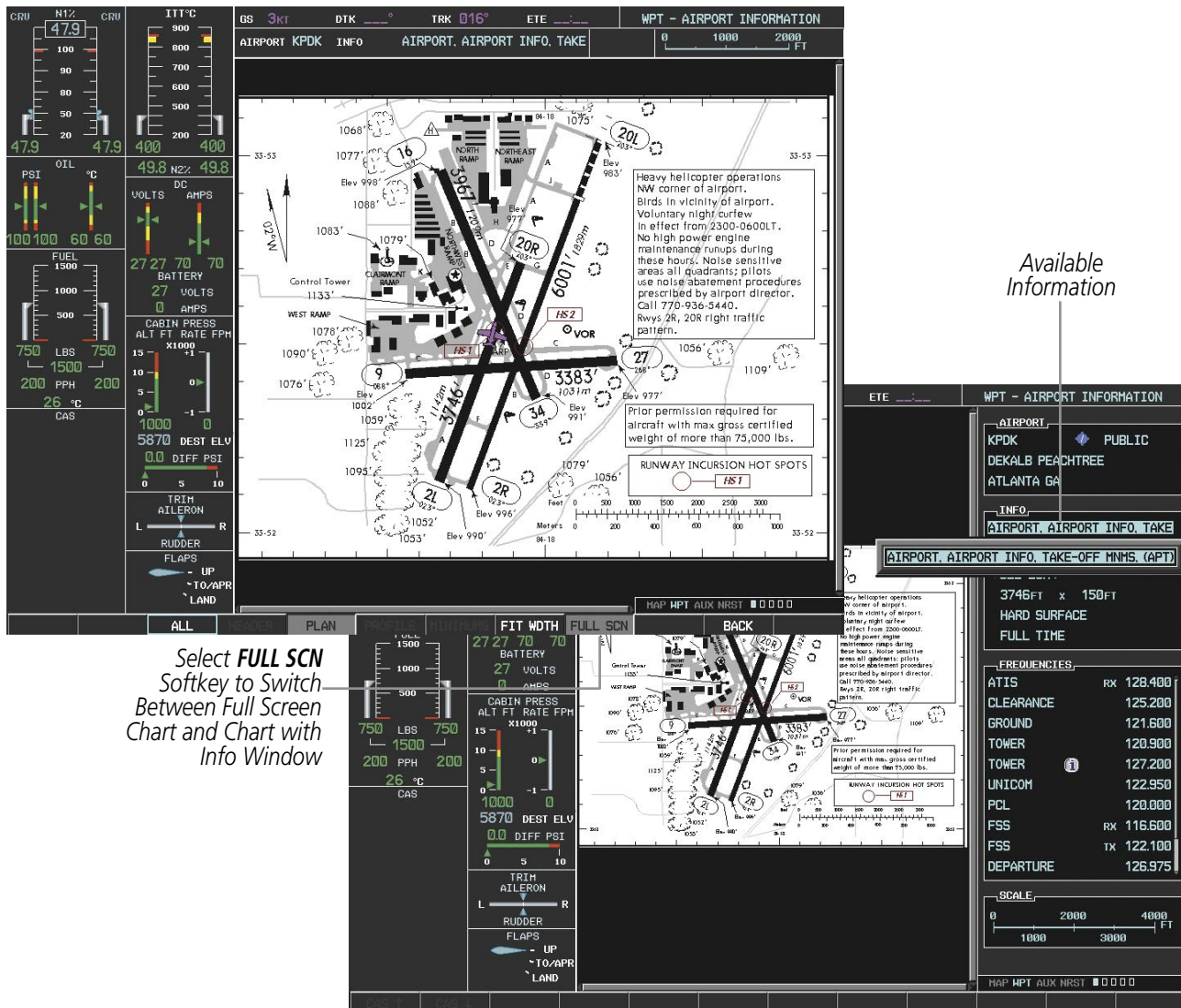
Figure 8-28 Airport Information Page, Full Screen and Info Window

Selecting the **BACK** Softkey, or waiting for 45 seconds reverts to the chart selection softkeys.

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.
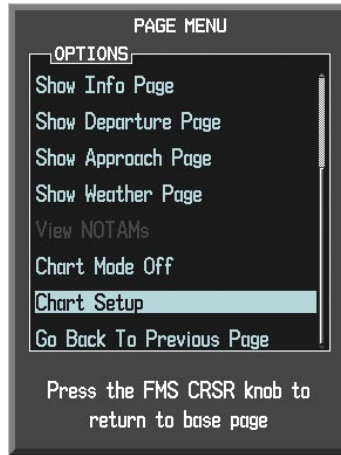
Figure 8-29 Waypoint Information Page, OPTIONS Menu

3) Turn the large **FMS** Knob to move between the 'FULL SCREEN' and 'COLOR SCHEME' Options (Figure 8-30).

4) Turn the small **FMS** Knob to choose between the 'On' and 'Off' Full Screen Options.

5) Turn the small **FMS** Knob to choose between 'Day', 'Auto', and 'Night' Options.

6) In Auto Mode, turn the large **FMS** Knob to select the percentage field and change percentage with the small **FMS** Knob. The percentage of change is the day/night crossover point based on backlighting intensity.

> *NOTE: Once an adjustment is made to the percentage field in Auto mode, the chart must be redrawn (zoomed in or out, or another chart selected) before the switch from Day to Night is seen.*

7) Press the **FMS** Knob when finished to remove the Chart Setup Menu.
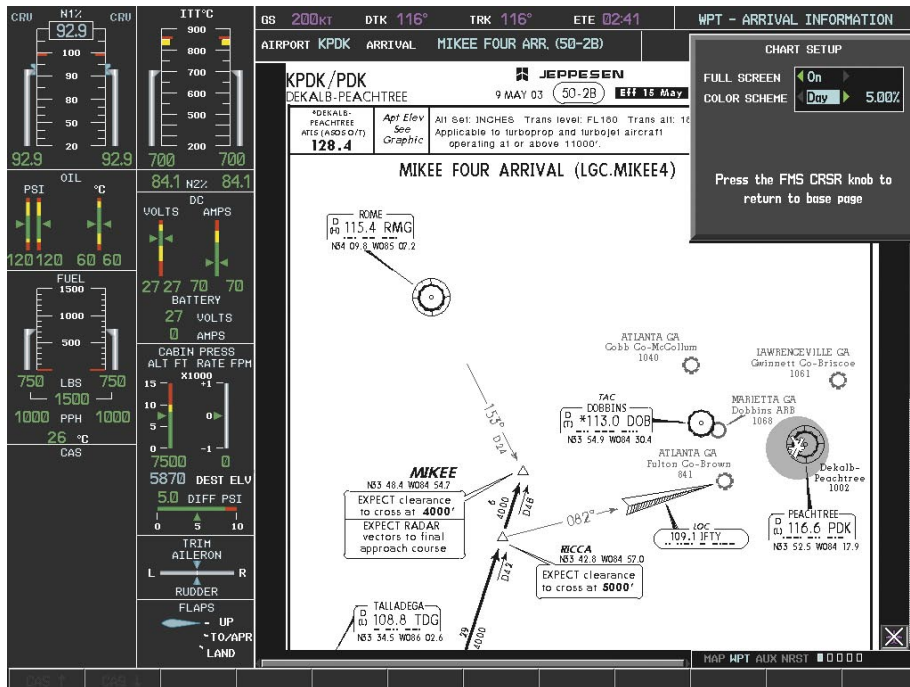
Figure 8-30 Arrival Information Page, Day View
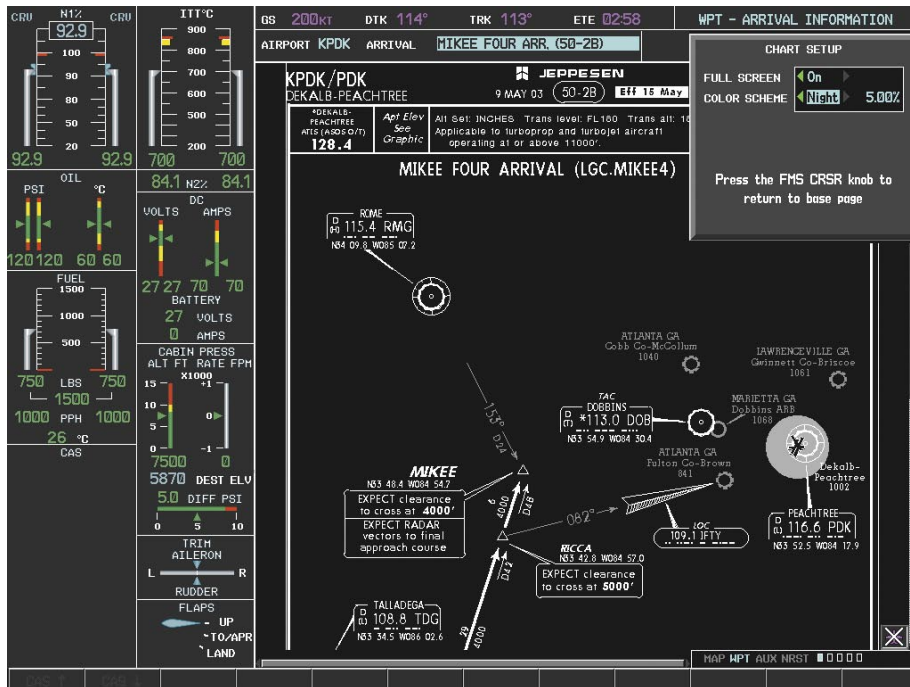
Figure 8-31 Arrival Information Page, Night View

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 upon reaching the disables date. When turning on the G1000, the Power-up Page indicates any of nine different possible criteria for ChartView availability. See Table 8-1 for the various ChartView Power-up Page displays and the definition of each.

Power-up Page Display	Definition
	Blank Line. G1000 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 21–SEP–2006	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 G1000 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 will not be available.

Table 8-1 ChartView Power-up Page Annunciations and Definitions

Examples of four possible Power-up Page conditions are shown in Figure 8-32. 'ChartView Disables' plus a date in white, indicates chart data is current. This indication for normal operation shows how long the charts may be viewed. 'Chart data update available.' in white, indicates the chart data cycle has expired within the past week and the next chart cycle is available. 'Chart data is out of date!' in yellow, indicates charts are still viewable, but approaching the disable date. 'Chart data is disabled.' in yellow, indicates the chart cycle has expired and is no longer viewable.

ChartView Database is Current and Available

Chart Cycle has Expired, Next Cycle is Available

Chart Cycle has Expired but is Still Viewable for 70 Days from Expiration Date

Chart Cycle is No Longer Viewable

Figure 8-32 Examples of Power-up Page, ChartView Database

> ✎ **NOTE:** *A subdued softkey label indicates the function is disabled.*

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.

Select the **DBASE** Softkey for scrolling through the database information. Scroll through the database with the **FMS** knob or **ENT** Key.

The ChartView database cycle number shown in Figure 8-33, '0613' is broken down as follows:

06 – Indicates the year 2006

13 – Indicates the 13th issue of the ChartView database for the year

The 'EXPIRES' date "13–JUL–06" is the date that this database should be replaced with the next issue.

The 'DISABLES' date "21–SEP–06" is the date that this database becomes inoperative.
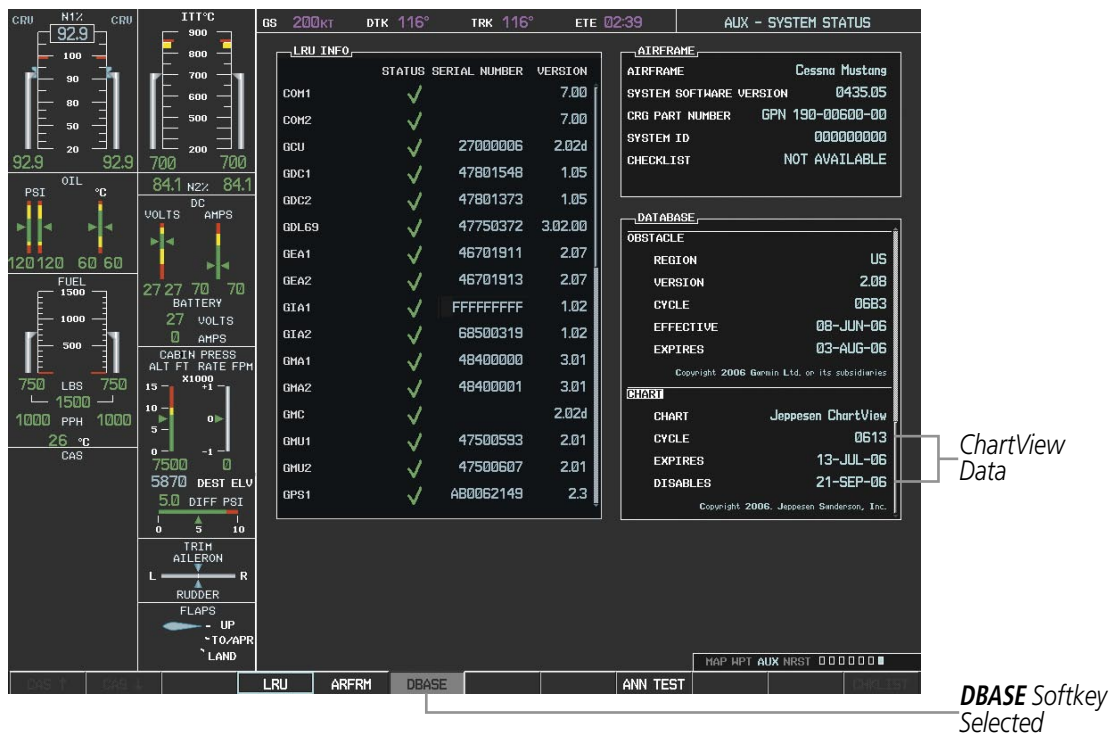
Figure 8-33 AUX – System Status Page, ChartView Current and Available

The ChartView database is provided directly from Jeppesen. Refer to Updating Jeppesen Databases in Appendix B for instructions on revising the ChartView database.

The other three possible AUX - System Status page conditions are shown in Figure 8-34. 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. 'REGION' and 'CYCLE' 'NOT AVAILABLE' in blue, indicate that no ChartView data is available on the database card or no database card is inserted.

ChartView Database has Expired, but is not Disabled

ChartView Database is Disabled

System is Configured for ChartView but Database is not Available

ChartView Database is Not Available

Figure 8-34 AUX – System Status Page, ChartView Expired, ChartView Disabled, ChartView Not Available

8.3 FLITECHARTS

FliteCharts resemble the paper version of National Aeronautical Charting Office (NACO) 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 or Nearest Airports Page, selecting the **SHW CHRT** Softkey displays the available terminal chart and advances to the chart selection level of softkeys: **CHRT OPT**, **CHRT**, **INFO**, **DP**, **STAR**, **APR**, **WX**, and **GO BACK**. The chart selection softkeys (Figure 8-35) appear on the Airport Information Page.

Selecting the **GO BACK** Softkey reverts to the top level softkeys and previous page.

Selecting 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.
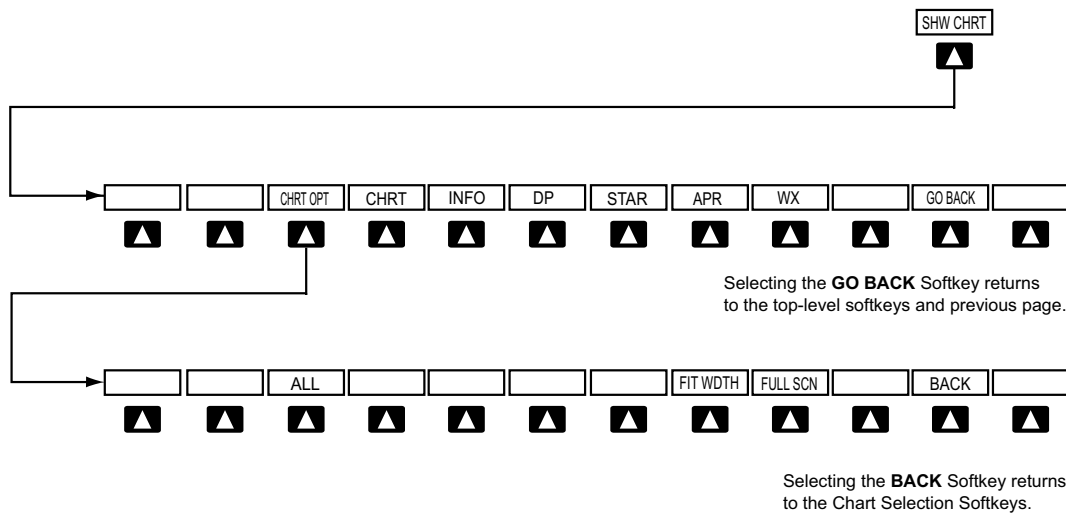
Figure 8-35 FliteCharts SHW CHRT, Chart Selection, and Chart Option Softkeys

TERMINAL PROCEDURES CHARTS

Selecting Terminal Procedures Charts:

1) While viewing the Navigation Map Page, Nearest Airport Page, or Flight Plan Page, select 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.
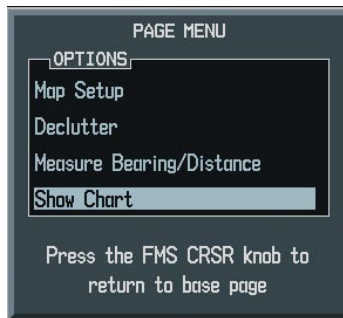
Figure 8-36 Navigation Map Page OPTIONS Menu

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 8-37 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 8-38 Unable To Display Chart Banner

When a chart is not available from the Navigation Map Page by selecting the **SHW CHRT** Softkey or selecting a Page Menu Option, charts may be obtained from the WPT Pages or Flight Plan Pages.

Figure 8-39 Waypoint Information Page OPTIONS Menu

If a chart is available for the destination airport, or the airport selected in the flight plan, it appears on the screen. When no flight plan is active, or when not flying to a direct-to destination, selecting the **SHW CHRT** Softkey displays the chart for the nearest airport, if available.

The chart shown will be 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 will appear. 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, select the **SHW CHRT** Softkey. The airport diagram or approach chart will be 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.

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 8-40 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 'CHART NOT TO SCALE', and the Aircraft Not Shown Icon is displayed in the lower right corner of the screen.

Selecting the **CHRT** Softkey switches 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.

*Select **CHRT** Softkey to Switch Between FliteCharts and WPT - Airport Information Page*
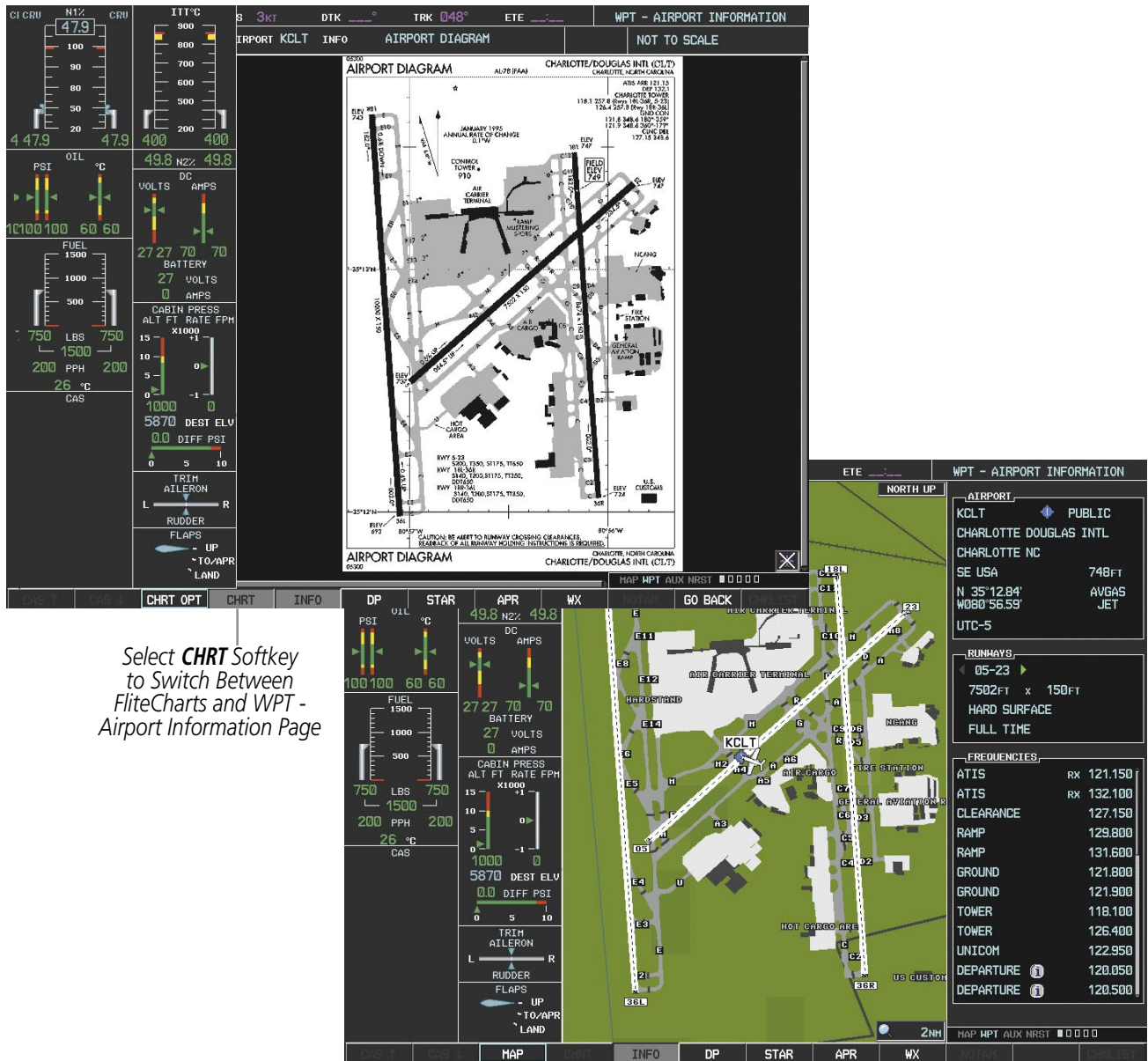
Figure 8-41 CHRT Softkey, Airport Information Page

Selecting the **INFO** Softkey returns to the airport diagram when the view is on a different chart. If the displayed chart is the airport diagram, the **INFO** Softkey will have no effect.

Another source for additional airport information is from the INFO Box above the chart (Figure 8-41) or to the right of the chart (Figure 8-42) for certain airports. This information source is not related to the **INFO** Softkey. When the INFO Box is selected using the **FMS** Knob, the G1000 softkeys are blank. The DeKalb Peachtree Airport has three additional charts offering information; the Airport Diagram, Alternate Minimums, and Take-off Minimums.
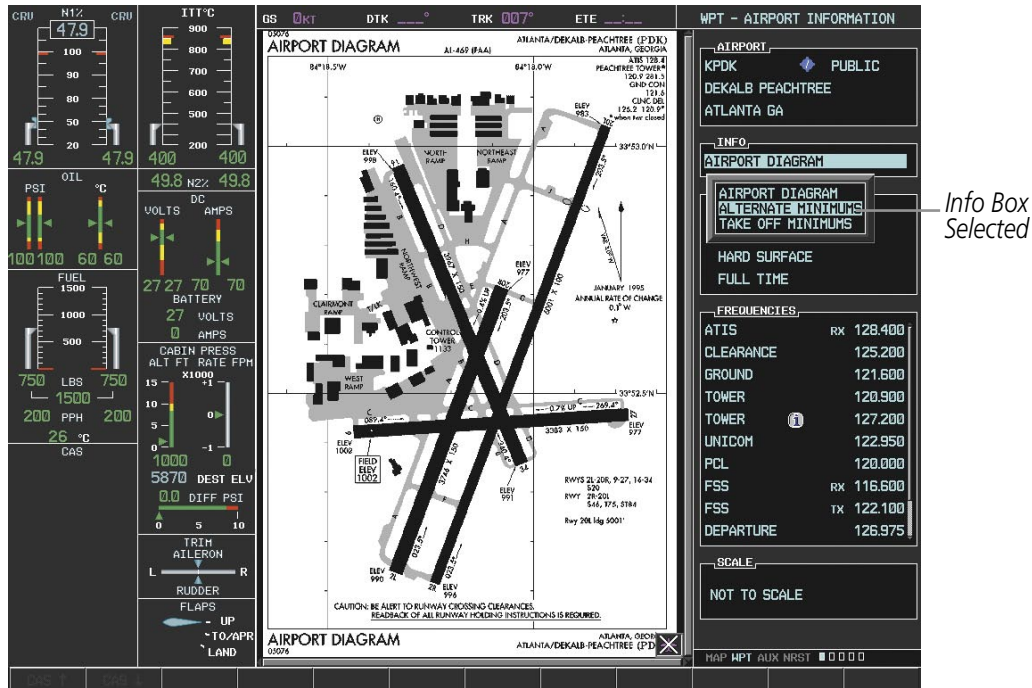
Figure 8-42 Airport Information Page, INFO View with Airport Information

In the example shown in Figure 8-42, 'ALTERNATE MINIMUMS' is selected. Pressing the **ENT** Key displays the IFR Alternate Minimums Chart (Figure 8-43).
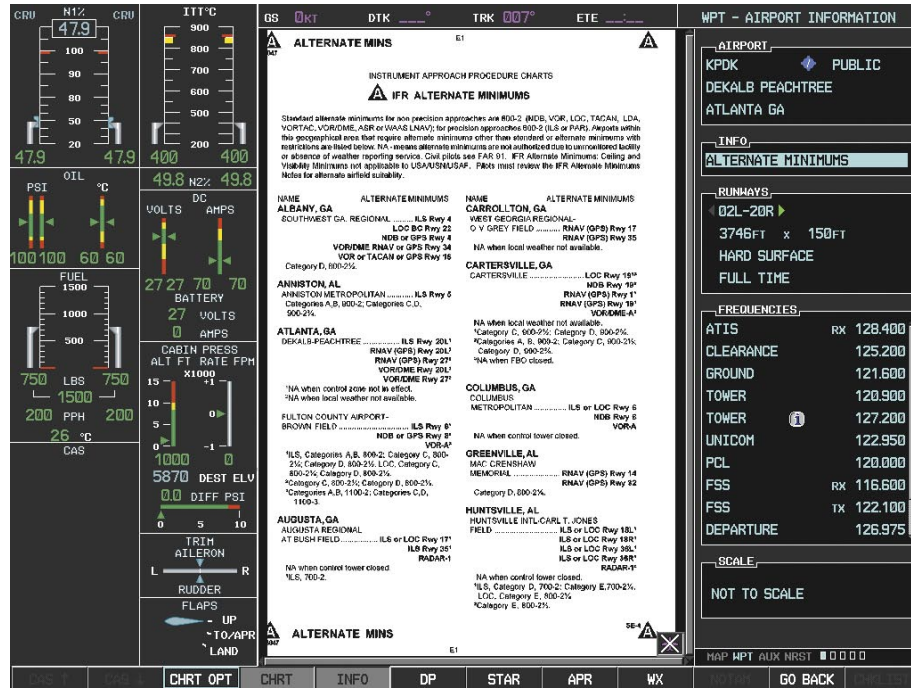
Figure 8-43 Airport Information Page, ALTERNATE MINIMUMS Selected from INFO View

Selecting the **DP** Softkey displays the Departure Procedure Chart if available.
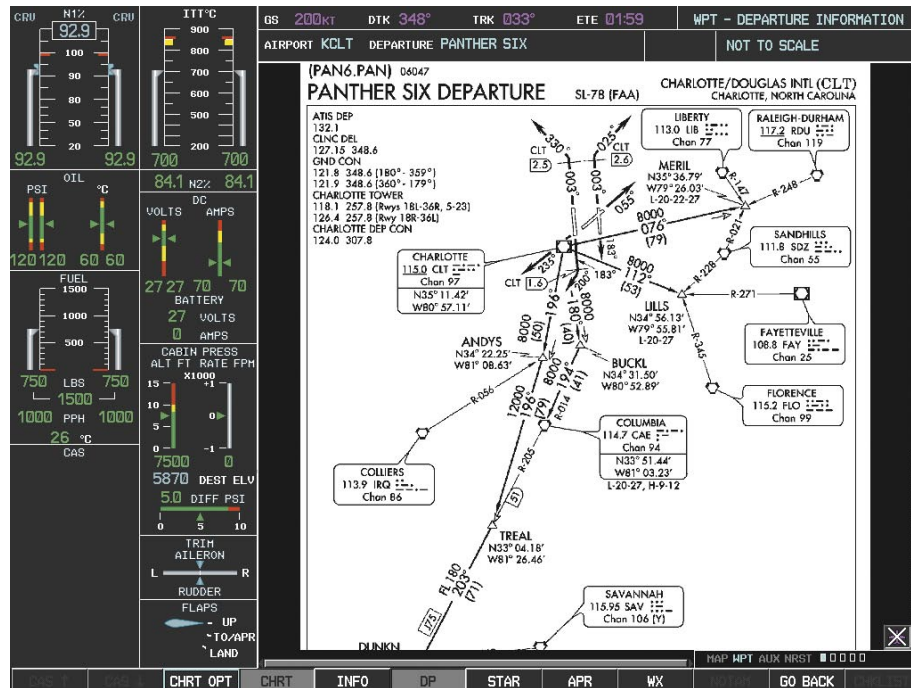
Figure 8-44 Departure Information Page

Selecting the **STAR** Softkey displays the Standard Terminal Arrival Chart if available.
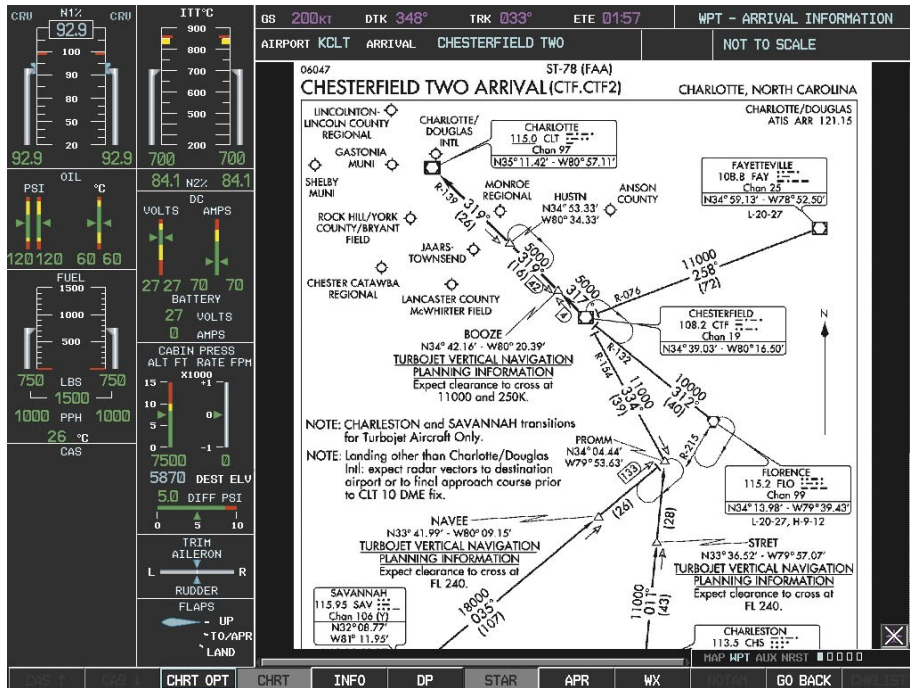
Figure 8-45 Arrival Information Page

Selecting the **APR** Softkey displays the approach chart for the airport if available.
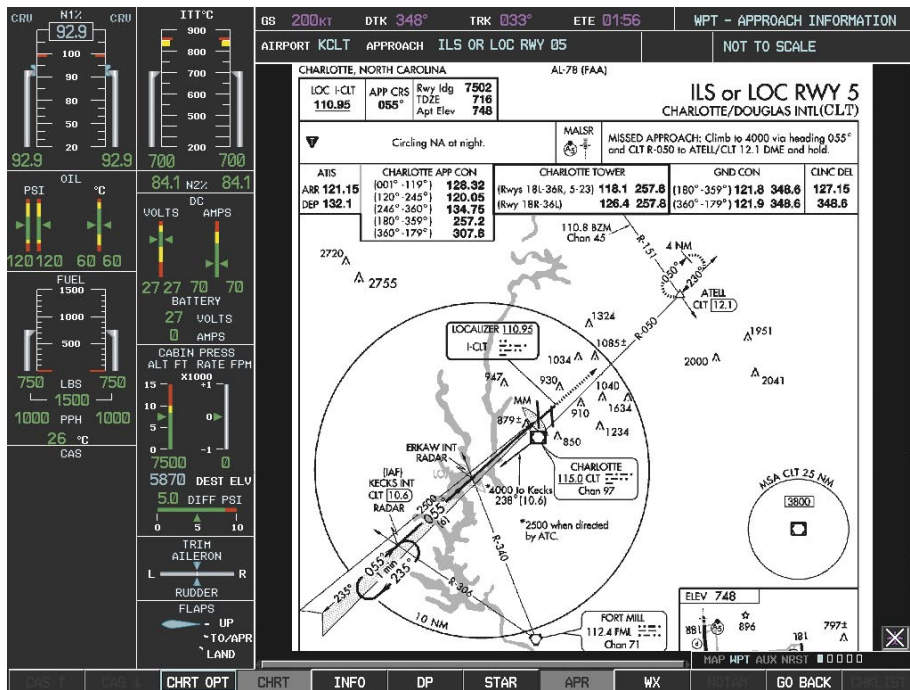
Figure 8-46 Approach Information Page

Selecting 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 Weather subscription is current.

Selecting Additional Information:

1) While viewing the Airport Taxi Diagram, select 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. When the INFO Box is selected the G1000 softkeys are blank.

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.

Info Available on This Airport

WX Info When Available

Chart Not To Scale

WX Softkey Selected
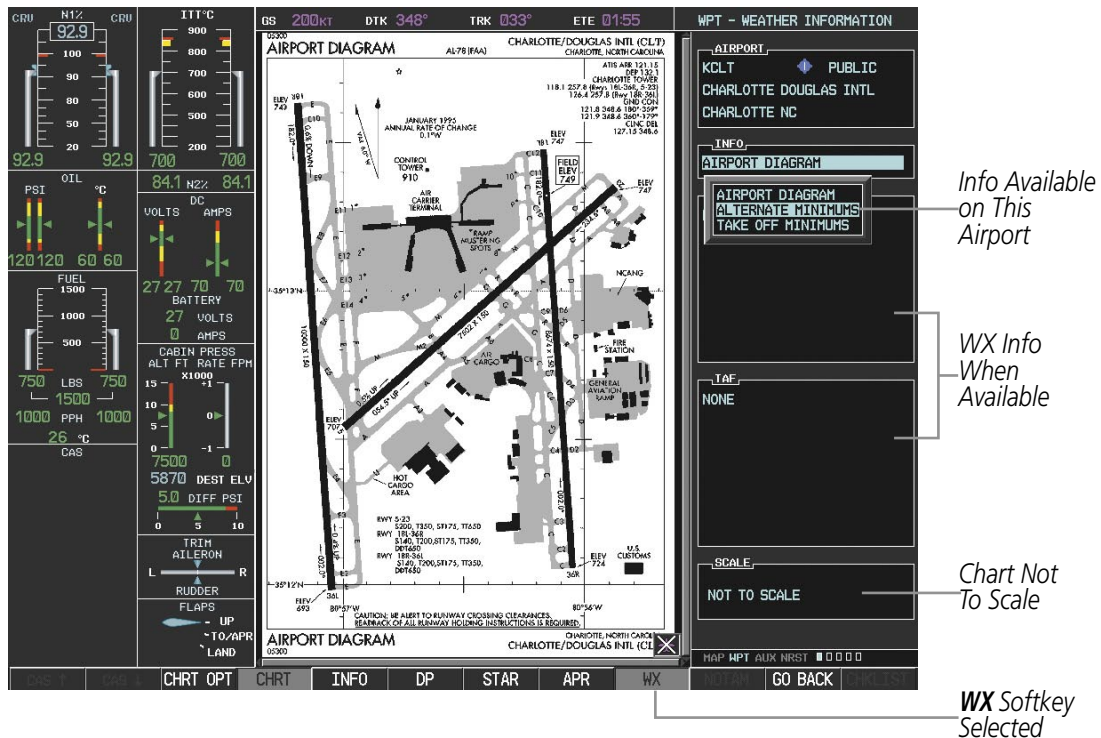
Figure 8-47 Weather Information Page

Selecting the **GO BACK** Softkey reverts to the previous page (Navigation Map Page or Flight Plan Page).

CHART OPTIONS

Selecting the **CHRT OPT** Softkey displays the next level of softkeys, the chart options level (Figure 8-35).

Selecting the **ALL** Softkey shows the entire chart on the screen.

Entire Chart Shown
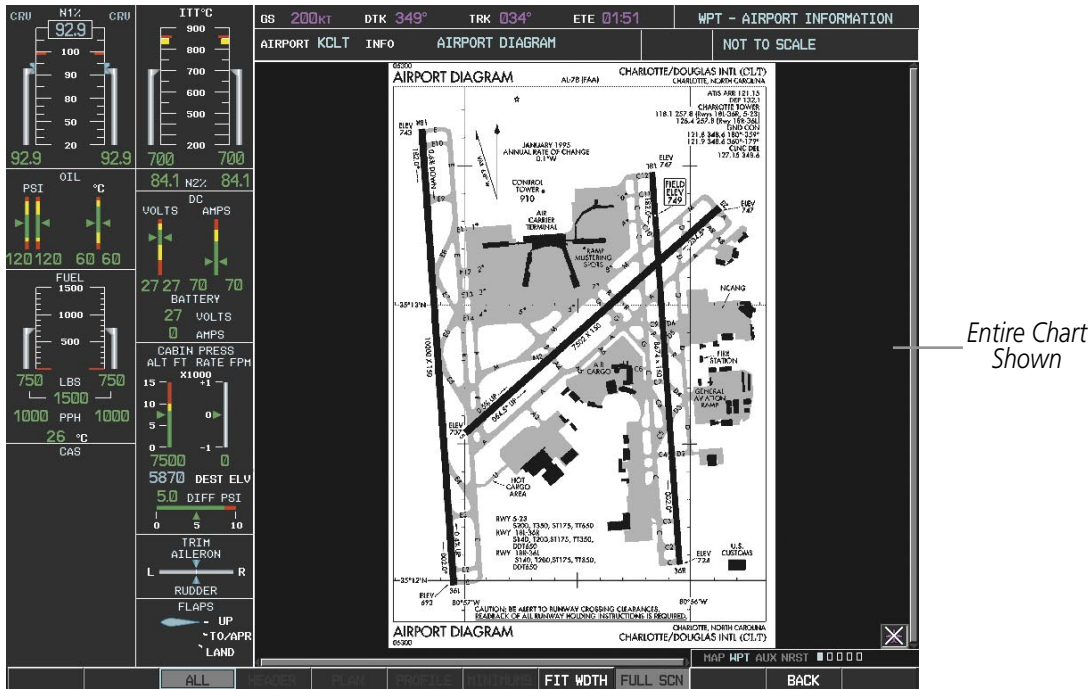
Figure 8-48 Airport Information Page, ALL View Selected

Selecting the **FIT WIDTH** Softkey fits the width of the chart in the display viewing area. In the example shown, the zoomed-in chart is replaced with the full width chart.
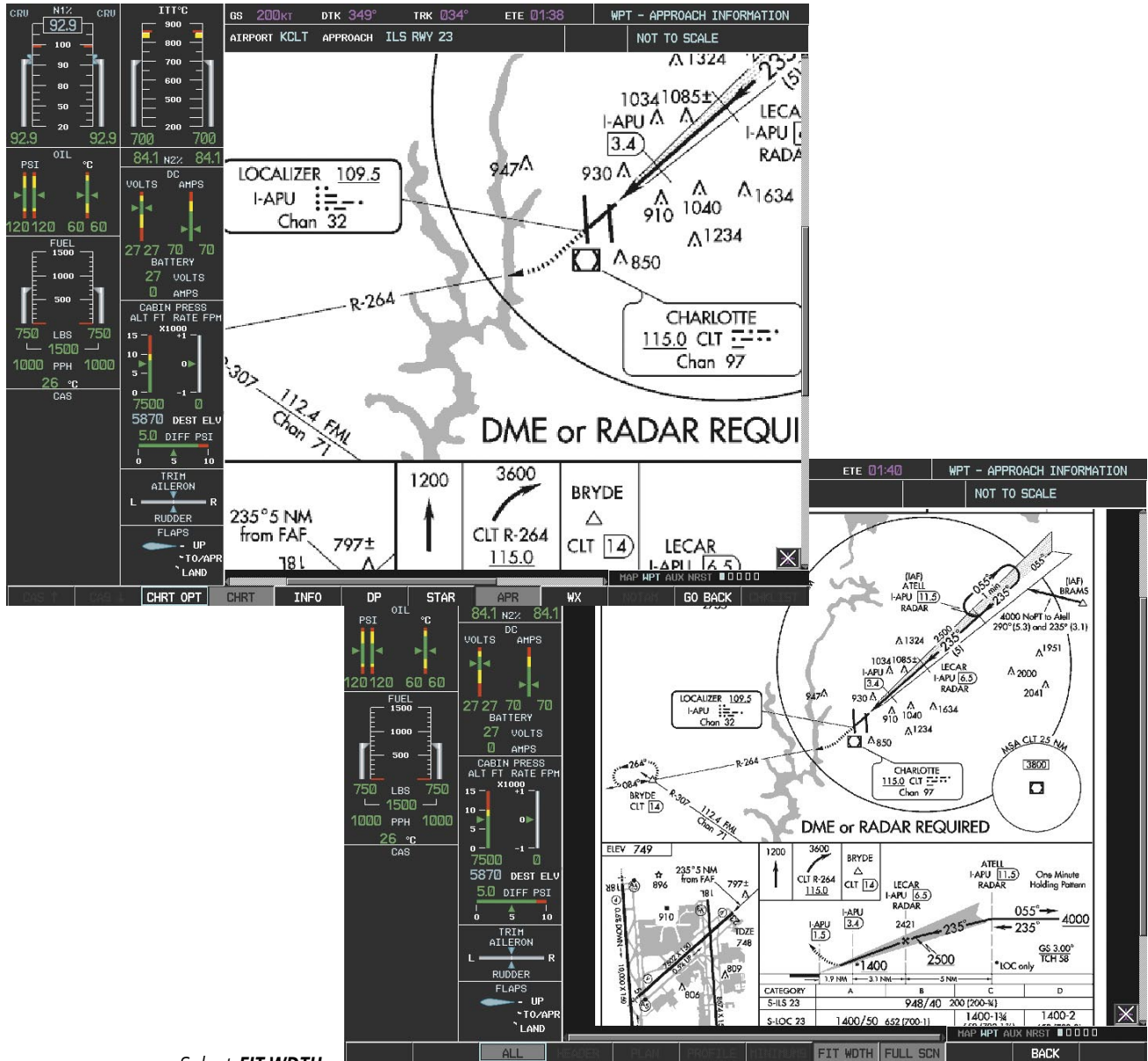
*Select **FIT WDTH** Softkey to Show Full Chart Width*

Figure 8-49 Approach Information Page, FIT WDTH Softkey Selected

Selecting the **FULL SCN** Softkey alternates between removing and replacing the data window to the right.
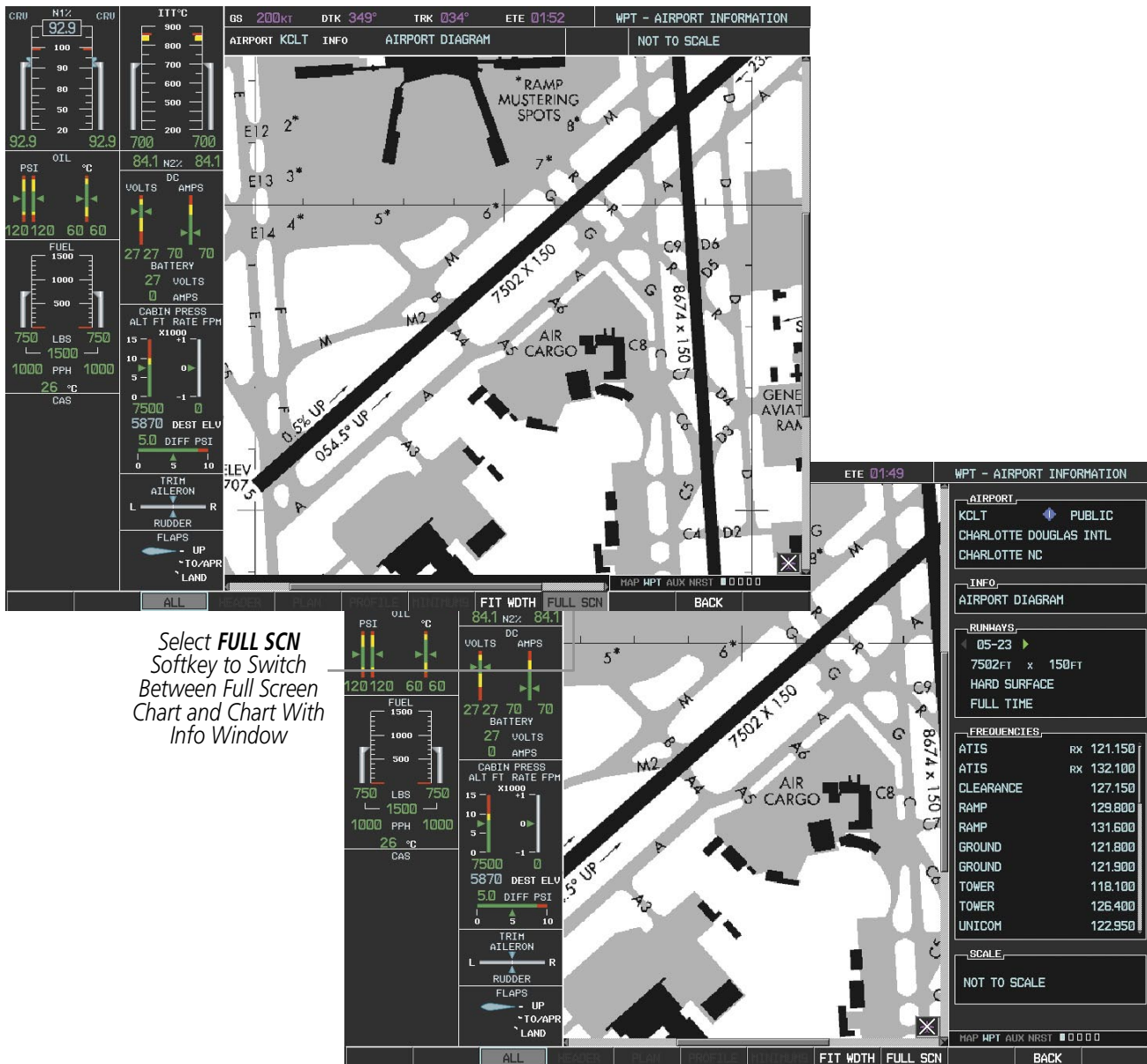
*Select **FULL SCN** Softkey to Switch Between Full Screen Chart and Chart With Info Window*

Figure 8-50 Airport Information Page, Full Screen and Info Window

Selecting the **BACK** Softkey, or waiting for 45 seconds reverts to the chart selection softkeys.

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.
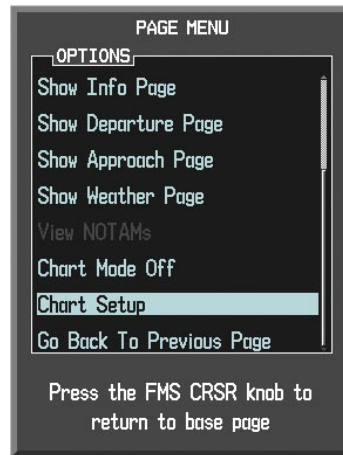
Figure 8-51 Waypoint Information Page, OPTIONS Menu

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.

5) Turn the small **FMS** Knob to choose between 'Day', 'Auto', and 'Night' Options.

6) In Auto Mode, turn the large **FMS** Knob to select the percentage field and change percentage with the small **FMS** Knob. The percentage of change is the day/night crossover point based on backlighting intensity.

NOTE: *Once an adjustment is made to the percentage field in Auto mode, the chart must be redrawn (zoomed in or out, or another chart selected) before the switch from Day to Night is seen.*

7) Press the **FMS** Knob when finished to remove the Chart Setup Menu.
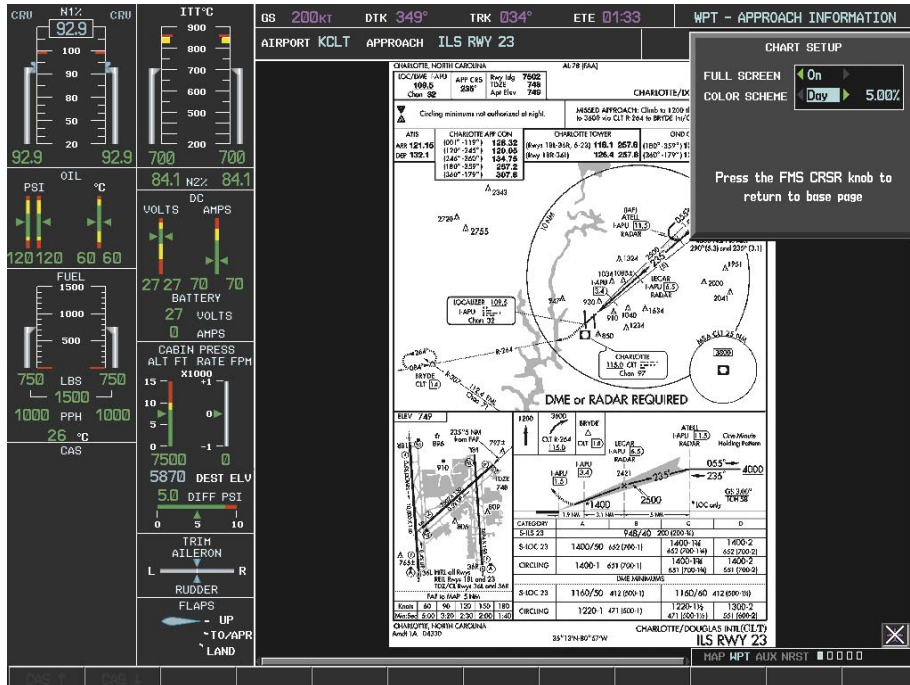
Figure 8-52 Approach Information Page, Day View
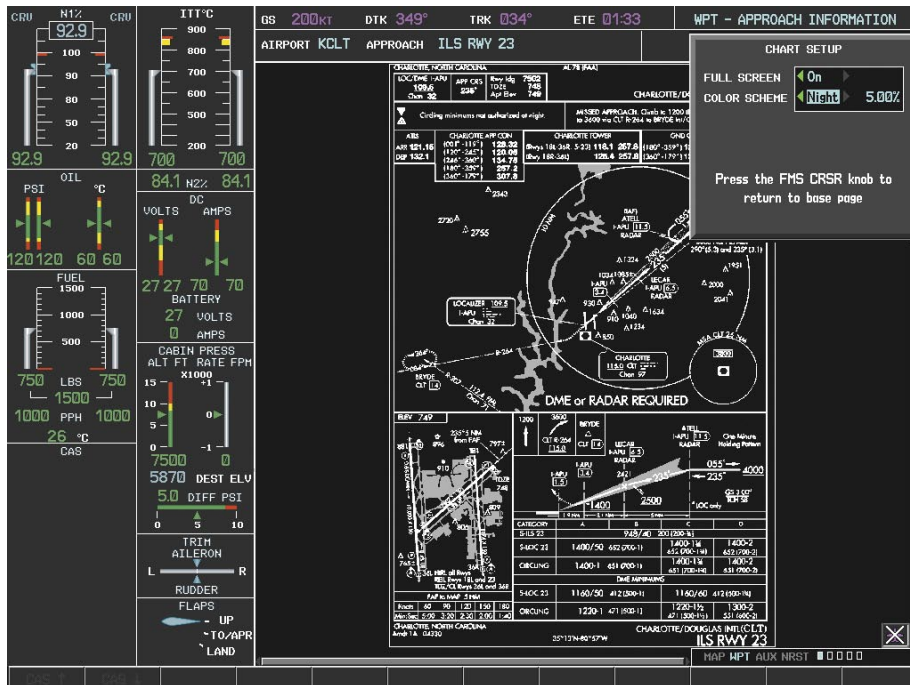
Figure 8-53 Approach Information Page, Night View

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 is disabled 180 days after the expiration date and are no longer available for viewing upon reaching the disables date. When turning on the G1000, the Power-up Page indicates any of five different possible criteria for chart availability. These indications are whether the databases are not configured, not available, current, out of date, or disabled. See Table 8-2 for the various FliteCharts Power-up Page displays and the definition of each.

Power-up Page Display	Definition
	Blank Line. G1000 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 11-MAY-2006	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 8-2 FliteCharts Power-up Page Annunciations and Definitions

Examples of four possible Power-up Page messages are shown in Figure 8-54. '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 Database is Current and Available

FliteCharts Database is Expired but Still Available

FliteCharts Database is Disabled

FliteCharts Database is Not Available

Figure 8-54 FliteCharts Power-up Page Messages

> ✓ **NOTE:** *A subdued softkey label indicates the function is disabled.*

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.

Select the **DBASE** Softkey for scrolling through the database information. Scroll through the database with the **FMS** knob or **ENT** Key.

The FliteCharts database cycle number shown in Figure 8-55, '0604' is broken down as follows:

06 – Indicates the year 2006

04 – Indicates the fourth issue of the FliteCharts database for the year

The FliteCharts 'EFFECTIVE' date "13–APR–06" is the first date that this database is current.

The FliteCharts 'EXPIRES' date "11–MAY–06" is the last date that this database is current.

The 'DISABLES' date "07–NOV–06" is the date that this database becomes inoperative.
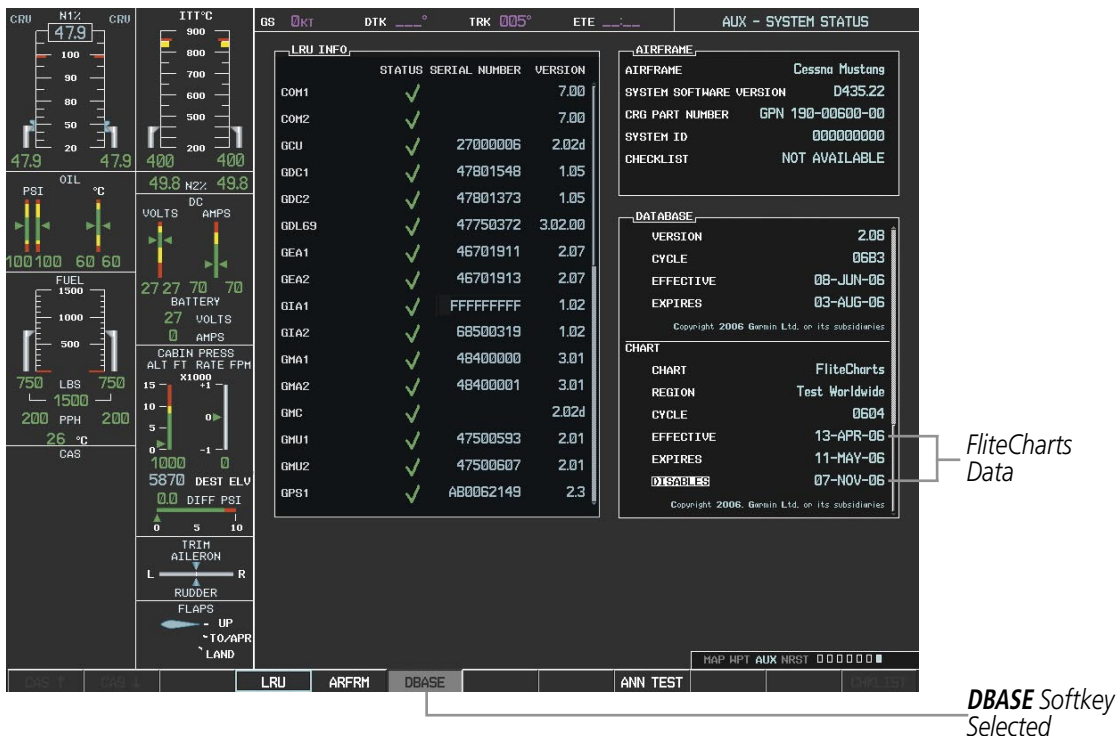
Figure 8-55 AUX – System Status Page, FliteCharts Current and Available

The FliteCharts database is provided from Garmin. Refer to Updating Garmin Databases in Appendix B for instructions on revising the FliteCharts database.

The other three possible AUX - System Status page conditions are shown in Figure 8-56. 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. 'REGION' and 'CYCLE' 'NOT AVAILABLE' in blue, indicate that FliteCharts database is not available on the database card or no database card is inserted.

FliteCharts Database has Expired, but is not Disabled

FliteCharts Database is Disabled

System is Configured for FliteCharts but Database is not Installed

FliteCharts Database is Not Available

Figure 8-56 AUX – System Status Page, FliteCharts Expired, FliteCharts Disabled, FliteCharts Not Available

8.4 XM RADIO ENTERTAINMENT (OPTIONAL)

> **NOTE:** *Refer to the Hazard Avoidance Section for information about XM Weather products.*

The optional XM Radio entertainment feature of the GDL 69A Data Link Receiver is available for the passengers' enjoyment. The GDL 69A can receive XM Satellite Radio® entertainment services at any altitude throughout the Continental U.S.

XM 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. XM Satellite Radio services are subscription-based. For more information on specific service packages, visit www.xmradio.com.

ACTIVATING XM SATELLITE RADIO SERVICES

The service is activated by providing XM 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 XM 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. XM 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 8-57)

• 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 XM services are initially set up. It is not used during normal XM Radio operation, but there should be no adverse effects if inadvertently selected during flight. Refer to the GDL 69/69A XM Satellite Radio Activation Instructions (190-00355-04, Rev F or later) for further information.

Activating the XM Satellite Radio services:

1) Contact XM WX Satellite Radio through the email address listed on their website (www.xmradio.com) or by the customer service phone number listed on the website. Follow the instructions provided by XM Satellite Radio services.

2) Select the Auxiliary Page Group.

3) Select the next to last page in the AUX Page Group.

4) Select the **INFO** Softkey to display the XM Information Page.

5) Verify that the desired services are activated.

6) Select the **LOCK** Softkey.

7) Turn the large **FMS** Knob to highlight YES.

8) To complete activation, press the **ENT** Key.

Figure 8-57 XM Information Page

If XM weather services have not been activated, all the weather product boxes are cleared 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 XM RADIO

The XM Radio Page provides information and control of the audio entertainment features of the XM 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) Select the **RADIO** Softkey to show the XM Radio Page where audio entertainment is controlled.

Figure 8-58 XM Radio Page

ACTIVE CHANNEL AND CHANNEL LIST

The Active Channel Box on the XM Radio Page displays the currently selected channel that the XM 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:

   Press the **FMS** Knob to highlight the channel list and turn the large **FMS** Knob to scroll through the channels.

3) Press the **ENT** Key to activate the selected channel.

Selecting a channel directly:

1) While on the XM Radio Page, select the **CHNL** Softkey.

2) Select the **DIR CH** Softkey. The channel number in the Active Channel Box will be highlighted.

3) Select 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) Select the **CATGRY** Softkey on the XM Radio Page.

2) Select 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 8-59 Categories List

PRESETS

Up to 15 channels from any category can be assigned a preset number. The preset channels are selected by selecting 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, select the **PRESETS** Softkey to access the first five preset channels (**PS1 - PS5**).

2) Select the **MORE** Softkey to access the next five channels (**PS6 – PS10**), and again to access the last five channels (**PS11 – PS15**). Selecting the **MORE** Softkey repeatedly cycles through the preset channels.

3) Select any one of the (**PS1 - PS15**) softkeys to assign a number to the active channel.

4) Select the **SET** Softkey on the desired channel number to save the channel as a preset.
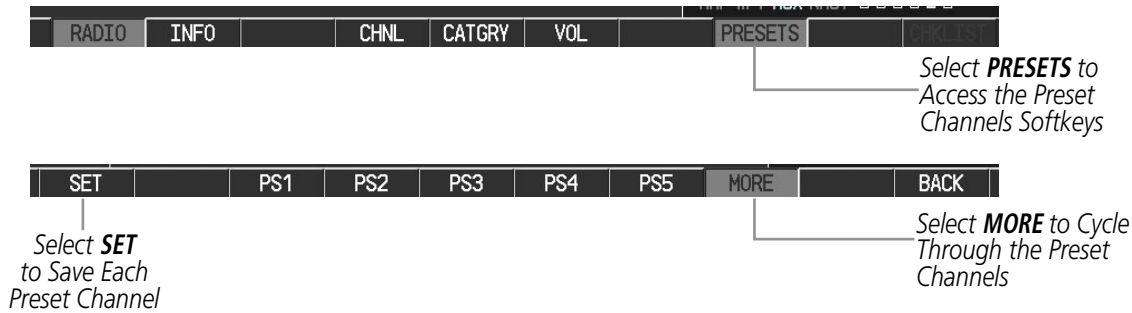
Figure 8-60 Accessing and Selecting XM Preset Channels

Selecting the **BACK** Softkey, or waiting during 45 seconds of softkey inactivity, returns the system to the top level softkeys.

VOLUME

Radio volume is controlled at each passenger station.

8.5 SCHEDULER

The Scheduler feature can be used to enter and display reminder messages (e.g., "Hot Section Inspection" or "Phase 1 Maintenance 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, messages are retained until deleted, and message timer countdown is restarted.
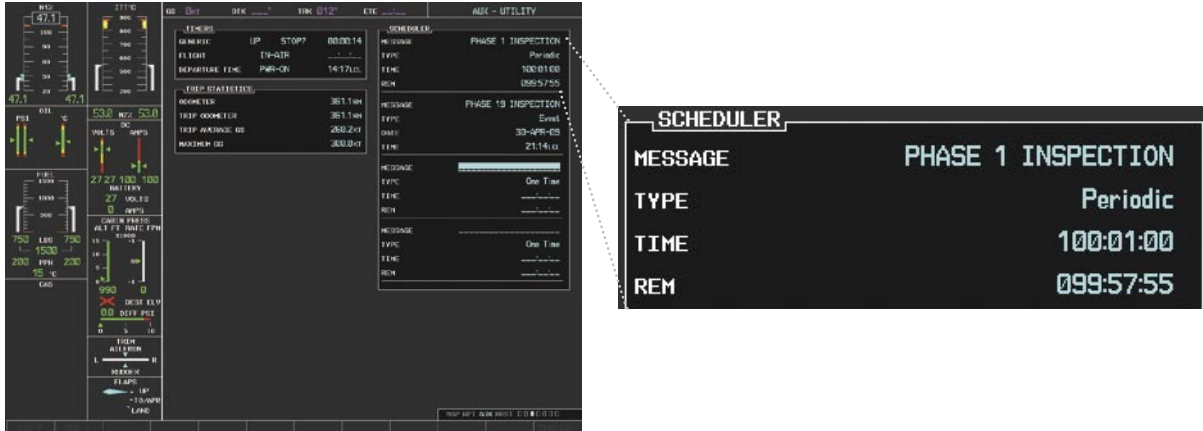
Figure 8-61 Scheduler (Utility Page)

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 (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-YY) and press the **ENT** Key.

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

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

10) 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 Messages Window on the PFD. Pressing the **MSG** Softkey opens the Messages Window and acknowledges the scheduler message. When pressed, the Messages Window is removed from the display and the scheduler message is deleted from the message queue.

Figure 8-62 PFD Alerts Window

8.6 ABNORMAL OPERATION

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 XM

• 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 will be 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
CO GUARDIAN	✓		7.00
COM1	✓		7.00
COM2	✓	27000006	2.02d
GDC1	✓	47801548	1.05
GDL69	✓	47801373	1.05
GEA1	✓	47750372	3.02.00
GIA1	✓	46701911	2.07
GIA2	✓	46701913	2.07
GMA1	✓	FFFFFFFF	1.02
GMU1	✓	68500319	1.02
GPS1	✓	48400000	3.01
GPS2	✓	48400001	3.01
GRS1	✓		2.02d
GS1	✓	47500593	2.01
GS2	✓	47500607	2.01
GSA PTCH CTL	✓	AB0062149	2.3

Figure 8-63 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	XM subscription is not activated

Table 8-3 GDL 69/69A Data Link Receiver Error Messages

ANNUNCIATIONS AND ALERTS

CAS MESSAGES

Messages			Description	Inhibits						
Warning	Caution	Advisory		ESI	TOPI	AIR	LOPI	ESDI	EMER	GND
	AFT DOOR		Tailcone baggage door not fully secured						X	
	AFT JBOX CB L-R*		Start control circuit breaker (located in aft j-box) tripped						X	
	AFT JBOX LMT L-R*		Current limiter blown (located in aft j-box)						X	
	ANTISKID FAIL		Antiskid Control Unit cannot perform anti-skid functions						X	
BATTERY O'TEMP	BATTERY O'TEMP		Overheated NiCad battery (optional)							
	BATT TEMP FAIL		Battery temperature sensor failure		X		X			
CABIN ALT	CABIN ALT	CABIN ALT	Cabin altitude potentially unsafe		X		X			X
	CABIN DOOR		Cabin door not fully secured						X	
	CHECK DOORS		A door monitor has not been properly tested or has failed		X	X	X		X	
	DUCT O'HEAT L-R*		Duct temperature too high or sensor disconnected				X		X	
	ENG A/I COLD L-R*	ENG A/I COLD L-R*	Engine anti-ice system ON and inlet temperature is cold					X	X	
	ENG CTRL SYS L-R*		FADEC has a fault that requires maintenance							
ENGINE FAIL L-R*			An engine has failed							
	F/W SHUTOFF L-R*		Fuel firewall shutoff valve fully closed						X	
	FLAPS FAIL		A flap system failure has occurred.						X	
	FUEL BOOST L-R*	FUEL BOOST L-R*	Electric fuel boost pump ON. Caution condition is displayed when the boost pump is operating in abnormal conditions.						X	
	FUEL FLTR BP L-R*		Engine fuel filter impending bypass switch closed						X	
		FUEL LO INOP L-R*	Fuel low level function failure		X		X			
	FUEL LVL LO L-R*		Fuel level in tank is too low						X	
	FUEL PRES LO L-R*		Fuel pressure too low					X	X	
		FUEL TRANSFER	Fuel transfer valve open						X	
GEN OFF L-R	GEN OFF L-R*		One or both electrical generators offline							
	HYD PRESS LO		Hydraulic system pressure too low		X				X	
	HYD PUMP ON		Hydraulic pump running too long				X		X	
	NOSE DOOR L-R*		One or both nose baggage doors not fully secured						X	
		NO TIRE SPINDOWN	Antiskid control spindown function not working				X		X	
OIL PRESS LO L-R*			Oil pressure less than redline low limit	X				X	X	
	OXYGEN OFF		Oxygen supply off		X		X		X	
	P/S HTR L-R*		No current detected to pitot static heater						X	
	PRESS CTRL	PRESS CTRL	Pressure controller loss of integrity		X		X		X	
		PRESS OFF	Air Source Selector switch in OFF or fresh air position				X		X	
		SPD BRK EXTEND	Speed brakes extended						X	
	STALL WARN FAIL		Failure detected in stall warning system	X	X		X		X	
		STALL WARN HI	Stall warning system on ice-contaminated schedule	X					X	
	STALL WARN HTR		No power delivered to stall warning vane heater	X					X	
		SURFACE DE-ICE	De-ice boots inflating/deflating as designed						X	
	T2 HTR FAIL L-R*		T2 probe heater failure		X		X		X	
TAIL CONE BLD LK			Tailcone temp high, possible bleed air leak.		X		X		X	
	TAIL DE-ICE FAIL		De-ice system not operating normally						X	
	W/S A/I FAIL L-R*	W/S A/I FAIL L-R*	Loss of power to windshield heater						X	
	W/S O'HEAT L-R*	W/S O'HEAT L-R*	Windshield anti-ice power ON; temperature too high						X	
	WING DE-ICE FAIL		De-ice system operating abnormally						X	
	WOW MISCOMPARE		Gear on-ground inputs do not agree		X		X		X	

Only affected side displayed (L, R, or L-R) in a CAS message; applicable CAS messages listed here display L-R for example.

Name	Inhibit
EMER	Emergency Bus Mode Inhibit
ESI	Engine Start Inhibit
TOPI	Takeoff Operation Phase Inhibit
AIR	In-Air Inhibit
LOPI	Landing Operation Phase Inhibit
ESDI	Engine Shutdown Inhibit
GND	On-Ground Inhibit

Red annunciation window text signifies warnings; yellow, cautions; and white, annunciation advisories. See the Airplane Flight Manual (AFM) for recommended pilot actions.

COMPARATOR ANNUNCIATIONS

The Comparator monitors critical values generated by redundant sensors. If differences in the sensors exceed a specified amount, this discrepency will be annunciated in the Comparator Window as a 'MISCOMP' (miscompare) as seen in Figure A-1. If one or both of the sensed values are unavailable, it will be annunciated as a 'NO COMP' (no compare). The following is a list of the possible annunciations:

Figure A-1 Sensor Comparator Window

Comparator Window Text	Condition
ALT MISCOMP	Difference in altitude sensors is ≥ 200 ft.
IAS MISCOMP	If both airspeed sensors detect < 35 kts, this is inhibited.
	If either airspeed sensor detects ≥ 35 kts, and the difference in sensors is > 10 kts.
	If either airspeed sensor detects ≥ 80 kts, and the difference in sensors is > 7 kts.
HDG MISCOMP	Difference in heading sensors is > 6º.
PIT MISCOMP	Difference in pitch sensors is > 5º.
ROLL MISCOMP	Difference in roll sensors is > 6º.
ALT NO COMP	No data from one or both altitude sensors.
IAS NO COMP	No data from one or both airspeed sensors.
HDG NO COMP	No data from one or both heading sensors.
PIT NO COMP	No data from one or both pitch sensors.
ROLL NO COMP	No data from one or both roll sensors..

REVERSIONARY SENSOR ANNUNCIATIONS

Reversionary sensor selection is annunciated in the Reversionary Sensor Window, as shown in Figure A-2. These annunciations reflect reversionary sensors selected on one or both PFDs. Pressing the **SENSOR** Softkey gives access to **ADC1**, **ADC2**, **AHRS1**, and **AHRS2** Softkeys. These softkeys allow manual switching of sensors. In the case of certain types of sensor failures, the G1000 may make some sensor selections automatically. The GPS sensor cannot be switched manually.

Figure A-2 Reversionary Sensor Windows

Reversionary Sensor Window Text	Condition
BOTH ON ADC1	Both PFDs are displaying data from the #1 Air Data Computer.
BOTH ON ADC2	Both PFDs are displaying data from the #2 Air Data Computer.
BOTH ON AHRS1	Both PFDs are displaying data from the #1 AHRS.
BOTH ON AHRS2	Both PFDs are displaying data from the #2 AHRS.
BOTH ON GPS1	Both PFDs are displaying data from the #1 GPS receiver.
BOTH ON GPS2	Both PFDs are displaying data from the #2 GPS receiver.
XSIDE ADC	The PFD displaying this annunciation is displaying data from the cross-side Air Data Computer.
XSIDE AHRS	The PFD displaying this annunciation is displaying data from the cross-side AHRS.

G1000 SYSTEM ANNUNCIATIONS

When a new message is issued, the **MSG** Softkey will flash to alert the flight crew of a new message. It will continue to flash until acknowledged by pressing the softkey. Active messages are displayed in white text. Messages that have become inactive will change to gray text. The **MSG** Softkey will flash 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 **MSG** Softkey.

The G1000 System Messages conveys 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 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.*

System Annunciation Red 'X'

Messages Window

Message Softkey Annunciation
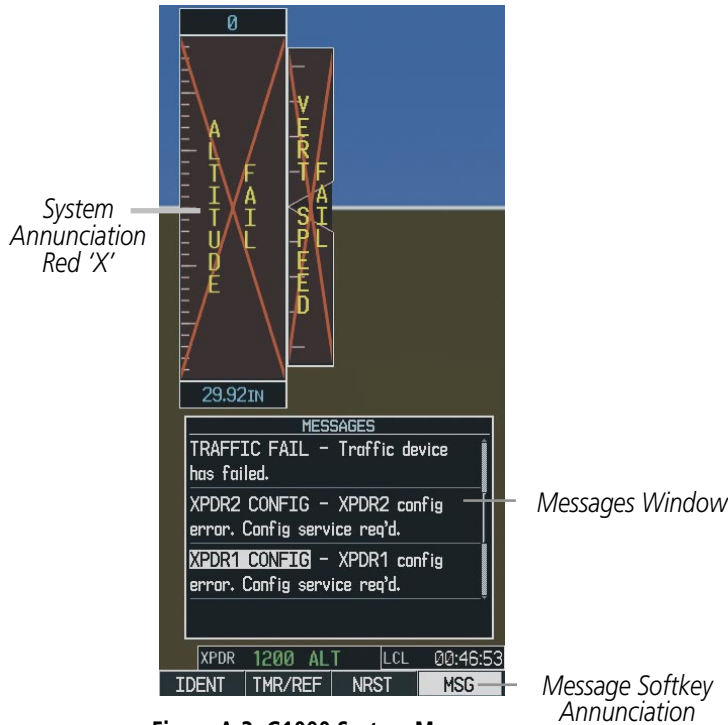
Figure A-3 G1000 System Messages

GIA 63W Integrated Avionics Units

GEA 71 Engine Airframe Unit Or GIA 63W Integrated Avionics Unit

Fuel Qty. Signal Conditioner

GEA 71 Engine Airframe Unit

KAPSII Pressure Controller

GEA 71 Engine Airframe Unit

FADEC

GDC 74B Air Data Computer

GIA 63W Integrated Avionics Units

GDC 74B Air Data Computer

GRS 77 AHRS Or GMU 44 Magnetometer

GIA 63W Integrated Avionics Units

GTX 33/D Transponder Or GIA 63W Integrated Avionics Units

Figure A-4 G1000 System Failure Annunciations

System Annunciation	Comment
	Attitude and Heading Reference System is aligning.
	Display system is not receiving attitude information from the AHRS.
	Indicates a configuration module failure.
	This annunciation will only be seen when the autopilot is engaged. The annunciation indicates an AHRS monitor has detected an abnormal flight parameter, possibly caused by strong turbulence. In this case, the situation should correct itself within a few seconds. If there is an actual failure, a red "X" will soon appear over the Attitude Indicator.
	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.

System Annunciation	Comment
	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).
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.

G1000 SYSTEM MESSAGE ADVISORIES

> **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 Citation Mustang Airplane Flight Manual (AFM) takes precedence over any conflicting guidance found in this section.*

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.

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 & PFDs with preferred settings, if desired.
XTALK ERROR – A flight display crosstalk error has occurred.	The MFD and PFDs 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.
PFD2 SERVICE – PFD2 needs service. Return unit for repair.	
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 – PFD2 software mismatch, communication halted.	
MANIFEST – MFD1 software mismatch, communication halted.	
PFD1 CONFIG – PFD1 config error. Config service req'd.	The PFD configuration settings do not match backup configuration memory. The G1000 system should be serviced.
PFD2 CONFIG – PFD2 config error. Config service req'd.	
MFD1 CONFIG – MFD1 config error. Config service req'd.	The MFD configuration settings do not match backup configuration memory. The G1000 system should be serviced.

MFD & PFD MESSAGE ADVISORIES (CONT.)

Message	Comments
SW MISMATCH – GDU software version mismatch. Xtalk is off.	The MFD and PFDs have different software versions installed. The G1000 system should be serviced.
CAS INOP – No Dispatch. Software correction required.	The MFD and/or PFDs have a software mismatch. 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.
PFD2 COOLING – PFD2 has poor cooling. Reducing power usage.	
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.
PFD2 KEYSTK – PFD2 [key name] Key is stuck.	
MFD1 KEYSTK – MFD [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.
PFD2 VOLTAGE – PFD2 has low voltage. Reducing power usage	The PFD2 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.

DATABASE MESSAGE ADVISORIES

Message	Comments
CAS INOP – No Dispatch. Database correction required.	The MFD and/or PFDs have an aviation database mismatch. Load the same aviation database version in the MFD and both PFDs.
MFD1 DB ERR – MFD1 aviation database error exists.	The MFD and/or PFD detected a failure in the aviation database. Attempt to reload the aviation database. If problem persists, the G1000 system should be serviced.
PFD1 DB ERR – PFD1 aviation database error exists.	
PFD2 DB ERR – PFD2 aviation database error exists.	
MFD1 DB ERR – MFD1 basemap database error exists.	The MFD and/or PFD detected a failure in the basemap database.
PFD1 DB ERR – PFD1 basemap database error exists.	
PFD2 DB ERR – PFD2 basemap database error exists.	

DATABASE MESSAGE ADVISORIES (CONT.)

Message	Comments
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.	
PFD2 DB ERR – PFD2 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.	
PFD2 DB ERR – PFD2 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.	
PFD2 DB ERR – PFD2 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.	
PFD2 DB ERR – PFD2 Safe Taxi database error exists.	
MFD1 DB ERR – MFD1 Chartview database error exists.	The MFD and/or PFDs 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 PFDs 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.
DB MISMATCH – Aviation database version mismatch. Xtalk is off.	The PFDs and MFD have different aviation database versions installed. Crossfill is off. Install correct aviation database version in all displays.
DB MISMATCH – Aviation database type mismatch. Xtalk is off.	The PFDs and MFD have different aviation database types installed (Americas, European, etc.). Crossfill is off. Install correct aviation database type in all displays.
DB MISMATCH – Terrain database version mismatch.	The PFDs and MFD have different terrain database versions installed. Install correct terrain database version in all displays.
DB MISMATCH – Terrain database type mismatch.	The PFDs and MFD have different terrain database types installed. Install correct terrain database type in all displays.
DB MISMATCH – Obstacle database version mismatch.	The PFDs and MFD have different obstacle database versions installed. Install correct obstacle database version in all displays.
DB MISMATCH – Airport Terrain database mismatch.	The PFDs and MFD have different airport terrrain databases installed. Install correct airport terrain database in all displays.

GMA 1347D 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.
GMA2 FAIL – GMA2 is inoperative.	
GMA XTALK – GMA crosstalk error has occurred.	An error has occurred in transferring data between the two GMAs. The G1000 system should be serviced.
GMA1 CONFIG – GMA1 config error. Config service req'd.	The audio panel configuration settings do not match backup configuration memory. The G1000 system should be serviced.
GMA2 CONFIG – GMA2 config error. Config service req'd.	
MANIFEST – GMA1 software mismatch, communication halted.	The audio panel has incorrect software installed. The G1000 system should be serviced.
MANIFEST – GMA2 software mismatch, communication halted.	
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.
GMA2 SERVICE – GMA2 needs service. Return unit for repair.	

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.	
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.	

GIA 63W MESSAGE ADVISORIES (CONT.)

Message	Comments
HW MISMATCH – GIA hardware mismatch. GIA1 communication halted.	A GIA mismatch has been detected, where only one is WAAS capable.
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.	
COM1 TEMP – COM1 over temp. Reducing transmitter power.	The system has detected an over temperature condition in COM1 and/or COM2. The transmitter will operate 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.	
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.	Use LNAV minima when approach is downgraded.
TRUE APR – True north approach. Change HDG reference to TRUE.	Displayed after passing the first waypoint of a true north approach when the nav angle is set to 'AUTO'.

GIA 63W MESSAGE ADVISORIES (CONT.)

Message	Comments
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.
GEA2 CONFIG – GEA2 config error. Config service req'd.	The GEA2 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.
MANIFEST – GEA2 software mismatch, communication halted.	The #2 GEA 71 has incorrect software installed. The G1000 system should be serviced.

GTX 33 & GTX 33D 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.
XPDR2 CONFIG – XPDR2 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.

GTX 33 & GTX 33D MESSAGE ADVISORIES (CONT.)

Message	Comments
MANIFEST – GTX2 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.
XPDR2 SRVC – XPDR2 needs service. Return unit for repair.	The #2 transponder should be serviced when possible.
XPDR1 FAIL – XPDR1 is inoperative.	There is no communication with the #1 transponder.
XPDR2 FAIL – XPDR2 is inoperative.	There is no communication with the #2 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.
AHRS2 TAS – AHRS2 not receiving airspeed.	The #2 AHRS is not receiving true airspeed from the air data computer. The AHRS relies on GPS information to augment the lack of airspeed. The 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.
AHRS2 GPS – AHRS2 using backup GPS source.	The #2 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.
AHRS2 GPS – AHRS2 not receiving any GPS information.	The #2 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.
AHRS2 GPS – AHRS2 not receiving backup GPS information.	The #2 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.
AHRS2 GPS – AHRS2 operating exclusively in no-GPS mode.	The #2 AHRS is operating exclusively in no-GPS mode. The G1000 system should be serviced.
AHRS MAG DB – AHRS magnetic model database version mismatch.	The #1 AHRS and #2 AHRS magnetic model database versions do not match.
AHRS1 SRVC – AHRS1 Magnetic-field model needs update.	The #1 AHRS earth magnetic field model is out of date. Update magnetic field model when practical.
AHRS2 SRVC – AHRS2 Magnetic-field model needs update.	The #2 AHRS earth magnetic field model is out of date. Update magnetic field model when practical.

GRS 77 MESSAGE ADVISORIES (CONT.)

Message	Comments
GEO LIMITS – AHRS1 too far North/ South, no magnetic compass.	The aircraft is outside geographical limits for approved AHRS operation. Heading is flagged as invalid.
GEO LIMITS – AHRS2 too far North/ South, no magnetic compass.	
MANIFEST – GRS1 software mismatch, communication halted.	The #1 AHRS has incorrect software installed. The G1000 system should be serviced.
MANIFEST – GRS2 software mismatch, communication halted.	The #2 AHRS has incorrect software installed. The G1000 system should be serviced.

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.
HDG FAULT – AHRS2 magnetometer fault has occurred.	A fault has occurred in the #2 GMU 44. Heading is flagged as invalid. The AHRS uses GPS for backup mode operation. The G1000 system should be serviced.
MANIFEST – GMU1 software mismatch, communication halted.	The GMU 44 has incorrect software installed. The G1000 system should be serviced.
MANIFEST – GMU2 software mismatch, communication halted.	

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.

GWX 68 ALERT MESSAGES

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 – GWX 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 ±10º 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.

GDC 74B MESSAGE ADVISORIES

Message	Comments
ADC1 ALT EC – ADC1 altitude error correction is unavailable.	GDC1 or GDC2 is reporting that the altitude error correction is unavailable.
ADC2 ALT EC – ADC2 altitude error correction is unavailable.	
ADC1 AS EC – ADC1 airspeed error correction is unavailable.	GDC1 or GDC2 is reporting that the airspeed error correction is unavailable.
ADC2 AS EC – ADC2 airspeed error correction is unavailable.	
MANIFEST – GDC1 software mismatch, communication halted.	The GDC 74B has incorrect software installed. The G1000 system should be serviced.
MANIFEST – GDC2 software mismatch, communication halted.	

GCU 475 MESSAGE ADVISORIES

Message	Comments
GCU CNFG – GCU Config error. Config service req'd.	GCU 475 configuration settings do not match those of backup configuration memory. The G1000 system should be serviced.
GCU FAIL – GCU is inoperative.	A failure has been detected in the GCU 475. The GCU 475 is unavailable.
MANIFEST – GCU software mismatch, communication halted.	The GCU 475 has incorrect software installed. The G1000 system should be serviced.
GCU KEYSTK – GCU [key name] Key is stuck.	A key is stuck on the GCU 475 bezel. Attempt to free the stuck key by pressing it several times. The G1000 system should be serviced if the problem persists.

GMC 710 MESSAGE ADVISORIES

Message	Comments
GMC CONFIG – GMC Config error. Config service req'd.	Error in the configuration of the GMC 710.
GMC FAIL – GMC is inoperative.	A failure has been detected in the GMC 710. The GMC 710 is unavailable.
MANIFEST – GMC software mismatch. Communication halted.	The GMC 710 has incorrect software installed. The G1000 system should be serviced.
GMC KEYSTK – GMC [key name] Key is stuck.	A key is stuck on the GMC 710 bezel. Attempt to free the stuck key by pressing it several times. The G1000 system should be serviced if the problem persists.

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 aviation database update eliminates an obsolete waypoint. The flight plan cannot find the specified waypoint and flags this message. This can also occur with user waypoints in 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 aviation 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 procedures that have been manually edited. This alert is issued only after an aviation 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 aviation database. This alert is issued only after an aviation 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 aviation 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 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.
LEG UNSMOOTH – Flight plan leg will not be smooth.	The approaching flight plan waypoints are too close to allow for smooth turns. Prepare for steep turns ahead and expect noticeable course deviations.
APR 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.

MISCELLANEOUS MESSAGE ADVISORIES (CONT.)

Message	Comments
PTK FAIL – Parallel track unavailable: bad geometry.	Bad parallel track geometry.
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 will automatically transition 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 will prevent 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 selected waypoint [xxxx] does not use the WGS 84 datum. Cross-check position with alternate navigation sources.
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.
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°.
SCHEDULER [#] – <message>.	Message criteria entered by the user.

AFCS ALERTS

System Status Field

Figure A-5 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.
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.
Emergency Descent Mode	**EDM**	AP engaged when aircraft altitude above 30,000 ft and cabin pressurization is lost. Selected Heading set 90° left of current heading; Selected Altitude set to 15000 ft
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 will be heard.
	PFT	Preflight system test has failed.

NOTE: *Do not press the **AP DISC** switch during servo power-up and preflight system tests as this may cause the preflight system test to fail or never to start (if servos fail their power-up tests). Power must be cycled to the servos to remedy the situation.*

TAWS ALERTS

Annunciations appear on the PFD and MFD. Pop-up alerts appear only on the MFD.

Alert Type	PFD/MFD TAWS Page Annunciation	MFD Map Page Pop-Up Alert	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"

* Mustang defualt configuration

TAWS SYSTEM STATUS ANNUNCIATIONS

Alert Type	PFD/MFD TAWS Page Annunciation	MFD Pop-Up Alert	Aural Message
TAWS System Test Fail	TAWS FAIL	None	"TAWS System Failure"
TAWS Alerting is disabled	TAWS INHB	None	None
No GPS position or excessively degraded GPS signal	TAWS N/A	None	"TAWS Not Available" "TAWS Available" will be heard when sufficient GPS signal is re-established.
System Test in progress	TAWS TEST	None	None
System Test pass	None	None	"TAWS System Test OK"

OTHER G1000 AURAL ALERTS

Aural Alert	Description
"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"	The Traffic Information Service (TIS) has issued a Traffic Advisory alert
"TIS not available"	The aircraft is outside the Traffic Information Service (TIS) coverage area.

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SD CARD USE

The G1000 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 aviation and ChartView database updates.

JEPPESEN DATABASES

The Jeppesen aviation 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 these databases are provided directly from Jeppesen. The ChartView database should be copied to the Garmin supplied Supplemental Data Card which will reside in the bottom card slot on the MFD. The aviation database may be installed from the Jeppesen supplied SD data card or copied to one of the Garmin supplied Supplemental Data Cards. Contact Jeppesen (www.jeppesen.com) for subscription and update information.

The aviation database may be programmed to only one of the Supplemental Data Cards. This card must then be used to update the PFDs and the MFD.

> **NOTE:** *After the aviation database is installed, the card may be removed after loading the update to each LRU.*

Updating the Jeppesen aviation database:

1) With the G1000 System OFF, insert the SD card containing the aviation database update into the top card slot of first PFD to be updated (Label of SD card facing left).

2) Turn the G1000 System ON. A prompt similar to the following is displayed in the upper left corner of the PFD:

```
DO YOU WANT TO UPDATE THE AVIATION DATABASE?
             FROM            TO
REGION:      WORLDWIDE       WORLDWIDE
CYCLE:       0604            0605
EFFECTIVE:   13-APR-2006     11-MAY-2006
EXPIRES:     11-MAY-2006     08-JUN-2006

NO WILL BE ASSUMED IN 8 SECONDS.
```

Figure B-1 Database Update Prompt

3) Press the **ENT** Key to start the database update. A prompt similar to the following is displayed:

```
DO YOU WANT TO UPDATE THE AVIATION DATABASE?
             FROM            TO
REGION:      WORLDWIDE       WORLDWIDE
CYCLE:       0604            0605
EFFECTIVE:   13-APR-2006     11-MAY-2006
EXPIRES:     11-MAY-2006     08-JUN-2006

NO WILL BE ASSUMED IN 8 SECONDS.
UPDATING AVIATION DATABASE, PLEASE WAIT.
.
UPDATED 1 FILES SUCCESSFULLY!
PRESS ANY KEY TO CONTINUE.
CONTINUING IN 8 SECONDS.
```

Figure B-2 Database Update Confirmation

4) After the update completes, the PFD starts in normal mode.

5) Turn the G1000 System OFF and remove the SD card.

6) Repeat steps 1 through 4 for the other PFD and the MFD. The MFD and PFD databases are now updated. Remove the SD card when finished.

7) Verify that the correct update cycle is loaded during startup of the MFD.

GARMIN DATABASES

The following G1000 databases are stored on Supplemental Data Cards provided by Garmin:

- Expanded basemap
- Obstacle
- Terrain
- SafeTaxi
- Airport terrain
- FliteCharts

After subscribing to the desired databases product, these database products will be downloaded to three Supplemental Data Cards (with the exception of FliteCharts, which is loaded on only one card). Insert each Supplemental Data Card into the correct location shown in Figure B-3. These cards must not be removed except to update the databases stored on each card.
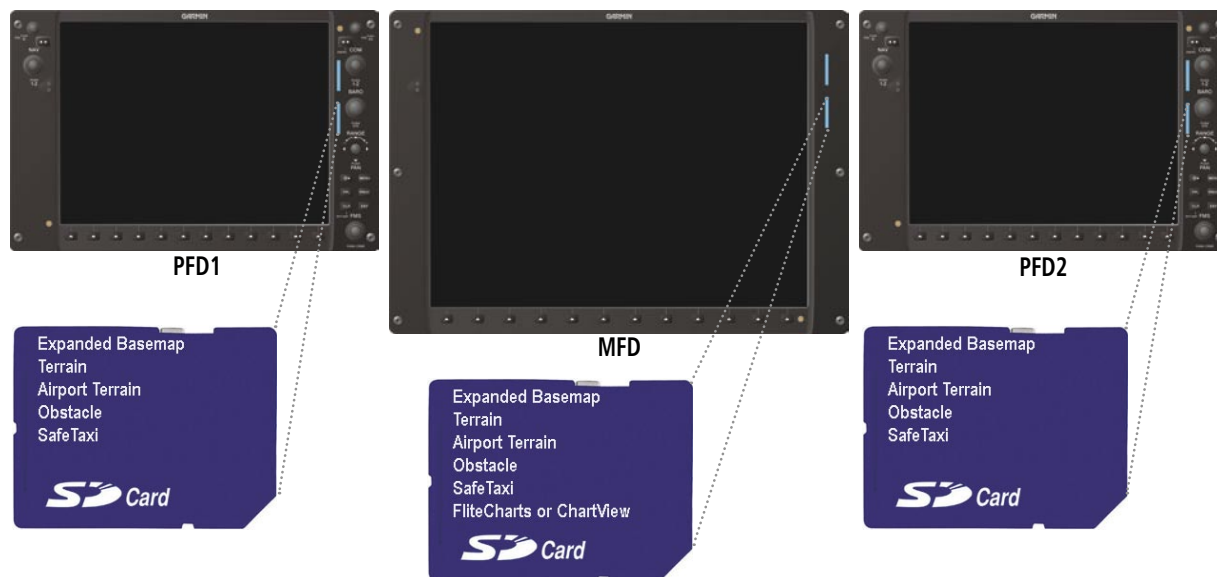
Figure B-3 Correct Database Locations

Since these databases are not stored internally in the MFD or PFDs, a Supplemental Data Card containing identical database versions must be kept in each display unit.

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 and airport terrain databases contain the terrain mapping and airport diagram data. They 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 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.

UPDATING GARMIN DATABASES

The Garmin database updates can be obtained by following the instructions detailed in the 'Aviation Databases' section of the Garmin website (www.garmin.com). Once the updated files have been downloaded from the website, a PC equipped with an appropriate SD card reader is used to unpack and program the new databases onto the existing Supplemental Data Cards. Equipment required to perform the update is as follows:

• Windows-compatible PC computer (Windows 2000 or XP recommended)

• SanDisk SD Card Reader, P/Ns SDDR-93 or SDDR-99 or equivalent card reader

• Updated database obtained from the Garmin website

• Existing 010-00330-42 Supplemental Database SD Cards from both PFD and MFD

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.

After the data has been copied to the appropriate data cards, perform the following steps:

1) Insert one SD card in the bottom card slot of the MFD and one in the bottom card slot of each PFD. The SD card containing the ChartView or FliteCharts database must be inserted into the bottom slot on the MFD.

2) Apply power to the G1000 System. View the MFD power-up splash screen. Check that the databases are initialized and displayed on the splash screen. When updating the terrain and FliteCharts databases, an 'in progress' message may be seen. If this message is present, wait for the system to finish loading before verifying the correct databases are initialized, then proceed to step 3.

Figure B-4 Database Information on the Splash Screen

3) Acknowledge the Power-up Page agreement by pressing the **ENT** Key or the right most softkey.

4) Turn the large **FMS** Knob to select the AUX Page group on the MFD.

5) Turn the small **FMS** Knob to select the System Status Page.

6) Press the **DBASE** Softkey to place the cursor in the 'DATABASE' box.

7) Turn either **FMS** Knob to scroll through the database list and check that all databases are current and there are no errors.

8) Power down the G1000.

GLOSSARY

ACC	accuracy
ACT, ACTV	active, activate
ADC	air data computer
ADF	Automatic Direction Finder
ADI	Attitude Direction Indicator
AF	Arc to fix
AFCS	Automatic Flight Control System
AFM	Airplane Flight Manual
AFMS	Airplane Flight Manual Supplement
AFRM	airframe
AGL	Above Ground Level
AHRS	Attitude and Heading Reference System
AIM	Airman's Information Manual
AIRMET	Airman's Meteorological Information
ALRT	alert
ALT	altitude
ALT, ALTN	alternator
AMPS	amperes
ANNUNC	annunciation
ANT	antenna
AP	autopilot
AP DISC	autopilot disconnect
APR	approach
APT	airport, aerodrome
ARINC	Aeronautical Radio Incorporated
ARSPC	airspace
ARTCC	Air Route Traffic Control Center
ARV	arrival
AS	airspeed
ASB	Aviation Support Branch
ASOS	Automated Surface Observing System
ATC	Air Traffic Control
ATCRBS	ATC Radar Beacon System
ATIS	Automatic Terminal Information Service
ATK	along-track
AUTOSEQ	automatic sequence
AUX	auxiliary
AWOS	Automated Weather Observing System
B ALT	barometric altitude
BARO	barometric setting
BATT	battery
BC	backcourse

Bearing	The compass direction from the present position to a destination waypoint.
BFO	beat frequency oscillator
BKSP	backspace
BRG	bearing
C	center runway
ºC	degrees Celsius
CA	Course to Altitude
CALC	calculator
Calibrated Airspeed	Indicated airspeed corrected for installation and instrument errors.
CD	Course to DME distance
CDI	Course Deviation Indicator
CDU	Control Display Unit
CF	Course to Fix
CHT	Cylinder Head Temperature
CHKLIST	checklist
CHNL	channel
CI	Course to Intercept
CLD	cloud
CLR	clear
cm	centimeter
CNS	Communication, Navigation, & Surveillance
CO	carbon monoxide
COM	communication radio
CONFIG	configuration
COOL	coolant
COPLT	co-pilot
Course	The line between two points to be followed by the aircraft.
Course to Steer	The recommended direction to steer in order to reduce course error or stay on course. Provides the most efficient heading to get back to the desired course and proceed along the flight plan.
CR	Course to Radial
CRG	Cockpit Reference Guide
CRNT	current
Crosstrack Error	The distance the aircraft is off a desired course in either direction, left or right.
CRS	course
CRS	Course to Steer
CRSR	cursor
CTA	Control Area
CTRL	control
Cumulative	The total of all legs in a flight plan.

CVR	Cockpit Voice Recorder
CVRG	coverage
CWS	control wheel steering
CYL	cylinder
D ALT	density altitude
DB, DBASE	database
dBZ	decibels 'Z' (radar return)
DCLTR, DECLTR	declutter
DEC FUEL	decrease fuel
deg	degree
DEIC, DEICE	de-icing
DEP	departure
Desired Track	The desired course between the active "from" and "to" waypoints.
DEST	destination
DF	Direct to Fix
DFLT	default
DGRD	degrade
DH	decision height
Dilution of Precision	A measure of GPS satellite geometry quality on a scale of one to ten (lower numbers equal better geometry, where higher numbers equal poorer geometry).
DIR	direction
DIS	distance
Distance	The 'great circle' distance from the present position to a destination waypoint.
DME	Distance Measuring Equipment
DOP	Dilution of Precision
DP	Departure Procedure
DPRT	departure
DR	dead reckoning
DSBL	disabled
DTK	Desired Track
E	empty, east
ECU	Engine Control Unit
Efficiency	A measure of fuel consumption, expressed in distance per unit of fuel.
EGT	Exhaust Gas Temperature
EIS	Engine Indication System
ELEV	elevation
ELEV	elevator
EMERGCY	emergency
EMI	Electromagnetic Interference
ENDUR	endurance

Endurance	Flight endurance, or total possible flight time based on available fuel on board.
ENG	engine
ENGD	engaged
ENR	enroute
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.
ENT	enter
EPE	Estimated Position Error
EPU	Estimated Position Uncertainty
ERR	error
ESA	Enroute Safe Altitude
Estimated Position Error	A measure of horizontal GPS position error derived by satellite geometry conditions and other factors.
Estimated Time of Arrival	The estimated time at which the aircraft should reach the destination waypoint, based upon current speed and track.
Estimated Time Enroute	The estimated time it takes to reach the destination waypoint from the present position, based upon current ground speed.
ETA	Estimated Time of Arrival
ETE	Estimated Time Enroute
EXPIRD	expired
°F	degrees Fahrenheit
FA	Course From Fix to Altitude
FAA	Federal Aviation Administration
FADEC	Full Authority Digital Engine Control
FAF	Final Approach Fix
FAIL	failure
FC	Course From Fix to Distance
FCC	Federal Communication Commission
FCST	forecast
FD	Course From Fix to DME Distance
FD	flight director
FDE	Fault Detection and Exclusion
FFLOW	fuel flow
FIS-B	Flight Information Services-Broadcast
FISDL	Flight Information Service Data Link
FL	flight level
FLC	Flight Level Change
FM	Course From Fix to Manual Termination

FMS	Flight Management System		Heading	The direction an aircraft is pointed, based upon indications from a magnetic compass or a properly set directional gyro.
FOB	Fuel On Board			
FPL	flight plan			
fpm	feet per minute			
FREQ	frequency		HF	Hold Terminating at Fix
FRZ	freezing		HFOM	Horizontal Figure of Merit
FSS	Flight Service Station		Hg	mercury
ft	foot/feet		HI	high
Fuel Flow	The fuel flow rate, expressed in units of fuel per hour.		HI SENS	High Sensitivity
			HM	Hold with Manual Termination
Fuel On Board	The total amount of usable fuel on board the aircraft.		Horizontal Figure of Merit	A measure of the uncertainty in the aircraft's horizontal position.
			hPa	hectopascal
G/S, GS	glideslope		HPL	Horizontal Protection Level
GA	go-around		hr	hour
gal, gl	gallon(s)		HSDB	High-Speed Data Bus
GBOX	gearbox		HSI	Horizontal Situation Indicator
GDC	Garmin Air Data Computer		HT	heat
GDL	Garmin Satellite Data Link		HUL	Horizontal Uncertainty Level
GDU	Garmin Display Unit		Hz	Hertz
GEA	Garmin Engine/Airframe Unit		I	Inner Marker
GEO	geographic		IAF	Initial Approach Fix
GFC	Garmin Flight Control		IAT	Indicated Air Temperature
GIA	Garmin Integrated Avionics Unit		IAU	Integrated Avionics Unit
GLS	Global Navigation Satellite Landing System		ICAO	International Civil Aviation Organization
GMA	Garmin Audio Panel System		ICS	Intercom System
GMT	Greenwich Mean Time		ID	Identification/Morse Code Identifier
GMU	Garmin Magnetometer Unit		IDENT, IDNT	identification
GND	ground		IF	Initial Fix
gph	gallons per hour		IFR	Instrument Flight Rules
GPS	Global Positioning System		IG	Imperial gallon
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		ILS	Instrument Landing System
			IMC	Instrument Meteorological Conditions
			in	inch
			INACTV	inactive
			INC FUEL	increase fuel
Groundspeed	The velocity that the aircraft is travelling relative to a ground position.		IND	indicated
			Indicated	Information provided by properly calibrated and set instrumentation on the aircraft panel.
Ground Track	*see Track*		INFO	information
GRS	Garmin Reference System		in HG	inches of mercury
GS	Ground speed		INT	intersection(s)
GTX	Garmin Transponder		INTEG	integrity (RAIM unavailable)
HA	Hold Terminating at Altitude		IrDA, IRDA	Infrared Data Association
HDG	heading		KEYSTK	key stuck
			kg	kilogram

kHz	kilohertz
km	kilometer
kt	knot
L	left, left runway
LAT	latitude
LBL	label
lb	pound
LCD	Liquid Crystal Display
LCL	local
LED	Light Emitting Diode
Left Over Fuel On Board	The amount of fuel remaining on board after the completion of one or more legs of a flight plan or direct-to.
Left Over Fuel Reserve	The amount of flight time remaining, based on the amount of fuel on board after the completion of one or more legs of a flight plan or direct-to, and a known consumption rate.
Leg	The portion of a flight plan between two waypoints.
LIFR	Low Instrument Flight Rules
LNAV	Lateral Navigation
LO	low
LOC	localizer
LOI	loss of integrity (GPS)
LON	longitude
LPV	Localizer Performance with Vertical guidance
LRU	Line Replacement Unit
LT	left
LTNG	lightning
LVL	level
M	Middle Marker
m	meter
MAG	Magnetic
MAG VAR	Magnetic Variation
MAHP	Missed Approach Hold Point
MAN IN	manifold pressure (inches Hg)
MAN SQ	Manual Squelch
MAP	Missed Approach Point
MASQ	Master Avionics Squelch
MAX	maximum
MAXSPD	maximum speed (overspeed)
MDA	barometric minimum descent altitude
MET	manual electric trim
METAR	Meteorological Aviation Routine

MEPT	manual electric pitch trim
MFD	Multi Function Display
MGRS	Military Grid Reference System
MHz	megahertz
MIC	microphone
MIN	minimum
Minimum Safe Altitude	Uses Grid MORAs to determine a safe altitude within ten miles of the aircraft present position.
MKR	marker beacon
MOA	Military Operations Area
MOV	movement
mpm	meters per minute
MSA	Minimum Safe Altitude
MSG	message
MSL	Mean Sea Level
MT	meter
mV	millivolt(s)
MVFR	Marginal Visual Flight Rules
N	north
NAV	navigation
NAVAID	NAVigation AID
NDB	Non-directional Beacon
NEXRAD	Next Generation Radar
nm	nautical mile(s)
NPT	
NRST	nearest
O	Outer Marker
OAT	Outside Air Temperature
OBS	Omni Bearing Selector
OFST	offset
OXY	oxygen
P ALT	pressure altitude
PA	Passenger Address
PA	Proximity Advisory
PASS	passenger(s)
PC	personal computer
PFD	Primary Flight Display
PI	Procedure Turn to Course Intercept
PIT, PTCH	pitch
POSN	position
PPM	parts per million
P. POS	Present Position
PRES, PRESS	pressure
PROC	procedure(s), procedure turn
psi	pounds per square inch
PT	Procedure Turn

PTK	parallel track		SLP/SKD	slip/skid
PTT	Push-to-Talk		SMBL	symbol
PWR	power		SPD	speed
			SPI	Special Position Identification
QTY	quantity		SPKR	speaker
			SQ	squelch
R	right, right runway		SRVC, SVC	service
RAD	radial		STAL	stall
RAIM	Receiver Autonomous Integrity Monitoring		STAR	Standard Terminal Arrival Route
			STATS	statistics
RAM	random access memory		STBY	standby
REF	reference		STD	standard
REM	remaining (fuel remaining above Reserve)		STRMSCP	Stormscope
			SUA	Special Use Airspace
REQ	required		SUSP	suspend
RES	reserve (fuel reserve entered by pilot)		SW	software
			SYS	system
REV	reverse, revision, revise			
RF	Constant Radius Turn to Fix		T	true
RMI	Radio Magnetic Indicator		TA	Traffic Advisory
RMT	remote		TACAN	Tactical Air Navigation System
RNG	range		TAF	Terminal Aerodrome Forecast
RNWY	runway		TAS	True Airspeed
ROL	roll		TAS	Traffic Advisory System, true airspeed
ROM	read only memory			
rpm	revolutions per minute		TAT	Total Air Temperature
RST FUEL	reset fuel		TAWS	Terrain Awareness and Warning System
RSV	reserve (fuel reserve entered by pilot)			
			TCA	Terminal Control Area
RT	right		TCAS	Traffic Collision Avoidance System
RVRSNRY	reversionary		TEL	telephone
RX	receive		TEMP	temperature
			TERM	terminal
S	south		TF	Track Between Two Fixes
SA	Selective Availability		TFR	Temporary Flight Restriction
SAT	Static Air Temperature		T HDG	True Heading
SBAS	Satellite-Based Augmentation System		TIS	Traffic Information System
			TIT	Turbine Inlet Temperature
SCIT	Storm Cell Identification and Tracking		TKE	Track Angle Error
			TMA	Terminal Maneuvering Area
SD	Secure Digital		TMR/REF	Timer/Reference
sec	second(s)		Topo	topographic
SEL, SLCT	select		Track	Direction of aircraft movement relative to a ground position; also 'Ground Track'
SFC	surface			
SIAP	Standard Instrument Approach Procedures			
			Track Angle Error	The angle difference between the desired track and the current track.
SID	Standard Instrument Departure			
SIGMET	Significant Meteorological Information		TRG	target
			TRK	track
Sim	simulator		TRSA	Terminal Radar Service Area

TRUNC	truncated
TTL	total
TURN	procedure turn
TX	transmit
UNAVAIL	unavailable
USR	user
UTC	Coordinated Universal Time
UTM/UPS	Universal Transverse Mercator / Universal Polar Stereographic Grid
V, Vspeed	velocity (airspeed)
VA	Heading Vector to Altitude
VAPP	VOR approach
VAR	variation
VD	Heading Vector to DME Distance
Vdc	volts, direct current
VERT	vertical
Vertical Figure of Merit	A measure of the uncertainty in the aircraft's vertical position.
Vertical Speed Required	The vertical speed necessary to descend/climb from a current position and altitude to a defined target position and altitude, based upon current groundspeed.
VFOM	Vertical Figure of Merit
VFR	Visual Flight Rules
VHF	Very High Frequency
VI	Heading Vector to Intercept
VLOC	VOR/Localizer Receiver
VM	Heading Vector to Manual Termination
VMC	Visual Meteorological Conditions
VNAV, VNV	vertical navigation
VOL	volume
VOR	VHF Omni-directional Range
VORTAC	very high frequency omnidirectional range station and tactical air navigation
VPL	Vertical Protection Level
VPROF	VNV profile, vertical profile
VPTH	VNV path, vertical path
VR	Heading Vector to Radial
VS	vertical speed
VSI	Vertical Speed Indicator
VSR	Vertical Speed Required
VTF	vector to final
W	watt(s), west
WAAS	Wide Area Augmentation System
WARN	warning (GPS position error)
WGS-84	World Geodetic System - 1984
WPT	waypoint(s)
WW	world wide
WX	weather
XFER, XFR	transfer
XPDR	transponder

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 WAAS?

The Wide Area Augmentation System (WAAS) 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 one of two geostationary satellites. This correction information can then be received by any WAAS-enabled GPS receiver.

WAAS is designed to provide the additional accuracy, availability, and integrity necessary to enable users to rely on GPS for all phases of flight. WAAS is currently available in the United States, including Alaska and Hawaii.

HOW DOES WAAS AFFECT APPROACH OPERATIONS?

Both LNAV/VNAV and LPV approaches use the accuracy of WAAS 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 WAAS. This approach combines the LNAV/VNAV vertical accuracy with lateral guidance similar to the typical Instrument Landing System (ILS). LPV approaches allow lower approach minimums.

WHAT IS RAIM AND HOW DOES IT AFFECT APPROACH OPERATIONS?

RAIM is an acronym for Receiver Autonomous Integrity Monitoring. RAIM is a GPS receiver function that performs the following functions:

• Monitors and verifies integrity and geometry of tracked GPS satellites

• Notifies the pilot when satellite conditions do not provide the necessary coverage to support a certain phase of flight

• Predicts satellite coverage of a destination area to determine whether the number of available satellites is sufficient to satisfy requirements

> **NOTE:** If RAIM is not predicted to be available for the final approach course, the approach does not become active, as indicated by the "RAIM not available from FAF to MAP" message and the LOI annunciation flagging on the HSI.

For RAIM to work correctly, the GPS receiver must track at least five satellites. A minimum of six satellites is required to allow RAIM to eliminate a single corrupt satellite from the navigation solution.

RAIM ensures that satellite geometry allows for a navigation solution calculation within a specified protection limit (2.0 nm for oceanic and en route, 1.0 nm for terminal, and 0.3 nm for non-precision approaches). The 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-C129 Class A1 or A2 installation. GPS approaches are not to be flown with an expired database. See the approved Airplane Flight Manual (AFM) as well as the Aeronautical Information Manual (AIM) for more information.

WHAT DOES THE OBS SOFTKEY DO?

The **OBS** Softkey 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

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?

When set to 'Auto' (default), the GPS CDI scale automatically adjusts to the desired limits based upon the current phase of flight. CDI scaling changes in the following circumstances:

- Once a departure procedure is activated, the CDI is scaled for departure (0.3 nm).

- Thirty nautical miles from the departure airport (or at the last departure waypoint if farther than 30 nm from the departure airport), the system automatically selects the enroute phase of flight and changes the CDI scaling to 2.0 nm.

- If after completing the departure procedure the nearest airport is more than 200 nm away from the aircraft and the approach procedure has not been activated, 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.

- During approach operations, the CDI scale begins to ramps down further within 2.0 nm of the final approach fix (FAF). The CDI switches to approach scaling automatically once any portion of the approach procedure becomes active or if Vectors-To-Final (VTF) are selected.

- When a missed approach is activated, the CDI scale changes to 0.3 nm.

See the discussion on CDI scaling in the Flight Instruments section for more details.

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.

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GENERAL TIS INFORMATION

INTRODUCTION

> ✓ NOTE: *Aircraft without an operating transponder are invisible to TIS.*

The Traffic Information Service (TIS) provides traffic advisory information to non-TAS/TCAS-equipped aircraft. TIS is a ground-based service providing the relative locations of all ATCRBS Mode-A and Mode-C transponder equipped aircraft within a specified service volume. The TIS ground sensor uses real-time track reports to generate traffic notification. The G1000 System displays TIS traffic information on the Traffic Map Page of the MFD. TIS information may also be displayed for overlay on the MFD Navigation Map Page, as well as on the PFD Inset Map. Surveillance data includes all transponder-equipped aircraft within the coverage volume. The G1000 System displays up to eight traffic targets within a 7.5 nm radius, from 3,000 feet below, to 3,500 feet above the requesting aircraft.

TIS VS. TAS/TCAS

The Traffic Information System (TIS) is a ground-based service that requires contact with a ground station through a datalink radio in order to receive traffic information. Traffic Advisory (TAS) and Traffic Collision Avoidance Systems (TCAS) are self-contained. TAS/TCAS uses an airborne interrogator with a half-second update rate, while TIS utilizes the terminal Mode-S ground interrogator and accompanying data link to provide a five-second update rate. TIS and TAS/TCAS have similar ranges.

TIS LIMITATIONS

> ✓ NOTE: *TIS is not intended to be used as a collision avoidance system and does not relieve the pilot of the responsibility to "see and avoid" other aircraft. TIS shall not be used for avoidance maneuvers during instrument meterorlogical conditions (IMC) or when there is no visual contact with the intruder aircraft.*

> ✓ NOTE: *Refer to the TIS Limitations section of the Aeronautical Information Manual (AIM) for a more comprehensive explanation.*

TIS relies on surveillance of the Mode-S radar system, which is a "secondary surveillance" radar system similar to that used by ATCRBS. Many limitations are inherent in secondary radar surveillance. Information provided by TIS is neither better nor more accurate than the information used by ATC. TIS is intended only to assist in visual acquisition of other aircraft in visual meterological conditions (VMC). While TIS is a useful aid for visual traffic avoidance, system limitations must be considered to ensure proper use. No recommended avoidance maneuvers are given, nor authorized, as a direct result of a TIS intruder display or TIS advisory.

- TIS operation may be intermittent during turns or other maneuvering.

- TIS is dependent on two-way, line-of-sight communications between the aircraft and the Mode-S radar antenna. Whenever the structure of the aircraft comes between the transponder antenna and the ground-based radar antenna, the signal may be temporarily interrupted.

- Other limitations and anomalies associated with TIS are described in the AIM.

⚠️ **WARNING:** *Garmin is not responsible for Mode S geographical coverage. Operation of the ground stations is the responsibility of the FAA. Refer to the AIM for a Terminal Mode S radar site map.*

✓ **NOTE:** *TIS is unavailable at low altitudes in many areas of the United States. This is often the case in mountainous regions.*

TIS information is collected during a single radar sweep. Collected information is then sent through the Mode S uplink on the next radar sweep. Because of this, the surveillance information is approximately five seconds old. TIS ground station tracking software uses prediction algorithms to compensate for this delay. These algorithms use track history data to calculate expected intruder positions consistent with the time of display. Occasionally, aircraft maneuvering may cause variations in this calculation and create slight errors on the Traffic Map Page. Errors affect relative bearing information and target track vector. This can cause a delay in the displayed intruder information. However, intruder distance and altitude typically remain relatively accurate and may be used to assist in spotting traffic.

The following errors are common examples:

• When the client or intruder aircraft maneuvers excessively or abruptly, the tracking algorithm may report incorrect horizontal position until the maneuvering aircraft stabilizes.

• When a rapidly closing intruder is on a course that intercepts the client aircraft course at a shallow angle (either overtaking or head-on) and either aircraft abruptly changes course within 0.25 nm, TIS may display the intruder aircraft on the incorrect side of the client aircraft.

These are rare occurrences and are typically resolved within a few radar sweeps once the client/intruder aircraft course stabilizes.

Pilots using TIS can provide valuable assistance in the correction of malfunctions by reporting observations of undesirable performance. Reports should identify the time of observation, location, type and identity of the aircraft, and describe the condition observed. Reports should also include the type of transponder and transponder software version. Since TIS performance is monitored by maintenance personnel, not ATC, malfunctions should be reported in the following ways:

• By telephone to the nearest Flight Service Station (FSS) facility

• By FAA Form 8000-7, Safety Improvement Report (postage-paid card can be obtained at FAA FSSs, General Aviation District Offices, Flight Standards District Offices, and General Aviation Fixed Base Operators)

DISPLAY SYMBOLS

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	

BASEMAP

Item	Symbol
Interstate Highway	
State Highway	
US Highway	
National Highway	
Small City or Town	
Medium City	
Large City	

NAVAIDS

Item	Symbol
Intersection	
LOM (compass locator at outer marker)	
NDB (Non-directional Radio Beacon)	
VOR	
VOR/DME	
VOR/ILS	
VORTAC	
TACAN	

TRAFFIC

Item	Symbol
Non-Threat Traffic (hollow diamond)	
Proximity Advisory	
Traffic Advisory, Out of Range	
Traffic Advisory	

LINE SYMBOLS

Item	Symbol
ICAO Control Area Class B Airspace	
Mode C Tower Area	
Warning Area Alert Area Caution Area Danger Area Prohibited Area Restricted Area Training 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	
Lattitude/Longitude	

OBSTACLE DATABASE

Obstacle Symbol	Unlighted Obstacle		Lighted Obstacle		Obstacle Color	Obstacle Location
	< 1000 ft AGL	> 1000 ft AGL	< 1000 ft AGL	> 1000 ft AGL		
					Red	Obstacle within 100 ft or above aircraft altitude
					Yellow	Obstacle within 1000 ft of aircraft altitude
					Gray	Obstacle more than 1000 ft below aircraft altitude

Table F-1 Obstacle Symbols and Colors

TERRAIN COLOR CHART

Terrain Color	Terrain Location
Red (WARNING)	Terrain above or within 100 ft below aircraft altitude
Yellow (CAUTION)	Terrain between 100 ft and 1000 ft of aircraft altitude
Black (NO DANGER)	Terrain more than 1000 ft below aircraft altitude

Potential Impact Points
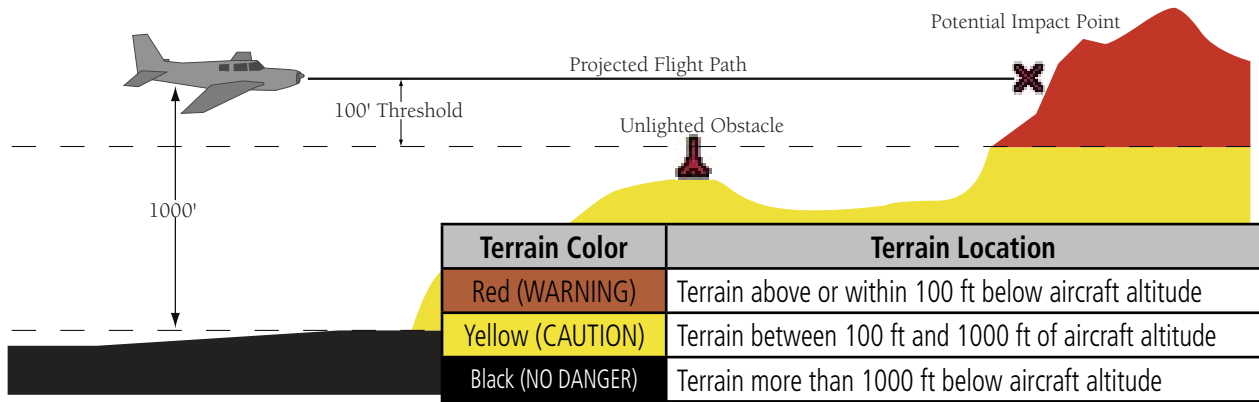
Figure F-2 TAWS Symbols & Colors

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	

Item	Symbol
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	

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