CHAPTER 16
AVIONICS

INTRODUCTION

This chapter is an overview of the avionics systems and does not contain complete details of every part of each system. Detailed operational information on the G1000 integrated flight deck system is available in the Garmin Cockpit Reference Guide, P/N 190-00600-00 as revised for the Cessna Citation Mustang. It is incumbent upon the pilot to adhere to the procedural policies stated within Garmin and Cessna FAA-approved documents, which include warnings, cautions, and notes. Refer to Chapter 1—"Aircraft General" for a list of Mustang publications.

GENERAL

The Cessna Citation Mustang utilizes a highly integrated electronics/instrumentation package (Figure 16-1). The Garmin G1000 integrated flight deck avionics suite is the main element of the system. In addition to normal flight operations with the G1000, standby and manual systems provide backup capabilities for essential flight operations and system control.

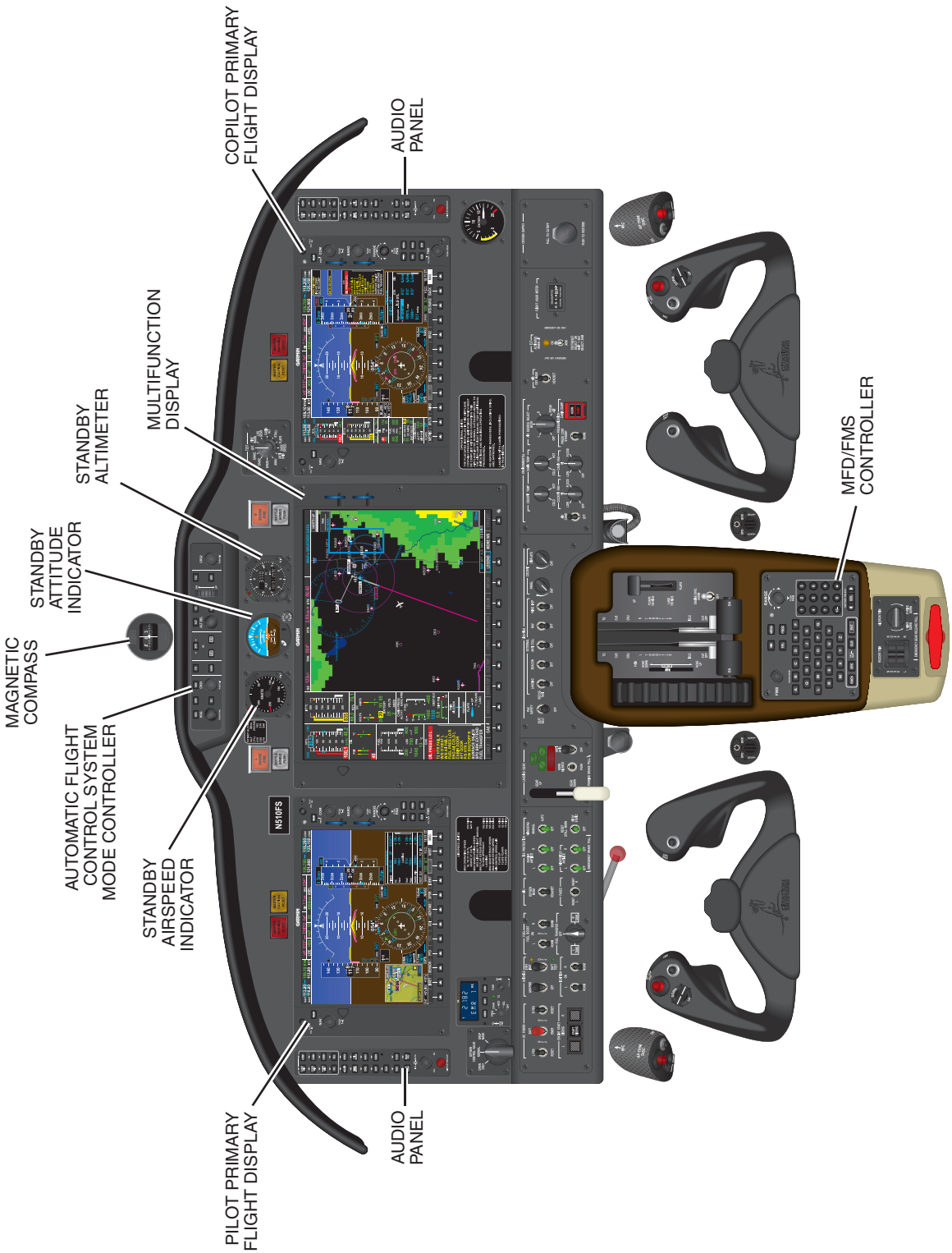


Figure 16-1. G1000 Integrated Flight Deck

G1000 INTEGRATED FLIGHT DECK OVERVIEW

The G1000 provides the pilot with communication, navigation, flight guidance, flight instrumentation, and monitoring of most aircraft systems. Functions are performed by various individual units. Three large displays and four control panels give the crew access to all functions.

Two *primary flight displays* (PFDs) provide flight instrument indications.

The larger *multifunction display* (MFD) provides a moving map display, incorporating information from navigation instruments, terrain/obstruction databases, weather information, and traffic alerts. The MFD also provides engine and airframe systems monitoring.

Supporting G1000 units provide data to these three displays, including air data, attitude and heading data, communications, navigation, transponders, weather radar, satellite-broadcast weather information, traffic information, and sensors for the engines and airframe systems.

The G1000 analyzes aircraft systems status and report crew alerts to the displays for various emergency, abnormal and advisory situations. The G1000 also provides automatic flight control, flight direction and an integrated flight management system. Finally, the processors automatically detect, report, and adjust for abnormal conditions in the G1000.

NOTE

While most *monitoring* of engine and airframe systems is through the displays, *control* of these systems is mostly performed through conventional electrical and mechanical cockpit controls, or through cockpit controls that command the independently powered full authority digital engine controls (FADECs).

STANDBY FLIGHT INSTRUMENTS OVERVIEW

The G1000 is supplemented by three 2”-display, stand-alone backup flight instruments on the top-center area of the instrument panel. These flight instruments are powered by the standby instrument battery pack:

- Airspeed indicator
- Altimeter
- Attitude indicator

AIR DATA REFERENCE SENSORS

Outside air data is supplied to the Mustang avionics (air data computer and standby instruments) through dual pitot-static systems, dual outside-air probes and a stall-warning vane. Two pitot probes, one on each side of the nose, supply ram-air inputs to the respective side (pilot/left or copilot/right) air data computer (ADC). A separate, two-port static system connects to each ADC. To minimize yaw effects, *both* static systems have a static port on *each* side of the fuselage.

All four static ports and both pitot tubes are electrically heated whenever the PITOT-STATIC switch (in the ICE PROTECTION switch panel) is on. To ensure continued air data reference if normal DC power fails in icing conditions, the *pilot* pitot-static system is electrically heated through the emergency bus (refer to Chapter 10—“Ice and Rain Protection”).

Two outside air temperature (OAT) probes are on the left fairing below the cabin door (one for each ADC). The ADCs analyze OAT levels and pitot-static inputs, and convert the information to data for the other components and displays of the G1000.

However, the standby altimeter and air data displays bypass the ADCs and receive reference inputs (static and ram-air pressures) directly from the pilot-side pitot-static system.

The stall-warning computer processes signals from the stall-warning vane (on the copilot side of the fuselage). The stall warning computer sends normalized angle of attack (AOA) to the G1000 to display a reference approach cue speed, 1.3 V_{S1}, represented as an open green circle on the airspeed tape. A red low-speed awareness range extends from the bottom of the airspeed tape up to the low speed velocity, V_{LSA}. The stall warning computer also sends an impending stall signal to disconnect the autopilot (AP). An aural stall warning tone is heard in the speakers and headsets when airspeed is below V_{LSA}. The stall warning system also provides three crew alerting system (CAS) messages: STALL WARN FAIL, STALL WARN HTR, and STALL WARN HI. The STALL WARN HI message appears when the stall warning system is operating on the ice-contaminated schedule (refer to Chapter 10—"Ice and Rain Protection" for more details).

G1000 ARCHITECTURE

The G1000 is a system of individual line-replaceable units (LRUs), which integrate into a modular avionics system that provides:

- Flight instrumentation
- Navigation and hazard avoidance
- Flight guidance
- Communications
- Monitoring of aircraft systems

The pilot and copilot monitor and operate the instruments and avionics, and some aircraft systems, through the displays and control panels (Figure 16-2 and Table 16-1).

The G1000 provides system redundancy through the use of dual, parallel systems (one for pilot and one for copilot), with cross-side connections to provide maximum capability to both sides, and to ensure system redundancy if a failure occurs. Any one of the three displays is capable of displaying all critical flight information (upon pilot command or automatically) in the event of a display failure.

DATA COMMUNICATIONS

LRUs communicate with each other through various types of data communication lines. Refer to Figure 16-2 for an interface diagram.

GARMIN INTEGRATED AVIONICS UNITS

The G1000 is regulated and coordinated by central processing computers in the two Garmin integrated avionics units (GIAs), which also contain the essential navigation and communications avionics:

- NAV/COM
- Instrument landing system (ILS)
- Global positioning system (GPS)
- Flight director (FD)

Each GIA receives additional information from its onside ADC and attitude and heading reference system (AHRS). Finally, each GIA monitors engine/airframe sensors directly, or through Garmin engine/airframe (GEA) interface units. All outputs from the GIAs are displayed on the PFDs and/or MFD. In addition to the main processors, specific features include:

- Wide-area augmentation system (WAAS)-enabled, 12-channel parallel GPS receiver (simultaneously tracks and uses up to 12 satellites).
- Very high frequency communication (VHF COM) transmitter providing frequencies from 118.00 to 136.990 MHz, in 25 kHz (760-channel) or 8.33 kHz (3040-channel) spacing.
- Very-high frequency omnidirectional range/ILS localizer (VOR/LOC) receiver tuning 108.00 to 117.95 MHz, at 50 kHz increments.
- ILS glide slope receiver tuning 328.6 to 335.4 MHz, as matched with the ILS frequency tuned in the VOR/LOC receiver.
- FD processor, which interfaces with the GFC 700 automatic flight control system (AFCS)
- Digital aural warnings

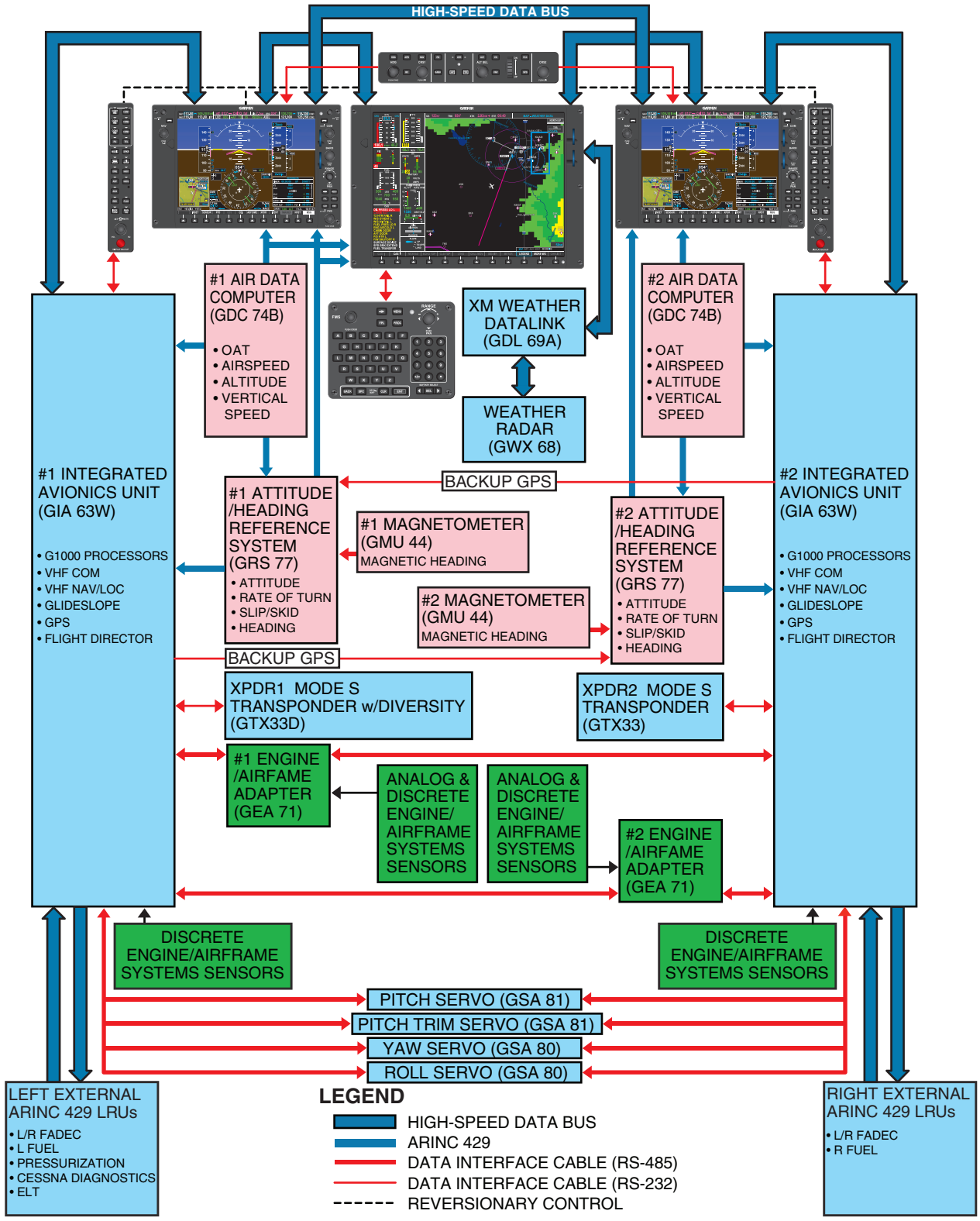


Figure 16-2. G1000 Integrated Avionics Architecture

Table 16-1. G1000 SYSTEM COMPONENTS

ITEM	FUNCTION	DESCRIPTION
GIA 63W	Interface Adapter	Main modules of the G1000 system. Coordinates information input from all sources to the cockpit displays. Also receives discrete data and ARINC 429 from various engine systems, and processes for presentation to other G1000 components. Each GIA includes a WAAS-enabled GPS receiver, VOR/ILS localizer receiver, ILS glide-slope receiver, FD system, and a VHF communications transceiver.
GDU 1040A	Primary Flight Display (PFD) Unit	Left and right color LCD displays. Each PFD displays flight instruments and flight guidance and basic avionics indications. MFD information may also appear on the PFDs and vice versa. TAWS is a built-in feature.
GDU 1500	Multifunction Display (MFD)	Center-panel color LCD display. The MFD displays a multifeature map. Also display EICAS.
GMC 710	Automatic Flight Control System (AFCS) Controller	Located in top center panel. Part of GFC700 system.
GSA 80	High Torque Servo	Yaw and roll servos for AFCS. Part of GFC700.
GSA 81	Low Torque Servo	Pitch and pitch trim servos for AFCS. Part of GFC700.
GCU 475	MFD/FMS Controller	MFD and flight management system controller on lower cockpit pedestal.
GRS 77	Attitude and Heading Reference System (AHRS)	Provides aircraft attitude and heading guidance to G1000 displays and AFCS.
GMU 44	Magnetometer	Measures local magnetic field information.
GDC 74B	Air Data Computer (ADC)	Processes inputs from pitot-static system, temperature sensors to determine airspeed, altitude, and vertical speed.
GEA 71	Engine/Airframe Unit (GEA)	Receives and processes signals from various engine and airframe sensors.
GMA 1347D	Audio Amp and Marker Beacon	Audio panel for controlling audio sources; integrated marker beacon receiver.
KN63	Distance Measuring Equipment (DME) System	Provides DME distance information to G1000 displays.
GTX 33	Transponder	Mode S transponder—Conventional Mode C transponder plus additional capability for data communications with ground radar and traffic information systems.
GTX 33D	Diversity Transponder	Mode S transponder—Conventional Mode C transponder plus additional capability for data communications with ground radar and traffic information systems and Mode S diversity.
GWX 68	Weather Radar	Provides airborne weather and ground map weather radar to MFD.
GDL 69A	Datalink	Satellite radio receiver that provides real-time weather information to the MFD as well as digital audio entertainment. Communicates with the MFD via HSDB connection. A subscription service required to enable.
RA350 2	Automatic Direction Finder (ADF) System	Provides ADF bearing to the G1000 displays (optional).
C406-N	Emergency Locator Transmitter (ELT) System	When activated, the ELT sends out a distress signal of 121.5, 243.0, and 406.028 MHz. The 406.028 MHz signal includes important information about the airplane including latitude and longitude, which is detected by the CosPas Sarsat Satellite System for search and resue operations.

NOTE

Marker beacon reception is in the audio panel, which connects to the GIAs.

DISPLAYS

Two PFDs and one MFD provide a central display and crew interface for the G1000. Various knobs and softkeys provide system control.

The PFDs are two identical, 10.4-inch color liquid crystal displays (LCDs) in the instrument panel (see Figure 16-1). Each PFD provides flight instrument displays and basic avionics indications (NAV/COM and transponder settings, course deviation indicator (CDI) and ILS indications.

The 15-inch MFD provides a moving-map display and indications for most airframe and engine systems. The moving map display indicates current aircraft position relative to topography and surface features, terrain obstructions, airspace boundaries, airways, aviation facilities (including airports and navaids), and weather. The left side of the MFD provides indications for engine and aircraft systems and crew alerts.

Reversionary Mode

Information from the PFDs may be partially or completely added to the MFD, and vice versa, through "reversionary mode." If any display fails, the essential information from that display automatically reverts to another display, through reversionary mode, to ensure availability of adequate information for continued flight.

Display Controls

The crew uses controls on the bezels of each PFD and MFD to command various instrument, avionics, and aircraft system settings. Along the bottom of each display, variable-purpose "softkeys" provide multiple control functions, depending upon flight conditions or settings selected by the crew. The function of each softkey appears immediately above it on the display.

Additional control of avionics and systems is provided through the AFCS controller on the top center panel, and by the MFD/FMS controller on the lower cockpit pedestal.

OTHER UNITS

Most elements of the Mustang avionics system are LRUs. Each LRU is a self-contained avionics module that can be removed from the airplane and replaced, independent of all other systems. Most LRUs are panel-mounted or in a rack immediately behind the MFD in the center panel. See Table 16-1 for a general overview of Mustang avionics modules, including LRUs.

Attitude and Heading Reference System

The remote-mounted GRS 77 AHRS and GMU 44 magnetometer combine to replace conventional gyros and magnetic compass systems with long-life, solid-state sensors. Each PFD has its own AHRS (AHRS1 for pilot PFD, AHRS2 for copilot PFD), which also connects to the same-side GIA.

An AHRS combines the functions of an attitude gyro, directional gyro and turn-and-slip instrument.

Each AHRS is electrically stabilized by retrieving information from three other sources besides itself. The magnetometer, ADC, and GIAs provide this supplemental data. These three external sources provide reference information that also enables the AHRS to function if powered on after power interruption in flight, and begin providing valid guidance within seconds.

Magnetometer

Each GMU 44 magnetometer is a magnetic sensor that provides local magnetic field information to its corresponding AHRS. The magnetometers are in the vertical tail to minimize magnetic influence from aircraft structures and contents.

Air Data Computer

Each GDC 74B air data computer (ADC1 for pilot, ADC2 for copilot) is a remote-mounted device that provides air data to the GIAs and the PFDs, including:

- Air temperature
- Pressure altitude
- Density altitude
- Vertical speed
- Indicated airspeed
- True airspeed
- Mach number

Each ADC measures aircraft static and impact pressure information from pressure transducers connected to the same-side (pilot or copilot) pitot-static system and raw air temperature data from its own outside temperature probe. Using the raw data, each ADC unit computes the air data values, then sends them to its corresponding GIA and PFD. The system is reduced vertical separation minimum (RVSM) compliant. Each ADC also communicates with the AHRS to provide stabilization and orientation information.

Engine/Airframe Interface Unit

Each GEA 71 interface unit is a computer that monitors analog and discrete (digital) sensors on airframe and engine systems, and translates these into system indications and alerting outputs to the GIAs. Each GEA interface unit supplies information to both GIAs. The GIAs process this information further, and distribute it to other systems, particularly to the engine indicating and crew alerting system (EICAS) display (normally presented on the MFD).

FMS and MFD Controller

A flight management system (FMS) is integrated into the processors for the displays and GIAs. The system is controlled with the the GCU 475 FMS and MFD controller, which is on the cockpit pedestal below the throttles.

The FMS controller also duplicates many of the functions of comparable controls on the PFDs when used to control settings and displays on the MFD.

Automatic Flight Control System

The Mustang has a GFC700 AFCS.

The system functions are distributed across various units:

- The AFCS controller is under the center glareshield and has the mode-select buttons.
- Each GIA performs mode logic and FD computations.
- The servos compute and monitor for the AP, yaw damper (YD), auto trim and manual electric pitch trim functions.
- The PFDs display FD commands and mode annunciations.

Yoke-mounted and throttle-mounted switches complete the system control inputs:

- CWS switch
- AP DISC switch
- GA switch

GTX33 Mode S Transponder and GTX33D Mode S Diversity Transponder

The G1000 includes two transponders: A GTX 33 Mode S transponder for the copilot side, and a GTX 33D Mode S diversity transponder for the pilot side. Each transponder connects (through its same-side GIA) to the PFDs for control and display.

Both transponders provide mode A (normal), mode C (altitude encoding) and mode S (data communications) functions. The GTX 33D provides diversity capability.

Both transponders are automated transceivers operating on radar frequencies, receiving

ground radar and traffic alert and collision avoidance system (TCAS) interrogations at 1030 MHz, then transmitting a coded response to ground-based radar at 1090 MHz.

Ground stations can interrogate mode S transponders individually using a 24-bit International Civil Aviation Organization (ICAO) mode S address, which is unique to the particular aircraft. In addition, ground stations may interrogate a GTX 33 for its transponder data capability and the aircraft flight identification, which is the registration number or other call sign. The GTX 33 makes the maximum airspeed capability (set during configuration setup) available to TCAS systems on board nearby aircraft to aid in the determination of TCAS advisories.

The unit includes an altitude monitor and traffic information service (TIS). Altitude and traffic alerts are announced by a voice or tone audio output. The PFD displays the code, reply indication, and operating mode. The MFD displays TIS graphical information, which may also appear in the PFD inset map. A traffic alert causes the PFD inset maps to automatically appear.

Audio/Marker Beacon System

The GMA 1347D audio amplifier and marker beacon receiver is a panel-mounted system. The unit has a microcontroller for processing front panel key commands, annunciator control, input/output functions, and communication. It includes an intercom system (ICS) with public-address (PA) function.

Weather Radar

The GWX 68 weather avoidance radar provides real-time radar information, including precipitation and ground-mapping returns to the G1000. Returns are displayed on the MFD. The GWX 68 communicates though the high-speed data bus by way of the GDL69A.

XM Weather Datalink

The GDL69A is a remote-mounted satellite-broadcast receiver that receives XM weather for display on the MFD (and/or PFD inset map). The GDL 69A can receive XM weather and XM radio services. It communicates to the G1000 through the high-speed data bus.

AVIONICS POWER SWITCHES

Three switches control power to the Citation Mustang avionics and instruments:

- Battery switch
- Avionics power switch
- Standby instruments switch

BATTERY SWITCH

The battery toggle switch is in the DC POWER section of the left lower instrument panel and has three positions: BATT, OFF, and EMER (Figure 16-3). The switch controls DC power to the other switches, and directly supplies power to components required for EICAS operation.

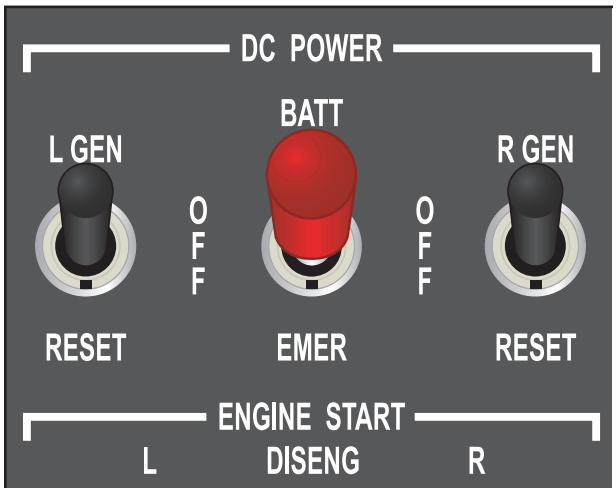


Figure 16-3. Battery Switch

The EICAS display is needed by the pilot during all aircraft operations, including start-up. For this reason, some components are powered when the battery switch is set to BATT or EMER:

- BATT—Both PFDs, MFD, GIAs, GEAs
- EMER—PFD1, GIA1, GEA1

NOTE

Flight instruments, and all navigation, communications, and flight guidance functions are not enabled by the battery switch alone. The AVN PWR switch must also be powered on (up).

AVIONICS POWER SWITCH

The avionics power switch is in the AVIONICS section of the left lower instrument panel and has two positions: AVN PWR and OFF (Figure 16-4). This switch energizes the avionics solid-state relays (SSRs) closed. Each relay provides DC power from a powered bus (left or right electrical bus or emergency bus), through a corresponding avionics bus, to power specific units. All units receive from an avionics bus, except those powered directly from the battery switch.

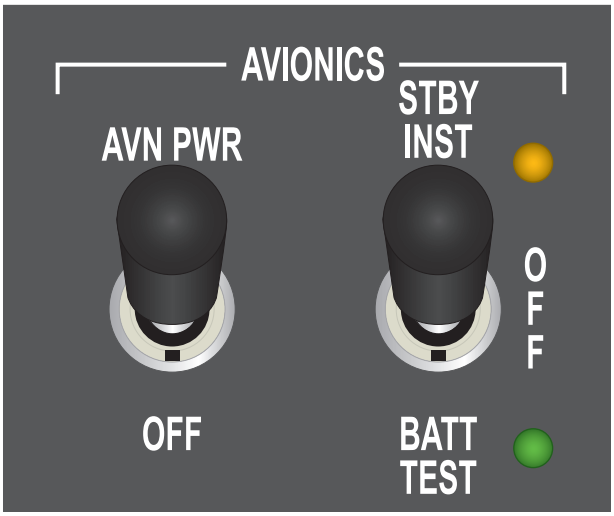


Figure 16-4. Avionics Power Switch and Standby Instruments Switch

STANDBY FLIGHT INSTRUMENTS SWITCH

The standby flight instruments switch is in the AVIONICS section of the left lower instrument panel and has three positions: STBY INST, OFF, and BATT TEST (Figure 16-4). When the switch is in the STBY INST position, it provides DC power (from a backup battery) to the standby flight instruments on the upper center instrument panel:

- Airspeed indicator
- Attitude gyro
- Altimeter

A small amber light emitting diode (LED) on the right side of the switch illuminates when in the STBY INST position, indicating the standby flight instruments are discharging power from the dedicated standby lead-acid battery pack. A fully charged battery supplies power for approximately 30 minutes. The amber light does not illuminate when aircraft power is charging the battery and providing power to the standby instruments.

In the BATT TEST position, the condition of the backup battery is tested. Illumination of the green light beside the switch indicates proper battery charge. If the green light does not illuminate, the backup battery is not properly charged, and standby flight instruments may not operate with the loss of normal DC power.

PRIMARY FLIGHT DISPLAY

DESCRIPTION

The main control display units for the G1000 are the PFDs. The Citation Mustang has two PFDs, one in front of the pilot and one in front of the copilot (Figure 16-5).

The PFDs are 10.4-inch color LCDs, which are designed for visibility in bright sunlight. (Brightness is manually or automatically

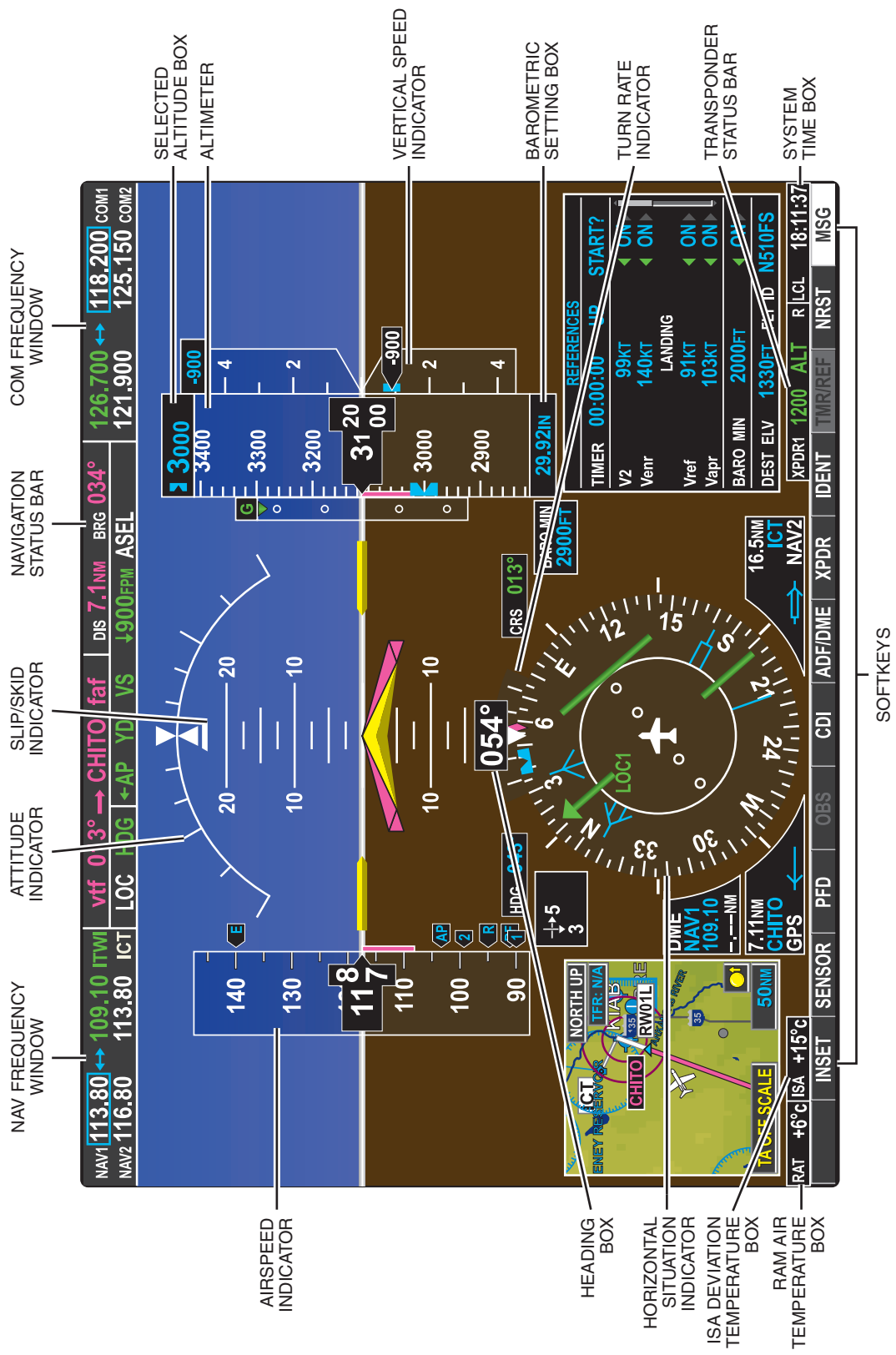


Figure 16-5. PFD Graphical Callouts

variable.) A bezel around each PFD contains controls for operating the PFD.

Display Color-Coding

Color-coding on the displays indicates common meanings to the pilot. These colors and their meanings are:

- Cyan—Pilot adjustable
- Green—Active
- White—Armed/standby
- Amber—Caution
- Red—Warning
- Magenta—GPS derived

GRAPHICAL FLIGHT INSTRUMENTATION

The following flight instruments are depicted graphically on the PFD:

- Airspeed display
- Altitude
- Attitude display including turn coordination (slip/skid)
- Horizontal situation indicator (HSI) (heading, turn rate, and radio navigation)
- Vertical speed

NOTE

If the aircraft exceeds normal flight attitudes (30° nose-up or 20° nose-down pitch, or roll greater than 65° bank), the PFD declutters leaving the primary flight instruments.

Airspeed Display

The airspeed is displayed as a vertical scale on the left side of the PFD (Figure 16-6).

Moving Tape Display Box

White numerals and tick marks on a transparent rolling-tape display box indicate airspeeds currently above and below the current airspeed. Each small tick mark represents 5 knots, and each large tick mark (with a number) represents 10 knots.

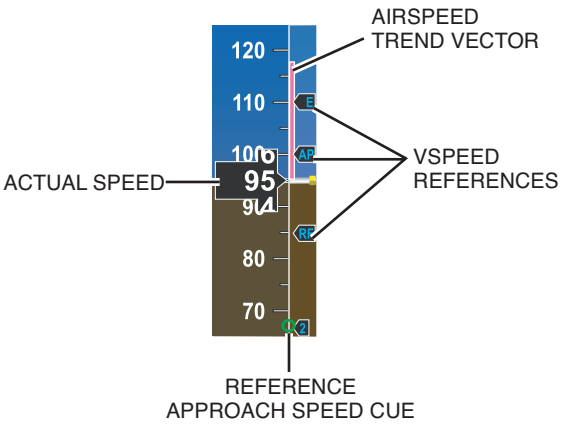


Figure 16-6. Airspeed Indicator

Airspeed Pointer

The airspeed (in KIAS) appears as a rolling numeric display (white numbers on black) in the center of the airspeed tape. This tape has a pointer, which always points at the center of the airspeed display. Below 20 KIAS, the digits change to dashes. Once the airspeed reaches and/or exceeds V_{MO} or M_{MO}, the pointer changes to red with white numbers.

Trend Vector

On the outside right edge of the tape, a magenta trend vector indicates predicted airspeed in 6 seconds at the current rate of airspeed acceleration. When the trend vector enters the barber pole range, the numbers inside the airspeed pointer change from white to amber.

Speed Awareness

Airspeeds above the maximum operating speed appear in the high-speed awareness range represented on the airspeed tape by a red/white "barber pole" (Figure 16-7) The flap speed references represent the airspeed limits when the aircraft is below 18,000 feet. A red low-speed awareness range extends up from the bottom of the tape to indicate V_{LSA}.

Figure 16-7. Red Pointer

Airspeed References

Airspeed references, or flags, appear on the outside right edge of the tape display fixed to their corresponding airspeed (Table 16-2). Takeoff and landing speed flags can be displayed and adjusted in the reference window using the TMR/REF softkey. Takeoff references are automatically turned off when airspeed reaches 160 kt (see Figure 16-6).

Table 16-2. V-SPEED TABLE

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

A reference approach speed cue appears as an open green circle on the right edge of the tape display. The open green circle represents 1.3 V_{S1} (see Figure 16-6).

Flap Speed References

Maximum flap-extension speeds are indicated on the outside right edge of the tape display by reference flags similar to the V-speed flag (Figure 16-8). Maximum speed for takeoff/approach flaps is indicated by a flag labeled "TA". Maximum speed for landing flaps is indicated by a flag labeled "LD." The flap reference speed flag cannot be turned off or adjusted by the pilot.

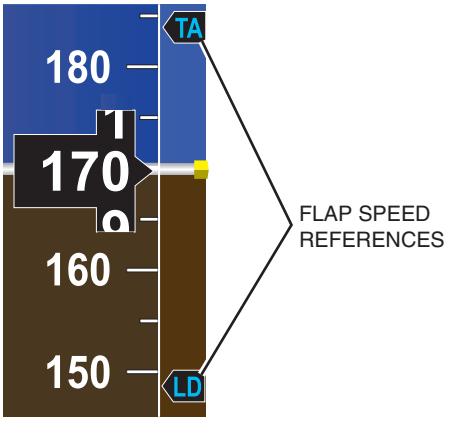


Figure 16-8. Flap Speed

AFCS Selected Airspeed Box and Bug

When the AFCS is set to a selected airspeed during flight level change mode, the selected airspeed appears in a box at the top of the display, and a corresponding notched blue bug appears on the inside right edge of the airspeed display (Figure 16-9).

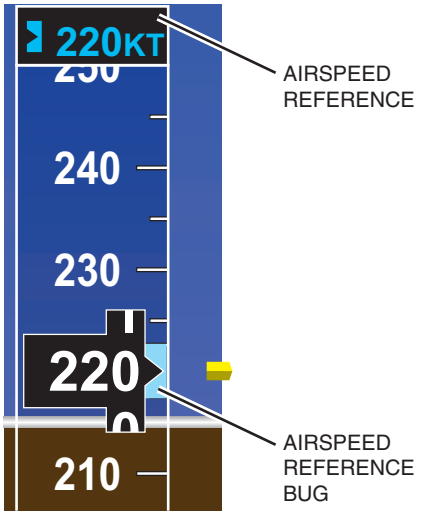


Figure 16-9. AFCS Reference

Mach Window

At the bottom of the airspeed tape display, a window indicates the Mach number, depending upon aircraft altitude or airspeed.

Attitude and Turn Coordination

At the center of the PFD is the attitude indication (Figure 16-10). The amber symbol represents the airplane, and the amber bars represent the wingtips. The horizon line is white, with brown (ground) below and blue (sky) above. The horizon line indicates 0° pitch. Pitch lines are at 2.5° intervals above and below the horizon line and are labeled at 10° intervals. Red chevrons indicate extreme pitch at greater than 50° nose-up or 30° nose-down (Figure 16-11).

Roll indication is provided by an arc at the top of the display that rotates with the horizon line. The arc has major tick marks at 30° and 60°, and minor tick marks at 10°, 20° and 45°.

Turn Coordination (Slip/Skid)

Turn coordination is indicated by a small sliding bar (slider) under the attitude display roll pointer (Figure 16-12). The slider deflects a full width left or right of the roll pointer to indicate the same condition as indicated by a ball positioned one ball width to the left or right of center in a conventional instrument.

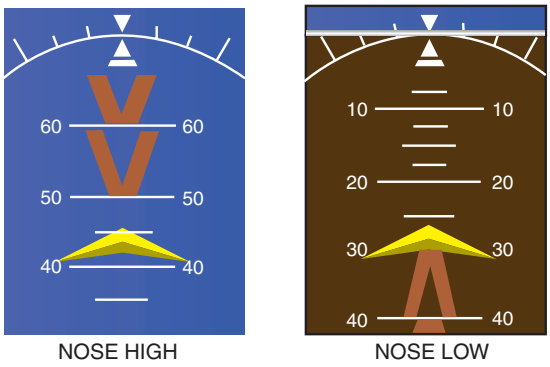


Figure 16-11. Pitch Attitude Warnings

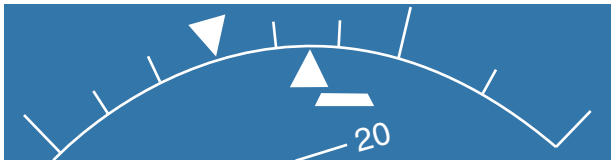


Figure 16-12. Slip/Skid Indication

Flight Director Command Bars

The single-cue command bars vertically move together to indicate pitch commands and bank left or right to indicate roll commands (Figure 16-13). Command bars that display as a cross

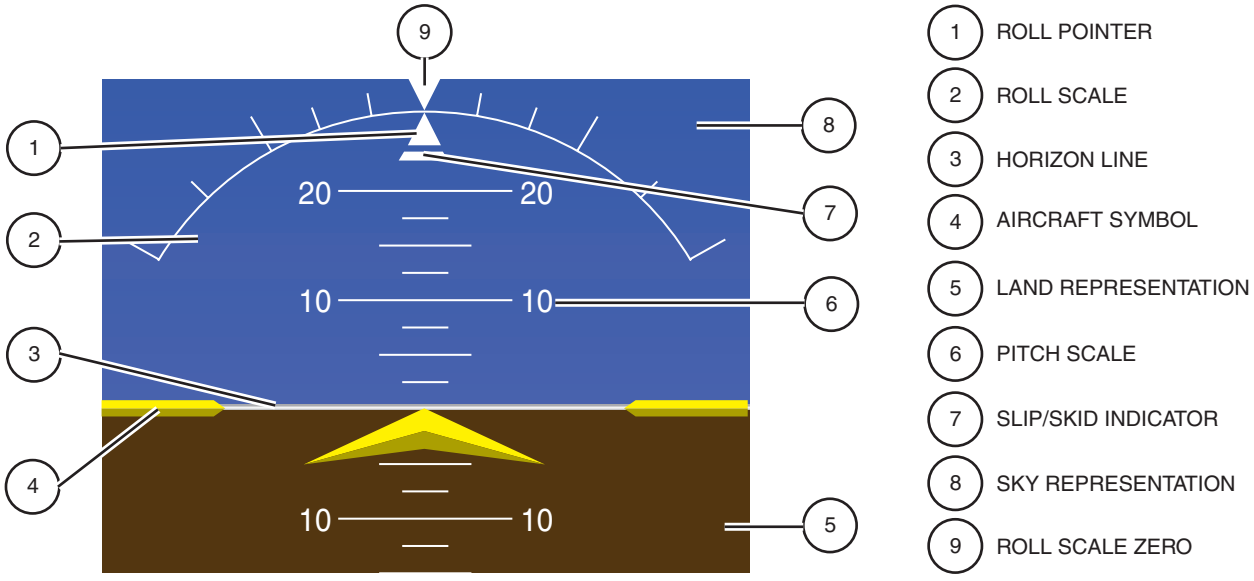


Figure 16-10. Attitude Indication

Figure 16-13. Flight Director Single-Cue Command Bars

pointer move independently to indicate pitch (horizontal bar) and roll (vertical bar) commands. Both PFDs show the same command bar format (Figure 16-14).

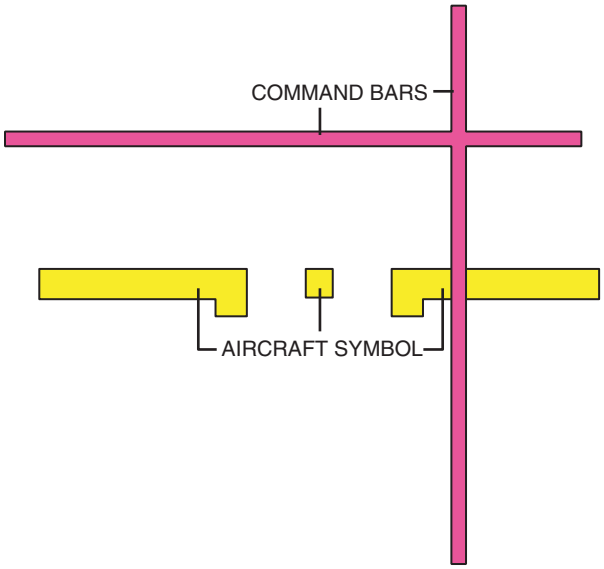


Figure 16-14. Flight Director Cross-Pointer Command Bars

To change the flight director format, activate the FD FRMT softkey using the PFD softkey. The pilot can then choose between SNGL CUE or X POINTR to determine the desired flight director information.

Altimeter

Moving Tape Display Box

White numerals and tick marks on a transparent rolling-tape display box indicate altitudes currently above and below the current altitude. Each minor tick mark indicates 20 feet, and each major tick mark (with a number) indicates 100 feet.

Altitude Pointer

The current altitude (indicated in feet above mean sea level) appears as a rolling numeric display (white numbers on black) in the center of the altitude display box (Figure 16-15). This display has a pointer, which always points at the center of the altitude tape.

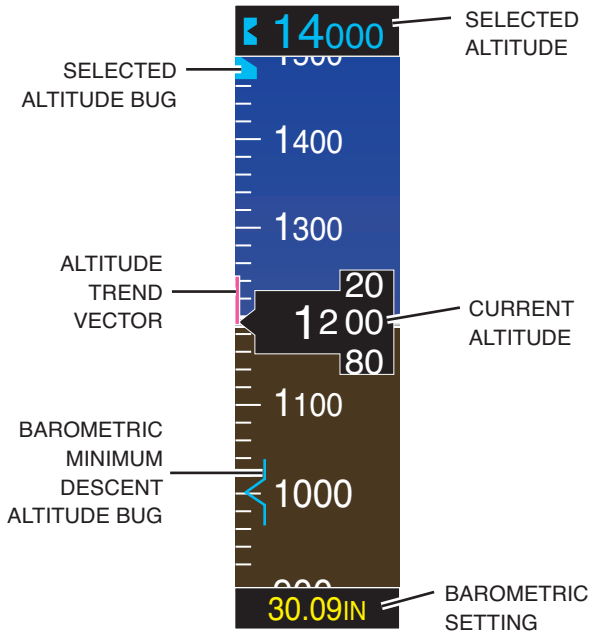


Figure 16-15. Altimeter

Trend Vector

On the inside left edge of the tape, a magenta trend vector indicates predicted altitude in 6 seconds at the current rate of altitude change.

Selected Altitude Bug and Box

A box at the top of the altitude display indicates the preselected altitude. A corresponding notched cyan bug appears on the right edge of the altitude display at the selected altitude, or at the end of the display if the selected altitude is off scale. The reference altitude is selected with the ALT SEL knob on the AFCS controller.

Reference Altitude Alerting

When the aircraft is more than 1,000 feet above or below the reference altitude, the digits in the selected altitude box are cyan on black

(see Figure 16-15). When the aircraft is at the reference altitude (±1,000 feet), the colors reverse (black digits on cyan). When approaching within 1,000 feet of the reference altitude, the digits and their background flash (alternate colors) continuously for 5 seconds. When departing the reference altitude by ±200 feet, the digits flash amber on black for 5 seconds (Figure 16-16).

Figure 16-16. Altitude Alerting Display

Barometric Setting

A box at the bottom of the altitude tape indicates the current altimeter setting in inches of mercury (or hectoPascals, if set to metric values) (Figure 16-17). To adjust the setting, rotate the BARO knob on the right side of each PFD bezel. The BARO settings on the pilot and copilot PFDs can be synchronized through the PFD setup menu window.

NOTE

If pilot and copilot PFD barometric settings differ by more than .02 inches (of mercury), the barometric setting boxes on both displays appear with amber digits. The baro settings for both PFDs can be synchronized.

Barometric Altitude Minimums and Alerting

For altitude awareness, a barometric minimum descent altitude (MDA, or decision height) can be set (Figure 16-18). When active, the MDA is displayed in a box labeled "BARO MIN" to the lower left of the altimeter and on the altitude tape with a bug (once the altitude is within range of the tape). This altitude can be adjusted in the BARO MIN field in the timer/references window from 0 to 16,000 feet (in 10-foot increments when using the small FMS knob). The MDA is reset any time the power is cycled.

Figure 16-18. Barometric MDA Altitude Alert Setting

Metric/Standard Units of Measure

After pressing the PFD softkey, an ALT UNIT softkey appears. It allows the display of the digital altitude and barometric pressure indications in metric values: altitudes in meters (MT) and barometric pressure in hectoPascals (hPA). The altitudes appear in boxes above the normal digital displays, which continue to display in feet. The moving-tape display continues to display in feet. The barometric pressure box at the bottom of the display changes to hPA indications.

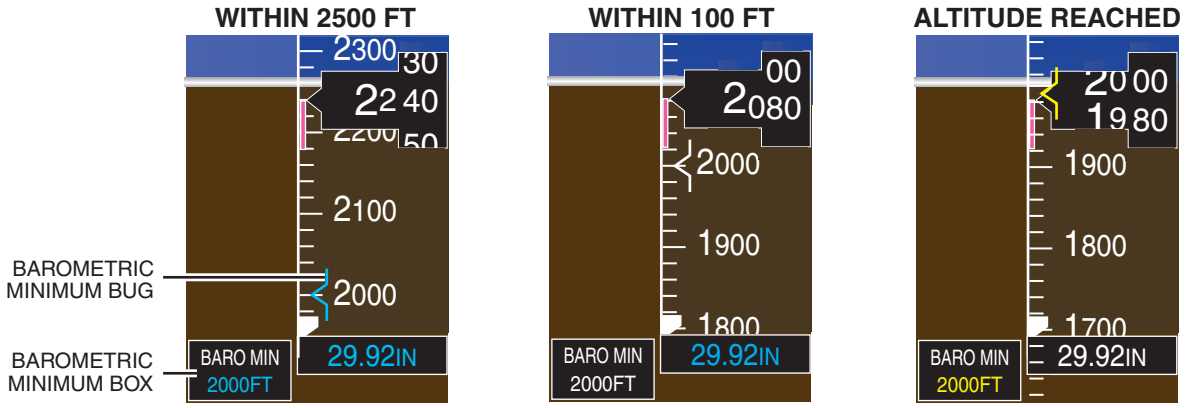


Figure 16-17. Barometric MDA Displays

Horizontal Situation Indication

Heading

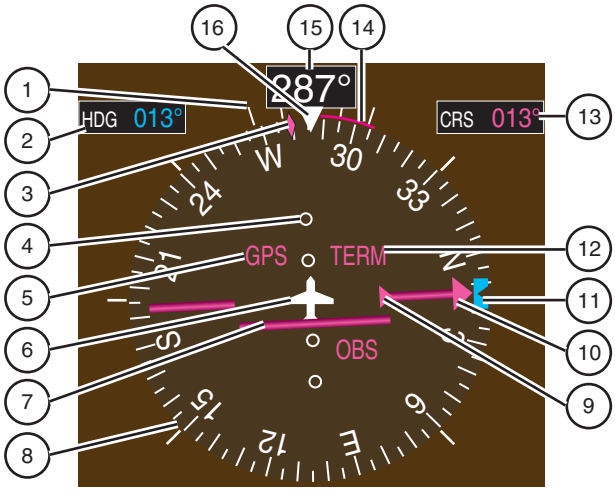
The compass card appears with the current aircraft magnetic heading under the white pointer at the top of the compass card (Figure 16-19). Letters (N–S–E–W) appear at the four cardinal points and numbers indicate degrees at 30° intervals. Major tick marks are at 10° increments and minor tick marks at 5°.

A digital readout of the current magnetic heading appears in a black box with large white digits immediately above the compass card pointer (lubber). For additional course awareness, a crosstrack error (XTK) indication appears near the bottom of the HSI whenever using GPS as the primary navigation source and course deviation indicator (CDI) exceeds maximum deviation.

Turn Rate Indication

When the aircraft is yawing or turning, a magenta arc extends from the center pointer, left or right (depending on the direction of turn), a few degrees around the outer edge of the compass rose, to indicate the heading the aircraft will reach in 6 seconds (up to 24°). Two tick marks on either side of the center pointer, above the compass rose, indicate turn rate. If the magenta arc extends to the second tick mark (at 18° from center), a standard-rate turn (360° in 2 minutes) is indicated. The first mark indicates a half-standard-rate turn.

At rates greater than 4°/second, an arrowhead appears at the end of the magenta trend vector and the prediction is no longer valid.



1. TURN RATE INDICATOR
2. SELECTED HEADING
3. CURRENT TRACK BUG
4. LATERAL DEVIATION SCALE
5. NAVIGATION SOURCE
6. AIRCRAFT SYMBOL
7. COURSE DEVIATION INDICATOR
8. ROTATING COMPASS ROSE
9. TO/FROM INDICATOR
10. COURSE POINTER
11. HEADING BUG
12. FLIGHT PHASE
13. SELECTED COURSE
14. TURN RATE/HEADING TREND VECTOR
15. CURRENT HEADING
16. LUBBER LINE

Figure 16-19. Horizontal Situation Indicator (HSI)

Selected Heading Bug

A rotatable cyan heading bug appears on the compass card at the selected heading, and the heading is presented with cyan digits in the black HDG box, immediately left of the magnetic heading digital readout.

Radio Navigation

Selected Course, Course Pointer and Course Deviation Indicator

The HSI can display three sources of navigation NAV1, 2, or GPS. The CDI softkey cycles through the navigation sources. The selected course appears as a digital readout in the black CRS box, immediately to the right of the magnetic heading readout. The selected course also appears as a long arrow across the face of the compass card. This arrow is the course pointer. The center section of the course pointer is the CDI, which disappears when there is no signal for navigation (Figure 16-20).

The color and depiction of the course indicator (and digits in the CRS box) varies as selected by the CDI softkey:

- NAV1—Green single arrow and green selected course digits
- NAV2—Green double arrow and green selected course digits
- GPS—Magenta single arrow and magenta selected course digits

The course is selected by the CRS 1 (for pilot PFD) or CRS 2 (for copilot PFD) knobs on the AFCS controller. The navigation source for the CDIs on the pilot and copilot PFDs can be synchronized through the PFD setup window. However, if the CDIs are not synchronized and PFDs are set to the same VHF navigation sources, the source reference (NAV or LOC) appears in amber lettering. Refer to Table 16-3 for information on flight phases and CDI scaling.

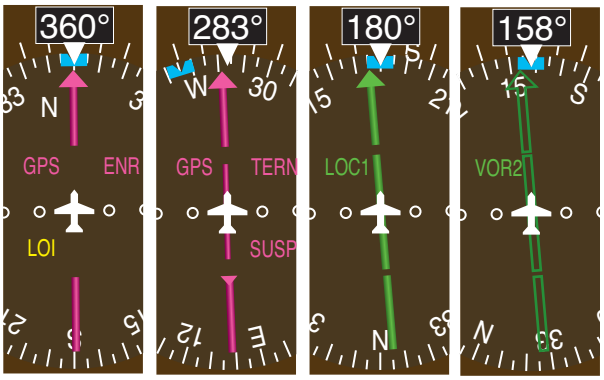


Figure 16-20. Navigation Sources

Bearing Pointers and Information Windows

Two bearing pointers can be selected to appear on the face of the compass card (press the PFD softkey and select BRG1 and/or BRG2). The BRG1 pointer is a single cyan line with an open arrow pointer and the BRG2 pointer is a double cyan line with an open arrow pointer. If a bearing pointer is selected for display, a white circle appears in the center of the compass card to separate the bearing pointer(s) from the CDI. Bearing pointers never override the CDI.

The BRG1 window is at the lower left corner of the compass display and the BRG2 window is at the lower right corner of the compass display. Each window indicates:

- Distance to the station/waypoint
- Station/waypoint identifier (or frequency)
- Source for the bearing (NAV1, NAV2, GPS, or automatic direction finder [ADF])
- Arrow icon matching the bearing pointer

OBS Mode

OBS mode is useful for holding and for intercepting a course to a waypoint. Enabling omni bearing selector (OBS) mode is useful for holding and for intercepting a course to a waypoint. OBS mode with the OBS softkey suspends the automatic sequencing of waypoints in a GPS flight plan, but retains the active-to waypoint as the navigation reference even after passing the waypoint. When OBS is disabled by pressing the OBS softkey again, the GPS returns to normal operation, with automatic sequencing of waypoints. OBS mode also allows a desired course TO/FROM a waypoint to be set (with a CRS knob); pressing the CRS knob recenters the CDI and returns the course point TO the waypount bearing.

Table 16-3. Flight Phases and CDI Scaling

FLIGHT PHASE	ANNUNCIATION	AUTO CDI SCALING
DEPARTURE	DPRT	0.3 NM
OCEANIC	OCN	2.0 NM
ENROUTE	ENR	2.0 NM
TERMINAL MODE	TERM	1.0 NM
APPROACH (NON-PRECISION)	LNAV	1.0 NM DECREASING TO 350 FT DEPENDING ON VARIABLES
APPROACH (VERTICAL GUIDANCE)	LNAV +V	1.0 NM DECREASING TO 350 FT DEPENDING ON VARIABLES
APPROACH (LNAV/VNAV)	L/V NAV	1.0 NM DECREASING TO 350 FT DEPENDING ON VARIABLES
APPROACH (LPV)	LPV	1.0 NM DECREASING TO 350 FT DEPENDING ON VARIABLES
MISSED APPROACH	MAPR	0.3 NM

SUSPend Mode

SUSPend mode is automatically activated when appropriate during approach operations. 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. Also suspends when on vectors to an approach or while in a hold.

Glide Slope

During precision approach operations, glide-slope position is indicated by a diamond on a glide-slope scale, which is on the left edge of the altitude display (Table 16-4 and Figure 16-21).

Marker Beacon

When passing over a marker beacon, a small box appears at the top left of the altitude display (Figure 16-22). The box appears differently for different beacons:

- Outer marker—Blue box with black letter “O”
- Middle marker—Amber box with black letter “M”
- Inner marker—White box with black letter “I”

Table 16-4. VERTICAL DEVIATION DISPLAY

INDICATOR	G (GLIDESLOPE)	G (GLIDEPATH)	V (VERTICAL DEVIATION)
BUG ICON	◆	◆	<

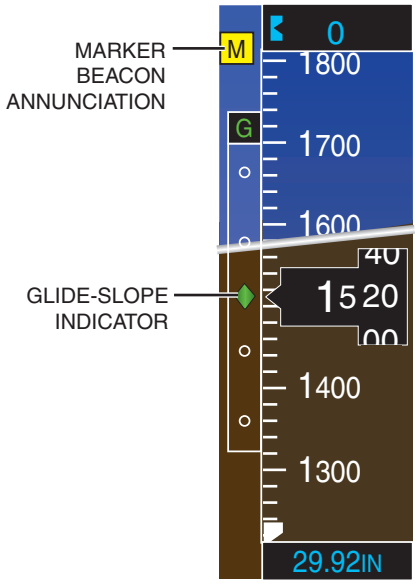


Figure 16-21. Glide-Slope Indicator

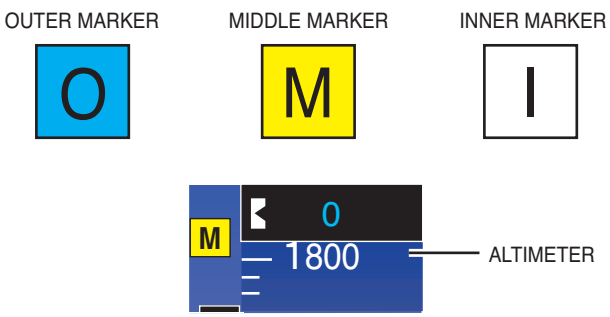


Figure 16-22. Marker Beacon Indications

Vertical Speed

Vertical Speed Indication

The vertical speed indication is through a fixed index scale on the right side of the altitude scale, and through a moving black pointer box with white digits indicating current vertical speed (when greater than 100 fpm up or down) (Figure 16-23). A negative number indicates descent. The vertical speed indication displays in 50-foot increments.

Vertical Speed Reference Box and Bug

A reference vertical speed set through the AFCS indicates on the vertical speed scale by a notched cyan bug on the scale and a vertical speed indicated with cyan digits in a box at the top of the scale.

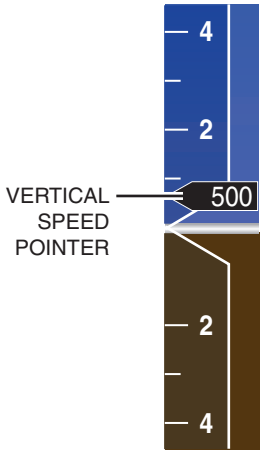


Figure 16-23. Vertical Speed Indicator

INSET MAP

The pilot may activate a small moving map or inset in the lower left corner of the PFD. The PFD inset map can contain much of the same information as available in the full-size moving map on the MFD.

AUXILIARY INFORMATION WINDOW

In the lower-right corner of the PFD, an auxiliary information window can be set to display information from the system, including:

- Nearest airports, with basic information as currently recorded in the navigation database (NRST softkey)
- ADF and distance measuring equipment (DME) tuning (ADF/DME softkey)
- Flight plan display and entry (FPL key)
- Garmin system messages (MSG softkey)
- PDF setup (MENU key)
- References (TMR/REF softkey)
- Flight plan procedures (PROC key)
- Direct-To (Ð Key)

Also use this window to select a waypoint from the database and/or to display information about the waypoint.

REVERSIONARY MODE

To provide emergency backup of the MFD and PFDs, and to provide flexibility in display modes, the G1000 has a reversionary mode that causes both the PFD and the MFD to display the essential information for continued flight. In the event of display failure, the display modes are as follows:

- PFD1 failure—MFD enters reversionary mode; PFD2 remains in normal mode.
- MFD failure—PFDI and PFD2 enter reversionary mode.
- PFD2 failure—PFD1 and the MFD remain in normal mode.

Reversionary mode can be manually selected for the onside display and the MFD by pressing the large red DISPLAY BACKUP button at the bottom of either audio control panel. Pressing the red DISPLAY BACKUP button a second time returns both displays to normal mode.

In reversionary mode, the left edge of the display includes a single-column of EICAS information condensed from the normal two-column EICAS display on the MFD. Additionally, a CAS message window appears on the right edge of the PFD and expands as necessary to display any active CAS messages (up to 14 in a window) (Figure 16-24). If more than 14 messages appear, they can be scrolled.

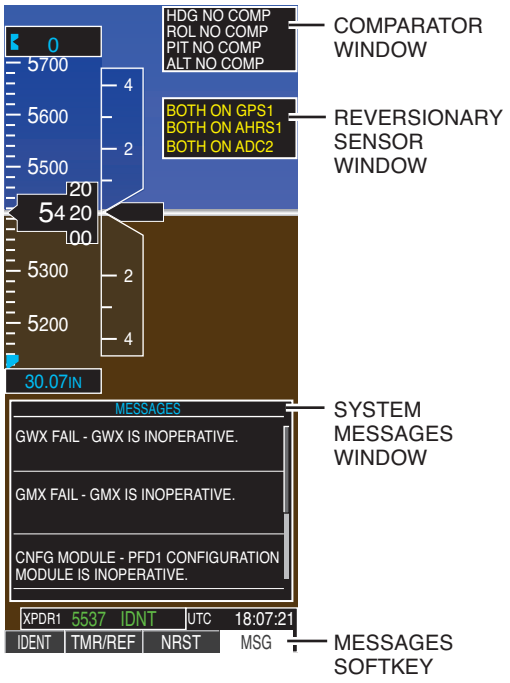


Figure 16-24. G1000 System Messages

NAV/COM FREQUENCIES AND NAVIGATION DATA WINDOWS

Across the top of the PFD are avionics settings and data indications, including VHF NAV and COM frequencies (active and standby), and navigation status data.

PFD CONTROLS

Each PFD is controlled by knobs and push-button keys on its bezel, and/or by pilot operation of the AFCS or MFD/FMS controller. The following general discussion of controls is also applicable to the other controllers.

Controls

Garmin displays (PFD and MFD) and control panels (audio panel, AFCS controller, and FMS controller) have various types of knobs, buttons and switches. Refer to Figure 16-25 for PFD controls locations and Table 16-5 for a description on those controls.

Softkeys

Along the bottom of the PFD, the bezel contains 12 “softkeys” marked with upward-pointing triangles. These keys do not have a single, specific, permanent function. They have different purposes at different times, as determined by the G1000 software.

Some (or all) softkeys have labels appearing immediately above them on the display. The labels change depending upon pilot settings and/or current conditions. Navigating the lower level menus is done through the top level softkey menu.

When the label for a specific feature is toggled off, the text is white on a black background. When the label is toggled on, the text is black on a light gray background.

When the BACK softkey is available (on the right end of the softkeys), this key can be pressed to escape the current menu and return to the previous menu display. For details on the menus for PFD softkeys. refer to Figure 16-26.

TRANSPONDER DISPLAY AND CONTROL

The PFD depicts current transponder status in the black XPDR box on the bottom right side

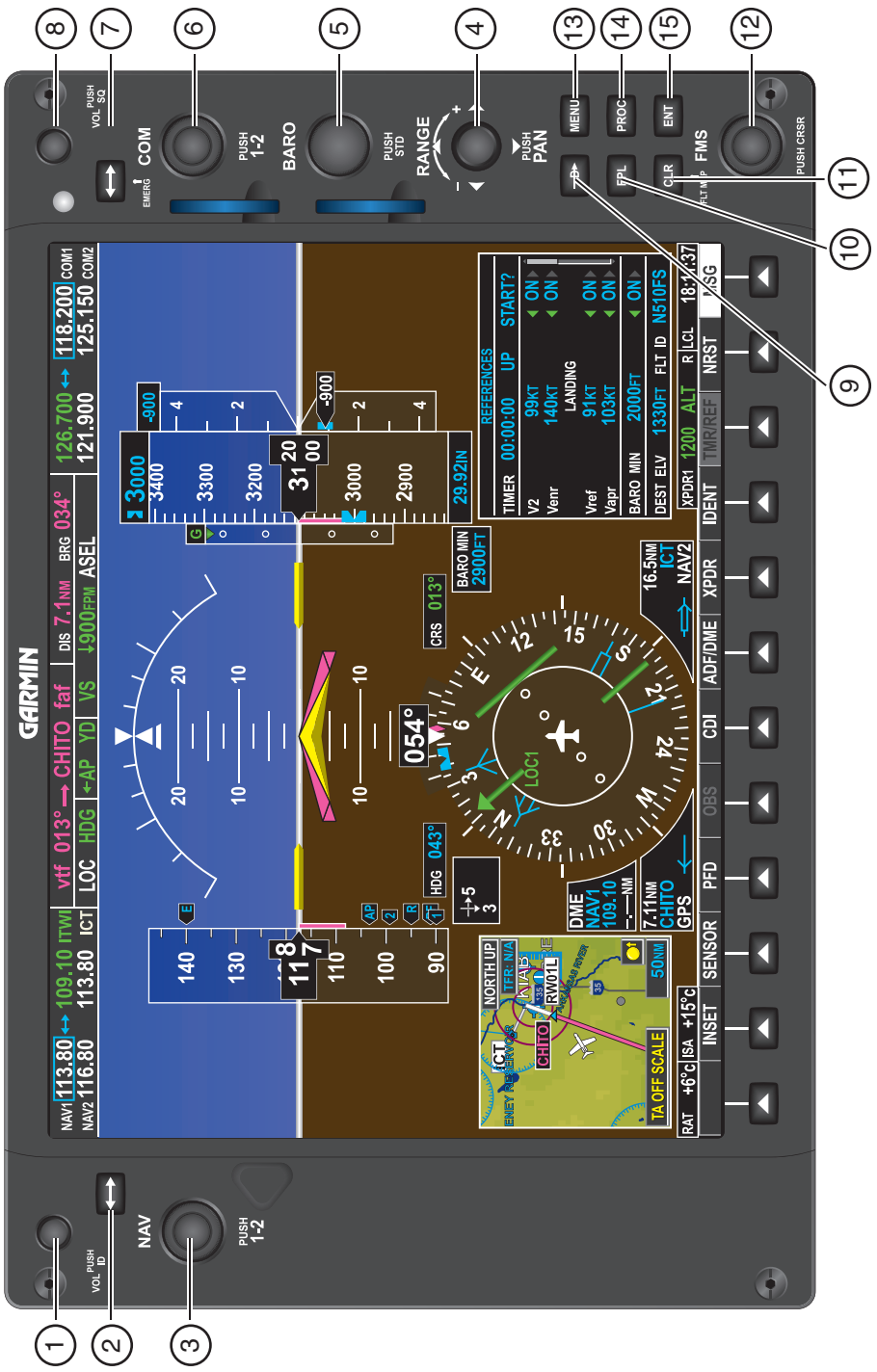


Figure 16-25. Primary Flight Display

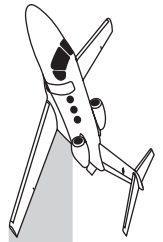


Table 16-5. PRIMARY FLIGHT DISPLAY CONTROL DESCRIPTIONS

#	CONTROL	DESCRIPTION
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 for pan when pressed.
5	BARO Knob	Sets the altimeter barometric pressure. Press to enter standard pressure (29.92) or return to the previous setting.
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. Press to turn the COM automatic squelch ON and OFF. Volume level is shown in the COM frequency field as a percentage.
9	Direct-to Key	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.

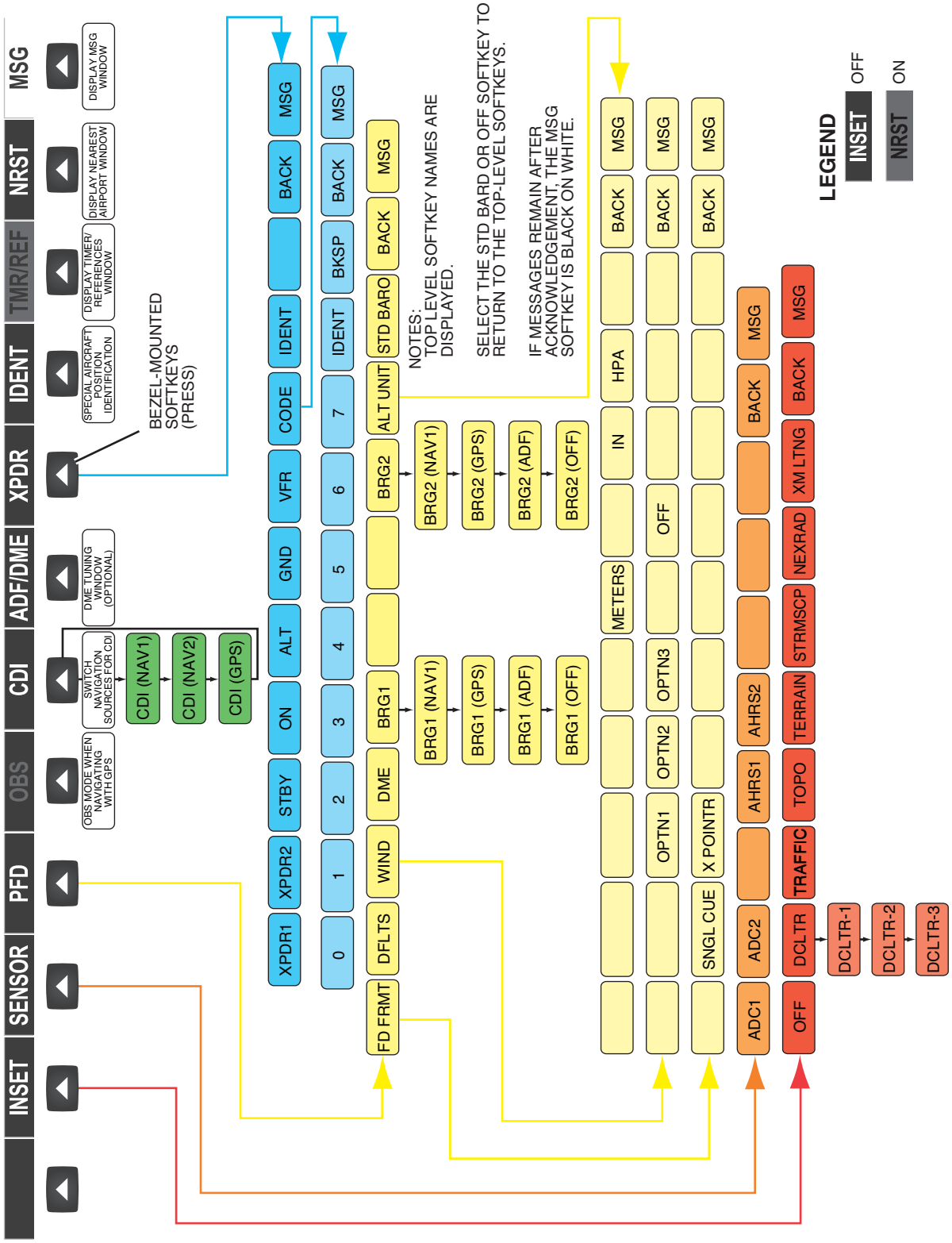


Figure 16-26. PFD Softkey Chart

of the PFD. With digits and letters, the box indicates current transponder code and mode of operation:

- STBY—Transponder in standby mode
- ON—Normal mode (mode A) operating
- ALT—Altitude encoding (mode C) operating
- IDENT
- GND—Ground

To indicate the transponder is replying to interrogations from radar or other sources, a small white letter "R" appears at the right end of the XPDR box.

The transponder code and mode are set by the pilot, through the softkey XPDR menu (appears when pressing the XPDR softkey). When in the XPDR softkey menu, the pilot selects modes (as listed above) by pressing the corresponding mode softkey. Pressing the VFR softkey automatically selects the appropriate VFR country code as preset at the factory.

Pressing the CODE softkey causes digits 0–7 to appear above the softkeys. Enter the transponder code. To change the code before confirming it, press the BKSP softkey, which backs the cursor through the code (erasing a digit at a time), and reenter the erased digits. Setting the code in active transponder also sets the same code in the inactive transponder. Five seconds after the fourth digit is entered, the transponder code becomes active.

Pressing BACK returns the pilot to the previous level of softkeys.

The IDENT key is always visible from the main softkey menu or the XPDR menu, and can be pressed at any time it is visible. Pressing the IDENT key always makes the transponder squawk IDENT, then always returns the softkeys to the main menu. IDENT can also be selected from the control wheel.

SUPPLEMENTAL FLIGHT DATA

SENSOR Source Selection

Each PFD normally presents data from the sensors associated with its respective-side ADC and AHRS. To select cross-side ADC or AHRS, use the SENSOR softkey on the main softkeys menu. In flight only, if a sensor fails, automatic conversion occurs after 2 seconds.

DME Information Window

The DME information window appears to the left of the HSI directly above the BRG 1 information (Figure 16-27).

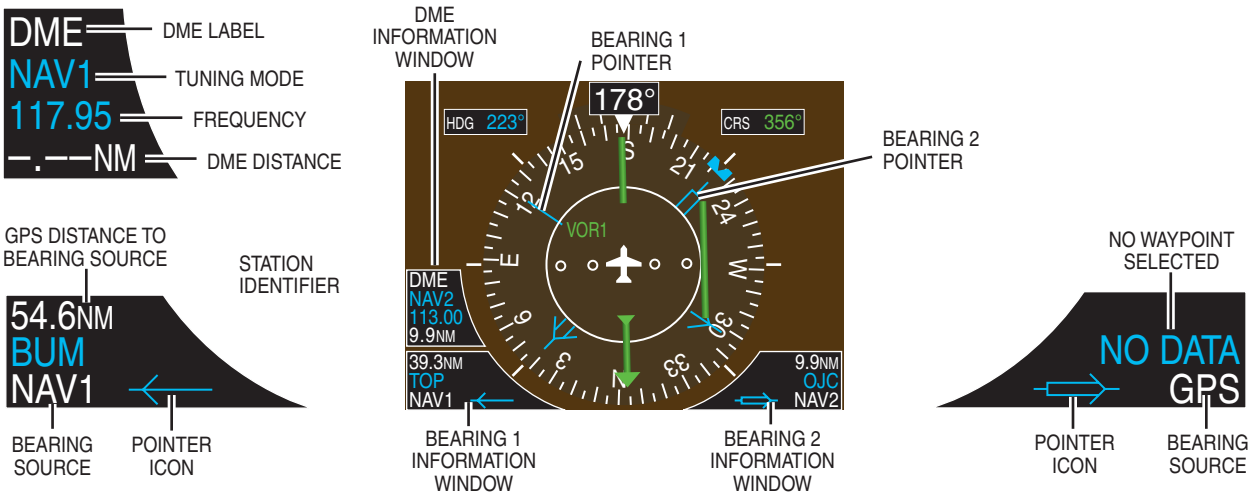


Figure 16-27. HSI With Bearing and DME Indication

Wind Data Box

The wind data box appears above the DME window. There are three wind presentations, which indicate the calculated wind velocity. When the window is selected for display, but window information is invalid or unavailable, the window displays NO WIND DATA (Figure 16-28).

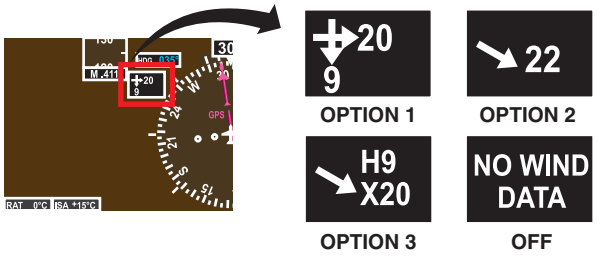


Figure 16-28. Wind Data Box

Traffic Alerts

When the TIS detects a traffic hazard, an amber/black TRAFFIC box appears to the right of the top of the airspeed scale. If a traffic alert occurs, the inset map scales to the appropriate range. If the range on the map is set appropriately, an amber symbol appears on the map with a track vector.

AFCS Alerts

The AFCS presents alerts in the system status field near the top of the airspeed scale.

Air Temperatures (RAT and ISA)

The ram air temperature (RAT) display is at the lower-left corner of the PFD display area (Figure 16-29). The ISA (International Standard Atmosphere) temperature display is immediately right of the RAT box. The ISA temperature box indicates the difference between ISA temperature and the OAT.

System Time Box

A box in the lower-right corner of the PFD indicates time as referenced by satellite data (Figure 16-30). The time is displayed as local time (LCL) in 12-hour or 24-hour format, or as Coordinated Universal Time (UTC).

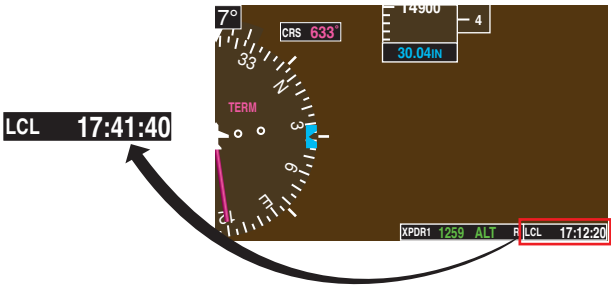


Figure 16-30. System Time Box

Generic Timer

A generic timer may be set and operated by the pilot (Figure 16-31). It displays hours/minutes/seconds, counting up or counting down. Access is through the TMR/REF softkey.

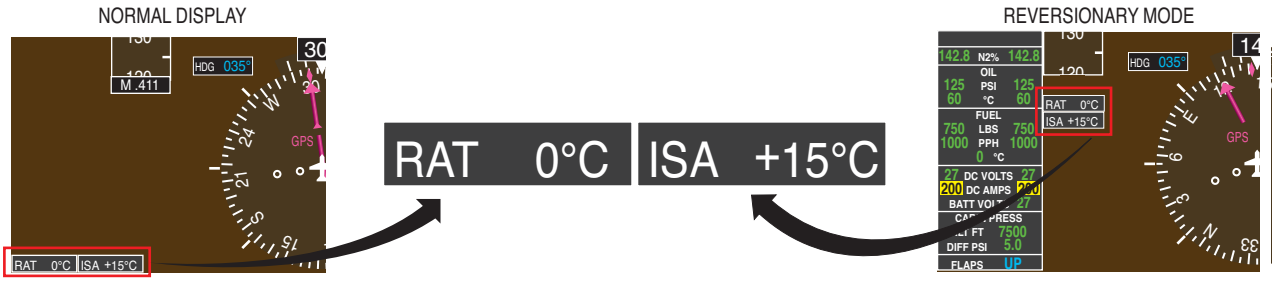


Figure 16-29. Ram Air Temperature Box

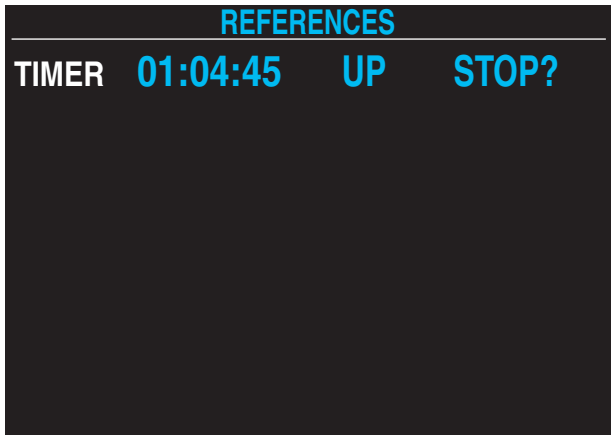


Figure 16-31. Timer References Window

MULTIFUNCTION DISPLAY

DESCRIPTION

This section provides a basic discussion of MFD displays and controls, and is intended to provide the pilot a useful understanding of the purpose and organization of the MFD (Figure 16-32).

The G1000 includes a single 15-inch MFD in the center of the instrument panel. The MFD provides indications for:

- EICAS
- Moving-map displays (with depictions of navigation references and flight hazards)
- Information pages on waypoints, instrument flight rule (IFR) procedures, airports, airways, and navaids
- Flight planning
- Navigation status indications
- System status indications

The MFD also provides an alternate display for essential flight instrumentation from either PFD through the use of reversionary mode.

The MFD has many possible settings and displays. For additional details, refer to the supplemental G1000 manuals and documents supplied with the Citation Mustang.

MFD CONTROLS

The MFD is controlled by softkeys across the bottom of the MFD bezel, and by the MFD/FMS controller on the cockpit pedestal, below the throttle quadrant (Figure 16-33, Tables 16-6 and 16-7).

MFD Softkeys

MFD softkey functions are variable depending on user inputs. Each softkey has a label above it, which indicates its current function.

MFD/FMS Controller

The MFD/FMS controller includes an alphanumeric keypad for direct entry of numbers and text.

Dual FMS Knob

The dual FMS knob on the MFD/FMS controller is the main control for selecting most MFD functions. The large knob selects page groups, while the small knob selects individual pages within the selected group.

For data entry, pressing the dual FMS knob activates the cursor, which allows the user to input new data. While the cursor is active, rotating the large FMS knob allows the user to move to different data entry locations on the display, as indicated by cursor movement. While the cursor is active, rotating the small FMS knob allows the user to change the text or data at the cursor location.

Rotating the FMS knob causes each possible character to display sequentially. When the correct entry at the cursor location is selected with the small FMS knob, confirm by pressing the ENT key. It moves to the next position when you press ENT.

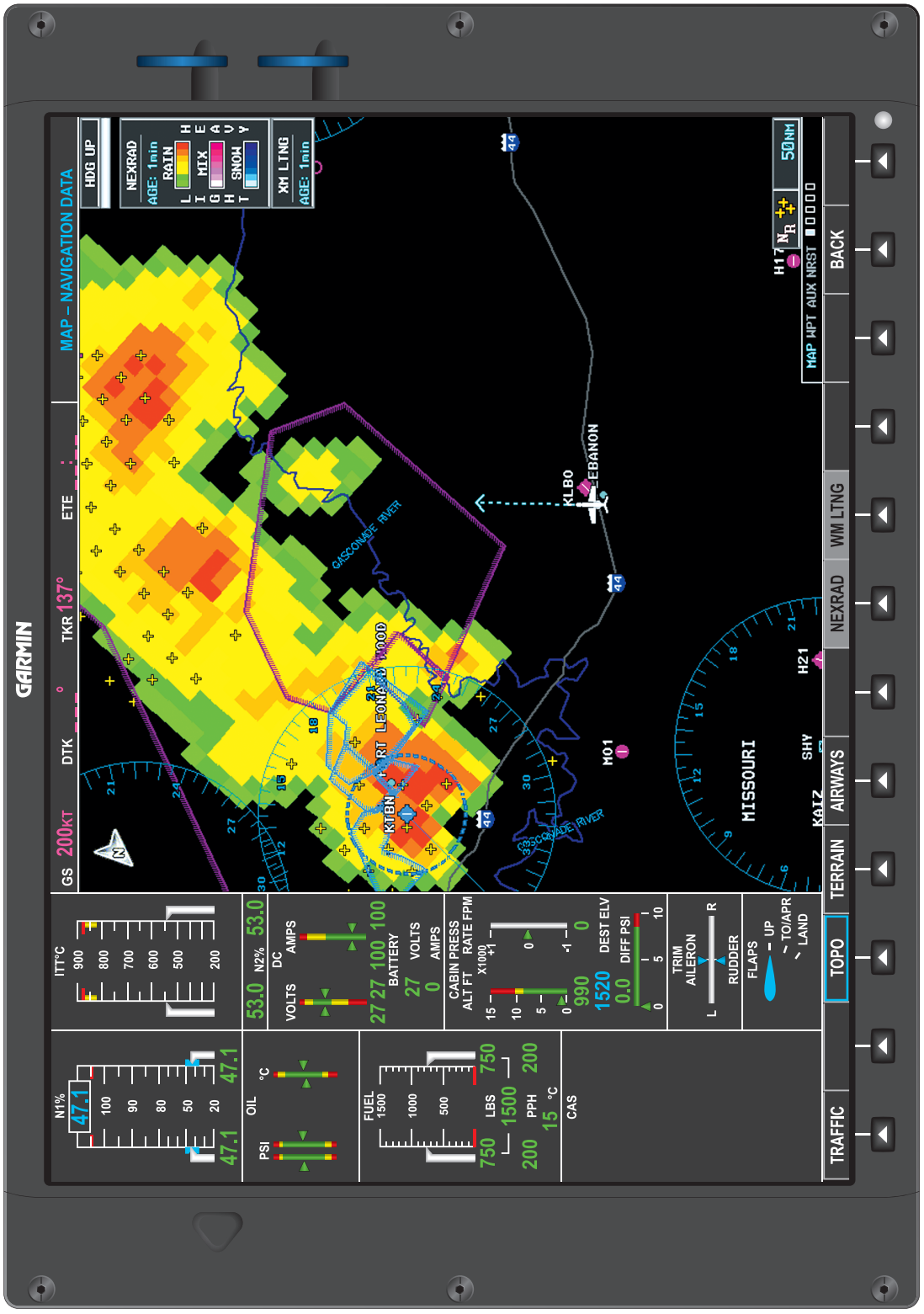


Figure 16-32. Multifunction Display

Figure 16-33. MFD Controller

Table 16-6. MFD SOFTKEYS

MFD SOFTKEYS	FUNCTION
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	AIRWAYS: Displays airways on the map when next level softkeys are pressed (default label is dependent on map setup option selected); cycles through the following:
AIRWY ON	AIRWY ON: All airways are displayed
AIRWY LO	AIRWY LN: Only low-altitude airways are displayed
AIRWY HI	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	Selects desired amount of map detail; cycles through declutter levels: DCLTR (No Declutter): All map features visible
DCLTR-1	DCLTR-1: Declutters land data
DCLTR-2	DCLTR-2: Declutters land and SUA data
DCLTR-3	DCLTR-3: Removes everything except for the active flight plan
SW CHRT	When available, displays optional airport and terminal procedure charts
CHKLIST	When available, displays optional checklists

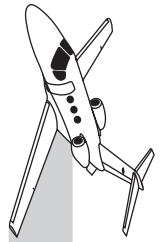


Table 16-7. MFD CONTROLLER DESCRIPTIONS

#	CONTROL	DESCRIPTION
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	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. 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.
6	Joystick	Changes the map range when rotated. Activates the map pointer when pressed. Pans the map or cursor when moved.
7	Alphanumeric Keys	Allow entry of airports, waypoints, etc.
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.
13	SPC Key	Adds a space character.
14	BKSP Key	Moves the cursor back one character space.

ENGINE INDICATING AND CREW ALERTING SYSTEM

The left side of the MFD displays the two-column EICAS display. The EICAS display includes the engine indicating system (EIS) and the CAS.

Engine Indicating System

The EIS is a group of graphical and digital indications of the condition and performance of the aircraft system. These include indications for:

- Engines and oil system
- Fuel system
- Electrical system
- Pressurization
- Rudder and aileron trim
- Flap position

Crew Alerting System

The CAS is described in detail in Chapter 4—"Master Warning," along with a summary explanation of each CAS message.

MAIN MFD DISPLAY AREA

The main MFD area presents different pages from four main page groups:

- MAP—Moving-map displays
- WPT—Waypoint information pages
- AUX—Auxiliary information pages
- NRST—Nearest facilities

The selected display page group is noted by a cyan abbreviation (MAP, WPT, AUX, or NRST) in the lower right corner of the main display area. Each page group contains more than one page, indicated by the group of boxes to the right of the page groups list. To select a page group, use the large knob of the dual FMS knob on the MFD/FMS controller. Rotating clockwise selects a page group farther right on the list.

The page being depicted is represented by a cyan box among the other boxes. The top right corner always indicates the page group and page name.

MAP Page Group

This page group displays various map presentations (Figure 16-34), which include:

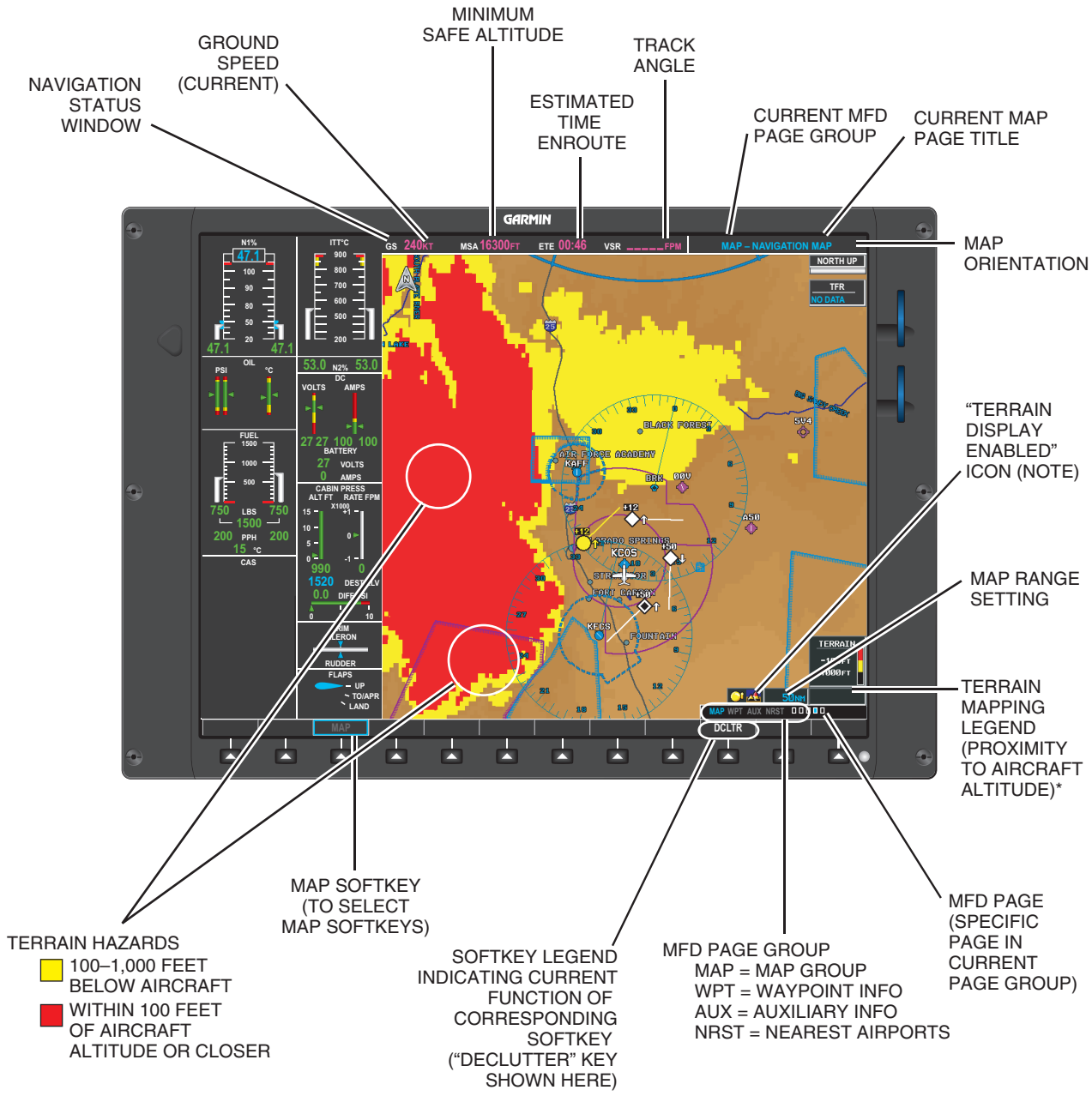
Standard maps:

- NAVIGATION—Displays navigation map with user-selected overlays (with variations including TRK UP, DTK UP, and NORTH UP).
- TRAFFIC—Displays only traffic, as reported by TIS or the optional traffic advisory system (TAS).
- WEATHER RADAR—Displays precipitation intensity.
- WEATHER DATA LINK—Displays any weather depiction or data available from XM Weather satellite downlink. Combinations of display overlay can be selected (subscription required).
- TERRAIN PROXIMITY—Displays only terrain/obstruction hazards, as indicated in terrain database.

MAP Softkey Menu

When the NAVIGATION MAP is selected, the MAP softkey is normally visible on the bottom-left of the MFD. Pressing the MAP softkey brings up secondary level softkeys, which provide the option to select/deselect various combinations of overlays for the navigation map display, including:

- TRAFFIC—Shows traffic indications (visible with any other overlay)
- TOPO—Shows topographic shading (not visible with NEXRAD)
- TERRAIN—Shows terrain and obstruction hazards, color coded by proximity to aircraft altitude (not visible with NEXRAD)
- AIRWAYS—Shows low and/or high altitude airways



NOTE—DISPLAY-ENABLED ICONS

- TERRAIN
- XM LIGHTNING
- TRAFFIC INFORMATION SYSTEM (TIS)
- STORMSCOPE (OPTIONAL)
- NEXRAD RADAR IMAGES

Figure 16-34. MFD With MAP Displays

- NEXRAD—Shows NEXRAD downloaded from optional XM weather satellite broadcast (also visible with TRAFFIC and/or XM LTNG)
- XM LTNG—Shows lightning strikes as downloaded from optional XM weather satellite broadcast
- BACK—Returns to the top level softkey menu

If the pilot has selected a specific GPS course to navigate (using the Direct-To key, the flight plan features, automatic flight control, or other methods), the NAVIGATION MAP, and other MFD map displays, depict the selected course by a magenta line from the aircraft to the currently selected destination or next scheduled waypoint.

Map Display Options

Range

The RANGE/PAN joystick knob on the MFD/FMS controller allows the user to zoom the map scale. To increase the map range, rotate the joystick knob clockwise. To decrease the map range, rotate the joystick knob counterclockwise.

Pan

Moving maps can also be panned (moved off-center to view other areas away from the aircraft). To pan, press the RANGE/PAN joystick knob. This causes an arrow to appear over the aircraft depiction. Pan the map by moving the joystick in the desired direction. As the arrow nears the edge of the display, it becomes stationary and the map moves (pans). Note that a MAP POINTER information box appears at the top of the map showing:

- Distance and bearing of the pointer from the aircraft
- Elevation at the pointer
- Current latitude and longitude of the pointer

If no further joystick input is provided by the pilot for 60 seconds, the map automatically returns to center on the current aircraft position. Pressing the joystick again deselects the panning arrow and returns the map to the aircraft position.

WPT Page Group

The WPT page group depicts information about specific waypoints. *Any* of the waypoints found in the WPT page group can be entered into a flight plan or used for direct-to navigation. The following are the pages found within the WPT page group:

- Airport
- Intersection
- NDB
- VOR
- User WPT

Selecting Waypoints

The user selects the waypoint of interest by entering its identifier, name, or location. As the selection is being made, the database automatically displays information for the first waypoint in the database that matches the selection criteria. The actual selection may not appear until the user has entered all of the selection criteria. Verify the correct waypoint page is displayed before using the information from that page.

Automatic Frequency Entry

Some waypoint information pages display associated frequencies. To automatically enter one of these frequencies into a standby NAV or COM, select the frequency with the dual FMS knob, then press the ENT key. The selected frequency does not change to the active until the user presses the COM frequency transfer key.

AUX Page Group

The AUX page group provides auxiliary information and data entry pages for the pilot. These include:

- WEIGHT PLANNING
- TRIP PLANNING

- UTILITY
- GPS STATUS
- SYSTEM SETUP
- XM INFORMATION
- SYSTEM STATUS
- DIAGNOSTICS (available on ground only for maintenance purposes)

For details on the functions of each of these pages, refer to the supplemental G1000 documents supplied with the aircraft.

NRST Page Group

The NRST page group displays a moving map showing aircraft position relative to the following:

- AIRPORTS
- INTERSECTIONS
- NDB
- VOR
- USER WPTS
- FREQUENCIES
- AIRSPACES

The moving map initially displays the course to the nearest resource as a dotted/dashed white line.

FPL Page Group

The FPL page group includes these pages:

- ACTIVE FLIGHT PLAN—Including vertical navigation.
- FLIGHT PLAN CATALOG—Allows the pilot to store several flight plans for future use.

NAVIGATION STATUS BOX

The navigation data bar is the center area across the top of the MFD. It displays four fields of real time, GPS derived, navigation data. The four fields are pilot adjustable and can display the following options:

- BRG—Bearing (to the active waypoint)
- DIS—Distance (to the active waypoint)
- DTK—Desired track (to the active waypoint)
- ETA—Estimated time of arrival (to the active waypoint)
- ETE—Estimated time enroute (to the active waypoint)
- ESA—Enroute safe altitude for the entire route of flight
- GS—Groundspeed
- MSA—Minimum safe altitude within a 10-mile radius of the aircraft
- TAS—True airspeed (taken from the GDC 74B)
- TKE—Track angle error
- TRK—Track angle
- VSR—Vertical speed required
- XTK—Crosstrack error

The fields can be selected in the AUX–SYSTEM SETUP page under the MFD DATA BAR FIELDS box.

FLIGHT MANAGEMENT SYSTEM

WEIGHT PLANNING

Before flight, when the G1000 initializes, the AUX–WEIGHT PLANNING page appears. The pilot uses the dual FMS knob to move through the windows of the page, and enter current data for the flight. Pressing the EMPTY WT softkey sets the cursor to that entry, and the pilot corrects as appropriate, then enters data for other weights. Fuel weights may be automatically entered from the current EICAS

indications by pressing the FOB SYNC softkey. During aircraft operation, fuel flow and ETE can be automatically determined from actual operation, and the blank calculated fields display corresponding calculated data.

FMS AND FLIGHT PLANS

A FMS provides for flight navigation planning and enroute status monitoring. The FMS primarily operates through the flight plan pages of the MFD, which allow the pilot to enter a flight plan with an entire flight profile, from takeoff to landing. Both lateral and vertical navigation courses may be entered into the flight plan. The flight plan may be used to guide the flight by the:

- Pilot viewing the FPL and MAP pages for general reference
- Pilot using the FD to follow the flight plan
- Aircraft using the AP to follow the flight plan

Flight plans changed or terminated in flight may be stored for future use and may be deleted.

Computers for these functions are in the displays. GPS navigation data (provided from the GIAs) is the primary navigation source that is automatically selected flight plan status tracking. Any one of the displays can perform the FMS functions. Airspeed and altitude information from the ADC may also be used, depending on flight plan configuration.

MFD/FMS FLIGHT PLAN CONTROLS AND INDICATIONS

The MFD/FMS controller provides primary control of these functions. PFDs may also be set to display smaller windows containing FMS information and maps. Corresponding controls on the PFD bezels may be used to control the FMS.

NOTE

Most explanations in this section are based on the assumption the user is using the MFD and the MFD/FMS controller. Some (but not all) FMS operations can also be performed with a PFD and its controls. This section provides limited operating information for training purposes only. For more detailed and current instructions, refer to the *AFM*, the *Garmin G1000 Pilot's Guide*, and the *Garmin G1000 Cockpit Reference Guide*.

Flight plans and their associated map and information pages are normally presented on the MFD. The FPL (flight plan) page group includes two types of pages:

- ACTIVE FLIGHT PLAN—Flight plan currently active in the G1000, including VNAV
- FLIGHT PLAN CATALOG—List of all flight plans stored in the G1000

Both FPL pages may be viewed on the MFD. Courses and waypoints in an active flight plan are depicted on the MAP–NAVIGATION MAP page (and other maps) of the MFD. The course for the active leg of an active flight plan is displayed as a magenta line. Other legs of the course display as white lines.

USER-DEFINED WAYPOINTS

The user may define new waypoints for use in navigation. This is helpful in FMS operations to allow maximum flexibility in flight planning. User-defined waypoints are necessary when a waypoint is not stored in the navigation database. The pilot enters user-defined waypoints into the WPT–USER WPT INFORMATION page. These waypoints may be selected, as needed, through the FPL (flight plan) pages.

IFR PROCEDURES

IFR procedures are stored in the database and can be included in flight plans. The procedures include:

- Standard instrument departures (SIDs)
- Arrival procedures (standard terminal arrival routes [STARs])
- Approach procedures

VERTICAL NAVIGATION

The MFD/FMS controller provides for vertical navigation (VNAV) capability in-flight planning (Figure 16-35). This feature is available for enroute/terminal cruise and descent operations when VNAV has been enabled and a VNAV flight plan (with at least one vertical waypoint) has been activated. Vertical DIRECT TO also provides VNAV functions. The flight director/AFCS may be *armed* for VNAV at any time; however, no target altitudes are captured during a climb.

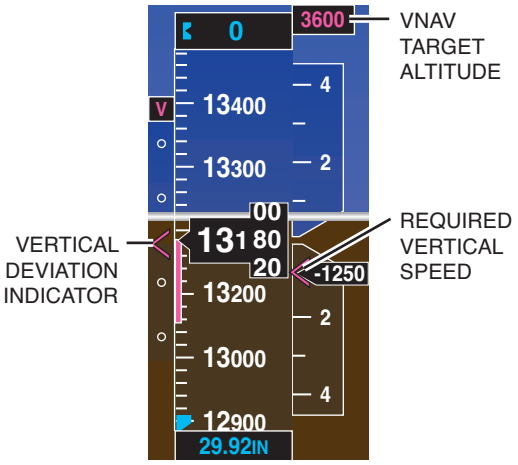


Figure 16-35. VNAV Indications

VNAV indications include the following:

- VNAV TARGET ALTITUDE—As preset by the pilot, that altitude in MSL to be reached by flying a programmed vertical speed.
- VERTICAL DEVIATION INDICATOR—This symbol indicates deviations from the correct flight path; thereby allowing the pilot (or AFCS) to make adjustments in pitch, as required, to maintain the selected vertical profile.
- REQUIRED VERTICAL SPEED—The vertical speed rate required to achieve the preselected altitude within that distance defined by the programmed flight plan.

For more information on vertical navigation, refer to the Garmin manuals and guides supplied with your Citation Mustang.

AUTOMATIC FLIGHT CONTROL SYSTEM

DESCRIPTION

The Mustang includes an AFCS that provides flight guidance and automatic flight control. The automatic flight control system includes three primary functions:

- Flight director
- Autopilot
- Yaw damper
- Manual electric pitch trim

The AFCS controller (above the MFD) provides control of these functions, and the PFDs provide necessary indications (Figure 16-36 and Table 16-8). Computers for these functions are in the GIAs and the servos. If either GIA fails, the other GIA performs the FD functions. If both GIAs fail, the AFCS is not operational.

The FD and AP follow the same sources of data for AFCS guidance. If AP is engaged, the information is used to control the airplane. If the FD is engaged, the information is used to guide the pilot.

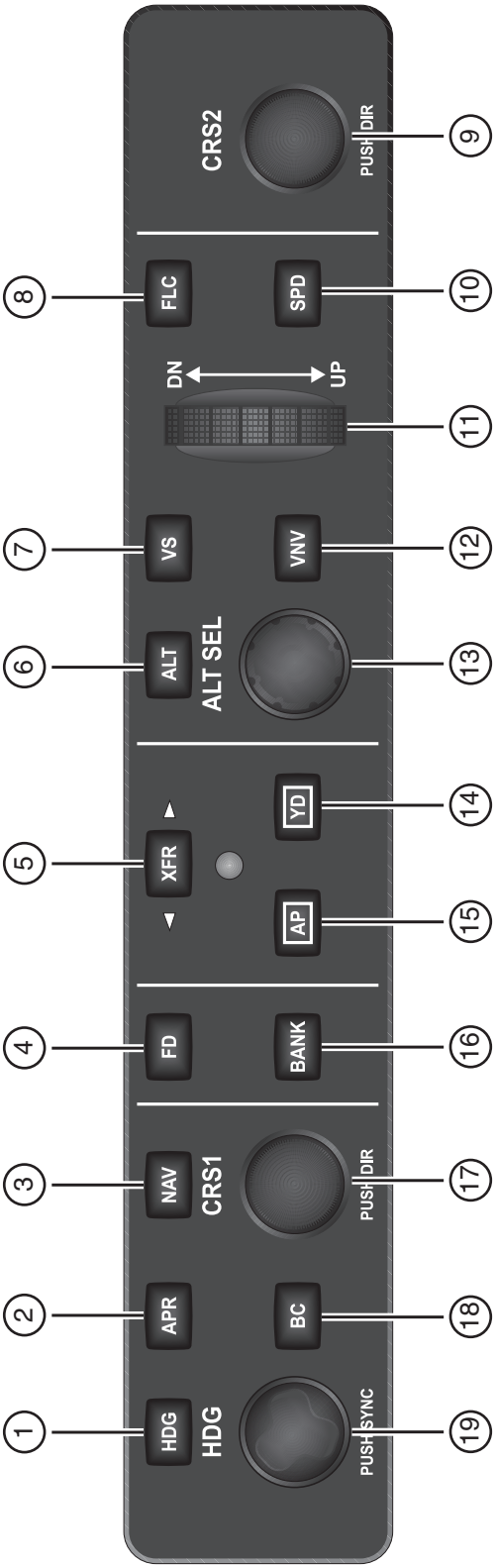


Figure 16-36. AFCS Controller

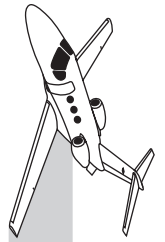


Table 16-8. AFCS CONTROLLER DESCRIPTIONS

#	CONTROL	DESCRIPTION
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 pilot-side 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 and 17	CRS Knobs	Adjusts the Selected Course in 1° increments on the HSI of the corresponding PFD. Press to center the course deviation indicator and return the course pointer directly to the bearing of the active waypoint/station.
10	SPD Key	Toggles Airspeed Reference between IAS and Mach for Flight Level Change Mode.
11	NOSE UP/DN Wheel	Adjusts the reference in Pitch Hold, Vertical Speed, and Flight Level Change Modes.
12	VNV Key	Selects/deselects Vertical Path Tracking Mode for Vertical Navigation flight control.
13	ALT SEL Knob	Controls the Selected Altitude in 100-ft increments (the Baro minimum altitude is also available).
14	YD Key	Engages/disengages the yaw damper.
15	AP Key	Engages/disengages the autopilot.
16	BANK Key	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.

The pilot commands AP engagement/disengagement with the AP key on the AFCS controller. Various controls on the yokes and throttles will also disengage the AP. FD can be selected using the FD key.

AFCS indications appear at the top of the PFD below the navigation status box (Figure 16-37). This status box contains information about the current status of the AFCS, including whether FD, AP, or YD are active, which guidance mode the AFCS is currently following, and which target values are being observed.

Flight Director

The AFCS FD function causes magenta command bars to appear on the PFDs, which indicates the attitude required to correctly navigate the selected horizontal and/or vertical flight path. The pilot maneuvers the aircraft to maintain the delta symbol on the PFD as closely as possible to the underside of the command bars.

Each GIA has a FD; one is active and the other is standby. The active FD is selected with the XFR key.

The active FD analyzes the selected flight profile and compares it to current aircraft position. It then computes such functions as attitude, heading and roll rate as necessary to maneuver to the selected flight path. Using these calculations, the active FD moves the command bars on both PFDs.

FD commands are limited to:

- Pitch—±20°
- Vertical acceleration—0.1g
- Bank angle—30°
- Bank Rate—5°/second

Autopilot

The AP maneuvers the airplane to follow the FD by providing signals to the four flight-control servos, which are:

- Pitch
- Roll
- Yaw
- Pitch trim

Yaw Damper

The YD stabilizes the aircraft in flight to prevent yaw instability. It can be engaged independently of the AP.

The YD must be selected off during takeoff and landing.

CONTROLS AND INDICATIONS

The AFCS is manipulated by various knobs and keys on the controller and by additional controls on the yoke and throttles.

AFCS Status Box on PFD

The AFCS status box indicates the settings and status of active and pending AFCS functions:

- White—Armed modes
- Green—Active modes
- Amber (flashing)—Canceled modes
- Red (flashing)—Abnormal AP disconnect

AFCS Controller

The AFCS controller is at the top of the instrument panel, above the MFD. It contains controls for the FD, AP, YD, and for making associated settings or selections on the PFDs (including

Figure 16-37. Automatic Autopilot

target headings, courses, altitudes, vertical speeds, and airspeeds). The pushbutton keys are momentary-contact on/off toggle switches. Most keys and knobs affect both FD and AP functions. However, the FD and AP keys select or deselect all FD and AP operation.

On the right side of most keys on the AFCS controller, small white LEDs indicate when the key is selected on, and the corresponding function is active or enabled (Figures 16-38 and 16-39).

Control Yoke Switches

On each control yoke, three switches control various AFCS functions, particularly disabling the AP, and returning manual flight control to the crew (Figure 16-40):

- DOWN–UP trim switches—When operated to adjust pitch, trim also disengages the AP.
- AP TRIM DISC switch—Immediately disconnects both the AP and the YD.
- CWS (control wheel steering) switch—Momentarily disengages the AP and synchronizes the FD command bars with the current aircraft pitch (if not in glide slope or vertical navigation mode) and roll (if in roll hold mode). A CWS button is on each control wheel. Upon release of the CWS button, the FD may establish new reference points, depending on the current vertical and lateral modes. The CWS display presents in the AFCS status box (Figure 16-41).

Figure 16-40. Control Yoke Switches

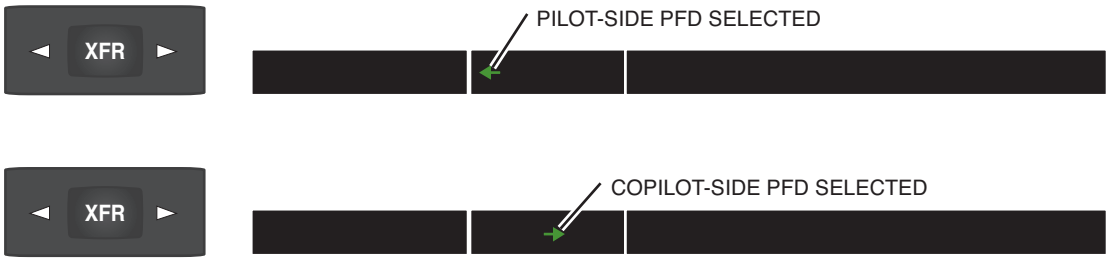


Figure 16-38. AFCS Status Bar

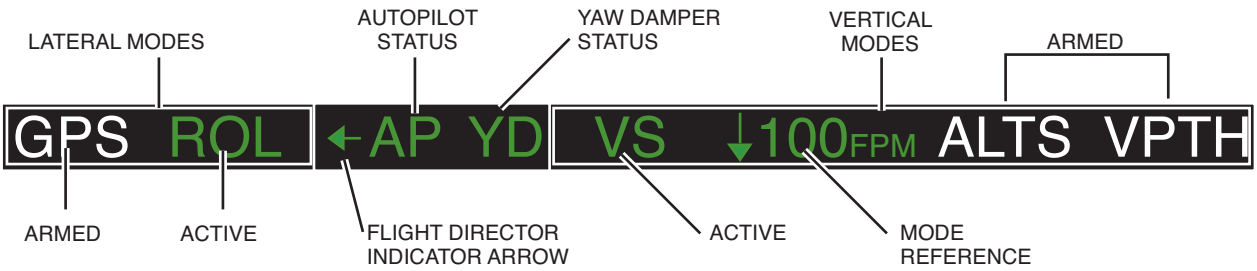


Figure 16-39. AFCS Status Box

Figure 16-41. CWS Display

GA Switches

On the outboard side of each throttle is a recessed go-around (GA) pushbutton switch (Figure 16-42). Either switch sets the AFCS for optimum single-engine climb configuration during a takeoff or go-around. Pressing the GA switch:

- Disengages the AP—The pilot can reengage the AP manually by pressing the AP key on the AFCS. The YD remains engaged.
- Engages the FD—Command bars appear on the PFDs, and immediately direct 8° nose-up pitch (Figure 16-43).
- On the ground, enables takeoff mode, which puts the command bars 10° pitch up.

During go-around mode, any attempt to modify pitch attitude (using the CWS button or the DN/UP thumbwheel knob) causes the AFCS to revert to default pitch and roll modes.

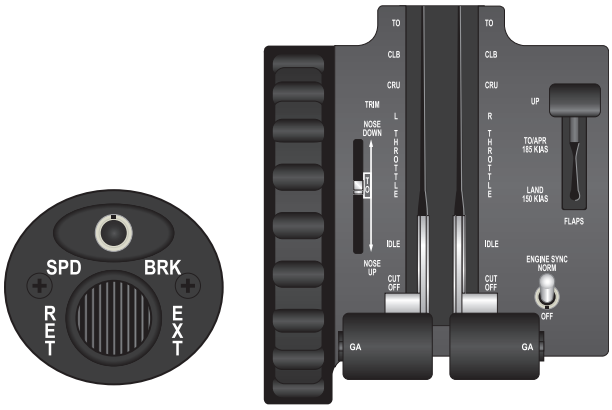


Figure 16-42. GA Switch

Figure 16-43. Go-Around Mode

OPERATION

Emergency Descent Mode

The AFCS has an emergency descent mode (EDM) that enables the AP, when pressurization is lost, to automatically descend the aircraft to 15,000 feet at V_{MO}/M_{MO}, regardless of pilot physiological condition (Figure 16-44). The aircraft must be above 30,000 MSL for EDM to arm. To exit EDM, disconnect the AP.

If the AP is engaged, and the onboard cabin pressure sensors detect a cabin altitude greater than 14,500 feet, the AP automatically enters EDM, and displays EDM (white letters in a red box) on the PFDs.

During EDM, the AFCS:

- Selects HDG mode and sets heading (heading bug on the PFD HSI) to 90° left of the current heading
- Selects FLC mode, 0.63 m and sets altitude preselect (altitude bug on the PFD altitude display) to 15,000 feet

To enable the maximum possible descent rate when in EDM, the pilot should immediately:

- Reduce throttles to IDLE
- Extend speedbrakes

AUDIO PANEL

DESCRIPTION

The Mustang avionics system includes an audio panel for each crewmember (pilot and copilot). The audio panels are visible as vertical switch panels on the instrument panel immediately outboard of each PFD. Each audio panel includes an audio amplifier, a marker beacon receiver, and controls for selecting and managing audio sources. These panels manage all audio sources, including COM transceivers, NAV, ADF, DME and marker beacon receivers, aircraft intercom and aural warning systems. They also control the switching of microphones and headsets. The audio panel also includes a digital voice recorder, which holds up to 2 minutes

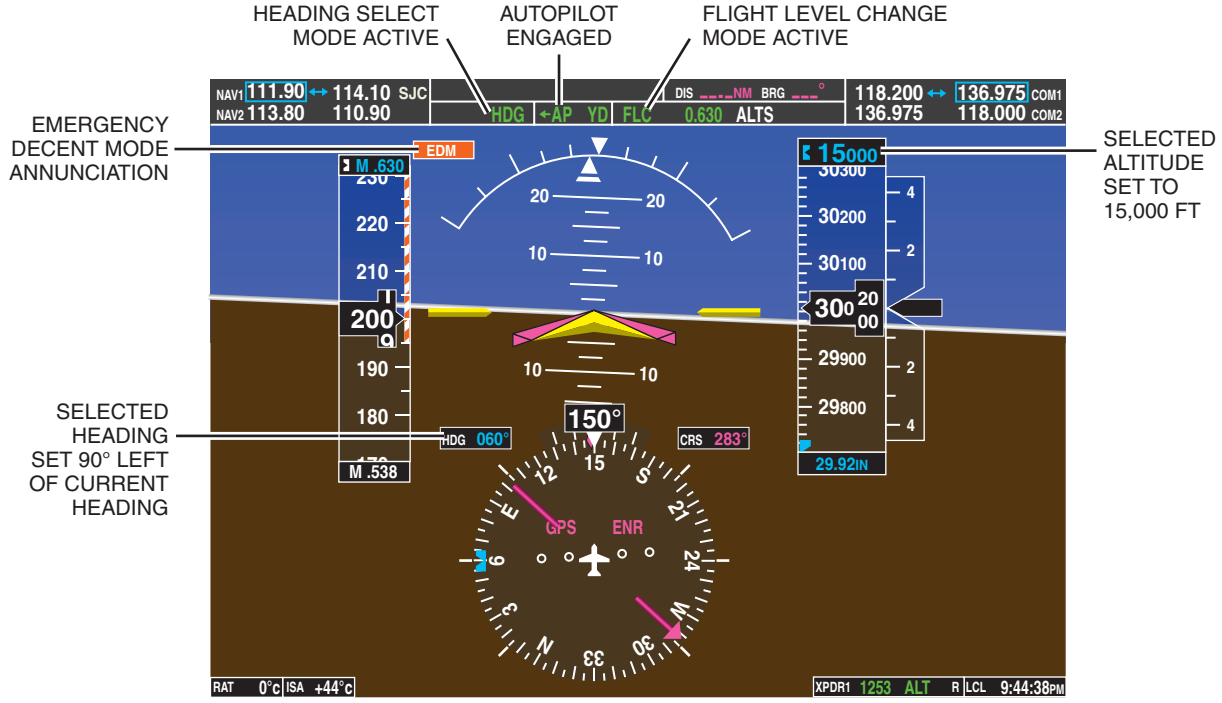


Figure 16-44. Emergency Descent Mode

and 30 seconds of recorded audio to assist the pilot in recording ATC clearances.

CONTROLS AND INDICATIONS

The audio panels use small keys for each item. Above each key is a small, triangle-shaped LED indicator, which illuminates when the device for the corresponding button is selected on that audio panel (Figure 16-45 and Table 16-9). Each audio panel may have different selections from the other panel.

Power-Up

During aircraft power-up, all audio panel annunciators illuminate for 2 seconds. Then all the audio switch selections (and annunciators) return the setting in effect when the aircraft was powered down. There are two exceptions: The speaker and intercom are always activated during power-up, and remain active until deselected.

Fail-Safe COM Operation

If both GIAs fail, the audio panels directly connect the pilot headset and microphone to the COM1 transceiver, and the copilot headset and microphone to the COM2 transceiver. (No audio is available to the speaker in this situation.) If only one GIA fails, the crewmember on that side will only have audio access to the corresponding COM transceiver.

COM Radio Priority

The G1000 includes two COM radios. COM1 is in GIA#1 and COM2 is in GIA#2. Either pilot may communicate using either COM radio. Each crew microphone is connected to a COM radio through a COM MIC key. For each crewmember, their COM MIC selection (COM MIC1 or COM MIC2) makes the selected COM radio their active transceiver, connected to their microphone. On each PFD, this is indicated by green digits for the active frequency of the primary transceiver. All other frequencies use white digits. The pilot

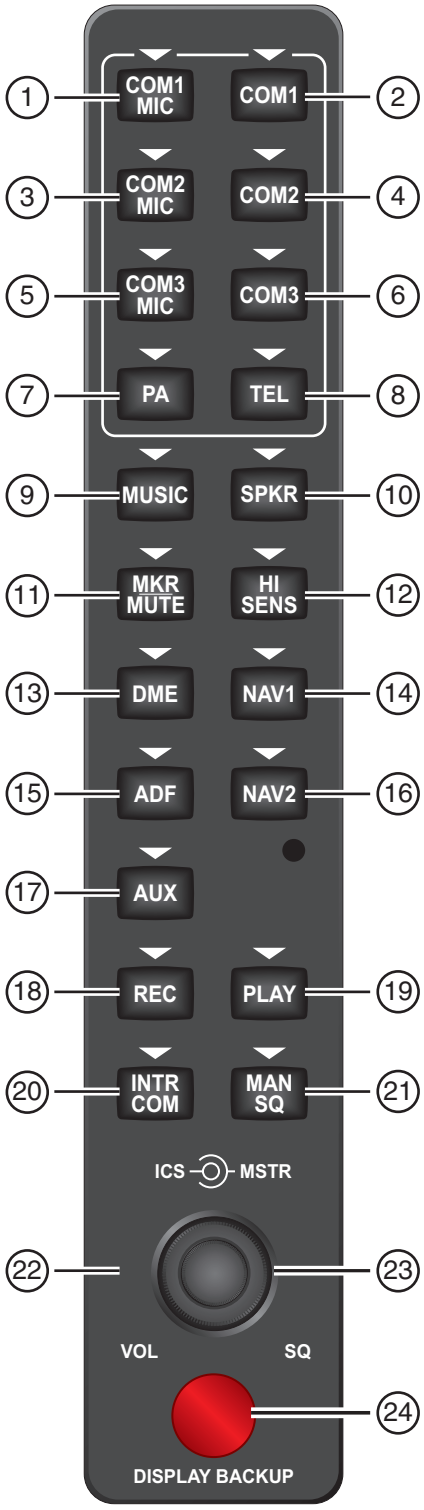


Figure 16-45. Audio Panel

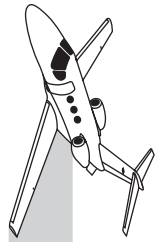


Table 16-9. AUDIO PANEL DESCRIPTIONS

#	CONTROL	DESCRIPTION
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.
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 the #2 Com receiver to be heard.
4	COM2	When selected, audio from the #2 Com receiver can be heard.
5	COM3 MIC	Not used on the Cessna Citation Mustang.
6	COM3	Not used on the Cessna Citation Mustang.
7	PA	Selects the passenger address system (if installed). The selected Com transmitter is deselected when the PA key is pressed. There are no cabin speekers. Headset jacks for passagers are an option.
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. All audio will be heard on the speaker, to include audio warnings.
11	MKR/MUTE	Activates the marker beacon receiver audio. Pressing mutes the currently received marker beacon receiver audio. Push again to turn off all marker audio.
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 all headset audio.
24	Reversionary Mode Button	Pressing manually selects reversionary mode.

may listen to the other COM radio by selecting the COM1 or COM 2 button.

Both crewmembers may select the same primary transceiver, or each may select a different primary transceiver. If both crewmembers select the same primary transceiver, and each crewmember keys their microphone at the same time, the microphone that transmits through the COM radio is the microphone of the crewmember with priority for that COM unit (the pilot has priority on COM1, and the copilot has priority on COM2). The hand microphone is connected to the pilot audio panel.

TRAFFIC INFORMATION SERVICE

The TIS provides the pilot with limited information about nearby potential air-traffic hazards in terminal areas that have TIS-capable ground-based radar.

NOTE

TIS is an advisory service only, to help the pilot locate traffic visually. It is the pilot responsibility to see and avoid traffic.

The service has three basic requirements:

- TIS-equipped aircraft must have an operating mode-S transponder (the G1000 includes two).
- Conflicting aircraft must have an operating mode-A, mode-C or mode-S transponder.
- Both aircraft must be within range (approximately 55 miles) of an air traffic control radar that has TIS enabled. These radars are most likely to be in congested terminal areas. (Refer to the *FAA Airman's Information Manual* for current TIS-radar coverage status).

The ground-based radar, when providing TIS, detects transponder-operating aircraft that are in proximity to other aircraft, and transmits traffic information about those aircraft to other aircraft nearby. If the client aircraft are operating a mode-S transponder, ground radar transmits the location, direction, speed, and vertical proximity of the other nearby aircraft. Ground radar only reports a maximum of eight traffic hazards, primarily those within 7 NM horizontally and+3,500/–3,000 feet vertically of the client aircraft.

The mode-S transponder receives this information, and depicts it on the TRAFFIC display of the MFD map and the PFD inset map.

CAUTION

Traffic Information Service is only effective when within range of a TIS-capable terminal radar site. It may operate intermittently, or not at all due to interference with transmission or reception (by obstacles, terrain or the aircraft itself, or condition of the ground radar). TIS does not provide information on aircraft without an operating transponder.

TIS is a "line-of-sight" system that uses tracking to report and update traffic notifications (every 5 seconds) on the MFD traffic map page or on the PFD map inset. Traffic alert messages appear on the PFD to the right of the top of the airspeed tape.

The GTX 33 transponder has selective addressing or MODE SELECT (mode-S) capability. Mode-S functions include a data link capability that allows information to be exchanged between aircraft and various air traffic control facilities.

TIS uses data acquired by surveillance of the mode-S radar system. During turns or other maneuvering, TIS data may become random as a result of interference between aircraft and ground antennae. Additionally,

reception may be interrupted by terrain (e.g. mountains).

TIS performs an automatic test during power-up and displays a standby screen on the traffic map page. If the power-up test fails, a NO DATA, DATA FAILED or FAILED message displays on the second page in the map group.

The traffic map page displays the following TIS information:

- Interrogating aircraft location, surrounding traffic locations, and range marking rings
- Current traffic mode (OPERATE, STANDBY)
- Traffic alert messages (FAILED, DATA FAILED, NO DATA, UNAVAILABLE)
- Traffic display banner (AGE, TRFC COAST, TA OFF Range, TRFC RMVD, TRFC FAIL, NO TRFC DATA, TRFC UNAVAIL, TRAFFIC)

When the aircraft is airborne, TIS switches from standby to operating mode. TIS OPERATING displays in the upper left corner of the traffic map page. A traffic advisory (TA) symbol displays when traffic is within the following range:

- ±500 feet
- 0.5 NM
- 34 seconds

A traffic advisory is accompanied by an aural "traffic" callout as well as when traffic becomes unavailable. In addition, an alert box appears on the PFD and the inset map is automatically displayed with traffic information.

Altitude deviation from the interrogating aircraft is shown above or below the target symbol. Target climb or descent is shown as an up or down arrow.

TIS assists pilots in the visual acquisition of other aircraft in visual meteorological conditions only. Do not use as a collision avoidance system. Pilots still have "see and avoid" responsibility for possible traffic conflicts. During instrument meteorological conditions, TIS must not be used for maneuvering when no visual contact exists with other aircraft.

TRAFFIC ADVISORY SYSTEM

As a substitute for the standard G1000 traffic information service (TIS), an optional traffic advisory system (TAS) is available. TIS and TAS have similar functions and indications. However, while TIS is dependent upon TIS-enabled ground stations to detect and report traffic, TAS directly detects and identifies traffic with an onboard interrogator. As a result, TAS can operate anywhere, not only in places with TIS-enabled ground stations. Also, because it is direct, TAS is faster, updating every half-second (TIS updates every 5 seconds).

WARNING

TAS cannot detect all traffic hazards. TAS is only effective at identifying traffic with an operating transponder. Only aircraft with a transponder operating in Mode C (altitude encoding) or Mode S (data link) can be identified by relative altitude. It is the pilot's responsibility to see and avoid traffic. Do not rely on TAS to avoid traffic instrument meteorological conditions (IMCs).

When equipped with TAS, the Citation Mustang uses the Honeywell KTA 870 (refer to the *Honeywell KTA 870 Pilot's Guide*).The unit connects to the MFD through GIA. Indications are provided on the MFD and PFD, and aural alerts through the audio panel.

TAS Traffic Symbols

Traffic indications are similar to those previously described for TIS. On MFD/PFD maps that display traffic, the following sym-

bols appear to indicate traffic that the TAS unit has identified:

- Solid yellow dot—Aircraft with TAS range, and a traffic hazard/threat
- Yellow/black dot (on outer ring)—Aircraft outside TAS range; whether traffic hazard threat or not is unknown
- Solid white diamond—Proximity traffic not an apparent hazard/threat, but approaching your altitude
- Hollow white diamond—Proximity traffic, all other
- "TA" text with data—Nonbearing traffic (bearing unknown), text includes distance, altitude, and trend, if known. (On the TRAFFIC MAP page, this message displays near the center of the map).

Digits appear above or below the symbol, indicating the difference between the aircraft's altitude and the other aircraft's altitude. The digits are above the symbol when the aircraft is above, and below the symbol when the aircraft is below. Also, a minus (–) symbol before the digits indicates the aircraft is below, and a plus (+) symbol before the digits indicates the aircraft is above. A down arrow beside the symbol indicates that the other aircraft is climbing (at 500 fpm or more).

MAP–TRAFFIC MAP Page and TAS Controls

To view TAS indications exclusively or to adjust TAS settings, switch to the MAP–TRAFFIC MAP page (use the large FMS knob to select the MAP page group and the small FMS knob to select the TRAFFIC MAP page).

The system self-test verifies operation of the aural warning when the STANDBY softkey is pressed, followed by pressing the TEST softkey; in approximately 8 seconds, three different traffic symbols appear and the aural message "TAS system test OK" is heard. (If the test fails, a different message is heard).

On the MAP–TRAFFIC MAP page, pressing the OPERATE softkey activates TAS, which begins displaying transponder-operating traffic in the area. The alert "TAS OPERATING" appears in the upper left corner of the TAS display.

To adjust the altitude-based traffic altering function, use the ALT MODE softkey. Select the threat zone to monitor: BELOW (current altitude), NORMAL (within _____ feet of current altitude), ABOVE, or UREST (unrestricted).

Rotate the RANGE/PAN joystick knob to change viewing range, and move the joystick knob vertically or horizontally to pan the display.

TAS on Other MFD/PFD Maps

TAS indications can be viewed on other MFD maps, and on the PFD inset map, by pressing the MAP softkey below the corresponding page, followed by the TRAFFIC softkey.

NOTE

The TRAFFIC softkey label is black letters on a gray background when TAS is active on that map.

AIRBORNE WEATHER RADAR

A GWX 68 airborne weather radar provides precipitation returns and ground-mapping returns. The radar primarily assists the pilot in detecting dangerous thunderstorms along the flight path. It also clarifies the boundaries and intensities of storm cells and locations of severe precipitation. The GWX 68 has both horizontal and vertical scan capability, which provides greater detail on the position of storms, including their heights. The ground-mapping feature of the onboard radar assists the pilot in identifying landmarks and bodies of water.

The GWX 68 radar unit is in the nose of the aircraft. The antenna sweeps across an arc of

90° horizontally (45° each side of center), and 60° vertically (30° above and below the horizon). The radar transmits a very-high-energy radio beam, which is reflected from precipitation and surface features.

WARNING

The radar beam is dangerous, and close exposure can cause severe injury. When operating the radar on the ground, ensure that no persons or objects are within 11 feet of the antenna. (People inside the aircraft are safe, if no object is close enough to the antenna to reflect the entire beam into the aircraft.) Do not begin to transmit, until the aircraft is clear of all persons and objects on the ground within 11 feet.

WEATHER RADAR PAGE AND CONTROLS

On the MFD, the MAP–WEATHER RADAR page provides access to the weather radar depiction and control.

On the ground, the weather radar must be activated to operate. Pressing the MODE softkey causes other softkeys to appear, providing control of the radar. The STANDBY key initiates the 1-minute warm-up period required before operating the radar. After 1 minute, ensure the aircraft is clear of all persons and objects within 11 feet of the antenna and forward of the aircraft, then select the WEATHER softkey, which activates the weather radar antenna.

NOTE

If the aircraft is already airborne, the STANDBY mode is not required before energizing the antenna. After landing, the radar automatically returns to STANDBY mode.

Pressing the BACK key exits the MODE softkey menu, and returns to the main radar softkey menu.

RADAR DISPLAY AND INDICATIONS

The GWX 68 digital radar utilizes a four-color display capable of scanning airspace ahead of the aircraft through various pilot adjustable angles. Specific sectors may be monitored through a horizontal plane of 20°, 40°, 60°, or 90°. A vertical scanning function provides for scanning through 8° of coverage, selectable by the pilot to assist in analyzing storm tops, gradients, and cell buildup activity at various altitudes.

The following additional features provide an added margin of safety:

- Extended sensitivity time control (STC)—Logic that automatically correlates distance of the return echo with intensity, so that 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. Radar return signals are weakened, or attenuated, by intense precipitation. The same is true for extensive areas of lesser precipitation. Under these circumstances, the potential exists for “the storm behind the storm” to be masked from viewing with airborne radar units.
- Weather alert looks ahead for intense cell activity in the 80–320 NM range, even if these ranges are not being monitored.

Refer to Table 16-10.

Range Adjustment

The range of the radar display is adjustable. Rotate the RANGE/PAN joystick knob to adjust the display range. The current distance to each dotted arc is noted at one end of each arc. Range adjustment only affects the display; it does not change the beam intensity or sensitivity (gain) of the radar.

Table 16-10. PRECIPITATION INTENSITIES

WEATHER MODE COLOR	INTENSITY	APPROXIMATE RAINFALL RATE
BLACK	< 23 DBZ	< .01 IN./HR.
GREEN	23 DBZ TO < 32 DBZ	.01 - 0.1 IN./HR.
YELLOW	32 DBZ TO < 41 DBZ	0.1 - 0.5 IN./HR.
RED	41 DBZ TO < 50 DBZ	0.5 - 2 IN./HR.
MAGENTA	50 DBZ AND GREATER	> 2 IN./HR.

WATCH Softkey

The GWX 68 radar includes a WATCH (weather-attenuated color highlight), which projects a colored "shadow" to indicate a warning to the pilot of possible attenuation. The WATCH softkey selects or deselects this feature.

Gain Control

Radar sensitivity may be adjusted by pressing the GAIN softkey, then rotating the small FMS knob to adjust the radar gain. This could change the color indications and give a false indication of actual precipitation and surface returns. However, adjusting radar-return gain may increase clarity of some situations.

CAUTION

When finished viewing at an adjusted gain, press the GAIN softkey again to turn off the gain adjustment, and return the radar to calibrated-gain mode, so that colors are again accurately indicating the strength of the returns.

ANTENNA STABILIZATION

The GWX 68 radar antenna is stabilized through gyro data to minimize low quality images as the pilot maneuvers around weather, particularly in turbulence. Through control key inputs, the STAB feature may be selected ON or OFF as desired.

ANTENNA TILT

Adjusting the vertical tilt angle of the antenna selects the vertical direction to scan. This enables the pilot to focus attention on a particular area, such as the tops of a storm, or the ground. To adjust the antenna tilt from the MAP–WEATHER RADAR page, press the FMS knob, and a cursor/highlight appears in the TILT field of the display. Adjust the antenna (radar beam) tilt as desired, using the small FMS knob. If the VERTICAL display is presented, a line appears indicating the angle of tilt.

GROUND MAPPING

Ground mapping mode highlights surface features. Cities and other built-up areas typically provide strong returns, while water typically provides little or no return. Ground mapping may assist the pilot in navigation.

To select ground mapping from the MAP –WEATHER RADAR page, press the MODE softkey. Press the GROUND softkey. Adjust antenna tilt to select the specific angle desired for ground mapping. Refer to Table 16-11.

TERRAIN AWARENESS AND WARNING SYSTEM

An integral terrain awareness and warning system (TAWS) provides the pilot with aural and visual warnings of terrain and obstacles near, at or above the aircraft altitude or flight

Table 16-11. GROUND TARGET RETURN INTENSITY LEVELS

GROUND MAP MODE COLOR	INTENSITY
BLACK	0 DB
CYAN	> 0 DB TO < 9 DB
YELLOW	9 DB TO < 18 DB
MAGENTA	18 DB TO < 27 DB
BLUE	27 DB AND GREATER

path (Figure 16-46). TAWS relies on current terrain and obstacle databases.

HAZARD DEPICTIONS AND ALERTS

Red areas on the terrain map indicate terrain within 100 feet (approximately 33 meters) of the current aircraft altitude or higher, including terrain above the current aircraft altitude (Figure 16-47). Amber areas on the terrain map indicate terrain between 100 feet and 1,000 feet below the aircraft altitude. Black areas on the map indicate terrain greater than 1,000 feet below the aircraft.

Obstacles are similarly colored, and depicted with standard obstacle symbols. If TAWS detects an imminent impact (based on aircraft course, ground speed, and vertical speed), an X is depicted in the current aircraft course at the point of expected impact.

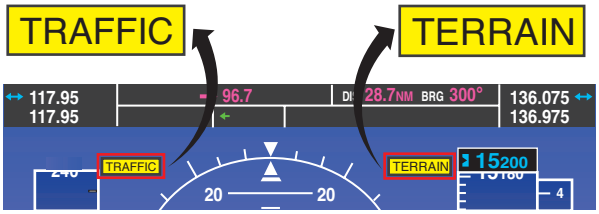


Figure 16-46. Traffic and Terrain Display

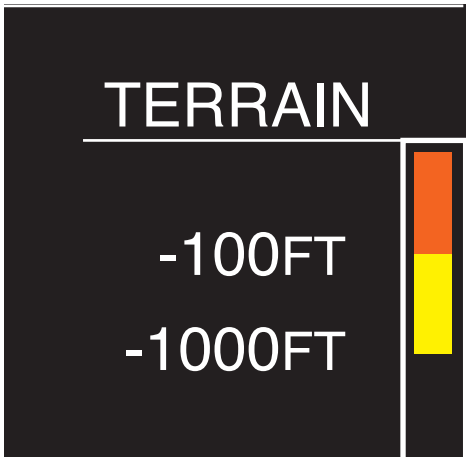


Figure 16-47. Terrain Colors

Color-coded warnings (for red areas) and cautions (for amber areas) are signaled through warning flags appearing on the PFD, and through aural warnings. If any page, except the TERRAIN PROXIMITY page is selected on the MFD, a pop-up warning message appears in the lower right corner of the display. In this situation, pressing the ENT (enter) key immediately switches the MFD to the MAP–TERRAIN PROXIMITY page; pressing the CLR (clear) key causes the current map to remain visible on the MFD.

TAWS hazard depictions may also be displayed as overlays on other maps by selecting the TERRAIN softkey. However, TAWS hazard depictions cannot be displayed simultaneously with XM Weather NEXRAD images or airborne weather radar indications, because they use similar color coding to indicate weather threat areas.

XM WEATHER AND GDL 69/69A DATA LINK

The MFD can display satellite-broadcast weather information. From any location in North America, the MFD can receive aviation weather information from the XM Weather™ satellite broadcasts. The XM Weather service also provides temporary flight restriction (TFR) reports. The system can download XM Weather data from satellite broadcasts, which is received from a commercial subscription service. The GDL 69/69A data link receiver enables the G1000 to receive XM Weather (and TFR) data. The data link is remotely mounted; its controls are on the G1000 panels and displays.

NOTE

For information on activating XM Weather service subscription, refer to the Garmin GDL69/69A XM Satellite Radio Activation Instructions, or refer to “Activating XM Radio Services” in the *Garmin G1000 Pilot’s Guide for the Cessna Citation Mustang*.

NOTE

This section contains basic, limited information on the features and operation of the XM Weather service data option. For more information on XM Weather and the Garmin GDL 69/69A Data Link LRU, refer to the Garmin manuals and guides supplied with your Citation Mustang.

XM Weather Information Available

The user level (class) of XM Weather service and specific weather-information products available are listed on the AUX–XM INFORMATION page on the MFD, along with the associated identification codes.

Complete XM Weather service can include the following information:

Graphical information depictions:

- NEXRAD data (NEXRAD)
- METAR data (METAR)
- Wind data (WIND)
- Echo tops (ECHO TOP)
- Cloud tops (CLD TOP)
- Lightning strikes (XM LTNG)
- Storm cell movement (CELL MOV)

Graphic and text information:

- SIGMETs/AIRMETs (SIG/AIR)
- Surface analysis including city forecasts (SFC)
- County warnings (COUNTY)
- Freezing levels (FRZ LVL)
- Hurricane track (CYCLONE)
- Temporary flight restrictions (TFR)

Text-only information:

- METAR data
- Terminal aerodrome forecasts (TAF)

XM Weather Display Options and Limitations

On MFD map pages (and PFD inset maps), softkeys allow the user to select which XM Weather information (if any) to display. Multiple XM Weather information products can be displayed simultaneously on some pages. Note that some XM Weather information products cannot display with certain other XM Weather products. Likewise, some XM Weather products cannot display with certain information from other sources. The NEXRAD legend is shown in Figure 16-48.

MAP–XM WEATHER DATA LINK Page

In the MAP page group, the WEATHER DATA LINK page provides the maximum number of views of XM Weather information products.

The range/pan joystick provides an interface with many of the weather products. When the map pointer is pointing to, or in, a specific feature on the map, the center box of the map pointer information bar gives information on that feature. When pointing to a specific symbol representing a weather hazard, information is given about that hazard. When the hazard is an area, and the map pointer is on the boundary, or inside the boundary of the area, information about the hazard appears in the center box. When the map pointer is in a place where multiple hazards exist, only one is identified in the center box; SIGMETs have priority.

For boundaries of hazard areas, refer to the Garmin manuals.

On the main softkey menu, the MORE WX softkey leads to more weather products. Selecting some of these features may require a more detailed softkey selection, such as specific altitudes for winds aloft depiction, or forecast periods (current, 12-hour, 24-hour, etc.) for surface weather depictions.

Weather Product	Symbol	Expiration Time (Minutes)	Refresh Rate (Minutes)
NEXRAD		30	5
Cloud Top (CLD TOP)		60	15
Echo Top		30	7.5
XM Lightning (LTNG)		30	5
Cell Movement (SCIT)		30	12
SIGMETs/AIRMETs (SIG/AIR)		60	12
METARs		90	12
City Forecast (CITY)		60	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

Figure 16-48. NEXRAD Legend

Viewing METARs and TAFs

METARS and TAFs are available in text format through XM Weather.

METARs and TAFs can be viewed by selecting the WPT–AIRPORT INFORMATION page and pressing the WX softkey. This changes the page to the WPT–WEATHER INFORMATION page (for the selected airport). On the right side of the page are windows for METAR reports and TAF forecasts.

STANDBY FLIGHT INSTRUMENTS

The Mustang has four standby flight instruments that can function independent of the electrical system or any other system, including the avionics. These instruments are the:

- Standby attitude indicator
- Standby airspeed indicator
- Standby altimeter
- Standby magnetic compass

Each 2-inch indicator is a self-contained unit. Electrical power for these units comes through the STBY INST switch from the right avionics electrical bus. The bus connects to normal DC power, and also has a dedicated 1.2 ampere-hour standby battery. The standby battery is in the nose and connects to the main electrical bus for charging power (refer to Chapter 2—"Electrical System"). Circuit breakers for the standby battery charging circuit, and each of the standby instruments (except the compass), are in the AVIONICS section of the right CB panel.

The pneumatic instruments (airspeed and altitude) bypass both ADCs and are directly connected (pneumatically) to the pilot-side pitot-static system. The magnetic compass operates without external power. However, an internal light in the compass receives DC power from the same source as the other standby instruments

STANDBY ATTITUDE INDICATOR

The standby attitude indicator is a self-contained unit that provides visual pitch and roll aircraft attitude information (Figure 16-49). The indicator contains an electrically powered gyroscope, which maintains vertical orientation. The instrument is internally lighted. A PULL TO CAGE knob allows the gyro to be aligned prior to flight.

CAUTION

The attitude indicator may be damaged if the PULL TO CAGE knob is released with a "snap." To release, pull to cage knob slowly in order to avoid a "snap" release.

STANDBY AIRSPEED INDICATOR

The standby airspeed indicator displays aircraft airspeed (Figure 16-50). It measures the ram and static air pressures directly from the pilot-side pitot-static system, and presents the airspeed on a single pointer indicator. The pointer is referenced against a dial marking to

Figure 16-49. Standby Attitude Indicator

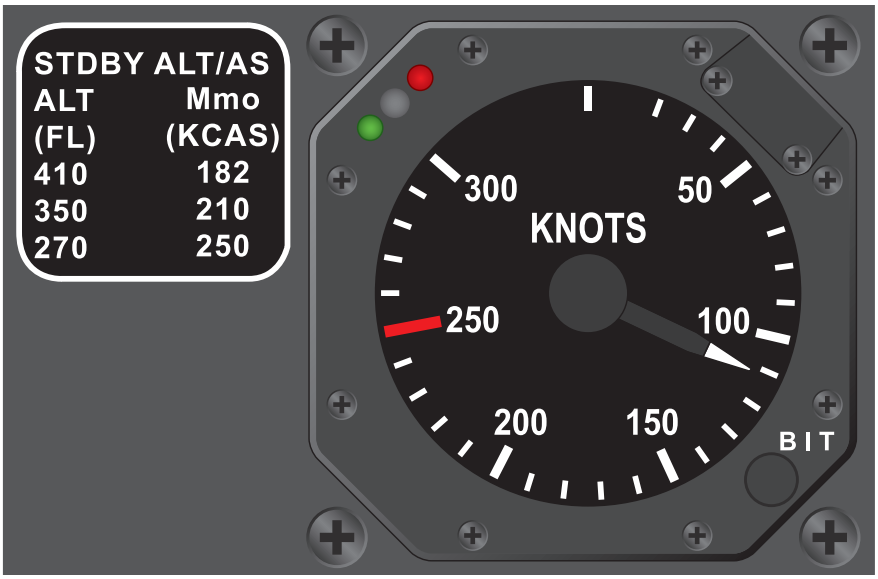


Figure 16-50. Standby Airspeed Indicator

display the indicated airspeed. V_{MO} is marked with a red line at 250 KIAS.

To determine M_{MO} limits, compare indicated altitude to the placarded altitudes, and determine the corresponding limiting calibrated airspeed (KCAS) from the table.

WARNING

When relying only on standby airspeed, use caution to remain below V_{MO} and M_{MO}.

Green and red LEDs on the upper left corner of the bezel provide self-test indications during power-up.

NOTE

When power is applied to the standby airspeed indicator, the green and red LEDs flash and the standby airspeed indicator needle rotates clockwise to the maximum limit, then counterclockwise to the zero-park position. After completion of the needle travel test, the needle returns to the measured pressure, and normal operation of the instrument begins.

If the red LED illuminates or the green LED is dark, the instrument is not operational and maintenance is required.

The instrument pointer may be tested by pushing the built-in test (BIT) switch on the lower right bezel.

STANDBY ALTIMETER DISPLAY

The standby altimeter displays aircraft altitude (Figure 16-51). The instrument measures the static air pressure directly from the pilot-side static system. It presents the baro-corrected altitude on a digital readout at the top center of the instrument dial, and a pointer displays the precise altitude on the dial markings. A barometric-setting knob is on the lower-left corner of the altimeter. The setting appears in a digital readout as hectoPascals (MB) on the lower-left face and inches of mercury (INHG) on the lower-right face of the instrument dial.

Green and red LEDs on the upper left corner of the bezel provide self-test indications during power-up.

Figure 16-51. Standby Altimeter

Figure 16-52. Magnetic Compass

NOTE

When power is applied to the standby altimeter, the green and red LEDs flash. The standby altimeter needle moves to the zero park position and then returns to the measured pressure once normal operation of the instrument begins.

When the power-up self-test is complete, verify the green LED illuminates, and the indicator needle reads the current altimeter barometric setting. If the red LED illuminates, the instrument is not operational, and maintenance is required.

The instrument pointer may be tested by pushing the BIT switch on the lower right bezel.

STANDBY MAGNETIC COMPASS

The standby magnetic compass is on the windshield post above the assist handle (Figure 16-52). It uses a standard magnetic compass wheel inside a kerosene-filled chamber, viewed through a window in the front of the instrument. The compass has a calibration placard on the windshield post. Aircraft heading appears in the window under the lubber line in the center of the window.

CAUTION

Avoid placing metal or magnetic objects near the compass, because these can cause errors.

NOTE

Magnetic compass is influenced by the windshield heat, cockpit fan, and fresh air fan. These items must be off prior to referencing magnetic compass heading, then may be reselected on. The items must then be reselected off prior to each referencing of the magnetic compass.