SECTION 7 AUTOMATIC FLIGHT CONTROL SYSTEM

7.1 AFCS OVERVIEW

> **NOTE:** *The approved current, pertinent flight manual always supersedes the information in this Pilot's Guide.*

> **NOTE:** *A failure of the primary (#1) Integrated Avionics Unit (IAU) results in loss of the Flight Director. Any IAU failure results in loss of the autopilot and manual electric trim.*

The Garmin AFCS is a digital Automatic Flight Control System (AFCS), fully integrated within the avionics architecture. The System Overview section provides a block diagram to support this system description.

The Garmin AFCS can be divided into these main operating functions:

- **Flight Director (FD)** — Flight Director operation takes place within the primary (#1) IAU. Flight Director commands are displayed on the PFD. The Flight Director provides:
  - Command Bars showing pitch/roll guidance
  - Pitch/roll mode selection and processing
  - Autopilot communication
- **Autopilot (AP)** — Autopilot operation occurs within the pitch, roll, and pitch trim servo and provides servo monitoring and automatic flight control in response to Flight Director steering commands, AHRS attitude and rate information, and airspeed.
- **Yaw Damper (YD**) — The yaw servo is self-monitoring and provides Dutch roll damping and turn coordination in response to yaw rate, roll angle, vertical acceleration, and airspeed.
- **Manual Electric Trim (MET)** — The pitch trim servo provides manual electric trim capability when the autopilot is not engaged.

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AFCS CONTROLS

The AFCS Controls are positioned on the MFD, and has the following controls:

1. **AP Key**   - Engages/disengages the autopilot
2. **FD Key**   - Activates/deactivates the Flight Director only
                       - Pressing once turns on the Flight Director in the default pitch and roll modes. Pressing again deactivates the Flight Director and removes the Command Bars. If the autopilot is engaged, the key is disabled.
3. **NAV Key**   - Selects/deselects Navigation Mode
4. **ALT Key**   - Selects/deselects Altitude Hold Mode
5. **VS Key**   - Selects/deselects Vertical Speed Mode
6. **FLC Key**   - Selects/deselects Flight Level Change Mode
7. **YD Key**   - Engages/disengages the yaw damper
8. **HDG Key**   - Selects/deselects Heading Select Mode
9. **APR Key**   - Selects/deselects Approach Mode
10. **VNV Key**   - Selects/deselects Vertical Path Tracking Mode for Vertical Navigation flight control
11. **NOSE UP/ NOSE DN Keys** - Control the mode reference in Pitch Hold, Vertical Speed, and Flight Level Change modes
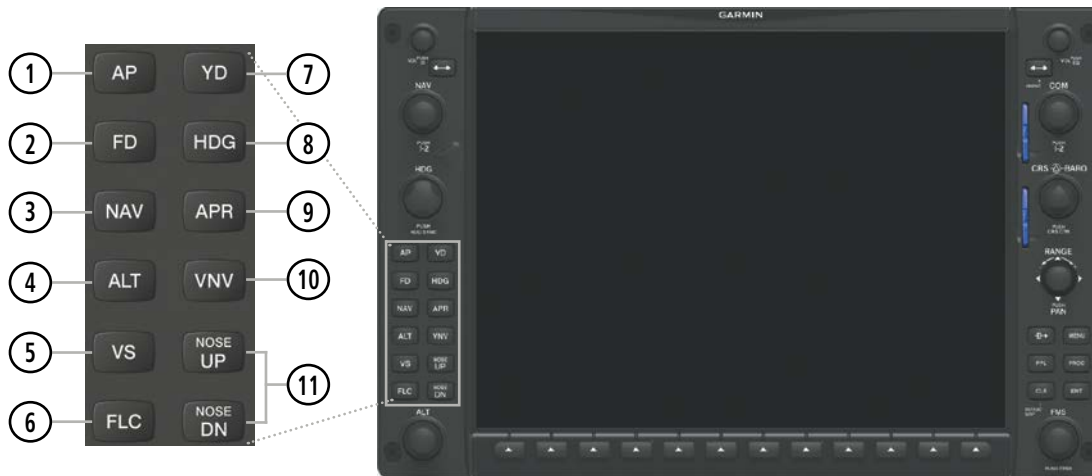

Figure 7-1 Dedicated MFD AFCS Controls

ADDITIONAL AFCS CONTROLS

The following AFCS controls are located in the cockpit separately from the MFD:

AP DISC Switch (Autopilot Disconnect)	- Disengages the autopilot and interrupts pitch trim operation - This switch may be used to mute the aural autopilot disconnect alert. - The **AP DISC** Switch is located on each control stick.
CWS Button (Control Wheel Steering)	- While pressed, allows manual control of the aircraft while the autopilot is engaged and synchronizes the Flight Director's Command Bars with the current aircraft pitch (if not in Glideslope Mode) and roll (if in Roll Hold Mode) - Upon release of the **CWS** Button, the Flight Director may establish new reference points, depending on the current pitch and roll modes. CWS operation details are discussed in the Flight Director modes section. - The **CWS** Button is located on the top of the left control stick.
GO AROUND Button (GO AROUND)	- Disengages the autopilot and selects Flight Director Takeoff (on ground) or Go Around (in air) Mode - If an approach procedure is loaded this switch also activates the missed approach when the selected navigation source is GPS or when the navigation source is VOR/LOC and a valid frequency has been tuned. - The **GO AROUND** Button is located on the left hand throttle
AP TRIM Switch (Autopilot Trim)	- Used to command manual electric trim (MET) - This composite switch is split into left and right sides. The left switch is the ARM contact and the right switch controls the DN (forward) and UP (rearward) contacts. The **AP TRIM** ARM switch can be used to disengage the autopilot and to acknowledge an autopilot disconnect alert and mute the associated aural tone. - Manual trim commands are generated only when both sides of the switch are operated simultaneously. If either side of the switch is active separately for more than three seconds, MET function is disabled and 'PTRM' is displayed as the AFCS Status Annunciation on the PFD. The function remains disabled until both sides of the switch are inactivated. - The **AP TRIM** Switch is located on the left control stick.

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BASIC AUTOPILOT OPERATION

This section provides an overview for autopilot engagement and disengagement. A more detailed description follows in Section 7.4.

- **Autopilot Engagement** — The autopilot may be engaged by pushing the **AP** Key. Annunciations regarding the engagement are indicated on the PFD.

- **Autopilot Engagement with Flight Director Off** — Upon engagement, the autopilot will be set to hold the current attitude of the airplane, if the flight director was not previously on. In this case, 'PIT' and 'ROL' will be annunciated.

- **Autopilot Engagement with Flight Director On** — If the flight director is on, the autopilot will smoothly pitch and roll the airplane to capture the FD command bars. The prior flight director modes remain unchanged.

- **Autopilot Disengagement** — The most common way to disconnect the autopilot is to press and release the **AP DISC/AP TRIM** Switch, which is located on the control stick. An autopilot disconnect tone will be heard and annunciated on the PFD. Other ways to disconnect the autopilot include:

  » Pressing the **AP Key**

  » Pressing the **AP TRIM** switch (disengages the autopilot, but leaves the YD engaged)

  » Pulling the autopilot circuit breaker

In the event of unexpected autopilot behavior, pressing and holding the **AP DISC/AP TRIM** Switch will disconnect the autopilot and remove all power to the servos.

7.2 FLIGHT DIRECTOR OPERATION

The Flight Director function provides pitch and roll commands to the AFCS and displays them on the PFD. With the Flight Director activated, the aircraft can be hand-flown to follow the path shown by the Command Bars. Maximum commanded pitch (-15°/+16°) and roll (22°) angles, vertical acceleration, and roll rate are limited to established values. The Flight Director also provides commands to the autopilot.

ACTIVATING THE FLIGHT DIRECTOR

An initial press of a key listed in following table (when the Flight Director is not active) activates the Flight Director in the listed modes. The Flight Director may be turned off and the Command Bars removed from the display by pressing the **FD** Key again. The **FD** Key is disabled when the autopilot is engaged.

Control Pressed	Modes Selected			
	Lateral		Vertical	
FD Key	Roll Hold (default)	ROL	Pitch Hold (default)	PIT
AP Key	Roll Hold (default)	ROL	Pitch Hold (default)	PIT
CWS Button	Roll Hold (default)	ROL	Pitch Hold (default)	PIT
GO AROUND Button	Takeoff (on ground)	TO	Takeoff (on ground)	TO
	Go Around (in air)	GA	Go Around (in air)	GA
ALT Key	Roll Hold (default)	ROL	Altitude Hold	ALT
VS Key	Roll Hold (default)	ROL	Vertical Speed	VS
VNV Key	Roll Hold (default)	ROL	Vertical Path Tracking[1]	VPTH
NAV Key	Navigation[2]	GPS VOR LOC BC	Pitch Hold (default)	PIT
APR Key	Approach[2]	GPS VOR LOC	Pitch Hold (default)	PIT GP GS
HDG Key	Heading Select	HDG	Pitch Hold (default)	PIT

[1] *Valid VNV flight plan must be entered before **VNV** Key press activates the Flight Director.*

[2] *The selected navigation receiver must have a valid VOR or LOC signal or active GPS course before **NAV** or **APR** Key press activates the Flight Director.*

Table 7-1 Flight Director Activation

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AFCS STATUS BOX

Flight Director mode annunciations are displayed on the PFD when the Flight Director is active. Autopilot status is displayed in the center of the AFCS Status Box. Lateral Flight Director modes are displayed on the left and Vertical Modes on the right. Armed modes are annunciated in white and active in green.
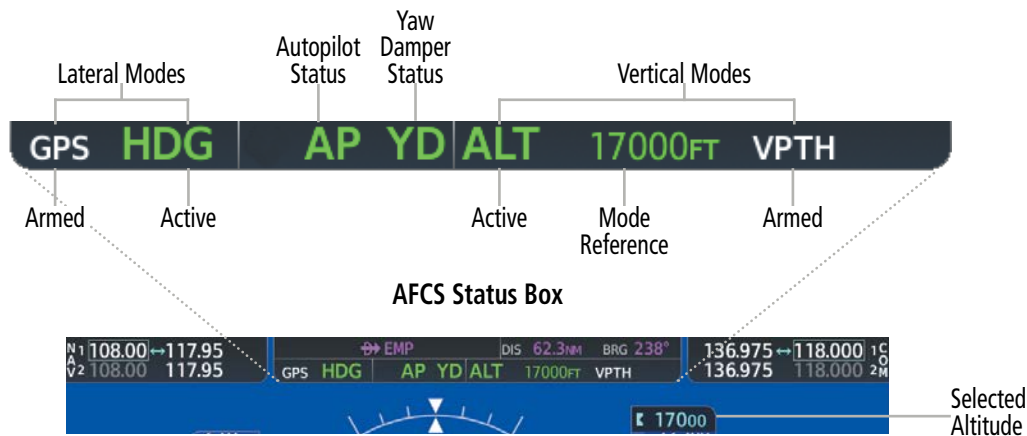

Figure 7-2 PFD AFCS Display

FLIGHT DIRECTOR MODES

Flight Director modes are normally selected independently for the pitch and roll axes. Unless otherwise specified, all mode keys are alternate action (i.e., press on, press off). In the absence of specific mode selection, the Flight Director reverts to the default pitch and/or roll mode(s).

Armed modes are annunciated in white and active in green in the AFCS Status Box. Under normal operation, when the control for the active Flight Director mode is pressed, the Flight Director reverts to the default mode(s) for the axis(es). Automatic transition from armed to active mode is indicated by the white armed mode annunciation moving to the green active mode field and flashing for 10 seconds.

If the information required to compute a Flight Director mode becomes invalid or unavailable, the Flight Director automatically reverts to the default mode for that axis. A flashing yellow mode annunciation and annunciator light indicate loss of sensor (ADC) or navigation data (VOR, LOC, GPS, VNV, SBAS) required to compute commands. When such a loss occurs, the system automatically begins to roll the wings level (enters Roll Hold Mode) or maintain the pitch angle (enters Pitch Hold Mode), depending on the affected axis. The flashing annunciation stops when the affected mode key is pressed or another mode for the axis is selected. If after 10 seconds no action is taken, the flashing annunciation stops.
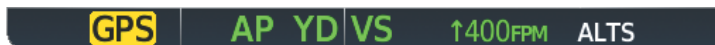

Figure 7-3 Loss of GPS Signal

The flight director is automatically disabled if the attitude information required to compute the default flight director modes becomes invalid or unavailable.

COMMAND BARS

Upon activation of the Flight Director, Command Bars are displayed on the PFD as a single magenta cue. The Command Bars move together vertically to indicate pitch commands and bank left or right to indicate roll commands. The Command Bars do not override the aircraft symbol.

If the attitude information sent to the Flight Director becomes invalid or unavailable, the Command Bars are removed from the display. The Flight Director Command Bars also disappear if either pitch exceeds +30°/-20° or bank exceeds 65°.

Command Bars

Aircraft Symbol

Single Cue Command Bars

Command Bars

Aircraft Symbol

X Pointer Command Bars
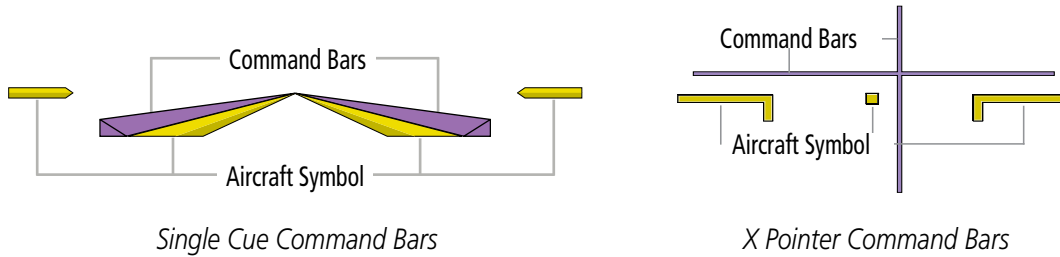
Figure 7-4 Single Cue and X Pointer Command Bars

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7.3 AFCS MODES

The AFCS is capable of operating in a variety of independent Lateral Modes, Vertical Modes and Combination of both the Lateral and Vertical Modes.

VERTICAL MODES

The following table lists the vertical modes with their corresponding controls and annunciations. The mode reference is displayed next to the active mode annunciation for Altitude Hold, Vertical Speed, and Flight Level Change modes. The **NOSE UP/DN** Keys can be used to change the vertical mode reference while operating under Pitch Hold, Vertical Speed, or Flight Level Change Mode.

Vertical Mode	Description	Control	Annunciation		Reference Range	Reference Change Increment
Pitch Hold	Holds the current aircraft pitch attitude; may be used to climb/descend to the Selected Altitude	(default)	PIT		-15° to +16°	0.5°
Selected Altitude Capture	Captures the Selected Altitude	[1]	ALTS			
Altitude Hold	Holds the current Altitude Reference	**ALT** Key	ALT	nnnnn FT		
Vertical Speed	Maintains the current aircraft vertical speed; may be used to climb/descend to the Selected Altitude	**VS** Key	VS	nnnn FPM	-3000 to +1500 fpm	100 fpm
Flight Level Change	Maintains the current aircraft airspeed while the aircraft is climbing/descending to the Selected Altitude	**FLC** Key	FLC	nnn KT	90 to 185 kt	1 kt

[1] ALTS armed automatically when PIT, VS, FLC, TO, or GA active, and under VPTH when Selected Altitude is to be captured instead of VNV Target Altitude

Table 7-2 Flight Director Vertical Modes

PITCH HOLD MODE (PIT)

When the flight director is activated (the **FD** Key is pressed), Pitch Hold Mode is selected by default. Pitch Hold Mode is indicated as the active vertical mode by the 'PIT' annunciation. This mode may be used for climb or descent to the Selected Altitude (shown above the Altimeter), since Selected Altitude Capture Mode is automatically armed when Pitch Hold Mode is activated.

In Pitch Hold Mode, the flight director maintains a constant pitch attitude, the pitch reference. The pitch reference is set to the aircraft pitch attitude at the moment of mode selection. If the aircraft pitch attitude exceeds the flight director pitch command limitations, the flight director commands a pitch angle equal to the nose-up/down limit.

Changing the Pitch Reference

When operating in Pitch Hold Mode, the pitch reference can be adjusted by:

- Using the **NOSE UP/DN** Keys
- Pressing the **CWS** Button, hand-flying the aircraft to establish a new pitch reference, then releasing the **CWS** Button
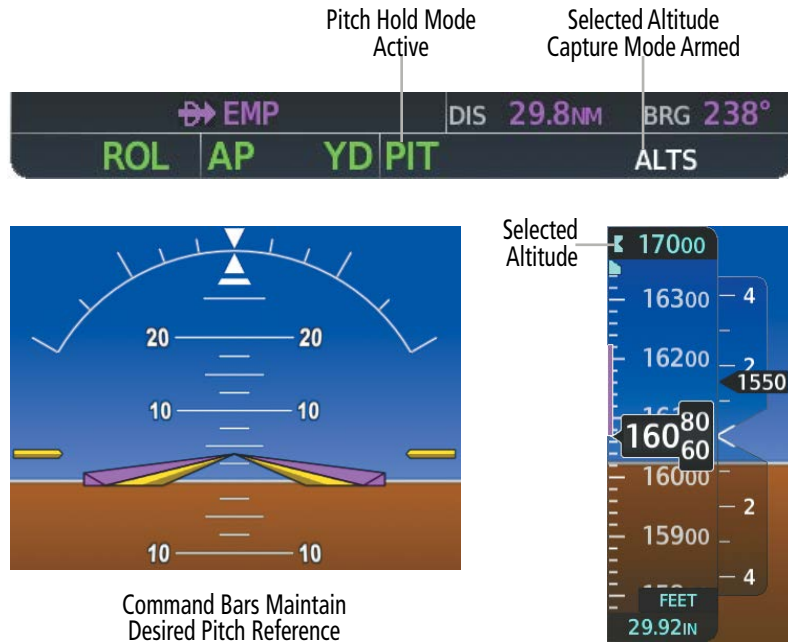

Figure 7-5 Pitch Hold Mode

SELECTED ALTITUDE CAPTURE MODE (ALTS)

Selected Altitude Capture Mode is automatically armed with activation of the following modes:

- » Pitch Hold
- » Vertical Speed
- » Flight Level Change
- » Takeoff/Go Around (if the Selected Altitude is at least 400 feet above the current aircraft altitude)
- » Vertical Path Tracking (if the Selected Altitude is to be captured instead of the VNV Target Altitude)

The white 'ALTS' annunciation indicates Selected Altitude Capture Mode is armed (see previous figure for example). The **ALT** Knob is used to set the Selected Altitude (shown above the Altimeter) until Selected Altitude Capture Mode becomes active.

As the aircraft nears the Selected Altitude, the flight director automatically transitions to Selected Altitude Capture Mode with Altitude Hold Mode armed (next figure). This automatic transition is indicated by the green 'ALTS' annunciation flashing for up to 10 seconds and the appearance of the white 'ALT' annunciation. The Selected Altitude is shown as the Altitude Reference beside the 'ALTS' annunciation.

At 50 feet from the Selected Altitude, the flight director automatically transitions from Selected Altitude Capture to Altitude Hold Mode and holds the Selected Altitude (shown as the Altitude Reference). As Altitude

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Hold Mode becomes active, the white 'ALT' annunciation moves to the active vertical mode field and flashes green for 10 seconds to indicate the automatic transition.
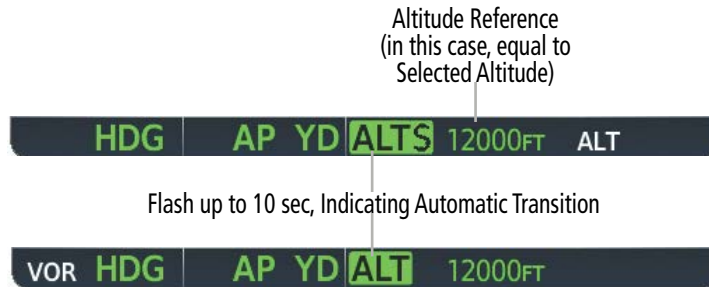

Figure 7-6 Automatic Mode Transitions During Altitude Capture

CHANGING THE SELECTED ALTITUDE

> **NOTE:** *Pressing the **CWS** Button while in Selected Altitude Capture Mode does not cancel the mode.*

Use of the **ALT** Knob to change the Selected Altitude while Selected Altitude Capture Mode is active causes the flight director to revert to Pitch Hold Mode with Selected Altitude Capture Mode armed for the new Selected Altitude.

ALTITUDE HOLD MODE (ALT)

Altitude Hold Mode can be activated by pressing the **ALT** Key; the flight director maintains the current aircraft altitude (to the nearest 10 feet) as the Altitude Reference. The flight director's Altitude Reference, shown in the AFCS Status Box, is independent of the Selected Altitude, displayed above the Altimeter. Altitude Hold Mode active is indicated by a green 'ALT' annunciation in the AFCS Status Box.

Altitude Hold Mode is automatically armed when the flight director is in Selected Altitude Capture Mode. Selected Altitude Capture Mode automatically transitions to Altitude Hold Mode when the altitude error is less than 50 feet. In this case, the Selected Altitude becomes the flight director's Altitude Reference.

CHANGING THE ALTITUDE REFERENCE

> **NOTE:** *Turning the **ALT** Knob while in Altitude Hold Mode changes the Selected Altitude, but not the flight director's Altitude Reference, and does not cancel the mode.*

With the **CWS** Button depressed, the aircraft can be hand-flown to a new Altitude Reference. When the **CWS** Button is released at the desired altitude, the new altitude is established as the Altitude Reference.
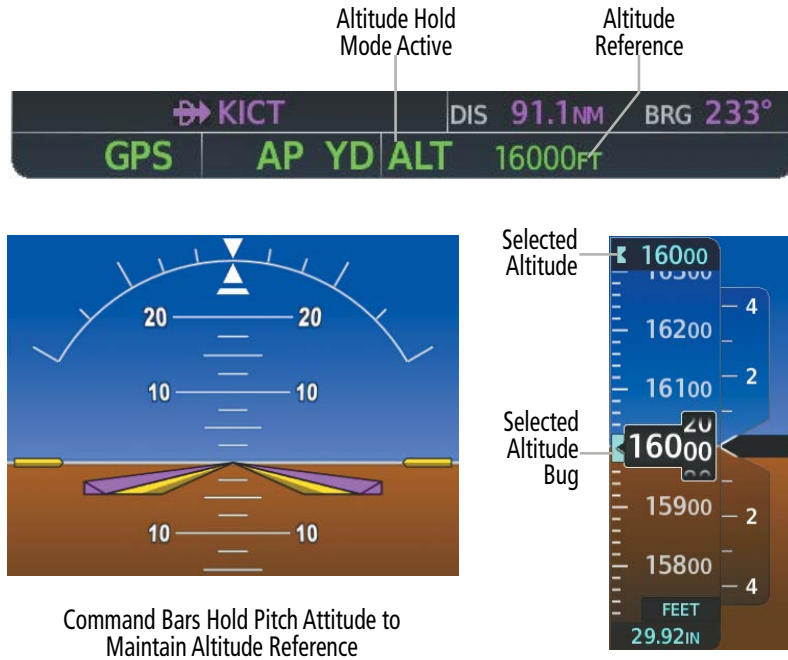
Figure 7-7 Altitude Hold Mode

VERTICAL SPEED MODE (VS)

In Vertical Speed Mode, the flight director acquires and maintains a Vertical Speed Reference. Current aircraft vertical speed (to the nearest 100 fpm) becomes the Vertical Speed Reference at the moment of Vertical Speed Mode activation. This mode may be used for climb or descent to the Selected Altitude (shown above the Altimeter) since Selected Altitude Capture Mode is automatically armed when Vertical Speed Mode is selected.

When Vertical Speed Mode is activated by pressing the **VS** Key, 'VS' is annunciated in green in the AFCS Status Box along with the Vertical Speed Reference. The Vertical Speed Reference is also displayed above the Vertical Speed Indicator. A Vertical Speed Reference Bug corresponding to the Vertical Speed Reference is shown on the indicator.

CHANGING THE VERTICAL SPEED REFERENCE

The Vertical Speed Reference (shown both in the AFCS Status Box and above the Vertical Speed Indicator) may be changed by:

- Using the **NOSE UP/NOSE DN** Keys
- Pressing the **CWS** Button, hand-flying the aircraft to attain a new Vertical Speed Reference, then releasing the **CWS** Button

✓ NOTE: *If the Selected Altitude is reached during CWS maneuvering, the Altitude Reference is not changed. To adjust the Altitude Reference in this case, the* **CWS** *Button must be pressed again after the Selected Altitude is reached.*

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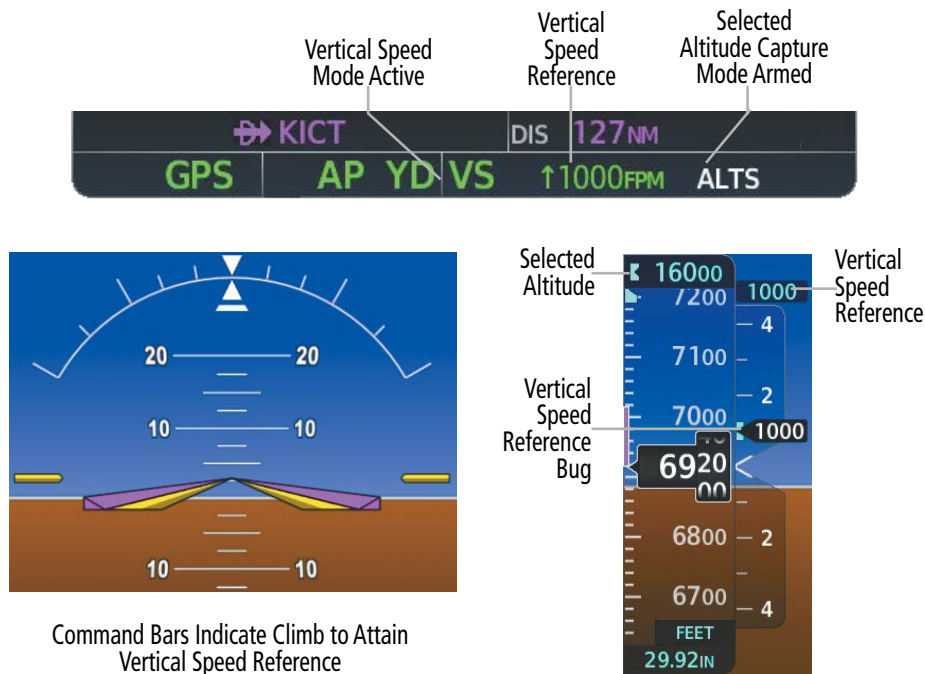**Figure 7-8 Vertical Speed Hold Mode**

FLIGHT LEVEL CHANGE MODE (FLC)

> **NOTE:** *The Selected Altitude should be set before selecting Flight Level Change Mode.*

Flight Level Change Mode is selected by pressing the **FLC** Key. This mode acquires and maintains the Airspeed Reference while climbing or descending to the Selected Altitude (shown above the Altimeter). When Flight Level Change Mode is active, the flight director continuously monitors Selected Altitude, airspeed, and altitude.

The Airspeed Reference is set to the current airspeed upon mode activation. Flight Level Change Mode is indicated by a green 'FLC' annunciation beside the Airspeed Reference in the AFCS Status Box. The Airspeed Reference is also displayed directly above the Airspeed Indicator, along with a bug corresponding to the Airspeed Reference along the tape.

Engine power must be adjusted to allow the autopilot to fly the aircraft at a pitch attitude corresponding to the desired flight profile (climb or descent) while maintaining the Airspeed Reference. The flight director maintains the current altitude until either engine power or the Airspeed Reference are adjusted and does not allow the aircraft to climb or descend away from the Selected Altitude.

CHANGING THE AIRSPEED REFERENCE

The Airspeed Reference (shown in both the AFCS Status Box and above the Airspeed Indicator) may be adjusted by:

- Using the **NOSE UP/NOSE DN** Keys
- Pressing the **CWS** Button, hand-flying the aircraft to attain a new Airspeed Reference, then releasing the **CWS** Button

*NOTE: If the Selected Altitude is reached during CWS maneuvering, the Airspeed Reference is not changed. To adjust the Airspeed Reference in this case, the **CWS** Button must be pressed again after the Selected Altitude is reached.*
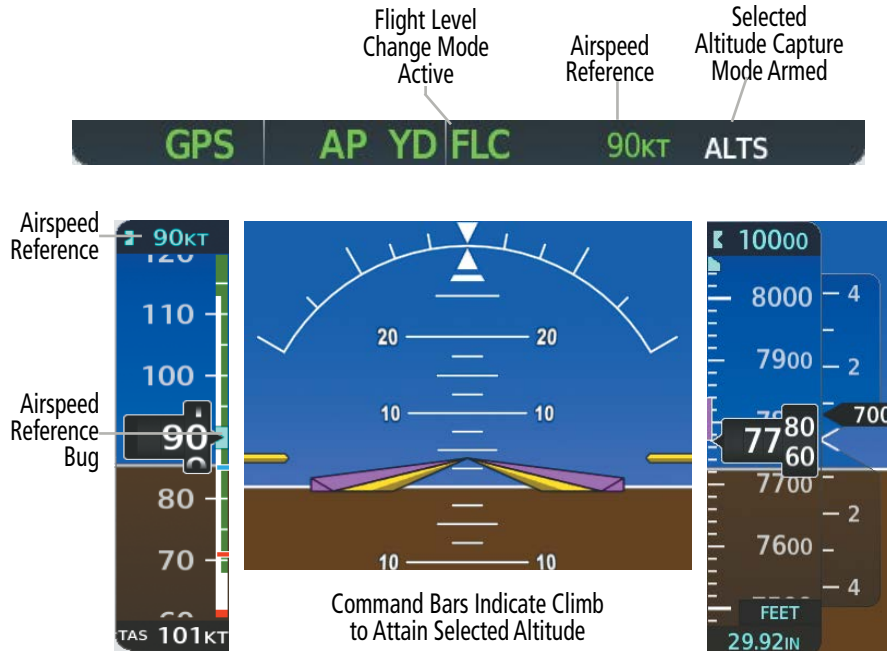

Figure 7-9 Flight Level Change Mode

LATERAL MODES

The following table relates each Garmin AFCS lateral mode to its respective control and annunciation. Refer to the combination modes section for information regarding Go Around and Takeoff modes.

Lateral Mode	Description	Control	Annunciation	Maximum Roll Command Limit
Roll Hold	Holds the current aircraft roll attitude or rolls the wings level, depending on the commanded bank angle	(default)	ROL	25°
Heading Select	Captures and tracks the Selected Heading	**HDG** Key	HDG	25°
Navigation, GPS	Captures and tracks the selected navigation source (GPS, VOR, LOC)	**NAV** Key	GPS	25°
Navigation, VOR Enroute Arm/Capture/Track			VOR	25° Capture 10° Track
Navigation, LOC Capture/Track (No Glideslope)			LOC	25° Capture 10° Track

Table 7-3 Flight Director Lateral Modes

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The **CWS** Button does not change lateral references for Heading Select, Navigation, Backcourse, or Approach Mode. The autopilot guides the aircraft back to the Selected Heading/Course upon release of the **CWS** Button.

ROLL HOLD MODE (ROL)

> **NOTE:** *If Roll Hold Mode is activated as a result of a mode reversion, the flight director rolls the wings level.*

When the flight director is activated or switched, Roll Hold Mode is selected by default. This mode is annunciated as 'ROL' in the AFCS Status Box. The current aircraft bank angle is held, subject to the bank angle condition.

Figure 7-10 Roll Hold Mode Annunciation

Bank Angle	Flight Director Response
< 6°	Rolls wings level
6 to 25°	Maintains current aircraft roll attitude
> 25°	Limits bank to 25°

Table 7-4 Roll Hold Mode Responses

CHANGING THE ROLL REFERENCE

The roll reference can be changed by pressing the **CWS** Button, establishing the desired bank angle, then releasing the **CWS** Button.

HEADING SELECT MODE (HDG)

Heading Select Mode is activated by pressing the **HDG** Key. Heading Select Mode acquires and maintains the Selected Heading. The Selected Heading is shown by a cyan bug on the HSI and in the box to the upper left of the HSI.

CHANGING THE SELECTED HEADING

> **NOTE:** *Pressing the **HDG** Knob synchronizes the Selected Heading to the current heading.*

The Selected Heading is adjusted using the **HDG** Knob. Pressing the **CWS** Button and hand-flying the aircraft does not change the Selected Heading. The autopilot guides the aircraft back to the Selected Heading upon release of the **CWS** Button.

Turns are commanded in the same direction as Selected Heading Bug movement, even if the bug is turned more than 180° from the present heading (e.g., a 270° turn to the right). However, Selected Heading changes of more than 330° at a time result in turn reversals.
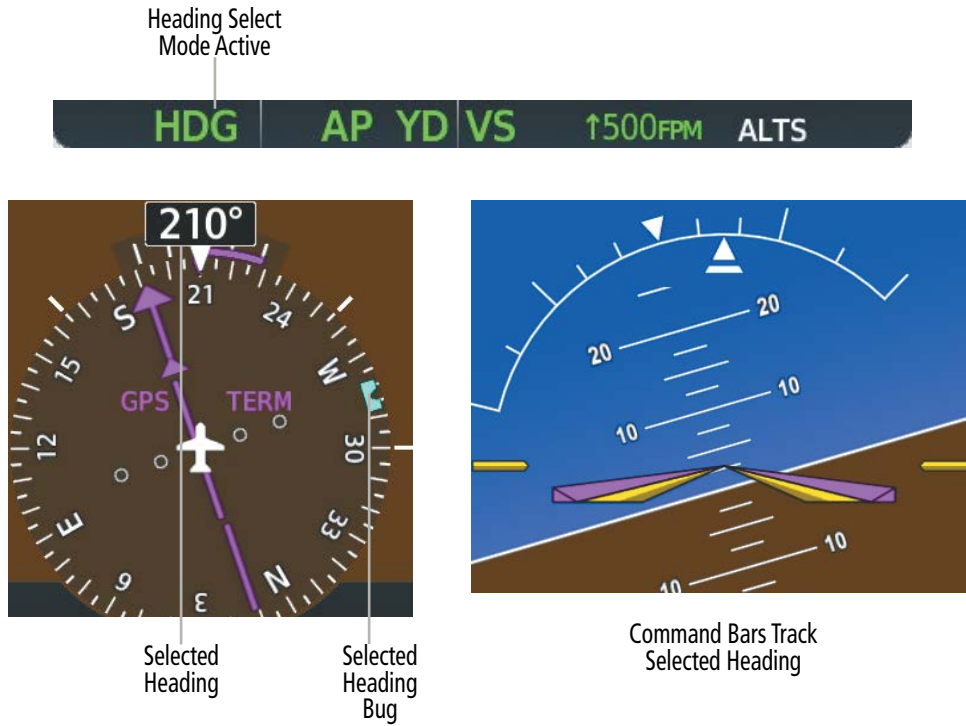
Heading Select
Mode Active

Selected
Heading

Selected
Heading
Bug

Command Bars Track
Selected Heading

Figure 7-11 Heading Select Mode

NAVIGATION MODES (GPS, VOR, LOC)

NOTE: The selected navigation receiver must have a valid VOR or LOC signal or active GPS course for the flight director to enter Navigation Mode.

Pressing the **NAV** Key selects Navigation Mode. Navigation Mode acquires and tracks the selected navigation source (GPS, VOR, LOC). The flight director follows GPS roll steering commands when GPS is the selected navigation source. When the navigation source is VOR or LOC, the flight director creates roll steering commands from the Selected Course and deviation. Navigation Mode can also be used to fly non-precision GPS and LOC approaches where vertical guidance is not required.

If the Course Deviation Indicator (CDI) shows greater than one dot when the **NAV** Key is pressed, the selected mode is armed. If the CDI shows less than one dot, Navigation Mode is automatically captured when the **NAV** Key is pressed. The armed annunciation appears in white to the left of the active lateral mode.

Figure 7-12 GPS Navigation Mode Armed

When the CDI has automatically switched from GPS to LOC during a LOC/ILS approach, GPS Navigation Mode remains active, providing GPS steering guidance until the localizer signal is captured. LOC Navigation Mode is armed automatically when the navigation source switch takes place if the **APR** Key is not pressed prior to the automatic source switch.

If Navigation Mode is active and either of the following occur, the flight director reverts to Roll Hold Mode (wings rolled level):

» Different VOR tuned while in VOR Navigation Mode (VOR Navigation Mode reverts to armed)

» Navigation source manually switched (with the **CDI** Softkey)

» During a LOC/ILS approach, the FAF is crossed while in GPS Navigation Mode after the automatic navigation source switch from GPS to LOC

CHANGING THE SELECTED COURSE

If the navigation source is VOR or localizer or OBS Mode has been enabled when using GPS, the Selected Course is controlled using the **CRS** Knob. Pressing the **CWS** Button and hand-flying the aircraft does not change the Selected Course while in Navigation Mode. The autopilot guides the aircraft back to the Selected Course (or GPS flight plan) when the **CWS** Button is released.

GPS Navigation
Mode Active

DIS 127NM

GPS   AP YD VS   ↑1000FPM   ALTS

218°
CRS 236°
GPS   ENR
XTK 2.81NM

GPS is Selected
Navigation Source

Selected
Course

Command Bars Indicate Right
Turn to Track GPS Course
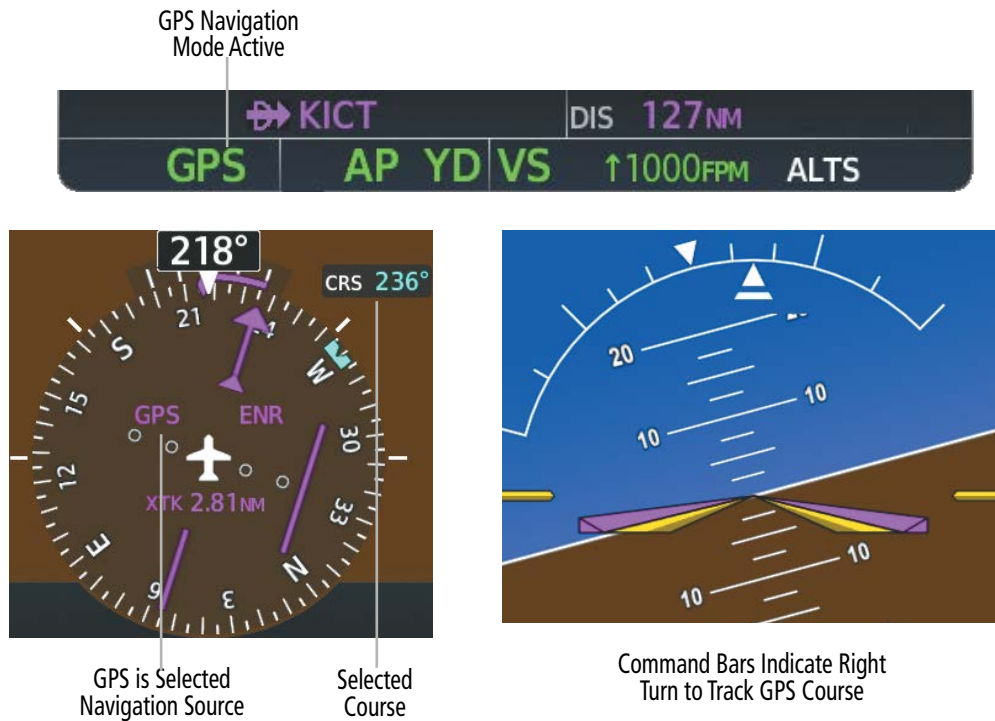
Figure 7-13 Navigation Mode

COMBINATION MODES (VNV, APR, NAV, BC, GA)

The following table lists the modes that operating by using both Vertical and Lateral Modes with their corresponding controls and annunciations.

Mode	Description	Control	Annunciation	Maximum Roll Command Limit	Reference Range
Vertical Path Tracking	Captures and tracks descent legs of an active vertical profile	**VNV** Key	VPTH		
VNV Target Altitude Capture	Captures the Vertical Navigation (VNV) Target Altitude	[1]	ALTV		
Glidepath	Captures and tracks the SBAS glidepath on approach	**APR** Key	GP		
Glideslope	Captures and tracks the ILS glideslope on approach		GS		
Backcourse Arm/Capture/Track	Captures and tracks a localizer signal for backcourse approaches	**BC** Key	BC	25°	
Approach, GPS Arm/Capture/Track			GPS	25°	
Approach, VOR Arm/Capture/Track	Captures and tracks the selected navigation source (GPS, VOR, LOC)	**APR** Key	VAPP	25°	
Approach, ILS Arm/Capture/Track (Glideslope Mode automatically armed)			LOC	25°	
Takeoff	Commands a constant pitch angle and wings level on the ground in preparation for takeoff	**GO-AROUND** Button	TO	6°	
Go Around[2]	Commands a constant pitch angle and wings level in the air	**GO-AROUND** Button	GA	6°	
Level	Autopilot engages and commands pitch angle necessary to establish zero vertical fpm	[3]	LVL	N/A	

[1] ALTV is armed automatically under VPTH when VNV Target Altitude is to be captured instead of Selected Altitude.

[2] Go Around mode disengages the autopilot unless a compatible lift computer is installed.

[3] Level mode can only become activated as a function of Electronic Stability and Protection (ESP). Refer to the Additional Features section for a detailed discussion of the optional ESP feature.

Table 7-5 Flight Director Combination Modes

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VERTICAL NAVIGATION MODES (VPTH, ALTV)

> **NOTE:** *VNV is disabled when parallel track or Dead Reckoning Mode is active.*

> **NOTE:** *The Selected Altitude takes precedence over any other vertical constraints.*

Vertical Navigation (VNV) flight control is available for enroute/terminal cruise and descent operations any time that VNV flight planning is available. Refer to the Flight Managment Section for more information on VNV flight plans. Conditions for availability include, but are not limited to:

» The selected navigation source is GPS.

» A VNV flight plan (with at least one altitude-constrained waypoint) or vertical direct-to is active.

» VNV is enabled (**VNV** Softkey pressed on the MFD).

» Crosstrack error is valid and within certain limits.

» Desired/actual track are valid or track angle error is within certain limits.

» The VNV Target Altitude of the active waypoint is no more than 250 ft above the current aircraft altitude.

The flight director may be armed for VNV at any time, but no target altitudes are captured during a climb. The Command Bars provide vertical profile guidance based on specified altitudes (entered manually or loaded from the database) at waypoints in the active flight plan or vertical direct-to. The appropriate VNV flight control modes are sequenced by the flight director to follow the path defined by the vertical profile. Upon reaching the last waypoint in the VNV flight plan, the flight director transitions to Altitude Hold Mode and cancels any armed VNV modes.

Vertical Path Tracking Mode (VPTH)

> **NOTE:** *If another vertical mode key is pressed while Vertical Path Tracking Mode is selected, Vertical Path Tracking Mode reverts to armed.*

> **NOTE:** *Pressing the **CWS** Button while Vertical Path Tracking Mode is active does not cancel the mode. The autopilot guides the aircraft back to the descent path upon release of the **CWS** Button.*

When a vertical profile (VNV flight plan) is active and the **VNV** Key is pressed, Vertical Path Tracking Mode is armed in preparation for descent path capture. 'VPTH' (or '/V' when Glidepath or Glideslope Mode is concurrently armed) is annunciated in white in addition to previously armed modes. If applicable, the appropriate altitude capture mode is armed for capture of the next VNV Target Altitude (ALTV) or the Selected Altitude (ALTS), whichever is greater.

| GPS | | AP YD | ALT | 27000FT | VPTH | GP |
| GPS | | AP YD | VS | ↓700FPM | ALTV | GP/V |

Figure 7-14 Vertical Path Tracking Armed Annunciations

Prior to descent path interception, the Selected Altitude must be set below the current aircraft altitude by at least 75 feet. For the flight director to transition from Altitude Hold to Vertical Path Tracking Mode, acknowledgment is required within five minutes of descent path interception by:

- Pressing the **VNV** Key
- Adjusting the Selected Altitude

If acknowledgment is not received within one minute of descent path interception, the white 'VPTH' annunciation starts to flash. Flashing continues until acknowledged or the descent path is intercepted. If the descent is not confirmed by the time of interception, Vertical Path Tracking Mode remains armed and the descent is not captured.

In conjunction with the "TOD [top of descent] within 1 minute" annunciation in the Navigation Status Box and the "Vertical track" voice message, VNV indications (VNV Target Altitude, vertical deviation, and vertical speed required) appear on the PFD in magenta.
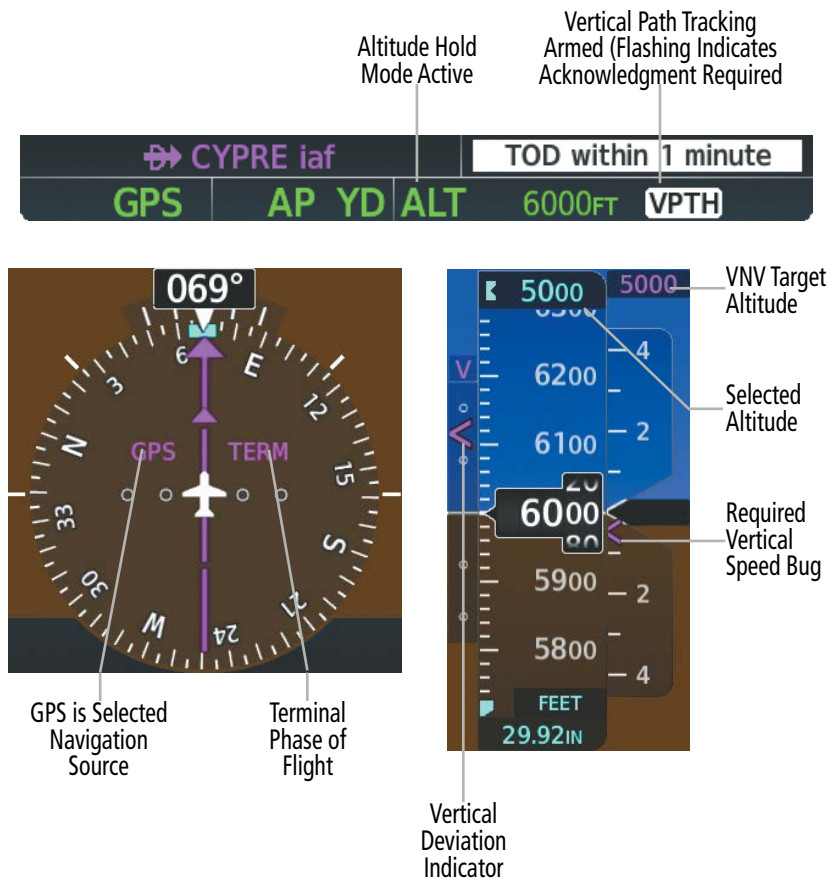
Figure 7-15 Vertical Path Capture

When a descent leg is captured (i.e., vertical deviation becomes valid), Vertical Path Tracking becomes active and tracks the descent profile (next figure). An altitude capture mode ('ALTS' or 'ALTV') is armed as appropriate.
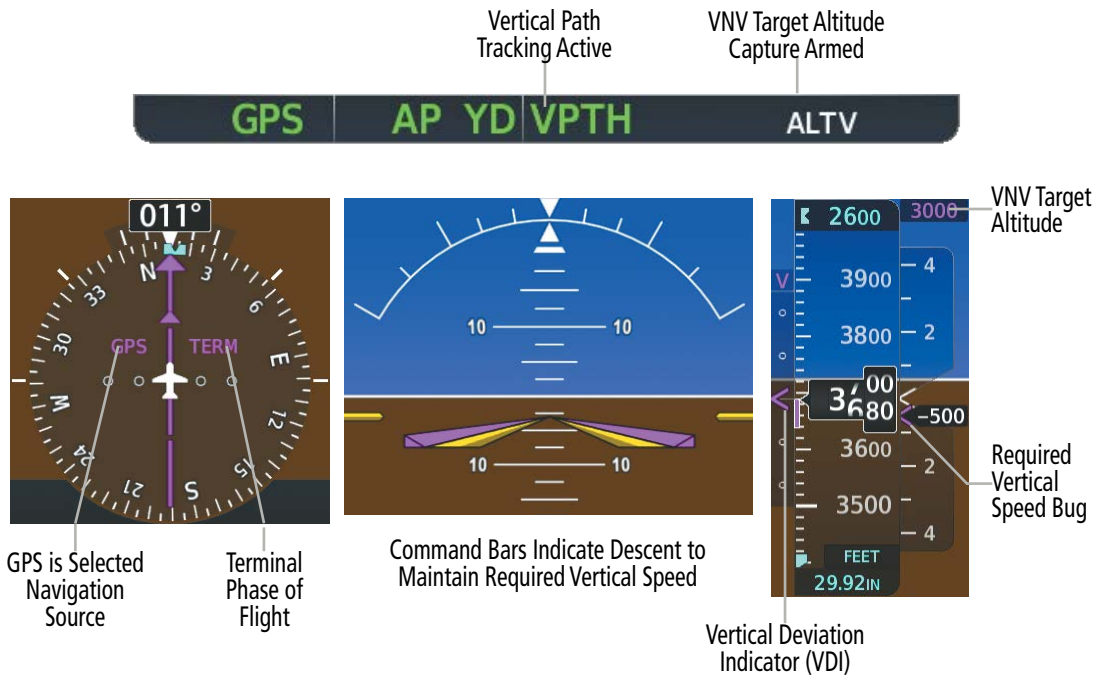
Figure 7-16 Vertical Path Tracking Mode

If the altimeter barometric setting is adjusted while Vertical Path Tracking is active, the flight director increases/decreases the descent rate by up to 500 fpm to re-establish the aircraft on the descent path (without commanding a climb). Adjusting the altimeter barometric setting creates discontinuities in VNV vertical deviation, moving the descent path. For large adjustments, it may take several minutes for the aircraft to re-establish on the descent path. If the change is made while nearing a waypoint with a VNV Target Altitude, the aircraft may not re-establish on the descent path in time to meet the vertical constraint.

Automatic Reversion to Pitch Hold Mode

Several situations can occur while Vertical Path Tracking Mode is active which cause the flight director to revert to Pitch Hold Mode:

→ Vertical deviation exceeds 200 feet during an overspeed condition.

→ Vertical deviation experiences a discontinuity that both exceeds 200 feet in magnitude and results in the vertical deviation exceeding 200 feet in magnitude. Such discontinuities are usually caused by flight plan changes that affect the vertical profile.

→ Vertical deviation becomes invalid (the Vertical Deviation Indicator is removed from the PFD).

→ A display enters Reversionary Mode (this does not apply to an active vertical direct-to).

Unless VNV is disabled, Vertical Path Tracking Mode and the appropriate altitude capture mode become armed following the reversion to Pitch Hold Mode to allow for possible profile recapture.

Non-Path Descents

Pitch Hold, Vertical Speed, and Flight Level Change modes can also be used to fly non-path descents while VNV flight control is selected. If the **VS** or **FLC** Key is pressed while Vertical Path Tracking Mode is selected, Vertical Path Tracking Mode reverts to armed along with the appropriate altitude capture mode to allow profile re-capture.

Figure 7-17 Flight Level Change VNV Non-Path Descent

To prevent immediate profile re-capture, the following must be satisfied:

➔ At least 10 seconds have passed since the non-path transition was initiated

➔ Vertical deviation from the profile has exceeded 250 feet, but is now less than 200 feet

Pressing the **VNV** Key twice re-arms Vertical Path Tracking for immediate profile re-capture.

VNV Target Altitude Capture Mode (ALTV)

> *NOTE: Armed VNV Target Altitude and Selected Altitude capture modes are mutually exclusive. However, Selected Altitude Capture Mode is armed implicitly (not annunciated) whenever VNV Target Altitude Capture Mode is armed.*

VNV Target Altitude Capture is analogous to Selected Altitude Capture Mode and is armed automatically after the **VNV** Key is pressed and the next VNV Target Altitude is to be intercepted before the Selected Altitude. The annunciation 'ALTV' indicates the VNV Target Altitude is to be captured. VNV Target Altitudes are shown in the active flight plan or vertical direct-to, and can be entered manually or loaded from a database (see the Flight Management Section for details). At the same time as "TOD within 1 minute" is annunciated in the Navigation Status Box, the active VNV Target Altitude is displayed above the Vertical Speed Indicator.

As the aircraft nears the VNV Target Altitude, the flight director automatically transitions to VNV Target Altitude Capture Mode with Altitude Hold Mode armed. This automatic transition is indicated by the green 'ALTV' annunciation flashing for up to 10 seconds and the appearance of the white 'ALT' annunciation. The VNV Target Altitude is shown as the Altitude Reference beside the 'ALTV' annunciation and remains displayed above the Vertical Speed Indicator. The Required Vertical Speed Indication (RVSI) is removed once VNV Target Altitude Capture Mode becomes active.

At 50 feet from the VNV Target Altitude, the flight director automatically transitions from VNV Target Altitude Capture to Altitude Hold Mode and tracks the level leg. As Altitude Hold Mode becomes active, the white 'ALT' annunciation moves to the active vertical mode field and flashes green for 10 seconds to indicate the automatic transition. The flight director automatically arms Vertical Path Tracking, allowing upcoming descent legs to be captured and subsequently tracked.
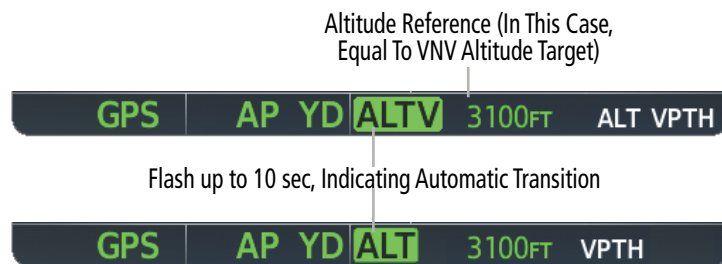

Figure 7-18 Automatic Mode Transitions During Altitude Capture

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CHANGING THE VNV TARGET ALTITUDE

✓ **NOTE:** *Pressing the **CWS** Button while in VNV Target Altitude Capture Mode does not cancel the mode.*

Changing the current VNV Target Altitude while VNV Target Altitude Capture Mode is active causes the flight director to revert to Pitch Hold Mode. Vertical Path Tracking and the appropriate altitude capture mode are armed in preparation to capture the new VNV Target Altitude or the Selected Altitude, depending on which altitude is to be intercepted first.

VNV target altitudes can be changed while editing the active flight plan (see the Flight Management Section for details).

GLIDEPATH MODE (GP)

Glidepath Mode is used to track the SBAS-based glidepath. When Glidepath Mode is armed, 'GP' is annunciated in white in the AFCS Status Box.

Selecting Glidepath Mode:

1) Ensure a GPS approach is loaded into the active flight plan. The active waypoint must be part of the flight plan (cannot be a direct-to a waypoint not in the flight plan).

2) Ensure that GPS is the selected navigation source (use the **CDI** Softkey to cycle through navigation sources if necessary).

3) Press the **APR** Key.

✓ **NOTE:** *Some RNAV (GPS) approaches provide a vertical descent angle as an aid in flying a stabilized approach. These approaches are NOT considered Approaches with Vertical Guidance (APV). Approaches that are annunciated on the HSI as LNAV or LNAV+V should be flown to an MDA, until visual with the landing surface, even though vertical glidepath (GP) information may be provided.*

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

Upon reaching the glidepath, the flight director transitions to Glidepath Mode and begins to capture and track the glidepath.

Figure 7-19 Glidepath Mode Armed

Once the following conditions have been met, the glidepath can be captured:

» A GPS approach with vertical guidance (LPV, LNAV/VNAV, LNAV+V) is loaded into the active flight plan.

» The active waypoint is at or after the final approach fix (FAF).

» Vertical deviation is valid.

» The CDI is at less than full-scale deviation

» Automatic sequencing of waypoints has not been suspended (no 'SUSP' annunciation on the HSI)

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> **NOTE:** *Pressing the **CWS** Button while Glidepath Mode is active does not cancel the mode. The autopilot guides the aircraft back to the glidepath upon release of the **CWS** Button.*
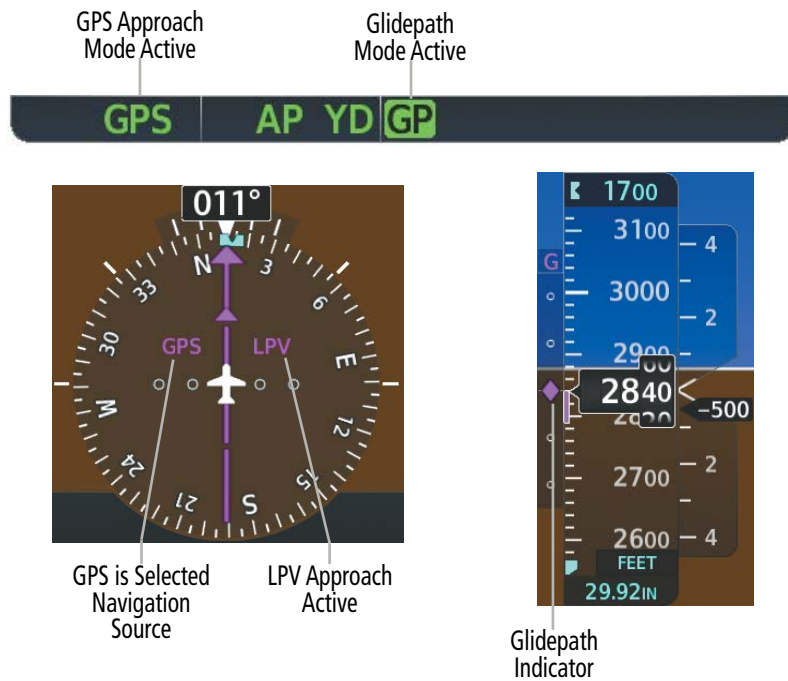

Figure 7-20 Glidepath Mode

GLIDESLOPE MODE (GS)

Glideslope Mode is available for LOC/ILS approaches to capture and track the glideslope. When Glideslope Mode is armed (annunciated as 'GS' in white), LOC Approach Mode is armed as the lateral flight director mode.

Selecting Glideslope Mode:

1) Ensure a valid localizer frequency is tuned.

2) Ensure that LOC is the selected navigation source (use the **CDI** Softkey to cycle through navigation sources if necessary).

3) Press the **APR** Key.

   Or:

1) Ensure that GPS is the selected navigation source (use the **CDI** Softkey to cycle through navigation sources if necessary).

2) Ensure a LOC/ILS approach is loaded into the active flight plan.

3) Ensure the corresponding LOC frequency is tuned.

4) Press the **APR** Key.

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| LOC | HDG | AP YD | ALT | 9000FT | GS |

Figure 7-21 Glideslope Mode Armed

Once LOC is the navigation source, the localizer and glideslope can be captured. Upon reaching the glideslope, the flight director transitions to Glideslope Mode and begins to capture and track the glideslope.

✓ **NOTE:** *Pressing the **CWS** Button while Glideslope Mode is active does not cancel the mode. The autopilot guides the aircraft back to the glideslope upon release of the **CWS** Button.*
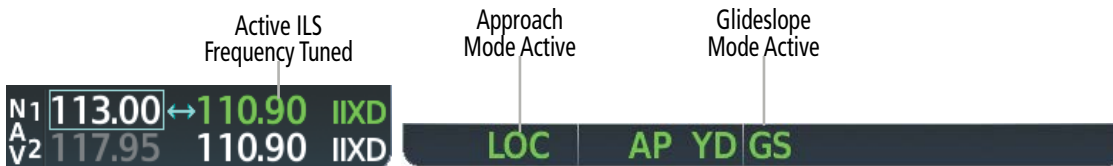
Figure 7-22 Glideslope Mode

APPROACH MODES (GPS, VAPP, LOC)

✓ **NOTE:** *The selected navigation receiver must have a valid VOR or LOC signal or active GPS course for the flight director to enter Approach Mode.*

Approach Mode is activated when the **APR** Key is pressed. Approach Mode acquires and tracks the selected navigation source (GPS, VOR, or LOC), depending on loaded approach. This mode uses the selected navigation receiver deviation and desired course inputs to fly the approach. Pressing the **APR** Key when the CDI is greater than one dot arms the selected approach mode (annunciated in white to the left of the active lateral mode). If the CDI is less the 1 dot, the LOC is automatically captured when the **APR** Key is pressed.

VOR Approach Mode (VAPP) provides greater sensitivity for signal tracking than VOR Navigation Mode.

Selecting VOR Approach Mode:

1) Ensure a valid VOR frequency is tuned

2) Ensure that VOR is the selected navigation source (use the **CDI** Softkey to cycle through navigation sources if necessary).

3) Press the **APR** Key.

When GPS Approach Mode is armed, Glidepath Mode is also armed.

Selecting GPS Approach Mode:

1) Ensure a GPS approach is loaded into the active flight plan. The active waypoint must be part of the flight plan (cannot be a direct-to a waypoint not in the flight plan).

2) Ensure that GPS is the selected navigation source (use the **CDI** Softkey to cycle through navigation sources if necessary).

3) Press the **APR** Key.

Figure 7-23 GPS Approach Mode Armed

LOC Approach Mode allows the autopilot to fly a LOC/ILS approach with a glideslope. When LOC Approach Mode is armed, Glideslope Mode is also armed automatically. LOC captures are inhibited if the difference between aircraft heading and localizer course exceeds 105°.

Selecting LOC Approach Mode:

1) Ensure a valid localizer frequency is tuned.

2) Ensure that LOC is the selected navigation source (use the **CDI** Softkey to cycle through navigation sources if necessary).

3) Press the **APR** Key.

   Or:

1) Ensure that GPS is the selected navigation source (use the **CDI** Softkey to cycle through navigation sources if necessary).

2) Ensure a LOC/ILS approach is loaded into the active flight plan.

3) Ensure the corresponding LOC frequency is tuned.

4) Press the **APR** Key.

If the following occurs, the flight director reverts to Roll Hold Mode (wings rolled level):

» Approach Mode is active and a Vectors-To-Final is activated

» Approach Mode is active and Navigation source is manually switched

» During a LOC/ILS approach, GPS Navigation Mode is active and the FAF is crossed after the automatic navigation source switch from GPS to LOC

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CHANGING THE SELECTED COURSE

If the navigation source is VOR or localizer or OBS Mode has been enabled when using GPS, the Selected Course is controlled using the **CRS** Knob.

Pressing the **CWS** Button and hand-flying the aircraft does not change the Selected Course while in Approach Mode. The autopilot guides the aircraft back to the Selected Course (or GPS flight plan) when the **CWS** Button is released.

BACKCOURSE MODE (BC)

> NOTE: When making a backcourse approach, set the Selected Course to the localizer front course.

Backcourse Mode captures and tracks a localizer signal in the backcourse direction. Backcourse Mode is armed if the CDI is greater than one dot when the mode is selected. The flight director creates roll steering commands from the Selected Course and deviation when in Backcourse Mode.

Backcourse
Mode Active

BC   AP YD ALT   2060FT

314°

LOC2

LOC2 is Selected Navigation Source

Figure 7-24 Backcourse Mode

CHANGING THE SELECTED COURSE

If the navigation source is VOR or localizer or OBS Mode has been enabled when using GPS, the Selected Course is controlled using the **CRS** Knob.

Pressing the **CWS** Button and hand-flying the aircraft does not reset any reference data while in Backcourse Mode. The autopilot guides the aircraft back to the Selected Course when the **CWS** Button is released.

INTERCEPTING AND FLYING A DME ARC

The AFCS will intercept and track a DME arc that is part of the active flight plan provided that GPS Navigation Mode is engaged, GPS is the active navigation source on the CDI, and the DME arc segment is the active flight plan leg. It is important to note that automatic navigation of DME arcs is based on GPS.

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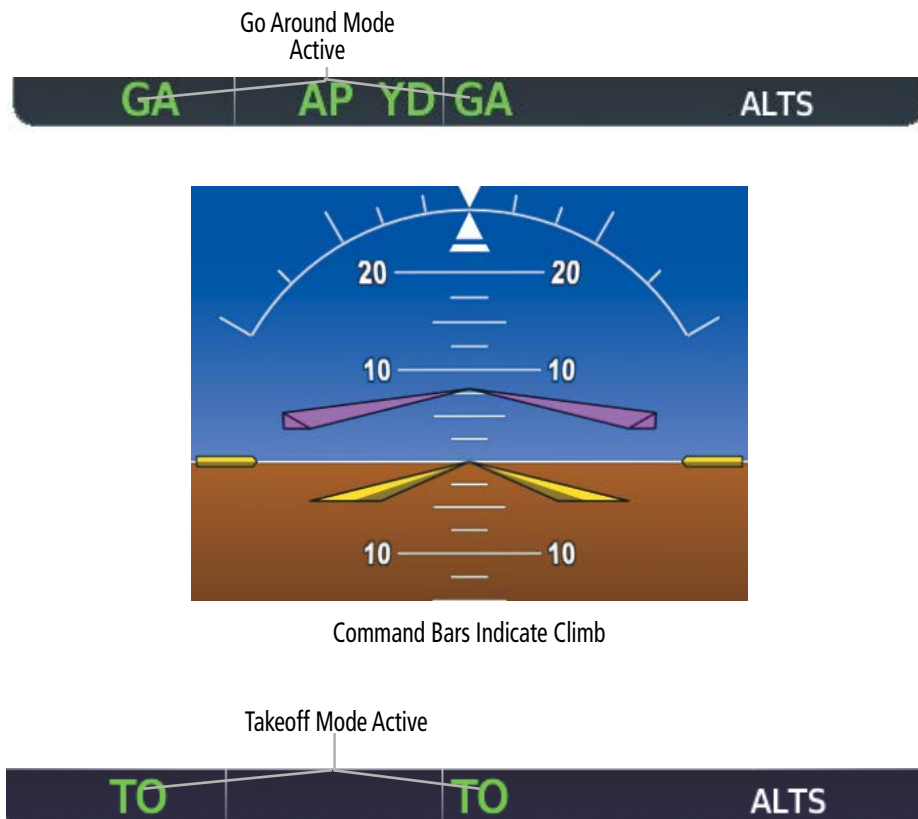
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Thus, even if the APR key is pressed and LOC or VOR Approach Mode is armed prior to reaching the Initial Approach Fix (IAF), Approach Mode will not activate until the arc segment is completed.

If the pilot decides to intercept the arc at a location other than the published IAF (i.e. ATC provides vectors to intercept the arc) and subsequently selects Heading Mode or Roll Mode, the AFCS will not automatically intercept or track the arc unless the pilot activates the arc leg of the flight plan and arms GPS Navigation Mode. The AFCS will not intercept and fly a DME arc before reaching an IAF that defines the beginning of the arc segment. Likewise, if at any point while established on the DME arc the pilot deselects GPS Navigation Mode, the AFCS will no longer track the arc.

TAKEOFF (TO) AND GO AROUND (GA) MODES

Go Around and Takeoff modes are coupled pitch and roll modes and are annunciated as both the vertical and lateral modes when active. In these modes, the flight director commands a constant set pitch attitude and wings level. The **Go Around** Button is used to select both modes. The mode entered by the flight director depends on whether the aircraft is on the ground.

Takeoff Mode provides an attitude reference during rotation and takeoff. This mode can be selected only while on the ground by pushing the **Go Around** Button. The flight director Command Bars assume a wings-level, pitch-up attitude.

Pressing the **Go Around** Button while in the air activates the flight director in wings level, pitch-up attitudes, allowing the execution of a missed approach or a go around.

Command Bars Indicate Climb

Figure 7-25 Takeoff and Go Around Modes

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LEVEL MODE (LVL)

Level (LVL) mode becomes active only as a function of Electronic Stability and Protection (ESP). Refer to the Additional Features section for a detailed discussion of the ESP feature.

When the normal flight envelope thresholds have been exceeded for more than 50% of the last 20 seconds, Level mode is activated. The autopilot will engage and provide input to bring the aircraft back into straight and level flight based on zero degrees roll angle and zero feet per minute vertical speed. An aural "Engaging Autopilot" alert sounds and the lateral and vertical flight director annunciations will display "LVL". The AFCS will remain in Level mode until the pilot selects another mode.

Figure 7-26 Level Mode

7.4 AUTOPILOT AND YAW DAMPER OPERATION

✓ *NOTE: Refer to the current pertinent flight manual for specific instructions regarding emergency procedures.*

The autopilot and yaw damper operate flight control surface servos to provide automatic flight control. The autopilot controls the aircraft pitch and roll attitudes following commands received from the Flight Director. Pitch autotrim provides trim commands to the pitch trim servo to relieve any sustained effort required by the pitch servo. The yaw damper reduces Dutch roll tendencies and coordinates turns.

FLIGHT CONTROL

Pitch and roll commands are provided to the servos, based on the active Flight Director modes. Servo motor control limits the maximum servo speed and torque. The servo mounts are equipped with slip-clutches set to certain values. This allows the servos to be overridden in case of an emergency.

PITCH AXIS AND PITCH TRIM

The autopilot pitch axis uses pitch rate to stabilize the aircraft pitch attitude during upsets and Flight Director maneuvers. Flight Director pitch commands are rate and attitude-limited, combined with pitch damper control, and sent to the pitch servo motor. The pitch servo measures the output effort (torque) and provides this signal to the pitch trim servo. The pitch trim servo commands the motor to reduce the average pitch servo effort.

When the autopilot is not engaged, the pitch trim servo may be used to provide manual electric trim. This allows the aircraft to be trimmed using a control stick switch rather than the trim wheel. Manual trim commands are generated only when both halves of the (Manual Electric Trim Pitch) **MEPT** Switch are operated simultaneously. Trim speeds are scheduled with airspeed to provide more consistent response.

ROLL AXIS

The autopilot roll axis uses roll rate to stabilize aircraft roll attitude during upsets and Flight Director maneuvers. The Flight Director roll commands are rate- and attitude-limited, combined with roll damper control, and sent to the roll servo motor.

YAW AXIS

The yaw damper uses yaw rate and roll attitude to dampen the aircraft's natural Dutch roll response. It also uses lateral acceleration to coordinate turns. Yaw damper operation is independent of autopilot engagement.

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ENGAGEMENT

> **NOTE:** *Autopilot engagement/disengagement is not equivalent to servo engagement/disengagement. Use the CWS Button to disengage the pitch and roll servos while the autopilot remains active.*

When the **AP** Key is pressed, the autopilot, yaw damper, and flight director (if not already active) are activated and the annunciator lights on the AFCS controller for the autopilot and yaw damper are illuminated. The flight director engages in Pitch and Roll Hold Modes when initially activated.

Autopilot Engaged   Yaw Damper Engaged

ROL | AP   YD | PIT   ALTS

Figure 7-27 Autopilot and Yaw Damper Engaged

When the **YD** Key is pressed, the system engages the yaw damper independently of the autopilot and the yaw damper annunciator light is illuminated.

Autopilot and yaw damper status are displayed in the center of the AFCS Status Box. Engagement is indicated by green 'AP' and 'YD' annunciations, respectively.

CONTROL WHEEL STEERING

During autopilot operation, the aircraft may be hand-flown without disengaging the autopilot. Pressing and holding the **CWS** Button disengages the pitch and roll servos from the flight control surfaces and allows the aircraft to be hand-flown. At the same time, the flight director is synchronized to the aircraft attitude during the maneuver. CWS activity has no effect on yaw damper engagement.

The 'AP' annunciation is temporarily replaced by 'CWS' in white for the duration of CWS maneuvers.

Control Wheel Steering

ROL | CWS YD | PIT   ALTS

Figure 7-28 CWS Annunciation

In most scenarios, releasing the **CWS** Button reengages the autopilot with a new reference. Refer to flight director mode descriptions for specific CWS behavior in each mode.

DISENGAGEMENT

The autopilot is manually disengaged by pushing the **AP DISC** Switch**, AP TRIM** ARM Switch, or the **AP** Key on the MFD. Manual disengagement is indicated by a five-second flashing yellow 'AP' annunciation and a two-second autopilot disconnect aural alert. After manual disengagement, the autopilot disconnect aural alert may be cancelled by pushing the **AP TRIM** ARM or **AP DISC** Switch (**AP DISC** Switch also cancels the flashing 'AP' annunciation).

GPS | AP YD | ALT   12000FT

Figure 7-29 Manual Autopilot Disengagement

The **YD** Key or **AP DISC** Switch can be used to disengage the yaw damper. The 'YD' annunciation turns yellow and flashes for five seconds upon disengagement.

Figure 7-30 Yaw Damper Disengagement

Automatic autopilot disengagement is indicated by a flashing red and white 'AP' annunciation and by the autopilot disconnect aural alert, which continue until acknowledged by pushing the **AP DISC** or **AP TRIM** ARM Switch. Automatic autopilot disengagement occurs due to:

- System failure
- Invalid sensor data
- Stall warning
- Inability to compute default flight director modes (FD also disengages automatically)

Yaw damper disengagement is indicated by a five-second flashing yellow 'YD' annunciation. Automatic yaw damper disengagement occurs when autopilot disengagement is caused by failure in a parameter also affecting the yaw damper. This means the yaw damper can remain operational in some cases where the autopilot automatically disengages. A localized failure in the yaw damper system or invalid sensor data also cause yaw damper disengagement.

Figure 7-31 Automatic Autopilot and Yaw Damper Disengagement

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7.5 AFCS ANNUNCIATIONS AND ALERTS

AFCS ALERTS

Alert Condition	Annunciation	Description
Rudder Mistrim Right	**RUD→**	Yaw servo providing sustained force in the indicated direction. Aircraft rudder retrim after substantial pitch and power changes required.
Rudder Mistrim Left	**←RUD**	
Aileron Mistrim Right	**AIL→**	Roll servo providing sustained force in the indicated direction
Aileron Mistrim Left	**←AIL**	
Elevator Mistrim Down	**↓ELE**	Pitch servo providing sustained force in the indicated direction. May indicate a failure of the pitch trim servo or trim system.
Elevator Mistrim Up	**↑ELE**	
Pitch Trim Failure (or stuck **MEPT** Switch)	**PTRM**	If AP engaged, take control of the aircraft and disengage AP If AP disengaged, move **MEPT** switches separately to unstick
Yaw Damper Failure	**YAW**	YD control failure
Roll Failure	**ROLL**	Roll axis control failure; AP inoperative
Pitch Failure	**PTCH**	Pitch axis control failure; AP inoperative
System Failure	**AFCS**	AP and MEPT are unavailable; FD may still be available
Preflight Test	**PFT**	Performing preflight system test; aural alert sounds at completion Do not press the **AP DISC** Switch during servo power-on and preflight system tests as this may cause the preflight system test to fail or never to start (if servos fail their power-on tests). Power must be cycled to the servos to remedy the situation.
	PFT	Preflight system test failed; aural alert sounds at failure

Table 7-6 AFCS Status Alerts

7.6 ABNORMAL OPERATION

OVERSPEED PROTECTION

> ✓ *NOTE: Overspeed protection is not active in ALT, GS or GP modes.*

While Pitch Hold, Vertical Speed, Flight Level Change, Vertical Path Tracking, or an altitude capture mode is active, airspeed is monitored by the flight director. Overspeed protection is provided to limit the flight director's pitch command in situations where the flight director cannot acquire and maintain the mode reference for the selected vertical mode without exceeding Vne.

When Overspeed Protection is active, the Airspeed Reference appears in a box above the Airspeed Indicator, flashing a yellow 'MAXSPD' annunciation. Engine power should be reduced and/or the pitch reference adjusted to slow the aircraft. The annunciation disappears when the overspeed condition is resolved.
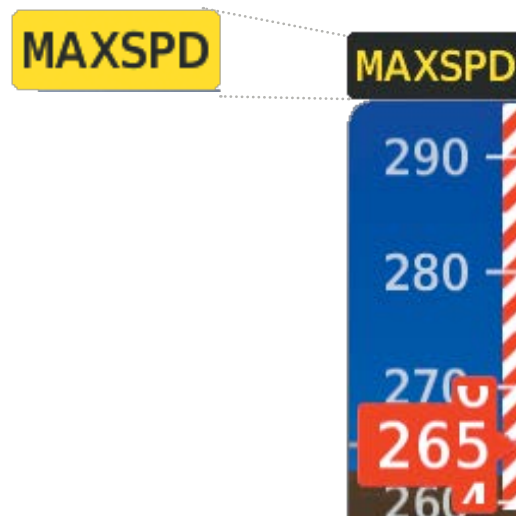
Figure 7-32 Overspeed Annunciation

UNDERSPEED PROTECTION

Underspeed Protection is available when the Electronic Stability and Protection (ESP) system is installed and the autopilot is on. It is designed to discourage aircraft operation below minimum established airspeeds.

When the aircraft reaches a predetermined airspeed (specific to each flap setting), a yellow MINSPD annunciation will appear above the airspeed indicator. When aircraft angle of attack is within four degrees of stall warning, the Pitch Limit Indicator will be displayed approximately four degrees above the aircraft symbol on the pitch attitude indicator. If deceleration continues, the Pitch Limit Indicator will move downward on the pitch attitude indicator until coincident with the aircraft symbol at stall warning angle of attack.

If the aircraft continues to decelerate, Underspeed Protection functionality depends on which vertical flight director mode is selected. For the purpose of this discussion, the vertical flight director modes can be divided into two categories: Those in which it is important to maintain altitude for as long as possible (altitude-critical modes), and those in which maintaining altitude is less crucial (non-altitude critical modes).

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ALTITUDE-CRITICAL MODES (ALT, GS, GP, TO, GA, FLC)

If the aircraft decelerates to stall warning, the lateral and vertical flight director modes will change from active to armed, and the autopilot will provide input causing the aircraft to pitch down and the wings to level.

Lateral and
Vertical FD
Modes Armed

HDG   AP YD ALT   9000FT

Figure 7-33 Lateral and Vertical Flight Director Modes Armed

An aural "AIRSPEED" alert will sound every five seconds and a red "UNDERSPEED PROTECT ACTIVE" annunciation (next figure) will appear to the right of the vertical speed indicator. The pitch down force will continue until the aircraft reaches a pitch attitude at which IAS equals the IAS at which stall warning turns off, plus two knots.

Figure 7-34 Underspeed Protect Active Annunciation

When airspeed increases (as a result of adding power/thrust) to above the IAS at which stall warning turns off, plus two knots, the autopilot will cause the aircraft to pitch up until recapturing the vertical reference. The vertical and lateral flight director modes will change from armed to active, and when aircraft angle of attack reaches approximately five degrees below stall warning angle of attack, the Pitch Limit Indicator will be removed.

NON-ALTITUDE CRITICAL MODES (VS, VNAV, IAS,)

When the airspeed trend vector (specific to each flap setting) reaches a predetermined airspeed, a single aural "AIRSPEED" will sound, alerting the pilot to the impending underspeed condition. If the aircraft decelerates to an IAS below the minimum commandable autopilot airspeed, a red "UNDERSPEED PROTECT ACTIVE" annunciation (previous figure) will appear to the right of the vertical speed indicator. The vertical flight director mode will change from active to armed (next figure), and the autopilot will cause the aircraft to pitch down until reaching a pitch attitude at which IAS equals the minimum commandable autopilot airspeed.

Vertical FD Mode
Armed

HDG   AP YD ALT   9000FT

Figure 7-35 Vertical Flight Director Mode Armed

When airspeed increases (as a result of adding power/thrust) to an IAS above the minimum commandable autopilot airspeed, the autopilot will cause the aircraft to pitch up until recapturing the vertical reference. The vertical flight director mode will change from armed to active, and when aircraft angle of attack reaches approximately five degrees below stall warning angle of attack, the Pitch Limit Indicator will be removed.

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SECTION 8 ADDITIONAL FEATURES

> **NOTE:** *With the availability of SafeTaxi®, ChartView, IFR/VFR, or FliteCharts®, it may be necessary to carry another source of charts on-board the aircraft.*

Additional features of the system include the following:

- SafeTaxi® Diagrams (Optional)
- SurfaceWatch™ (Optional)
- Electronic Charts:
  - FliteCharts® (Optional)
  - ChartView (Optional)
  - IFR/VFR Electronic Charts (Optional)
- Satellite Telephone and Datalink Services (Optional)
- SiriusXM Satellite Radio (Optional)

- Flight Data Logging (Optional)
- Connext® (Optional)
- Wi-Fi connections
- Electronic Stability and Protection (ESP™) System (optional)
- Auxiliary Video (Optional)
- Electronic Checklists

SafeTaxi diagrams provide detailed taxiway, runway, and ramp information at more than 1300 airports in the United States. By decreasing range on an airport that has a SafeTaxi diagram available, a close up view of the airport layout can be seen.

Electronic charts offer the convenience of rapid access to essential flight chart information. FliteCharts (optional) provide AeroNav Services on-board electronic terminal procedures charts. ChartView (optional) provides Jeppesen on-board electronic terminal procedures charts.

The optional Iridium Transceiver provides an airborne low speed datalink, Iridium Satellite Telephone service, and Short Message Service (SMS).

The optional SiriusXM Satellite Radio entertainment audio feature of the SiriusXM Datalink Receiver handles more than 170 channels of music, news, and sports. SiriusXM Satellite Radio offers more entertainment choices and longer range coverage than commercial broadcast stations.

The optional Flight Data Logging feature automatically stores critical flight and engine data on an SD data card. Approximately 1,000 flight hours can be recorded for each 1GB of available space on the card.

The optional Connext feature allows for setting up the installed optional Flight Stream device for a Bluetooth connection between the system and a mobile device running the Garmin Pilot™ application.

WiFi connections allow for transmitting of maintenance data while the aircraft is on the ground and in range of a local WiFi network.

The optional Garmin Electronic Stability and Protection (ESP™) system discourages aircraft operation outside the normal flight envelope.

The system provides a control and display interface to an optional auxiliary video system.

Electronic checklists allow a pilot to quickly find the proper procedure for a particular phase of flight.

8.1 SAFETAXI

SafeTaxi is an enhanced feature that gives greater map detail when viewing airports at close range. The maximum map ranges for enhanced detail are pilot configurable. When viewing at ranges close enough to show the airport detail, the map reveals taxiways with identifying letters/numbers, airport Hot Spots, and airport landmarks including ramps, buildings, control towers, and other prominent features. Resolution is greater at lower map ranges. When the MFD display is within the SafeTaxi ranges, the airplane symbol on the airport provides enhanced position awareness.

Designated Hot Spots are recognized at airports with many intersecting taxiways and runways, and/or complex ramp areas. Airport Hot Spots are outlined to caution pilots of areas on an airport surface where positional awareness confusion or runway incursions happen most often. Hot Spots are defined with a magenta circle or outline around the region of possible confusion.

Any map page that displays the navigation view can also show the SafeTaxi airport layout within the maximum configured range. The following is a list of pages where the SafeTaxi feature can be seen:

- 'Map - Navigation Map' Page
- 'Map - Weather Data Link' Page
- Inset Map (PFD)
- 'WPT - Airport Information' Page
- 'WPT - Intersection Information' Page
- 'WPT - NDB Information' Page
- 'WPT - VOR Information' Page
- 'WPT - VRP WPT Information' Page
- 'WPT - User WPT Information' Page
- 'Aux - Trip Planning' Page
- The Nearest Pages
- 'FPL - Active Flight Plan' Page
- 'FPL - Flight Plan Catalog' Page
- 'FPL - SurfaceWatch Setup' Page

During ground operations the aircraft's position is displayed in reference to taxiways, runways, and airport features. In the example shown, the aircraft is on taxiway Alpha near the High Alert Intersection boundary on KAPA airport. Airport Hot Spots are outlined in magenta. When panning over the airport, features such as runway holding lines and taxiways are shown at the cursor.
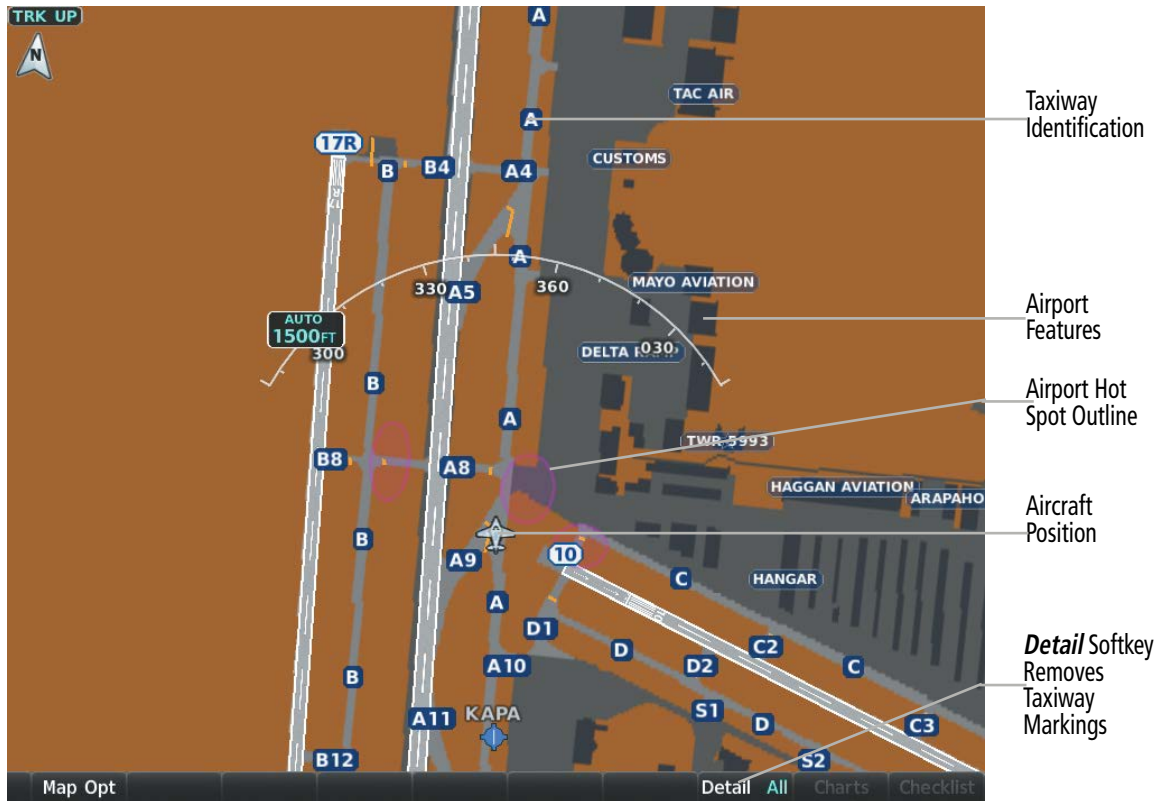
Figure 8-1 SafeTaxi Depiction on the Navigation Map Page

The **Detail** Softkey (declutter) label advances to Detail All, Detail 3, Detail 2 and Detail 1 each time the softkey is selected for easy recognition of decluttering level. Pressing the **Detail All** Softkey removes the taxiway markings and airport feature labels. Pressing the **Detail 3** Softkey removes VOR station ID, the VOR symbol, and intersection names if within the airport plan view. Pressing the **Detail 2** Softkey removes the airport runway layout, unless the airport in view is part of an active route structure. Pressing the **Detail 1** Softkey cycles back to the original map detail. Refer to Map Declutter Levels in the Flight Management Section.

Configuring SafeTaxi range:

1) While viewing the 'Map-Navigation Map' Page, press the **MENU** Key to display the 'Page Menu.'

2) Turn the large **FMS** Knob to highlight the 'Map Settings' Menu Option and press the **ENT** Key.

3) Turn the **FMS** Knob to select the 'Aviation' Group and press the **ENT** Key.

4) Turn the large **FMS** Knob to scroll through the 'Aviation' Group options to SafeTaxi.

5) Turn the small **FMS** Knob to display the range of distances.

6) Turn either **FMS** Knob to select the desired distance for maximum SafeTaxi display range.

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

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

8.2 SURFACEWATCH (OPTIONAL)

⚠️ **WARNING:** *Do not use SurfaceWatch™ information as the primary method of flight guidance during airborne or ground operations. SurfaceWatch does not have NOTAM or ATIS information regarding the current active runway, condition, or information about the position of hold lines.*

✓ **NOTE:** *The SafeTaxi database must be available to provide information regarding taxiways, aprons, and other objects in the airport environment.*

✓ **NOTE:** *When the flight plan is modified, data manually entered on the 'FPL - SurfaceWatch' Page will be cleared.*

The SurfaceWatch™ feature provides visual annunciations to help the flight crew maintain situational awareness and avoid potential runway incursions and excursions during ground and air operations in the airport environment. The SurfaceWatch feature is comprised of the following key components:

- Alert Annunciations
  - Taxiway Takeoff
  - Runway Too Short (during takeoff or landing)
  - Check Runway (during takeoff or landing)
  - Taxiway Landing
- Provides information on the Primary Flight Display (PFD) that contains runway and taxiway information that changes as the aircraft moves through the airport environment.

The full SurfaceWatch feature is not available in Reversionary Mode.

> **Inhibiting/uninhibiting SurfaceWatch:**
>
> **1)** Select the 'Aux - System Setup 1' Page**.**
>
> **2)** Push the **FMS** Knob momentarily to activate the flashing cursor..
>
> **3)** Turn the large **FMS** Knob to highlight the SurfaceWatch field.
>
> **4)** Turn the small **FMS** Knob to toggle the SurfaceWatch alerts on or off.

INFORMATION BOX

The SurfaceWatch™ Information Box is displayed on the PFD. It contains runway and taxiway information that dynamically changes as the aircraft moves through the airport environment. The information that is displayed in the Information Box is the aircraft's relative position to nearby aprons, taxiways, and runways.

There are three components to the SurfaceWatch™ Information Box. These components are Currently Occupied, Approaching, and Crossing Runways.
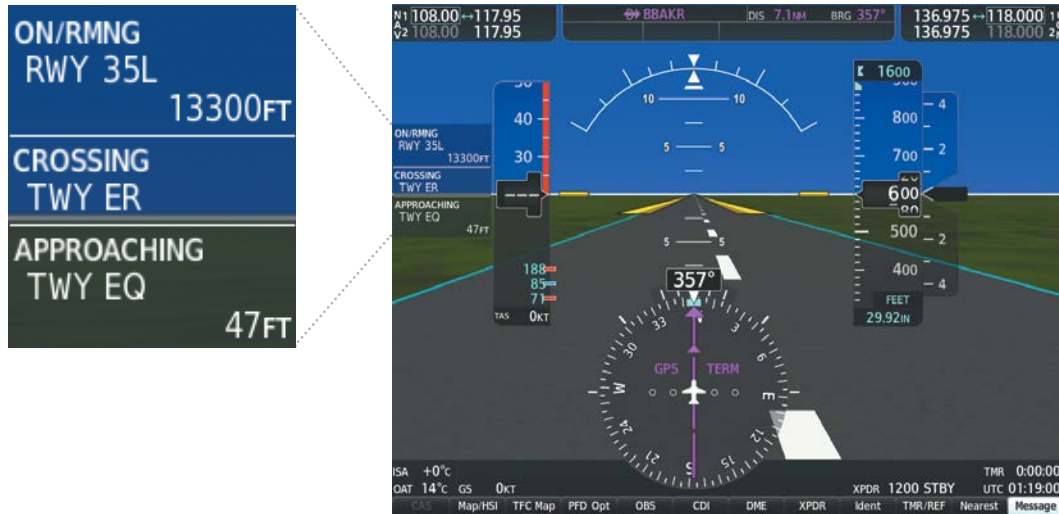
Figure 8-2 Information Types Displayed in the Information Box

CURRENTLY OCCUPIED

This component indicates the aircraft is 'ON' the indicated apron, taxiway, or runway. The aircraft is currently 'ON' runway 35 Left (RWY 35L). The remaining runway distance is also shown when the aircraft is situated on and aligned with a runway.

If the aircraft is airborne and approaching an airport, 'AIRBORNE TO' and the destination airport identifier will be displayed.

Information regarding non-manuevering areas not labeled on the SafeTaxi diagram will not be displayed.

APPROACHING COMPONENT

This component indicates the aircraft is 'APPROACHING' the indicated apron, taxiway, or runway. In the previous figure, the aircraft is currently 'APPROACHING' taxiway EQ (TWY EQ). The distance to the taxiway is also shown.

When the aircraft is taxiing and approaching an intersection of multiple taxiways, the taxiway identifiers will be listed in order of proximity and the distance to the nearest is displayed.

When the aircraft is taxiing and crossing an intersection of multiple taxiways, 'CROSSING' will be displayed and no distance will be shown.

CROSSING RUNWAYS

This component lists the runways, from closest to furthest, that are 'CROSSING' the runway the aircraft currently occupies. The distance to each runway is also shown in order of closest distance. Runways behind the aircraft are not depicted.

The Crossing Runways component is shown in conjunction with the Currently Occupied component of the Information Box.

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ALERTS

The SurfaceWatch alert annunciations are displayed in the central portion of the PFD. The alert annunciations are accompanied by a corresponding voice alert.

SurfaceWatch Alert Annunciation	Associated Voice Alert	Description
TWY TAKEOFF	"Taxiway"	Issued when the aircraft is taking off from a non-runway (e.g. a taxiway).
RWY TOO SHORT	"Runway too short"	Issued when the aircraft is taking off from a runway with a length less than needed as calculated by the PERF function.
CHECK RUNWAY	"Check runway"	Issued when the aircraft is taking off from a runway different than that entered in PERF.
TWY LANDING	"Taxiway"	Issued when the aircraft is landing on a non-runway (e.g. a taxiway).
RWY TOO SHORT	"Runway too short"	Issued when the aircraft is landing on a runway with a length less than needed as calculated by the PERF function.
CHECK RUNWAY	"Check runway"	Issued when the aircraft is landing on a runway different than that entered in PERF.

Table 8-1 SurfaceWatch Alert Annunciations

TAKEOFF ALERTS

The Takeoff phase-of-flight, as determined by the system, must be valid in order for the system to issue Takeoff Alerts.

TAXIWAY TAKEOFF

The Taxiway Takeoff alert is issued when the aircraft attempts to takeoff from a non-runway (e.g. a taxiway) or the aircraft is not aligned with a runway.

In addition to the visual and voice alerts, the Information Box contains a textual description of the currently occupied taxiway (or other maneuvering area) and potentially the next area (apron or maneuvering area) to be occupied (based on aircraft heading and the airport geometry) and the distance to that area.
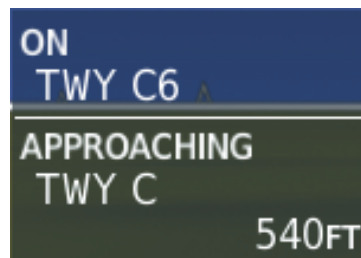
Figure 8-3 Typical Taxiway Information Displayed in the Information Box

RUNWAY TOO SHORT

The Runway Too Short (during takeoff) alert is issued when the aircraft attempts to takeoff from a runway and the remaining runway length is less than the required length. The insufficient runway length condition is determined based on aircraft current position during the takeoff roll and the required takeoff distance information entered on the Takeoff Data Screen.

Note that while the Runway Too Short alert may be issued for any runway from which the aircraft is taking off, the system will always calculate the runway length for the specific runway entered in the Takeoff Data.

In addition to the visual and voice alert, the Information Box will contain a textual description of the currently occupied runway and the remaining runway length.
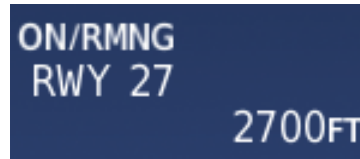
Figure 8-4 Typical Runway Information Displayed in the Information Box

CHECK RUNWAY

The Check Runway alert is issued when the aircraft attempts to takeoff from a runway that does not match the departure runway entered in the Takeoff Data Screen.

In addition to the visual and voice alert, the Information Box contains a textual description of the currently occupied runway.

LANDING ALERTS

The On-Final phase-of-flight, as determined by the system, must be valid in order for the system to issue Landing Alerts.

TAXIWAY LANDING

The Taxiway Landing alert is issued when the aircraft attempts to land on a non-runway (e.g. a taxiway) or the aircraft is not aligned with a runway.

In addition to the visual and voice alert, the Information Box will display the destination airport identifier and the text "APPROACHING TWY" to indicate a non-runway landing is being attempted.
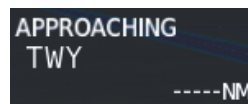
Figure 8-5 Typical Information Displayed During a Taxiway Landing Alert

RUNWAY TOO SHORT

The Runway Too Short alert is issued when the aircraft attempts to land on a runway where the remaining runway length is less than the required landing runway length entered in the Landing Data Screen.

Note that while the Runway Too Short alert may be issued for any runway with which aircraft is aligned, the system will always calculate the runway length for the specific runway entered in the Landing Data Screen.

In addition to the visual and voice alert, the Information Box will display the destination airport identifier and the text "APPROACHING REMAINING" to indicate a the remaining runway length.

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RWY 27
2700FT
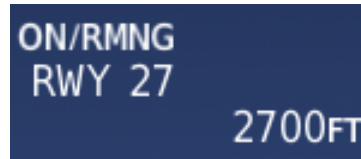
Figure 8-6 Typical Information Displayed During a Runway Too Short Alert

CHECK RUNWAY

The Check Runway alert is issued when the aircraft attempts to land on a runway that does not match the arrival runway specified in the Landing Data.

Additionally, the Information Box will display the destination airport identifier, the runway with which the aircraft is aligned, and the distance to the runway.

ON/RMNG
RWY 09
6800FT
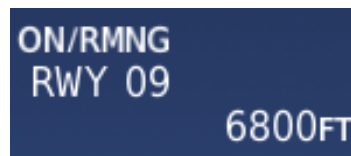
Figure 8-7 Typical Information Displayed During a Check Runway Alert

SURFACEWATCH SETUP

Origin/destination airport, runway and distance data entered integrates with SurfaceWatch technology to alert the flight crew to a runway too short for takeoff/landing, or to advise of a potential taxiway takeoff/landing. The runway selected in SurfaceWatch Setup appears on the airport diagram in cyan, and appears outlined in cyan on the synthetic vision representation of the runway on the PFD.

Entering origin/destination airport:

1) Select the 'FPL - SurfaceWatch Setup' Page.

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

3) Turn the large **FMS** Knob if necessary to highlight the Origin or Destination Airport field.

4) Use the **FMS** Knobs to input the desired Origin or Destination Airport.

Selecting origin/destination runway:

1) Select the 'FPL - SurfaceWatch Setup' Page.

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

3) Turn the large **FMS** Knob if necessary to highlight the Runway or Landing Runway field.

4) Turn the small **FMS** Knob to select the desired available Runway or Landing Runway. As the small **FMS** Knob is turned, the preview of the selected runway or landing runway is also displayed.

Selecting required takeoff/landing distance:

1) Select the 'FPL - SurfaceWatch Setup' Page.

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

3) Turn the large **FMS** Knob if necessary to highlight the REQD Takeoff DIS or REQD Landing DIS field.

4) Use the **FMS** Knobs to enter the required takeoff or landing distance. Upon pushing the **FMS** Knob and committing the required takeoff or landing distance, the Runway Length field will turn amber if an insufficient runway length exists.

Figure 8-8 SurfaceWatch Setup Page (MFD)

8.3 CHARTS

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

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

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

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

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

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

Electronic charts that resemble the paper versions of AeroNav Services terminal procedures charts (FliteCharts) and Jeppesen terminal procedures charts (ChartView) can be displayed on the MFD.

When the databases for both chart types are purchased and loaded in the system, the desired charts brand, or source, can be selected for viewing. The active chart source for a particular procedure is shown on the information pane under Source.

Selecting Preferred Charts Source:

1) While viewing a chart press the **MENU** Softkey to display the Page Menu Options.

2) Turn the large **FMS** Knob to highlight the Chart Setup menu option and press the **ENT** Key.

3) Turn the large **FMS** Knob to move to the Preferred Charts Source option.

4) Turn the small **FMS** Knob to choose between the available options (FliteCharts, ChartView).

Chart Setup Option

Preferred Charts Source Option
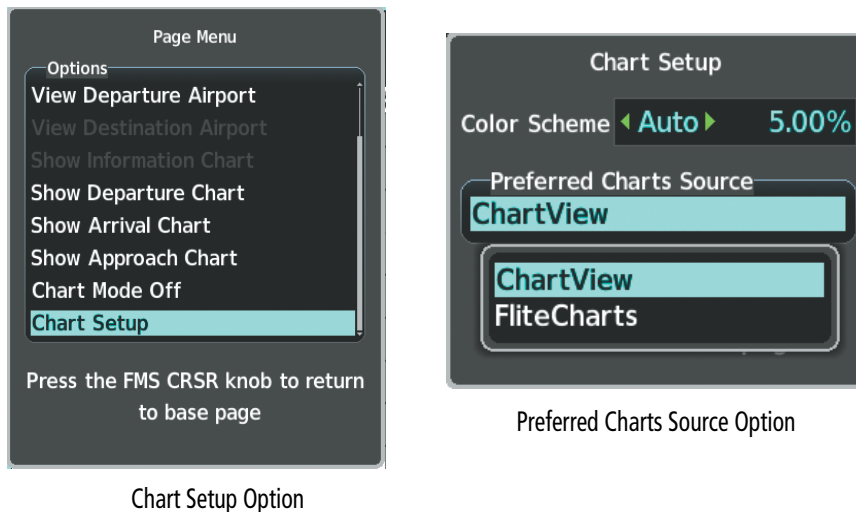
Figure 8-9 Preferred Charts Source

FLITECHARTS (OPTIONAL)

FliteCharts resemble the paper version of AeroNav Services terminal procedures charts. The charts are displayed with high-resolution and in color for applicable charts.

The geo-referenced aircraft position is indicated by an aircraft symbol displayed on the chart when the current position is within the boundaries of the chart. Not all charts are geo-referenced. These charts will display an Aircraft Not Shown Icon in the lower right corner of the MFD.

Figure 8-10 Aircraft Not Shown Icon

An aircraft symbol may be displayed within an off-scale area depicted on some charts. Off-scale areas are indicated by the grey shading. Note, these areas are not shaded on the published chart. These off-scale areas appear on the chart to convey supplemental information. However, the depicted geographical position of this information, as it relates to the chart planview, is not the actual geographic position. Therefore, when the aircraft symbol appears within one of these areas, the aircraft position indicated is relative to the chart planview, not to the off-scale area.

The FliteCharts database subscription is available from Garmin. Available data includes:
- Arrivals (STAR)
- Departure Procedures (DP)
- Approaches
- Airport Diagrams

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Off-Scale Areas

Off-Scale Area
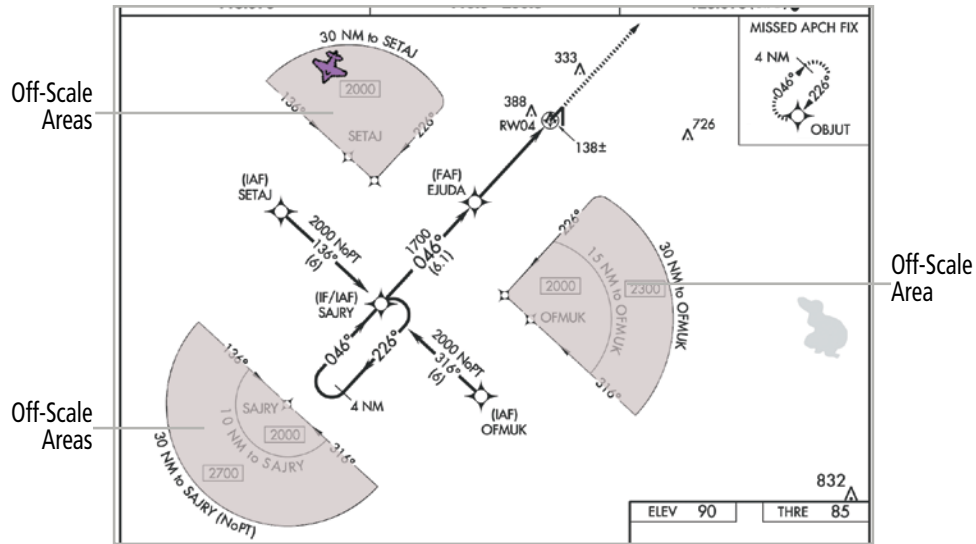
Off-Scale Areas

Figure 8-11 Sample Chart Indicating Off-Scale Areas

> ✓ **NOTE:** *Do not maneuver the aircraft based solely upon the geo-referenced aircraft symbol.*

TERMINAL PROCEDURES CHARTS

Selecting Terminal Procedures Charts:

While viewing the 'Map-Navigation Map' Page, 'NRST-Nearest Airport' Page, or 'FPL-Active Flight Plan' Page, press the **Charts** Softkey.

Or:

1) From the 'Map-Chart + Navigation Map' page, press the **MENU** Key to display the 'Page Menu.'

2) Turn the large **FMS** Knob to scroll through the 'Options' Menu to 'Show Departure Chart', 'Show Arrival Chart' or 'Show Approach Chart'.

3) Press the **ENT** Key to display the chart.

When no terminal procedure chart is available, the banner No Available Charts appears on the screen. The No Available Charts banner does not refer to the FliteCharts subscription, but rather the availability of a particular airport chart selection or procedure for a selected airport.

Figure 8-12 'No Available Charts' Banner

If there is a problem in rendering the data (such as a data error or a failure of an individual chart), the banner Unable To Display Chart is then displayed.

Figure 8-13 'Unable To Display Chart' Banner

When a chart is not available by pressing the Charts Softkey or selecting a Page Menu Option, charts may be obtained for other airports from the WPT Pages or Flight Plan Pages.

If a chart is available for the destination airport, or the airport selected in the active flight plan, the chart appears on the screen. When no flight plan is active, or when not flying to a direct-to destination, pressing the **Charts** Softkey displays the chart for the nearest airport, if available.

The chart shown is one associated with the 'WPT – Airport Information' page. Usually this is the airport runway diagram. Where no runway diagram exists, but Take Off Minimums or Alternate Minimums are available, that page appears. If Airport Information pages are unavailable, the Approach Chart for the airport is shown.

Selecting a chart:

1) While viewing the 'Map-Navigation Map' Page, 'FPL-Flight Plan' Page, or 'NRST-Nearest Airports' Page, select the **Charts** Softkey. The airport diagram or approach chart is displayed on the 'WPT-Airport Information' Page.

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

3) Turn the large **FMS** Knob to select either the Airport Identifier Field or the 'Charts' Field.

4) Turn the small and large **FMS** Knob to enter the desired airport identifier.

5) Press the **ENT** Key to complete the airport selection. The flashing cursor is moved to the 'Charts' Field.

6) Turn the small **FMS** Knob to show the approach chart selection choices.

7) Turn either **FMS** Knob to scroll through the available charts.

8) Press the **ENT** Key to complete the chart selection.
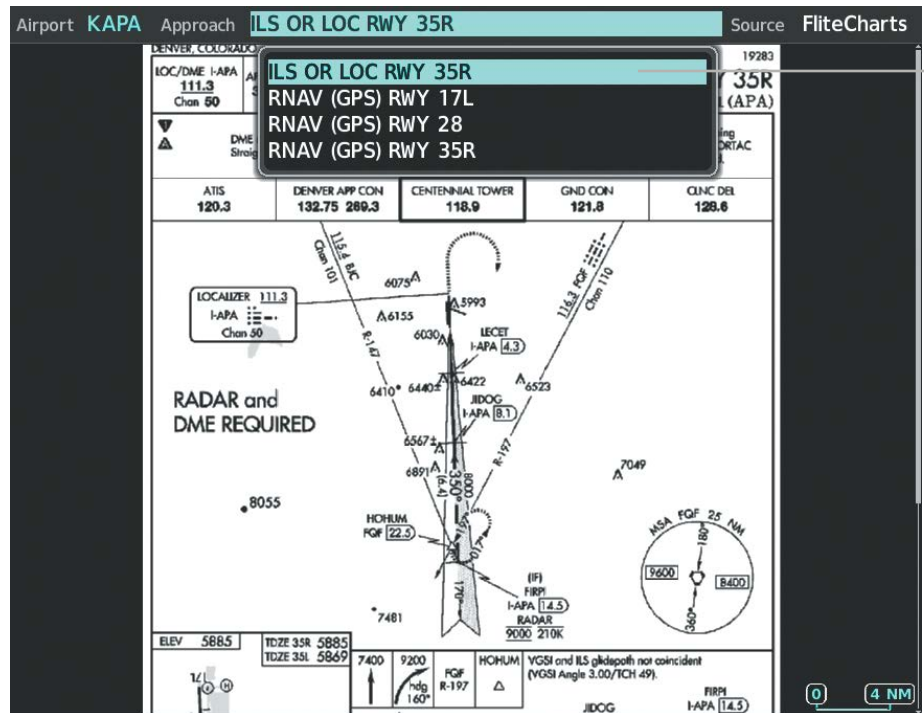
Figure 8-14 Approach Information Page, Chart Selection

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Selecting Additional Information:

1) While viewing the Airport Taxi Diagram, press the **WX** Softkey to display the information windows.

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

3) Turn the large **FMS** Knob to highlight the 'Info' Box.

4) Turn the small **FMS** Knob to select the 'Info' Box choices. When the 'Info' Box is selected the softkeys are blank. If multiple choices are available, scroll to the desired choice with the large **FMS** Knob and press the **ENT** Key to complete the selection.

5) Push the **FMS** Knob again to deactivate the cursor.

Pressing the **Go Back** Softkey reverts to the previous page (Navigation Map Page or Flight Plan Page).

FLITECHARTS SOFTKEYS

FliteCharts functions are displayed on four levels of softkeys. While on the 'Map - Navigation Map' Page, 'WPT - Airport Information' Page, 'FPL - Active Flight Plan' Page, or 'NRST - Nearest Airport' Page, pressing the **Charts** Softkey displays the available terminal chart and advances to the chart selection level of softkeys: The following options are available.

» Pressing the **CHRT Opt** Softkey advances to the next level of chart option softkeys (see below).

» Pressing the **SYNC** Softkey displays the database linked chart associated with the current phase of flight.

» Pressing the **Info** Softkey displays the Airport Diagram.

» Pressing the **DP** Softkey displays the Departure Procedure Chart if available.

» Pressing the **STAR** Softkey displays the Standard Terminal Arrival Chart if available.

» Pressing the **APR** Softkey displays the approach chart for the airport if available.

» Pressing the **NOTAM** Softkey shows the local NOTAM information for selected airports, when available. When NOTAMS are not available, the **NOTAM** Softkey label appears subdued and is disabled. The **NOTAM** Softkey may appear on the 'WPT - Airport Information' Page and all of the chart page selections. Pressing the **NOTAM** Softkey again removes the NOTAMS information.

» Pressing the **Charts** Softkey switches between the chart diagram and the associated map in the 'WPT' Page Group.

CHART OPTIONS

While viewing the **CHRT Opt** softkeys, after 45 seconds of softkey inactivity, the system reverts to the chart selection softkeys. The following describes the sublevel softkeys:

▪ Pressing the **ROT CCW** Softkey rotates the chart counterclockwise.

▪ Pressing the **ROT CW** Softkey rotates the chart clockwise.

▪ Pressing the **Fit WIDTH** Softkey fits the width of the chart in the display viewing area.

▪ Pressing the **Full SCN** Softkey alternates between removing and replacing the data window to the right.

▪ Pressing the **Back** Softkey reverts to the top level softkeys and previous page.

Selecting full screen On or Off:

1) While viewing a terminal chart press the **MENU** Key to display the 'Page Menu' Options.

2) Turn the large **FMS** Knob to highlight 'Full Scree (On/Off)'.

3) Press the **ENT** Key to enable or disable Full Screen Mode.

PHASE OF FLIGHT MATCHING

The Phase of Flight Matching Feature provides quick access to charts matching the current phase-of-flight (e.g., the departure, arrival, and approach phases of flight).

When a chart is accessed via the navigation map and/or flight plan pages, the chart may be updated automatically as the phase of flight changes. This feature may be enabled/disabled by following the procedure below. The chart for the current phase of flight may be recalled at any time on the navigation map and/or flight plan pages when a chart pane is displayed by pressing the **SYNC** Softkey.

Syncing charts to the current phase of flight:

1) While viewing a chart, press the **MENU** Softkey to display the 'Page Menu.'

2) Turn the large **FMS** Knob to highlight the 'Charts Setup' menu option and press the **ENT** Key.

3) Turn the large **FMS** Knob to move to the 'Phase of Flight' option in the 'AUTO Chart Update' Box.

4) With the 'Phase of Flight' option highlighted, turn the small **FMS** Knob to choose either 'On' or 'Off.'

DAY/NIGHT VIEW

FliteCharts can be displayed on a white or black background for day or night viewing. The Day View offers a better presentation in a bright environment. The Night View gives a better presentation for viewing in a dark environment. When the Chart Setup Box is selected the MFD softkeys are blank.

Selecting Day, Night, or Automatic View:

1) While viewing a terminal chart press the **MENU** Key to display the Page Menu 'Options.'

2) Turn the large **FMS** Knob to highlight the 'Chart Setup' Menu Option and press the **ENT** Key.
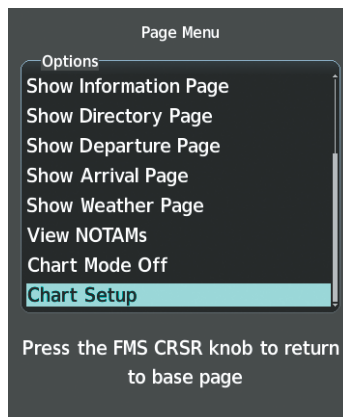
Figure 8-15 Page Menu Chart Setup

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3) Turn the large **FMS** Knob to move to the 'Color Scheme' Option.

4) Turn the small **FMS** Knob to choose between 'Day', 'Auto', and 'Night' Options.

5) If Auto Mode is selected, turn the large **FMS** Knob to select the percentage field. Use the small **FMS** Knob to change the percentage value. The percentage value is the day/night crossover point based on the percentage of backlighting intensity. For example, if the value is set to 15%, the day/night display changes when the display backlight reaches 15% of full brightness.

The display must be changed in order for the new setting to become active. This may be accomplished by selecting another page or changing the display range.

6) Push the **FMS** Knob when finished to remove the 'Chart Setup' Menu.

Figure 8-16 Arrival Information Page, Day View

Figure 8-17 Arrival Information Page, Night View

CHARTVIEW (OPTIONAL)

ChartView resembles the paper version of Jeppesen terminal procedures charts. The charts are displayed in full color with high-resolution. The MFD depiction shows the aircraft position on the moving map in the planview of approach charts and on airport diagrams. Airport Hot Spots are outlined in magenta.

The geo-referenced aircraft position is indicated by an aircraft symbol displayed on the chart when the current position is within the boundaries of the chart. Inset boxes are not considered within the chart boundaries. Therefore, when the aircraft symbol reaches a chart boundary line, or inset box, the aircraft symbol is removed from the display.

The following figure shows examples of off-scale areas, indicated by the grey shading. Note, the grey shading is for illustrative purposes only and will not appear on the published chart or MFD display. These off-scale areas appear on the chart to convey supplemental information. However, the depicted geographical position of this information, as it relates to the chart planview, is not the actual geographic position. Therefore, when the aircraft symbol appears within one of these areas, the aircraft position indicated is relative to the chart planview, not to the off-scale area.
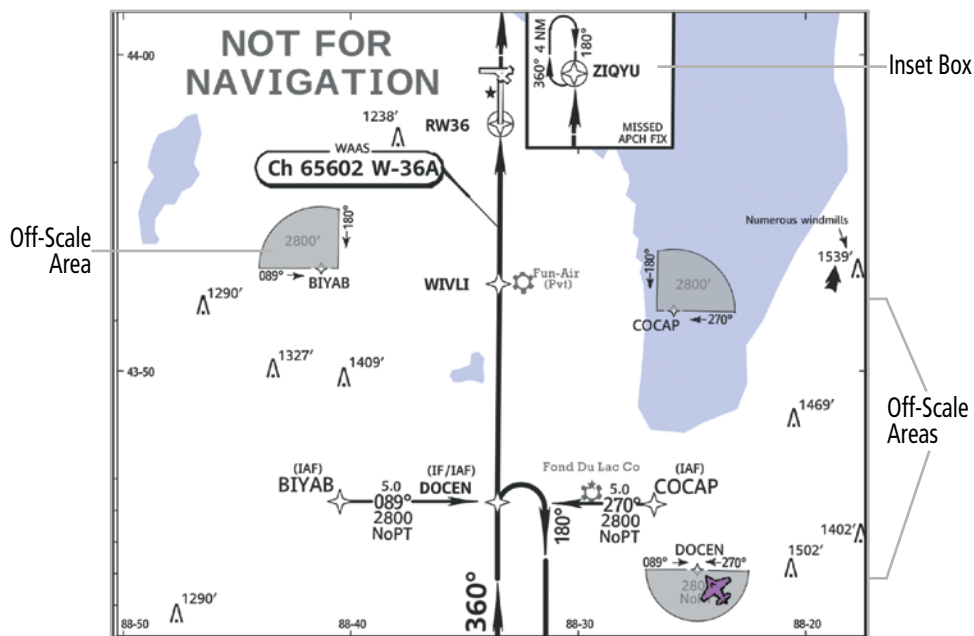
Figure 8-18 Sample Chart Indicating Off-Scale Areas

NOTE: *Do not maneuver the aircraft based solely upon the geo-referenced aircraft symbol.*

The ChartView database subscription is available from Jeppesen, Inc. Available data includes:
- Arrivals (STAR)
- Departure Procedures (DP)
- Approaches
- Airport Diagrams
- NOTAMs

TERMINAL PROCEDURES CHARTS

Selecting Terminal Procedures Charts:

While viewing the 'Map-Navigation Map' Page, NRST-Nearest Airport' Page, or 'FPL-Flight Plan' Page, select the **Charts** Softkey.

Or:

1) From the 'Map-Chart + Navigation Map' page, press the **MENU** Key to display the 'Page Menu.'

2) Turn the large **FMS** Knob to scroll through the 'Options' Menu to 'Show Departure Chart', 'Show Arrival Chart'or 'Show Approach Chart'.

3) Press the **ENT** Key to display the chart.

When no terminal procedure chart is available, the banner Chart Not Available appears on the screen. The Chart Not Available banner does not refer to the FliteCharts subscription, but rather the availability of a particular airport chart selection or procedure for a selected airport.

Figure 8-19 'No Available Charts' Banner

If there is a problem in rendering the data (such as a data error or a failure of an individual chart), the banner Unable To Display Chart is then displayed.

Figure 8-20 'Unable To Display Chart' Banner

When a chart is not available by pressing the **Charts** Softkey or selecting a Page Menu Option, charts may be obtained for other airports from the WPT Pages or Flight Plan Pages.

If a chart is available for the destination airport, or the airport selected in the active flight plan, the chart appears on the screen. When no flight plan is active, or when not flying to a direct-to destination, pressing the **Charts** Softkey displays the chart for the nearest airport, if available.

The chart shown is one associated with the 'WPT – Airport Information' Page. Usually this is the airport runway diagram. Where no runway diagram exists, but Take Off Minimums or Alternate Minimums are available, that page appears. If Airport Information pages are unavailable, the Approach Chart for the airport is shown.

Selecting a chart:

1) While viewing the 'Map-Navigation Map' Page, press the **Charts** Softkey.
2) Press the **FMS** Knob to activate the cursor.
3) Turn the large **FMS** Knob to select either the Airport Identifier Field or the 'Charts' Field.
4) Turn the small and large **FMS** Knob to enter the desired airport identifier.
5) Press the **ENT** Key to complete the airport selection. The flashing cursor is moved to the 'Charts' Field.
6) Turn the small **FMS** Knob to show the approach chart selection choices.
7) Turn either **FMS** Knob to scroll through the available charts.
8) Press the **ENT** Key to complete the chart selection.

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While the list of charts is displayed, the softkeys are blank. Once the desired chart is selected, the chart scale can be changed and the chart page can be scrolled using the **Joystick**. Pressing the **Joystick** centers the chart on the screen.

The aircraft symbol is shown on the chart only if the chart is to scale and the aircraft position is within the boundaries of the chart. The aircraft symbol is not displayed when the Aircraft Not Shown Icon appears. If the Chart Scale Box displays a banner NOT TO SCALE, the aircraft symbol is not shown. The Aircraft Not Shown Icon may appear at certain times, even if the chart is displayed to scale.

CHARTVIEW SOFTKEYS

ChartView functions are displayed on four levels of softkeys. While on the 'Map - Navigation Map' Page, 'WPT - Airport Information' Page, 'FPL - Active Flight Plan' Page, or 'NRST - Nearest Airport' Page, pressing the **Charts** Softkey displays the available terminal chart and advances to the chart selection level of softkeys:

CHRT Opt, **SYNC, Info, DP**, **STAR**, **APR**, **NOTAM, Charts**, and **Checklist.**   The softkeys available depends on the page selected.

The following options are available:

» Pressing the **CHRT Opt** Softkey advances to the next level of chart option softkeys (see below).
» Pressing the **SYNC** Softkey displays the database linked chart associated with the current phase of flight.
» Pressing the **Info** Softkey displays the Airport Diagram.
» Pressing the **DP** Softkey displays the Departure Procedure Chart if available.
» Pressing the **STAR** Softkey displays the Standard Terminal Arrival Chart if available.
» Pressing the **APR** Softkey displays the approach chart for the airport if available.
» Recent NOTAMS applicable to the current ChartView cycle are included in the ChartView database. Pressing the **NOTAM** Softkey shows the local NOTAM information for selected airports, when available. When NOTAMS are not available, the **NOTAM** Softkey label appears subdued and is disabled. The **NOTAM** Softkey may appear on the 'WPT - Airport Information' Page and all of the chart page selections. Pressing the **NOTAM** Softkey again removes the NOTAMS information.
» Pressing the **Charts** Softkey switches between the chart diagram and the associated map in the 'WPT' Page Group.

> **NOTE:** Only NOTAMs applicable to specific information conveyed on the displayed Jeppesen chart are available when the **NOTAM** Softkey is pressed. There may be other NOTAMs available pertaining to the flight that may not be displayed. Contact Jeppesen for more information regarding Jeppesen database published NOTAMs.

CHART OPTIONS

While viewing the **CHRT Opt** softkeys, after 45 seconds of softkey inactivity, the system reverts to the chart selection softkeys. The following describes the sublevel softkeys:

- Pressing the **ROT CCW** Softkey rotates the displayed chart counter clockwise in 90 degree increments.
- Pressing the **ROT CW** Softkey rotates the displayed chart clockwise in 90 degree increments.
- Pressing the **All** Softkey shows the complete approach chart on the screen.
- Pressing the **Header** Softkey shows the header view (approach chart briefing strip) on the screen.
- Pressing the **Plan** Softkey shows the approach chart two dimensional plan view.
- Pressing the **Profile** Softkey displays the approach chart descent profile strip.
- Pressing the **Minimums** Softkey displays the minimum descent altitude/visibility strip at the bottom of the approach chart.

Selecting Additional Information:

1) While viewing the Airport Taxi Diagram, press the **Full SCN** Softkey to display the information windows (Airport, Info).

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

3) Turn the large **FMS** Knob to highlight the Airport, Info, Runways, or Frequencies Box.

4) Turn the small **FMS** Knob to select the Info Box choices. If multiple choices are available, scroll to the desired choice with the large **FMS** Knob and press the **ENT** Key to complete the selection.

5) Press the **FMS** Knob again to deactivate the cursor.

Pressing the **Back** Softkey, or waiting for 45 seconds reverts to the chart selection softkeys. The full screen view can also be selected by using the page menu option.

Selecting full screen On or Off:

1) While viewing a terminal chart press the **MENU** Key to display the 'Page Menu' Options.

2) Turn the large **FMS** Knob to highlight 'Full Scree (On/Off)'.

3) Press the **ENT** Key to enable or disable Full Screen Mode.
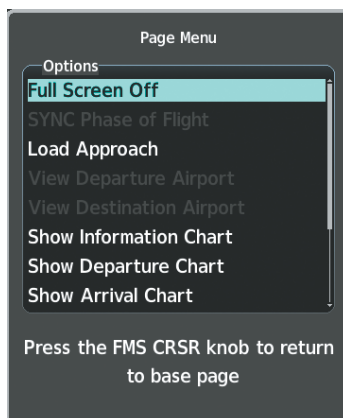
Charts Page Menu

Figure 8-21 Charts Page Menu Full Screen On/Off

DAY/NIGHT VIEW

ChartView can be displayed on a white or black background for day or night viewing. The Day View offers a better presentation in a bright environment. The Night View gives a better presentation for viewing in a dark environment. When the Chart Setup Box is selected the MFD softkeys are blank.

Selecting Day, Night, or Automatic View:

1) While viewing a terminal chart press the **MENU** Key to display the 'Page Menu' Options.

2) Turn the large **FMS** Knob to highlight the 'Chart Setup' Menu Option and press the **ENT** Key.

3) Turn the large **FMS** Knob to move to the 'Color Scheme' Option.

4) Turn the small **FMS** Knob to choose between 'Day', 'Auto', and 'Night' Options.

5) If Auto Mode is selected, turn the large **FMS** Knob to select the percentage field. Use the small **FMS** Knob to change the percentage value. The percentage value is the day/night crossover point based on the percentage of backlighting intensity. For example, if the value is set to 15%, the day/night display changes when the display backlight reaches 15% of full brightness.

   The display must be changed in order for the new setting to become active. This may be accomplished by selecting another page or changing the display range.

6) Push the **FMS** Knob when finished to remove the 'Chart Setup' Menu.

IFR/VFR CHARTS (OPTIONAL)

The system can display GPS navigation information on a VFR chart, a low altitude IFR chart, or a high altitude IFR chart, if installed. The information overlaid on the IFR/VFR Charts is selected and setup on the Navigation Map, but the IFR/VFR charts will not display some of the selected items. Only the following items will be overlaid on the chart:

- Map Pointer (distance and bearing to pointer, location of pointer, name, and other pertinent information)
- Map Range (17 range choices from 1 nm to 150 nm)
- Map Orientation (always North Up for IFR/VFR Charts)
- Aircraft Icon (representing present position)
- Wind Direction and Speed
- Icons for enabled map features (Traffic only)
- Flight Plan Legs
- Track Vector
- Runway Extension
- Missed Approach Preview
- Intersections (only as part of active flight plan)
- Visual Reporting Points
- VNAV Constraints
- Selected Altitude Intercept Arc

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Map panning on the IFR/VFR Charts works the same as on the Navigation Map. Map range selected on either the Navigation Map or the IFR/VFR Charts applies to both. However, if the range selected on the Navigation Map it is not a valid chart range, the chart is shown with a range of 7.5 nm.

When different VFR charts exist for the same area the chart type will automatically display according to the range chosen. For example, in an area where both a Sectional and a Terminal Area Chart (TAC) are available, a range of 6 nm or more will show the Sectional chart. Once the range is decreased below 6 nm, the system will automatically change the displayed chart from the Sectional to the TAC.

Due to the potential error involved with the electronic depiction of maps, charts will display a 'gray circle of uncertainty' centered upon the aircraft icon. The aircraft's actual position can be anywhere within the range of the gray circle. The range of the circle will change based on the chart displayed and current zoom range.

The geo-referenced aircraft position is indicated by an aircraft symbol displayed on the chart when the current position is within the boundaries of the chart. Not all charts are geo-referenced. IFR/VFR charts may be viewed by selecting the 'Map - IFR/VFR Charts' Page.
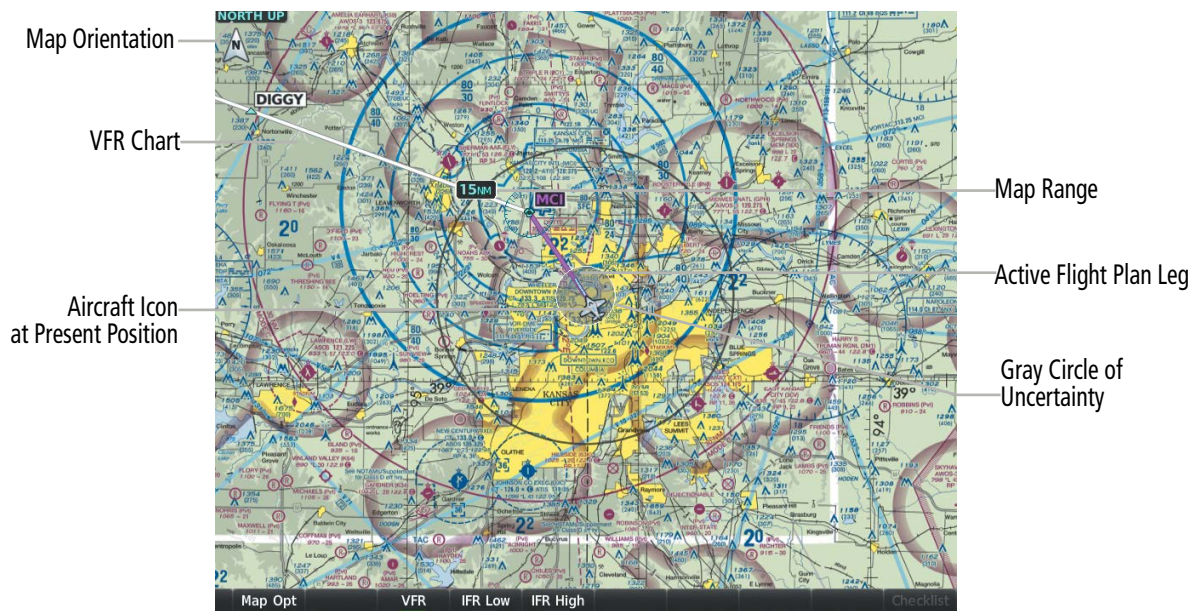
Figure 8-22 GPS Navigation Information on the VFR Chart

Selecting IFR Low, IFR High, VFR Charts:

1) Select the 'Map - IFR/VFR Charts' Page.

2) Press the **VFR**, **IFR Low**, or **IFR High** Softkey to display the desired chart.

    Or:

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

2) Select 'Display VFR', 'Display IFR Low' or 'Display IFR High' to display the desired chart.

3) Press the **ENT** Key.
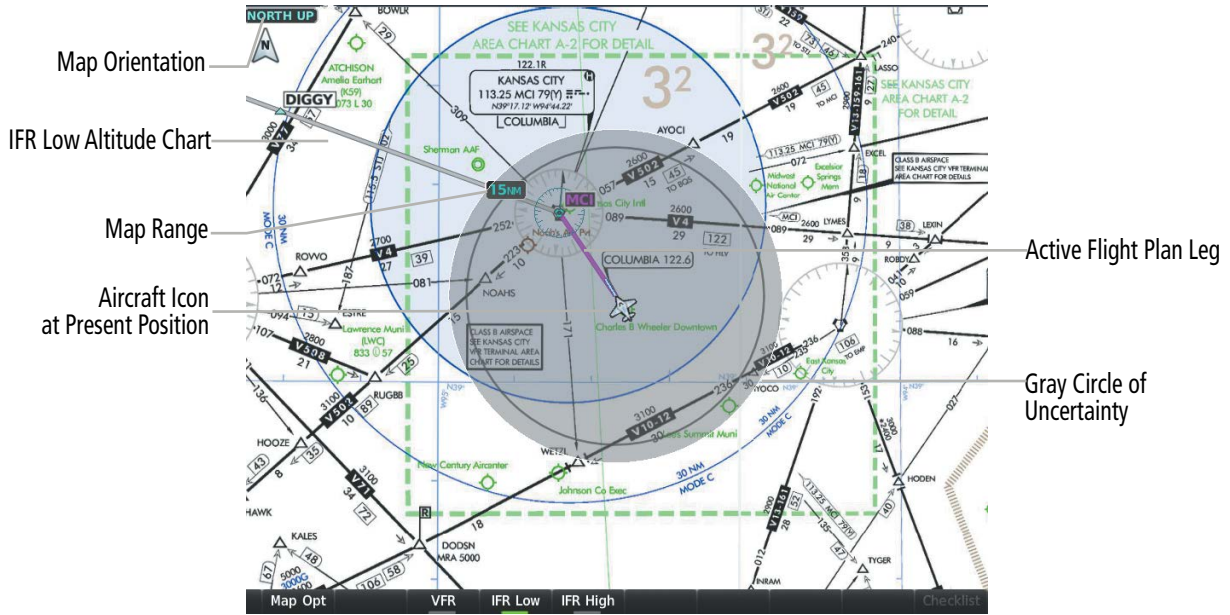
Figure 8-23 GPS Navigation Information on the IFR Low Altitude Chart

Map Orientation
IFR Low Altitude Chart
Map Range
Aircraft Icon at Present Position
Active Flight Plan Leg
Gray Circle of Uncertainty
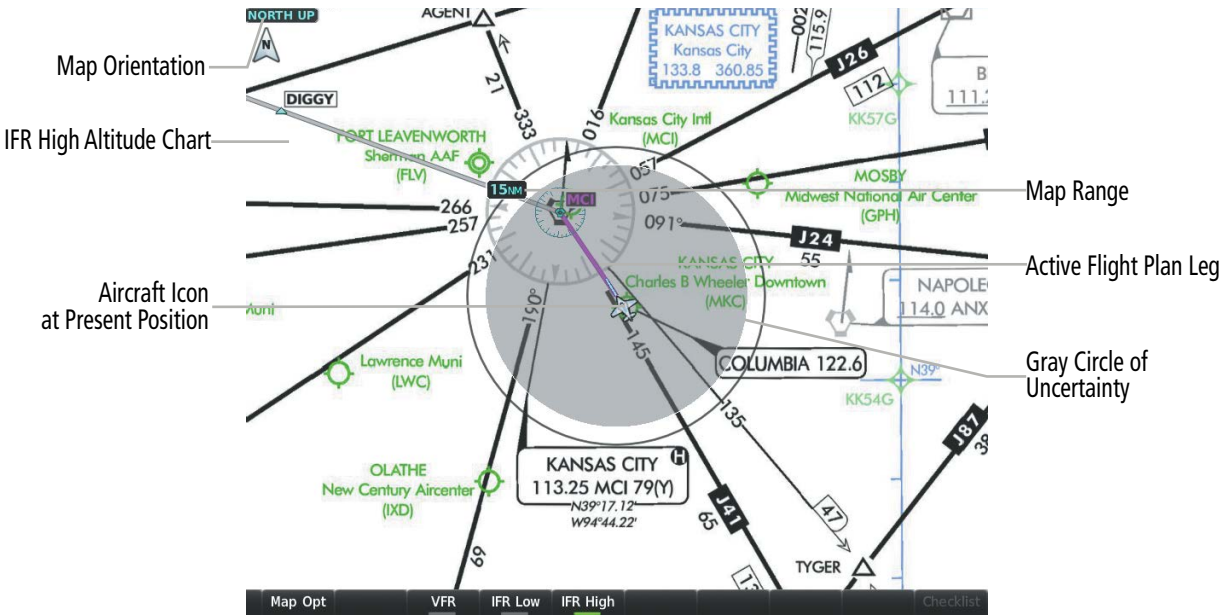
Figure 8-24 GPS Navigation Information on the IFR High Altitude Chart

Map Orientation
IFR High Altitude Chart
Map Range
Aircraft Icon at Present Position
Active Flight Plan Leg
Gray Circle of Uncertainty

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8.4 DATABASE MANAGEMENT

⚠️ **CAUTION:** *Never disconnect power to the system when loading a database. Power interruption during the database loading process could result in maintenance being required to reboot the system.*

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

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

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

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

CYCLE NUMBER AND REVISION

   Databases that may be available include FliteCharts, ChartView, IFR/VFR Charts, Checklist, Navigation, Basemap Land, Terrain, Obstacle, SafeTaxi, and Airport Directory Databases. Data is revised and expiration dates vary. Data is still viewable during a period that extends from the cycle expiration date to the disables date. After applying power to the system, the 'Aux - Databases' Page displays the current status of the databases. As an example, see the table below for the various initialization page displays and the definition of each. The expiration date and disables date varies for each database.

Example Page Initialization Display Text
🗂️ FliteCharts Data: └─ N/A
🗂️ FliteCharts Data: └─ Expires DD–MMM–YYYY
🗂️ FliteCharts Data: └─ Disables DD–MMM–YYYY
🗂️ FliteCharts Data: └─ Disabled

Table 8-2 Database Initialization Annunciations

White text, such as 'FliteCharts Data Expires' plus a date, indicates the chart database is current. Amber text, such as 'Chart data is out of date!' or 'FliteCharts Data: Disabled", indicates charts are no longer viewable and have expired.

Database time critical information can also be found on the 'Aux - System Status' Page. The database Region, Cycle Number, Effective, Expires, and Disables dates of the subscription appear in either white or amber text. Dates shown in white are current data. Dates shown in amber indicate the data is not within the current subscription period. Refer to Updating Garmin Databases in Appendix for instructions on revising databases.

> ✓ **NOTE:** *A subdued softkey label indicates the function is disabled.*

Viewing database information:

1) Turn the large **FMS** Knob to select the 'Aux' Page Group.

2) Turn the small **FMS** Knob to select the 'Aux - System Status' Page.

3) Touch the softkey corresponding to the display (**MFD1** or **PFD1**) for which the database information will be viewed.

4) Press the **FMS** Knob to activate the flashing cursor in the 'MFD1 Database' or the 'PFD1 Database' Window.

5) Scroll to display the appropriate database information by turning the **FMS** Knob or pressing the **ENT** Key until the applicable database information is shown.

Database cycle numbers are in a format such as YYTI or YYII, which are deciphered as follows:

YYTI

» YY – Indicates the last two digits of the year (e.g., 20 represents 2020)

» T – Indicates the database type (e.g., S is for SafeTaxi, D is for Airport Directory).

» I – Indicates the numerical issue of the database for the year (e.g., 5 is the fifth issue of the year).

YYII

» YY – Indicates the last two digits of the year (e.g., 20 represents 2020).

» II – Indicates the numerical issue of the database for the year (e.g., 05 is the fifth issue of the year).

Example Text on MFD at Initialization	Database Cycle Number Format	Revision Cycle
Navigation	YYII	28 days
Basemap Land	YYMI	Not Applicable
Terrain	YYTI	Not Applicable
Obstacle	YYBI	56 days

Example Text on MFD at Initialization	Database Cycle Number Format	Revision Cycle
SafeTaxi	YYSI	56 days
Airport Directory	YYDI	56 days
FliteCharts	YYII	28 days
ChartView	YYII	14 days
IFR/VFR Charts	YYII	56 days

Table 8-3 Database Cycle Number and Revision

8.5 SIRIUSXM SATELLITE RADIO (OPTIONAL)

> **NOTE:** *Refer to the Hazard Avoidance Section for information about SiriusXM Weather products.*

The SiriusXM Satellite Radio entertainment feature provided by the SiriusXM Datalink Receiver (GDL 69A) is available for the pilot's and passengers' enjoyment. The SiriusXM Datalink Receiver receives XM Satellite Radio entertainment services at any altitude throughout the Continental U.S. Audio entertainment is available only with the GDL 69A Datalink Receiver, not the GDL 69.

SiriusXM Satellite Radio offers a variety of radio programming reliably over long distances. Based on signals from satellites, coverage far exceeds land-based transmissions. SiriusXM Satellite Radio services are subscription-based. For more information on specific service packages, visit www.siriusxm.com.

ACTIVATING SIRIUSXM SATELLITE RADIO SERVICES

The service is activated by providing SiriusXM Satellite Radio with either one or two coded IDs, depending on the equipment. The Audio Radio ID (XM Weather), the Data Radio ID (XM Radio), or both, must be provided to SiriusXM Satellite Radio to activate the entertainment subscription.

It is not required to activate both the entertainment and weather service subscriptions separately with the SiriusXM Datalink Receiver. Either service can be activated. SiriusXM Satellite Radio uses the coded IDs to send an activation signal that, when received by the SiriusXM Datalink Receiver, allows it to play entertainment programming.

These IDs are located:
- On the label on the back of the SiriusXM Datalink Receiver.
- On the 'Aux - XM Information' Page on the MFD.
- On the XM Satellite Radio Activation Instructions included with the unit.

Contact the installer if the Data Radio ID and the Audio Radio ID cannot be located.

Activating the SiriusXM Satellite Radio services:

1) After gathering the Audio Radio ID and the Data Radio ID, contact SiriusXM and complete subscription activation.
2) Turn the large **FMS** Knob to select the 'Aux' Page Group.
3) Turn the small **FMS** Knob to select the 'Aux - XM Radio' Page.
4) Select the **Info** Softkey to display the 'Aux - XM Information' Page.
5) Verify the desired services are activated.
6) Select the **Lock** Softkey. A confirmation window is displayed.
7) Turn the large **FMS** Knob to highlight 'Yes.'
8) To complete activation, press the **ENT** Key.

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Figure 8-26 'Aux - XM Information' Page

If SiriusXM Weather services have not been activated, all the weather product boxes are blank on the 'Aux - XM Information' Page. The 'Service Class' refers to the groupings of weather products available for subscription.

USING SIRIUSXM RADIO

The 'Aux - XM Radio' Page provides information and control of the audio entertainment features of the SiriusXM Satellite Radio.

Selecting the 'Aux - XM Radio' Page:

1) Turn the large **FMS** Knob to select the 'Aux' Page Group.

2) Turn the small **FMS** Knob to select the 'Aux - XM Radio' Page.

3) If not already selected, press the **Radio** Softkey to show the 'Aux - XM Radio' Page where audio entertainment is controlled.

Figure 8-27 'Aux - XM Radio' Page

'ACTIVE CHANNEL' BOX AND 'CHANNELS' LIST

The 'Active Channel' Box on the 'Aux - XM Radio' Page displays the currently selected channel. The 'Channels' Box on the 'Aux - XM Radio' Page shows a list of the available channels for the selected category. Channels can be stepped through one at a time or may be selected directly by channel number.

Selecting a channel from the 'Channels' List:

1) While on the 'Aux - XM Radio' Page, press the **Channel** Softkey.

2) Press the **CH +** Softkey to go up through the list of channels, or move down the list with the **CH –** Softkey.

Or:

1) From the 'Aux - XM Radio' Page, press the **FMS** Knob to highlight the 'Channels' List and turn the large **FMS** Knob to scroll through the channels.

2) Press the **ENT** Key to activate the selected channel.

Selecting a channel directly:

1) While on the 'Aux - XM Radio' Page, press the **Channel** Softkey.

2) Press the **Direct CH** Softkey. The channel number in the 'Active Channel' Box is highlighted.

3) Press the numbered softkeys located on the bottom of the display to directly select the desired channel number.

4) Press the **ENT** Key to activate the selected channel.

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CATEGORY

The Category Box of the 'Aux - XM Radio' Page, displays the currently selected category of audio. Categories of channels such as jazz, rock, or news can be selected to list the available channels for a type of music or other contents. One of the optional categories is Presets which is used to view channels that have been programmed by the crew.

Selecting a category:

1) While on the 'Aux - XM Radio' Page, press the **Category** Softkey.

2) Press the **CAT +** and **CAT -** softkeys to cycle through the categories.

   Or:

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

2) Turn the large **FMS** Knob to select the 'Categories' Field.

3) Using the small **FMS** Knob, highlight the desired category and press the **ENT** Key. Selecting 'All Categories' places all channels in the list.

Figure 8-28 Categories List

PRESETS

Up to 15 channels from any category can be assigned a preset number. The preset channels are selected by pressing the **Presets** and **More** softkeys. Then the preset channel can be selected directly and added to the channel list for the Presets category.

Setting a preset channel number:

1) On the 'Aux - XM Radio' Page, while listening to an active channel, press the **Presets** Softkey to access the first five preset channels (**Preset 1 - Preset 5**).

2) Press the **More** Softkey to access the next five channels (**Preset 6 – Preset 10**), and again to access the last five channels (**Preset 11 – Preset 15**). Pressing the **More** Softkey repeatedly cycles through the preset channels.

3) Press any one of the (**Preset 1 - Preset 15**) softkeys to assign a number to the active channel.

4) Press the **Set** Softkey on the desired channel number to save the channel as a preset.

Figure 8-29 Accessing and Selecting SiriusXM Preset Channels

Pressing the **Back** Softkey, or 45 seconds of softkey inactivity, returns the system to the top level softkeys.

VOLUME

Radio volume is shown as a percentage. Volume level is controlled by pressing the **Volume** Softkey, which brings up the **VOL –** and **VOL +** softkeys.

> **Adjusting the volume:**

1) With the 'Aux - XM Radio' Page displayed, press the **Volume** Softkey.

2) Press the **VOL –** Softkey to reduce volume or press the **VOL +** Softkey to increase volume. Once the **VOL** Softkey is pressed, the volume can also be adjusted using the small **FMS** Knob. Volume can also be adjusted with the Audio Panel **Volume** Knob. See the Audio Panel and CNS Section for further information. Volume can also be adjusted with the Audio Panel Volume Knob when **MUS1**, **MUS2**, or **MUSIC/MUS** Buttons are pressed, as applicable.
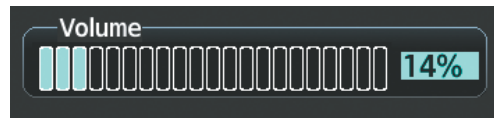

Figure 8-30 Volume Control

SiriusXM Radio volume may also be adjusted on each passenger headset.

> **Muting SiriusXM audio:**

Refer to the Audio Panel Controls in Section 4 for SiriusXM muting instructions.

SIRIUSXM DATA LINK RECEIVER TROUBLESHOOTING

For troubleshooting purposes, check the LRU Information Box on the 'Aux - System Status' Page for SiriusXM Datalink Receiver status, serial number, and software version number. If a failure has been detected, the status is marked with a red X.

> **Selecting the 'Aux - System Status' Page:**

1) Turn the large **FMS** Knob to select the Aux Page Group.

2) Turn the small **FMS** Knob to select the 'Aux - System Status' Page.

Some quick troubleshooting steps listed below can be performed to find the possible cause of a failure.

- Ensure the installed Data Link Receiver or Iridium Transceiver has an active subscription or account
- Perform a quick check of the circuit breakers to ensure that power is applied to the Data Link Receiver or Iridium Transceiver

Ensure that nothing is plugged into the MUSIC 1 or MUSIC 2 jacks because that would prevent SiriusXM radio from being heard

If a failure still exists, the following messages may provide insight as to the possible problem:

Message	Message Location	Description
CHECK ANTENNA	XM Information Page (MFD)	Data Link Receiver antenna error; service required
UPDATING	XM Information Page (MFD)	Data Link Receiver updating encryption code
NO SIGNAL	XM Information Page Weather Datalink Page (MFD)	Loss of signal; signal strength too low for receiver
LOADING	XM Radio Page (MFD)	Acquiring channel audio or information
OFF AIR	XM Radio Page (MFD)	Channel not in service
--------	XM Radio Page (MFD)	Missing channel information
WEATHER DATA LINK FAILED	Weather Datalink Page (MFD)	No communication from Data Link Receiver within last 5 minutes
ACTIVATION REQUIRED	XM Information Page (MFD)	SiriusXM subscription is not activated
DETECTING ACTIVATION	Weather Datalink Page (MFD)	SiriusXM subscription is activating.
WAITING FOR DATA...	Weather Datalink Page (MFD)	SiriusXM subscription confirmed downloading weather data.

Table 8-4 Sirius XM Datalink Receiver Messages

8.6 SATELLITE TELEPHONE AND DATALINK SERVICES (OPTIONAL)

> **NOTE:** *An account must be established to access the Iridium Satellite Network for voice and SMS Services.*

The Iridium Transceiver provides an airborne low speed datalink, Iridium Satellite Telephone service, and Short Message Service (SMS). The telephone is available to the flight crew through the audio panel and headsets. Operation of these features in the cockpit is accomplished through the 'Aux - Telephone' Page or the 'Aux - Text Messaging' Page.

For aircraft equipped with an Iridium Transceiver (GSR 56) and a Wireless Transceiver (FS 510), calls and SMS text can be made using a Portable Electronic Device through the Garmin Pilot™ App. Please refer to the Garmin Pilot™ User Guide for further information.

REGISTERING THE SYSTEM WITH GARMIN CONNEXT

A subscriber account must be established prior to using the Iridium Satellite System. Before setting up an Iridium account, obtain the serial number of the Iridium Transceiver (GSR 1) and the System ID by selecting the 'Aux - System Status' Page. Contact Garmin at flygarmin.com.

Registering the system for datalink services:

1) Using the **FMS** Knob, select the 'Aux - System Status' Page.

2) Touch the **LRU** Softkey, if not already selected.

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

4) Use the large **FMS** Knob to view 'GSR 1.'

5) Note the GSR 1 Serial Number as seen in the following figure. This number will be needed when contacting Garmin Connext to establish the account.

6) Also note the System ID. It is found in the Airframe Box on the 'Aux - System Status' Page (see following figure). The System ID will also be needed when contacting Garmin Connext.

7) Contact Garmin Connext to establish an account and receive an access code.

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Figure 8-31 'Aux - System Status' Page

DISABLING/ENABLING THE IRIDIUM TRANSCEIVER

Iridium telephone and data communications may be turned on or off by performing these simple steps.

Disabling/enabling telephone and low speed data services:

1) Turn the large **FMS** Knob on the MFD to select the 'Aux' page group.

2) Turn the small **FMS** Knob to select the 'Aux - Satellite Phone' Page.

3) If necessary, press the **Phone** Softkey to display the 'Aux - Telephone' Page.
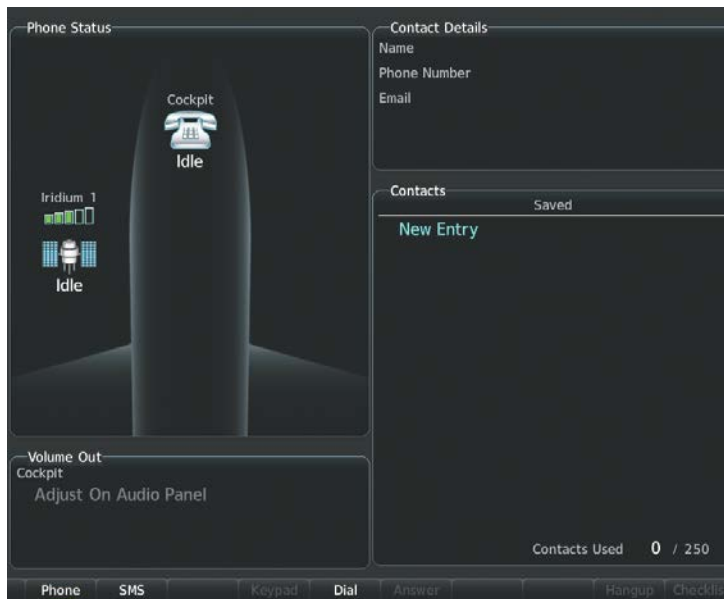
Figure 8-32 'Aux - Telephone' Page

4) Press the **MENU** Key. The 'Page Menu' Window is now displayed.

5) Turn the **FMS** Knob to select 'Disable Iridium Transmission' in the menu list.

Figure 8-33 Select 'Disable Iridium Transmission'

6) Press the **ENT** Key. The Iridium transceiver is now disabled.

7) To enable the Iridium transceiver, repeat steps 1 through 4, then select 'Enable Iridium Transceiver.'

CONTACTS

The names, telephone number, and email addresses can be saved in a list of contacts for easy use when making telephone calls.

Creating a new contact:

1) With the 'Aux - Telephone Phone' Page displayed, press the **FMS** Knob to display the cursor.

2) If necessary, turn either **FMS** Knob to place the cursor on 'New Entry.'

3) Press the **ENT** Key. The cursor moves the 'Name' Field of the 'Contact Details' Window.

4) Enter the desired name of the new contact. Entry is accomplished through the **FMS** Knob on the MFD.

5) Press the **ENT** Key. The cursor moves to the 'Phone Number' Field.

6) Enter the desired telephone number. Entry is accomplished through the **FMS** Knob on the MFD.

7) Press the **ENT** Key. The cursor moves to the 'Email' Field.

8) Enter the desired email address. Entry is accomplished through the **FMS** Knob on the MFD.

9) The **Symbols** Softkey can display the "@" symbol, the period, and other special characters. Pressing the **More** Softkey will cycle through additional special characters.

Figure 8-34 Special Characters

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10) Press the **ENT** Key. The **Save** Softkey is highlighted.

11) Press the **ENT** Key. The new contact entry is added to the list of saved contacts.
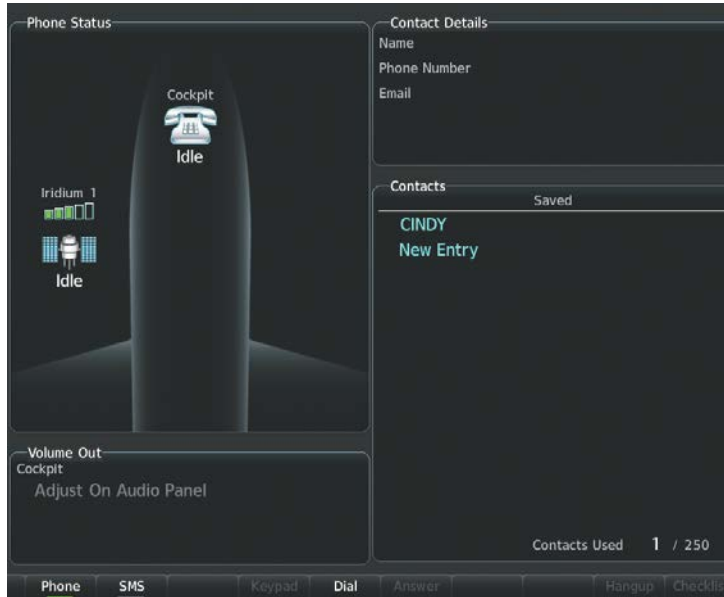

Figure 8-35 New Contact Added

Editing a contact:

1) With the 'Aux - Telephone' Page displayed, press the **FMS** Knob to display the cursor.

2) Turn either **FMS** Knob to place the cursor on the desired contact name.

3) Press the **Edit** Softkey. The cursor is placed in the 'Name' Field. Enter the desired changes. Entry is accomplished through the **FMS** Knob on the MFD.

4) Press the **ENT** Key when each field is complete. The **Save** Button is now highlighted.

5) Press the **ENT** Key to save the changes.

Deleting a contact:

1) With the 'Aux - Telephone' Page displayed, press the **FMS** Knob to display the cursor.

2) Turn either **FMS** Knob to place the cursor on the desired contact name.

3) Press the **Delete** Softkey. A confirmation window is displayed.

4) With 'OK' highlighted, press the **ENT** Key to delete the selected contact.

TELEPHONE COMMUNICATION

The pilot or copilot can place and answer calls on the Iridium Satellite Network. Control and monitoring of telephone functions are accomplished through the 'Aux - Telephone' Page.

Viewing the 'Aux - Telephone' Page:

1) Turn the large **FMS** Knob on the MFD to select the 'Aux' Page Group.

2) Turn the small **FMS** Knob to select the 'Aux - Satellite Phone' Page.

3) If necessary, press the **Phone** Softkey to display the 'Aux - Telephone' Page.

The phone status display gives a graphical representation of the current disposition of voice and/or data transmissions.
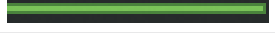
Internal Phone	External Phone	Description
Idle	Idle	Phone is Idle
Ringing	Ringing	Phone is ringing
Connected	Connected	Phone has a dial tone (off hook) or connected to another phone
		Phone dialed is busy
Dialing	Dialing	Phone is dialing another phone
		Phone has failed
		Phone status not known
	Disabled	Phone is disabled
	DATA TX	Phone is reserved for data transmission
		Calling other phone or incoming call from other phone
		Other phone is on hold
		Phones are connected

Table 8-5 Telephone Symbols

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INCOMING CALLS

When viewing MFD pages other than the 'Aux - Telephone' Page, a pop-up alert will be displayed and an aural alert "Incoming Call" will be heard. If the incoming call is an Iridium Network call, 'Iridium' will be displayed. The pop-up alert may be inhibited at times, such as during takeoff. In addition to the pop-up alert, a ringing phone symbol will be displayed to the right of the MFD page title. Also, the voice alert "Incoming Call" will be heard on the selected cockpit audio.

> ✓ **NOTE:** The **Push-to-Talk** Switch is not utilized for telephone communication. The microphone is active after pressing the **Answer** Softkey, and stays active until the call is terminated.

Answering a call from the cockpit:

1) Press the **Phone** Key on the appropriate audio panel.

2) Press the **Answer** Softkey on the MFD.

> **Or:**

While viewing the 'Aux - Satellite Phone' Page, press the **Answer** Softkey on the MFD.

> **Or:**

1) Press the **Phone** Key on the appropriate audio panel.

2) Press the **MENU** Key to display the 'Page Menu.'

3) Turn either **FMS** Knob to place the cursor on 'Answer Incoming Call.'

4) Press the **ENT** Key.

Pressing the **Ignore** Softkey will extinguish the pop-up window and leave the call unanswered. Pressing the **Phone** Softkey will display the 'Aux - Telephone' Page allowing additional call information to be viewed before answering.

Muting incoming call alerts:

1) With the 'Aux - Telephone' Page displayed, press the **MENU** Key on the MFD to display the 'Page Menu.'

2) Turn either **FMS** Knob to place the cursor on 'Disable Incoming Call Alerts.'

3) Press the **ENT** Key. The voice and pop-up alert will not be displayed now when an incoming call is received and in the 'Phone Status' Box, "Incoming Call Alerts Disabled" is displayed.

OUTGOING CALLS

Voice calls can be made from the cockpit to an external phone through the Iridium Satellite Network.

The International dialing sequence is necessary to place a call from the cockpit to an external phone: Country Code + City/Area Code (if any) + Telephone Number. The following country codes may be used when calling other satellite telephone systems.

Satellite System	Country Code
Inmarsat	870
ICO	8810 or 8811
Ellipso	8812 or 8813
Iridium	8816 or 8817
Globalstar	8818 or 8819

Table 8-6 Country Codes

Making an external call from the cockpit using the Iridium satellite network:

1) With the 'Aux - Telephone' Page displayed, press the **Phone** Softkey (if not already selected).

    Or:

    Press the **Phone** Key on the appropriate audio panel to display the 'Aux - Telephone' Page. Then press the **Phone** Softkey (if not already selected).

2) Press the **Dial** Softkey on the MFD.
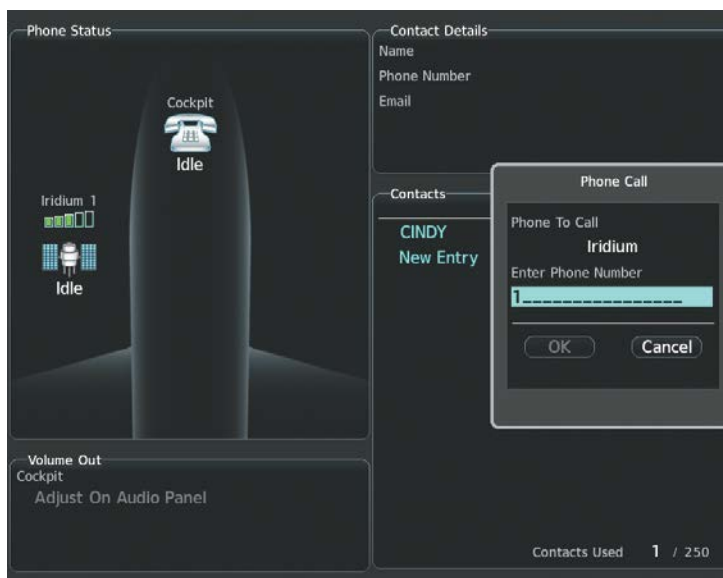
Figure 8-36 Enter Phone Number

3) Enter the desired telephone number (country code first) by using the **FMS** Knob on the MFD or by pressing the number softkeys on the MFD.

4) Press the **ENT** Key. 'OK' is highlighted.

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Figure 8-37 Make the Call

5) Press the **ENT** Key. The system will begin calling the number.
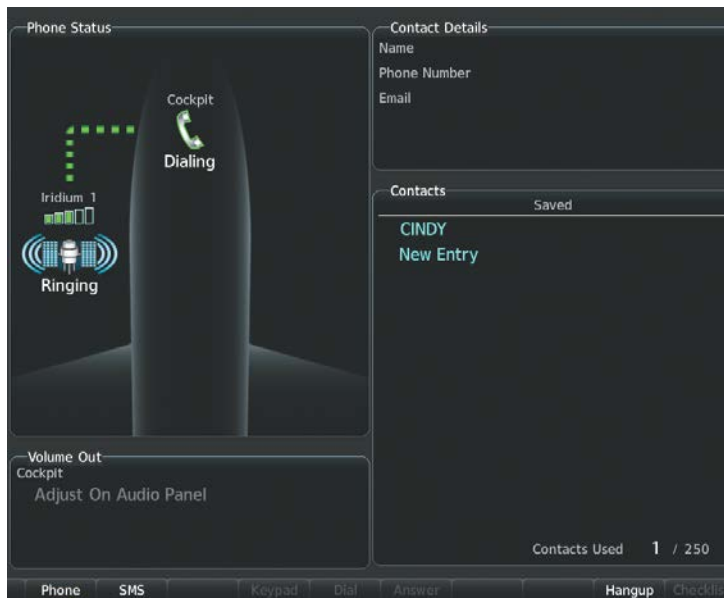
Figure 8-38 Establishing a Connection

When the phone is answered, the connection is established. To exit the call, press the **Hangup** Softkey.
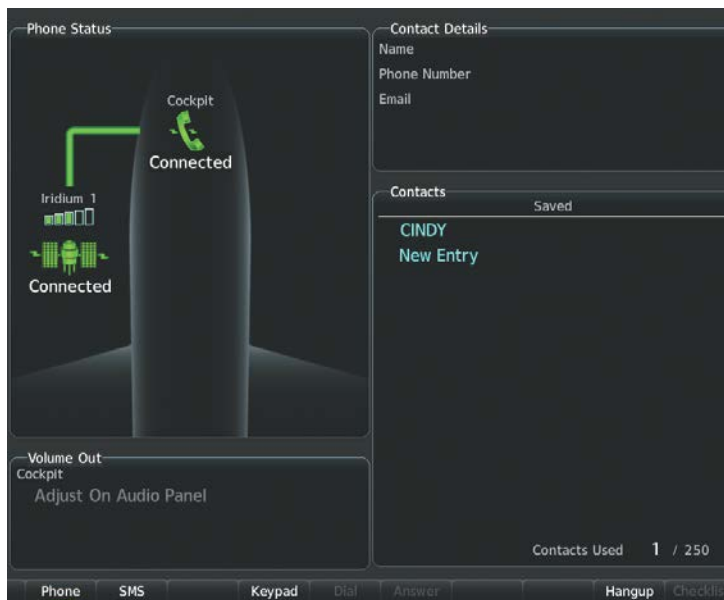
Figure 8-39 Telephone Connected

Making an external call from the cockpit by using the Contact List:

1) With the 'Aux - Telephone' Page displayed, press the **Phone** Softkey (if not already selected).

   Or:

   Press the **Phone** Key on the appropriate audio panel to display the 'Aux - Telephone' Page. Then press the **Phone** Softkey (if not already selected).

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

3) Turn the small **FMS** Knob to select the desired contact name in the list of contacts.

4) Press the **Call** Softkey. The external call is initiated and the number associated with the contact name is dialed.

TEXT MESSAGING (SMS)

The pilot or copilot can send and receive text messages on the Iridium Satellite Network. Messages may be sent to an email address or text message capable cellular telephone. Message length is limited to 160 characters, including the email address. Senders should address text messages to aircraft by entering [aircraft Iridium phone number]@msg.iridium.com.

The text messaging user interface is accessed through the 'Aux - Text Messaging' Page.

Viewing the 'Aux - Text Messaging' Page:

1) Turn the large **FMS** Knob on the MFD to select the 'Aux' Page Group.

2) Turn the small **FMS** Knob to select the 'Aux - Satellite Phone' Page.

3) Press the **SMS** Softkey to display the 'Aux - Text Messaging' Page.
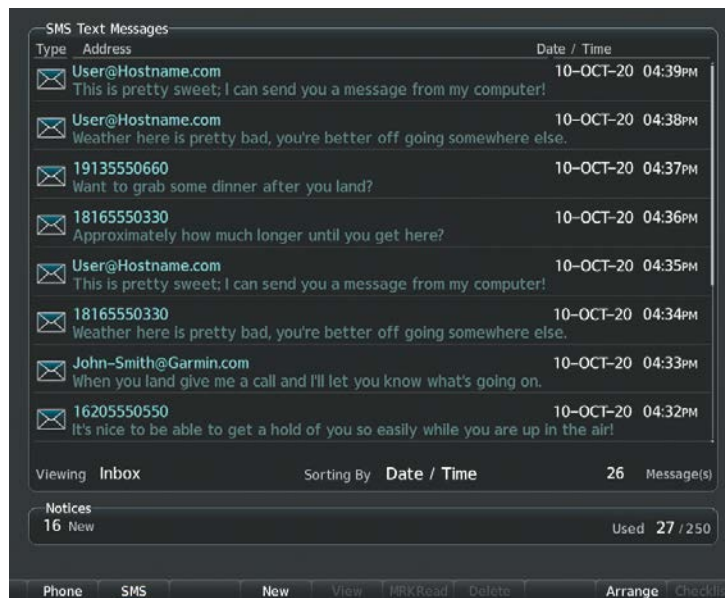
Figure 8-40 'Aux - Text Messaging' Page

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Message Symbol	Description
	Received text message that has not been opened
	Received text message that has been opened
	A reply has been sent for this text message
	Saved text message, draft not sent
	System is sending text message
	Text message has been sent
	System failed to send text message

Table 8-7 Text Message Symbols

VIEWING A TEXT MESSAGE WHEN RECEIVED

When viewing MFD pages other than the 'Aux - Text Messaging' Page, a pop-up alert will be displayed when a new text message is received.

Figure 8-41 New Text Message Pop-up

Press the **View** Softkey (see previous figure) to view the message. Pressing the **Ignore** Softkey will extinguish the pop-up window and leave the text message unopened. Pressing the **Ignore All** Softkey will extinguish the pop-window and ignore all future incoming text messages. Pressing the **SMS** Softkey will display the 'Aux - Text Messaging' Page.

Figure 8-42 Text Message Displayed from Pop-Up Alert

Pop-up alerts may be enabled or disabled through the 'Page Menu.'

Enabling/disabling incoming text message pop-up alerts:

1) With the 'Aux - Text Messaging' Page displayed, press the **MENU** Key on the MFD to display the 'Page Menu.'

2) Turn either **FMS** Knob to place the cursor on 'Disable New Message Popups' or 'Enable New Message Popups.'

3) Press the **ENT** Key. The pop-up alert will not be displayed when an incoming text message is received. The notification, "New Message Popups Disabled" displays in the 'Notices' Window.
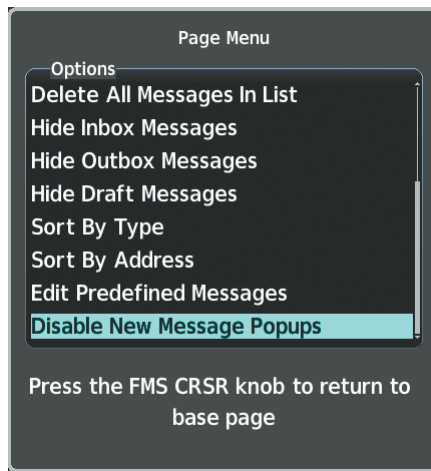
Figure 8-43 Disabling New Text Message Pop-Ups

REPLY TO A TEXT MESSAGE

After reading a text message, a reply may be sent.

Replying to a text message:

While viewing the text message, press the **Reply** Softkey.

Or:

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

2) Turn either **FMS** Knob to place the cursor on 'Reply To Message.'

3) Press the **ENT** Key.

SENDING A TEXT MESSAGE

Text messages may be sent from the 'Aux - Text Messaging' Page.

Sending a new text message:

1) While viewing the 'Aux - Text Messaging' Page, press the **New** Softkey.

Or:

a) While viewing the 'Aux - Text Messaging' Page, press the **MENU** Key to display the 'Page Menu.'

b) Turn either **FMS** Knob to place the cursor on 'Draft New Message.'

c) Press the **ENT** Key.
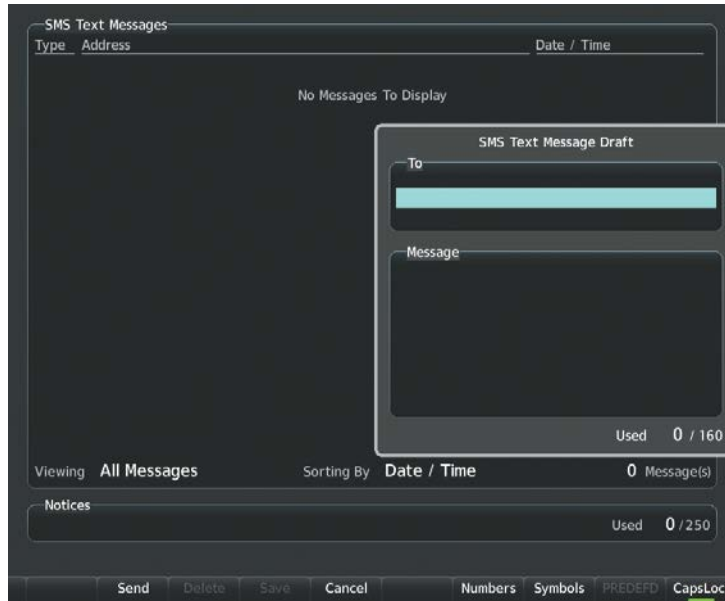
Figure 8-44 Composing a New Text Message

2) The 'SMS Text Message Draft' Window is now displayed with the cursor in the 'To' Field. Enter the desired telephone number or email address.

Entry is accomplished through use of the **FMS** Knob on the MFD and by use of the softkeys on the MFD. The **FMS** Knob is used to enter letters, numbers, and the "@" symbol, or numbers can be entered from the MFD by pressing the **Numbers** Softkey. Press the **CapsLock** Softkey to create upper and lower case alpha characters. Special characters can be accessed by pressing the **Symbols** Softkey.

3) Press the **ENT** Key. The cursor is now displayed in the 'Message' Field.

4) Enter the desired message using any combination of entry methods as described in step 2.

5) Press the **ENT** Key.

6) Press the **Send** Softkey to send the message immediately. Confirm you wish to send the message by pressing the **ENT** Key with 'Yes' highlighted.

Or:

Press the **Save** Softkey to save the message in Outbox for sending at a later time.

Or:

Press the **Cancel** Softkey to delete the message.

Text messages and emails may also be sent to contacts from the 'Aux - Telephone' Page.

Sending a new text message/email to a saved contact:

1) With the 'Aux - Telephone' Page displayed, press the **FMS** Knob to display the cursor.

2) Turn either **FMS** Knob to place the cursor on the desired contact name.

3) Press either the **Text EML** Softkey to send to the email address saved for the contact or the **Text PHN** Softkey to send to the phone number saved for the contact. The cursor is placed in the 'To' Field. Confirm the contact you wish to send a message to by pressing the **ENT** Key.

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4) Enter the desired message, then press the **ENT** Key.

5) Press the **Send** Softkey to send the message immediately. Confirm you wish to send the message by pressing the **ENT** Key with 'Yes' highlighted.

Or:

Press the **Save** Softkey to save the message as a draft.

Or:

Press the **Cancel** Softkey to delete the message.

PREDEFINED TEXT MESSAGES

Time and effort can be saved in typing text messages that are used repeatedly by saving these messages as a predefined message.

Creating a predefined text message:

1) While viewing the 'Aux - Text Messaging' Page, press the **MENU** Key to display the 'Page Menu.'

2) Turn either **FMS** Knob to select 'Edit Predefined Messages.'
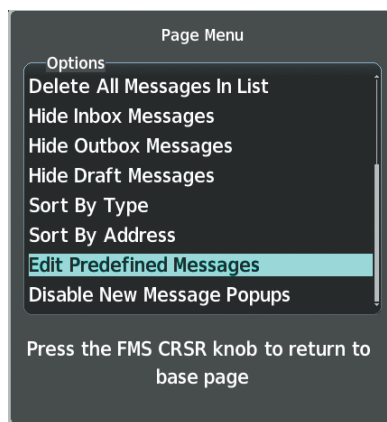
Figure 8-45 Creating/Editing Predefined Messages

3) Press the **ENT** Key. The Predefined Messages view is now displayed.

4) Press the **NEW** Softkey. The 'Predefined SMS Text Message' Window is now displayed.

Or:

a) Press the **MENU** Key to display the 'Page Menu.'

b) Turn either **FMS** Knob to place the cursor on 'Draft New Predefined Message.'

c) Press the **ENT** Key. The 'Predefined SMS Text Message' Window is now displayed.

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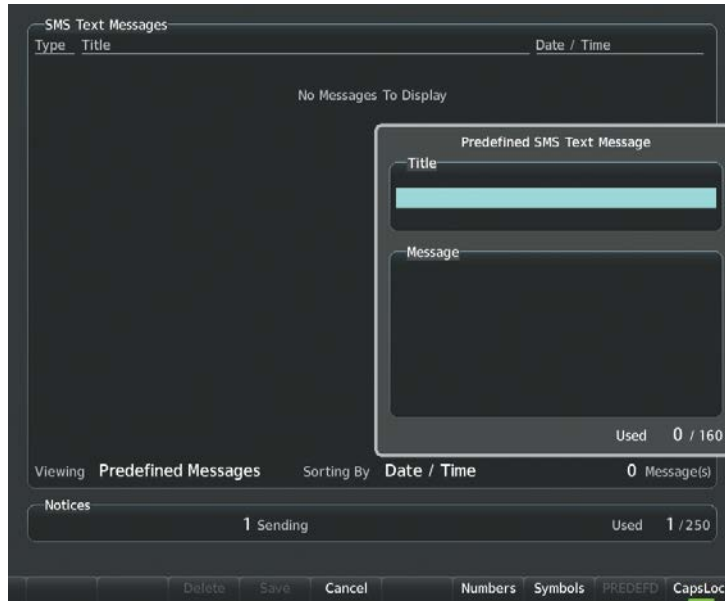
Figure 8-46 Composing a Predefined Message

5) The cursor is displayed in the 'Title' Field. Enter the desired message title.

   Entry is accomplished through use of the **FMS** Knob on the MFD and by use of the softkeys on the MFD. The **FMS** Knob is used to enter letters, numbers, and the "at" symbol, or numbers can be entered from the MFD by pressing the **Numbers** Softkey. Press the **CapsLock** Softkey to create upper and lower case alpha characters. Special characters can be accessed by pressing the **Symbols** Softkey.

6) Press the **ENT** Key. The cursor is now displayed in the 'Message' Field.

7) Enter the desired message using any combination of entry methods as described in step 5.

8) Press the **ENT** Key.

9) Press the **Save** Softkey. The new predefined message is now shown in the displayed list. Pressing the **Cancel** Softkey will delete the message without saving.

> **NOTE:** In order to send a predefined text message, as in the following procedure, a predefined text message must first be created using the previous procedure: 'Creating a predefined text message.'

Sending a predefined text message:

1) While viewing the 'Aux - Text Messaging' Page, press the **New** Softkey.

2) The 'SMS Text Message Draft' Window is now displayed with the cursor in the 'To' Field. Enter the desired telephone number or email address.

   Entry is accomplished through use of the **FMS** Knob on the MFD and by use of the softkeys on the MFD. The **FMS** Knob is used to enter letters, numbers, and the "at" symbol, or numbers can be entered from the MFD by pressing the **Numbers** Softkey. Press the **CapsLock** Softkey to create upper and lower case alpha characters. Special characters can be accessed by pressing the **Symbols** Softkey.

3) Press the **ENT** Key. The cursor is now displayed in the 'Message' Field.

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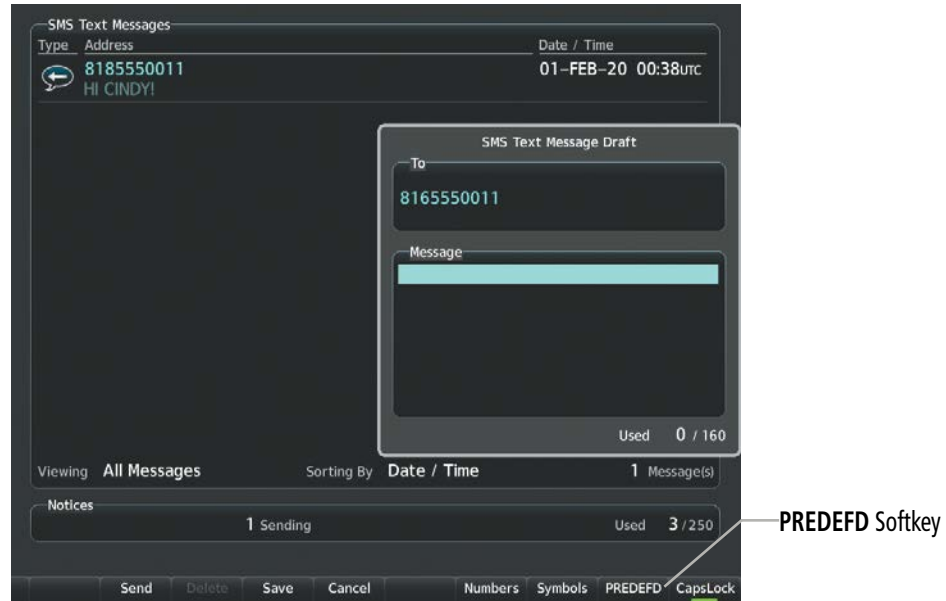
Figure 8-47 Predefined Message Key Visible

4)   Press the **PREDEFD** Softkey. The 'Predefined Message Menu' Window is displayed.
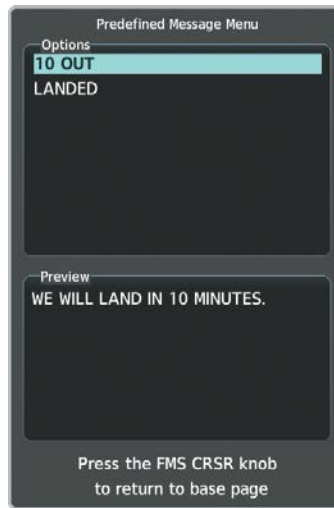
Figure 8-48 Predefined Message Key Visible

5)   Turn either **FMS** Knob to select the desired predefined message.

6)   Press the **ENT** Key. The predefined message text is inserted into the message field. If desired, the message can be edited.

7)   Press the **ENT** Key.

8)   Confirm you wish to send the message by pressing the **ENT** Key with 'Yes' highlighted. Select 'No' to return to the message entry field.

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TEXT MESSAGE BOXES

Received text messages reside in the Inbox as Read or Unread Messages. The Outbox contains sent and unsent text messages. Saved messages that are meant to be sent later are stored as drafts. Each text message box may be viewed separately, or together in any combination.

Showing Inbox messages:

While viewing the 'Aux - Text Messaging' Page, press the **Arrange** Softkey, then press the **Outbox** Softkey and the **Drafts** Softkey to only display the Inbox Messages. After pressing each softkey, the green annunciation below the applicable softkey will extinguish.

Or:

1) If the Inbox is not already displayed, press the **MENU** Key to display the 'Page Menu.'

2) Turn either **FMS** Knob to place the cursor on 'Hide Outbox Messages.'

3) Press the **ENT** Key. Then press the **MENU** Key again to display the 'Page Menu' and turn either **FMS** Knob to place the cursor on 'Hide Draft Messages.' Press the **ENT** Key.

4) The message box selected for viewing is indicated at the bottom left of the list window.
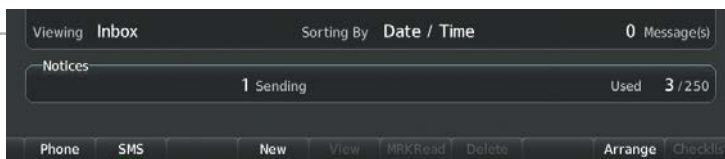
Figure 8-49 Viewing Inbox Messages

Showing Outbox messages:

While viewing the 'Aux - Text Messaging' Page, press the **Arrange** Softkey, then press the **Inbox** Softkey and the **Drafts** Softkey to only display the Outbox. After pressing each softkey, the green annunciation below the applicable softkey will extinguish.

Or:

1) If the Outbox is not already displayed, press the **MENU** Key to display the 'Page Menu.'

2) Turn either **FMS** Knob to place the cursor on 'Show Outbox Messages.'

3) Press the **ENT** Key. The message box selected for viewing is indicated at the bottom left of the list window as seen in the previous figure.

Showing Draft messages:

While viewing the 'Aux - Text Messaging' Page, press the **Arrange** Softkey, then press the **Inbox** Softkey and the **Outbox** Softkey to only display the Draft messages. After pressing each softkey, the green annunciation below the applicable softkey will extinguish.

Or:

1) If the Draft messages are not already displayed, press the **MENU** Key to display the 'Page Menu.'

2) Turn either **FMS** Knob to place the cursor on 'Show Draft Messages.'

3) Press the **ENT** Key. The message box selected for viewing is indicated at the bottom left of the list window.

MANAGING TEXT MESSAGES

The viewed messages may be sorted according to the date/time the message was sent or received, the type of message (e.g., read, unread, sent, unsent, etc.), or by message address.

Viewing messages sorted by type:

While viewing the 'Aux - Text Messaging' Page, press the **Arrange** Softkey, then press the **Type** Softkey (if not already selected).

Or:

1) If not already sorted by type, press the **MENU** Key to display the 'Page Menu.'

2) Turn either **FMS** Knob to place the cursor on 'Sort By Type.'

3) Press the **ENT** Key. The sorting selection is indicated at the bottom center of the list window.

Viewing messages sorted by date/time:

While viewing the 'Aux - Text Messaging' Page, press the **Arrange** Softkey, then press the **Time** Softkey (if not already selected).

Or:

1) If not already sorted by date/time, press the **MENU** Key to display the 'Page Menu.'

2) Turn either **FMS** Knob to place the cursor on 'Sort By Date/Time.'

3) Press the **ENT** Key. The sorting selection is indicated at the bottom center of the list window.

Viewing messages sorted by address:

While viewing the 'Aux - Text Messaging' Page, press the **Arrange** Softkey, then press the **Address** Softkey (if not already selected).

Or:

1) If not already sorted by address, press the **MENU** Key to display the 'Page Menu.'

2) Turn either **FMS** Knob to place the cursor on 'Sort By Address.'

3) Press the **ENT** Key. The sorting selection is indicated at the bottom center of the list window.

Viewing the content of a text message:

1) While viewing the 'Aux - Text Messaging' Page, press the **FMS** Knob to activate the cursor.

2) Turn either **FMS** Knob to select the desired message.

3) Press the **View** Softkey.

Or:

Press the **ENT** Key.

Or:

a) Press the **MENU** Key to display the 'Page Menu.'

b) Turn either **FMS** Knob to place the cursor on 'View Selected Message.'

c) Press the **ENT** Key. The message content is displayed.

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Figure 8-50 Viewing Message Content

4)   To close the text message, press the **Close** Softkey.

  Or:

  a)   Press the **MENU** Key to display the 'Page Menu.'

  b)   Turn either **FMS** Knob to place the cursor on 'Close Message.'

  c)   Press the **ENT** Key.

Marking selected message as read:

1)   While viewing the Inbox on the 'Aux - Text Messaging' Page, press the **FMS** Knob to activate the cursor.

2)   Turn either **FMS** Knob to select the desired message.

3)   Press the **MRK Read** Softkey.

  Or:

  a)   Press the **MENU** Key to display the 'Page Menu.'

  b)   Turn either **FMS** Knob to place the cursor on 'Mark Selected Message As Read.'

  c)   Press the **ENT** Key. The message symbol now indicates the message has been opened.

Marking all messages as read:

1)   While viewing the Inbox on the 'Aux - Text Messaging' Page, press the **MENU** Key to display the 'Page Menu.'

2)   Turn either **FMS** Knob to place the cursor on 'Mark All New Messages As Read.'

3)   Press the **ENT** Key. A confirmation window is displayed.

4)   With cursor highlighting 'Yes,' press the **ENT** Key. The message symbols now indicate all the message have been opened.

Deleting a message:

1) While viewing the Inbox on the 'Aux - Text Messaging' Page, press the **FMS** Knob to activate the cursor.

2) Turn either **FMS** Knob to select the desired message.

3) Press the **Delete** Softkey. A confirmation window is displayed.

4) With cursor highlighting 'YES', press the **ENT** Key. The message is now deleted.

    Or:

    a) Press the **MENU** Key to display the 'Page Menu.'

    b) Turn either **FMS** Knob to place the cursor on 'Delete Selected Message.'

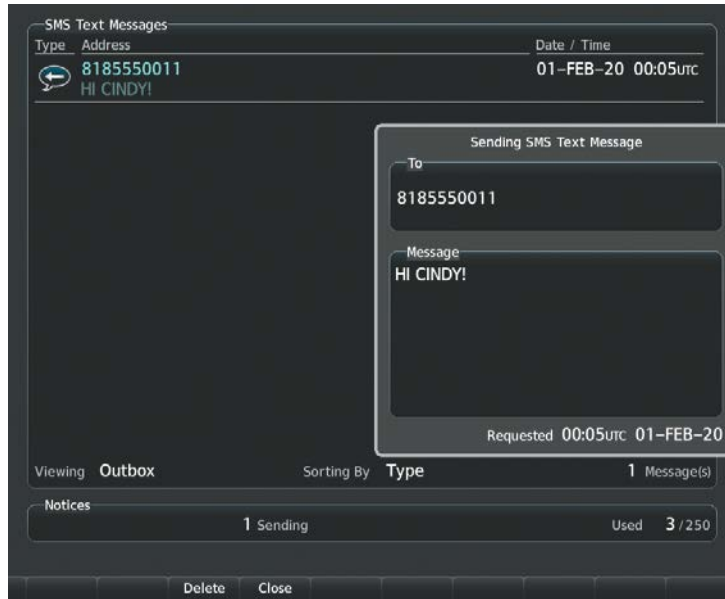   c) Press the **ENT** Key. A confirmation window is displayed.

5) With cursor highlighting 'Yes,' press the **ENT** Key. The message is now deleted.

Deleting all messages:

1) While viewing the Inbox on the 'Aux - Text Messaging' Page, press the **MENU** Key to display the 'Page Menu.'

2) Turn either **FMS** Knob to select 'Delete All Messages in List.'

3) Press the **ENT** Softkey. A confirmation window is displayed.

4) With cursor highlighting 'YES', press the **ENT** Key. All messages are now deleted.

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8.7 CONNEXT (OPTIONAL)

The 'Aux - Connext Setup' Page allows aircrew to setup a Wireless Transceiver (FS510) for a Bluetooth connection between the system and a mobile device running the Garmin Pilot™ application.

The mobile device must be 'paired' with the system in order to use the various functions. Pairing is accomplished by first placing the system in pairing mode by displaying the 'Aux - Connext Setup' Page. The system is 'discoverable' whenever this page is displayed. The pairing operation is completed from the mobile device and the Garmin Pilot application. See the device Bluetooth pairing instructions and the connection instructions in the Garmin Pilot application.

Viewing the 'Aux - Connext Setup' Page:

1) Turn the large **FMS** Knob on the MFD to select the 'Aux' Page Group.

2) Turn the small **FMS** Knob to select the 'Aux - Connext Setup' Page.

Changing the Bluetooth Name:

1) While viewing the 'Aux - Connext Setup' Page, press the **FMS** Knob to activate the cursor.

2) Turn the large **FMS** Knob to place the cursor in the 'Bluetooth Name' Field.

3) Enter the desired name by using the large **FMS** Knob to select the character field, and the small **FMS** Knob select the desired alphanumeric character for that field.

4) Press the **ENT** Key. The cursor is removed and the new name is displayed.

Figure 8-51 Changing the Bluetooth Name

Enabling/disabling Flight Plan Importing from Garmin Pilot:

1) While viewing the 'Aux - Connext Setup' Page, press the **FMS** Knob to activate the cursor.

2) Turn the large **FMS** Knob to place the cursor in the 'Flight Plan Import' Field.

3) Turn the small **FMS** Knob to select 'Enabled' or 'Disabled.'
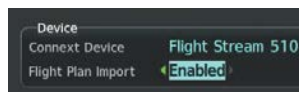
4) Press the **FMS** Knob to remove the cursor.

Figure 8-52 Flight Plan Import Enabled

Enabling/disabling WiFi Database Importing from Garmin Pilot:

1) While viewing the 'Aux - Connext Setup' Page, press the **FMS** Knob to activate the cursor.

2) Turn the large **FMS** Knob to place the cursor in the 'WiFi Database Import' Field.

3) Turn the small **FMS** Knob to select 'Enabled' or 'Disabled.'

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

WiFi Database Import   ◄ Disabled ►

Figure 8-53 WiFi Database Disabled

Enabling/disabling automatic reconnection of a paired device:

1) While viewing the 'Aux - Connext Setup' Page, press the **FMS** Knob to activate the cursor.

2) Turn the large **FMS** Knob to highlight the desired paired device.

3) Turn the small **FMS** Knob to select 'Enabled' or 'Disabled.' Selecting 'Enabled' allows the system to automatically connect to a previously paired device when detected.

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

Paired Devices		
Name	Status	Auto Reconnect
Galaxy J3 Prime	N/A	◄ Enabled ►
Galaxy Tab A	N/A	◄ Disabled ►
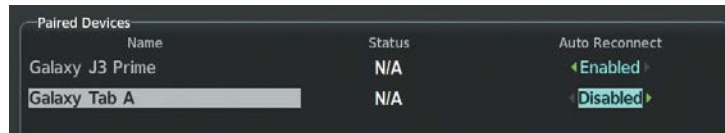
Figure 8-54 Auto Reconnect Disabled

Removing a paired device from the List of Paired Devices:

1) While viewing the 'Aux - Connext Setup' Page, press the **FMS** Knob to activate the cursor.

2) Turn the large **FMS** Knob to highlight the desired paired device.

3) Press the **Remove** Softkey. A confirmation screen is displayed.

4) If necessary, turn the large **FMS** Knob to select 'Yes.'

5) Press the **ENT** Key to remove the device from the list of paired devices.

Are you sure you want to remove the selected device? The device will have to be manually paired to use again.

Yes   or   No

Figure 8-55 Removing Paired Device

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8.8 MAINTENANCE WIFI CONNECTIONS

The optional WiFi Datalink provides a high speed IEEE 802.11g WiFi data link between the aircraft and a ground computer network while the aircraft is on the ground and located within range of the network.

The system is capable of WEP64, WEP128, WPA-PSK, and WPA2-PSK encryption formats. WPA-Enterprise and WPA2-Enterprise are not supported. Connections that require web proxies, captive portals, or other elements that require user credentials, including a user name and password or a redemption or access code; or require action such as accepting a user agreement, are not supported.

Control and monitoring of WiFi functions are accomplished through the 'Aux-Maintenance WiFi Setup' Page.
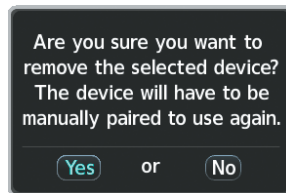
Viewing the WiFi Setup Page:

1) Turn the large **FMS** Knob on the MFD to select the Aux page group.

2) Turn the small **FMS** Knob to select the 'Aux-Maintenance WiFi Setup' Page.

Setting up a new WiFi connection:

1) Press the **Avail** Softkey on the MFD. A list of available networks will be displayed in the Available Networks window. Signal strength is shown for each network, as well as security requirements and whether the network has been saved in the system's memory.

Figure 8-56 Available Wi-Fi Networks

2) If necessary, press the **Rescan** Softkey to have the system scan again for available networks.

   Or:

   a) Press the **MENU** Key to display the Page Menu.

   b) Turn either **FMS** Knob to place the cursor on 'Rescan Available Networks'.

   c) Press the **ENT** Key.

3) Push the **FMS** Knob to place the cursor in the list of networks.

4) Turn either **FMS** Knob to select the desired network.

Figure 8-57 Desired Network Selected

5) Press the **Connect** Softkey.

 Or:

 a) Press the **MENU** Key to display the Page Menu.

 b) Turn either **FMS** Knob to place the cursor on 'Connect to Selected Network'.

 c) Press the **ENT** Key.

6) If the network is secured, a window will be displayed in order to enter the necessary passcode. Use the **FMS** Knobs to enter the desired alpha numeric characters. Press the **CapsLock** Softkey to enter upper case letters. If there is no security associated with the network, proceed to step 9.

7) Press the **ENT** Key. 'OK' will be highlighted.

8) Press the **ENT** Key again.

9) The Save Settings window is now displayed with the cursor highlighting 'Save Connection'.

10) The selected network can be saved to system memory to make re-connection easier at a later time.

 Connecting the selected network without saving:

 a) Turn the large **FMS** Knob to move the cursor to highlight 'Connect'.

 b) Press the **ENT** Key.

Saving and connect the selected network:

a) Press the **ENT** Key. A checkmark is placed in the checkbox and the cursor moves to the airport field.

b) Using the **FMS** Knobs, enter an airport identifier to be associated with the saved network. This aids in identifying the network later in the event of duplicate network names.

c) Press the **ENT** Key. The cursor moves to 'Connect'.

d) Press the **ENT** Key again to connect to the selected network.

Editing a saved network:

1) While viewing list of saved networks, push the **FMS** Knob to activate the cursor.

2) Turn either **FMS** Knob to highlight the network to be edited.

3) Pressing the **ENT** Key at this point will check or uncheck the Auto Connect checkbox. When a checkmark is present, the system will automatically connect to the network when within range.

4) Press the **Edit** Softkey. The cursor now appears in the Connection Settings window.

5) Turn the large **FMS** Knob to select the network attribute to be edited.

6) Turn the small **FMS** Knob to begin editing the field.

7) When the entry is complete, press the **ENT** Key.

8) Turn the large **FMS** Knob or press the **ENT** Key until 'Save' is highlighted.

9) Press the **ENT** Key.

Disconnecting a WiFi network:

Press the **DISCNCT** Softkey.

Or:

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

2) Turn either **FMS** Knob to place the cursor on 'Disconnect From Network'.

3) Press the **ENT** Key.

Deleting a saved WiFi network:

1) While viewing the list of saved networks, push the **FMS** Knob to activate the cursor.

2) Turn either **FMS** Knob to highlight the network to be deleted.

3) Press the **Delete** Softkey. The selected network is removed from the list.

8.9 DATA LOGGING

> ✓ **NOTE:** Some aircraft installations may not provide all aircraft/engine data capable of being logged by the system.

> ✓ **NOTE:** If a Wireless Transceiver (FS 510) is installed, Flight Data Logging will be available through Connext and the Garmin Pilot™ application. See Garmin Pilot User's Guide for further information.

The Flight Data Logging feature will automatically store critical flight and engine data on an SD data card (up to 16GB) inserted into the top card slot of the MFD. Approximately 1,000 flight hours can be recorded for each 1GB of available space on the card.

Data is written to the SD card once each second while the MFD is powered on. All flight data logged on a specific date is stored in a file named in a format which includes the date, time, and nearest airport identifier. The file is created automatically each time the system is powered on, provided an SD card has been inserted.

When a wireless transceiver (FS 510) is installed, logged data from the current flight plan and from past flights can be streamed via a Bluetooth connection. This requires a Flight Stream 510 to be inserted in the bottom slot of the GDU, and a the Garmin Pilot application running on a mobile device.

Once the data has been transferred to Garmin Pilot, the app. can transfer the flight log to the pilot's flygarmin.com account for archiving and analysis once the mobile device connects to the internet.

> ✓ **NOTE:** Past flights cannot be viewed directly on Garmin Pilot and need to be pushed to flygarmin.com to access them.

The status of the Flight Data Logging feature can be viewed on the 'Aux - Utility' Page. If no SD card has been inserted, "NO CARD" is displayed. When data is being written to the SD card, "LOGGING DATA" is displayed. The .csv file may be viewed with Microsoft Excel® or other spreadsheet applications. The following is a list of data parameters the system is capable of logging.

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- Date
- Time
- GPS altitude (MSL)
- GPS altitude (WGS84 datum)
- Baro-Corrected altitude (feet)
- Baro Correction (in/Hg)
- Indicated airspeed (kts)
- Vertical speed (fpm)
- GPS vertical speed (fpm)
- OAT (degrees C)
- True airspeed (knots)
- Pitch Attitude Angle (degrees)
- Roll Attitude Angle (degrees)
- Ground Speed (kts)
- Ground Track (degrees magnetic)
- Latitude (degrees; geodetic; +North)

- Longitude (degrees; geodetic; +East)
- Magnetic Heading (degrees)
- HSI source
- Selected course
- Com1/Com2 frequency
- Nav1/Nav2 frequency
- CDI deflection
- VDI/GP/GS deflection
- Wind Direction (degrees)
- Wind Speed (knots)
- Active Waypoint Identifier
- Distance to next waypoint (nm)
- Bearing to next waypoint (degrees)
- Magnetic variation (degrees)
- Autopilot On/Off
- AFCS roll/pitch modes

- AFCS roll/pitch commands
- GPS fix
- GPS horizontal alert limit
- GPS vertical alert limit
- SBAS GPS horizontal protection level
- SBAS GPS vertical protection level
- Fuel Qty (right & left)(gals)
- Fuel Flow (gph)
- Oil Pressure (psi)
- Oil Temperature (deg. F)
- EGT (1-6 deg F)
- CHT (1-6 deg F)
- Engine Speed (rpm)
- Power (%)

The file containing the recorded data will appear in the format shown in the following figure. This file can be imported into most computer spreadsheet applications.
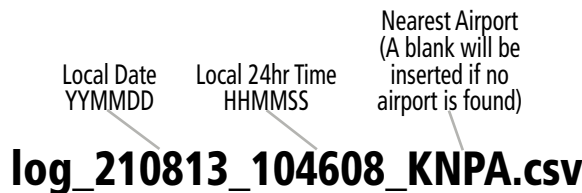
Local Date YYMMDD   Local 24hr Time HHMMSS   Nearest Airport (A blank will be inserted if no airport is found)

log_210813_104608_KNPA.csv

Figure 8-58 Log File Format

Data logging status can be monitored on the 'Aux - Utility' Page.

8.10 ELECTRONIC STABILITY AND PROTECTION (ESP™) (OPTIONAL)

> **NOTE:** *Refer to the current, pertinent flight manual to determine approval of ESP functionality.*

The Garmin Electronic Stability and Protection (ESP™) is designed to provide automatic control inputs to discourage aircraft operation outside a normal flight envelope. Garmin ESP™ works to maintain the desired pitch, roll, and airspeed operating envelope by automatically engaging one or more servos when the aircraft is near a defined pitch, roll, and/or airspeed operating limit. While ESP™ utilizes the same sensors, processors, and actuators as the autopilot, it is a separate function. The ESP™ system only operates when autopilot is not engaged and the aircraft is above 200 feet AGL.

ESP™ engages when the aircraft exceeds one or more conditions (pitch, roll, and airspeed) beyond the normal flight parameters. Enhanced stability for each condition is provided by applying a force to the appropriate control surface to return the aircraft to the normal flight envelope. This is perceived by the pilot as resistance to control movement in the undesired direction when the aircraft approaches a steep attitude or high airspeed.

As the aircraft deviates further from the normal attitude and/or airspeed range, the force increases (up to an established maximum) to encourage control movement in the direction necessary to return to the normal attitude and/or airspeed range. Except in the case of high airspeed, when maximum force is reached, force remains constant up to the maximum engagement limit. Above the maximum engagement limit, forces are no longer applied. There is no maximum engagement related to a high airspeed condition.

When ESP™ has been engaged for more than ten seconds (cumulative; not necessarily consecutive seconds) of a 20-second interval, the autopilot is automatically engaged with the flight director in Level Mode, bringing the aircraft into level flight. An aural "Engaging Autopilot" alert is played and the flight director mode annunciation will indicate 'LVL' for vertical and lateral modes.

The pilot can interrupt ESP™ by pressing and holding the Autopilot Disconnect (**AP DISC**) switch or the Control Wheel Steering (**CWS**) button. Upon releasing **AP DISC** or **CWS**, ESP™ force will again be applied, provided aircraft roll attitude is within engagement limits. ESP™ can also be overridden by overpowering the servo's mechanical torque limit.

ESP™ can be enabled or disabled on the 'Aux - System Setup 2' Page on the MFD.

To enable or disable ESP™:

1) Turn the large **FMS** Knob to select the Aux Page Group.

2) Turn the small **FMS** Knob to select the System Setup Page.

3) If necessary, press the **Setup 2** Softkey to display the 'Aux - System Setup 2' Page. If the 'Aux - System Setup 2' Page is already displayed, proceed to step 4.

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

5) Turn the large **FMS** Knob to place the cursor in the Stability & Protection field.

6) Turn the small **FMS** Knob to select 'Enabled' or 'Disabled'.

7) Push the **FMS** Knob to remove the cursor.

ESP™ is automatically enabled on system power on.

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ROLL ENGAGEMENT

Roll Limit Indicators are displayed on the roll scale at 45° right and left, indicating where ESP™ will engage. As roll attitude exceeds 45°, ESP™ will engage and the on-side Roll Limit Indicator will move to 30°. The Roll Limit Indicator is now showing where ESP™ will disengage as roll attitude decreases.
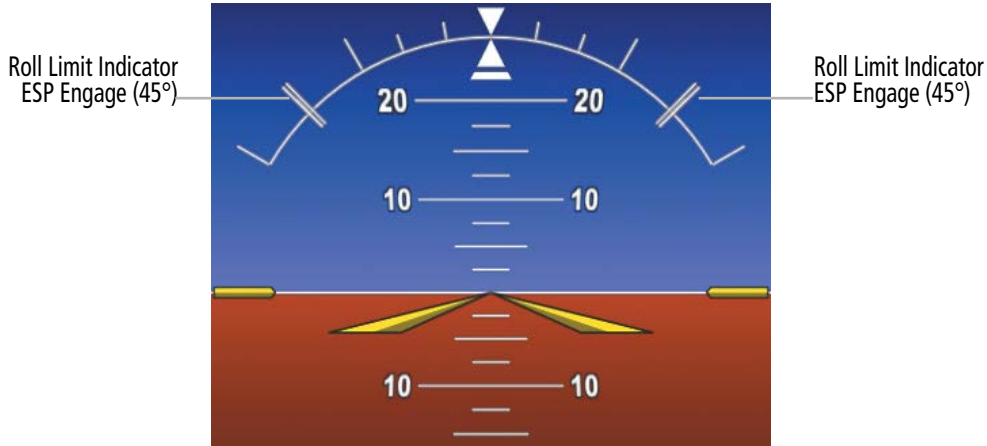

Roll Limit Indicator
ESP Engage (45°)

Roll Limit Indicator
ESP Engage (45°)

Figure 8-59 ESP Roll Engagement Indication (ESP NOT Engaged)

ESP Engage (45°)
Aircraft Roll Attitude = 44°

ESP Disengage (30°)
Aircraft Roll Attitude = 46°

Before ESP Engage

After ESP Engage

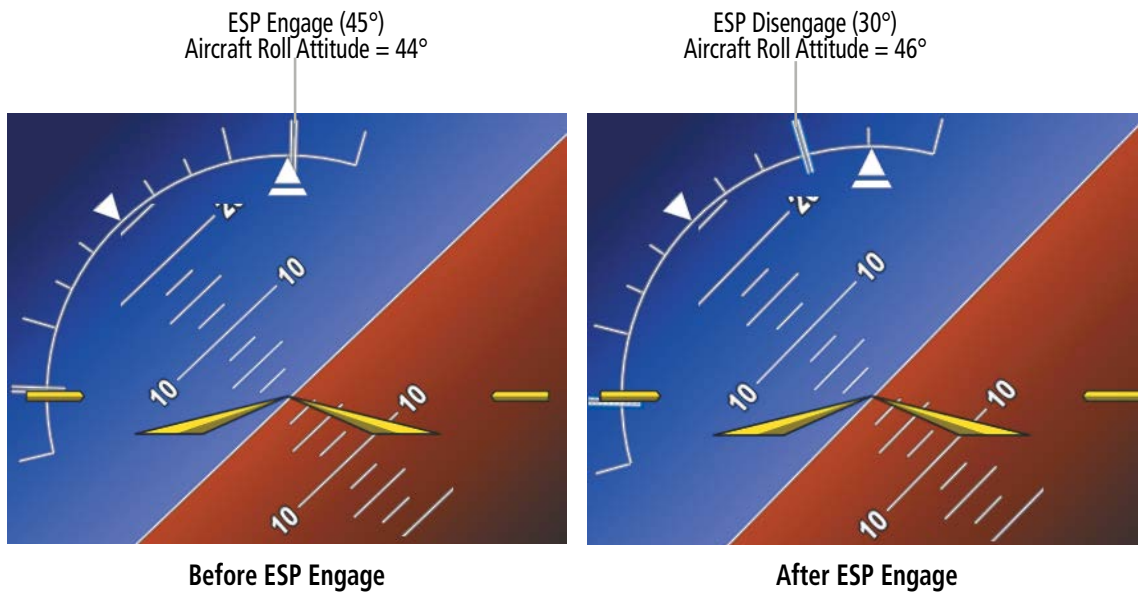**Figure 8-60 Roll Increasing to ESP Engagement**

Once engaged, ESP™ force will be applied between 30° and 75°, as illustrated in the following figure. The force increases as roll attitude increases and decreases as roll attitude decreases. The applied force is intended to encourage pilot input that returns the airplane to a more normal roll attitude. As roll attitude decreases, ESP™ will disengage at 30°.
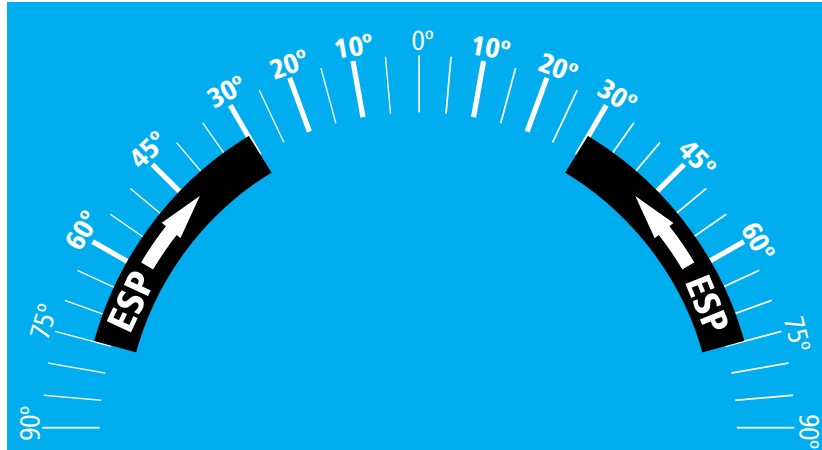
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Figure 8-61 ESP Roll Operating Range When Engaged
(Force Increases as Roll Increases & Decreases as Roll Decreases)

ESP™ is automatically disengaged if the aircraft reaches the autopilot roll engagement attitude limit of 75°.
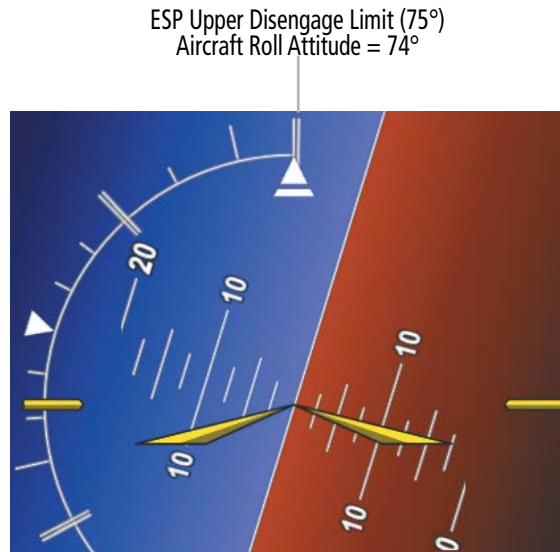
Figure 8-62 Roll Attitude Autopilot Engagement Limit (ESP Engaged)

PITCH ENGAGEMENT

ESP™ engages at 16° nose-up and 22° nose-down. Once ESP™ is engaged, it will apply increasing opposing force between 16° and 20° nose-up and between 22° and 25° nose-down, as indicated in the following figure. Maximum opposing force is applied at 20° nose up and at 25° nose-down.

With ESP™ engaged, and the aircraft in a nose-up condition, opposing force steadily decreases from 20° nose-up to 12° nose-up as aircraft pitch moves toward zero degrees. ESP™ disengages at 12° nose-up. With ESP™ engaged, and the aircraft in a nose-down condition, opposing force steadily decreases from 25° nose-down to 22° nose-down as aircraft pitch moves toward zero degrees. ESP™ disengages at 17° nose-down.

The opposing force increases or decreases depending on the pitch angle and the direction of pitch travel. This force is intended to encourage movement in the pitch axis in the direction of the normal pitch attitude range for the aircraft.

There are no indications marking the pitch ESP™ engage and disengage limits in these nose-up/nose-down conditions.
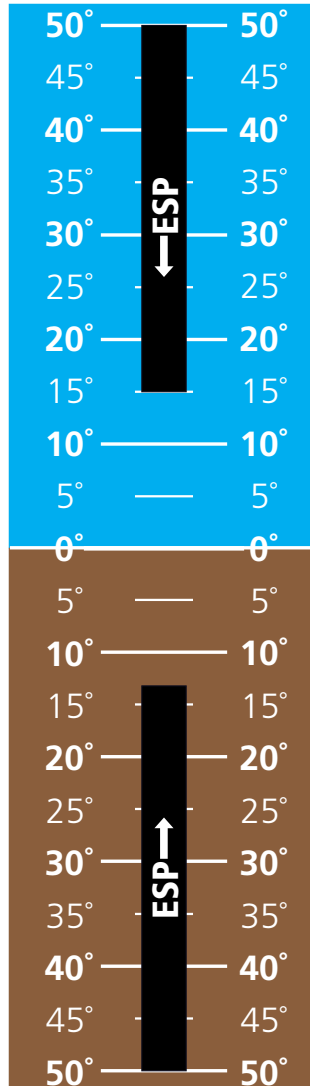

**Figure 8-63   ESP Pitch Operating Range When Engaged
(Force Increases as Pitch Increases & Decreases as Pitch Decreases)**

HIGH AIRSPEED PROTECTION

Exceeding Vmo/Mmo will result in ESP™ applying force to raise the nose of the aircraft. When the high airspeed condition is remedied, ESP™ force is no longer applied.

8.11 AUXILIARY VIDEO (OPTIONAL)

The Auxiliary Video feature provides a control and display interface to an optional auxiliary video system. The system can display video for up to two inputs.

There are four modes of operation of the auxiliary video display: Full-Screen, Full-Screen with Digital Zoom, Split-Screen with Map, and Split-Screen with Map and Digital Zoom.

Displaying auxiliary video:

1) Turn the large **FMS** Knob to select the 'Aux' Page Group.

2) Turn the small **FMS** Knob to select the 'Aux-Video' Page.

Control of the 'Aux - Video' Page can also be accessed through the 'Page Menu.'

Selecting video menu options:

1) While viewing the 'Aux - Video' Page press the **MENU** Key to display the 'Page Menu' options.

2) Turn the large **FMS** Knob to highlight the desired video adjustment option and press the **ENT** Key. Once the **ENT** Key is pressed on any option, the 'Page Menu' closes and returns to the 'Aux - Video' Page.
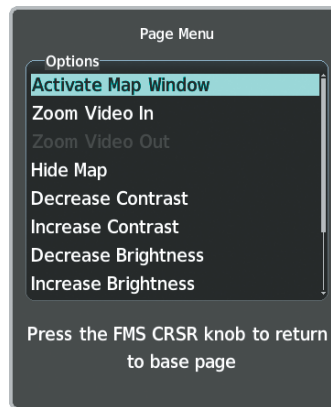

Figure 8-64 'Aux - Video' Page Menu

VIDEO SETUP

Video brightness, contrast, and saturation may be adjusted be selecting the setup function. While viewing the setup function softkeys, after 45 seconds of softkey inactivity, the system reverts to the 'Aux - Video' Page softkeys.

Adjusting the video settings:

1) With the 'Aux - Video' Page displayed, press the **Setup** Softkey.

2) Press the **Contrast -** or **Contrast +** Softkey, to adjust display contrast in five percent increments from 0 to 100%.

3) Press the **Bright -** or **Bright +** Softkey, to adjust display brightness in five percent increments from 0 to 100%.

4) Press the **SAT -** or **SAT +** Softkey, to adjust display saturation in five percent increments from 0 to 100%.

5) If desired, return the display to the default settings by pressing the **Reset** Softkey.

6) Press the **Back** Softkey to return to the previous softkey level.

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DISPLAY SELECTION

Pressing the **Hide Map** Softkey removes the map and displays video on the full screen. The softkey annunciator changes from gray to green indicating the 'Hide Map' feature is active. Pressing the **Hide Map** Softkey again restores the map view and the small video image. The softkey annunciator returns to gray indicating the 'Hide Map' function has been disabled.
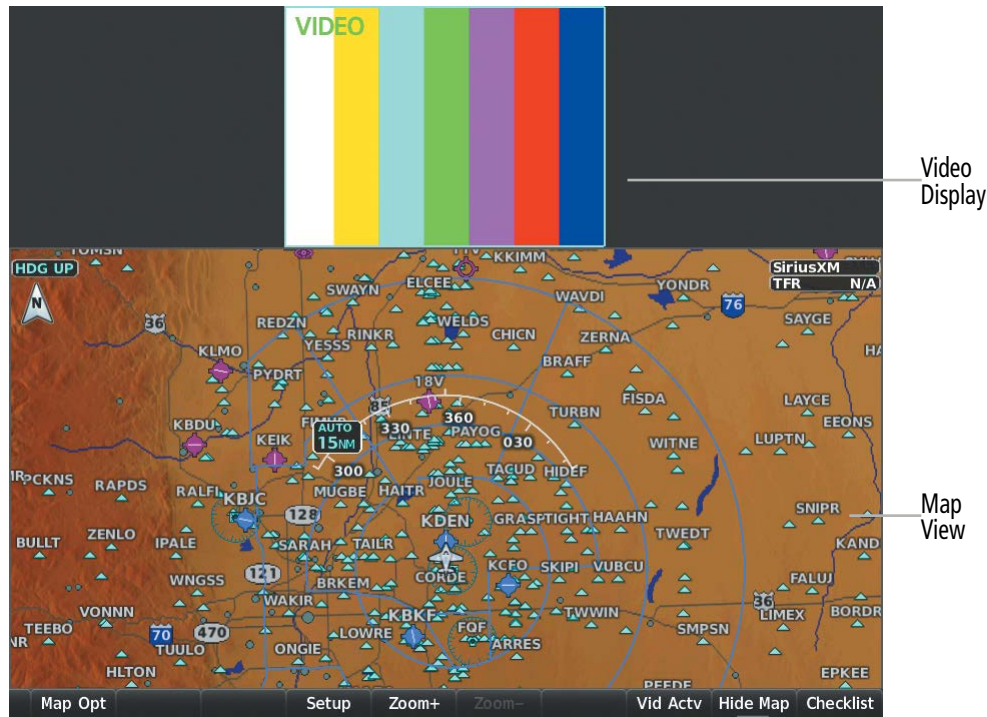

Figure 8-65 Split-Screen Video Display
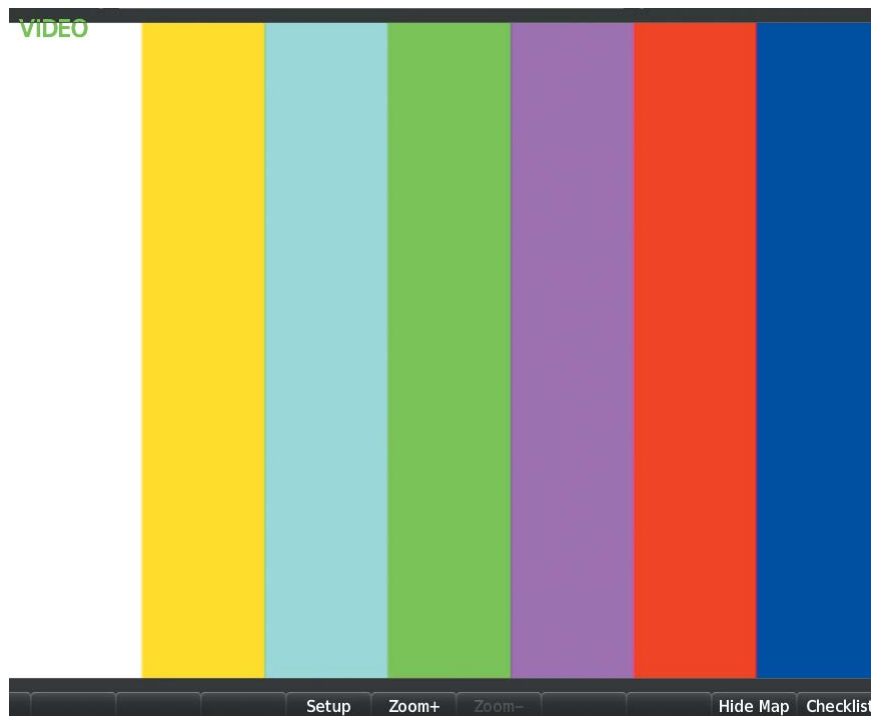
Figure 8-66 Full Screen Video Display

ZOOM/RANGE

Pressing the **Zoom +** or **Zoom -** Softkey increases or decreases video display magnification between 1x and 10x.

While in the Split-Screen Mode, pressing the **Map Actv** or **Vid Actv** Softkey determines which display the **RANGE** Knob adjusts. The **RANGE** Knob can be used to increase or decrease the range setting on the map display or zoom in and out on the video display. Pressing the **Map Actv** Softkey allows the **RANGE** Knob to control the range setting of the map display. Pressing the **Vid Actv** Softkey allows the **RANGE** Knob to control the zoom setting of the video display.

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8.12 ENHANCED ELECTRONIC CHECKLIST

> ✓ **NOTE:** *The checklists presented here are for example only and may differ from checklists available for the airframe. The information described in this section is not intended to replace the checklist information described in the approved current pertinent flight manual or the Pilot Safety and Warning Supplements document.*

> ✓ **NOTE:** *Garmin is not responsible for the content of checklists. Checklists are created by the aircraft manufacturer. Modifications or updates to the checklists are coordinated through the aircraft manufacturer. The user cannot edit these checklists.*

The Electronic Checklists feature allows the pilot to view and interact with aircraft checklists on the ground and during each phase of flight. Checklist contents are displayed on the MFD. The crew can upload a checklist file to the system by placing it on a Secure Digital (SD) card hosted in the top card slot or bottom slot of each GDU. Once the checklist file is synced across the system, the SD card with the checklist file is no longer required.

If the SD card contains an invalid checklist file or no checklist, the message displayed on the power initialization page is 'Checklist File: Invalid' or 'Checklist File: N/A' (not available) and the **Checklist** Softkey is not available.

ENHANCED CHECKLIST FEATURES

CHECKSET TOOL

A checklist file can be created or edited by the pilot without involvement from Garmin. Garmin provides a CheckSet Tool which is used to generate and edit enhanced electronic checklist files. These files are saved in the .gcl format. Previous files in the .ace format should be converted to .gcl using the CheckSet Tool. Visit flygarmin.com to download the CheckSet Tool.

> ✓ **NOTE:** *Garmin does not provide a checklist file required for flight operation. The file is expected to be authored and certified by the customer.*

FONTS AND COLORS

Enhanced Electronic Checklists allow the pilot to configure checklist information in various font sizes and colors. Additional checklists support all characters available on a standard keyboard, however titles and text may limit character use. Challenge items notes, subtitles, etc., have a new palette of colors available based on the design selection from the author of the checklist.

The following table displays the recommended color scheme for various elements. It is possible to define a custom scheme for these items.

Item	Color
'Checked' Checklist Item	Green
'Unchecked' Checklist Item	White
Plain Text	Silver
Notes	Silver
Cursor Box on Selected Item	Cyan
Warning Statements	Amber
Hyperlinks	Cyan
Subtitle	White
Caution Statements	White

Table 8-9 Suggested Color Scheme

HYPERLINK-BASED NAVIGATION

Checklist files support navigation using hyperlinks. The author can develop checklists with embedded hyperlinks and the pilot can select the link to navigate to the associated checklist. A checklist can contain one or more links to allow rapid navigation to the associated checklists.

> **NOTE:** *The pilot must add return links for navigating back to the initial checklist if applicable.*

BRANCHED QUESTIONING

Many checklists involve a decision-making process that depends on operational conditions. Branched questioning allows the checklist to provide two or more options. Each option can have a sub checklist associated with it. The pilot can pick the appropriate option and complete the associated checklist. Only one of the sub checklists needs to be filled out in order to satisfy the "Checklist Complete" criteria.

When the pilot is complete with all items on a branched checklist, the bottom of the page will display "Back to Previous?" which will return the pilot back to the main checklist.
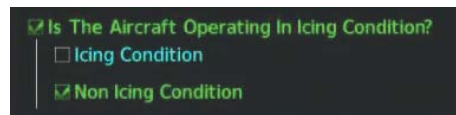

Figure 8-67 Branched Questioning

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CHECKLIST IMAGES

The Enhanced Checklists feature can display an image as a part of the checklist. The image can be setup as a challenge item with an associated check box or as a reference item without a check box. The images are included in the checklist file uploaded to the system.

Accessing and navigating checklists:

1) From any page on the MFD (except the 'EIS' Page Group), press the **Checklist** Softkey or turn the large **FMS** Knob to select the 'CHKLST' Page Group.
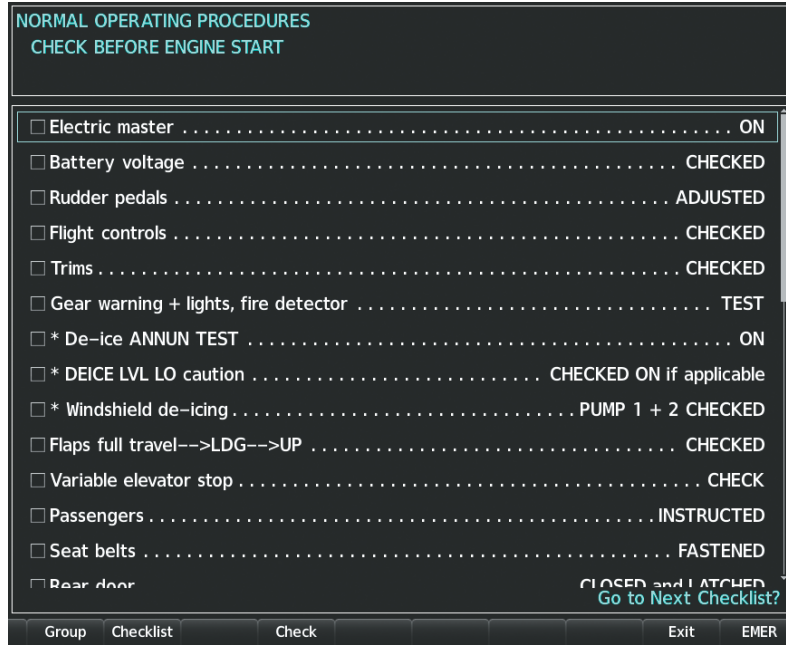
```
NORMAL OPERATING PROCEDURES
    CHECK BEFORE ENGINE START


  □ Electric master . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . ON
  □ Battery voltage . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . CHECKED
  □ Rudder pedals . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . ADJUSTED
  □ Flight controls . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . CHECKED
  □ Trims . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . CHECKED
  □ Gear warning + lights, fire detector . . . . . . . . . . . . . . . . . . . . . . . . . . . . . TEST
  □ * De-ice ANNUN TEST . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . ON
  □ * DEICE LVL LO caution . . . . . . . . . . . . . . . . . . . . . . . . . . . CHECKED ON if applicable
  □ * Windshield de-icing . . . . . . . . . . . . . . . . . . . . . . . . . . . . PUMP 1 + 2 CHECKED
  □ Flaps full travel-->LDG-->UP . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . CHECKED
  □ Variable elevator stop . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . CHECK
  □ Passengers . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .INSTRUCTED
  □ Seat belts . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . FASTENED
  □ Rear door                                       CLOSED and LATCHED
                                                      Go to Next Checklist?
    Group   Checklist          Check                            Exit    EMER
```

Figure 8-68 The 'CHKLST - Checklist' Page

2) Press the **Group** Softkey to choose from the group of checklists.

```
NORMAL OPERATING PROCEDURES

  EMERGENCY Procedures ENGINE
  EMERGENCY Procedures SMOKE and FIRE
  EMERGENCY Procedures LANDING GEAR
  EMERGENCY Procedures ENVIRONMENT                       . . ON
  G1000 WARNINGS&#32;&#32;(RED)                           ECKED
  USER AGREEMENT
  NORMAL OPERATING PROCEDURES                             USTED
  ABNORMAL OPS PROC – G1000 CAUTION LIGHTS (yellow) and Other abnormals
  ABNORMAL OPS PROC – Indications outside green range     ECKED
  □ Trims . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . CHECKED

  □ Gear warning + lights, fire detector . . . . . . . . . . . . . . . . . . . . . . . TEST
```
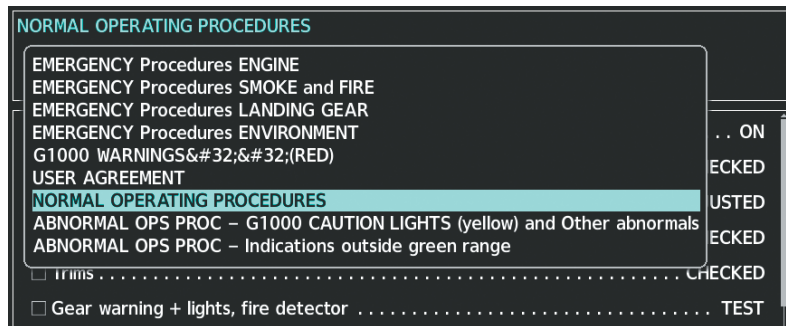
Figure 8-69 'Normal Operating Procedures' Group

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

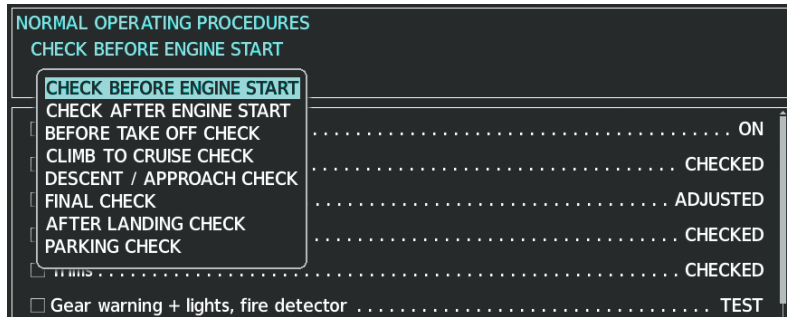4) Turn the large **FMS** Knob to select the desired checklist inside that group and press the **ENT** Key.

Figure 8-70 'Check Before Engine Start' Checklist

5) The system defaults to step 1 selected. The selected checklist item is indicated with white text surrounded by a cyan box.

6) Press the **ENT** Key or the **Check** Softkey to check the selected checklist item. The line item turns green and a checkmark is placed in the associated box. The next line item is automatically selected for checking. Either **FMS** Knob can be used to scroll through the checklist and select the desired checklist item. Press the **CLR** Key or **Uncheck** Softkey to remove a check mark from an item.
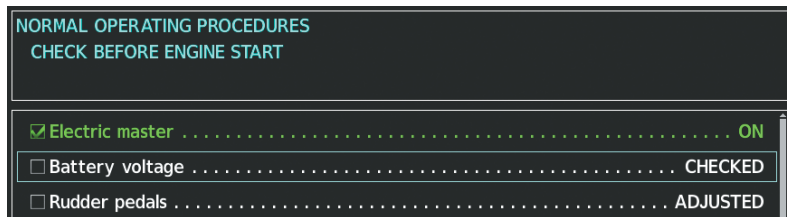
Figure 8-71 First Checklist Item Completed

7) When all checklist items have been checked, '*Checklist Finished*' is displayed in green text at the bottom left of the checklist window. If all items in the checklist have not be checked, '*Checklist Not Finished*' will be displayed in amber text.

8) Press the **ENT** Key. 'Go To Next Checklist?' will be highlighted by the cursor.
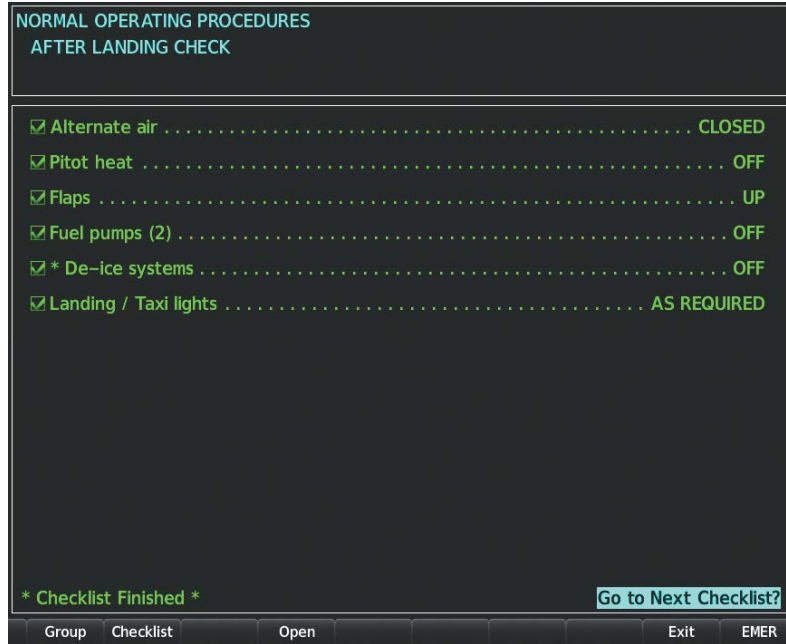
Figure 8-72 Checklist Finished

9) Press the **ENT** Key to advance to the next checklist.

10) Press the **Exit** Softkey to exit the checklist and return to the page last viewed.

Accessing emergency procedures:

1) From any page on the MFD (except the 'EIS' Page Group), press the **Checklist** Softkey or turn the large **FMS** Knob to select the 'CHKLST' Page Group.

2) Press the **EMER** Softkey.

3) Turn the **FMS** Knob to select the desired emergency checklist and press the **ENT** Key.
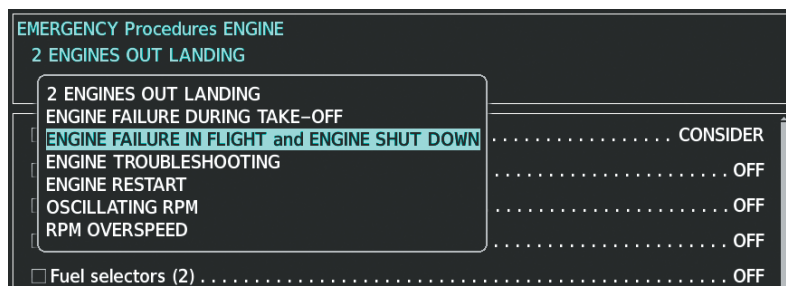
Figure 8-73 Emergency Procedures Checklists

4) Press the **ENT** Key or **Check** Softkey to check the selected checklist item. The line item turns green and a checkmark is placed in the associated box. The next line item is automatically selected for checking. Either **FMS** Knob can be used to scroll through the checklist and select the desired checklist item. Press the **CLR** Key or **Uncheck** Softkey to remove a check mark from an item.

5) When all checklist items have been checked, '*Checklist Finished*' is displayed in green text at the bottom left of the checklist window. If all items in the checklist have not be checked, '*Checklist Not Finished*' will be displayed in amber text.

6) Press the **ENT** Key. 'Go To Next Checklist?' will be highlighted by the cursor.

7) Press the **ENT** Key to advance to the next checklist.

8) Press the **Return** Softkey to return to the previous checklist.

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ANNUNCIATIONS AND ALERTS

✓ **NOTE:** *The current version of the pertinent flight manual supersedes information found in this document.*

The G1000 Alerting System conveys alerts using the following:

- **CAS Annunciation Window:** The CAS Annunciation Window displays abbreviated annunciation text. Text color is based on alert levels described later in the Alert Levels Definitions section. When Crew Alerting System (CAS) messages are generated, the CAS Window opens on the PFD. Up to 12 messages can be displayed; when more than 12 messages accumulate, the **CAS Up** Softkey and the **CAS Dn** Softkey become available. Press the CAS scrolling softkeys to scroll up and down through the messages in the CAS Window. A white horizontal line separates annunciations that are acknowledged from annunciations that are not yet acknowledged. Higher priority annunciations are displayed towards the top of the window. Lower priority annunciations are displayed towards the bottom of the window.

- **Alerts Window:** The Alerts Window displays text messages for up to 64 prioritized alert messages. Pressing the **Alerts/Messages** Softkey displays the Alerts Window. Pressing the **Alerts** Softkey a second time removes the Alerts Window from the display. When the Alerts Window is displayed, the **FMS** Knob can be used to scroll through the alert message list.

- **Softkey Annunciation:** During certain alerts, the **Message** Softkey may appear as a flashing annunciation to accompany a message. The **Message** Softkey assumes a new label **Alerts**, when pressed. The **Messags/Alerts** Softkey also assumes the labels 'Warming', 'Caution', or 'Advisory' when triggered. By selecting the softkey when flashing an annunciation, the message is acknowledged. If messages are still present, the **Alerts** label is displayed in white with black text. Selecting the **Alerts** Softkey a second time views the text messages.

- **System Annunciations:** Typically, a large red or amber 'X' appears over instruments whose information is supplied by a failed Line Replaceable Unit (LRU).
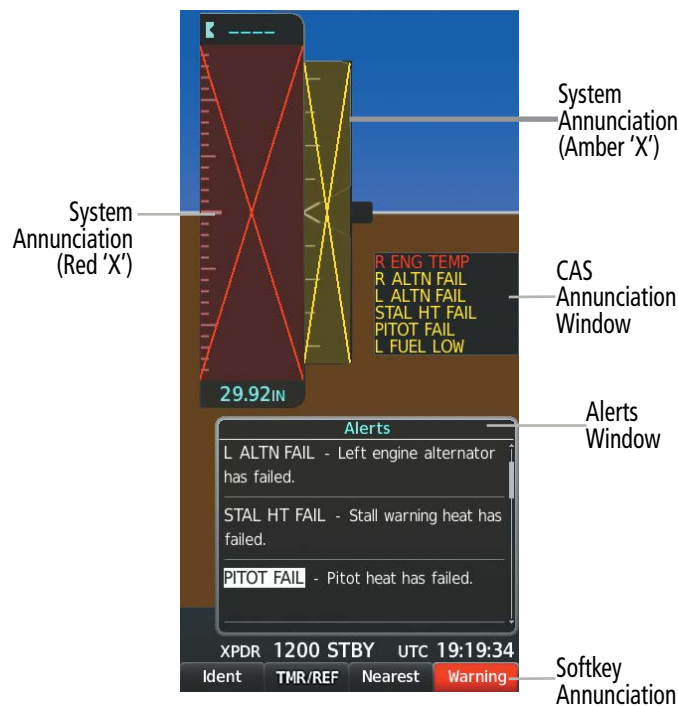

Figure A-1 G1000 Alerting System

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- **Audio Alerting System:** The Garmin System issues audio alert tones when specific system conditions are met. See the CAS and Alert Definitions Prioritization Section for more information. The annunciation tone may be tested from the 'AUX - System Status' Page.

> **Testing the system annunciation tone:**
>
> 1) Use the **FMS** Knob to select the 'AUX - System Status' Page.
> 2) Press the **ANN Test** Softkey.
>
>   **Or**:
>
>   a) Press the **MENU** Key.
>   b) Highlight 'Enable Annunciator Test Mode' and press the **ENT** Key.

CAS AND ALERT DEFINITION PRIORITIZATION

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

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

- **Warning** (red) – Immediate crew awareness and action required. The system displays a warning alert in the Alerts Window and is accompanied by a continuous aural tone. Text appearing in the Alerts Window is red. A warning alert is accompanied by a flashing red **Warning** Softkey annunciation. Pressing the **Warning** Softkey acknowledges the presence of the warning alert, stops the aural tone, and extinguishes the **Warning** Softkey annunciation.

- **Caution** (amber) – Immediate crew awareness and possible future corrective action required. The system displays a caution alert in the Alerts Window with a single chime. Text appearing in the Alerts Window is amber. A caution alert is accompanied by a flashing amber **Caution** Softkey annunciation. Pressing the **Caution** Softkey acknowledges the presence of the caution alert and extinguishes the **Caution** Softkey annunciation.

- **Advisory** (white) – Crew awareness required and subsequent action may be required. The system displays a white advisory alert in the Alerts Window. Pressing the **Advisory** Softkey acknowledges the presence of the advisory alert and extinguishes the **Advisory** Softkey annunciation.

Figure A-2 Warning, Caution, Advisory, and Message PFD Softkey Annunciations

A CAS message does not appear more than once at a given time. Warning, caution, and advisory CAS messages and Alerts flash when they are generated, and continue to flash until acknowledged.

After the acknowledgment, a message remains displayed at the top of its respective priority group in the CAS Annunciation Window until either a newer message of the same priority appears or the condition(s) that caused the alert to display no longer exist.

SYSTEM MESSAGE ADVISORIES

This section describes various Garmin system message advisories. Certain messages are issued due to an LRU or an LRU function failure. Such messages are normally accompanied by a corresponding red 'X' annunciation as shown previously in the System Annunciation section.

> ✓ *NOTE: This Section provides information regarding message advisories that may be displayed by the system. Knowledge of the aircraft, systems, flight conditions, and other existing operational priorities must be considered when responding to a message. Always use sound pilot judgment. The current version of the pertinent flight manual takes precedence over any conflicting guidance found in this section.*

Message Advisory	Comments
ABORT APR – Loss of GPS navigation. Abort approach.	Abort approach due to loss of GPS navigation.
ADC1 ALT EC – ADC1 altitude error correction is unavailable.	GDC1 is reporting the altitude error correction is unavailable.
ADC1 AS EC – ADC1 airspeed error correction is unavailable.	GDC1 is reporting the airspeed error correction is unavailable.
ADC1 SERVICE – ADC1 needs service. Return unit for repair.	The GDC1 should be serviced.
AHRS MAG DB – AHRS magnetic model database version mismatch.	The #1 AHRS and #2 AHRS magnetic model database versions do not match.
AHRS1 CAL – AHRS1 calibration version error. Srvc req'd.	The #1 AHRS calibration version error. The system should be serviced.
AHRS1 CONFIG – AHRS1 config error. Config service req'd.	AHRS configuration settings do not match those of backup configuration memory. The system should be serviced.
AHRS1 GPS – AHRS1 using backup GPS source.	The #1 AHRS is using the backup GPS path. Primary GPS path has failed. The system should be serviced when possible.
AHRS1 GPS – AHRS1 not receiving any GPS information.	The #1 AHRS is not receiving any or any useful GPS information. Check the current version of the pertinent flight manual limitations. The system system should be serviced.
AHRS1 GPS – AHRS1 not receiving backup GPS information.	The #1 AHRS is not receiving backup GPS information. The system should be serviced.
AHRS1 GPS – AHRS1 operating exclusively in no-GPS mode.	The #1 AHRS is operating exclusively in no-GPS mode. The system should be serviced.
AHRS1 SERVICE – AHRS 1 needs service. Return unit for repair.	The #1 AHRS should be serviced.
AHRS1 SRVC – AHRS1 Magnetic-field model needs update.	The #1 AHRS earth magnetic field model is out of date. Update magnetic field model when practical.
AHRS1 TAS – AHRS1 not receiving valid airspeed.	The #1 AHRS is not receiving true airspeed from the air data computer. The AHRS relies on GPS information to augment the lack of airspeed. The system should be serviced.
APR ADVISORY – SBAS VNAV not available. Using Baro VNAV.	SBAS not available. The system is calculating the VNAV profile using BARO VNAV.

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Message Advisory	Comments
APR DWNGRADE – Approach downgraded.	Use LNAV minima when approach is downgraded.
ARSPC AHEAD – Airspace ahead less than 10 minutes.	Special use airspace is ahead of aircraft. The aircraft will penetrate the airspace within 10 minutes.
ARSPC NEAR – Airspace near – less than 2 nm.	Special use airspace is within 2 nm of the aircraft position.
ARSPC NEAR – Airspace near and ahead.	Special use airspace is near and ahead of the aircraft position.
APR INACTV – Approach is not active.	The system notifies the pilot the loaded approach is not active. Activate approach when required.
ARM VNAV CLIMB – Reset altitude preselect to arm climb.	Adjust altitude preselect value to enable VNAV climb.
ARM VNAV DESCENT – Reset altitude preselect to arm descent.	Adjust altitude preselect value to enable VNAV descent.
AUDIO MANIFEST - Audio software mismatch, communication halted.	The GIA 64W has incorrect software installed. The system should be serviced.
CHECK CRS – Database course for LOC 1 / [LOC ID] is [CRS]°.	Selected course for LOC1 differs from published localizer course by more than 10 degrees.
CHECK CRS – Database course for LOC2 / [LOC ID] is [CRS]°.	Selected course for LOC2 differs from published localizer course by more than 10 degrees.
CNFG MODULE – PFD1 configuration module is inoperative.	The PFD1 configuration module backup memory has failed. The system should be serviced.
COM #[1, 2] INOP - CAL - Check COM calibration.	COM 1 and/or COM 2 calibration version error. Check COM calibration.
COM #[1, 2] INOP - CRNT - Check COM current.	COM 1 and/or COM 2 current is low. Check COM current.
COM #[1, 2] INOP - NTRL - Com internal fault.	COM 1 and/or COM 2 has an internal fault.
COM #[1, 2] INOP: VOLT – Check COM Voltage.	COM 1 and/or COM 2 has low voltage.
COM #[1, 2] REDUCED TX POWER - COM synthesizer lock fault.	COM 1 and/or COM 2 has a reduced transmission power.
COM #[1, 2] INOP - SYNTH - COM synthesizer lock fault.	The COM 1 and/or COM 2 has a synthesizer lock fault.
COM1 MANIFEST – COM1 software mismatch, communication halted.	COM 1 has incorrect software installed. The system should be serviced.
COM2 MANIFEST – COM2 software mismatch, communication halted.	COM 2 has incorrect software installed. The system should be serviced.
COM1 PTT – COM1 push-to-talk key is stuck.	The COM1 external push-to-talk switch is stuck in the enable (or "pressed") position. Press the PTT switch again to cycle its operation. If the problem persists, the system should be serviced.
COM1 RMT XFR – COM1 remote transfer key is stuck.	The COM1 transfer switch is stuck in the enabled (or "pressed") position. Press the transfer switch again to cycle its operation. If the problem persists, the system should be serviced.

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Message Advisory	Comments
COM1 SERVICE – COM1 needs service. Return unit for repair.	The system has detected a failure in COM1. COM1 may still be usable. The system should be serviced when possible.
COM1 TEMP – COM1 over temp. Reducing transmitter power.	The system has detected an over temperature condition in COM1. The transmitter operates at reduced power. If the problem persists, the system should be serviced.
COM2 CONFIG – COM2 config error. Config service req'd.	The COM2 configuration settings do not match backup configuration memory. The system should be serviced
COM2 PTT – COM2 push-to-talk key is stuck.	The COM2 external push-to-talk switch is stuck in the enable (or "pressed") position. Press the PTT switch again to cycle its operation. If the problem persists, the system should be serviced.
COM2 RMT XFR – COM2 remote transfer key is stuck.	The COM2 transfer switch is stuck in the enabled (or "pressed") position. Press the transfer switch again to cycle its operation. If the problem persists, the system should be serviced.
COM2 SERVICE – COM2 needs service. Return unit for repair.	The system has detected a failure in COM2. COM2 may still be usable. The system should be serviced when possible.
COM2 TEMP – COM2 over temp. Reducing transmitter power.	The system has detected an over temperature condition in COM2. The transmitter operates at reduced power. If the problem persists, the system should be serviced.
Confirm BARO QFE – Confirm BARO QFE Reference Elevation	Confirm BARO QFE Reference Elevation.
DATA LOST – Pilot stored data was lost. Recheck settings.	The pilot profile data was lost. System reverts to default pilot profile and settings. The pilot may reconfigure the MFD & PFD with preferred settings, if desired.
DATABASE CHANGE – Database changed. Verify user modified procedures.	This occurs when a stored flight plan contains procedures that have been manually edited. This alert is issued only after an navigation database update. Verify the user-modified procedures in stored flight plans are correct and up to date.
DATABASE CHANGE – Database changed. Verify stored airways.	This occurs when a stored flight plan contains an airway that is no longer consistent with the navigation database. This alert is issued only after an navigation database update. Verify use of airways in stored flight plans and reload airways as needed.
DATABASES EXPIRED – Restart avionics to activate standby databases.	The databases in the system have expired. Restart the system to move the standby databases to active status.
DATABASES MISMATCHED – Restart displays to correct mismatch.	The GDUs have different database versions or regions. Restart the system to move the standby databases to active status.
DB ERR – Database error exists.	Database verification error. Reload databases with new data card. If problem persists, delete databases and reload with a new card.
DB MISMATCH – Navigation database mismatch. Xtalk is off.	The PFD and MFD have different navigation database versions or types installed. Crossfill is off. Check the Aux-System Status Page to determine versions or regions. Also, check the Aux-System Status Page for a database synchronization function not completed. After synchronization is complete, power must be turned off, then on.
DB MISMATCH – Obstacle database mismatch.	The PFD and MFD have different obstacle database versions or types installed. Check the Aux-System Status Page to determine versions or regions. Also, check the Aux-System Status Page for a database synchronization function not completed. After synchronization is complete, power must be turned off, then on.
DB MISMATCH – Terrain database mismatch.	The PFD and MFD have different terrain database versions or types installed. Check the Aux-System Status Page to determine versions or regions. Also, check the Aux-System Status Page for a database synchronization function not completed. After synchronization is complete, power must be turned off, then on.

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Message Advisory	Comments
DIG GMA1 MANIFEST – DIG GMA 1 software mismatch, communication halted.	The digital audio panel has incorrect software installed. The system should be serviced.
ESP CONFIG – ESP config error. Config service req'd.	ESP is not configured properly. The system should be serviced.
ESP DEGRADE – ESP IAS mode is inoperative.	IAS mode of ESP is inoperative. The system should be serviced.
ESP FAIL – ESP is inoperative.	The ESP function has failed and is inoperative. The system should be serviced.
ESP OFF – ESP selected off.	Electronic Stability and Protection has been disabled on the Aux-System Setup 2 page.
FAILED PATH – A data path has failed.	A data path connected to the GDU or the GIA 64W has failed.
FPL TRUNC – Flight plan has been truncated.	This occurs when a newly installed navigation database eliminates an obsolete approach or arrival used by a stored flight plan. The obsolete procedure is removed from the flight plan. Update flight plan with current arrival or approach.
FPL WPT LOCK – Flight plan waypoint is locked.	Upon applied power, the system detects that a stored flight plan waypoint is locked. This occurs when an navigation database update eliminates an obsolete waypoint. The flight plan cannot find the specified waypoint and flags this message. This can also occur with user waypoints in a flight plan that is deleted. Remove the waypoint from the flight plan if it no longer exists in any database, OR update the waypoint name/identifier to reflect the new information.
FPL WPT MOVE – Flight plan waypoint moved.	The system has detected that a waypoint coordinate has changed due to a new navigation database update. Verify that stored flight plans contain correct waypoint locations.
FS 510 MANIFEST – FS 510 software mismatch.	Incorrect software version. The system should be serviced.
FS510 CARD ERROR – FS510 not detected in MFD Bottom Slot.	The wireless transceiver (FS 510) multimedia card for the wireless transceiver (FS 510) was removed from the bottom card slot of the MFD. The multimedia card needs to be reinserted.
G/S1 FAIL – G/S1 is inoperative.	A failure has been detected in glideslope receiver 1. The system should be serviced.
G/S1 SERVICE – G/S1 needs service. Return unit for repair.	A failure has been detected in glideslope receiver 1. The receiver may still be available. The system should be serviced when possible.
G/S2 FAIL – G/S2 is inoperative.	A failure has been detected in glideslope receiver 2. The system should be serviced.
G/S2 SERVICE – G/S2 needs service. Return unit for repair.	A failure has been detected in glideslope receiver 2. The receiver may still be available. The system should be serviced when possible.
GDC1 MANIFEST – GDC1 software mismatch, communication halted.	The GDC 72 has incorrect software installed. The system should be serviced.
GDL59 CONFIG – GDL 59 config error. Config service req'd.	GDL 59 configuration settings do not match those of backup configuration memory. The system should be serviced.
GDL59 FAIL – GDL 59 has failed.	A fault has been detected in the GDL 59. The receiver is unavailable. The system should be serviced.
GDL59 MANIFEST – GDL59 software mismatch, communication halted.	The GDL 59 has incorrect software installed. The system should be serviced.
GDL59 RTR FAIL – The GDL 59 router has failed.	A fault has been detected in the GDL 59 router. The system should be serviced.

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GDL59 SERVICE – GDL 59 needs service. Return unit for repair.	A fault has been detected in the GDL 59. The system should be serviced.
GDL69 CONFIG – GDL 69 config error. Config service req'd.	GDL 69A SXM configuration settings do not match those of backup configuration memory. The system system should be serviced.
GDL69 FAIL – GDL 69 has failed.	A failure has been detected in the GDL 69A SXM. The receiver is unavailable. The system system should be serviced.
GDL69 MANIFEST – GDL software mismatch, communication halted.	The 69A SXM has incorrect software installed. The system should be serviced.
GEA # [1, 2] CM INOP: COMM – Check GEA config module connection.	There is a problem with the GEA 1 and/or GEA 2 config module connection. Check the connection.
GEA # [1, 2] CM INOP: TEMP – Check GEA config module connection.	There is a problem with the GEA 1 and/or GEA 2 config module connection. Check the connection.
GEA # [1, 2] INOP: INTRL – GEA internal fault.	GEA 1 and/or GEA 2 has an internal fault. The system should be serviced.
GEA #[1, 2] INOP: POWER – Check GEA power.	GEA 1 and/or GEA 2 power is low. Check GEA power. If the problem persists, the system should be serviced.
GEA # [1, 2] INOP: SENS – Check GEA software and configuration.	There is an error in the GEA 1 and/or GEA 2 software and configuration. Check the software and configuration. If the problem persists, the system should be serviced.
GEA # [1, 2] INOP: TEMP – Check GEA cooling arrangement.	The GEA 1 and/or GEA 2 has insufficient cooling. If the problem persists, the system should be serviced.
GEA # [1, 2] INSPECT REQD – Redundant power supply is not present.	GEA 1 and/or GEA 2 backup power source is not connected. The system should be serviced.
GEA # [1, 2] INSPECTION REQUIRED – Redundant power supply is not present.	GEA 1 and/or GEA 2 backup power source is not connected. The system should be serviced.
GEA #[1, 2] INOP: VOLT – Check GEA voltages.	The GEA 1 and/or GEA 2 voltage is low. Check GEA voltages.
GEA #[1, 2] INOP: VOLT EXCIT – Check GEA transducer power outputs.	The GEA 1 and/or GEA 2 transducer power is low. Check GEA transducer power.
GEA1 CONFIG – GEA1 config error. Config service req'd.	The GEA1 configuration settings do not match those of backup configuration memory. The system should be serviced.
GEA1 MANIFEST – GEA1 software mismatch, communication halted.	The GEA 1 has incorrect software installed. The system should be serviced.
GEA2 CONFIG – GEA2 config error. Config service req'd.	The GEA2 configuration settings do not match those of backup configuration memory. The system should be serviced.
GEA2 MANIFEST – GEA2 software mismatch, communication halted.	The #2 GEA has incorrect software installed. The system should be serviced.
GEO LIMITS – AHRS1 too far North/South, no magnetic compass.	The aircraft is outside geographical limits for approved AHRS operation. Heading is flagged as invalid.
GFC MANIFEST – GFC software mismatch, communication halted.	Incorrect servo software is installed, or gain settings are incorrect.
GIA1 CONFIG – GIA1 audio config error. Config service req'd.	The GIA1 have an error in the audio configuration. The system should be serviced.

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GIA1 CONFIG – GIA1 config error. Config service req'd.	The GIA1 configuration settings do not match backup configuration memory. The system should be serviced.
GIA1 COOLING – GIA1 temperature too low.	The GIA1 and/or GIA2 temperature is too low to operate correctly. Allow units to warm up to operating temperature.
GIA1 COOLING – GIA1 over temperature.	The GIA1 temperature is too high. If problem persists, the system should be serviced.
GIA1 MANIFEST – GIA1 software mismatch, communication halted.	The GIA1 has incorrect software installed. The system should be serviced.
GIA1 SERVICE – GIA1 needs service. Return the unit for repair.	The GIA1 self-test has detected a problem in the unit. The system should be serviced.
GIA2 CONFIG – GIA2 audio config error. Config service req'd.	The GIA2 have an error in the audio configuration. The system should be serviced.
GIA2 CONFIG – GIA2 config error. Config service req'd.	The GIA2 configuration settings do not match backup configuration memory. The system should be serviced.
GIA2 COOLING – GIA2 over temperature.	The GIA2 temperature is too high. If problem persists, the system should be serviced.
GIA2 COOLING – GIA2 temperature too low.	The GIA2 temperature is too low to operate correctly. Allow units to warm up to operating temperature.
GIA2 MANIFEST – GIA2 software mismatch, communication halted.	The GIA 2 has incorrect software installed. The system should be serviced.
GIA2 SERVICE – GIA2 needs service. Return the unit for repair.	The GIA2 self-test has detected a problem in the unit. The system should be serviced.
GMA XTALK – GMA crosstalk error has occurred.	An error has occurred in transferring data between the two GMAs. The system should be serviced.
GMA1 AUX MANIFEST – Software mismatch, communication halted.	The digital audio controller has incorrect software installed. The system should be serviced.
GMA1 CONFIG – GMA1 config error. Config service req'd.	The audio panel configuration settings do not match backup configuration memory. The system should be serviced.
GMA1 FAIL – GMA1 is inoperative.	The audio panel self-test has detected a failure. The audio panel is unavailable. The system should be serviced.
GMA1 INSPECTION REQUIRED – Redundant power supply is not present.	GMA1 backup power source is not connected. The system should be serviced.
GMA1 MANIFEST – GMA1 software mismatch, communication halted.	The audio panel has incorrect software installed. The system should be serviced.
GMA1 SERVICE – GMA1 needs service. Return unit for repair.	The audio panel self-test has detected a problem in the unit. Certain audio functions may still be available, and the audio panel may still be usable. The system should be serviced when possible.
GPS NAV LOST – Loss of GPS navigation. Enable GPS sensors.	Loss of GPS navigation due to GPS sensors not enabled.
GPS NAV LOST – Loss of GPS navigation. Position error.	Loss of GPS navigation due to position error.
GPS NAV LOST – Loss of GPS navigation. GPS fail.	Loss of GPS navigation due to GPS failure.

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GPS #[1, 2] INSPECT RQRD - BATT - Check GPS battery.	The GPS battery needs to be checked.
GPS #[1, 2] INSPECT INOP - CAL - Check GPS battery.	GPS 1 and/or GPS 2 calibration version error. Check GPS calibration.
GPS1 SERVICE – GPS1 needs service. Return unit for repair.	A failure has been detected in the GPS1 and/or GPS2 receiver. The receiver may still be available. The system should be serviced.
GPS2 SERVICE – GPS2 needs service. Return unit for repair.	
GRA1 CAL – GRA1 calibration. Service req'd.	GRA1 has improper calibration. The system should be serviced.
GRA1 CONFIG – GRA1 config error. Config service req'd.	The GRA and GDU have incompatible configurations.
GRA1 MANIFEST – GRA1 software mismatch, communication halted.	The GRA has incorrect software installed. The system should be serviced.
GRA1 SERVICE – GRA1 needs service. Return unit for repair	The GRA self-test has detected a problem in the unit. The system should be serviced.
GRA1 TEMP – GRA1 over temperature.	The system has detected an over temperature condition in GRA1.
GRS1 MANIFEST – GRS1 software mismatch, communication halted.	The #1 AHRS has incorrect software installed. The system should be serviced.
GSR1 FAIL – GSR1 has failed.	A failure has been detected in the GSR 56. The transceiver is unavailable. The system should be serviced.
GTS CONFIG – GTS Config error. Config service req'd.	The GTS and GDU have different copies of the GTS configuration, or the Mode S address is invalid. The system should be serviced.
GTS MANIFEST – GTS software mismatch, communication halted.	The GTS has incorrect software installed. The system should be serviced.
GTX1 MANIFEST – GTX1 software mismatch, communication halted.	The transponder has incorrect software installed. The system should be serviced.
GWX CONFIG – GWX config error. Config service req'd.	GWX 70/75 configuration settings do not match those of the GDU configuration. The system should be serviced.
GWX FAIL – GWX is inoperative.	The GDU is not recieving status packet from the GWX 70/75 is reporting a fault. The GWX 70/75 radar system should be serviced.
GWX MANIFEST – GWX software mismatch, communication halted.	The GWX 70/75 has incorrect software installed. The system should be serviced.
GWX SERVICE – Needs service. Return unit for repair.	A failure has been detected in the GWX 70/75. The GWX 70/75 may still be usable.
HDG FAULT – AHRS1 magnetometer fault has occurred.	A fault has occurred in the GMU. Heading is flagged as invalid. The AHRS uses GPS for backup mode operation. The system should be serviced.
HW MISMATCH – GIA hardware mismatch. GIA1 communication halted.	A GIA mismatch has been detected, where only one is SBAS capable.
HW MISMATCH – GIA hardware mismatch. GIA2 communication halted.	

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INSIDE ARSPC – Inside airspace.	The aircraft is inside the airspace.
INVALID ADM – Invalid ADM: ATN communication halted.	Data link avionics were not configured correctly and therefore will not be able to communicate with the ground network.
LOI – GPS integrity lost. Crosscheck with other NAVS.	GPS integrity is insufficient for the current phase of flight.
LRG MAG VAR – Verify all course angles.	The GDU's internal model cannot determine the exact magnetic variance for geographic locations near the magnetic poles. Displayed magnetic course angles may differ from the actual magnetic heading by more than 2°.
LRU CARD1 ERR – LRU card 1 is invalid.	The SD card in the top card slot of the LRU is invalid.
LRU CARD1 REM – LRU card 1 was removed. Reinsert card.	The SD card was removed from the top card slot of the LRU. The SD card needs to be reinserted.
LRU CARD2 ERR – LRU card 2 is invalid.	The SD card in the bottom card slot of the LRU is invalid.
LRU CARD2 REM – LRU card 2 was removed. Reinsert card.	The SD card was removed from the bottom card slot of the LRU. The SD card needs to be reinserted.
LRU CARD3 ERR – LRU card 3 is invalid.	The internal SD micro card of the LRU is invalid.
LRU CARD3 REM – LRU card 3 was removed. Reinsert card.	The internal SD micro card was removed. The SD card needs to be reinserted.
LRU CONFIG – LRU config error. Config service req'd.	The LRU configuration settings do not match backup configuration memory. The system should be serviced.
LRU COOLING – LRU has poor cooling. Reducing power usage.	The LRU is overheating and is reducing power consumption by dimming the display. If problem persists, the system should be serviced.
LRU DB ERR – LRU multiple database errors exists.	The LRU detected a failure in more than one database. If problem persists, the system should be serviced.
LRU DB ERR – LRU obstacle database error exists.	The LRU detected a failure in the obstacle database. Reload the database with new data card. If problem persists, delete database and reload with a new card.
LRU DB ERR – LRU terrain database error exists.	The LRU detected a failure in the terrain database. Reload the database with new data card. If problem persists, delete database and reload with a new card.
LRU DB ERR – LRU terrain database missing.	The terrain database is present on another LRU, but is missing on the specified LRU.
LRU REPLACEMENT – [LRU name].	The system has detected an LRU replacement. Perform LRU replacement software or full configuration loading procedure.
LRU SERVICE – LRU needs service. Return unit for repair.	The LRU self-test has detected a problem. The system should be serviced.
LRU SOFTWARE – LRU mismatch, communication halted.	LRU has different software versions installed. The system should be serviced.
LRU TERRAIN DSP – LRU Terrain awareness display unavailable.	One of the terrain or obstacle databases required for TAWS in the LRU is missing or invalid.
LRU VOLTAGE – LRU has low voltage. Reducing power usage.	LRU voltage is low. The system should be serviced.

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MANIFEST – MFD1 software mismatch, communication halted.	The PFD and/or MFD has incorrect software installed. The system should be serviced.
MANIFEST – PFD1 software mismatch, communication halted.	
MFD1 CARD 1 ERR – Card 1 is invalid.	The SD card in the top card slot of the specified MFD contains invalid data.
MFD1 CARD 1 REM – Card 1 was removed. Reinsert card.	The SD card was removed from the top card slot of the specified MFD. The SD card needs to be reinserted.
MFD1 CARD 2 ERR – Card 2 is invalid.	The SD card in the bottom card slot of the specified MFD contains invalid data.
MFD1 CARD 2 REM – Card 2 was removed. Reinsert card.	The SD card was removed from the bottom card slot of the specified MFD. The SD card needs to be reinserted.
MFD1 CONFIG – MFD1 config error. Config service req'd.	The MFD configuration settings do not match backup configuration memory. The system should be serviced.
MFD1 COOLING – MFD1 has poor cooling. Reducing power usage.	The MFD is overheating and is reducing power consumption by dimming the display. If problem persists, the system should be serviced.
MFD1 DB ERR – MFD1 Airport Directory database error exists.	The MFD detected a failure in the Airport Directory database. Attempt to reload the database. If problem persists, the system should be serviced.
MFD1 DB ERR – MFD1 basemap database error exists.	The MFD detected a failure in the basemap database.
MFD1 DB ERR – MFD1 Chartview database error exists.	The MFD detected a failure in the ChartView database (optional feature). Attempt to reload the database. If problem persists, the system should be serviced.
MFD1 DB ERR – MFD1 FliteCharts database error exists.	The MFD detected a failure in the FliteCharts database (optional feature). Attempt to reload the database. If problem persists, the system should be serviced.
MFD1 DB ERR – MFD1 multiple database errors exists.	The MFD detected a failure in more than one database. If problem persists, the system should be serviced.
MFD1 DB ERR – MFD1 navigation database error exists.	The MFD detected a failure in the navigation database. Attempt to reload the navigation database. If problem persists, the system should be serviced.
MFD1 DB ERR – MFD1 obstacle database error exists.	The MFD detected a failure in the obstacle database. Attempt to reload the database. If problem persists, the system should be serviced.
MFD1 DB ERR – MFD1 obstacle database missing.	The obstacle database is present on another LRU, but is missing on the specified LRU.
MFD1 DB ERR – MFD1 Safe Taxi database error exists.	The MFD detected a failure in the Safe Taxi database. Attempt to reload the database. If problem persists, the system should be serviced.
MFD1 DB ERR – MFD1 terrain database error exists.	The MFD detected a failure in the terrain database. Attempt to reload the database. If problem persists, the system should be serviced.
MFD1 DB ERR – MFD1 terrain database error exists.	The MFD detected a failure in the terrain database. Attempt to reload the database. If problem persists, the system should be serviced.
MFD1 DB ERR – MFD1 terrain database missing.	The terrain database is present on another LRU, but is missing on the specified LRU.
MFD FAN FAIL – The cooling fan for the MFD is inoperative..	The cooling fan in the MFD has failed. The system should be serviced.

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MFD1 SERVICE – MFD1 needs service. Return unit for repair.	The MFD self-test has detected a problem. The system should be serviced.
MFD1 KEYSTK – MFD1 [key name] is stuck.	A key is stuck on the MFD bezel. Attempt to free the stuck key by pressing it several times. The system should be serviced if the problem persists.
MFD1 VOLTAGE – MFD1 has low voltage. Reducing power usage	The MFD voltage is low. The system should be serviced.
NAV #[1, 2] INOP - CAL - Check COM calibration.	NAV 1 and/or NAV 2 calibration version error. Check COM calibration.
NAV #[1, 2] INOP - CRNT - Check COM current.	NAV 1 and/or NAV 2 current is low. Check COM current.
NAV #[1, 2] INOP - INTRL - Com internal fault.	NAV 1 and/or NAV 2 has an internal fault.
NAV #[1, 2] INOP - SERIAL - Check NAV serial communication.	Loss of NAV 1 and/or NAV 2 serial communication. Check NAV serial communication.
NAV #[1, 2] INOP - SYNTH LOCK - COM synthesiser lock fault.	NAV 1 and/or NAV 2 has a synthesizer lock fault.
NAV1 RMT XFR – NAV1 remote transfer key is stuck.	The remote NAV1 transfer switch is stuck in the enabled (or "pressed") state. Press the transfer switch again to cycle its operation. If the problem persists, the system should be serviced.
NAV1 SERVICE – NAV1 needs service. Return unit for repair.	A failure has been detected in the NAV1 receiver. The receiver may still be available. The system should be serviced.
NAV2 RMT XFR – NAV2 remote transfer key is stuck.	The remote NAV2 transfer switch is stuck in the enabled (or "pressed") state. Press the transfer switch again to cycle its operation. If the problem persists, the system should be serviced.
NAV2 SERVICE – NAV2 needs service. Return unit for repair.	A failure has been detected in the NAV2 receiver. The receiver may still be available. The system should be serviced.
NO RUNWAY POSITION DATA – Inhibit SurfaceWatch. No runway position data.	Inhibit SurfaceWatch.
NON WGS84 WPT – Do not use GPS for navigation to [xxxx]	The position of the selected waypoint [xxxx] is not calculated based on the WGS84 map reference datum and may be positioned in error as displayed. Do not use GPS to navigate to the selected non-WGS84 waypoint..
PFD1 CARD 1 ERR – Card 1 is invalid.	The SD card in the top card slot of the specified PFD contains invalid data.
PFD1 CARD 1 REM – Card 1 was removed. Reinsert card.	The SD card was removed from the top card slot of the specified PFD. The SD card needs to be reinserted.
PFD1 CARD 2 ERR – Card 2 is invalid.	The SD card in the bottom card slot of the specified PFD contains invalid data.
PFD1 CARD 2 REM – Card 2 was removed. Reinsert card.	The SD card was removed from the bottom card slot of the specified PFD. The SD card needs to be reinserted.
PFD1 CONFIG – PFD1 config error. Config service req'd.	The PFD configuration settings do not match backup configuration memory. The system should be serviced.
PFD1 COOLING – PFD1 has poor cooling. Reducing power usage.	The PFD is overheating and is reducing power consumption by dimming the display. If problem persists, the system should be serviced.

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PFD1 DB ERR – PFD1 basemap database error exists.	The PFD detected a failure in the basemap database.
PFD1 DB ERR – PFD1 multiple database errors exists.	The PFD detected a failure in more than one database. If problem persists, the system should be serviced.
PFD1 DB ERR – PFD1 navigation database error exists.	The PFD detected a failure in the navigation database. Attempt to reload the navigation database. If problem persists, the system should be serviced.
PFD1 DB ERR – PFD1 obstacle database missing.	The obstacle database is present on another LRU, but is missing on the specified LRU.
PFD1 DB ERR – PFD1 Safe Taxi database error exists.	The PFD detected a failure in the Safe Taxi database. Attempt to reload the database. If problem persists, the system should be serviced.
PFD1 DB ERR – PFD1 terrain database error exists.	The PFD detected a failure in the terrain database. Attempt to reload the database. If problem persists, the system should be serviced.
PFD1 DB ERR – PFD1 terrain database missing.	The terrain database is present on another LRU, but is missing on the specified LRU.
PFD FAN FAIL – The cooling fan for the PFD is inoperative.	The cooling fan in the PFD has failed. The system should be serviced.
PFD1 INOP - DISABLE DISPLAY – Check Disable Display Input Wiring	The specified GDU has insufficient voltage. The system should be serviced.
PFD1 INOP - ECC ERROR – Internal memory unstable - needs repair.	The internal memory of the specified GDU is unstable. The system should be serviced.
PFD1 INOP - HTR CRNT – Heater Current Error.	The specified GDU has a heater current error. The system should be serviced.
PFD1 INOP - LED STR FAULT – Reduced backlight level - needs repair.	The specified GDU has reduced backlight levels. The system should be serviced.
PFD1 INOP - TEMP – Check external cooling fans.	The specified GDU is over-temperature. The system should be serviced.
PFD1 INSPECT RQRD – BTM SD - Bottom SD Card Unstable - Install new card.	The bottom SD card is unstable and should be replaced.
PFD1 INSPECT RQRD - INTERN SD – Internal Micro SD Unstable - Install new card.	The internal SD card is unstable and should be replaced.
PFD1 INSPECT RQRD – TOP SD - Top SD Card Unstable - Install new card.	The top SD card is unstable and should be replaced.
PFD1 KEYSTK – PFD1 [key name] is stuck.	A key is stuck on the PFD bezel. Attempt to free the stuck key by pressing it several times. The system should be serviced if the problem persists.
PFD1 SERVICE – PFD1 needs service. Return unit for repair.	The PFD self-test has detected a problem. The system should be serviced.
PFD1 VOLTAGE – PFD1 has low voltage. Reducing power usage	The PFD1 voltage is low. The system should be serviced.
PTK FAIL – Parallel track unavailable: invalid leg type.	Invalid leg type for parallel offset.

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PTK FAIL – Parallel track unavailable: past IAF.	IAF waypoint for parallel offset has been passed.
PTK FAIL – Parallel track unavailable: bad geometry.	Bad parallel track geometry.
SCHEDULER [#] – <message>.	Message criteria entered by the user.
SLCT FREQ – Select appropriate frequency for approach.	The system notifies the pilot to load the approach frequency for the appropriate NAV receiver. Select the correct frequency for the approach.
SLCT MAG – Select MAGNETIC NAV ANGLE display units.	The system notifies the pilot to set the Nav Angle units on the Avionics Settings Screen to Magnetic.
SLCT NAV – Select NAV on CDI for approach.	The system notifies the pilot to set the CDI to the correct NAV receiver. Set the CDI to the correct NAV receiver.
SLCT NON-MAG – Select alternate NAV ANGLE display units.	The system notifies the pilot to set the Nav Angle units on the Avionics Settings Screen to True.
STEEP TURN – Steep turn ahead.	A steep turn is 15 seconds ahead. Prepare to turn.
STRMSCP FAIL – Stormscope has failed.	Stormscope has failed. The system should be serviced.
SURFACEWATCH DISABLED – Too far north/south.	The SurfaceWatch system has been disabled.
SURFACEWATCH FAIL – Invalid audio configuration.	The SurfaceWatch system has failed due to an invalid audio configuration.
SURFACEWATCH FAIL – Invalid configurable alerts.	The SurfaceWatch system has failed due to invalid configurable alerts.
SURFACEWATCH FAIL – One or more inputs invalid.	The SurfaceWatch system has failed due to one or more invalid inputs.
SURFACEWATCH INHIBITED – Surfacewatch inhibited.	The SurfaceWatch system has been inhibited.
SVT DISABLED – Out of available terrain region.	Synthetic Vision is disabled because the aircraft is not within the boundaries of the installed terrain database.
SVT DISABLED – Terrain DB resolution too low.	Synthetic Vision is disabled because a terrain database of sufficient resolution (4.9 arc-second or better) is not currently installed.
TIMER EXPIRD – Timer has expired.	The system notifies the pilot the timer has expired.
TRAFFIC FAIL – Traffic device has failed.	The system is no longer receiving data from the traffic system. The traffic device should be serviced.
UNABLE V WPT – Can't reach current vertical waypoint.	The current vertical waypoint can not be reached within the maximum flight path angle and vertical speed constraints. The system automatically transitions to the next vertical waypoint.
VNV UNAVAILABLE. – Excessive crosstrack error.	The current crosstrack exceeds the limit, causing vertical deviation to go invalid.
VNV UNAVAILABLE. – Excessive track angle error.	The current track angle error exceeds the limit, causing the vertical deviation to go invalid.

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VNV UNAVAILABLE. – Parallel course selected.	A parallel course has been selected, causing the vertical deviation to go invalid.
VNV UNAVAILABLE. – Unsupported leg type in flight plan.	The lateral flight plan contains a procedure turn, vector, or other unsupported leg type prior to the active vertical waypoint. This prevents vertical guidance to the active vertical waypoint.
WPT ARRIVAL – Arriving at waypoint -[xxxx]	Arriving at waypoint [xxxx], where [xxxx] is the waypoint name.
WX ALERT – Possible severe weather ahead.	The GWX 70 indicates severe weather within ±10 degrees of the aircraft heading at a range of 80 to 320 nm.
XPDR1 ADS-B FAIL – XPDR1 unable to transmit ADS-B messages.	ADS-B is inoperative. Other transponder functions may be available. Transponder should be serviced when possible.
XPDR1 CONFIG – XPDR1 config error. Config service req'd.	The transponder configuration settings do not match those of backup configuration memory. The system should be serviced.
XPDR1 SRVC – XPDR1 needs service. Return unit for repair.	The #1 transponder should be serviced when possible.
XPDR1 FAIL – XPDR1 is inoperative.	There is no communication with the #1 transponder.
XTALK ERROR – A flight display crosstalk error has occurred.	The MFD and PFD are not communicating with each other. The system should be serviced.

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Database information is obtained from third party sources. Inaccuracies in the data may be discovered from time to time. Garmin communicates this information by issuing a Database Alert. These notifications are available on flygarmin.com.

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

A 32 GB Supplemental Data (SD) card (including FS 510 Wireless Transceiver card when used as a storage device) is required to perform database updates. Only cards provided by Garmin or the OEM should be used. In the event there is a file corruption problem with the SD card or Wireless Transceiver card, it may be necessary to reformat the card. This can cause an issue when formatting using Mac OS, where the newly formatted device will not be recognized by the avionics system. When using a Macintosh computer to format the SD card or Wireless Transceiver card, Garmin recommends using the SD Memory Card Formatter application made available by the SD Association as a download from sdcard.org. When running the application, use the Quick Format option.

> **NOTE:** Use of SD cards that are not Garmin or OEM provided may cause system malfunctions when left in the MFD after the databases are loaded.

Databases may be loaded through Garmin Pilot™ and Wireless Transceiver. When loading databases through Garmin Pilot™ and the Wireless Transceiver, the Wireless Transceiver must be enabled on the system and the Wireless Transceiver card inserted in the bottom SD slot of the MFD.

LOADING UPDATED DATABASES

> **CAUTION:** Never disconnect power to the system when loading a database. Power interruption during the database loading process could result in maintenance being required to reboot the system.

> **NOTE:** When loading database updates, the 'DB Mismatch' message will be displayed until database synchronization is complete, followed by turning system power off, then on. Synchronization can be monitored on the 'Aux-Database' Page.

The cycles and dates for both standby and active databases are displayed on the 'Aux – Databases' Page on the MFD. Any active databases with expiration dates in the past will be highlighted with amber text. When an expired active database has a standby database that is ready to become effective, a cyan double-sided arrow will be displayed between the database cycles. When this arrow is visible, it indicates the standby and active databases in that row will be switched on the next power cycle, activating the current standby database. Databases can also be manually selected (or deselected) by highlighting a list item and pressing the **ENT** Key, provided a valid, verified standby database is present.

In some cases it may be necessary to obtain an unlock code from Garmin in order to make the database product functional. It may also be necessary to have the system configured by a Garmin authorized service facility in order to use some database features.

In some cases it may be necessary to obtain an unlock code from Garmin in order to make the database product functional. It may also be necessary to have the system configured by a Garmin authorized service facility in order to use some database features.

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The navigation database contains the aeronautical data used by the system for the flight management and flight planning functions. Included is detailed data for waypoints, procedures (arrivals, departures, approaches), and airways. The navigation database is updated every 28 days.

The basemap database contains data for the topography and land features, such as rivers, lakes, and towns. It is updated only periodically, with no set schedule. There is no expiration date.

The terrain database contains the terrain mapping data. These databases are updated periodically and have no expiration date.

The obstacle database contains data for obstacles, such as towers, that pose a potential hazard to aircraft. Obstacles 200 feet and higher are included in the obstacle database. It is very important to note that not all obstacles are necessarily charted and therefore may not be contained in the obstacle database. This database is updated on a 56-day cycle.

> **NOTE:** *The data contained in the terrain and obstacle databases comes from government agencies. Garmin accurately processes and cross-validates the data, but cannot guarantee the accuracy and completeness of the data.*

The AOPA or AC-U-KWIK Airport Directory provides data on airports and heliports throughout the U.S. or worldwide, respectively. The AOPA Directory offers detailed information for over 5,300 U. S. airports, along with the names and phone numbers of thousands of FBOs. These databases are updated every 56 days. The AC-U-KWIK Directory offers detailed information for more than 8,000 airports with runways longer than 3,000 feet worldwide.

The SafeTaxi database contains detailed airport diagrams for selected airports. These diagrams aid in following ground control instructions by accurately displaying the aircraft position on the map in relation to taxiways, ramps, runways, terminals, and services. This database is updated on a 56-day cycle.

The FliteCharts database contains procedure charts. This database is updated on a 28-day cycle. If not updated within 180 days of the expiration date, FliteCharts will no longer function.

The optional ChartView database is updated on a 14-day cycle. If the ChartView database is not updated within 70 days of the expiration date, ChartView will no longer function. The ChartView database must be purchased directly from Jeppesen, but can be updated at jeppesen.com or flygarmin.com.

The IFR/VFR charts database contains VFR and IFR raster charts. The VFR Charts are digital representations of the Sectional Aeronautical Charts and Terminal Area Charts. The IFR Charts include both IFR High (designed for navigation at or above 18,000 ft) and IFR Low (designed for navigation below 18,000 ft). IFR/VFR Charts are updated every 28 days except for Canadian IFR/VFR Charts which are updated every 56 days.

UPDATING DATABASES WITH SD CARD OR WIRELESS TRANSCEIVER CARD

All databases are updated through a single SD card or Wireless Transceiver card in the bottom slot of the MFD. When the card is inserted, the databases on the card will be copied to standby and synchronized across all powered, configured units. After update, the card is removed and the databases are stored on the system. When in standby, databases are not immediately available for use, but stored to be activated at a later time.

Database updates can be obtained by following the instructions detailed in the 'Aviation Databases' section of the Garmin website (flygarmin.com). Once the updated files have been downloaded from the website, a personal computer equipped with an appropriate SD card reader is used to unpack and program the new databases onto an existing SD card. When database files are loaded to the SD card, any previously loaded database files of the same type residing on the SD card will be overwritten. This includes loading a database of a different coverage area or data cycle than that currently residing on the SD card. Equipment required to perform the update is as follows:

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» PC with Window Vista or later/Mac with OS X 10.9 or later

» SD card Reader: SanDisk SDDR-93, SanDisk SDDR-99, Verbatim #96504, or equivalent.

» Garmin SD card reader for Wireless Transceiver cards.

» Updated databases obtained from the Garmin website.

» Garmin or OEM provided 32 GB SD card or Wireless Transceiver card.

Update Databases:

1) With the system OFF, remove an SD card or Wireless Transceiver card from the bottom SD card slot of the MFD.

2) Download and install the databases on an SD card.

3) Put the card in the bottom SD card slot of the MFD.

4) Turn the system ON.

5) Press the **ENT** Key or the right-most softkey on MFD display to acknowledge the startup screen.

6) Turn the large **FMS** Knob and select 'Aux'.

7) Turn the small **FMS** Knob and select 'Databases'.

8) Database synchronization will begin. Monitor the Sync Status on the 'Aux-Databases' Page. Wait for all databases to complete syncing, indicated by 'Sync Complete' being displayed. A cyan double-arrow will appear between the 'Standby' and 'Active' columns to show which Standby databases will be transferred to 'Active' at the next power cycle.

Or:

If Automatic Swap is inhibited:

a) Press the **FMS** Knob. The first database title on the screen will be selected.

b) To select the database for transfer, press the **ENT** Key. A cyan double-sided arrow will appear indicating the standby database will become active.

Or:

Press the **Menu** Key and select 'Swap Standby and Active' using the small **FMS** Knob and press the **ENT** Key. A cyan double-sided arrow will appear indicating the standby database will become active. Press the **ENT** Key or the **FMS** Knob to exit.

c) Turn the small **FMS** Knob as necessary to select the additional titles.

d) Repeat steps a through c for additional databases to be transferred.

Figure B-1 'Aux - Databases' Page before Activation of Standby Databases

9)   Verify the correct database cycle information is shown in the 'Standby' Column.

10) Remove and reapply power to the system.

11) Press the **ENT** Key or the right-most softkey on MFD display to acknowledge the start-up screen.

12) Turn the large **FMS** Knob and select 'Aux'.

13) Turn the small **FMS** Knob and select 'Databases'.

14) Verify the standby databases transferred and are now in the 'Active' Column.
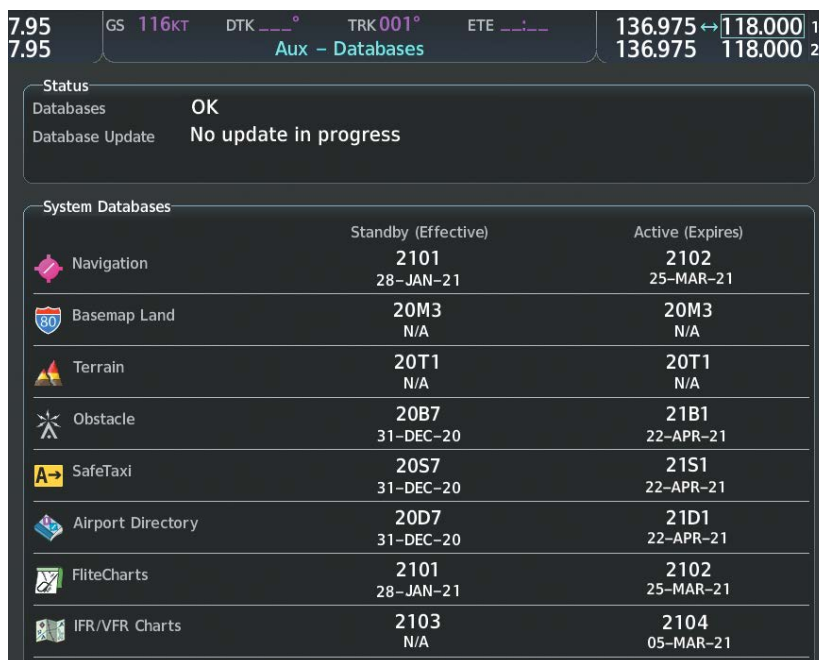
Figure B-2 'Aux - Databases' Page - Updated Databases

15) To manually activate any databases that did not transfer to the 'Active' Column:

a)   Press the **FMS** Knob. The first database title on the screen will be selected.

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b) To select the database for transfer, press the **ENT** Key. A cyan double-sided arrow will appear indicating the standby database will become active.

Or:

Press the **Menu** Key and select 'Swap Standby and Active' using the small **FMS** Knob and press the **ENT** Key. A cyan double-sided arrow will appear indicating the standby database will become active. Press the **ENT** Key or the **FMS** Knob to exit.

c) Turn the small **FMS** Knob as necessary to select the additional titles.

d) Repeat steps a through c for additional databases to be transferred.

e) Remove and reapply power to the system.

f) Press the **ENT** Key or the right-most softkey on MFD display to acknowledge the start-up screen.

g) Turn the large **FMS** Knob and select Aux.

h) Turn the small **FMS** Knob and select Databases.

i) Verify the standby databases transferred and are now in the 'Active' Column.

16) For additional information on each database, press and then turn the **FMS** Knob to select the database, and then press the **Details** Softkey. Press the **ENT** Key or the **FMS** Knob to exit.

Or:

Press the **Menu** Key and select 'View Details' using the small **FMS** Knob and press the **ENT** Key. Press the **ENT** Key or the **FMS** Knob to exit.

17) To view database information for an individual display:

a) Turn the large **FMS** Knob and select Aux.

b) Turn the small **FMS** Knob and select System Status.

c) Press the Display Database Selection Softkey (MFD1 DB, PFD1 DB) to show database information for each display. Use the small **FMS** Knob to scroll through the database information. Press the **ENT** Key or the **FMS** Knob to exit.

UPDATING DATABASES WITH GARMIN PILOT / WIRELESS TRANSCEIVER

In order to load databases through Garmin Pilot™ and the Wireless Transceiver, the Wireless Transceiver must be enabled on the system and inserted in the bottom SD slot of the MFD. A mobile device with Garmin Pilot™ must be paired with the wireless transceiver over Bluetooth (Refer to the Additional Features section). When the system is enabled it will automatically connect to the preferred device. If the preferred device has not been selected or is not available, the system will automatically connect to the first of any available, paired devices. The preferred device can be selected on the 'Aux - Databases' Page from a menu list of paired devices.

Once a connection to the paired mobile device is made, Garmin Pilot™ makes available databases that can be transferred to the Wireless Transceiver. If any of these databases is more recent than the respective standby database on the system, (or if there is no standby database on the system) those databases will be automatically selected to load. The database updates may be initiated from the 'Aux - Databases' Page, or from other pages on the MFD.

> **NOTE:** The system will only provide a WIFI connection if new databases have been detected for download on Garmin Pilot™ WIFI a valid Bluetooth connection. If there are no database updates required the system will not provide a WiFi signal.

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NOTE: If the mobile device has previously connected to the Wireless Transceiver, and is not connected to another bluetooth device, the mobile device should connect automatically to the Wireless Transceiver. If the mobile device is connected to another bluetooth device, then the Wireless Transceiver will not connect automatically.

NOTE: For these instructions, if Automatic Swap has been disabled, no databases will be selected to transfer from Standby to Active. Use the instructions later in this section to update databases from the 'Aux - Databases' Page, or use the instructions later in this section to enable Automatic Swap.

Update Databases from any MFD page (except the 'Aux - Databases' Page):

1) Insert the Wireless Transceiver card in the bottom slot of the MFD if not already inserted.

2) Turn the system ON.

3) Press the **ENT** Key or the right-most softkey on MFD display to acknowledge the startup screen.

4) On the mobile device, start Garmin Pilot and touch **Home > Connext > Database Concierge.**

5) Turn the large **FMS** Knob and select 'Aux'.

6) Turn the small **FMS** Knob and select the 'Connext Setup'.

7) Ensure that WIFI Database Import is enabled in the 'Device' Window (Refer to Additional Features section for instructions to enable WIFI Database Import).

Figure B-3 'Connext Setup' Page

8) Verify the mobile device is enabled via Bluetooth in the Bluetooth settings on the mobile device.

9) In the 'Paired Devices' Window on the 'Connext Setup' Page, ensure the system is paired with the mobile device in use. (Refer to Additional Features for instructions on connection to a preferred device).

NOTE: The database updates may now be continued from any MFD page, however, the update windows shown in these instructions will not be shown on the 'Aux - Databases' Page. Use the instructions for updating databases from the 'Aux - Databases' Page if desired.

10) Press the **Update** Softkey when the following window appears. (Pressing the **View** Softkey will allow database updates to be viewed from the 'Aux Databases' Page, however, the windows shown below will not appear on the 'Aux Databases' Page. Pressing the **Ignore** Softkey will postpone the updates until further action is taken.)

Figure B-4 Database Update Available

11) If using a device that has not been previously paired with the system, a password prompt will appear on the mobile device. Enter the password shown in the 'Password' Field of the 'Aux - Connext Setup' Page.

12) The following window will appear. Database update progress may be monitored on the mobile device.
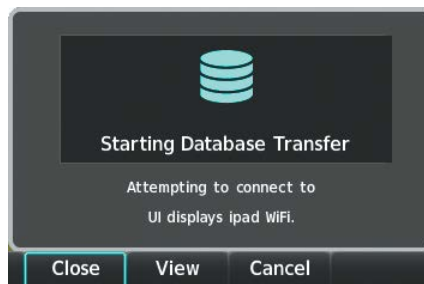
Figure B-5 Starting Database Transfer

13) When the transfer is complete, the following screen will appear.
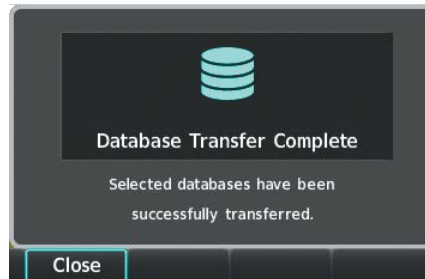
Figure B-6 Database Transfer Complete

14) Press the **Close** Softkey.

15) Remove and reapply power to the system.

16) Press the **ENT** Key or the right-most softkey on MFD display to acknowledge the startup screen.

17) Turn the large **FMS** Knob and select 'Aux'.

18) Turn the small **FMS** Knob and select 'Databases'.

19) Verify the standby databases transferred and are now in the 'Active' Column.

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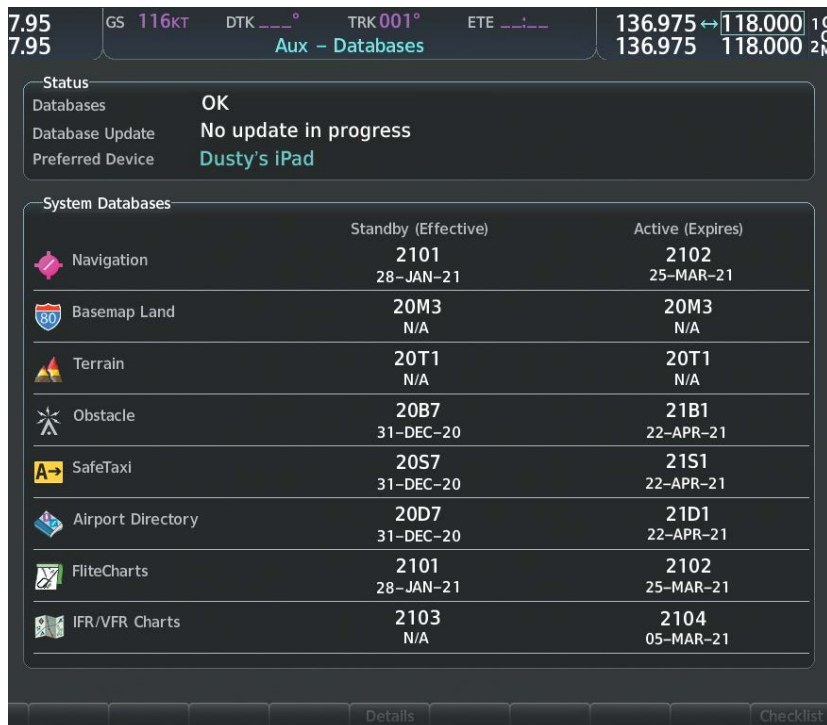HAZARD AVOIDANCE

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Figure B-7 'Aux Databases' Page with Updated Databases

20) To manually activate any databases that did not transfer to the 'Active' Column:

   a) Press the **FMS** Knob. The first database title on the screen will be selected.

   b) To select the database for transfer, press the **ENT** Key. A cyan double-sided arrow will appear indicating the standby database will become active.

   Or:

   Press the **Menu** Key and select 'Swap Standby and Active' using the small **FMS** Knob and press the **ENT** Key. A cyan double-sided arrow will appear indicating the standby database will become active. Press the **ENT** Key or the **FMS** Knob to exit.

   c) Turn the small **FMS** Knob as necessary to select the additional titles.

   d) Repeat steps a through c for additional databases to be transferred.

   e) Remove and reapply power to the system.

   f) Press the **ENT** Key or the right-most softkey on MFD display to acknowledge the start-up screen.

   g) Turn the large **FMS** Knob and select Aux.

   h) Turn the small **FMS** Knob and select Databases.

   i) Verify the standby databases transferred and are now in the 'Active' Column.

21) For additional information on each database, press and then turn the **FMS** Knob to select the database, and then press the **Details** Softkey. Press the **ENT** Key or the **FMS** Knob to exit.

   Or:

   Press the **Menu** Key and select 'View Details' using the small **FMS** Knob and press the **ENT** Key. Press the **ENT** Key or the **FMS** Knob to exit.

22) To view database information for an individual display:

    a)   Turn the large **FMS** Knob and select Aux.

    b)   Turn the small **FMS** Knob and select System Status.

    c)   Press the Display Database Selection Softkey (MFD1 DB, PFD1 DB) to show database information for each display. Use the small **FMS** Knob to scroll through the database information. Press the **ENT** Key or the **FMS** Knob to exit.

Update Databases from the 'Aux - Databases' Page:

> ✓ **NOTE:** The system will only provide a WIFI connection if new databases have been detected for download on Garmin Pilot via a valid Bluetooth connection. If there are no database updates required the system will not provide a WIFI signal.

> ✓ **NOTE:** If the mobile device has previously connected to the Wireless Transceiver, and is not connected to another bluetooth device, the mobile device should connect automatically to the Wireless Transceiver. If the mobile device is connected to another bluetooth device, then the Wireless Transceiver will not connect automatically.

1)   Insert the wireless transceiver SD card in the bottom slot of the MFD if not already inserted.

2)   Turn the system ON.

3)   Press the **ENT** Key or the right-most softkey on MFD display to acknowledge the start-up screen.

4)   On the mobile device, start Garmin Pilot and touch **Home > Connext > Database Concierge.**

5)   Turn the large **FMS** Knob and select 'Aux'.

6)   Turn the small **FMS** Knob and select the 'Connext Setup'.

7)   Ensure that WIFI Database Import is enabled in the 'Device' Window (Refer to Additional Features section for instructions to enable WIFI Database Import).

Figure B-8 'Connext Setup' Page

8)   Verify the mobile device is enabled via Bluetooth in the Bluetooth settings on the mobile device.

9)   In the 'Paired Devices' Window on the 'Connext Setup' Page, ensure the system is paired with the mobile device in use. (Refer to Additional Features for instructions on connection to a preferred device).

10) Press the **Device** Softkey to view databases that are ready to be loaded from the mobile device (pressing the **Stby/Actv** Softkey will again display the current Standby and Active databases).

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11) The 'Aux - Databases' Page will show the databases connected to the mobile device in place of the active databases on the system. Databases selected to load to the system will be indicated by a single cyan arrow.

12) Press the **Update** Softkey.

13) If using a device that has not been previously paired with the system, a password prompt will appear on the mobile device. Enter the password shown in the 'Password' Field of the 'Aux - Connext Setup' Page.

14) Database Update status will appear in the 'Status' Window at the top of the page. Monitor update progress in the 'Status' Window, or on the mobile device.

Figure B-9 Device Database Transfer

15) When all databases have been successfully transferred from the mobile device, they will appear in the Standby Column.

16) Database synchronization will begin. Monitor the 'Sync Status' on the 'Aux-Databases' Page. Wait for all databases to complete synchronizing, indicated by 'Sync Complete' being displayed. A cyan double-arrow will appear between the 'Standby' and 'Active' Columns to show which Standby databases will be transferred to 'Active' at the next power cycle.

Or:

If Automatic Swap is inhibited:

a) Press the **FMS** Knob. The first database title on the screen will be selected.

    b) To select the database for transfer, press the **ENT** Key. A cyan double-sided arrow will appear indicating the standby database will become active.

        Or:

        Press the **Menu** Key and select 'Swap Standby and Active' using the small **FMS** Knob and press the **ENT** Key. A cyan double-sided arrow will appear indicating the standby database will become active. Press the **ENT** Key or the **FMS** Knob to exit.

    c) Turn the small **FMS** Knob as necessary to select the additional titles.

    d) Repeat steps a through c for additional databases to be transferred.

17) Remove and reapply power to the system.

18) Press the **ENT** Key or the right-most softkey on MFD display to acknowledge the startup screen.

19) Turn the large **FMS** Knob and select 'Aux'.

20) Turn the small **FMS** Knob and select 'Databases'.

21) Verify the standby databases transferred and are now in the 'Active' Column.

Figure B-10 'Aux - Databases' Page with Updated Databases

22) To manually activate any databases that did not transfer to the 'Active' Column:

    a) Press the **FMS** Knob. The first database title on the screen will be selected.

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    b) To select the database for transfer, press the **ENT** Key. A cyan double-sided arrow will appear indicating the standby database will become active.

        Or:

    Press the **Menu** Key and select 'Swap Standby and Active' using the small **FMS** Knob and press the **ENT** Key. A cyan double-sided arrow will appear indicating the standby database will become active. Press the **ENT** Key or the **FMS** Knob to exit.

    c) Turn the small **FMS** Knob as necessary to select the additional titles.

    d) Repeat steps a through c for additional databases to be transferred.

    e) Remove and reapply power to the system.

    f) Press the **ENT** Key or the right-most softkey on MFD display to acknowledge the start-up screen.

    g) Turn the large **FMS** Knob and select Aux.

    h) Turn the small **FMS** Knob and select Databases.

    i) Verify the standby databases transferred and are now in the 'Active' Column.

23) For additional information on each database, press and then turn the **FMS** Knob to select the database, and then press the **Details** Softkey. Press the **ENT** Key or the **FMS** Knob to exit.

    Or:

Press the **Menu** Key and select 'View Details' using the small **FMS** Knob and press the **ENT** Key. Press the **ENT** Key or the **FMS** Knob to exit.

24) To view database information for an individual display:

    a) Turn the large **FMS** Knob and select Aux.

    b) Turn the small **FMS** Knob and select System Status.

    c) Press the Display Database Selection Softkey (MFD1 DB, PFD1 DB) to show database information for each display. Use the small **FMS** Knob to scroll through the database information. Press the **ENT** Key or the **FMS** Knob to exit.

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DELETING DATABASES

If databases are not properly loading or functioning, and an attempt has been made to load the databases using a new SD card or multimedia card, it may be necessary to delete the databases from the system.

Deleting the databases:

1) Turn the large **FMS** Knob and select 'Aux'.

2) Turn the small **FMS** Knob and select 'Databases'.

3) Press the **Menu** Key.

4) Turn the small **FMS** Knob to select 'Delete Databases.'

5) Press the **ENT** Key.

6) A prompt will appear to confirm deletion of all internal databases. Push the **ENT** Key.
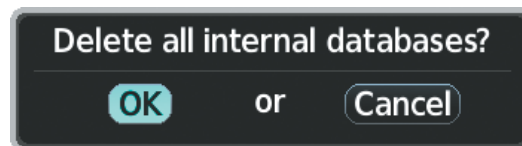
Figure B-11 Delete Databases Confirmation Window

7) Another prompt will appear to confirm deletion of all internal databases. Push the **ENT** Key.
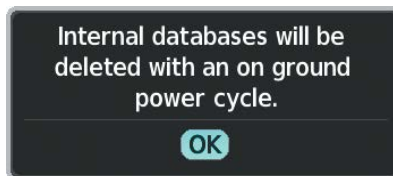
Figure B-12 Delete Databases Confirmation Window

8) Remove and reapply power to the system.

9) Press the **ENT** Key or the right-most softkey on MFD display to acknowledge the startup screen.

10) Turn the large **FMS** Knob and select 'Aux'.

11) Turn the small **FMS** Knob and select 'Databases'.

12) Confirm that all databases have been deleted from the system.

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MAGNETIC FIELD VARIATION DATABASE UPDATE

A copy of the current magnetic field variation database (MV DB) is included with the navigation database. At startup, the system compares this version of the MV DB with that presently being used by the AHRS (GRS1). If the system determines the MV DB needs to be updated, a prompt is displayed on the MFD.
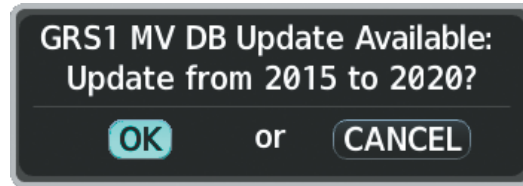
Figure B-13 GRS1 Magnetic Field Variation Database Update Prompt

Load the magnetic field variation database update:

1) With 'OK' highlighted, press the **ENT** Key on the MFD. A progress monitor is displayed.
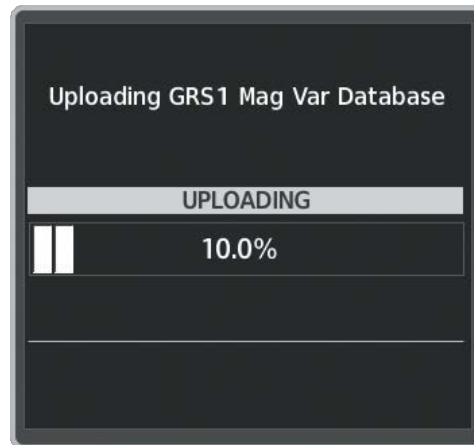
Figure B-14 Uploading Database to GRS1

2) When the upload is complete, the system is ready for use.

AVIATION TERMS, ABBREVIATIONS, AND ACRONYMS

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ABN	Abnormal	**ALT, ALTN**	Alternator, Alternate
AC	Advisory Circular, Alternating Current	**ALTM**	Altimeter
ACARS	Aircraft Communications Addressing and Reporting System	**ALTS**	Altitude Select, Selected Altitude Capture Mode
ACC	Accuracy	**ALTV**	VNAV Altitude Capture Mode
ACFT	Aircraft	**AM**	Amplitude Modulation
ACK	Acknowledge	**AMP**	Amplifier, Ampere
ACT, ACTV	Active, Activate, Altitude Compensated Tilt	**AMPS**	Amperes
ADAHRS	Air Data, Attitude and Heading Reference System	**ANN/ANNUNC**	Annunciation/Annunciator
ADC	Air Data Computer	**ANSP**	Air Navigation Service Provider
ADF	Automatic Direction Finder	**ANT**	Antenna
ADI	Attitude Direction Indicator	**AOA**	Angle of Attack, ACARS Over AVLC
ADIZ	Air Defense Identification Zone	**AOC**	Aeronautical Operational Control
ADM	Administrative Domain	**AOG**	Aircraft On Ground
ADS-B	Automatic Dependent Surveillance-Broadcast	**AOPA**	Aircraft Owners and Pilots Association
ADS-C	Automatic Dependent Surveillance-Contract	**AP**	Autopilot
		AP DISC	Autopilot Disconnect
ADS-R	Automatic Dependent Surveillance-Rebroadcast	**APPR, APR**	Approach, Approach Control
		APT	Airport, Aerodrome, Automatic Pitch Trim
AEA	Aircraft Electronic Association	**APTSIGNS**	Airport Signs
AF	Arc to Fix Leg	**APU**	Auxiliary Power Unit
AFCS	Automatic Flight Control System	**APV**	Approaches with Vertical Guidance
AFM	Airplane Flight Manual	**ARINC**	Aeronautical Radio Incorporated
AFMS	Airplane Flight Manual Supplement	**ARM**	Arm, Armed
AFN	ATS Facilities Notification	**ARSPC**	Airspace
AFRM	Airframe	**ARTCC**	Air Route Traffic Control Center
AFTN	Aeronautical Fixed Telecommunication Network	**ARV**	Arrival
		AS	Airspeed
A/G	Air-to-Ground	**ASB**	Aviation Support Branch
AGL	Above Ground Level	**ASDA**	Accelerate-Stop Distance Available
AHRS	Attitude and Heading Reference System	**ASI**	Airspeed Indicator
AIM	Aeronautical Information Manual	**ASOS**	Automated Surface Observing System
AIRB	Airborne	**AT**	Auto Throttle
AIRMET, AIRM	Airman's Meteorological Information	**ATAS**	ADS-B Traffic Advisory System
AIRREP	Air Reports	**ATC**	Air Traffic Control
ALRT	Alert, Alerting	**ATCRBS**	ATC Radar Beacon System

ATD	Along-Track Distance
ATE	Along-Track Error, Automatic Test Equipment
ATIS	Automatic Terminal Information Service
ATK	Along Track
ATN	Aeronautical Telecommunications Network
ATS	Air Traffic Services
ATT	Attitude
ATZ	Aerodrome Traffic Zone
AUD	Audio
AUTO	Automatic
AUTOSEQ	Automatic Sequence
AUX	Auxiliary
AVAIL	Available
AVG	Average
AVLC	Aviation VHF Link Control
AWOS	Automated Weather Observing System
AWY	Airway
AZ	Azimuth
B	Both Runways
B ALT	Barometric Altitude
BC, B/C	Back Course
BARO	Barometer, Barometric Setting
BATT	Battery
Bearing	The compass direction from the present position to a destination waypoint.
BFO	Beat Frequency Oscillator
BKLT	Backlight
BKSP	Backspace
BKUP	Backup
BLKHD	Bulkhead
Bluetooth	Wireless standard for data exchange over short distances
BOC	Bottom of Climb
BOD	Bottom of Descent
BRG	see also Bearing
BRK	Brake
BTM	Bottom

°C	Degrees Celsius
C	Center Runway
CA	Course to Altitude Leg
CAL	Calibrated
CALC	Calculator
Calibrated Airspeed	Indicated airspeed corrected for installation and instrument errors.
CAS	Crew Alerting System
CAT	Clear Air Turbulence
CLB	Climb
CB	Circuit Breaker
CCG	Current Climb Gradient
CD	Course to DME Distance Leg
CDA	Current Data Authority
CDI	Course Deviation Indicator
CDU	Control Display Unit
CF	Course to Fix Leg
CFG	Configuration
CFIT	Controlled Flight into Terrain
CG	Center of Gravity
CH, CHNL	Channel
CHK	Check
CHKLIST	Checklist
CHRG	Charge
CHT	Cylinder Head Temperature
CI	Course to Intercept Leg
CIP	Current Icing Potential
CL	Class, Centerline
CLB	Climb
CLD	Cloud
CLG	Ceiling
CLR	Clear
CLS	Close
CLTR	Clutter
CM	Centimeter, Context Management
CMC	Central Maintenance Computer
CMPRTR	Comparator
CN	Canada

CNCL	Cancel
CNFM	Confirm
CNI	Communication, Navigation, & Identification
CNS	Communication, Navigation, & Surveillance
CNXT	Connext
CO	Carbon Monoxide
COM	Communication Radio
COMP	Compensated, Compensation
CONFIG	Configuration
CONUS	Continental United States
COOL	Coolant
COPLT	Copilot
CORR	Correct, Corrected, Correction
Course	The line between two points to be followed by the aircraft.
Course to Steer	The recommended direction to steer in order to reduce course error or stay on course. Provides the most efficient heading to get back to the desired course and proceed along the flight plan.
CP	Copilot, Control Panel
CPDLC	Controller Pilot Datalink Communications
CPL	Couple
CR	Course to Radial Leg
CRC	Cyclic Redundancy Check
CRG	Cockpit Reference Guide
CRNT	Current
Crosstrack Error	The distance the aircraft is off a desired course in either direction, left or right.
CRS	see also Course, Course to Steer
CRSR	Cursor
CRU, CRZ	Cruise
CSA	Conflict Situational Awareness
CSC	Current Speed Control
CSTR	Constraint
CTA	Control Area
CTAF	Common Traffic Advisory Frequency
CTR	Center, Controlled Traffic Region
CTRL	Control
Cumulative, CUM	The total of all legs in a flight plan.
CVDR	Cockpit Voice Data Recorder
CVFP	Charted Visual Flight Procedure
CVR	Cockpit Voice Recorder
CVRG	Coverage
CWS	Control Wheel Steering
CYC CTR	Cyclic Centering
CYL	Cylinder
CZ	Control Zone
D->, D→	Direct-To
D/A	Digital to Analog Converter
D ALT	Density Altitude
D-ATIS	Digital Automatic Terminal Info Service
DA	Decision Altitude, Drift Angle
DB, DBASE	Database
DBZ	Decibels 'Z' (Radar Return)
DCL	Departure Clearance
DCLTR, DECLTR	Declutter
DEC	Declination
DEC FUEL	Decrease Fuel
DEG	Degree
DEIC, DEICE	De-icing
DEL	Delete
DEP	Departure, Departure Control
DESC	Descent
Desired Track	The desired course between the active "from" and "to" waypoints.
DEST, DES	Destination, Destination Airport Identifier
DET	Detect, Detected, Detection, Detector
DEV	Deviation
DF	Direction Finder, Direct to Fix Leg
DFLT	Default
DG	Directional Gyro
DGPS	Differential GPS
DGRD	Degrade
DH	Decision Height
DIFF	Differential

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Dilution of Precision	A measure of GPS satellite geometry quality on a scale of one to ten (lower numbers equal better geometry, where higher numbers equal poorer geometry).
DIR	Direction
DIS	Distance
DISENG	Disengage
DISP	Display
Distance	The 'great circle' distance from the present position to a destination waypoint.
DIV	Divert, Diversion
DL LTNG	Datalink Lightning
DLS	Data Link System
DME	Distance Measuring Equipment
DN	Down
DNALT	Density Altitude
DNGR	Danger
DNLK	Downlink
DOD	Department of Defense
DOP	see also Dilution of Precision
DOPP	Doppler
DP	Departure Procedure, Differential Pressure
DPRT	Departure
DQR	Data Quality Requirements
DR	Dead Reckoning
DSBL	Disabled
DSP	Display, Datalink Service Provider, Digital Signal Processor
DTG	Distance To Go, Remaining distance to last active FPL waypoint
DTK	see also Desired Track
DWNGRADE	Downgrade
E	Empty, East
EAS	Engine and Airframe Systems
EC	Error Correction
ECC	Error Correcting Code
ECL	Eledtronic Checklist
ECR	Excessive Closure Rate
ECS	Environmental Control System

ECU	Engine Control Unit
EDM	Emergency Descent Mode
EDR	Excessive Descent Rate
EEP	Expanded Envelope Protection
EFB	Electronic Flight Bag
EFC	Expected Further Clearance
Efficiency	A measure of fuel consumption, expressed in distance per unit of fuel.
EGNOS	European Geostationary Navigation Overlay Service
EGT	Exhaust Gas Temperature
EHS	Enhanced Surveillance
EICAS	Engine Indication and Crew Alerting System
EIS	Engine Indication System
ELEC	Electrical
ELEV	Elevation, Elevator
ELT	Emergency Locator Transmitter
EMER, EMERG, EMERGCY	Emergency
EMI	Electromagnetic Interference
END, ENDUR	Endurance
Endurance	Flight endurance, or total possible flight time based on available fuel on board.
ENG	Engine
ENGA	Engage
ENGD	Engaged
ENR	Enroute; ETE to Final Destination
Enroute Safe Altitude (ESA)	Uses Grid MORAs to determine a safe altitude within ten miles left or right of the desired course on an active flight plan or direct-to.
ENT	Enter
EP	Envelope Protection
EPE	see also Estimated Position Error
EPU	Estimated Position Uncertainty
ERR	Error
ES	Extended Squitter
ESA	Emergency Safe Altitude, see also Enroute Safe Altitude
ESOSP	Electronic Stability Overspeed Protection

ESP	Electronic Stability and Protection		**FDR**	Flight Data Recorder
Estimated Position Error (EPE)	A measure of horizontal GPS position error derived by satellite geometry conditions and other factors.		**FF, FFLOW**	see also Fuel Flow
			FIS-B	Flight Information Services-Broadcast
			FISDL	Flight Information Service Data Link
Estimated Time Enroute (ETE)	The estimated time it takes to reach the destination waypoint from the present position, based upon current groundspeed.		**FIT**	Flight Into Terrain
			FL	Flight Level
			FLC, FLCH	Flight Level Change
Estimated Time of Arrival (ETA)	The estimated time at which the aircraft should reach the destination waypoint, based upon current speed and track.		**FLT**	Flight, Flight Timer
			FLTA	Forward Looking Terrain Avoidance
			FLW	Follow, Following
ET	Elapsed Time		**FM**	Course From Fix to Manual Termination Leg
ETA	see also Estimated Time of Arrival		**FMS**	Flight Management System
ETD	Estimated Time of Departure		**FOB**	see also Fuel On Board
ETE	see also Estimated Time Enroute		**FOD**	see also Fuel Over Destination
EVS	Enhanced Vision System		**FPA**	Flight Path Angle
EXP	Expand		**FPL**	Flight Plan
EXPIRD	Expired		**FPM**	Feet Per Minute, Flight Path Marker
EXT	External		**FR**	From
EXTD	Extend		**FREQ**	Frequency
EXTING	Extinguish, Extinguisher		**FRMT**	Format
EXTR	Extract, Extraction		**FRT**	Front
°F	Degrees Fahrenheit		**FRZ**	Freezing
FA	Course From Fix to Altitude Leg		**FS**	Flight Stream
FAA	Federal Aviation Administration		**FSD**	Full-Scale Deflection
FADEC	Full Authority Digital Engine Control		**FSM**	Flight System Messages
FAF	Final Approach Fix		**FSS**	Flight Service Station
FAIL	Failure		**FT**	Foot/Feet
FANS	Future Air Navigation System		**Fuel Flow**	The fuel flow rate, expressed in units of fuel per hour.
FAP	Final Approach Point		**Fuel On Board**	The total amount of usable fuel on board the aircraft.
FAPP	Final Approach		**Fuel Over Destination**	The estimated fuel remaining when the aircraft reaches the destination waypoint, based upon current fuel flow.
FAR	Federal Aviation Regulations			
FBO	Fixed Base Operator			
F/C	Flight Crew			
FC	Course From Fix to Distance Leg			
FCC	Federal Communication Commission		**FWD**	Forward
FCST	Forecast		**G/A**	Ground to Air
FCTN	Function		**G/S**	Glideslope
FD	Flight Director, Course From Fix to DME Distance Leg		**GA**	Go-Around
FDE	Fault Detection and Exclusion		**GAGAN**	GPS Aided GEO Augmented Navigation

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GAGL	GPS AGL Altitude
GAL, GL	Gallon(s)
GBAS	Ground Based Augmentation System
GBOX	Gearbox
GBT	Ground Based Transceiver
GCS	Ground Clutter Suppression
GCSS	Garmin Connext Satellite Services
GCU	Garmin Control Unit
GDC	Garmin Air Data Computer
GDL	Garmin Satellite Data Link
GDR	Garmin Data Radio
GDU	Garmin Display Unit
GEA	Garmin Engine/Airframe Unit
GEAR	Landing Gear
GEN	Generator
GEO	Geographic
GFC	Garmin Flight Control
GHZ	Gigahertz
GIA	Garmin Integrated Avionics Unit
GLONASS	Global Orbiting Navigation Satellite Landing System
GLS	Global Navigation Satellite Landing System
GMA	Garmin Audio Panel System
GMC	Garmin Mode Controller
GMT	Greenwich Mean Time
GMU	Garmin Magnetometer Unit
GND	Ground
GNSS	Global Navigation Satellite System
GOLD	Global Operational Data Link
GP	Glidepath
GPH	Gallons per Hour
GPN	Garmin Part Number
GPS	Global Positioning System
GPWS	Ground Proximity Warning System
GRA	Garmin Radar Altimeter
GRC	Garmin Remote Control

Grid MORA (Minimum Off-Route Altitude)	One degree latitude by one degree longitude in size and clears the highest elevation reference point in the grid by: a) 1,000 feet where the highest elevation is <5001MSL or b) 2,000 feet where the highest elevation is >5000MSL
Ground Track	See Track
Groundspeed	The velocity the aircraft is travelling relative to a ground position.
GRP	Geographic/Ground Reference Point
GRS	Garmin Reference System
GRT	Garmin Radio Transceiver
GS	Ground Speed, Glideslope
GSA	Garmin Servo Adapter
GSD	Glideslope/Glidepath Deviation, Garmin Data Concentrator
GSL	Geometric/Geodetic Sea Level
GSR	Garmin Satellite Radio
GSU	Garmin Sensor Unit
GTC	Garmin Touchscreen Controller
GTS	Garmin Traffic System
GTX	Garmin Transponder
GW	Gross Weight
GWX	Garmin Weather Radar
H	Hours
H+MM	Hours and Minutes
HA	Hold Terminating at Altitude Leg
HAL	Horizontal Alert Limit
HAT	Height Above Threshold
HDG	see also Heading
HDOP	Horizontal Dilution of Precision
Heading	The direction an aircraft is pointed, based upon indications from a magnetic compass or a properly set directional gyro.
HF	High Frequency, Hold Terminating at Fix Leg
HFOM	see also Horizontal Figure of Merit
HG	Mercury
HI	High
HI SENS	High Sensitivity
HLD	Hold, Holding, Holding Pattern

HM	Hold with Manual Termination Leg
HNS	Hybrid Navigation Sensor
Horizontal Figure of Merit	A measure of the uncertainty in the aircraft's horizontal position.
HOV	Hover
HOV-P	Hover Prediction
HP	High Pressure, Horsepower
HPA	Hectopascal
HPI	Hover Power Indicator
HPL	Horizontal Protection Level
HR	Hour
HRZN HDG	Horizon Heading
HSDB	High-Speed Data Bus
HSI	Horizontal Situation Indicator
HT	Heat, Height
HTR	Heater
HUL	Horizontal Uncertainty Level
HWND	Headwind
HYD	Hydraulic
HZ	Hertz (cycles per second)
HZN	Horizon
I	Inner Marker
IAF	Initial Approach Fix
IAP	Instrument Approach Procedure
IAS	Indicated Air Speed
IAT	Indicated Air Temperature
IATA	International Air Transport Association
IAU	Integrated Avionics Unit
IBD, INBD	Inboard
ICAO	International Civil Aviation Organization
ICE	Icing
ICS	Intercom System
ID	Identification/Morse Code Identifier
IDENT, IDNT	Identification
IEEE	Institute of Electrical & Electronics Engineers
IF	Initial Fix
IFR	Instrument Flight Rules
IG	Imperial Gallon

IGE	In Ground Effect
ILI	Imminent Line Impact
ILS	Instrument Landing System
IM	Inner Marker
IMC	Instrument Meteorological Conditions
IN	Inch
IN HG, "HG	Inches of Mercury
INACTV	Inactive
INBD	Inboard
INBND	Inbound
INC FUEL	Increase Fuel
IND	Indicator, Indicated
Indicated	Information provided by properly calibrated and set instrumentation on the aircraft panel.
INDX	Index
INFO	Information
INH, INHIB	Inhibit
INIT	Initialization
INOP	Inoperative
INS	Inertial Navigation System
INSTR	Instrument
INT	Intersection(s)
INTEG	Integrity (RAIM unavailable)
INTERN, INTRL	Internal
INV	Invalid
IOI	Imminent Obstacle Impact
IR	Infrared
IrDA, IRDA	Infrared Data Association
IRST	Infrared Surveillance and Tracking
ISA	International Standard Atmosphere; ISA Relative Temperature
ISO	International Standards Organization
ISOL	Isolation
ITI	Imminent Terrain Impact
ITT	Inter-Turbine Temperature, Interstage Turbine Temperature
KEYSTK	Key Stuck
KG	Kilogram
KHZ	Kilohertz

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KIAS	Knots Indicated Airspeed		**LT**	Left, Light
KM	Kilometer		**LTNG**	Lightning
KT	Knot		**LVL**	Level
L	Left, Left Runway		**M**	Meter, Middle Marker, Mach
LAT	Latitude, Lateral		**Mach Number**	Mach number is the ratio of the true airspeed to the speed of sound.
LB	Pound			
LBL	Label		**MAG**	Magnetic
LCD	Liquid Crystal Display		**MAG VAR**	Magnetic Variation
LCL	Local		**MAHP**	Missed Approach Hold Point
LDA	Landing Distance Available, Localizer Type Directional Aid		**MAINT**	Maintain
			MAL	Malfunction
LDG	Landing, ETA at Final Destination		**MAN**	Manual
LED	Light Emitting Diode		**MAN IN**	Manifold Pressure (inches Hg)
Left Over Fuel On Board	The amount of fuel remaining on board after the completion of one or more legs of a flight plan or direct-to.		**MAN SQ**	Manual Squelch
			MANSEQ	Manual Sequence
			MAP	Missed Approach Point
Left Over Fuel Reserve	The amount of flight time remaining, based on the amount of fuel on board after the completion of one or more legs of a flight plan or direct-to, and a known consumption rate.		**MAPROC**	Missed Approach Procedure
			MASQ	Master Avionics Squelch
			MAX	Maximum
			MAXSPD	Maximum Speed (overspeed)
			MB	Marker Beacon, Millabar(s)
Leg	The portion of a flight plan between two waypoints.		**MCDU**	Multifunction Control and Display Unit
			MCLB	Maximum Climb Thrust
LEN	Length		**MCP**	Maximum Continuous Power
LGND	Legend		**MCRZ**	Maximum Cruise Thrust
LIFR	Low Instrument Flight Rules		**MCT**	Maximum Continuous Thrust
LI-ION	Lithium Ion		**MDA**	Barometric Minimum Descent Altitude
LIM	Limit		**MEA**	Minimum Enroute Altitude
LMM	Locator Middle Marker		**MEM**	Memory
LNAV	Lateral Navigation		**MEPT**	Manual Electric Pitch Trim
LO	Low		**MET**	Manual Electric Trim
LOA	Letter of Authorization		**METAR**	Aviation Routine Weather Report
LOC	Localizer		**METRO**	Metropolitan
LOI	Loss of Integrity (GPS)		**MFI**	Multi-Function Instrument
LOM	Locator Outer Marker		**MFD**	Multi Function Display
LON, LONG	Longitude, Longitudinal		**MFW**	Multi Function Wndow
LP	Localizer Performance, Low Pressure		**MGRS**	Military Grid Reference System
LPV	Localizer Performance with Vertical Guidance		**MGT**	Measured Gas Temperature
			MHz	Megahertz
LRU	Line Replaceable Unit			
LSB V	Lower Sideband Voice			

MIC	Microphone		NORM	Normal
MID	Middle		NOTAM	Notice To Airman
MIN	Minimum, Minute		NP	Power Turbine Speed
MKR	Marker Beacon		NPA	Non-Precision Approach
MM	Middle Marker		NR	Rotor Speed
MMO (VMO)	Maximum Speed		NRST	Nearest
MOA	Military Operations Area		NWHL	Nosewheel
MOD	Modification, Modify		NWS	National Weather Service, Nosewheel Steering
MON	Monitor, Monitored, Monitoring		O	Outer Marker
MORA	Minimum Off-Route Altitude		OAT	Outside Air Temperature
MOV	Movement		OBD, OUTBD	Outboard
MPEL	Maximum Permissible Exposure Level		OBS	Omni Bearing Selector, Observation, Observe, Observed
MPM	Meters per Minute		OBSCR	Obscuration
MSA	Minimum Safe Altitude		OCL	Oceanic Clearance
MSAS	Multi-functional Satellite Augmentation System		OEM	Original Equipment Manufacturer
MSG	Message		OFST	Offset
MSL	Mean Sea Level		OGE	Out of Ground Effect
MT, M	Meter		OM	Outer Marker
MTG	Mounting		OOOI	Out of the gate, Off the ground, On the ground, and In the gate
MTN	Mountain		OROCA	Off Route Obstacle Clearance Altitude
MTOGW	Maximum Takeoff Gross Weight		OSP	Overspeed Protection
MTOW	Maximum Takeoff Weight		OUTBD	Outboard
MV	Millivolt(s)		OUTBND	Outbound
MVFR	Marginal Visual Flight Rules		OVBD	Overboard
N	North		OVFL	Overflow
NATS	North Atlantic Tracks System		OVFLY	Overfly, Overflying
NAV	Navigation		OVHD	Overhead
NAVAID	Navigation Aid		OVHT	Overheat
NCR	Negative Climb Rate		OVLIM	Overlimit
NDA	Next Data Authority		OVLD	Overload
NDB	Non-Directional Beacon		OVPR	Overpressure
NEG	Negative		OVR, OVRD	Override
NEXRAD	Next Generation Radar		OVRN	Overrun
NG	Gas Producer Rotation Speed		OVSPD	Overspeed
NM	Nautical Mile(s)		OVTMP	Overtemperature
NMPG	Nautical Miles per Gallon		OXY	Oxygen
NoPT	No Procedure Turn Required (procedure shall not be executed without ATC clearance)		P ALT	Pressure Altitude

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P-ATT	Pitch Attitude
PA	Precision Approach, Passenger Address, Proximity Advisory
PB	Push Button
PASS, PAX	Passenger(s)
PC	Personal Computer
PCL	Pilot Controlled Lighting
PDA	Premature Descent Alerting
PDC	Pre-Departure Clearance
PED	Portable Electronic Device
PERF	Performance
PFD	Primary Flight Display
PFT	Preflight Test
PG	Pilot's Guide
PI	Procedure Turn to Course Intercept Leg
PIREP	Pilot Report
PIT, PTCH	Pitch
PLT	Pilot
PNR	Prior Notice Required
POA	Plain Old ACARS
POB	Persons (Souls) on Board
POF	Phase of Flight
POH	Pilot's Operating Handbook
POHS	Pilot's Operating Handbook Supplement
POS, POSN	Position
POSS	Possible
PPH	Pounds per Hour
PPM	Parts per Million
PPOS, P. POS	Present Position
PREFLT	Preflight
PRES, PRESS, P	Pressure
PREV	Previous
PRI	Primary
PRL	Parallel
PRN	Pseudo Random Noise
PROC	Procedure(s), Procedure Turn
PROP	Propeller
PROX	Proximity
PSI	Pounds per Square Inch, Power Situation Indicator

PT	Procedure Turn, Part Time
PTK	Parallel Track
PTT	Push-to-Talk
PWR	Power
Q	Engine Torque
QFE	Field Elevation Pressure
QNE	Pressure Altitude
QNH	Sea Level Pressure
QTY	Quantity
R	Right, Right Runway
RA	Resolution Advisory, Radio Altimeter, Radar Altimeter
RAD	Radial
RAD ALT	Radio Altimeter, Radar Altimeter
RAIM	Receiver Autonomous Integrity Monitoring
RAM	Random Access Memory
RAT	Ram Air Temperature
RCVR	Receiver
R/D	Radial/Distance
RDR	Radar
REC	Record, Recorder
RECIRC	Recirculate/Recirculating
REF	Reference
REGL	Regulator
REM	Remaining (fuel remaining), Reminder, Removed, Remote
REQ	Request
REQD	Required
RES	Reserve (fuel reserve entered by pilot)
REST	Restricted, Restriction
RET	Return
REV	Reverse, Revision, Revise
RF	Radio Frequency, Constant Radius Turn to Fix Leg
RFM	Rotorcraft Flight Manual
RLC	Required Line Clearance
RMI	Radio Magnetic Indicator
RMT	Remote
RNAV	Area Navigation
RNG	Range

RNP	Required Navigation Performance		**SEG**	Segment
RNWY, RWY	Runway		**SEL, SLCT**	Select
ROASS	Runway Overrun Awareness and Alerting System		**SELCAL**	Selective Calling
ROC	Required Obstacle Clearance, Rate of Cllmb		**SENS**	Sense, Sensitivity
			SEQ	Sequence, Sequencing
ROD	Rate of Descent		**SERL**	Serial
ROL	Roll		**SERV**	Service, Servicing, Served
ROM	Read Only Memory		**SET**	Setup
ROT	Rotary		**SFC**	Surface
RPM	Revolutions Per Minute		**SHT**	Short
RQRD	Required		**SIAP**	Standard Instrument Approach Procedures
RST FUEL	Reset Fuel		**SID**	Standard Instrument Departure
RSV	Reserve (fuel reserve entered by pilot)		**SIG**	Signal
RT	Right		**SIG/AIR**	SIGMET/AIRMET
RTC	Required Terrain Clearance		**SIGM**	SIGMET
RTE	Route		**SIGMET**	Significant Meteorological Information
RTR	Router		**SIM**	Simulator
RUDICS	Router-Based Unrestricted Digital Interworking Connectivity Solution		**SITA**	Societe Internationale de Telecommunications
RVRSNRY	Reversionary		**SLD**	Supercooled Large Droplet
RVSI	Required Vertical Speed Indicator		**SLP/SKD**	Slip/Skid
RVSM	Reduced Vertical Separation Minimums		**SLW**	Slow
RX	Receive		**SM**	Statute Mile
S	South		**SMBL**	Symbol
SA	Selective Availability		**SMK**	Smoke
SAIB	Special Airworthiness Information Bulletin		**SMS**	Short Message System
SAR	Search and Rescue		**SNGL**	Single
SAT	Static Air Temperature		**SOB**	Souls on Board
SATCOM	Satellite Communication		**SPBK**	Speed Brake
SBAS	Satellite-Based Augmentation System		**SPC**	Space
S-CLB	Step Climb		**SPD**	Speed
SC	Short Circuit		**SPI**	Special Position Identification
SCIT	Storm Cell Identification and Tracking		**SPKR**	Speaker
S-DES	Step Descent		**SQ, SQL**	Squelch
SD	Secure Digital		**SRVC, SVC**	Service
SDF	Simplified Directional Facility		**SSEC**	Static Source Error Correction
SEC	Second(s)		**SSID**	Wireless Service Set Identifier
SECT	Section		**SSR**	Secondary Surveillance Radar
			STAB	Stabilization

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STAL	Stall
STAR	Standard Terminal Arrival Route
STAT	Status
STATS	Statistics
STBY	Standby
STC	Sensitivity Time Constant, Supplemental Type Certificate
STD	Standard
STN	Station
STR	Strip
STRMSCP	Stormscope
SUA	Special Use Airspace
SUB	Substitute
SUPPRESS	Suppression
SURF	Surface
SUSP	Suspend
SVBL	Serviceable
SVT	Synthetic Vision Technology
SW	Software
SYN TERR	Synthetic Terrain
SYN VIS	Synthetic Vision
SYNC	Synchronize
SYNTH	Synthesizer
SYS	System
T	True
T HDG	True Heading
T/R	Thrust Reverser
TA	Traffic Advisory, Transition Altitude
TAC	Tactical, Terminal Area Chart
TACAN, TCN	Tactical Air Navigation System
TAF	Terminal Aerodrome Forecast
TAS	True Airspeed, Traffic Advisory System
TAT	Total Air Temperature
TAWS	Terrain Awareness and Warning System
TC	Table of Contents
TCA	Terminal Control Area
TCAS	Traffic Alert Collision Avoidance System
TCH	Threshold Crossing Height
TD	Touchdown

TEL	Telephone
TEMP, TMP	Temperature
TERM	Terminal
TERR	Terrain
T/F	To/From
TF	Track Between Two Fixes Leg
TFR	Temporary Flight Restriction
TGT	Target
TH	True Heading
THLD	Threshold
THR	Thrust
TIS	Traffic Information Service
TIS-B	Traffic Information Service-Broadcast
TIT	Turbine Inlet Temperature
TIZ	Traffic Information Zone
TKE	see also Track Angle Error
TL	Transition Level
TLA	Throttle Lever Angle, Thrust Lever Angle
TMA	Terminal Maneuvering Area
TMR/REF	Timer/Reference
TNK	Tank
TO	To, Takeoff
TOC	Top of Climb, Table of Contents
TOD	Top of Descent, Time to TOD
TOGA, TO/GA	Take-Off, Go-Around
TOLD	Takeoff and Landing Data
TOPO	Topographic
TORA	Takeoff Run Available
TOT	Total
TPA	Traffic Pattern Altitude
Track	Direction of aircraft movement relative to a ground position; also 'Ground Track'.
Track Angle Error	The angle difference between the desired track and the current track.
TRFC	Traffic
TRK	see also Track
TRM	Trim
TRN	Terrain
TRSA	Terminal Radar Service Area

TRUNC	Truncated		VAL	Vertical Alert Limit
TSO	Technical Standard Order		VAPP	VOR Approach Mode
TST	Test		V_{APP}, V_{AC}	Approach Climb Speed
TTA	Time-to-Alert		VAR	Variable, Variation
TTK	True Track		VCO	Voice Call Out
TTL	Total		VD	Heading Vector to DME Distance Leg
TTS	Text to Speech		VDC	Volts Direct Current
TUR	Turbine		VDI	Vertical Deviation Indicator
TURB	Turbulence		VDL	VHF Datalink
TURN	Procedure Turn		V_E, V_{ENR}	Enroute Climb Speed
TWND	Tailwind		VECT	Vector
TWIP	Terminal Weather Information for Pilots		VERT	Vertical
TWR	Tower		Vertical Figure of Merit	A measure of the uncertainty in the aircraft's vertical position.
TWY	Taxiway			
TX	Transmit		Vertical Speed Required	The vertical speed necessary to descend/climb from a current position and altitude to a defined target position and altitude, based upon current groundspeed.
UA	Routine PIREP			
UAT	Universal Access Transceiver			
UAV	Unmanned Airborne Vehicle			
UHF	Ultra-High Frequency		V_{FE}	Maximum Flap Extended Speed
UNABL	Unable		VFOM	see also Vertical Figure of Merit
UNAVAIL	Unavailable		VFR	Visual Flight Rules
UNLIM	Unlimited		VHF	Very High Frequency
UPLK	Uplink		VI	Heading Vector to Intercept Leg
US	United States		VIB	Vibration
USB V	Upper Sideband Voice		V_{LE}	Maximum Landing Gear Extended Speed
USP	Underspeed Protection		V_{LNDx}	Approach Speed (Flaps at x°)
USR	User		V_{LO}	Maximum Landing Gear Operating Speed
UTC	Coordinated Universal Time		VLD	Valid
UTM/UPS	Universal Transverse Mercator/ Universal Polar Stereographic Grid		VLOC, VOR/L	VOR/Localizer Receiver
			VM	Heading Vector to Manual Termination Leg
UUA	Urgent PIREP			
V	Volts, Vertical		V_{MC}	Minimum Control Speed
V DEV	Vertical Deviation		VMC	Visual Meteorological Conditions
V, Vspeed	Velocity (airspeed)		V_{MO} (M_{MO})	Maximum Operating Speed
V_1	Takeoff Decision Speed		VNAV, VNV	Vertical Navigation
V_2	Takeoff Safety Speed		V_{NE}	Never-Exceed Speed
V_A	Maneuvering Speed		VOL	Volume
VA	Heading Vector to Altitude Leg		VOR	VHF Omnidirectional Range
VAC	Volts Alternating Current		VOR/D	VOR/DME
			VOR/I	VOR/ILS

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VORTAC	VHF Omnidirectional Range Station and Tactical Air Navigation
VPATH, VPTH	Vertical Path
VPL	Vertical Protection Level
VPROF	VNAV Profile, Vertical Profile
V_R	Takeoff Rotate Speed
VR	Heading Vector to Radial Leg
V_{REF}	Landing Approach Speed, Reference Landing Speed
VRP	Visual Reporting Point
VS	Vertical Speed
V_{SB}	Maximum Speedbrake Speed
VSD	Vertical Situation Display
VSI	Vertical Speed Indicator
VSM	Vertical Separation Minima
V_{SR}	Stall Speed
VSR, VS REQ	see also Vertical Speed Required
V_T	Takeoff Flap Retraction Speed
VTE	Vertical Track Error
VTF	Vector to Final
VTK	Vertical Track
V_{TIRE}	Maximum Tire Speed
V_X	Best Angle of Climb Speed
V_Y	Best Rate of Climb Speed
V_{YSE}	Best Single-Engine Rate of Climb Speed
W	Watt(s), West
WAAS	Wide Area Augmentation System
WARN	Warning
WATCH	Weather Attenuated Color Highlight
WDIR	Wind Direction
WEP	Wired Equivalent Privacy
WSPD	Wind Speed
WGS-84	World Geodetic System - 1984
WI-FI, WIFI	Wireless Local Area Network based on IEEE 802.11
WILCO	Will Comply
WNDSHR, WSHEAR	Windshear
WL	Wings Level
WOG	Weight on Gear

WOW	Weight on Wheels
WPA	Wi-Fi Protected Access
WPT	Waypoint(s)
WT	Weight
WUXGA	Widescreen Ultra Extended Graphics Array
W/V	Wind Velocity
WW	World Wide
WX	Weather
WXR	Weather Radar
XFD	Crossfeed
XFER, XFR	Transfer
XFLOW	Crossflow
XM LTNG	SiriusXM Lightning
XMIT	Transmit
XMSN	Transmission
XPDR	Transponder
XTALK	Cross-Talk
XTE	Crosstrack Error
XTK	Cross-Track, Crosstrack Error
YD	Yaw Damper
Z	Reflectivity Factor
ZPL	Zero Pitch Line

Garmin G1000 NXi Pilot's Guide for the Diamond DA42NG

FREQUENTLY ASKED QUESTIONS

If a particular aspect of G1000 NXi operational capability is not addressed by these commonly asked questions or in the index, contact Garmin (see the copyright page or back cover for contact information) or a Garmin-authorized dealer. Garmin is dedicated to supporting its products and customers.

WHAT IS SBAS?

The Satellite Based Augmentation System (SBAS) uses a system of ground stations to correct any GPS signal errors. These ground stations correct for errors caused by ionospheric disturbances, timing, and satellite orbit errors. It also provides vital integrity information regarding the health of each GPS satellite. The signal correction is then broadcast through geostationary satellites. This correction information can then be received by any SBAS-enabled GPS receiver.

SBAS is designed to provide the additional accuracy, availability, and integrity necessary to enable users to rely on GPS for all phases of flight.

There are several SBAS systems serving different parts of the world. The Wide Area Augmentation System (WAAS) is currently available in the United States, including Alaska and Hawaii. The European Geostationary Navigation Overlay Service (EGNOS) offers coverage of Europe, parts of the middle east and northern Africa. The Multi-functional Satellite Augmentation System (MSAS) covers mainly Japan and parts of northern Australia.

HOW DOES SBAS AFFECT APPROACH OPERATIONS?

LP and LPV approaches use the accuracy of SBAS to provide additional precision for lateral (LP, LPV) and vertical (LPV) guidance capability. LPV approaches also allow lower approach minimums. When SBAS is not available, LP and LPV approaches cannot be added to the active flight plan. An LP or LPV approach already loaded will be downgraded to an LNAV or LNAV/VNAV approach, using LNAV or LNAV/VNAV minima.

WHAT IS RAIM AND HOW DOES IT AFFECT APPROACH OPERATIONS?

RAIM is an acronym for Receiver Autonomous Integrity Monitoring. RAIM is a GPS receiver function that performs the following functions:
- Monitors and verifies integrity and geometry of tracked GPS satellites
- Notifies the pilot when satellite conditions do not provide the necessary coverage to support a certain phase of flight
- Predicts satellite coverage of a destination area to determine whether the number of available satellites is sufficient to satisfy requirements

NOTE: If RAIM is not predicted to be available for the final approach course, the approach does not become active, as indicated by the "RAIM not available from FAF to MAP" message and the LOI annunciation flagging on the HSI.

For RAIM to work correctly, the GPS receiver must track at least five satellites. A minimum of six satellites is required to allow RAIM to eliminate a single corrupt satellite from the navigation solution.

RAIM ensures that satellite geometry allows for a navigation solution calculation within a specified protection limit (2.0 nm for oceanic and en route, 1.0 nm for terminal, and 0.3 nm for non-precision approaches). The system monitors RAIM and issues an alert message when RAIM is not available (see Appendix A). Without RAIM, GPS position accuracy cannot be monitored. If RAIM is not available when crossing the FAF, the pilot must fly the missed approach procedure.

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WHAT IS GSL ALTITUDE?

GSL (Geodetic Sea Level) altitude is the height above Mean Sea Level (MSL), as calculated geometrically, generally using a global positioning system (GPS) as the primary data source. The calculated result may or may not include a barometric component, but the primary source is geometric.

WHY ARE THERE NOT ANY APPROACHES AVAILABLE FOR A FLIGHT PLAN?

Approaches are available for the final destination airport in a flight plan or as a direct-to (keep in mind that some VOR/VORTAC identifiers are similar to airport identifiers). If a destination airport does not have a published approach, the system indicates "NONE" for the available procedures.

WHAT HAPPENS WHEN AN APPROACH IS SELECTED? CAN A FLIGHT PLAN WITH AN APPROACH, A DEPARTURE, OR AN ARRIVAL BE STORED?

When an approach, departure, or arrival is loaded into the active flight plan, a set of approach, departure, or arrival waypoints is inserted into the flight plan, along with a header line showing the title of the selected instrument procedure. The original en route portion of the flight plan remains active, unless the instrument procedure is activated. This may be done either when the procedure is loaded or at a later time.

Flight plans can also be stored with an approach, a departure, or an arrival. Note that the active flight plan is erased when the system is turned off. Also, the active flight plan is overwritten when another flight plan is activated. When storing flight plans with an approach, a departure, or an arrival, the system uses the waypoint information from the current database to define the waypoints. If the database is changed or updated, the system automatically updates the information, provided the procedure has not been modified. Should an approach, departure, or arrival procedure no longer be available, the flight plan becomes locked until the procedure is deleted from the flight plan.

WHAT DOES THE OBS SOFTKEY DO?

The **OBS** Softkey is used to select manual sequencing of waypoints. Activating OBS mode sets the current active-to waypoint as the primary navigation reference and prevents the system from sequencing to the next waypoint in a flight plan. When OBS mode is cancelled, automatic waypoint sequencing is continued, and the system automatically activates the next waypoint in the flight plan once the aircraft has crossed the present active waypoint.

Normal (OBS not activated)	OBS
• Automatic sequencing of waypoints	• Manual sequencing - 'holds' on selected waypoint
• Manual course change on HSI not possible	• Manually select course to waypoint from HSI
• Always navigates 'TO' the active waypoint	• Indicates 'TO' or 'FROM' waypoint
• Must be in this mode for final approach course	• Cannot be set for final approach course or published holding patterns

When OBS mode is active, the system allows the pilot to set a desired course to/from a waypoint using the **CRS/BARO** Knob and HSI (much like a VOR).

The most common application for using the **OBS** Softkey is the missed approach. The system suspends automatic waypoint sequencing (indicated by a 'SUSP' annunciation placed on the HSI) when the missed approach point (MAP) is crossed. This prevents the system from automatically sequencing to the missed approach holding point (MAHP). During this time, the **OBS** Softkey designation changes to **SUSP**. Pressing the **SUSP** Softkey reactivates automatic waypoint sequencing. The **OBS** Softkey then resumes its normal functionality.

WHY DOES THE SYSTEM NOT AUTOMATICALLY SEQUENCE TO THE NEXT WAYPOINT?

The system only sequences flight plan waypoints when automatic sequencing is enabled (i.e., no "OBS" or 'SUSP' annunciation). For automatic sequencing to occur, the aircraft must also cross the "bisector" of the turn being navigated. The bisector is a line passing through the waypoint common to two flight plan legs at an equal angle from each leg.

HOW CAN A WAYPOINT BE SKIPPED IN AN APPROACH, A DEPARTURE, OR AN ARRIVAL?

The system allows the pilot to manually select any approach, departure, or arrival leg as the active leg of the flight plan. This procedure is performed on the MFD from the Active Flight Plan Page by highlighting the desired waypoint and selecting the **ACT LEG** Softkey then the **ENT** Key to approve the selection. The GPS then provides navigation along the selected flight plan leg.

WHEN DOES TURN ANTICIPATION BEGIN?

The system smooths adjacent leg transitions based on a normal 15° bank angle (with the ability to roll up to 30°) and provides three pilot cues for turn anticipation:

- A waypoint alert ('Next DTK ###° in # seconds' or 'Next HDG ###° in # seconds') appears on the PFD 10 seconds before the turn point and flashes as it counts down to zero.
- A flashing turn advisory ('Turn [right/left] to ###° in # seconds') appears on the PFD 10 seconds before the turn and flashes as it counts down to zero. 'Turn [right/left] to ###° now' or 'Next [DTK/HDG] to ###° now' is displayed when the pilot is to begin the turn and the HSI (GPS mode) automatically sequences to the next DTK or HDG value.
- The To/From indicator on the HSI flips momentarily to indicate that the midpoint of the turn has been crossed.

WHEN DOES THE CDI SCALE CHANGE?

Once a departure is activated, the G1000 NXi Course Deviation Indicator (CDI) full scale deflection is set to 0.3 nm. The CDI scale changes to 1.0 nm (terminal mode) then ramps up to 2.0 nm (enroute mode) at 30 nm from the departure airport. When 31 nm from the destination, the CDI scale smoothly transition from 2.0 nm back to 1.0 nm (terminal mode). At 2.0 nm before the FAF during an active approach, the CDI scale transitions down further based on the type of approach activated (LNAV, LNAV/VNAV, LP, LPV). When a missed approach is activated, the CDI is set to 0.3 nm. See the Flight Instruments Section for more details on CDI scaling.

WHY DOES THE HSI NOT RESPOND LIKE A VOR WHEN OBS MODE IS ACTIVE?

Unlike a VOR, the CDI scale used on GPS equipment is based on the crosstrack distance to the desired course, not on the angular relationship to the destination. Therefore, the CDI deflection on the GPS is constant regardless of the distance to the destination and does not become less sensitive when further away from the destination.

WHAT IS THE CORRECT MISSED APPROACH PROCEDURE? HOW IS THE MISSED APPROACH HOLDING POINT SELECTED?

To comply with TSO specifications, the system does not automatically sequence past the MAP. The first waypoint in the missed approach procedure becomes the active waypoint when the **SUSP** Softkey is selected *after* crossing the MAP. All published missed approach procedures must be followed, as indicated on the approach plate.

To execute the missed approach procedure prior to the MAP (not recommended), select the Active Flight Plan Page and use the **ACT Leg** Softkey to activate the missed approach portion of the procedure.

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AFTER A MISSED APPROACH, HOW CAN THE SAME APPROACH BE RE-SELECTED? HOW CAN A NEW APPROACH BE ACTIVATED?

> **NOTE:** Do not attempt to reactivate the current approach prior to crossing the missed approach point (MAP). If an attempt to do so is made, an alert message "Are you sure you want to discontinue the current approach?" appears. The system directs the pilot back to the transition waypoint and does not take into consideration any missed approach procedures, if the current approach is reactivated.

After flying the missed approach procedure, the pilot may reactivate the same approach for another attempt by pressing the **PROC** Key. Once the clearance is given for another attempt, activate the approach by highlighting 'Activate Approach' using the large **FMS** Knob and pressing the **ENT** Key. The system provides navigation along the desired course to the waypoint and rejoins the approach in sequence from that point.

To activate a new approach for the same airport, select the new procedure by pressing the **PROC** Key. Choose 'Select Approach', select the desired approach from the list shown, and press the **ENT** Key. Select the desired transition, then activate the approach using the **ENT** Key.

To activate a new approach to a different airport, press the **Direct-to** Key and select the desired airport using the **FMS** Knobs. Press the **ENT** Key to accept the selected airport, then follow the steps in the preceding paragraph to select an approach for the new airport.

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