PILOT'S GUIDE

FOR THE

ROADRUNNER™
EFI

AFI4700
ELECTRONIC FLIGHT INSTRUMENT
(EFI)

ASTRONAUTICS PN 276800-()

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Astronautics Corporation of America

Revision History

Rev	Description	Date	Author
A	Initial Release	2018-10-02	G. Gruebling
B	1. Removed extraneous HTAWS. 2. Updated power up page. 3. Corrected image annotations. 4. Removed RID/encoder text. 5. Clarified approach annunciation and figures.	2019-02-19	H. Faye
C	1. Added marker beacon test section. 2. Updated RA Test Section. 3. Updated GPS CDI Section.	2019-04-11	G. Younger
D	1. Added HTAWS alerts. 2. Added error messages along with their description. 3. Added description for DH adjust on the right rotary knob when in DH menu. 4. Added images and description of vertical profile WXR overlays. 5. Added HSI overlay ranges. 6. Updated map mode selection based on DME configuration.	2019-06-28	G. Younger
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Rev	Description	Date	Author
	3. Updated figure 3-12 to show rotary craft depiction. 4. Added GPS mode descriptions to section 3.3.6. 5. Updated figures 3-14, 3-19, 3-20 and 3-22 for Time to Waypoint indication. 6. Changed EFI FAIL to CHECK EFI in table 4-1. 7. Replaced Storm Scope with Lightening Detection throughout.		

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1 System Overview

1.1 System Description

The Astronautics Flight Instrument (AFI) 4700 is a 5" by 7" Electronic Flight Instrument (EFI) designed to replace and improve upon the legacy electromechanical Attitude Director Indicator (ADI) and Horizontal Situation Indicator (HSI).

Figure 1-1: System Description

The AFI4700 is designed to interface with existing and/or retrofit attitude and heading units, navigation radios, GPS systems, etc. A list of compatible equipment is found in the installation manual.

The EFI is capable of displaying several HSI overlays to consolidate situational awareness information normally available in different locations in the instrument panel to the AFI4700.

Course Deviation

VOR Map

Optional Overlays

TCAS
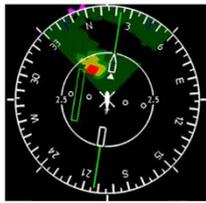
Terrain Awareness

GPS Map

Stormscope
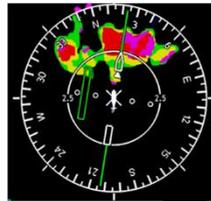
Weather Radar

1.2 System Power Up

Initial power up displays color bars on the screen. After several seconds, the color bars are replaced by the flight application.

During aircraft power up, the display may start faster than other systems, such as gyros, resulting in a time delay between power-up and the system receiving valid signals. During this time, the display will present color bars for a short time followed by failure warnings on the ADI and HSI sections. After valid signals are received, the display will begin functioning normally.
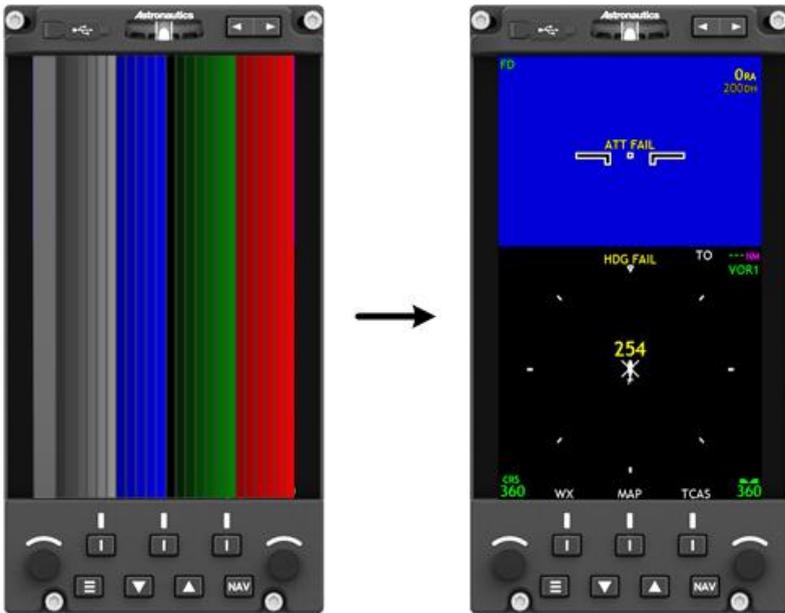
Figure 1-2: System Power Up

1.3 System Operation

The AFI4700 is an EFI whose design consolidates the ADI and HSI information with the addition of Radar Altitude, Traffic Collision and Avoidance System (TCAS), Global Positioning Satellite (GPS), and VHF Omnidirectional Range (VOR) map overlays, display of Weather Radar, external Terrain Awareness and Warning System (TAWS), and a Physical Slip/Skid Indicator.

To interact with these features the display unit includes eight (7) bezel buttons one (1) brightness rocker button, and two (2) rotary knobs that rotate and push.

The bezel layout shown in Figure 1-3 describes the multiple bezel buttons and rotary knobs on the AFI4700.
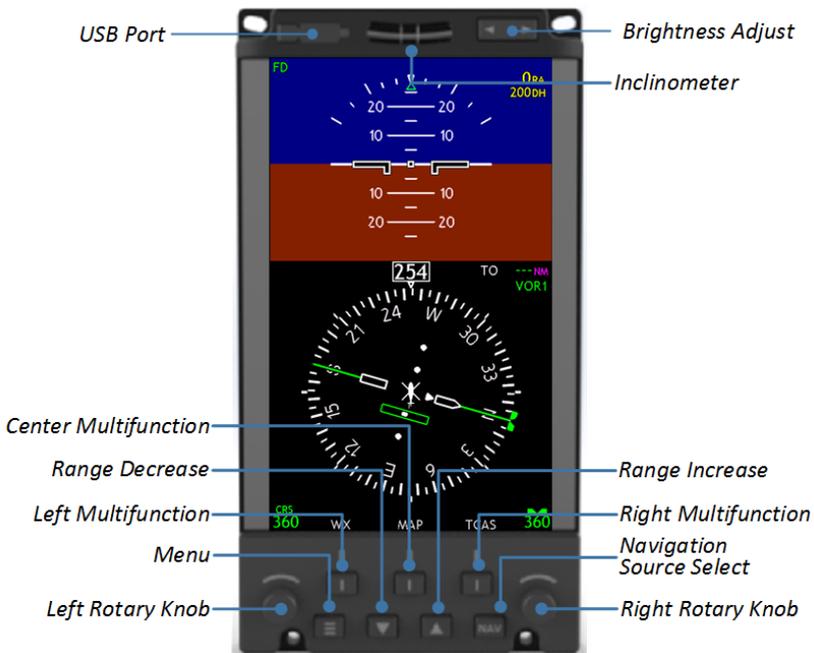
Figure 1-3: System Layout

Left Rotary Knob

The left rotary knob performs two functions. Rotating the knob in normal operation changes the selected course, and pressing the knob synchronizes the selected course with the bearing of the selected

navigation source. When navigating the menu, the left knob scrolls through the page selections.

Right Rotary Knob

The right rotary knob is used to adjust the selected heading. Rotating the knob moves the heading bug around the compass card and pressing the knob synchronizes the heading bug with the current heading.

When in the Decision Height (DH) menu and DH is configured for rotary on the configuration page, the right rotary knob adjusts the DH value.

Adjust Brightness

On the upper right-hand corner of the AFI4700 is a rocker switch used to adjust the brightness of the display.

Left Multifunction

The left bezel button toggles the Weather Radar, Terrain, and Lighting Detection overlay when configured.

Center Multifunction

The center bezel button toggles map mode ON and OFF. The map overlay can be used to display map information from the GPS, or VOR station when DME is provided.

Right Multifunction

When the AFI4700 is configured to display Traffic Collision and Avoidance (TCAS) information, this bezel button toggles TCAS overlay On and Off.

Menu Button

The lower left hand bezel button commands the system menu to open and close.

Range Increase and Decrease

The center two bezel buttons along the bottom row of bezel buttons adjust the map range.

Navigation Source Select

The lower right-hand bezel button allows the primary navigation source to be selected from the list of available navigation sources.

Inclinometer

In the center along the top bezel is a physical ball in a tube inclinometer, which displays slip or skid.

USB Port

The USB Port along the top of the bezel allows access to run maintenance and diagnostics on the EFI, as well as to update databases.

1.3.1 Using the System Menu

Figure 1-4: System Menu

Selecting the Menu button displays a page with a list of items, which can be cycled through using the left rotary knob. Options can be chosen by pressing the corresponding left or center bezel button directly below the selection. Pressing the menu bezel button closes the menu.

Menu Headings:

BRGS

The bearings menu page allows the preview of one or two navigation sources overlaid on the compass. The left bezel button selects between OFF, VOR/ILS1, GPS1, ADF, DF. The center bezel button selects between OFF, VOR/ILS2, GPS2, ADF, DF.

DH

Adjusts the decision height UP or DOWN. DH values range from 10ft to 1000ft in 1ft increments from 10-200ft and 10ft increments from 200-1000ft.

DISP

Change the compass between a full mode showing 360° and arc mode showing 120° with the left bezel button (ARC/FULL). When the weather overlay is selected, alternates between 360° compass and vertical profile mode with the center bezel button (VP).

LX

Provides an option to clear lightning icons when the map is displayed with the left bezel button (CLEAR).

HSYNC

Hold the left bezel button (SYNC) for three seconds to enter Horizon Sync mode.

TEST

The left bezel button (RA) executes a test of the radar altimeter, if equipped. The center bezel button (MAINT) enters the EFI Status page. The EFI Status page is only available when the aircraft is on ground.

1.3.2 Navigating the System Menu

After selecting the MENU bezel button, the MENU Page is displayed where six (6) pages can be cycled using the left rotary knob. Select the page items by using the left and center multifunction keys.
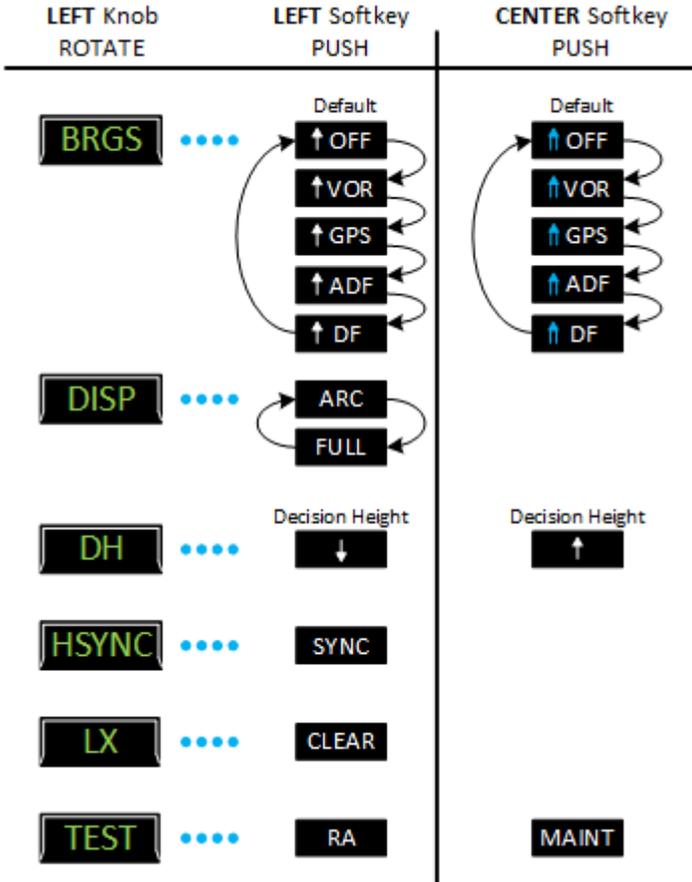
Figure 1-5: System Menu Navigation

1.3.3 Navigating the Maintenance Menu

When the MAINT option is selected from the System Menu, additional information is displayed in the EFI STATUS page. MAINT is only selectable when the aircraft is on ground. This page contains a further sub-menu from which maintenance related functionality can be accessed.
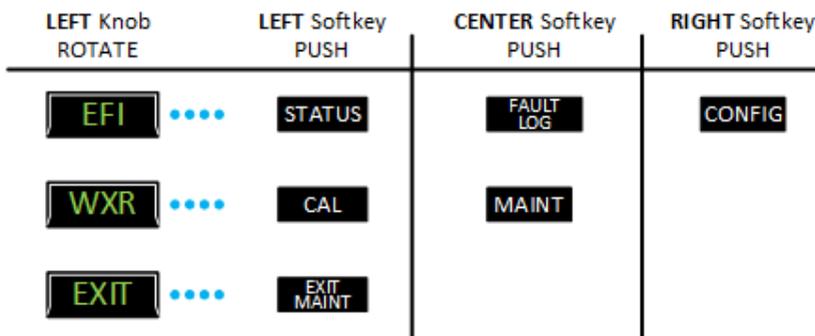
Figure 1-6: Maintenance Menu Navigation

1.3.4 Display Dimming Control

The brightness of the display unit can be adjusted manually through the brightness rocker button in the top right corner of the bezel to compensate for ambient lighting conditions. Press the left side of the rocker button to dim and the right side of the rocker button to brighten.

1.3.5 Bezel Dimming Control

Bezel lighting brightness is controlled externally from the flight deck bezel lighting control.

1.3.5.1 Night Vision Mode

The AFI4700 is equipped with a Night Vision (NVIS) mode where a separate secondary NVIS LED activates instead of the daylight backlight. This NVIS backlight is designed to meet MIL-STD-3009, Type II class B White and Max for multi-color displays. Night vision mode is activated via a discrete switch wired to the display.

1.3.6 Crosslink

When more than one display is installed, the AFI4700s will communicate with each other via an RS-422 serial interface crosslink bus. In order to provide assurance of data accuracy, the EFIs constantly compares attitude, heading, localizer, glideslope, and radar altimeter information between the two displays. The crosslink bus also allows the display of offside attitude and heading.

Figure 1-7: Crosslink

2 Attitude Display Indicator Portion of Display

The Attitude Display Indicator (ADI) provides the pilot with primary flight display information.

2.1 Indicator Description
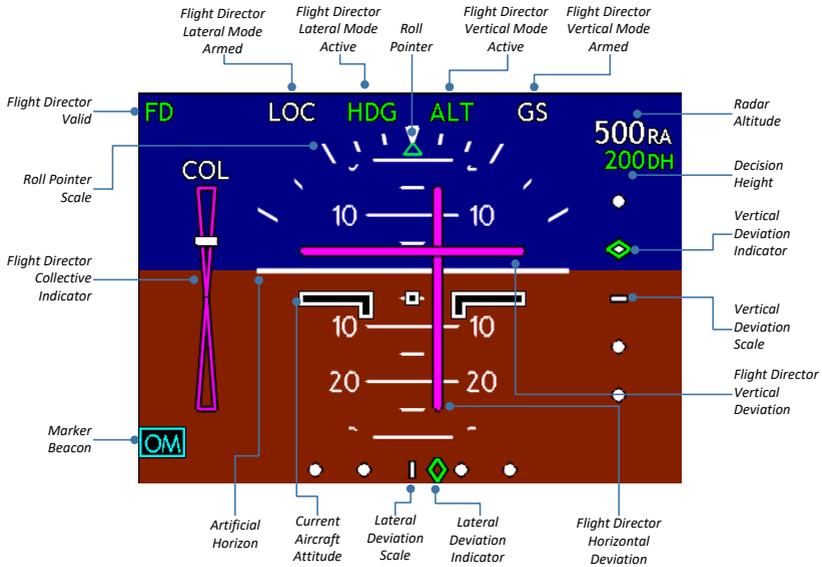
Figure 2-1: ADI Description

Current Aircraft Attitude

Two bars and a center square represent the nose of the aircraft in relation to the artificial horizon.

Artificial Horizon

Responding to input from the vertical gyro, the artificial horizon moves relative to the pitch and roll of the aircraft.

Roll Pointer

This slides along the roll pointer scale to indicate the current roll angle.

Roll Pointer Scale

Large tick marks indicate banks of 30° and 60° to the left and right with smaller tick marks indicating 10°, 20°, and 45°.

Radar Altitude

Indicates the current radar altitude from the radar altimeter.

Decision Height

Pilot selected decision height.

Lateral Deviation Scale

Four white dots indicate lateral deviation scale from the active navigation source input.

Lateral Deviation Indicator

The current lateral deviation from the active navigation source input.

Vertical Deviation Scale

Four white dots indicate vertical deviation scale from the active navigation source input.

Vertical Deviation Indicator

The current vertical deviation from the active navigation source input.

Flight Director Valid

FD appears when the Flight Director is valid.

Flight Director Modes

Lateral and vertical flight director modes are indicated from the flight director panel. Armed modes are in white text and active modes are in green text.

Flight Director Deviation Indicators

Flight Director bars overlay the center of the ADI when selected from the Flight Director panel. These are hidden when not in use.

Flight Director Collective Indicator

When Go Around mode is selected through the flight director, the collective indicator appears on the left side of the ADI.

2.2 Attitude Indicator

The primary purpose of the ADI is to display aircraft attitude information and provide flight direction cues. This is achieved by presenting a graphical format resembling a conventional electromechanical ADI ball. The ADI uses colors and symbols to orient the aircraft with the inertial frame of reference. A white horizon line is drawn on the ADI, which separates the two background colors: Blue represents sky, and is filled in above the horizon line while brown represents earth, and is filled in below the horizon line. Additional information regarding aircraft state, flight cues, and rising runway are also displayed on the ADI.
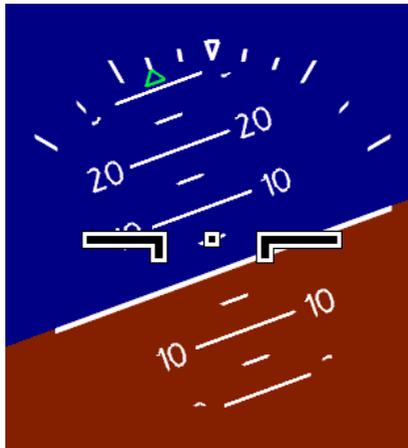
Figure 2-2: Attitude Indicator

Each horizontal white line above or below the horizon line indicates the pitch ladder where shorter lines show every 5° between +/- 30° and the longer lines show every 10° between +/- 40° and 20° when greater than +/- 40°.

Above the ADI is the roll angle scale, which indicates several fixed angles with respect to the horizon and a green triangle, which is fixed to the centerline of the aircraft reference symbol and moves with it to represent roll. The tick marks in the roll angle scale proceed from the 0° white triangle as follows: 10°, 20°, 30°, 45°, and 60°.

The aircraft reference symbol is a square with two L-shaped brackets projecting horizontally with respect to the aircraft. This represents the

aircraft's pitch along the pitch ladder and roll along the roll angle scale within the ADI.

2.2.1 Extreme Attitude
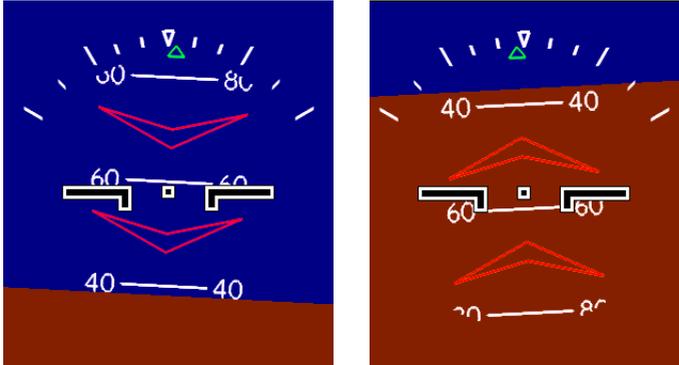
Figure 2-3 Extreme Attitude

Extreme attitude is defined as a roll greater than 65°, 30° pitch up, or 20° pitch down. Red chevrons are displayed at +/- 50° and +/- 70° pitch up and pitch down respectively. At pitch angles above 80° the brown color is removed, likewise at pitch angles less than -80° the blue color is removed with a white dot appearing at +/- 90° pitch.

At extreme pitch attitudes, the ADI will never be fully blue or fully brown. The horizon line will always remain visible.

2.3 Radar Altimeter & Decision Height

The radar altimeter displays the aircraft height above the ground via radar sensing in the upper right corner of the ADI display.

The decision height (DH) is provided as a visual cue as the aircraft crosses a selected altitude. DH is indicated just below the radar altitude in the upper right corner of the ADI. When in the DH menu, DH can be adjusted on the front bezel from 9' to 1000' with a progressive resolution using the Left and Center Push Keys. The left push button decreases the DH, and the center push button increases the DH Height. When DH is configured for rotary on the configuration page, the right rotary knob can also be used to adjust the DH. When in the DH menu, the right rotary knob adjusts only the DH, and not the HDG. When not in the DH menu, the right rotary knob adjusts the

HDG bug. The decision height is displayed in green text when the aircraft is above the selected DH.

Figure 2-4: RA & DH

The Radar Altimeter is tested from the test menu. In the test menu, depressing the RA button for three seconds activates a discrete output to the RA unit to initiate the test. The exact behavior of the RA test pattern will be dependent on the RA unit. A "TST" annunciation is presented to the left of the RA indication as shown in Figure 2-5.

Figure 2-5: RA TST Annunciation

2.4 Autopilot Annunciation

Autopilot status and mode information is displayed in two dedicated regions on the top edge of the display. Autopilot and flight director information are only available if the AFI4700 is configured to support the aircraft's flight director and autopilot.

2.4.1 Flight Director / Autopilot Modes

Figure 2-6: Autopilot Modes

Flight Director validity is shown in the top left corner as "FD". This is annunciated in one of three modes: 1) Green letters indicating FD coupled, 2) Magenta letters indicating FD decoupled, or 3) Yellow letters showing "FD FAIL" indicating FD failure.

The EFI does not control the flight director modes, it only displays what is commanded. Below are the modes that the EFI is capable of, however not all may be available from the installed flight director. Consult the manual of the flight director for operation and full mode descriptions.

Table 2-1: Flight Director Lateral Modes

Armed	Active	Description
	HDG	Heading mode
LGPS	LGPS	GPS navigation mode or GPS approach mode (lateral guidance)
NAV	NAV	VOR navigation mode
LOC	LOC	Localizer approach mode, tuned to an ILS
VAPP	VAPP	VOR approach mode
BC	BC	Backcourse mode

Table 2-2: Flight Director Vertical Modes

Armed	Active	Description
	ALT	Altitude capture mode
	VS	Vertical speed climb or descend
	IAS	Indicated air speed climb or descend
VGPS	VGPS	GPS navigation mode or GPS approach mode (vertical guidance)
GS	GS	Glideslope capture mode
	GA	Go around mode

Autopilot modes are annunciated along the top of the display. White indicates armed modes and green indicates active modes. Armed or captured modes are displayed in yellow on the display not coupled to the flight director. The AFI4700 is designed to mirror the autopilot panel. Refer to your particular autopilot manual for specific information and operating instructions.

2.4.2 Flight Director Display
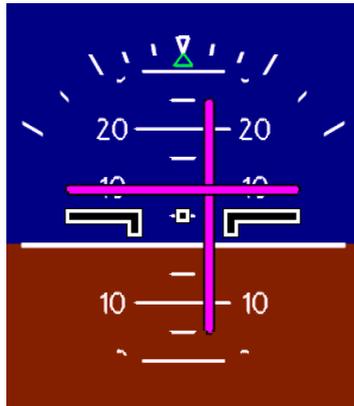
Figure 2-7: FD Display

The flight director display consists of two magenta bars overlaid on the ADI, which serve as a guide in orienting the aircraft flight path. The vertical bar is a heading cue (roll command), and the horizontal bar is a pitch cue. The aircraft is on-path when the bars are both centered over the aircraft reference symbol. The flight director bars are displayed over a range of $\pm$ 15°. When a command is greater than 15°, the bars will be "pegged". The flight director cues are only available when the flight director mode is engaged.

2.5 Approach Annunciation

When an ILS approach is tuned by the selected NAV radio, the ADI changes functions to show annunciations relative to the approach.

When performing an approach, tune NAV radio 1 and NAV radio 2 to the same approach ILS frequency. On final approach, select the runway course using the bezel course knob to ensure that the aircraft's heading and runway course are the same. When tuned to an ILS approach, pressing the course knob will have no effect on the selected course.

During an ILS approach, glideslope (GS) and lateral deviation indicators will appear along the ADI. The vertical deviation, or glideslope (GS) indicator, will appear to the right of the pitch scale while the lateral deviation indicator will appear along the bottom of the ADI. Verify on both the pilot and co-pilot displays that there are no annunciations of <-> LOC, <-> GS, or <-> ILS (see Table 3-15).

The deflection scales are driven from either the active ILS or active GPS navigation source. When ILS navigation is selected, the lateral and GS deviation indicators are scaled for localizer deviation. When GPS navigation is selected, the lateral and GS deviation indicator scaling is controlled by the GPS' phase of flight and approach type.

2.5.1 Glideslope Indicator
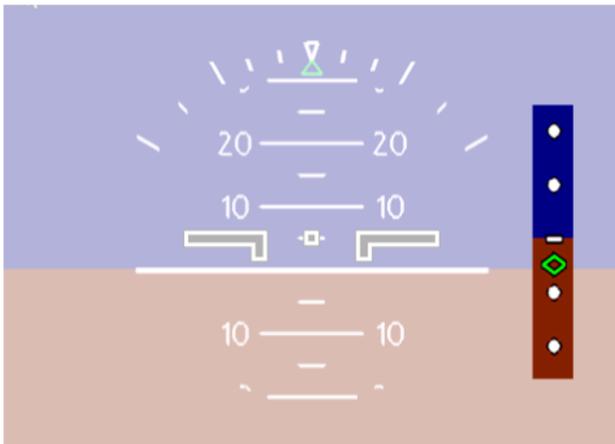
Figure 2-8: GS Indicator

The glideslope deviation indicator is displayed to the right of the ADI when VOR is tuned to a valid ILS and is selected as the active NAV source. It appears as is shown in Figure 2-7 with four white dots and a green diamond. The glideslope indicator diamond appears yellow on the offside display when it is tuned to the same navigation source.

If a localizer frequency is tuned and no glideslope signal is provided, GS FAIL is annunciated in place of the glideslope indicator.

2.5.2 Lateral Deviation Indicator
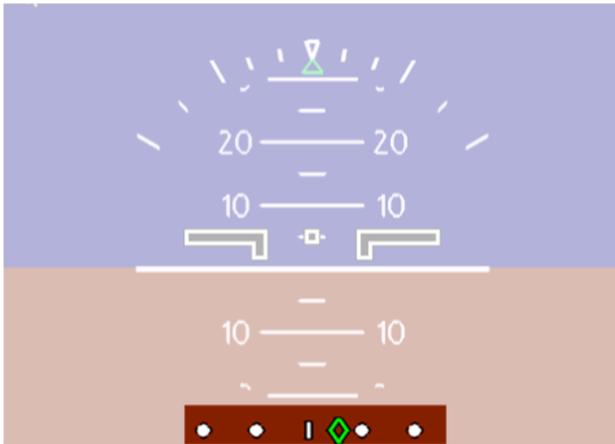
Figure 2-9: Lat Dev Indicator

The lateral deviation indicator is displayed on the bottom of the ADI, displaying aircraft horizontal orientation to a desired aircraft track. Like the glideslope indicator, the lateral deviation indicator consists of white dots and a center tick-mark, which are fixed relative to the aircraft, while a moving diamond represents the desired track.

When tuned to an approach and not in map mode, the Course Deviation Indicator (CDI) also displays lateral offset.

2.5.3 Expanded Localizer Mode

To support Category II approaches, an expanded localizer mode is displayed when the selected Decision Height is set to a value under 200 ft. The lateral deviation indicator is expanded, or zooms in, and the first dot to covers the entire lateral scale. To indicate this mode is different, bars are used in place of dots.

Full-scale deflection for the Lateral Deviation Indicator during expanded localizer mode is 0.0875 DDM when tuned to an ILS approach, and is not available when controlled by the GPS.

The course deviation indicator on the HSI does not change to indicate expanded localizer mode and operates consistently regardless of decision height.
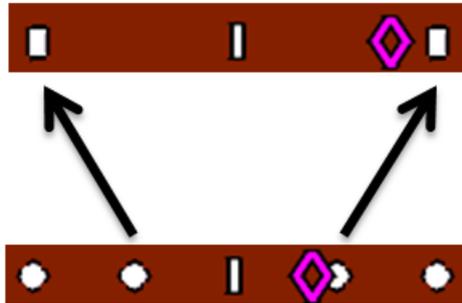
Figure 2-10: Expanded Localizer

2.5.4 WAAS Annunciations

When the active navigation source is GPS and the connected GPS is capable of supporting WAAS vertical guidance, the Glideslope Indicator and Lateral Deviation Indicator both change from a diamond to a rectangle.

Figure 2-11: WAAS Indicator

2.5.5 Rising Runway
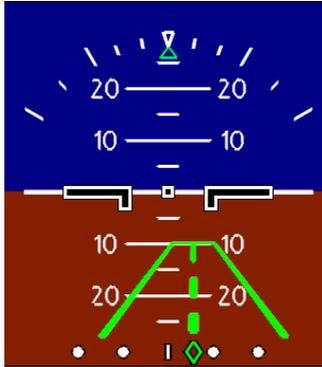
Figure 2-12: Rising Runway

The Rising Runway symbol provides an additional visual aid during landing. It consists of a virtual runway, which rises up from the very bottom of the ADI to meet the aircraft reference symbol as the aircraft descends. The rising runway height is controlled by radar altitude and horizontally aligned with the Lateral Deviation Indicator.

The rising runway symbol is displayed when the aircraft is tuned to an ILS or GPS approach and below 200' above the runway.

2.5.6 Marker Beacon

Color-coded marker beacons are annunciated in the bottom left corner of the ADI. Outer Marker, Middle Marker, and Inner Marker are displayed when the associated audio tones are received by the navigation radio. For analog marker beacons, MB TST is annunciated when the Marker Beacon Receiver initiates test mode. Test mode is initiated when all three marker beacon signals are present. If one or more of the signals are missing during this test sequence, the remaining signals could trigger a marker beacon to display, rather than the expected MB TST Icon.

Table 2-3: Marker Beacon

OM	MM	IM	MB TST
Outer Marker	Middle Marker	Inner Marker	Marker Beacon Test

2.6 Horizon Sync

When flying at a nose down attitude for extended periods, it becomes more difficult to determine slight changes in pitch attitude. Horizon Sync mode compensates for this by changing the current pitch attitude to zero and placing yellow tick marks where the pitch attitude used to be.

Horizon Sync mode is selected through the system menu's HSYNC tab. In order to activate, the bezel button must be held down for three (3) seconds. Horizon sync will activate when the pitch is within +/-11 degrees.

Horizon sync mode is cancelled by pressing the HSYNC bezel button again.
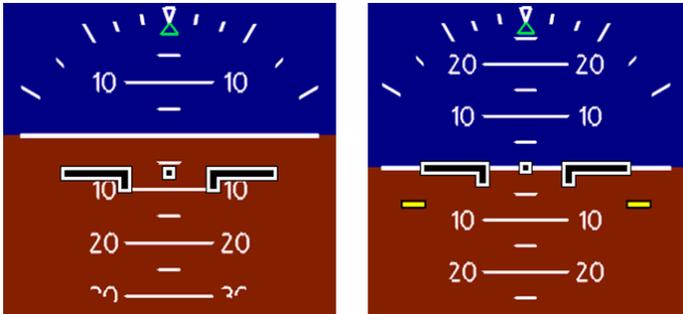
Figure 2-13: Horizon Sync

2.7 Offside Indications

When two displays are installed, each display is assigned "onside" navigation sources and "offside" navigation sources.

Table 2-4: Offside Indications

Nav Source	Copilot Display	Pilot Display
VOR1	Offside	Onside
VOR2	Onside	Offside
GPS1	Offside	Onside
GPS2	Onside	Offside

Indicators that are affected by onside and offside coloring include navigation sources, lateral and vertical deviations, and course indications.
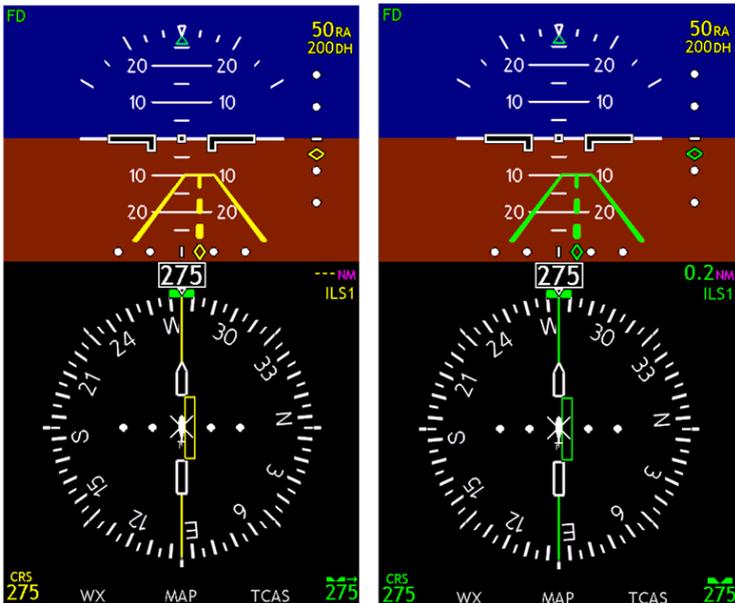
Figure 2-14: Offside Indications

Attitude Source Selection

A cockpit switch for each display selects attitude source. When operating normally, each switch is selected to onside attitude source.

In the case of abnormal operation or a gyro failure, the pilot or copilot can select their EFI to display attitude from the offside source. ATT1 or ATT2 is annunciated in the top left corner of the ADI to indicate which side the attitude is sourced from. Even though one display may be listening to an offside source, ATT1 or ATT2 appears on both displays to alert both pilots that the attitudes are not independent.
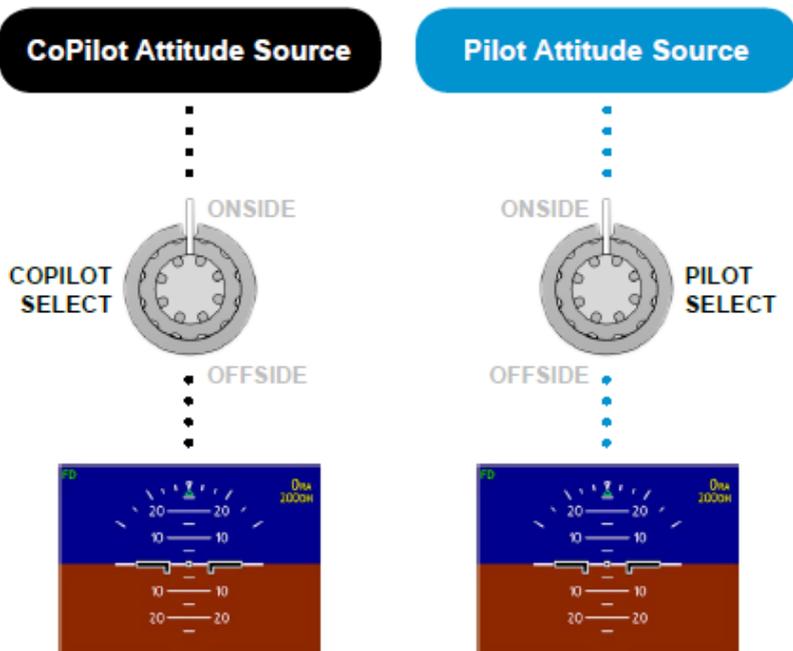
Figure 2-15: Onside Attitude
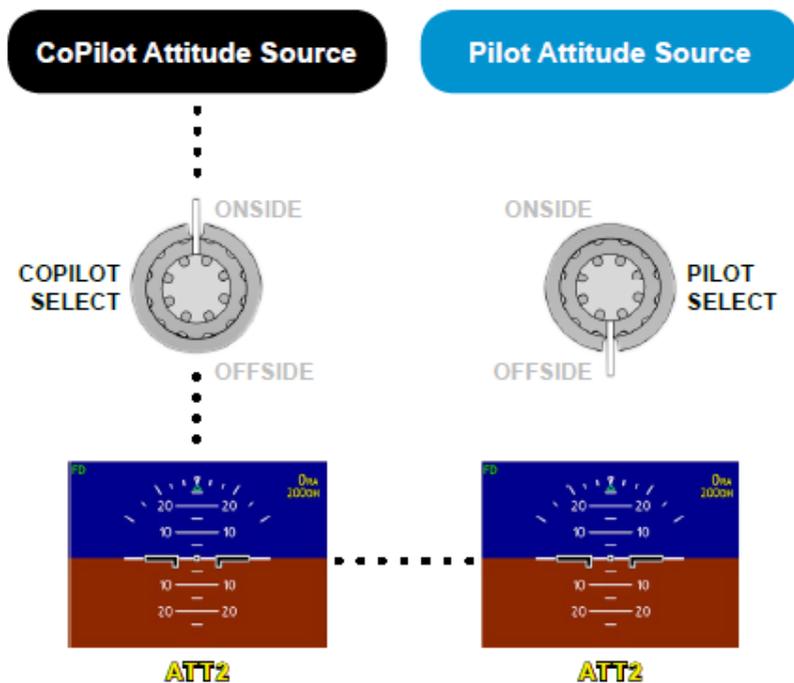
Figure 2-16: Pilot Offside Attitude
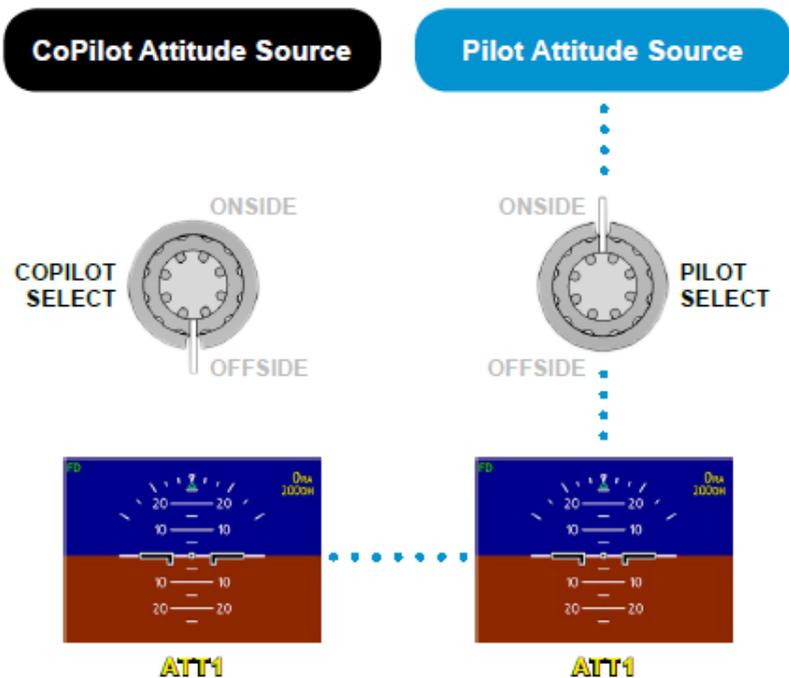
Figure 2-17: Copilot Offside Attitude
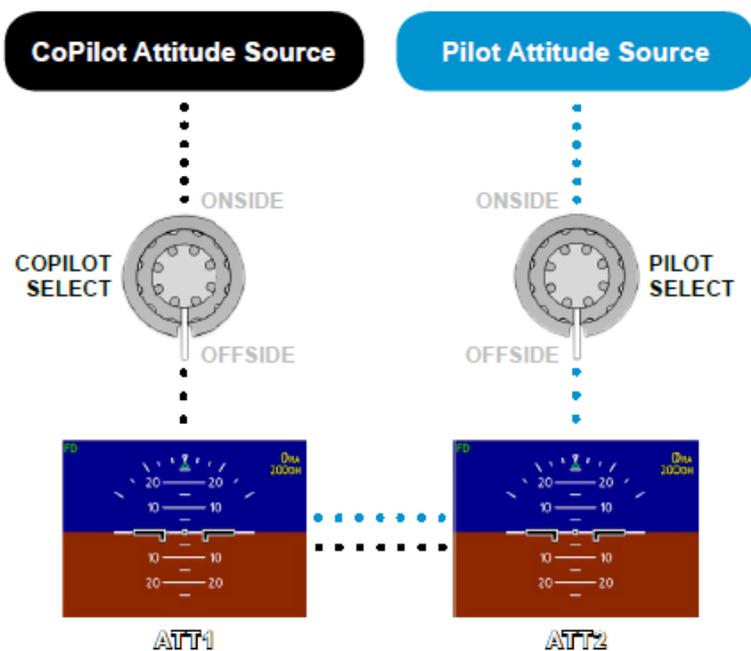
Figure 2-18: Offside Attitude

2.8 Attitude Comparison Monitoring

When a pitch, roll, or pitch and roll miscompare between both onside and offside attitude sources is detected, ATT is annunciated in the top left corner of the HSI.

Table 2-5: Attitude Miscompare Symbols

Symbol	Description
<-> PIT	The pitch difference between onside and offside sources exceeds 6°.
<-> ROL	The roll difference between onside and offside sources exceeds 6°.
<-> ATT	The pitch and roll difference between onside and offside sources exceeds 6°.

3 Horizontal Situation Indicator Portion of Display

The Horizontal Situation Indicator (HSI) provides the pilot with horizontal situation information, navigation information, and graphical overlays.

3.1 Indicator Description

The depiction below is the HSI in a "standard" view and tuned to a radio navigation source. The AFI4700 supports GPS navigation sources and graphical overlays and are described in further detail in their respective sections.
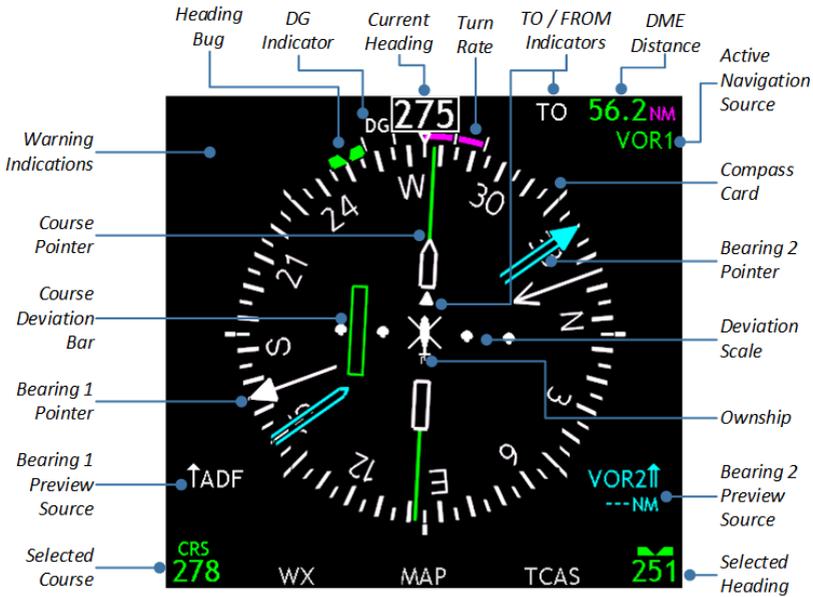
Figure 3-1: HSI Description

Compass Card

Responding to input from the directional gyro, it rotates around the ownship icon such that the nose of the icon is always pointing at the current heading. Small tick marks are displayed at 5° intervals with longer ones at every 10° in addition to cardinal direction (N, E, S, W) marks and numerical markings every 30°.

Current Heading

Always residing at the top of the compass card, the current heading indicates magnetic heading from the directional gyro. If the current heading is configured to display true heading, a small "T" appears to the right of the Current Heading box.

Ownship

A representation of the actual aircraft, this icon always points to the top of the compass card.

Selected Course

A numerical representation of the course selected by adjusting the left knob. When both displays are selected to the same active navigation source, the selected course and course pointers are synched between displays.

Course Pointer

A graphical representation of the selected course. A two-part arrow that rotates around the compass card and changes color based on navigation source.

Course Deviation Bar

This bar corresponds indicates deviation from the selected course line.

Deviation Scale

Four (4) white dots indicate deviation along the selected course.

Selected Heading

A numerical representation of selected heading that can be adjusted by rotating the right knob.

Heading Bug

A moveable marker on the outer perimeter of the compass card that shows the graphical depiction of the selected heading.

To-From Indicator

Annunciated both as a white triangle on the course pointer and in white text, it shows whether the course pointer is pointed to or from the navigation source. Not available when selected to a GPS source.

Active Navigation Source

Displays the active navigation source, as selected by the NAV bezel button.

Bearing 1 Preview Source

An annunciation of the currently displayed bearing 1 preview source. This may be enabled or hidden through the BRGS page in the system menu.

Bearing 1 Pointer

A graphical representation of the currently selected bearing 1 preview source that points towards the navigation source or along the navigation course line.

Bearing 2 Preview Source

An annunciation of the currently displayed bearing 2 preview source. This may be enabled or hidden through the BRGS page in the system menu.

Bearing 2 Pointer

A graphical representation of the currently selected bearing 1 preview source that points towards the navigation source or along the navigation course line.

DME Distance

Distance data coming from the DME unit is displayed here.

DG Indicator

DG is annunciated to the left of the heading when the connected directional gyro indicates slave mode is off.

Directional Gyros periodically cross-reference heading with a compass source to eliminate gyroscopic precession. The EFI itself only listens to the gyro's output and does not have a way to adjust DG slave mode or adjust the compass card.

Turn Rate Indication

The EFI depicts turn rate as a magenta bar along the top of the compass card. Fixed reference marks indicate left/right 1.5°/second and 3°/second turns. The bar is capped with an arrowhead when the turn rate exceeds 4.5°/second left or right. Turn Rate is displayed on either the Full or Arc compass card. When there is zero or no turn rate the indication is removed from the display.

Turn Rate on Full Compass   **Turn Rate on Arc Compass**
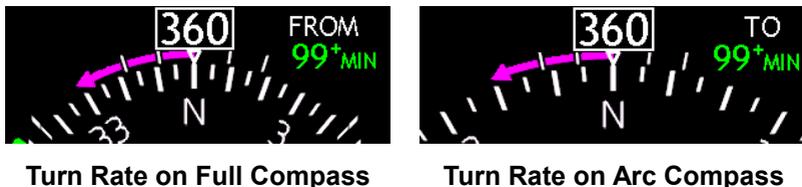
Figure 3-2 Turn Rate Indication

The display of the Turn Rate Indication is optional with selection "on" or "off" on the Configuration page.

3.2 HSI Controls

3.2.1 Selecting an Active Navigation Source

The EFI Active Navigation Sources are cycled by pressing the NAV bezel button. When the key is pressed, the next navigation source will be displayed. After the last source, the list rolls back to the first source. A primary navigation source is displayed at all times on the HSI.

NAV Softkey
PUSH
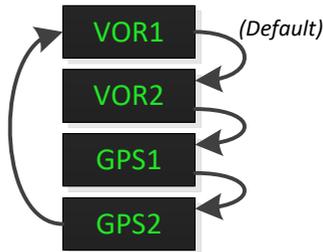
Figure 3-3: NAV Bezel button Selections

If a navigation source is not available, it will be annunciated in yellow with FAIL after the source name.

3.2.2 Setting the Heading Bug

The heading bug is set by rotating the right rotary knob until the desired heading is selected. As the heading bug is adjusted, it rotates around the outside of the compass card to indicate selected heading. Pressing the right rotary knob changes the heading bug to the current heading. As the heading bug rotates, a dashed line extends from the aircraft symbol to the heading bug and remains for 5 seconds.

The readout and heading bug is colored green except when the autopilot indicates HDG mode, then the selected heading is changed to magenta.

3.2.3 Changing Course

When the active navigation source is VOR1 or VOR2, the course can be adjusted by rotating the left knob. Both the numerical representation and graphical overlay on the compass card change to indicate current course. Pressing the left knob synchronizes the selected course with the bearing to the source. The selected course display will be colored green.

When both displays are selected to the same active navigation source, the selected course and course pointers are synched between displays. Rotating the course knob will change the HSI on both displays in real time.

When GPS1 or GPS2 is the active navigation source, the selected course will be slaved to the active leg's course and is unable to be changed by the left knob. This is indicated by changing the color of the readout and graphical depiction to magenta.

3.2.3.1 Course Deviation Indicator

The course deviation indicator (CDI) consists of a bar that shifts left or right from the course pointer overlaid on four white dots and depicts relative deviation from the course line. The CDI only appears when course deviation data is valid.

Figure 3-4: CDI

3.2.3.2 CDI Sources

VOR1 or VOR2

When the active navigation source is VOR1 or VOR2 and the aircraft is exactly aligned with the course radial, the deviation bar will be centered. The bar tracks left or right to indicate position to the left or right of the selected course.

Each of the four (4) white dots represents a 5° deviation from the course line. A maximum of 12° of deviation can be depicted, indicated by the portion of the course deviation bar furthest from the ownship icon partially obscured.

The selected course indicator, course deviation bar, and course pointer are colored green.

GPS1 or GPS2

If GPS1 or GPS2 is selected as the active navigation source, the course deviation bar is commanded by the GPS's lateral cross-track error. Each dot no longer represents a constant deviation and changes based on phase of flight and type of approach. Consult the GPS operations manual for more information.

The selected course indicator, course deviation bar, and course pointer are colored magenta.

3.2.3.3 Bearing Preview

Two (2) bearing pointers are available for display on the compass card to orient the aircraft with a selected navigation target without changing the active navigation source.

As with all navigation indicators, bearing pointers are corrected as necessary to be consistent with the current compass card heading source (Magnetic or True).

The Bearings (BRGS) tab in the system menu enables bearing pointers. The left bezel button cycles through NAV 1 sources and center bezel buttons cycle through NAV 2 sources.
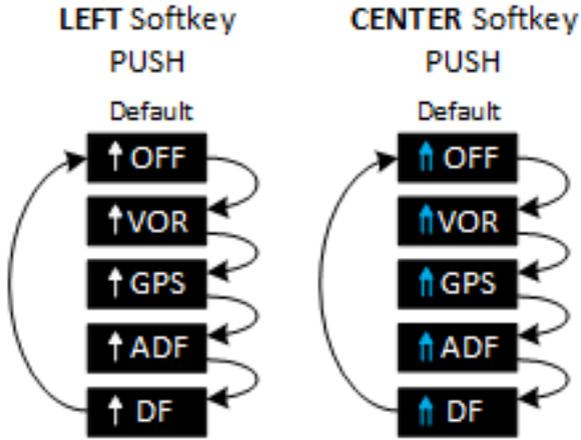
Figure 3-5: Bearing Selections

If the configuration consists of a single VOR or GPS, the second source will be not be displayed. Likewise, if the system configuration only has a single ADF, then the DF option will not be displayed.

3.2.4 Full Compass or Arc Mode Selection

The compass card can be changed to depict either a full 360° with the ownship icon at the center, or an arc view that shows 60° on either side of the current heading with the ownship icon shifted towards the bottom.
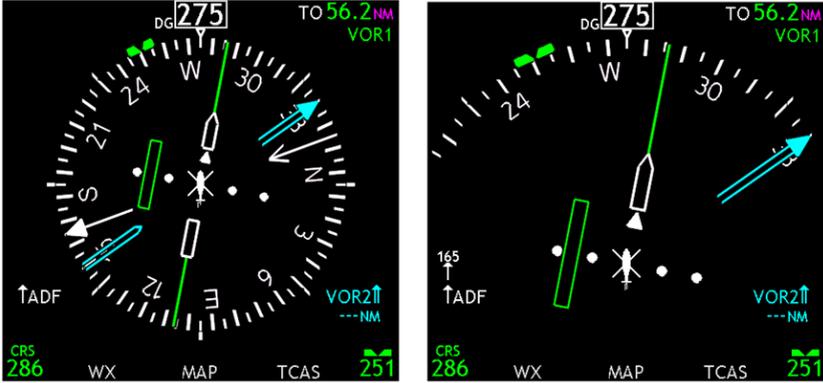
Figure 3-6: Bearing Preview

Full or Arc mode may be selected through the DISP page in the system menu.

3.2.5 Off Scale Indications

When the HSI is displayed in ARC mode and the heading bug or bearing previews are to be shown outside of the field of view, the icons are drawn at the edge of the display closest towards their relative direction.

Heading Bug Off-Scale Indication

Bearing 1 Preview Off-Scale Indication

Figure 3-7: Off-Scale Indications

3.3 HSI Overlays

Map Overlay mode is available when valid data is provided by the selected navigation source. During map mode the course deviation indicator is suppressed and range rings are added at full scale (solid) and half scale (dashed). Overlay data can be selected from one or all of the following options:
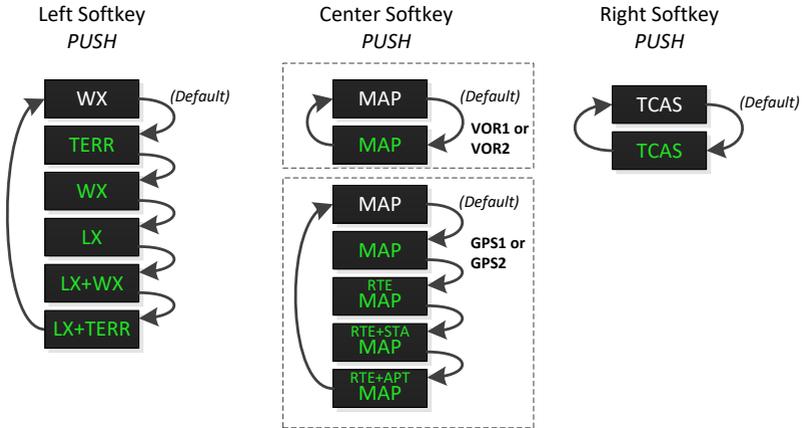
Figure 3-8: Bezel button Selections

3.3.1 Bezel button Operation

The three (3) center bezel buttons control HSI map overlay selection. A single option from each key can be selected at the same time.

Green text indicates a selection is currently overlaid, and white text indicates no overlay.

If weather radar, terrain, or lightning detection are not enabled and correctly configured, those selections will be hidden.

3.3.1.1 Left Bezel button

Table 3-1: Left Bezel button Actions

Bezel button Text	Description
WX	Default selection, white indicates no overlay is active
TERR	Terrain Awareness and Warning System (TAWS) overlay
WX	Weather Radar overlay
LX	Lightening Detection overlay
LX+WX	Lightening Detection and Weather Radar overlays
LX+TERR	Lightening Detection and Terrain Awareness and Warning System (TAWS) overlays

3.3.1.2 Center Bezel button

Table 3-2: Center Bezel button Actions

Bezel button Text	Nav Source	Description
MAP	VOR1 VOR2	Default selection when VOR 1 or VOR 2 is the active navigation source. Course deviation indicator is shown over the HSI
MAP	VOR1 VOR2	VOR Map overlay.
MAP	GPS1 GPS2	Default selection when GPS 1 or GPS 2 is the active navigation source. Course deviation indicator is shown over the HSI
MAP	GPS1 GPS2	GPS Map overlay displaying active route, closest airports, and closest navaids.

RTE **MAP**	GPS1 GPS2	GPS Map overlay displaying active route only.
RTE+STA **MAP**	GPS1 GPS2	GPS Map overlay displaying active route and nearest navaids.
RTE+APT **MAP**	GPS1 GPS2	GPS Map overlay displaying active route and nearest airports.

3.3.1.3 Right Bezel button

Table 3-3: Right Bezel button Actions

Bezel button Text	Description
TCAS	Default selection, white indicates no overlay is active
TCAS	Traffic Collision and Avoidance System (TCAS) overlay.

3.3.1.4 Bottom Center buttons

The bottom center two bezel buttons adjust the map range for the HSI and the displayed overlays. The up arrow increases the range displayed and the down arrow decreases the displayed range. One-half of the full range is displayed on the on the inner ring, as seen in Figure 3-9. The full range is twice the distance displayed on the inner ring. Selectable range distances are [2, 5, 10, 20, 40, 80, 160, 240, 320] nm.

Figure 3-9: Map Range Ring Distance

3.3.2 Weather Radar

The EFI interfaces with a Color Weather Radar (WXR) to provide weather patterns to the flight crew on the HSI. The left bezel button cycles through the weather radar map overlay. When the overlay is being displayed, the bezel button legend will indicate WX in green.

The weather radar control panel and not the EFI itself control the weather radar unit range and mode selection. The EFI has communication with both the control panel and radar unit to ensure the modes selected are properly annunciated and displayed.

The color weather overlay may be displayed on the HSI in full mode or arc mode.
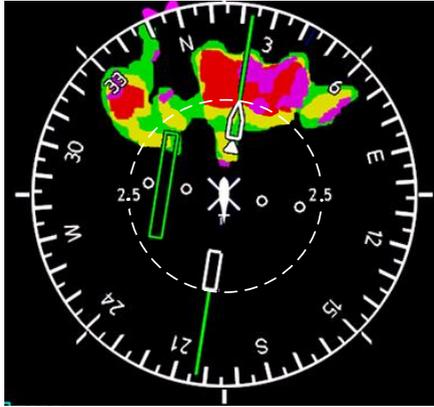
Figure 3-10: Weather Radar Full Mode
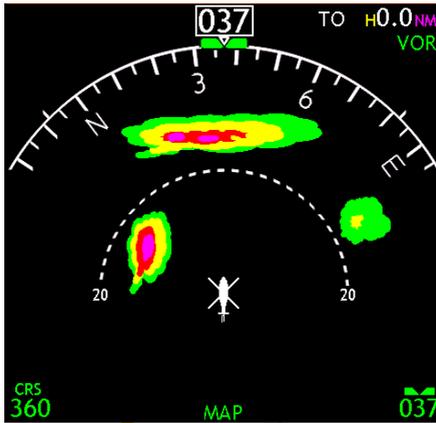
Figure 3-11: Weather Radar Arc Mode

3.3.2.1 Weather Radar Patterns

The weather radar signal returns are displayed on the HSI overlay according to intensity.

Table 3-4: Weather Radar Patterns

Color	Precipitation Level
▓	Very Light (< 1 mm/hr)
🟩	Light (1 – 4 mm/hr)
🟨	Moderate (4 – 12 mm/hr)
🟥	Strong (12 – 50 mm/hr)
🟪	Intense (> 50 mm/hr)

3.3.2.2 Weather Radar Mode Annunciation

The EFI communicates with the control panel and the weather radar unit at the same time to ensure the selections

Table 3-5: Weather Radar Mode Annunciations

Weather Annunciations	Description
WX STBY	Weather radar indicates it is in standby mode
WX ALRT	The weather radar indicates a target alert
WX MAP	The weather radar indicates it is in map mode
WX TEST	Weather radar is displaying in test mode
15↓ WX	Weather radar unit is angled down at 15°

A yellow track line and cyan sweep line extend forward from the aircraft position to indicate track and sweep of the weather radar unit. During normal operation, the sweep line will slowly sweep back and forth.

3.3.2.3 Weather Radar Vertical Mode

The Weather Radar overlay can also be displayed in a vertical profile mode. To enter this display mode, enable the Weather Radar overlay then use the MENU bezel button to open the system menu and navigate to the DISP tab. Press VP using the center bezel button.

The HSI changes formats to display the top half of the compass and a side view of the Weather Radar output. The range of this profile view is selectable using the bottom center bezel buttons, giving the full ranges of [2, 5, 10, 20, 40, 80, 16, 240, or 320 NM]. The inner three rings are ¼, ½, and ¾ of the full range scale.
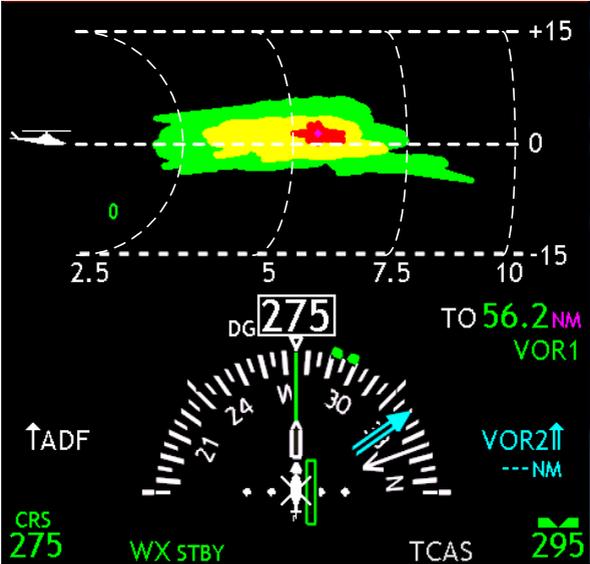
Figure 3-12: Weather Radar Vertical Profile

WXR SCAN is a menu tab that appears only when in Vertical Profile mode. It allows the pilot to control the left-right angle in which the weather radar unit is pointed.

Figure 3-13: WX VP Menu

To exit Vertical Profile mode, either press the left bezel button to cycle out of WX display, or navigate to the DISP menu tab and select VP.

3.3.3 Lightening Detection

The EFI interfaces with an Adaptive Passive Thunderstorm Detection System (APTDS) or Lightening Detection to provide storm cell and lightning information for thunderstorm monitoring. The EFI displays the electrical discharge information on the HSI using distance, bearing, and intensity information received from the Lightening Detection system.
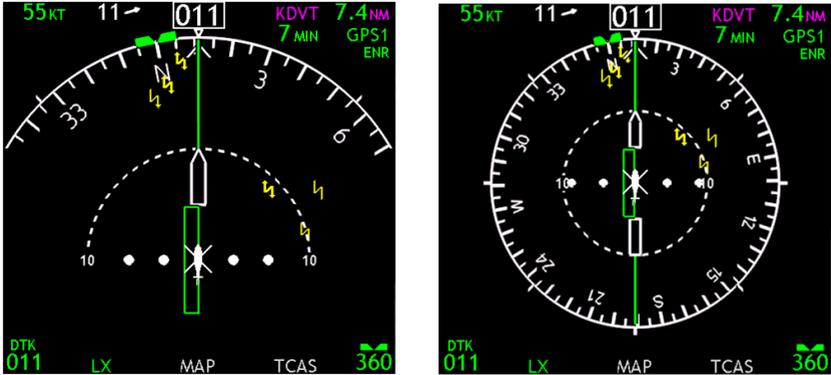
Figure 3-14: Lightening Detection

When the overlay is not displayed, the bezel button legend will appear as "LX" in white. When the overlay is being displayed, the bezel button legend will appear as "LX" in green.

There is a selection contained in the "LX" tab of the system menu that allows the pilot to clear the display of any existing Lightening Detection symbols.

Figure 3-15: Lightening Detection Menu

3.3.3.1 Lightening Detection Symbology

Different symbols are used to depict variances in lightning intensity from thin yellow, thick yellow with arrow, and thicker yellow with arrows, lightning bolts representing low, medium, and high intensity storm cells respectively.

Table 3-6: Lightening Detection Symbols

Symbol	Intensity
⚡	Unknown or Low (up to 8 strikes/minute)
⚡	Medium (9-25 strikes/minute)
⚡	High (26 or more strikes/minute)

3.3.4 External Terrain Awareness and Warning System

This section describes the visual display of terrain, terrain coloring, and annunciation of alerts. For specific operation and alert criteria, consult the guide for the connected HTAWS device.

The AFI4700 supports interfacing with inputs from an external HTAWS or EGPWS, unit depending on the particular helicopter configuration.

Inputs from an external HTAWS is viewable as a map overlay.

Figure 3-16: External HTAWS

3.3.4.1 External HTAWS Terrain Color

Terrain is colored according to the following table.

Table 3-7: External HTAWS Terrain Color

Color	Description	Function Description
	Solid Red	Terrain/Obstacle Threat Area – Warning
	Solid Amber	Terrain/Obstacle Threat Area – Caution
	50% Red Dots	Terrain/Obstacle is more than 500 feet above aircraft altitude
	50% Amber Dots	Terrain/Obstacle is between aircraft altitude and 500 feet above
	25% Amber Dots	Terrain/Obstacle is between aircraft altitude and 250 feet below
	50% Green Dots	Terrain/Obstacle is 250 to 500 feet below aircraft altitude
	16% Green Dots	Terrain/Obstacle is 500 to 1500 feet below aircraft altitude
	Black	No significant Terrain/Obstacle
	16% Cyan Dots	Sea Level (0 feet mean sea level)
	Magenta Dots	Unknown Terrain

3.3.4.2 External HTAWS Alerts

An external HTAWS device can drive different HTAWS alerts as shown in Table 3-8. The external device can also drive "Pop-Up" alerts, where the display automatically displays "ARC" mode when a threat criteria is met. A pop-up menu provides the option to "Revert Display" back to "FULL" mode, or to "Dismiss Pop-Up" the pop-up and remain in "ARC" mode, as seen in Figure 3-17. Consult your HTAWS manual for the specific alerts and alerting criteria when interfacing with an external HTAWS device.

Table 3-8: HTAWS Alerts

Displayed Alert	Alert Description
TERR INHBT	TERRAIN AWARENESS & TCF INHIBIT
GPWS	GPWS ALERT
GPWS	GPWS WARNING
GPWS INOP	GPWS INOP
TERR	TERRAIN AWARENESS WARNING
TERR	TERRAIN AWARENESS CAUTION
TERR INOP	TERRAIN AWARENESS INOP
TERR NA	TERRAIN AWARENESS NOT AVAILABLE
EGPWS RP	REDUCED PROTECTION

Figure 3-17: FLTA Popup Alert

3.3.5 VOR Display

The VOR map function draws the active navigation source on the map overlay when the center bezel button is pressed. It is only available if bearing and distance to the station is provided by the navigation radio. When DME is not configured, the "MAP" label and selection are not available.
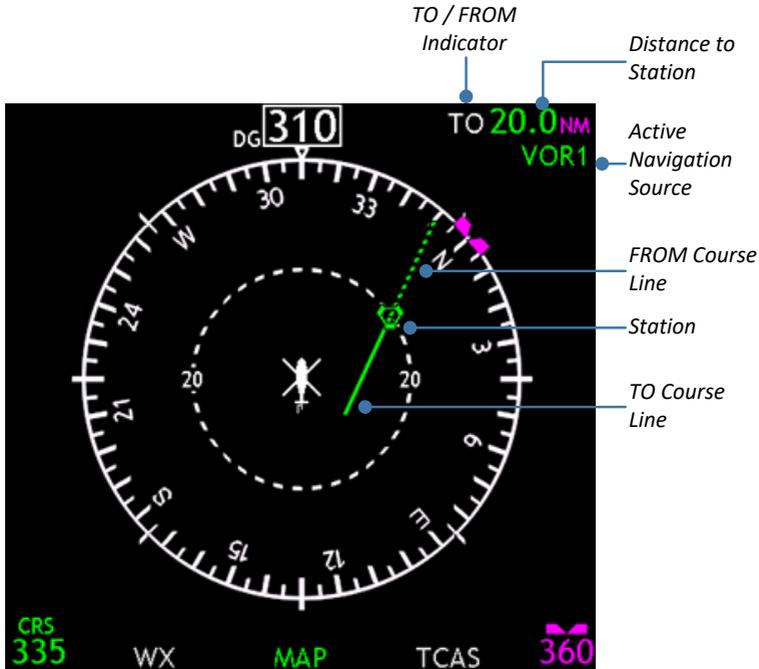
Figure 3-18: VOR Map

TO / FROM Indicator

Annunciated only in white text with no arrow, it indicates whether the course pointer is pointed to or from the navigation source.

Distance To Station

Distance coming from the DME unit is displayed here.

Active Navigation Source

Displays the active navigation source, as selected by the NAV bezel button. VOR Map mode is only available when VOR1 or VOR2 is the active navigation source.

Station

A green navaid icon represents the station on a map.

TO Course Line

The solid green line extending from the station is the TO course line. This line rotates around the station when the Course knob is rotated.

FROM Course Line

The dashed green line extending from the station is the FROM course line. This line rotates around the station when the Course knob is rotated.

3.3.5.1 Using the VOR Map

As the course knob rotates, the solid green TO course and dashed green FROM course lines rotate around the station. To fly directly to the station, line up the solid green line between the aircraft and the navaid. To fly directly away from the station, line up the dashed green line between the aircraft and the navaid.

An example of flying a heading to intercept the 20° radial is provided both using the CDI and the VOR map.

Table 3-9: Intercepting a Radial

Steps	Using the CDI	Using the VOR MAP
Flying a course of 310° to intercept the 20° radial		
Radial inter-cepted, CDI is centered		
Right turn towards VOR maintain-ing 20° radial		

3.3.6 GPS Overlays

The FMS/GPS map overlay presents the active flight plan to the pilot on the HSI if the FMS/GPS primary navigation source is selected. It is enabled by the center bezel button. Additional map elements (route, navaids, and airports) not on the active flight plan can be hidden from view by selecting the center bezel button.
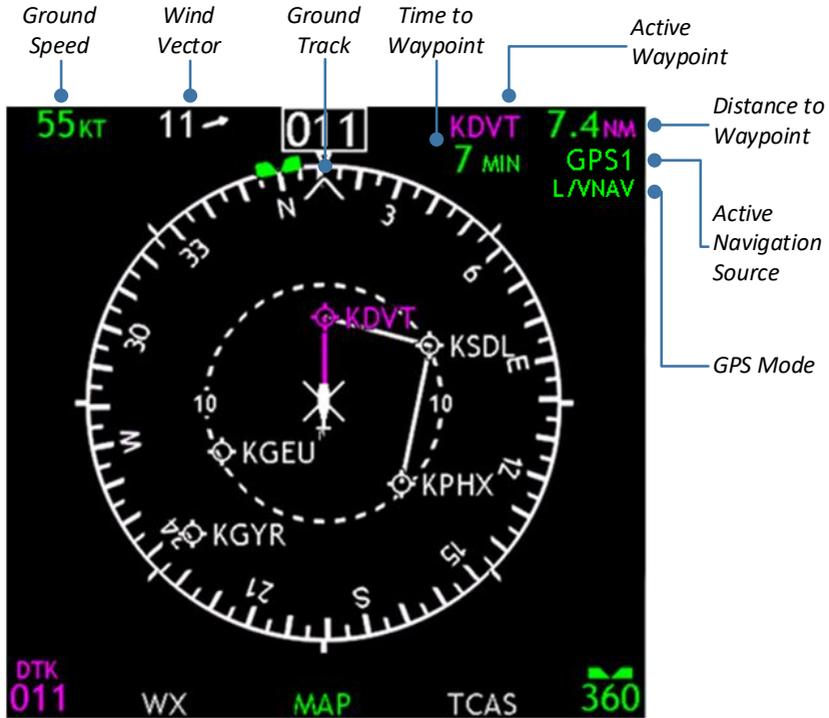
Figure 3-19: GPS Map

When the FMS/GPS primary navigation source is selected and the CDI overlay is selected, the CDI will be displayed in place of the map.

Figure 3-20: GPS CDI

Ground Speed

GPS derived ground speed is displayed in knots.

Wind Vector

Wind direction and magnitude are displayed relative to the aircraft's orientation.

Ground Track

This white caret displays the track of the aircraft over the ground. This is useful when correcting for wind.

Active Waypoint

The active waypoint is displayed in magenta alphanumeric symbols.

Time to Waypoint

Time to the active waypoint is displayed in MM (minutes).

Distance to Waypoint

The distance to the active waypoint is displayed in nautical miles.

Active Navigation Source

GPS1 or GPS2 will be annunciated here depending on the active source.

GPS Mode

The GPS indicates in which mode it is operating. Depending on the modes, CDI scaling may differ. Consult the manual for the specific GPS for more information.

The GPS indicates in which mode it is operating. Depending on the modes, CDI scaling may differ. Consult the manual for the specific GPS for more information.

Table 3-10: GPS Modes

GPS Mode	Description
ENR	Enroute
TERM	Terminal
OCN	Oceanic
LNAV	Lateral Navigation
L/VNAV	Lateral Navigation / Vertical Navigation
LP	Localizer Performance without Vertical Guidance
LPV	Localizer Performance with Vertical Guidance

Pressing the center multifunction bezel button cycles through the four available options to display GPS map data.
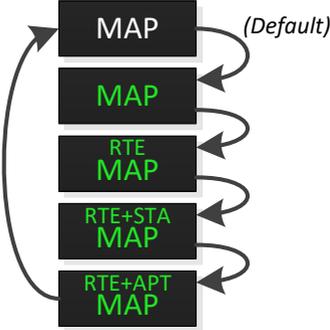
Figure 3-21: GPS Map Bezel button Selections

3.3.6.1 GPS Symbol Description

Map symbols and vectors are displayed as magenta or white. Magenta symbols and vectors represent the active waypoint. White symbols and vectors represent non-active waypoints. The various symbols used on the map overlay are presented below.

Table 3-11: GPS Map Symbols

Symbol	Description
✦	Waypoint
♈	VORTAC
♈	TACAN
⬡	VOR
☐	DME
◨	VOR/DME (collocated)
✛	Airport
⬤	NDB
⋀	Altitude Profile Point
△	Intersection

3.3.7 TCAS Display

The EFI interfaces with a Traffic Alert and Collision Avoidance System (TCAS) to provide situational awareness through the depiction of traffic on the HSI. When operating normally, TCAS detects and displays traffic vertically between –2,700 ft and +2,700 ft of the aircraft.

The TCAS uses colors and symbols to represent severity of the aircraft intruders and can be visible in combination with any other overlay.

The display of the Traffic Overlay can be toggled using the right bezel button. When the overlay is active, the bezel button legend will appear in green.
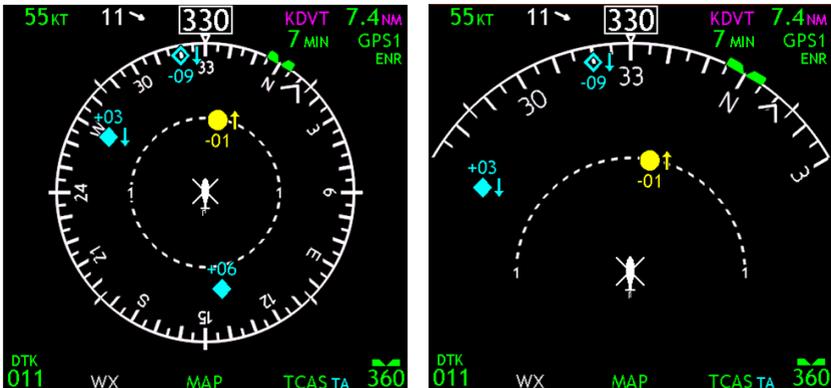
Figure 3-22: TCAS

3.3.7.1 TCAS Symbol Description

When the traffic symbols are displayed on the Traffic Overlay, they are accompanied by their altitude information. Traffic altitude information is received by the EFI in two possible formats: Relative or Absolute.

The Relative mode of displaying traffic symbols uses two digits with leading zeros to represent the traffic aircraft altitude. The digits are in hundreds of feet and represent the _relative_ height above or below ownship. Heights above ownship are preceded with a '+' and heights below ownship are preceded with a '-'.

The Absolute mode of displaying traffic symbols uses three digits with leading zeros to represent the traffic aircraft altitude. The digits are in

hundreds of feet and represent the _absolute_ height above or below sea level. Heights below sea level are preceded with a '-'.

The Relative and Absolute modes have a few display characteristics in common. Both modes display the traffic aircraft altitude above its symbol if the traffic aircraft is above ownship or the traffic aircraft altitude is displayed below its symbol if the traffic aircraft is below ownship. Both modes display a trend arrow next to the traffic aircraft symbol pointing up if the traffic is climbing or pointing down if the traffic is descending.

Traffic Symbol

Trend Vector
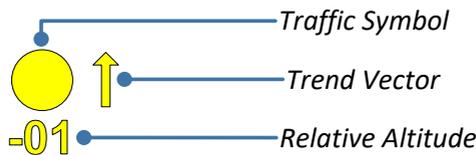
Relative Altitude

Figure 3-23: TCAS Symbol

Traffic Symbol

A symbol depicts the type of threat and relative location on the HSI.

Trend Vector

An arrow to the right of the symbol depicts the vertical trend of the threat.

Relative Altitude

A numerical readout in hundreds of feet is depicted either above or below the symbol. This changes to absolute altitude if the TCAS is operating in absolute mode.

Table 3-12: TCAS Symbols

Symbol	Description
	Other Traffic Traffic is greater than 1200 ft vertical separation and beyond 6 nm
	Proximate Traffic Traffic is less than 1200 ft vertical separation and within 5 nm
	Traffic Advisory TCAS criteria for a Traffic Advisory is met
	Resolution Advisory TCAS criteria for a Resolution Advisory is met. (The EFI does not provide resolution cues on the ADI but will display the resolution advisory icon if the threat type generated by the TCAS unit is "RESOLUTION")

3.3.7.2 TCAS Mode Annunciation

The TCAS Modes and Submodes are displayed either next to (modes) or above (submodes) the TCAS bezel button label. The tables below display the TCAS mode annunciations.
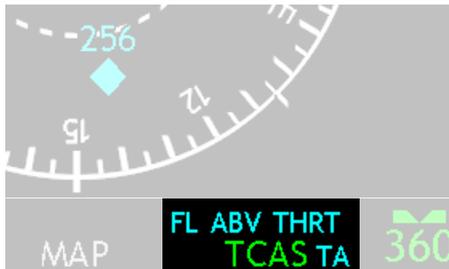
Figure 3-24: TCAS Modes

Table 3-13: TCAS Modes

Modes	Description
TCAS TA	The TCAS system indicates that only traffic advisories are available and resolution advisories are not available.
TCAS TST	The TCAS indicates test mode is active.
TCAS OFF	The TCAS system indicates it is off.

Table 3-14: TCAS Submodes

Submodes	Description
FL TCAS	The TCAS system indicates the altitude state is Absolute. Threat symbols are displayed with absolute altitude instead of relative altitude.
ABV TCAS	The TCAS system indicates it is operating in "look up" mode where traffic detected –2,700 ft and +9,000 ft of ownship is displayed.
BLW TCAS	The TCAS system indicates it is operating in "look up" mode where traffic detected –9,000 ft and +2,700 ft of ownship is displayed.
THRT TCAS	The TCAS system indicates that only threats will be displayed. Normal Proximate and Other traffic will be suppressed.

3.3.7.3 Offscale Intruders

When the TCAS detects a TA intruder that cannot be displayed on the HSI due to the selected range, the EFI will annunciate "OFFSCALE" in the top left corner of the HSI. Additionally, the EFI will display the intruder symbol on the edge of the HSI. This, in conjunction with the "OFFSCALE" annunciation, represents that the intruder is at a distance beyond the other range ring. If the HSI range is increased beyond the intruder, the "OFFSCALE" annunciation will be removed and the intruder symbol will be displayed normally on the HSI.

3.3.7.4 No Bearing Intruders

When the TCAS is unable to track the bearing of an intruder, the EFI will display the TA distance, altitude, and trend next to the TCAS bezel legend. The EFI will display up to three No-Bearing intruders next to the TCAS button legend.
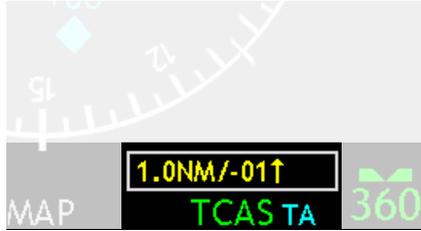
Figure 3-25: TCAS No Bearing

3.4 Heading Source Selection

A cockpit switch for each display selects the heading source. The pilot or copilot can select their EFI to display heading from either the same side or offside source. HDG1 or HDG2 is annunciated in the top left corner of the HSI to indicate which side the heading is sourced from. Even though one display may be listening to an offside source, HDG1 or HDG2 appears on both displays to alert both pilots that the headings are not independent.
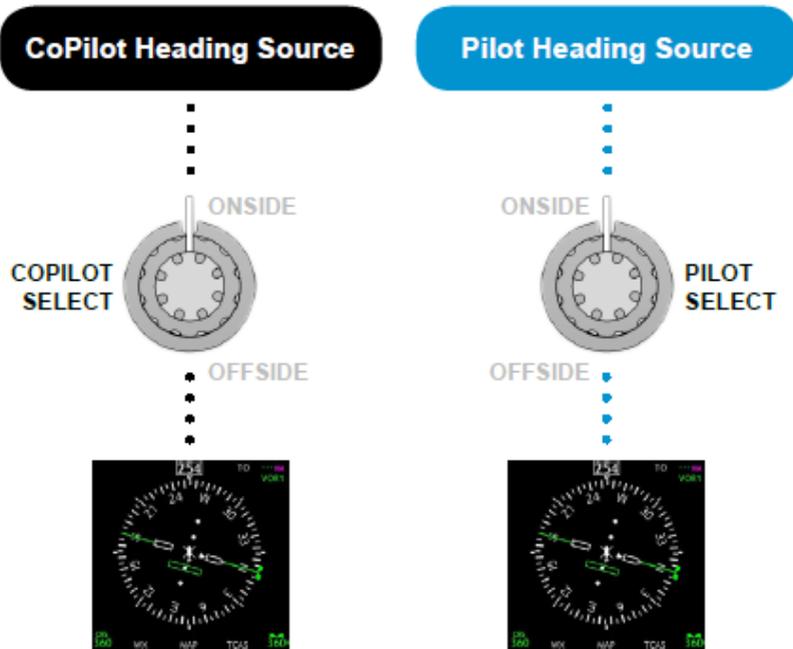
Figure 3-26: Onside Heading
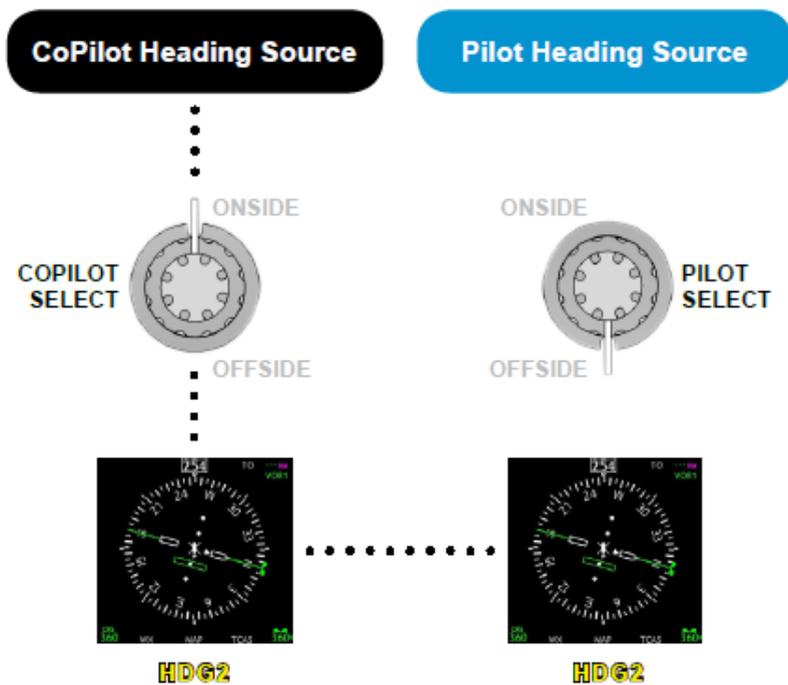
Figure 3-27: Pilot Offside Heading
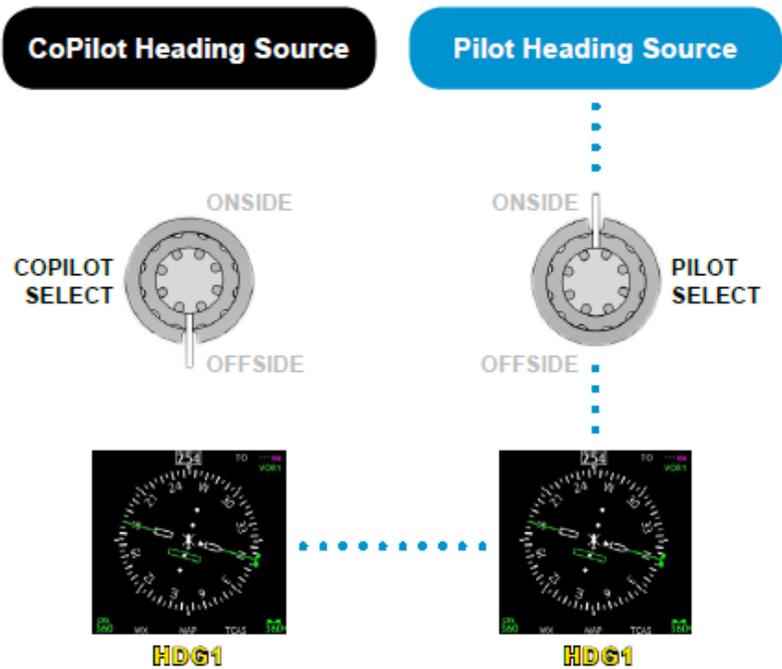
Figure 3-28: Copilot Offside Heading
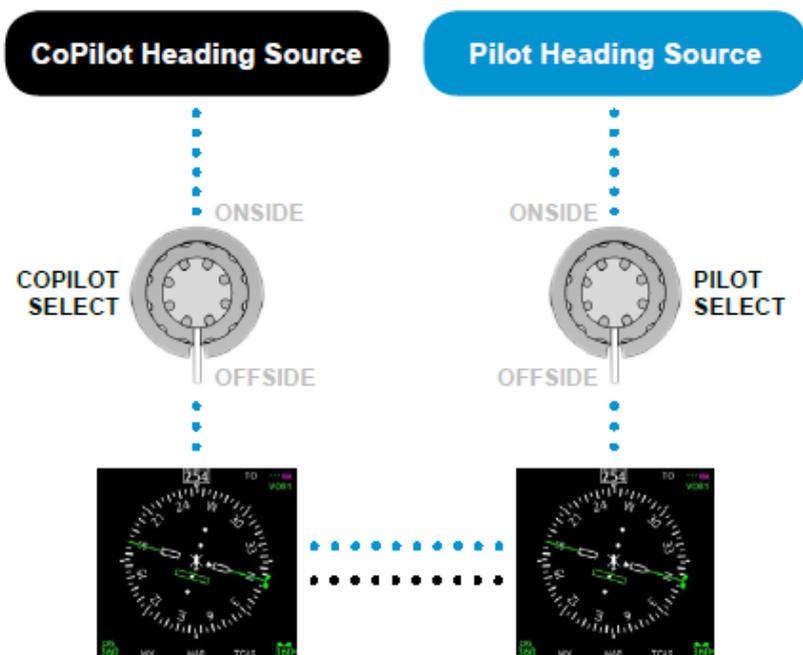
Figure 3-29: Offside Heading

3.5 Heading Miscompare Annunciations

When a heading, lateral deviation, vertical deviation, miscompare between both left and right sources is detected, it is annunciated in the top left corner of the HSI. For a complete listing of warnings and cautions, see Section 4.1.

Table 3-15: Heading Miscompare Annunciations

Symbol	Description
<-> HDG	The heading difference between onside and offside sources exceeds 6°.
<-> RA	The radar altitude reported between dual radar altitude units differs by more than 25'.
<-> LOC	The localizer information between ILS1 and ILS2 differs by more than two-thirds of a dot.
<-> GS	The glideslope information between ILS1 and ILS2 differs by more than two-thirds of a dot.
<-> ILS	The localizer and glideslope information between ILS1 and ILS2 differs by more than two-thirds of a dot.

4 Messages

4.1 Visual Alerts

Table 4-1: Visual Alerts

Message	Description	Crew Action
`ATT1` Attitude source	An advisory message that occurs when both EFI displays are configured to display attitude from the Attitude 1 source.	Switch the EFI attitude source selection switch to choose independent attitude sources. This switch is found on the aircraft panel.
`ATT1` Attitude source	An advisory message that occurs when both EFI displays are configured to independently display offside sources. Attitude on this EFI is displayed from the Attitude 1 source.	No action is necessary.
`ATT2` Attitude source	An advisory message that occurs when both EFI displays are configured to display attitude from the Attitude 2 source.	Switch the EFI attitude source selection switch to choose independent attitude sources. This switch is found on the aircraft panel.
`ATT2` Attitude source	An advisory message that occurs when both EFI displays are configured to independently display offside sources. Attitude on this EFI is displayed from the Attitude 2 source.	No action is necessary.
`<-> ATT` Miscompare annunciation	Indicates the pitch and roll attitude from the onside attitude source and the offside attitude	Compare both EFI displays and the standby attitude indicator for the correct attitude.

Message	Description	Crew Action
	source differs by more than 6°.	
CDI FAIL Navigation	VOR is selected and communication from unit providing lateral deviations is missing or invalid.	Contact maintenance for service and do not use VOR for navigation
CHECK CONFIG EFI configuration	In a dual EFI installation, the configuration of each EFI does not match each other.	Contact maintenance for service.
DR GPS	The GPS unit indicates it has lost satellite communication and is now in dead reckoning mode.	GPS position is now estimated. Consult the GPS for more information.
CHECK EFI EFI	A Built In Test (BIT) fault has been detected.	Contact maintenance for service.
GPWS GPWS Mode 1	GPWS Mode 1: Excessive Rate of Descent (ERD) warning accompanied with an aural alert that says "Pull Up".	Pull up.
GPWS GPWS Mode 1	GPWS Mode 1: Excessive Rate of Descent (ERD) caution accompanied with an aural alert that says "Don't Sink".	Arrest descent.
GPWS GPWS Mode 3	GPWS Mode 3: Negative Climb After Takeoff (NCAT) caution accompanied with an aural alert that says "Don't Sink".	Arrest descent.
GPWS GPWS	GPWS Mode 4a: Flight Into Terrain Not Landing	Arrest rate of descent or lower landing gear.

Message	Description	Crew Action
Mode 4a	(FITNL) caution accompanied with an aural alert that says "Too Low Gear".	
GPWS GPWS Mode 5	GPWS Mode 5: Excessive Downward Glide Slope Deviation (EDGSD) caution accompanied with an aural alert that says "Glide Slope".	Correct vertical deviation.
<-> GS Miscompare annunciation	Indicates the glideslope information from ILS1 and ILS2 differs by more than two-thirds of a dot deviation. Both NAV radios must be tuned to an ILS.	Ensure both NAV radios are tuned to the same frequency. If so, fly an approach that does not use the NAV radio and contact maintenance for service.
HDG1 Heading source	An advisory message that occurs when both EFI displays are configured to display heading from the Heading 1 source.	Switch the EFI heading source selection switch to choose independent heading sources. This switch is found on the aircraft panel.
HDG2 Heading source	An advisory message that occurs when both EFI displays are configured to display heading from the Heading 2 source.	Switch the EFI heading source selection switch to choose independent heading sources. This switch is found on the aircraft panel.
<-> HDG Miscompare annunciation	Indicates the heading from the onside heading source and the offside heading source differs by more than 6°.	Compare both EFI displays and the whiskey compass for the correct heading.

Message	Description	Crew Action
<-> ILS Miscompare annunciation	Indicates both the localizer and glideslope information from ILS1 and ILS2 differs by more than two-thirds of a dot deviation. Both NAV radios must be tuned to an ILS.	Ensure both NAV radios are tuned to the same frequency. If so, fly an approach that does not use the NAV radio and contact maintenance for service.
<-> LOC Miscompare annunciation	Indicates the localizer information from ILS1 and ILS2 differs by more than two-thirds of a dot deviation. Both NAV radios must be tuned to an ILS.	Ensure both NAV radios are tuned to the same frequency. If so, fly an approach that does not use the NAV radio and contact maintenance for service.
LOC FAIL Navigation	ILS is selected and communication from the unit providing lateral deviations is missing or invalid.	Contact maintenance for service and do not use ILS for navigation
LOI GPS	The GPS unit indicates that satellite coverage is insufficient to pass its built in integrity monitor.	Consult the GPS for more information.
LX DGRD Lightening Detection	Lightening Detection is selected as an overlay and a partial failure occurs in the Lightening Detection unit that prevents the EFI from correctly displaying bearing and distance to the storm cell.	Contact maintenance for service and do not use the Lightening Detection overlay.
LX FAIL Lightening Detection	Lightening Detection is selected as an overlay and communication from the unit is missing or invalid.	Contact maintenance for service and do not use the Lightening Detection overlay.
MAP FAIL GPS	GPS is the active navigation source and	Contact maintenance for service.

Message	Description	Crew Action
	GPS map information is missing or invalid.	Do not use GPS for navigation.
MAP FAIL DME	VOR1 or VOR2 is the active navigation source and DME distance is unavailable.	Select a navigation source with DME distance.
MON DGRD EFI configuration	Some crosslink communication between EFI displays are missing.	Contact maintenance for service.
MON FAIL EFI configuration	All crosslink communication between EFI displays is missing.	Contact maintenance for service.
MSG GPS	The GPS unit indicates a message alert.	A message is present on the GPS unit. Clear the message to clear the alert on the EFI.
OFFSCALE TCAS	TCAS is enabled and is detecting a traffic threat but the map range is too low to display the threat.	Increase map range to display the traffic threat.
<-> PIT Miscompare annunciation	Indicates the pitch attitude from the onside attitude source and the offside attitude source differs by more than 5°.	Compare both EFI displays and the standby attitude indicator for the correct pitch attitude.
<-> RA Miscompare annunciation	Indicates the altitude from the onside radar altitude source and the offside radar altitude source differs by more than 20'.	Do not rely on radar altitude as the sole source of height information.
RNG DISAGREE Weather radar	The range received by the EFIs from the weather radar unit does not match the range received by the EFIs from the control panel.	Contact maintenance for service. Do not use the weather radar overlay.

Message	Description	Crew Action
<-> ROL Miscompare annunciation	Indicates the roll attitude from the onside attitude source and the offside attitude source differs by more than 6°.	Compare both EFI displays and the standby attitude indicator for the correct roll attitude.
STORM Lightening Detection	Indicates when a lightning alert is present and the Lightening Detection map overlay on the HSI is not selected.	Enable the Lightening Detection overlay to see bearing and distance of active lightning alert.
TCAS FAIL TCAS	TCAS is selected as an overlay and communication from the unit is missing or invalid.	Contact maintenance for service and do not use the TCAS overlay.
TERR 453 HTAWS	No ARINC 453 HTAWS data detected when external HTAWS selected	Contact maintenance for service.
TGT ALERT Weather radar	The weather radar unit indicates either a horizontal or vertical target alert ahead	No action is necessary. Consult the weather radar overlay on the HSI for more information.
TK FAIL GPS	True track from the GPS device is missing or invalid.	Contact maintenance for service. Do not use GPS for navigation.
TRAFFIC TCAS	The TCAS unit indicates a traffic advisory is present and the TCAS overlay is not visible.	No action is necessary. The TCAS overlay will auto pop up to show intruder bearing and distance.
TRAFFIC TCAS	The TCAS unit indicates a resolution advisory is present and the TCAS overlay is not visible.	No action is necessary. The TCAS overlay will auto pop up to show intruder bearing and distance. The EFI does not support the resolution advisory

Message	Description	Crew Action
		portion of TCAS II but will display targets as red squares.
WPT GPS	The GPS unit indicates a waypoint sequencing alert.	No action is necessary.
WX CP FAIL Weather radar	Information received by the EFI from the weather radar control panel is missing of invalid.	Contact maintenance for service. Do not use the weather radar overlay.
WX DISAGREE Weather radar - vertical	The vertical mode and vertical gain received by the EFI from the weather radar unit does not match the vertical mode and vertical gain received by the EFI from the control panel.	Contact maintenance for service. Do not use the weather radar overlay.
WX DISAGREE Weather radar - horizontal	The horizontal mode and horizontal gain received by the EFI from the weather radar unit does not match the horizontal mode and horizontal gain received by the EFI from the control panel.	Contact maintenance for service. Do not use the weather radar overlay.
WX FAIL Weather radar	Weather radar communication is missing or invalid.	Contact maintenance for service. Do not use the weather radar overlay.
XTK FAIL Navigation	FMS is selected and communication from a unit providing lateral deviations is missing or invalid.	Contact maintenance for service and do not use FMS for navigation

5 Maintenance and Data loading Page

The Maintenance mode provides information regarding the EFI operational status, permits EFI setup, and allows for maintenance of Weather Radar. The maintenance mode is available upon selection of MAINT in the menu while the aircraft is on-ground. Upon entering the maintenance mode, a list of installed software parts and Built In Test (BIT) results are viewable. For more information regarding maintenance or data loading, please contact an Astronautics dealer and/or refer to PLI12862.

6 Symbol Quick Reference

Note: The following tables describe the symbols that are located on the HSI Map displays.

6.1 Map Symbols

Table 6-1: GPS Map Symbols

Symbol	Description
✦	Waypoint
☗	VORTAC
☖	TACAN
⬡	VOR
☐	DME
◨	VOR/DME (collocated)
◇	Airport
⦿	NDB
∧	Altitude Profile Point
△	Intersection

6.2 Lightening Detection Symbols

Table 6-2: Lightening Detection symbols

Symbol	Intensity
⚡	Unknown or Low (up to 8 strikes/minute)
⚡	Medium (9-25 strikes/minute)
⚡	High (26 or more strikes/minute)

6.3 External TAWS Terrain Colors

Table 6-3: External TAWS Terrain Colors

Color	Description	Function Description
	Solid Red	Terrain/Obstacle Threat Area – Warning
	Solid Amber	Terrain/Obstacle Threat Area – Caution
	50% Red Dots	Terrain/Obstacle is more than 500 feet above aircraft altitude
	50% Amber Dots	Terrain/Obstacle is between aircraft altitude and 500 feet above
	25% Amber Dots	Terrain/Obstacle is between aircraft altitude and 250 feet below
	50% Green Dots	Terrain/Obstacle is 250 to 500 feet below aircraft altitude
	16% Green Dots	Terrain/Obstacle is 500 to 1500 feet below aircraft altitude
	Black	No significant Terrain/Obstacle
	16% Cyan Dots	Sea Level (0 feet mean sea level)
	Magenta Dots	Unknown Terrain

6.4 Weather Patterns

Table 6-4: Weather Radar Colors

Symbol	Description
	Very Light or None (< 1 mm/hr)
	Light (1 – 4 mm/hr)
	Moderate (4 – 12 mm/hr)
	Strong (12 – 50 mm/hr)
	Intense (> 50 mm/hr)
	Not Used
	Not Used
	Not Used
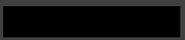
6.5 TCAS Symbols

Table 6-5: TCAS Symbols

Symbol	Description
	Other Traffic Traffic is greater than 1200 ft vertical separation and beyond 6 nm
	Proximate Traffic Traffic is less than 1200 ft vertical separation and within 5 nm
	Traffic Advisory TCAS criteria for a Traffic Advisory is met
	Resolution Advisory TCAS criteria for a Resolution Advisory is met. (The EFI does not provide resolution cues on the ADI but will display the resolution advisory icon if the threat type generated by the TCAS unit is "RESOLUTION")

List of Acronyms

ABV	Above
ADF	Automatic Direction Finder
ADI	Attitude Director Indicator
AFI	Astronautics Flight Instrument
ALRT	Alert
ALT	Altitude
APTDS	Adaptive Passive Thunderstorm Detection System
ATT	Attitude
BC	Back Course
BIT	Built-In Test
BLW	Below
BRGS	Bearings
CDI	Course Deviation Indicator
CP	Control Panel
DDM	Difference in the Depth of Modulation
DF	Directional Finder
DG	Directional Gyro
DGRD	Degraded
DH	Decision Height
DME	Distance Measuring Equipment
DR	Dead Reckoning
EDGSD	Excessive Downward Glide Slope Deviation
EFI	Electronic Flight Instrument
EGPWS	Enhanced Ground Proximity Warning System
ERD	Excessive Rate of Descent
FD	Flight Director
FITNL	Flight Into Terrain Not Landing
FL	Flight Level
FLTA	Forward Looking Terrain Avoidance
FMS	Flight Management System
GA	Go Around
GPS	Global Positioning System
GPWS	Ground Proximity Warning System
GS	Glide Slope
HDG	Heading
HSI	Horizontal Situation Indicator
HSYNC	Horizon Sync
HTAWS	Helicopter Terrain Awareness Warning System

IAS	Indicated Air Speed
ILS	Instrument Landing System
INOP	Inoperative
LOC	Localizer
LED	Light Emitting Diode
LGPS	Lateral Global Positioning System
LOI	Loss of Integrity
LON	Longitude
LX	Lightening Detection Mode
LX+TERR	Lightening Detection + Terrain
LX+WX	Lightening Detection + Weather
MAINT	Maintenance
MM	Millimeters
MON	Monitor
MSG	Message
NAV	Navigation
NCAT	Negative Climb After Takeoff
NVIS	Night Vision System
PIT	Pitch
RA	Radar Altimeter
RNG	Range
ROL	Roll
RTE	Route
RTE+APT	Route + Airport
RTE+STA	Route + Navaids
SS	Lightening Detection
STBY	Standby
TA	Traffic Advisory
TACAN	Tactical Air Navigation
TCAS	Traffic Collision Avoidance System
TAWS	Terrain Awareness Warning System
TERR	Terrain
TGT	Target
THRT	Threat
TK	Track
TST	Test
USB	Universal Serial Bus
VAPP	VOR Approach
VGPS	Vertical Guidance GPS
VHF	Very High Frequency
VOR	Very High Frequency Omnidirectional Radio
VORTAC	VOR Tactical Aircraft Control

VP	Vertical Profile
VS	Vertical Speed
WAAS	Wide Area Augmentation System
WPT	Waypoint
WX	Weather
WXR	Weather Radar