

EVOLUTION

FLIGHT DISPLAY

Evolution Synthetic Vision Pilot's Guide Supplement

ASPEN AVIONICS™
A NEW WAY TO LOOK AT AVIONICS™



Document Revisions

Revision	Description of Change
B	Updated for software v2.5. Blue tower obstacle threshold is reduced from 2,500 feet to 900 feet.
A	Grammatical, pictorial, and technical corrections and updates. Added Document Revisions page, Runways, microSD card loading, installation, operational check, and removal procedures.
()	Initial Release

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Chapter 1

Evolution Synthetic Vision Welcome and Introduction

Welcome to Aspen Avionics' Evolution Synthetic Vision (ESV), the most versatile and flexible synthetic vision technology available for certified avionics.

The Evolution Synthetic Vision option, when selected on your flight display, replaces the traditional blue-over-brown background of the legacy attitude indicator with a real-time, computer-generated 3D view of terrain, obstacles, and traffic¹ for the utmost in pilot situational awareness. ESV uses 9 arc-second and 3 arc-second resolution terrain data to render the Synthetic Vision VIEW.

You will find that Aspen's ESV is intuitive and easy to use. Aspen's exclusive flexible display layouts permit you to personalize a configuration that works best for you – on the Primary Flight Display, the Multi-Function Flight Display, or both. ESV may be presented on any of the window configurations – Full Screen, Split Screen, or Thumbnail LAYOUT.

ESV also has a field of view option, narrow or wide, which allows you to toggle to the view that best suits the phase of flight. The wide field of view is suited for enroute, while the narrow field of view is best for zooming in on the approach environment.

ESV's easy-to-read display features include: Flight Path Marker symbology that graphically depicts the lateral GPS track and vertical speed of the aircraft, a Distance Marker to assist in estimating the distance to a point ahead of the aircraft, and a Terrain Warning System (TWS) that provides visual, audio, and text warning annunciations when the system predicts a collision with terrain or an obstacle.

Aspen is proud to offer this enhancement to your glass panel system. Welcome to the next level of innovation and functionality for your Evolution Flight Displays.



1. Traffic is available when configured with Aspen's Evolution Hazard Awareness (EHA) option.

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Chapter 2

ESV Display Features

2.1 Zero Pitch Line - ZPL

The Zero Pitch Line (ZPL) is a white line on the Attitude Display that represents the horizon, similar to the horizon line on an attitude indicator. The center of the ZPL is removed to present a clear view of the center of the Synthetic Vision display (**Figure 2-1**). Terrain above the aircraft's altitude is presented above the ZPL while terrain below the aircraft's altitude is presented below the ZPL.



Figure 2-1 Zero Pitch Line (ZPL)

2.2 Flight Path Marker - FPM

The Flight Path Marker (FPM) displays the aircraft's lateral and vertical flight path (**Figure 2-2**). The FPM position is derived from the GPS ground track and vertical speed. When the FPM intercepts terrain, an obstacle, or a runway, this indicates that the aircraft is tracking in three dimensions toward that feature. When the FPM is above the Synthetic Vision terrain, this indicates the aircraft will clear that terrain. When the FPM is held on the ZPL, the aircraft is maintaining its current altitude. The Flight Path Marker can be removed from view to reduce display clutter.

See Section 6, *ESV Display Options MENU*.

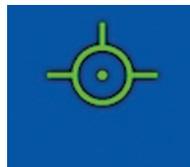


Figure 2-2 Flight Path Marker (FPM)

NOTE

The FPM is for use in steady state. Like the GPS Track and Vertical Speed it is based on, the FPM will lag during dynamic maneuvers.



Figure 2-3 Aircraft Reference Symbol



Figure 2-4 SV Distance Marker

2.3 Aircraft Reference Symbol

The Aircraft Reference Symbol (**Figure 2-3**) is used to determine the pitch attitude of the aircraft relative to the pitch scale on the PFD and relative to the depicted terrain on the MFD. The Aircraft Reference symbol can be removed from view on the MFD.

To display or remove the Aircraft Reference Symbol on the MFD

1. Press the MENU button and rotate the Right Knob to the CHART/SV SETTINGS A page.
2. Press the SV AIRCRAFT REF SYMBOL Menu Key and rotate the Right Knob to the desired setting (ON or OFF).

See Section 6, *ESV Display Options MENU*.

2.4 SV Distance Marker

The DIST Hot Key presents a cyan dashed line (Distance Line) representing the ground distance ahead of the aircraft (**Figure 2-4**). The Distance Marker is used to estimate the ground distance from the aircraft to a feature on the display. The selectable distance options are OFF, 1nm thru 20nm (in 1nm increments), 20nm, 25nm, 30nm, and 40nm. The maximum distance ESV presents the virtual horizon is 40nm.

To edit the Distance Line and SV Distance Marker

1. Press the DIST Hot Key (The Right Knob label turns magenta and displays "SV DIST MARKER" with the distance selected).
2. Rotate the Right Knob to the desired distance setting or press and hold the Right Knob to automatically SYNC the Distance Line to the 5nm range.

2.5 Airport Flags

An Airport Flag displays the airport's identifier and its location. A flag is presented when the aircraft is approximately 20nm away from an airport. When the aircraft is approximately 2nm away from the airport, the flag is removed from view.

The destination airport that has been loaded into the aircraft's GPS flight plan is identified with a magenta flag (**Figure 2-5**). Other airports are identified with a white flag (**Figure 2-6**).

The Airport Flag can be decluttered according to several parameters: Flight Plan Airports only, no flags shown, all hard surface runways, or only airports with runway lengths greater than 4500, 4000, 3500, 3000, 2500 feet.

The Airport Flag display option is found in the MENU of the PFD and MFD. The settings for the Airport Flags are; Flight Plan Airports Only, None, ON>4500, ON>4000, ON>3500, ON>3000, ON>2500, All Hard Surface, and ALL ON.

See Section 6 *ESV Display Options MENU*.



Figure 2-5 Magenta Airport Flag (destination airport)



Figure 2-6 White Airport Flag

WARNING

The Terrain and Obstruction information is based on terrain and obstacle elevation information contained in a third party database. This data may contain inaccuracies and/or omissions and must only be used as an aid to situational awareness. The information provided should never be used for primary terrain avoidance or navigation.

2.6 Runways

Hard-surfaced runways are gray in color with white runway markings. Runway markings include the runway centerline, runway numbers, letters for parallel runways, runway threshold markings, and displaced thresholds (**Figure 2-7**).

Other than hard-surfaced runways, often referred to as a grass runway or a gravel runway, are colored differently depending on the airport field elevation. Runways at field elevations 2000 feet and greater are colored tan with gray (**Figure 2-8**). Runways at field elevations less than 2000 feet are colored green with gray (**Figure 2-9**).

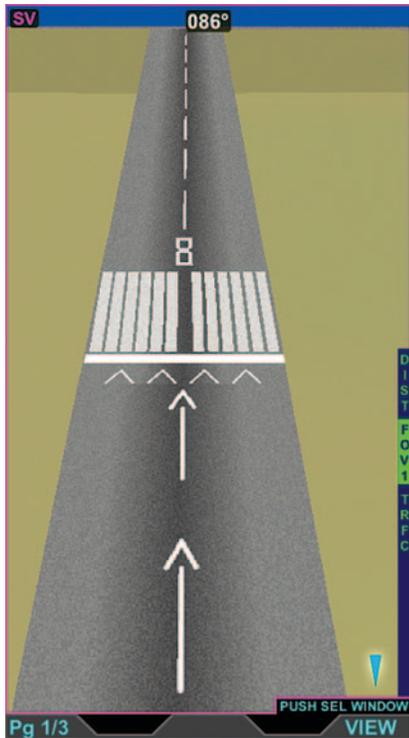


Figure 2-7 Runway Markings

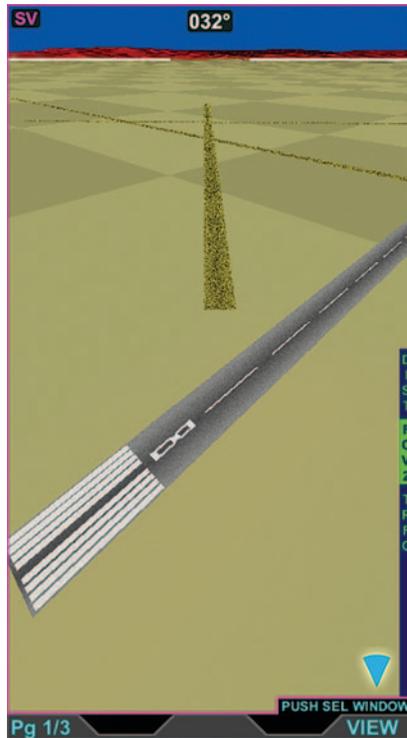


Figure 2-8 Other than Hard-surfaced Runways,
Field elevation 2000 feet and greater



Figure 2-9 Other than Hard-surfaced Runways,
Field elevation less than 2000 feet

2.7 Obstacle Symbols - Towers

Three-dimensional obstacle symbols (**Table 2-1**) are presented in perspective on all Synthetic Vision VIEWS and also in a top-down two-dimensional view on the Nav Display of SV3 (**Figure 3-1**). ESV presents obstacles taller than 200 feet AGL that are within 900 feet vertically of the aircraft altitude.

The obstacles presented in the Synthetic Vision VIEW appear small at first and grow larger as they get closer to the aircraft.

- Obstacles that are between 500 feet and 900 feet below the aircraft's altitude are blue.
- Obstacles that are between 100 feet and 500 feet below the aircraft's altitude are amber.
- Obstacles that are above the aircraft's altitude or within 100 feet below the aircraft's altitude are red.

Obstacle Height < 1000' AGL		Obstacle Height > 1000' AGL		Obstacle Symbol Color Meaning
				Obstacle is between 500' and 900' below aircraft's altitude
				Obstacle is between 100' and 500' below aircraft's altitude
				Obstacle is above aircraft's altitude or within 100' below aircraft's altitude

Table 2-1, Obstacle Symbols and Meanings

Chapter 3

Displaying Evolution Synthetic Vision

ESV uses 9 and 3 arc-second resolution terrain data to render the Synthetic Vision VIEW. The Narrow Field of View, FOV1 is most like the outside view and is best used on an approach for landing. FOV2 is best used for enroute. The PFD display options for ESV are Full Screen, Split Screen with the standard Nav Display, or Split Screen with the Nav Display overlaying the Topographical Map (**Figure 3-1**).



Figure 3-1
(left to right) PFD Full Screen (SV1),
Split Screen with standard Nav Display (SV2),
and Split Screen with Nav Display
overlaying Topographical Map (SV3)

3.1 Primary Flight Display - PFD

The Evolution Synthetic Vision option is accessed by displaying the 3/3 Hot Key Menu (Figure 3-2). Pressing the SV Hot Key enables the ESV function and changes the SV Hot Key label to SV1 (Figure 3-3). Each successive press of the SV Hot Key cycles through the Synthetic Vision VIEWS; SV1, SV2, SV3, and SV Off (disabled).



Figure 3-3 Hot Key Menu 3 / 3



Figure 3-4 Hot Key Label SV1

NOTE

- The PFD and MFD(s) require a properly configured micro SD Card for Synthetic Vision loaded with Jeppesen terrain, obstacle, and navigation databases.
- For units configured without the Evolution Hazard Awareness option (Traffic, Stormscope, or NEXRAD), select the 2/2 Hot Key for Synthetic Vision.
- If the GPS position is invalid or ESV is unavailable, the gray SV label can be pressed to determine the reason for the unavailable SV.

3.1.1 SV1 - Full Screen

SV1 (Synthetic Vision 1) Full Screen presents Synthetic Vision under the entire primary flight data area of the PFD (Figure 3-4).

The CRS and HDG Fields are presented on SV1 whenever the Left or Right Knob is rotated to set the desired course/heading value (Figure 3-5). After 10 seconds of inactivity, the CRS/HDG Field is removed from view.

The Selected Heading Field with GPSS is presented on SV1 until the GPSS is disabled by the pilot (Figure 3-6).

OAT and Map features on the HSI are not shown. Winds are shown in an abbreviated style to maximize the screen area.



Figure 3-4 SV1 Full Screen



Figure 3-5 CRS and HDG display



Figure 3-6 GPSS display



Figure 3-7 Split Screen Standard Nav Display



Figure 3-8 Split Screen Nav Display with Topo Map

3.1.2 SV2 and SV3 – Split Screen

SV2 and SV3 present Synthetic Vision on the Attitude Display portion of the PFD. The lower half of the display presents the standard Nav Display, SV2 (**Figure 3-7**) or the Nav Display overlaying a high-resolution topographical map, SV3 (**Figure 3-8**).

NOTE

- When SV2 is selected, LTNG and NXRD Hot Keys are shown on Hot Key page 2/3.
- LTNG and NXRD are not available on SV3.

3.1.3 Unusual Attitudes

At extreme pitch attitudes (above 15° nose up or below 15° nose down), red Unusual Attitude Recovery chevrons come into view, pointing toward the horizon or ground as applicable. At these extreme pitch attitudes, some sky (blue) or ground (brown) will always be displayed to help maintain situational awareness, even though the Zero Pitch Line may be off-scale. The red chevrons aid the pilot in unusual attitude recovery by indicating the direction to restore to level flight.

In the Narrow Field of View (FOV1), the red chevrons are drawn on the pitch ladder every 5 degrees beginning at 20° above and below the Zero Pitch Line (**Figure 3-9**).

In the Wide Field of View (FOV2), the red chevrons are drawn on the pitch ladder every 10° beginning at 30° above and below the Zero Pitch Line (**Figure 3-10**).

Unusual Attitude functionality is the same as on the Standard display.



Figure 3-8 Unusual Attitude - Narrow Field of View



Figure 3-10 Unusual Attitude - Wide Field of View



Figure 3-11 Narrow FOV Icon



Figure 3-12 Wide FOV Icon

3.2 Field of View

ESV can be presented in a Narrow Field of View or in a Wide Field of View by pressing the FOV1 (Narrow Field of View) or FOV2 (Wide Field of View) Hot Key. A quick glance at the FOV Icon (**Figure 3-11** and **Figure 3-12**) presented at the bottom right corner of all Synthetic Vision VIEWS indicates which field of view is currently displayed.



Figure 3-13 Narrow Horizontal FOV



Figure 3-14 Wide Horizontal FOV

The FOV Icon correlates with the two-dashed lines radiating from the center of the ownship symbol on the Nav Display, indicating if a narrow horizontal field of view (**Figure 3-13**) or a wide horizontal field of view has been selected (**Figure 3-14**).

NOTE

The ends of the dashed lines do not imply a Synthetic Vision range limit. The range limit presented for the Synthetic Vision horizon is always 40 nautical miles.

3.2.1 FOV1 - Narrow Field of View

FOV1 (**Figure 3-15 and Figure 3-16**) presents an approximate 20° horizontal view (10° either side of the nose) and a visible pitch ladder range between 5° to -20° for SV1.

FOV1 (Narrow Field of View) is the most accurate representation of the outside view. FOV1 is best used for close range operation, such as final approach.



NOTE

The vertical Field of View is also narrow. See **Figure 3-19**



Figure 3-15 SV1 Narrow Field of View

Figure 3-16 SV2 Narrow Field of View



Figure 3-17 SV1 Wide Field of View



Figure 3-18 SV2 Wide Field of View

3.2.2 FOV2 - Wide Field of View

FOV2 (**Figure 3-17 and Figure 3-18**) presents an approximate 50° horizontal view (25° either side of the nose) and a visible pitch ladder range between 20° to -50° for SV1. The pitch ladder scale on FOV2 is equal to that on the standard display.

FOV2 is a wider field of view and objects on the display are closer than they appear. FOV2 is best used for enroute.

Figure 3-19 shows the portion of FOV1 display that is depicted in FOV2.

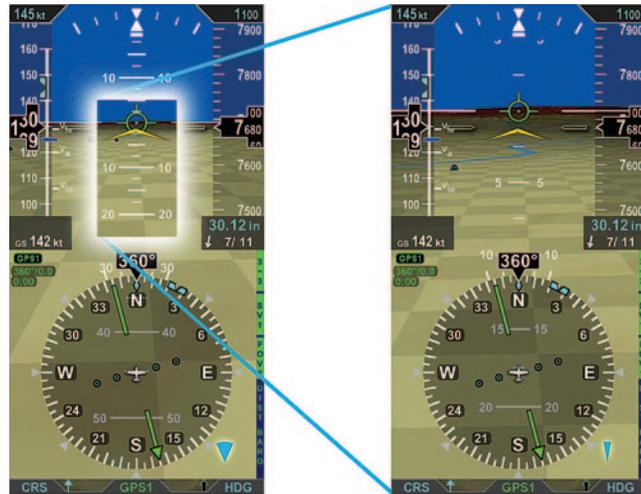


Figure 3-19 Wide and Narrow Fields of View, Relative Area

3.2.3 Field of View - MFD

FOV1 and FOV2 Hot Key selection is also available on all MFD WINDOWS that support ESV.

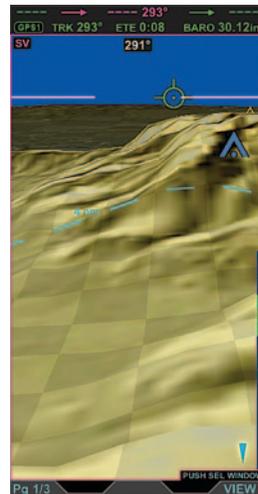


Figure 3-20 FOV1 Narrow Field of View

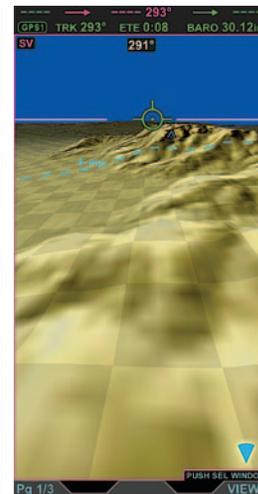


Figure 3-21 FOV2 Wide Field of View

3.3.1 Full Screen LAYOUT (Pg 1/3)

ESV is presented in Full Screen LAYOUT on Pg 1/3. **Figure 3-24** shows the Full Screen LAYOUT with FOV2 (Wide Field of View) selected.

The following ESV display features are shown on **Figure 3-24** and **Figure 3-25**:

- Zero Pitch Line
- Flight Path Marker
- Blue obstacle
- SV Distance Marker
- Wide Field of View Icon

3.3.2 Split Screen LAYOUT (Pg 2/3)

ESV may be presented in either WINDOW of the Split Screen LAYOUT (**Figure 3-25**).

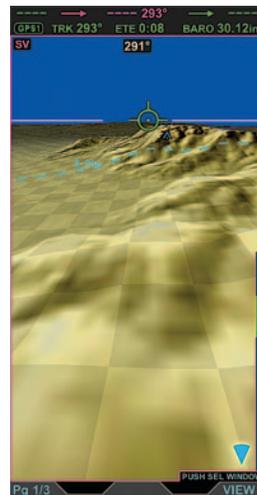


Figure 3-24 Full Screen Layout



Figure 3-25 Split Screen Layout



Figure 3-26 ESV in Bottom Window



Figure 3-27 ESV in Thumbnail Window

3.3.3 Thumbnail LAYOUT (Pg 3/3)

ESV can be displayed in any window of the Thumbnail LAYOUT.

In this example, ESV is presented in the Bottom WINDOW (**Figure 3-26**) and in the Thumbnail WINDOW (**Figure 3-27**).

In the smaller Thumbnail WINDOW (**Figure 3-27**), all of the display features are visible as shown in the Bottom WINDOW (**Figure 3-26**) and in the Full Screen LAYOUT (**Figure 3-24**).

- Zero Pitch Line
- Flight Path Marker
- Blue obstacle
- SV Distance Marker
- Wide Field of View Icon

Chapter 4

Terrain Warning System – TWS

The Aspen Terrain Warning System (TWS) is included with the Evolution Synthetic Vision System to provide simple and effective terrain and obstacle alerting. To enhance the pilot's situational awareness of a potential terrain/obstacle collision, the Terrain Warning System employs the following TWS Alerts (**Figure 4-1**):

- Terrain Coloring
- FPM Coloring
- Caution/Warning Text Annunciations, and
- Aural Alert (*see note*)

NOTE

In aircraft certified with a Terrain Avoidance Warning System (TAWS), the Aspen TWS system does not provide audible alert or text alert information. Only the FPM coloring and the Terrain Coloring are displayed.



Figure 4-1 Terrain Warning System Alerts



Figure 4-2 Inflight Terrain Color Legend

4.1 Terrain Coloring

Red and yellow coloring are used for visual terrain awareness and alerting. This terrain coloring represents the relative terrain elevation compared to the aircraft's altitude.

Enroute terrain that is between 100 and 500 feet below the aircraft is shown as yellow. The terrain that is less than 100 feet below the aircraft and above is shown as red (**Figure 4-2**).

When operating within the airport environment, terrain coloring is removed except for terrain that is 100 feet above the airport elevation.

NOTE

Obstacles are always alerted and never removed.

4.2 Flight Path Marker Coloring

The Flight Path Marker (FPM) has a terrain warning function when a collision with terrain or an obstacle is predicted. The FPM will change shape and color, depending on the predicted time to collision. The FPM colors are green, white, amber, and red.

A green FPM indicates that full TWS Alerts are available (**Figure 4-3**).

A white FPM is a visual cue indicating that TWS terrain alerts are on; however, Terrain Alerts will be generated by terrain 100 feet higher than the runway elevation and all mapped obstacles (**Figure 4-4**).

An amber FPM is a Caution alert predicting terrain/obstacle collision within 45 seconds if the current flight path is maintained (**Figure 4-5**).

A red FPM is a Warning alert predicting terrain/obstacle collision within 30 seconds if the current flight path is maintained (**Figure 4-6**).

The FPM shows the predicted path of the aircraft and lags in dynamic maneuvers. See *Section 2.2 Flight Path Marker - FPM*.

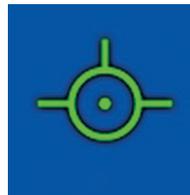


Figure 4-3 Green FPM

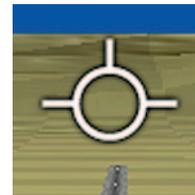


Figure 4-4 White FPM



Figure 4-5 Amber FPM



Figure 4-6 Red FPM

4.3 Caution/Warning Text Annunciations

Textual annunciations for TWS Alerts are annunciated on the Data Bar of the PFD and MFD announcing the type of threat, i.e. terrain or obstacle.

4.4 Aural Alert

The Aural Alert (an audible alarm from an external tone generator) provides a distinct stuttered, 3-second aural tone when a terrain/obstacle alert occurs. After the initial alert tone has sounded, the aural alert will sound again whenever a higher priority alert occurs.



In aircraft certified with a Terrain Avoidance Warning System (TAWS), the Aspen TWS system does not provide audible alert or text alert information. Only the FPM Coloring and the Terrain Coloring is displayed.

4.5 TWS Elements and Warning Levels

The two basic elements of the Terrain Warning System are:

- Predictive Terrain/Obstacle Conflict, and
- Predictive Terrain/Obstacle Proximity

The two basic Warning Levels are:

- Normal Warning Level, and
- In-Range Warning Level

4.5.1 Predictive Terrain/Obstacle Conflict

The TWS uses the Flight Path Marker to predict a collision with terrain or an obstacle. When the Flight Path Marker is positioned over terrain or an obstacle and the Terrain Warning System predicts that a potential collision will occur within 45 seconds (if the current flight path is maintained) the audible alarm is sounded and the green Flight Path Marker changes its shape and turns to an amber color (**Figure 4-7**).

An amber text alert is annunciated on the Data Bar announcing the type of threat, e.g.

“CAUTION - TERRAIN, TERRAIN” (**Figure 4-7**) or

“CAUTION - OBSTACLE, OBSTACLE” (**Figure 4-8**).

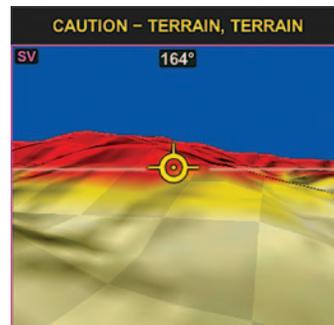


Figure 4-7 Amber FPM and CAUTION – Terrain



Figure 4-8 Amber FPM and CAUTION – Obstacle



Figure 4-9 Red FPM and CAUTION - Obstacle

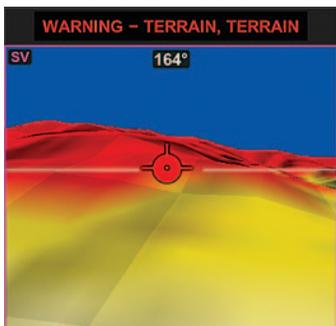


Figure 4-10 Red FPM and CAUTION - Terrain

Similarly, when TWS predicts that a potential collision will occur within 30 seconds (if the current flight path is maintained) the audible alarm is sounded and the Flight Path Marker changes its shape and turns to a red color (Figure 4-9).

A red text alert is announced on the Data Bar announcing the type of threat, e.g.

“WARNING - TERRAIN, TERRAIN” (Figure 4-9) or “WARNING - OBSTACLE, OBSTACLE” (Figure 4-10).

WARNING

Changes in heading can cause an immediate conflict that is much less than the 45 or 30 seconds explained here.

4.5.2 Predictive Terrain/Obstacle Proximity

When the aircraft is close to the ground, the terrain and obstacles displayed in Synthetic Vision and on the SV3 moving map change color. The terrain and tops of obstacles ahead show yellow when within 500 feet of the aircraft and red when within 100 feet.

WARNING

Accurate terrain information is predicated on the correct barometric pressure. Always ensure that you have accurate and timely barometric pressure information otherwise the terrain and obstacle elevation data could be erroneous.

4.5.3 Normal Warning Level

The Normal Warning Level is in effect when away from an airport. A green Flight Path Marker indicates that full terrain/obstacle colorization and alerting is used. (TWS is operating at the normal warning level).

4.5.4 In-Range Warning Level

When on approach to a runway, the terrain coloring is reduced. Only obstacles over 200 feet AGL, and terrain higher than 100 feet above the runway elevation will elicit a caution or warning indication. The terrain 100 feet above the aircraft will be red-colored. A white Flight Path Marker indicates that the system is operating within the airport environment where reduced terrain colorization and alerting is used. (TWS is operating at the in-range warning level).

On takeoff, the Flight Path Marker appears at 40 knots and is white in color until leaving the immediate runway vicinity or at 300 feet AGL.

What this means is under normal circumstances there should not be a terrain or obstacle conflict. In abnormal circumstances, cautions and warnings can be very helpful.

On a precision approach, terrain cautions or warnings are not anticipated. On a non-precision approach, a terrain caution or warning is probable depending on the rate of descent toward the terrain.

Landings at most airports do not generate an alert. Some airports with unusual topography may generate alerts when the Flight Path Marker points toward nearby higher terrain.

If multiple landings are anticipated at a runway that elicits alerts, TWS can be inhibited in the Menu.

Unless inhibited, TWS operates in the background even when Synthetic Vision is not selected. If a caution or warning is generated (non-TAWS aircraft) the conflict can be instantly displayed by pressing the Lower Middle button labeled TERR (Figure 4-11 and Figure 4-12).

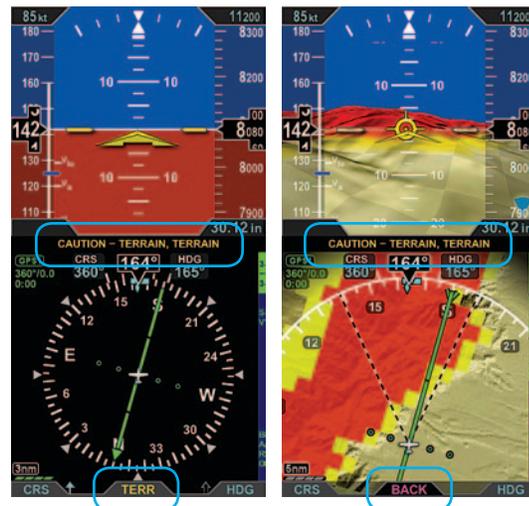


Figure 4-11 PFD Terrain Alert, Synthetic Vision Not Selected

Figure 4-12 PFD Terrain Alert, Synthetic Vision View



Figure 4-13 MFD Obstacle WARNING, Synthetic Vision Not Selected

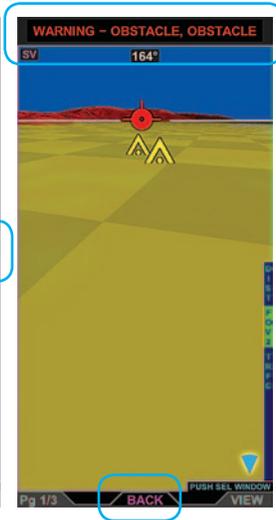


Figure 4-14 MFD Obstacle WARNING, Synthetic Vision VIEW

When a terrain alert occurs with Synthetic Vision not displayed on the PFD, pressing the Lower Middle button will switch the display to SV3 for situational awareness. SV3 automatically presents the ARC mode with a 5nm range set on the HSI. After selection, the Lower Middle button changes to BACK (Figure 4-12) to enable the pilot to quickly return to the previous display.

If the BACK button is not pressed, the BACK label will be removed after 30 seconds and the SV3 display remains. Press the SV3 Hot Key to return to the previous display.

When an advisory occurs on the MFD and Synthetic Vision is not shown, pressing the Lower Middle TERR button will switch the display to the Full Screen LAYOUT, presenting the Synthetic Vision VIEW for situational awareness (Figure 4-13). After selection, the Lower Middle button changes to BACK to enable the pilot to quickly return to the previous display (Figure 4-14).

If the BACK button is not pressed, the BACK label will be removed after 30 seconds and the Full Screen (Pg 1/3) LAYOUT remains. Rotate the Left Knob to return to the previous display.

4.6 TWS Settings

The Terrain Warning System (TWS) is enabled from the MENU and has three settings; ON, INH (Inhibit), and SV ONLY. See Section 6 *ESV Display Options MENU*.

- ON** The TWS is enabled. (TWS Alerts are on)
- INH** The TWS Alerts are inhibited. The terrain coloring, Aural Alert, and terrain/obstacle Caution and Warning text annunciations are turned off.
- SV ONLY** The TWS Alerts are enabled only when Synthetic Vision is displayed.

4.7 TWS INH (Inhibit) Annunciation

A “TWS INH” is annunciated on the Nav Display (**Figure 4-15**) whenever “INH” is selected from the TWS Menu. When INH is selected, the following are inhibited:

- Terrain Coloring
- FPM Coloring
- Caution/Warning Text Annunciations and
- Aural Alert

NOTE

In aircraft certified with a Terrain Avoidance Warning System (TAWS), the Aspen TWS system does not provide audible alert or text alert information. Only the FPM Coloring and the Terrain Coloring are displayed.

Figure 4-15 illustrates the Terrain Warning Inhibit message, meaning, the terrain coloring is not displayed and terrain alerting is not operating. Figure 4-1 shows the same conditions with Terrain Warning Enabled.

TWS INH is also annunciated whenever SV ONLY is selected and Synthetic Vision is not displayed (**Figure 4-16**).

See Section 6, *ESV Display Options MENU*.

Figure 4-17 illustrates the TWS INH annunciation on the Data Bar of the MFD.



Figure 4-15 TWS INH Annunciation



Figure 4-16 TWS INH Annunciation, PFD



Figure 4-17 TWS INH Annunciation, MFD

4.8 Invalid TWS Annunciation

When ESV is detected as failed, an Invalid TWS message is shown with a red slash, indicating that Terrain Warning is unavailable.

The Invalid TWS is annunciated on the Nav Display of the PFD (**Figure 4-18**) and on the Data Bar of the MFD (**Figure 4-19**).

See Section 7, *ESV Failure Annunciations*.



Figure 4-18 Invalid TWS Annunciation, PFD



Figure 4-19 Invalid TWS Annunciation, MFD

Chapter 5

Traffic Symbols

For aircraft equipped with a compatible traffic detection system and the optional Evolution Hazard Awareness (EHA) option, ESV 3D Traffic Symbols (**Table 5-1**) are presented on the Synthetic Vision VIEWS. The traffic symbols are oriented in three dimensions. A traffic symbol will appear larger as the traffic approaches and smaller as the traffic recedes.

Traffic Advisory	Proximity Advisory	Other Traffic
		

Table 5-1 ESV 3D Traffic Symbols



NOTE

A compatible traffic detection system must be installed and the optional Evolution Hazard Awareness (EHA) must be enabled in the PFD software. EHA is included as a standard feature on all Aspen MFDs.



WARNING

Do not rely on the PFD/MFD as the sole source of data for traffic avoidance. It is the pilot's responsibility to visually acquire other aircraft for safe flight. Maneuver your aircraft based only on ATC guidance or positive acquisition of conflicting traffic. Traffic information is:

- *Provided as a proximity warning only.*
- *Intended to assist the pilot in the visual acquisition of other aircraft.*
- *Not intended to provide recommended avoidance maneuvers.*
- *Not provided for aircraft that are not transponder equipped, experiencing a transponder failure, or (in the case of TIS) out of radar coverage.*



Figure 5-1 PFD Traffic 2 / 3 Hot Key



Figure 5-2 Traffic Advisory

5.1 PFD Traffic

When the optional Evolution Hazard Awareness (EHA) is installed, the PFD TRFC Hot Key (located in the 2/3 Hot Key Menu of the PFD) enables and disables the ESV 3D Traffic Overlay and the traffic Altitude Filter settings. Multiple presses of the TRFC Hot Key cycles through the traffic Altitude Filter settings; TRFC (Off)-TFCN (Normal)-TFCU (Unrestricted)-TFCA (Above) and TFCB (Below) in a round-robin sequence (**Figure 5-1**).

5.2 PFD Traffic Advisory

When a traffic advisory occurs on the Synthetic Vision VIEW, an amber TRAFFIC annunciation is automatically presented in the Data Bar. Additionally, TRFC appears in amber above the Lower Middle button (**Figure 5-2**).

Pressing the Lower Middle button when the amber TRFC appears, switches the display to SV2 and presents the traffic on the Nav Display for situational awareness on the Nav Display. After selection, the Lower Middle button label changes to BACK to enable the pilot to quickly return to the previous display (**Figure 5-3**).

All traffic shown on the Nav Display of SV2 and SV3 are presented in 2D plan view (top-down view) and represent the relative range and bearing to the aircraft. The range shown on the lower left of the view represents the range from the center of the compass rose to the edge of the compass rose.



Figure 5-3 Traffic Display

5.3 MFD Traffic

The TRFC Hot Key selects the traffic Altitude Filter settings. Pressing the TRFC Hot Key will cycle through the filter settings; TRFC (Off) - TFCN (Normal) - TFCU (Unrestricted)- TFCA (Above) and TFCB (Below) in a round-robin sequence (**Figure 5-4**).

5.4 MFD Traffic Advisory

When a traffic advisory occurs while viewing the Full Screen (Pg 1/3) of the MFD, an amber TRAFFIC annunciation will be presented in the Data Bar. Additionally, TRFC appears in amber above the Lower Middle button (**Figure 5-5**). Pressing the Lower Middle button will switch the display to the Split Screen (Pg 2/3) and present the traffic in the upper window (Traffic VIEW) for situational awareness. The middle button label changes to BACK to enable the pilot to quickly return to the previous display (**Figure 5-6**).

If the BACK button is not pressed, the BACK label will be removed when the traffic is no longer a threat and the Split Screen (Pg 2/3) display remains. To return to the previous Full screen LAYOUT, rotate the Left Knob to Pg 1/3.



Figure 5-4 MFD Traffic Hot Key



Figure 5-5 MFD Traffic Advisory



Figure 5-6 MFD Traffic Display

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Chapter 6

ESV Display Options MENU

6.1 PFD Menu

The SV SETTINGS page in the MENU displays options for inhibiting the Terrain Warning System (terrain colorization and alerting), selecting the airports to be displayed or removing the Flight Path Marker from Synthetic Vision (**Figure 6-1**).

To access the SV SETTINGS page

1. Press the MENU Button and rotate the Right Knob to the SV SETTINGS page.
2. Select the Menu Key display option and rotate the Right Knob to the desired setting.
3. Press the MENU Button to exit.



Figure 6-1 PFD Menu



Figure 6-2 MFD Menu

6.2 MFD Menu

The CHART/SV SETTINGS page in the MENU displays options for Terrain Warning System (TWS), SV Airport Flag Display, and SV Aircraft Reference Symbol (**Figure 6-2**).

To access the CHART/SV SETTINGS A page

1. Press the MENU Button and rotate the Right Knob to the SV SETTINGS page.
2. Select the Menu Key display option and rotate the Right Knob to the desired setting.
3. Press the Menu Button to exit.

Chapter 7

ESV Failure Annunciations

All ESV Failure Annunciations are presented on the Data Bar of the PFD and on the bottom of each Synthetic Vision VIEW of the MFD. Additionally, an Invalid TWS (TWS slashed with a red line) is displayed whenever an ESV failure occurs.

When Synthetic Vision VIEW becomes unavailable on the PFD, the PFD reverts to the traditional blue over brown symbology and a text annunciation is presented on the display indicating the SV fault, e.g. "SV DATABASE UNAVAILABLE" (**Figure 7-1**).

When Synthetic Vision becomes unavailable on the MFD, the MFD Synthetic Vision VIEW turns black and a text annunciation indicating the failure is presented at the bottom of the SV VIEW, e.g. "SV POSITION INVALID" (**Figure 7-2**).

The following conditions will render ESV unavailable:

- Attitude, Altitude or Heading is invalid
- GPS is not receiving the position or the magnetic variation
- Database failure
- Aircraft is near or outside of the lateral limits of the database area
- While the terrain data is loading
- While the obstruction data is loading



Figure 7-1 SV DATABASE UNAVAILABLE Annunciation



Figure 7-2 SV POSITION INVALID Annunciation

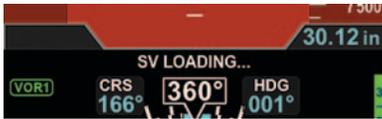


Figure 7-3 SV LOADING... Annunciation

NOTE

"SV LOADING..." is annunciated at start up or whenever SV Data is loading (Figure 7-3).

PFD Annunciation Display	Annunciation Description
	<p>SV UNAVAILABLE : ADAHRS FAIL The attitude, altitude or heading have become invalid</p>
	<p>SV DATABASE UNAVAILABLE The aircraft is outside the valid database area</p>
	<p>DATABASE FAIL The Jeppesen database failed</p>

Table 7-1 PFD ESV Failure Description

MFD Annunciation Display	Annunciation Description
	<p>SV POSITION INVALID The GPS is not receiving the position or magnetic variation</p>
	<p>ADAHRS FAIL (Thumbnail VIEW) The attitude, altitude or heading have become invalid</p>
	<p>SV DATABASE UNAVAILABLE The aircraft is outside the valid database area</p>
	<p>DATABASE FAIL The Jeppesen database failed</p>

Table 7-2 MFD ESV Failure Description

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Chapter 8

8.1 Database Confirmation Screen

The Confirmation Screen displays the validity dates of the currently loaded Jeppesen Database, the Synthetic Vision Awareness and Terrain Awareness messages (**Figure 8-1** and **Figure 8-2**).

The information presented on Synthetic Vision is advisory only. The pilot is responsible for terrain and obstacle avoidance by visual means or by following approved instrument procedures. At start up, the pilot must acknowledge this operational limitation and the validity dates on the confirmation screen by pressing either the Left or Right Knob.

8.2 MicroSD Card

This section contains the instructions for loading the Terrain, Obstacle, and Navigation databases into the EFD1000 or 500 system. Each Aspen MFD that uses the database must have a micro Secure Digital (microSD) card. If the EFD1000 PFD has Synthetic Vision, it too must have a microSD card loaded with the database.



Figure 8-1 Database Confirmation Screen

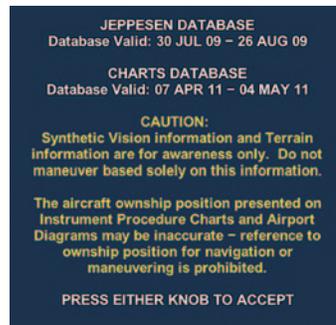


Figure 8-2 Database Confirmation Screen

8.3 Loading Database on microSD Card

The Terrain, Obstacle, and Navigation database information is loaded onto a microSD card that is shipped with the Aspen EFD1000 or EFD500 unit. Obstacle and Navigation databases data are combined and presented as a single update file from Jeppesen that is delivered every 28 days. Contact Jeppesen for information or subscribing to the data service and instructions for downloading data to the microSD card.



CAUTION

Do not expose the cards to electrostatic discharge or electrical interference.

Keep the cards out of direct sunlight.

If the microSD card is misplaced, contact Jeppesen directly to purchase an additional or replacement terrain card. Jeppesen Customer Service: 1-800-621-5377 or email captain@jeppesen.com.



NOTE

Only microSD cards received from Aspen Avionics or Jeppesen are authorized. Do not use other microSD cards for the Aspen systems.



NOTE

EFD1000 and EFD500 units with the Charts option have Charts loaded on the microSD card. Contact seattleavionics.com for update information.

8.4 Loading the microSD Card into the EFD System

The microSD card slot on the EFD is a small horizontal slot located on the lower part of the unit bezel in the center (Figure 8-3). The slot is spring-loaded with an integral locking mechanism. Pushing the card in once locks the card in place. Pushing it again releases the locking mechanism for removal.

8.4.1 Card Installation Procedure and Operational Check

Installation Procedure

1. Remove the card from the packaging.
2. Slide the card into the card slot with the label side face up and the metal contacts facing down and toward the unit.



CAUTION

Do not force the card. The microSD card only goes one way.

3. Press the card against the spring tension until it is fully inserted, then slowly release the pressure. The card will lock into place.



NOTE

It is possible to jam the card between the bezel and the outer edge of the card slot. If the card does not slide in smoothly, something is wrong. Make sure the card is in the card slot and oriented correctly.



Figure 8-3 microSD Card Slot Locations

Operational Check after installing the microSD card

1. Turn on the EFD system(s) and select the functions that use databases (Moving Map, Terrain, Charts, and Synthetic Vision).
2. Verify the EFD(s) start properly and the functions can be accessed.

8.4.2 Removal Procedure

microSD card Removal

1. Have a suitable packaging available to accept the card.
2. Press the card against the spring tension, then slowly release the pressure. The card will unlock and is ready to be removed.
3. Grasp the card with the thumb and forefinger and remove the card.
4. Place the microSD card in the packaging.



CAUTION

It is possible to push the card in with a fingernail and then suddenly release it, ejecting the microSD card. If the card is dropped, keep in mind that it can be resting on its side.

Chapter 9

Glossary

2D	Two-dimension	FOV2	Field of View 2 (Wide Field of View)
3D	Three-dimension	FP APT ONLY	Flight Plan Airports Only
		FPM	Flight Path Marker
ADAHRS	Air Data, Attitude and Heading Reference System		
AGL	Above Ground Level	GPS	Global Positioning System
ALL HRD SFC	All Hard Surface Runway Airports		
ATC	Air Traffic Control	INH	Inhibit
DIST	Distance	MFD	Multi-Function Display
		microSD	micro Secure Digital card
EFD	Evolution Flight Display		
EHA	Evolution Hazard Awareness	NDB	Non-Directional Beacon
ESV	Evolution Synthetic Vision	nm	Nautical Mile
FD	Flight Director	OAT	Outside Air Temperature
FOV	Field of View		
FOV1	Field of View 1 (Narrow Field of View)	PFD	Primary Flight Display

SV	Synthetic Vision
SV1	Synthetic Vision 1 (PFD Full Screen)
SV2	Synthetic Vision 2 (PFD Split Screen)
SV3	Synthetic Vision 3 (PFD Split Screen)
SV APT FLG DSPL	Synthetic Vision Airport Flag Display
SYNC	Synchronize
TAWS	Terrain Awareness and Warning System
TERR WRN SYS	Terrain Warning System
TFCA	Traffic Above
TFCB	Traffic Below
TFCN	Traffic Normal
TFCU	Traffic Unrestricted
TIS	Traffic Information System
TRFC	Traffic
TWS	Terrain Warning System
TWS INH	Terrain Warning System Inhibit
VOR	VHF Omnidirectional Radio Range
ZPL	Zero Pitch Line



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