



EGPWS

TAD - Terrain Alert Display

Provides a graphic display of the surrounding terrain on the Weather Radar Indicator.

Digital Values are displayed representing the highest terrain/obstacle elevation and the elevation for the bottom of the lowest color band.

Obstacles 100' elevation or higher

Airport Runways 3500' or longer

The terrain topography (within the display range selected) that is above or within 2,000 feet below the aircraft altitude is presented on the system display.

GREEN

Highest Terrain/Obstacle not within 500 feet of aircraft altitude
(250' w/gear down)

50% **Green** Fill

500' to 1000' below aircraft

YELLOW

Terrain/Obstacle Threat Area Caution

60 Secs. from projected impact

"Caution Terrain"

ALERT UP TO 8 NM

50% **Yellow** Fill

Between 1000' & 2000' feet above aircraft altitude

25% **Yellow** Fill

500' below to 1000' above aircraft altitude

(250' with gear down)

RED

Terrain/Obstacle Threat Area

Warning

50% **Red** Fill

More than 2000' above aircraft altitude

30 Secs. from projected impact:

"Terrain Terrain Pull Up"

ALERT UP TO 4 NM

BLACK

More than 2000' below the aircraft, or within 400' (vertical) of the nearest runway elevation is not displayed.

MAGENTA

Unknown Terrain

Not in Data-Base

500' CALLOUT

EGPWS - Another feature available in the Altitude Callouts is a "Smart 500" foot callout. When selected, this callout assists pilots during a non-precision approach by enunciating "FIVE HUNDRED" feet in addition to any other altitude callout if selected in the initial setup. The EGPWS determines a non-precision approach when Glideslope is greater than 2 dots deviation (valid or not) or a back-course approach is detected.

This feature has the distinction of adding the 500-foot callout during non-precision approaches and removing the 500-foot callout on precision approaches when part of the callout option.

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"**PEAKS**" is a TAD supplemental feature providing additional display features for enhanced situational awareness, independent of the aircraft's altitude. This includes digital elevations for the highest and lowest displayed terrain, additional elevation (color) bands, and a unique representation of 0 MSL elevation (sea level and its corresponding shoreline). This feature is an option, enabled by program pins during installation.

GPWS vs. EGPWS

GPWS works off of an aircraft's radar altimeter. If the system senses that the aircraft is getting dangerously close to the ground, it alerts the crew. However, since the altimeter is looking straight down and not in front of the aircraft, very steep terrain such as a vertical rock face would give almost no warning. Secondly, GPWS was inhibited if the aircraft was in the landing configuration.

EGPWS addresses these issues. The system receives the aircraft's position and velocity information from either GPS or the aircraft's INS/IRS. It then checks this position with a terrain database stored in the EGPWS system. The system will look ahead of the aircraft and see if the potential for a collision with terrain exists. This is the big advantage of EGPWS. The predictive ability allows for greater warning time to the crew. This is why there is such a great rush to implement the system.

Another improvement is that the system still works if the aircraft is in the landing configuration.

A final great improvement is that EGPWS will give you a visual depiction of the terrain around the aircraft. Terrain above the aircraft's altitude is shown as either yellow or red depending on the height above the aircraft of the terrain.

FOM 4.4.1

In Day VMC conditions, any CAUTION or WARNING MUST be visually verified prior to descending in order NOT to take any corrective action.

In IMC or Night, an immediate full power recovery to a safe altitude shall be initiated using the recovery procedure outlined in the AFM and/or the aircraft SOPs as appropriate.

If, in response to terrain avoidance CAUTION or WARNING, the aircraft is operated contrary to an ATC clearance, notify ATC immediately.

Note: In any instance of Terrain Avoidance WARNING the PIC shall notify the Chief Pilot / ACP on duty as soon as possible.

All other ADVISORIES and CALL OUTS: Take action appropriate to the type of advisory as outlined in the aircraft's SOP and/or the AFM.

The system monitors an aircraft's height above ground as determined by a radio altimeter. A computer then keeps track of these readings, calculates trends, and will warn the captain with visual and audio messages if the aircraft is in certain defined flying configurations ("modes").

The modes are:

1. Excessive descent rate ("SINK RATE" "PULL UP")
2. Excessive terrain closure rate ("TERRAIN" "PULL UP")
3. Altitude loss after takeoff or with a high power setting ("DON'T SINK")

4. Unsafe terrain clearance ("TOO LOW – TERRAIN" "TOO LOW – GEAR" "TOO LOW – FLAPS")
5. Excessive deviation below glideslope ("GLIDESLOPE")
6. Excessively steep bank angle ("BANK ANGLE")
7. Windshear protection ("WINDSHEAR")

Traditional GPWS does have a blind spot. Since it can only gather data from directly below the aircraft, it must predict future terrain features. If there is a dramatic change in terrain, such as a steep slope, GPWS will not detect the aircraft closure rate until it is too late for evasive action.

In the late 1990s improvements were made and the system was renamed "Enhanced Ground Proximity Warning System" (EGPWS/TAWS). The system was now combined with a worldwide digital terrain database and relies on Global Positioning System (GPS) technology. On-board computers compared its current location with a database of the Earth's terrain. The Terrain Display now gave pilots a visual orientation to high and low points nearby the aircraft.

EGPWS software improvements were focused on solving two common problems; no warning at all, and late or improper response.

The primary cause of CFIT occurrences with no GPWS warning is landing short. When the landing gear is down and landing flaps are deployed, the GPWS expects the airplane to land and therefore, issues no warning. EGPWS introduces the Terrain Clearance Floor (TCF) function, which provides GPWS protection even in the landing configuration.

The occurrence of a GPWS alert typically happens at a time of high workload and nearly always surprises the flight crew. Almost certainly, the aircraft is not where the pilot thinks it should be, and the response to a GPWS warning can be late in these circumstances. Warning time can also be short if the aircraft is flying into steep terrain since the downward looking radio altimeter is the primary sensor used for the warning calculation. The EGPWS improves terrain awareness and warning times by introducing the Terrain Display and the Terrain Data Base Look Ahead protection.