MK V and MK VII EGPWS

Honeywell

PILOT'S GUIDE

Enhanced Ground Proximity Warning System (EGPWS) and Flight Safety Functions TSO C151b Class A TAWS

ID-298262

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SECTION 1 INTRODUCTION

This Pilot Guide describes the functions and operation of the MK V and MK VII Enhanced Ground Proximity Warning System (EGPWS).

The document is divided into four sections:

Section 1 is this introduction and the following brief description of the EGPWS and its features.

Section 2 provides a functional description of the EGPWS. This includes descriptions of the various system modes; Built-In-Test (BIT) and monitoring functions, and system features.

Section 3 provides general operating procedures to follow when the system gives a caution or warning alert.

Section 4 provides definitions of terms used in this manual.

This guide does not supersede FAA approved data, Flight Manuals, individual Operations Manuals, requirements, or procedures. Pilots should be thoroughly familiar with their own company policies, system configuration, requirements, and procedures with respect to the operation of the aircraft with the EGPWS.

The information in this document is intended as a general explanation of the Honeywell EGPWS. It contains a general description of system performance assuming identified options are active, and highlights deviations in system performance resulting when a feature is disabled.

What is the EGPWS?

The EGPWS is a Terrain Awareness and Alerting system providing terrain alerting and display functions with additional features meeting the requirements of TSO C151b Class A TAWS.

The EGPWS uses aircraft inputs including geographic position, attitude, altitude, airspeed, and glideslope deviation. These are used with internal terrain, obstacles, and airport runway databases to predict a potential conflict between the aircraft flight path and terrain or an obstacle. A terrain or obstacle conflict results in the EGPWS providing a visual and audio caution or warning alert.

Additionally, the EGPWS provides alerts for excessive glideslope deviation, too low with flaps or gear not in landing configuration, and optionally provides bank angle and altitude callouts based on system program pin selection. Detection of severe windshear conditions is also provided for selected aircraft types when enabled.

What is the EGPWS? Continued

The EGPWS incorporates several "enhanced" features:

- **Terrain Alerting and Display (TAD)** provides a graphic display of the surrounding terrain on the Weather Radar Indicator, EFIS, or a dedicated display. Based on the aircraft's position and the internal database, the terrain topography (within the display range selected) that is above or within 2000 feet below the aircraft altitude is presented on the system display. This feature is an option, enabled by program pins during installation.
- **"Peaks"** is a TAD supplemental feature providing additional terrain 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.
- **"Obstacles"** is a feature utilizing a database of man-made objects for obstacle conflict alerting and display. Additionally, when TAD is enabled, Obstacles are graphically displayed similar to terrain. This feature is an option, enabled by program pins during installation.
- **Envelope Modulation** is a feature utilizing a database of airport approach and departure profiles to tailor EGPWS alerts at certain geographic locations to reduce nuisance alerts and provide added protection.
- A **Terrain Clearance Floor (TCF)** feature adds an additional element of protection by alerting the pilot of possible premature descent. This is intended for non-precision approaches and is based on the current aircraft position relative to the nearest runway. This feature is enabled with the TAD feature.
- The **Runway Field Clearance Floor (RFCF)** feature is circular band similar to the TCF feature except that RFCF is based on the current aircraft position and height above the destination runway based on Geometric Altitude (see next page) and only extends 5 NM past the end of the runway. This provides improved protection at locations where the destination runway is significantly higher than the surrounding terrain. (In -210-210 and later versions).
- An **Aural Declutter** feature reduces the repetition of warning messages. This feature is optional, and may be disabled by system program pins during installation.

What is the EGPWS?

Continued

- **Geometric Altitude,** based on GPS altitude, is a computed pseudo-barometric altitude designed to reduce or eliminate altitude errors resulting from temperature extremes, nonstandard pressure altitude conditions, and altimeter miss-sets. This ensures an optimal EGPWS alerting and display capability.
- The **Runway Awareness & Advisory System (RAAS)** option provides alerts and advisories that increase crew situational awareness during operations on and around airports. This feature is an option, enabled by PCMCIA card, available in -218-218 or later versions.
- The **SMARTRUNWAY®** option provides alerts and advisories that increase crew situational awareness during operations on and around airports; combining the RAAS functions with added improvements for Taxiway Landing, Taxiway Takeoff, Short Runway Cautions, Visual Messaging, and Takeoff Flap Monitor (incorrect takeoff flap configuration). These features are optional, enabled by PCMCIA card, available in -230-230 or later versions.
- The **SMARTLANDING™** option provides visual and aural annunciations that supplement flight crew awareness of un-stabilized approaches, altimeter setting problems, landing long and select RAAS advisories. These features are optional, enabled by PCMCIA card, available in -230-230 or later versions.

Physical Description

Some of these features have been added to the EGPWS as the system evolved and are not present in all Enhanced Ground Proximity Warning Computer (EGPWC) part numbers. For specific effectivity, refer to an applicable Airplane Flight Manual (AFM) or EGPWS Airplane Flight Manual Supplement (AFMS) or contact Honeywell for assistance.

The EGPWC is packaged in a 2 MCU ARINC 600-6 rack mounted enclosure weighing less than 8 lbs. No special vibration isolation mounting or forced air-cooling is required.

115 VAC (400 Hz.) or 28 VDC versions of the EGPWC are available. Units are also available with an internal GPS receiver for required GPS data when another GPS source is not available.

For more detailed descriptions and information, contact Honeywell.

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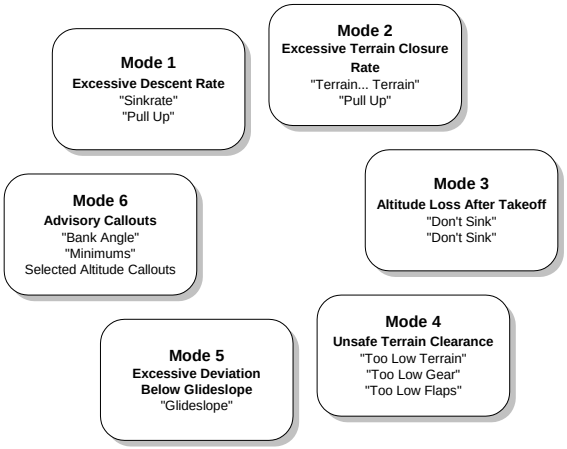
Enhanced Ground Proximity Warning System

The EGPWS incorporates the functions of the basic Ground Proximity Warning System (GPWS). This includes the following alerting modes:



Additionally, Windshear alerting (Mode 7) is provided for specific aircraft types. Mode 7 provides windshear caution and/or warning alerts when an EGPWS windshear threshold is exceeded.

EGPWS Database

The EGPWS adds to these 7 basic functions the ability to compare the aircraft position to an internal database and provide additional alerting and display capabilities for enhanced situational awareness and safety (hence the term "Enhanced" GPWS).

The EGPWS internal database consists of four sub-sets:

1. A worldwide terrain database of varying degrees of resolution.
2. An obstacles database containing cataloged man-made objects 100 feet or greater in height located within North America, portions of Europe and portions of the Caribbean (expanding as data is obtained).
3. A worldwide airport database containing information on runways 3500 feet or longer in length. For a specific list of the airports included, refer to Honeywell document 060-4267-000 or access on the Internet at website www.egpws.com.
4. An Envelope Modulation database containing information on airport approach and departure profiles to support the Envelope Modulation feature.

EGPWS Database

Continued

Honeywell is constantly striving to improve the EGPWS database in content, resolution, and accuracy. Notification of a database update is accomplished by Service Bulletin. Database updates are distributed on PCMCIA data cards and downloaded via a card slot in the front panel of each EGPWC. Contact Honeywell for additional information.

Because the overwhelming majority of "Controlled Flight Into Terrain" (CFIT) accidents occur near an airport, and the fact that aircraft operate in close proximity to terrain near an airport, and to address prevention of airport runway/taxiway incursions, the terrain database contains higher resolution grids for airport areas. Lower resolution grids are used outside airport areas where aircraft enroute altitude make CFIT accidents less likely and terrain feature detail is less important to the flight crew.

With the use of accurate GPS or FMS information, the EGPWS is provided present position, track, and ground speed. With this information the EGPWS is able to present a graphical plan view of the aircraft relative to the terrain and advise the flight crew of a potential conflict with the terrain or obstacle. Conflicts are recognized and alerts provided when terrain violates specific computed envelope boundaries on the projected flight path of the aircraft. Alerts are provided in the form of visual light annunciation of a caution or warning, audio annunciation based on the type of conflict, and color enhanced visual display of the terrain or obstacle relative to the forward look of the aircraft. The terrain display is provided on the Weather Radar Indicator, EFIS display, or a dedicated EGPWS display and may or may not be displayed automatically.

Also available with high integrity GPS data is alerting advisory information to help prevent runway/taxiway incursions in the form of audio advisory alerts.

The following sections provide functional descriptions of the EGPWS basic and enhanced functions and features, and system input and output requirements.

The operator should have a program of continuous maintenance that checks the system operation periodically, updates the software to the latest available, and ensures a policy of updating the runway, terrain and obstacle databases.

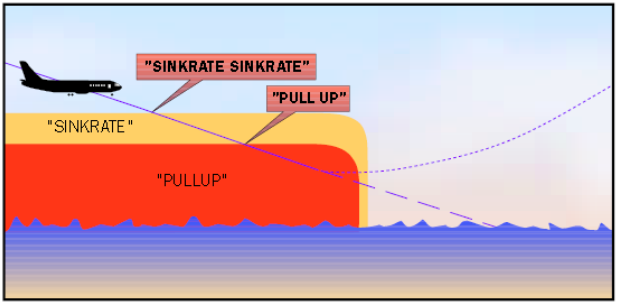
BASIC FUNCTIONS:

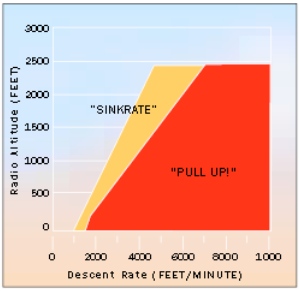
MODE 1

Excessive Descent Rate

Mode 1 provides alerts for excessive descent rates with respect to altitude AGL and is active for all phases of flight. This mode has inner and outer alert boundaries as illustrated in the diagram and graph below.

Penetration of the outer boundary activates the EGPWS caution lights and **"SINKRATE, SINKRATE"** alert annunciation. Additional **"SINKRATE, SINKRATE**" messages will occur for each 20% degradation in altitude. During the time that the Sinkrate aural is inhibited and the alert lamp is ON, the Mode 5 aural "Glideslope" is allowed to annunciate for excessive glideslope deviation below the beam.





Penetration of the inner boundary activates the EGPWS warning lights and changes the audio message to **"PULL UP"** which repeats continuously until the inner warning boundary is exited.

Note: "Pull Up" may be preceded by "Whoop, Whoop" in some configurations based on the audio menu option selected.

MODE 1

Continued

Glideslope Deviation Bias

If a valid ILS Glideslope front course is received and the aircraft is above the glideslope centerline, the outer (sinkrate) boundary is adjusted to desensitize the sinkrate alerting. This is to prevent unwanted alerts when the aircraft is safely capturing the glideslope (or repositioning to the centerline) from above the beam.

If the Aural Declutter feature is disabled, the Sinkrate alert boundary remains fixed and the aural message **"SINKRATE"** repeats continuously until the outer boundary is exited.

Envelope Modulation

Through Envelope Modulation, both boundaries can be biased to the right at certain airports to minimize nuisance alerts or warnings.

Steep Approach Bias

The EGPWS offers a Steep Approach option for given aircraft types that desensitizes the alert boundaries to permit steeper than normal approaches without unwanted alerts. If Steep Approach is selected (active) then the cockpit self-test is inhibited if the aircraft is on the ground.

For Airbus A318/319/320/321 with version -226-226/-003 or later, when Steep Approach is active Mode 1 is disabled below 130 ft and no other Mode 1 bias functions are allowed to operate (Envelope Modulation or above the beam Glideslope bias).

MODE 2

Excessive Closure to Terrain

Mode 2 provides alerts to help protect the aircraft from impacting the ground when rapidly rising terrain with respect to the aircraft is detected. Mode 2 is based on Radio Altitude and on how rapidly Radio Altitude is decreasing (closure rate). Mode 2 exists in two forms, 2A and 2B.

MODE 2A

Mode 2A is active during climbout, cruise, and initial approach (flaps not in the landing configuration and the aircraft not on glideslope centerline). If the aircraft penetrates the Mode 2A caution envelope, the aural message **"TERRAIN, TERRAIN"** is generated and cockpit EGPWS caution lights will illuminate. If the aircraft continues to penetrate the envelope, the EGPWS warning lights will illuminate and the aural warning message **"PULL UP"** is repeated continuously until the warning envelope is exited.

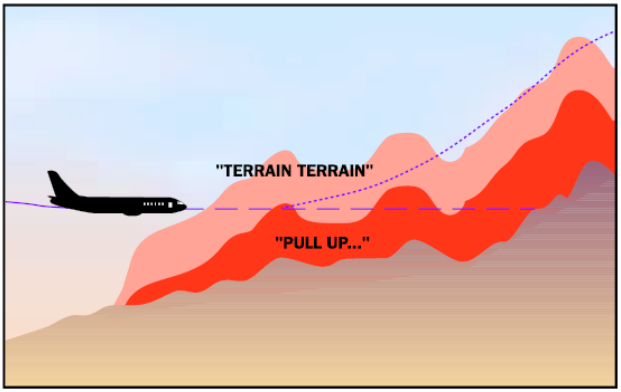
Note: "Pull Up" may be preceded by "Whoop, Whoop" in some configurations based on the audio menu option selected.

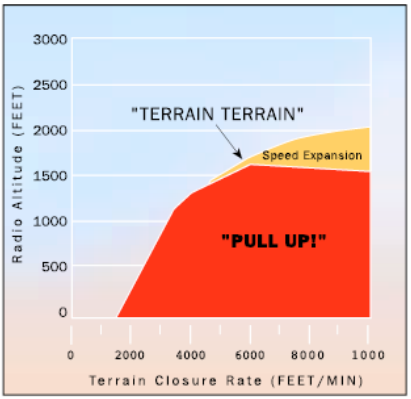
Upon exiting the warning envelope, if terrain clearance continues to decrease, the aural message **"TERRAIN"** will be given until the terrain clearance stops decreasing. In addition, the visual alert will remain on until the aircraft has gained 300 feet of barometric altitude, 45 seconds has elapsed, or landing flaps or the flap override switch is activated.

MODE 2A

Continued

The graph below shows how the upper boundary of the Mode 2 alert envelope varies as a function of the aircraft speed. As airspeed increases from 220 knots to 310 knots, the boundary expands to provide increased alert times at higher airspeeds.



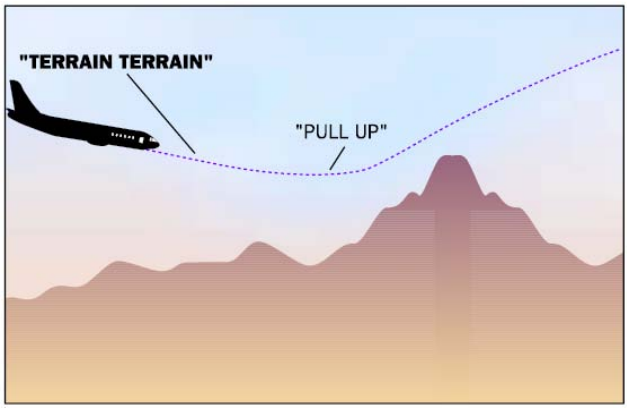


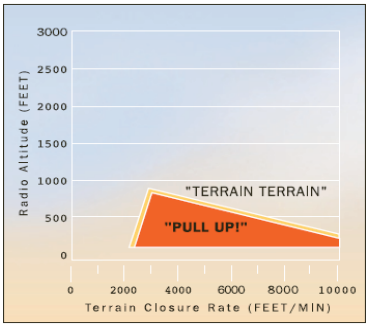
With version -210-210 and later models, the Mode 2A upper limit is reduced to 1250 feet (950 feet with version -218-218 and later) for all airspeeds when the Terrain Alerting and Display (TAD) function is enabled and available. This is due to the enhanced alerting capability provided with TAD, resulting from high integrity GPS Altitude and Geometric Altitude data. The Mode 2A envelope is lowered in order to reduce the potential for nuisance alerts during an approach. This modification allows EGPWS operation to be compatible with RADAR vectoring minimum terrain clearances.

MODE 2B

Mode 2B provides a desensitized alerting envelope to permit normal landing approach maneuvers close to terrain without unwanted alerts. Mode 2B is automatically selected with flaps in the landing configuration (landing flaps or flap over-ride selected) or when making an ILS approach with Glideslope and Localizer deviation less than 2 dots. It is also active during the first 60 seconds after takeoff.

With version -210-210 and later models, Mode 2B is selected when the aircraft is within 5 NM (10 NM with version -218-218 and later) and 3500 feet of the destination airport (independent of configuration) and the Terrain Alerting and Display (TAD) function is enabled and available. This is due to the enhanced alerting capability provided with TAD, resulting from high integrity GPS Altitude and Geometric Altitude data. The Mode 2B envelope is selected in order to reduce the potential for nuisance alerts during an approach.





The graph above shows the Mode 2B envelope.

MODE 2B

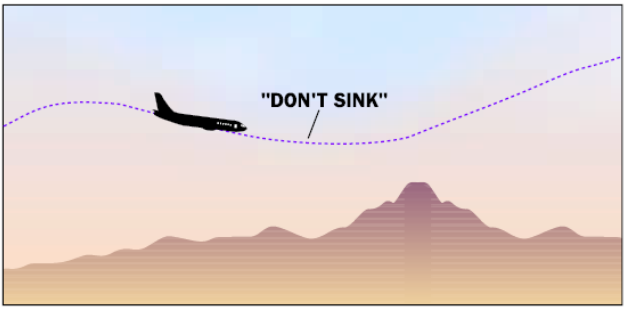
Continued

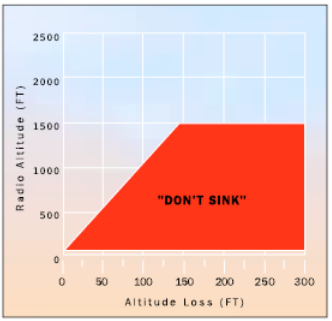
During an approach, if the aircraft penetrates the Mode 2B envelope with either the gear or flaps not in the landing configuration, the aural message **"TERRAIN, TERRAIN"** is generated and the EGPWS caution lights illuminate. If the aircraft continues to penetrate the envelope, the EGPWS warning lights illuminate and the aural message **"PULL UP"** is repeated continuously until the warning envelope is exited. If the aircraft penetrates the Mode 2B envelope with both gear and flaps in the landing configuration, the aural **"PULL UP"** messages are suppressed and the aural message **"TERRAIN"** is repeated until the envelope is exited.

MODE 3

Altitude Loss After TakeOff

Mode 3 provides alerts for significant altitude loss after takeoff or low altitude go-around (less than 245 feet AGL or 150 feet, depending on aircraft type) with gear or flaps not in the landing configuration. The amount of altitude loss that is permitted before an alert is given is a function of the height of the aircraft above the terrain as shown below. This protection is available until the EGPWS determines that the aircraft has gained sufficient altitude or that it is no longer in the takeoff phase of flight. Significant altitude loss after takeoff or during a low altitude go-around activates the EGPWS caution lights and the aural message "**DON'T SINK, DON'T SINK"**.





MODE 3

Continued

The aural message is enunciated twice for each 20% degradation in altitude. Upon establishing a positive rate of climb, the EGPWS caution lights extinguish and the aural alert will cease.

If the Aural Declutter feature is disabled, the warning is enunciated continuously until positive climb is established.

MODE 4

Unsafe Terrain Clearance

Mode 4 provides alerts for insufficient terrain clearance with respect to phase of flight, configuration, and speed. Mode 4 exists in three forms, 4A, 4B, and 4C.

- Mode 4A is active during cruise and approach with the gear and flaps not in the landing configuration.
- Mode 4B is active during cruise and approach with the gear in the landing configuration and flaps not in the landing configuration.
- Mode 4C is active during the takeoff phase of flight with either the gear or flaps not in the landing configuration.

Mode 4 alerts activate the EGPWS caution lights and aural messages.

To reduce nuisance alerts caused by over-flying another aircraft, the upper limit of the Mode 4A/B alerting curve can be reduced (from 1000) to 800 feet. This occurs if the airplane is above 250 knots with gear and flaps not in landing configuration and a sudden change in Radio Altitude is detected. This is intended to eliminate nuisance alerts while flying a holding pattern and an aircraft over-flight occurs (with 1000 foot separation).

With version -210-210 and later models, Mode 4 airspeed expansion is disabled (upper limit held at lowest airspeed limit) when the Terrain Alerting and Display (TAD) function is enabled and available. This is due to the enhanced alerting capability provided with TAD, resulting from high integrity GPS Altitude and Geometric Altitude data. This change to the Mode 4 envelopes reduces the potential for nuisance alerts when the aircraft is not in the landing configuration.

MODE 4A

Mode 4A is active during cruise and approach with gear and flaps up. This provides alerting during cruise for inadvertent flight into terrain where terrain is not rising significantly, or the aircraft is not descending excessively. It also provides alerting for protection against an unintentional gear-up landing.

MODE 4A

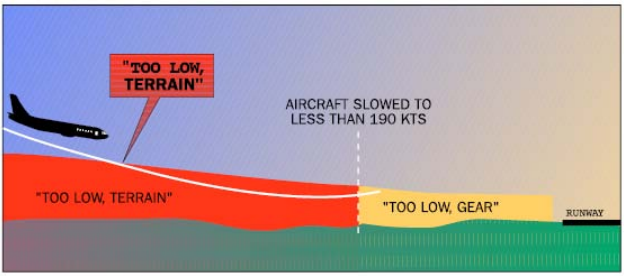
Continued

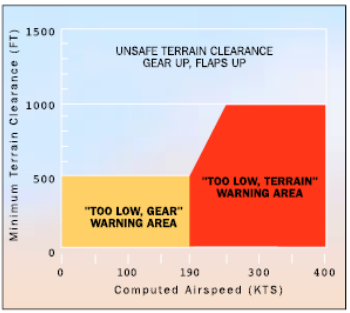
Below 1000 feet AGL and above 190 knots airspeed, the Mode 4A aural alert is **"TOO LOW TERRAIN"**. This alert is dependent on aircraft speed such that the alert threshold is ramped between 500 feet at 190 knots to 1000 feet at 250 knots.

Below 500 feet AGL and less than 190 knots airspeed, the Mode 4A aural alert is **"TOO LOW GEAR".**

For either Mode 4A alert, subsequent alert messages occur for each 20% degradation in altitude. EGPWS caution lights extinguish and aural messages cease when the Mode 4A alert envelope is exited.

If the Aural Declutter feature is disabled, mode 4A alert messages are repeated continuously until the Mode 4A envelope is exited.





MODE 4B

Mode 4B is active during cruise and approach, with gear down and flaps not in the landing configuration.

Below 1000 feet AGL and above 159 knots (185 knots for Boeing 747-8) airspeed, the Mode 4B aural alert is **"TOO LOW TERRAIN"**. This alert is dependent on aircraft speed such that the alert threshold is ramped between 245 feet at 159 knots (185 knots for Boeing 747-8) to 1000 feet at 250 knots.

MODE 4B

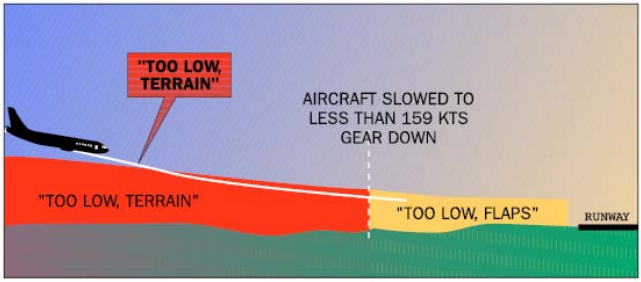
Continued

Below 245 feet AGL and less than 159 knots (185 knots for Boeing 747-8) airspeed, the Mode 4B aural alert is **"TOO LOW FLAPS"**. For turboprop and selected turbofan aircraft, the **"TOO LOW FLAPS"** warning curve is lowered to 150 feet AGL and less than 148 knots.

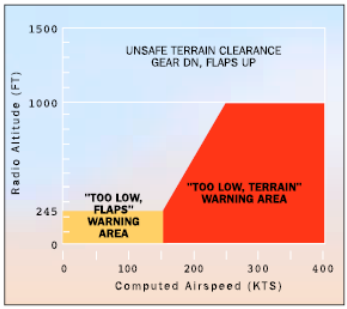
If desired, the pilot may disable the **"TOO LOW FLAPS"** alert by engaging the Flap Override switch (if installed). This precludes or silences the Mode 4B flap alert until reset by the pilot.

If the aircraft's Radio Altitude decreases to the value of the Minimum Terrain Clearance (MTC), the EGPWS caution illuminates and the aural message **"TOO LOW TERRAIN"** is enunciated.

For either Mode 4B alert, subsequent alert messages occur for each 20% degradation in altitude. EGPWS caution lights extinguish and aural messages cease when the Mode 4B alert envelope is exited.



If the Aural Declutter feature is disabled, mode 4B alert messages are repeated continuously until the Mode 4B envelope is exited.



MODE 4C

The Mode 4C alert is intended to prevent inadvertent controlled flight into the ground during takeoff climb into terrain that produces insufficient closure rate for a Mode 2 alert. After takeoff, Mode 4A and 4B provide this protection.

MODE 4C

Continued

Mode 4C is based on an EGPWS computed Minimum Terrain Clearance (MTC) floor that increases with Radio Altitude. It is active after takeoff when the gear or flaps are not in the landing configuration. It is also active during a low altitude go-around if the aircraft has descended below 245 feet AGL (or 150 feet depending on aircraft type).

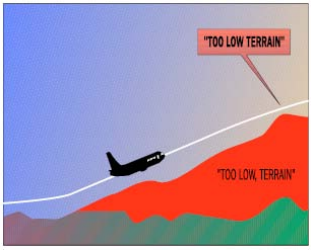
At takeoff the Minimum Terrain Clearance (MTC) is zero feet. As the aircraft ascends the MTC is increased to 75% of the aircraft's Radio Altitude (averaged over the previous 15 seconds).

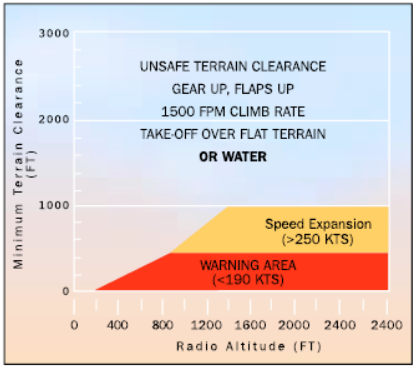
This value is not allowed to decrease and is limited to 500 feet AGL for airspeed less than 190 knots. Beginning at 190 knots, the MTC increases linearly to the limit of 1000 feet at 250 knots.

If the aircraft's Radio Altitude decreases to the value of the MTC, the EGPWS caution illuminates and the aural message **"TOO LOW TERRAIN"** is enunciated.

EGPWS caution lights extinguish and aural messages cease when the Mode 4C alert envelope is exited.

If the Aural Declutter feature is disabled, mode 4C alert messages are repeated continuously until the Mode 4C envelope is exited.





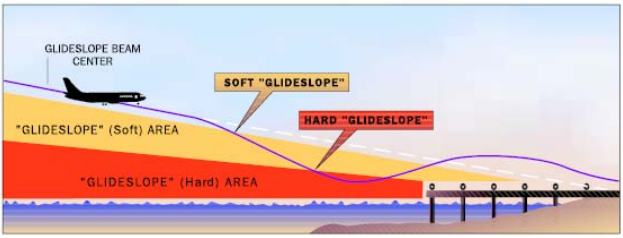
MODE 5

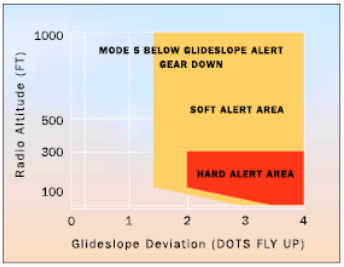
Excessive Deviation Below Glideslope

Mode 5 provides two levels of alerting for when the aircraft descends below glideslope, resulting in activation of EGPWS caution lights and aural messages.

The first level alert occurs when below 1000 feet Radio Altitude and the aircraft is 1.3 dots or greater below the beam. This turns on the caution lights and is called a "soft" alert because the audio message **"GLIDESLOPE"** is enunciated at half volume. 20% increases in the below glideslope deviation cause additional **"GLIDESLOPE"** messages enunciated at a progressively faster rate.

The second level alert occurs when below 300 feet Radio Altitude with 2 dots or greater glideslope deviation. This is called a "hard" alert because a louder **"GLIDESLOPE, GLIDESLOPE"** message is enunciated every 3 seconds continuing until the "hard" envelope is exited. The caution lights remain on until a glideslope deviation less than 1.3 dots is achieved.





To avoid unwanted Below Glideslope alerts when capturing the localizer between 500 and 1000 feet AGL, alerting is varied in the following ways:

- Below Glideslope alerts are enabled only if the localizer is within 2 dots, landing gear and flaps are selected, Glideslope Cancel is not active, and a front course approach is determined.

MODE 5

Continued

- The upper altitude limit for the alert is modulated with vertical speed. For descent rates above 500 FPM, the upper limit is set to the normal 1000 feet AGL. For descent rates lower than 500 FPM, the upper limit is desensitized (reduced) to a minimum of 500 feet AGL.

Additionally, both alert levels are desensitized below 150 feet AGL, to allow for normal beam variations nearer the ground, and reduce the possibility of nuisance alerts.

If the Aural Declutter feature is disabled, messages are repeated continuously until the Mode 5 envelope is exited.

Mode 5 alerts can be canceled by pressing the Glideslope Cancel switch (if installed). The EGPWS will interpret this switch one of two ways depending on the installation configuration.

- A *standard* glideslope cancel switch allows for manually canceling Mode 5 alerting any time below 2000 feet AGL. This is automatically reset when the aircraft descends below 50 feet or climbs above 2000 feet AGL (1000 feet AGL for current Boeing production aircraft).
- An *alternate* glideslope cancel switch allows for manually canceling Mode 5 alerting at any time and any altitude. The cancel is reset by again pressing the cancel switch, or automatically if gear or flaps are raised, or the aircraft is on the ground. Due to the nature of the alternate cancel switch, this method requires that there be a cockpit annunciation that glideslope cancel is in effect (this configuration is currently not allowed on aircraft operating under FAA part 121 rules).

EGPWS Mode 5 alerts are inhibited during backcourse approaches to prevent nuisance alerts due to false fly up lobes from the Glideslope. The EGPWC determines a backcourse approach if either: 1) the aircraft's magnetic track is greater than 90 degrees from the runways approach course, or 2) a glideslope inhibit discrete is set.

MODE 6

Advisory Callouts

Mode 6 provides EGPWS advisory callouts based on the menu-selected option established at installation (set by program pin configuration). These callouts consist of predefined Radio Altitude based voice callouts or tones and an excessive bank angle advisory. There is no visual alerting provided with these callouts.

MODE 6

Continued

Altitude Callouts

The following is a list of each of the possible altitude callouts or tones:

CALLOUT	Occurs at (feet AGL)
"RADIO ALTIMETER"	2500
"TWENTY FIVE HUNDRED"	2500
"ONE THOUSAND"	1000 [a]
"EIGHT HUNDRED"	800 [a]
"FIVE HUNDRED"	500 [a]
Five Hundred Tone (2 second 960 Hz)	500
"FOUR HUNDRED"	400
"THREE HUNDRED"	300
"TWO HUNDRED"	200
"APPROACHING MINIMUMS"	DH+80 [b]
"APPROACHING DECISION HEIGHT"	DH+100 [b]
"PLUS HUNDRED"	DH+100 [b]
"FIFTY ABOVE"	DH+50 [b]
"MINIMUM"	DH [b]
"MINIMUMS"	DH [b]
"MINIMUMS - MINIMUMS"	DH [b]
"DECISION HEIGHT"	DH [b]
"DECIDE"	DH [b]
"ONE HUNDRED"	100
One Hundred Tone (2 second 700 Hz)	100
"EIGHTY"	80
"SIXTY"	60
"FIFTY"	50
"FORTY"	40
"THIRTY FIVE"	35
Thirty Five Tone (1 second 1400 Hz)	35
"THIRTY"	30
"TWENTY"	20
Twenty Tone (1/2 second 2800 Hz)	20
"TEN"	10
"FIVE"	5

a. May be Barometric Altitude above the field elevation for some aircraft types.
b. May be MDA or DH for some aircraft types.

MODE 6

Continued

In some cases a callout is stated twice (e.g., "MINIMUMS, MINIMUMS") but in all cases a given altitude callout is only annunciated once per approach.

Decision Height (DH) based callouts (Approaching Minimums, Minimums, etc.) require the landing gear to be down and occur when descending through the Radio Altitude corresponding to the selected DH. These also have priority over other altitude callouts when overlapping. For example, if DH is set to 200 and both "TWO HUNDRED" and MINIMUMS" are valid callouts, then only "MINIMUMS" will be called out at 200 feet AGL.

DH plus based callouts (e.g., Approaching Minimums) are only applicable for aircraft providing a Decision Height altitude to the EGPWS. Consequently, not all EGPWS installations can utilize these callout options.

Due to the variety of altitude callout choices available, it is not possible to identify every combination in this guide. Refer to an appropriate Airplane Flight Manual or EGPWS Airplane Flight Manual Supplement for callout identification in a specific application or contact Honeywell.

Smart 500 Foot Callout

Another feature available in the Altitude Callouts (options) 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 discussed above. The EGPWS determines a non-precision approach when Glideslope or Localizer is greater than 2 dots deviation (valid or not) or a back-course approach is detected or Glideslope Cancel is selected.

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.

MODE 6

Continued

Bank Angle Callout

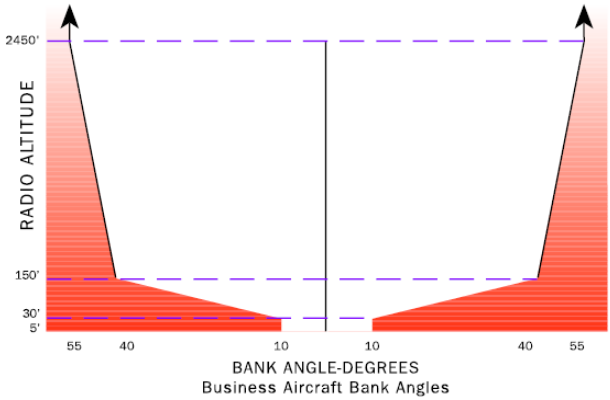
The callout **"BANK ANGLE, BANK ANGLE"** advises of an excessive roll angle. The EGPWS provides several excessive bank angle envelopes supporting Air Transport, Business, or Military aircraft types (only Air Transport and Business aircraft types are addressed below).

Business Bank Angle

One envelope is defined for turbo-prop and business jet aircraft (see graph below). Bank angles in excess of:

- ±10° between 5 and 30 feet,
- ±10 to 40° between 30 and 150 feet,
- ±40 to 55° between 150 and 2450 feet,
- 55° above 2450 feet

produce the bank angle advisory (shaded area). Bank angle advisories are inhibited below 5 feet.

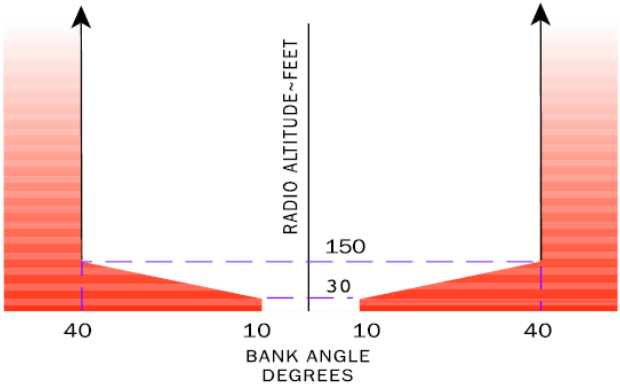


Business Aircraft Bank Angles

MODE 6
Air Transport Bank Angle

Three envelopes are defined for Air Transport aircraft. These are identified as Basic Bank Angle, Bank Angle Option 1, and Bank Angle Option 2 advisories.

The Air Transport Basic Bank Angle limits are similar to the Business Aircraft Bank Angle limits except above 150 feet the bank limit remains at 40 as shown below.



Bank Angle Option 1 provides bank angle advisory thresholds at 35, 40, and 45 independent of altitude. In this case, an advisory at 35 is provided and another is not given unless 40 is exceeded and then again only if 45 is exceeded. If the roll rate exceeds the audio callout time, then the bypassed limit is not indicated.

Also, when any one of the thresholds is exceeded, the bank angle must reduce below 30 for the process to reset before additional Bank Angle Advisories can be provided.

For example, if greater than 40 is obtained before the 35 callout is complete, another callout is provided only if 45 is obtained or the bank angle is reduced to less than 30 and then again increases to 35.

Bank Angle Option 2 provides a combination of the Basic Bank Angle and Bank angle Option 1. The Basic Bank Angle limits are provided below 130 feet, and Bank Angle Option 1 is provided above 130 feet.

Any one of these three Bank Angle limits can be selected by program pin if the aircraft type is defined as an Air Transport aircraft.

MODE 7

Windshear Alerting

Mode 7 is designed to provide alerts if the aircraft encounters windshear. Two alerting envelopes provide either a Windshear Caution alert or a Windshear Warning alert each with distinctive aural and visual indications to the flight crew.

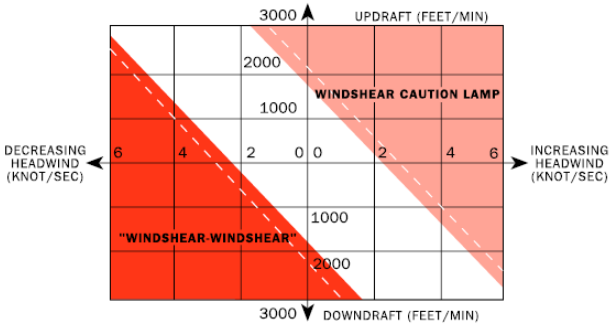
EGPWS windshear is provided for certain (not all) aircraft types and is a function of certain additionally required input signals and enabled internal detection algorithms. These are established during the initial installation and addressed in the appropriate Airplane Flight Manual (AFM) or EGPWS Airplane Flight Manual Supplement (AFMS).

Windshear Caution

Windshear Caution alerts are given if an increasing headwind (or decreasing tailwind) and/or a severe updraft exceeds the defined threshold. These are characteristic of conditions preceding an encounter with a microburst.

A Windshear Caution (if enabled) results in illumination of amber Windshear Caution lights and may (if separately enabled) also be accompanied by the aural message **"CAUTION, WINDSHEAR"**. The lights remain on for as long as the aircraft is exposed to conditions in excess of the caution alert threshold. The Windshear Caution envelope is illustrated in the figure below.

The Windshear Caution alerting can be disabled by EGPWS program pin selection so that only Windshear Warning alerts are provided.



Windshear Warning

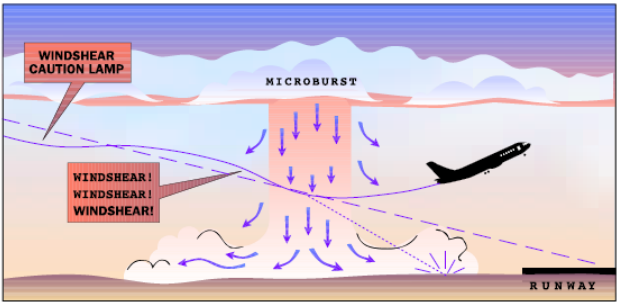
Windshear Warning alerts are given if a decreasing headwind (or increasing tailwind) and/or a severe downdraft exceeds the defined threshold. These are characteristic of conditions within or exiting an encounter with a microburst.

MODE 7

Continued

Windshear Warning

Windshear Warning results in illumination of red Windshear Warning lights and an aural siren followed by the message **"WINDSHEAR, WINDSHEAR, WINDSHEAR"**. The lights remain on for as long as the aircraft is exposed to conditions in excess of the warning alert threshold. The aural message will not repeat unless another separate windshear event is encountered. The threshold is adjusted as a function of available climb performance, flight path angle, airspeeds significantly different from normal approach speeds, and unusual fluctuations in Static Air Temperature (typically associated with the leading edge of a microburst). The Windshear Warning envelope is illustrated in the figure shown on page 25.



Mode 7 Windshear alerting is active under the following conditions:

- During takeoff; from rotation until an altitude of 1500 feet AGL is reached,
- During approach; From an altitude of 1500 feet down to 10 feet AGL,
- During a missed approach; until an altitude of 1500 feet AGL is reached.

ENHANCED FUNCTIONS:

Envelope Modulation

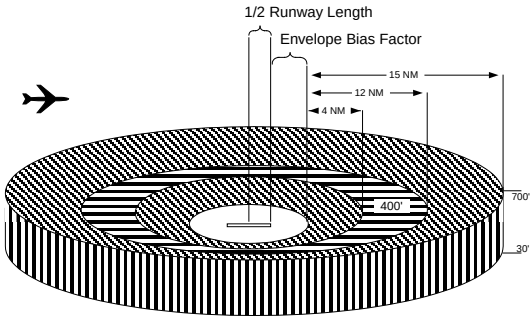
Due to terrain features at or near certain specific airports around the world, normal operations have resulted in nuisance or missed alerts at these locations in the past. With the introduction of accurate position information and a terrain and airport database, it is possible to identify these areas and adjust the normal alerting process to compensate for the condition.

The EGPWS Envelope Modulation feature provides improved alert protection and expanded alerting margins at identified key locations throughout the world. This feature is automatic and requires no flight crew action.

Modes 4, 5, and 6 are expanded at certain locations to provide alerting protection consistent with normal approaches. Modes 1, 2, and 4 are desensitized at other locations to prevent nuisance alerts that result from unusual terrain or approach procedures. In all cases, very specific information is used to correlate the aircraft position and phase of flight prior to modulating the envelopes.

Terrain Clearance Floor

The Terrain Clearance Floor (TCF) function (enabled with TAD) enhances the basic GPWS Modes by alerting the pilot of descent below a defined "Terrain Clearance Floor" regardless of the aircraft configuration. The TCF alert is a function of the aircraft's Radio Altitude and distance (calculated from latitude/longitude position) relative to the center of the nearest runway in the database (all runways greater than 3500 feet in length). The TCF envelope is defined for all runways as illustrated below and extends to infinity, or until it meets the envelope of another runway. The envelope bias factor is typically 1/2 to 2 nm and varies as a function of position accuracy.



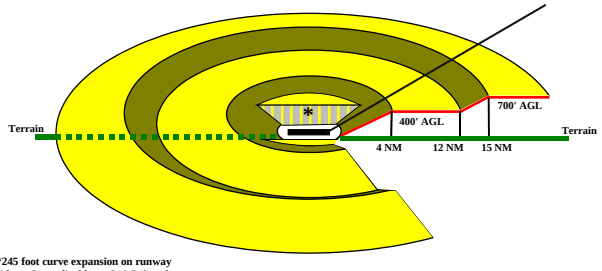
TCF Alert Envelope

Terrain Clearance Floor

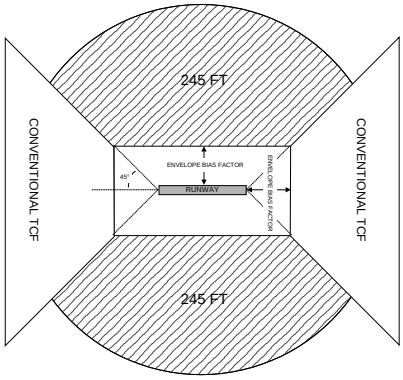
Continued

In -210-210 and later versions, the TCF alert envelope and Envelope Bias Factor are improved. The alert envelope is limited to a minimum of 245 feet AGL adjacent to the runway as illustrated in the following diagrams. The Envelope Bias Factor is reduced (moved closer to the runway) when higher accuracy aircraft position and runway position information is available.

This is typically 1/3 to 1 nm providing greater protection against landing short events. With version -218-218 and later models, the envelope bias factor is reduced to 1/4 nm if runway and position data is of high integrity.



***245 foot curve expansion on runway sides only applicable to -210-210 and on.**

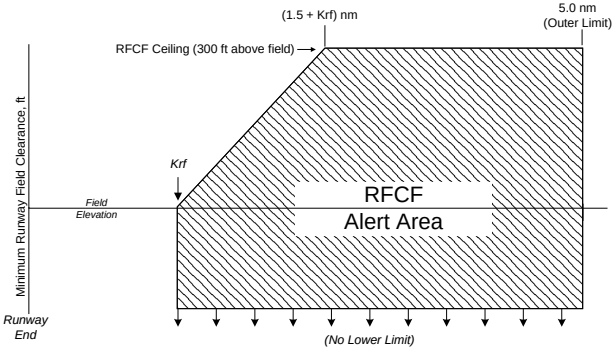


Also in -210-210 and later versions, runway selection logic is improved to better identify the destination runway. Comprehensive aircraft position and navigation information is used to evaluate proximate runways and determine the most likely destination runway for all alerting purposes.

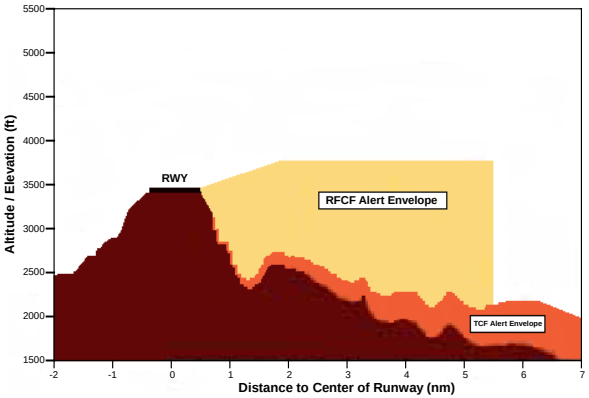
Runway Field Clearance Floor

In -210-210 and later versions, a **Runway Field Clearance Floor** feature is included. This is similar to the TCF feature except that RFCF is based on the current aircraft position and height above the destination runway, using Geometric Altitude (in lieu of Radio Altitude). This provides improved protection at locations where the runway is significantly higher than the surrounding terrain as illustrated below.

With version -218-218 and later models, the RFCF envelope is moved from 1nm to 1/2nm if runway and position data is of high integrity.



RFCF Alert Envelope



TCF and RFCF alerts result in illumination of the EGPWS caution lights and the aural message **"TOO LOW TERRAIN"**. The audio message is provided once when initial envelope penetration occurs and again only for additional 20% decreases in Radio Altitude. The EGPWS caution lights will remain on until the TCF and RFCF envelopes are exited.

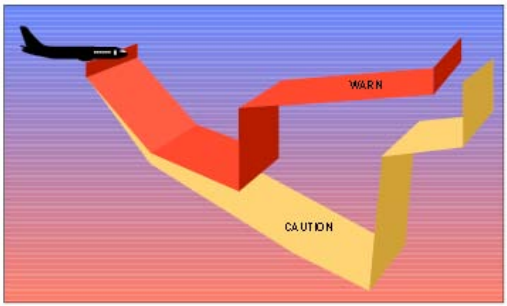
Terrain Look Ahead Alerting

Another enhancement provided by the internal terrain database, is the ability to look ahead of the aircraft and detect terrain or obstacle conflicts with greater alerting time.

This is accomplished (when enabled) based on aircraft position, flight path angle, track, and speed relative to the terrain database image forward the aircraft.

Through sophisticated look ahead algorithms, both caution and warning alerts are generated if terrain or an obstacle conflict with "ribbons" projected forward of the aircraft (see following illustration). These ribbons project down, forward, then up from the aircraft with a width starting at 1/4 nm and extending out at ±3º laterally, more if turning. The look-down and up angles are a function of the aircraft flight path angle, and the look-down distance a function of the aircraft's altitude with respect to the nearest or destination runway. This relationship prevents undesired alerts when taking off or landing. The look-ahead distance is a function of the aircraft's speed, and distance to the nearest runway.

A terrain conflict intruding into the caution ribbon activates EGPWS caution lights and the aural message **"CAUTION TERRAIN, CAUTION TERRAIN"** or **"TERRAIN AHEAD, TERRAIN AHEAD"**. An obstacle conflict provides a **"CAUTION OBSTACLE, CAUTION OBSTACLE"** or **"OBSTACLE AHEAD, OBSTACLE AHEAD"** message. The caution alert is given typically 60 seconds ahead of the terrain/obstacle conflict and is repeated every seven seconds as long as the conflict remains within the caution area. When the warning ribbon is intruded (typically 30 seconds prior to the terrain/obstacle conflict), EGPWS warning lights activate and the aural message **"TERRAIN, TERRAIN, PULL UP"** or **"OBSTACLE, OBSTACLE, PULL UP"** is enunciated with **"PULL UP"** repeating continuously while the conflict is within the warning area.



Terrain Look Ahead Alerting Continued

In -210-210 and later versions, the look-ahead alerting algorithms are improved at higher airspeeds (about 300 knots or greater). The look-ahead distance is designed to provide a 60-second warning alert up to 8 nm look-ahead (as opposed to 30-seconds or up to 4 nm). With version -218-218 and later, the look-ahead distance is increased by 12.5%, and the allowed terrain clearance height is increased for descents at high speeds to improve alerting times.

The specific aural message provided is established during the initial installation of the EGPWS as a function of whether or not the terrain and obstacles features are enabled and the selected audio menu (via program pin selection).

Refer to an applicable AFM or EGPWS AFMS for specific application information or contact Honeywell for additional information.

Terrain Alerting and Display

When a compatible Weather Radar, EFIS, or other display is available and enabled, the EGPWS Terrain Alerting and Display (TAD) feature provides an image of the surrounding terrain represented in various colors and intensities.

There are two types of TAD displays depending on the options selected. The original type provides a terrain image only when the aircraft is 2000 feet or less above the terrain. A second type called "Peaks" enhances the display characteristics to provide a higher degree of terrain awareness independent of the aircraft's altitude (available for selected display types in version -206-206 with additional displays added in later versions). In either case, terrain and obstacles (if enabled) forward of the aircraft are displayed. Obstacles are presented on the cockpit display as terrain, employing the same display-coloring scheme. TAD, Peaks and Obstacle functions are enabled by EGPWS program pin selection.

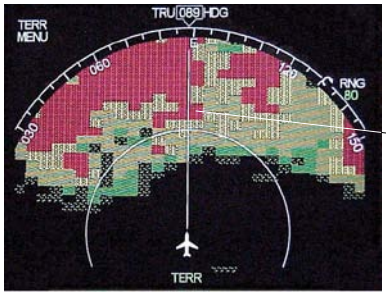
Note: With respect to Non-Peaks or Peaks display, terrain and or obstacle presentation is always based on (and scaled for) the geographic area available for display. Consequently, terrain and/or obstacles outside of the selected display range and defined display sweep do not have any effect on the displayed image.

Non-Peaks Display

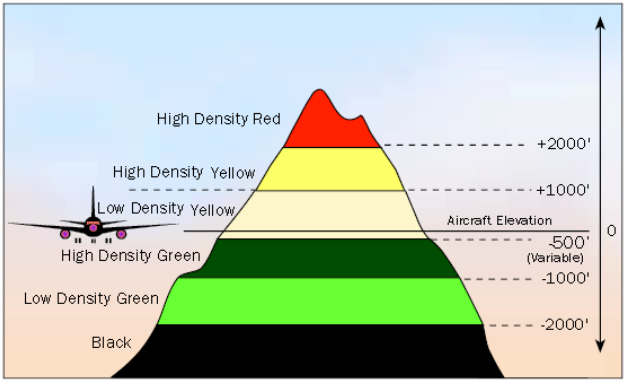
The Non-Peaks display provides a graphical plan-view image of the surrounding terrain as varying density patterns of green, yellow, and red as illustrated in the following graphics. The selected display range is also indicated on the display, and an indication that TAD is active is either indicated on the display (i.e., "**TERR**") or by an adjacent indicator.

Non-Peaks Display

Continued



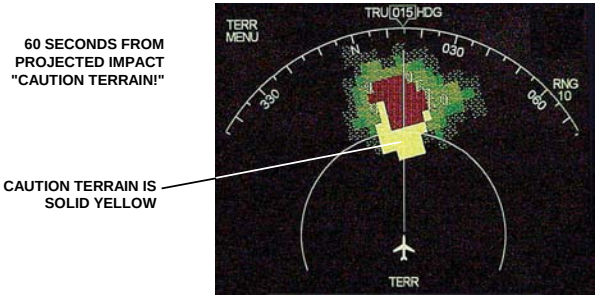
Each specific color and intensity represents terrain (and obstacles) below, at, or above the aircraft's altitude based on the aircraft's position with respect to the terrain in the database. If no terrain data is available in the terrain database, then this area is displayed in a low-density magenta color. Terrain more than 2000 feet below the aircraft, or within 400 (vertical) feet of the nearest runway elevation, is not displayed (black). With version -218-218 or later, the transition to black may occur below 400 feet based on runway and terrain database integrity for a given area.



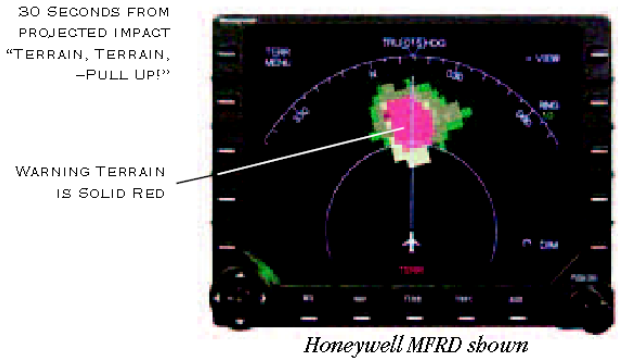
When a caution alert is triggered, the terrain (or obstacle) that created the alert is changed to solid yellow (100% density) as illustrated below.

Non-Peaks Display

Continued



When a warning alert is triggered, the terrain (or obstacle) that created the alert is changed to solid red (100% density) as illustrated below.



Honeywell MFRD shown

Note: When a TAD caution or warning alert is active, the display image (cells) surrounding the target are enlarged (surrounding cells are illuminated). This allows a smaller terrain or obstacle (e.g., a single tower) to be better seen on the display.

The transition between green and yellow is below the aircraft in order to account for altimetry and/or terrain/obstacle height errors. Also, the transition altitudes between colors are biased upward proportional to the descent rate when greater than 1000 feet per minute. This provides approximately a 30 second advance display of terrain.

Essentially, pilots should note that any yellow or red painted terrain is at, or above the aircraft's altitude and appropriate terrain clearance needs to be provided.

"Pop-Up" and "Auto-Range"

Based on the display system used, there may be additional terrain display features. These are defined as installation options and allow for:

- Automatic display of terrain on the cockpit display ("TAD pop-up") in the event that a caution or warning alert is triggered as described in Terrain Look Ahead Alerting. In some cases, an active display mode must be selected first.
- "Auto-range" when Pop-up occurs. This provides for the automatic range presentation for terrain as defined for the display system configuration (typically 10 nm). In some cases, if the terrain auto-range is different than the display system selected range, the displayed range value on the cockpit display is flashed or changes color until the range is manually reselected or terrain display is deselected.

PEAKS DISPLAY

Peaks Display has all the characteristics of the Non-Peaks Display but with additional terrain display features for enhanced situational awareness independent of the aircraft's altitude. The principle additions are:

- The digital display of the highest and lowest terrain/obstacle elevations currently displayed.
- The display of additional solid or lower density color bands, including the addition of the graphic representation of sea level (0 feet MSL).

With Terrain Display selected on, digital values representing the highest terrain/obstacle elevation and the elevation for the bottom of the lowest color band are displayed. These are based on the range selected (terrain in view).

The location of the digital values can vary somewhat for the display used, but for this guide will be shown in the upper left of the display. These elevations are expressed in hundreds of feet above sea level (e.g., 125 is 12,500 feet MSL) with the highest elevation on top and the lowest on the bottom. However, in the event that there is no appreciable difference in the terrain/obstacle elevations (flat terrain), only the highest value is displayed. Additionally, the color of the elevation value is presented the same as the color of the terrain display containing that elevation (i.e., red if the terrain/obstacle with that elevation is depicted as red in the terrain plan view, yellow if yellow, etc.). The color of the Peaks elevations does not change during a warning. If, during a warning, there is no terrain displayed >2000 ft above the aircraft then the upper peaks elevations will not be colored red.

PEAKS DISPLAY

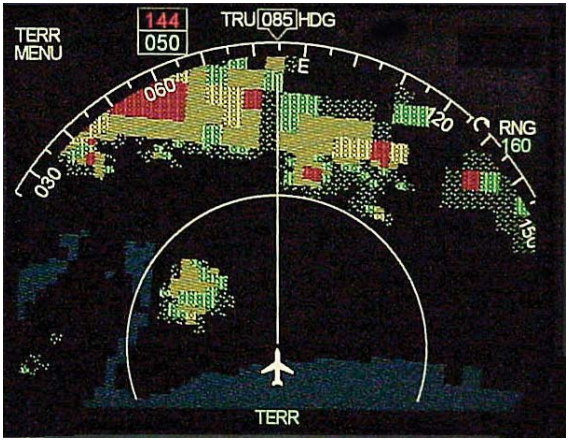
Continued

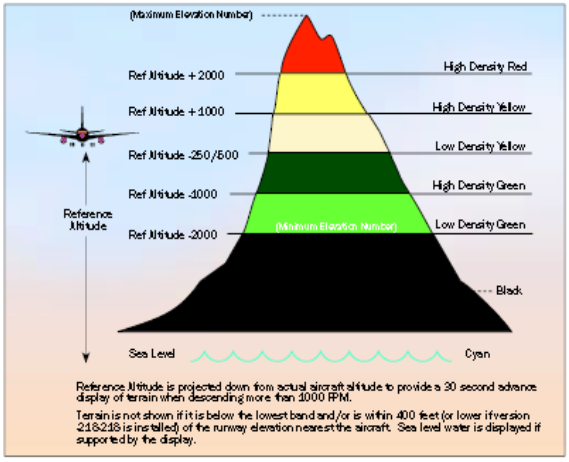
When the aircraft is 500 feet (250 with gear down) or less above the terrain in view (yellow or red is displayed), the Peaks color scheme is identical to the standard display, with the exception of the addition of sea level when supported by the display.

Note: some displays do not support cyan (blue) and will not display sea level in this case.

Note: Differences may exist between the highest terrain/obstacle being displayed and the digital elevation value/color of the "Peaks" numbers at or near the top and sides of the display.

The following illustrate the Peaks display at a low relative altitude.

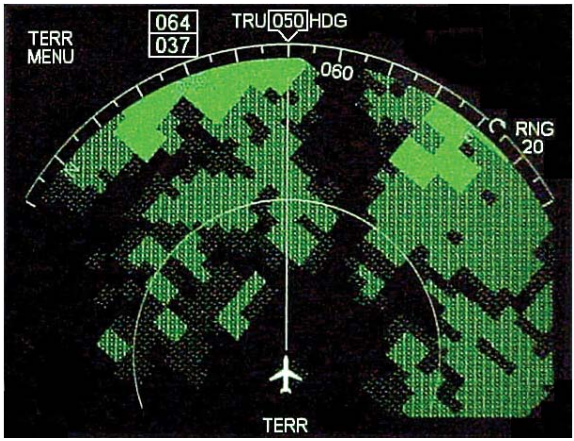


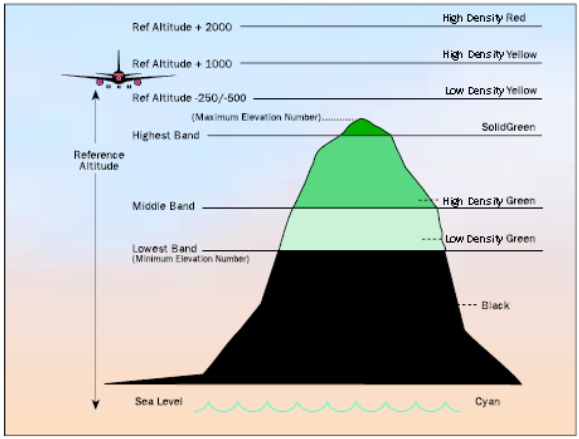


PEAKS DISPLAY

The following illustrate the Peaks display at a high relative altitude.

Continued





PEAKS DISPLAY
Continued

When the aircraft is greater than 500 feet (250 with gear down) above the terrain in view, additional (green) color bands are presented. These added bands are computed and displayed as a function of the highest and lowest elevations in view.

The following table indicates the TAD colors and elevations (Non-Peaks and Peaks).

Color	**Indication**
Solid Red	Terrain/Obstacle Threat Area – Warning.
Solid Yellow	Terrain/Obstacle Threat Area – Caution.
High Density Red Fill	Terrain/Obstacle that is more than 2000 feet above aircraft altitude.
High Density Yellow Fill	Terrain/Obstacle that is between 1000 and 2000 feet above aircraft altitude.
Low Density Yellow Fill	Terrain/Obstacle that is 500 (250 with gear down) feet below to 1000 feet above aircraft altitude.
Solid Green (Peaks only)	Highest terrain not within 500 (250 with gear down) feet of aircraft altitude. May appear with dotted yellow terrain when the aircraft altitude is within 500 feet (250 feet with gear down) of terrain. Top 5% of Range.
High Density Green Fill	Terrain/Obstacle that is 500 (250 with gear down) feet below to 1000 below aircraft altitude.
(Peaks only)	Terrain/Obstacle that is the middle elevation band. 1000 ft Below A/C Top 35% of Range, or Top 5 Percentile
Low Density Green Fill	Terrain/Obstacle that is 1000 to 2000 feet below aircraft altitude.
(Peaks only)	Terrain/Obstacle that is the lower elevation band. 2000 ft Below A/C Top Half of Range, Top 15th Percentile.
Black	No significant Terrain/Obstacle.
Low Density Cyan Fill (Peaks only)	Water at sea level elevation (0 feet MSL).
Magenta Fill	Unknown terrain. No terrain data in the database for the magenta area shown.

Note: Magenta may be displayed at or near the South and North Poles dependent upon the airplane flight path and location.

TCF/TAD INOP and INHIBIT

The EGPWS TCF and TAD functions are available when all required data is present and acceptable. Aircraft position and numerous other parameters are monitored and verified for adequacy in order to perform these functions. If determined invalid or unavailable, the system will display Terrain inoperative or unavailable annunciations and discontinue the terrain display if active.

TAD/TCF functions may be inhibited by manual selection of a cockpit Terrain Inhibit switch. Neither loss nor inhibiting TAD/TCF affects the basic GPWS functions (modes 1-6) or windshear.

If Peaks display mode is not active and TAD becomes unavailable due to position error, terrain inoperative or unavailable is not indicated if the aircraft is greater than 8000 feet above the highest terrain or obstacle within a 320nm radius. If indicated below the 8000 foot threshold, it is extinguished when the aircraft climbs above, and is again displayed once the aircraft descends below the 8000 foot threshold. This eliminates potentially long-term illumination of the condition during the high enroute phase of flight.

Geometric Altitude

Based on GPS altitude, geometric altitude is a computed pseudo-barometric altitude (Above Sea Level - ASL) designed to reduce or eliminate errors potentially induced in Corrected Barometric Altitude by temperature extremes, non-standard pressure altitude conditions, and altimeter miss-sets. This ensures an optimal EGPWS Terrain Alerting and Display capability. Geometric Altitude also allows EGPWS operations in QFE environments without custom inputs or special operational procedures.

Geometric Altitude requires GPS Altitude input with its associated Vertical Figure Of Merit (VFOM) and Receiver Autonomous Integrity Monitoring (RAIM) failure indication, standard (uncorrected) altitude, Radio Altitude, Ground Speed, Roll Angle, and aircraft position (Latitude and Longitude). Additionally, corrected Barometric Altitude, Static Air Temperature (SAT), GPS mode, and the number of satellites tracked are used if available.

The Geometric Altitude is computed by blending a calculated Non-Standard Altitude, Runway Calibrated Altitude (determined during takeoff), GPS Calibrated Altitude, Radio Altitude Calibrated Altitude (determined during approach), and Barometric Altitude (if available). Estimates of the VFOM for each of these are determined and applied in order to determine its weight in the final altitude.

Geometric Altitude Continued

The blending algorithm gives the most weight to altitudes with a higher estimated accuracy, reducing the effect of less accurate altitudes.

Each component altitude is also checked for reasonableness using a window monitor computed from GPS Altitude and its VFOM. Altitudes that are invalid, not available, or fall outside the reasonableness window are not included in the final Geometric Altitude value.

The Geometric Altitude algorithm is designed to allow continued operation when one or more of the altitude components are not available. If all component altitudes are invalid or unreasonable, the GPS Altitude is used directly. If GPS Altitude fails or is not present, then the EGPWS reverts to using Corrected Barometric Altitude alone.

The Geometric Altitude function is fully automatic and requires no pilot action.

Weather Radar Auto-Tilt

In -210-210 and later versions, the EGPWC computes a optimum Weather Radar tilt angle based on the aircraft altitude (ASL) and the terrain elevation ahead of the aircraft. This is output and available to a compatible Weather Radar system so that the tilt angle may be automatically set for optimum operation.

Aural Message Priority

Two or more alert envelopes may be opened simultaneously, so a message priority has been established. The following table reflects the priority for these message callouts. Messages at the top of the list will start before or immediately override a lower priority message even if it is already in progress. Only one message may be generated at a time.

MESSAGE	MODE
"Windshear, Windshear, Windshear" [d, j]	7
"Pull Up" [k]	1, 2
"Terrain, Terrain"	2
"V1" [c]	ANN
"Engine Fail" [c]	ANN
"Terrain, Terrain Pull Up" [h, k]	TA
"Obstacle, Obstacle Pull Up" [c, i, k]	TA
"Terrain"	2
"Minimums" [a, c]	6
"Caution Terrain, Caution Terrain" [c, f]	TA
"Caution Obstacle, Caution Obstacle" [c, g]	TA
"Too Low Terrain"	4, TCF

Aural Message Priority

Continued

MESSAGE	MODE
Altitude Callouts [c]	6
"Speed Brake, Speed Brake" [c]	6
"Too Low Gear"	4A
"Too Low Flaps"	4B
"Sink Rate, Sink Rate"	1
"Don't Sink, Don't Sink"	3
"Glideslope"	5
"Approaching Minimums" [b, c]	6
"Bank Angle, Bank Angle" [c]	6
"Caution Windshear" [c, d, e]	7
"Autopilot" [c]	6
"Airspeed Low, Airspeed Low" [c]	MON
"Flaps, Flaps" [c]	6
"Too High, Too High"	MON
"Too Fast, Too Fast"	MON
"Flaps (pause) Flaps" or "Flaps, Flaps"	MON
"Unstable, Unstable"	MON
"Altimeter Setting, Altimeter Setting"	MON
RAAS Advisories	RAAS
RAAS Distance Remaining Callouts	RAAS

Notes:

a) May also be "Minimum", "Minimums, Minimums", "Decision Height" or "Decide".

b) May also be "Approaching Decision Height", "Fifty Above", "Plus Hundred".

c) Message is dependent on aircraft type or option selected.

d) Windshear detection alerts provided for some aircraft types.

e) Audio alert may or may not be enabled.

f) May also be "Terrain Ahead, Terrain Ahead".

g) May also be "Obstacle Ahead, Obstacle Ahead"

h) May also be "Terrain Ahead Pull Up"

i) May also be "Obstacle Ahead Pull Up"

j) May be preceded by siren.

k) "Pull Up" voice may be preceded by "Whoop, Whoop"

TA = Terrain Look-Ahead Alert

TCF = Terrain Clearance Floor

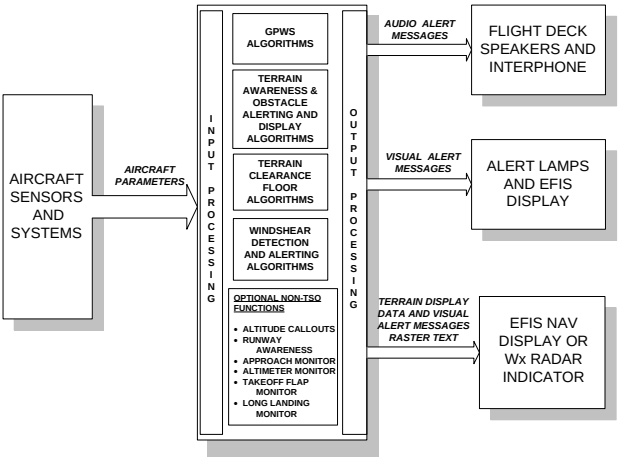
RAAS = Runway Awareness and Advisory System (including Long Landing and Takeoff Flap Configuration Monitors)

MON = Stabilized Approach Monitor, Altimeter Monitor, Takeoff Flap Configuration Monitor, Long Landing Monitor, Corrected Altitude Monitor, Low Airspeed Monitor

ANN = EGPWS annunciated alert generated by another aircraft system.

System Inputs

The EGPWS uses various input signals from other on-board systems. The full complement of these other systems is dependent on the EGPWS configuration and options selected. Systems providing Altitude, Airspeed, Attitude, Glideslope, and position are required for basic and enhanced functions. Accelerations, Angle-of-Attack (AOA), and Flap position is required for Windshear. Inputs are also required for discrete signal and control input.



EGPWC

The EGPWS utilizes signals from the following systems:

Air Data

Uncorrected and corrected Barometric Altitude, Altitude rate, Computed Airspeed, True Airspeed, and Static Air Temperature are provided by Air Data system.

Radio Altitude

Radio Altitude is provided by a Radio Altimeter system. Decision Height or Decision Height Altitude is provided by a Radio Altimeter system or ancillary system.

In -210-210 and later versions, the EGPWC performs Radio Altitude reasonableness checks based on the Computed Terrain Clearance (pseudo-radio altitude). Computed Terrain Clearance is computed by subtracting the elevation of the (database) terrain below the aircraft from Geometric Altitude (ASL). Radio Altitude is considered unreasonable when it indicates a terrain clearance that is less than the Computed Terrain Clearance by more than 2000 feet (1500 feet with version -218-218 or later). For example, if the Computed Terrain Clearance is 10,000 feet and the Radio Altitude is any value (0-2500) then the Radio Altitude is considered unreasonable.

Radio Altitude Continued	This is only performed if TAD is enabled, high integrity terrain and position data is available (based on GPS/ Geometric Altitude), and the Computed Terrain Clearance is greater than 4000 feet (2500 feet with version -218-218 or later). This feature reduces the potential for nuisance alerts caused by false tracking of the Radio Altimeter.
FMS, IRS, AHRS	Pitch and Roll Attitude, Latitude and Longitude Position, Body Normal and Longitudinal Accelerations, Magnetic and True Track Angles, Magnetic and True Heading, Inertial Altitude, Groundspeed, and Attitude Mode.
Global Positioning System (GPS)	Latitude and Longitude Position, True Track Angle, GPS Altitude, Groundspeed, Horizontal and Vertical Figure of Merit (VFOM/HFOM), Horizontal and Vertical Dilution of Precision (HDOP/VDOP), Horizontal Integrity Limit (HIL), and sensor status. **Note:** Runway Awareness and Advisory System (RAAS), Stabilized Approach Monitor, Takeoff Flap Configuration Monitor, and Long Landing monitor functions require a GPS source capable of providing Latitude (fine) and Longitude (fine) data.
VHF Nav Receiver	Glideslope, Localizer, ILS Tuned, Selected Runway Heading.
Terrain Display System	Display range, and if available the Hazard Bus from a Predictive Windshear System (PWS). If EFIS, the EFIS display mode is used in some configurations.
AOA Vane or Stall Warning	AOA, Stick Shaker Margin.
Discretes	Discrete inputs are used for system configuration, signal/status input, and control input functions. EGPWS program pins are utilized to tell the system the type of aircraft and interface that it is in. These are defined and established during the EGPWS installation. EGPWS output functions are consequently the result of the program pin state read each time the EGPWS is powered on. Signal/status discretes include signals such as Decision Height, Landing Flaps selected or Flap Position discretes, Landing Gear selected, Terrain Display Range, and status discretes such as Glideslope Valid, Localizer Valid, Radio Altitude Valid associated with analog signal inputs. Control discretes control EGPWS functions. These include EGPWS Test, Glideslope Cancel, Glideslope Inhibit or Glideslope Backcourse, Terrain (display) select, Terrain Inhibit, Flap Override, Audio Inhibit, Altitude Callout Enable, Steep Approach Enable, and ILS Tuned discretes.

System Outputs

The EGPWS provides both audio and visual outputs.

Audio outputs are provided as specific alert phrases, and altitude callouts or tones provided by an EGPWS speaker and via the cockpit Interphone system for headset usage. Several audio output levels are available. They are established during the installation of the EGPWS. These EGPWS audio outputs can be inhibited by other systems having higher priority (i.e., windshear) or cockpit switches in some cases. The EGPWS also has the ability to inhibit other system audio outputs such as TCAS.

Visual outputs provide discrete alert and status annunciations, and display terrain video when a compatible display system is available and enabled. The discrete visual alerts coincide with audio caution and warning alerts to achieve an optimum terrain alerting capability. Status annunciations provide information to the flight crew about the status of the EGPWS (e.g., GPWS INOP) or activation of selected functions. Terrain video is generated by the EGPWC based on the aircraft's current position relative to the surrounding terrain. This video is presented to a Weather Radar indicator, EFIS display, or a dedicated display unit.

Options

The EGPWC uses program pin discrete inputs to define the installation configuration and option selection. Software upgrades (Reloadable Customer Definitions (RCD)) are also available for RAAS and SMARTLANDING™ functions. The EGPWS has been designed for maximum flexibility while being tailored to specific aircraft equipment, sensors, and displays. The following list summarizes available Operator options (excluding sensor and equipment configuration options):

- **RAAS** – Provides audio-only advisories and caution alerts of position during ground operations and approach to landing. In -230-230 software, an option was added to overlay RAAS Visual messages on the dedicated Terrain display.
- **Flashing Lamps** – When selected causes alert annunciators to flash when active.
- **TAD and TCF Disable** – Suppresses all TAD and TCF alerting and display functions.
- **Altitude Callouts** – Selects desired altitude callouts from a menu of options.
- **Audio Output Level** – Selects desired audio output level High, Medium, or Low.
- **Alternate Mode 6 Volume** – Selects reduced Mode 6 volume (-3 dB).

Options

Continued

- **Obstacle Awareness Enabled** – Enables obstacle alerting and display.
- **TAD Alternate Pop Up** – If TRUE, disables (or enables) automatic terrain display when TAD or Obstacle alert is active, dependent on aircraft/display type.
- **Mode 6 Volume Reduction** – Selects reduced Mode 6 volume (-6 dB).
- **Smart Callout Enable** – Enables the 500-foot smart callout. "Five Hundred" is called out at 500 feet Radio Altitude during non-precision approaches. If 500' is part of the altitude callout option selected, this callout is not given on precision approaches.
- **Bank Angle Enable** – Enables Bank Angle alerts.
- **Windshear Caution Voice Disable** – Disables Windshear Caution voice alerts providing visual alerts only.
- **Audio Declutter Disable** – Disables the Audio Declutter function so that audio alerts are constant.
- **Audio Alerting Voice Select** – Selects the type(s) of voice that are used for audio alerts.
- **Lamp Format** – One of two lamp formats are available.
  - Lamp Format 1 provides only Mode 5 "Glideslope" alerts to the caution (amber) lamp output and all other alerts (except Windshear and Mode 6 callouts) to the warning (red) lamp output.
  - Lamp Format 2 provides all "Pull Up" warning alerts to the warning (red) lamp output and all caution alerts to the caution (amber) lamp output (FAA requirement for new installations).

  Note: Windshear annunciations are provided by separate outputs and indications and are not affected by lamp format. Mode 6 advisories do not effect any annunciation and are not affected by lamp format.
- **Peaks Enable** – Adds additional density patterns and level thresholds to the Standard Display Mode, allowing display of highest and lowest terrain/obstacle to increase situational awareness.
- **Stabilized Approach Monitor –** Enables Landing Flap, Excessive Speed, Excessive Approach Angle, and Un-Stabilized Approach monitor and issues annunciations if the monitor criteria are not met. Visual messages can be overlaid on the Terrain display.
- **Takeoff Flap Configuration Monitor –** issues annunciations if the Flap handle setting is not proper for takeoff.

Options

Continued

- **Altimeter Monitor –** issues annunciations if the altimeter setting is improper.
- **Long Landing Monitor –** issues annunciations if the aircraft does not touchdown within an operator defined distance from the runway threshold.
- **Low Airspeed Monitor –** (basic function for Boeing 737NG aircraft only) issues annunciations when airspeed decreases below 70% of the amber band on the PFD Speed tape.

Additional input discretes are used to control or define EGPWS operations:

- **EGPWS Self-Test** – Cockpit switch initiates EGPWS Self-Test on the ground. Typically part of EGPWS warning (red) lamp.
- **Glideslope Cancel** – Cockpit switch cancels Mode 5 Glideslope alerting. Typically part of EGPWS caution (amber) lamp.
- **Glideslope Inhibit** – Inhibits Mode 5 Glideslope alerting. Normally used for backcourse approaches.
- **Altitude Callout Enable** – Enables Mode 6 Callouts.
- **Mode 6 Low Volume** – Reduces Mode 6 volume (an additional) 6 dB. This is typically hardwired or connected to an external switch.
- **TAD and TCF Inhibit** – Cockpit switch to disable all TAD and TCF functions. (FAA requirement)
- **Audio Inhibit** – disables all EGPWS audio outputs.
- **Steep Approach Enable** – Enables Steep Approach (Mode 1 Excessive Descent Rate) alerts biasing.
- **Steep Approach Select** – Selects (activates) Steep Approach (Mode 1 Excessive Descent Rate) alerts biasing to reduce nuisance alerts.
- **Flap Over-Ride** – Cockpit switch to select landing flaps when not in the landing flap configuration.
- **Gear Over-Ride** – Cockpit switch to select gear down when not in the gear down configuration.
- **PLI Select/Deselect** – Used for displaying or deselecting the display of EGPWS derived Pitch Limit Indicator (PLI) signals when a Windshear warning occurs.
- **RAAS/MON Inhibit/Enable** – Inhibits or Enables RAAS and/or Stabilized Approach, Takeoff Flap Configuration, and Long Landing monitor functions.

For additional options information contact Honeywell.

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SECTION 3
OPERATIONAL PROCEDURES

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System Constraints

System constraints for the EGPWS are:

- If terrain data is unavailable for a particular area, then Terrain and Obstacle alerting and display is not available for that area and the affected display area is colored MAGENTA (normally only displayed at or near North and South Poles dependent upon airplane flight path and location).
- The display of terrain and obstacle information is intended to serve as a situational awareness tool. It does not provide the accuracy and/or fidelity to be the sole source for deciding terrain or obstacle avoidance. Navigation must not be predicated upon the use of the EGPWS terrain/Obstacle display.
- If there is no source of aircraft position data meeting the accuracy requirements for the TAD and TCF functions, then these enhanced functions are automatically inhibited with a resultant Terrain inoperative or unavailable indication.
- TAD/TCF functions should be manually inhibited:
  - Within 15 nm on approach to an airport or runway that is not in the airport/runway database to avoid unwanted alerts.
  - During QFE operations if GPS data is unavailable or inoperative.
- When the TAD/TCF functions are inhibited and the EGPWS is otherwise functional, the EGPWS reverts to providing basic GPWS functions (Modes 1 to 6 and Windshear). In this state, the EGPWS may give little or no advance warning time for flight into precipitous terrain where there are few or no preceding obstructions. This particularly applies if:
  - The aircraft is in the landing configuration.
  - The aircraft is in a stabilized descent at a normal approach descent rate.
  - There is no ILS Glideslope signal being received by the EGPWS (not tuned, not available, or inoperative).
- Terrain clearance or descent rates that are not compatible with required minimum regulatory standards for Ground Proximity Warning equipment may cause unwanted alerts.

System Constraints

Continued

- If enabled, the EGPWS uses onboard measurement of air mass parameters and aircraft acceleration for detection of windshear. This is a reactive system and cannot predict windshear, which may be ahead of the aircraft.
- The EGPWS terrain/obstacle database includes cataloged man-made obstructions 100 feet high or greater within North America and portions of Europe, Asia and the Caribbean. The database is not all-inclusive and newer, smaller, or unknown obstructions could be encountered.

Refer to an appropriate AFM or EGPWS AFMS for specific system limitations and procedures.

System Activation

The EGPWS is fully active when the following systems are powered and functioning normally:

- EGPWS
- Radio Altimeter
- Air Data
- ILS or Glideslope Receiver
- IRS, AHRS, VG (attitude)
- GPS, FMS, or IRS (position)
- Landing gear
- Landing flaps
- Stall warning or AOA (windshear only)
- Weather Radar, EFIS, or a dedicated terrain display (if terrain/obstacle display enabled)

In the event that required data for a particular function is not available, then that function is automatically inhibited and annunciated (e.g., if position data is not available or determined unacceptable, TAD and TCF is inhibited, any active terrain display is removed, and "TERR INOP", "TERR UNAVAIL" (or equivalent) is indicated).

Some installations utilize redundant systems so that if the primary source of data fails, the EGPWS continues on the secondary source.

EGPWS status annunciations are provided for GPWS inoperative (mode 1-6 functions), Terrain inoperative (TAD/TCF functions), and windshear inoperative.

RAAS status messages are provided on the dedicated Terrain display and can be configured to be shown on a separate cockpit indicator.

Monitor functions which provide Caution annunciations can be configured to activate the existing GPWS inoperative indicator if the function is inoperative.

Refer to an appropriate AFM or EGPWS AFMS for specific system and status requirements.

EGPWS Self-Test

The EGPWS provides a Self-Test capability for verifying and indicating intended functions. This Self-Test capability consists of six levels to aid in testing and troubleshooting the EGPWS.

These six levels are:

Level 1 – **Go/No Go Test** provides an overview of the current operational functions and an indication of their status.

Level 2 – **Current Faults** provides a list of the internal and external faults currently detected by the EGPWC.

Level 3 – **EGPWS Configuration** indicates the current configuration by listing the EGPWS hardware, software, databases, and program pin inputs detected by the EGPWC.

Level 4 – **Fault History** provides an historical record of the internal and external faults detected by the EGPWC.

Level 5 – **Warning History** provides an historical record of the alerts given by the EGPWS.

Level 6 – **Discrete Test** provides audible indication of any change to a discrete input state.

A level 1 Go/No Go Test is normally performed by flight crews as part of preflight checks. All other levels are typically used for installation checkout and maintenance operations.

Level 1 Self-Test

Level 1 Self-Test is used to verify proper operation of the EGPWS on the ground as follows:

1. Ensure that adequate aircraft power is available and the EGPWS and associated systems are powered.
2. Ensure that any EGPWS inhibiting switches are in the normal (non-inhibiting) position.
3. Verify that EGPWS inoperative annunciations are extinguished. If an inoperative annunciation is indicated, perform the EGPWS Self-Test (below) and then seek corrective action if the inoperative condition persists.
4. If a terrain display is enabled, select terrain to be displayed.
5. Momentarily depress the EGPWS Self-Test switch.

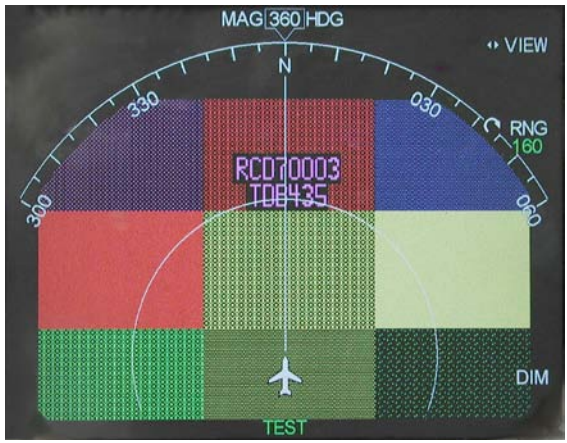
Level 1 Self-Test Continued

When a Self-Test is initiated, the EGPWC first checks for any configuration (installation or database) errors. If any are detected it is audibly enunciated and the test is terminated. If none detected, the test continues through a sequence resulting in turning on and off all system annunciators, enunciating specific audio messages, and if enabled, displaying a video test pattern on the terrain display (see illustration below). Any functions determined inoperative are also enunciated (e.g., "GLIDESLOPE INOP"). The Self-Test terminates automatically at its conclusion.

The following is a description of the expected results of a typical Level 1 Self-Test. Actual annunciation nomenclature and sequence may differ depending on the installation.

- GPWS INOP, W/S INOP, and TERR INOP annunciators turn on.
- Amber caution ("BELOW G/S" or "GPWS") annunciators turn on.
- "GLIDESLOPE" is announced over speaker.
- Amber annunciators turn off.
- G/S CANCEL annunciators turn on (if installed).
- G/S CANCEL annunciators turn off.
- Red warning ("PULL UP" or "GPWS") annunciators turn on.
- "PULL UP" is announced over speaker.
- Red warning annunciators turn off.
- Red Windshear warning annunciators turn on.
- (Siren) "WINDSHEAR, WINDSHEAR, WINDSHEAR" is announced over speaker.
- Red Windshear warning annunciators turn off.
- Amber Windshear caution annunciators turn on (if installed and enabled).
- Amber Windshear caution annunciators turn off.
- Red warning ("PULL UP" or "GPWS") Terrain Awareness annunciators turn on.
- "TERRAIN, TERRAIN, PULL UP" is announced over speaker.
- Red warning Terrain Awareness annunciators turn off.
- Amber alert Terrain Awareness annunciators momentarily turn on, then off.

- Terrain test pattern is displayed (RCD XXXXX indicates loaded Reloadable Customer Definitions (RCD) and is shown only in RCD enabled installations, TDB XXX indicates loaded Terrain Database (TDB) and is shown only in -218-218 or later versions).



- If RAAS and/or Long Landing Monitor and/or Takeoff Flap Configuration Monitor is enabled "RUNWAY AWARENESS OKAY FEET" (or "METERS") is announced over the speaker.
- If RAAS, Long Landing Monitor, Takeoff Flap Configuration Monitor, and/or Approach Monitor are INOP or Inhibited the following message may be announced over the speaker:
  - "RUNWAY AWARENESS INOP"
  - "APPROACH MONITOR INOP"
  - "FLAP MONITOR INOP"
  - "ALTIMETER MONITOR INOP"
- If Low Airspeed Monitor is enabled the following message may be announced over the speaker:
  - "AIRSPEED LOW"
  - "AIRSPEED LOW INHIBITED"
  - "AIRSPEED LOW INOP"
- GPWS INOP, W/S INOP, and TERR INOP annunciators turn off.
- Terrain test pattern is turned off.

6. Verify expected indications and annunciations during test, repeating as necessary noting any erroneous conditions.

A successful test is accomplished if all expected indications are observed and no inoperative functions or display anomalies are

indicated or observed.

For more specific information, refer to an applicable AFM or EGPWS AFMS, or contact Honeywell.

Normal Procedures

The EGPWS provides visual and/or audio alerts for detected:

- Potentially dangerous terrain conditions (modes 1 – 4, TCF, TAD),
- Below glideslope conditions (mode 5),
- Descent below predefined altitudes or excessive bank angle (mode 6),
- Severe windshear conditions (mode 7)
- Runway Awareness and Advisory System (RAAS)
- Unstable approaches (MON)
- Altimeter mis-settings (MON)
- Incorrect takeoff flap settings (MON)
- Landing Long (MON)
- Low Airspeed (MON)

These consist of warning, caution, and advisory alerts based on the detection alert threshold penetration. The following list identifies the various alerts by type and mode:

ALERT	WARN	CAUT.	ADV.
(SIREN) "WINDSHEAR (3x)"	**7**		
Any "PULL UP"	1,2,TA		
"CAUTION WINDSHEAR"		**7**	
"TERRAIN, TERRAIN"		2, TA	
"OBSTACLE, OBSTACLE"		TA	
"TERRAIN"		2	
"APPROACHING MINIMUMS"			**6**
"MINIMUMS"			**6**
"CAUTION TERRAIN"		TA	
"CAUTION OBSTACLE"		TA	
"TOO LOW TERRAIN"		4, TCF	
"TOO LOW GEAR or FLAPS"		4	
Altitude callouts			**6**
"SINK RATE"		1	
"DON'T SINK"		3	
"GLIDESLOPE"		5	
"BANK ANGLE"			**6**
"FLAPS (pause) FLAPS" or "FLAPS, FLAPS"			MON
"TOO HIGH, TOO HIGH"			MON
"TOO FAST, TOO FAST"			MON
"UNSTABLE, UNSTABLE"		MON	
"ALTIMETER SETTING"			MON
"AIRSPEED LOW"		MON	
"FLAPS, FLAPS"		MON[1]	
"LONG LANDING, LONG LANDING" or "DEEP LANDING, DEEP LANDING"		MON	
"CAUTION TAXIWAY, CAUTION TAXIWAY"		RAAS	
"CAUTION SHORT RUNWAY, SHORT RUNWAY"		RAAS	
"CAUTION ON TAXIWAY, ON TAXIWAY"		RAAS	
Any RAAS Advisories			RAAS

[1] "Flaps, Flaps" caution is for the Takeoff Flaps Configuration monitor.

Note: Visual and audio indications may vary and procedures provided are representative. Refer to an applicable AFM or EGPWS AFMS for specific implementation.

Recommended response to EGPWS alerts are as follows:

Caution Alerts

1. Stop any descent and climb as necessary to eliminate the alert. Analyze all available instruments and information to determine best course of action.
2. Advise ATC of situation as necessary.

Warning Alerts

1. Aggressively position throttles for maximum rated thrust. Apply maximum available power as determined by emergency need. The pilot not flying (if applicable) should set power and ensure that TO/GA power and modes are set.
2. If engaged, disengage the autopilot and smoothly but aggressively increase pitch toward "stick shaker" or Pitch Limit Indicators (PLI) to obtain maximum climb performance.
3. Continue climbing until the warning is eliminated and safe flight is assured.
4. Advise ATC of situation.

Note: Climbing is the only recommended response unless operating in visual conditions and/or pilot determines, based on all available information, that turning in addition to the climbing is the safest course of action. Follow established operating procedures.

Warning Alerts

Note: Navigation must not be based on the use of the Terrain Awareness and Alerting Display (TAD).

Glideslope Alerts

Below Glideslope alerts consist of "soft" and "hard" alerts based on the degree of glideslope deviation and altitude. Respond to these alerts as necessary to correct the aircraft's flightpath back to the Glideslope centerline or perform a missed approach.

Advisory Callouts

Advisory callouts being advisory in nature are used to announce an event or condition (e.g., "Minimums", "RunwayXX" - if RAAS enabled).

Response to these callouts should be in accordance with standard operating procedures.

Windshear Caution

This alert generally occurs due to increasing performance windshear conditions (i.e., increasing headwind, decreasing tailwind, and/or updraft). This alert is generally considered advisory in that the crew response is to be alert to the possibility of subsequent significant airspeed loss and down draft conditions. Coupled with other weather factors, the Windshear Caution should be considered in determining the advisability of performing a go-around.

Wind and gust allowances should be added to the approach speed, increasing thrust if necessary. It may be necessary to disengage autopilot or auto-throttle. Avoid getting low on the approach glidepath or reducing the throttles to idle.

Windshear Warning

When a Windshear warning occurs, the following procedures should be followed:

1. Immediately initiate the Windshear escape maneuver in accordance with established Windshear procedures.
2. Aggressively apply maximum rated thrust, disengage autopilot and/or auto-throttle if necessary.
3. Rotate smoothly to the go-around/take-off pitch attitude, allowing airspeed to decrease if necessary. Maintain wings level. Do not retract flaps or landing gear.
4. If the aircraft continues to descend, increase pitch attitude smoothly and in small increments, bleeding air speed as necessary to stop descent. Use Stall Warning onset (stick shaker) as the upper limit of pitch attitude.
5. Maintain escape attitude and thrust and delay retracting flaps or landing gear until safe climb-out is assured.

Note: Engine overboost should be avoided unless the airplane continues to descend and airplane safety is in doubt.

If overboost is required, adjust throttles back to maximum rated thrust as soon as safety has been assured.

Overboosting engines while at high angle of attack near airplane stall may cause engine stall, surge, or flameout.

Maintain escape attitude and thrust and delay retracting flaps or landing gear until safe climb-out is assured.

Abnormal Procedures

Partial system deactivation or compensation can be accomplished for abnormal procedures as follows:

Mode 1 Excessive Descent Rates

If steep approaches are to be performed (4º or greater) EGPWS STEEP APPROACH should be enabled and selected for these operations. This may be accomplished automatically by on-board systems or manually selected by a cockpit switch.

When active, Mode 1 alerts are desensitized to compensate for normally higher descent rates for these types of operation, eliminating related unwanted alerts. If implemented with a cockpit switch, this requires manual deactivation.

Mode 2 Excessive Closure to Terrain

When required to operate in close proximity to terrain (less than 2500' above), Mode 2 alerts can be desensitize or overridden by activating the FLAP OVER-RIDE switch to eliminate related unwanted alerts. This requires manual deactivation.

Mode 4 Unsafe Terrain Clearance

Mode 4 alerts can be reduced by activation of the FLAP OVER-RIDE switch, or GEAR OVER-RIDE. This is generally recommended when performing approaches with less than normal landing flaps selected, or landing gear not down. This requires manual deactivation.

Mode 5 Descent Below Glideslope

Mode 5 Glideslope alerts can be manually canceled when below 2000 feet Radio Altitude (or 1000 feet dependant on aircraft type) by pressing the G/S Cancel switch (commonly part of the amber caution annunciators "BELOW G/S" or "GPWS"). This is typically selected when an unreliable Glideslope is expected or when maneuvering is required during ILS final approach. The G/S Cancel is automatically reset following landing or if the aircraft climbs above the 2000 or 1000 feet dependant on aircraft type.

In some cases, an Alternate G/S Cancel is available. This allows the Mode 5 alerting to be canceled at any time and any altitude. In this configuration, which is defined only for certain aircraft types or by program pin, pressing the G/S Cancel switch in the cockpit has the effect of inhibiting Mode 5 alerting. It can be manually reset by again pressing the G/S Cancel switch, or it is automatically reset following landing, if flap or gear state changes (i.e., down to up), or when the

aircraft climbs above a predetermined altitude (defined for the aircraft type). Because of the nature of this type of G/S Cancel, a cockpit indication of its activation is required.

Some aircraft may be configured with a G/S inhibit switch. This switch is separate from the one discussed above but also results in inhibiting Mode 5 alerting. This switch is intended for selection during back course approaches to eliminate unwanted alerts that may result. If a discrete back course signal is available from another system, this input to the EGPWC may be connected to that system for automatic Mode 5 inhibiting.

Note: Implementation of the Glideslope Cancel and/or Inhibit inputs to the EGPWS varies. Verify a particular application to determine the implementation used.

Terrain Alerting and Clearance Floor

Pressing the Terrain Inhibit switch inhibits TAD and TCF alerting and display, including Obstacles and Peaks when enabled. This is used when position accuracy is inadequate or when operating at airports or runways not in the terrain database. Selection of Terrain Inhibit does not cause the Terrain Inoperative annunciation unless the aircraft is wired for this to occur. Terrain Inhibit requires manual deactivation.

Emergency Procedures

The EGPWS Flap or Gear Over-ride, TAD/TCF Inhibit, or other switches (as installed) may be used as required for an emergency situation (e.g., landing gear up).

For additional information refer to an applicable AFM or EGPWS AFMS or contact Honeywell.

SECTION 4 DEFINITIONS

Acronyms shall be interpreted as shown:

AFE	Above Field Elevation
AFM	Airplane Flight Manual
AFMS	Airplane Flight Manual Supplement
AGL	Above Ground Level
AHRS	Attitude/Heading Reference System
ANN	EGPWS annunciated alert generated by another aircraft system
AOA	Angle of Attack
ASL	Above Sea Level
ATC	Air Traffic Control
BIT	Built In Test
CFIT	Controlled Flight into Terrain
CTC	Computed Terrain Clearance
dB	Decibels
DH	Decision Height
EFIS	Electronic Flight Instrument System
EGPWC/S	Enhanced Ground Proximity Warning Computer/System
FAA	Federal Aviation Administration
FMS	Flight Management System
FPM	Feet Per Minute
F/W	Fail Warning
GPS	Global Positioning System
GPWS	Ground Proximity Warning System
G/S	Glideslope
HDOP	Horizontal Dilution of Precision
HFOM	Horizontal Figure of Merit
HIL	Horizontal Integrity Limit
Hz	Hertz (cps)
ICD	Interface Control Document
ILS	Instrument Landing System
INOP	Inoperative
IRS	Inertial Reference System
IVS	Inertial Vertical Speed
MCP	Mode Control Panel
MCU	Modular Concept Unit
MFD	Multi Function Display
MLS	Microwave Landing System
MON	SMARTRUNWAY® and SMARTLANDING™ monitors
MSL	Mean Sea Level
MTC	Minimum Terrain Clearance
NM	Nautical Mile
PCMCIA	Personal Computer Memory Card Industry Association

PLI	Pitch Limit Indicator
PPI	Plan Position Indicator
PWS	Predictive Windshear System
QFE	A method of setting the altimeter to compensate for changes in barometric pressure and runway elevation. Pilot receives information from airfield and adjusts his altimeter accordingly and it will read zero altitude at touchdown on the runway.
QNE	The method of setting the altimeter to the standard atmosphere datum -29.92 inches of mercury (1,013.25 mb). This setting is used in the United States airspace by all aircraft above FL180.
QNH	The more common method of setting the altimeter to compensate for changes in barometric pressure. Pilot receives information from airfield, adjusts his altimeter accordingly and the altimeter will read airfield elevation at touchdown.
RAAS	Runway Awareness and Advisory System
RAIM	Receiver Autonomous Integrity Monitoring
RCD	Reloadable Customer Definition
RFCF	Runway Field Clearance Floor
SAT	Static Air Temperature
TA	Terrain Awareness
TAD	Terrain Alerting and Display
TCAS	Traffic Collision Avoidance System
TCF	Terrain Clearance Floor
TERR	Terrain
TO/GA	Takeoff/Go-Around
VDOP	Vertical Dilution of Precision
VFOM	Vertical Figure of Merit
VFR	Visual Flight Rules
VG	Vertical Gyro
VHF	Very High Frequency
WS	Windshear

SMARTRUNWAY® PILOT GUIDE

RUNWAY AWARENESS AND ADVISORY SYSTEM (RAAS)

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SECTION 1

Introduction

This Pilot Guide section describes the functions and operation of the MKV and MKVII EGPWS Runway Awareness and Advisory System (RAAS).

The document is divided into the following sections:

- Section 1 – An introduction to the RAAS;
- Section 2 – A *Quick Reference* guide to the operation of the RAAS;
- Section 3 – A detailed description of the operation of RAAS;
- Section 4 – A summary of the options available to operators to configure RAAS;
- Section 5 – Overview of the three audio levels employed for RAAS;
- Section 6 – Means for the flight crew to check the operational availability of RAAS.
- Section 7 – Frequently Asked Questions

This guide does not supersede FAA approved data, Flight Manuals, individual Operations Manuals, requirements, or procedures. Pilots should be thoroughly familiar with their own company policies, system configuration, requirements, and procedures with respect to the operation of aircraft with the EGPWS and RAAS.

The information in this document is intended as a general explanation of the Honeywell RAAS. It contains a description of system performance assuming the identified options are active.

Why RAAS?

It is well recognized that runway incursions and overruns are a high-profile operational safety issue worldwide. For example, the USA is currently experiencing at least one runway incursion per day at towered airports alone. Safety data indicate that lack of flight crew position awareness during ground operations and on approach have contributed to such occurrences worldwide. Recent industry safety recommendations advocate the need for new flight deck runway incursion prevention systems. Honeywell has developed the RAAS as a practical and low-cost system with significant input from hundreds of pilots. Extensive human factors evaluations confirm the positive operational safety benefits of RAAS: increased position awareness; enhanced crew decision making; reduced crew workload; and superior detection of position errors leading to runway incursions.

What is RAAS?

The purpose of the Honeywell RAAS is to provide the flight crew with supplemental information of aircraft position relative to runways during surface operations and on final approach. In -218, RAAS is an aural-only advisory function, and therefore, a visual display of the information is not provided. In -230 some additional functions are available which provide caution alerts. Visual annunciations are available for all RAAS aurals, typically the system will be configured so that the GPWS lamp will be illuminated for caution alerts. RAAS provides timely aural advisory messages to the flight crew in a significant number of scenarios that have led to runway incursions. It should be noted that RAAS is not intended for navigation purposes, e.g., to guide an aircraft in or around the terminal area.

RAAS is integrated with the EGPWS. EGPWS protection and operation is unaltered by the addition of RAAS. Note that RAAS advisories have a lower priority than any EGPWS terrain-related alerts, including radio altitude call-outs.

How Does RAAS Work?

The RAAS uses aircraft inputs within the EGPWS such as GPS position, heading, groundspeed and a runway database to generate the aural annunciations shown in the tables below. Note that GPS availability is a requirement for the operation of RAAS. Aircraft position is referenced to the GPS antenna position. RAAS does not have knowledge of taxiways, Automatic Terminal Information Service (ATIS) & Notice to Airmen (NOTAM) information, other traffic, pilot intent, ATC clearance, ground markings and signage. Crews should be cognizant of the prevailing ATIS and any NOTAMs. RAAS operates automatically, without any action required from the flight crew.

Summary of Routine Advisories

Routine Advisory	Purpose
Approaching Runway - On Ground	Awareness of a runway being approached by the aircraft during ground operations (e.g., "Approaching one-one").
On Runway	Awareness of which runway the aircraft is lined-up with during ground operations (e.g., "On runway three-four left").
Approaching Runway - In Air	Awareness of which runway the aircraft is tracking on final approach (e.g., "Approaching one-six right").
Landing Distance Remaining	Awareness of aircraft position relative to the runway end (e.g., "One-thousand remaining").
Runway End	Awareness of the position of the aircraft relative to the runway end (e.g., "One-hundred remaining").

How Does RAAS Work?

Continued *Summary of Non-Routine Advisories/ Cautions*

Non-Routine Advisory	Purpose
Taxiway Take-off	Awareness of excessive taxi speeds or a take-off on a taxiway ("On Taxiway! On Taxiway!"). [1] If caution is enabled aural is changed to "Caution On Taxiway! On Taxiway! ".
Insufficient Runway Length – On Ground	Awareness of which runway the aircraft is lined-up with, and that the runway length available for takeoff is less than a defined nominal take-off runway length (e.g., "On runway three-four left, six-hundred remaining"). [1] If caution is enabled additional aural is "Caution Short Runway Short Runway".
Extended Holding on Runway	Awareness of an extended holding period on the runway (e.g., "On runway three-four left, On runway three-four left").
Distance Remaining – Rejected Take-off	Awareness of aircraft position during a Rejected Take-off (RTO) (e.g., "Two-thousand remaining").
Approaching Short Runway - In Air	Awareness of runway the aircraft is tracking, and that the runway length available for landing is less than a defined nominal landing runway length (e.g., " Approaching three-four right, three-thousand remaining"). [1] If caution is enabled additional aural is "Caution Short Runway Short Runway".
Taxiway Landing [1]	Awareness that the aircraft is determined to be on Approach and is not aligned with a runway ("Caution Taxiway!, Caution Taxiway!").
Take-off Flap Monitor [1]	Awareness of improper flap setting when the aircraft is lined up on a runway in advance of take-off.

[1] Added in -230-230 and equivalent and later software.

Note that during normal operations, the crew would only be exposed to the five routine advisories for the entire period between push-back at the departure airport and taxi-in at the destination airport. The five advisories alone have the potential to address many classic runway incursion scenarios.

RAAS annunciations are heard over the same aircraft audio systems that presently provide EGPWS audio caution and warning alerts in the flight deck. The volume of RAAS messages is controlled by the EGPWS and the RAAS message volume level is based on the expected flight operation for each message.

As mentioned above, RAAS operates automatically, without any action required from the flight crew. The EGPWS circuit-breaker disables all EGPWS functionality including RAAS. The EGPWS Self-Test push-button (if available) allows the crew to verify the operational availability of all EGPWS

How Does RAAS Work?

Continued

functions, including the RAAS. An optional RAAS Audio Inhibit Switch may be installed. A single push of the Audio Inhibit Switch inhibits all RAAS annunciations. Depressing the switch reactivates all RAAS annunciations. In software version -224-224 a change was made to provide an immediate inhibit of any RAAS voice in progress and prevent issuing of non-current RAAS advisories.

It is important to note that some RAAS features are optional and may not be active in a given installation. Therefore you will need to check the options selected by your company. Refer to an applicable Airplane Flight Manual (AFM) or EGPWS Airplane Flight Manual Supplement (AFMS) for details. Alternatively contact Honeywell for assistance.

The default setting for the RAAS aurals is a female voice. Aurals that include runway length in the annunciation may be annunciated in feet or metres. The default setting for these aurals is feet. These options are discussed in detail in the "RAAS Options" section of this Pilot Guide.

Appropriate flight crew actions to RAAS advisories are:

On-Ground: If in doubt, stop, VERIFY POSITION, and contact ATC for assistance if necessary. Do not hesitate to request progressive taxi instructions.

In-Air: If the advisory is in conflict with expectations, VERIFY POSITION, contact ATC for assistance if necessary. Consideration should be given to a go-around in accordance with company SOPs.

Information contained herein or provided by a RAAS annunciation does not supersede any operator Standard Operating Procedure (SOP). Pilots should be thoroughly familiar with regulatory, company, and other approved operational procedures as required by their aircraft and type of operation. Operators should also include RAAS in their training curriculum.

Where And When Does RAAS Work?

RAAS provides annunciations during surface operations and on final approach. RAAS is operationally available anytime the EGPWS is powered and the following conditions are met:

- The software for the RAAS functions have been loaded into an EGPWS and enabled;
- The aircraft is on or approaching an airport in the RAAS runway database; and
- RAAS is functional (e.g., all external signals are available and not faulted, GPS position accuracy meets minimum

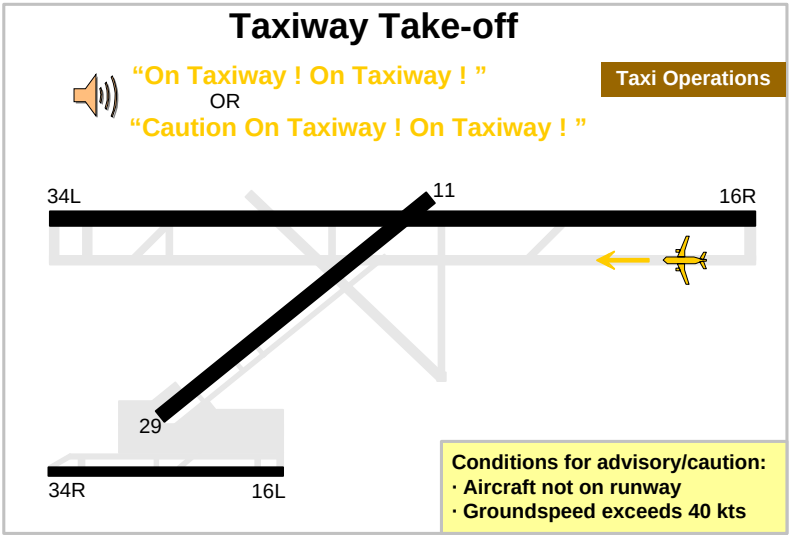
Where And When Does RAAS Work?

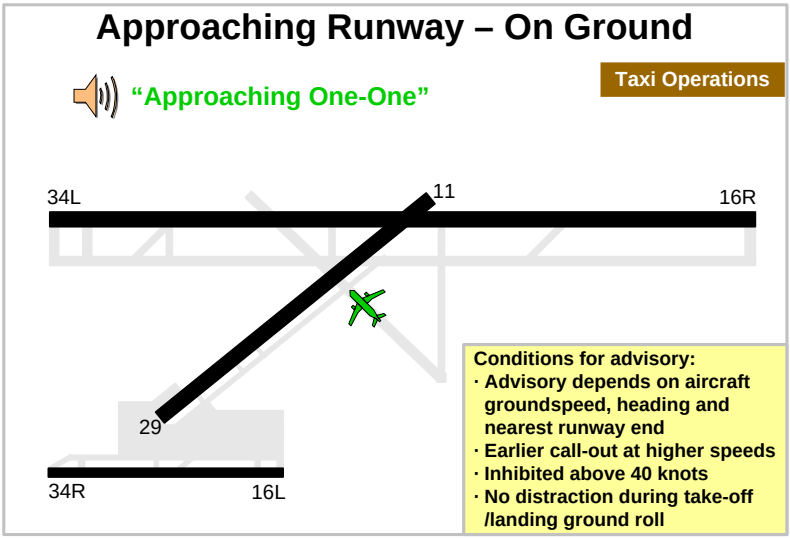
Continued

RAAS requirements and there are no internal EGPWS faults). The RAAS runway database is included as part of the installed terrain/ obstacle/runway database, and is updated periodically. Operators should ensure that they are using the most recent RAAS runway database. Further details of the specific airports included in the RAAS database and procedures for operators to acquire the latest RAAS database are provided on the Internet at www.egpws.com. Alternatively contact Honeywell for further assistance. The crew can verify the RAAS runway database in use for their installation by viewing the terrain display test pattern during a Go/No Go self-test.

RAAS operational availability is integrated into the existing EGPWS fault monitoring and self-test functions. Consistent with approved EGPWS self-test design, the loss of RAAS functions is indicated on-ground only during a self-test. There is no automatic annunciation of the loss of RAAS functionality. RAAS status can also be displayed on the terrain display. This is active only when the aircraft is on the ground. RAAS Inoperative, Inhibit, and Not available conditions are shown immediately on the display. For other status messages see page 91. The procedure requires the flight crew to select the terrain display followed by a change in the displayed range (to a higher or lower range). RAAS status is annunciated for two sweeps of the terrain display. This feature is available on all aircraft, but is primarily intended for those aircraft where the flight crew does not perform a self-test. The various self-test messages are presented later in the "Operational Availability" section.

SECTION 2
RAAS Quick
Reference





RAAS Quick Reference

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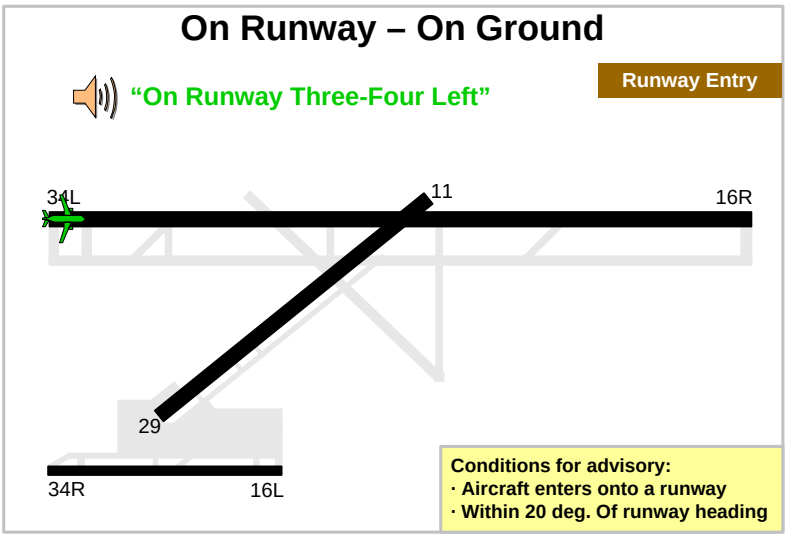
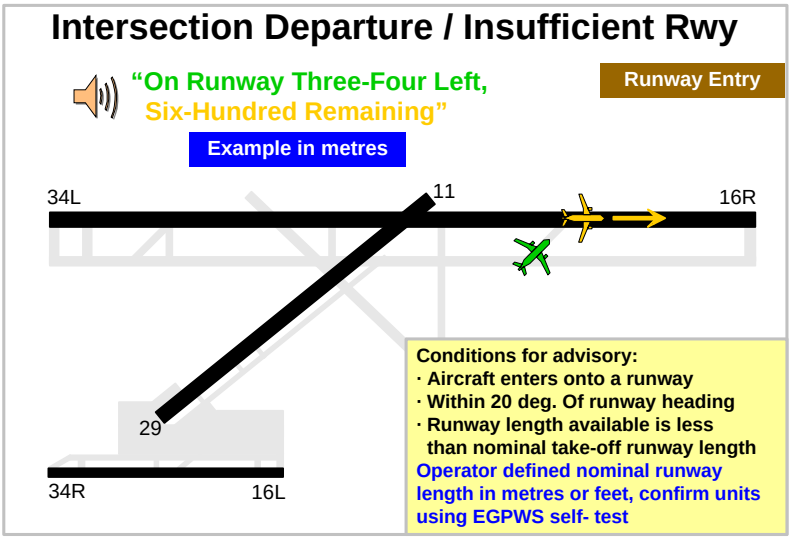




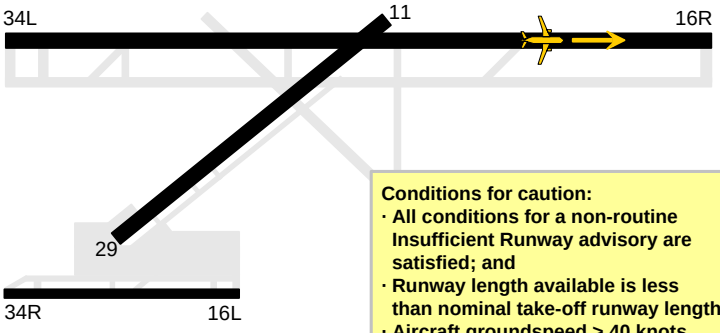
RAAS Quick Reference

Continued

Insufficient Runway / Caution

"On Runway Three-Four Left, Six-Hundred Remaining"
"Caution Short Runway, Short Runway"

Runway Entry

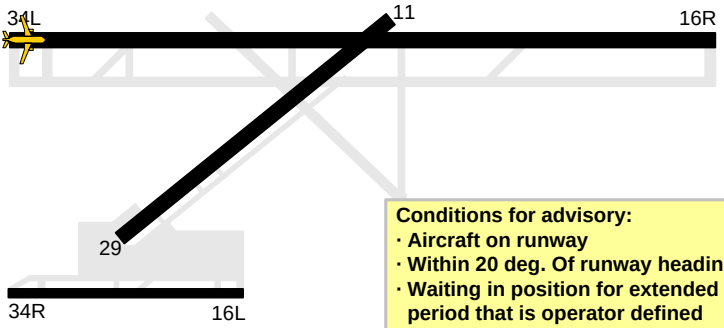


Conditions for caution:
- **All conditions for a non-routine Insufficient Runway advisory are satisfied; and**
- **Runway length available is less than nominal take-off runway length**
- **Aircraft groundspeed > 40 knots**

Extended Holding On Runway

"On Runway Three-Four Left, On Runway Three-Four Left"

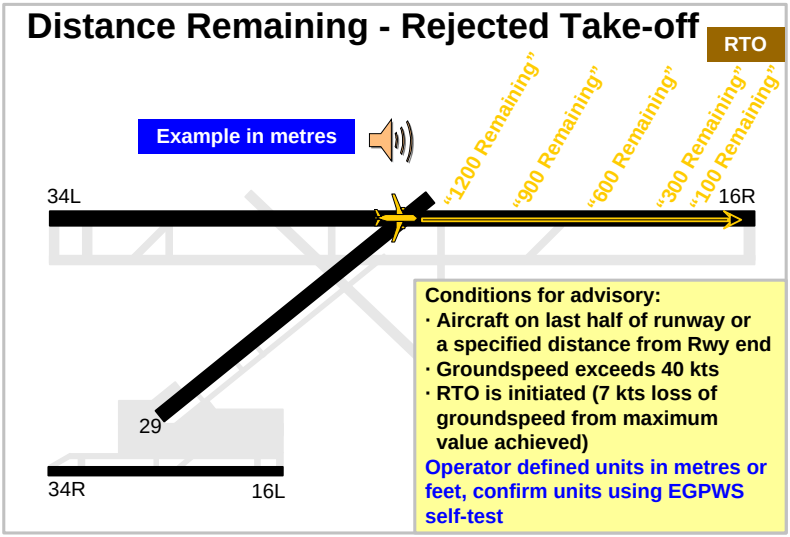
Runway Occupancy

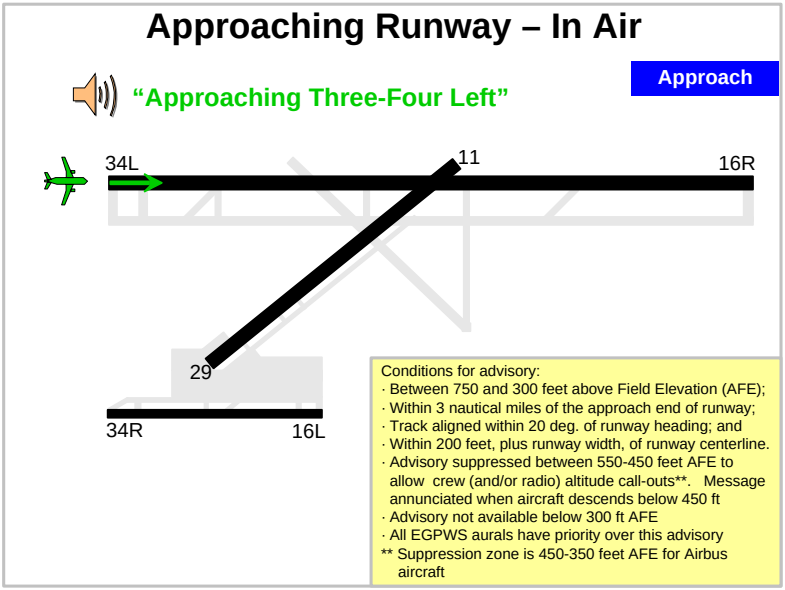


Conditions for advisory:
- **Aircraft on runway**
- **Within 20 deg. Of runway heading**
- **Waiting in position for extended period that is operator defined e.g. 90 seconds**

RAAS Quick Reference

Continued





RAAS Quick Reference

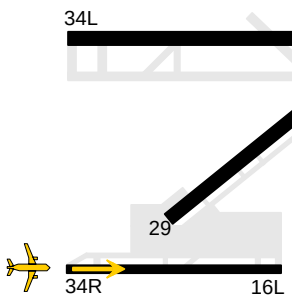
Continued

Approaching Short Runway – In Air

"Approaching Three-Four Right, Three-Thousand Feet Available"

Approach

Example in feet



Conditions for advisory:
· All Approaching Runway – In Air criteria
· Runway length is less than nominal landing runway length

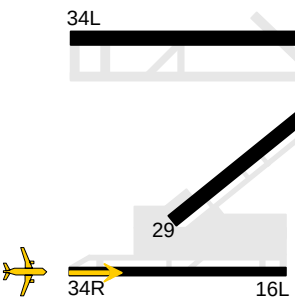
Operator defined nominal runway length in metres or feet, RCD option to annunciate unit of measurement selected

Approaching Runway – In Air / Caution

"Approaching Three-Four Right, Three-Thousand Available"

"Caution Short Runway, Short Runway"

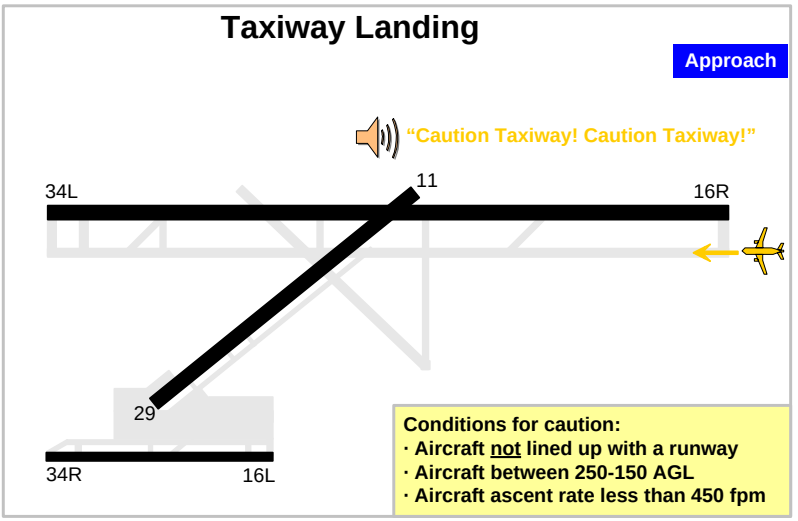
Approach

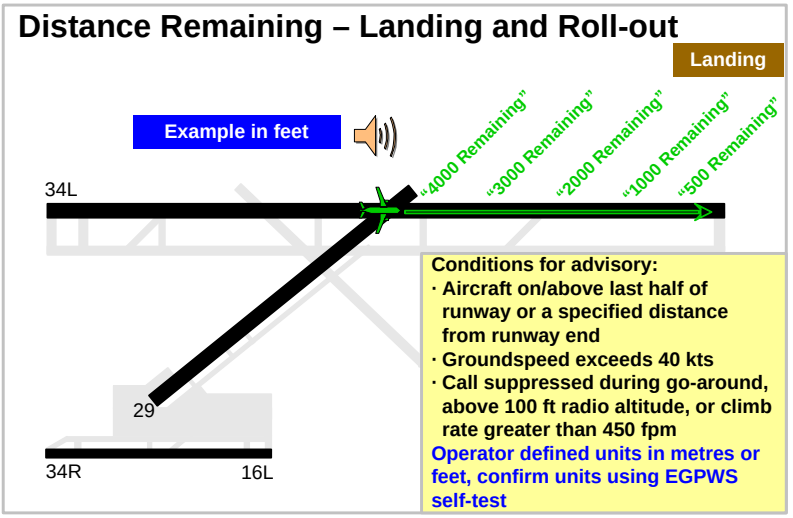


Conditions for caution:
· All conditions for a non-routine Approaching Short Runway – In Air are satisfied; and
· Aligned runway is shorter than a nominal length; and
· Aircraft is between 450 and 300 feet AFE.

RAAS Quick Reference

Continued





RAAS Quick Reference

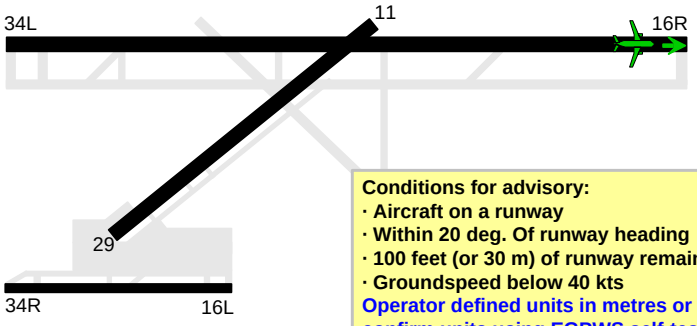
Continued

Runway End

Landing

Example in feet

"100 Remaining"



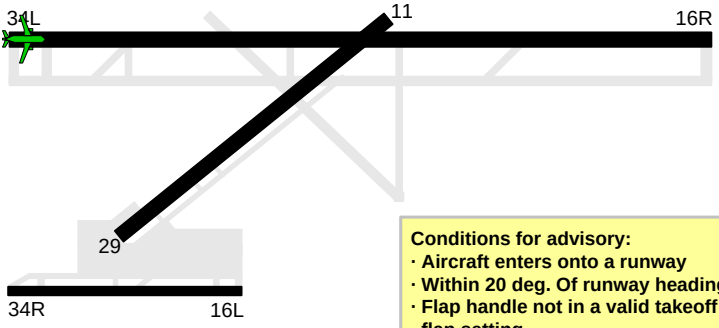
Conditions for advisory:
- **Aircraft on a runway**
- **Within 20 deg. Of runway heading**
- **100 feet (or 30 m) of runway remaining**
- **Groundspeed below 40 kts**

Operator defined units in metres or feet, confirm units using EGPWS self-test

Take-off Flap Monitor

Runway Entry

"On Runway Three-Four Left"
"Flaps, Flaps"



Conditions for advisory:
- **Aircraft enters onto a runway**
- **Within 20 deg. Of runway heading**
- **Flap handle not in a valid takeoff flap setting**

SECTION 3

System Operation Description

The RAAS uses aircraft inputs from the EGPWS such as GPS position, heading, groundspeed and a runway database to generate the runway awareness aural advisories. Note that GPS availability is a requirement for the operation of RAAS. Aircraft position is referenced to the GPS antenna position. RAAS does not have knowledge of taxiways, ATIS & NOTAM information, other traffic, pilot intent, ATC clearance, ground markings and signage. Crews should be cognizant of the prevailing ATIS and any NOTAMs. (Similarly, data on newly constructed runways or changes to length of existing runways may not necessarily be included in the RAAS runway database). RAAS operates automatically, without any action required from the flight crew.

The RAAS advisories are presented below for the relevant flight phases. Note that all RAAS advisories have a lower priority than any existing EGPWS alert, including radio altitude call-outs.

Taxi Operations

Taxiway Take-Off Advisory

A Honeywell runway incursion study indicates that 7% of incidents during takeoffs and landings were from/onto a taxiway. The purpose of the Taxiway Take-Off Advisory is to enhance crew awareness of excessive taxi speeds or a take-off on a taxiway.

This advisory is provided for each of the following conditions:

- Inadvertent taxiway take-off or excessive taxi speeds; and
- Approved take-off operations on a taxiway (e.g., at airports with a single runway that is closed for surface repairs).

The advisory "On Taxiway! On Taxiway!" is provided once if:

- Groundspeed of the aircraft exceeds 40 Kts; and
- Aircraft is on a surface other than a runway.

Note: RAAS functions are based on a database of runway locations. The system does not have knowledge of the location of taxiways, ramp areas, grass surfaces, etc.

If groundspeed reduces below 40 knots after an advisory is provided (i.e., corrective pilot action taken), the system will generate a single advisory again if the conditions above are met.

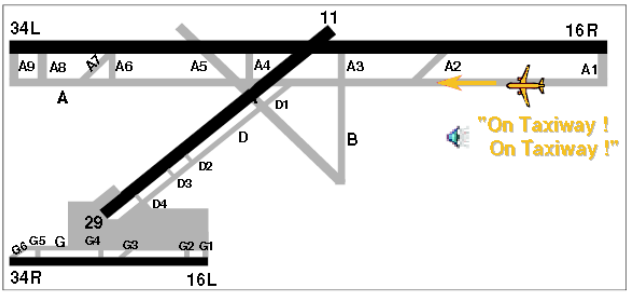
Taxi Operations Continued

Note that there are situations where a runway may be closed (e.g., for construction) and take-off and landing operations authorized on a taxiway. In that case, this advisory serves to confirm a non-normal operation.

The advisory would also be activated at RAAS-enabled airports for take-offs on runways that are not yet included in the RAAS database, for example in the case of newly constructed runways. It is recommended that the take-off briefing include reference to this advisory.

The aural message *"On Taxiway! On Taxiway!"* is annunciated once each time the advisory is generated. For example, the advisory would not be heard continuously during an authorized take-off on a taxiway.

If a caution instead of advisory is enabled, the aural message is *"Caution On Taxiway! On Taxiway!"*.



Taxiway Take-Off Advisory

Approaching Runway On-Ground Advisory

Safety data show that lack of position awareness has resulted in flight crews lining-up with both the wrong runway and a taxiway for take-off. In addition, in some cases crews failed to hold-short (58% of ground operations occurrences) and/or inadvertently entered an active runway. In many of these latter cases crews were unaware of their position relative to a proximate *runway* edge.

The purpose of the Approaching Runway On-Ground Advisory is to provide the crew with awareness of a proximate runway edge being approached by the aircraft during taxi operations.

This advisory depends upon aircraft groundspeed, current heading and closest runway end and is provided if:

- Aircraft is on the ground; and

Taxi Operations

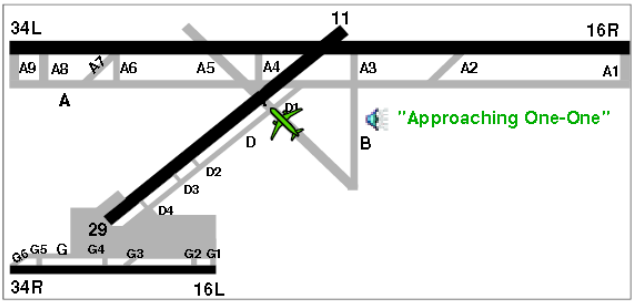
- Aircraft groundspeed is less than 40 knots; and
- Aircraft is within a specified distance from the runway edge.

Continued

This distance depends on aircraft groundspeed and closure angle with the runway. Approaching the runway at relatively higher groundspeeds results in an earlier advisory. The advisory is not intended to guarantee stopping the aircraft short of the runway edge.

The annunciation is inhibited above groundspeeds in excess of 40 knots. For example, the advisory would not be heard during the high-speed regime on take-off or landing – this reduces potential distraction in the flight deck. A runway crossing can be encountered below 40 knots, for example during an intersection departure. Therefore it is recommended that crews reference an anticipated low speed (below 40 knots) Approaching Runway Advisory in the take-off briefing.

The aural message consists of the word "*Approaching*" followed by the runway identifier of the nearest runway end. For example, "*Approaching one-one*". This advisory is issued once each time the aircraft approaches a runway. For example, for an aircraft approaching a 9000-foot runway (34L / 16R) at a distance of 5000 feet from the 34L end of the runway, the advisory is "*Approaching one-six-right*".



Example of Approaching Runway On-Ground Advisory

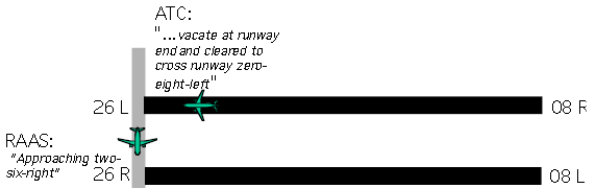
If more than one runway meets the qualifying conditions above (e.g., two runways with headings within 20 degrees of each other), then the message "*Approaching runways*" is provided.

Note after landing on a parallel runway, ATC may clear the aircraft to cross the parallel runway at the far end of the

Taxi Operations

Continued

landing runway. In this case the ATC clearance to cross the parallel runway would refer to the same landing direction but other runway, and the RAAS Approaching Runway Advisory would refer to the closest runway threshold. For example, consider an aircraft that has landed on runway 08 right, and then cleared to cross runway 08 left after roll-out. The RAAS advisory generated as the aircraft approaches runway 08 Left is "*Approaching two-six-right*." This is normal and consistent with the runway markings at the threshold of runway 26R.



Example of Crossing Parallel Runway After Landing

Runway Entry and Occupancy

On Runway Advisory

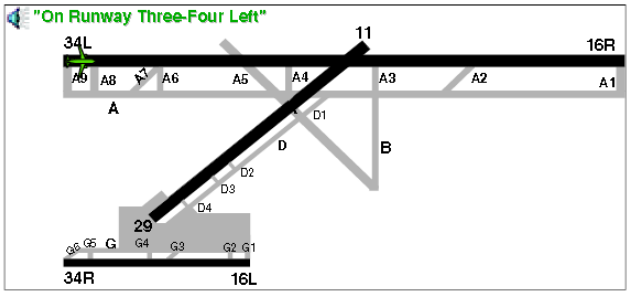
Runway incursion data indicate that

- 44% of incursions involved poor crew position awareness;
- 12% of all take-off incursions were from the incorrect runway; and
- 7% of take-off and landing incursions were from/onto a taxiway.

The purpose of the On Runway Advisory is to provide the crew with awareness of which runway the aircraft is lined-up with during ground operations.

The On Runway Advisory is generated when the following conditions are met:

- Aircraft enters onto a runway; and
- Aircraft heading is within 20 degrees of the runway heading.



Example of On Runway Advisory

Runway Entry and Occupancy

Continued

This advisory is inhibited above a 40-knot groundspeed. The annunciation "*On runway*" followed by the runway identifier is provided as the aircraft lines-up on the runway.

For example, "*On runway three-four-left*." Note that for additional emphasis, the use of the word "*runway*" is strictly reserved for this case where the aircraft is on the runway. The advisory is presented once each time the aircraft enters a runway.

Insufficient Runway Length - On-Ground Advisory

Safety data indicate that loss of situational awareness on the airport surface resulted in 12% of all take-off runway incursions being conducted from the incorrect runway. In some of those cases the take-off distance available was less than that required. Data also indicates that 24% of runway incursion take-offs involved an intersection departure. While not as common, there have been instances where crews have turned the wrong direction while lining-up on a runway for an intersection departure (i.e., heading error of 180°). This situation not only creates a conflict with any aircraft on short-final, but the runway distance available may be insufficient for a safe take-off.

The purpose of the Insufficient Runway Length - On-Ground Advisory is to provide the crew with awareness of which runway the aircraft is lined-up with, and that the runway length available for takeoff is less than a defined nominal take-off runway length. The "nominal" runway distance for take-off is aircraft type specific and is set by an operator. Note: it cannot be changed by the flight crew.

This advisory is provided when the following conditions are met:

- All conditions for a routine On-Runway Advisory are satisfied;

  and

- Available distance for takeoff is less than the defined nominal runway length.

This advisory does not take into account prevailing conditions such as aircraft weight, wind, runway condition & slope, air temperature and altitude of airport. If the operator does not specify the nominal runway length, the advisory is defaulted to off, unless the operator has chosen to always advise the runway length available for takeoff.

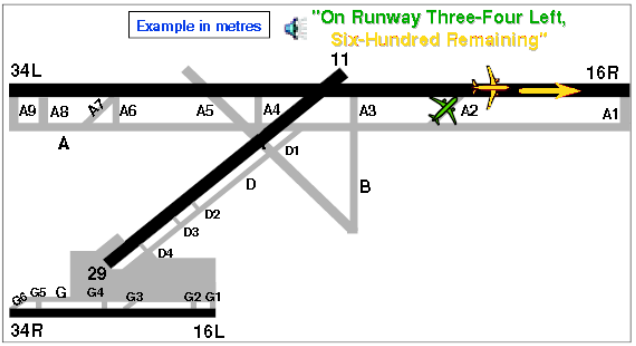
Runway Entry and Occupancy

Continued

RAAS does not account for operational data such as NOTAMs that refer to areas of runway that are not available (e.g., due construction, snow removal, etc.). Crews should be cognizant of any NOTAMs and other published restrictions in effect.

The routine "On runway" message advisory is appended by runway length remaining in either feet or metres, e.g., "*On runway three-four-left, two-thousand remaining*". The "remaining" element of the message refers to the runway distance remaining in the EGPWS database to the nearest 100 feet (or 100 metres for a metric option). Note that the unit (feet or metres) is not annunciated. The unit of length used by RAAS can be confirmed by performing an EGPWS self-test (See "Operational Availability" section).

If caution is enabled, *"Caution Short Runway, Short Runway"* is heard after the existing aural when groundspeed exceeds 40 knots.



Example of Insufficient Runway Length - On-Ground Advisory in Units of Metres

Dissimilar references to the runway heading during the Approaching Runway and the On Runway advisories are a cue to a potentially unusual situation. In this example assume that the aircraft is cleared for an intersection departure at Alpha 2 for runway 16R. The "*Approaching-one-six right*" advisory is provided as the aircraft approaches the runway at Alpha 2. However, an inadvertent turn on to runway 34L (as opposed to 16R) implies that runway identifier for the Insufficient Runway Length Advisory is runway "34L". If the crew correctly turns onto runway 16R, the runway identifier for the routine On Runway Advisory is "16R". Note that a third reference to the "intended" runway for departure, in this example, is a clearance for take-off from runway "16R" from ATC.

Runway Entry and Occupancy

Continued

During a back-taxi scenario, the Insufficient Runway Length Advisory would aid as a confirmation of pilot intent to back-taxi.

Extended Holding On Runway

Safety data show that 17% of runway incursions involved the poor use of a line-up-and-wait clearance (or a taxi-into-position-and-hold clearance [TIPH]). The typical scenario involved Tower ATC clearing an aircraft into position-and-hold on to the departure runway. Factors such as distractions in the Tower, handling multiple frequencies, high workload and memory lapses have resulted in the tower controller simultaneously clearing other traffic to land on the occupied runway. In some cases crews issued with the TIPH clearance were holding-in-position for an unusually extended period. Industry safety recommendations suggest that flight crews holding-in-position on an active runway for an unexpected extended period should contact tower to confirm the extended holding clearance. Timely crew intervention could potentially reduce the risk of a runway incursion.

The purpose of the Extended Holding On Runway Advisory is to provide crew awareness of an extended holding period on the runway.

The aural advisory is given if the following criteria are met:

- Aircraft must be on a runway; and
- Aircraft heading is within 20 degrees of runway heading; and
- Aircraft remains in position for a time period considered to be an extended holding period.

The extended holding period time is set in the RCD and it cannot be changed by the flight crew. The time period can be configured for 60, 90, 120, 180, 240, or 300 seconds.

The aircraft heading must be within 20 degrees of runway heading and the aircraft must not move more than 100 ft along the runway for this advisory to be activated.

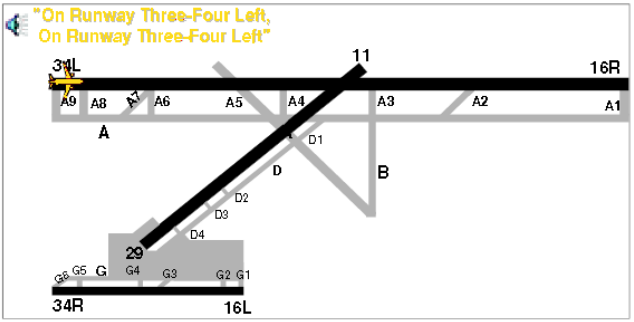
Note that if the aircraft continues to hold for a period in excess of the initial extended holding period, the advisory may be set to repeat for the same or different holding interval. The repeat advisory time may also be configured to be off. These options are set in the RCD and cannot be changed by the flight crew.

Runway Entry and Occupancy

Continued

The Extended Holding On Runway Advisory is suppressed after a Rejected Take-Off (RTO). The advisory is reset and available again once the aircraft exits the current runway.

After the specified extended holding period has elapsed, RAAS provides an aural message that is a double repetition of the On Runway Advisory. For example, if an aircraft has been holding-in-position on runway 34 left for an extended period (e.g., 90 seconds), the system will annunciate "*On runway three-four left, on runway three-four left.*"



Example of Extended Holding On Runway Advisory

Rejected Take-Off

Distance Remaining - Rejected Take-Off Advisory

The purpose of the Rejected Take-Off Distance Remaining Advisory is to provide the flight crew with position awareness information during a RTO.

The advisory is generated if the following conditions are satisfied:

- Aircraft is on the last half of the runway or a specified distance from the runway end;
- Groundspeed is greater than 40 knots; and
- An RTO is initiated (RTO status is assumed if groundspeed during the take-off roll decreases by 7 knots from the maximum value achieved).

The advisory terminates once the groundspeed decreases below 40 knots during the RTO. The Extended Holding On Runway Advisory is not provided during the period following the RTO.

The advisories are generated at whole thousand-foot intervals if RAAS is configured in "feet", except that the last possible advisory occurs at 500 feet. For example, the following advisories would be generated during a RTO on a 9000-foot runway:

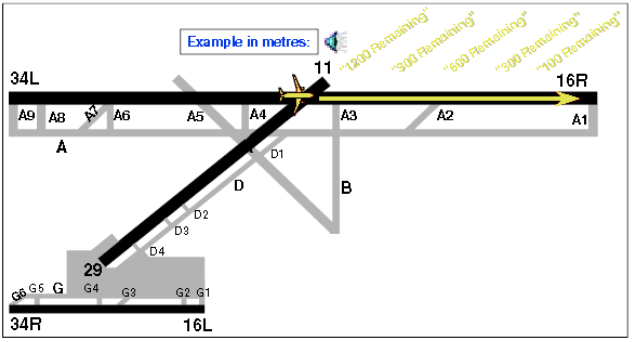
Rejected Take-Off Continued

- "*Four-thousand remaining*";
- "*Three-thousand remaining*";
- "*Two-thousand remaining*";
- "*One-thousand remaining*"; and
- "*Five-hundred remaining*".

The metric distance advisories are generated at 300-metre intervals, except that the last possible advisory occurs at 100 metres. For example, the following advisories would be provided during a RTO on a 3000-metre runway:

- "*One-thousand-two-hundred remaining*";
- "*Nine-hundred remaining*";
- "*Six-hundred remaining*";
- "*Three-hundred remaining*"; and
- "*One-hundred remaining*".

If the option to annunciate the "unit of measurement" is enabled, "*feet*" or "*meters*" is included in the phrase for the first distance remaining callout. Example "*Four-thousand feet remaining*" followed by "*Three-thousand remaining*".



Distance Remaining - Rejected Take-off Advisory in Metres

Note that message content is identical to that for the Landing Roll-Out Distance Remaining Advisory.

Approach to Runway

Approaching Runway - In-Air Advisory

Safety data indicate that poor spatial awareness on approach (lining-up and/or landing on the incorrect runway) is a significant factor in runway incursions. The purpose of the Approaching Runway In-Air Advisory is to provide the crew with awareness of which runway the aircraft is tracking on final approach.

Approach to Runway Continued

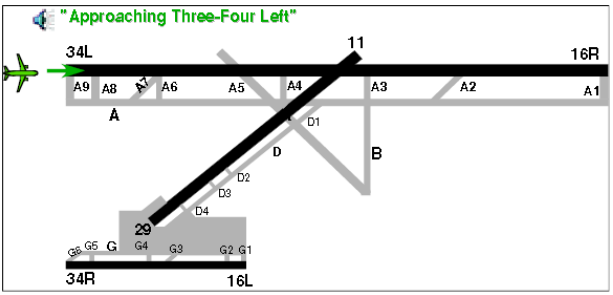
This advisory is provided when:

- Aircraft is between 750 feet and 300 feet Above Field Elevation (AFE);
- Aircraft is within approximately 3 nautical miles of the approach end of the runway;
- Aircraft lateral position is within approximately 200 feet, plus runway width, from the runway centerline; and
- Aircraft track is aligned within 20 degrees of runway heading.

All current EGPWS alerts have a higher priority than this RAAS advisory. The Approaching Runway In-Air Advisory is suppressed between 550 feet and 450 feet above runway elevation to allow the normal 500-foot radio altitude call-out and/or crew procedures without conflict. There is an option to select an alternative suppression zone of 450 – 350 feet AFE to allow the 400-foot altitude call-out in Airbus aircraft.

The advisory is not provided below 300 feet AFE. This reduces potential distraction during high workload conditions.

This advisory is annunciated once for each runway alignment when the conditions noted above are satisfied. The advisory message consists of the word "approaching" followed by the runway identifier, for example, "Approaching three-four-left." An aircraft that is required to side-step to an alternative runway while on short-final could potentially be provided with two Approaching Runway Advisory messages; one call-out for the original runway and another as the aircraft aligns with the second runway. The advisory conditions above would have to be satisfied for each runway call-out.



Example of Approaching Runway - In-Air Advisory

Approach to Runway

Continued

For some approaches more than one runway could meet the qualifying conditions above, e.g., two closely spaced runways with headings that are within 20 degrees of each other. The message "*Approaching Runways*" is provided in such cases.

Example of "Approaching Runways" Advisory

Approaching Short Runway - In-Air Advisory

Safety data indicate that loss of position awareness on approach is a factor in runway incursions – lining up and/or landing on the wrong runway. In some cases the landing distance available (on the incorrect runway) was less than that required.

The purpose of the Approaching Short Runway - In-Air Advisory is to provide the crew with awareness of which runway the aircraft is tracking, and that the runway length available for landing is less than a defined nominal landing runway length. The "nominal" runway distance for landing is aircraft type specific and is set by an operator. Note that it cannot be changed by the flight crew.

This advisory is provided when the following conditions are met:

- All conditions for a routine Approaching In-Air Advisory are satisfied (see previous section for details); and
- The aligned runway is shorter than a nominal landing runway length.

The system uses the same altitude zones to suppress this advisory that are used for the routine Approaching Runway In-Air Advisory.

Note that this advisory does not take into account prevailing conditions such as aircraft weight, wind, runway condition & slope, air temperature and altitude of airport. If the operator does not specify the nominal runway length, the advisory is defaulted to off, unless the operator has chosen to always advise the runway length available for landing.

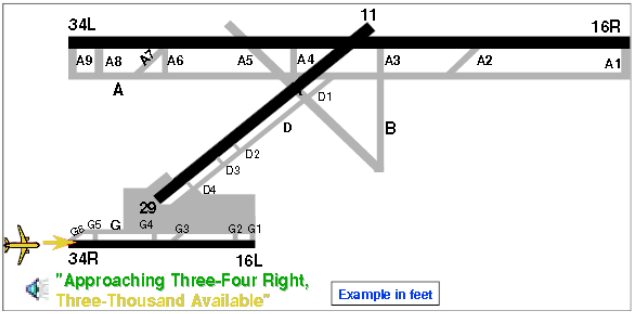
Approach to Runway Continued

RAAS does not account for operational data such as NOTAMs that refer to areas of runway that are not available (e.g., due construction, snow removal, etc). Crews should be cognizant of any NOTAMs and other published restrictions in effect.

The Routine Approaching Runway In-Air Advisory message is appended with available runway length information, for example "Approaching three-four-right, three-thousand-available". The "available" element of the message refers to the runway distance in the EGPWS database to the nearest 100-ft (or 100 m for the metric option). Note that the unit (feet or metres) is not annunciated.

The unit of length used by RAAS can be confirmed by performing an EGPWS self-test (See "Operational Availability" section). This advisory occurs once for each runway alignment based on the conditions specified above.

If caution is enabled *"Caution Short Runway, Short Runway"* is heard after the existing aural when the aircraft has descended between 450 and 300 feet AFE.



Example of Approaching Short Runway - In-Air Advisory (in Feet)

Landing Roll-Out

Distance Remaining - Landing and Roll-Out Advisory

The purpose of the Distance Remaining Advisory is to enhance crew awareness of aircraft position relative to the runway end.

The Distance Remaining Advisory is provided when the following conditions are met:

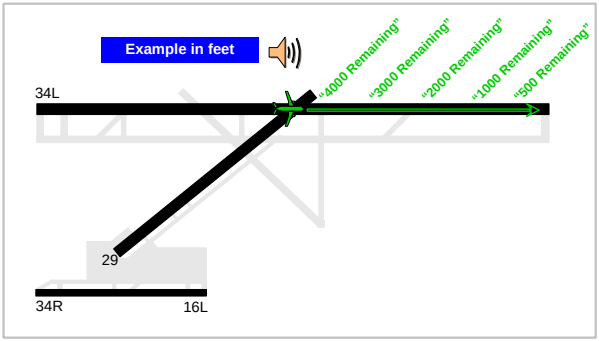
- Aircraft is within 100 feet of the ground, over the last half of the runway or a specified distance from the runway end; or
- Aircraft is on the ground, over the last half of the runway or a specified distance from the runway end; and
- Aircraft groundspeed is above 40 knots.

Landing Roll-Out Continued

If the crew decides to go-around after the Distance Remaining Advisory is triggered, the call-outs continue to be annunciated at the appropriate distances along the runway. The advisories are inhibited once the aircraft attains a Radio Altitude of 100 feet or a climb rate of 450 feet-per-minute.

The advisories are generated at whole thousand-foot intervals if RAAS is configured in "feet", except that the last possible advisory occurs at 500 feet. For example, the following advisories would be generated during a landing on a 9000-foot runway:

- "*Four-thousand remaining*"; [1]
- "*Three-thousand remaining*";
- "*Two-thousand remaining*";
- "*One-thousand remaining*"; and
- "*Five-hundred remaining*".



Example of a Landing and Roll-Out Advisory in Feet

The metric distance advisories are generated at 300-metre intervals, except that the last possible advisory occurs at 100 metres. For example, the following advisories would be generated during a landing on a 3000-metre runway:

- "*One-thousand-two-hundred remaining*"; [1]
- "*Nine-hundred remaining*";
- "*Six-hundred remaining*";
- "*Three-hundred remaining*"; and
- "*One-hundred remaining*".

Note that message content is identical to that for the Rejected Take-Off Distance Remaining Advisory.

[1] If the option to annunciate the unit of measure is enabled, "*feet*" or "*meters*" are included in the first distance remaining call.

Landing Roll-Out Continued

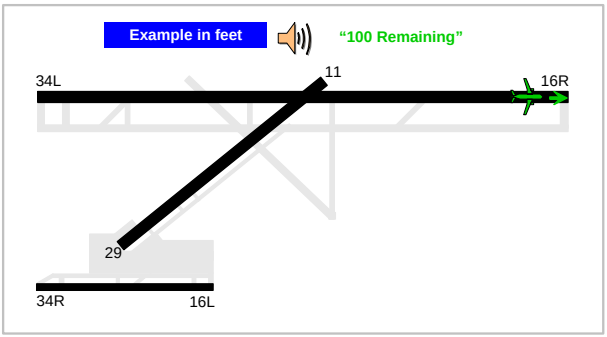
Runway End Advisory

The purpose of the Runway End Advisory is to improve flight crew awareness of the position of the aircraft relative to the runway end during low visibility conditions. Note that the advisory is not intended to prevent a landing overrun. The Runway End Advisory is provided to the flight crew when:

- Aircraft is on a runway and aligned within 20 degrees of runway heading;
- Aircraft approaches within 100 feet (or 30 metres for the metric option) of the runway end; and
- Aircraft groundspeed is below 40 knots.

The aural message is "One-hundred remaining" for systems configured in feet and "Thirty remaining" for a metric configuration.

If the option to annunciate the "unit of measurement" is enabled, *"Feet"* or *"Meters"* is included in the phrase. For example *"100 Feet Remaining"*.



Example of runway End Advisory in feet

Taxiway Landing

Taxiway Landing Caution

The purpose of the Taxiway Landing Caution is to enhance crew awareness that the aircraft is not aligned with a runway.

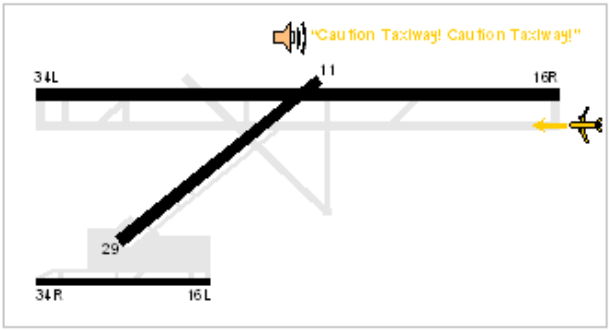
The Taxiway Landing Caution is provided when the following conditions are met:

- Aircraft is in the air; and
- Aircraft is between 250 and 150 AGL; and
- Aircraft is not aligned with the runway; and
- Aircraft climb rate is less than or equal to 450 FPM.

The typical aural message is "Caution Taxiway, Caution Taxiway". The annunciation is re-armed when the aircraft is more than 400 feet AGL.

Taxiway Landing

Continued



Example of Taxiway Landing

Crew briefing for approved landing on a taxiway should include the expected *Caution Taxiway* alert and appropriate use of inhibit control if available.

Takeoff Flap Configuration Monitor

The Takeoff Flap Configuration Monitor function offers a significant safety advancement to provide the flight crew with awareness of improper Flap setting when the aircraft is lined-up on a runway in advance of takeoff. With the benefit of a "virtual" box around the EGPWS runway data, the alert is provided well before thrust levers are advanced for runway takeoff.

The Takeoff Flap Configuration Monitor uses GPS position data and the Runway Database to provide aural and visual annunciations that supplement flight crew awareness of flap setting during ground operations.

The Takeoff Flap Configuration annunciation is generated when the following conditions are met:

- Flap handle is not within the valid takeoff flap setting;
- Aircraft enters a runway;
- Aircraft heading is within ±20 degrees of the runway heading.

The aural message consists of the phrase "*Flaps Flaps*". This caution message is annunciated once each time the aircraft enters, and is aligned with, a runway. No further calls are provided unless the flap handle is adjusted and, after 5 seconds of settling time, the flaps are still not set within the valid takeoff flap setting. Should the pilot adjust the flaps after the first caution but fails to set takeoff flaps, an additional "*Flaps Flaps*" message is provided. Each time a new flap setting is made the caution will be provided if not within the takeoff flaps range.

If RAAS On Runway advisory is enabled, "Flaps Flaps" is appended to the end of the On Runway callout. For example, "*On Runway Two-Four, Flaps Flaps*". This alert message is annunciated once each time the aircraft enters a runway unless a new flap setting is made as explained above. In this case, the "Flaps Flaps" message will be annunciated without a RAAS advisory.

The Takeoff Flap Configuration Monitor function is enabled using the RCD. This function requires that RAAS be enabled. None of the Advisories or cautions need be enabled, but the RAAS processing must be running. When enabled, the Takeoff Flap Configuration Monitor operates automatically, without any action required from the flight crew.

In addition to the aural annunciations provided, the GPWS lamp will be illuminated. Visual text annunciations can also be overlaid on the terrain display for a period of time when the monitor condition is entered. The visual annunciation may be enabled or disabled via the RCD. If configured to do so, the EGPWS presents the text string "FLAPS" overlaid on top of the terrain image upon activation of the aural. The text is centered on the display. The text will remain on the display until any one of the following conditions exists: configured timer expires (typically 16 seconds), range on the terrain display is changed, a new voice with associated visual annunciation is issued, or a Terrain/Obstacle caution or warning condition exists.

Inhibit of the Takeoff Flap Configuration Monitor function via an external cockpit selection may be configured.

System inoperative messages may be indicated as required using existing inoperative indications. The Takeoff Flap Configuration Monitor inoperative status will be indicated during the EGPWS Self-Test if the monitor is enabled via the RCD and the status indicates the function is inoperative.

Crew briefing for taxiing on a runway that is not the departure runway should include the potential *Flaps Flaps* alert if a takeoff flap has not been set by the Standard Operating Procedure (SOP).

Simultaneous onset of Takeoff Configuration Warning System (TOCWS) horn and the Takeoff Flap Configuration Monitor *Flaps Flaps* alert could occur. It should be noted that multiple aircraft configuration errors could cause a TOCWS horn, including Takeoff Flap Configuration. E.g., Once the flap anomaly is resolved, the TOCWS horn will persist for other configuration errors. The flight crew should perform their normal cross-checks to verify aircraft configuration.

RAAS Display Messages

RAAS advisory/caution visual messages can also be displayed on the Terrain Display. RAAS visual messages are shown for two sweeps of the Terrain Display. This feature is available on all aircraft, but may not Pop-up on some displays unless the terrain image is selected. The displayed visual messages are as follows (and an option exists to only display the cautions).

Displayed Message	Conditions
APP 34L (green)	Approaching runway 34L (example). APP with runway ID appended. In air the runway ID will be the aligned runway. On ground the runway ID will be the crossing runway.
APP RWYS (green)	Approaching runway with indeterminate runway. In air the reference runways will be the aligned runways. On ground the reference runways will be the crossing runways.
ON 34L (green)	On runway 34L (example). ON with runway ID appended. This message will also appear with Extended Holding advisories.
ON RWYS (green)	On runways with indeterminate aligned runway.
APP 34R 3000 (amber)	Approaching runway 34R with 3000 feet length. APP with runway ID and runway length appended. The Approaching Short Runway in air advisory will reference the aligned runway.
SHORT RUNWAY (amber)	Short runway alert (in air or on ground) associated with audio message "Caution Short Runway, Short Runway".
ON 34R 3000 (amber)	On runway 34R with 3000 feet available length. APP with runway ID and remaining runway length appended. The Insufficient Short Runway on ground advisory will reference the aligned runway.
ON TAXIWAY (amber)	Aircraft groundspeed is greater than 40 knots on a taxiway.
TAXIWAY (amber)	RAAS has detected an inadvertent landing on a Taxiway. The message will appear for the period of the in air condition.
FLAPS (amber)	The Takeoff Flap Configuration Monitor has detected an improper Flap setting when the aircraft is lined-up on a runway in advance of takeoff.

Summary of Pilot Response to Non-Routine Advisories/Cautions

Non-Routine Advisory/Cautions	Purpose
Runway Awareness and Advisory System	
Approaching Short Runway in air Advisory (eg. "Approaching 34R 3000 Available")	Confirm aircraft position and initiate go-around if appropriate.
Approaching Short Runway in air Caution (eg. "Approaching 34R 3000 Available Caution Short Runway, Short Runway")	Confirm aircraft position and initiate go-around if appropriate.
Insufficient Runway on ground Advisory (eg. "On 34R 3000 Remaining")	Confirm aircraft position and that sufficient runway is available for takeoff.
Insufficient Runway on ground Caution (eg. "On 34R 3000 Remaining Caution Short Runway, Short Runway")	Confirm aircraft position and discontinue takeoff if appropriate.
Taxiway Landing Caution ("Caution Taxiway! Caution Taxiway!")	Confirm aircraft position and initiate go-around if appropriate.
On Taxiway Advisory ("On Taxiway! On Taxiway!")	Confirm aircraft position and speed. Take necessary action as required (eg. Abort, slow down or continue in case of approved taxiway takeoff).
On Taxiway Caution ("Caution On Taxiway! On Taxiway!")	Confirm aircraft position and speed, discontinue takeoff if appropriate.
Take-off Flap Caution ("Flaps, Flaps")	Verify Flap setting and configure as necessary for Take-off.

SECTION 4

RAAS Options

The options listed below are set in the RCD and setup during the installation of RAAS. The flight crew cannot configure them.

RAAS Options:

Configurable Feature	Option
Distance Unit of Measurement	Feet or Metres
Voice Gender	Female or Male
GPS Antenna Location	Customer-selected location based on aircraft installation
Taxiway Takeoff	Off or On
Caution Taxiway Takeoff	Off or On
Insufficient Runway Length - On Ground (Takeoff)	Off or On using customer - selected nominal runway length based on aircraft type, or always On
Caution Short Runway – On Ground (Takeoff)	Off or On
Extended Holding - On Runway	INITIAL: 60, 90, 120, 180, 240, 300, Off REPEAT: 30, 60, 90, 120, 180, 240, 300, Off
Distance Remaining - Rejected Takeoff	Off or On (50% of runway) or with -224 or later software selected distances 1000 (300), 2000 (600), 3000 (900), 4000 (1200) or 5000 (1500) Feet (meters)
Approaching Runway - In Air Advisory suppression zone	Off or On 550 - 450 feet AFE or 450 - 350 feet AFE
Approaching Short Runway - In Air (Landing)	Off or On using customer - selected nominal runway length based on aircraft type, or always On
Caution Short Runway – In Air (Landing)	Off or On
Distance Remaining - Landing	Off or On (50% of runway) or with -224 or later software selected distances 1000 (300), 2000 (600), 3000 (900), 4000 (1200) or 5000 (1500) Feet (meters)
Runway End Callout	Off or On
Taxiway Landing	Off or On
Take-off Flap	Off or On Male or Female voice Inhibit control Minimum and Maximum Flap setting

SECTION 5

Audio Levels

RAAS advisories are heard over the same aircraft audio systems that presently provide EGPWS audio caution and warning alerts in the flight deck. The volume of RAAS advisories is controlled by the EGPWS - the RAAS message volume level is based on the expected flight operation for each advisory. RAAS employs three relative audio volume levels:

Audio Levels:

Audio Level	Advisory / Caution
High	The Taxiway Take-Off Advisory is issued at the EGPWS caution and warning alert volume level plus 3 dB.
Medium	Distance Remaining advisories and cautions are issued at the same volume level as EGPWS cautions and warnings.
Low	All other in-air and on-ground advisories (excludes Distance Remaining and Taxiway Takeoff Advisories) are issued at the same volume level as the EGPWS cautions and warnings volume level minus 6 dB. *

* other volumes levels selectable by RAAS configuration

SECTION 6

Operational Availability

RAAS is operationally available anytime the EGPWS is powered and the following conditions are met:

- The software for the RAAS functions have been loaded and enabled into an EGPWS (with a minimum of software version -218-218 (or later) and Terrain Database 435). For RAAS with software version -230-230 (or later) Terrain Database 454 (or later) is required;
- The aircraft is on or approaching an airport in the RAAS runway database; and
- RAAS is functional (e.g., all external signals are available and not faulted, GPS position accuracy meets minimum RAAS requirements, there are no internal EGPWS faults).

RAAS operational availability is integrated into the existing EGPWS fault monitoring and self-test functions. Consistent with approved EGPWS self-test design, the loss of RAAS functions is indicated on-ground only during an EGPWS self-test. There is no automatic annunciation of the loss of RAAS functionality on most aircraft. The audio self-test messages are as follows.

RAAS Self-Test Audio Messages:

Audio Message	Conditions
"Runway Awareness OK Feet"	RAAS software enabled, functioning, has good position information, and is at a validated airport. Feet will be annunciated in the gender voice option (male or female) selected for RAAS.
"Runway Awareness OK Metres"	RAAS software enabled, functioning, has good position information, and is at a validated airport. Metres will be annunciated in the gender voice option (male or female) selected for RAAS.
"Runway Awareness Not Available"	RAAS software enabled, but the system either has no position information, the accuracy of the position information is insufficient to allow RAAS to function, or the aircraft is at an airport that has not been validated for RAAS in the EGPWS Terrain Database.
"Runway Awareness Inhibited"	RAAS software enabled, but the advisories have been inhibited with the activation of an external discrete.
"Runway Awareness R-T-O"	RAAS software enabled and functioning, but RAAS has detected a Rejected Take-Off condition. To clear this message, the aircraft must be taxied off the runway area.
"Runway Awareness INOP"	RAAS software enabled but function is inoperative.

"Flap Monitor INOP"	Take-off Flap Configuration Monitor is enabled but the function is inoperative. Annunciated on ground during Level 1 Self-Test.

RAAS status can also be displayed on the Terrain Display. This is active only when the aircraft is on the ground. If the INOP, Inhibit or Not available conditions exist, the status is immediately shown on the Terrain display and can be cleared by a range change. For all other status messages, the procedure requires the flight crew to select the terrain display followed by a change in the displayed range (to a higher or lower range). RAAS status is annunciated for two sweeps of the Terrain Display. This feature is available on all aircraft, but is primarily intended for those aircraft where the flight crew does not perform an EGPWS self-test. The displayed status messages are as follows.

RAAS Status Display Messages

Displayed Message	Conditions
RAAS OK FT (green)	RAAS software enabled, functioning, has good position information, and is at a validated airport. Distances annunciated in feet.
RAAS OK M (green)	RAAS software enabled, functioning, has good position information, and is at a validated airport. Distances annunciated in metres.
RAAS N/AVBL (amber)	RAAS software enabled, but the system either has no position information or the accuracy of the position information is insufficient to allow RAAS to function.
RAAS NA X (amber)	RAAS software enabled, but the location airport has not been validated for RAAS in the EGPWS Terrain Database. X = the location airport designator. For example RAAS-NA-KSBP for San Luis Obispo Co. Regional Airport. Added in -230-230 software version.
RAAS INH (amber)	RAAS software enabled, but the advisories have been inhibited with the activation of an external discrete.
RAAS RTO (green)	RAAS software enabled and functioning, but RAAS has detected a Rejected Take-Off condition. To clear this message, the aircraft must be taxied off the runway area.
RAAS INOP (amber)	RAAS software enabled but function is inoperative.

SECTION 7

Frequently Asked Questions

Q. How do I know that the RAAS is enabled?

A. Perform an EGPWS self-test or select the Terrain Display followed by a change in the displayed range (to a higher or lower range). RAAS status is annunciated for two sweeps of the Terrain Display. These functions available only when aircraft is on the ground.

Q. How can the flight crew determine which RAAS database is currently loaded in the EGPWS computer?

A. The RAAS status message on the Terrain Display during the EGPWS self-test (see last question) also displays the version of the currently installed database.

Q. How can the flight crew determine if RAAS will work at the destination airport upon arrival?

A. RAAS status can be displayed on the Terrain Display only when the aircraft is on the ground. The crew should check in advance if the destination airport is included in the RAAS database – see answer to the next question. Once on the ground at the destination airport, RAAS status can be displayed on the Terrain Display.

Q. How can the flight crew determine what airports are enabled for RAAS?

A. Details of the specific airports included in the RAAS database and procedures for operators to acquire the latest RAAS database are provided on the Internet at www.egpws.com. A telephone number for voice contact is included as well.

Q. Who do I contact for help with a RAAS database issue (such as adding an airport to the RAAS database), or a problem encountered in the operation of RAAS at a particular airport?

A. An online form for RAAS discrepancies is provided on the Internet at www.egpws.com. A telephone number for voice contact is included as well.

877-436-2005 (In U.S.)

602-436-2005 (Outside U.S.)

Frequently Asked Questions Continued

Q. How do I know what units are being used for the RAAS distance related advisories?

A. This information is provided during the EGPWS self-test audio message or on the RAAS status message on the terrain display.

Q. How does RAAS account for temporary runway closures?

A. RAAS does not include knowledge of prevailing Notice to Airmen (NOTAM) and therefore factors such as closure of runways is not reflected by advisories. Crews are assumed to be cognizant of prevailing NOTAM and Automatic Terminal Information Service (ATIS) data. Similarly, data on newly constructed runways or changes to length of existing runways may not necessarily be included in the RAAS runway database.

Q. Why does RAAS provide an On Taxiway advisory on some runways?

A. The runway is not yet in the RAAS database, Crews are always required to use conventional means to ascertain and confirm position of runways.

Q. Why doesn't RAAS always provide an approaching runway advisory when I am at the hold-short line?

A. The Advisory is always provided at a fixed distance from the runway edge at groundspeeds below 10 knots, and in some cases the hold-short lines are not painted at positions that correspond to ICAO standards. RAAS does not have knowledge of ground markings. In RAAS RCDs with part numbers ending -400 or later, a Pilot Point of View (PPoV) distance compensation was added between the nose of the aircraft and the runway edge.

Q. I received a *Flaps Flaps* alert while taxing on a runway to my exit ramp, what caused this?

A. The Takeoff Flap Configuration Monitor will provide a *Flaps Flaps* alert if aligned with the runway and Flaps are not in takeoff configuration, 5 minutes after landing.

Abbreviations

AFE	Above Field Elevation [ft]

ATC	Air Traffic Control
EGPWS	Enhanced Ground Proximity Warning System
GPWS	Ground Proximity Warning System
NOTAM	Notice to Airmen
RAAS	Runway Awareness and Advisory System
RCD	Reloadable Customer Definition
PPOV	Pilot Point Of View
RTO	Rejected Take-Off
TIPH	Taxi-Into-Position-and-Hold

SMARTLANDING™ PILOT GUIDE

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SECTION 1

Introduction

This Pilot Guide section describes the functions and operation of the MKV and MKVII EGPWS SMARTLANDING™ functions added in -230-230 software version and equivalent and later.

The document is divided into the following sections:

- Section 1 – An introduction to the SMARTLANDING™ functions;
- Section 2 – A detailed description of the operation of SMARTLANDING™ functions;
- Section 3 – A summary of the options available to operators to configure SMARTLANDING™ functions;
- Section 4 – Means for the flight crew to check the operational availability of SMARTLANDING™ functions.

This guide does not supersede FAA approved data, Flight Manuals, individual Operations Manuals, requirements, or procedures. Pilots should be thoroughly familiar with their own company policies, system configuration, requirements, and procedures with respect to the operation of aircraft with the EGPWS and RAAS.

The information in this document is intended as a general explanation of the Honeywell Monitor Functions. It contains a description of system performance assuming the identified options are active.

Why SMART LANDING™ functions?

The intended function of the Monitor Functions is to supplement the existing approved flight crew standard operating procedures. Existing EGPWS protection and operation is unaltered by the addition of the new non-TSO Monitor Functions.

New Flight Safety Functions Hosted in EGPWS

- Stabilized Approach Monitor
- Altimeter Monitor
- Long Landing Monitor

Stabilized Approach Monitor

The Stabilized Approach Monitor function offers a significant safety advancement to supplement flight crew awareness of unstabilized approaches as described below. The Stabilized Approach Monitor uses the inputs described below and the Honeywell EGPWS Terrain Database to

Stabilized Approach Monitor

provide visual and aural annunciations that supplement flight crew awareness of unstabilized approaches.

Continued

An unstabilized approach can lead to a runway overrun accident as a result of long touchdown and/or insufficient runway length left to stop. Many airlines are viewing an unstabilized approach as one of the biggest remaining safety issues. They have created "approach gates" in their Standard Operating Procedures (SOP) to help pilots decide whether a go-around action needs to be taken. The gates are typically at 1,000 feet and 500 feet above field elevation (AFE). A typical SOP states that the aircraft should be stabilized by 1,000ft AFE, and must be stabilized by 450ft AFE. A go-around must be initiated if the stabilized approach criteria are not satisfied. The stabilized approach criteria can vary from operator to operator, and also on the type of approach (precision approach vs. non-precision approach, for example).

Altimeter Monitor

The Altimeter Monitor function offers a significant safety advancement to provide the flight crew with awareness of problems with the pressure altitude system.

The Altimeter Monitor uses existing altitude sources and the Honeywell EGPWS Terrain Database to provide aural and visual annunciations as described below.

The Altimeter Monitor continuously monitors the existing altitude inputs to the EGPWS and alerts the crew if an error in the altitude is detected. The Altimeter Monitor provides protection against incorrectly set or erroneous altimeter settings and can help ensure a proper altitude reference is being used, especially for RNP or VNAV based approach procedures with undetected altimetry errors from incorrect altimeter settings

Long Landing Monitor

The Long Landing Monitor function offers pilot increased runway awareness and complements the RAAS Distance Remaining callouts. The function advises the crew of their position during a landing when the aircraft has not touched down in a nominal amount of time and/or distance.

The Long Landing Monitor adds two new distance remaining annunciations to enhance crew awareness of aircraft along-track position relative to the runway end. One provides annunciations if the aircraft has not touched down before a configurable threshold and the second provides airborne only aural annunciations of current distance from aircraft to the runway end.

Non-Routine Advisory/Cautions	Purpose
Stabilized Approach Monitor	
Flaps not in landing configuration	Awareness of unstabilized approach due to improper flap position for landing ("Flaps, Flaps").
Excessive approach angle	Awareness of unstabilized approach due to steep approach angle ("Too High, Too High").
Excessive approach speed	Awareness of unstabilized approach due to excessive approach speed ("Too Fast, Too Fast").
Unstable approach	Awareness of unstabilized approach due to proximity to runway and not meeting other stabilized approach criteria ("Unstable, Unstable").
Altimeter Monitor	
Altimeter setting	Awareness of improper altimeter setting ("Altimeter Setting").
Long Landing Monitor	
Long landing	Awareness of position beyond threshold before touchdown ("Long Landing, Long Landing").
Long landing distance remaining	Awareness of runway distance remaining before touchdown (ex: "five-thousand remaining").

Summary of Pilot Response to Non-Routine Advisories/Cautions

Non-Routine Advisory/Cautions	Purpose
Stabilized Approach Monitor	
Flaps not in landing configuration ("Flaps, Flaps")	Verify flap position and select flap as required.
Excessive approach angle ("Too High, Too High")	Verify vertical position, apply corrections as required.
Excessive approach speed ("Too Fast, Too Fast")	Verify airspeed and adjust as necessary.
Unstable approach ("Unstable, Unstable")	Verify whether approach parameters are as expected/briefed and take appropriate action if necessary.
Altimeter Monitor	
Above Transition Altitude, Altimeter setting ("Altimeter Setting")	Check altimeter setting and procedure altitude, request ATC assistance as necessary.
Below Transition Altitude, Altimeter setting ("Altimeter Setting")	Check the Flight deck (Baro setting) and request an updated Altimeter setting from ATC controller.

Long Landing Monitor	
Long landing ("Long Landing, Long Landing")	Confirm aircraft position and initiate go-around if appropriate.
Long landing distance remaining (eg. "five-thousand remaining").	Confirm aircraft position and initiate go-around if appropriate.

SECTION 2

System Operation Description

The SMARTLANDING™ functions use aircraft inputs from the EGPWS such as GPS position, heading, groundspeed and a runway database to generate the aural advisories/cautions. Note that GPS availability is a requirement for the operation of these SMARTLANDING™ functions. Aircraft position is referenced to the GPS antenna position. The SMARTLANDING™ functions do not have knowledge of taxiways, ATIS & NOTAM information, other traffic, pilot intent, ATC clearance, ground markings and signage. Crews should be cognizant of the prevailing ATIS and any NOTAMs. (Similarly, data on newly constructed runways or changes to length of existing runways may not necessarily be included in the runway database). The SMARTLANDING™ functions operate automatically, without any action required from the flight crew.

Note that all SMARTLANDING™ function annunciations have a lower priority than existing EGPWS alerts, including radio altitude call-outs.

Stabilized Approach Monitor

Stabilized Approach Monitor is armed when the aircraft climbs more than 1,450 ft AFE. Each monitoring function is then separately enabled at different altitudes during the final approach when the aircraft is descending more than 400 fpm at less than 5 NM from the destination runway.

The criteria for a stabilized approach for air transport category aircraft is typically:

- Landing Gear down
- Landing Flaps set
- Aircraft Speed within the final approach speed +10 knots / -5 knots
- Vertical Speed less than -1,000 fpm
- Aircraft on approach profile (Glideslope and Localizer captured)

The Stabilized Approach Monitor observes these parameters during the approach and automatically issues advisories/cautions if the stabilized approach criteria are not met. **No advisory/caution is issued by Stabilized Approach Monitor during normal approach**.

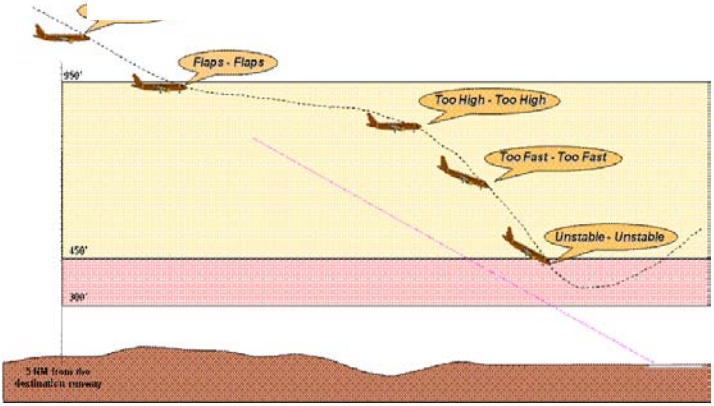
The aircraft is stabilized during the final approach if the aircraft is fully configured to land and the aircraft energy is properly managed. If the aircraft is not configured properly at certain gates or is flown with excessive energy, the Stabilized Approach Monitor issues an annunciation indicating which

Stabilized Approach Monitor Continued

parameter needs attention giving the pilot a chance to correct the problem. When the aircraft reaches the final "gate", which is typically 450' AFE and the problem(s) still exists, an "*Unstable Unstable*" caution is issued.

The Stabilized Approach Monitor specifically has the following four monitoring functions:

- Landing Flap Monitor – Issues "*Flaps (pause) Flaps*" or "*Flaps Flaps*" aural if the landing flaps are not set.
- Excessive Speed Monitor – Issues "*Too Fast – Too Fast"* aural if the aircraft speed becomes excessive compared to the final approach speed (V_{REF} or V_{APP}).
- Excessive Approach Angle Monitor – Issues "*Too High – Too High"* aural if the aircraft approach angle to the runway threshold becomes too steep.
- Unstable Monitor – Issues "*Unstable - Unstable"* aural if the aircraft has not been stabilized at 450' AFE Gate.



The annunciations generated from all the approach monitors except Unstable are classified as advisory level as crew awareness is required and may require subsequent flight crew response. The annunciation generated from the Unstable monitor is classified as caution level as crew awareness and subsequent flight crew response is required.

Each Stabilized Approach Monitor function is independently enabled using the Reloadable Customer Definitions file called the RCD. When enabled, the Stabilized Approach Monitors operate automatically, without any action required from the flight crew.

Stabilized Approach Monitor

By default, the aural message is generated at the EGPWS Warning volume, but the audio level may be adjusted to a different level using the RCD.

Continued

In addition to the aural annunciations provided, visual text annunciations can also be overlaid on the terrain display for a period of time when the monitor condition is entered. The visual annunciation may be enabled or disabled via the RCD. If configured to do so, the EGPWS presents the following text strings overlaid on top of the terrain image upon activation of the aural. The text is centered on the display. The text will remain on the display until any one of the following conditions exists: configured timer expires (typically 16 seconds), range on the terrain display is changed, a new voice with associated visual annunciation is issued, a Terrain/Obstacle caution or warning condition exists, or the Height Above Field Elevation is less than or equal to 300 feet.

Displayed Message	Approach Monitor Aural
FLAPS (amber)	"*Flaps (pause) Flaps*" or "*Flaps Flaps*" aural
TOO FAST (amber)	"*Too Fast – Too Fast*" aural
TOO HIGH (amber)	"*Too High – Too High*" aural
UNSTABLE (amber)	"*Unstable – Unstable*" aural

The following is an example of the visual terrain display message associated with the Flaps aural.

Inhibit of the Stabilized Approach Monitor annunciations via an external cockpit switch or existing cockpit switches may be configured.

System inoperative messages may be indicated as required using existing inoperative indications. The Stabilized Approach Monitor inoperative status will be indicated during the EGPWS Self test if any one of the monitors is enabled via the RCD and the status indicates the function is inoperative.

Landing Flaps Monitor

The Landing Flaps monitor provides the flight crew with awareness of possible unstabilized approach due to flaps not in landing configuration. This function, if enabled, provides a *"Flaps* (pause) *Flaps"* callout if the landing flaps are not set at 950ft AFE (typical upper Flap gate). A "Flaps Flaps" (no pause in between) call is provided if the aircraft is aligned with the runway and the landing flaps are still not set at 600ft AFE (typical lower Flap gate). Note that there is an effective 450 foot lower limit where the "*Unstable*" voice would take precedence.

According to pilots from several major airlines who fly large air transport jets in the U.S., Europe and Asia, the landing flaps are typically set before the aircraft reaches 1,000ft AGL except during a circling approach. The landing flaps are not set until the aircraft is on base during a circling approach. Since Stabilized Approach Monitor does not know the destination runway set in the FMS, Stabilized Approach Monitor can issue a "Flaps-Flaps" callout during a circling approach, most likely on downwind leg. If this becomes an issue, the function can be disabled by the RCD.

Although the existing EGPWS Mode 4 envelope is already covering the landing flaps callout (i.e., "Too Low Flaps" callout at 245ft radio altitude), some operators commented that pilots need to be advised at much higher altitude from a stabilized approach point of view. Therefore, Stabilized Approach Monitor is designed to provide a landing flaps callout independent from Mode 4.

Crew briefing for an engine-out approach without normal landing flaps set should include the potential *Flaps Flaps* alert and appropriate use of Flap over-ride or inhibit control if available.

Crew briefing for a circling approach with a low circling minima (e.g., <1000 ft) should include the potential *Flaps Flaps* alert before the circling procedure begins and appropriate use of Flap over-ride or inhibit control if available.

Excessive Speed Monitor

The Excessive Speed monitor provides the flight crew with awareness of possible unstabilized approach due to excessive approach speeds. This function, if enabled, provides a *"Too Fast – Too Fast"* callout if the aircraft approach speed becomes too fast compared to the target approach speed (V_{REF} or V_{APP}). Since pilots are often asked by ATC to maintain high speed during the final approach, the excessive speed envelope is designed to allow greater deviation from the target approach speed at higher altitude.

Excessive Speed Monitor Continued

When a circling approach is flown, the aircraft speed remains high on the downwind leg. Therefore, Excessive Speed Monitor is not enabled until 600 ft AFE (typical gate) unless the aircraft is fully configured to land, which indicates the aircraft is committed to land.

V_{REF} is typically the stall speed multiplied by 1.3. For an Airbus FMGC, V_{APP} is V_{LS} (Airbus equivalent of V_{REF}) plus additional factors such as wind. Because V_{APP} on Airbus already has wind factors added, the Excessive Speed Monitor Envelope for Airbus aircraft will be different from one for Boeing aircraft using V_{REF}, and can be set more sensitive.

There is a potential association between the Stabilized Approach Monitor *Too Fast* and a Windshear condition. The windshear will have alert priority over the Excessive Speed. Crew action should be focused on the windshear escape.

Excessive Approach Angle Monitor

The Excessive Approach Angle monitor provides the flight crew with awareness of a possible unstabilized approach if the approach angle to the destination runway becomes too steep. This function, if enabled, provides a *"Too High – Too High"* callout if the approach angle to the destination runway becomes too steep.

The aircraft must be lined up with the destination runway on final approach to enable this function. When a circling approach is flown, the aircraft can fly over the runway on downwind leg, which makes computed angle to the runway very large. Therefore, Excessive Approach Angle Monitor is not enabled until 600 ft AFE (minimum circling minima) unless the aircraft is fully configured to land. The destination runway must be identified with very high likelihood and the runway location must be accurate for this function to work properly. The aircraft position must also be accurate (requires a Direct-GPS).

Crew briefing for side-step approach and approach to a runway with a temporary displaced threshold should include the potential *Too High* and/or *Unstable* alert and appropriate use of inhibit control if available.

Unstable Approach Monitor

The Unstable Approach monitor provides the flight crew with awareness of a possible unstabilized approach. This function provides an "Unstable – Unstable" callout and illuminates the GPWS lamp if the aircraft has not reached the 450 ft AFE gate in a stabilized condition. Annunciation of one of the previously discussed monitors must have been activated before the Unstable annunciation is provided so the crew has an indication of why the aircraft is considered unstable.

Altimeter Monitor

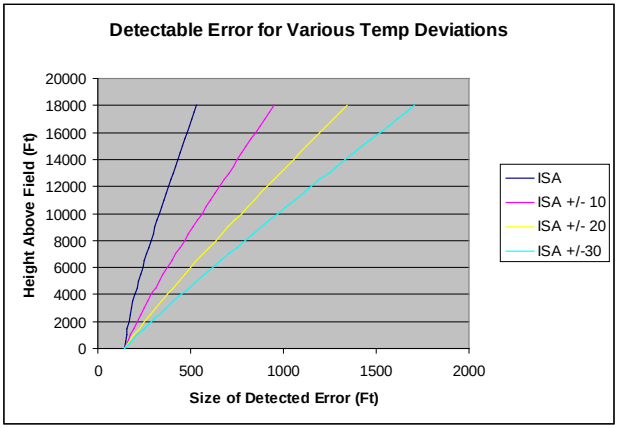
The Altimeter Monitor function provides the flight crew with two advisories that inform of improper altimeter setting. The Below Transition Altitude monitor provides the flight crew with awareness of an anomaly in the pressure altitude system while the aircraft is operating below the transition altitude. The Above Transition Altitude monitor provides the flight crew with awareness of an anomaly in the pressure altitude system if the altimeter has not been set to the standard altitude when the aircraft is operating above the transition altitude.

The annunciations generated from this monitor are classified as advisory level as crew awareness may be required and crew response is not necessarily imminent.

Below Transition Altitude

The Below Transition Altitude - Altimeter monitor compares Corrected Altitude from the Air Data Computer (ADC) with the Global Positioning System (GPS) Altitude from the GPS receiver. If the difference between the two altitudes exceeds a computed threshold value an Altimeter Setting aural message and an optional visual annunciation are generated. Note that the EGPWS does not perform a cross check of both Air Data inputs, on some aircraft a function external to the EGPWS provides an indication to the crew. Therefore the EGPWS compares Corrected Altitude with GPS Altitude from the Captain's side data only. The advisory threshold is dynamically computed based on estimated errors due to non-standard atmospheric conditions, current GPS accuracy, and Air Data system errors. Since the threshold is dynamic, the size of the error that can be detected varies with the current aircraft state and sensor conditions. The figure below shows the size of errors that can be detected for typical conditions as function of the aircraft height above field for different ISA temperature deviations.

The Altimeter Monitor includes a cross check on the GPS Altitude to prevent nuisance advisories caused by erroneous GPS Altitude values. The cross-check compares GPS Altitude with aircraft altitude computed using radio altitude and the terrain elevation from the terrain database. This difference between these altitudes is compared against a dynamically computed threshold based on the current GPS accuracy, radio altitude accuracy, and the estimated terrain database accuracy. If the cross-check fails, then the Below Transition Altitude - Altimeter Monitor is disabled to prevent nuisance annunciations caused by erroneous GPS Altitude values.



Below Transition Altitude Continued

The Altimeter Monitor uses the following inputs: GPS data (including Altitude, Vertical Figure of Merit, Non-Isolatable Satellite Failure (NISF), Operating Mode, Horizontal Integrity Limit, Number of Satellites) and ADC data (Corrected Barometric Altitude, Pressure Altitude, and Static Air Temperature).

The Below Transition Altitude - Altimeter Monitor annunciation is generated when the following conditions are met:

- GPS Altitude and Vertical Figure of Merit (VFOM) are valid and have passed internal reasonableness checks
- GPS is not in altitude aiding mode, the number of satellites tracked is 5 or greater, a non-isolatable satellite failure (NISF) does not exist, and GPS Horizontal Integrity Limit (HIL) is valid
- Corrected Barometric Altitude and Static Air Temperature are valid
- EGPWS Runway Database is valid
- Aircraft Altitude is less than the Transition Altitude for more than 30 seconds OR Height Above Field is less than 1500 feet. The transition altitude is obtained from the EGPWS runway database for the destination runway.
- Aircraft is within 20 nautical miles of the EGPWS Selected destination runway
- Height above field is less than 5000 feet
- Airport is not indicated as QFE, altimeter setting is not QFE, and QFE program pin is not selected
- Radio Height is greater than 600 feet

Below Transition Altitude Continued

The filtered difference between Corrected Altitude and GPS Altitude exceeds a computed threshold based on the current estimated altimetry system errors.

Above Transition Altitude

The there are two selectable options for the Above Transition Altitude - Altimeter monitor. The first option compares Corrected Barometric Altitude with Uncorrected Altitude and generates an annunciation if the difference is greater than the specified threshold after the aircraft has climbed above the transition altitude. This option is applicable to Boeing installations and other aircraft, except Airbus, where the corrected altitude output from the ADC (typically label 204) equals uncorrected altitude when the barometric reference is set to standard.

The second option is applicable to Airbus installations where the Corrected Altitude output from the ADC is not set to standard setting when the barometric reference is set to Standard. In these installations, the barometric reference setting is directly received by the EGPWS. An advisory will be generated if the barometric reference is not set to standard after passing through the transition altitude.

The Above Transition Altitude - Altimeter Monitor advisory is generated when the following conditions are met:

- Corrected Barometric Altitude, Uncorrected Barometric Altitude, and Runway Database are valid.
- The aircraft has been above the transition altitude for more than 30 seconds and not more than 5 minutes.

The difference between Corrected Altitude and Uncorrected Altitude is less than the fixed threshold or the Barometric Altitude Reference does not equal standard, depending on the selected monitor option.

Message content, Audio & Visuals

The aural message consists of the phrase "*Altimeter Setting*". This aural message is issued once when the altimeter error is first detected and will repeat once, 8 seconds later. After two messages, no additional message will be generated.

The monitor will be re-armed if the enable logic goes false and then true or after a change in the altimeter setting is detected by the EGPWS.

By default, the aural message is generated at the EGPWS Warning volume, but the audio level may be adjusted to a different level using the RCD.

In addition to the aural annunciations provided, visual text annunciations can also be overlaid on the terrain display for a period of time when the monitor condition is entered.

The visual annunciation may be enabled or disabled via the RCD. If configured to do so, the EGPWS presents the text string "ALTM SETTING" overlaid on top of the terrain image upon activation of the aural. The text is centered on the display. The text will remain on the display until any one of the following conditions exists: configured timer expires (typically 16 seconds), range on the terrain display is changed, a new voice with associated visual annunciation is issued, a Terrain/Obstacle caution or warning condition exists, or the aircraft is above the transition altitude for the Below Transition Altitude Monitor or below the transition altitude for the Above Transition Altitude Monitor.

Altimeter Monitor Inhibit & Inop

There is not an option to inhibit the Altimeter Monitor annunciations.

The Altimeter Monitor inoperative status will be indicated during the EGPWS Self test if any one of the monitors is enabled via the RCD and the status indicates the function is inoperative.

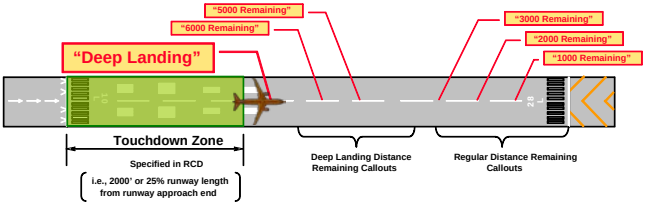
Long Landing Monitor

The Long Landing Monitor provides two new distance remaining annunciations to the flight crew with awareness that the aircraft has not touched down within a defined along-track distance from the runway threshold or the end of the runway, depending on how it has been configured.

The Long Landing Monitor uses GPS position data and the Honeywell EGPWS Terrain Database to provide aural and visual annunciations that supplement flight crew awareness of aircraft position in relation to the runway.

The annunciation generated from this monitor is classified as caution level as crew awareness and immediate and subsequent crew response is required.

If the aircraft has not touched down before a configurable threshold, the EGPWS will issue the default aural "*Long Landing – Long Landing*". The message can be configured to "*Deep Landing – Deep Landing*". In addition, airborne only aural annunciations of current distance from aircraft to the runway end can be enabled.



Long Landing Monitor Continued

The new Long Landing and airborne only Distance Remaining alerts are generated when the following conditions are met:

- Aircraft is within 100 feet AGL, over a customer specified distance from the runway end;
- Aircraft is airborne above 5 feet AGL, or weight on wheels is false

The Long Landing Monitor function is enabled using the RCD. This function requires that RAAS be enabled. None of the Advisories or cautions need be enabled, but the RAAS processing must be running. When enabled, the Long Landing Monitor function operates automatically, without any action required from the flight crew.

In addition to the aural annunciations provided, visual text annunciations can also be overlaid on the terrain display for a period of time when the monitor condition is entered. The visual annunciation may be enabled or disabled via the RCD. If configured to do so, the EGPWS presents the text string "LONG LANDING" or "DEEP LANDING" overlaid on top of the terrain image upon activation of the aural. The text is centered on the display. The text will remain on the display until any one of the following conditions exists: configured timer expires (typically 16 seconds), range on the terrain display is changed, a new voice with associated visual annunciation is issued, or a Terrain/Obstacle caution or warning condition exists.

Inhibit of the Long Landing Monitor function via an external cockpit selection may be configured.

System inoperative messages may be indicated as required using existing inoperative indications. The Long Landing Monitor inoperative status will be indicated during the EGPWS Self-Test if the monitor is enabled via the RCD and the status indicates the function is inoperative.

Crew briefing for landing on a runway with a temporary displaced threshold should include the potential *Long Landing* alert and appropriate use of inhibit control if available. Note, use of inhibit control will also inhibit the Long Landing Distance Remaining callouts.

SECTION 3
MONITOR Options

The options listed below are set in the RCD and setup during the installation of Stabilized Approach Monitor, Altimeter Monitor, and Long Landing Monitor. The flight crew cannot configure them.

Monitor Options:

Configurable Feature	Option
Distance Unit of Measurement	Feet or Metres
GPS Antenna Location	Customer-selected location based on aircraft installation
Enable/Inhibit Discrete	Takeoff Flap and Long Landing monitors use the same discrete as Runway Awareness
Stabilized Approach Monitor	Off or On
Voice Gender	Female or Male
Enable/Inhibit Discrete	Off or On; or use the same discrete as Takeoff Flap, Long Landing and Runway Awareness
Landing Flap Monitor	Off or On
Upper Flap Gate Alert; Altitude	Off or On; 500 ft. to 1400 ft., typically 950 ft.
Lower Flap Gate Alert; Altitude	Off or On; 500 ft. to 1000 ft., typically 600 ft.
Excessive Approach Angle Monitor	Off or On
Excessive Approach Speed Monitor	Off or On; Boeing or Airbus alert curve
Altimeter Monitor	Off or On
Voice Gender	Female or Male
Below Transition Altitude Enable	Off or On
Above Transition Altitude Enable	Off or On
Long Landing Monitor	Off or On
Voice Gender	Female or Male
Configure Callout	"Long Landing" or "Deep Landing"
Long Landing Distance	Distance from the selected end to trigger alert
Long Landing Percentage	Off or On; Percentage of runway remaining to trigger alert
Long Landing Distance Remaining	Off or On; Distance from the selected end to trigger distance remaining alert
Long Landing Percentage Remaining	Off or On; Percentage of runway remaining to trigger distance remaining alert

SECTION 4

Operational Availability

Monitors are operationally available anytime the EGPWS is powered and the following conditions are met:

- The software for the Monitor functions have been loaded and enabled into an EGPWS (with software version -230-230 (or later) and a minimum of Terrain Database version 454 if RAAS or any of the Stabilized Approach Monitors are enabled, otherwise Terrain Database Version 435 or later is required);
- The aircraft is on or approaching an airport in the runway database; and
- Monitors are functional (e.g., all external signals are available and not faulted, GPS position accuracy meets minimum requirements, there are no internal EGPWS faults).

Monitor operational availability is integrated into the existing EGPWS fault monitoring and self-test functions. Consistent with approved EGPWS self-test design, the loss of Monitor functions is indicated on-ground only during an EGPWS self-test. There is no automatic annunciation of the loss of Monitor functionality. The audio self-test messages are as follows.

Monitor Self-Test Audio Messages:

Audio Message	Conditions
"*Altimeter Monitor INOP*"	Altimeter Monitor is enabled but the function is inoperative. Annunciated on ground during Level 1 Self-Test.
"Approach Monitor INOP"	Stabilized Approach Monitor is enabled but the function is inoperative. Annunciated on ground during Level 1 Self-Test.

SECTION 5

Frequently Asked Questions

Q. Will a Side-Step Approach cause a Stabilized Approach Monitor alerts?

A. A potential Stabilized Approach Monitor – Excessive Approach Angle *Too High* callout and *Unstable* alert may occur during the side-step maneuver if the approach becomes too high.

Q. Will a Temporary Displaced Threshold cause a Stabilized Approach Monitor alerts?

A. A potential Stabilized Approach Monitor – Excessive Approach Angle *Too High* callout and *Unstable* alert may occur during the approach to a temporary displaced threshold runway. Also, a potential Long Landing callout may occur during the approach to a temporary displaced threshold runway.

Q. Do I need to select TERR ON to activate Visual Text Messages?

A. The visual alerts are only provided if the Terrain display is selected ON. They do not pop-up on the Terrain display, if the Terrain display is OFF.

Q. How does the Altitude Monitor know that the transition altitude is different in Europe than in the U.S.?

A. The transition altitude is stored in the Runway database, and aircraft position determines the location.

Dear Honeywell EGPWS Customer:

This form is a request for information that will allow Honeywell to notify you of future updates to your Enhanced Ground Proximity Warning System. Please complete the information below and fax the information sheet to **Honeywell at 425-885-8722** or return via U.S. mail to:

Honeywell International, Inc.
Attn: Sandra Slick
Technical Publications
P.O. Box 97001
Redmond, WA 98073-9701

Customer Information:

Customer Contact: _____

Company Name: _____

Shipping Address: _____

_____

Phone Number: _____

Fax Number: _____

E-mail Address: _____

Aircraft Information:

Aircraft Model _____

EGPWS Part Number _____ EGPWS Serial # _____

Aircraft Model _____

EGPWS Part Number _____ EGPWS Serial # _____

Aircraft Model _____

EGPWS Part Number _____ EGPWS Serial # _____

Please detach and send back to Honeywell

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Redmond, Washington USA 98073-9701
Telephone: (425) 885-8367
http://www51.honeywell.com/aero/Products-Services/Avionics-Electronics/EGPWS-Home.html

OR:

Honeywell Global Customer Care
Telephone: 800-601-3099 (U.S.A./Canada)
Telephone: 602-365-3099 (International)
FAX: (602) 822-7272
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