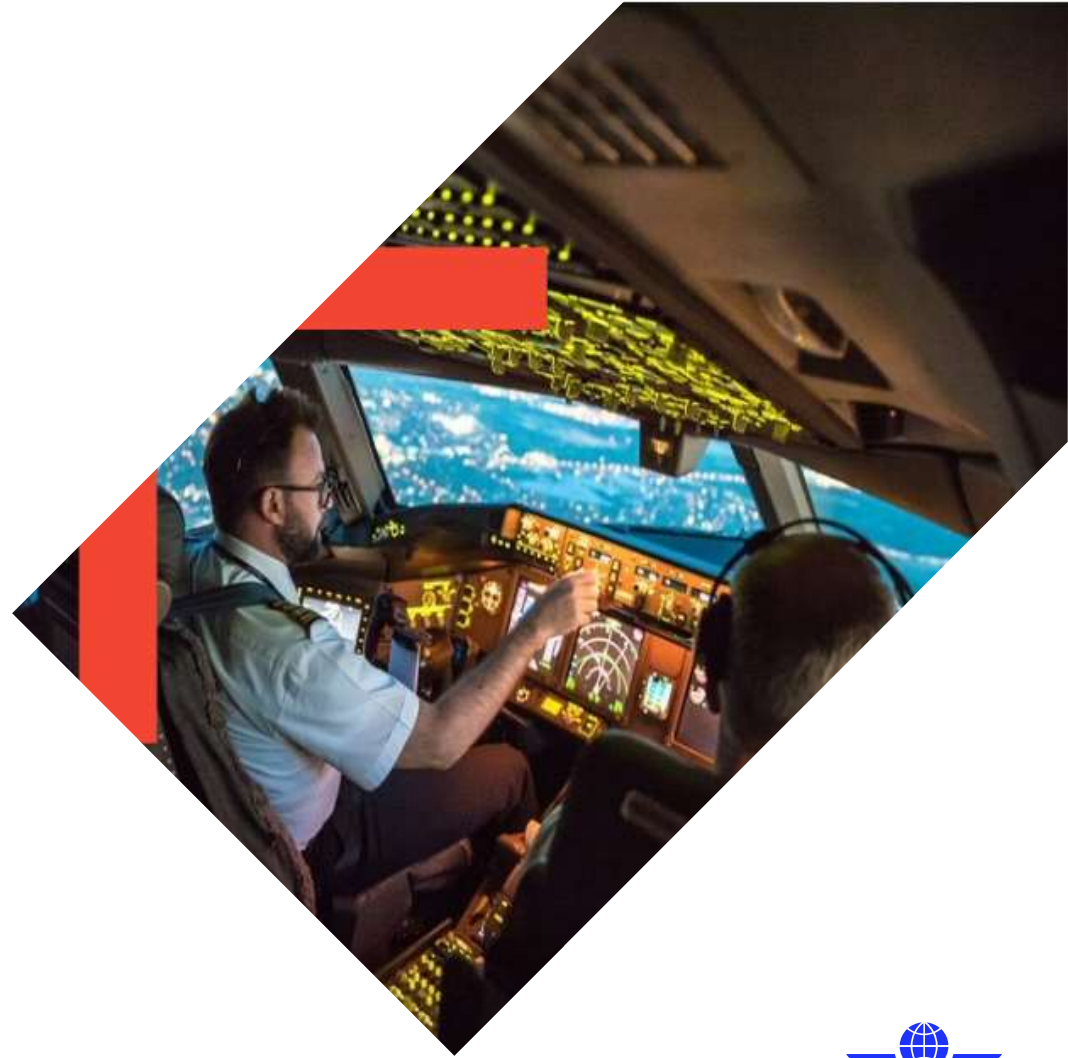


Pilot Response to EGPWS Alerts

Yasuo Ishihara
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Honeywell Aerospace



EGPWS Descriptions

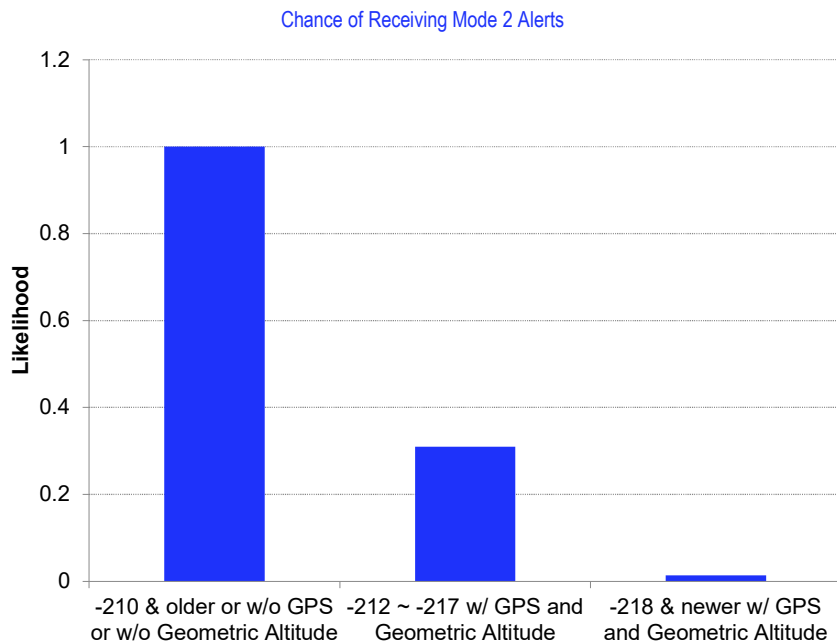
EGPWS Class-A TAWS includes functions such as:

- **Mode 1:** Excessive Descent Rate
- **Mode 2:** Excessive Terrain Closure Rate
- **Mode 3:** Descent After Takeoff
- **Mode 4:** Unsafe Terrain Clearance
- **Mode 5:** Descent Below Glideslope
- **Mode 6:** Advisory Callouts (Optional)
- **Mode 7:** Reactive Windshear (Optional)
- **Terrain Awareness Alerting (Forward Looking Terrain Avoidance)**
- **Terrain Display**
- **Terrain Clearance Floor / Runway Field Clearance Floor**

EGPWS contains

- **Terrain Database**
- **Obstacle Database**
- **Runway Database**

EGPWS Statistics



Source: Honeywell

Summary of findings based on EGPWS event data analysis conducted by Honeywell.

- **Mode 1 (Excessive Descent Rate)**
 - 89% of Mode 1 alerts occurred below 500 ft radio altitude, and 67% below 200 ft radio altitude.
- **Mode 2 (Excessive Terrain Closure Rate)**
 - 98% of Mode 2 alerts occurred on airplanes with EGPWS software version older than -217 (or Boeing P/N 965-1690-050 or Airbus P/N 965-1676-001) or without GPS or without Geometric Altitude.

EGPWS Statistics

Mode 3 (Descent After Takeoff)

- The majority of Mode 3 alerts were occurring during a flight in a traffic pattern such as a training flight. However, some Mode 3 alerts were induced by departure procedures.

Mode 4 (Insufficient Terrain Clearance)

- 57% of Mode 4 alerts were false alerts caused by external faults. The primary cause of the false alerts was faulty radio altimeter (false tracking).

Mode 5 (Descent Below Glideslope)

- 34% of Mode 5 glideslope alerts occurred below 100 ft radio altitude. There were a large number of cases where pilots were ducking under the glideslope below 100 ft. Glideslope alerts occurring at higher altitude were often triggered while maneuvering to intercept the localizer below 1000 ft.

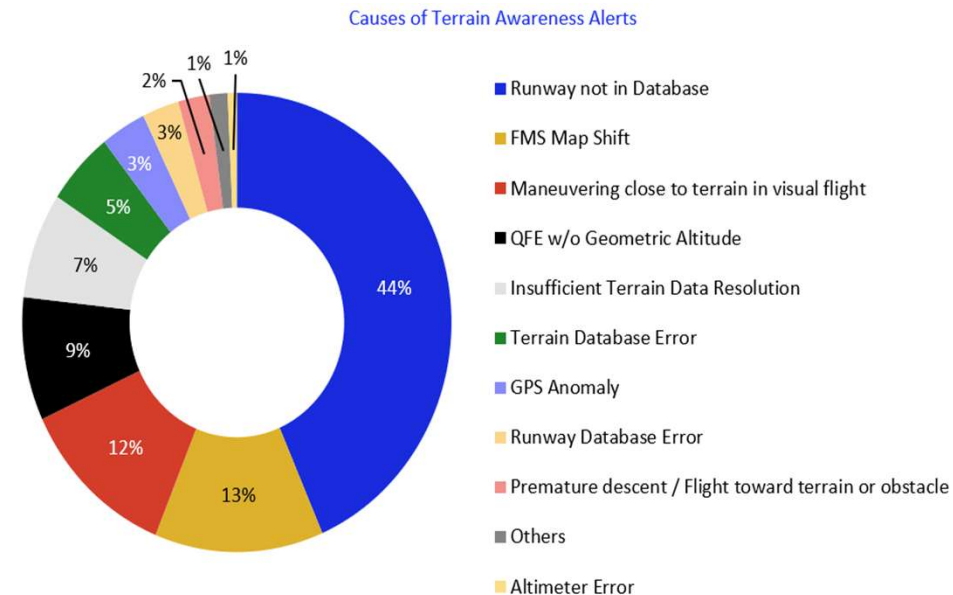
Source: Honeywell



EGPWS Statistics

- **Terrain Awareness Alerting & Terrain Clearance Floor**

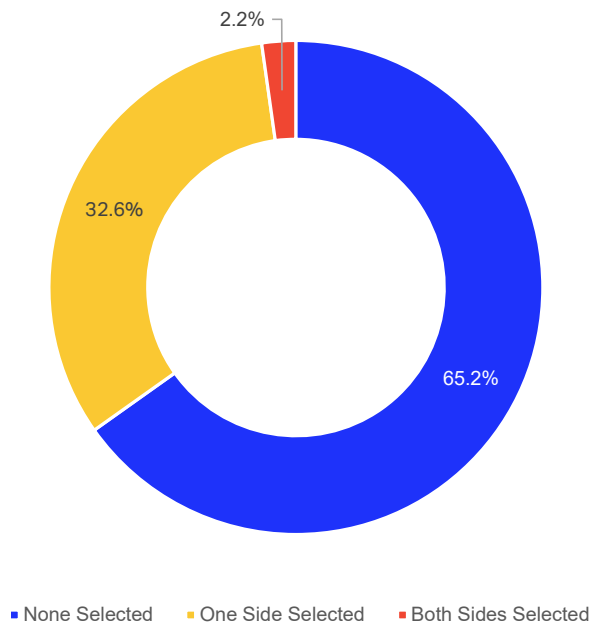
- Some causes of Terrain Awareness alerting and TCF/ Runway Field Clearance Floor (RFCF) functions are shown in the figure below.
- Majority of the alerts were caused by external signal faults (e.g., FMS map shift or altimeter error) and terrain/obstacle/runway databases. Nearly a half of Terrain Awareness and TCF/RFCF alerts were caused by not having a destination runway in the database.
- This often meant the latest terrain/runway database was not installed (the database was not kept up-to-date in the EGPWS).



Source: Honeywell



EGPWS Statistics



Source: Honeywell

- **Terrain Awareness Display**
 - A terrain awareness display had not been selected prior to terrain awareness alerts in 65% of the cases.

Response to an EGPWS Alert

- Appropriate response procedures for flight crew are determined by the aircraft type performance capability. They must be clearly defined by operators and defined in an applicable airplane flight manual (AFM). In the case of a warning, flight crew should follow the warnings without hesitation as soon as triggered.
- During night or in instrument meteorological conditions (IMC), apply the procedures immediately in response to caution and warning level alerts. Do not delay reaction for diagnosis.
- During daylight or in visual meteorological conditions (VMC), take positive corrective action until the alert stops or a safe trajectory is ensured.
- Following an EGPWS alert, flight crew should control the aircraft flight path with immediate maximum Required Obstacle Clearance (ROC) and maximum thrust to clear the obstacles threatening the flight. For detailed Standard Operating Procedures (SOP's) consult the respective Original Equipment Manufacturer (OEM) flight operations documentation.

Response to an EGPWS Alert

Warning level alert

- Aggressively position throttles for maximum rated thrust.
- Apply maximum available power as determined by emergency need. The pilot not flying (PNF) should set power and ensure that takeoff / go-around (TO/GA) power and modes are set.
- If engaged, disengage the autopilot and smoothly but aggressively increase pitch toward “stick shaker” or Pitch Limit Indicators (PLI) to obtain maximum climb performance.
- Continue climbing until the warning is eliminated and safe flight is assured.
- 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.
- Navigation must not be based on the use of the Terrain Awareness and Alerting Display (TAD).

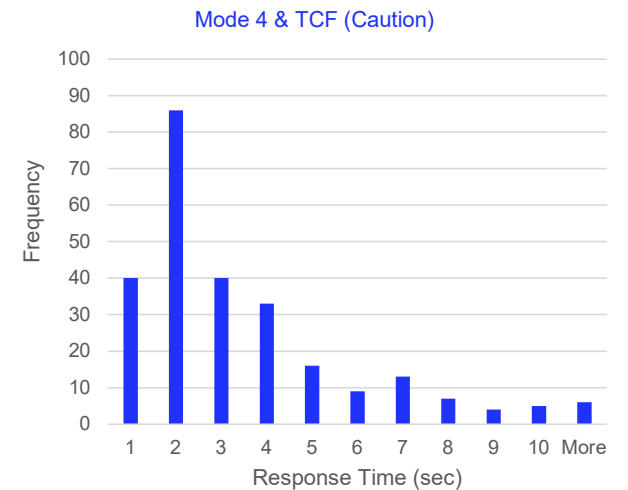
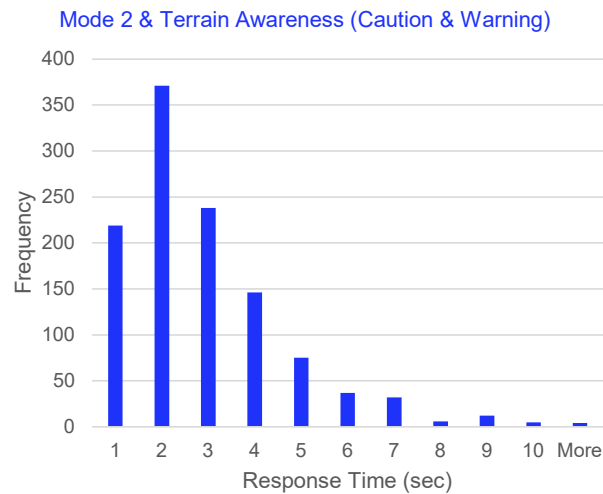
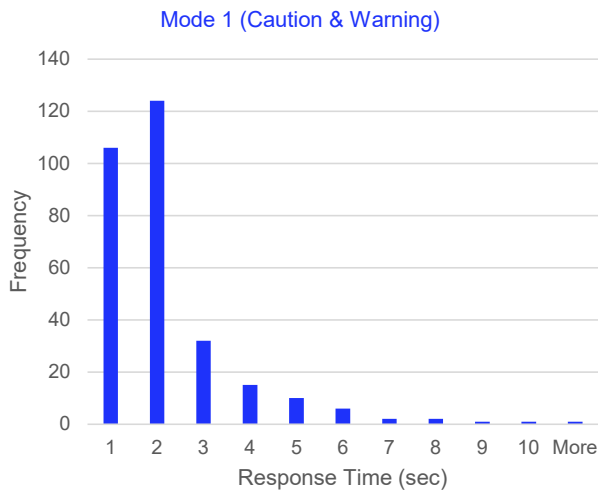
Caution level alert

- Take immediate corrective action as necessary to recover safe terrain clearance.
- Advise ATC of situation as necessary.

Pilot's Response to EGPWS Alert

- **Response Time**

- Data collected suggests that pilot's response time is very similar regardless of EGPWS alert types or alert level (caution vs. warning).



Source: Honeywell



IATA Safety Report – 2022

Recommendations for Accident Prevention in Aviation

- Aviation executive should demonstrate safety leadership and strong commitment to a positive safety culture

Procedures and Policies

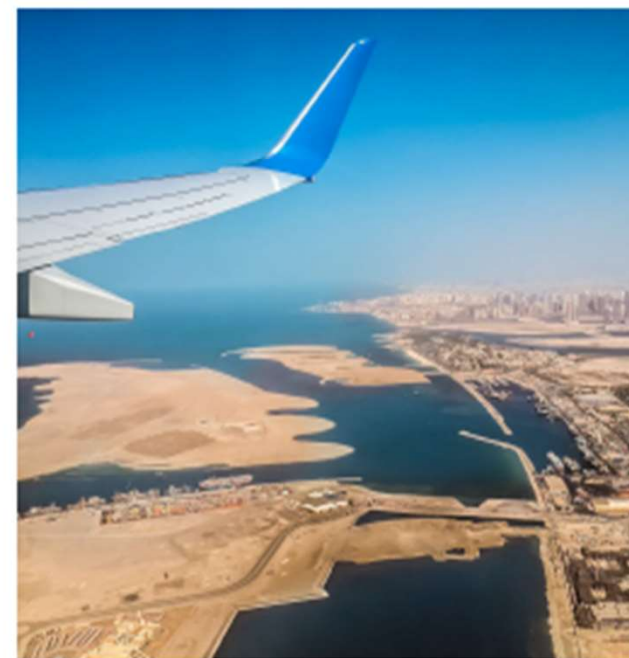
- Operators are encouraged to have a procedure in place to ensure that
 - EGPWS software and terrain, runway and obstacle databases are current and continually updated;
 - Major enhancements were introduced in EGPWS software version -218, which was released in 2003.
 - FAA issued a Special Airworthiness Information Bulletin (NM-15-11) advising operators of potential safety enhancements made available in -218 software.
 - GPS/ GNSS is used as a position source for the EGPWS.
 - EGPWS equipment remains activated and serviceable at all times;
 - At least one pilot selects terrain display during critical phases of flight (such as climb and descent below MSA) for additional situational awareness. If weather is not a threat, then both pilots could decide to select terrain display

10



Safety Report - 2022

Recommendations for Accident Prevention in Aviation



1 | Safety Report - 2022

Safety Report - 2022

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11

1 Safety Report - 2022

IATA Safety Report – 2022

Recommendations for Accident Prevention in Aviation

Training policy and programs

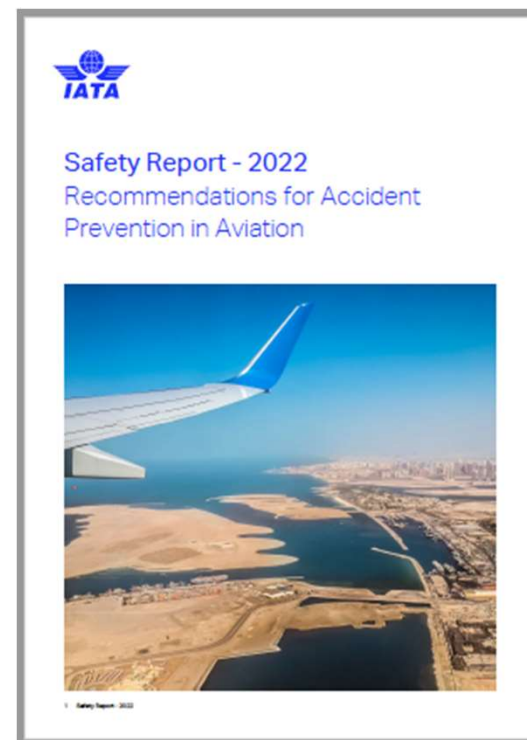
- Operators should:
 - Enhance flight crew training by implementing CBTA to include an EBT program,
 - Establish a training program to ensure flight crew is trained to respond to EGPWS alerts effectively,
 - Implement a TEM arrival briefing that includes aspects regarding the prescribed missed approach procedure and any threats, such as at airports surrounded by high terrain (with higher required climb gradients), aircraft performance in case of a one-engine inoperative situation, or a balked landing.
 - Provide awareness to flight crew on the importance to immediately respond to an EGPWS warning.



IATA Safety Report – 2022

Recommendations for Accident Prevention in Aviation

- Training departments should perform gap analysis against the latest EGPWS training GM available from IATA, EASA, FAA, ICAO, OEMs, and others,
- Pilots should promptly notify the respective authorities of the interference location and the relevant ATC if they experience GPS or radio altimeter anomalies
- Operators should implement and use FOQA data to monitor proper responses by flight crew to EGPWS events
- Consult the [Recommendations for Accident Prevention in Aviation](#), [IATA Safety Report](#), and [IATA/Honeywell Performance Assessment of Pilot Response Guidance Material](#).



EGPWS Terrain Database Release Schedule

- **Terrain Database Release Schedule (2023 – 2024)**

| Calendar Year 2023 | | | Calendar Year 2024 | |
|--------------------|--------------|--|--------------------|--------------|
| TDB Version | Release Date | | TDB Version | Release Date |
| 632 | 15-Feb | | 638 | 14-Feb |
| 633 | 12-Apr | | 639 | 10-Apr |
| 634 (w/ Server DB) | 7-Jun | | 640 (w/ Server DB) | 5-Jun |
| 635 | 2-Aug | | 641 | 31-Jul |
| 636 | 27-Sep | | 642 | 25-Sep |
| 637 (w/ Server DB) | 22-Nov | | 643 (w/ Server DB) | 20-Nov |

NOTE:

- Terrain database for B787 EGPWS is planned to be released by Honeywell on the same release cycle as the others starting in later 2023.

