

EGPWS Download Report – N771XW

Background

Download of flight history data from an EGPWS unit recovered from a Cessna 441 accident in Rossville, IN was performed at the Honeywell Aerospace facility in Redmond, WA on March 20, 2018.

Attendees: Pam Sullivan (NTSB), Dana Metz (Honeywell), Steve R. Johnson (Honeywell), Maggie Wintermute (Honeywell)

General Notes: EGPWS flight history recording is not continuous; it is event driven. When an event occurs to trigger a flight history recording (e.g. takeoff, landing) specific data related to that event is recorded in EGPWS non-volatile memory. EGPWS flight history sample rate is 1 Hz. EGPWS does not record date and time. Times shown below are in EGPWS system operating time (hours:minutes:seconds), which is the total time that the unit has been powered on.

EGPWS Configuration

Present Status information from N771XW.TXT:

Part Number: 965-1198 (GA EGPWS with internal GPS)

Serial Number: 1286

Hardware Mod Status: 3

Boot Software: B101.1

Application Software: 003

Terrain Database: 454N (North America region)

Terrain Database version installed on the unit was 454N, which was released in 2009. The latest version available at the time of the incident was 601. Note that Honeywell has recently changed the terrain database version numbering convention; version 601 would have been 489 under the previous convention.

EGPWS Category Settings from COUNTS.TXT:

- 0 - Category 1 (Aircraft Type: GEN-AV)
- 1 - Category 2 (Air Data: Altitude Encoder - 9 wire Gillham/Gray coded altitude)
- 0 - Category 3 (Position Input: Internal GPS-PXPRESS)
- 0 - Category 4 (Terrain Display: KCPB)
- 0 - Category 5 (I/O Discrete Type: Basic, Lamp Format 2)
- 1 - Category 6 (Audio Menu: Basic)
- 2 - Category 7 (Audio Output Level: -12 dB)
- 0 - Category 8 (Altitude Monitor/MSL Label Options: MSL, Altitude Monitor Disable False, Altitude Monitor Callout Disable False, Altitude Monitor Display Disable False)
- 0 - Category 9 (Options: Flap Reversal False, TA&D Alternate Pop Up False)
- 0 - Category 10 (Attitude and Heading Select: No Heading or Roll)
- 0 - Category 11 (Display Option Select: Type 0)

The EGPWS was not configured to use heading or roll inputs. Roll angle shown in the warning history (WARN.CSV) is derived by EGPWS software based on track angle and groundspeed from the GPS. The I/O discrete interface includes a Terrain Awareness Inhibit discrete (< 1 K Ω (to ground) or < +3 VDC = active, > 40 K Ω (to ground) or > +17 VDC = not active).

Recorded Data

The relevant flight leg is 1955, which is the last flight leg for which STATUS.TXT contains records. The STATUS.TXT records from leg 1955 (and landing event on the previous flight leg 1954) are shown below.

LANDING (EGPWS record of flight below 50 feet computed terrain clearance):

FLIGHT LEG 1954: (2765:25:58)
Lat/Long: 39.82595 / -86.29733
Geometric Alt: 838.00 True Hdg: 0.00
GPS Alt: 838.00 VFOM: 40.00
Pos. Uncert: 0.0044 Pos. Source: GPS1
Airport: KEYE

TAKEOFF (EGPWS record of groundspeed greater than 45 knots for 3 seconds):

FLIGHT LEG 1955: (2765:39:27)
Lat/Long: 39.82792 / -86.29618
Geometric Alt: 810.00 True Hdg: 0.00
GPS Alt: 810.00 VFOM: 38.00
Pos. Uncert: 0.0039 Pos. Source: GPS1
Airport: KEYE

TERRAIN INHIBIT OFF (EGPWS record of de-select Terrain Awareness Inhibit discrete, corresponding to Line No 208 in TANA.CSV):

FLIGHT LEG 1955: (2765:53:24)
Lat/Long: 40.23383 / -86.47721
Geometric Alt: 14098.00 True Hdg: 0.00
Pos. Uncert: 0.0037 Pos. Source: GPS1
Map Req. Acc: 0.14 Max. Alt: 1550.00
Inhibit Discrete: FALSE
Airport: KFKR

TERRAIN INHIBIT ON (EGPWS record of select Terrain Awareness Inhibit Discrete, corresponding to Line No 209 in TANA.CSV):

FLIGHT LEG 1955: (2765:53:25)
Lat/Long: 40.23446 / -86.47812
Geometric Alt: 14110.00 True Hdg: 0.00
Pos. Uncert: 0.0037 Pos. Source: GPS1
Map Req. Acc: 0.14 Max. Alt: 1550.00
Inhibit Discrete: TRUE
Airport: KFKR

TA NOT AVAILABLE ON (EGPWS record of Terrain Awareness Alerting Not Available, corresponding to Line No 210 in TANA.CSV):

FLIGHT LEG 1955: (2765:58:13)
Lat/Long: 40.42649 / -86.60756
Geometric Alt: 18608.00 True Hdg: 0.00
Pos. Uncert: 0.0891 Pos. Source: DR
Map Req. Acc: 0.14 Max. Alt: 1550.00
Inhibit Discrete: TRUE
Airport: 512

TA NOT AVAILABLE OFF (EGPWS record of Terrain Awareness Alerting Available, corresponding to Line No 211 in TANA.CSV):

FLIGHT LEG 1955: (2765:58:45)
Lat/Long: 40.44038 / -86.61687
Geometric Alt: 6790.00 True Hdg: 0.00
Pos. Uncert: 0.0254 Pos. Source: GPS1
Map Req. Acc: 0.14 Max. Alt: 1550.00
Inhibit Discrete: TRUE
Airport: 512

TA NOT AVAILABLE ON (EGPWS record of Terrain Awareness Alerting Not Available, corresponding to Line No 212 in TANA.CSV):

FLIGHT LEG 1955: (2765:58:54)
Lat/Long: 40.45028 / -86.62522
Geometric Alt: 7668.00 True Hdg: 0.00
Pos. Uncert: 0.1021 Pos. Source: DR
Map Req. Acc: 0.14 Max. Alt: 1550.00
Inhibit Discrete: TRUE
Airport: 119

Data from the two Terrain Inhibit events and three Terrain Not Available events is also captured in TANA.CSV. The two Terrain Awareness Not Available On events (TANA.CSV lines 210 and 212) show invalid GPS data received by the EGPWS (GPS latitude and longitude in TANA.CSV columns K and L), and invalid Terrain Awareness Corrected Altitude (TACAlt in TANA.CSV column AD). Invalid data is indicated by a "*" in front of the data value.

NOTE: The Terrain Awareness Corrected Altitude (TACAlt,) is an internally computed GPS-based altitude used for Terrain Awareness and Mode 1 alerting.

Summary

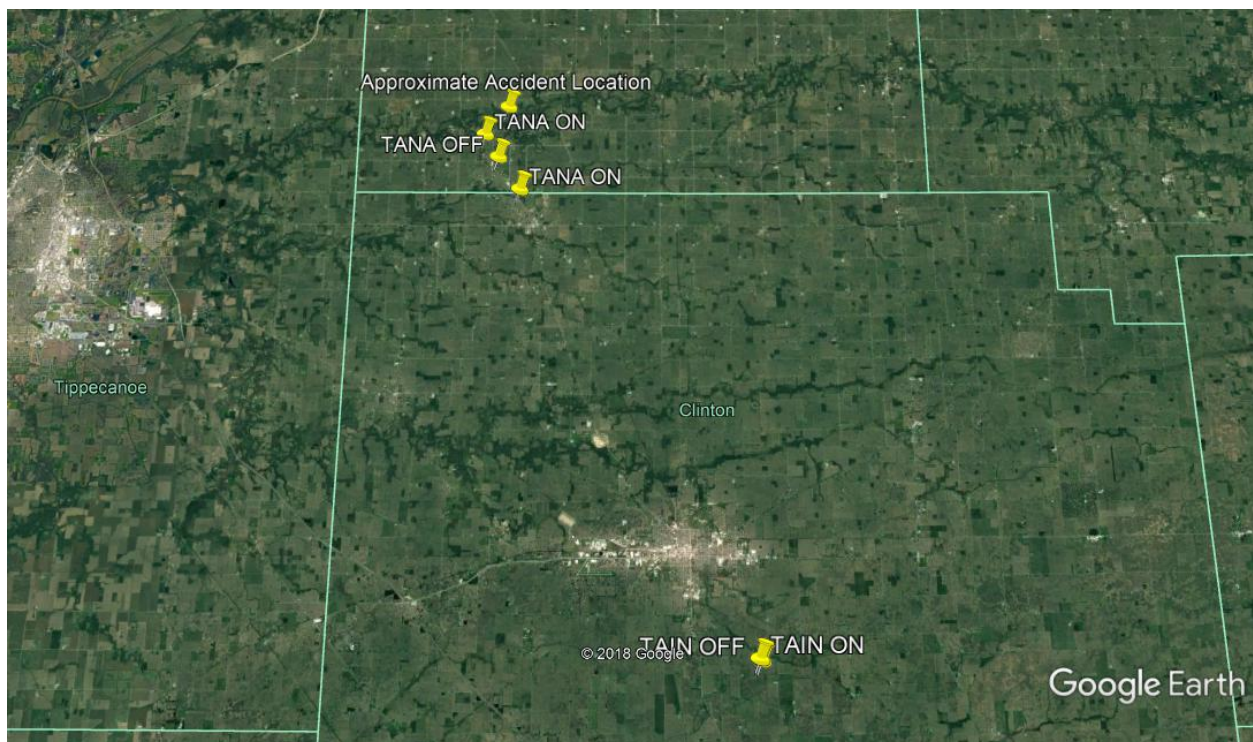
The last takeoff event recorded by the EGPWS was from airport KEYE on flight leg 1955 at operating time 2765:39:27.

Two transitions of the Terrain Awareness Inhibit discrete were recorded one second apart at 2765:53:24 and 2765:53:25. The Terrain Awareness Corrected Altitude values captured for these two events were 14098 and 14110 feet.

At operating time 2765:58:13 a Terrain Awareness Not Available ON event was recorded; GPS data and Terrain Awareness Corrected Altitude captured in TANA.CSV for this event were invalid. At time 2765:58:45 a Terrain Awareness Not Available OFF event was recorded; GPS data and Terrain Awareness Corrected Altitude captured in TANA.CSV for this event were valid. The Terrain Awareness Corrected Altitude was 6790 feet. At operating time 2765:58:54 a Terrain Awareness Not Available OFF event was recorded; GPS data and Terrain Awareness Corrected Altitude captured in TANA.CSV for this event were invalid. No further events were recorded in TANA.CSV.

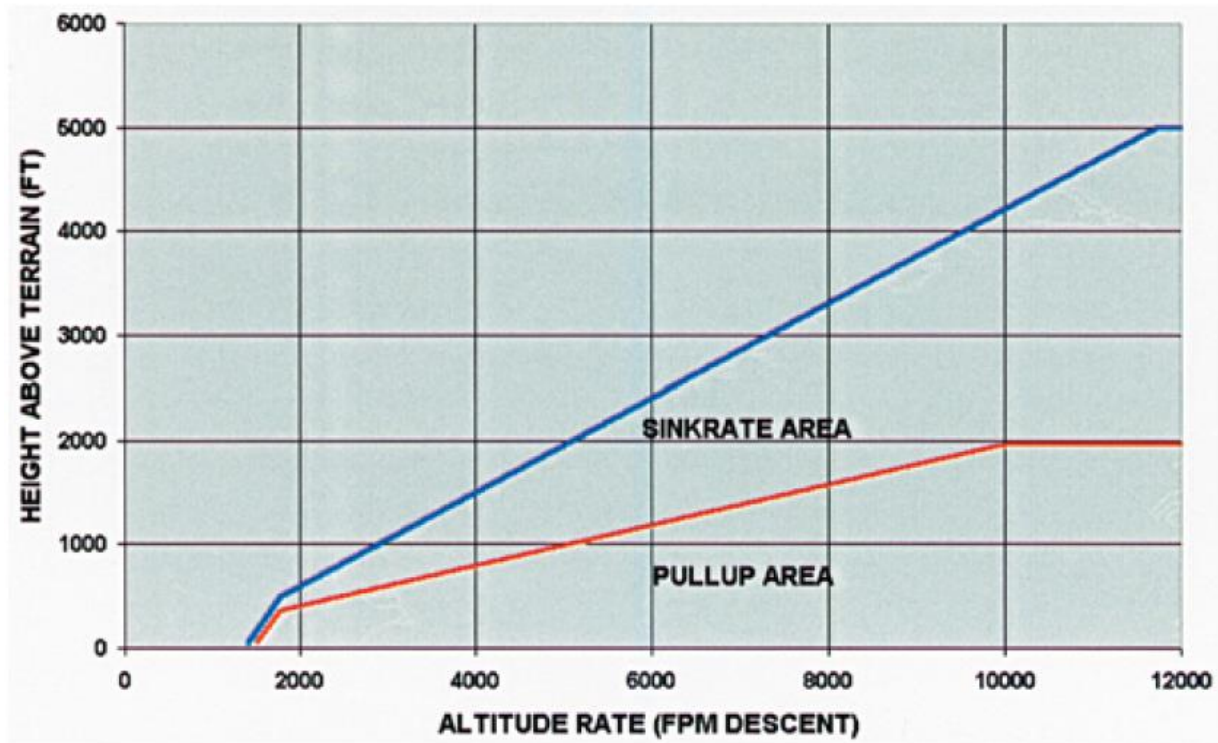
No EGPWS warnings were recorded in WARN.CSV for flight leg 1955. No landing record was created in STATUS.TXT for flight leg 1955.

The Google Earth images below show the position (GPS latitude and longitude) of the Terrain Inhibit and Terrain Awareness Not Available events. Note that the GPS data for the two Terrain Awareness Not Available ON (TANA ON) events was invalid.





GA EGPWS Mode 1



Height Above Terrain is computed by the EGPWS using the Terrain Awareness Corrected Altitude (TACAlt) and the terrain elevations in the EGPWS terrain database. Altitude Rate is computed by the EGPWS based on barometric altitude and GPS vertical velocity.