

Hicks Ralph

From: Stein Stephen
Sent: Thursday, April 24, 2014 7:49 AM
To: seth.buttner@eurocopterus.com; Hicks Ralph; shawn.r.phelps@faa.gov; david.d.hays@faa.gov
Subject: FW: NTSB HTAWS Inquiry
Attachments: NTSB Run Report with Waypoint Numbers.png; HTAWS Flight Test Notes.docx

All,

Below you will find the results of Garmin's HTAWS simulation. I have asked Garmin to clarify the relativity of GSL ("geometric sea level") to MSL for this simulation, but for now I have been told by some of our folks that we can treat them as the same for purposes of this study.

Summary

Garmin added waypoint numbers to Hospital Wing's radar report of the accident flight (see attached). They plugged in the lat/long for each point and ran the simulation at various altitudes and airspeeds under two different modes: Normal and Reduced Protection. Normal mode is full protection which includes all caution and warning alerts. Reduced protection provides only warnings, no cautions and is intended for when the pilot is operating in visual contact with terrain.

Findings

- Location 36 (the last 6:02 radar plot): the simulation produced both an obstacle warning and caution at 900 ft. MSL (471 ft. AGL)
- Location 39+ (6:04 radar plot): the simulation produced a terrain caution at 700 ft. MSL (250 ft. AGL)

Conclusions

- There are a few discrepancies when comparing Garmin's simulation to our test flight. In their last simulation, Garmin "flew" the last five radar points down to 700 ft. MSL (250 ft. AGL), but received no alerts for the water tower and/or cell tower located near the last two radar points. Our test flight (notes attached) produced alerts for the cell tower and water tower near waypoint 39 around 743 ft MSL (300 ft. AGL) (terrain elevation derived from Google Earth). You will also notice there was only one terrain caution in Garmin's simulation while our test flight produced terrain cautions at 900 ft. AGL, 800 ft. AGL and 300 ft. AGL. According to Dave Childress' statement, if he receives a terrain caution he takes it to mean he is either at 500 ft. or "the ground is coming up at him." In light of this and to better understand the discrepancy in the terrain alerts I have asked Garmin to explain how descent rates affect HTAWS and if it's something they can simulate.

I will update you when I have more information.

Stephen Stein

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From: Doyle, Sean [<mailto:sean.doyle@Garmin.com>]
Sent: Monday, April 14, 2014 12:37 PM
To: Stein Stephen
Cc: Robertson, Logan
Subject: NTSB HTAWS Inquiry

Stephen:

We completed a simulation of HTAWS performance using the data you provided last week. Our results are shown below.

The test was conducted using a GNS530W running software version 5.03 with terrain database 2.04 (cycle 13T1, current) and obstacle database 2.10 (cycle 13B6, valid 10/17/13 – 12/12/13); the unit is configured for HTAWS. We loaded a flight plan into the unit using the LAT/LONG data provided by the NTSB; there are 40 waypoints total in this flight plan. The waypoints entered into the unit are ordered chronologically, as shown in the attached document. Using demo mode on the unit, we “flew” the flight plan at various altitudes and airspeeds, once with normal alerting and once with reduced protection mode enabled. The results of these “flights” are below.

Normal Alerting:

Pass	Altitude (ft GSL)	Speed (knots)	Obstacle Caution Locations	Obstacle Warning Locations
1	900	120	13, 14, 15, 16, 24, 36	13, 14, 15, 16, 24, 36
2	1000	120	13, 14, 15, 16	13, 14, 15, 16
3	1100	120	13, 14, 15, 16	14, 15, 16
4	1200	120	13, 14, 15, 16	15, 16
5	1200	100	14, 15, 16	15, 16
6	1200	90	14, 15, 16	15, 16

Reduced Protection Mode Enabled:

Pass	Altitude (ft GSL)	Speed (knots)	Obstacle Caution Locations	Obstacle Warning Locations
1	900	120	N/A	15, 16
2	1000	120	N/A	15, 16
3	1100	120	N/A	15, 16
4	1200	120	N/A	N/A
5	1200	100	N/A	N/A
6	1200	90	N/A	N/A

It should be noted that no terrain alerts were received at any of the reported altitudes in any of the tests. In an effort to generate a terrain alert, the path of flight from point 35 to point 40 was “flown” with normal alerting while iteratively decrementing the GSL altitude by 100 feet; no alerts were generated until the ship was lowered to an altitude of 700 feet, and then we only saw a terrain caution beyond point 39.

Please let us know if you need any additional evaluations conducted.

Regards,

Sean Doyle
Garmin AT
(503) 391-3373

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