NATIONAL TRANSPORTATION SAFETY BOARD
Vehicle Recorder Division
Washington, D.C. 20594

April 20, 2017

Data Logger

Specialist's Factual Report
By James Cash

1. EVENT SUMMARY

Location: Superior, Arizona
Date: December 15, 2015
Aircraft: Eurocopter AS350B3
Registration: N74317
Operator: Air Methods Corporation
NTSB Number: WPR16FA040

On December 15, 2015, about 1723 Mountain Standard Time, an Airbus helicopter, AS350B3, N74317, was substantially damaged when it impacted terrain while maneuvering near Superior, Arizona. The helicopter air ambulance (HAA) was registered to Air Methods Corporation and was doing business as Native Air Ambulance, under the provisions of Title 14 Code of Federal Regulations Part 135. The commercial pilot, and flight nurse sustained fatal injuries and the flight paramedic sustained serious injuries. Visual meteorological conditions prevailed and a company visual flight rules (VFR) flight plan was filed for the flight. The cross-country positioning flight originated from the Phoenix-Mesa Gateway Airport (IWA), Mesa, Arizona, at 1705 with an intended destination of Globe, Arizona.

2. DATA LOGGER GROUP

A data logger group was not convened.

3. DETAILS OF INVESTIGATION

The National Transportation Safety Board (NTSB) Vehicle Recorder Division received the following data logger:

Recorder Manufacturer/Model: **Appareo GAU2000**
Recorder Serial Number: **462**

3.1. Appareo GAU2000 Description

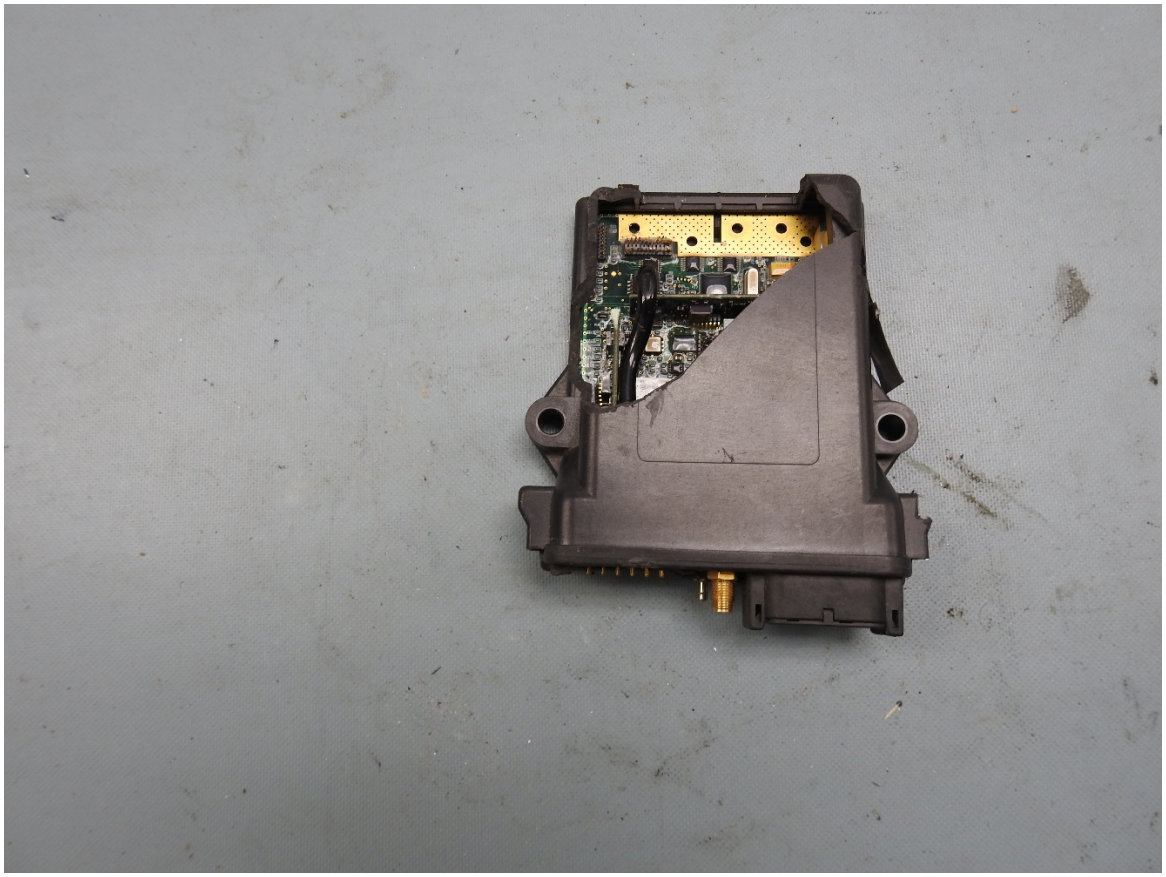
The Appareo GAU2000 is a lightweight self-contained attitude, air-data and GPS recording system. The small recorder has an internal GPS unit that provides latitude and longitude position, GPS altitude and GPS track. The unit also has air data inputs that when connected to the aircraft's pitot static system, provide indicated airspeed and

pressure altitude of the aircraft. The unit also has a mini attitude reference (AHARS) unit that senses 3-axis accelerations and records enough information to derive aircraft pitch, roll and yaw.

3.1.1. Device Condition

The data logger suffered extensive impact damage in the accident. See figure 1 The exterior plastic case of the device was cracked and fragmented. The internal circuit board, which contains the on-board non-volatile[1] memory was cracked and bent.

Figure 1. Recovered memory module



[1] Non-volatile memory is solid-state memory that retains the recorded information after electrical power is removed.

3.1.2. Data Recovery

The Appareo GAU2000 is supplied with a factory download and replay kit. This kit only works if the unit is undamaged and can be powered up normally. Due to the extent of the damage, the accident unit could not be repaired enough to use the factory download procedures.

The memory chip from the accident unit was removed from the circuit board. The chip was cleaned and placed in the lab's memory chip programmer/reader using the appropriate device socket. An image copy of the accident memory chip was obtained. This memory image was then converted using the laboratory's software to match the download format that is needed to run through the Appareo replay software.

3.1.3. Recording Description

The recording contained approximately 13 flights dating back several months. Timing of the recorded data is derived from the GPS data string that is included in the recorded data. This time is referenced to UTC. The appropriate conversion was made to correct the data to Mountain Standard Time.

3.1.4. Engineering Units Conversions

The engineering units conversions used for the data contained in this report are based on documentation provided by the recorder manufacturer. Unique installation-specific orientation correction data was also provided by the manufacturer: Yaw +180 degrees, Pitch -90 degrees and Roll 0 degrees

3.1.5. Terrain Height Calculation

The GPS position (latitude and longitude) track of the accident aircraft was used in Google Earth to determine how high the aircraft was over the terrain over the aircraft's route of flight. The difference was calculated between the GPS altitude and the terrain elevation to derive the aircraft's height above the terrain. Figure 6 depicts the various altitude calculations.

3.2. Plots and Corresponding Tabular Data

The following Figures, 1-6 depict data recovered from the Appareo GAU2000 data logger installed on the accident aircraft. Figure 1 is an engineering unit depiction of the accident flight from takeoff to the end of the data. Figure 2 depicts the data zoomed in on the last 4 minutes of the accident flight. The recorded data stops short of the point of 1st impact as provided by the investigator in-charge. The Appareo units buffer a small segment of data prior to writing it to memory. Where the unit is in its buffer/write cycle determines how much data is lost during a catastrophic shutdown of the unit.

Figures 3 through 5 depict the ground track of the accident aircraft overlaid on Google Earth terrain data.

Figure 6 is a graphical presentation of the GPS altitude, terrain elevation and the aircraft's height above the terrain for the accident flight. Additionally GPS groundspeed is also depicted on the figure for reference.

The corresponding tabular data used to create these six figures are provided in electronic (*.csv[2]) format as Attachment 1 to this report in the NTSB docket system

[2] Comma Separated Value format.

Figure 1. Plot of engineering data for the entire flight.

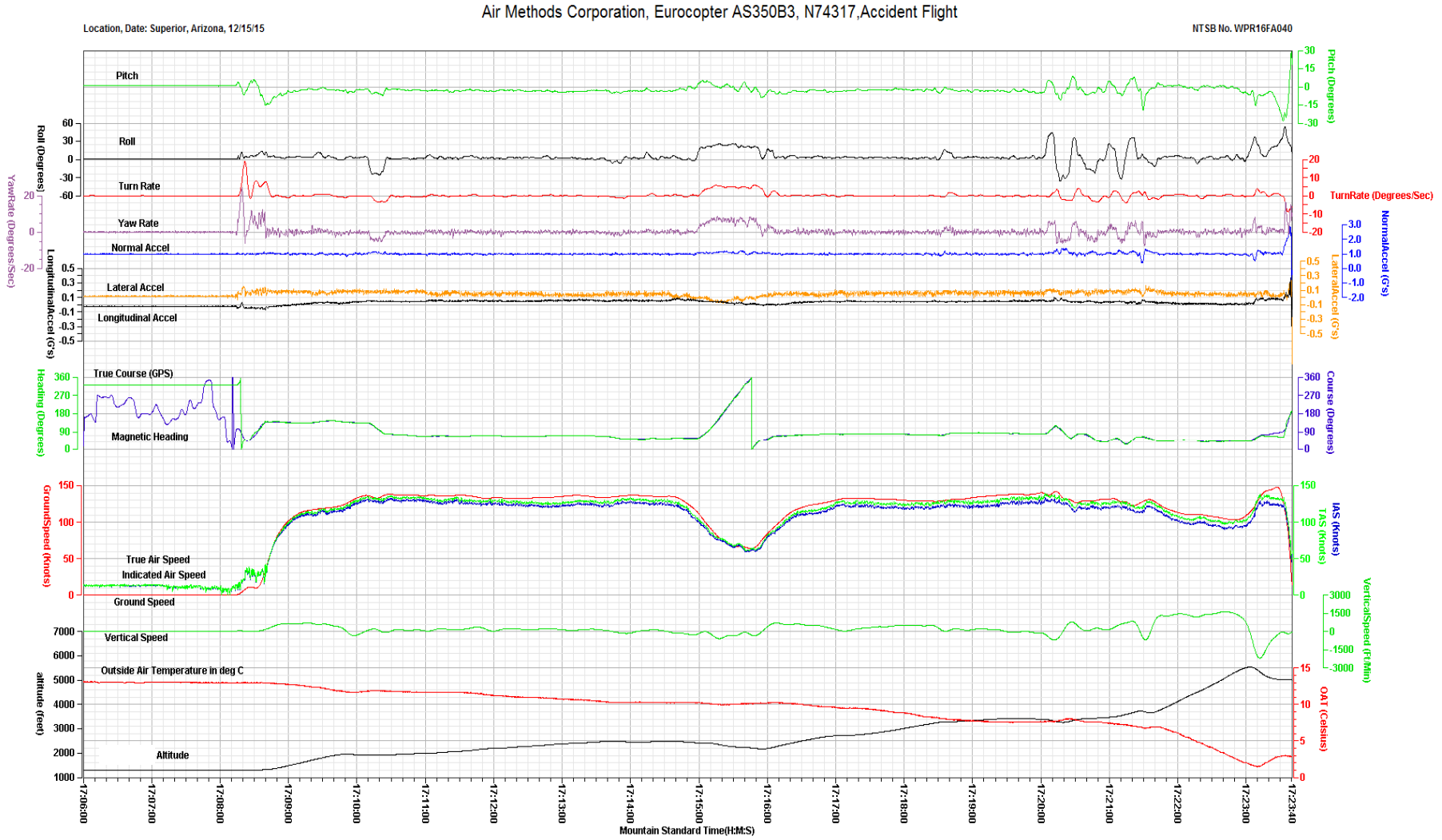


Figure 2. Plot of engineering data for last 4 minutes of the accident flight.

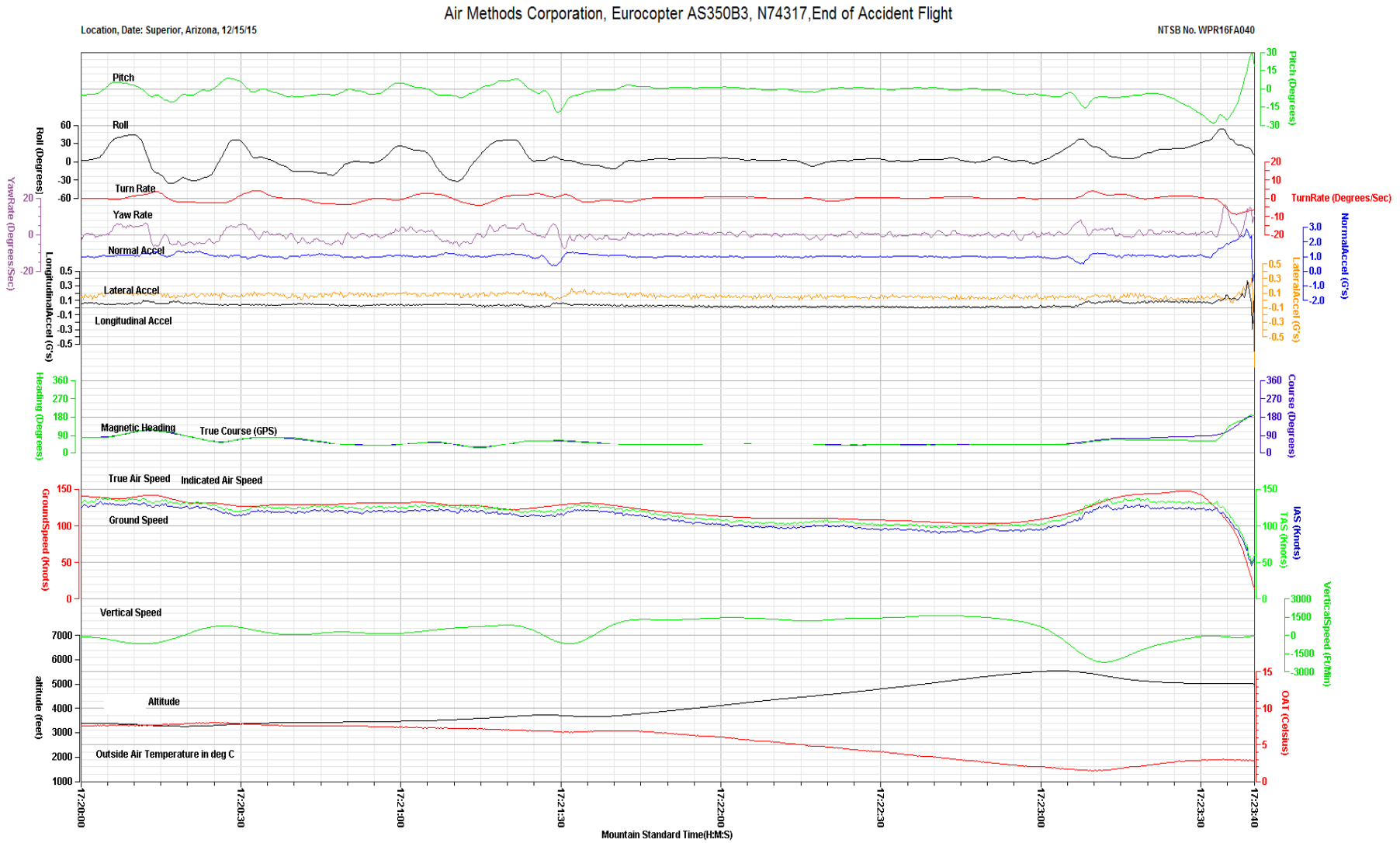


Figure 3. Google Earth overlay of the entire accident flight.

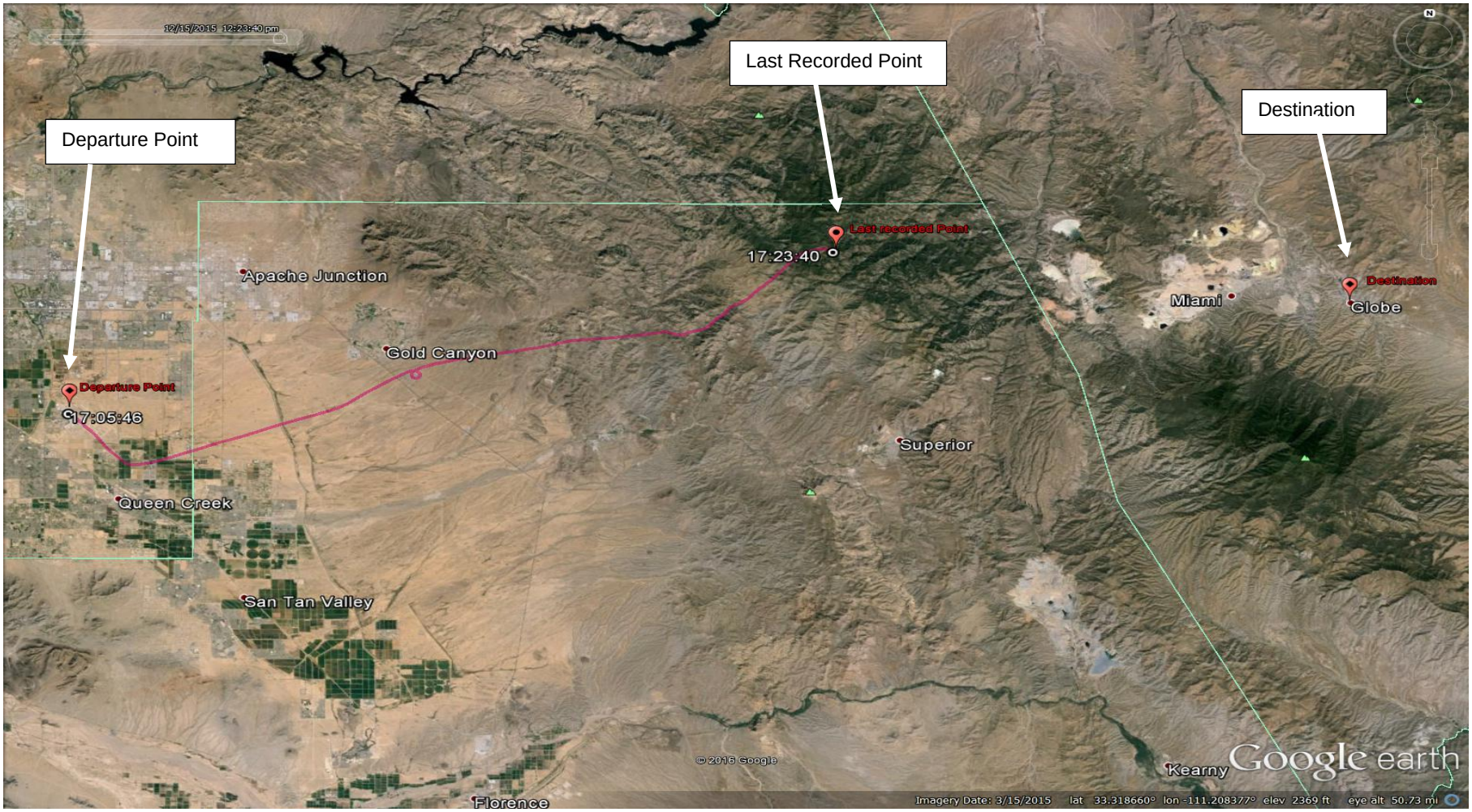


Figure 4. Google Earth Overlay of last 4 minutes of the accident flight.

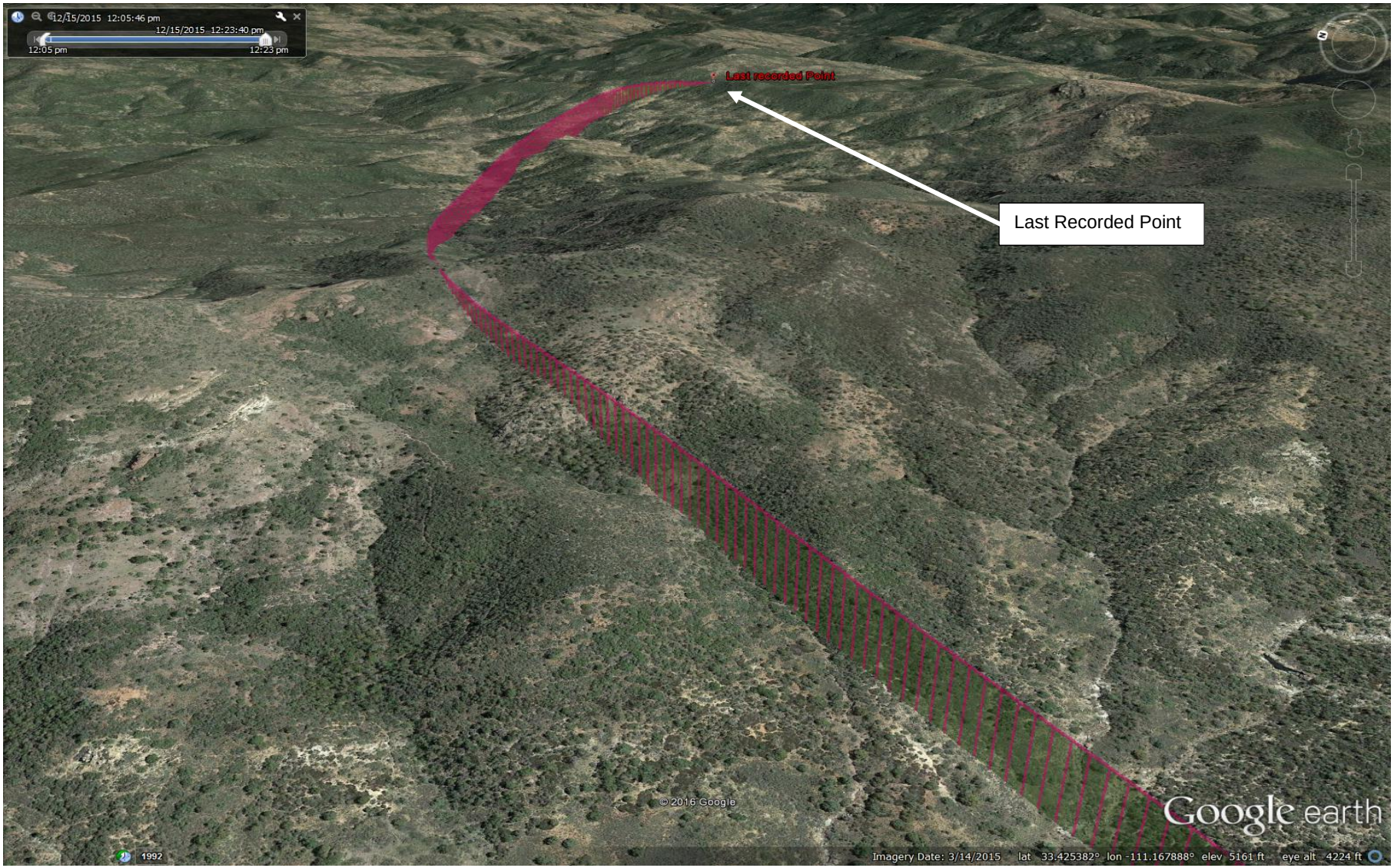


Figure 5. Google Earth Overlay viewed at the approximate aircraft's flight path level

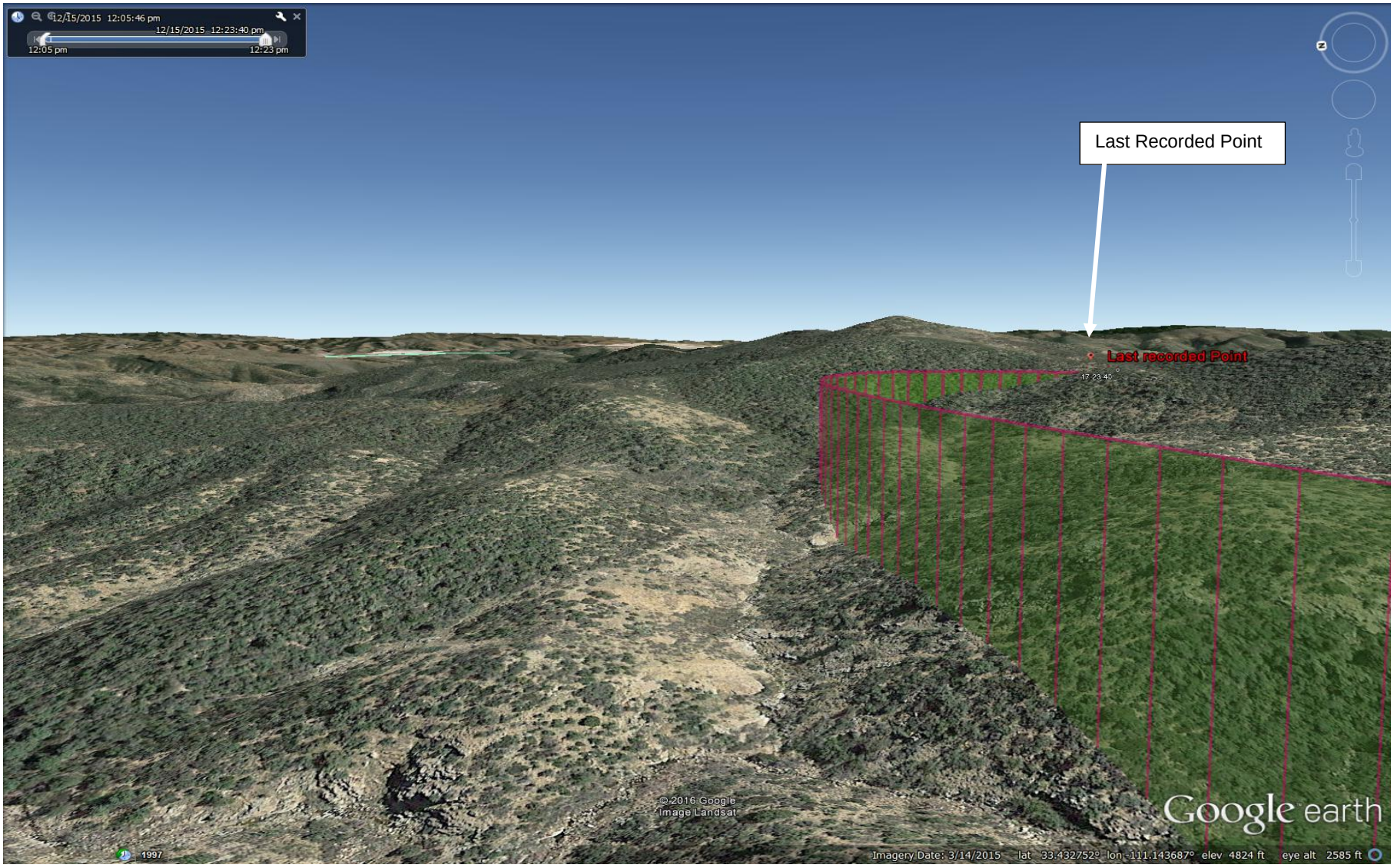


Figure 6. Plot of altitude and terrain height data for the accident flight.