

# NATIONAL TRANSPORTATION SAFETY BOARD

Vehicle Recorder Division

Washington, D.C. 20594

January 28, 2019

## Electronic Devices

### Specialist's Factual Report

by Gerald Kawamoto

#### 1. EVENT SUMMARY

Location: Brinnon, Washington  
Date: September 29, 2017  
Aircraft: Piper PA-28-140  
Registration: N9549W  
Operator: Private  
NTSB Number: WPR17FA215

On September 29, 2017, about 2213 Pacific daylight time, a Piper PA-28-140, N9549W, was destroyed when it impacted trees and terrain near Brinnon, Washington, during a night cross-country flight. The student pilot received serious injuries, and the certificated flight instructor (CFI) received fatal injuries. The instructional flight was conducted in accordance with visual flight rules (VFR) under the provisions of Title 14 *Code of Federal Regulations* Part 91.

#### 2. GROUP

A group was not convened.

#### 3. DETAILS OF INVESTIGATION

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

Device 1: Apple iPad Mini  
Device 1 Serial Number: F4LK3N2QF193

Device 2: Appareo Stratus PRX V2  
Device 2 Serial Number: 230528

##### 3.1. Apple iPad Mini Device Description

Personal Electronic Devices (PEDs) are a category of devices comprised primarily of portable computing devices and mobile phones. Portable computing devices are typically capable of internet access, email, messaging services, and can run user-installed applications to perform specific tasks. PED user and system data is typically stored on

non-volatile memory (NVM)<sup>1</sup> and can be accessed through manufacturer-provided interfaces.

### **3.1.1. Apple iPad Mini Data Recovery**

Upon arrival at the Vehicle Recorder Division, an exterior examination revealed the unit had sustained severe impact damage, as shown in Figure 1. The main board was removed and installed in a surrogate device. The surrogate device powered on normally.



**Figure 1.** Front and back of the iPad Mini as received.

### **3.1.2. Apple iPad Mini Data Description**

Upon powering, ForeFlight<sup>2</sup> was in the recently used applications. A flight plan pertaining to the accident flight was documented within the “Flights” tab of the application. Figure 2 shows a planned route in the “Flights” tab from Foreflight pertaining to the accident flight. A “Track Log” corresponding to the accident flight was not recorded on the device.

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<sup>1</sup> Non-volatile memory is semiconductor memory that does not require external power for data retention.

<sup>2</sup> iOS Device application that communicates wirelessly with the Appareo Stratus unit to display aircraft's altitude, navigation, weather, and traffic information.

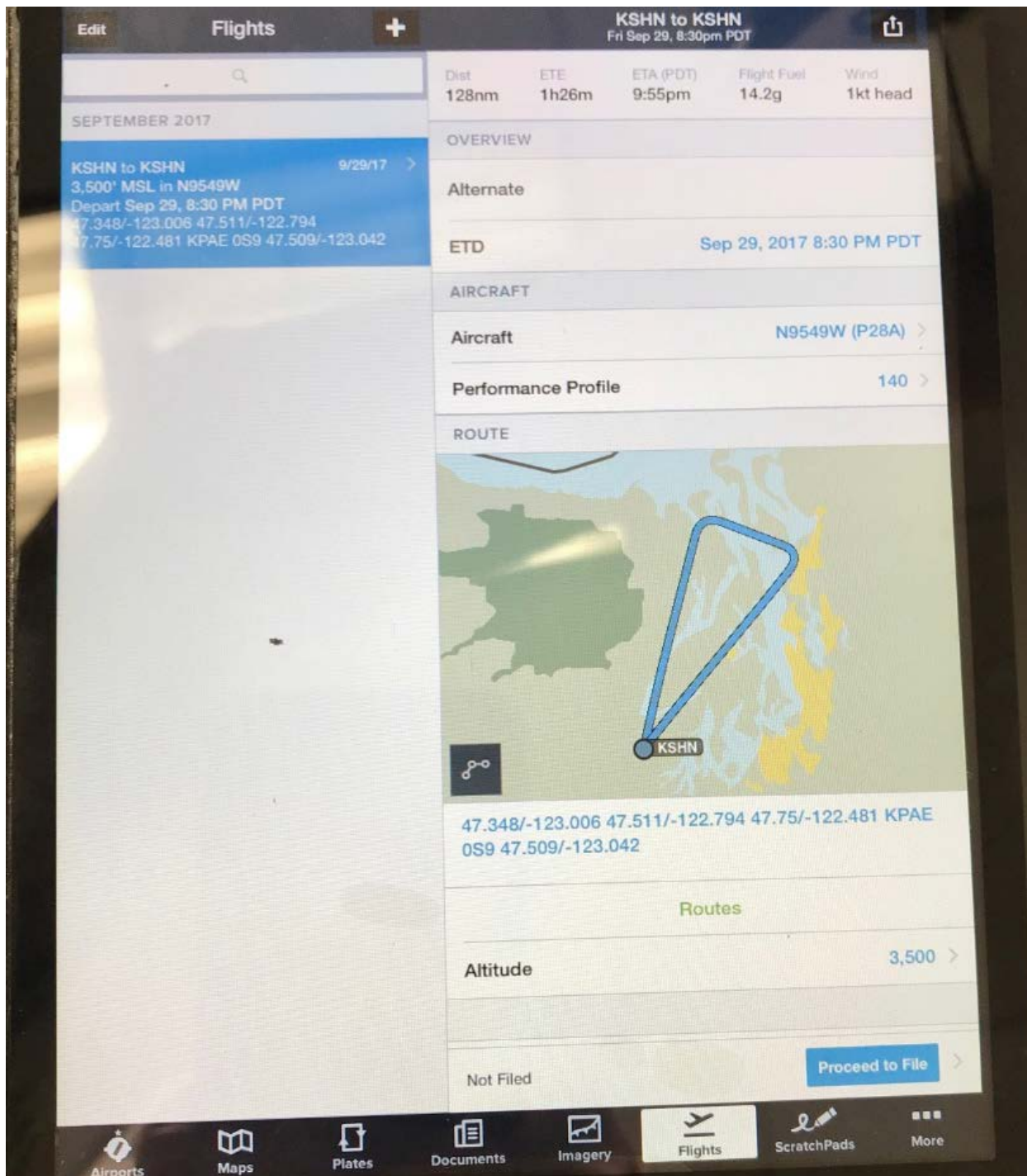


Figure 2. Flights screen from ForeFlight.

### 3.2. Appareo Stratus PRX V2 Device Description

The Appareo Stratus PRX V2 device is a self-contained battery powered unit that contains an internal Attitude and Heading Reference System (AHRS), GPS/WAAS receiver<sup>3</sup>, and Automatic Dependent Surveillance - Broadcast (ADS-B) receiver in one compact unit. The unit communicates wirelessly with compatible devices, such as an iPad, to display all acquired information. In addition to communicating with compatible devices, the Stratus device records GPS position and AHRS information internally on a non-volatile flash memory chip at approximately 5 data records per second (5 Hz).

#### 3.2.1. Appareo Stratus PRX V2 Data Recovery

Upon arrival at the Vehicle Recorder Laboratory, the device appeared undamaged externally as shown in Figure 3. The unit, however, did not power on normally. The device was opened and an examination revealed damage to the circuit boards. The device's internal memory chip was identified and removed. The chip was cleaned and read with the appropriate model reader. A binary image was obtained of the internal memory and laboratory software tools were used to convert the binary data to engineering units.



**Figure 3.** Front and back of the Appareo Stratus PRX V2 as received.

<sup>3</sup> The Wide Area Augmentation System (WAAS) is an air navigation aid to augment the Global Positioning System (GPS), by improving its accuracy, integrity, and availability.

### 3.2.2. Appareo Stratus PRX V2 Data Description

The data extracted included various sessions from June 19, 2017<sup>4</sup>, through September 30, 2017. The session determined to be relevant to the accident event was parsed out and started at 03:35:43 UTC and ended at 05:12:48 UTC on September 30, 2017.

Vertical Speed and Acceleration Z were found to be reversed when compared to other data. These data were inversed in the plotted information and tabular data provided in this report. It was unclear whether the device was mounted upside down by the pilot, or if there was a conversion error in the translation of the binary data to engineering units.

### 3.2.3. Appareo Stratus PRX V2 Parameters Provided

Table 1 describes data parameters provided by the GPS device. Date, Time, Latitude, Longitude, Pitch, Roll, Acceleration (X,Y,&Z) and GPS Altitude are recorded by the device. Ground Speed, Ground Track and Vertical Speed are derived from the recorded parameters.

**Table 1: GPS Data Parameters**

| Parameter Name | Parameter Description                         |
|----------------|-----------------------------------------------|
| Date           | Date for recorded data point (MM/DD/YYYY)     |
| Time           | Time (UTC) for recorded data point (HH:MM:SS) |
| Latitude       | Recorded Latitude (degrees)                   |
| Longitude      | Recorded Longitude (degrees)                  |
| GPS Altitude   | Recorded GPS Altitude (feet)                  |
| Ground Speed   | Average derived ground speed (knots)          |
| Ground Track   | Average derived true course (degrees)         |
| Vertical Speed | Vertical Speed (feet per minute)              |
| Pitch          | Pitch (degrees)                               |
| Roll           | Roll (degrees)                                |
| Acceleration X | Acceleration in X-Axis (g)                    |
| Acceleration Y | Acceleration in Y-Axis (g)                    |
| Acceleration Z | Acceleration in Z-Axis (g)                    |

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<sup>4</sup> All dates and times are referenced to Coordinated Universal Time (UTC).

### **3.3. Overlays and Tabular Data**

Figure 4 is a graphical overlay generated using Google Earth showing all three legs of the September 30, 2017 flight. The flight originated at Sanderson Field Airport (SHN), Shelton, Washington and the last recorded data point was near Brinnon, Washington. The weather and lighting conditions in Google Earth are not necessarily the weather and lighting conditions present at the time of the recording.

The first leg of the flight departed SHN about 0350 UTC September 30, 2017, heading generally northeast towards Snohomish County Airport (Paine Field, PAE), Everett, Washington. The airplane arrived at PAE about 0430 UTC and departed on the second leg about 0433 UTC heading west towards Jefferson County International Airport (OS9), Port Townsend, WA. The airplane arrived at OS9 about 0454 UTC and departed on the accident leg about 0458 UTC on a direct course towards SHN. The last recorded parameter was as at 05:12:48 UTC on September 30, 2017.

Figure 5 is a graphical overlay generated using Google Earth zoomed in on the last portion of the accident flight.

Figure 6 is a plot of basic parameters during the entire accident flight. The time interval is 03:49:00 to 05:13:00 UTC.

Figure 7 is a plot of basic parameters during the last portion of the accident flight. The time interval is 05:10:00 to 05:13:00 UTC.

Tabular data used to generate figures 4 through 7 are included as Attachment 1. This attachment is provided in electronic comma separated value (.CSV) format.

Figure 4. Google Earth overlay showing all three legs of September 30, 2017 flight.

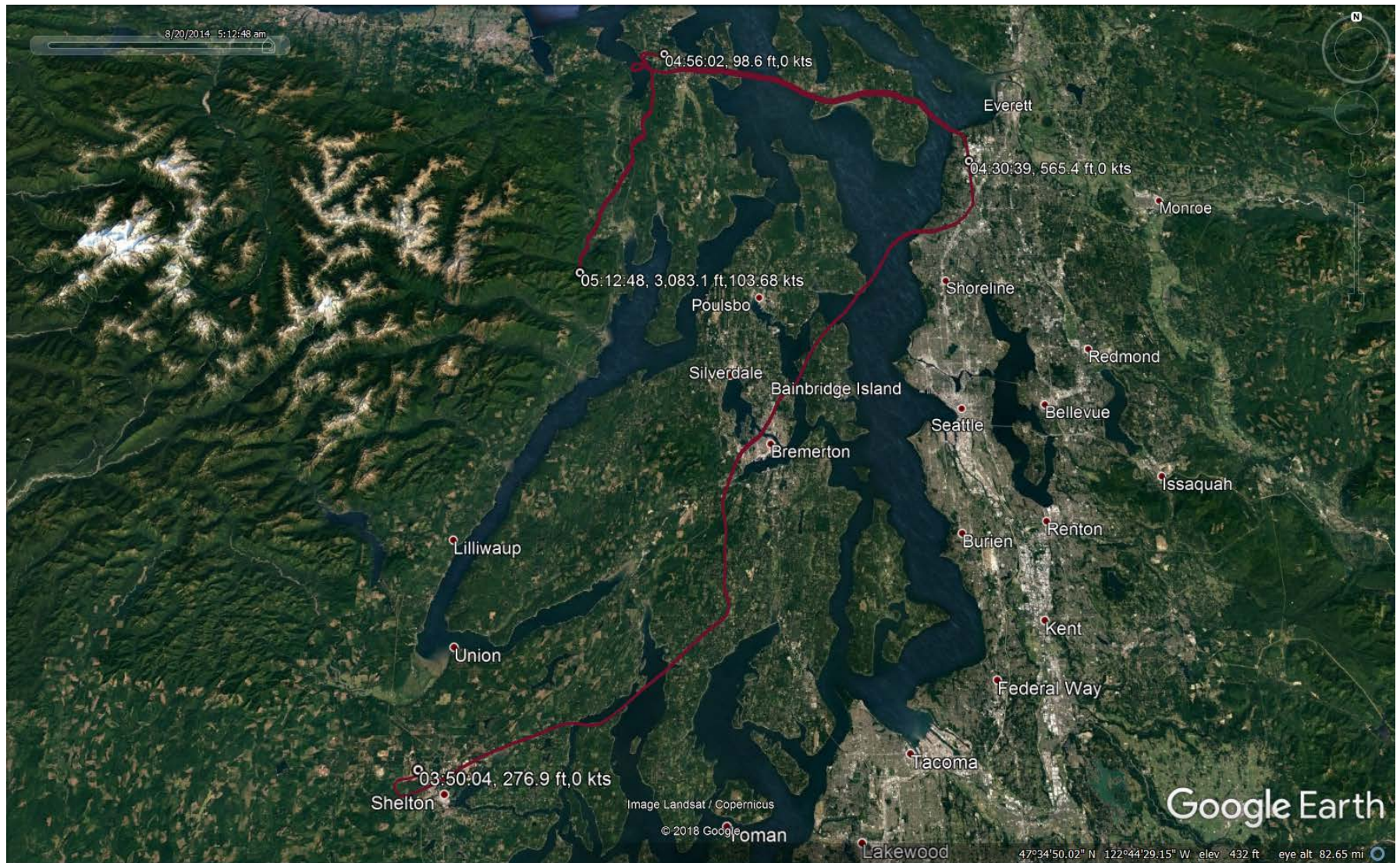


Figure 5. Google Earth overlay showing the last portion of the accident flight near Brinnon, Washington.

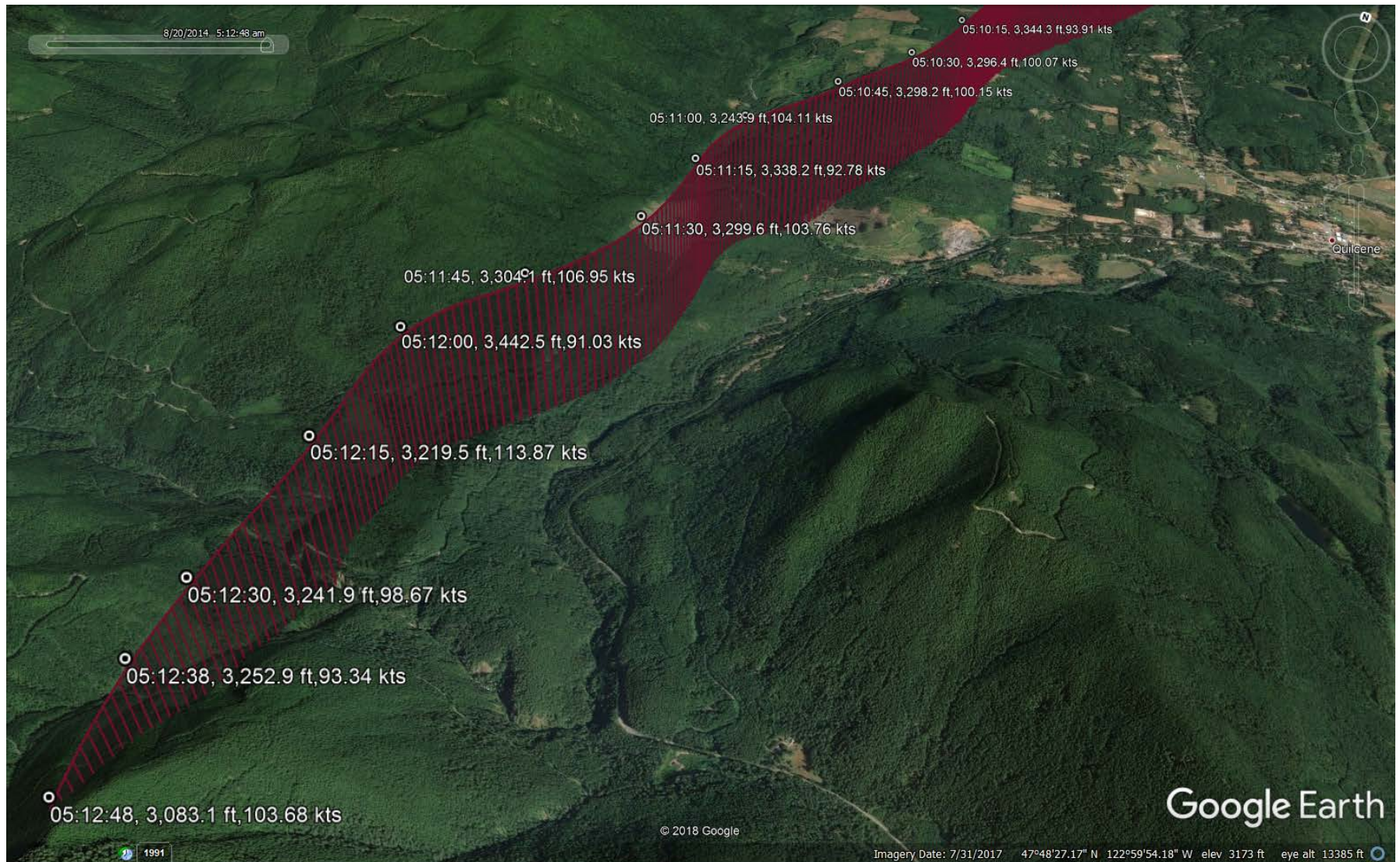


Figure 6. Plot of basic parameters for all three legs of the September 30, 2017 flight.

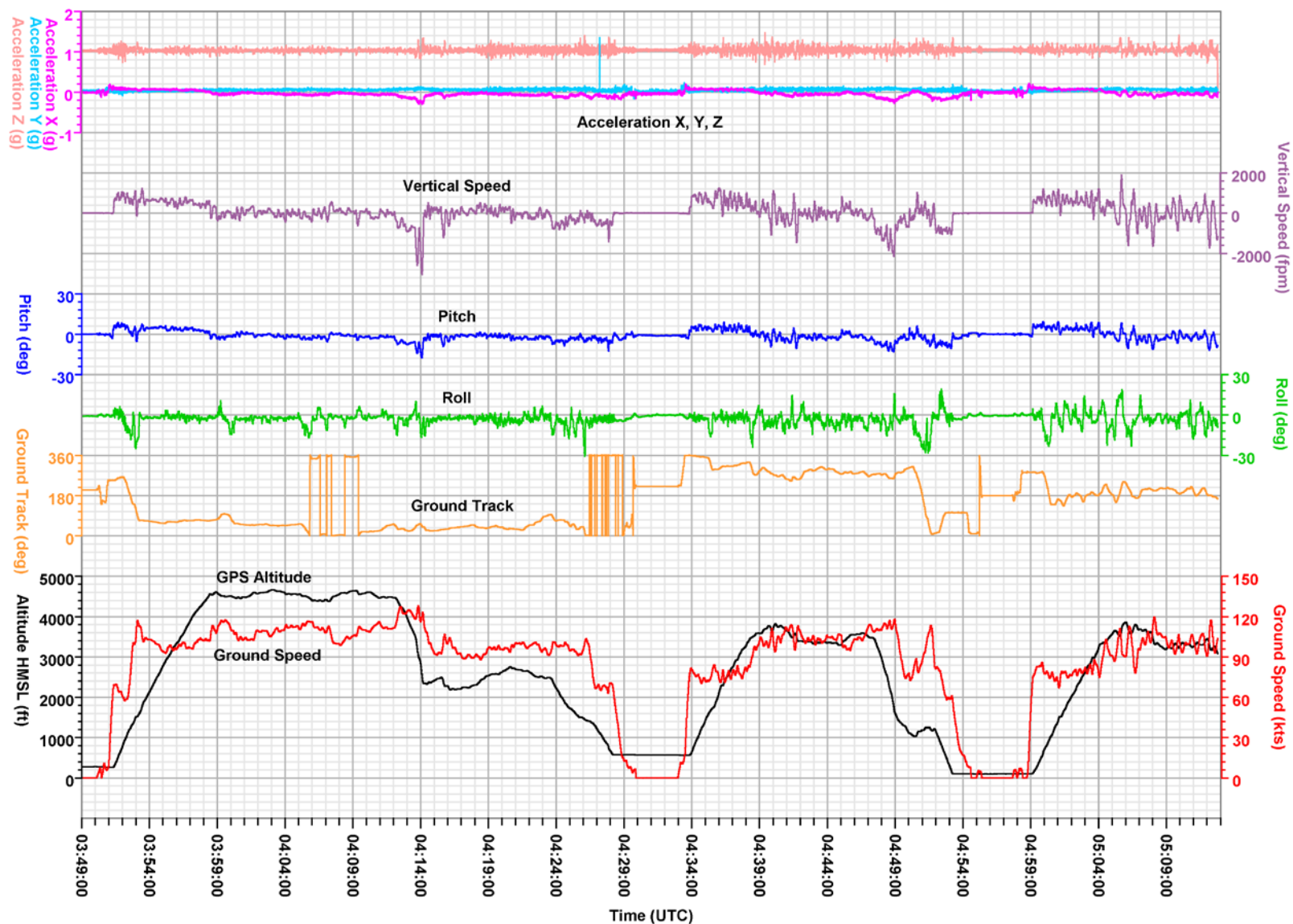


Figure 7. Plot of basic parameters at the end of the accident flight.

