

# NATIONAL TRANSPORTATION SAFETY BOARD

Vehicle Recorder Division  
Washington, D.C. 20594

August 13, 2019

## Electronic Devices

### Specialist's Factual Report by Gerald Kawamoto

#### 1. EVENT

Location: Santa Ana, California  
Date: August 5, 2018  
Aircraft: Cessna 414  
Registration: N727RP  
Operator: Category III Aviation Corporation  
NTSB Number: WPR18FA211

On August 5, 2018, about 1229 Pacific daylight time, a Cessna 414 airplane, N727RP, sustained substantial damage when it impacted the ground in a shopping mall parking lot in Santa Ana, California. The private pilot and four passengers were fatally injured. The airplane was registered to and operated by Category III Aviation Corporation under the provisions of Title 14 *Code of Federal Regulations* Part 91, as a business flight. Visual meteorological conditions prevailed, and no flight plan was filed for the cross-country flight. The flight departed Buchanan Field Airport (CCR), Concord, California, about 1022 and was destined for John Wayne-Orange County Airport (SNA), Santa Ana, California.

#### 2. DETAILS OF INVESTIGATION

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

Device 1: Appareo Stratus 2S  
Device 1 Serial Number: Stratus2s024239  
Device 2: Samsung Galaxy Note 8  
Device 2 Serial Number: 358505083795563  
Device 3: Apple iPad 4  
Device 3 Serial Number: DMPJM14PF18C  
Device 4: Apple iPhone 6S Plus  
Device 4 Serial Number: 353294070441318  
Device 5: Apple iPhone 6S  
Device 5 Serial Number: 353259079764200  
Device 6: Apple iPhone 7  
Device 6 Serial Number: 359214073098208

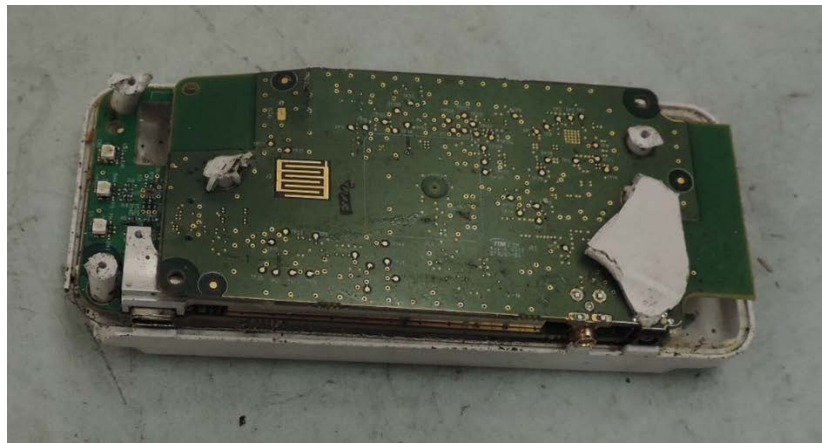
## 2.1. Appareo Stratus 2S Device Description

The Appareo Status 2S device is a self-contained battery powered unit that contains an internal AHRS,<sup>1</sup> GPS/WAAS receiver,<sup>2</sup> and ADS-B<sup>3</sup> receiver in one compact unit. The unit communicates wirelessly with compatible devices to display all the acquired information. In addition to communicating with compatible devices, the Stratus device records GPS position and AHRS information internally on a non-volatile flash<sup>4</sup> memory chip. Internal memory has the space to store over 13 hours of flight data that is sampled at approximately 5 data records per second (5 Hz).

### 2.1.1. Appareo Stratus 2S Data Recovery

Upon arrival at the Vehicle Recorder Division, an exterior examination revealed the unit had sustained impact damage, which removed one of the protective covers from the device, as shown in Figure 1. The NVM chip was removed, read out, and converted to engineering units using laboratory tools.

**Figure 1. Appareo Stratus 2S as received.**



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<sup>1</sup> The Attitude Heading Reference System consists of a set of 3-axis gyroscope, accelerometers and heading reference sensors that enable the unit to compute pitch, roll, and yaw motions.

<sup>2</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.

<sup>3</sup> Automatic Dependent Surveillance-Broadcast (ADS-B) is a surveillance technology deployed throughout the national airspace system. The ADS-B system is composed of aircraft avionics and a ground infrastructure. Onboard avionics determine the position of the aircraft by using the GPS and transmit its position along with additional information about the aircraft to ground stations for use by air traffic control (ATC) and other ADS-B services. This information is transmitted at a rate of approximately once per second. Operators equipped with ADS-B realize additional benefits from ADS-B broadcast services: Traffic Information Service - Broadcast (TIS-B) (traffic information) and Flight Information Service - Broadcast (FIS-B) (weather information).

<sup>4</sup> Non-volatile memory (NVM) is semiconductor memory that does not require external power for data retention.

### 2.1.2. Appareo Stratus 2S Data Description

The data extracted included sessions from July 20, 2018<sup>5</sup>, through August 5, 2018. The session determined to be relevant to the accident event was parsed out and started at 17:08:10 UTC and ended at 19:29:32 UTC on August 5, 2018.

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.

### 2.1.3. Appareo Stratus 2S Parameters Provided

Table 1 describes data parameters recorded and derived by the device.

**Table 1: Appareo Stratus 2S 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)
MSL Altitude	Recorded MSL Altitude (feet)
Ground Speed	Averaged derived ground speed (knots)
Ground Track	Averaged 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)

## 2.2. Personal Electronic Device (PED) Description

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 and can be accessed through manufacturer-provided interfaces.

### 2.2.1. Samsung Galaxy Note 8 Data Recovery & Description

Upon arrival at the Vehicle Recorder Laboratory, an exterior examination revealed the unit had sustained impact damage resulting in cosmetic damage to the device as shown in Figure 2. The device powered on normally and data was forensically extracted using

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<sup>5</sup>Coordinated Universal Time (UTC).

laboratory tools. Text messages, images, and video files were reviewed and it was determined that the device did not contain data pertinent to the investigation.

**Figure 2. Samsung Galaxy Note 8 as received.**



### **2.2.2. Apple PEDs Data Recovery & Description**

Upon arrival at the Vehicle Recorder Laboratory, exterior examinations of the iPad 4, iPhone 7, iPhone 6S Plus, and iPhone 6S revealed the devices had sustained severe impact damage as shown in Figures 3 through 6. The extent of the damage precluded normal recovery procedures and additional attempts were unsuccessful in yielding usable data.

**Figure 3. Apple iPad 4 as received.**



**Figure 4. Apple iPhone 7 as received.**



**Figure 5. Apple iPhone 6S Plus as received.**



**Figure 6. Apple iPhone 6S as received.**



### **2.3. Plots and Corresponding Tabular Data**

Figure 7 is a graphical overlay generated using Google Earth showing the entire accident flight. Data from the Appareo Stratus 2S was used to create the flight track. The weather and lighting conditions in Google Earth are not necessarily the weather and lighting conditions present at the time of the recording.

The device started recorded data at 17:08:10 UTC. The flight departed Buchanan Field Airport (CCR) around 17:20 UTC and the last recorded parameter was at 19:29:32 UTC.

Figure 8 is a graphical overlay generated using Google Earth showing the end of the accident flight.

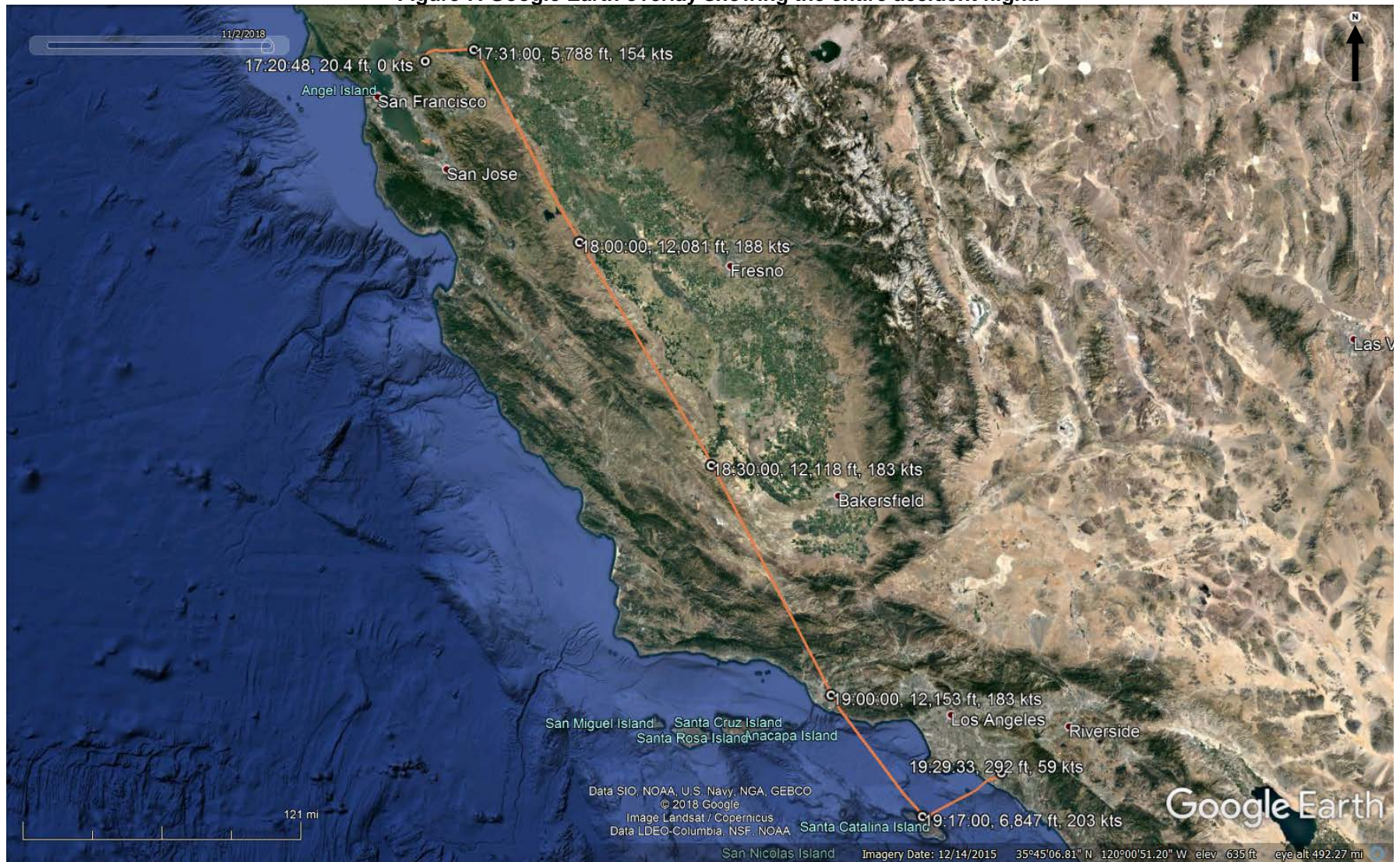
Figure 9 is a plot of parameters from the Appareo Stratus 2S for the entire accident flight. The time interval is 17:05:00 to 19:30:00 UTC.

Figure 10 is a plot of parameters from the Appareo Stratus 2S at the end of the accident flight. The time interval is 19:28:00 to 19:29:40 UTC.

The corresponding tabular data used to create Figures 7 through 10 are provided in electronic comma separated value (.CSV) format at Attachment 1 to this report.



Figure 7. Google Earth overlay showing the entire accident flight.





**Figure 8. Google Earth overlay showing the end of the accident flight.**

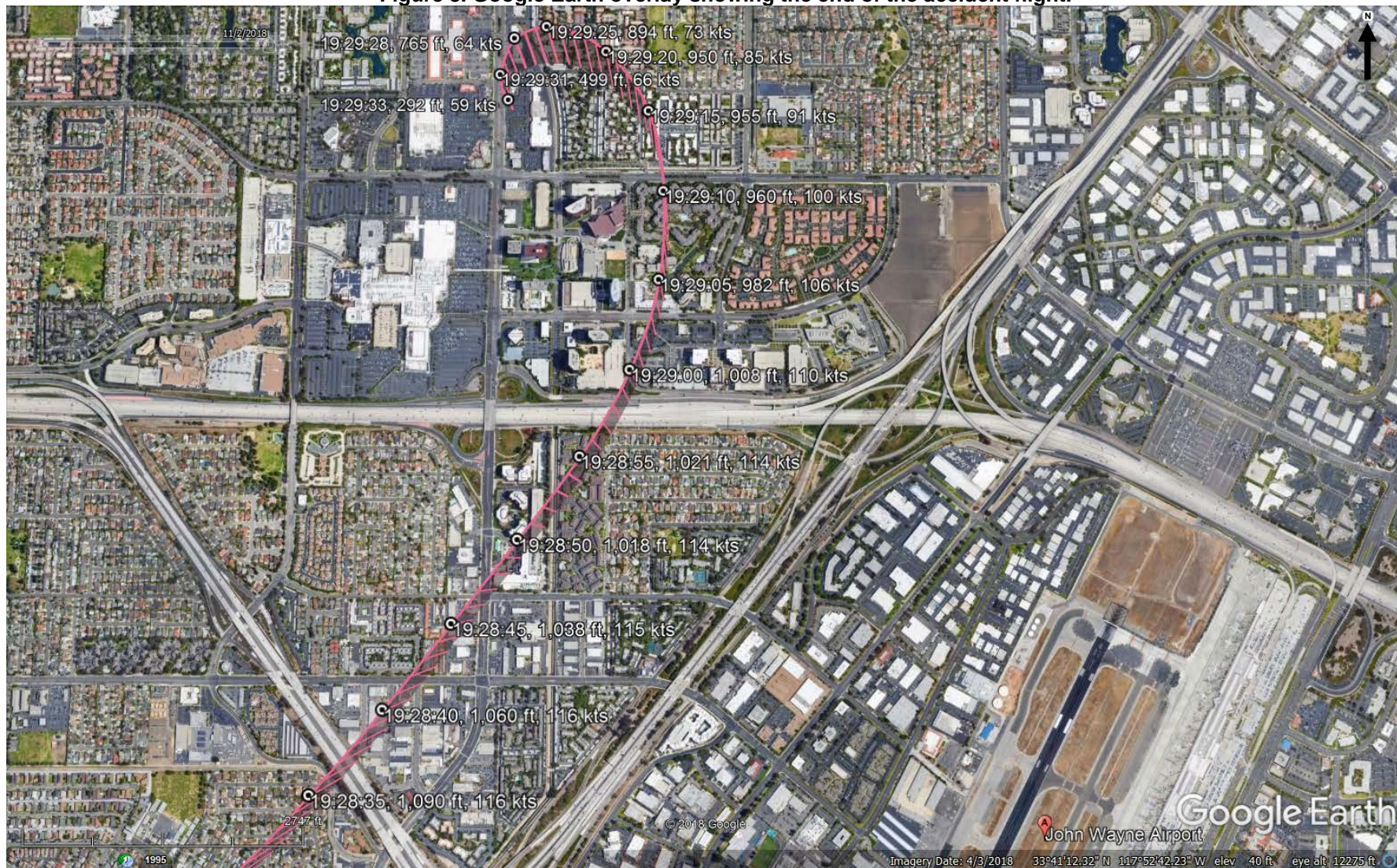




Figure 9. Plot of parameters form the Appareo Stratus 2S for the entire accident flight.

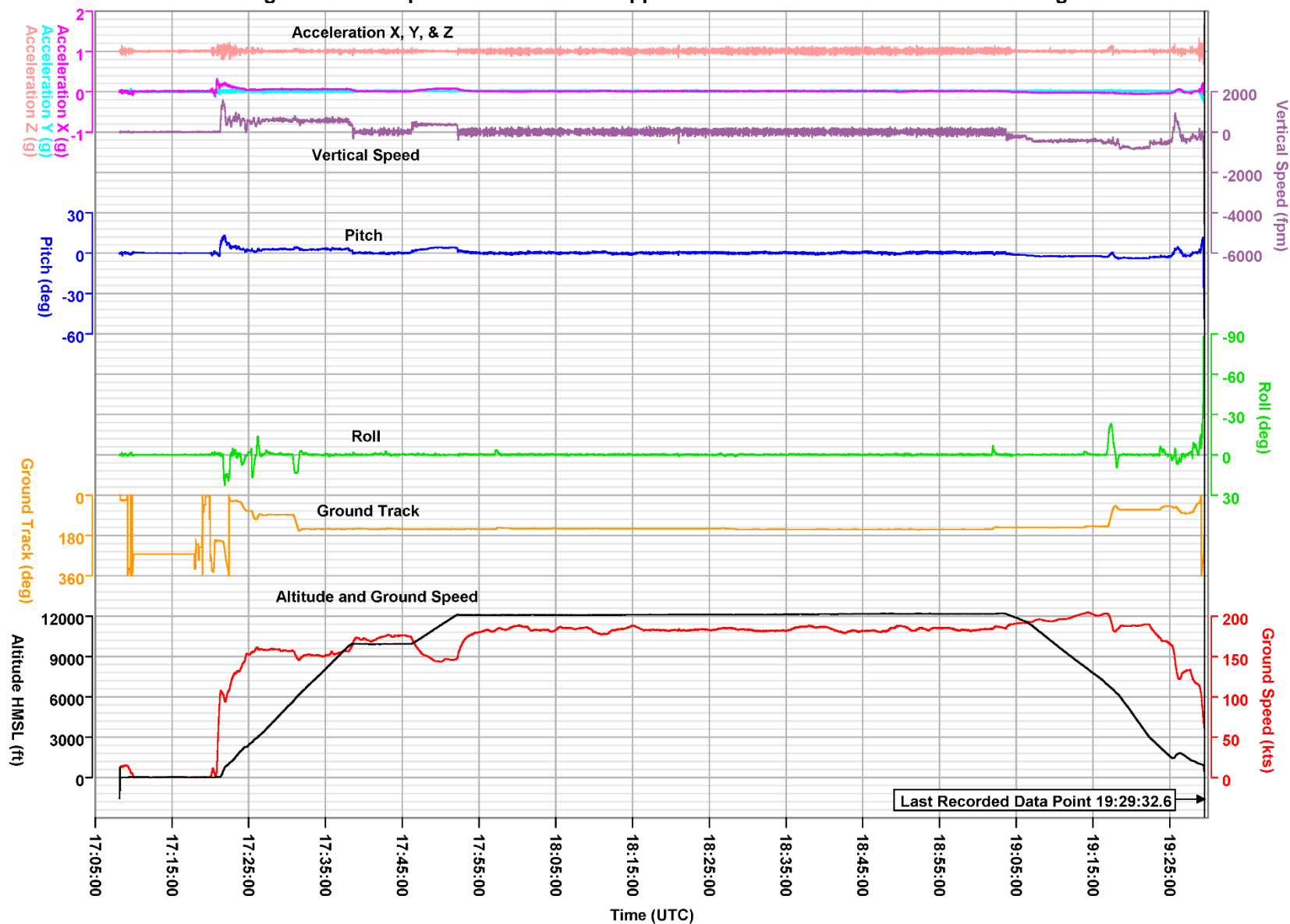


Figure 10. Plot of parameters from the Appareo Stratus 2S at the end of the accident flight.

