

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

December 29, 2021

Electronic Device

Specialist's Factual Report by Gerald Kawamoto

1. EVENT

Location: Bernard, Idaho
Date: August 28, 2021
Aircraft: Cessna TU206F
Registration: N922MA
Operator: Private
NTSB Number: WPR21FA330

2. DETAILS OF INVESTIGATION

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

Device: **Appareo Stratus 3i**
Device Serial Number: **005542**

2.1. Appareo Stratus 3i Description

The Appareo Status 3i device is a self-contained battery-powered unit that contains an internal AHRS, GPS/WAAS receiver, and ADS-B receiver in one compact unit.^{1, 2, 3} 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 memory chip.

¹ 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.

² 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 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).

2.1.1. Appareo Stratus 3i Data Recovery

Upon arrival at the Vehicle Recorder Division, an exterior examination revealed the unit was in good condition, as shown in Figure 1, and data were extracted normally using laboratory tools.



Figure 1. Front and back of the Appareo Stratus 3i as received.

2.1.2. Appareo Stratus 3i Data Description

The data extracted included 27 sessions from August 22, 2021, through August 28, 2021.⁴ The accident flight was the last session recorded, starting at 18:30:49 UTC and ending at 19:16:38 UTC on August 28, 2021. Accuracy of gyroscopic parameters such as pitch angle and bank angle is dependent on the correct orientation of the device in the aircraft and proper calibration of the device while it's stationary.

⁴ All dates and times are referenced to Coordinated Universal Time (UTC).

2.1.3. Appareo Stratus 3i Parameters Provided

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

Table 1. Appareo Stratus 3i Parameters.

Parameter Name	Parameter Description
Date	Date for recorded data point (MM/DD/YYYY)
Time	Time for recorded data point (HH:MM:SS.0)
Latitude (deg)	Latitude (degrees)
Longitude (deg)	Longitude (degrees)
Altitude (ft)	MSL Altitude (feet)
Ground Speed (kts)	Average derived ground speed (knots)
Heading (deg)	Magnetic Heading (degrees)
Bank (deg)	Bank Angle (degrees)
Pitch (deg)	Pitch Angle (degrees)

3. PLOTS AND CORRESPONDING TABULAR DATA

Figures 2 through 4 are Google Earth overlays of data recorded on the Appareo Stratus 3i. The weather and lighting conditions in Google Earth are not necessarily the weather and lighting conditions present at the time of the recording.

Figure 2 is a Google Earth overlay of the entire accident flight.

Figure 3 is a Google Earth overlay of approximately the last 10 minutes of the accident flight.

Figure 4 is a Google Earth overlay of approximately the last 20 seconds of the accident flight and the reported wreckage location.

Figure 5 is a plot of parameters recorded for the entire accident flight. The time interval plotted is 18:30:00 to 19:20:00 UTC.

Figure 6 is a plot of parameters recorded for the last minute of the accident flight. The time interval plotted is 19:15:40 to 19:16:40 UTC.

Tabular Data used to generate Figures 2 through 6 are included in electronic comma-separated variable (.csv) format as Attachment 1 to this report.



Figure 2. Google Earth overlay of the entire accident flight.

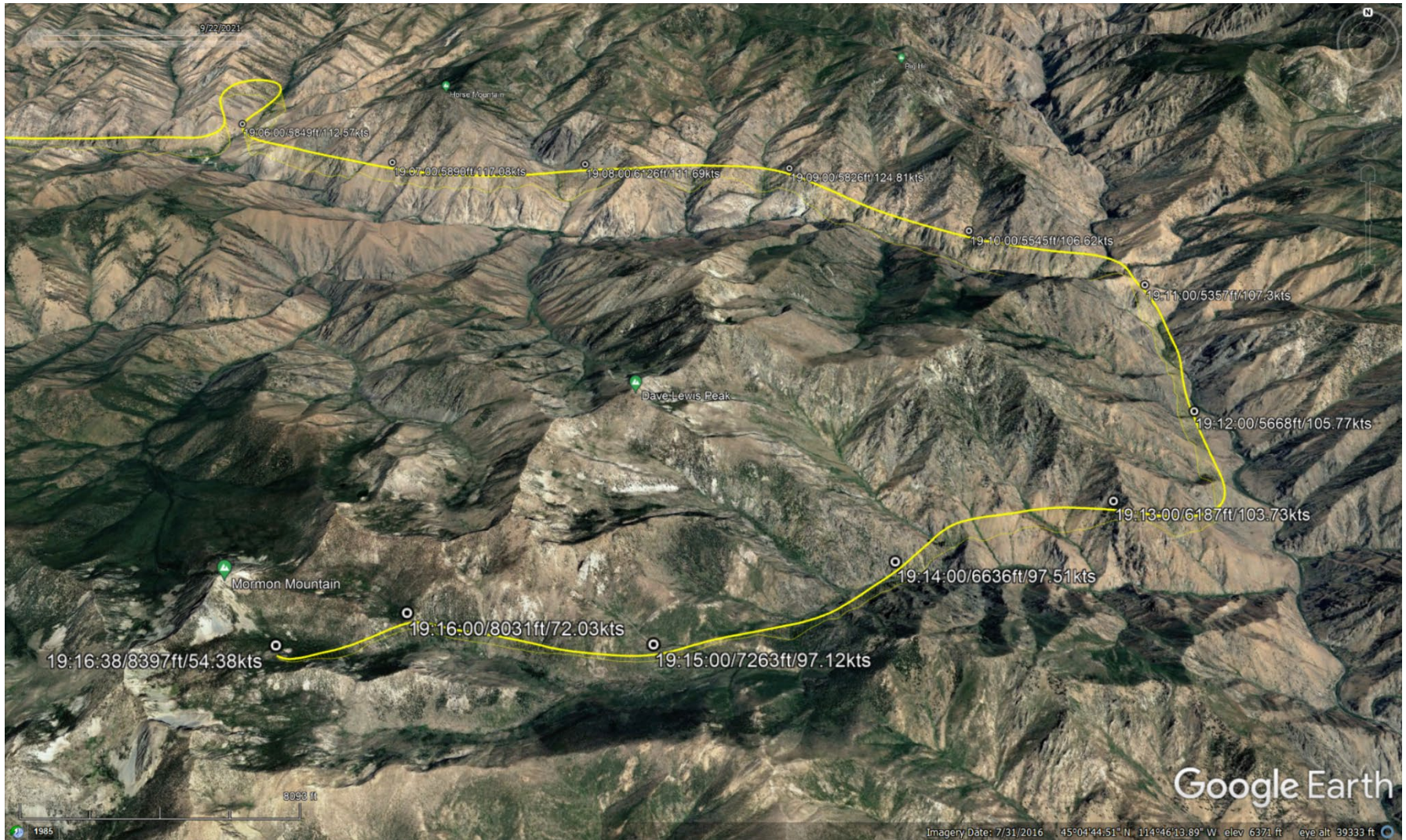


Figure 3. Google Earth overlay of the last 10 minutes of the accident flight.



Figure 4. Google Earth overlay of the last 20 seconds of the accident flight and the reported wreckage location.

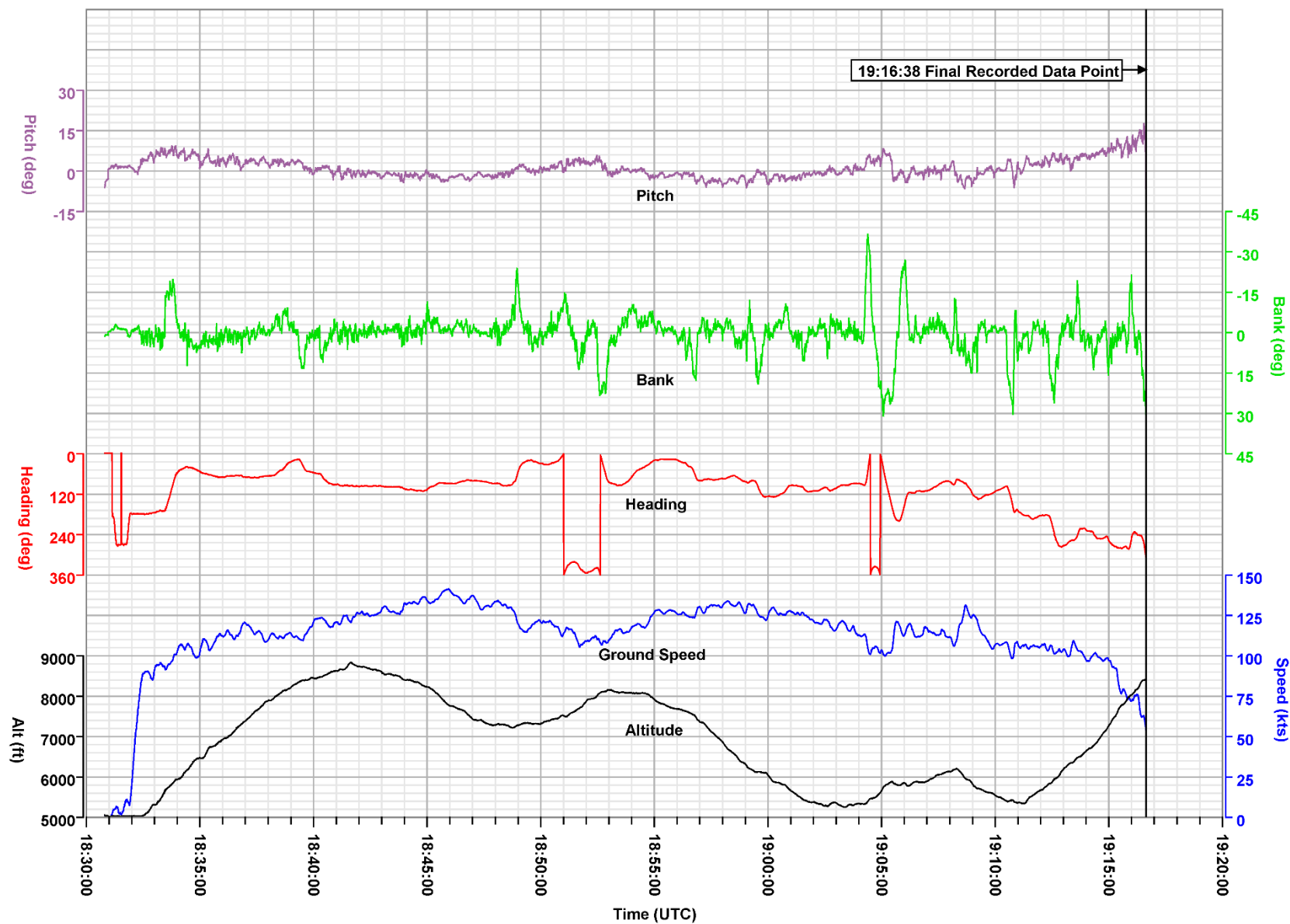


Figure 5. Plot of parameters for the entire accident flight.

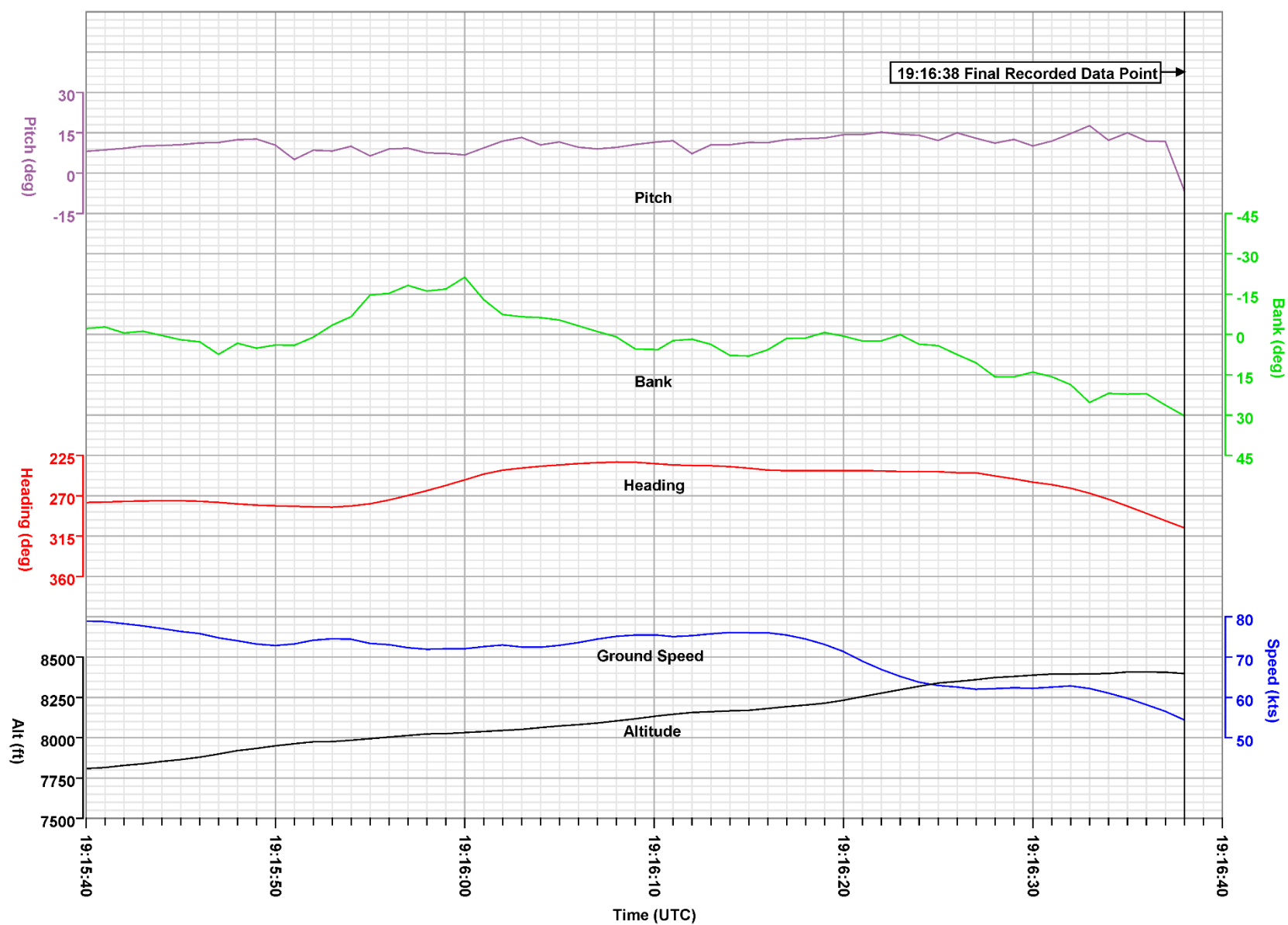


Figure 6. Plot of parameters at the end of the accident flight.