

NATIONAL TRANSPORTATION SAFETY BOARD

Vehicle Recorder Division
Washington, D.C. 20594

October 22, 2018

Appareo Stratus 2 Device

Specialist's Factual Report
by Alice Park

1. EVENT

Location: Whiteville, North Carolina
Date: October 31, 2017
Aircraft: Beech 35-C33
Registration: N293GC
Operator: Private
NTSB Number: ERA18FA012

On October 31, 2017, at 1005 eastern daylight time, a Beech 35-C33, N293GC, was substantially damaged when it impacted trees and terrain after a loss of engine power during approach to Columbus County Municipal Airport (CPC), Whiteville, North Carolina. The private pilot was fatally injured, and the pilot-rated passenger sustained minor injuries. Visual meteorological conditions prevailed, and no flight plan was filed for the personal flight, conducted under the provisions of 14 *Code of Federal Regulations* Part 91. The accident flight departed from Cannon Creek Airport (15FL), Lake City, Florida about 0735 to its destination of Westerly State Airport (WST), Westerly, Rhode Island.

2. DETAILS OF INVESTIGATION

The National Transportation Safety Board (NTSB) Vehicle Recorder Division received the following Appareo Stratus 2:

Recorder Manufacturer: Appareo Stratus 2
Serial Number: 232319

2.1 Appareo Stratus 2 Device Description

The Appareo Stratus device is a self-contained battery powered unit that contains an internal AHRS,¹ GPS/WAAS receiver,² and ADS-B³ receiver in one compact unit. The

¹ The Attitude Heading Reference System consists of a 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.

unit communicates wirelessly with the pilot's iPad or iPhone ("iOS Device") to display all the acquired information. The pilot needs to have a software application called ForeFlight⁴ installed on their iOS Device to view the Stratus data. In addition to communicating with the iOS Device, the Stratus device records GPS position and AHRS information internally on a non-volatile⁵ flash memory chip. Internal memory has the space to store over 13 hours of flight data that is sampled at a rate of 5 data records per second (5 Hz).

2.2 Appareo Stratus 2 Data Recovery

Upon arrival at the Vehicle Recorder Laboratory, an exterior examination revealed the unit was in good condition, as shown in figure 1 and 2. The unit was powered on, and data logs downloaded using the ForeFlight application.

2.3 Appareo Stratus 2 Data Description

Downloaded data included the accident flight from October 31, 2017, starting at 11:39:30 UTC (Coordinated Universal Time) through October 31, 2017, at 14:01:55 UTC. Additionally, a near stationary series of points at about longitude -78.727016, latitude 34.263787, were recorded on October 31, 2017, from 14:02:01 to 14:06:48 UTC.

While the Stratus 2 recorded vertical and horizontal acceleration data, the acceleration entries in the download appeared to report only the integer portion of the acceleration data. Based on prior Stratus 2 investigations, it is likely higher resolution acceleration data existed on the non-volatile memory chip in the Stratus 2; however, for this investigation the chip was not accessed directly, and acceleration data were omitted from this report.

Onboard avionics determine the position of the aircraft by using the Global Navigation Satellite System (GNSS) 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).

⁴ iOS Device application (program) that communicates wirelessly with the Appareo Status unit to display aircraft's attitude, navigation, weather, and traffic information.

⁵ Solid-state memory that does not require electrical power to retain information.

Figure 1. Undamaged exterior of Stratus 2 (front side)



Figure 2. Undamaged exterior of Stratus 2 (back side)



3. Appareo Stratus 2 Parameters Provided

Table 1 describes data parameters provided by the Stratus 2. All parameters were as recorded by the Stratus 2 unit (that is, none were derived).

Table 1. Appareo Stratus 2 Data Parameters

Parameter Name	Parameter Description
Date	Date (UTC) for recorded data point (MM/DD/YYYY)
Time	Time (UTC) for recorded data point (HH:MM:SS)
Latitude	Latitude (degrees)
Longitude	Longitude (degrees)
Altitude	GPS Altitude (feet (ft), MSL)
Speed	Groundspeed (knots (kts))
Course	Track course (degrees)
Pitch	Pitch angle (degrees) (- down, + up)
Bank	Bank angle (degrees) (- left, + right)

Note: MSL means altitude above mean sea level

3.1 Appareo Stratus 2 Plots and Tabular Data

Figures 3 and 4 are generated using data extracted from the Stratus 2 and overlaid using Google Earth. The weather and lighting depicted in Google Earth are not necessarily representative of the weather and lighting conditions experienced during the accident flight.

Figure 3 provides an overview of the accident flight recording. The recording began at 11:39:30 UTC and ended at 14:01:55 UTC on October 31, 2017.

Figure 4 shows the last segment of the accident flight. The airplane was about 2,000 ft from the threshold of Runway 6 of the Columbus County Municipal Airport at the time of impact.

Tabular data used to generate figures are included as attachment 1 in electronic comma separated value (.CSV) format.

Figure 3. Entire flight, satellite overlay.

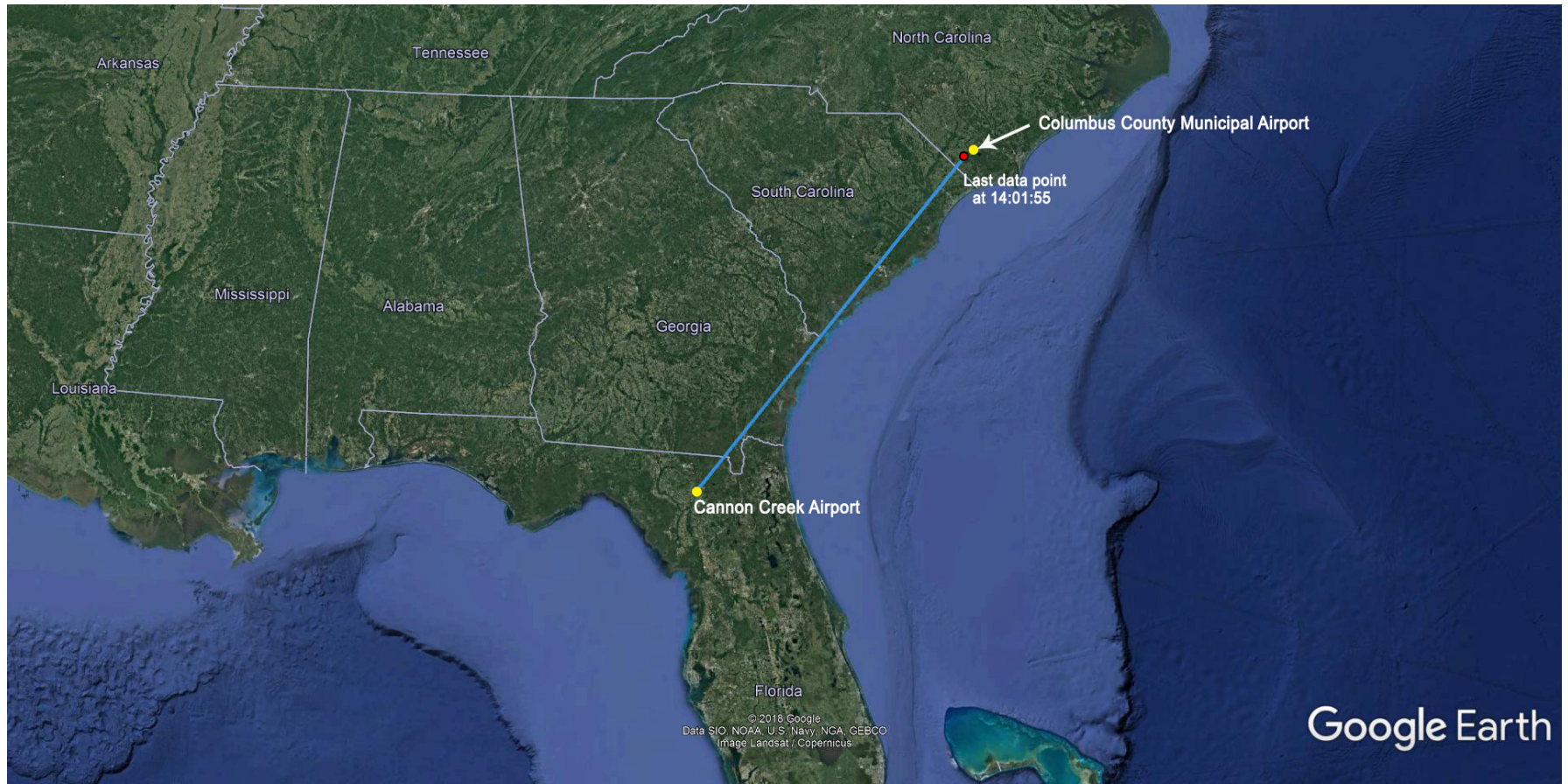


Figure 4. Last segment of the accident flight in large scale.

