

# NATIONAL TRANSPORTATION SAFETY BOARD

Vehicle Recorder Division  
Washington, D.C. 20594

January 9, 2017

## Electronic Devices

Specialist's Factual Report  
By Bill Tuccio, Ph.D.

### 1. EVENT SUMMARY

Location: Farmington, Pennsylvania  
Date: December 11, 2015  
Aircraft: Beech A36  
Registration: N72054  
Operator: Private  
NTSB Number: ERA16FA064

On December 11, 2015, at approximately 1420 eastern daylight time, a Beech A36; N72054, was destroyed when it impacted trees and terrain after a loss of control during a return to the airport, after takeoff from Nemaquin Airport (PA88), Farmington, Pennsylvania. The certificated commercial pilot and two passengers were fatally injured. Visual meteorological conditions prevailed, and no flight plan was filed for the Title 14 *Code of Federal Regulations Part 91* personal flight, destined for Montgomery County Airport (GAI), Gaithersburg, Maryland.

### 2. GROUP

A group was not convened.

### 3. DETAILS OF INVESTIGATION

The National Transportation Safety Board (NTSB) Vehicle Recorder Division received an unknown item and the following global positioning system (GPS) device:

Device Manufacturer/Model:	Garmin GPS <sup>1</sup>
Serial Number:	Unknown

Figure 1 shows a photo of the unknown item. Due to the damage, no identification or recovery was attempted.

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<sup>1</sup> The device was likely a model 395, 396, 495, or 496 based on an internal inspection.

**Figure 1. Additional unknown device.**



### **3.1. Garmin GPS Device Description**

The Garmin GPSMAP 39x/49x series devices are battery-powered, portable, 12-channel GPS receivers with display screens. Units include a built-in Jeppesen database. Devices store date, route-of-flight, and flight-time information for up to 50 flights. A flight record is triggered when groundspeed exceeds 30 knots and altitude exceeds 500 feet, and ends when groundspeed drops below 30 knots for 10 minutes or more. A detailed tracklog – including latitude, longitude, date, time, and GPS altitude information for an unspecified number of points – is stored within the unit whenever the receiver has a lock on the GPS navigation signal. Position is updated within the tracklog as a function of time or distance moved, depending on how the unit has been configured. Once the current tracklog memory becomes full, new information either overwrites the oldest information or the recording stops, depending on how the unit is configured. The current tracklog can be saved to long-term memory and 15 saved tracklogs can be maintained in addition to the current tracklog. Tracklog storage may be activated or de-activated at user discretion. All recorded data is stored in non-volatile memory.<sup>2</sup> Units contain hardware and software permitting the download of recorded waypoint, route, and tracklog information to a PC via a built-in serial port using the NMEA 0183 version 2.0 protocol. Units can also communicate with external devices, such as a computer, using a built in USB port. An internal button-battery is used to backup power to the internal memory and real-time clock during those periods when main power is removed.

### **3.2. Garmin GPS Data Recovery**

The unit suffered extreme thermal damage, as shown in figure 2. An internal inspection revealed the non-volatile memory chip was intact, as shown in figure 3. The non-volatile memory chip was removed from the printed circuit board using a hot air re-work station. The 6x8 ball grid array on the back of the chip was reworked and a raw-data binary readout of the chip was obtained using a Xeltek SP-3000u EEPROM programmer. Recorded tracklog data was identified and converted to engineering units using an in-house software program.

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<sup>2</sup> Non-volatile memory is semiconductor memory that does not require external power for data retention.

Figure 2. Unit as received at NTSB.



Figure 3. Internal inspection; non-volatile memory chip annotated.



### 3.3. Data Description

The data extracted included 58 sessions from June 1, 2015,<sup>3</sup> through December 11, 2015 (14,004 datapoints). The accident flight was recorded starting 1915:57 UTC and ending 1922:22 UTC on December 11, 2015 (40 datapoints).

### 3.4. Parameters Provided

Table 1 describes data parameters provided by the GPS device. Date, Time, Latitude, Longitude, and GPS Altitude are recorded by the device. Groundspeed and Track 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 Alt	Recorded GPS Altitude (feet)
Groundspeed	Average derived groundspeed (knots)
Track	Average derived true course (degrees)

### 3.5. OVERLAYS AND TABULAR DATA

Graphical overlays were generated using Google Earth. The weather and lighting conditions in Google Earth are not necessarily the weather and lighting conditions present at the time of the recording.

Figures 2 through 4 collectively show:

- The recording began at 1915:57 UTC near the parking area. By 1917:07 UTC the aircraft had taxied southwest out of the parking area, then turned northeast and back-taxed down the runway. By 1919:11 UTC, the aircraft was at the northeast end of runway 23. By 1920:18 UTC, the aircraft had started its takeoff roll. Recorded GPS altitudes during the taxi were about 1,975 feet MSL.
- At about 1921:00 UTC, at an altitude of 2,184 feet MSL, the aircraft began a left, climbing turn. At this time the aircraft was about 2,500 feet from the departure end (southwest end) of runway 23.
- The aircraft continued the climbing left turn, reaching a maximum recorded altitude of 2,457 feet MSL at 1921:36 UTC when it was flying northeast-bound, parallel to runway 23.

<sup>3</sup> All dates and times are referenced to Coordinated Universal Time (UTC).

- By 1922:09 UTC, the aircraft had begun turning left again and was descending through 2,211 feet at 97 knots groundspeed.
- The last recorded point was at 1922:22 UTC.

Tabular data used to generate these figures are included as attachment 1. This attachment is provided in electronic comma-delimited (.CSV) format.

Figure 4. Start of accident flight recording.

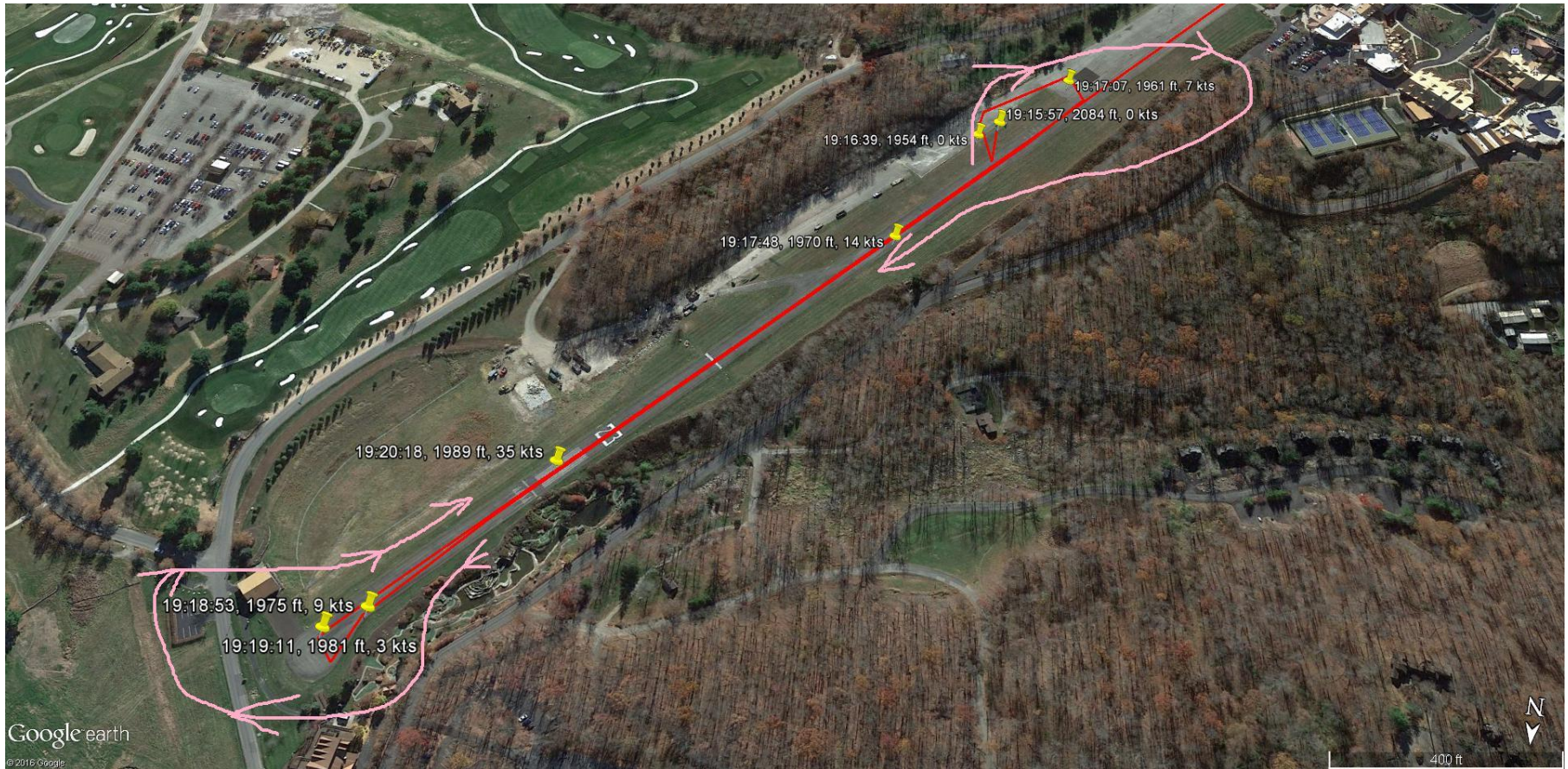


Figure 5. Pattern portion of accident flight recording.

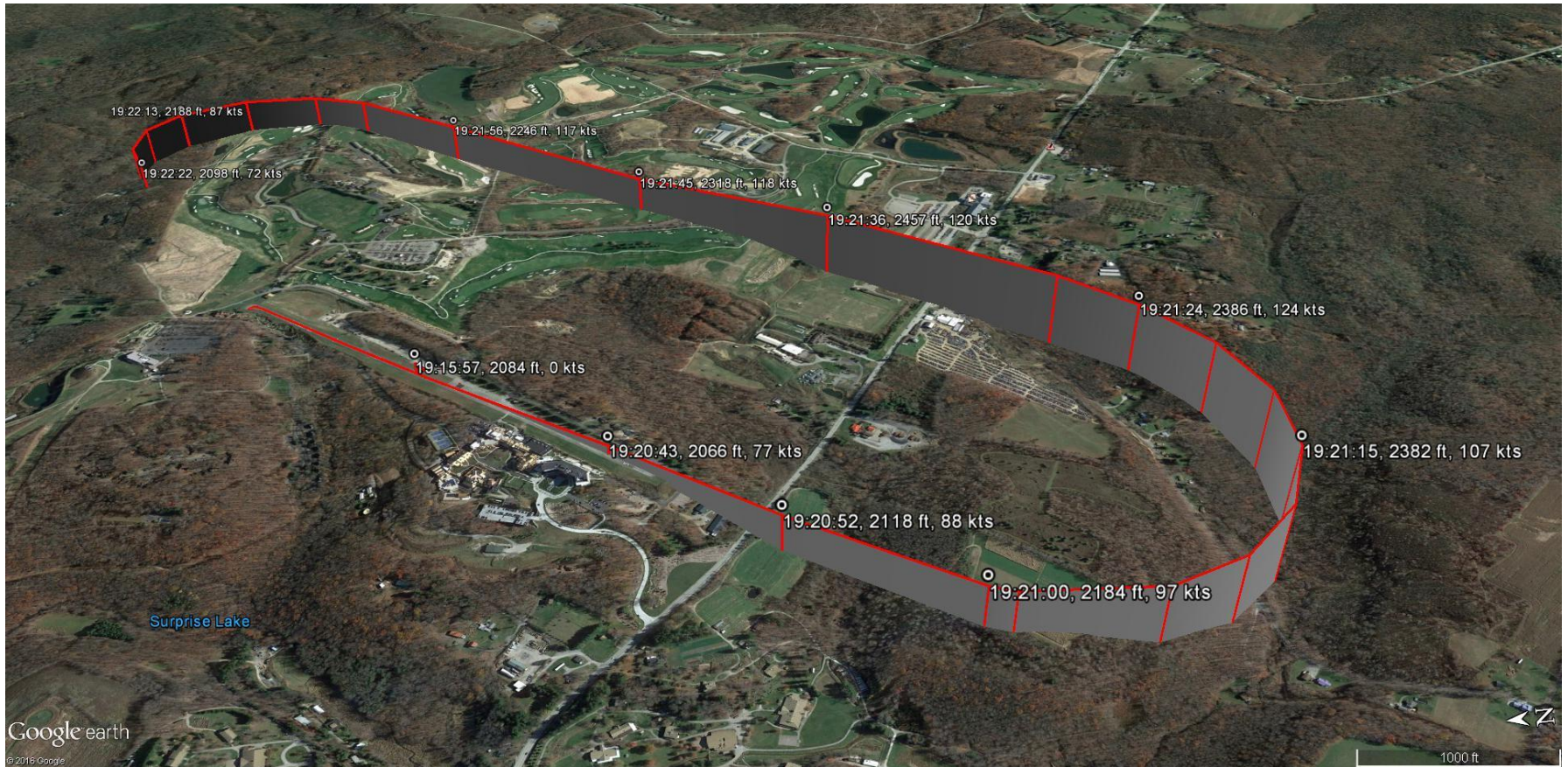


Figure 6. End of accident flight recording.

