

NATIONAL TRANSPORTATION SAFETY BOARD

Vehicle Recorder Division

Washington, D.C. 20594

November 23, 2015

Global Positioning System Device

Specialist's Factual Report

By Jane Foster

1. EVENT SUMMARY

Location: Mulberry, Tennessee
Date: May 3, 2015
Aircraft: Cessna 182P
Registration: N6579M
Operator: Private
NTSB Number: ERA15FA204

On May 3, 2015, at around 1430 CDT, N6579M, a Cessna 182P single-engine airplane, was destroyed when it impacted terrain and livestock near Mulberry, Tennessee. The certified private pilot was killed. The airplane was registered to and operated by the pilot. No flight plan was filed for the flight that originated at Winchester Municipal Airport (BGF), Winchester, Tennessee, about 1430 central daylight time. Visual meteorological conditions prevailed for the personal flight conducted under 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 global positioning system (GPS) device:

Device Manufacturer/Model:	Garmin GPSMAP 396
Serial Number:	125001618

3.1. Device Description

The Garmin GPSMAP 396 is a battery-powered portable 12-channel GPS receiver with a 256-color TFT LCD display screen. The unit includes a built-in Jeppesen database and is capable of receiving XM satellite radio for flight information including NEXRAD radar, lightning, METARs, TAFs, and TFRs. The unit stores date, route-of-flight, and flight-time information. 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 – 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 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 memory¹. The unit contains 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. The unit can also communicate with external devices such as a computer using a built in USB port. An internal button-battery is used to back-up power to the internal memory and real-time clock during those periods when main power is removed.

3.2. Data Recovery

Upon arrival at the Vehicle Recorder Laboratory, an exterior examination revealed that the unit had sustained moderate damage. The device was covered with a coating of an unknown grey powdered substance. The glass protecting the screen on the front was broken. Figure 1 and 2 show the front and back of the device as received at the Vehicle Recorder Laboratory.



Figure 1. Front of Garmin GPSMAP 396

¹ Non-volatile memory is semiconductor memory that does not require external power for data retention



Figure 2. Back of Garmin GPSMAP 396

The unit was powered in the laboratory with a power cable and power supply appropriate for the device model. The unit powered up but the screen did not function. The unit did not respond to keypad inputs. The unit was connected to a laboratory computer for readout, but was not able to be detected by the readout station. The device was opened and was inspected for any additional damage.

No visible damage was found and no obvious repairs could be made. The chip containing the unit's non-volatile memory (NVM) was identified. The NVM chip was removed from the board using hot air to melt the solder holding the chip to the main board. The chip was found to be in good condition after removal and was restored to working condition so data could be extracted. The chip read out normally using an adapter socket appropriate for the type and model of chip. The read out resulted in a binary file which was converted to engineering units using laboratory software. The binary readout and subsequent conversion produced files consistent with a normally operating GPS device.

3.3. Data Description

The data extracted included 81 sessions. The date and time were unable to be converted accurately, however the final flight matches the accident description but had an hour difference in the time recorded and the time of the accident and a 10 year and one day difference in date recorded and date of the accident. The accident flight was recorded starting 18:13:04 UTC and ending 18:33:54 UTC on May 4, 1995.

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

Figures 3, 4, and 5 are graphical overlays generated using Google Earth for the accident flight. The weather and lighting conditions in Google Earth are not necessarily the weather and lighting conditions present at the time of the recording.

The flight departed Winchester Municipal Airport at approximately 18:13:04 UTC. The last recorded parameter was as at 18:33:54 UTC on May 4, 1995, with a GPS altitude of 822 feet above Mean Sea Level (MSL) and a ground speed of 144 knots. Due to data buffering on the GPS unit, the data recording may have ended before the accident event.

Tabular data used to generate figure 3 are included as Attachment 1. This attachment is provided in electronic comma-delimited (.CSV) format.

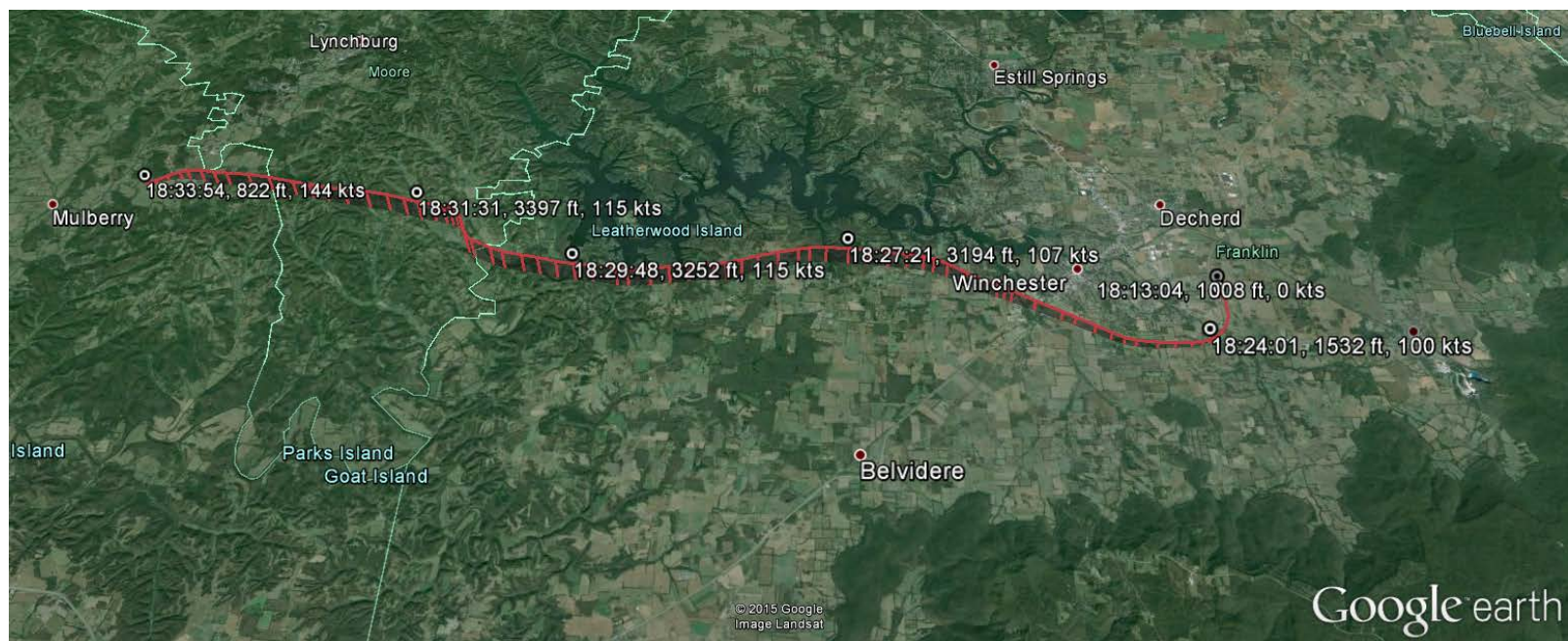


Figure 3. Google Earth overlay showing the accident flight.

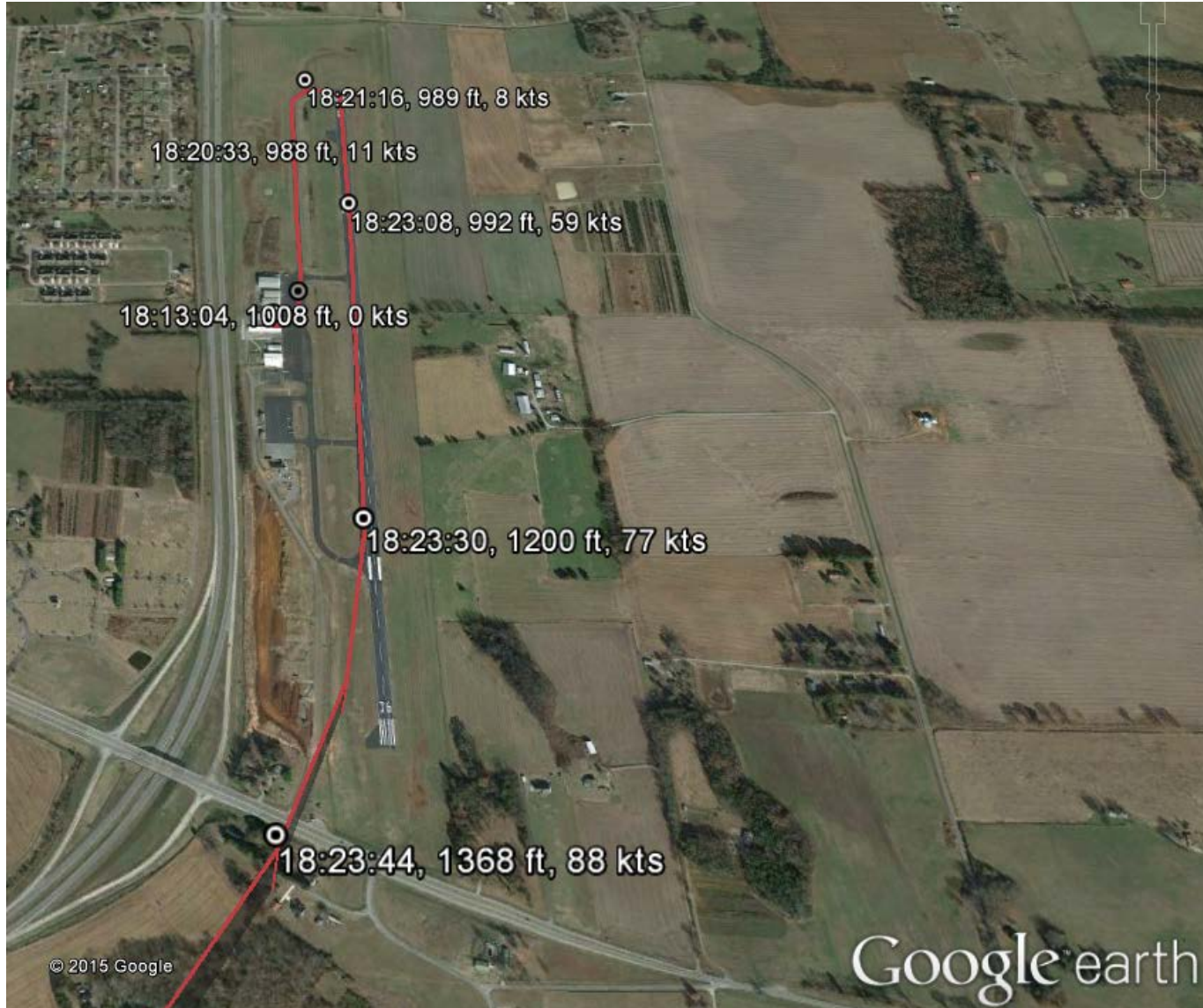


Figure 4. Google Earth overlay showing the beginning of the accident flight



Figure 5. Google Earth overlay showing the end of the accident flight