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

April 9, 2015

Global Positioning System Device

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

1. EVENT SUMMARY

Location:	Osage Beach, Missouri
Date:	March 11, 2015
Aircraft:	Beechcraft B19
Registration:	N774TA
Operator:	Private
NTSB Number:	CEN15LA172

On March 11, 2015, at 1233 central daylight time, a Beech B19, N774TA, was ditched in Lake Ozark, Osage Beach, Missouri, after oil pressure was lost and the engine seized. One passenger was seriously injured, but the pilot and another passenger escaped injury. The airplane was substantially damaged. The airplane was registered to GDS Properties and operated by the pilot, both of St. Charles, Missouri, under the provisions of 14 *Code of Federal Regulations* Part 91 as a personal flight. Visual meteorological conditions prevailed at the time of the accident, and no flight plan had been filed. The cross-country flight originated from Grand Glaize-Osage Beach Airport (K15), Osage Beach, Missouri, about 1225, and was en route to Creve Coeur Airport (1H0), St. Louis, Missouri.

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 196
Serial Number:	65418467

3.1. Device Description

The Garmin GPSMAP 196 is a portable GPS unit equipped with a detachable antenna, and a 320 x 240 12-level grayscale LCD display. The unit is equipped with a built in

base map and internal Jeppesen aviation database. The unit employs a parallel 12 channel WAAS-capable receiver and can be operated using external power, or alternatively by four standard AA-size batteries. The GPSMAP 196 is capable of storing date, route of flight, and flight time information for up to 50 individual flights in the form of a flight log. Flight logging begins when the GPS unit senses a speed increase of greater than 30 knots together with an altitude gain of greater than 500 feet. Recorded flight log data is saved when the speed is sensed to decrease to below 30 knots, and a new log is started if more than 10 minutes passes from this time. A detailed track log – 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. Track log position is updated as a function of time or distance moved, depending on how the unit has been configured. Once the current track log memory becomes full, new information either overwrites the oldest information or recording stops, depending on how the unit is configured. The current track log can be saved to long-term memory and 15 saved track logs can be maintained in addition to the current track log. Track log storage may be activated or de-activated at user discretion. All recorded data is stored in non-volatile memory[1]. The unit contains hardware and software permitting the download of recorded waypoint, route, and track log information to a PC via a built-in serial port using the NMEA 0183 version 2.0 protocol.

3.2. Data Recovery

According to investigators, the device was retrieved from an unknown depth of fresh water in Lake Ozark, Missouri. The device was delivered to the NTSB Vehicle Recorder division in a sealed plastic bag, as shown in figure 1.

The unit was disassembled and each component was rinsed in deionized water, cleaned with Methanol, scrubbed with an acid brush, and then re-rinsed in deionized water. The components are shown in figure 2. After this treatment, all components were dried and vacuum-baked for 2 hours at 40º Celsius and 15 inches of Mercury to remove any remaining moisture and salts.

After the drying and baking treatment, components were inspected. There was some evidence of residual contamination. The unit was reassembled and power was applied; however, the unit would not start.

The unit was disassembled and the non-volatile, AMD memory chip, shown in figure 3, was removed from the component board using a hot-air rework station. The chip was installed in an NTSB surrogate unit and data was downloaded normally via the unit's serial port using Garmin MapSource software and proprietary cables.

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

Figure 1. Photo of device, as received.

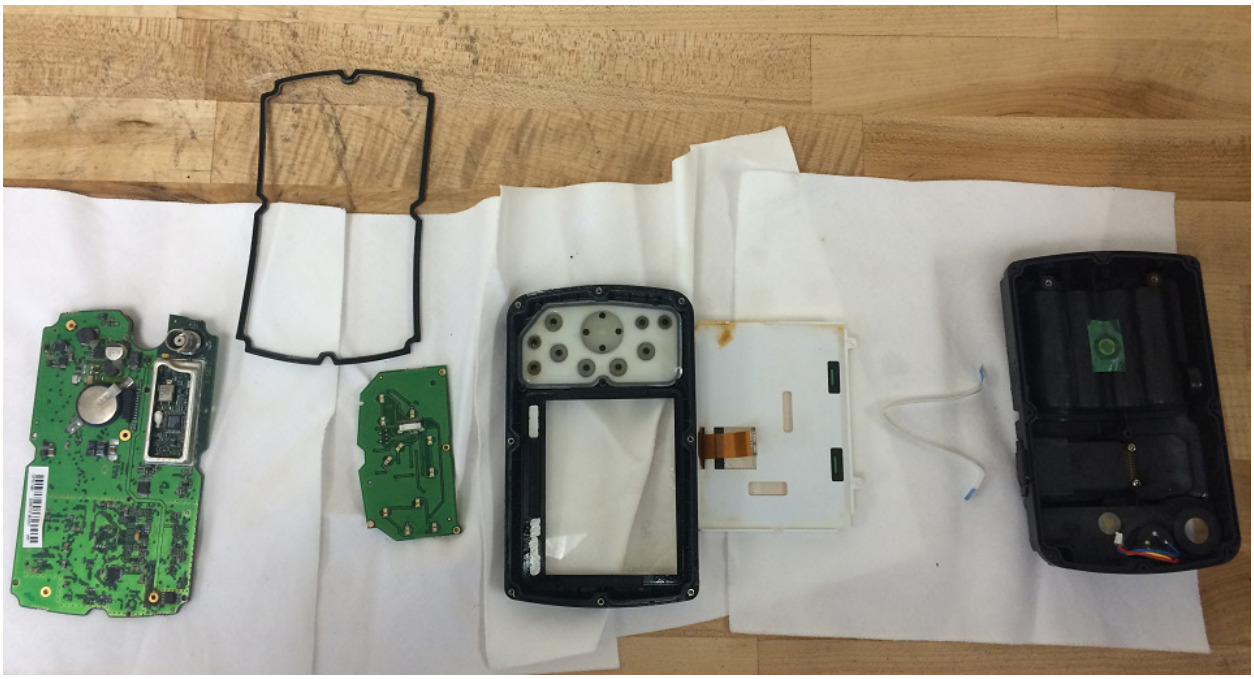

Figure 2. Components after disassembly and cleaning.

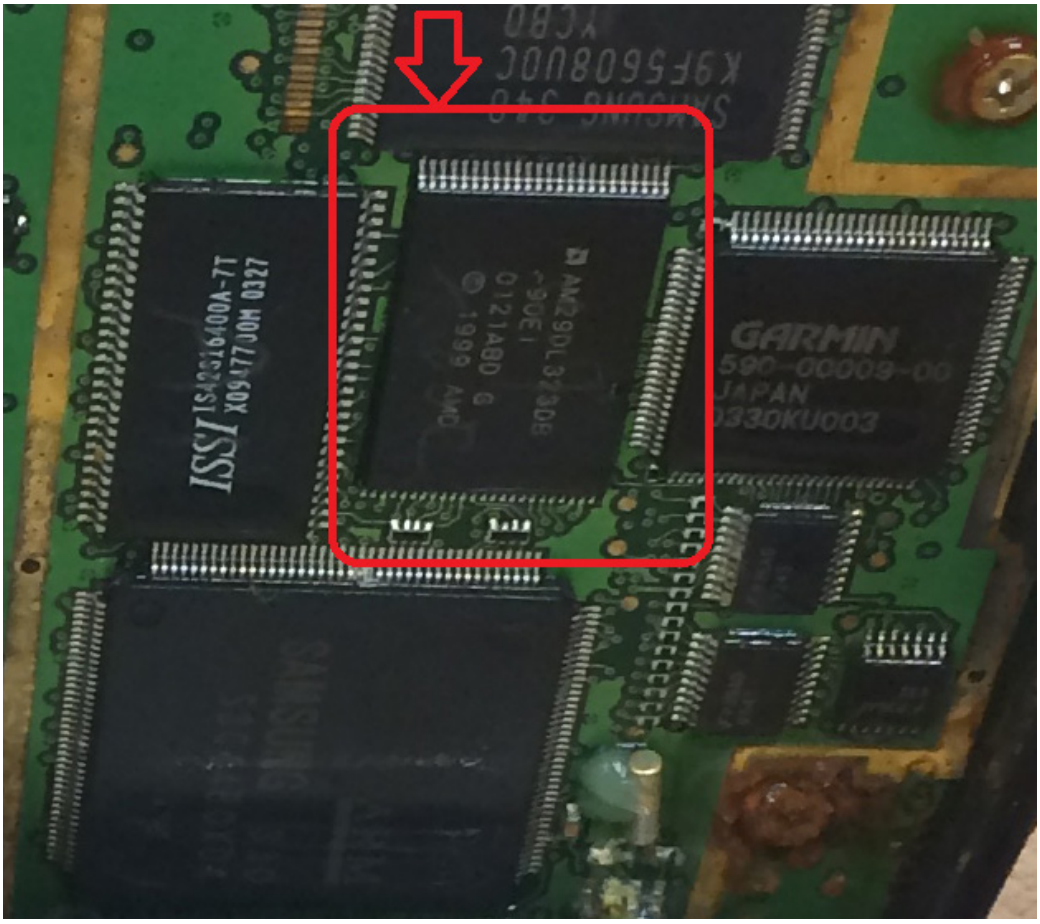

Figure 3. Non-volatile memory chip.

3.3. Data Description

The data extracted included 11 sessions from December 26, 2014,[2] through March 11, 2015. The accident flight was recorded starting at 17:14:34 UTC and ending at 17:30:30 UTC on March 11, 2015.

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.

[2] All dates and times are referenced to Coordinated Universal Time (UTC).

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 4 through 6 show 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.

Figure 4 shows an overview of the accident flight recording. The recording began at 17:14:34 UTC at the K15 airport. By 17:20:13 UTC, the aircraft began its takeoff roll. At about 17:22:34 UTC, the aircraft began a right turn towards the northeast and continued to climb. At about 17:27:11 UTC, at an altitude of 2,769 feet, the aircraft began a right turn towards the southwest. The recording ended at 17:30:30 UTC, about 1.2 nautical miles northeast of K15.

Figure 5 shows ground operations at K15. By 17:16:00 UTC, the aircraft began to taxi towards runway 32. By 17:18:17 UTC, the aircraft reached runway 32 and by 17:20:13 UTC the aircraft began its takeoff roll.

Figure 6 shows the end of the recording. The aircraft descended southwest at about 63 knots groundspeed. The last recorded point was in Lake Ozark at 17:30:30 UTC.

Tabular data used to generate figures 4 through 6 are included as Attachment 1. This attachment is provided in electronic comma-delimited (.CSV) format].

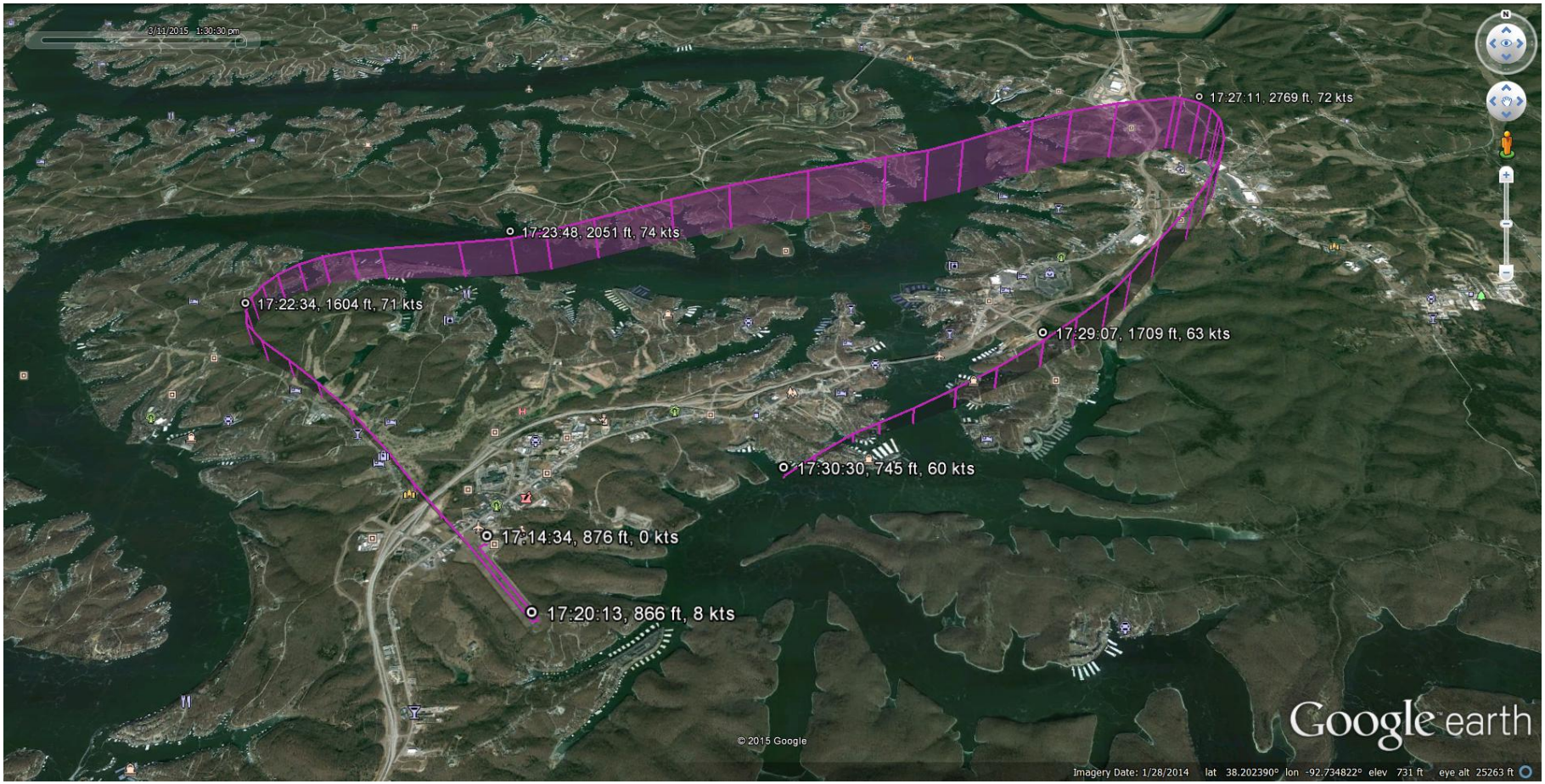

Figure 4. Google Earth overlay of accident recording.

Figure 5. Google Earth overlay of accident ground operations.

Figure 6. Google Earth overlay of end of accident recording.