

NATIONAL TRANSPORTATION SAFETY BOARD

Vehicle Recorder Division
Washington, D.C. 20594

February 24, 2015

Global Positioning System (GPS)

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

1. EVENT

Location: Cordele, Georgia
Date: October 16, 2014
Aircraft: Aeronca 7AC
Registration: N946DR
Operator: Private
NTSB Number: ERA15FA017

On October 16, 2014, about 1230 eastern daylight time, an Aeronca 7AC airplane, N946DR, was substantially damaged when it impacted terrain shortly after takeoff from Crisp County Cordele Airport (CKF), Cordele, Georgia. The private pilot was fatally injured and the passenger received serious injuries. Visual meteorological conditions prevailed and no flight plan was filed. The planned cross-country flight departed from CKF at 1230 and was destined for Peach State Airport (GA2), Williamson, Georgia. The personal flight was conducted under the provisions of Title 14 *Code of Federal Regulations* Part 91.

2. GROUP

A Global Positioning System (GPS) group was not convened.

3. DETAILS OF DEVICE INVESTIGATION

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

Device: Garmin GPSMAP 496
Device Serial Number: 19713840

3.1. Garmin GPSMAP 496 Device Description

The Garmin GPSMAP 496 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 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 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.

3.1.1. Garmin GPSMAP 496 Data Recovery

Upon arrival at the NTSB’s Vehicle Recorder Division, an exterior examination revealed the unit had sustained minor impact damage, as shown in figure 1. An internal inspection revealed the internal component board was bent under pressure, a connector was loose, and an inductor housing was broken; this damage is annotated in figure 2. Repairs were made by bending the component board back in place, tightening connectors, and then confirming inductor electrical continuity.

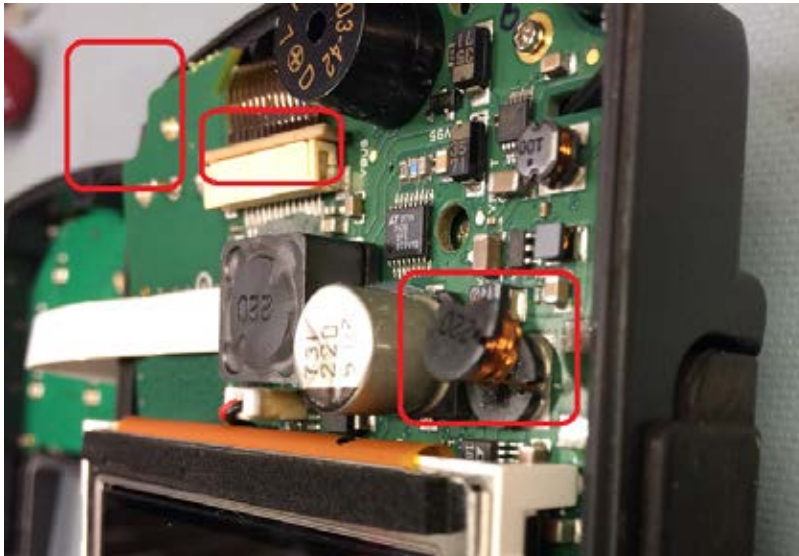
The device was reassembled and power was applied. Although the screen would not start, information was downloaded using Garmin’s MapSource software normally.

Figure 1. GPSMAP 496 with crack across display screen.



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

Figure 2. Damage to internal components.



3.1.2. Garmin GPSMAP 496 Data Description

The data extracted included 5 sessions, all recorded on October 16, 2014 (201 total data points). The accident flight was not recorded. In agreement with the Investigator-in-Charge, all the recorded data on October 16, 2014 are described. All times are expressed in Coordinated Universal Time (UTC).

Reasons the accident flight may not have been recorded include: power was removed from the GPS or the device settings were changed to not record. Given that only 201 points were recorded on the device and the device is capable of storing thousands of points, the memory was not filled and had adequate storage for additional points. It is also unlikely the accident impact caused data loss, as prior NTSB investigations of a Garmin 496 showed little (i.e., a few seconds) to no data loss in writing a track history. Lastly, pilot actions to reprogram the device (such as choosing a new route) are not expected to interrupt the track history recording.

4. GPS 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) |

| Parameter Name | Parameter Description |
|----------------|---|
| Longitude | Recorded Longitude (degrees) |
| GPS Alt | Recorded GPS Altitude (feet, MSL ²) |
| Groundspeed | Average groundspeed between current and previous data point (knots) |
| Track | Average true course between current and previous data point (degrees) |

5. OVERLAYS AND TABULAR DATA

The graphical overlay generated in this report was generated using Google Earth. Weather conditions in Google Earth are not necessarily representative of weather conditions at the time of the accident. The aviation sectional overlay was produced using charts from ChartBundle.com.

Figure 3 shows the three legs recorded on October 16, 2014, with a tabular summary shown in table 2. Average groundspeed on the three legs was about 75 knots and average GPS altitudes varied between about 475 feet and 750 feet.

The last, singular data point was recorded at 16:32:10 UTC on the CKF airport ramp area.

Table 2. Summary of recorded legs.

| Leg Start Location | Leg End Location | Approximate Distance | Approximate Start Time | Approximate End Time | Approximate Duration |
|--|--|----------------------|------------------------|----------------------|----------------------|
| | | (nautical miles) | (UTC) | (UTC) | (HH:MM:SS) |
| Treasure Coast Airport, Port St. Lucie, Florida (FL37) | Umatilla Municipal Airport, Umatilla, Florida (X23) | 118 | 10:56:56 | 12:38:25 | 1:41:29 |
| Umatilla Municipal Airport, Umatilla, Florida (X23) | Cook County Airport, Florida (15J) | 162 | 13:03:15 | 15:08:58 | 2:05:43 |
| Cook County Airport, Florida (15J) | Crisp County Cordele Airport, Cordele, Georgia (CKF) | 55 | 15:25:51 | 16:06:59 | 0:41:08 |

Note: Start and End times were determined by airspeed and altitude consistent with the aircraft in flight.

Tabular data used to generate figure 2 are included as attachment 1. This attachment is provided in electronic comma-delimited (.CSV) format.

² MSL means altitude above mean sea level

Figure 3. Three legs recorded on October 16, 2014.

