

NATIONAL TRANSPORTATION SAFETY BOARD

Vehicle Recorder Division

Washington, D.C. 20594

July 3, 2018

Global Positioning System Device

Specialist's Factual Report

By Alice Park

1. EVENT SUMMARY

Location: Bonita Springs, Florida
Date: January 22, 2018
Aircraft: Vans RV-12
Registration: N262WS
Operator: Private
NTSB Number: ERA18FA064

On January 22, 2018, about 1214 eastern standard time, a Van's Aircraft Inc. RV-12, N262WS, was destroyed when it collided with terrain near Bonita Springs, Florida. The sport pilot was fatally injured. The special light sport airplane was registered to a corporation and was operated by the pilot under the provisions of Title 14 *Code of Federal Regulations* part 91. Visual meteorological conditions prevailed, and no flight plan was filed for the personal flight. The flight originated at Page Field (FMY), Fort Myers, Florida about 1200, and was destined for Everglades Airpark (X01), Everglades City, Florida.

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) devices:

Device Manufacturer/Model:	Garmin GPSMAP 495
Serial Number:	1E0003699
Device Manufacturer/Model:	Garmin GPSMAP 696
Serial Number:	1H6008368

3.1. Device Description

The Garmin GPSMAP 495 is a battery-powered portable 12-channel GPS receiver with a color LCD display screen. The unit includes a built-in Jeppesen database and can receive 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 250 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. Once the current tracklog memory becomes full, new information either overwrites the oldest information or recording stops, depending on how the unit is configured.¹ 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. The unit contains hardware and software permitting the download of recorded waypoint, route, and tracklog information to a PC. 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.

The Garmin GPSMAP 696 is a battery-powered portable multi-function display and GPS receiver with a 7-inch diagonal high-resolution LCD display screen. The unit includes a built-in Jeppesen database and can receive XM satellite radio for flight information including NEXRAD radar, lightning, METARs, TAFs, and TFRs. The unit can also perform and store weight and balance calculations. A built-in AOPA Airport Directory and Safe Taxi Airport Diagrams are included for selected fields. 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 250 feet and ends when groundspeed drops below 30 knots for 10 minutes or more. 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. Position is updated within the track log 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*² memory. The unit contains hardware and software permitting the download of recorded waypoint, route, and track log information to a PC via a built-in USB

¹ A third "Resolution setting" is available which records a new track point only when the direction and speed have changed significantly. In this mode the unit examines current 2-D position, velocity, and ground track once per-second, and calculates a projected position. If the unit's actual position 1-second later differs from the projected position by a set value (25 meters or 82 feet by default), or if the ground track changes by more than 5°, a new track point is recorded. This saves memory during non-maneuvering flight.

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

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 Garmin GPSMAP 495 was in good condition and data was downloaded successfully. Figures 1 and 2 show the device as received.

The Garmin GPASMAP 696 had sustained impact damage during the accident and would not power on (Figure 3 and 4). It was disassembled for further examination.

The GPSMAP 696 stores recorded data on an eMMC³ (SAMSUNG KMAKG000M-B998), FLASH⁴ memory device mounted to the main printed circuit board (PCB) (see Figure 5 in red circle). It was removed from the PCB using a hot air re-work station. A *Sireda eMMC Reader*⁵ was used to readout of the device. No track data was recorded.

³ eMMC (embedded Multi-Media Controller) refers to a package consisting of both flash memory and a flash memory controller integrated on the same silicon die.

⁴ FLASH memory is a form re-writable, non-volatile memory that can retain data without external power.

⁵ This eMMC USB data recovery extractor recovers data and images using an external USB adapter to connect eMMC Chip Flash Memory to PCs and Notebooks.

Figure 1. Undamaged exterior of Garmin GPSMAP 495 (front side)



Figure 2. Undamaged exterior of Garmin GPSMAP 495 (back side)



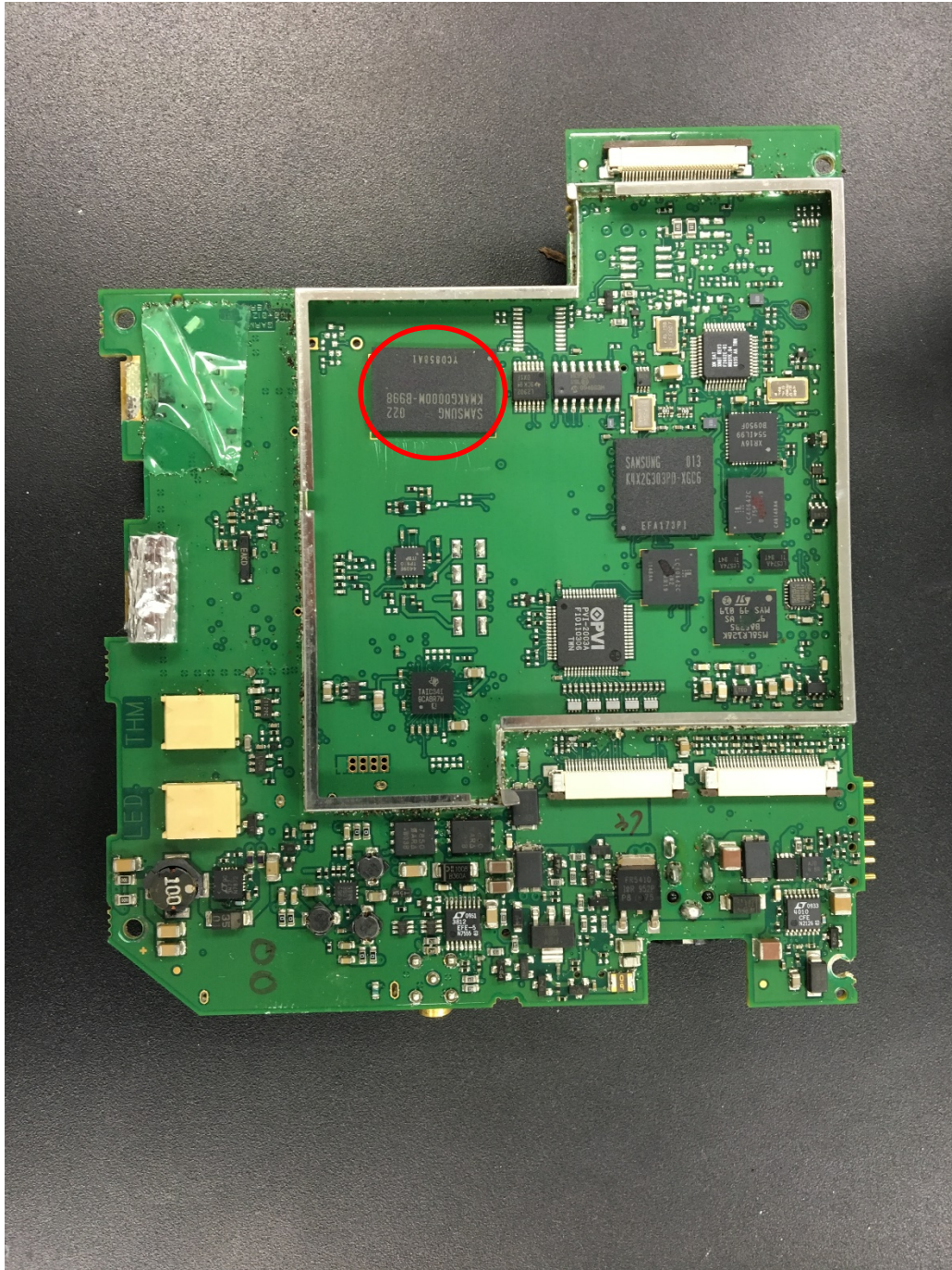
Figure 3. Damaged exterior of Garmin GPSMAP 696 (front side)



Figure 4. Damaged exterior of Garmin GPSMAP 696 (back side)



Figure 5. Garmin GPSMAP 696 main PCB



3.3. Data Description

Several track logs were downloaded from the Garmin GPSMAP 495, from May 3, 2014, to 22 January 2018. The accident data was identified based on the date and location of the accident.

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 6 and 7 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.

Figure 6 displays the entire track of the accident flight from the departing airport, Page Field (FMY), Fort Myers, Florida, to the final resting location of the main wreckage near Bonita Springs, Florida. Figure 7 shows the close-up view of the final location of the accident with time, altitude and speed of the accident flight.

Tabular data used to generate figures 6 and 7 are included as Attachment 1. This attachment is provided in electronic comma-delimited (.CSV) format

Figure 6. Entire flight of the accident airplane

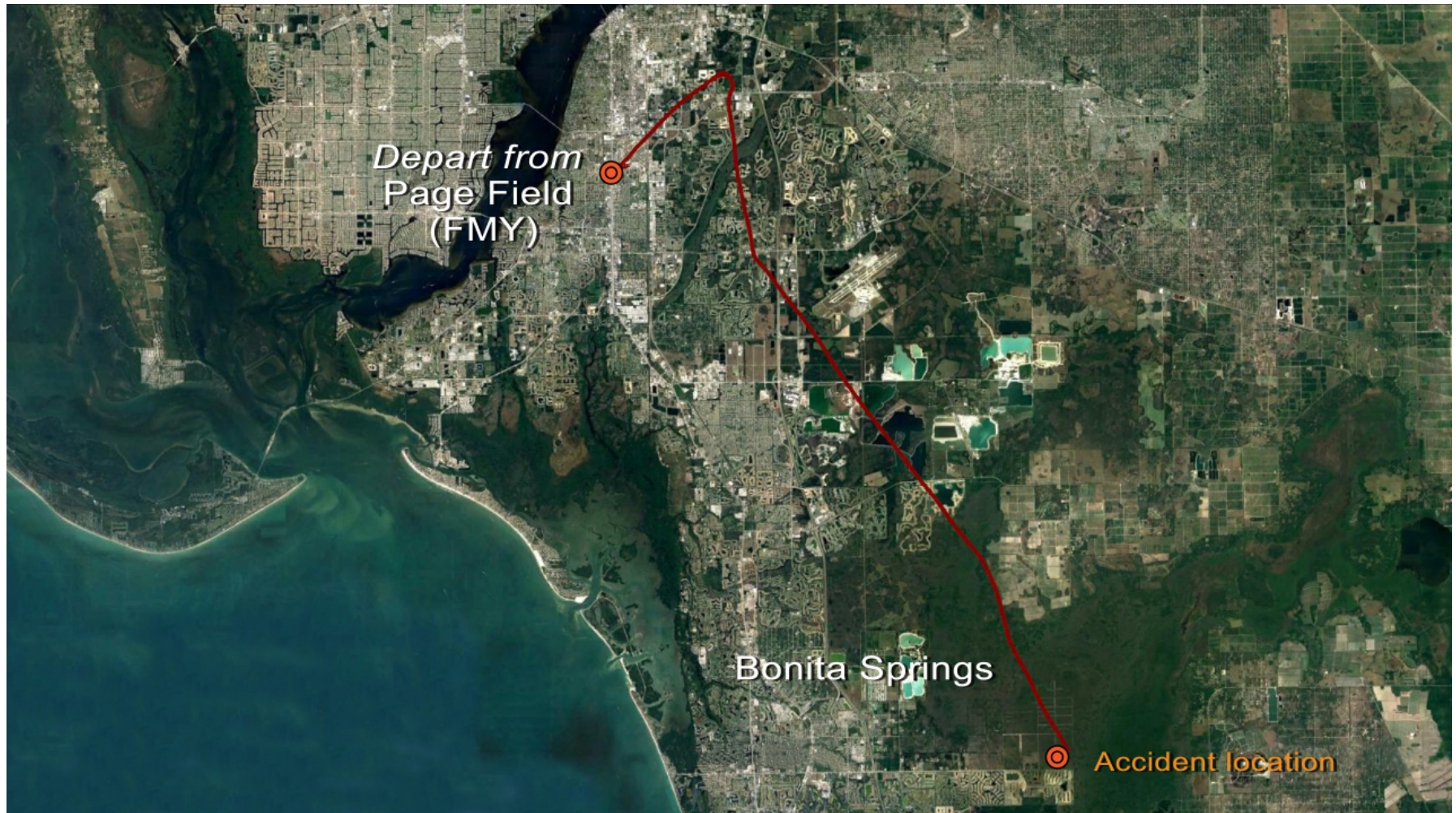


Figure 7. Close view of the end portion of the accident airplane

