

National Transportation Safety Board

Office of Research and Engineering

Washington, DC 20594



ANC23FA074

GLOBAL POSITIONING SYSTEM DEVICE

Specialist's Factual Report

April 18, 2024

A. ACCIDENT

Location: St. Mary's, Alaska
Date: September 12, 2023
Time: 2047 Alaska daylight time (AKDT)
Airplane: Piper PA-18-150, Neitz Aviation Inc., N109T

B. GLOBAL POSITIONING SYSTEM DEVICE SPECIALIST

Specialist: Steven Smith
Mechanical Engineer (Recorder Specialist)
National Transportation Safety Board (NTSB)

C. DETAILS OF THE INVESTIGATION

A group was not convened. The NTSB Vehicle Recorder Division received the following Global Positioning System (GPS) device:

Recorder Manufacturer/Model: Garmin GPSMAP 696
Recorder Part Number: 10R-024616
Recorder Serial Number: 1H7001539

1.0 Garmin GPSMAP 696 Device Description

The Garmin GPSMAP 696 is a portable GPS receiver capable of storing date, route-of-flight, and flight-time information for up to 50 flights. A detailed tracklog, including latitude, longitude, altitude, date, time, and groundspeed information, is stored within the unit whenever the receiver has a lock on the GPS navigation signal. All recorded data is stored in non-volatile memory.¹ 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. 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.

1.1 Garmin GPSMAP 696 - Condition and Data Recovery

Upon arrival at the Vehicle Recorder Laboratory, an exterior examination revealed the unit had sustained impact damage, as shown in figure 1. The device was able to power on, and the data were downloaded normally using the manufacturer's procedure.

¹ Non-volatile memory is semiconductor memory that doesn't require power for data retention.



Figure 1. Garmin GPSMAP 696 as received by the Vehicle Recorder's Lab.

1.2 Garmin GPSMAP 696 - Recording Description

The data extracted included 52 track logs. The recorded date for all sessions was 1024 weeks (7168 days) offset from the actual recorded dates, a phenomenon known as GPS week number rollover. Software not coded to anticipate the rollover may be set back 20 or 40 years. The recorded dates ranged from February 12, 2000, through January 28, 2004. The last recorded session corresponded to the accident event and was 7168 days offset from the event date. In addition to the accident flight, three previous flights were determined to be of interest and are included in this report.

1.3 Garmin GPSMAP 696 - Time Correlation

Correlation of the Garmin GPSMAP 696 data from Coordinated Universal Time (UTC) to the event local time, AKDT, was established by applying an additional 8 hour offset to change UTC to AKDT. Therefore, for the rest of this report, all times are referenced as AKDT.

1.4 Garmin GPSMAP 696 - Parameters Provided

Table 1 describes data parameters provided by the GPSMAP 696 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 (unit)	Parameter Description (unit)
Date	Date for recorded data point (MM/DD/YYYY)
Time (UTC)	Time (UTC) for recorded data point (HH:MM:SS)
Latitude (deg)	Recorded Latitude (degrees)
Longitude (deg)	Recorded Longitude (degrees)
GPS Alt (ft)	Recorded GPS Altitude (feet)
Groundspeed (kts)	Average derived groundspeed (knots)
Track (deg)	Average derived true course (degrees)

D. OVERLAYS AND TABULAR DATA

Data obtained from the Garmin GPSMAP 696 was used to produce the following overlays and tabular data. Figures 2 and 3 are graphical overlays generated using Google Earth for the departing and arrival flights that day to and from Holy Cross and St. Mary's, respectively. The weather and lighting conditions in Google Earth are not necessarily the weather and lighting conditions present at the time of the recording.

The day of the accident flight, there were 4 total flights conducted:

- Flight 1 was from Holy Cross to St. Mary's, and the Garmin GPSMAP 696 device recorded from 15:08:44 AKDT to 16:11:49 AKDT. The arrival of this flight is displayed in figure 2 as the magenta line.
- Flight 2 was from St. Mary's to Holy Cross, and the Garmin GPSMAP 696 device recorded from 16:58:02 AKDT to 17:57:46 AKDT. The departure of this flight is displayed in figure 3 as the blue line.

- Flight 3 was from Holy Cross to St. Mary's, and the Garmin GPSMAP 696 device recorded from 18:48:25 AKDT to 19:45:31 AKDT. The arrival of this flight is displayed in figure 2 as the green line.
- Flight 4 was the accident flight departing St. Mary's, and the Garmin GPSMAP 696 device recorded from 20:43:08 AKDT to 20:45:36 AKDT. The departure of this flight is displayed in figure 3 as the yellow line.

The corresponding tabular data used to create flight 4 (accident flight) are provided in electronic comma-separated value (CSV) format as attachment 1 to this report.

The corresponding tabular data used to create flight 3 are provided in electronic CSV format as attachment 2 to this report.

The corresponding tabular data used to create flight 2 are provided in electronic CSV format as attachment 3 to this report.

The corresponding tabular data used to create flight 1 are provided in electronic CSV format as attachment 4 to this report.

Submitted by:

Steven Smith
Mechanical Engineer (Recorder Specialist)



Figure 2. Google Earth overlay of the arrival flights (1 and 3) into St. Mary's.



Figure 3. Google Earth overlay of the departure flights (2 and 4) from St. Mary's.