

National Transportation Safety Board

Office of Research and Engineering

Washington, DC 20594



WPR23FA153

ELECTRONIC DEVICES

Specialist's Factual Report

January 22, 2024

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A. ACCIDENT

Location: Cal-Nev-Ari, Nevada
Date: April 11, 2023
Time: 0419 pacific daylight time (PDT)
1119 coordinated universal time (UTC)
Airplane: Glasair GlaStar, N8488

B. ELECTRONIC DEVICES SPECIALIST

Specialist: Gerald Kawamoto
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 electronic devices:

Recorder Manufacturer/Model: Garmin aera 500
Recorder Serial Number: 1QN002351

Recorder Manufacturer/Model: Garmin GPSMAP 296
Recorder Serial Number: 67002605

Recorder Manufacturer/Model: Dynon EFIS-D10A
Recorder Serial Number: 003378

Recorder Manufacturer/Model: Samsung Galaxy S22 Ultra
Part Number: SM-S908U
IMEI: 359433587367228

Recorder Manufacturer/Model: Samsung Galaxy S22
Part Number: SM-S901U
IMEI: Unknown

Recorder Manufacturer/Model: Unknown Tablet
Part Number: N/A

1.0 Garmin aera 500 Description

The Garmin aera 500 is a portable GPS navigation device with a 4.3-inch touchscreen and color moving map display. The aera is capable of storing track logs

in non-volatile memory (NVM) that contain GPS position information.¹ This data is stored internally in an industry-standard format and may be exported using the mini-USB port on the device. 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. Track log storage may be activated or de-activated at user discretion.

1.1 Garmin aera 500 Data Recovery

The device sustained impact damage, as shown in figure 1, rendering it inoperable. The internal motherboard was removed and installed in a functioning lab surrogate. The surrogate unit powered on normally, and upon review of the device's contents, the accident track log was not recorded, thus no accident-related data were recovered from this device.



Figure 1. Garmin aera 500 as received.

2.0 Garmin GPSMAP 296 Description

The Garmin GPSMAP 296 is a portable GPS receiver capable of storing date, route-of-flight, and flight-time information. A detailed tracklog including latitude, longitude, 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. 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 Non-volatile memory is semiconductor memory that does not require external power for data retention.

2.1 Garmin GPSMAP 296 Data Recovery

The device sustained impact damage, as shown in figure 2, rendering it inoperable. The internal motherboard was removed and installed in a functioning lab surrogate. The surrogate unit powered on normally and data were extracted using laboratory tools.



Figure 2. Garmin GPSMAP 296 as received.

2.2 Garmin GPSMAP 296 Data Description

The data extracted included 41 sessions. 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 August 7, 2002, through August 26, 2003. The last recorded session corresponded to the accident event and was 7168 days offset from the event date.

Table 1 describes data parameters provided by the device. Date, Time, Latitude, Longitude, and GPS Altitude are recorded by the device. Groundspeed and Track are derived from the recorded parameters.

Table 1. Garmin GPSMAP 296 Parameters.

Parameter Name (unit)	Parameter Description (unit)
Date	Date for recorded data point (mm/dd/yyyy)
Time	Time (UTC) for recorded data point (hh:mm:ss)
Latitude (deg)	Recorded Latitude (degrees)
Longitude (deg)	Recorded Longitude (degrees)
Altitude (ft)	Recorded GPS Altitude (feet)
Groundspeed (kts)	Average derived groundspeed (knots)
Track (deg)	Average derived true course (degrees)

3.0 Dynon EFIS-D10A Description

The Dynon EFIS-D10A is a 4-inch cockpit display mounted in non-type certificated (experimental) aircraft. The instrument integrates multiple flight instruments including airspeed, altitude, gyro-stabilized magnetic compass, turn rate, slip/skid ball, bank angle, pitch angle and vertical speed. Other functions include a clock/timer, g-meter, voltmeter, and a density altitude/true airspeed calculator. The unit contains an Air Data, Attitude and Heading Reference System (ADAHRS) to provide air data, attitude and heading information to the display. Depending on the installation in the operator's aircraft certain parameters might not be displayed, for example angle-of-attack.

The data logging must be configured by the operator to enable logging and set the data log interval. Data are stored in NVM when the device has software version 5.0 and later, otherwise, no data are stored. The unit can also be configured to start logging data automatically at boot-up. The data logging interval can be set to store at 1, 3, 5, 10, 30 and 60 second intervals. The internal memory can store at least 2 hours of cumulative data at a 1 second recording interval or at least 120 hours at a 60 second data recording interval. When the recording limit in the internal memory is reached, the oldest record is erased, and a new record is added.

3.1 Dynon EFIS-D10A Recovery

The Dynon EFIS-D10A sustained impact damage, as shown in figure 3, rendering it inoperable. The internal non-volatile memory chip was removed and readout using laboratory tools.

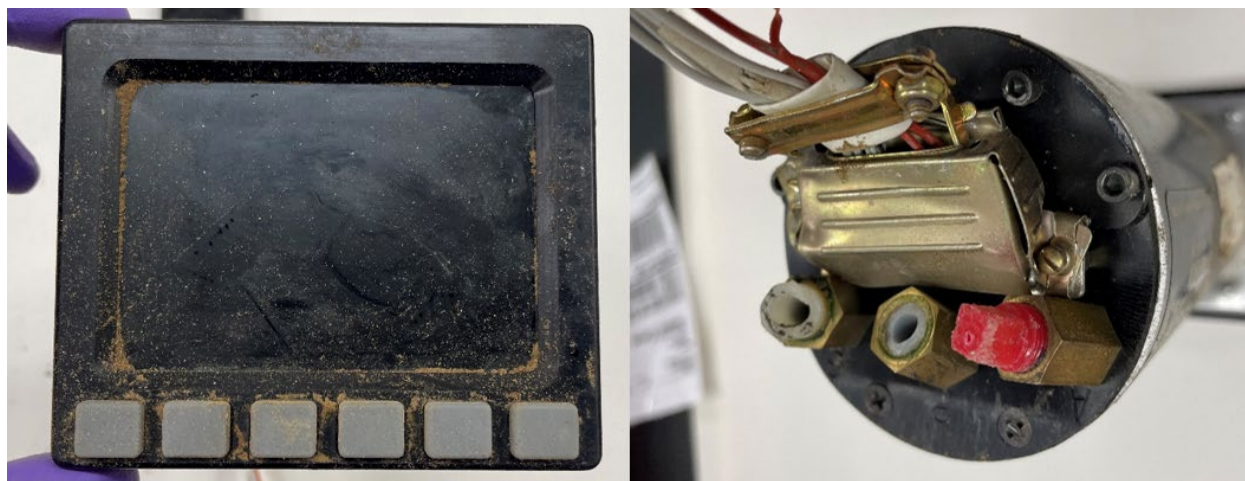


Figure 3. Front and back of the Dynon EFIS-D10A as received.

3.2 Dynon EFIS-D10A Data Description

The binary image of the chip was examined using laboratory tools, and no historical flight data were identified, thus no accident-related data were recovered.

4.0 Personal Electronic Devices (PEDs) Description

PEDs are a category of devices comprised primarily of portable computing devices and mobile phones. Portable computing devices are typically capable of internet access, email, messaging services, and can run user-installed applications to perform specific tasks. Depending on the model, mobile phones can perform many of the same tasks as portable computing devices, plus have voice call and text messaging capabilities. PED user and system data is typically stored on non-volatile memory and can be accessed through manufacturer-provided interfaces.

4.1 Personal Electronic Devices (PEDs) Data Recovery

The condition of the devices upon arrival at the Vehicle Recorder Laboratory is shown in figures 4 through 6. All devices sustained impact damage rendering them inoperable. The Samsung Galaxy S22 and tablet sustained significant damage to their internal components, thus no data were recovered.

The Samsung Galaxy S22 Ultra powered on using surrogate parts and data were extracted using forensic laboratory tools. No accident-related data were present upon review of the device's contents.

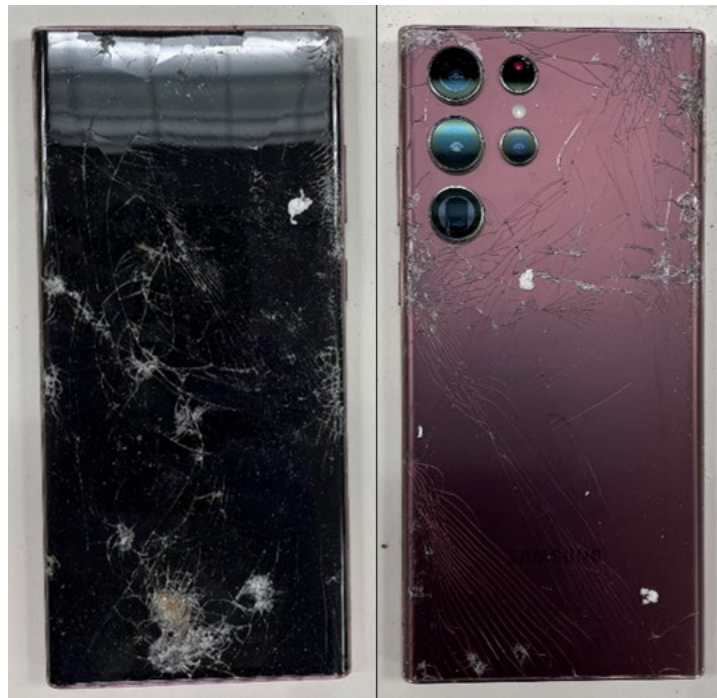


Figure 4. Samsung Galaxy S22 Ultra as received.



Figure 5. Samsung Galaxy S22 as received.



Figure 6. Unknown tablet as received.

D. FIGURES AND TABULAR DATA

Figure 7 is a Google Earth overlay of the accident flight recorded on Garmin GPSMAP 296. The weather and lighting conditions in Google Earth are not necessarily the weather and lighting conditions present at the time of the accident flight.

Figure 8 is a plot of parameters of the entire accident flight recorded on the GPSMAP 296. The time displayed is 11:01:00 to 11:20:00 UTC.

The corresponding tabular data used to create figures 7 and 8 are provided in CSV format as attachment 1 to this report.

Submitted by:

Gerald Kawamoto
Recorder Specialist



Figure 7. Google Earth overlay of the accident session recorded on the Garmin GPSMAP 296 and the reported wreckage location.

Location, Date: Cal-Nev-Ari, NV, 04/11/23

NTSB No. WPR23FA153

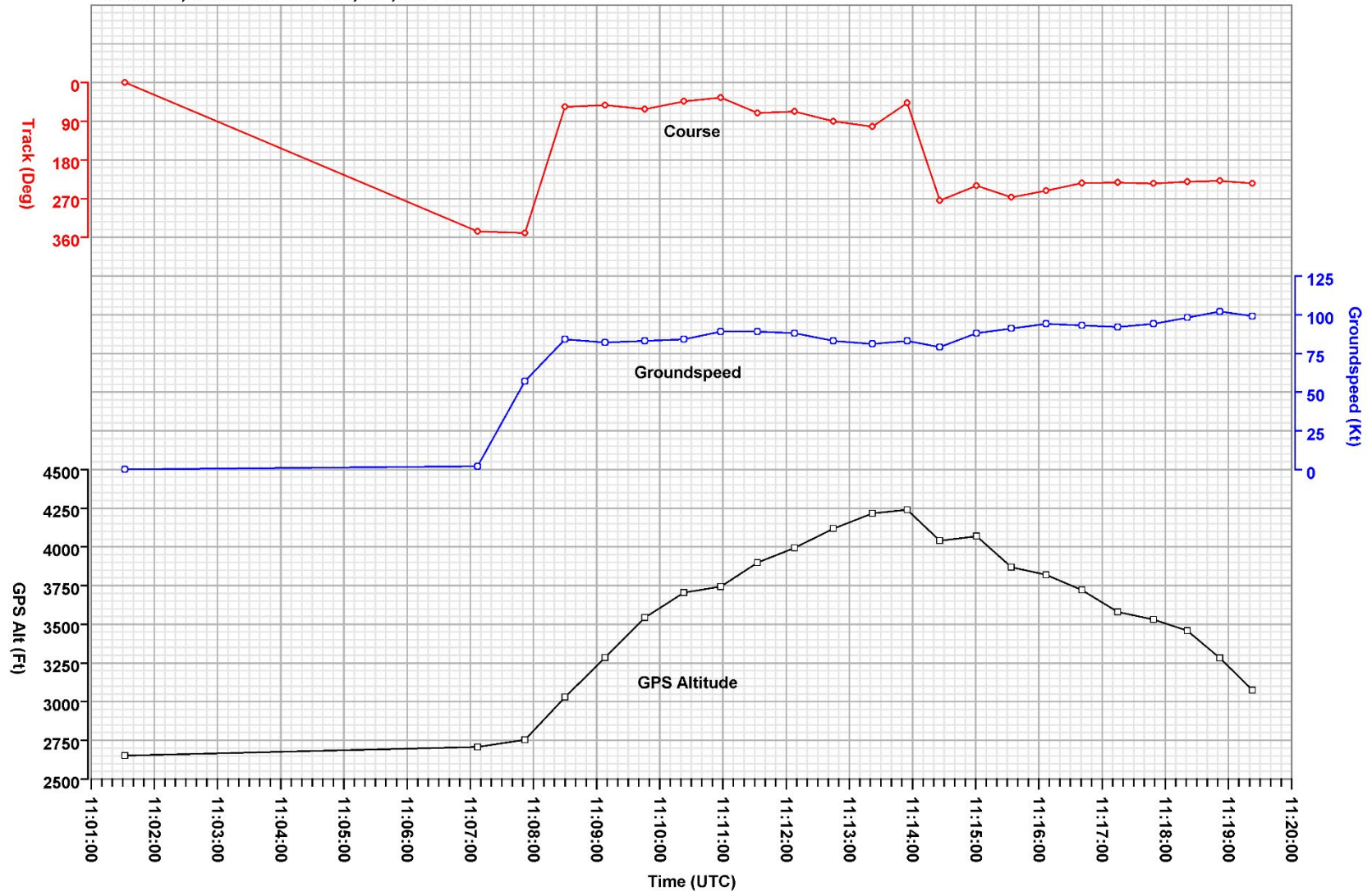


Figure 8. Plot of Garmin GPSMAP 296 parameters for the accident session.