

NATIONAL TRANSPORTATION SAFETY BOARD

Vehicle Recorder Division
Washington, D.C. 20594

August 8, 2022

Global Positioning System Device

Specialist's Factual Report

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1. EVENT SUMMARY

Location: Branchville, NJ
Date: November 11, 2021
Aircraft: Cessna 172S
Registration: N90559
Operator: Private
NTSB Number: ERA22FA058

2. GROUP

A group was not convened.

3. DETAILS OF INVESTIGATION

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

Device Manufacturer/Model:	Garmin G1000 SD cards (4GB, 16GB, 16GB)
Serial Number:	N/A

3.1. Device Description

The Garmin G1000 is a collection of multiple avionics units which include flight displays, air data computers, attitude/heading reference system (AHRS), communications and other systems. A typical installation includes a primary flight display (PFD) and a multi-function display (MFD). Each display includes two SD card slots, an upper and a lower slot. The lower SD card slot is used by the system for software updates and various databases.

Depending on the display unit software, the aircraft can include a data logging feature. The data logging feature must be enabled by the aircraft operator and an SD card has to be installed in the upper slot of the MFD to record data. Depending on the airframe and engine combination, as many as 64 parameters can be stored at a rate of one sample per second (1Hz). According to the manufacturer of the display unit, one flight hour can be stored in approximately 2 MB.

3.2. Data Recovery

Figure 1 shows the 3 SD cards as received by the Vehicle Recorder Laboratory. The cards exhibited minor external damage. Each card was read normally using laboratory tools.

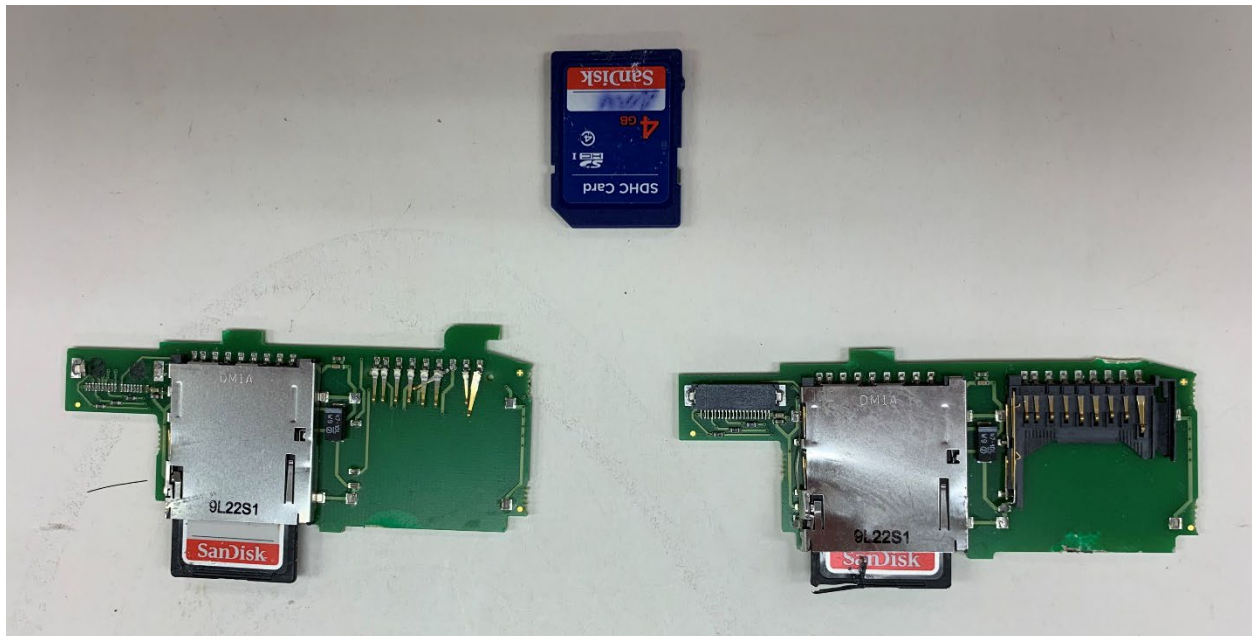


Figure 1. Garmin G1000 SD cards as received.

3.3. Data Description

The 4GB SD card contained historical flight data. The other two 16 GB SD cards contained database and overhead files. Data on the 4GB card included sessions from January 18, 2021, through November 11, 2021.¹ The last session recorded was the event flight which started at 10:20:38 EST and ended at 10:48:03 EST on November 11, 2021. Due to data buffering in the device, the end of the session may not have been recorded. The last recorded data point of gyroscopic parameters, such as pitch and roll, was 26 seconds before the last data point of other parameters. Gyroscopic data parameters provided data until 10:47:37 EST.

¹ All dates and times are referenced to local time at the time of recording. Eastern Standard Time (EST) was the local time for the event flight.

3.4. Parameters Provided

Table 1 describes the 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. Parameters Provided.

Parameter Name (units)	Parameter Description (units)
Date	Date for recorded data point (MM/DD/YYYY)
Time	Time (EST) for recorded data point (HH:MM:SS)
Latitude (deg)	Recorded Latitude (degrees)
Longitude (deg)	Recorded Longitude (degrees)
AltGPS (ft)	Recorded GPS Altitude (feet)
AltB (ft)	Barometric Altitude (feet)
AltMSL (ft)	MSL Altitude (feet)
Groundspeed (kts)	Average derived groundspeed (knots)
IAS (kts)	Indicated Airspeed (knots)
TAS (kts)	True Airspeed (knots)
TRK (deg)	Average derived true course (degrees)
HDG (deg)	Heading (degrees)
Roll (deg)	Roll Angle (degrees)
Pitch (deg)	Pitch Angle (degrees)
VSpd (fpm)	Vertical Speed (feet per minute)
LatAc (G)	Lateral Acceleration (G)
NormAc ² (G)	Normal Acceleration (G)
CHT # (degF)	Cylinder Head Temperature # (degrees Fahrenheit)
EGT # (degF)	Exhaust Gas Temperature # (degrees Fahrenheit)
E1 RPM (rpm)	Engine Revolutions Per Minute
E1 FFlow (gph)	Fuel Flow (gallons per hour)
E1 OILP (psi)	Oil Pressure (pounds per square inch)
E1 OILT (degF)	Oil Temperature (degrees Fahrenheit)

3.5. OVERLAYS AND TABULAR DATA

Figures 2 and 3 are graphical overlays generated using Google Earth for the last session recorded. The weather and lighting conditions in Google Earth are not necessarily the weather and lighting conditions present at the time of the recording.

² Normal Accelleration on the G1000 has a base of 0.

Figure 2 shows the entire last session recorded.

Figure 3 shows the end of the last session and the reported wreckage location. Due to data buffering in the device, the end of the session may not have been recorded.

Figure 4 is a plot of basic parameters recorded for the entire last session. The time interval plotted is 10:20:00 to 10:50:00 EST.

Figure 5 is a plot of basic parameters recorded at the end of the last session. The time interval plotted is 10:45:30 to 10:48:15 EST.

Figure 6 is a plot of engine parameters recorded for the entire last session. The time interval plotted is 10:20:00 to 10:50:00 EST.

Figure 7 is a plot of engine parameters recorded at the end of the last session. The time interval plotted is 10:45:30 to 10:48:15 EST.

Tabular data used to generate Figures 2 through 7 are included as Attachment 1 in electronic comma-delimited (.CSV) format.



Figure 2. Google Earth overlay of the last session recorded on the Garmin G1000.

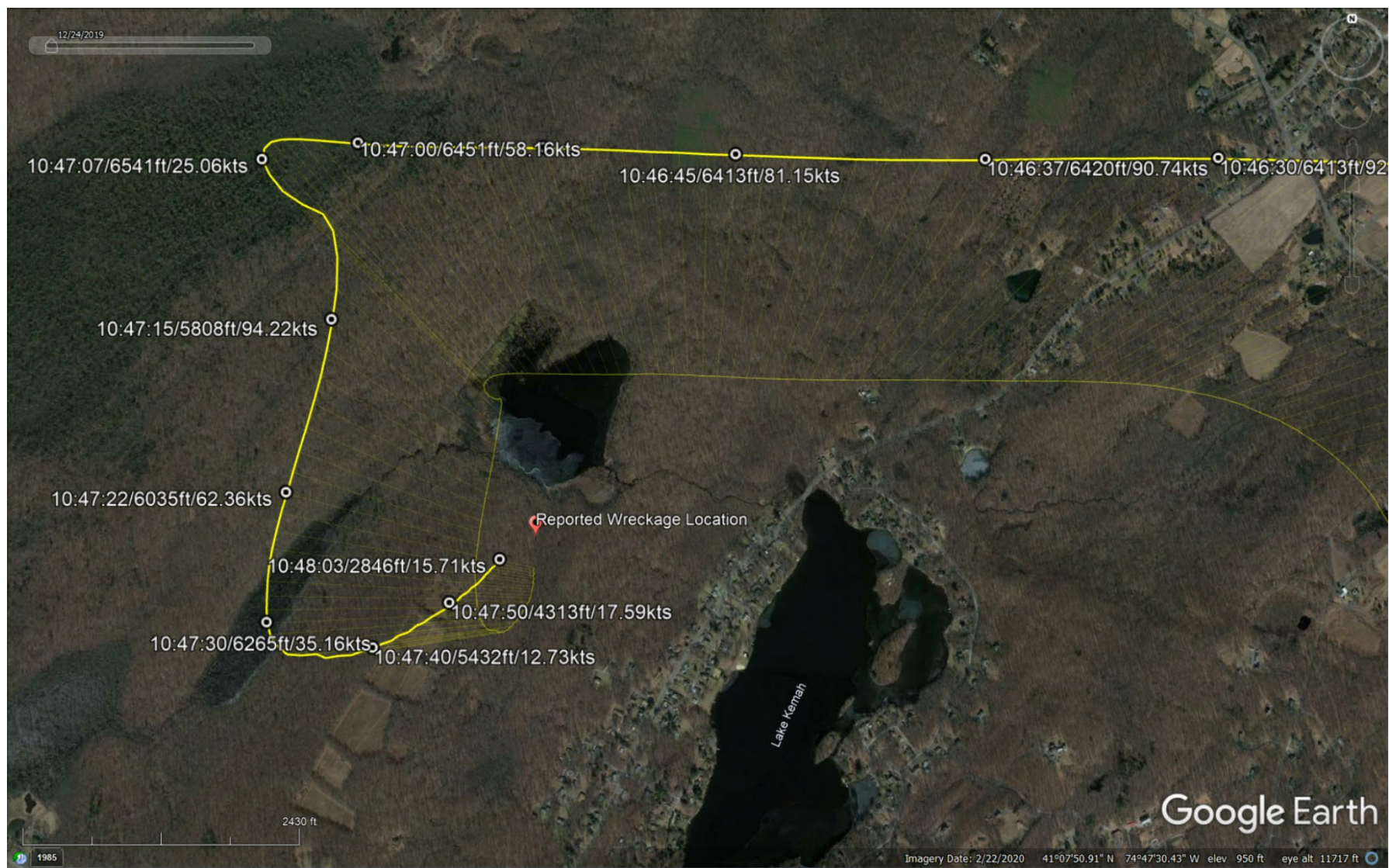


Figure 3. Google Earth overlay of the end of the last session recorded on the Garmin G1000 and the reported wreckage location.

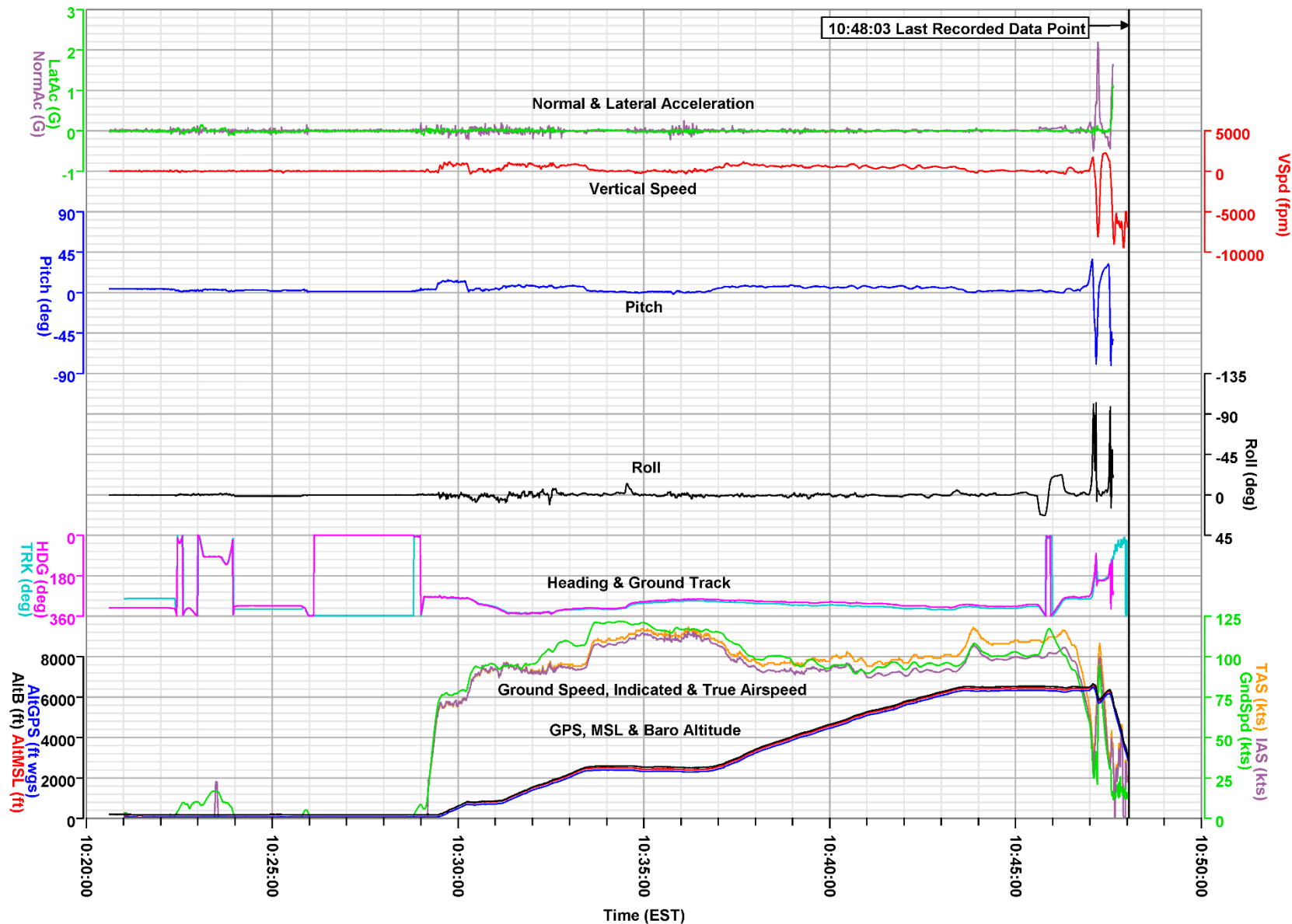


Figure 4. Plot of Garmin G1000 basic parameters for the entire last session.

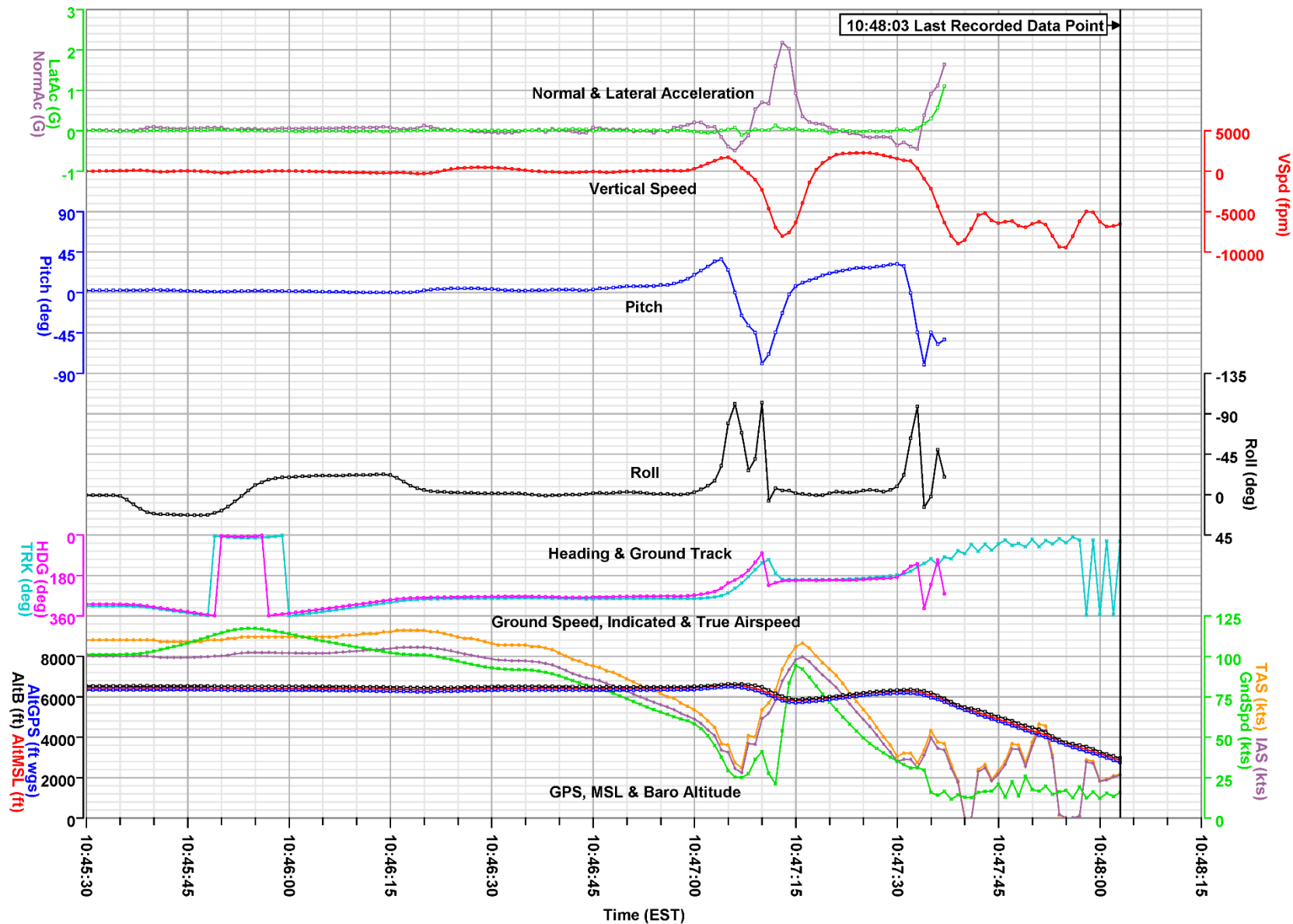


Figure 5. Plot of Garmin G1000 basic parameters at the end of the last session.

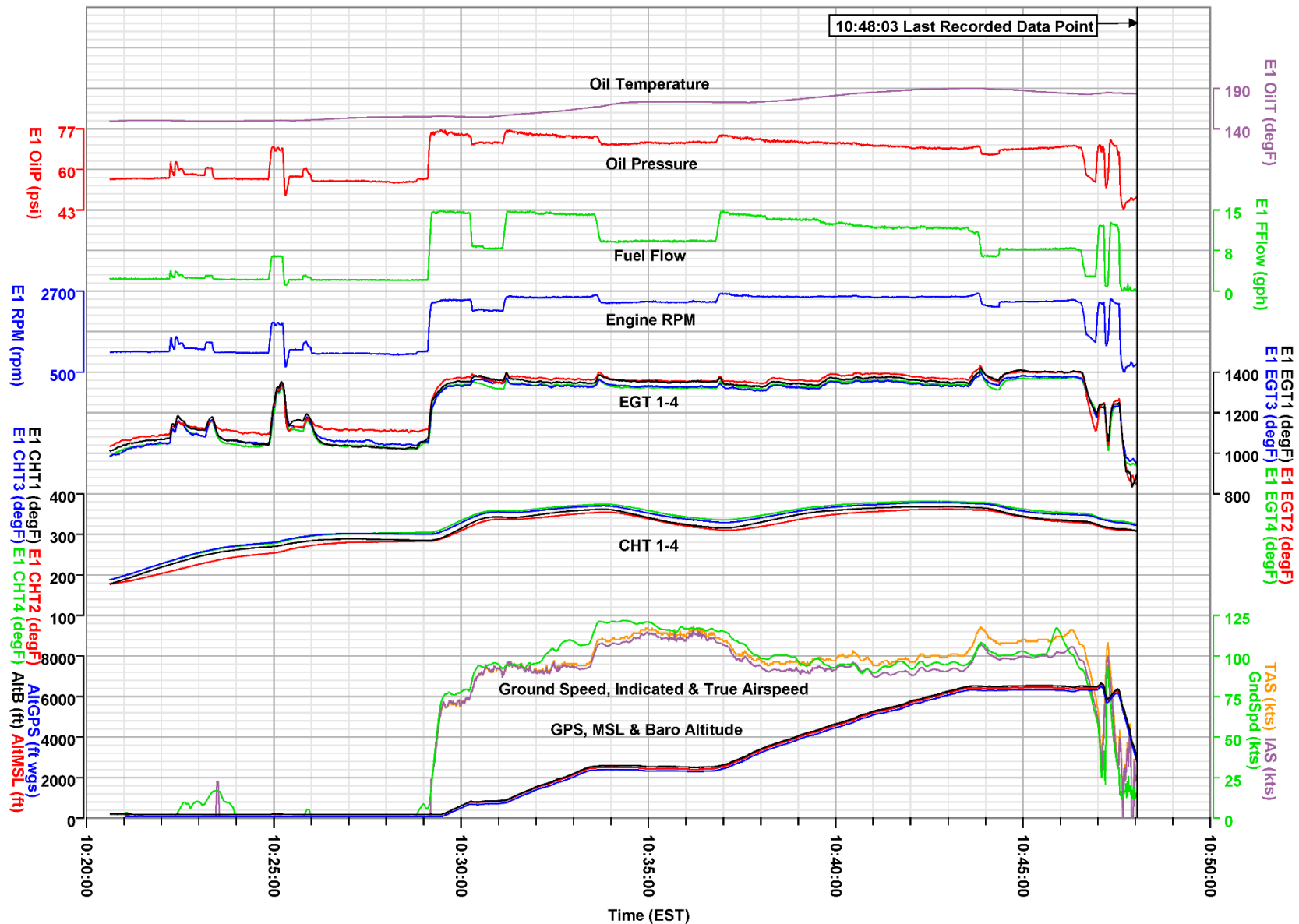


Figure 6. Plot of Garmin G1000 engine parameters for the entire last session.

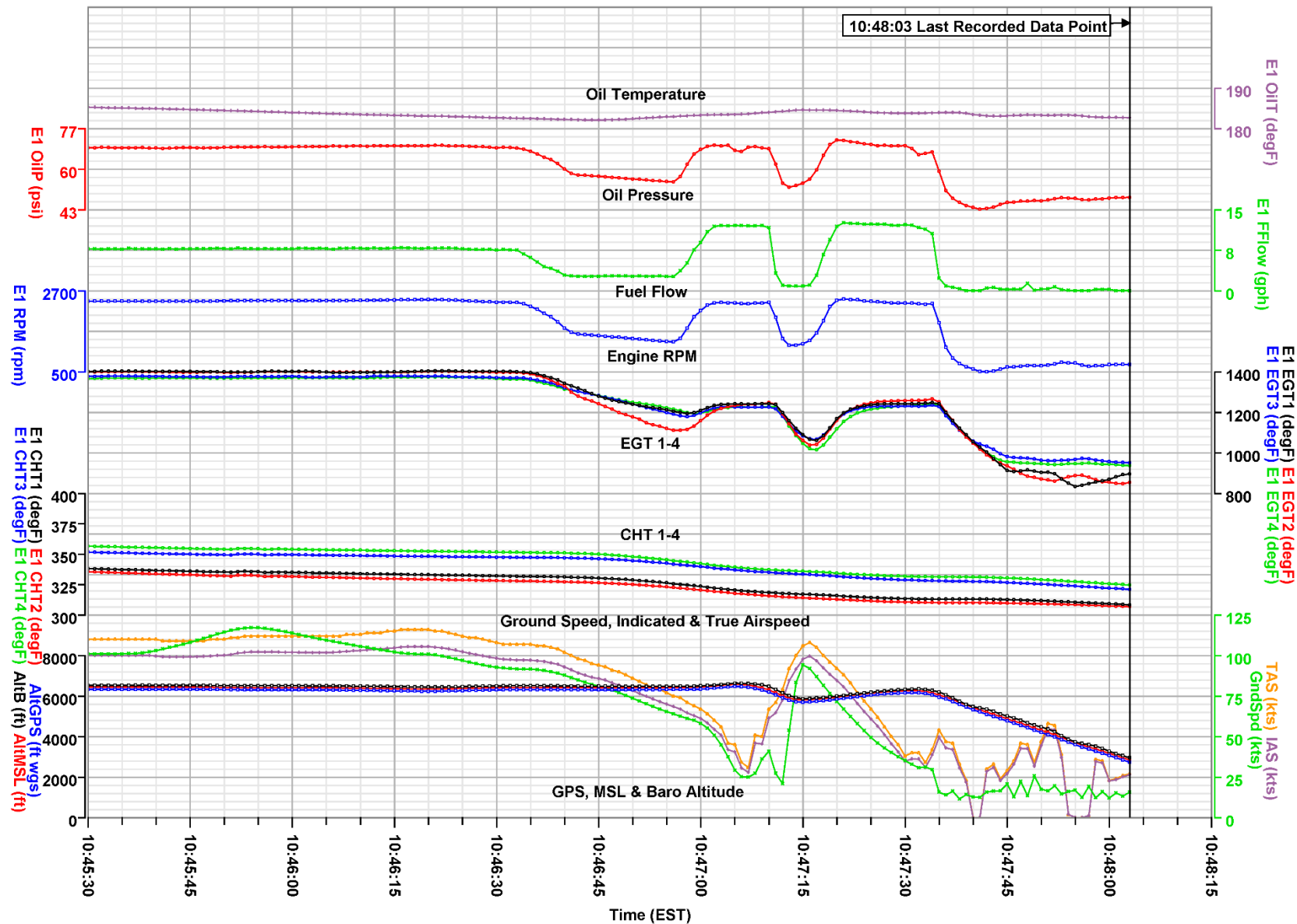


Figure 7. Plot of Garmin G1000 engine parameters at the end of the last session.