

National Transportation Safety Board

Office of Research and Engineering

Washington, DC 20594



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ELECTRONIC DEVICES

Specialist's Factual Report

December 2, 2024

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A. ACCIDENT

Location: Douglas, Wyoming
Date: June 22, 2024
Time: 0835 mountain daylight time (MDT)
1435 coordinated universal time (UTC)
Airplane: Piper PA-12 Replica, private operator, N406Z

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 devices:

Recorder Manufacturer/Model: Garmin GDU 460
Recorder Serial Number: 7Y9100663

Recorder Manufacturer/Model: Garmin aera 660
Recorder Serial Number: 4NN020173

Recorder Manufacturer/Model: EFII System
Recorder Serial Number: Unknown

1.0 Garmin GDU 460 Description

The Garmin GDU 460 is a 10.6-inch display employing a touch-screen user interface and can be utilized as a Primary Flight Display (PFD), Multi-Function Display (MFD), Engine Monitoring Device, or a combination of all, depending on how the unit is integrated with other compatible avionics products. Each unit is capable of recording data via an externally mounted SD card under the center of the screen, or internally on a series of non-volatile memory chips.¹

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

1.1 Garmin GDU 460 Data Recovery

The device was in good condition upon arrival at the Vehicle Recorder Laboratory, as shown in Figure 1, and its internal memory was exported to an SD card using the manufacturer's procedures.



Figure 1. Front and back of the Garmin GDU 460 as received.

1.2 Garmin GDU 460 Recording Description

Data extracted included sessions from June 21, 2024, through June 22, 2024. Data were recorded in UTC and converted to MDT, the local time of the accident. The difference between UTC and MDT is 6 hours. The accident session started at 6:26:25.8 MDT and ended 8:35:51.1 MDT on June 22, 2024.

1.3 Parameters Provided

Table 1 describes data parameters provided by the Garmin GDU 460 PFD.

Table 1. Garmin GDU 460 PFD Parameters.

Parameter Name (units)	Parameter Description (units)
Date	Date for recorded data point (MM/DD/YYYY)
Time	Time (MDT) for recorded data point (HH:MM:SS)
CHT # (degF)	Cylinder Head Temperature (degrees Fahrenheit)
EGT # (degF)	Exhaust Gas Temperature (degrees Fahrenheit)
Fuel Press (psi)	Fuel Pressure (pounds per square inch)
GPS Altitude (ft)	Recorded GPS Altitude (feet)
GPS Ground Speed (kts)	Average derived ground speed (knots)
GPS Ground Track (deg)	Average derived true course (degrees)
Indicated Airspeed (kts)	Indicated Airspeed (knots)
Manifold Press (inHg)	Manifold Pressure (inches of mercury)
Oil Press (psi)	Oil Pressure (pounds per square inch)
Oil Temp (degF)	Oil Temperature (degrees Fahrenheit)
Pitch (deg)	Pitch Angle (degrees)
Pressure Altitude (ft)	Pressure Altitude (feet)
Roll (deg)	Roll Angle (degrees)
RPM (rpm)	Engine Revolutions Per Minute
True Airspeed (kts)	True Airspeed (knots)
Vertical Speed (fpm)	Vertical Speed (feet per minute)
Volts (V)	Battery Voltage (volts)
X, Y, Z Acceleration (G)	Lateral, Longitudinal and Normal Acceleration (gravitational unit of acceleration)

2.0 Garmin aera 660 Description

The Garmin Aera 660 is a battery-powered portable multi-function display and GPS receiver with a sunlight-readable 5-inch diagonal touch screen operation display. 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. The unit has 23 different map ranges available, from 200 feet to 800 nautical miles.

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 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 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 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 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.

2.1 Garmin aera 660 Data Recovery

The device was in good condition, as shown in Figure 2, and data were exported normally using the manufacturer's procedures.



Figure 2. Front and back of the Garmin aera 660 as received.

2.2 Garmin aera 660 Recording Description

Data extracted included sessions from August 30, 2023, through June 22, 2024. Data were recorded in UTC and converted to MDT, the local time of the accident. The accident session started at 6:27:32 MDT and ended at 8:36:23 MDT on June 22, 2024.

2.3 Parameters Provided

Table 2 describes data parameters provided by the Garmin aera 660. Date, Time, Latitude, Longitude, and GPS Altitude are recorded by the device. Groundspeed and Track are derived from the recorded parameters.

Table 2. Garmin aera 660 Parameters.

Parameter Name (units)	Parameter Description (units)
Date	Date for recorded data point (MM/DD/YYYY)
Time	Time (MDT) for recorded data point (HH:MM:SS)
Latitude (deg)	Recorded Latitude (degrees)
Longitude (deg)	Recorded Longitude (degrees)
GPS Altitude (ft)	Recorded GPS Altitude (feet)
Groundspeed (kt)	Average derived groundspeed (knots)
Track (deg)	Average derived true course (degrees)

3.0 EFII System Description

The EFII (Electronic Fuel Injection and Ignition) system is an electronic engine management system. Data is recorded to an SD card when installed.

4.0 EFII System Data Recovery

An SD card was not installed in the device, therefore, no data were recovered.

D. OVERLAYS AND TABULAR DATA

Figure 3 and Figure 4 are graphical overlays generated using Google Earth for the accident session. Data from both Garmin devices were compared and corresponding timestamps and location data were mostly aligned. Data obtained from the Garmin aera 660 were used to produce the overlays. Figure 3 is an overview of the entire flight. Figure 4 shows the end of the 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 5 is a plot of Garmin GDU 460 basic parameters for the entire accident session. The time displayed is 6:25:00 MDT to 8:40:00 MDT.

Figure 6 is a plot of Garmin GDU 460 basic parameters for the end of the accident session. The time displayed is 8:33:00 MDT to 8:36:00 MDT.

Figure 7 is a plot of Garmin GDU 460 engine parameters for the entire accident session. The time displayed is 6:25:00 MDT to 8:40:00 MDT.

Figure 8 is a plot of Garmin GDU 460 engine parameters for the end of the accident session. The time displayed is 8:33:00 MDT to 8:36:00 MDT.

The corresponding tabular data used to create Figure 3 and Figure 4 are provided in electronic comma-separated value (CSV) format as attachment 1 to this

report. The corresponding tabular data used to create Figure 5 through Figure 8 are provided in electronic comma-separated value (CSV) format as attachment 2 to this report. Not all parameters recorded were validated by the recorder specialist.

Submitted by:

Gerald Kawamoto
Recorder Specialist

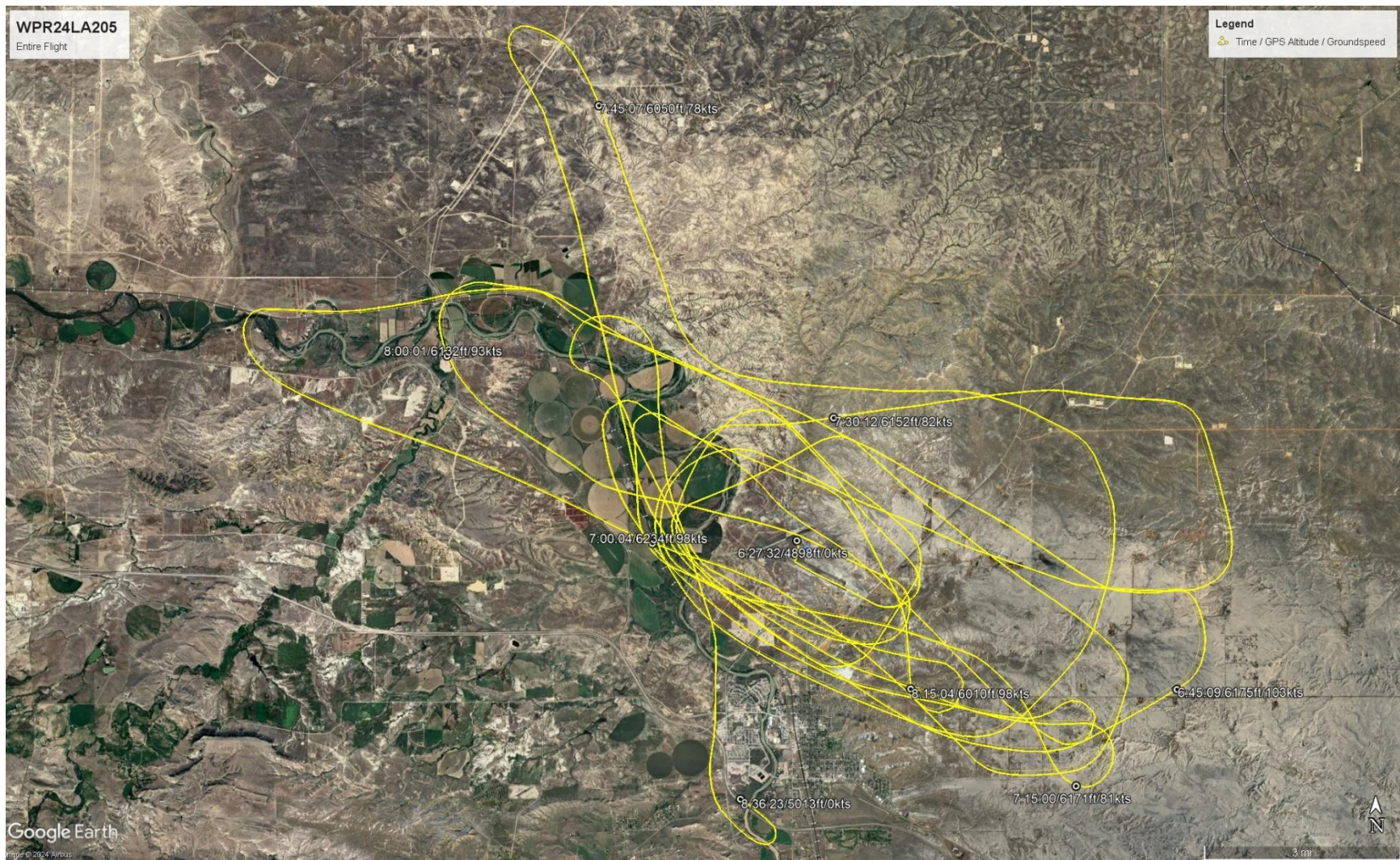


Figure 3. Google Earth overlay of the entire flight track recorded on the Garmin aera 660.

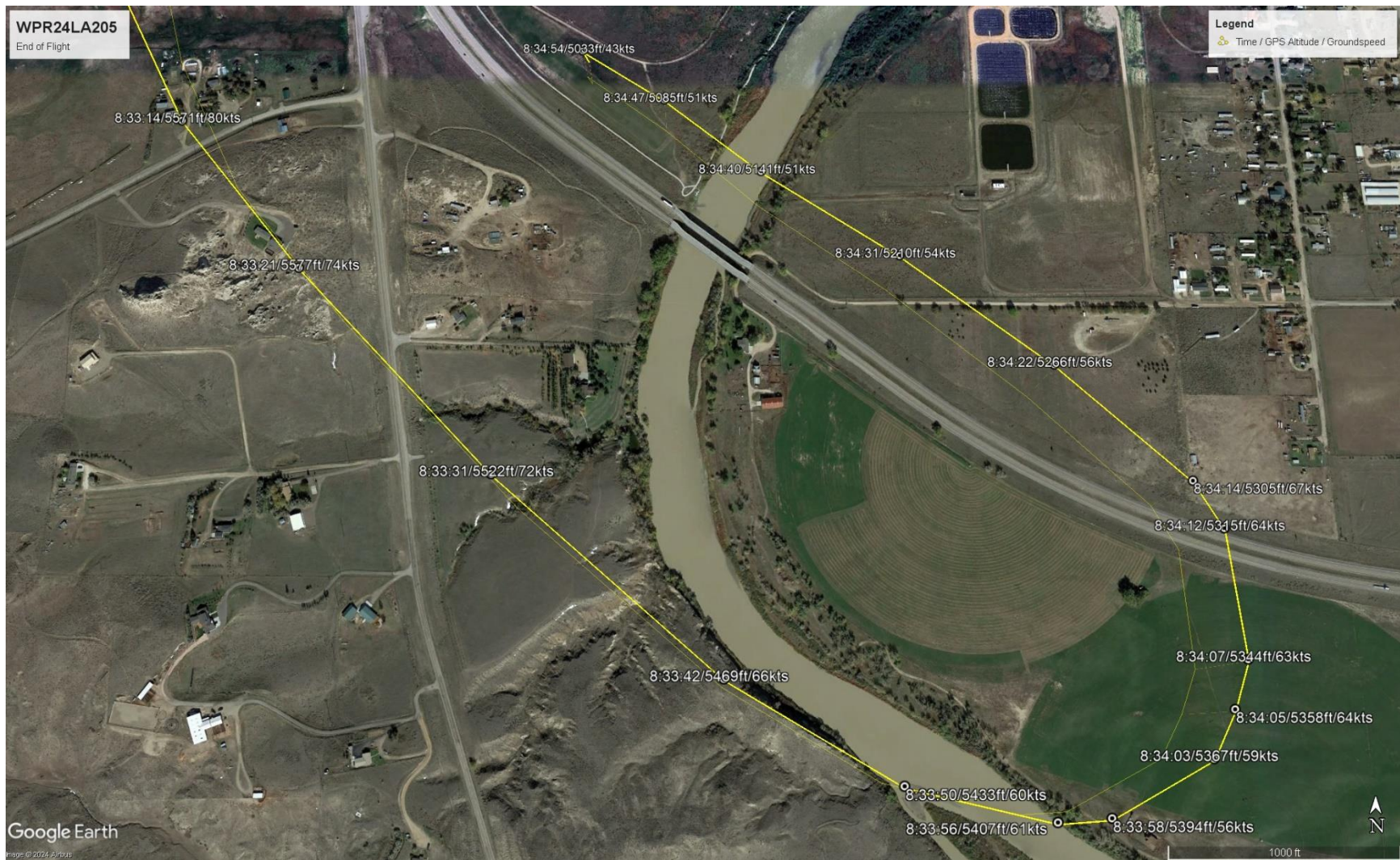


Figure 4. Google Earth overlay of the end of the flight track recorded on the Garmin aera 660.

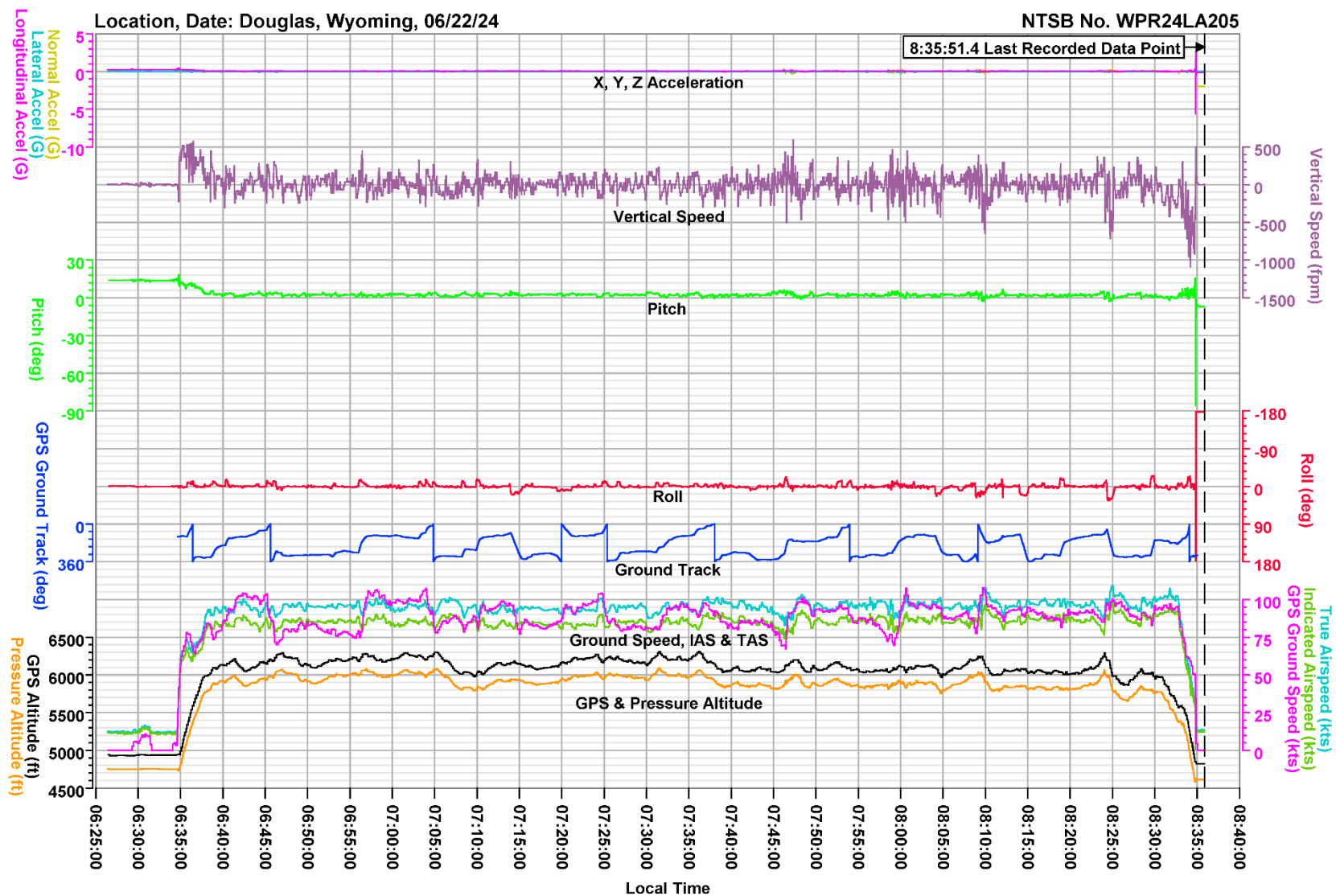


Figure 5. Plot of basic parameters recorded on the Garmin GDU 460 for the entire accident flight recording.

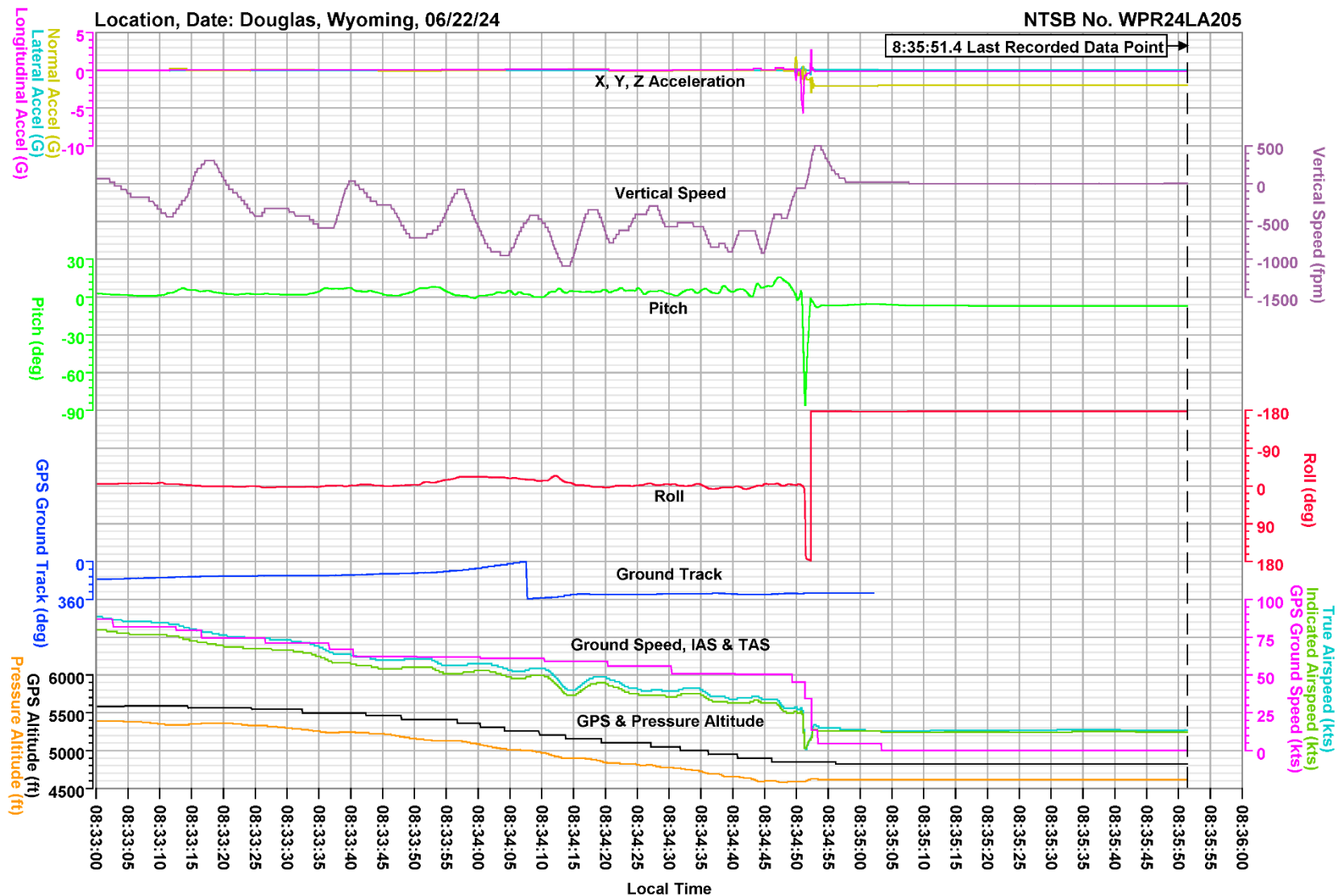


Figure 6. Plot of basic parameters recorded on the Garmin GDU 460 at the end of the accident flight recording.

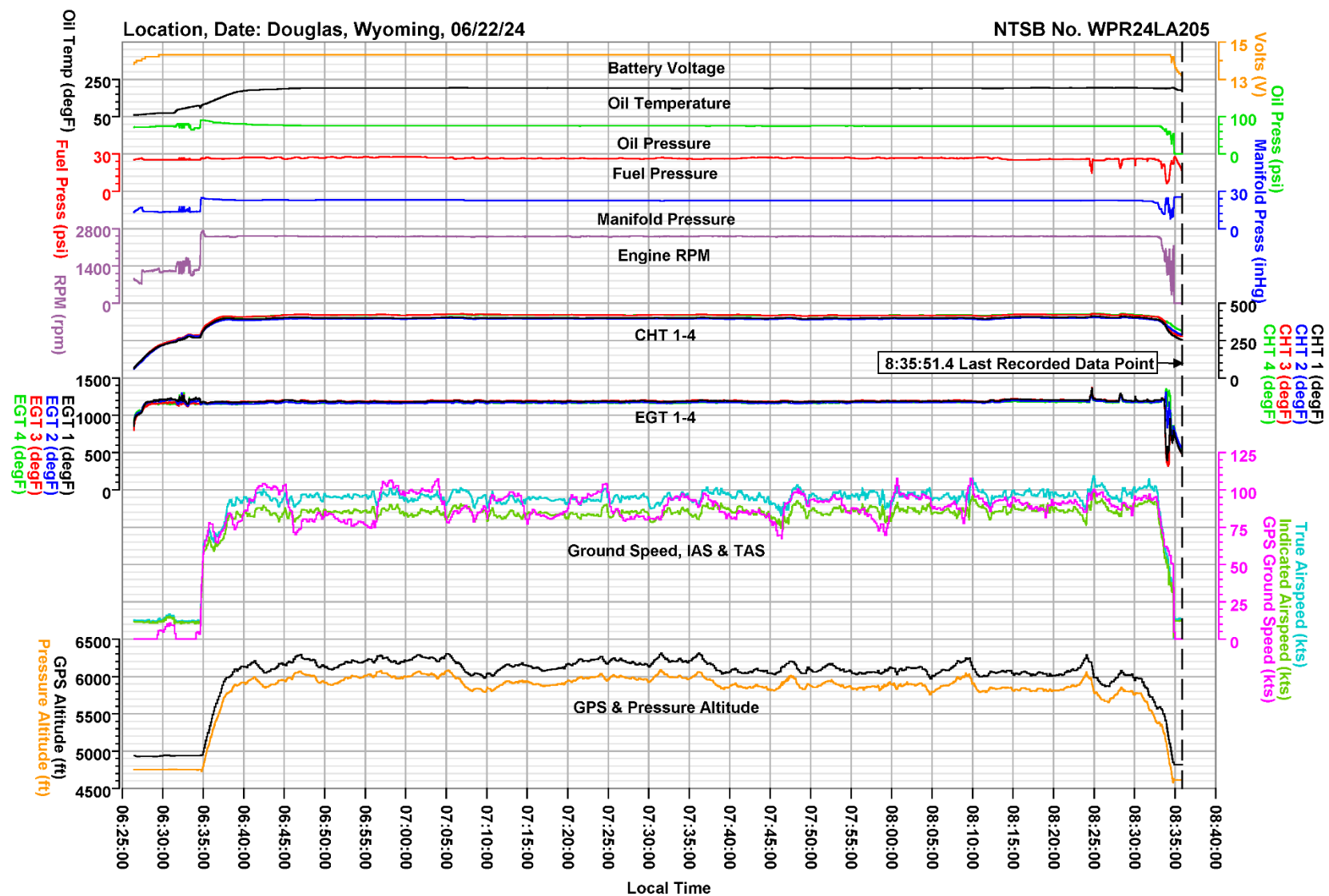


Figure 7. Plot of engine parameters recorded on the Garmin GDU 460 for the entire accident flight recording.

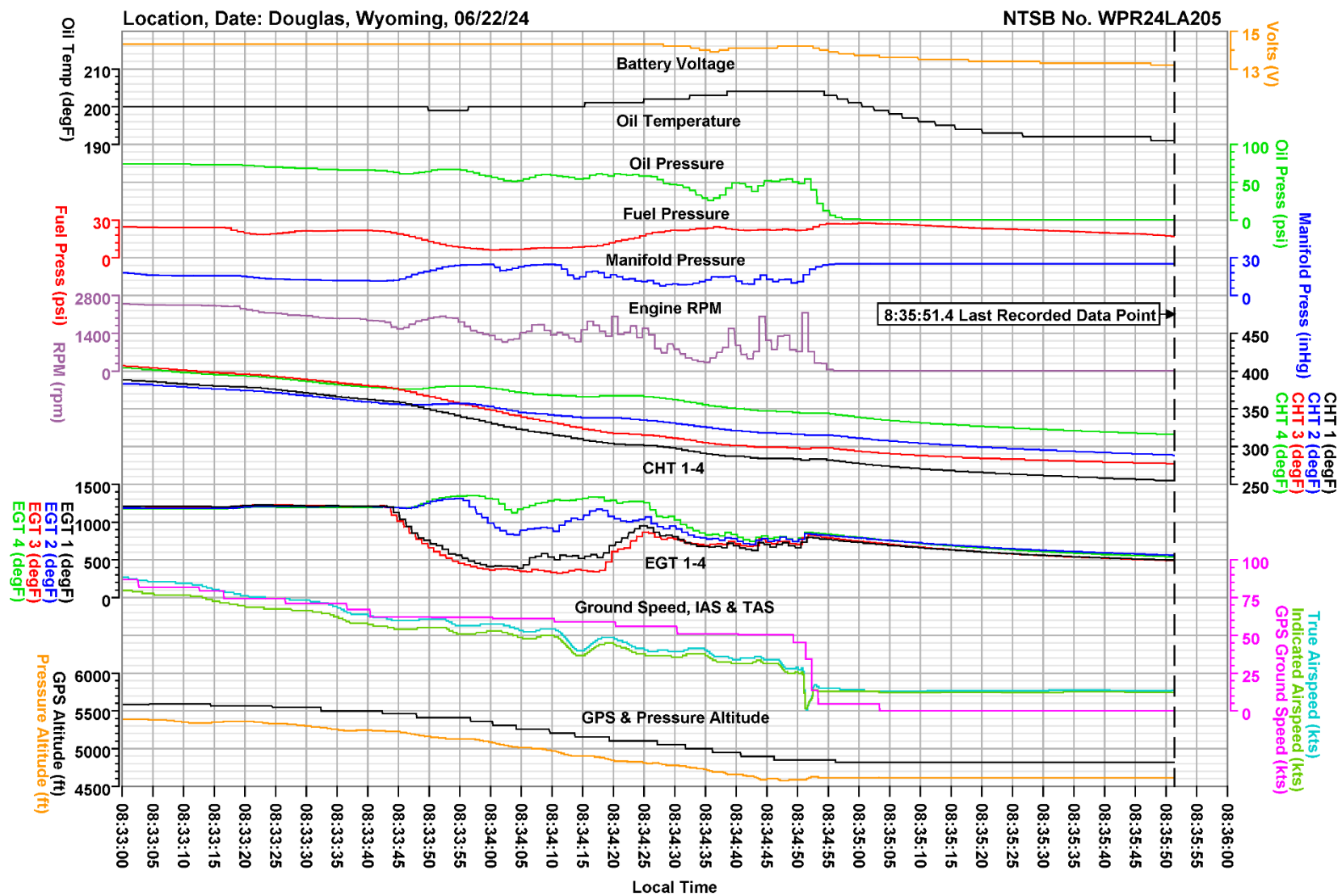


Figure 8. Plot of engine parameters recorded on the Garmin GDU 460 at the end of the accident flight recording.