

National Transportation Safety Board

Office of Research and Engineering

Washington, DC 20594



ERA24LA211

COCKPIT DISPLAY - RECORDED FLIGHT DATA

Specialist's Factual Report

November 18, 2024

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A. ACCIDENT

Location: Apopka, Florida
Date: May 8, 2024
Time: 1130 eastern daylight time (EDT)
1530 coordinated universal time (UTC)
Airplane: Piper PA-32-300, private operator, N908DK

B. COCKPIT DISPLAY - RECORDED FLIGHT DATA 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 electronic device:

Recorder Manufacturer/Model: Garmin GDU 460
Recorder Serial Number: 350011077

1.0 Garmin GDU 460 Device Description

The Garmin GDU 460 is a panel-mounted GPS receiver, with color liquid crystal displays (LCD) in 10-inch landscape. It is a variant of the Garmin G3X Touch series. The Garmin G3X series employ a touch-screen user interface and can be utilized as a primary flight display (PFD), multi-function display (MFD), engine monitoring device (EDM), or a combination of all, depending on how the unit is integrated with other compatible avionics products. The unit has the ability to record data via an externally removable SD card mounted on the screen, or internally on a series of non-volatile memory (NVM) chips.¹

If not disabled, the unit is capable of logging historical information at a variable rate to the internal NVM. Historical logs may be copied to a standard secure digital (SD) card inserted into the slot provided on the front of the unit in configuration mode. Data is exported in engineering units, in a comma-separated value (CSV) format. Each record contains UTC date and time, as well as an integer number of milliseconds since the unit was last powered.

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

1.1 Garmin GDU 460 Data Recovery

The Garmin GDU 460 was in good condition upon arrival at the NTSB Vehicle Recorder Laboratory, as shown in figure 1, without an SD card. Using a surrogate SD card, the unit was powered on and the internal memory was download normally.

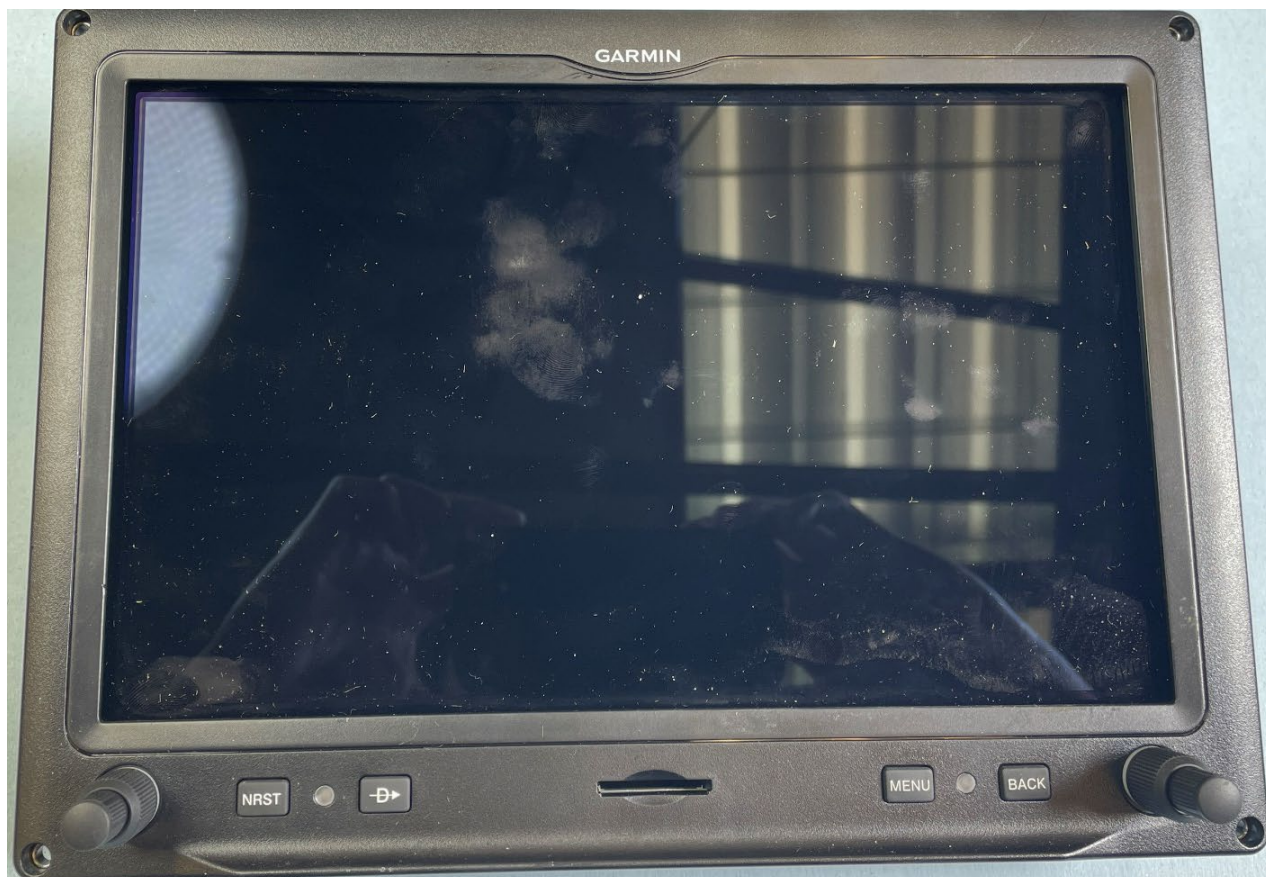


Figure 1. Garmin GDU 460 as received by the NTSB Vehicle Recorder Laboratory.

1.2 Garmin GDU 460 Recording Description

The data extracted included 22 sessions from April 6, 2019, through May 8, 2024. The last session recorded was determined to be associated with the accident flight. The recording was 29 minutes and 4 seconds in duration with a variable sampling rate of 3 Hertz (Hz) to 5 Hz. All times were converted to EDT, the local time of the accident. The difference between UTC and EDT is 4 hours. The distance from the last recorded data point at 15:30:50 EDT and the reported wreckage location was approximately 129 feet. In addition to the accident flight, the previous flight on May 8, 2024, starting at 10:23:00 EDT and ending at 10:53:00 EDT, was determined to be of interest and is included in this report.

1.3 Garmin GDU 460 Parameters Provided

Table 1 lists the Garmin GDU 460 parameters verified and provided in this report. This aircraft engine is configured with 6 cylinders. In table 1, # represents the number of cylinders. In the data plots, the # is replaced with the appropriate cylinder ID.

Table 1. Garmin GDU 460 Parameters.

Parameter Name (unit)	Parameter Description (unit)
Accel Lat (g)	Lateral Acceleration (unit of gravitational acceleration)
Accel Long (g)	Longitudinal Acceleration (unit of gravitational acceleration)
Accel Norm (g)	Normal Acceleration (unit of gravitational acceleration)
AFCS State	Automatic Flight Control System State
CHT# (degF)	Engine Cylinder Head Temperature (degrees Fahrenheit)
Date (MM/DD/YYYY)	Date for recorded data point (Month/Day/Year)
EGT# (degF)	Engine Exhaust Gas Temperature (degrees Fahrenheit)
Fuel Flow (gph)	Engine Fuel Flow (gallons per hour)
Fuel Press (psi)	Engine Fuel Pressure (pounds per square inch)
Gnd Track (deg)	Ground Track (degrees true)
GPS Alt (ft)	Global Positioning System Altitude (feet)
Ground Spd (kts)	Ground Speed (knots)
IAS (kts)	Indicated Airspeed (knots)
Latitude (deg)	Latitude (degrees)
Longitude (deg)	Longitude (degrees)
Mag Hdg (deg)	Magnetic Heading (degrees)
Man Press (inHg)	Engine Manifold Pressure (inches of Mercury)
Oil Press (psi)	Engine Oil Pressure (pounds per square inch)
Oil Temp (degF)	Engine Oil Temperature (degrees Fahrenheit)
Pitch (deg)	Pitch Attitude (degrees)
Roll (deg)	Roll Attitude (degrees)
RPM (rpm)	Engine Speed (revolutions per minute)
Time (HH:MM:SS)	Time for recorded data point (Hours:Minutes:Seconds)
Vert Spd (fpm)	Vertical Speed (feet per minute)

D. OVERLAYS AND TABULAR DATA

Figures 2 to 6 contain Garmin GDU 460 data recorded during the event on May 8, 2024. Figures 7 and 8 contain Garmin GDU 460 data recorded from a previous flight on May 8, 2024. All parameters listed in table 1 are plotted except Date and Time.

Figures 2 and 3 present time history plots of basic flight data for the entire accident flight and the last 7 minutes of the recording, respectively. Figures 4 and 5 present time history plots of engine-related data for the entire accident flight and the last 7 minutes of the recording, respectively. These figures are configured such that right turns are indicated by the trace moving toward the bottom of the page, left turns towards the top of the page, and nose up attitudes towards the top of the page.

The Garmin GDU 460 data indicated the following sequence of events:

- **11:01:45 EDT:** The unit was powered on and recording data.
- **11:19:15 EDT:** The aircraft was lined up on runway 25 at Orlando Executive Airport (KORL) in Orlando, Florida.
- **11:19:16 EDT:** Engine RPM, fuel flow, and manifold pressure began to increase. Two seconds later, ground speed began to increase, consistent with takeoff roll.
- **11:19:45 EDT:** GPS altitude increased from 107 ft to 157 ft, consistent with takeoff rotation.
- **11:22:55 EDT:** The aircraft leveled off at 1,607 ft GPS altitude. The indicated airspeed was 103 kts and increasing.
- **11:25:00 EDT:** EGT on cylinder 2 began to reduce in temperature.
- **11:26:34 EDT:** EGT on cylinder 4 began to reduce in temperature.
- **11:26:45 EDT:** EGT on cylinder 3 began to reduce in temperature.
- **11:26:51 EDT:** Fuel flow began to reduce from 22.2 gph.
- **11:29:13 EDT:** Engine RPM began to reduce from 2380 rpm.
- **11:30:51.846 EDT:** Last recorded Garmin GDU 460 data sample.

Figure 6 is a graphical overlay generated using Google Earth for the entire 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. The appearance of the flight track may not be representative of the airplane's actual flight track and may be attributed to the update rate of GPS parameters as well as the software encoding of the GPS input to the device.

The corresponding tabular data used to create figures 2 to 6, including Date and Time are provided in electronic CSV format as attachment 1 to this report.

The corresponding tabular data used to create figures 7 to 8, including Date, Latitude, Longitude, and Time are provided in electronic CSV format as attachment 2 to this report.

Submitted by:
Steven Smith
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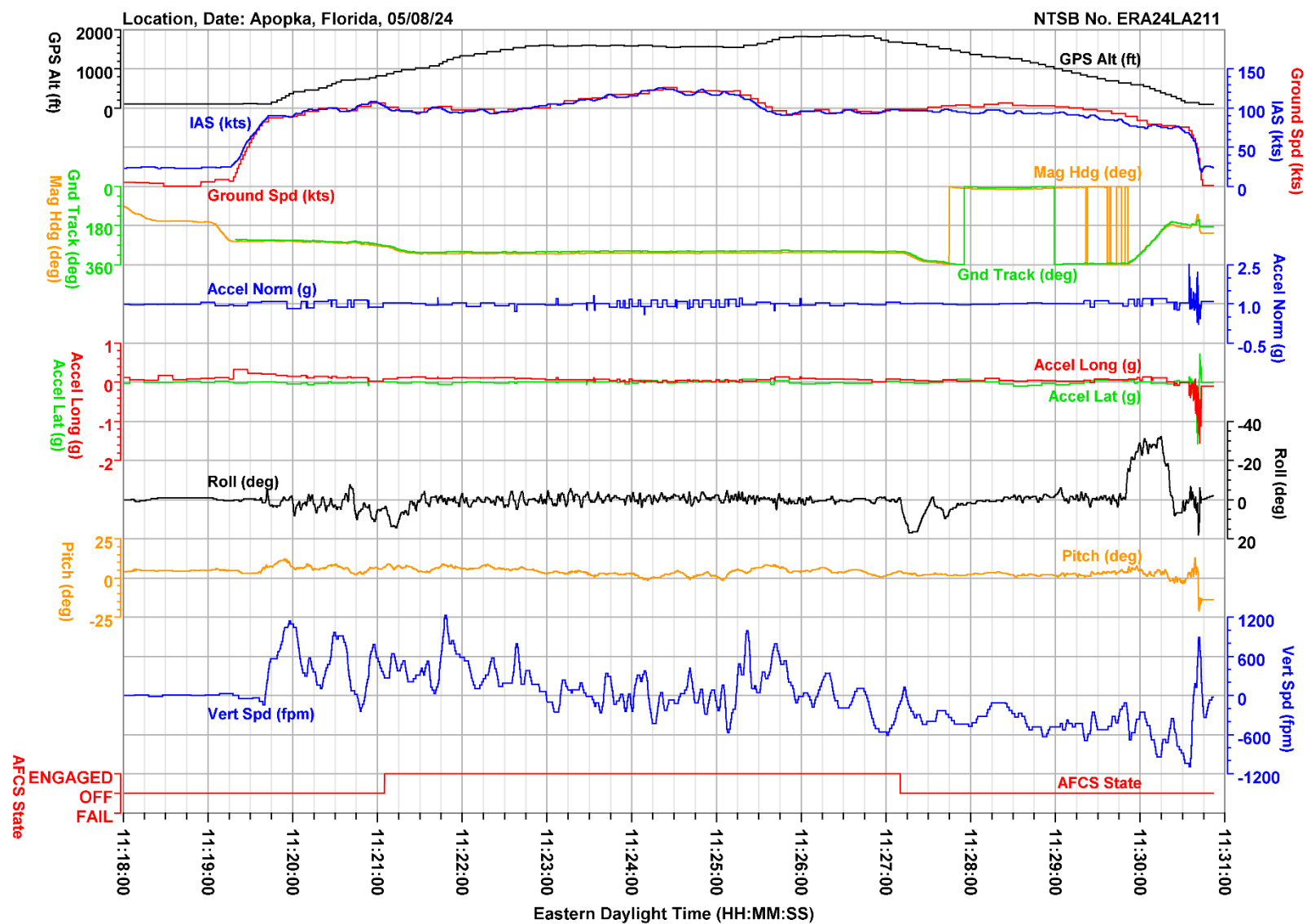


Figure 2. Time history plot of basic parameters for the entire accident flight.

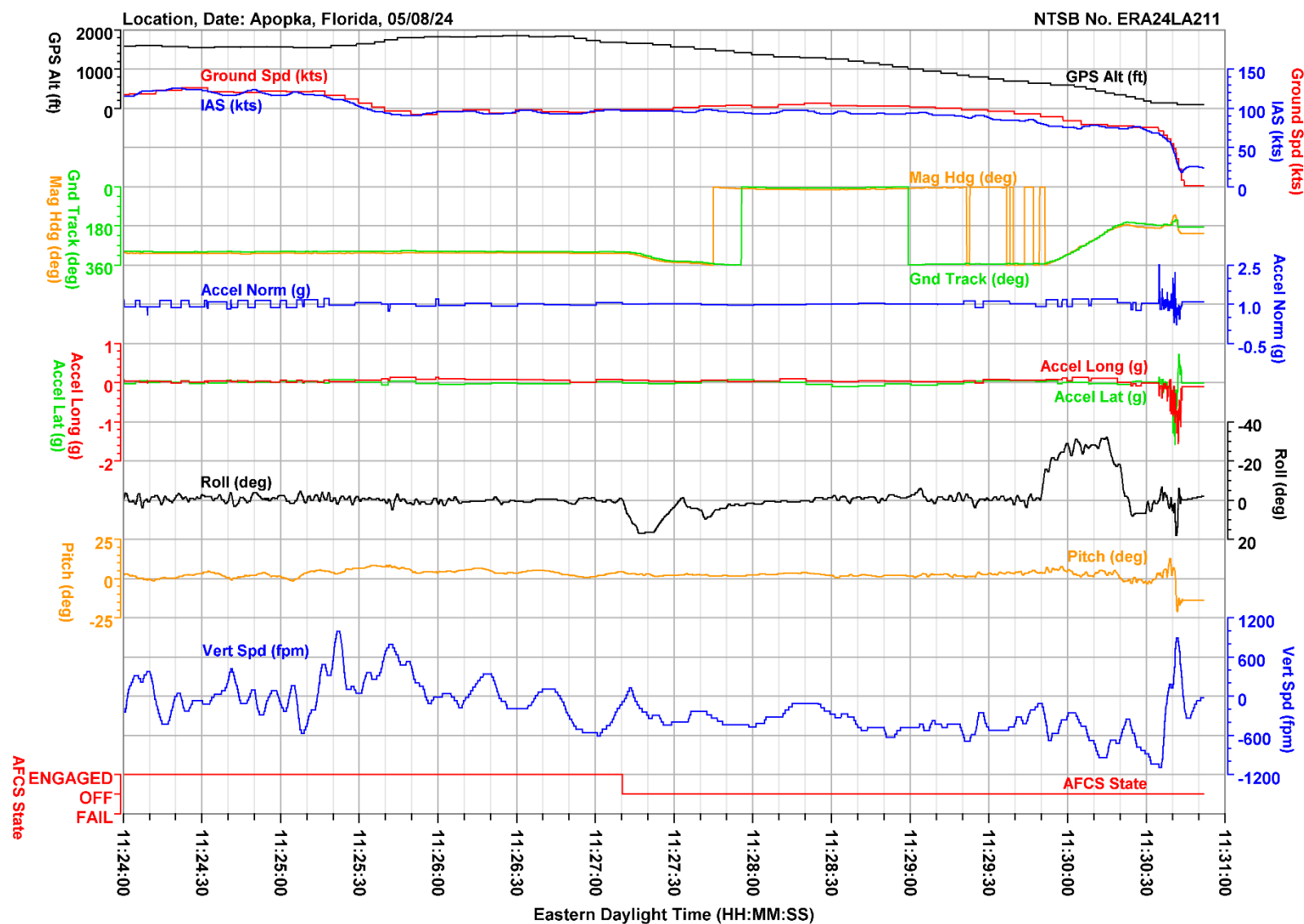


Figure 3. Time history plot of basic parameters for final 7 minutes of the recording of the accident flight.

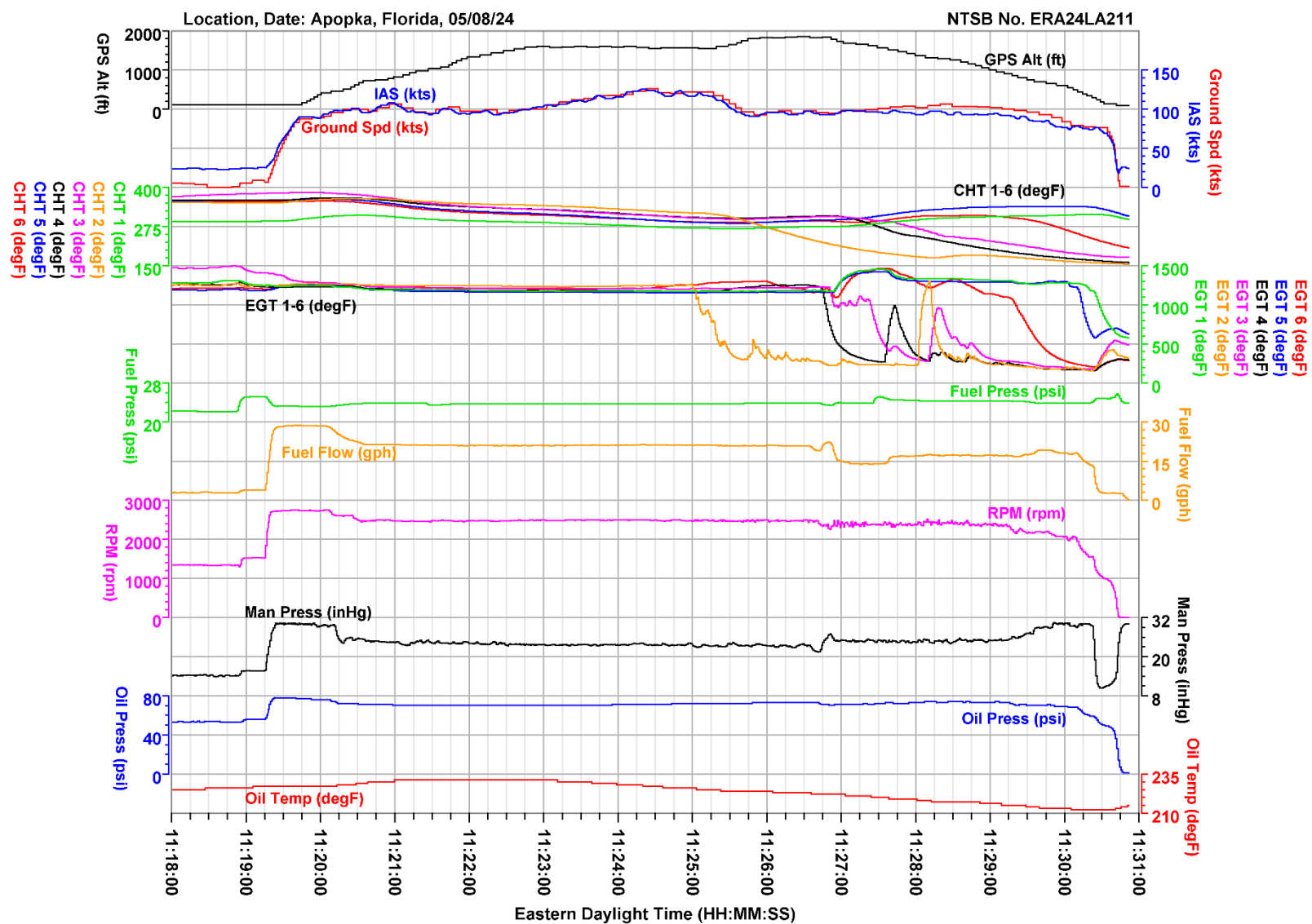


Figure 4. Time history plot of engine parameters for the entire accident flight.

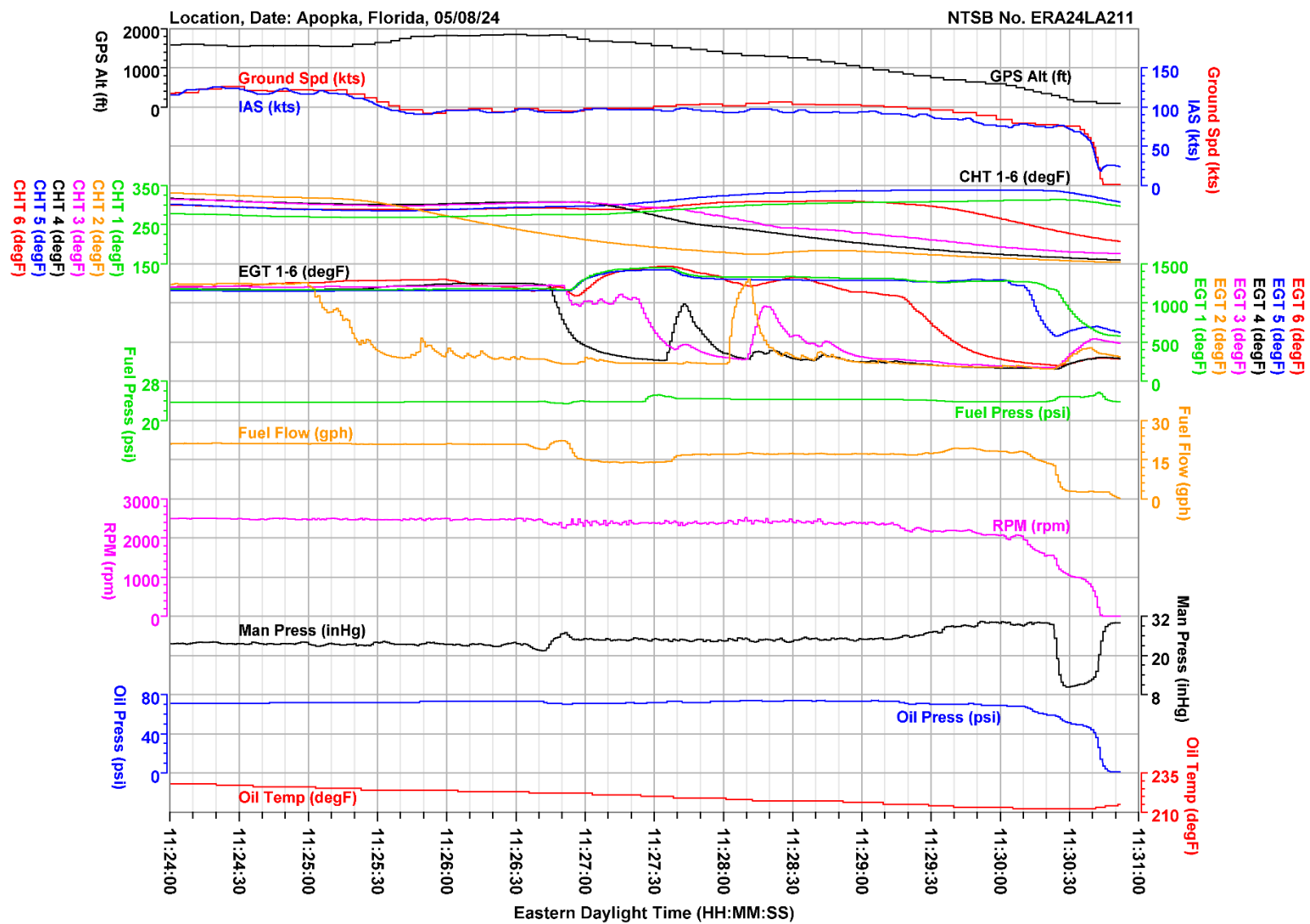


Figure 5. Time history plot of engine parameters for the final 7 minutes of the recording of the accident flight.

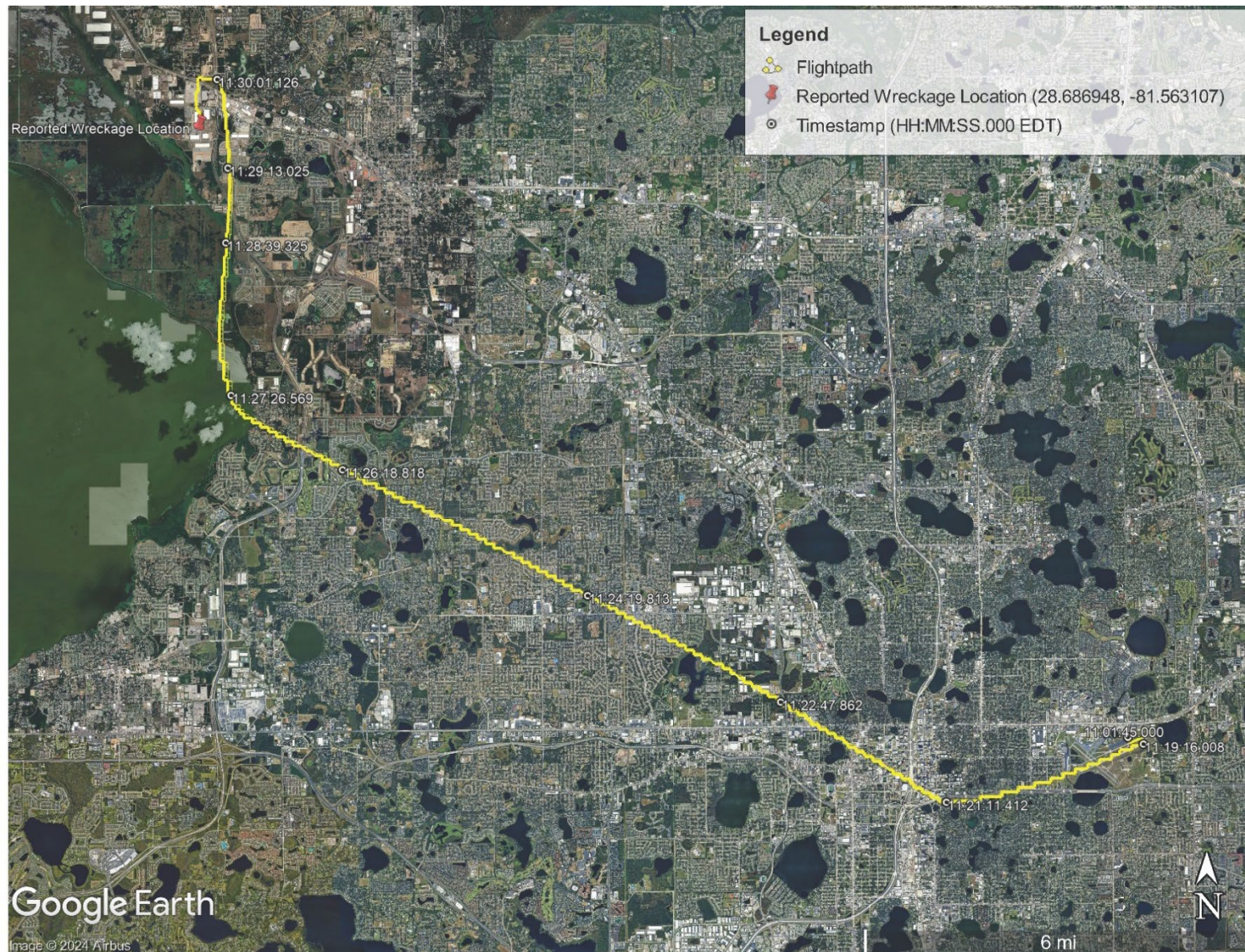


Figure 6. Google Earth overlay of the entire accident flight. The flight path depicted in the figure may not be representative of the actual flight path of the airplane

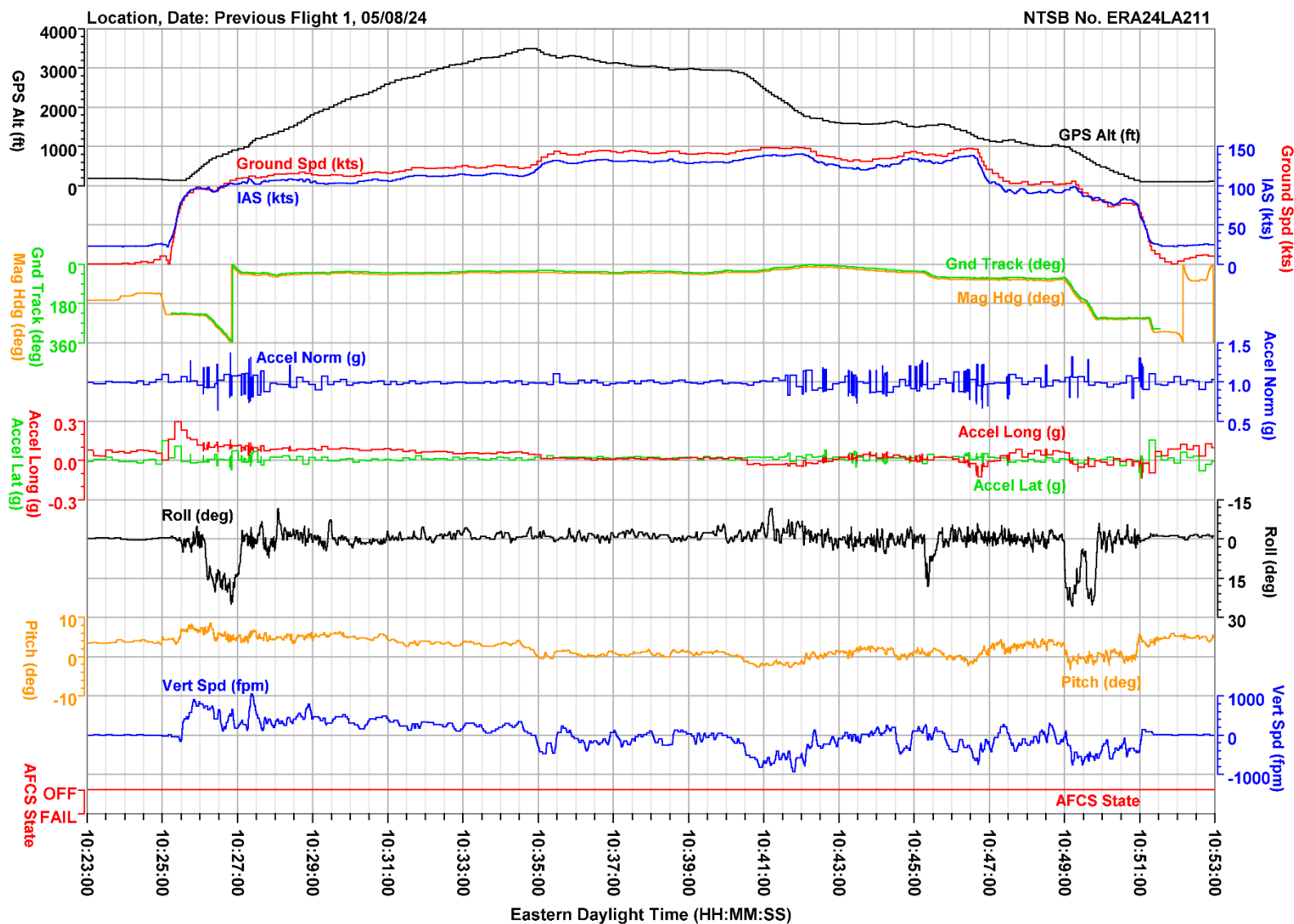


Figure 7. Time history plot of basic parameters for entire previous flight.

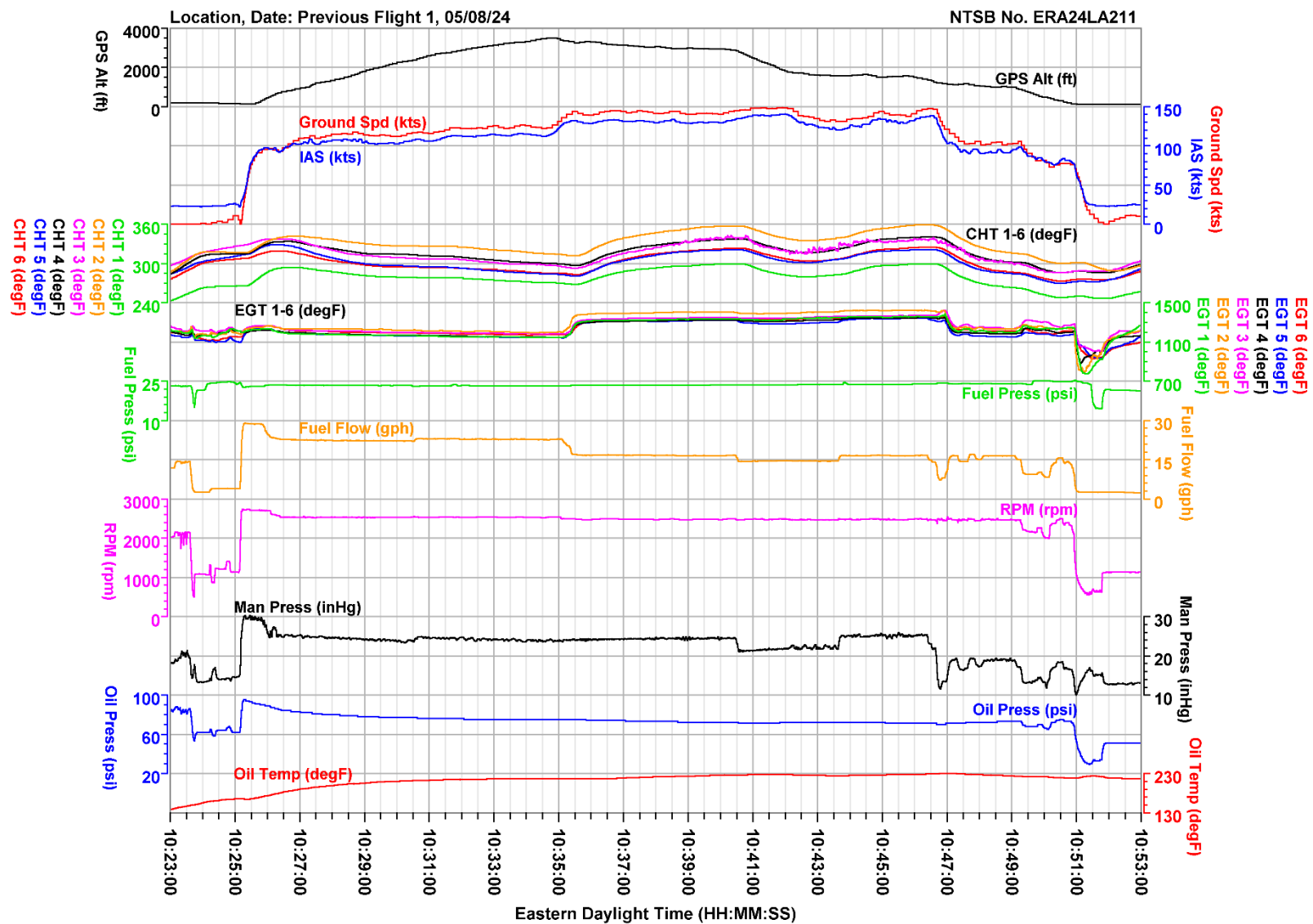


Figure 8. Time history plot of engine parameters for the entire previous flight.