

National Transportation Safety Board

Office of Research and Engineering

Washington, DC 20594



WPR22FA184

ENGINE CONTROL UNIT DATA

Specialist's Factual Report

February 7, 2023

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A. EVENT SUMMARY

Location: Cape Girardeau, Missouri
Date: May 22, 2022
Time: 0803 central daylight time (CDT)
Airplane: experimental M24 Orion Plus gyroplane, N590DM

B. ENGINE CONTROL UNIT DATA SPECIALIST

Specialist: W. Deven Chen
National Transportation Safety Board (NTSB)
Washington, DC

C. DETAILS OF THE INVESTIGATION

A recorder group was not convened. The NTSB Vehicle Recorder Division received engine parameter data files electronically. Those data files were downloaded from a Rotax engine control unit (ECU) installed on the accident gyroplane. The data showed that the serial numbers of the Rotax engine and ECU were 9133597 and 215194, respectively.

1.0 Rotax ECU Device Description

The Rotax ECU's primary function is to control engine functions to reduce pilot workload such as automatically adjusting air/fuel mixture, and control exhaust gas temperature. The ECU has two channels, also known as lanes, the primary lane "A", and a secondary lane "B". The two channels are used for engine feedback and monitoring. The ECU will automatically detect failures and switch to the secondary lane seamlessly when necessary.

In addition to its primary function, the ECU contains a data logging feature that captures the last one hour of engine parameters data. Data is recorded at 1 Hz or 10 Hz, depending on the parameter. Additionally, the ECU captures fault codes at the time of occurrence. The data is time stamped based on device operating time.

1.1 Rotax ECU Data Description

The data files received by the lab contained engine parameter data recorded from two flights, in CSV (comma-separated value) format. The latter flight, with 843 seconds (14 minutes and 3 seconds) of recording, was determined to be related to the event. The data were recorded in ECU operating time, with parameters sampled either in 1 Hz or 10 Hz.

1.1.1 Parameters Provided

The received engine parameter data were in International System of Unit (SI) and were converted into British Imperial System. Table 1 lists the parameters verified and provided in this report.

Table 1. Rotax ECU data parameters provided.

Parameter Name (unit)	Parameter Description	Sample Rate (Hz)
AmbientTemperature (degF)	ECU ambient temperature in degrees Fahrenheit	1
BoostPressure (PSI)	Boost pressure in pounds per square inch	10
BusVoltage (V)	Circuitry bus voltage in volts	10
CoolantTemperature (degF)	Coolant temperature in degrees Fahrenheit	1
EngineSpeed (RPM)	Engine speed in revolution per minute	10
EGTTemp# (degF)	Exhaust gas temperature for cylinder # in degrees Fahrenheit	10
FuelFlow (GPH)	Fuel flow rate in gallons per hour	10
FuelInjMassCyl# (pps)	Fuel injection mass for cylinder # in particles per second	10
LinearizedThrottlePos (%)	Linearized throttle position in percentage	10
ManifoldAirPressure (inHg)	Manifold air pressure in inches of mercury	10
OilPressure (PSI)	Engine Oil pressure in pounds per square inch	1
OilTemp (degF)	Engine temperature in degrees Fahrenheit	1

1.2 Time Correlation

A time correlation of the engine parameter data to the local time was not conducted, instead, the times in the report are kept in Rotax ECU operating time.

D. FIGURES AND TABULAR DATA

Figures 1 to 4 show parameter plots of the data recorded on the Rotax ECU during the event on May 22, 2022. Figure 1 shows the entire recording. Figure 2 shows the flight portion of the recording. Figures 3 and 4 show the last 20 and 10 seconds of the recording, respectively.

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

Submitted by:

W. Deven Chen
Electrical Engineer - Recorder Specialist

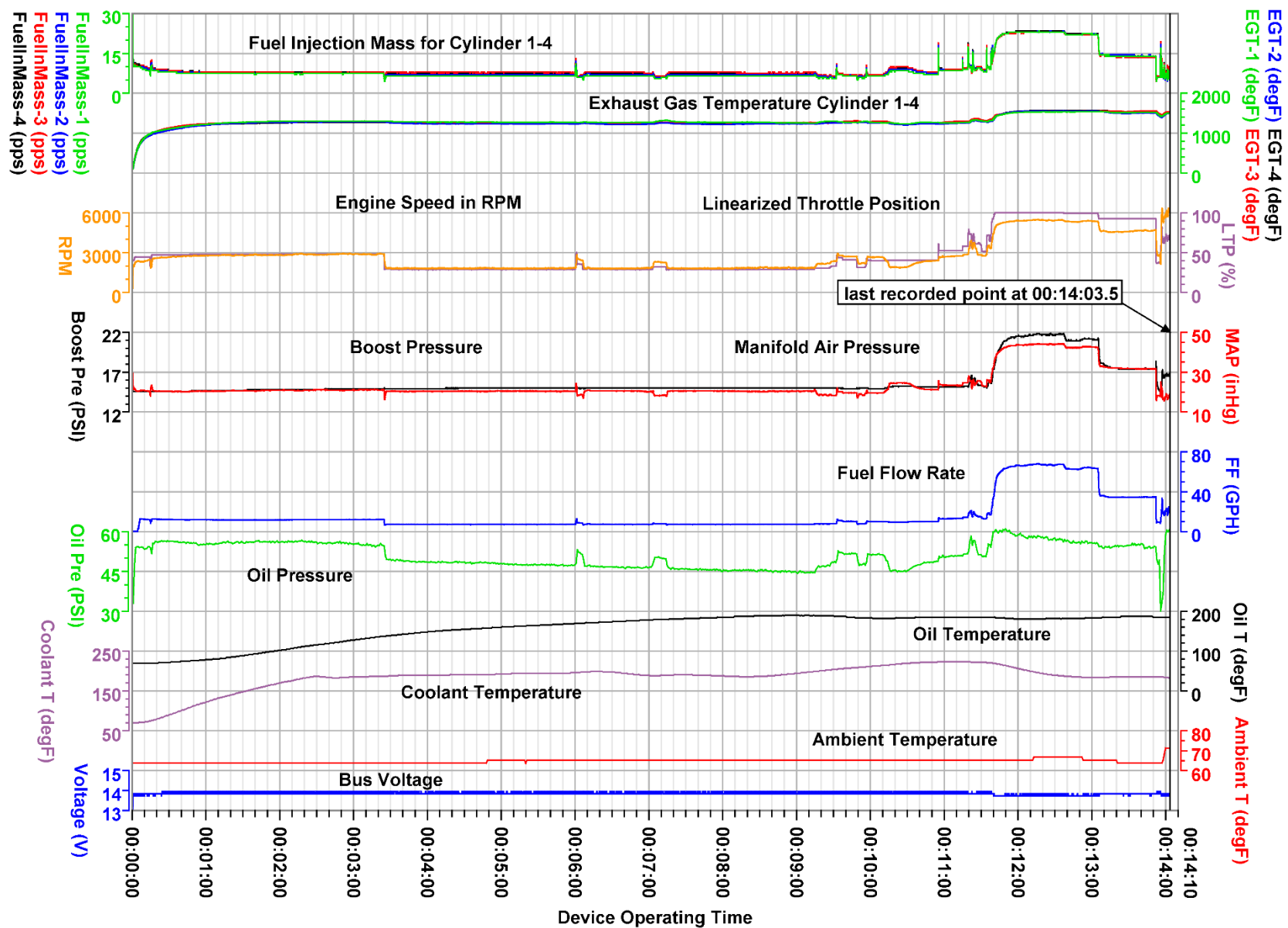


Figure 1. Plot of data parameters for the entire event flight recording.

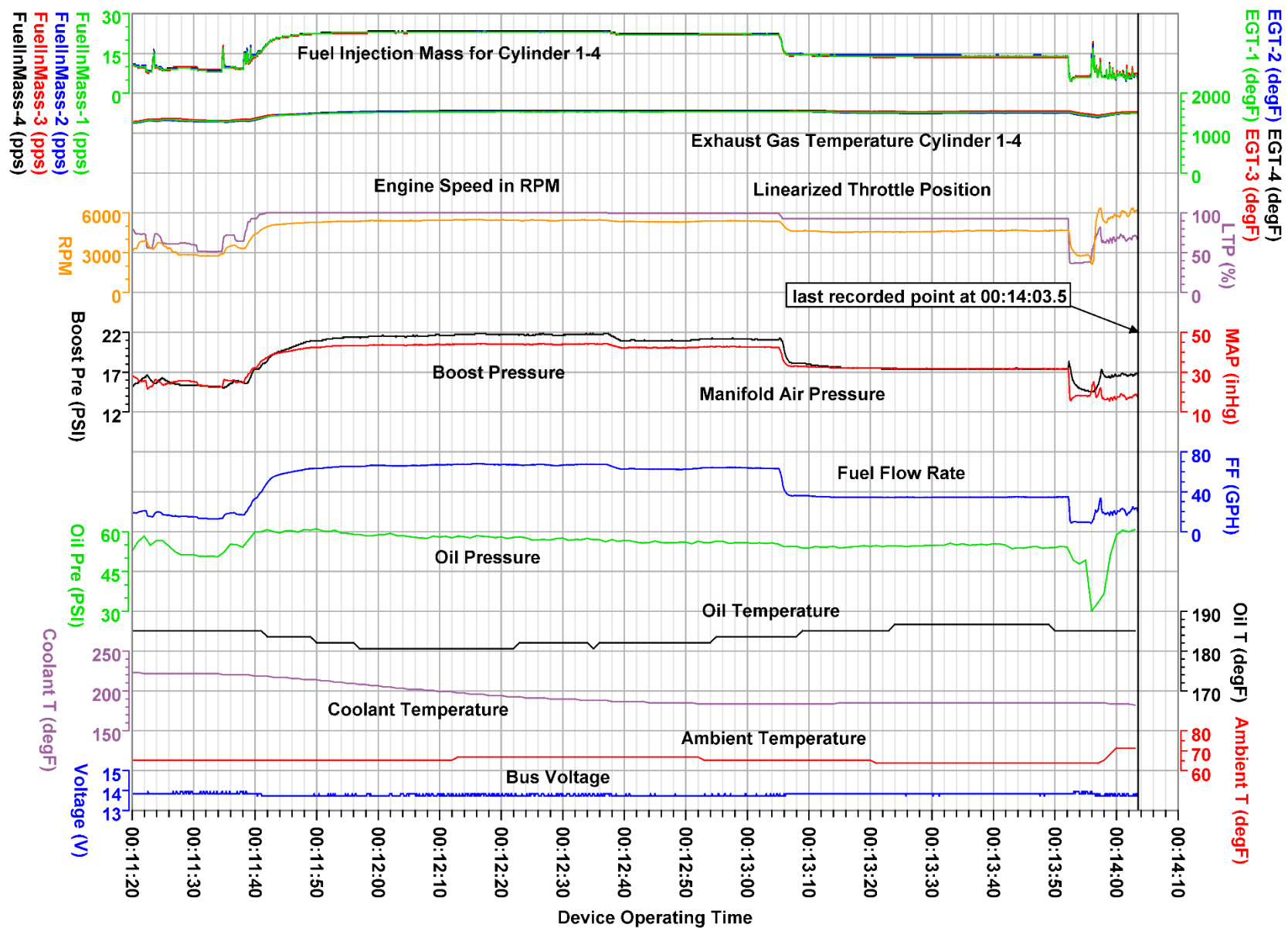


Figure 2. Plot of data parameters for the flight portion of the event flight recording.

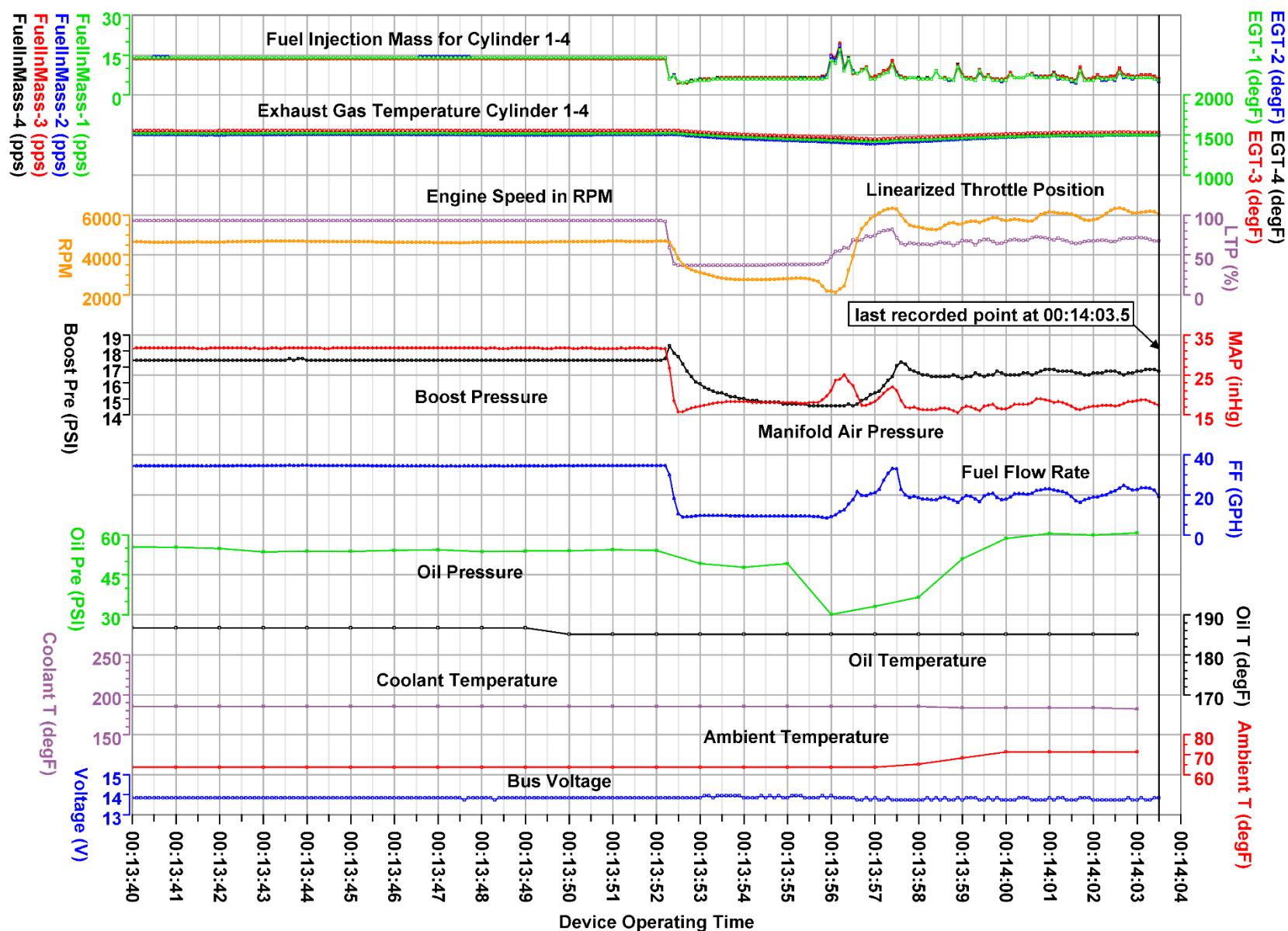


Figure 3. Plot of data parameters for approximately the last 20 seconds of the event flight recording.

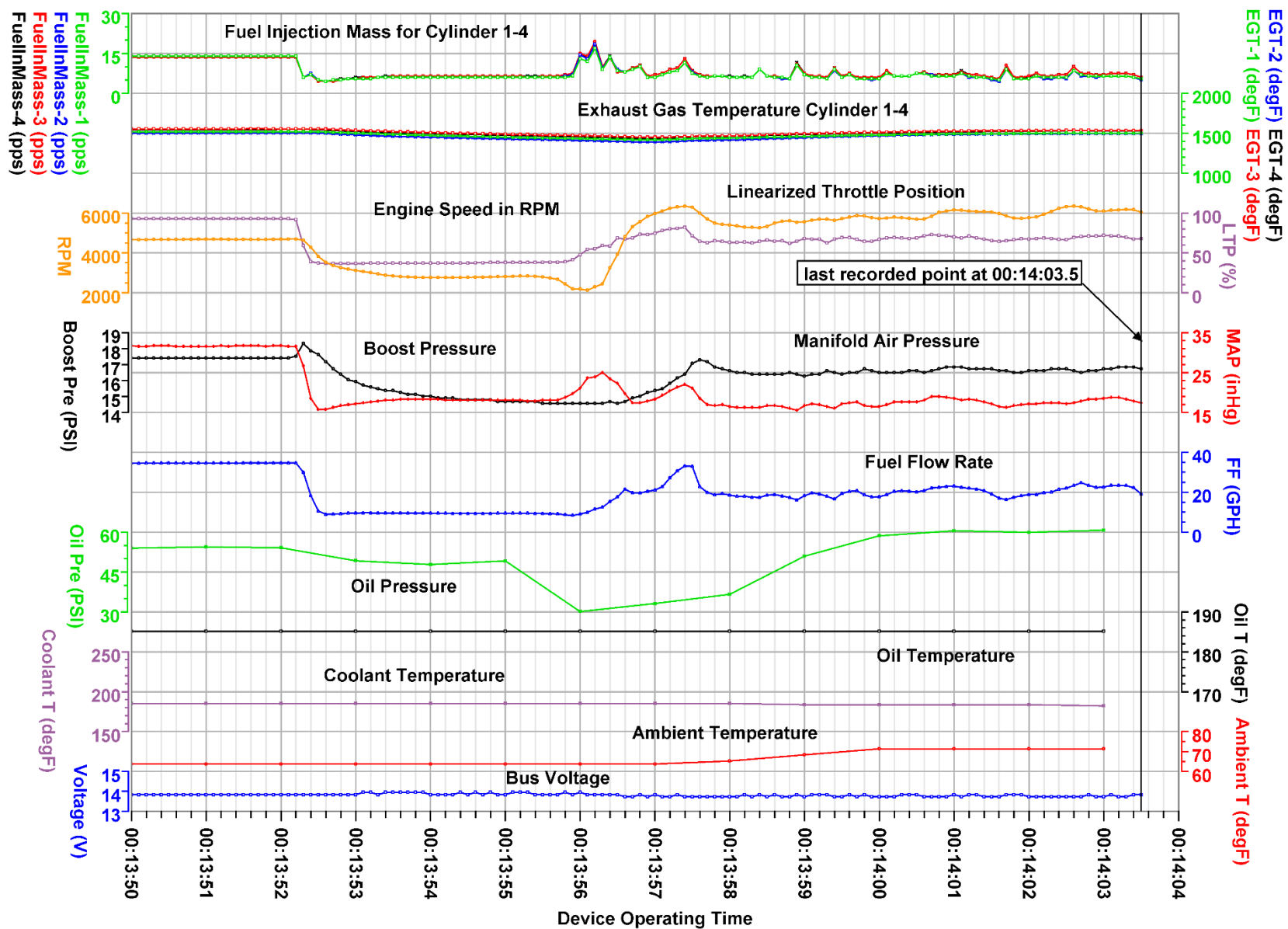


Figure 4. Plot of data parameters for approximately the last 10 seconds of the event flight recording.