

National Transportation Safety Board

Office of Research and Engineering

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ENGINE DATA MONITOR

Specialist's Factual Report

October 6, 2023

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A. ACCIDENT

Location: Blairsville GA
Date: October 13, 2021
Time: 0816 eastern standard time (EST)
Airplane: Piper PA-24, private operator, N9126P

B. ENGINE DATA MONITOR SPECIALIST

Specialist David Case
Computer Engineer / Vehicle Recorder Specialist
National Transportation Safety Board (NTSB)

C. DETAILS OF THE INVESTIGATION

An engine data monitor (EDM) group was not convened.

The NTSB Vehicle Recorder Division received the following EDM:

Recorder Manufacturer/Model: JPI EDM-700
Part Number: EGT-701-6C-F
Recorder Serial Number: 18278

1.0 EDM 700/800 Description

The J. P. Instruments EDM-700/800 is a panel mounted gauge that the operator can monitor and records up to 24 parameters related to engine operations. Depending on the installation engine parameters monitored can include:

- Exhaust Gas Temperature (EGT)
- Cylinder Head Temperature (CHT)
- Oil Pressure and Temperature
- Manifold Pressure
- Outside Air Temperature
- Turbine inlet Temperature
- Engine Revolutions per Minute

- Compressor Discharge Temperature
- Fuel Flow
- Carburetor Temperature
- Battery Voltage

The unit can also calculate, in real-time, horsepower, fuel used, shock cooling rate and EGT differentials between the highest and lowest cylinder temperatures. The calculations are also based on the aircraft installation.

The unit contains non-volatile memory (NVM) for data storage of the recorded and calculated parameters. The rate at which the data is stored is selectable by the operator from 2 to 500 seconds per sample. The memory can store up to 20 hours of data at a 6 second sample rate. The data can then be downloaded by the operator using the J.P. Instruments EzTrends software.

1.1 EDM Data Recovery

The EDM was damaged in the event. The extent of the damage is shown in figure 1. The NVM chips were removed from the device and read out with lab equipment. Existing software was used to convert the data from the device to a human readable format, but only provided the first minute of data after startup. Later, the contents of the NVM were fed into a new data conversion tool, and an additional 14 minutes were recovered.

Figure 2 is a photo of the device after it had been cleaned and disassembled. Figure 3 is a photo of the DIP-8 chips containing the unit's data.



Figure 1. The JP Instruments EDM-700 as delivered.



Figure 2. Disassembled Recorder

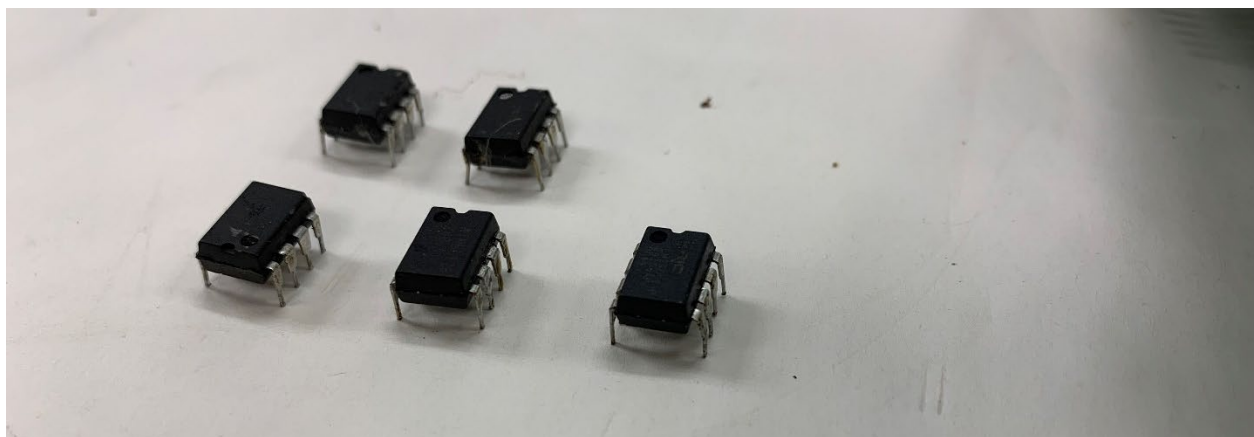


Figure 3. DIP-8 memory chips after removal.

1.2 EDM Data Description

The NVM removed from the JPI-700 contained 12 recorded log files. The last session recorded was time stamped on the date of the accident, and the elapsed time was about 15 minutes.

1.2.1 EDM Engineering Unit Conversions

The engineering unit conversions used for the data contained in this report are based on documentation from JP Instruments.

Appendix A lists the EDM parameters verified and provided in this report.

1.3 EDM Time Correlation

The last log recorded on the device was marked as starting on October 13, 2021 and running from 10:33:28 to 10:56:58, which does not match up with the accident time recorded by the IIC. Date and time on the JPI-700 are kept using a battery backed up clock and are dependent on the operator to be set properly.

Exact time correlation could not be determined, so time is recorded as seconds since startup.

D. FIGURES AND TABULAR DATA

Figure 4 contains EDM data from the last flight recorded, with a time stamp of October 13, 2021 (the day of the accident). All the parameters listed in table 1 are plotted.

The data recorded were not consistent with a typical startup, taxi, runup, takeoff sequence. Fuel consumption started at a high rate, and quickly dropped to a value typical for cruise flight. The recording never showed the engine at idle fuel consumption.

A previous flight was examined (figures 5 and 6), which was consistent with a complete flight recorded from engine startup through shutdown. The flight was approximately four hours and 20 minutes in duration and was consistent with normal engine operation.

It was noted that the beginning of the last recorded flight is similar to the post takeoff climb portion of the previous flight, however, the last recording on the device was 15 minutes of the aircraft in flight. According to ADS-B data, the entire flight lasted less than 2 minutes. The last data log recorded does not appear to be of the accident flight.

The similar regions of the two recordings are depicted as a gray bar on figures 4 and 5.

The data for the last flight recorded included anomalous oil temperature readings compared to the previous flight. Oil temperature rises to around 127

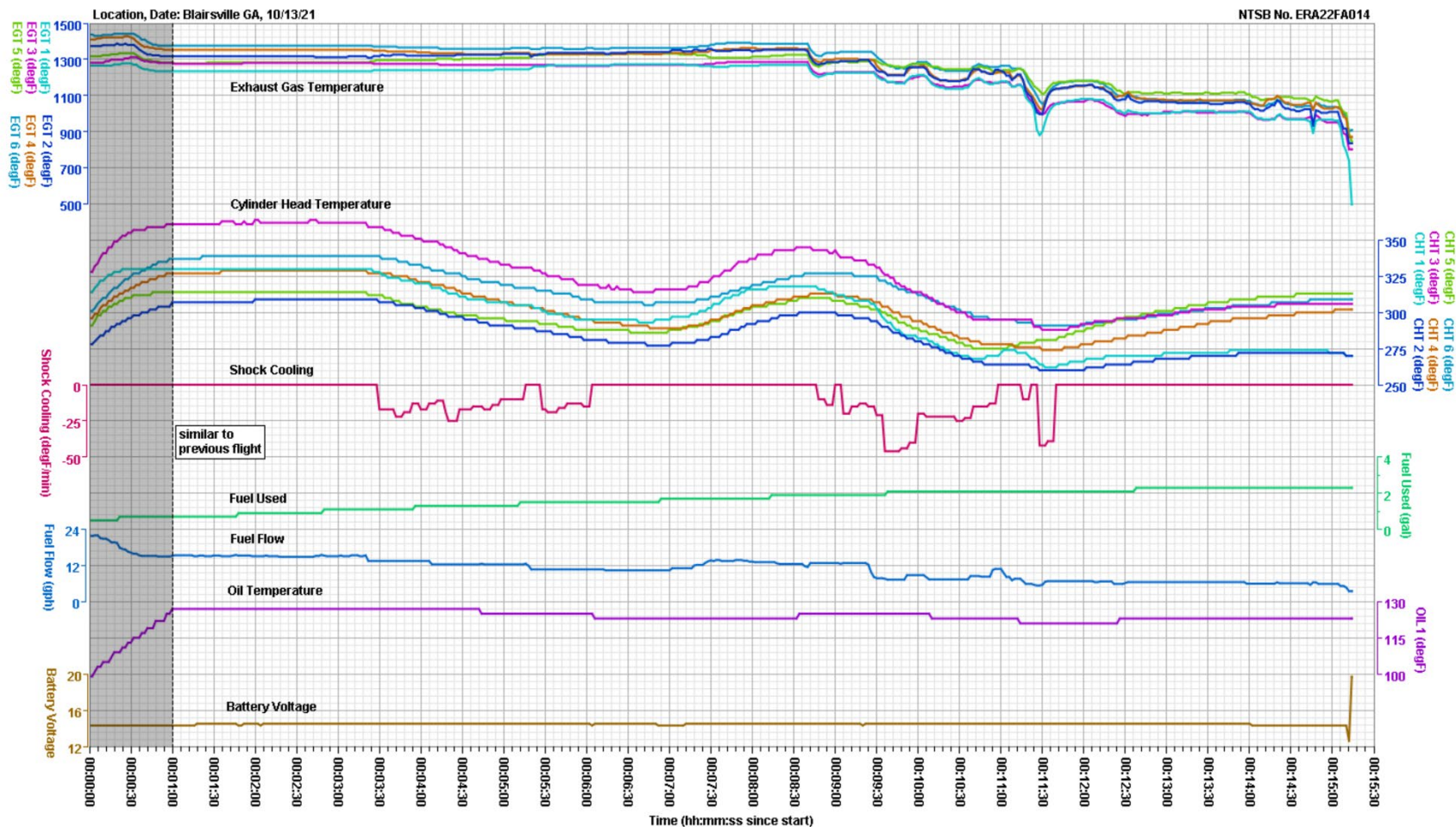
degrees Fahrenheit, but never went higher. Oil temperature on the previous flight reached 200 degrees Fahrenheit, which is a typical value for this engine.

The corresponding tabular data used to create figures 4 and 5 are provided in electronic comma separated value (CSV) format as attachments 1 and 2 to this report respectively.

Submitted by:

David L. Case
Computer Engineer / Vehicle Recorder Specialist

Piper Pa-24-260, N9126P



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Figure 4. Plot of JPI data from the last recorded log file, timestamped as 10/13/21. (0 - 912 sec). The timestamp could not be validated.

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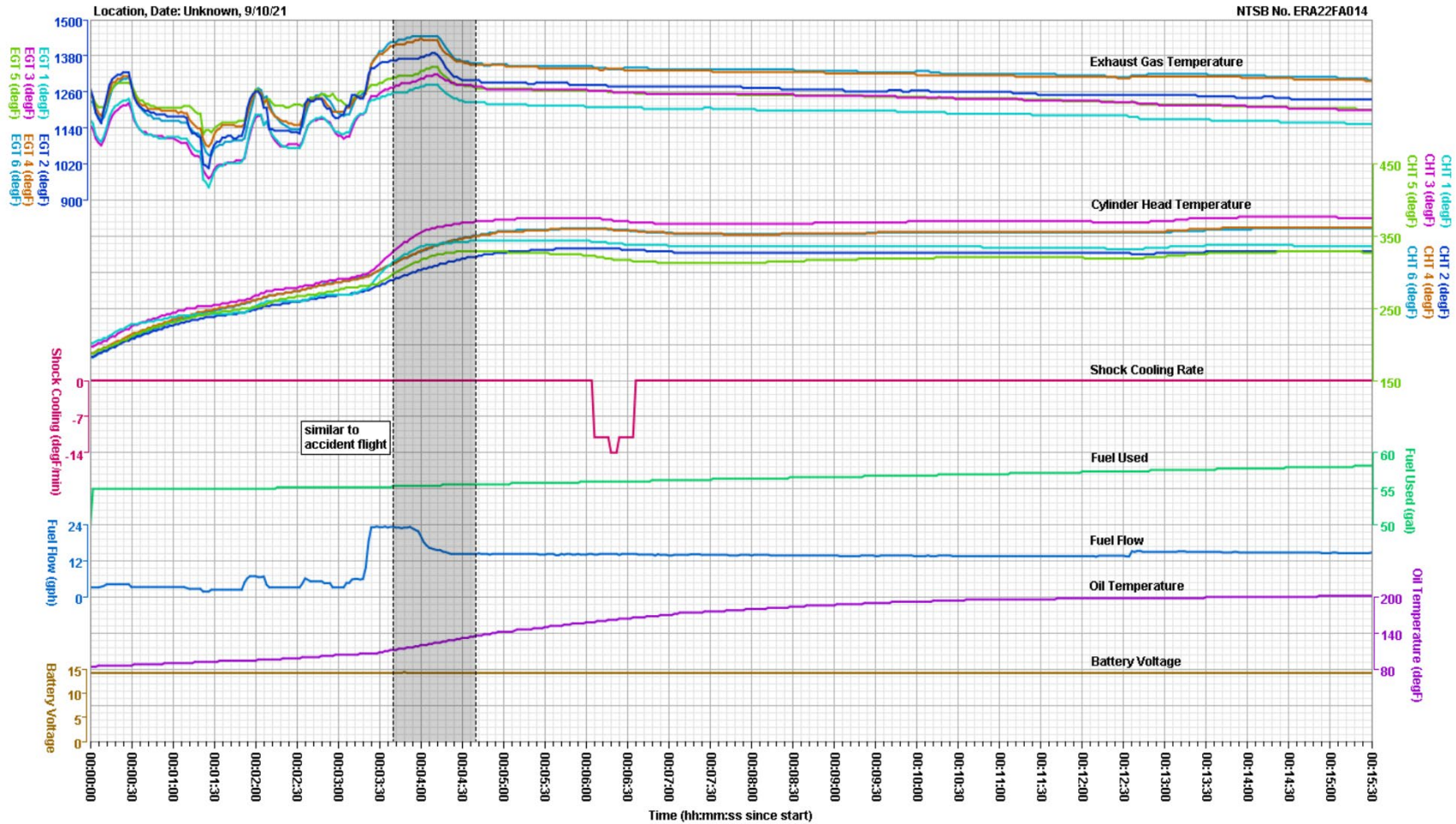
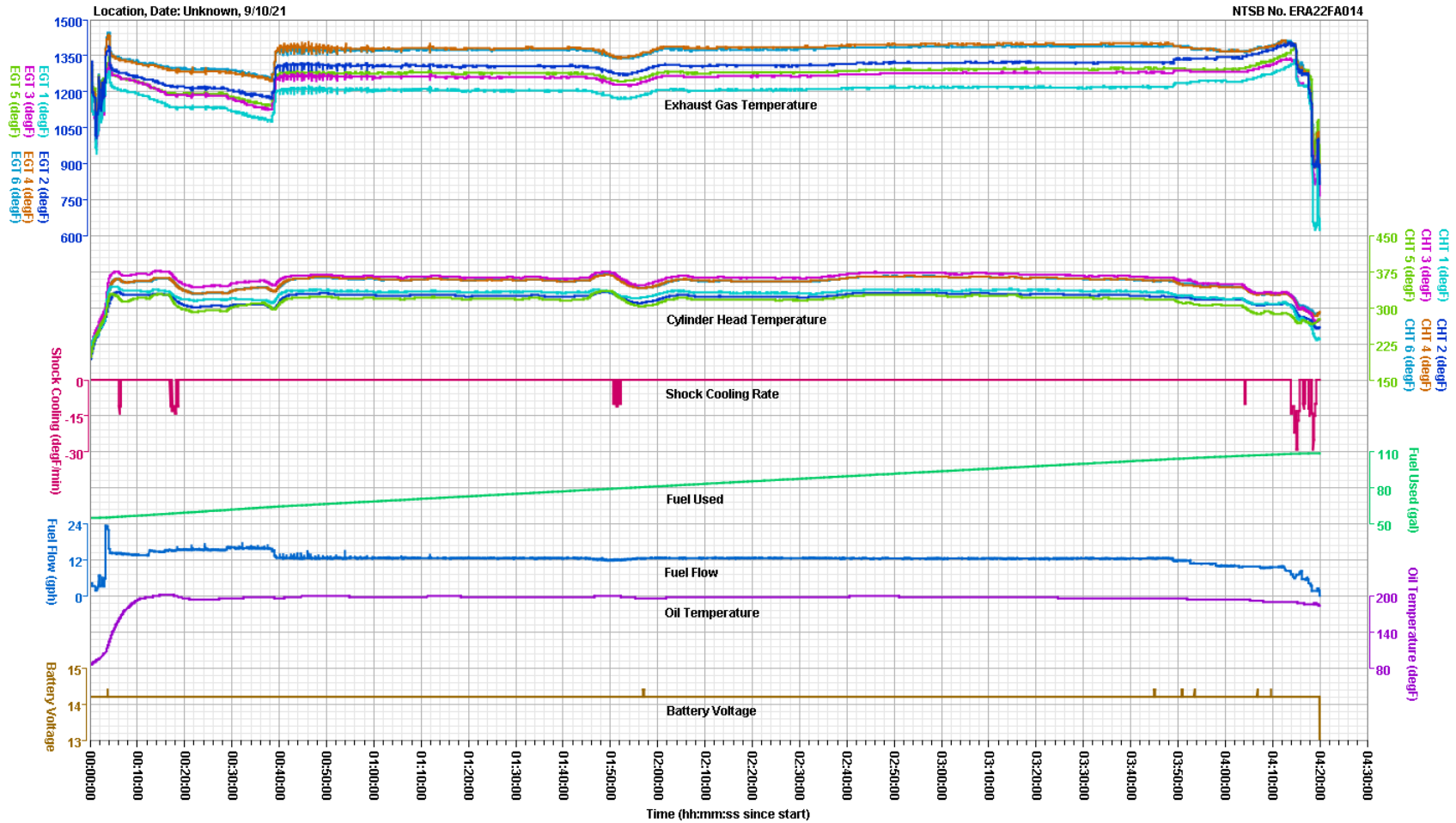


Figure 5. Plot of the beginning of the previous flight, timestamped with 9/10/21, (0-930 sec). The similar regions for both flights are shown as a gray bar in figures 4 and 5.

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Figure 5. Plot of the entire previous flight, timestamped with 9/10/21 (4 hours, 20 minutes duration).

APPENDIX A. VERIFIED AND PROVIDED PARAMETERS FROM EDM 700

This appendix describes the parameters provided and verified in this report. Table 1 lists the parameters and table 2 describes the unit abbreviations used in this report.

Table 1. Verified and provided parameters

Parameter Name	Parameter Description
Battery Voltage (V)	Battery Voltage
CHT 1-6 (degF)	Cylinder Head Temperature for cylinders 1 through 6.
EGT 1-6 (degF)	Exhaust Gas Temperature for cylinders 1 through 6.
Fuel Flow (gph)	Fuel Flow Rate
Fuel Used (gal)	Fuel Used
Oil Temperature (degF)	Oil Temperature
Shock Cooling Rate (degF/min)	Measures highest rate of cooling for any CHT value over time. Recorded as zero if temperature is steady, or increasing.

Table 2. Verified and provided parameters

Unit Name	Unit Description
degF	Degrees Fahrenheit
degF/min	Degrees Fahrenheit per minute
gal	US Gallon.
gph	US Gallons Per Hour.
V	Volts