

NATIONAL TRANSPORTATION SAFETY BOARD

Vehicle Recorder Division
Washington, D.C. 20594

April 18, 2022

Engine Data Monitor (EDM)

Specialist's Factual Report By Sean Payne

1. EVENT SUMMARY

Location: Orcas Islands, WA
Date: September 16, 2021
Aircraft: Piper PA-32-300
Registration: N33022
Operator: Private
NTSB Number: WPR21LA363

2. ENGINE DATA MONITOR GROUP

An Engine Data Monitor (EDM) group was not convened.

3. DETAILS OF INVESTIGATION

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

Recorder Manufacturer/Model: **JPI EDM-700**
Recorder Serial Number: **31032**

3.1. EDM 700 Description

The J. P. Instruments EDM-700 is a panel mounted gauge that the operator can monitor and record 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
- Latitude
- Longitude

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 for data storage of the parameters recorded and calculated. 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 per sample rate. The data can then be downloaded by the operator using the J.P. Instruments software.

3.1.1. Data Recovery

The device appeared undamaged. The device was downloaded normally, using the manufacturer's recommended procedure and software.



Figure 1. Photo of EDM.

3.1.2. Data Description

The EDM recording contained a number of hours of data over multiple power cycles. The event flight was the last flight of the recording.

3.1.3. Engineering Units Conversions

The engineering units conversions used for the data contained in this report are based on documentation from the manufacturer of the EDM.

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

3.2. Time Correlation

The EDM records time with the first data sample based on the unit's internal clock. This clock is set and updated by the operator. The recorded time of the accident flight was offset to Pacific daylight time (PDT). The time correlation was made by correlating the last recorded data point from the EDM to the reported time of the accident.

All times in this report are given in PDT.

3.3. Plots and Corresponding Tabular Data

The following five figures contain EDM data recorded during the September 16, 2021, event.

Figure 2 is a plot of engine parameters recorded on the JPI EDM-700. The data describes nominal piston engine operation up until approximately 18:22:48. Around this time, values for EGT dropped rapidly. At the same time, values for CHT began dropping. Just prior to the EGTs dropping rapidly, the EGTs rose sharply in unison. Around 18:24, values for EGT began rising but never indicated a smooth trend for the rest of the recording.

The unit is able to keep track of the amount of fuel used. This condition is typically user set by the pilot and it's accuracy requires proper input from the operator at the start of every JPI power cycle. The value for fuel used at the beginning of the flight indicated 28 gallons. By the end of the recording, the value for fuel used indicated approximately 31 gallons. The data ended at 18:25:00.

Previous JPI recordings were reviewed in order to determine when the fuel totalizer of the unit was last reset. Records indicated the fuel totalizer was reset 6 power cycles ago. The timing record indicated that that power cycle occurred 23 hours and 8 minutes prior to the last recorded data point contained on the overall recording. The maximum recorded value for fuel used prior to the reset condition was 54.7 gallons.

The corresponding tabular data used to create these two plots are provided in electronic (*.csv) format as Attachment 1 to this report.¹

¹ Comma Separated Value format.

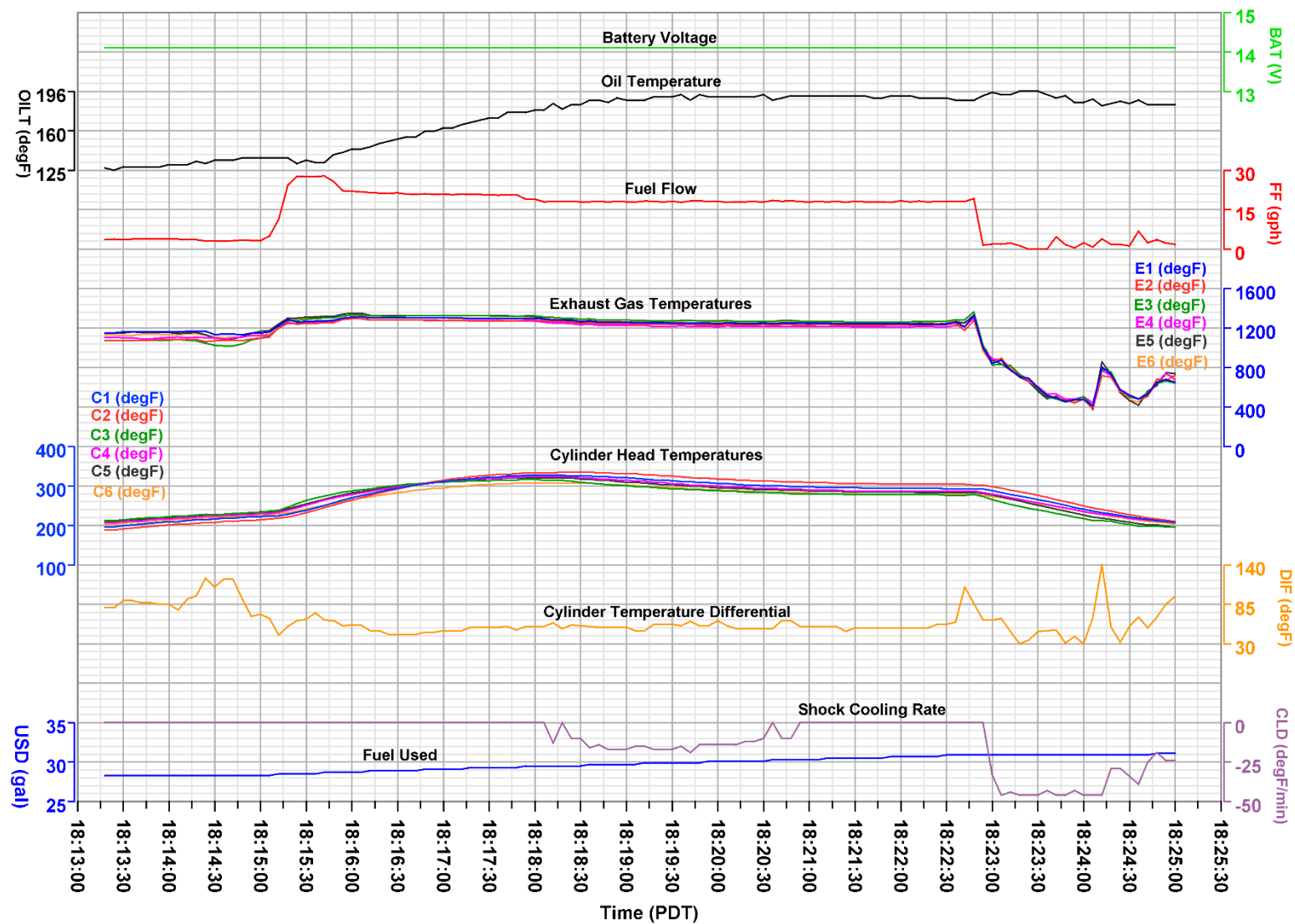


Figure 2. Plot of engine parameters for the entire accident recording.

APPENDIX A

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

Table A-1. Verified and provided parameters.

Parameter Name (units)	Parameter Description (units)
1. C-# (deg F)	Cylinder Head Temperature Cylinder # ² (degrees Fahrenheit)
2. E-# (deg F)	Exhaust Gas Temperature Cylinder # ² (degrees Fahrenheit)
3. FF (gph)	Engine Fuel Flow (gallons per hour)
4. USD (gal)	Engine Fuel Used (gallons)
5. CLD (deg F/min)	Engine Shock Cooling (degrees Fahrenheit per minute)
6. DIF (deg F)	Engine Cylinder Maximum Temperature Differential (degrees Fahrenheit)
7. OIL T (deg F)	Oil Temperature (degrees Fahrenheit)
8. BAT (V)	Battery Voltage (volts)

² Depending on aircraft configuration number of cylinders that are instrumented varies. In the data plots the '#' is replaced with the appropriate cylinder ID.