

NATIONAL TRANSPORTATION SAFETY BOARD
Vehicle Recorder Division
Washington, D.C. 20594

November 18, 2019

Engine Data Monitor (EDM)

Specialist's Factual Report
By Sean Payne

1. EVENT SUMMARY

Location: Redding, CA
Date: November 15, 2018
Aircraft: Cessna 182K
Registration: N2629R
Operator: Private
NTSB Number: WPR19FA025

On November 15, 2018 at 1827 Pacific standard time (PST), a Cessna 182K airplane, N2629R, was destroyed when it impacted terrain near Redding Municipal Airport (RDD), Redding, California. The private pilot and passenger were fatally injured. The airplane was registered to Sacramento Aero Club and operated by the pilot as a 14 *Code of Federal Regulations* Part 91 personal flight. Instrument meteorological conditions prevailed within the area for the cross-country flight and an instrument flight rules flight plan was filed. The flight originated from RDD at 1825 destined for Sacramento Executive Airport (SAC), Sacramento, California.

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: **15456**

3.1. EDM 700/800 Description

The J. P. Instruments EDM-700/800 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

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 sample rate. The data can then be downloaded by the operator using the J.P. Instruments software.

3.1.1. Data Recovery

The recorder arrived at the lab damaged. The extent of the damage is shown in figure 1. The unit's internal memory chips were extracted and read with a chip reading device. Subsequent chip image files were converted to engineering units using NTSB software.



Figure 1. Damaged exterior 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. The time reflected for the accident flight was incorrect.

The first 21 minutes and 24 seconds of data appeared valid. After 21 minutes and 24 seconds elapsed, the data showed values inconsistent with valid flight data.

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 as per the JPI was one day after the accident occurred, therefore the time was assumed to be incorrect and was discarded. Instead, the time given in the plots and attachment are referenced as JPI Elapsed Time which is a measure of time elapsed in seconds from the beginning of the recording.

3.3. Plots and Corresponding Tabular Data

The following two figures contain EDM data recorded during the November 15, 2018, event.

Figure 2 is a plot of recorded flight data for the entire session. EGT and CHT values for each cylinder generally tracked together. Around 17 minutes elapsed, EGT and CHT values rose briefly consistent with an engine runup. A few minutes later EGT and CHT values rose to values reflecting takeoff power in a horizontally opposed air-cooled engine. After 21:24, data could no longer be validated as flight data.

The corresponding tabular data used to create these two plots are provided in electronic (*.csv¹) format as Attachment 1 to this report.

¹ Comma Separated Value format.

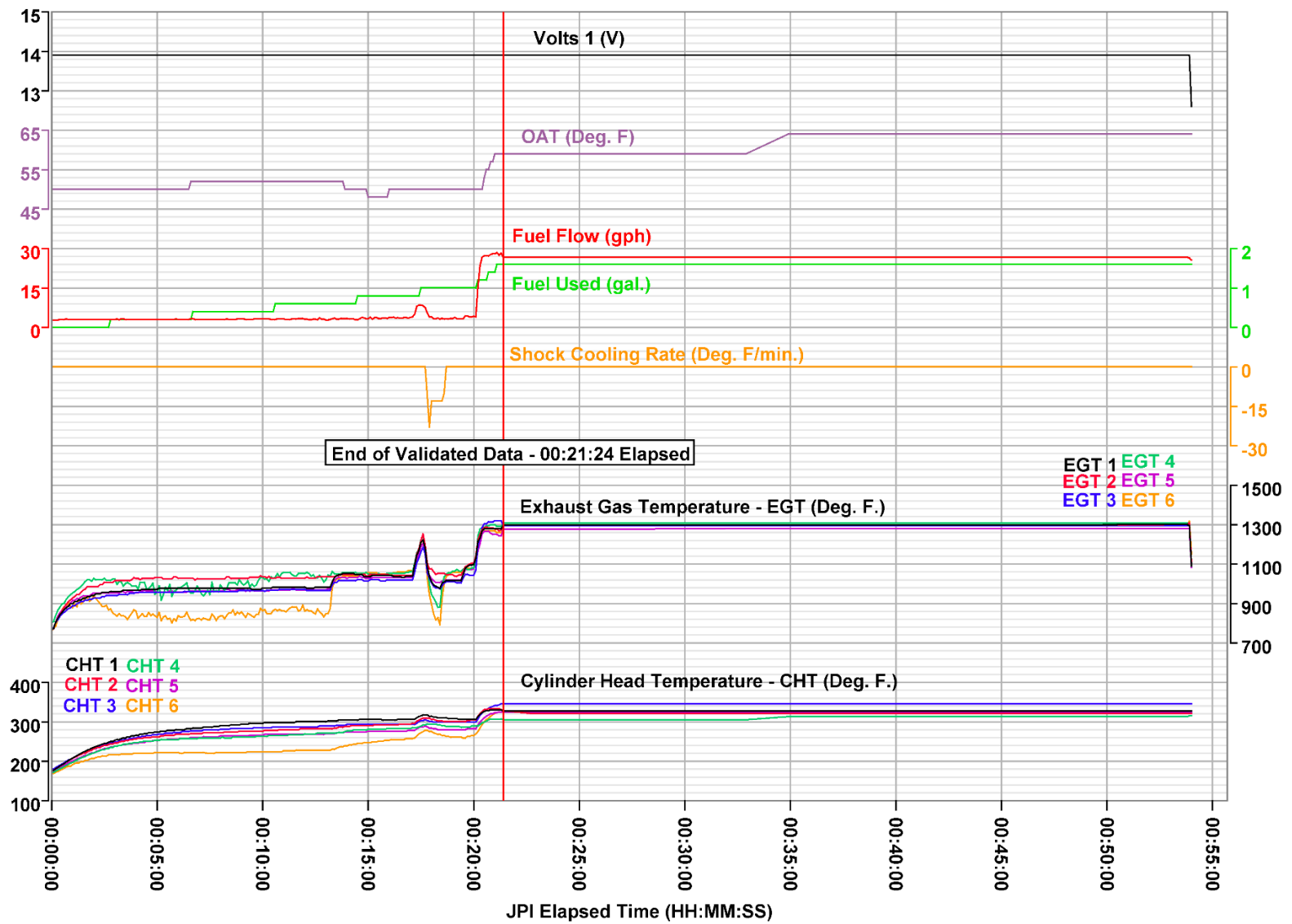


Figure 2. Plot of parameters during entire recorded session.

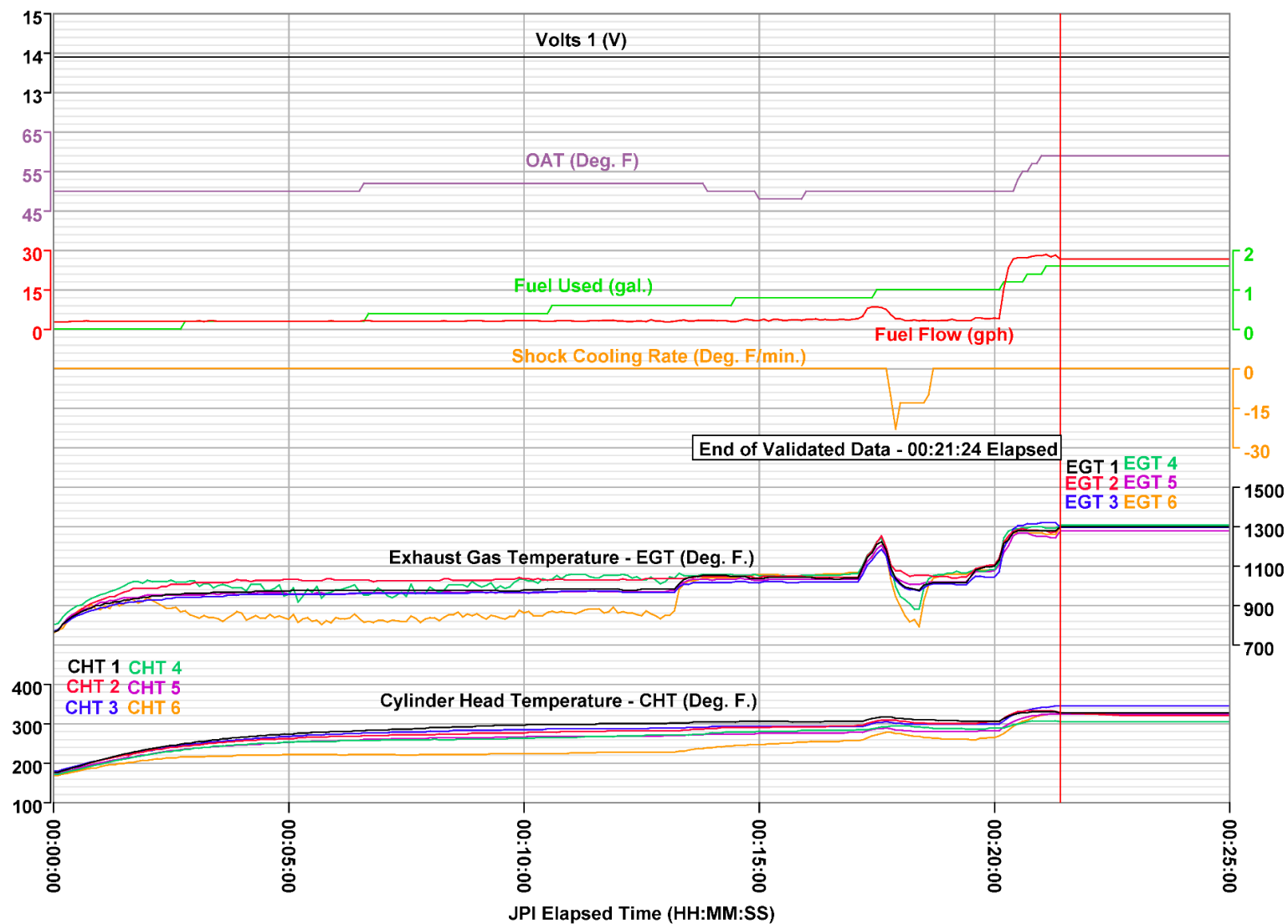


Figure 3. Plot of parameters during the time interval of validated data.

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	Parameter Description
1. Eng1 CHT-# (deg F.)	Cylinder Head Temperature Cylinder # ²
2. EGT-# (deg F.)	Exhaust Gas Temperature Cylinder #
3. Fuel Flow (gph)	Engine Fuel Flow
4. Fuel Used (gal)	Engine Fuel Used
5. Shock Cool (deg F./min)	Engine Shock Cooling
6. OAT (deg)	Outside Air Temperature
7. Volts 1 (V)	Battery Voltage

Table A-2. Unit abbreviations.

Units Abbreviation	Description
deg F./min	degrees per minute
deg F	Degrees Fahrenheit
gal	gallons
gph	gallons per hour
V	Volts DC

NOTE: For parameters with a unit description of discrete, a discrete is typically a 1-bit parameter that is either a 0 state or a 1 state where each state is uniquely defined for each parameter.

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