

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

February 23, 2016

Engine Data Monitor (EDM)

Specialist's Factual Report
By Sean Payne

1. EVENT SUMMARY

Location: Oshkosh, Wisconsin
Date: July 22, 2015
Aircraft: Piper PA-46-310P
Registration: N4BP
Operator: Private
NTSB Number: CEN15FA311

On July 22, 2015, about 0744 central daylight time (CDT), a Piper PA-46-310P single-engine airplane, N4BP, sustained substantial damage when it impacted runway 27 (6,179 ft by 150 ft, concrete) while landing at the Wittman Regional Airport (OSH), Oshkosh, Wisconsin. The pilot and two passengers sustained serious injuries and two passengers sustained minor injuries. The airplane was registered to DLM Holding Group LLC and operated by the pilot under the provisions of the 14 *Code of Federal Regulations* Part 91 as a personal flight. Visual meteorological conditions prevailed at the time of the accident and no flight plan was filed. The flight departed the Southwest Michigan Regional Airport (BEH), Benton Harbor, Michigan, about 0730 eastern daylight time.

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-930**
Recorder Serial Number: **02113**

3.1. EDM 930 Description

The J. P. Instruments EDM-930 is a panel mounted display that the operator can monitor and record multiple engine parameters related to engine operations and GPS parameters, if connected. 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
- Fuel Pressure
- Fuel Level
- 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 memory¹ 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. Data recording typically begins when EGT's are greater than 500°F or RPM is greater than 500 rpm. The memory can store up to 100 hours of data at a 6 second sample rate. For a non-damaged unit, the data can then be downloaded by the operator using a USB flash drive and following the instructions on the unit.

3.1.1. Data Recovery

The recorder was in good condition and the data were extracted normally from the recorder using the manufacturer's software. Figure 1 shows the as received condition of the JPI EDM-930.

Figure 1. Exterior of JPI EDM-930.



¹ Non-volatile memory (NVM) – electronic memory that retains data after a power source has been removed.

3.1.2. Data Description

The EDM recording contained data for approximately 135 power cycles. The event flight was the last flight of the recording, marked “flt486”, and its duration was approximately 1 hour, 23 minutes and 42 seconds.

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 internal clock time is independent and not synchronized with an external time source, i.e. GPS clock. Operators can set the time for a local time zone, or Coordinated Universal Time (UTC). The recorded data time was consistent with neither UTC or the local time zone.

Correlation of the EDM data to the event local time, Central Daylight Time, was established by comparing the final timestamp of the JPI EDM-930 to the accident time provided by the Investigator-In-Charge. An offset of -30,832 seconds was applied to align the JPI timestamps to the accident time.

$$\text{JPI EDM-930 Time} - 30832 \text{ seconds} = \text{CDT}$$

Therefore, for the rest of this report, all times are referenced as CDT, not recorded time.

3.3. Plots and Corresponding Tabular Data

The following two figures contain EDM data recorded during the July 22, 2015 event.

Figure 2 is a plot of selected parameters extracted from the JPI for the entire accident flight. The recording began around 06:20 CDT. Values for exhaust gas temperature and cylinder head temperature began to rise. Around 06:30 CDT, manifold pressure and engine RPM rapidly increased consistent with the aircraft beginning a takeoff roll. Most recorded parameters remained stable from approximately 06:35 CDT until approximately 07:25 CDT.

At 07:25 CDT, manifold pressure was reduced. Fuel flow, oil pressure, oil temperature, EGT and CHT all began slightly negative trends. Near the end of the recording, around 07:43, manifold pressure sharply decreased in value along with engine RPM. In the last recorded values, engine RPM, manifold pressure, fuel flow and values for CHT and EGT began to sharply rise. The recording ended abruptly at 07:44 CDT.

Figure 3 shows the end of the accident recorded in an expanded time scale. The plotted time interval is between 07:22 CDT and 07:45 CDT. The plot shows engine parameters generally increasing in value just prior to the recording abruptly ending at 07:44 CDT.

The corresponding tabular data used to create these two plots are provided in electronic (*.csv²) format as Attachment 1 to this report.

² Comma Separated Value format.

Figure 2. Plot of selected parameters recorded by the JPI EDM-930 during the entire flight.

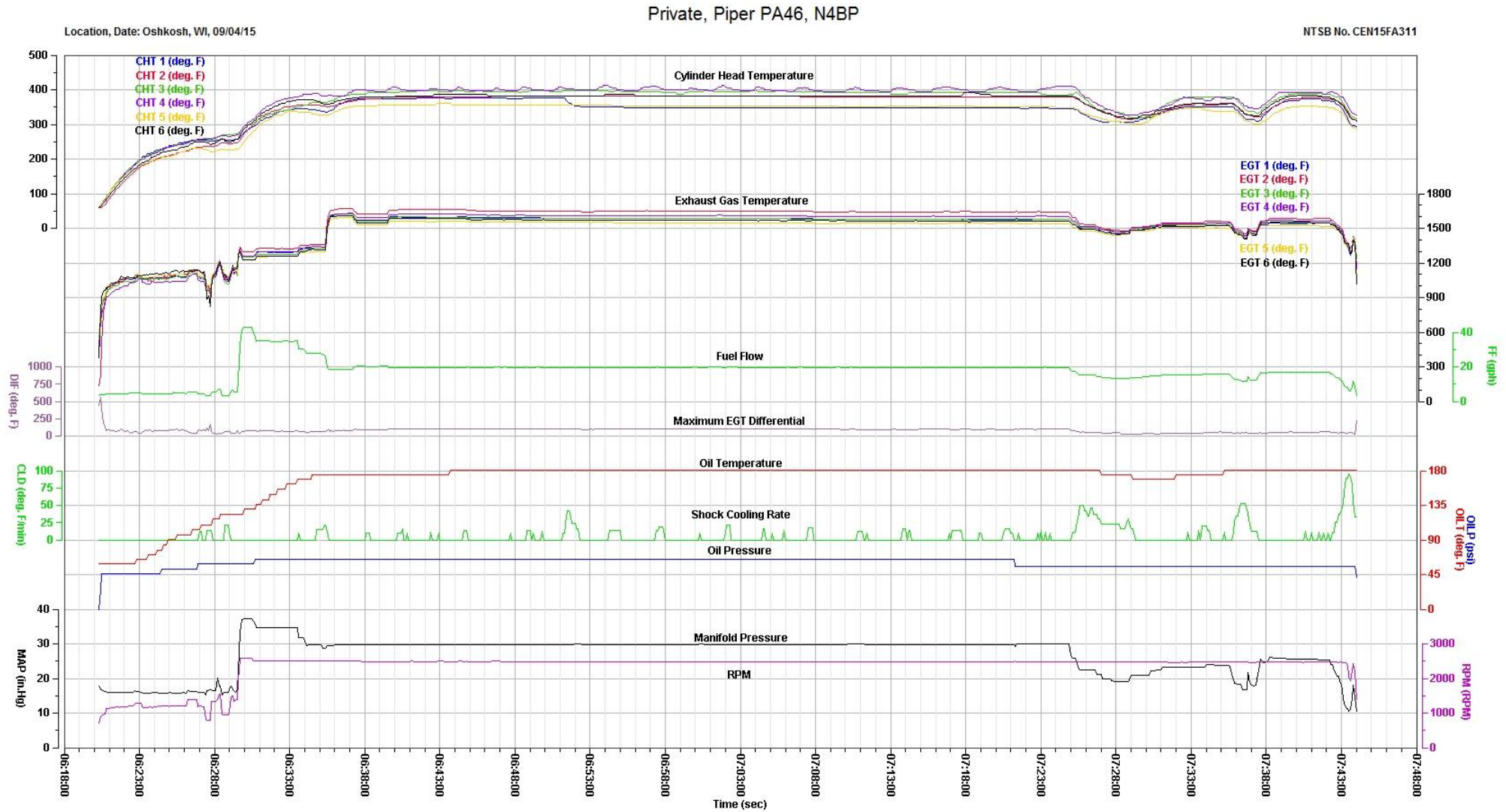
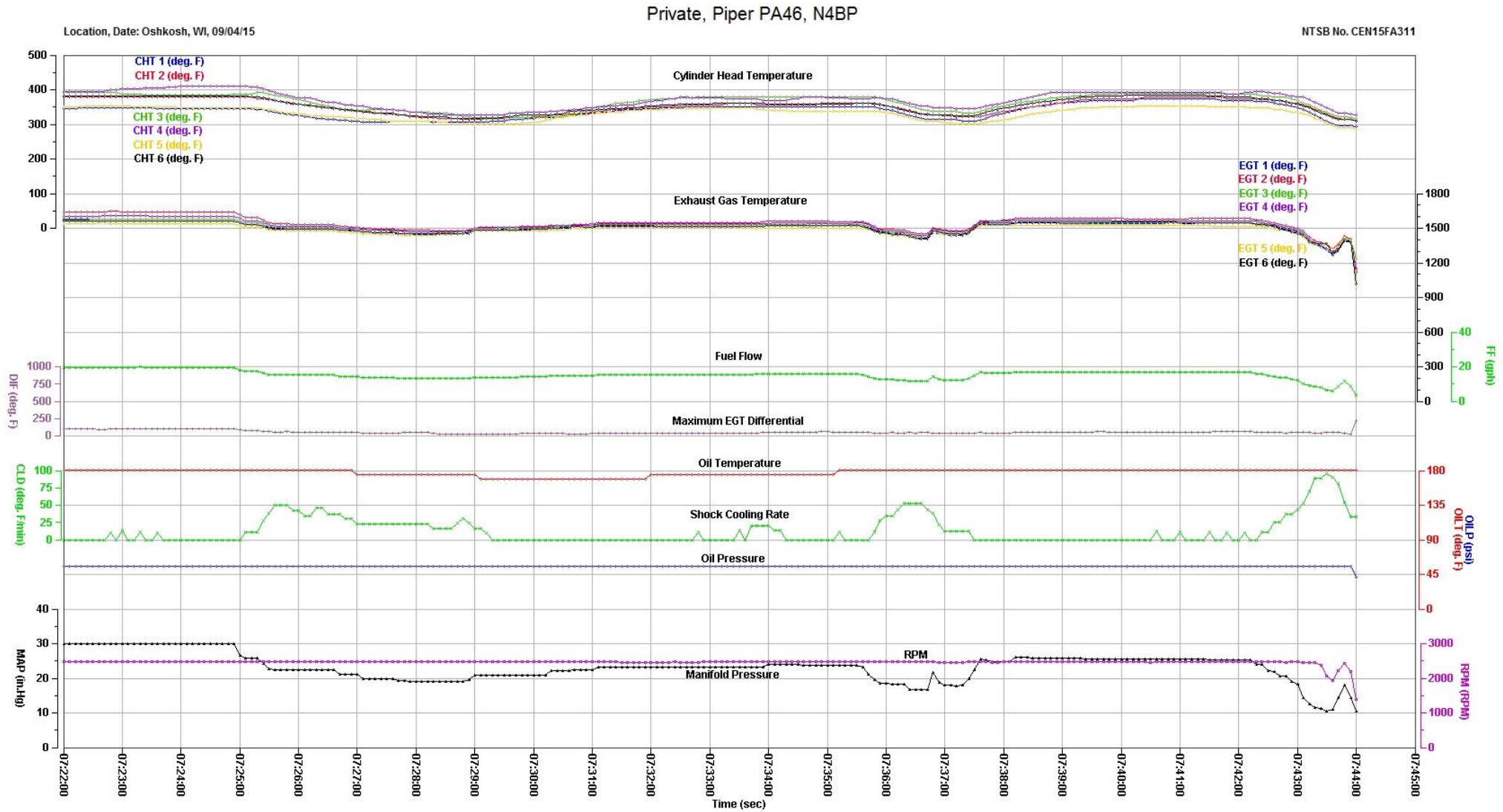


Figure 3. Plot of selected parameters recorded by the JPI EDM-930 during the final portion of the accident flight.



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
Amp (A)	Bus Amperage
Bat (V)	Battery Voltage
CHT-# (deg)	Cylinder Head Temperature Cylinder #1
EGT-# (deg)	Exhaust Gas Temperature Cylinder #1
FF (gph)	Fuel Flow
MAP (inHg)	Engine Manifold Pressure
OILP (psi)	Engine Oil Pressure
OILT (deg)	Engine Oil Temperature
RPM (rpm)	Engine Tachometer
CLD (deg. F/Min.)	Cylinder Head Temperature Shock Cooling Rate

Table A-2. Unit abbreviations.

Units Abbreviation	Description
A	Amperes
Deg F/min	degrees Fahrenheit per minute
deg. F	Degrees Fahrenheit
gal	gallons
gph	gallons per hour
hrs	hours
in	inches
inHg	inches of Mercury
psi	pounds per square inch
sec	seconds
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.