

National Transportation Safety Board

Office of Research and Engineering

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ENGINE DATA MONITOR

Specialist's Factual Report

November 20, 2024

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A. ACCIDENT

Location: Exeland, Wisconsin
Date: July 28, 2024
Time: 1140 central daylight time (CDT)
Airplane: Piper PA-46-310P, N4646G

B. ENGINE DATA MONITOR SPECIALIST

Specialist Tatum Butler
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 engine data monitor:

Recorder Manufacturer/Model: J.P. Instruments EDM-900
Part Number: 790000-A-835
Recorder Serial Number: 04275

1.0 JPI EDM-900 Description

The J.P. Instruments (JPI) EDM-900 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 (RPM)
- Compressor Discharge Temperature
- Fuel Flow

- Fuel Pressure
- Fuel Level
- Carburetor Temperature
- Amperage Load
- Bus Voltage

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

The unit contains non-volatile memory for data storage of the parameters recorded and calculated.¹ The rate at which the data is stored is selectable by the operator from 1 to 500 seconds between samples. Data recording typically begins when the RPM exceeds 500 rpm. The memory can typically store over 300 hours of data at a 6 second sample rate. For an undamaged unit, the data can be downloaded by the operator using a USB flash drive and following the instructions on the unit.

1.1 JPI EDM-900 Data Recovery

The EDM-900 was in good condition, as shown in Figure 1. The device powered on normally and data were downloaded and converted to engineering units using the manufacturer's software.



Figure 1. Front and back of the JPI EDM-900 as received.

¹ Non-volatile memory (NVM) is semiconductor memory that does not require external power for data retention.

1.2 JPI EDM-900 Data Description

The recovered data included 29 sessions recorded from March 22, 2024, to July 28, 2024. The last session, recorded on July 28, 2024, was determined to be the recording of the accident flight. The GPS data from this session matched the expected start and end locations of the accident flight. Conversion of the EDM-900 data from the raw recorded information to engineering units was performed using the manufacturer's software. The unit's internal clock, which is set and updated by the operator, was found to be about 3 hours ahead of Central Daylight Time (CDT). This recorded time was not referenced back to a verified standard time and is therefore referred to as the "Device Time" for the remainder of the report. Data were sampled once per second. Table 1 describes the EDM-900 parameters provided and verified in this report.

Table 1. Verified and provided parameters.

Parameter Name	Parameter Description
CLD (degF/min)	Shock Cooling Rate (degrees Fahrenheit per minute)
C# (degF)	Cylinder Head Temperature Cylinder # ² (degrees Fahrenheit)
Device Time	Internal Clock Time (HH:MM:SS)
E# (degF)	Exhaust Gas Temperature Cylinder # (degrees Fahrenheit)
FF (gph)	Fuel Flow (gallons per hour)
SPD (kts)	Ground Speed (knots)
HP (%)	Horsepower (percent)
LAT (deg)	Latitude (degrees)
LFL (gal)	Left Fuel Level (gallons)
LNG (deg)	Longitude (degrees)
MAP (inHg)	Manifold Pressure (inches of Mercury)
OAT (degC)	Outside Air Temperature (degrees Celsius)
OILP (psi)	Oil Pressure (pounds per square inch)
OILT (degF)	Oil Temperature (degrees Fahrenheit)
RFL (gal)	Right Fuel Level (gallons)
RPM	Engine Revolutions Per Minute
SPD (kts)	Groundspeed (knots)
T# (degF)	Turbine Inlet Temperature (degrees Fahrenheit)
USD (gal)	Fuel Used (gallons)

D. FIGURES AND TABULAR DATA

Figure 2 and Figure 3 are Google Earth overlays of the accident flight recorded on the EDM-900. The weather and lighting conditions in Google Earth do not represent the conditions present at the time of the accident flight. Figure 2 shows the ground track from departure at Lake in the Hills Airport (3CK), Lake in the Hills, IL, to

² Depending on aircraft configuration number of cylinders that are instrumented varies. In the data plots the '#' is replaced with the appropriate cylinder ID. Same applies for EGT and turbine inlet temp.

the approach at Sawyer County Airport (HYR), Hayward, WI. Also shown are periodic device time stamps and ground speeds. Figure 3 shows the end of the accident flight with associated device time stamps and ground speeds. The reported wreckage location matches that of the last recorded GPS data.

Figure 4 is a plot of parameters of the entire accident flight. The time displayed is 12:50:00 to 14:44:00 Device Time.

Figure 5 is a plot of the final 5 minutes of the accident flight. The time displayed is 14:38:15 to 14:43:15 Device Time.

The corresponding tabular data used to create the figures below are provided in CSV format as Attachment 1 to this report.

Submitted by:

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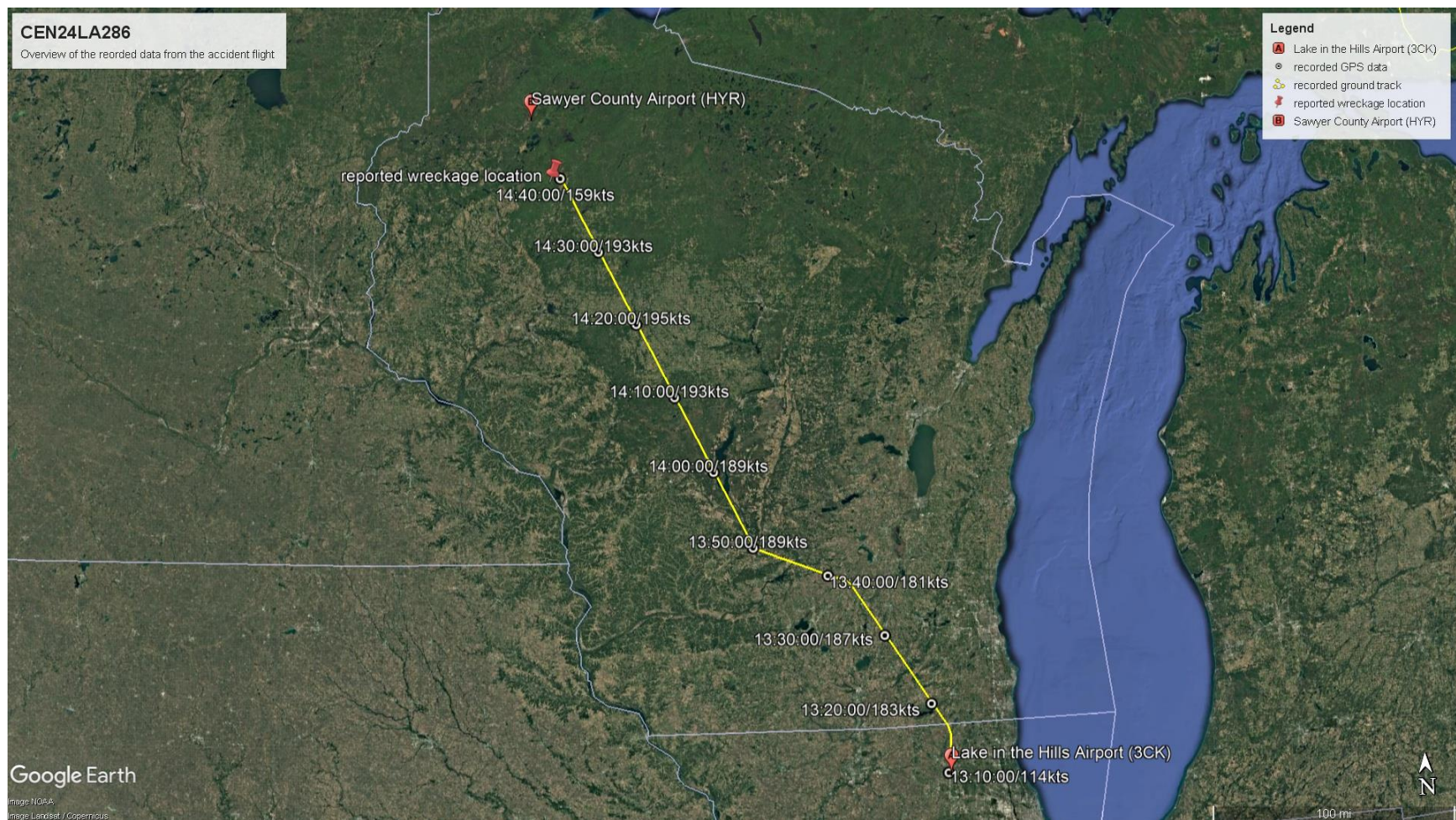
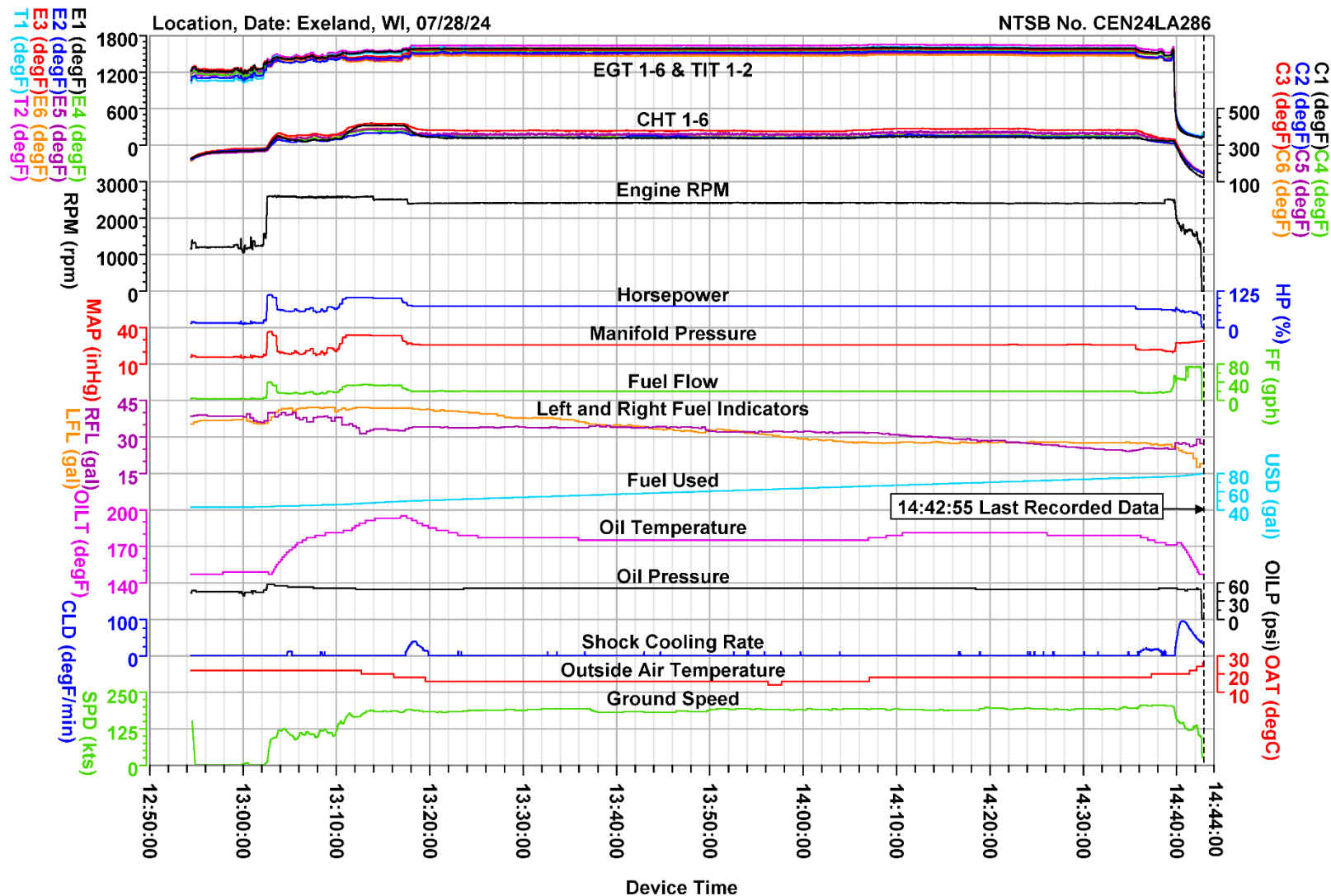


Figure 2. Google Earth overlay of the entire accident flight recorded on the EDM-900.



Figure 3. Google Earth overlay of the end of the accident flight recorded on the EDM-900.

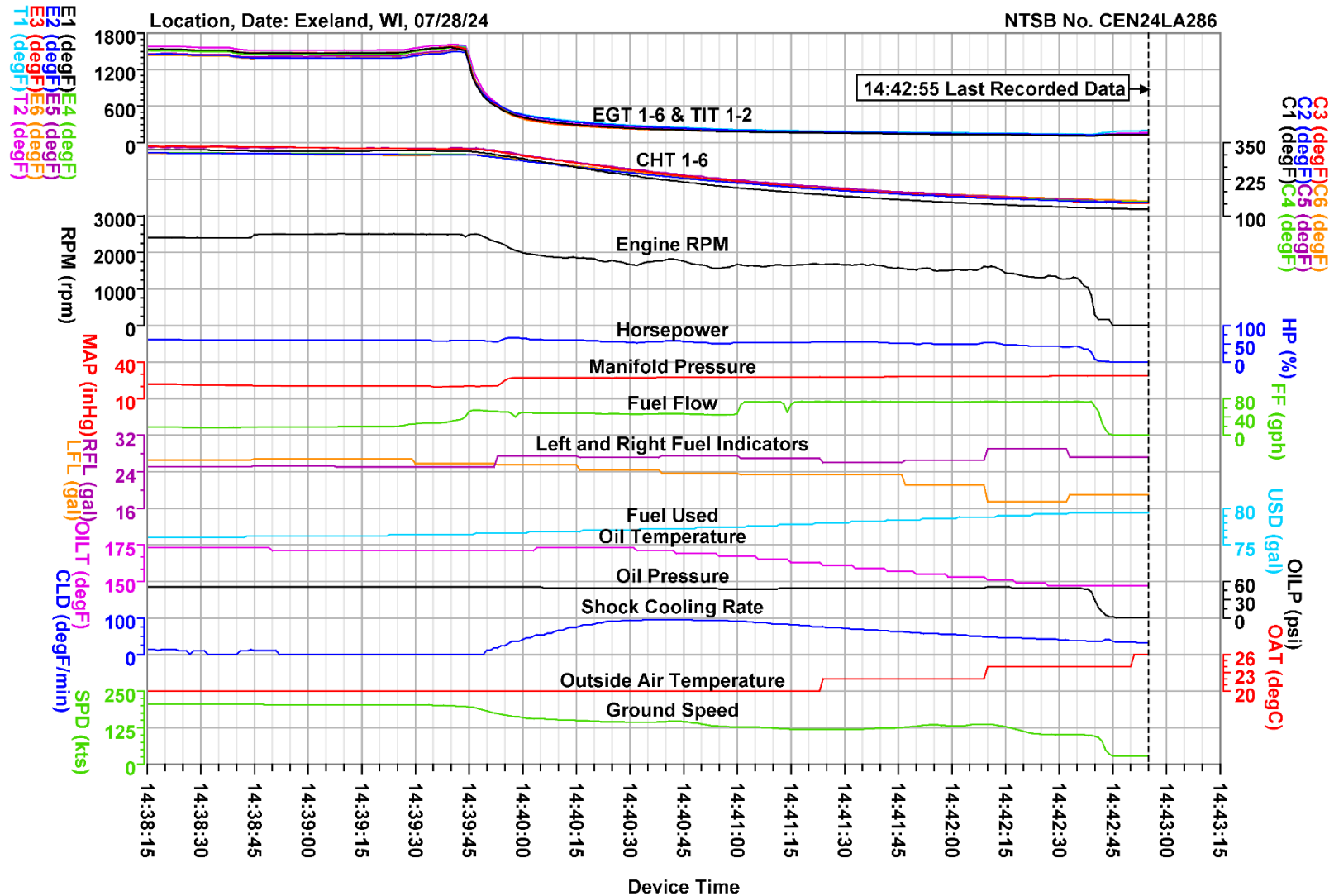
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Figure 4. Plot of parameters for the entire accident flight recorded on the EDM-900.

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Figure 5. Plot of parameters for the last 5 minutes of the accident flight recorded on the EDM-900.