

National Transportation Safety Board

Office of Research and Engineering

Washington, DC 20594



CEN24LA104

ENGINE DATA MONITOR

Specialist's Factual Report

May 13, 2024

A. ACCIDENT

Location: Cherokee, Oklahoma
Date: February 2, 2024
Time: 1042 central standard time (CST)
1642 coordinated universal time (UTC)
Airplane: Piper PA-42-260, private operator, N4284

B. ENGINE DATA MONITOR SPECIALIST

Specialist: Steven Smith
Mechanical Engineer (Recorder Specialist)
National Transportation Safety Board (NTSB)

C. DETAILS OF THE INVESTIGATION

A group was not convened. The NTSB Vehicle Recorder Division received the following engine data monitor (EDM) electronic file extracted from a JPI EDM-930:

Electronic File: U240209.JPI

1.0 EDM-930 Description

The J. P. Instruments (JPI) 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 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 2 to 500 seconds per sample. Data recording typically begins when EGTs are greater than 500 degrees Fahrenheit (degF) 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.

1.1 EDM-930 Data Recovery

The EDM-930 device was provided and downloaded by the manufacturer. The manufacturer provided the NTSB Vehicle Recorder Laboratory with an electronic file. The electronic file was run through the manufacturer's post processing tool, EzTrends, which produced an electronic comma-separated value (CSV) file containing the converted data. When loading the JPI file into EzTrends, the manufacturer's tool identified the device used to record the data as an EDM-930.

1.2 EDM-930 Data Description

When processed, the JPI file contained only 1 recording. This recording was identified as the accident flight, and its duration was approximately 56 minutes. The recording began 09:46:47 CST and the last sample was recorded at 10:42:35 CST. The data were sampled at a 6 seconds per sample rate.

1.2.1 EDM-930 Parameters Provided

Table 1 lists the EDM-930 parameters verified and provided in this report.

Table 1. EDM-930 data parameters provided.

Parameter Name (unit)	Parameter Description (unit)
ALT (ft)	Altitude MSL (feet)
BAT (VDC)	Battery Bus Voltage (volts direct current)
C# (degF)	Engine Cylinder Head Temperature # ² (degrees Fahrenheit)
DATE (mm/dd/yyyy)	Date (month/day/year)
E# (degF)	Engine Exhaust Gas Temperature # (degrees Fahrenheit)
ENG SPD (RPM)	Engine Speed (revolutions per minute)
FF (gph)	Fuel Flow (gallons per hour)
FP (psi)	Fuel Pressure (pounds per square inch)
HP (%)	Horsepower (percentage)

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

² This aircraft engine is configured with 6 cylinders. In the data plots, the '#' is replaced with the appropriate cylinder ID.

Parameter Name (unit)	Parameter Description (unit)
LAT (deg)	Latitude (degrees)
LNG (deg)	Longitude (degrees)
MAP (inHg)	Engine Manifold Pressure (inches of Mercury)
OILP (psi)	Oil Pressure (pounds per square inch)
OILT (degF)	Oil Temperature (degrees Fahrenheit)
SPD (kts)	Groundspeed (kts)
TIME (HH:MM:SS)	Time UTC (hours:minutes:seconds)

1.3 EDM-930 Time Correlation

The time recorded on the EDM-930 was not valid. The device data were correlated to the event by comparing known information, such as the Automatic Dependent Surveillance - Broadcast (ADS-B) data. An offset of -21,405 seconds was applied to the data. This offset was applied to correct for both time correlation to the accident and to change time displayed from UTC to the local time, CST. The offset was determined by correlating the altitude, latitude, and longitude data parameters from the EDM-930 to the same ADS-B data parameters.

D. FIGURES AND TABULAR DATA

Figures 1 and 2 contain JPI data recorded during the event on February 2, 2024. All the parameters listed in table 1 are plotted except DATE, TIME, LAT, and LNG. Figures 1 and 2 present time history plots of the same EDM-930 parameters for the entire accident flight and the final 5 minutes of the recording, respectively.

The data show the following:

- **09:46:47 CST:** The JPI EDM-930 powered on and began recording.
- **09:57:23 CST:** The aircraft began takeoff roll from Enid-Woodring Regional Airport, Enid, Oklahoma, (KWDG) runway 17.
- **10:00:47 CST:** Exhaust gas temperatures for all 6 cylinders (from #1 to #6) were 1466 degF, 1461 degF, 1433 degF, 1433 degF, 1429 degF, 1409 degF, respectively. For a remainder of the flight, cylinders #4 and #6 reduced and maintained an offset from the other 4 cylinders by approximately 60 degF to 100 degF.
- **10:11:35 CST:** Altitude was 6,556 ft and the groundspeed was 158 kts. The aircraft was at cruise altitude and was on a northwest course. Exhaust gas temperatures for all 6 cylinders were 1456 degF, 1471 degF, 1436 degF, 1361 degF, 1446 degF, 1366 degF, respectively.

- **10:21:23 CST:** Altitude was 6,666 ft and the groundspeed was 137 kts. The aircraft began to descend. Exhaust gas temperatures for all 6 cylinders were 1418 degF, 1411 degF, 1398 degF, 1302 degF, 1377 degF, 1297 degF, respectively.
- **10:28:29 CST:** The aircraft leveled off at an altitude 2,200 ft.
- **10:32:17 CST:** Exhaust gas temperature for cylinder #5 began to reduce from 1421 degF. Cylinder #5 began following the pattern of cylinders #4 and #6.
- **10:37:35 CST:** Altitude was 2,421 ft and groundspeed was 133 kts. Exhaust gas temperatures for all 6 cylinders were 1392 degF, 1379 degF, 1346 degF, 1381 degF, 1381 degF, 1364 degF, respectively.
- **10:38:05 CST:** Altitude was 2,333 ft and groundspeed was 124 kts. Exhaust gas temperatures for all 6 cylinders were 1422 degF, 1369 degF, 1374 degF, 1188 degF, 1347 degF, 1248 degF, respectively. Cylinders #4 through #6 significantly reduced from the other 3 cylinders' temperatures.
- **10:41:47 CST:** Altitude was 1464 ft and groundspeed was 87 kts. Exhaust gas temperatures for all 6 cylinders were 1083 degF, 1323 degF, 857 degF, 263 degF, 200 degF, 185 degF, respectively.
- **10:42:17 CST:** The last recorded ADS-B data point.
- **10:42:35 CST:** The last recorded JPI EDM-930 data point.

The corresponding tabular data used to create figures 1 and 2, including DATE, TIME, LAT, and LNG, are provided in CSV format as attachment 1 to this report.

Figures 3 and 4 are graphical overlays derived from the ADS-B data and generated using Google Earth presenting the entire accident flight from KWDG and the final 6.25 minutes of the recorded data, respectively. Weather and lighting conditions in Google Earth are not necessarily the weather and lighting conditions present at the time of the recording.

The corresponding tabular data used to create figures 3 and 4 are provided in CSV format as attachment 2 to this report.

Submitted by:

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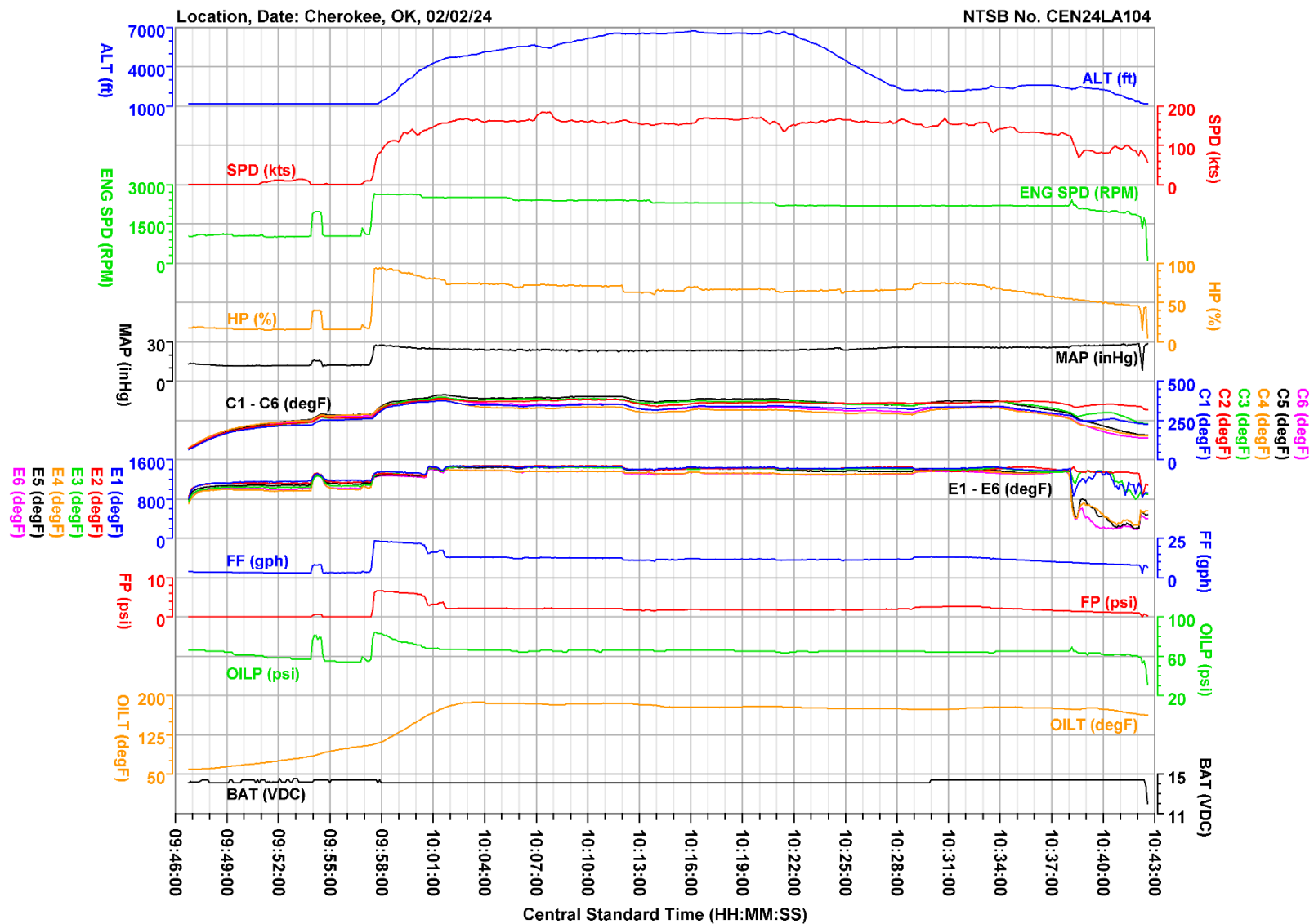


Figure 1. Time history plot of JPI parameters for the entire flight.

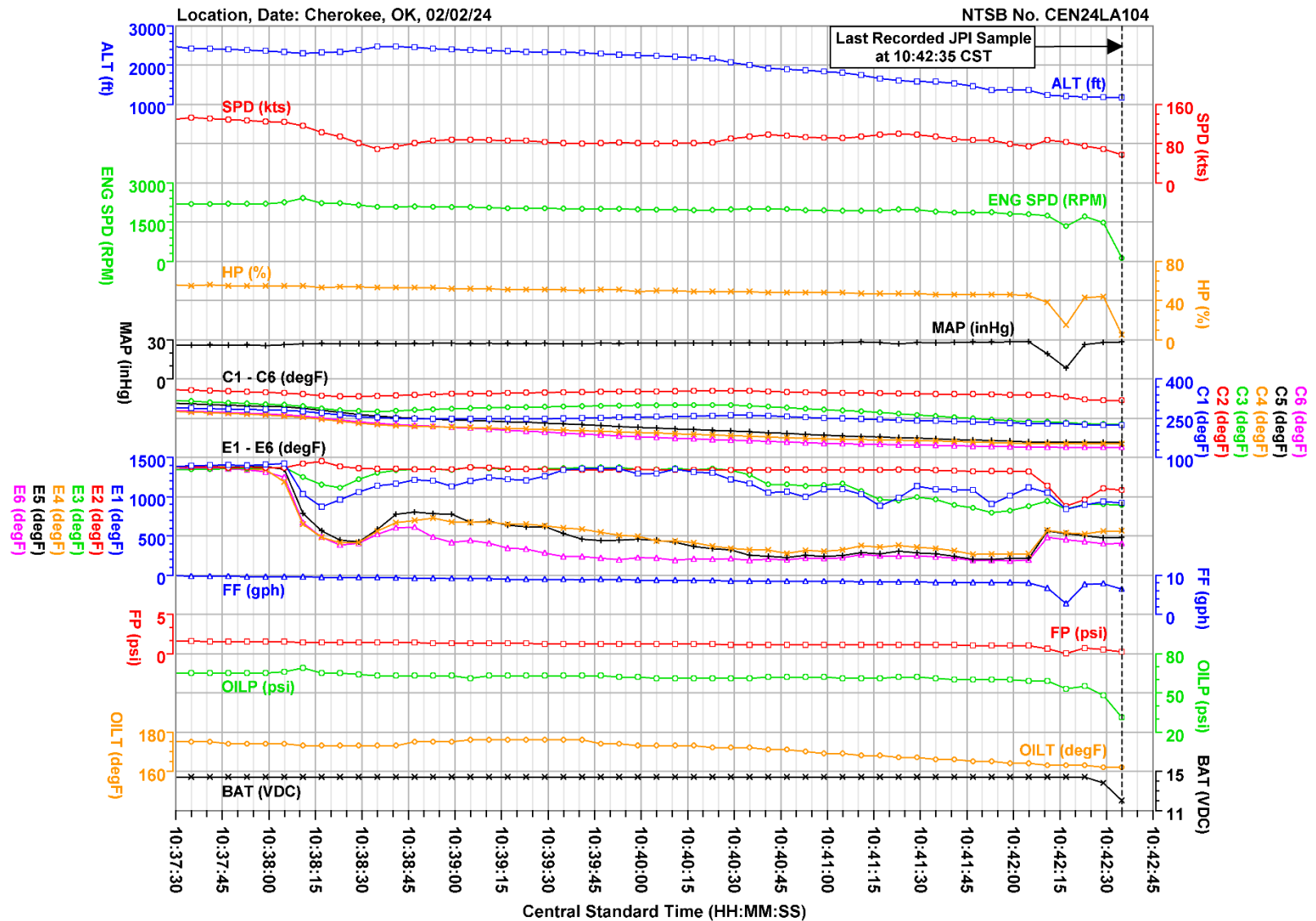


Figure 2. Time history plot of JPI parameters for the final 5 minutes of the recording.

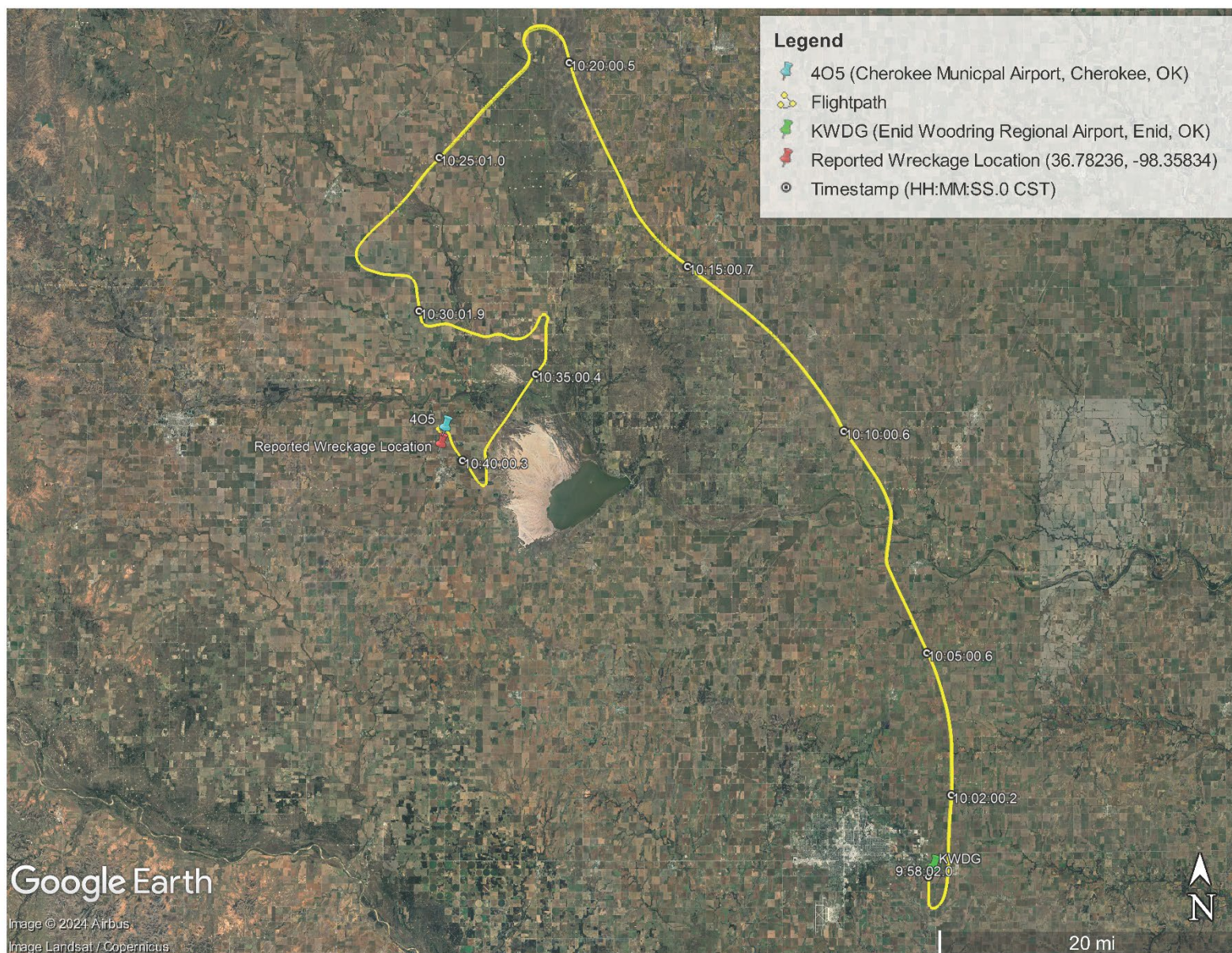


Figure 3. Google Earth overlay of the entire accident flight.

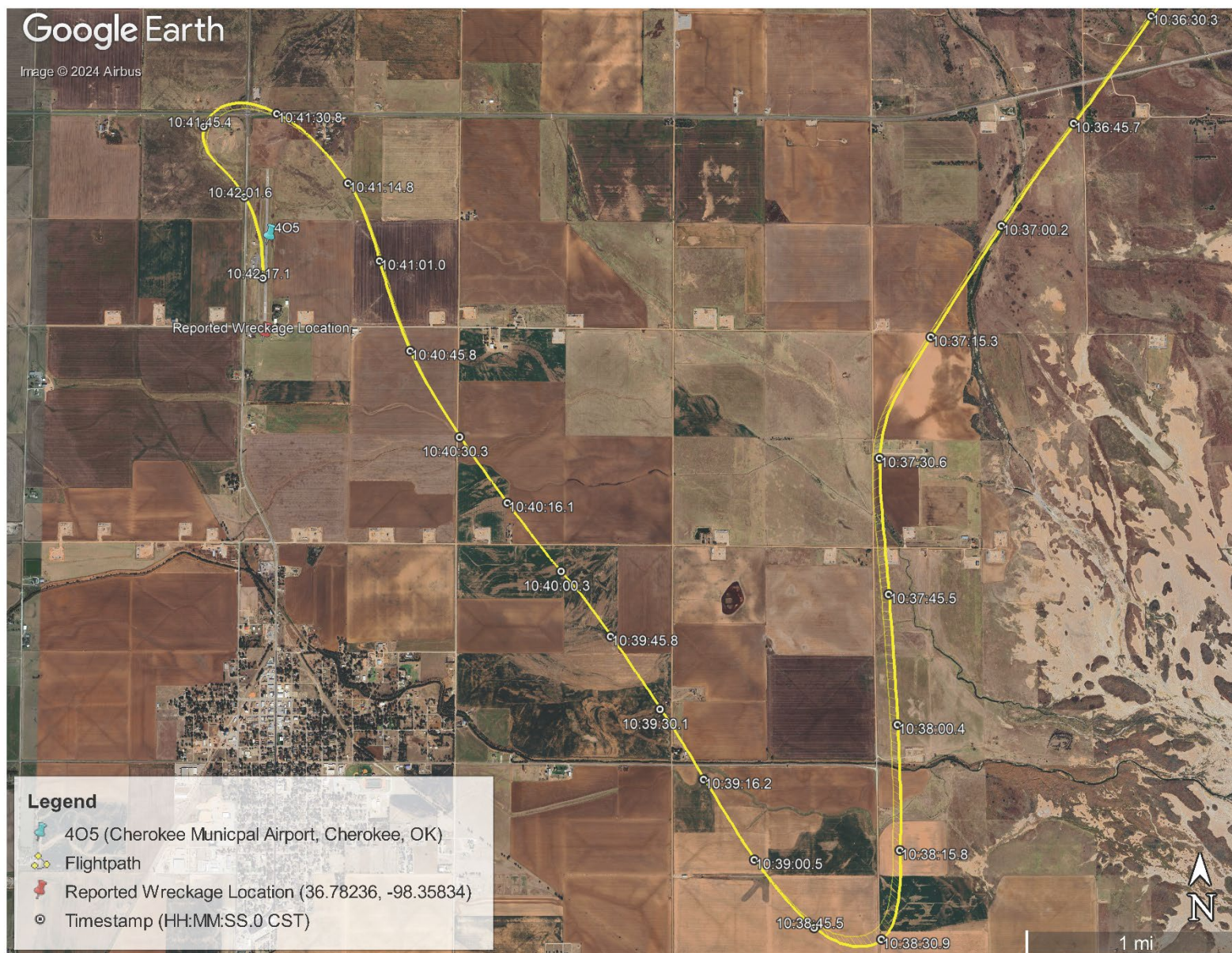


Figure 4. Google Earth overlay of the final 6.25 minutes of the recording.