

National Transportation Safety Board

Office of Research and Engineering

Washington, DC 20594



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ELECTRONIC DEVICES

Specialist's Factual Report

October 21, 2024

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A. ACCIDENT

Location: Selden, Kansas
Date: June 30, 2024
Time: 1752 central daylight time (CDT)
2252 coordinated universal time (UTC)
Airplane: Waco YKC, NS14137

B. ELECTRONIC DEVICES SPECIALIST

Specialist: Gerald Kawamoto
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 electronic devices:

Device Manufacturer/Model:	Appareo Stratus 3
Device Serial Number:	Unknown
Device Manufacturer/Model:	JPI EDM-700/800
Device Serial Number:	Unknown
Device Manufacturer/Model:	Garmin GPSMAP 496
Device Serial Number:	Unknown

1.0 Appareo Stratus 3 Description

The Appareo Stratus 3 device is a self-contained battery-powered unit that contains an internal AHRS, GPS/WAAS receiver, and ADS-B receiver in one compact unit.^{1, 2, 3} The unit communicates wirelessly with compatible devices to display all the

¹ The Attitude Heading Reference System (AHRS) consists of a set of 3-axis gyroscope, accelerometers and heading reference sensors that enable the unit to compute pitch, roll, and yaw motions.

² The Wide Area Augmentation System (WAAS) is an air navigation aid to augment the Global Positioning System (GPS), by improving its accuracy, integrity, and availability.

³ Automatic Dependent Surveillance-Broadcast (ADS-B) is a surveillance technology deployed throughout the national airspace system. The ADS-B system is composed of aircraft avionics and a ground infrastructure. Onboard avionics determine the position of the aircraft by using the GPS and transmit its position along with additional information about the aircraft to ground stations for use by air traffic control (ATC) and other ADS-B services. This information is transmitted at a rate of approximately once per second. Operators equipped with ADS-B realize additional benefits from ADS-B broadcast services: Traffic Information Service - Broadcast (TIS-B) (traffic information) and Flight Information Service - Broadcast (FIS-B) (weather information).

acquired information. In addition to communicating with compatible devices, the Stratus device records GPS position and AHRS information internally on a non-volatile flash memory chip.⁴

1.1 Appareo Stratus 3 Data Recovery

Upon arrival at the Vehicle Recorder Division, an external examination revealed the device had sustained extensive structural damage. The circuit board containing the NVM chip (highlighted in the red rectangle) is shown in Figure 1. The NVM chip was removed, read out and converted to engineering units using laboratory tools.

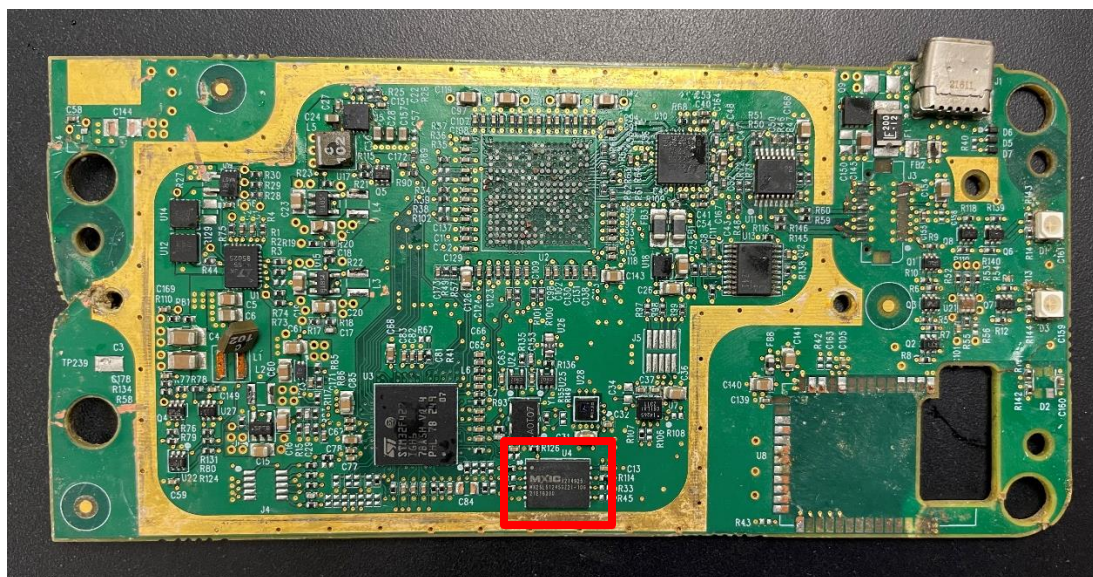


Figure 1. Appareo Stratus 3 circuit board. The NVM chip is shown in the red rectangle.

1.2 Appareo Stratus 3 Recording Description

The recorded data included data recorded on June 2, 2024, and June 30, 2024. Data recorded on June 30, 2024, contained incomplete flight segments from the date of the accident, however, the flight leg of the accident ending near Selden, Kansas was not recorded. The final segment recovered started at 18:45:09 UTC at Chillicothe Municipal Airport (CHT) Chillicothe, Missouri and ended at 18:56:41.4 UTC with the last GPS data point at 39°46'52.9"N 93°53'19.7"W.

2.0 JPI EDM-700/800

The J. P. Instruments (JPI) 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:

⁴ Non-volatile memory (NVM) is semiconductor memory that does not require external power for data retention.

- 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 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.

2.1 JPI EDM-700/800 Data Recovery

Upon arrival at the Vehicle Recorder Division, an external examination revealed the device had sustained extensive structural damage. The circuit board containing the NVM chips (highlighted in the red rectangle) is shown in Figure 2. Three of four of the chips were present. The fourth chip appeared to have dislodged from the board due to damage sustained and was not recovered with the wreckage. The NVM chips were removed, read out and converted to engineering units using laboratory tools.

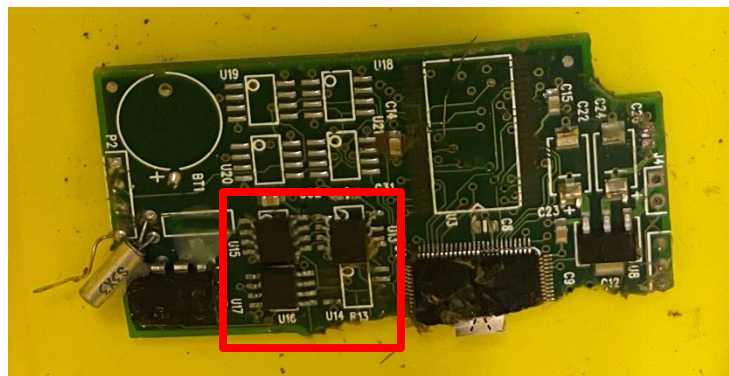


Figure 2. JPI EDM-700/800 circuit board. The NVM chips are shown in the red rectangle.

2.2 JPI EDM-700/800 Data Description

One session dated July 1, 2024, was recovered. The session started at 00:06:48 recorded time and ended at 1:08:54 recorded time. Date and time in the device are set by the operator and due to the condition of the device, it was not possible to correlate the recorded time to a standard time. The device recorded at a 6 second-per-sample rate. The engineering unit conversions used for the data contained in this report are based on documentation from the manufacturer of the JPI EDM-700/800. Table 1 describes the JPI EDM-700/800 parameters provided and verified in this report.

Table 1. Verified and provided JPI EDM-700/800 parameters.

Parameter Name (units)	Parameter Description (units)
CHT# (degF)	Cylinder Head Temperature (degrees Fahrenheit)
CLD (degF/min)	Shock Cooling Rate (degrees Fahrenheit per minute)
EGT# (degF)	Exhaust Gas Temperature (degrees Fahrenheit)
FF (gph)	Fuel Flow (gallons per hour)
OILT (degF)	Oil Temperature (degrees Fahrenheit)
USD (gal)	Fuel Used (gallons)
VOLTS (V)	Battery Voltage (volts)

3.0 Garmin GPSMAP 496

The Garmin GPSMAP 496 is a battery-powered portable 12-channel GPS receiver with a 256-color thin-film transistor (TFT) liquid-crystal display (LCD) display screen. The unit includes a built-in Jeppesen database and is capable of receiving XM satellite radio for flight information including NEXRAD radar, lightning, Meteorological Aerodrome Reports (METARs), Terminal Aerodrome Forecasts (TAFs), and Temporary Flight Restrictions (TFRs). A built-in Aircraft Owners and Pilots Association (AOPA) Airport Directory and SafeTaxi Airport Diagrams are included for selected fields.

The unit stores date, route-of-flight, and flight-time information for up to 50 flights. A flight record is triggered when groundspeed exceeds 30 knots and altitude exceeds 250 feet. The flight record ends when groundspeed drops below 30 knots for 10 minutes or more. A detailed track log, including latitude, longitude, date, time, and GPS altitude information is stored within the unit whenever the receiver has a lock on the GPS navigation signal. Position is updated within the track log as a function of time or distance moved, depending on how the unit has been configured.

Once the current track log memory becomes full, new information either overwrites the oldest information or the recording stops, depending on how the unit is configured. The current track log can be saved to long-term memory and 15 saved track logs can be maintained in addition to the current tracklog. Track log storage may be activated or de-activated at user discretion. All recorded data is stored in non-volatile memory. The unit contains hardware and software permitting the download of recorded waypoint, route, and track log information to a PC via a built-in

serial port. An internal button-battery is used to back-up power to the internal memory and real-time clock during those periods when main power is removed.

3.1 Garmin GPSMAP 496 Data Recovery

Upon arrival at the Vehicle Recorder Division, an external examination revealed the device had sustained extensive structural damage. An examination of the circuit board, as shown in Figure 3, revealed the NVM chip had dislodged from the board, thus no data were recovered.

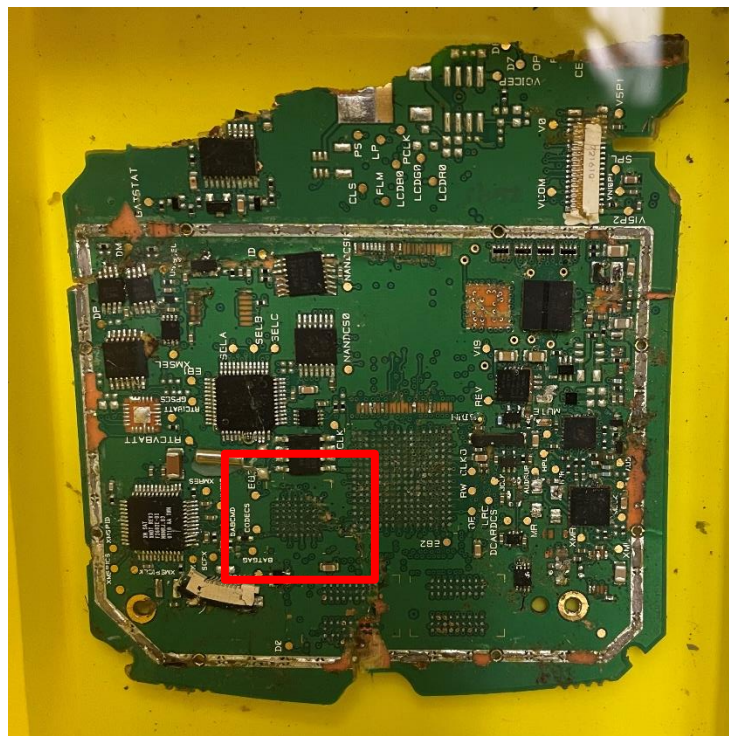


Figure 3. Garmin GPSMAP circuit board. The location of the dislodged memory chip is shown in a red rectangle.

D. FIGURES AND TABULAR DATA

Figure 4 shows a plot of JPI EDM-700/800 parameters recorded during a session dated on July 1, 2024, recorded time.

The corresponding tabular data used to create Figure 4 is provided in electronic comma-separated value (CSV) format as attachment 1 to this report

Submitted by:

Gerald Kawamoto
Recorder Specialist

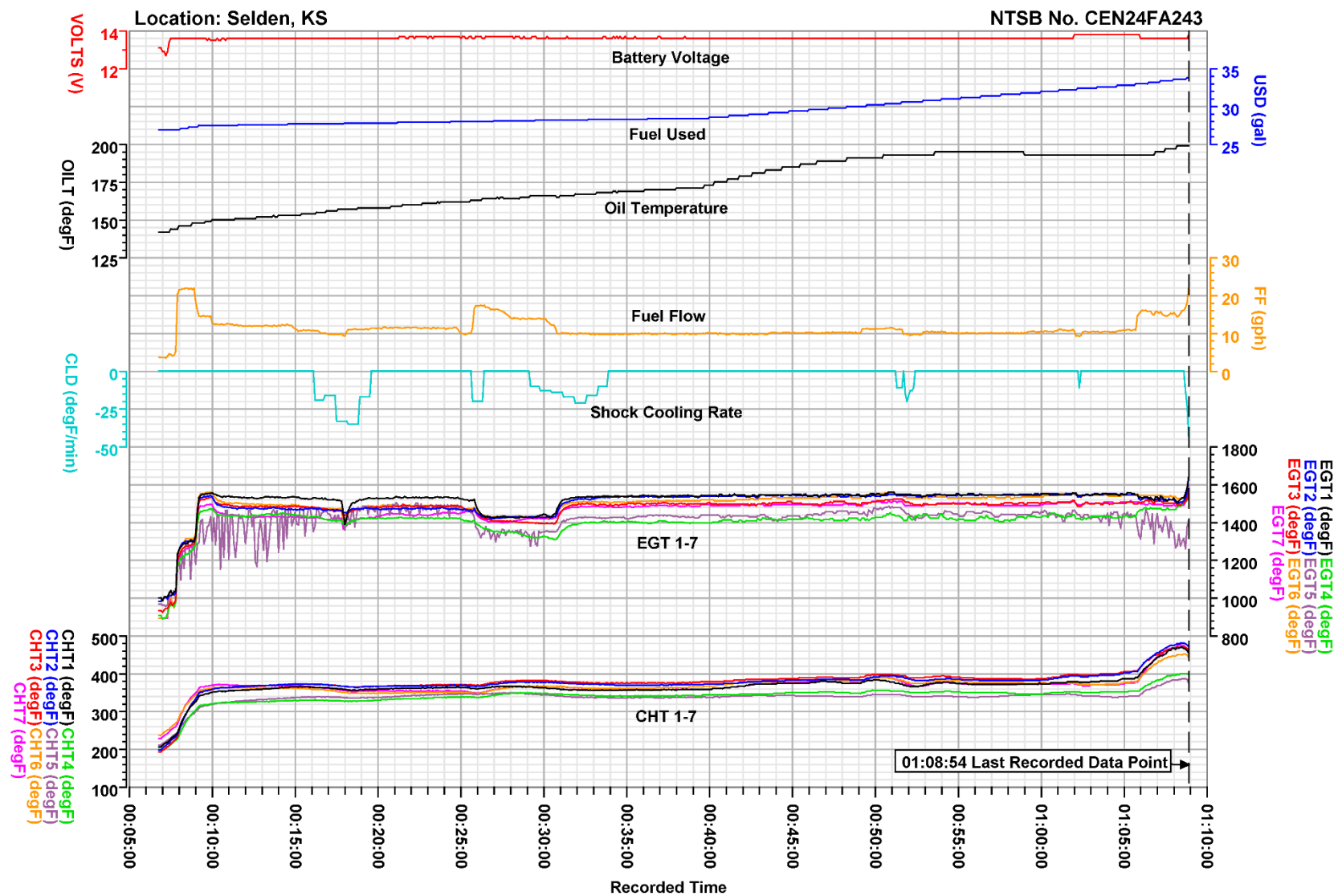


Figure 4. Plot of parameters from a flight recorded on the JPI EDM 700/800 on July 1, 2024, recorded time.