

National Transportation Safety Board

Office of Research and Engineering

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CEN24FA028

ELECTRONIC DEVICES

Specialist's Factual Report

November 1, 2024

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A. ACCIDENT

Location: McCook, Nebraska
Date: October 30, 2023
Time: 1200 central daylight time (CDT)
1700 coordinated universal time (UTC)
Airplane: Piper PA 46-350P, private operator, N510KC

B. ELECTRONIC DEVICES 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 electronic devices:

Recorder Manufacturer/Model: Garmin GDU 620
Part Number: 011-01264-50
Recorder Serial Number: 165205027

Recorder Manufacturer/Model: Electronics International MVP-50T
Part Number: MVP-50T-RE-21
Recorder Serial Number: 183296

Recorder Manufacturer/Model: Electronics International EDC-33T
Part Number: EDC-33T
Recorder Serial Number: 183297

Recorder Manufacturer/Model: Electronics International DPIM-1S
Part Number: Unknown
Recorder Serial Number: 183301

Recorder Manufacturer/Model: L-3 Lynx PED Interface Module PIM-9000
Part Number: 9230-17005-01
Recorder Serial Number: 00000732

1.0 Garmin GDU 620 Description

The Garmin GDU 620 has dual VGA (620 x 480 pixels) 6.5-inch LCD displays. The left side of the GDU 620 is the primary flight display (PFD) and the right side is

the multi-function display (MFD). The MFD shows a moving map, flight plan, weather, and other supplemental data. The PFD shows primary flight information, in place of traditional pitot-static and gyroscopic systems and provides a horizontal situation indicator (HSI) for navigation.

1.1 Garmin GDU 620 Data Recovery

The Garmin GDU 620 does not record or store any non-volatile memory (NVM).¹ Therefore, no data were recovered from this device. The device, as received by the NTSB Vehicle Recorder Laboratory, is shown in figure 1.



Figure 1. Garmin GDU 620 as received by the NTSB Vehicle Recorder Laboratory.

2.0 Electronics International MVP-50T Description

The EI (Electronics International Inc.) MVP-50T is a panel-mounted, color, electronic engine display allowing the operator to monitor and record parameters related to turboprop engine operations and user customizable parameters. Depending on the installation, parameters monitored may include: engine power, fuel flow, fuel levels, oil pressure and temperature, outside air temperature, and battery voltage and amperage. User customizable parameters may be defined by installation, examples include but are not limited to sensors for door states, annunciators, and flight control positions.

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

The unit contains NVM for data storage of the parameters recorded and calculated. The rate at which the data is stored is selectable by the operator. The recording function also records minimum and maximum values for each flight. The data is stored in engineering units in comma-separated value (CSV) format on an internal microSD card, using a Linux file system format. The data can be downloaded to a USB memory device via a USB port on the front of the unit or by removing the internal microSD card. Each set of recorded data is grouped by power cycle and identified by an MVP-50T assigned sequential flight number.

2.1 EI MVP-50T Data Recovery

Upon arrival at the NTSB Vehicle Recorder Laboratory, an initial attempt to power on the device by applying 12 VDC failed. The device was taken apart and the internal microSD card was found to be in good condition and was downloaded via commercially available data forensics software. The device, as received by the NTSB Vehicle Recorder Laboratory, is shown in figure 2.



Figure 2. EI MVP-50T as received by the NTSB Vehicle Recorder Laboratory.

2.2 EI MVP-50T Data Description

The data extracted included 1598 files from August 31, 2016, through October 30, 2023. The accident flight was recorded starting at 11:52:00 CDT and ending at 12:01:23 CDT on October 30, 2023. The distance between the last recorded sample at 12:01:23 CDT and the reported wreckage location was approximately 2,004 feet.

2.3 EI MVP-50T Parameters Provided

Table 1 describes data parameters verified and provided in this report. Since the EI MVP-50T was linked via a global positioning system (GPS), parameters such as Latitude, Longitude, Time, and GPS Altitude were recorded.

Table 1. EI MVP-50T data parameters provided.

Parameter Name (unit)	Parameter Description (unit)
AIRSPD (kts)	Indicated Airspeed (kts)
AMPS (A)	Battery System Current (amps)
Date (MM/DD/YYYY)	Date for recorded data point (Month/Day/Year)
F.Flow (gph)	Fuel Flow (gallons per hour)
FUEL P (psi)	Fuel Pressure (pounds per square inch)
GPS ALT (ft)	Global Positioning System Altitude (feet)
ITT (degC)	Interstage Turbine Temperature (degrees Celsius)
Latitude (deg)	Global Positioning System Latitude (degrees)
Longitude (deg)	Global Positioning System Longitude (degrees)
MSTR WARN	Master Warning
NG (%)	Gas Generator Rotation Speed Indication (percentage)
NP (RPM)	Propeller Rotation Speed Indication (rotations per minute)
OIL P (psi)	Oil Pressure (pounds per square inch)
OIL T (degF)	Oil Temperature (degrees Fahrenheit)
Time (HH:MM:SS)	Time (CDT) for recorded data point (Hours:Minutes:Seconds)
TORQ (ft-lbs)	Engine Torque (foot-pounds)
TRACK (deg)	Global Positioning System Magnetic Ground Track (degrees)
VSI (fpm)	Vertical Speed (feet per minute)
VOLTS (V)	Battery System Voltage (volts)

2.4 EI MVP-50T Time Correlation

The data recorded by the EI MVP-50T was in local time, CDT. However, this time was user input, as opposed to GPS time. An attempt to power on the device and compare the device's elapsed time to GPS time failed, as the unit was unable to be powered on. Therefore, no correlation of the recorded data from device time to GPS time was established. For the remainder of the report, all times displayed are in the device's elapsed time (DET).

3.0 Electronics International EDC-33T Description

The EI EDC-33 (Engine Data Converter) is sometimes referred to as a data acquisition unit (DAU) and has a broad range of applications. Its main purpose is to

monitor the probes, transducers, and sensors mounted on the engine and airframe. It then processes this data and outputs it on a serial bus. This allows a display unit or MFD to display the data without having to perform the intense processing required in a set timeframe. Also, annunciators and status switches can be monitored.

The EDC-33 can be used on piston, turboprop, or jet aircraft as well as helicopters. The accident aircraft was a turboprop, which designates the unit as an EDC-33T.

3.1 EI EDC-33T Data Recovery

The EI EDC-33T does not record or store any NVM. Therefore, no data were recovered from this device. The device, as received by the NTSB Vehicle Recorder Laboratory, is shown in figure 3.



Figure 3. EI EDC-33T as received by the NTSB Vehicle Recorder Laboratory.

4.0 Electronics International DPIM-1S Description

The EI DPIM-1S is a fuel pressure differential module, for aircraft that measure fuel pressure in reference to the upper deck.

4.1 EI DPIM-1S Data Recovery

The EI DPIM-1S does not record or store any NVM. Therefore, no data were recovered from this device. The device, as received by the NTSB Vehicle Recorder Laboratory, is shown in figure 4.



Figure 4. EI DPIM-1S as received by the NTSB Vehicle Recorder Laboratory.

5.0 L-3 Lynx PED Interface Module PIM-9000 Description

The L-3 Lynx PED Interface Module, model PIM-9000, is a wifi interface module that allows wireless connectivity to tablet flight applications for the Lynx NGT-9000 panel and remote mount, mode S transponder.

5.1 L-3 Lynx PED Interface Module PIM-9000 Data Recovery

The L-3 Lynx PED Interface Module, model PIM-9000, does not record or store any NVM. Therefore, no data were recovered from this device. The device, as received by the NTSB Vehicle Recorder Laboratory, is shown in figure 5.



Figure 5. L-3 Lynx PED Interface Module PIM-9000 as received by the NTSB Vehicle Recorder Laboratory.

D. FIGURES AND TABULAR DATA

Figures 6 to 9 contain EI MVP-50T data recorded during the event on October 30, 2023. All the parameters listed in table 1 are plotted except Time Hours, Time Minutes, and Time Seconds.

Figures 6 and 7 are time history plots presenting the entire EI MVP-50T recording and the takeoff roll through the end of the recording, respectively.

Figure 8 is a time history plot of additional EI MVP-50T parameters for the takeoff roll through the end of the recording.

Figure 9 is a graphical overlay derived from the EI MVP-50T data and generated using Google Earth presenting the entire accident flight from McCook Ben Nelson Regional Airport (KMCK) in McCook, Nebraska. Weather and lighting conditions in Google Earth are not necessarily the weather and lighting conditions present at the time of the recording.

The electronic device data indicated the following sequence of events:

- **11:51:53 DET:** The device was powered on, but no GPS data was available.
- **11:55:57 DET:** GPS data became available and the aircraft position was north of runway 12-30 on taxiway B.
- **12:00:33 DET:** The aircraft was positioned at the end of runway 22.
- **12:00:43 DET:** NG and fuel flow increased, and were 79.6% and 30.5 gph, respectively, consistent with takeoff roll. NP leveled off at 2180 RPM. Airspeed was 31 kts.

- **12:00:57 DET:** Engine torque reached a peak of 1090 ft-lbs. Fuel Flow peaked at 47.7 gph. NP remained constant at 2180 RPM. Airspeed was 70 kts and GPS Altitude was 2,553² ft, indicating the aircraft was still on the ground.
- **12:00:59 DET:** NG peaked at 92.7%.
- **Between 12:01:03 DET and 12:01:07 DET:** VSI indicated a descent of -436 fpm followed by a climb of 706 fpm, and GPS altitude increased from 2,559 ft to 2,595 ft, consistent with rotation. Torque, fuel flow, and NG continued to decrease.
- **12:01:08 DET:** NG, NP, engine torque, and fuel flow were 86.0%, 2170 RPM, 700 ft-lbs, and 36.6 gph, respectively. Airspeed was 88 kts.
- **12:01:14 DET:** Airspeed remained approximately constant at 88 kts. Vertical speed was 555 fpm and GPS altitude was 2,659 ft. NG, NP, engine torque, and fuel flow were 83.8%, 2170 RPM, 540 ft-lbs, and 31.8 gph, respectively.
- **12:01:23 DET:** The last recorded EI MVP-50T data point. NG, NP, engine torque, and fuel flow were 78.6%, 2170 RPM, 290 ft-lbs, and 25.3 gph, respectively. GPS altitude was 2,725 ft.

The corresponding tabular data used to create figures 6 to 9, including Time Hours, Time Minutes, and Time Seconds, are provided in electronic CSV format as attachment 1 to this report.

Submitted by:

Steven Smith
Mechanical Engineer (Recorder Specialist)

² Field Elevation at KMCK is 2,582 ft. Elevation at the end of runway 22 is 2,555.6 ft.

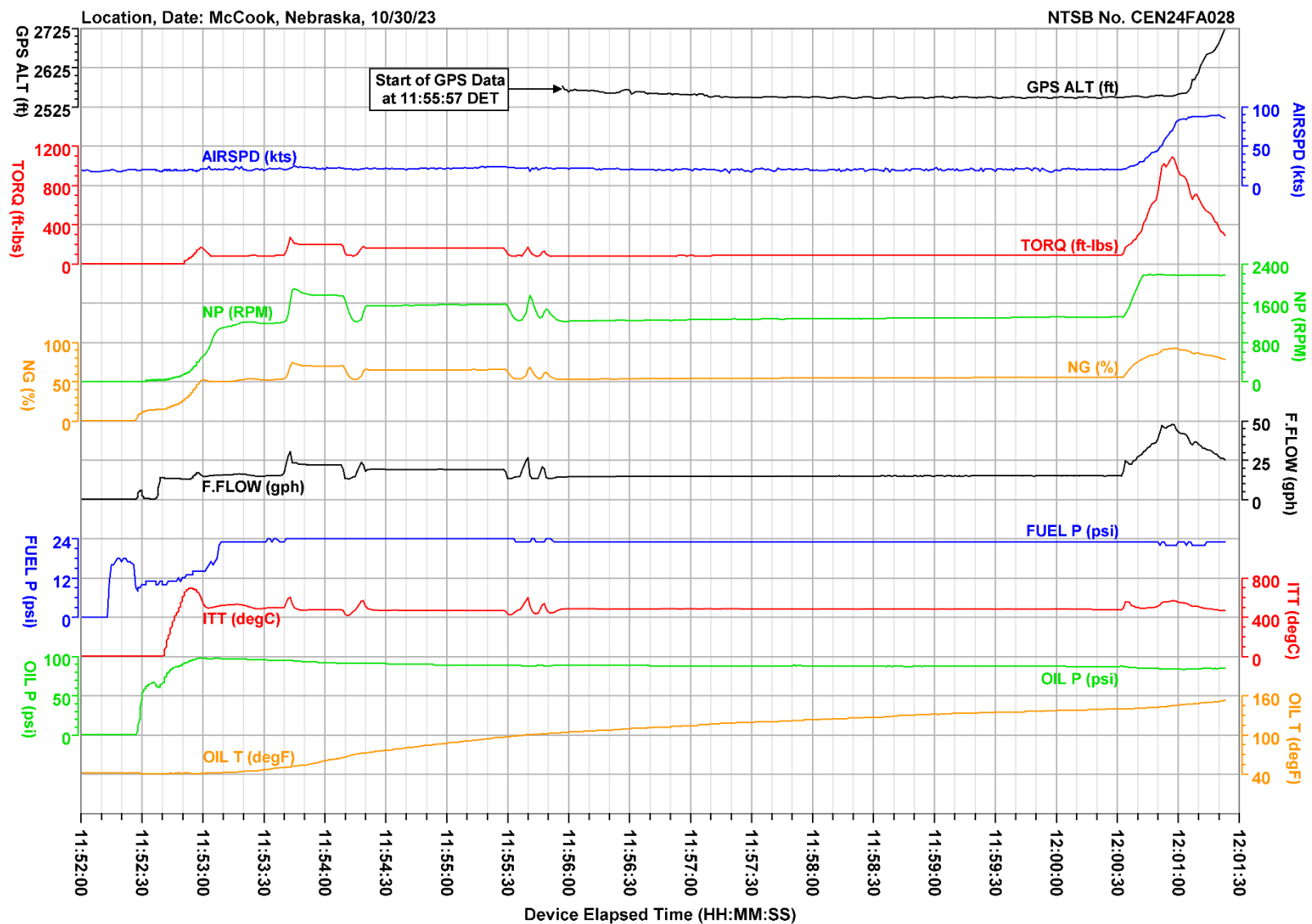


Figure 6. Time history plot of entire recording from 11:52:00 DET to 12:01:30 DET.

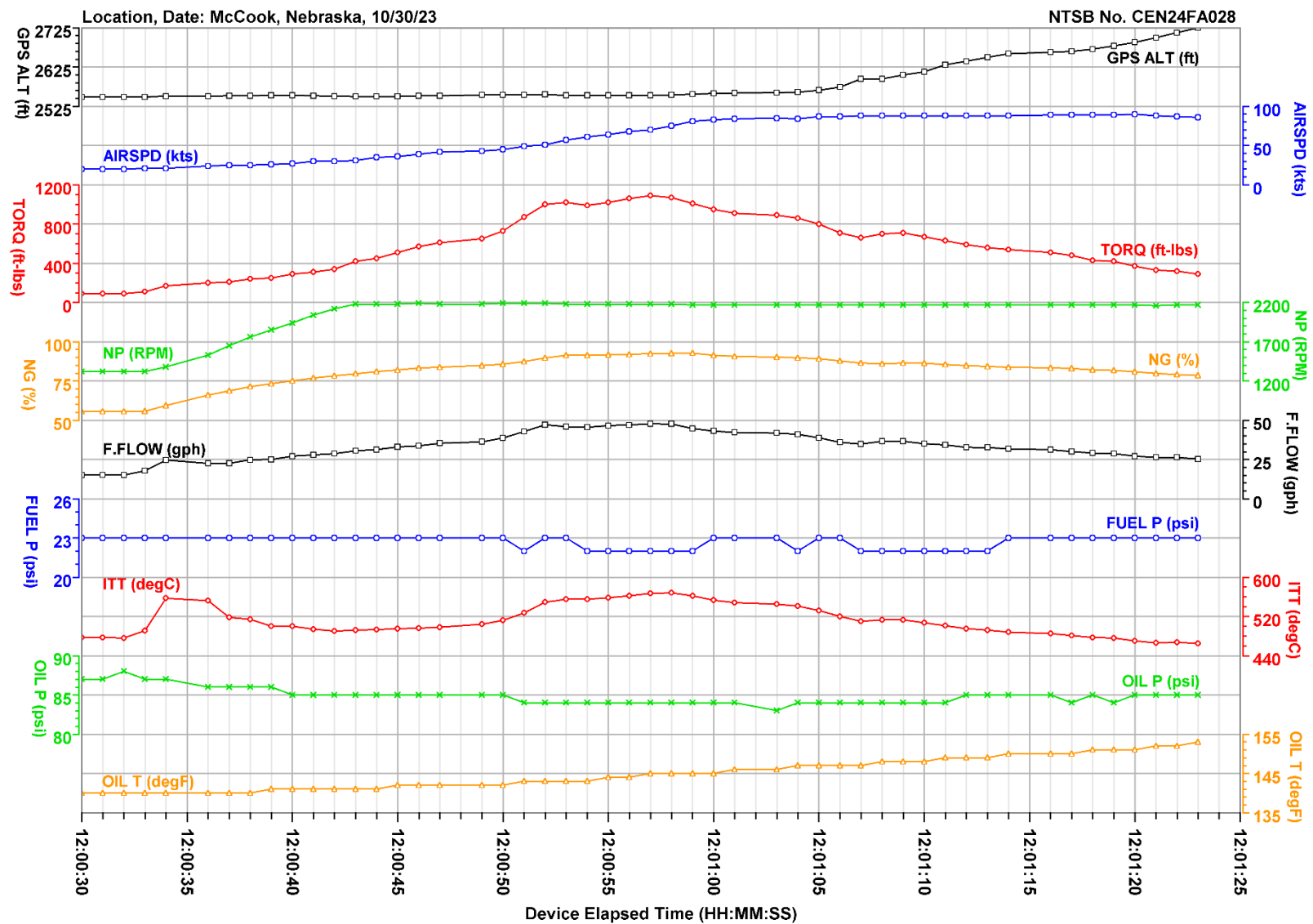


Figure 7. Time history plot of takeoff roll through the end of the recording from 12:00:30 DET to 12:01:25 DET.

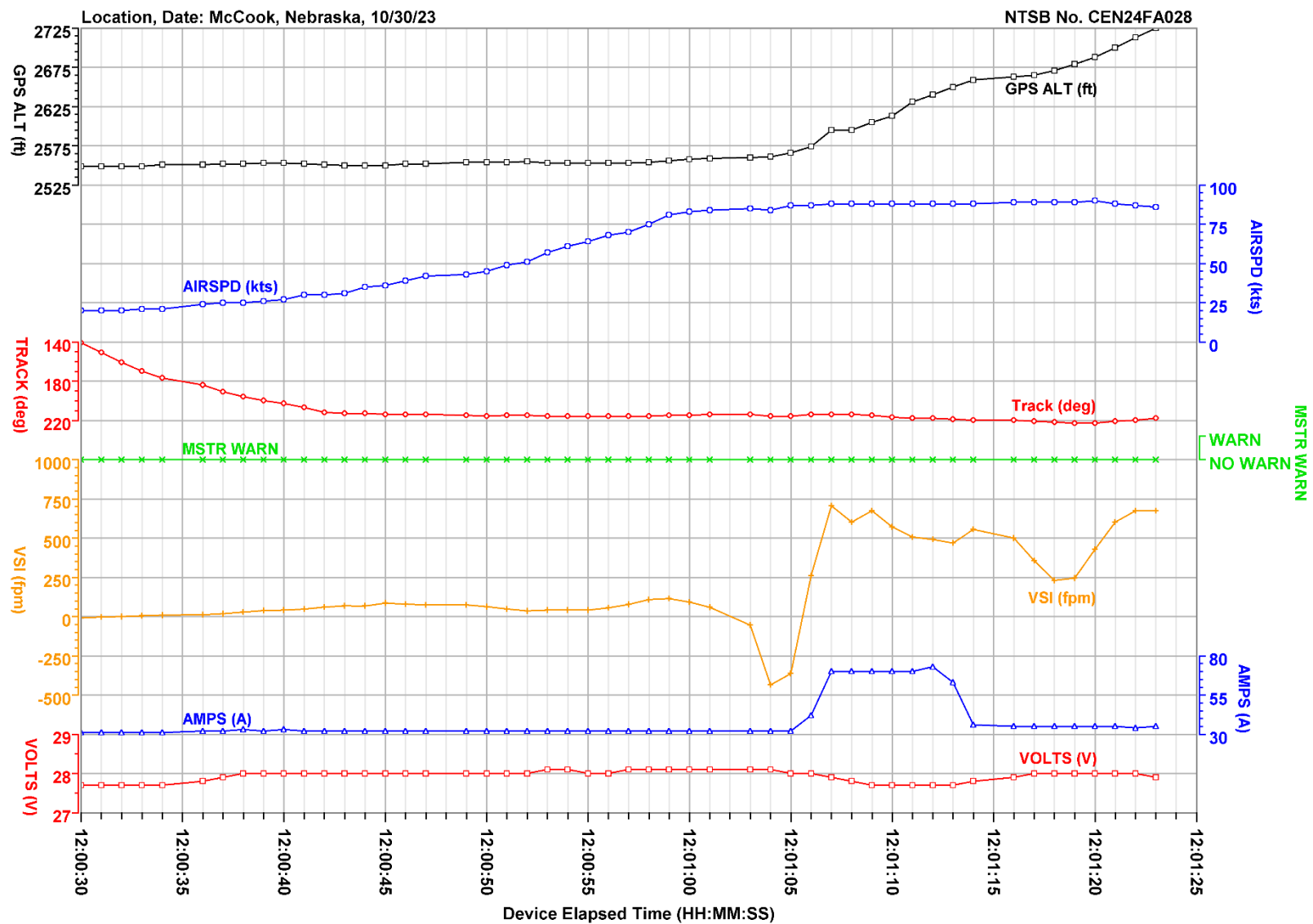


Figure 8. Time history plot of additional parameters from takeoff roll through the end of the recording from 12:00:30 DET to 12:01:25 DET.



Figure 9. Google Earth overlay of the accident flight from 11:56:00 DET to 12:01:23 DET.