

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

December 15, 2020

Data Recording Devices

Specialist's Factual Report
By W. Deven Chen

1. EVENT SUMMARY

Location: Emmett, Idaho
Date: September 22, 2020
Aircraft: Air Tractor AT-802A
Registration: N836MM
Operator: Aero Seat Inc
NTSB Number: WPR2OLA315

On September 22, 2020, about 1845 mountain daylight time, an Air Tractor AT-802A, N836MM, was substantially damaged when it was involved in an accident near Emmett, Idaho. The pilot was fatally injured. The airplane was operated as a Title 14 *Code of Federal Regulations* Part 91 aerial firefighting flight.

2. DATA RECORDING DEVICES GROUP

A data recording devices group was not convened.

3. DETAILS OF INVESTIGATION

The National Transportation Safety Board (NTSB) Vehicle Recorder Division received, on October 9, 2020, the following electronic devices:

Device 1 Manufacturer/Model:	Aero Cloud DataVault
Serial Number:	124
Device 2 Manufacturer/Model:	Garmin GDL 52
Serial Number:	N/A
Device 3 Manufacturer/Model:	Garmin Aera 660
Serial Number:	NM41LM47B05MK
Device 3 Manufacturer/Model:	Electronics International MVP-50T
Serial Number:	191609

3.1. Aero Cloud DataVault Description

The Aero Cloud DataVault is a built-in module used to send gate and aircraft data in near real time via the Iridium satellite constellation for display to an operator or fire-fighting

authority. With its external GPS and Iridium dual function antenna, DataVault provides advanced tracking services which replay position data via satellite to TracPlus¹ on a configurable time or distance basis.

A DataVault has both fixed and removable data storage, which when combined with its internal motion sensors, enables deep post-mission analysis to assess delivery efficiency, aircraft utilization and pilot performance. Internal memory constantly records more than 40 parameters, including geo-tags at intervals as short as 0.1 second and has capacity for more than 1,000 flight hours. Information can also be collected on a USB stick and uploaded to an internet accessible database for mission replay, plotting and reporting.

3.1.1. Aero Cloud DataVault Data Recovery

Upon arrival at the Vehicle Recorder Division, the device did not have obvious physical damage except having been covered by pink fire retardant, as shown in Figure 1. A microSD card was removed from the device, however, only configuration data and some test files were present. According to Trotter Controls, the seller of the device, reasons for flight data not being stored on the microSD card could be that the microSD card was not properly inserted or as a result of a technical issues of the device itself. Trotter Controls further explained that the DataVault contained only a small amount of non-volatile memory (32 kilobytes) internally for storage of configuration data only. Thus, no accident related data recovered from the device.



Figure 1: Aero Cloud DataVault as received.

¹ TracPlus is a trusted real-time tracking and communication platform of first responders, government agencies, militaries, and other critical operators around the world.

3.2. Garmin GDL 52 & Garmin Aera 660 Description

The Garmin GDL 52 is a certified ADS-B (Automatic Dependent Surveillance-Broadcast) datalink transceiver that combines GPS satellite navigation with datalink communications to deliver interactive traffic and hazard surveillance. The GDL 52 is designed to transmit, receive and decode ADS-B messages via onboard datalink. It broadcasts the aircraft's position, velocity, projected track, altitude and flight identification to other equipped aircraft in the vicinity, as well as to ground-based transceivers maintained by the FAA. The unit is designed to interface with a display to visually display other aircraft, and weather information to the pilot. There are no provisions with the device to store any track or navigation data.

The Garmin Aera 660 is a battery-powered portable multi-function display and GPS receiver with a sunlight readable 5-inch diagonal touchscreen operation display. The unit includes a built-in Jeppesen database and can receive XM satellite radio for flight information including NEXRAD radar, lightning, METARs, TAFs, and TFRs. The unit can also perform and store weight and balance calculations. A built-in AOPA Airport Directory and Safe Taxi Airport Diagrams are included for selected fields. The unit stores date, route-of-flight, and flight-time information for up to 50 flights. The unit has 23 different map ranges available, from 200 feet to 800 nm. A flight record is triggered when groundspeed exceeds 30 knots and altitude exceeds 250 feet and 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 for an unspecified number of points – 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 configured². Once the current track log memory becomes full, new information either overwrites the oldest information or 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 track log. Track log storage may be activated or de-activated at user discretion. All recorded data is stored in non-volatile memory (NVM)³. The unit contains hardware and software permitting the download of recorded waypoint, route, and track log information to a PC via a built-in USB port. An internal button-battery is used to provide back-up power to the internal memory and real-time clock during those periods when main power is removed.

3.2.1. Garmin GDL 52 & Garmin Aera 660 Data Recovery

Both devices did not have obvious physical damage upon arrival at the Vehicle Recorder Division, as shown in Figure 2. The Garmin GDL 52 that worked as a transceiver did not store any flight data. The Garmin Aera 660 that worked as a display powered up normally and data were extracted and converted to engineering units using laboratory tools.

² Changing track log setting can be done in the Main Menu. Track 'Distance' records after a specified distance has been traveled. 'Time' creates after a specified time elapsed track log interval. Recording begins when the speed of the flight exceeds 30 knots and gains 250 feet of altitude. If the flight has landed and ground speed drops below 30 knots, the flight entry is saved, and a new entry is recorded when the flight departs the airport (by default).

³ Non-volatile memory is semiconductor memory that does not require external power for data retention.



Figure 2: Garmin Aera 660 (left) and Garmin GDL 52 (right) as received.

3.2.2. Garmin Aera 660 Data Description

The recovered data contained 12 sessions, from September 5, 2020 to September 23, 2020. The device recorded data in UTC (Coordinated Universal Time). The last session recorded on September 23, 2020 was determined to be the accident flight. The session was approximately 54 minutes and 10 seconds, from 0:03:13 to 0:57:23 UTC. The data logging rate varied, ranging from a few second per sample to a few minutes per sample. The timestamps were converted to the local time, mountain daylight time (MDT) for the remainder of this report. The difference between MDT and UTC is 6 hours.

3.2.3. Garmin Aera 660 Parameters Provided

Table 1: Garmin Aera 660 Data Parameters.

Parameter Name	Parameter Description
Date	Date for recorded data point (MM/DD/YYYY)
Time	Converted MDT for recorded data point (HH:MM:SS)
Latitude (Deg)	Recorded Latitude (degrees)
Longitude (Deg)	Recorded Longitude (degrees)
GPS Alt (Ft)	GPS Altitude (feet)
Groundspeed (Kt)	Average derived groundspeed between current and previous data point (knots)
Track (Deg)	Path on the surface of the Earth directly below an aircraft (degrees)

3.3. Electronics International MVP-50T Description

The Electronics International MVP-50T is a panel-mounted, color, electronic engine display allowing the operator to monitor and record parameters related to engine operations and user customizable parameters. Depending on the installation, parameters monitored may include: engine parameters, oil pressure and temperature, outside air temperature, propeller revolutions per minute (RPM), fuel flow, fuel levels, 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.

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. 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.

3.3.1. Electronics International MVP-50T Data Recovery

Upon arrival at the Vehicle Recorder Division, an external examination revealed the device did not have obvious physical damage, as shown in Figure 3. The device powered up normally and data were downloaded using an USB stick.



Figure 3: Electronics International MVP-50T as received.

3.3.2. Electronics International MVP-50T Data Description

The last flight recorded on September 22, 2020 was identified to be related to the accident. The device recorded data in local time, MDT. The flight was approximately 43 minutes and 41 seconds, from 18:02:08 to 18:45:49 MDT. The data logging rate was approximately 0.3 second per sample.

3.3.3. Electronics International MVP-50T Parameters Provided

Table 2: Electronics International MVP-50T Data Parameters.

Parameter Name	Parameter Description
TIME	Time (MDT) for recorded data point (HH:MM:SS)
AMPS (A)	Battery bus current in Amperage
F.FLOW (GPH)	Fuel flow rate in gallon per hour
F.REM (GAL)	Fuel remaining in gallons
FUEL L (GAL)	Fuel in the left tank in gallons
FUEL R (GAL)	Fuel in the right tank in gallons
FUEL P (PSI)	Fuel Pressure in Pounds per square inches
G-METR (G)	Normal acceleration in gravity of Earth
HP (HP)	Horsepower calculated based on torque and NP
ITT (degC)	Inlet Turbine temperature in Celsius
MSTR_WRN	Master warning (discrete)
NG (%)	Gas generator speed in percentage
NP (RPM)	Power turbine speed in revolutions per minute
OAT (degF)	Outside air temperature in Fahrenheit
OIL P (PSI)	Oil pressure in pounds per square inches
OIL T (degF)	Oil temperature in Fahrenheit
TORQ (FT-LB)	Torque in foot-pound
VOLTS (V)	Battery bus voltage in volts

3.4. Plots and Corresponding Tabular Data

The following seven figures contain data recorded on the Garmin Aera 660 and Electronics International (E.I.) MVP-50T on September 22, 2020. The parameters were separated into two groups to be displayed on two plots. Figures 4 and 5 show the parameters plots for the entire flight; figures 6 and 7 show the parameters plots for the last 10 minutes of the accident flight and figures 8 through 10 show Google Earth overlays of the accident flight.

Figure 4 is a plot of the first parameters group for the entire accident flight recorded on September 22, 2020. The time interval displayed is 18:00:00 to 19:00:00 MDT. The Ground Speed, Ground Track and GPS Altitude were recorded on the Garmin Aera 660 and the rest of the parameters were recorded on the E.I. MVP-50T.

Figure 5 is a plot of the second parameters group for the entire accident flight. The time interval displayed is 18:00:00 to 19:00:00 MDT.

Figure 6 is a plot of the first parameters group for the last 10 minutes of the accident flight. The time interval displayed is 18:37:00 to 18:47:00 MDT.

Figure 7 is plot of the second parameters group for the last 10 minutes of the accident flight. The time interval displayed is 18:37:00 to 18:47:00 MDT.

Figure 8 is a Google Earth overlay of the entire accident flight recorded on September 22, 2020. The figure shows the flight originated from the Ontario Municipal Airport. The weather and lighting conditions in Google Earth are not necessarily the weather and lighting conditions present at the time of the recording.

Figure 9 is a Google Earth overlay of the end of the accident flight.

Figure 10 is a Google Earth overlay of the final portion of the accident flight. The reported wreckage location is shown with a red pin.

The corresponding tabular data used to create figures 4 through 10 are provided in electronic comma-delimited (.csv) format as Attachments to this report. The Attachment 1 contains data recovered from the Garmin Aera 660 and the Attachment 2 contains data recovered from the E.I. MVP-50T. Not every additional parameter in the attachments have been validated by the specialist.

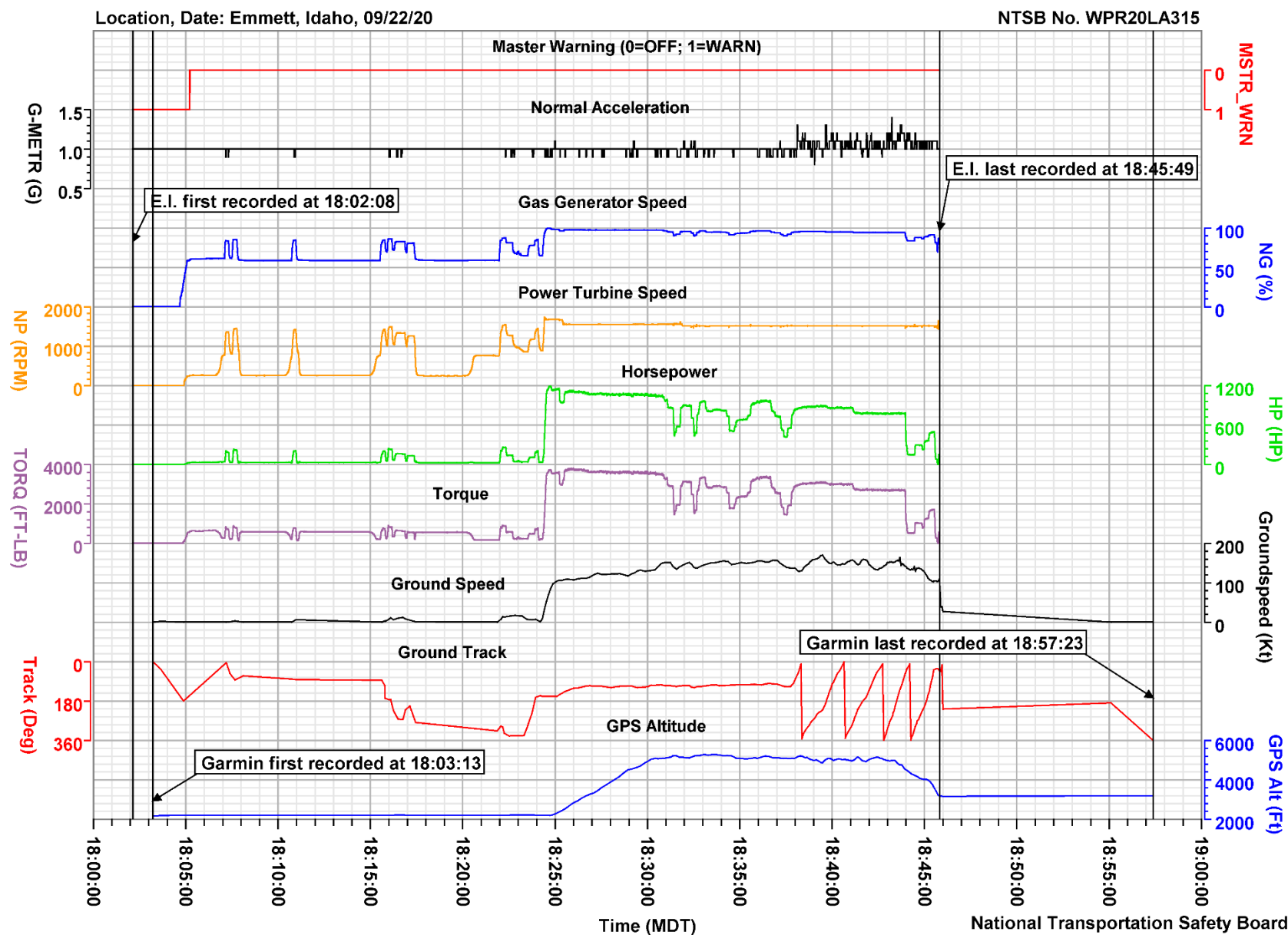


Figure 4: Plot of the first parameters group of the entire accident flight.

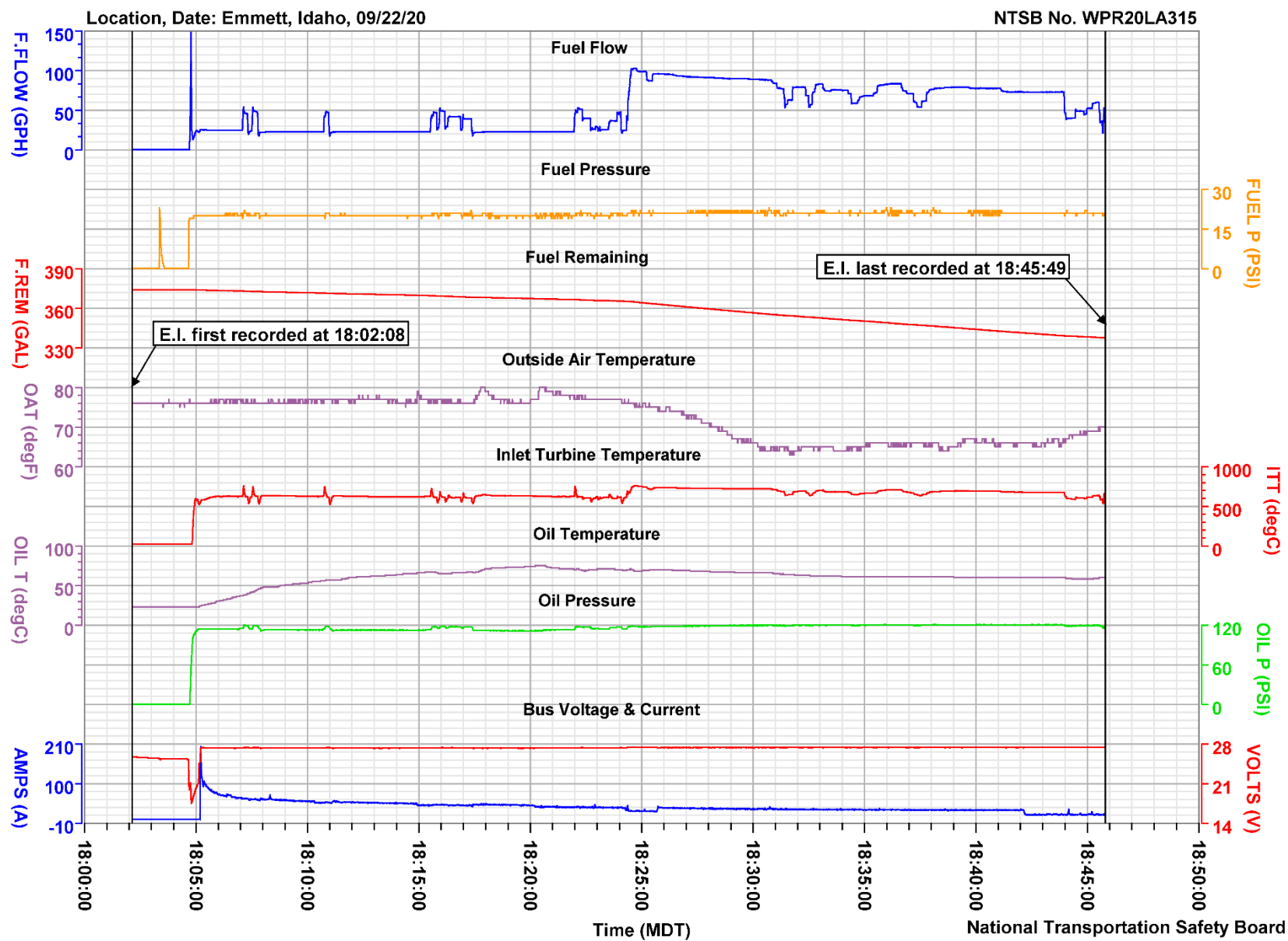


Figure 5: Plot of the second parameters group of the entire accident flight.

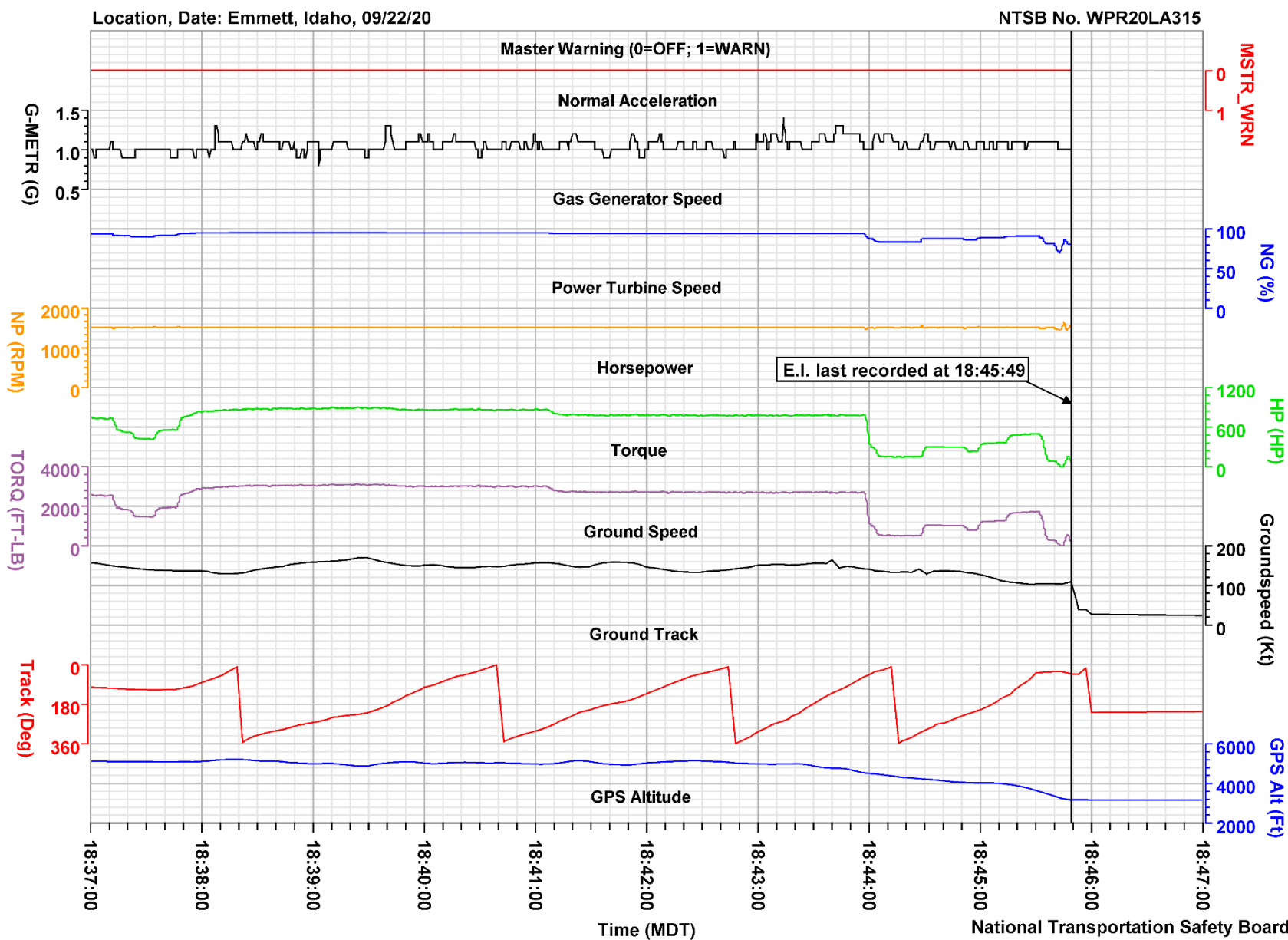


Figure 6: Plot of the first parameters group of the last 10 minutes of the accident flight.

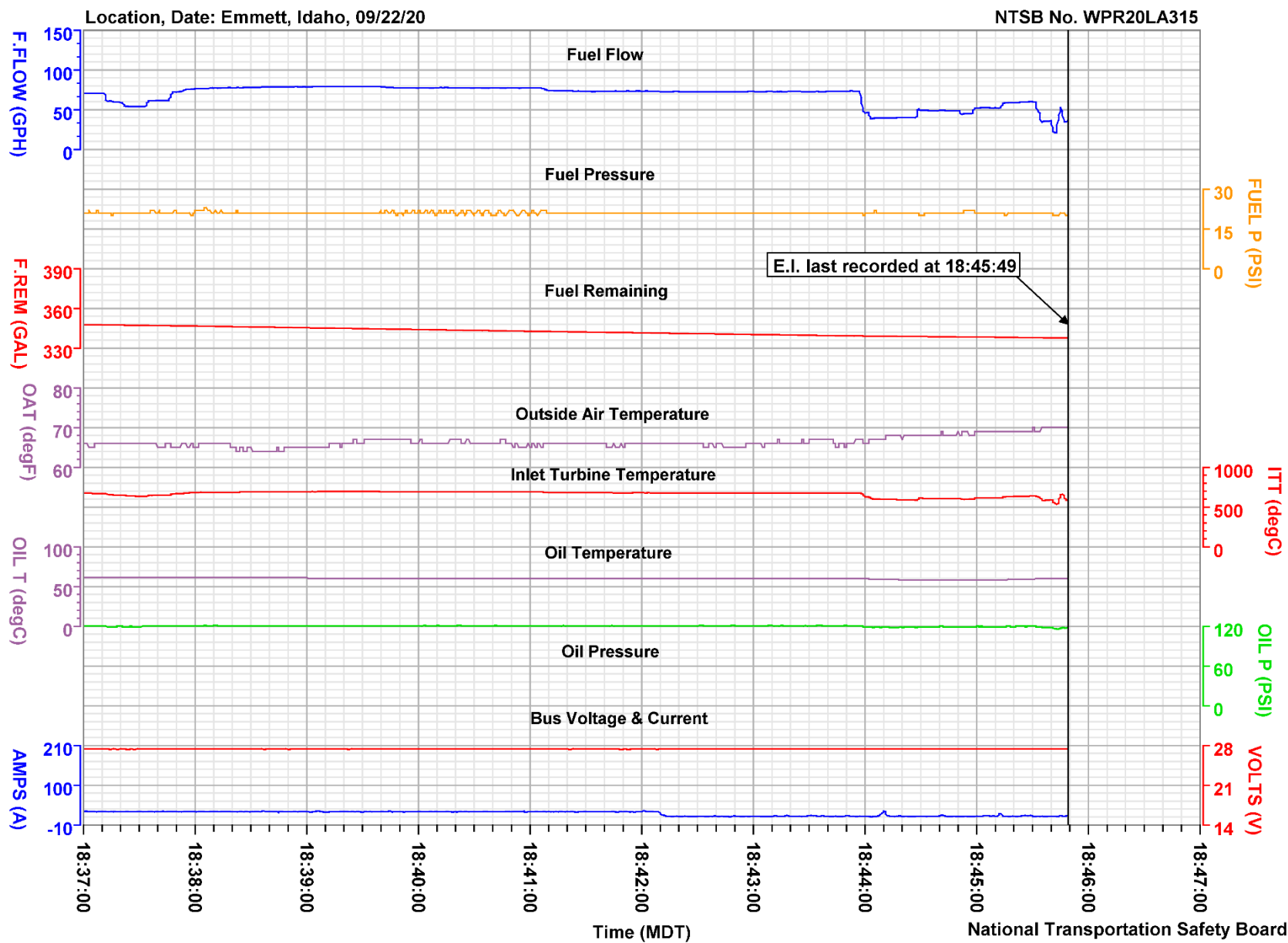


Figure 7: Plot of the second parameters group of the last 10 minutes of the accident flight.

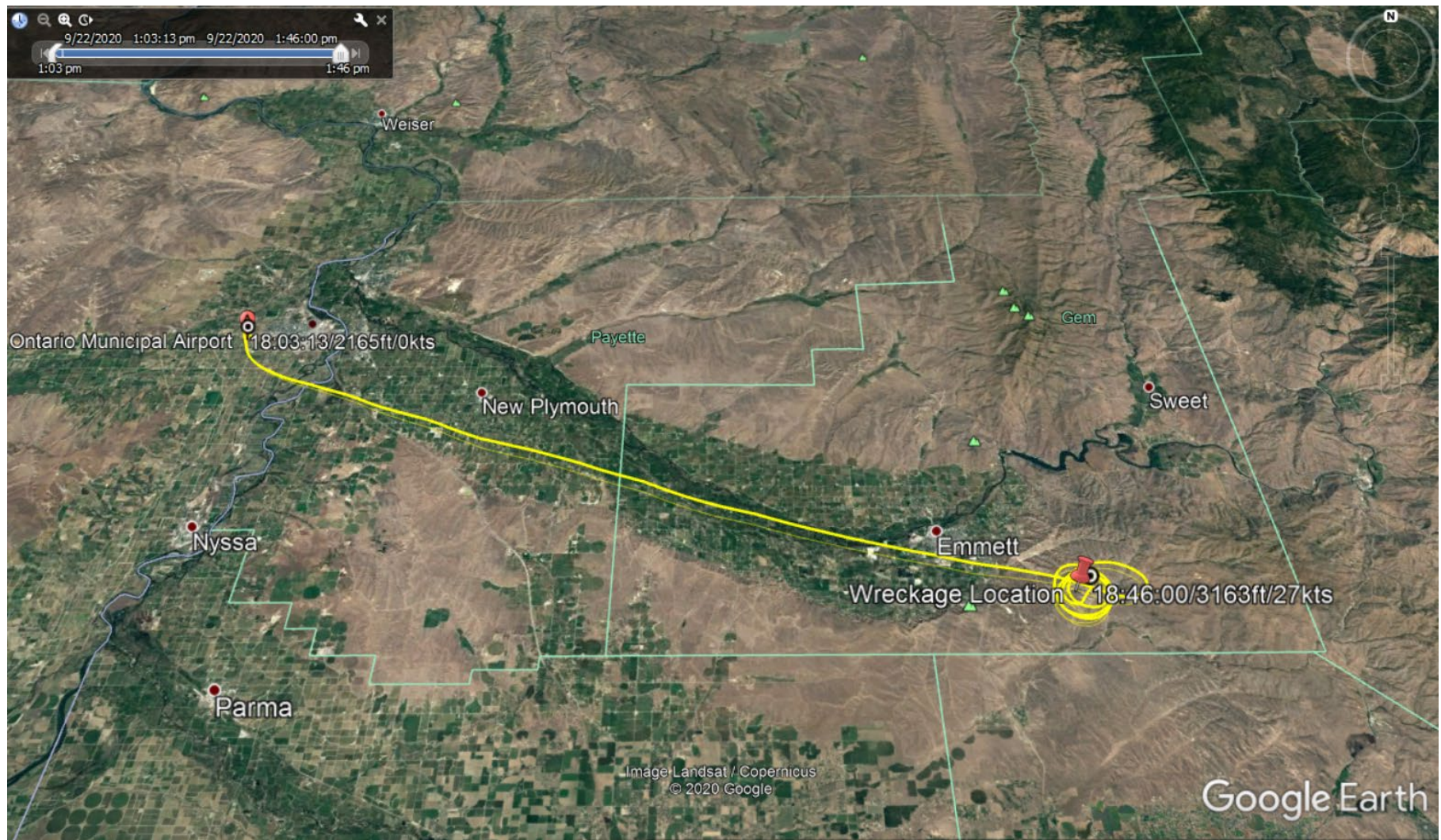


Figure 8: Google Earth overlay of the overview of the entire accident flight.

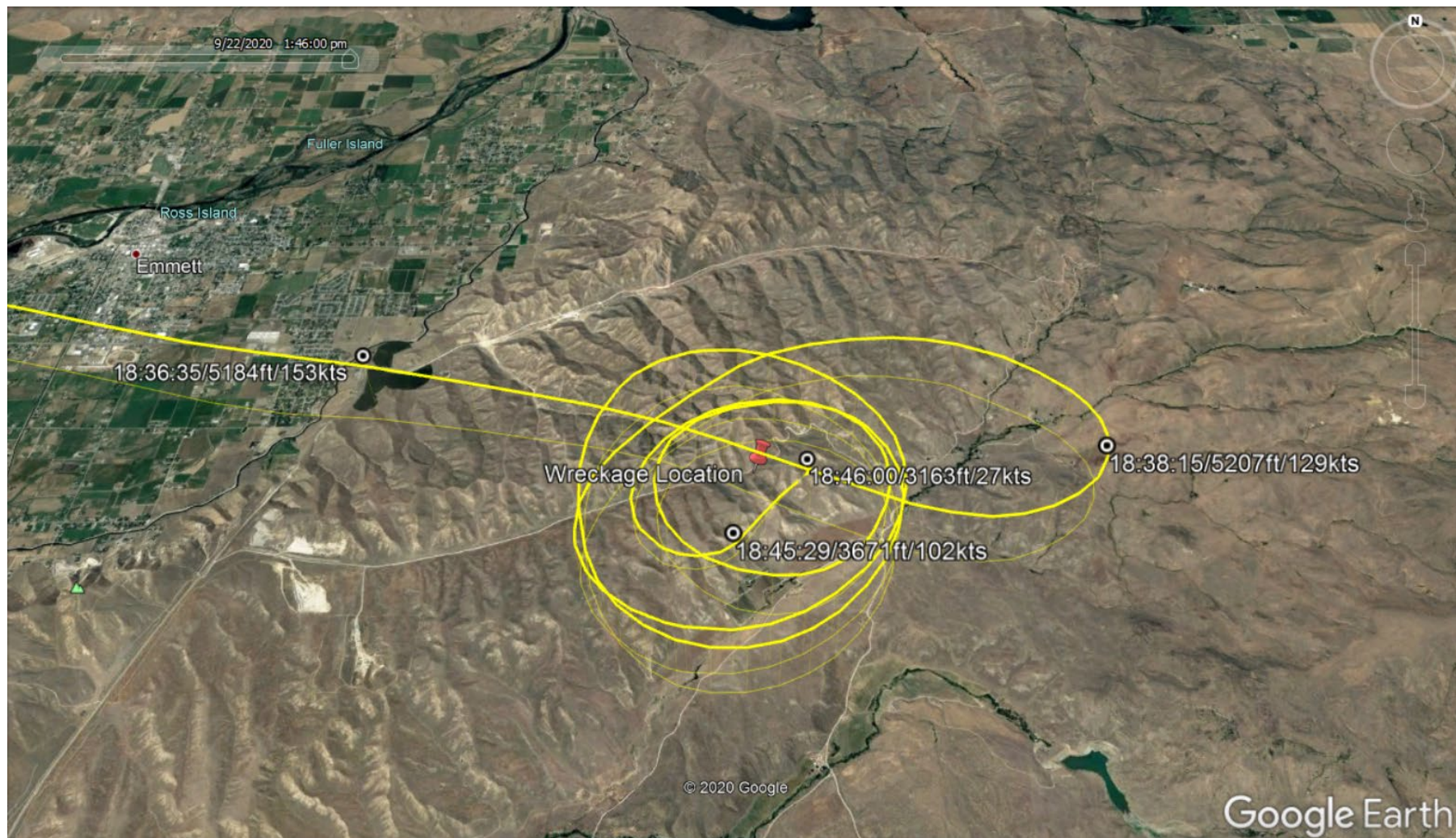


Figure 9: Google Earth overlay of the overview of the end of the accident flight.



Figure 10: Google Earth overlay of the final portion of the accident flight.