

National Transportation Safety Board

Office of Research and Engineering

Washington, DC 20594



CEN22LA334

ELECTRONIC FLIGHT INFORMATION SYSTEM (EFIS)

Specialist's Factual Report

January 23, 2023

A. ACCIDENT

Location: Beaver Dam, Wisconsin
Date: July 22, 2022
Time: 1647 Central Daylight Time (CDT)
Airplane: Van's Aircraft RV-10, private operator, N4400K

B. ELECTRONIC FLIGHT INFORMATION SYSTEM (EFIS) SPECIALIST

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

C. DETAILS OF THE INVESTIGATION

An Electronic Flight Information System (EFIS) group was not convened. The NTSB Vehicle Recorder Division received the following EFIS device:

Recorder Manufacturer/Model: Garmin GDU 460
Recorder Serial Number: 350006303

1.0 Garmin GDU 460 Device Description

The Garmin G3X is a series of EFIS displays certified to be installed on certified and experimental aircraft. The model comes in 10.6" (GDU 460) and 7" (GDU 470) inch display versions. The unit employs a touch-screen user interface and can be utilized as a Primary Flight Display (PFD), Multi-Function Display (MFD), Engine Monitoring Device (EDM), or a combination of all, depending on how the unit is integrated with other compatible avionics products. The unit has the ability to record data via an externally removable SD card mounted under the center of the screen, or internally on a series of non-volatile memory (NVM) chips.

If not disabled, the unit is capable of logging historical information at a variable rate of up to 10 Hertz to internal NVM. Historical logs may be copied to a standard SD card inserted into the slot provided on the front of the unit, by selecting the touchscreen option, "Copy to SD Card", in configuration mode. Data is exported in engineering units, in a comma-separated value (CSV) format.

1.1 Data Recovery

The EFIS was in good condition and the data were downloaded normally using the manufacturer's procedure. Figure 1 shows the Garmin GDU 460 in excellent condition, suffering minimal damage during the accident.

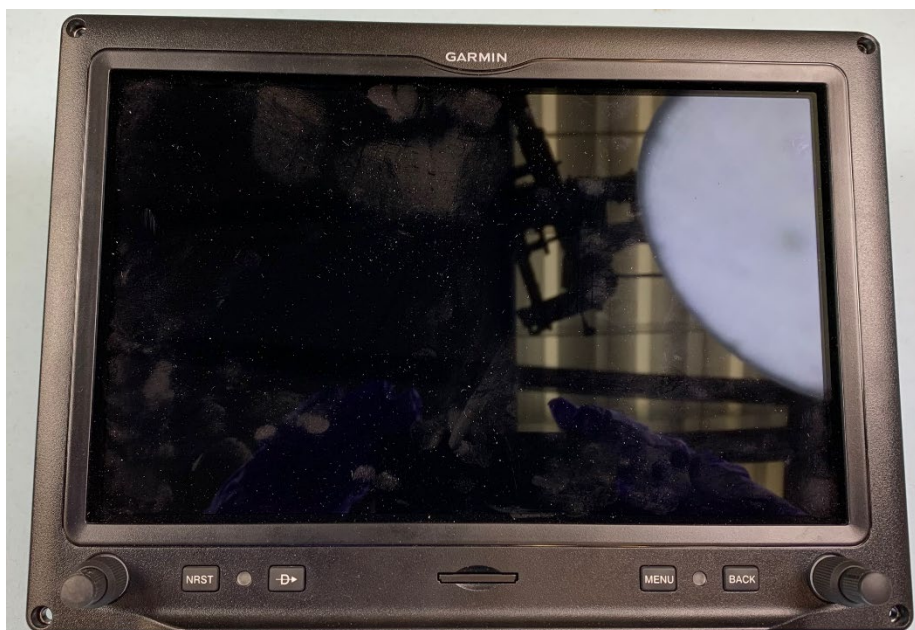


Figure 1. Photo of the GDU in excellent condition, minimal damage.

1.2 Recording Description

The data extracted included 50 log sessions from September 14, 2021, through July 22, 2022.¹ The accident flight was recorded starting 16:35:24 CDT and ending 16:45:59 CDT on July 22, 2022.

1.3 Parameters Provided

Table 1 lists the recorder parameters validated in this report. Many parameters such as Date, Time, Latitude, Longitude, and GPS Altitude are recorded by the device. Other parameters such as Groundspeed and Track are derived from the recorded parameters.

Table 1. EFIS Data Parameters.

Parameter Name	Parameter Description (units)
Date	Date for recorded data point (MM/DD/YYYY)
Time	Time (UTC) for recorded data point (HH:MM:SS)
Latitude	Recorded Latitude (degrees)
Longitude	Recorded Longitude (degrees)
Baro Altitude	Barometric Altitude (feet)
CHT	Cylinder Head Temperature (degrees Fahrenheit)
EGT	Exhaust Gas Temperature (degrees Fahrenheit)
Engine Power	Engine Power (%)

¹ All dates and times are referenced to Central Daylight Time (CDT).

Parameter Name	Parameter Description (units)
Fuel Flow	Fuel Flow (gallons per hour)
Fuel Pressure	Fuel Pressure (pounds per square inch)
GPS Altitude	Recorded GPS Altitude (feet)
Ground Speed	Average derived groundspeed (knots)
Ground Track	Average derived true course (degrees)
Indicated Airspeed	Indicated Airspeed (knots)
Lateral Accel	Lateral Acceleration (g)
Longitudinal Accel	Longitudinal Acceleration (g)
Mag Hdg	Magnetic Heading (degrees)
Manifold Pressure	Manifold Pressure (inches of Mercury)
Normal Accel	Normal Acceleration (g)
Oil Pressure	Oil Pressure (pounds per square inch)
Oil Temperature	Oil Temperature (degrees Fahrenheit)
Pitch Attitude	Pitch Attitude (degrees)
Pressure Altitude	Pressure Altitude (feet)
Roll Attitude	Roll Attitude (degrees)
RPM	Rotations Per Minute
True Airspeed	True Airspeed (knots)
Vertical Speed	Vertical Speed (feet per minute)

D. OVERLAYS AND TABULAR DATA

Data obtained from the Garmin GDU 460 was used to produce the following overlays and tabular data. Figure 2 through Figure 8 were generated using the data downloaded from this device.

The device began recording at approximately 16:35:24 CDT and ended at 16:45:59 CDT. Due to data buffering on the EFIS, the data recording may have ended before the accident event.

Figure 2 and Figure 3 show time histories of general aircraft dynamics for the entire flight and a one-minute portion of the same parameters, respectively. Figure 4 and Figure 5 show time histories of the engine parameters for the entire flight and a one-minute portion of the same parameters, respectively. Figure 6 through Figure 8 show Google Earth overlays of the entire event flight track, the ground track as the aircraft came in for landing, and a perspective view of the landing, respectively. Note that the weather and lighting conditions in Google Earth are not necessarily the weather and lighting conditions present at the time of the recording.

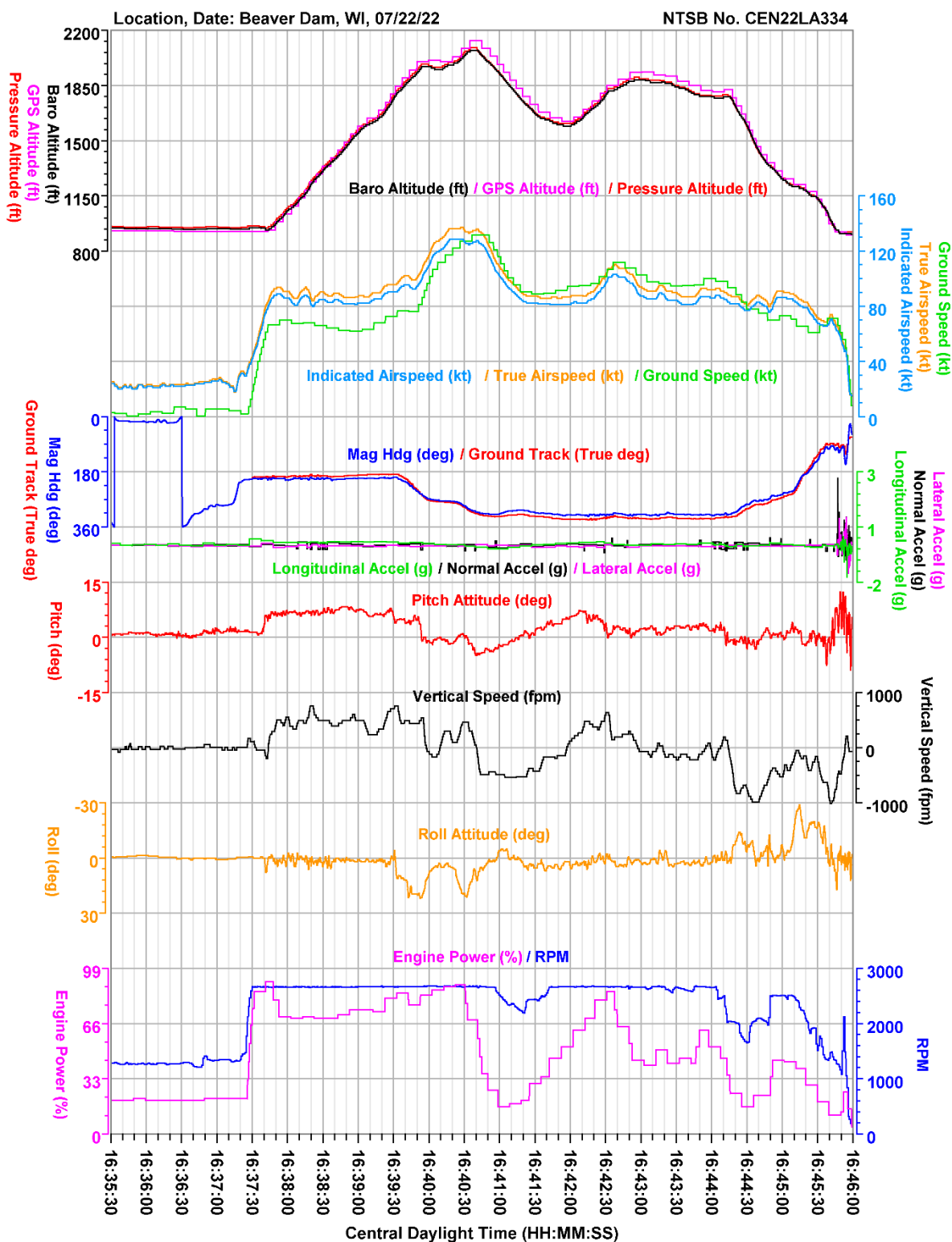
When viewing the Google Earth path, one will observe that there is sawtooth pattern. This is because the Garmin is holding a value as recorded until it changes by a certain amount. After such, the Garmin will then update.

In summary, data records began at 16:35:24 CDT, and the aircraft began takeoff roll at approximately 16:37:38 CDT from Dodge County Airport (KUNU). The aircraft departed from runway 20 and continued to head south-southwest before turning right on a westerly heading of approximately 276 degrees. During the climb out and turn, the aircraft reached a maximum GPS altitude of 2134 feet and maximum indicated airspeed of 129 knots. The aircraft then continued with a northwest heading of 320 degrees while descending to a GPS altitude of 1621 feet. The aircraft began to climb again around 16:42:03 CDT and reached a GPS altitude of 1935 feet before entering a descent, approach, and landing. The last recorded data collected by the Garmin GDU 460 was at approximately 16:45:59 CDT.

The corresponding tabular data used to create Figure 2 through Figure 8 for the entire event flight, including UTC Hours, UTC Minutes, UTC Seconds, Latitude, and Longitude, are provided in electronic comma separated value (CSV) format as attachment 1 to this report.

Submitted by:

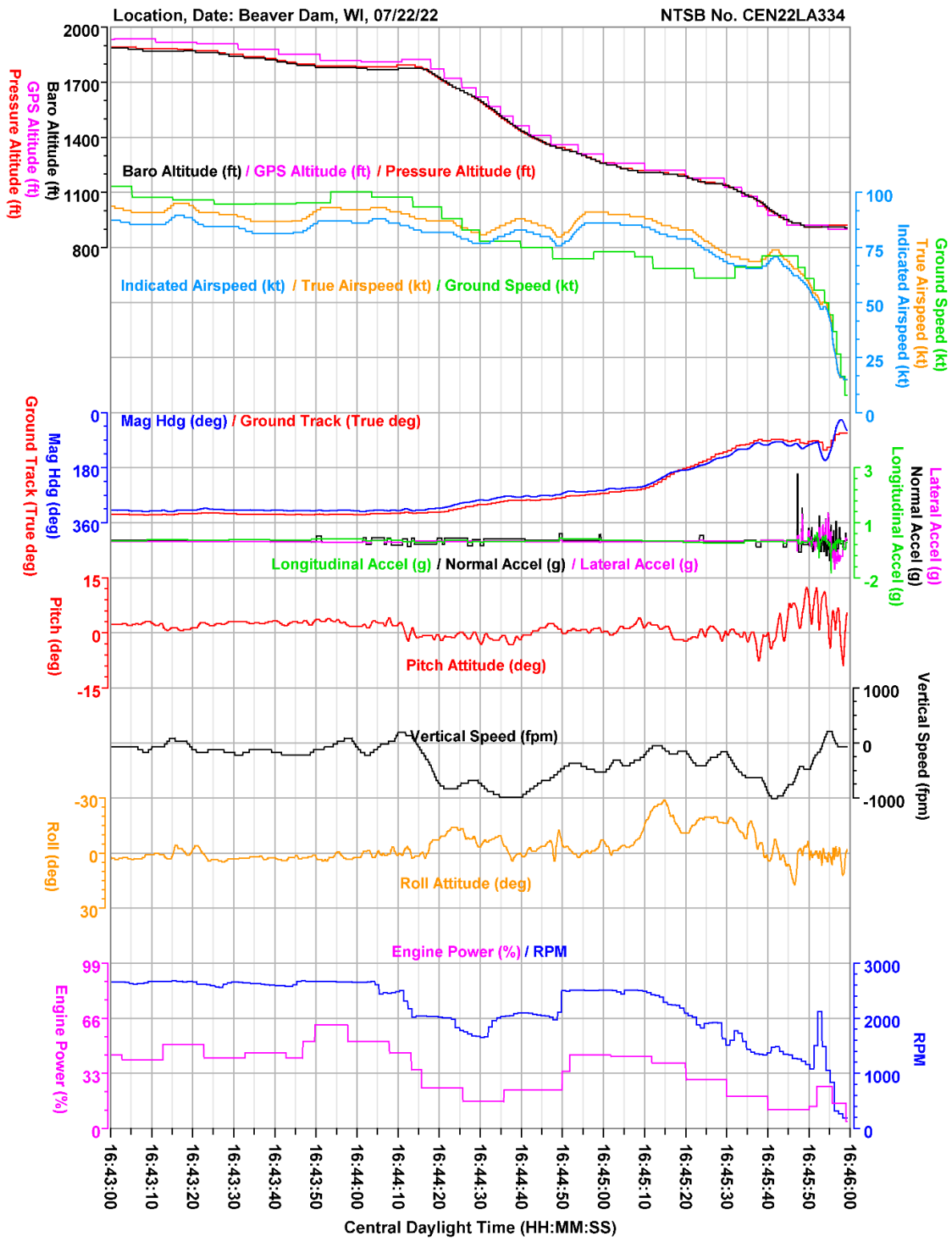
Steven Smith
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Private, Van's Aircraft RV-10, N4400K

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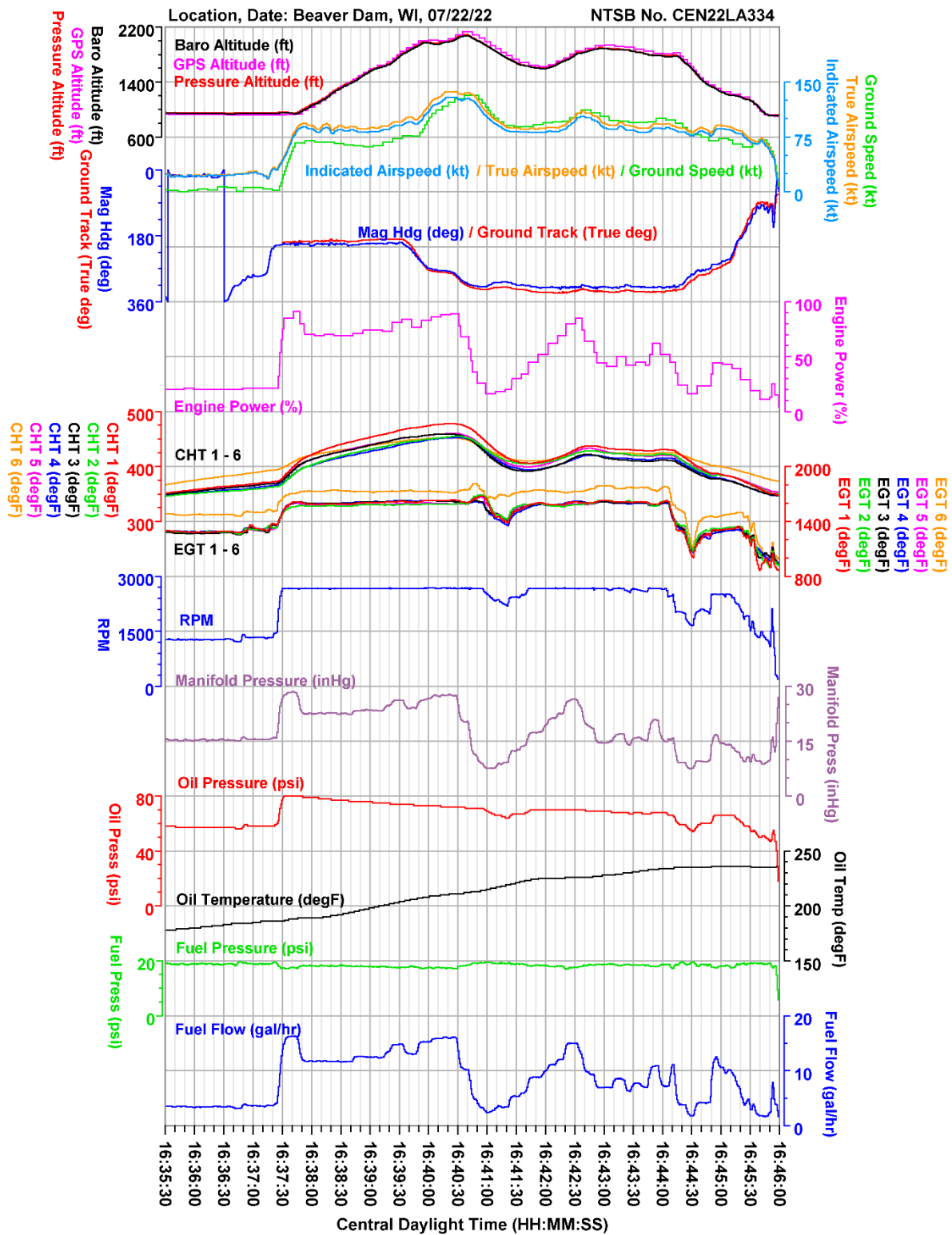
Figure 2. Plot of aerodynamic and general flight dynamic parameters for the entire event flight.



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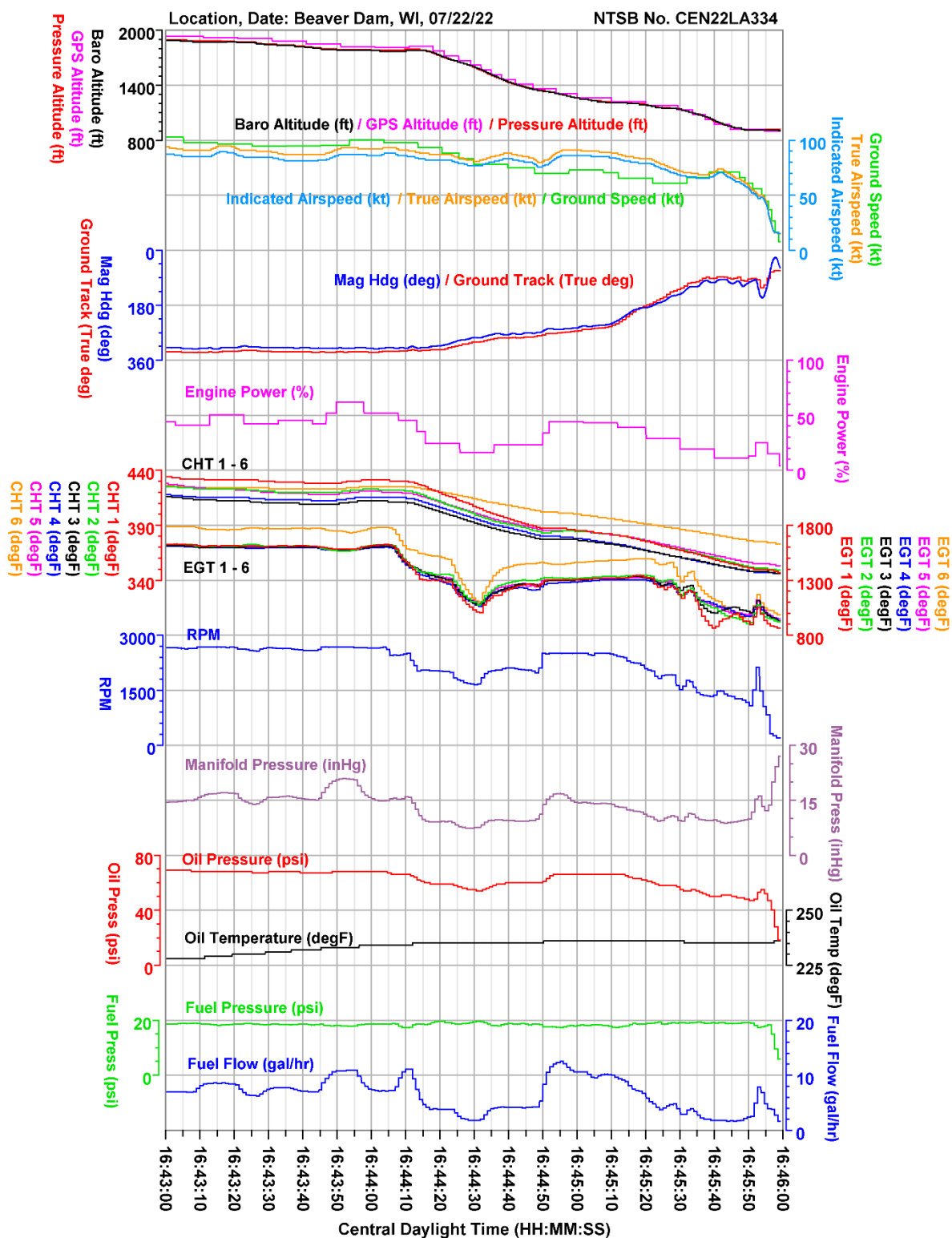
Figure 3. Plot of aerodynamic and general flight dynamic parameters for the final three minutes of the event flight.



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Figure 4. Plot of engine parameters for the entire event flight.



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Figure 5. Plot of the engine parameters for the final three minutes of the event flight.

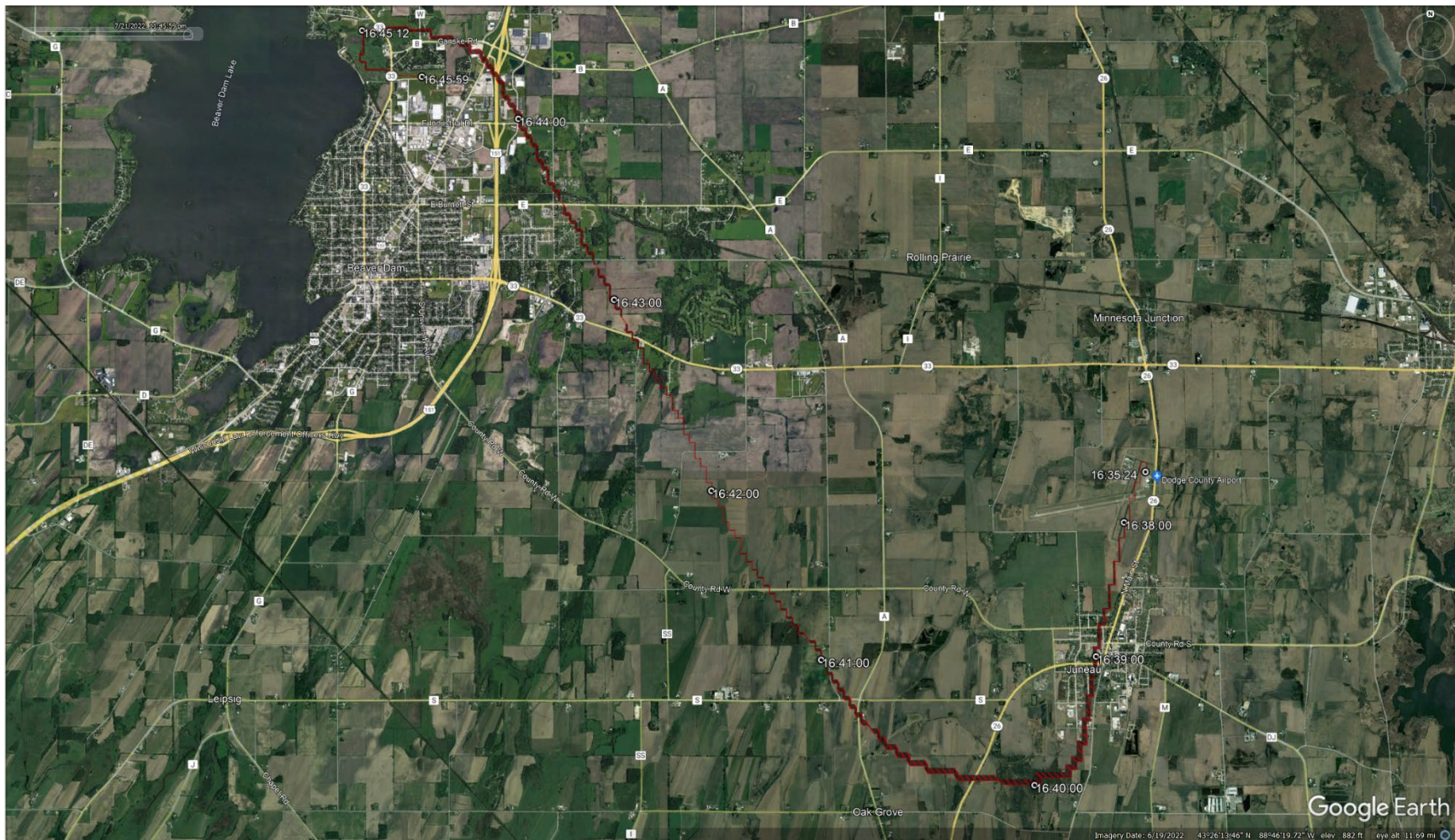


Figure 6. Google Earth overlay showing the entire flight.

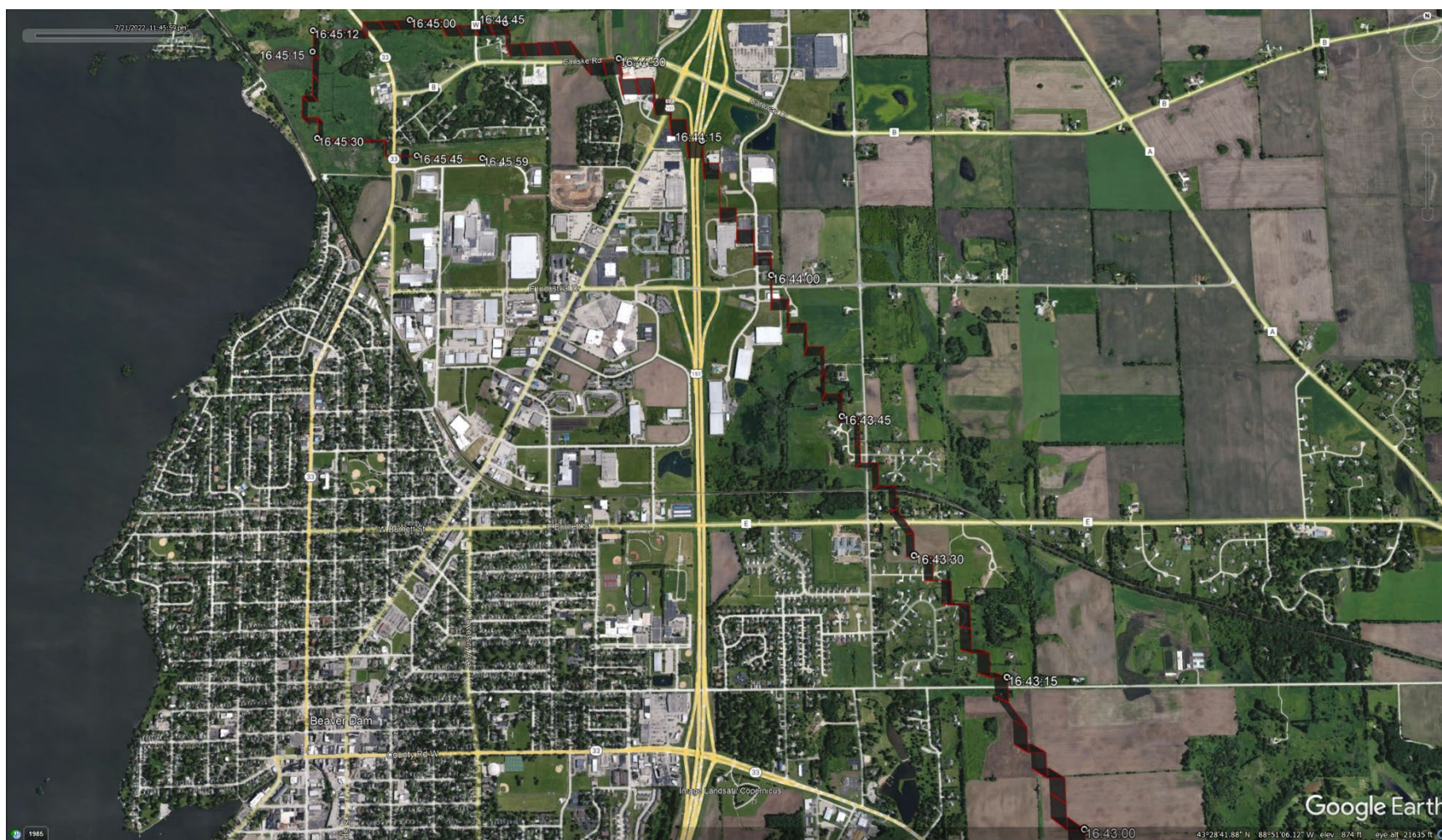


Figure 7. Google Earth overlay showing the final approach.

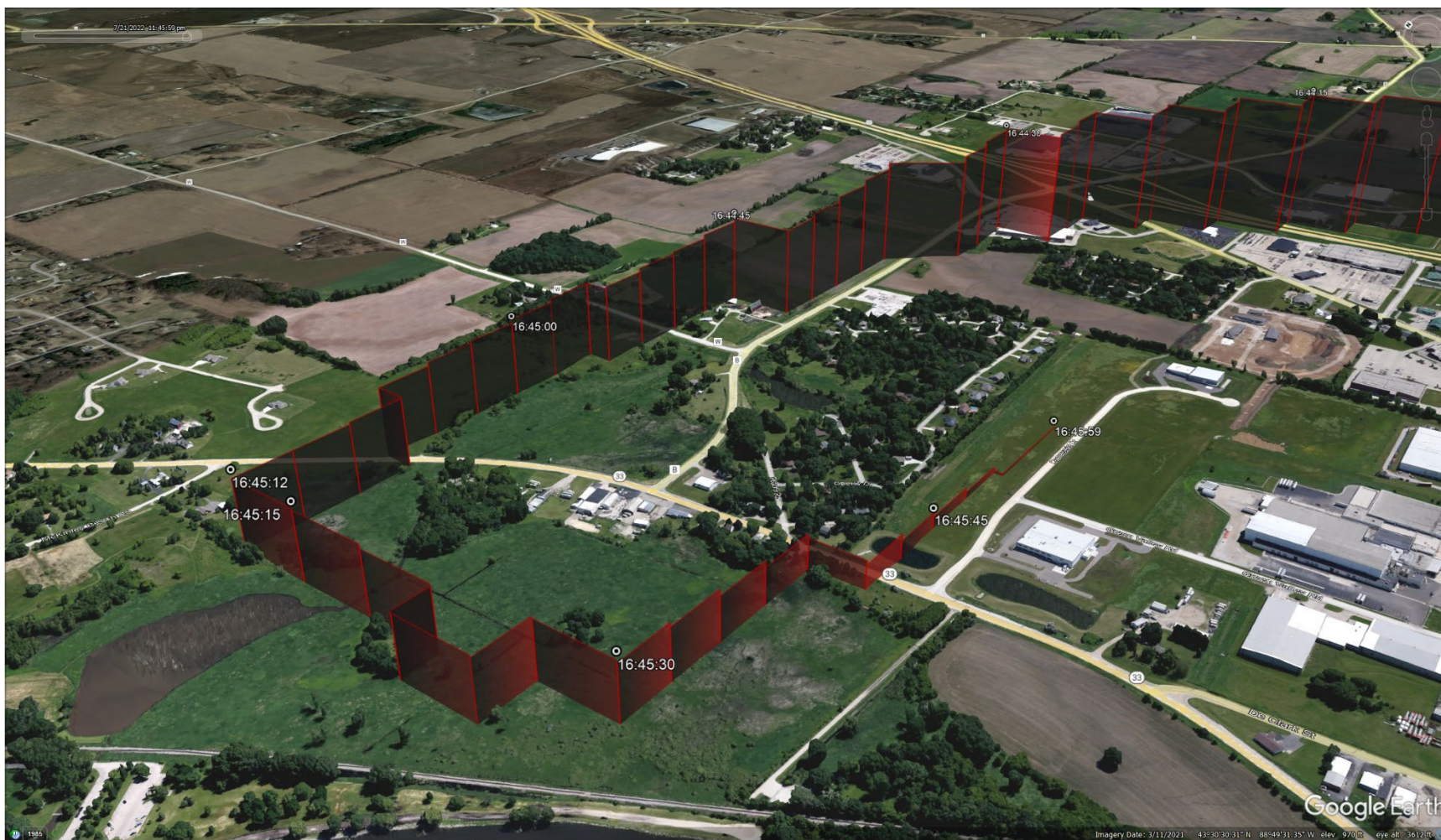


Figure 8. Google Earth overlay showing a perspective view of the landing.