

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

August 13, 2021

Global Positioning System Devices

Specialist's Factual Report
By W. Deven Chen

1. EVENT SUMMARY

Location: Wingate, North Carolina
Date: May 2, 2021
Aircraft: Robinson R44 helicopter
Registration: N4528T
Operator: Kritter Cropdusting Inc.
NTSB Number: ERA21FA200

2. GROUP

A group was not convened.

3. DETAILS OF INVESTIGATION

On May 6, 2021, the National Transportation Safety Board (NTSB) Vehicle Recorder Division received the following Global Positioning System (GPS) devices:

Device Manufacturer/Model:	AgNav Guia P151 (main display)
Serial Number:	15191124

Device Manufacturer/Model:	AgNav P500 (GPS receiver)
Serial Number:	500131003

3.1. Devices Description

The AgNav Guia P151 is a 6.5-inch main display which provides pilots with customizable agricultural spray application data on a color moving map. The AgNav P500 is a GPS receiver which receives GPS information, performs calculations and feeds data to the main display. Those two devices are parts of the AgNav Guia GPS navigation system for aerial applications. The AgNav Guia GPS system has an obstacle warning feature which is compatible with FAA tower obstacle data and provides pilots with warnings regarding incoming obstacles and power lines.

3.2. Data Recovery

Upon arrival at the Vehicle Recorder Division, an exterior examination revealed the two devices had sustained minor impact damage, as shown in Figure 1. The main display which

is equipped with non-volatile memory ¹(NVM) powered on, but the screen was not functional due to the impact damage, as shown in Figure 2, thus a normal data download could not proceed. The NVM was removed from the device, and the data were extracted by placing the NVM into a surrogate device provided by the manufacturer. The extracted data included 155 sessions of recording. The session recorded on the accident date, May 2, 2021, was sent to the manufacturer for decoding.

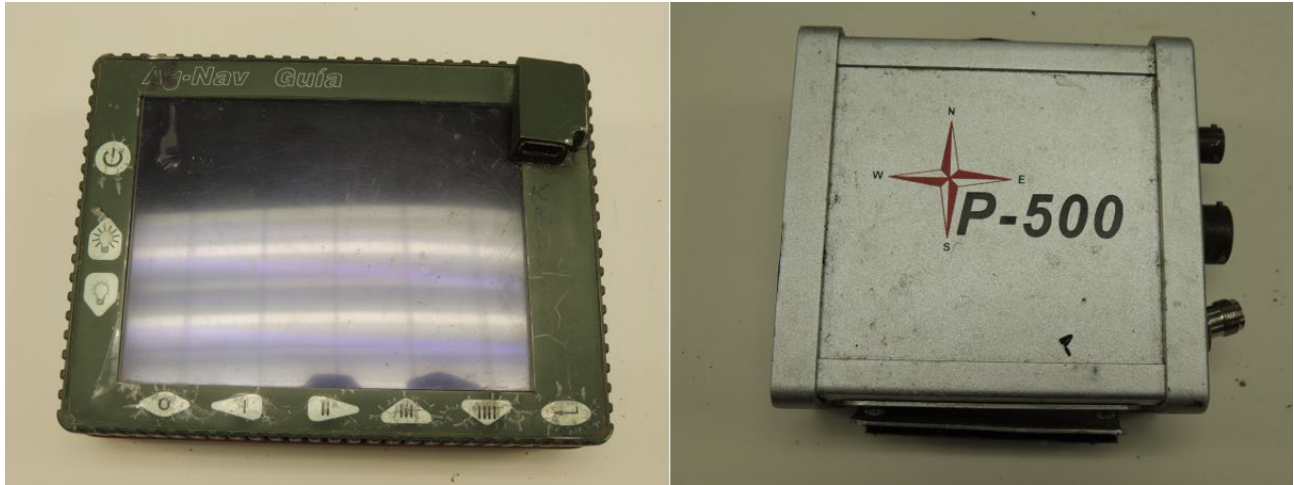


Figure 1: AgNav main display (left) and GPS receiver (right) as received.

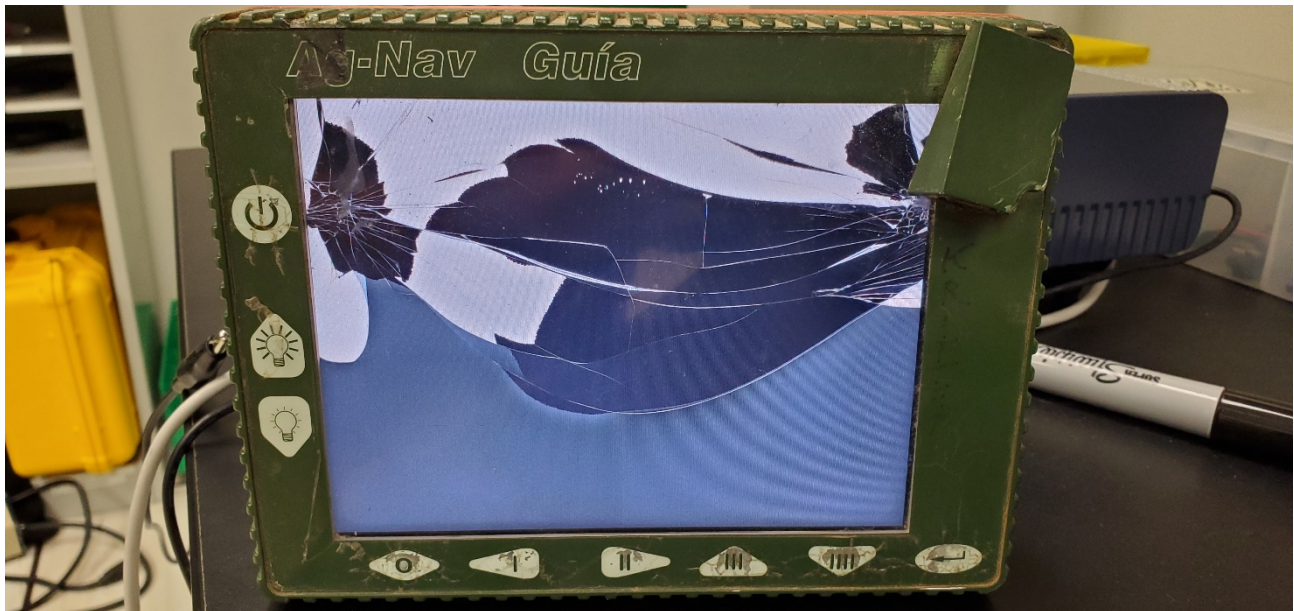


Figure 2: AgNav main display powered on with damaged screen.

3.3. Data Description

The decoded data sent back from the manufacturer showed the session recorded on the accident date included numerous flights and was approximately 3 hours and 19 minutes.

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

The device recorded data in Coordinated Universal Time (UTC). All timestamps were converted to the local time, eastern daylight time (EDT), for the rest of this report. The last flight was approximately 2 minutes and 41 seconds, from 13:09:00 to 13:11:41, and was identified to be the accident flight. The sampling rate was approximately five data points per second. The flight before the accident flight was approximately 11 minutes and is provided in this report as well.

3.4. Parameters Provided

Table 1 describes data parameters provided by the devices. Time, Latitude, Longitude, and Altitude are recorded by the device. Groundspeed and Heading are derived from the recorded parameters.

Table 1: AgNav Guia Data Parameters.

Parameter Name	Parameter Description
Time	EDT for recorded data point (HH:MM:SS.S)
Lat (deg)	Recorded Latitude (degrees)
Lon (deg)	Recorded Longitude (degrees)
Altitude (ft)	Altitude above Mean Sea Level (feet)
Speed (kts)	Average groundspeed between current and previous data point (knots)
Heading (deg)	Aircraft Heading (degrees)
Spray (0/1)	Spray status (0 = OFF, 1 = ON)

3.5. Plots and Corresponding Tabular Data

The following eight figures contain data recorded on the AgNav Guia on May 2, 2021. Figure 3 shows the data parameter plots for the entire recording session. Figures 4 and 5 show the data parameter plots for the flight before the accident flight and the accident flight.

Figures 6 - 10 are Google Earth overlays of the recorded flights. Figures 6 shows the Google Earth overlay of the entire recording session, from 9:52:13 to 13:11:41 EDT. Figure 7 shows the Google Earth overlay of the flight before the accident flight, from 12:49:00 to 13:00:00 EDT. Figures 8 - 9 show the Google Earth overlays of the accident flights. The reported wreckage location is shown with a red pin. The accident flight started at 13:09:00, and the last recorded point was at 13:11.41 EDT. Figure 10 shows the Google Earth overlay of the accident flight with spray status; each green rectangle along the flight path indicates that the spray of the accident aircraft was active at the time of recording. Due to data buffering on the device, the data recording may have ended before the crash occurred. According to the technical specialist from the manufacturer, the data recording could have ended as much as 10 seconds before the crash occurred. The 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 through 10 are provided in electronic comma-delimited (.csv) format as Attachment 1 to this report.

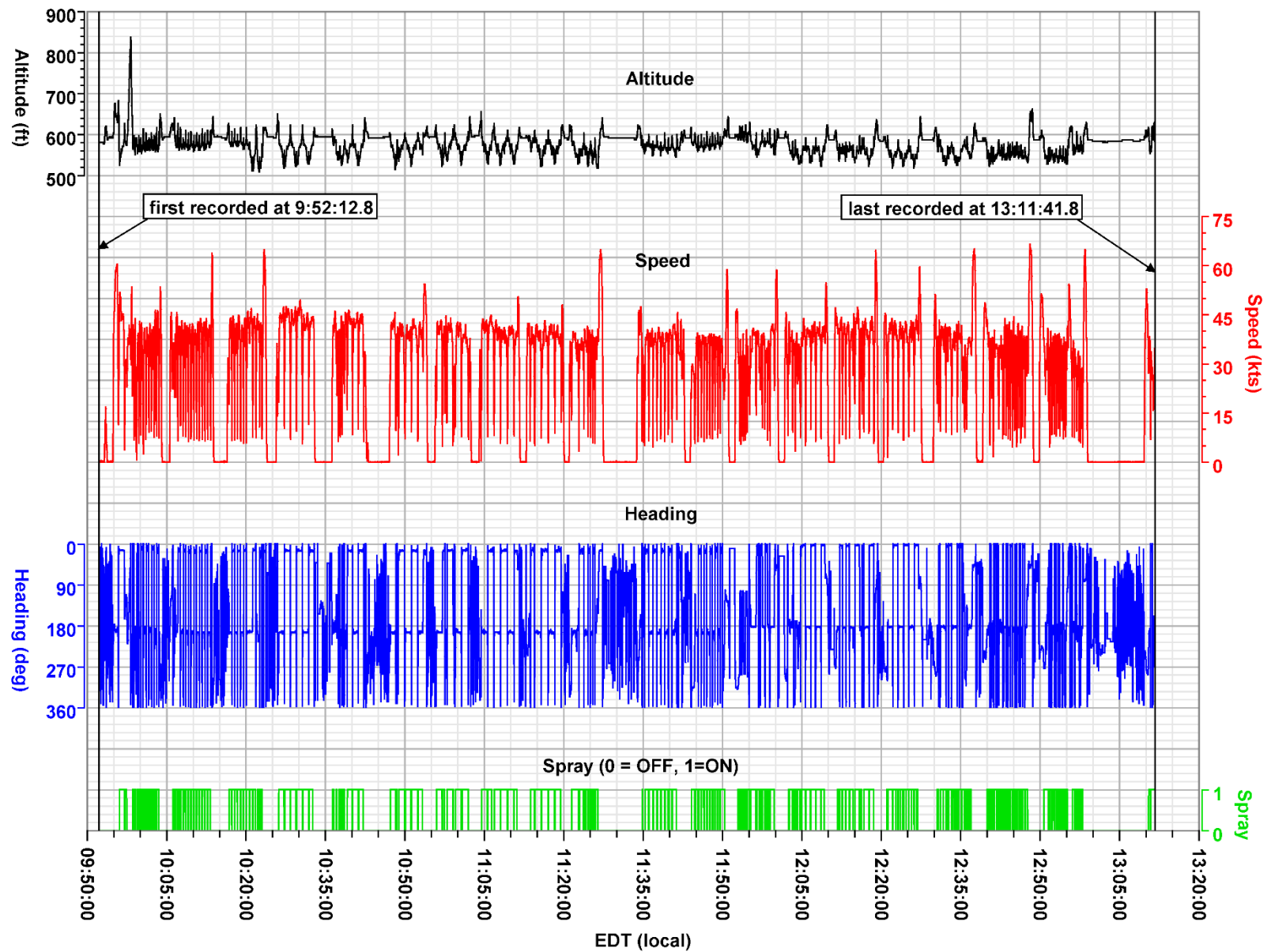


Figure 3: Plot of the data parameters of the entire recording session.

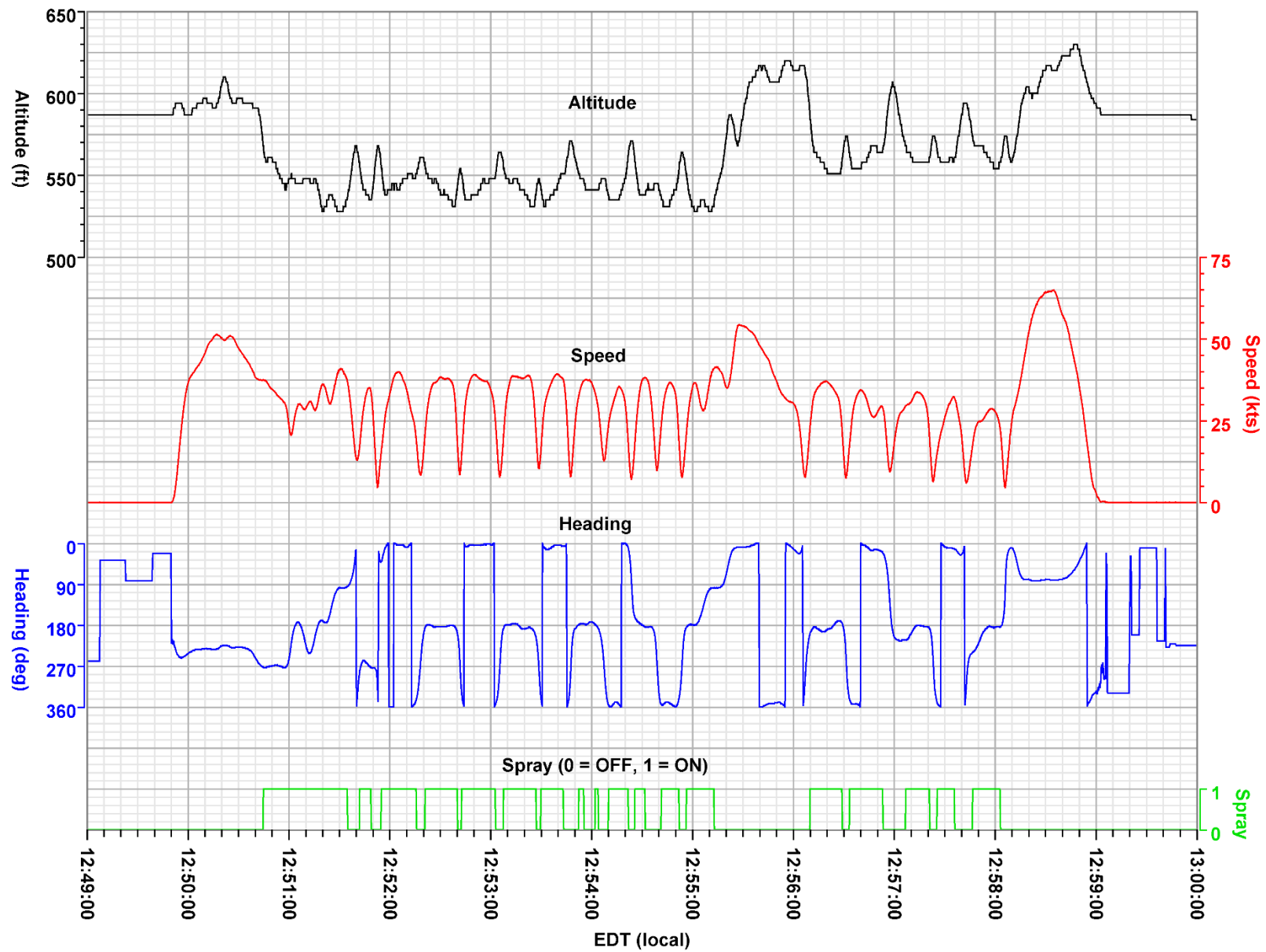


Figure 4: Plot of the data parameters of the flight before the accident flight.

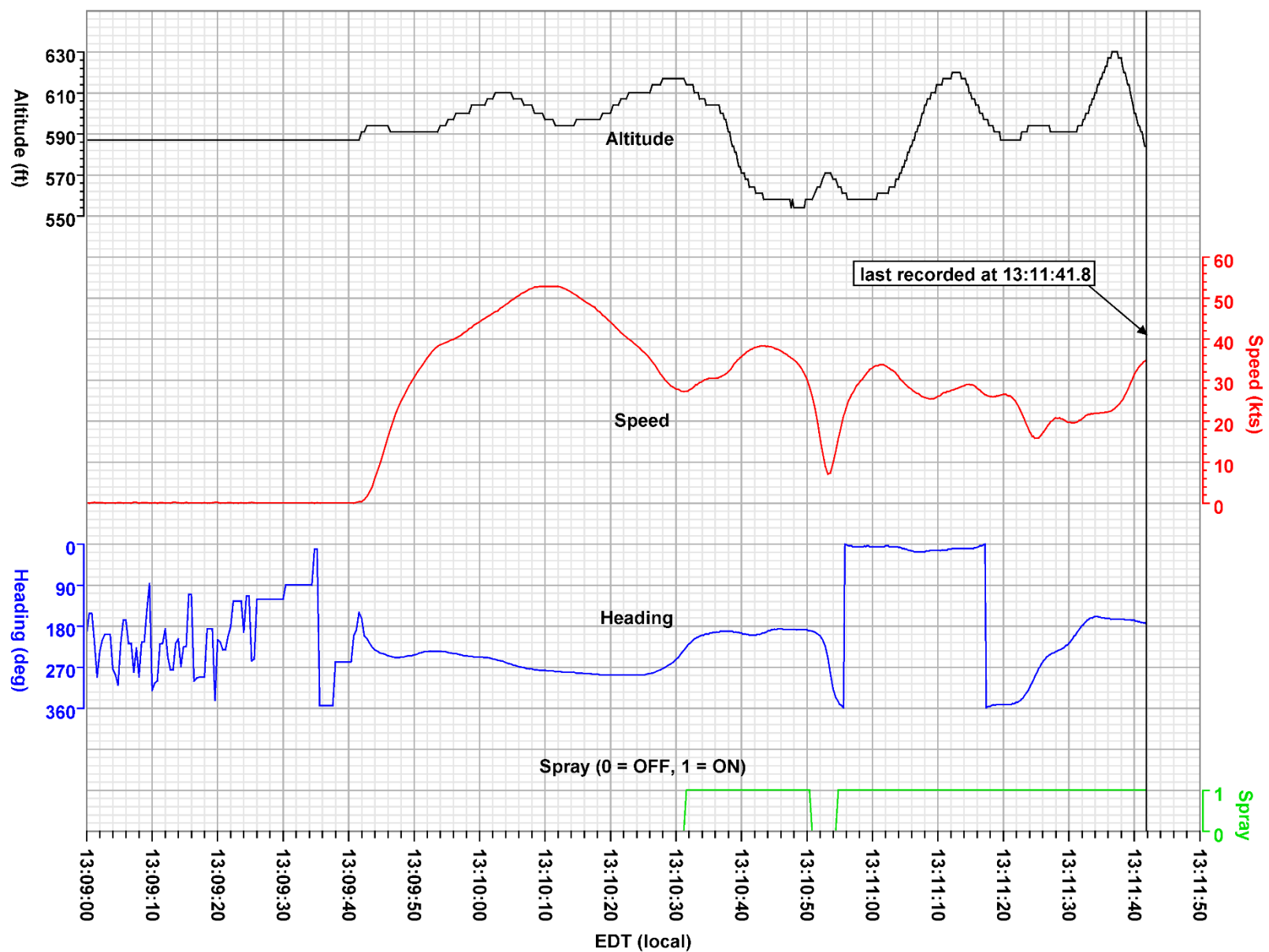


Figure 5: Plot of the data parameters of the accident flight.

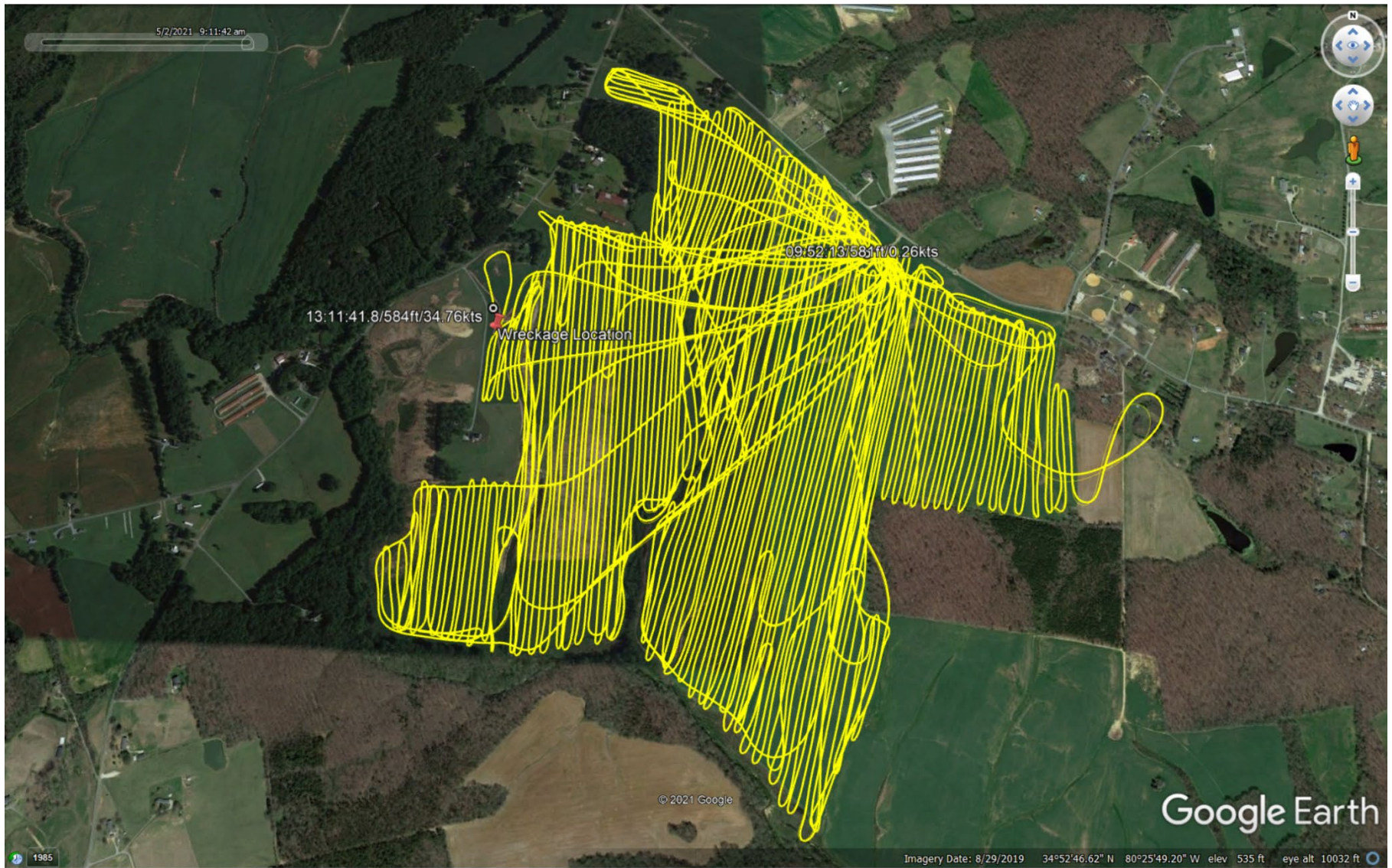


Figure 6: Google Earth overlay of the overview of the entire recording session.

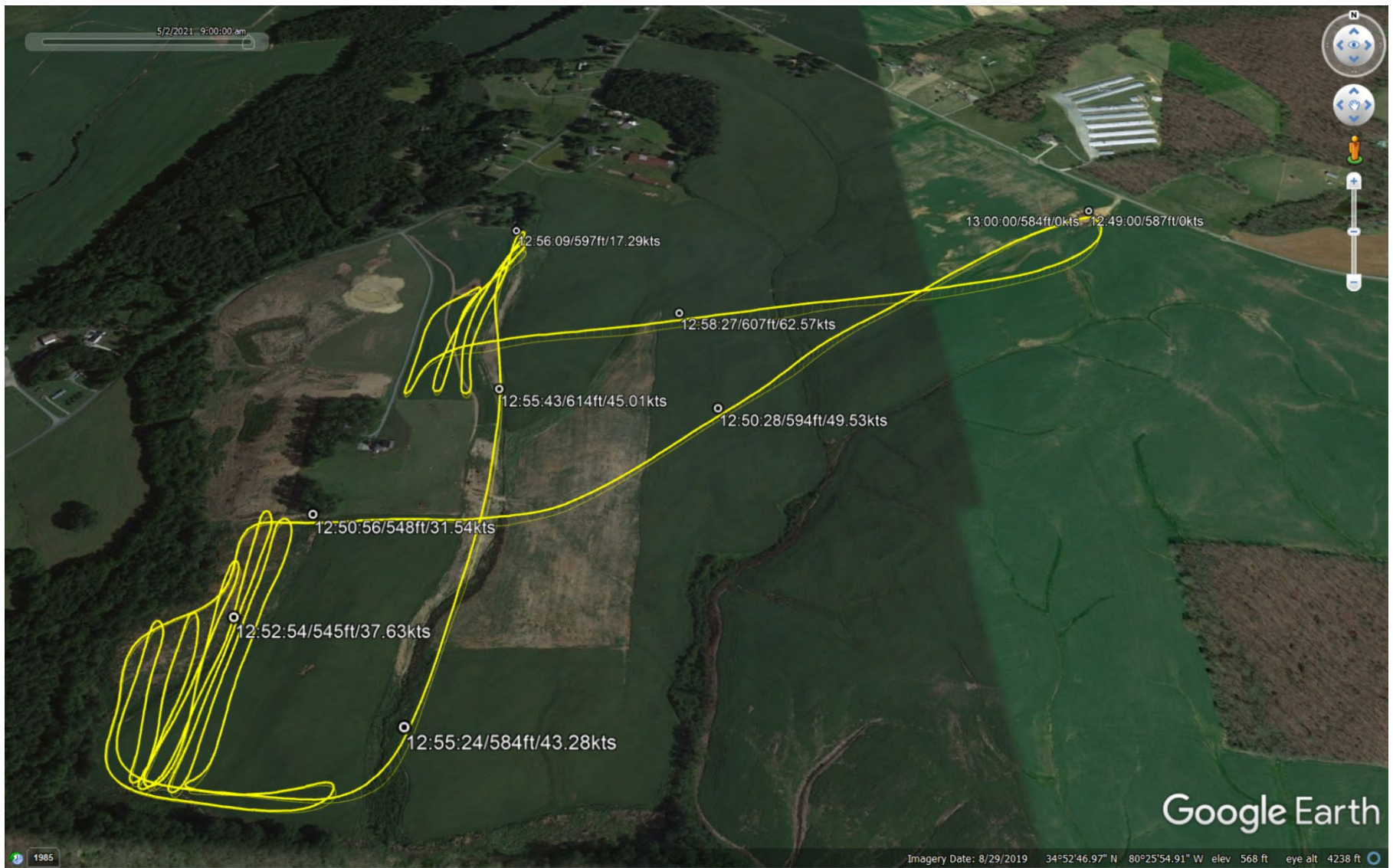


Figure 7: Google Earth overlay of the overview of the flight before the accident flight.



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

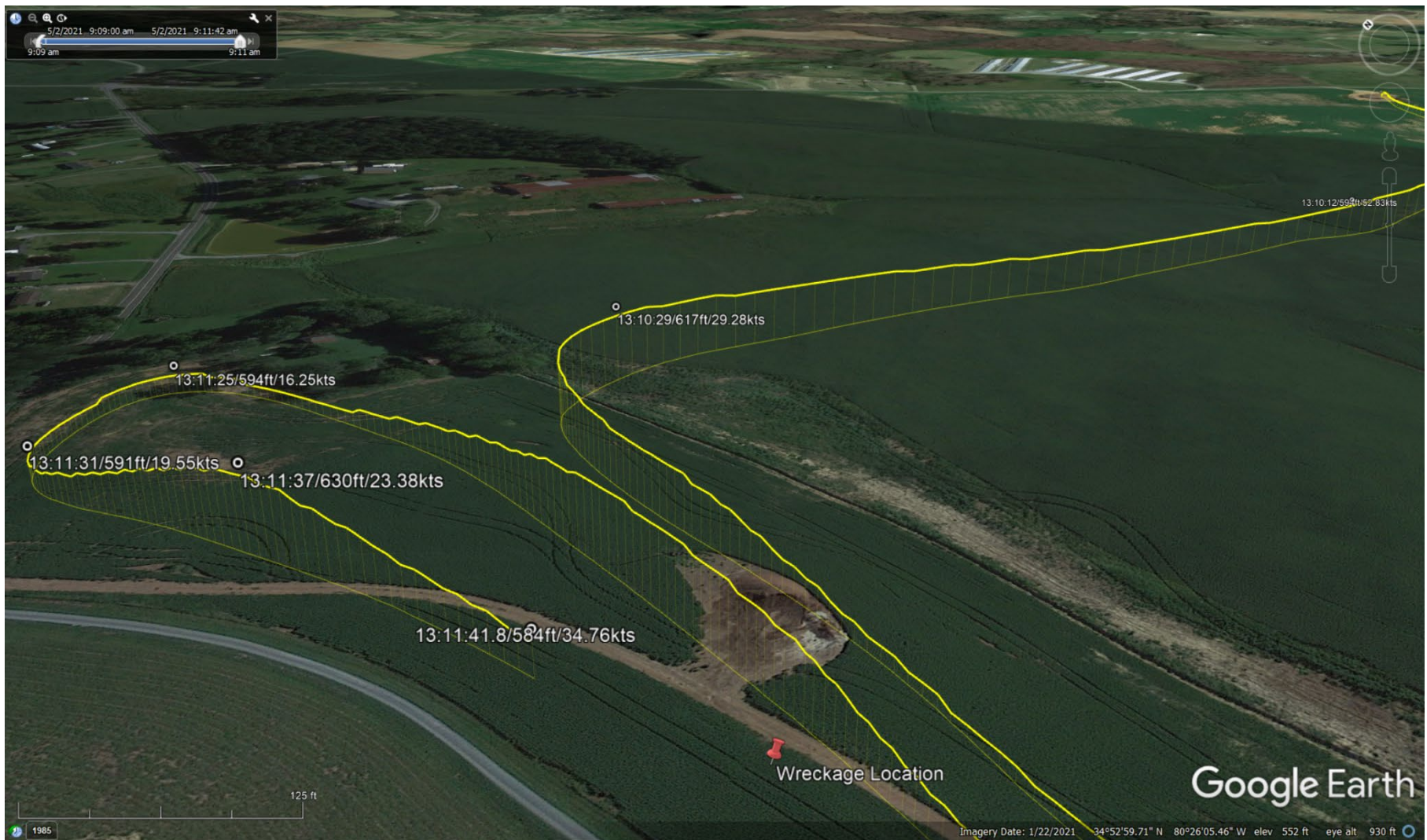


Figure 9: Google Earth overlay of the end of the accident flight.

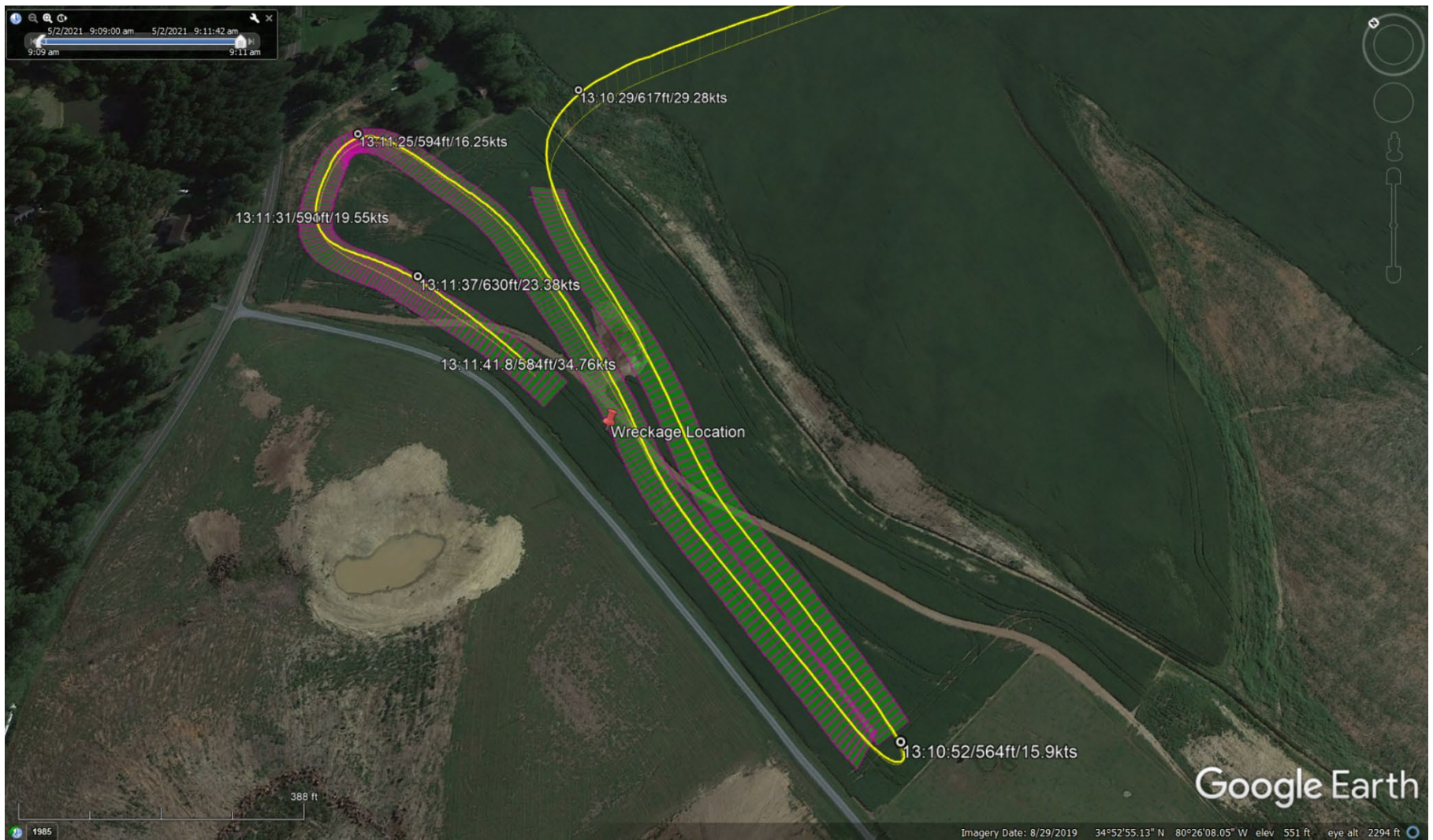


Figure 10: Google Earth overlay of the end of the accident flight with spray view.