

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

February 9, 2022

Electronic Flight Instrument System (EFIS)

Specialist's Factual Report
By W. Deven Chen

1. EVENT SUMMARY

Location: Galt, Missouri
Date: February 8, 2021
Aircraft: Cessna 177RG
Registration: N8080G
Operator: Private
NTSB Number: CEN21FA125

2. GROUP

A group was not convened.

3. DETAILS OF INVESTIGATION

On February 16, 2021, the National Transportation Safety Board (NTSB) Vehicle Recorder Division received the following EFIS:

Device Manufacturer/Model:	Garmin GDU 470
Serial Number:	59D000689

3.1. Device Description

The Garmin GDU 470 is a panel-mounted GPS receiver with 7-inch color liquid crystal (LCD) portrait display. It is a variant of the Garmin G3X Touch series. The Garmin G3X series employ 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 series have the ability to record data via an externally removable SD card mounted on 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 in configuration mode. Data is exported in engineering units, in a comma separated value (CSV) format. Each record contains UTC date and time, as well as an integer number of milliseconds since the unit was last powered.

3.2. Data Recovery

Upon arrival at the Vehicle Recorder Division, an exterior examination revealed the device had sustained impact damage, as shown in Figure 1. There was no SD card present in the device's front card slot. When opened, the main circuit board was found in slightly bent condition. A formal assistance request was sent to the manufacturer. Under the instruction of the manufacturer, the memory chip where the flight data stored was transplanted to a surrogate of Garmin GDU 460 (a different model in the G3X series) at the lab. The flight data were then exported through the surrogate device.



Figure 1: The front and back of the Garmin GDU 470, as received.

3.3. Data Description

The exported data from the surrogate device contained seven sessions, ranging from October 15, 2020, to February 8, 2021. There were two flights recorded on February 8, 2021. The first flight was from Saint Louis Downtown Airport (CPS) to Omar N. Bradley Regional Airport (MBY) and was recorded from 10:50 to 12:09 central standard time (CST). The second flight was recorded from 14:09 to 14:42 (CST) and was identified to be related to the event. Only the data from the second flight recording (event flight) are included in this report. The sampling rate of the data varied.

3.3.1. Parameters Provided

Table 1 describes data parameters provided.

Table 1: Validated Parameters.

Parameter Name	Parameter Description
Time	Time (CST) for recorded data point (HH:MM:SS)
Present Position Latitude (deg)	GPS position latitude in degrees
Present Position Longitude (deg)	GPS position longitude in degrees
Lateral Accel (g)	Lateral direction Acceleration in G

Parameter Name	Parameter Description
Normal Accel (g)	Normal direction Acceleration in G
Longitudinal Accel (g)	Longitudinal direction Acceleration in G
Pitch (deg)	Pitch angle in degrees
Roll (deg)	Roll angle in degrees
Pitch Rate (deg/s)	Pitch Rate in degrees per second
Roll Rate (deg/s)	Roll Rate in degrees per second
Yaw Rate (deg/s)	Yaw Rate in degrees per second
GPS Ground Speed (kts)	Aircraft ground speed in knots
Indicated Airspeed (kts)	Indicated Air Speed in knots
True Airspeed (kts)	True Air Speed in knots
Vertical Speed (ft/m)	Vertical Speed in feet per minute
GPS Altitude (ft)	Altitude above Mean Sea Level (MSL) in feet
Pressure Altitude (ft)	Altitude above MSL with reference to Standard pressure
Ground Track (deg)	Ground track with reference to true north in degrees
Magnetic Heading (deg)	Heading with reference to magnetic north in degrees

3.4. Plots and Corresponding Tabular Data

The following figures contain data recorded during the February 8, 2021, event.

Figure 2 is a Google Earth overlay showing the overview of the entire event flight. The flight started at around 14:09:47 CST and ended at around 14:42:10 CST. The reported wreckage location is shown with a red pin. The weather and lighting conditions in Google Earth are not necessarily the weather and lighting conditions present at the time of the recording.

Figure 3 is a Google Earth overlay showing that the aircraft took off at Omar N. Bradley Regional Airport at around 14:09:47 CST. The recorded flight path is in staircase pattern when showed in zoom-in view. According to the manufacturer, this was caused by varied sampling rate during the recording, and the recorded data are the best resolution that could be obtained in this instance.

Figure 4 is a Google Earth overlay showing the final portion of the event flight. The last recorded data point was at 14:42:10 CST.

Figure 5 is a Google Earth overlay showing the final portion of the event flight at a different angle with respect to Figure 4.

Figure 6 is a plot of the recorded data parameters from the Garmin GDU 470 for the entire event flight. The time period displayed is from 14:09:00 to 14:43:00 CST.

Figure 7 is a plot of the last 5 minutes of recorded data for the event flight.

The corresponding tabular data used to create figures 2-7 are provided in comma separated value (CSV) format as Attachment 1 to this report. The attachments contain additional parameters that were recorded during the event flight. Not every additional parameter has been validated by the specialist.

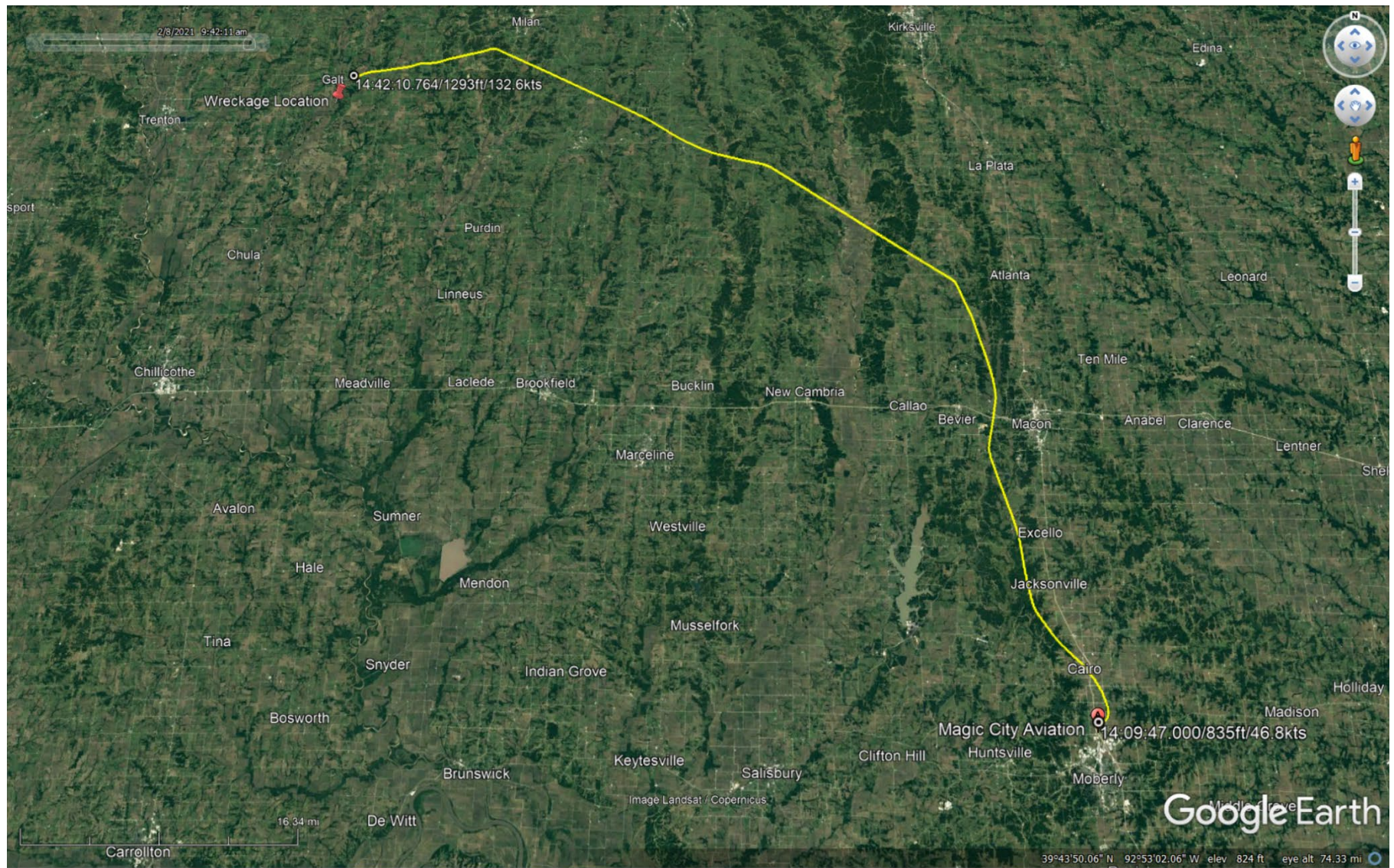


Figure 2: Google Earth overlay showing the overview of the entire event flight.

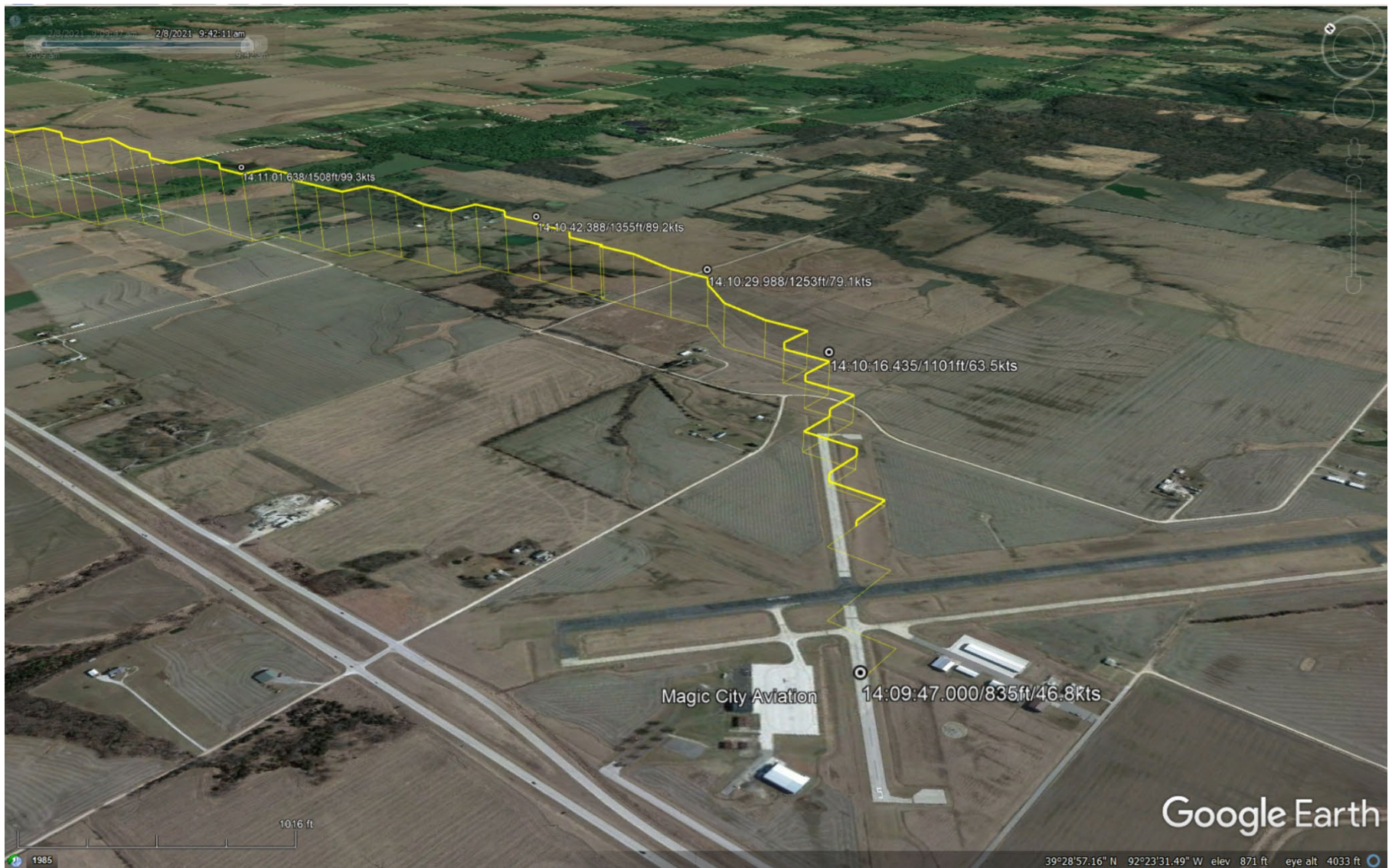


Figure 3: Google Earth overlay showing the beginning of the event flight.

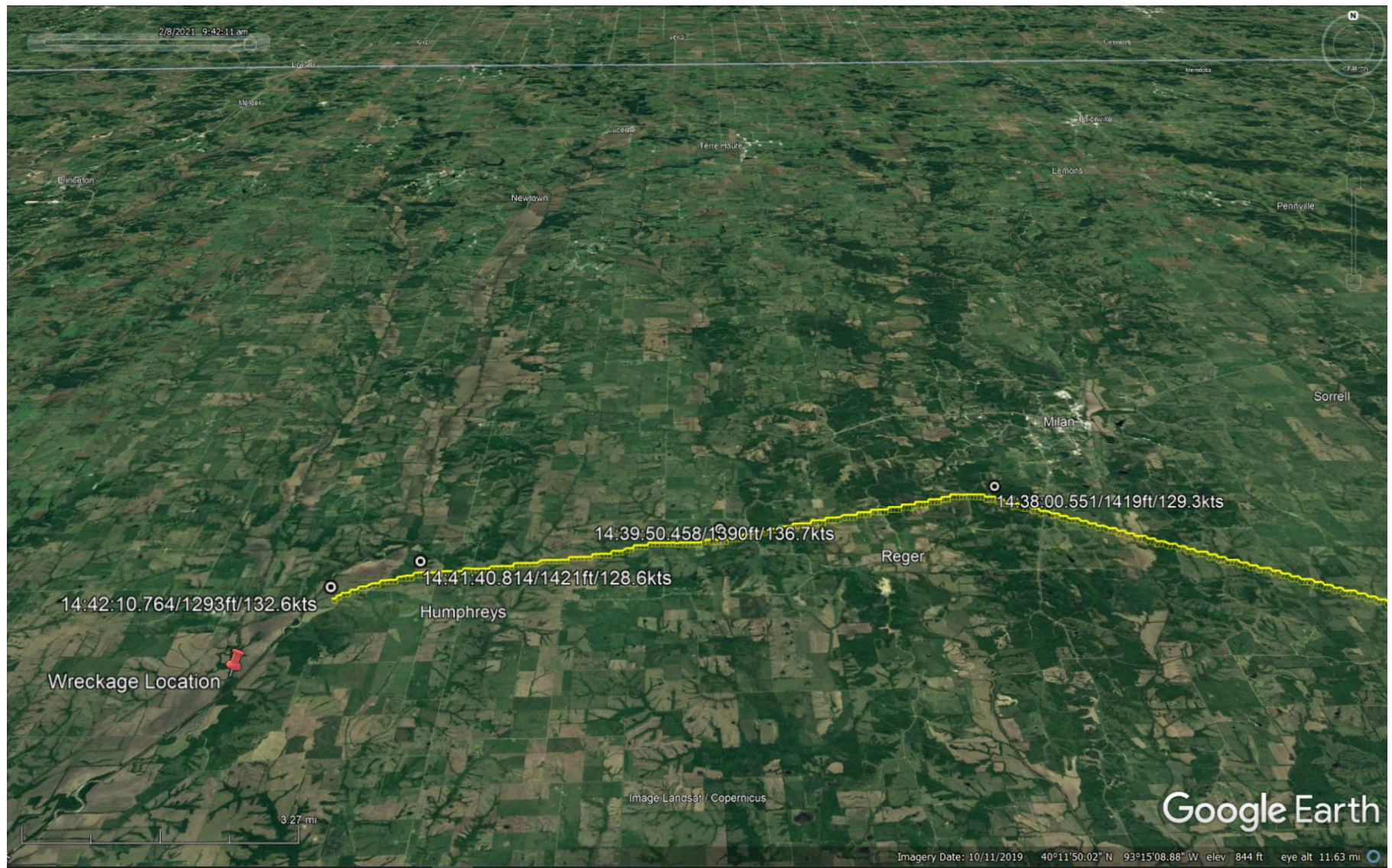


Figure 4: Google Earth overlay showing the end of the event flight and wreckage location.

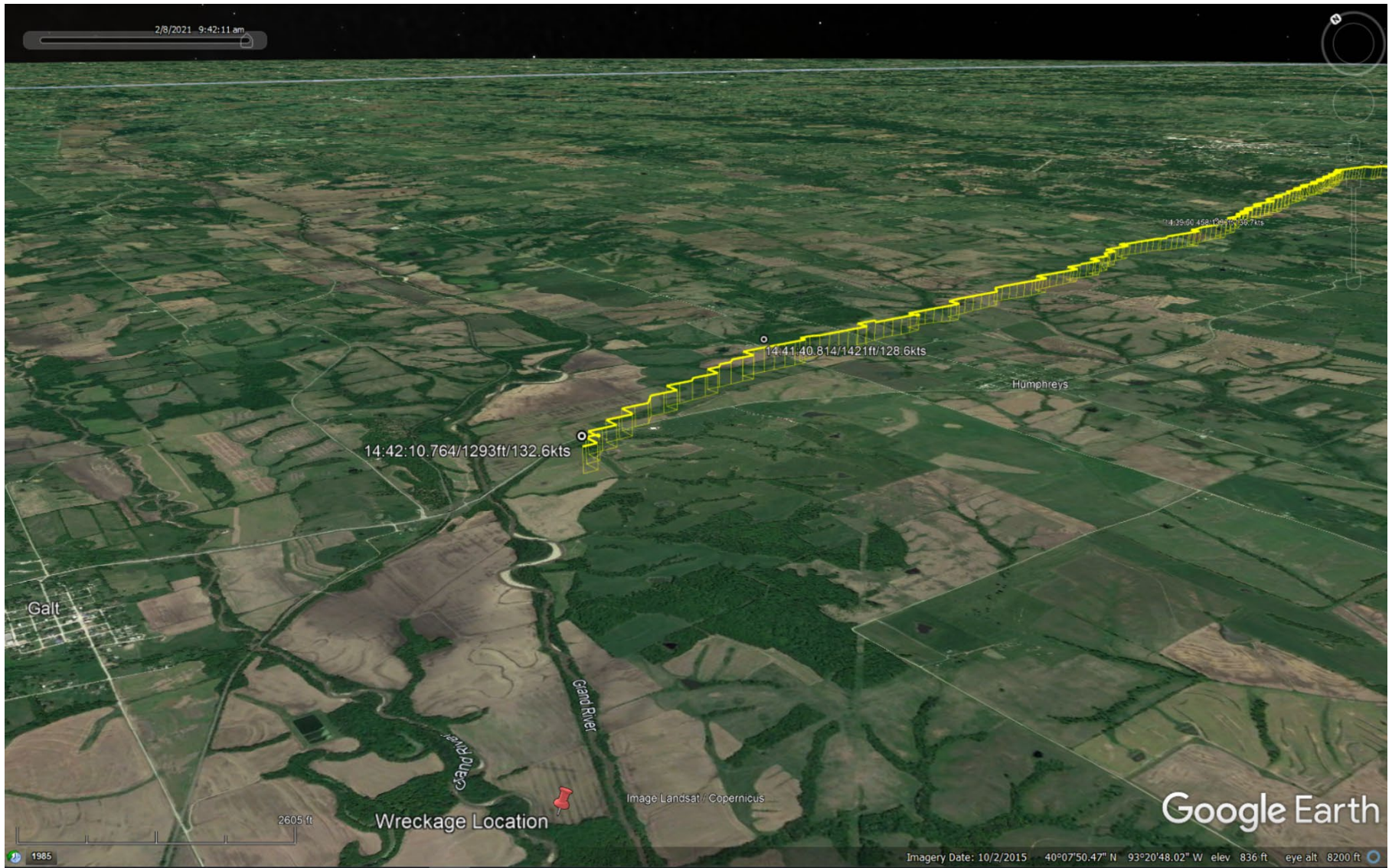


Figure 5: Google Earth overlay showing the end of the event flight at a different angle.

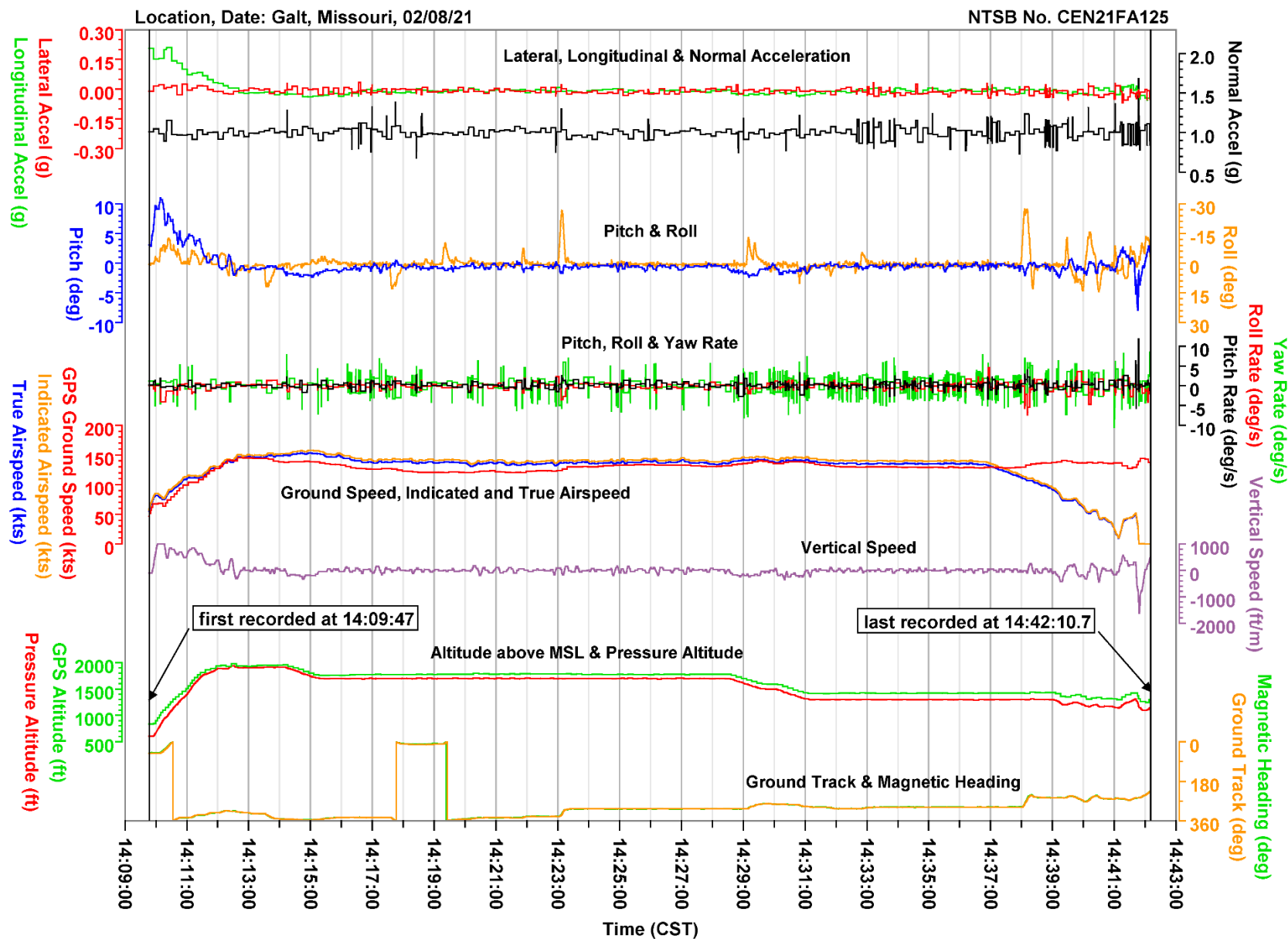


Figure 6: Plot of selected and validated data parameters of the entire event flight.

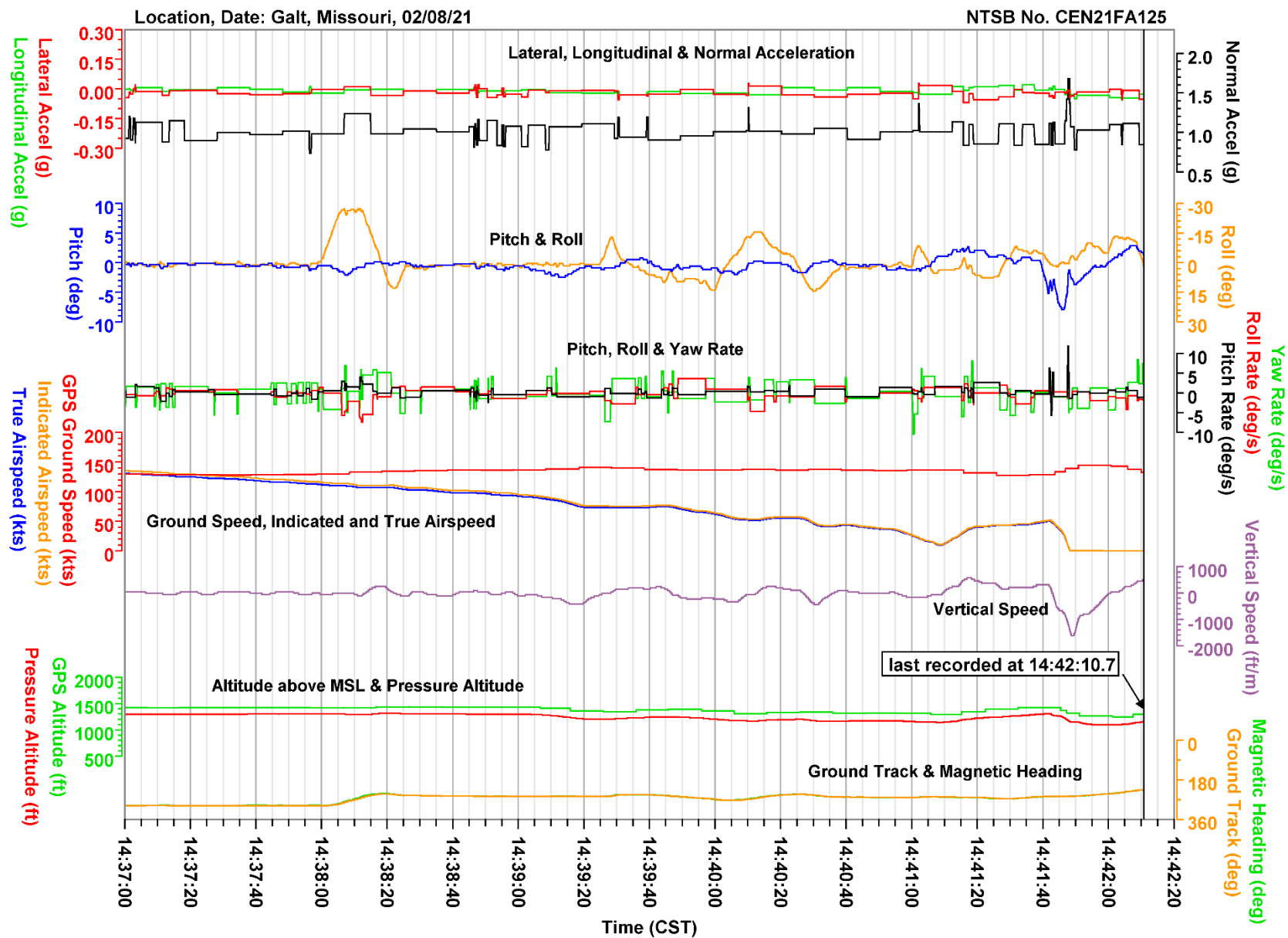


Figure 7: Plot of selected and validated data parameters of last 5 minutes of the event flight.