

# National Transportation Safety Board

Office of Research and Engineering

Washington, DC 20594



WPR22FA184

## **COCKPIT DISPLAY - RECORDED FLIGHT DATA**

Specialist's Factual Report

September 19, 2022

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## **A. EVENT SUMMARY**

Location: Cape Girardeau, Missouri  
Date: May 22, 2022  
Time: 0803 central daylight time (CDT)  
Airplane: experimental M24 Orion Plus gyroplane, N590DM

## **B. COCKPIT DISPLAY - RECORDED FLIGHT DATA SPECIALIST**

Specialist: W. Deven Chen  
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Washington, DC

## **C. DETAILS OF THE INVESTIGATION**

A recorder group was not convened. The NTSB Vehicle Recorder Division received the following flight data recorder:

|                              |                  |
|------------------------------|------------------|
| Recorder Manufacturer/Model: | Dynon SV HDX1100 |
| Recorder Serial Number:      | 14798            |

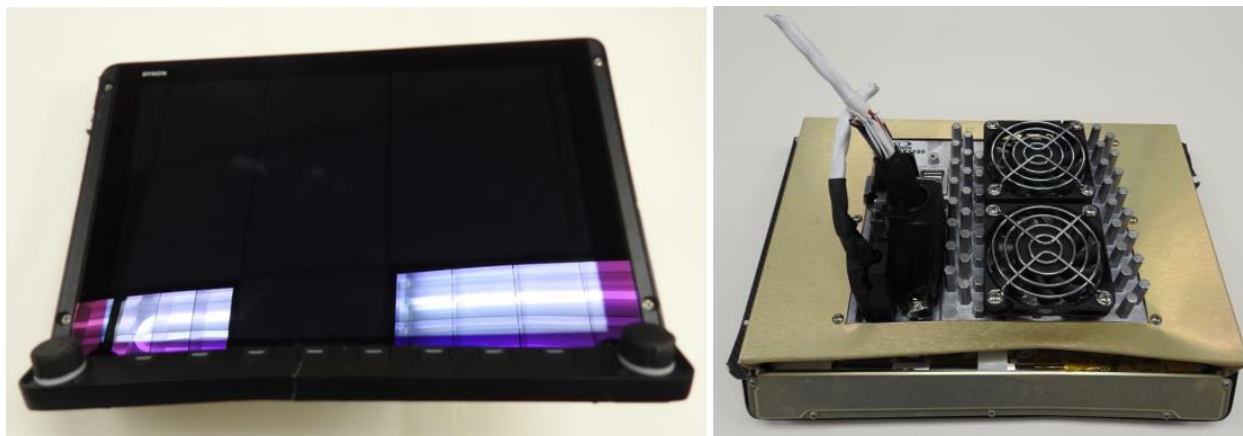
### **1.0 Recorder Description**

The Dynon SV HDX1100 has an 11" screen with both a touchscreen and softkey interface. The device can serve as either a Primary Flight Display (PFD) or a Multifunction Display (MFD) depending on the installation. The unit has a solid-state Air Data and Attitude Heading Reference System (ADAHRS) and displays aircraft parameter data including altitude, airspeed, attitude, vertical speed, and heading. The unit also has external pitot/static inputs for altitude, airspeed, and vertical speed information. The device contains an internal flash memory device. The flash memory stores information sampled every 60 milliseconds for the last two hours of flight in a file called a "Black\_Box\_Log," detailed alert logs that show both caution, warning and aural alerts generated by the display in a file called "Alert\_Data," as well as a flight history log which is sampled at a lower rate that can record many more hours of operation. The flight history is recorded as a file called "User\_Log" and is sampled about every 250 milliseconds.

### **1.1 Recorder Condition and Data Recovery**

The device had sustained impact damage to its lower part upon arrival at the Vehicle Recorder Division, as shown in fFigure 1. Some damages to its internal circuit boards were exposed when the device was opened for further examination. The internal memory module was found with no damage. The memory module was

connected to a write-block reader kit, and its stored data was exported with laboratory software.



**Figure 1.** Dynon SV HDX1100 as received.

## 1.2 Recording Description

The exported data contained 3 data folders: BLACK\_BOX\_LOG\_DATA, USER\_LOG\_DATA, and ALERT\_DATA. All 3 folders contained data files recorded on May 22, 2022, as their last recording files, which were determined to be associated with the event. For the event flight recording, the BLACK\_BOX\_LOG\_DATA had sampling frequency of 16 Hz, but only had the last portion of the event flight, from the takeoff to the end. The USER\_LOG\_DATA had the entire flight recording, including the taxiing to runway portion, but only had 4 Hz sampling frequency. To have a best data set, the data from the BLACK\_BOX\_LOG\_DATA and USER\_LOG\_DATA were combined for this report. The ALERT\_DATA contained warning events triggered during the flight. The duration of the event flight recording was approximately 16 minutes and 53 seconds.

### 1.2.1 Parameters Provided

Table 1 lists the recorder parameters verified and provided in this report.

**Table 1.** Dynon SV HDX1100 data parameters provided.

| Parameter Name (unit)   | Parameter Description                                               |
|-------------------------|---------------------------------------------------------------------|
| Latitude (deg)          | Geographic latitude (degrees)                                       |
| Longitude (deg)         | Geographic longitude (degrees)                                      |
| Lateral Accel (g)       | Lateral Acceleration (g)                                            |
| Vertical Accel (g)      | Vertical Acceleration (g)                                           |
| Pitch (deg)             | Pitch Angle (degrees)                                               |
| Roll (deg)              | Roll Angle (degrees)                                                |
| Vertical Speed (ft/min) | Aircraft vertical speed (feet per minute)                           |
| Ground Speed (kts)      | Average groundspeed between current and previous data point (knots) |
| Indicated Speed (kts)   | Airspeed read from airspeed indicator onboard (knots)               |

| Parameter Name (unit)  | Parameter Description                                              |
|------------------------|--------------------------------------------------------------------|
| True Speed (kts)       | Airspeed corrected for temperature and pressure altitude (knots)   |
| GPS Altitude (ft)      | Geometric altitude above Mean Sea Level (feet)                     |
| Pressure Altitude (ft) | Altitude recorded at a 29.92 inHg pressure setting (feet)          |
| Density Altitude (ft)  | Altitude relative to standard atmospheric conditions (feet)        |
| Ground Track (deg)     | Path on the surface of the Earth directly below aircraft (degrees) |
| Magnetic Heading (deg) | Direction relative to magnetic north (degrees)                     |

### 1.3 Time Correlation

The data was recorded in coordinated universal time (UTC) and converted to CDT, the local time of the event, for the rest of the report.

## D. FIGURES AND TABULAR DATA

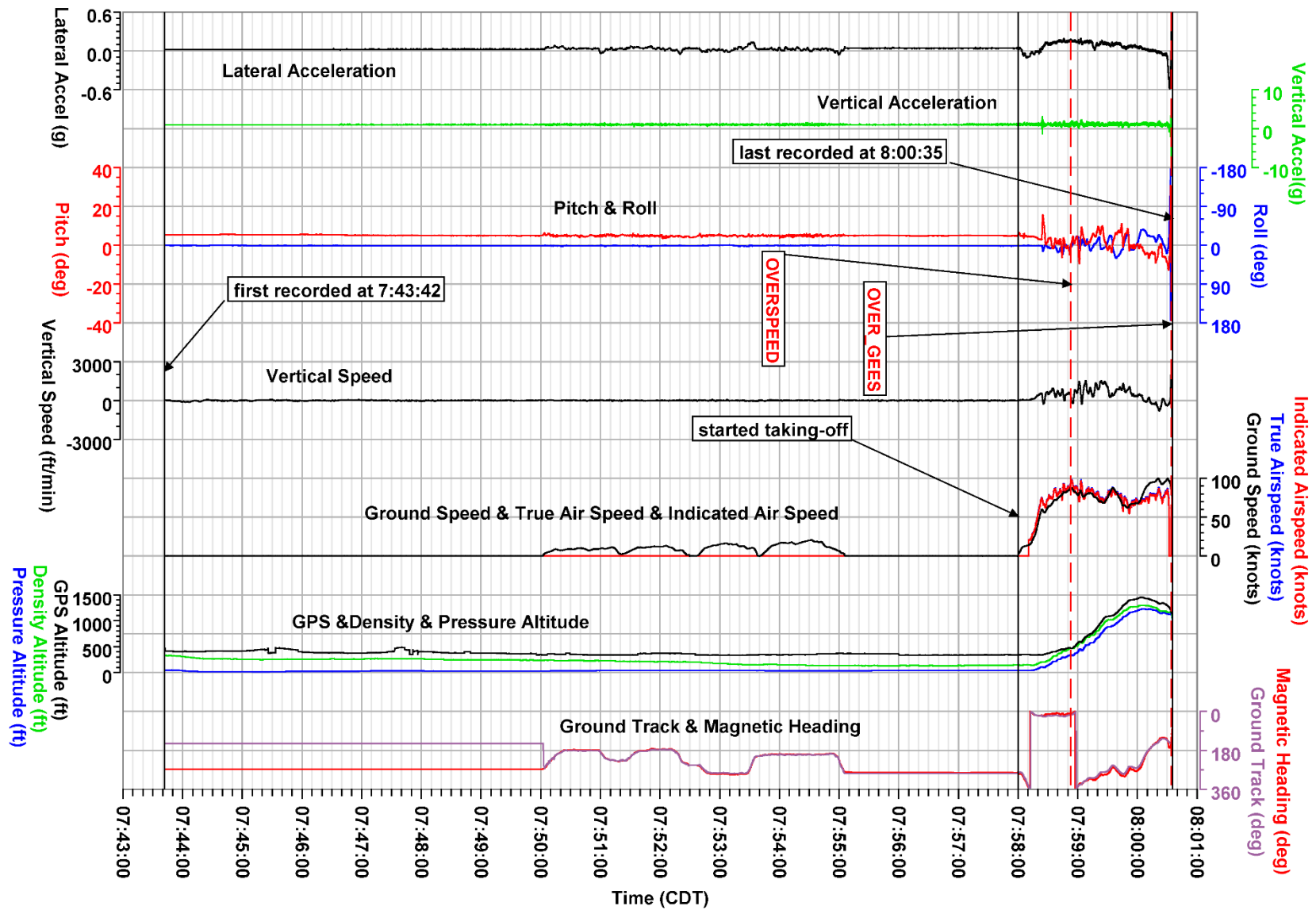
Figure 2 to 5 show parameter plots of the data recorded during the event on May 22, 2022. These figures are configured such that right turns are indicated by the trace moving toward the bottom of the page, left turns towards the top of the page, and nose up attitudes towards the top of the page. Alert data from the ALERT\_DATA file is overlaid on the plots. The Dynon system gave "OVERSPEED" audio alert at 7:58:53 and "OVER\_GEES" audio alert at 8:00:34. Based on the configuration data of the Dynon system, the threshold of the OVERSPEED audio alert was set to 110 mile per hour (approximately 95.6 knots), and the thresholds of the positive and negative OVER\_GEES were set to 4 g and -3 g.

Figures 6 and 7 show Google Earth overlays of the event flight. The weather and lighting conditions in Google Earth are not necessarily the weather and lighting conditions present at the time of the recording.

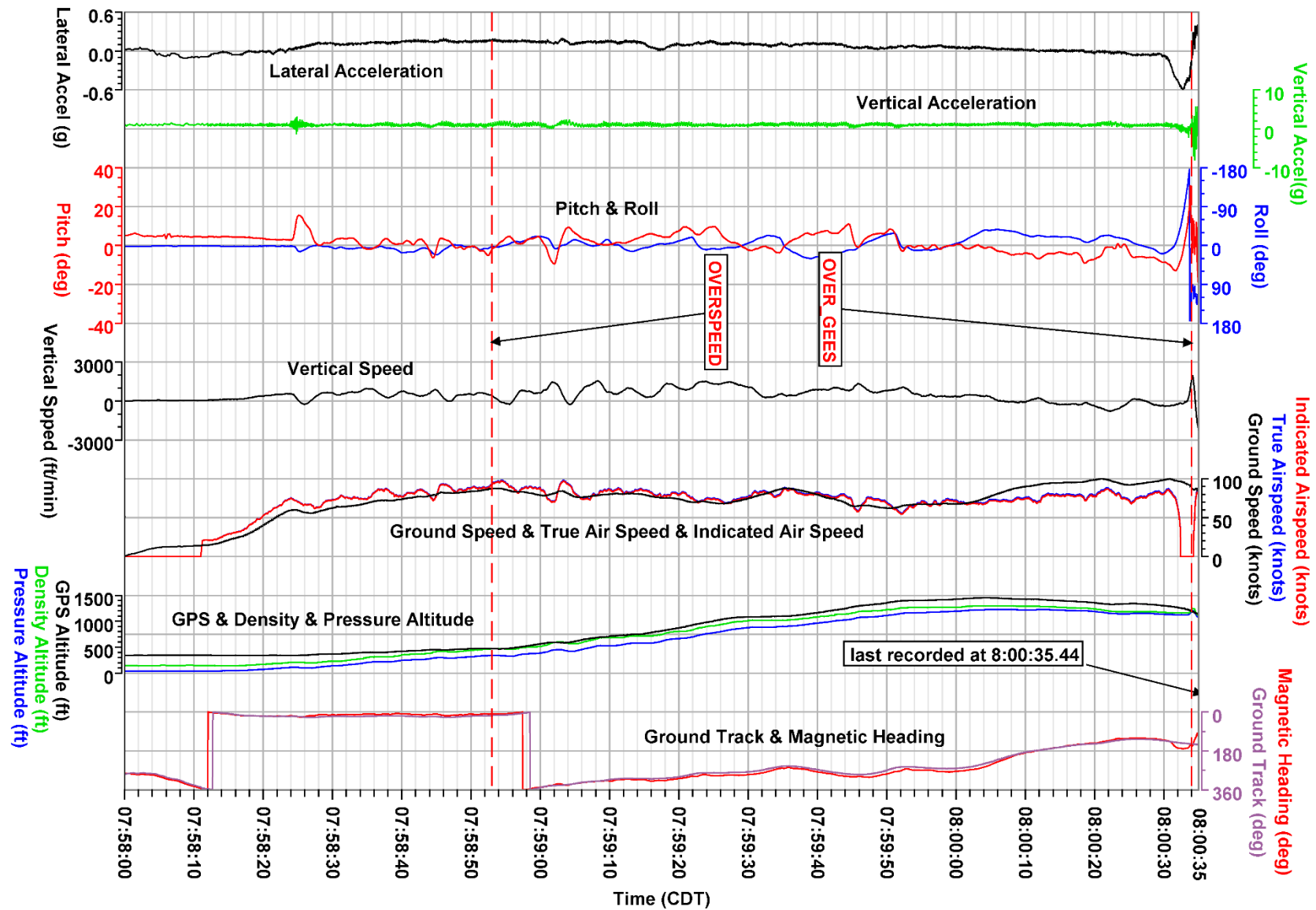
The corresponding tabular data used to create Figure 2 to 7 are provided in electronic comma-separated value (CSV) format as attachment 1 to this report. The ALERT\_DATA file is provided as attachment 2 to this report.

Submitted by:

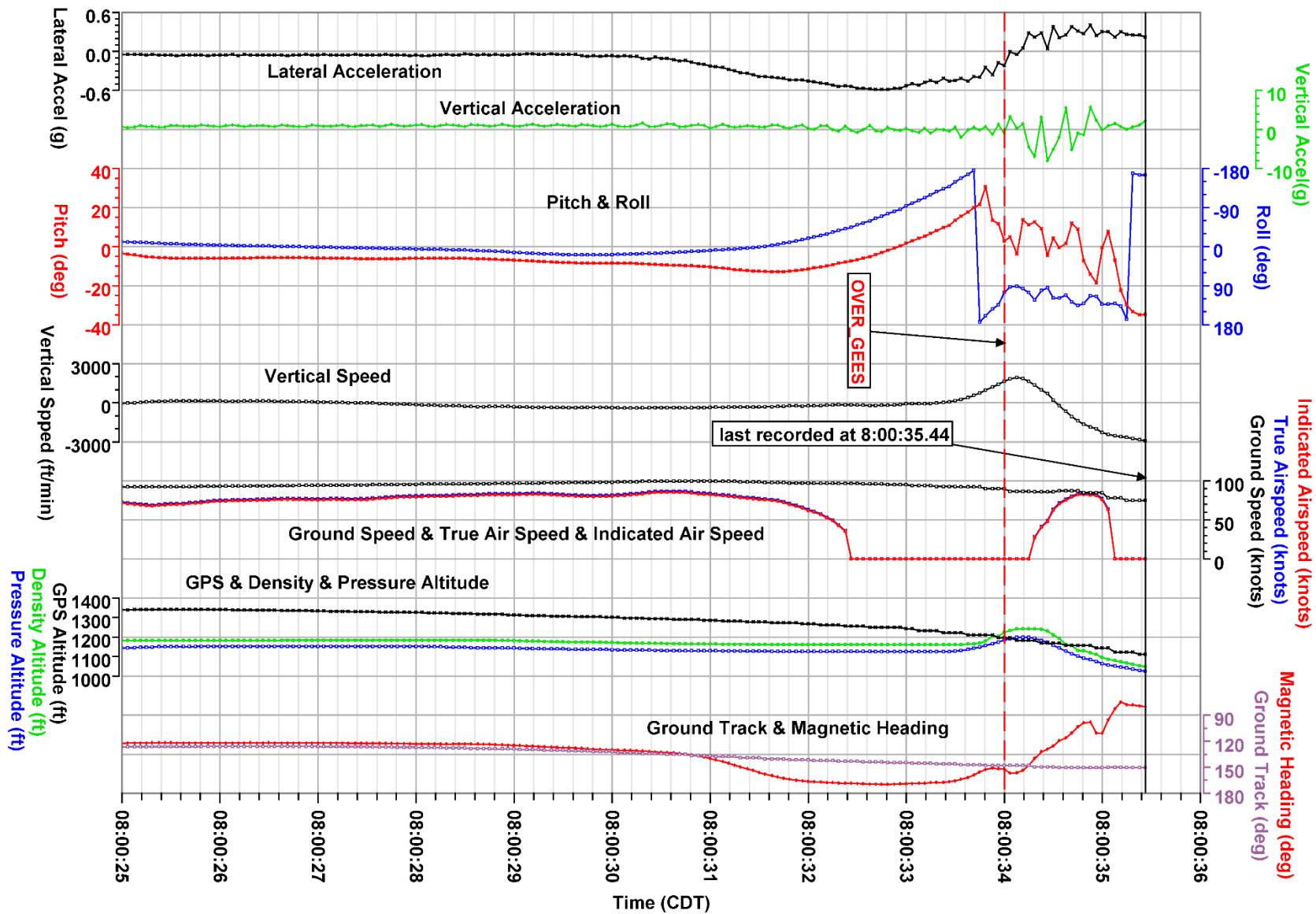
W. Deven Chen  
Electrical Engineer - Recorder Specialist



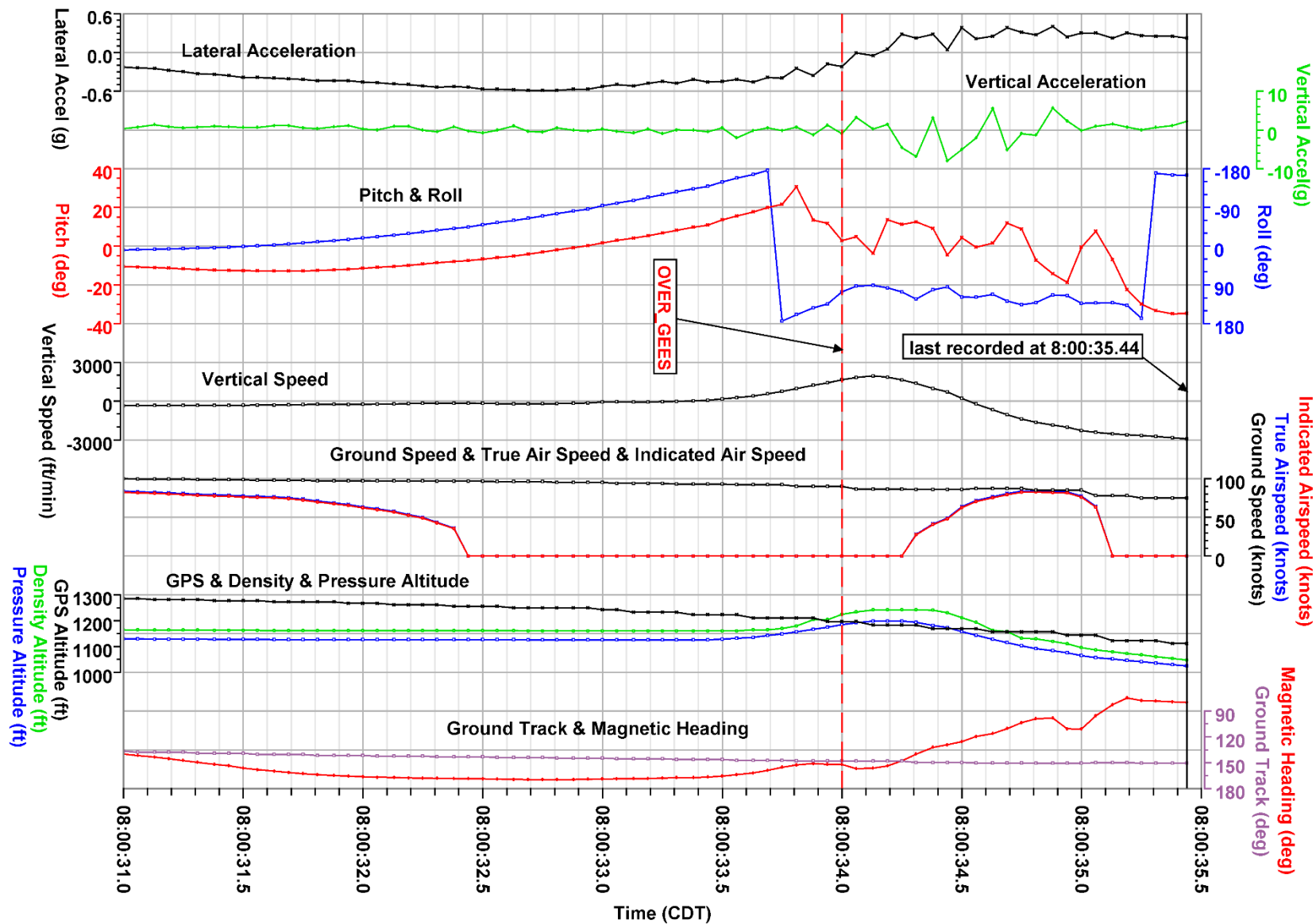
**Figure 2.** Plot of data parameters for the entire event flight recording.



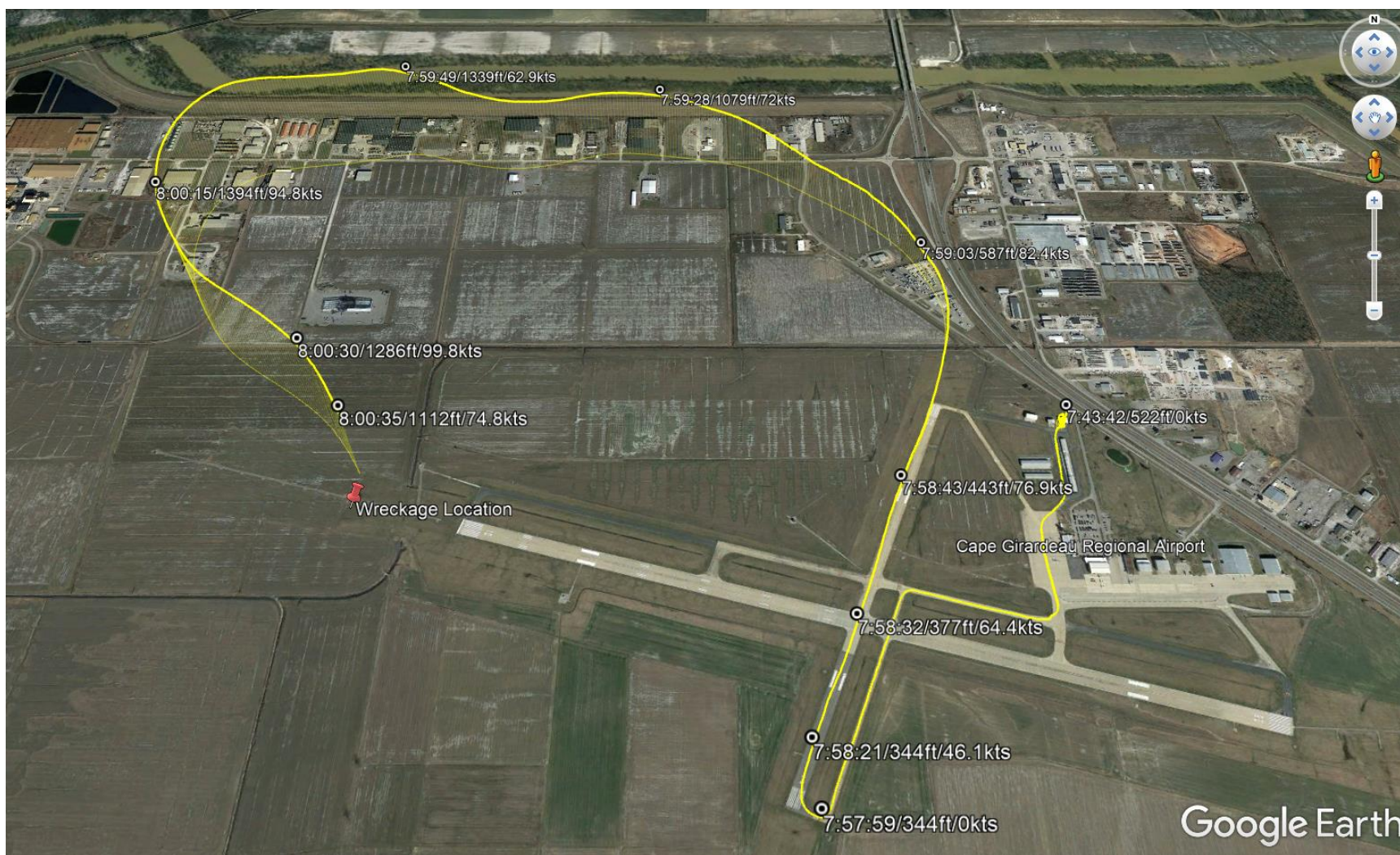
**Figure 3.** Plot of data parameters for the flight portion of the event flight recording.



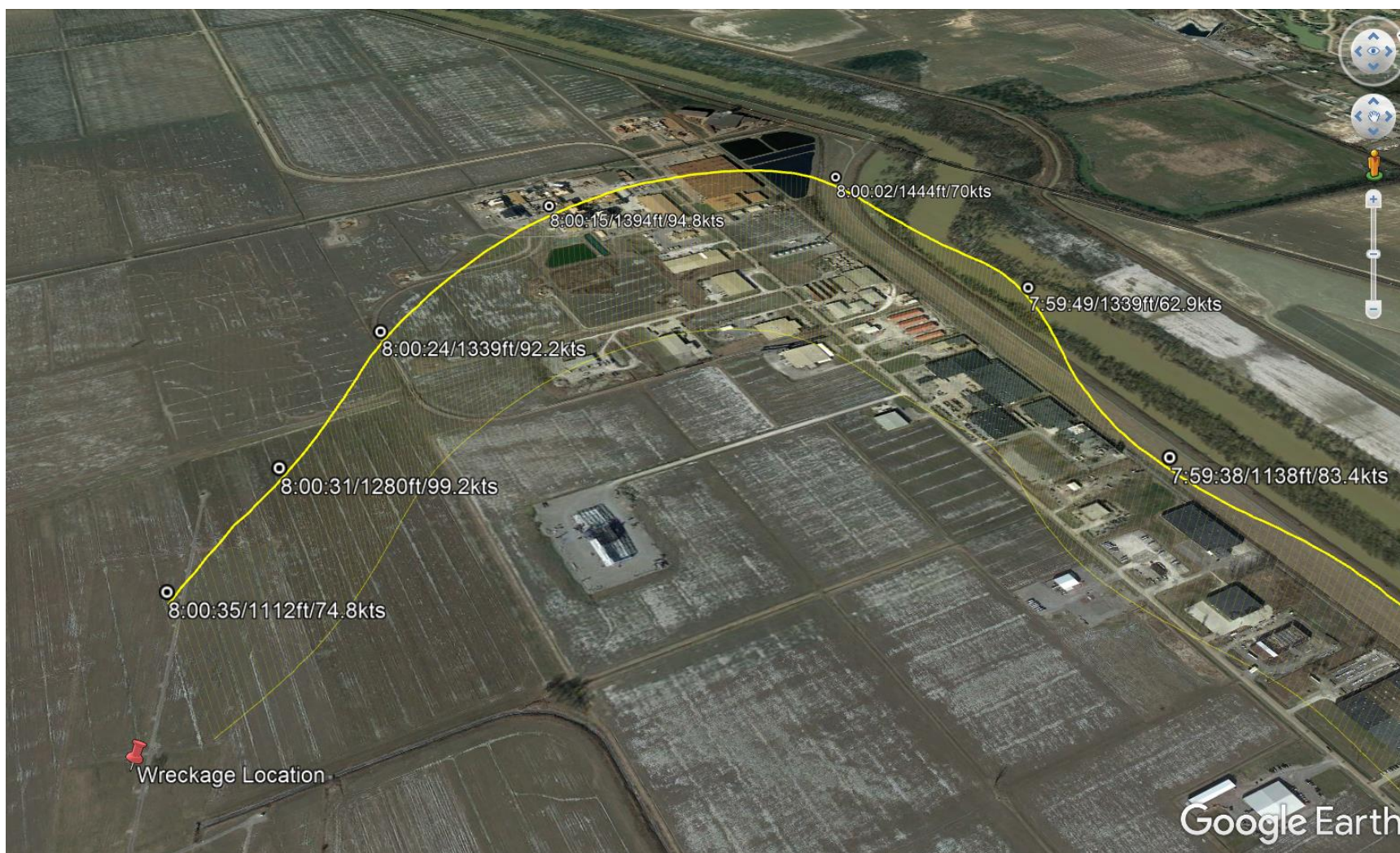
**Figure 4.** Plot of data parameters for the last 10 seconds of the event flight recording.



**Figure 5.** Plot of data parameters for the last 5 seconds of the event flight recording.



**Figure 6.** Google Earth overfly of the entire event flight.



**Figure 7.** Google Earth overfly of the final portion of the event flight.