

National Transportation Safety Board

Office of Research and Engineering

Washington, DC 20594



ERA23FA131

GLOBAL POSITIONING SYSTEM DEVICE

Specialist's Factual Report

July 18, 2023

TABLE OF CONTENTS

A. ACCIDENT.....	3
B. GLOBAL POSITIONING SYSTEM DEVICE SPECIALIST	3
C. DETAILS OF THE INVESTIGATION	3
1.0 DEVICE DESCRIPTION	3
1.1 Data Recovery	4
1.2 Recording Description	4
1.3 Parameters Provided	5
D. OVERLAYS AND TABULAR DATA.....	5

A. ACCIDENT

Location: Hillsville, Virginia
Date: February 27, 2023
Time: 1656 eastern standard time (EST)
2156 coordinated universal time (UTC)
Airplane: Cessna 150G, private operator, N2991J

B. GLOBAL POSITIONING SYSTEM DEVICE SPECIALIST

Specialist: Gerald Kawamoto
Recorder Specialist
National Transportation Safety Board (NTSB)

C. DETAILS OF THE INVESTIGATION

A global positioning system (GPS) group was not convened. The NTSB Vehicle Recorder Division received the following GPS device:

Recorder Manufacturer/Model: Garmin aera 660
Recorder Serial Number: 4NN011536

1.0 Device Description

The Garmin Aera 660 is a battery-powered portable multi-function display and GPS receiver with a sunlight-readable 5-inch diagonal touch screen 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 nautical miles.

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 - 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 configured. Once the current track log memory becomes full, new information 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.¹ 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 back-up power to the internal memory and real-time clock during those periods when main power is removed.

1.1 Data Recovery

Upon arrival at the Vehicle Recorder Laboratory, an exterior examination revealed the unit had sustained damage to its display, as shown in Figure 1. The device was otherwise in good condition and powered on normally using a functional laboratory surrogate display. Data were downloaded normally using the manufacturer's procedures.

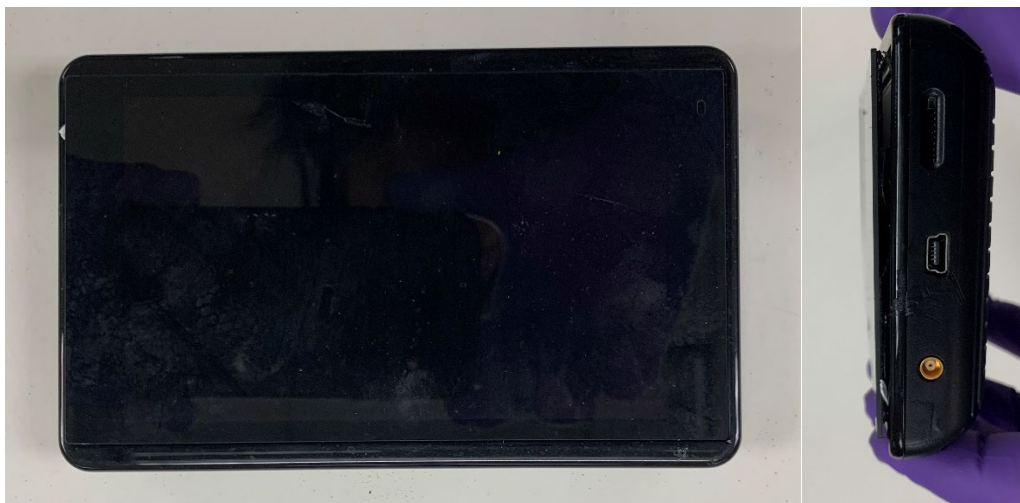


Figure 1. Front and side view of the Garmin aera 660 as received.

1.2 Recording Description

The data extracted included sessions recorded from February 8, 2023, through the accident flight on February 27, 2023, coordinate universal time.² The accident session started at 21:05:33 UTC and ended at 22:33:15 UTC on February 27, 2023. Location data was stagnant after 21:56:42 UTC, which may be attributed to the device remaining powered on after the time of impact. A total of 20 data points were recorded after 21:56:42 UTC until the final data point at 22:33:15 UTC.

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

² All dates and times are referenced to coordinated universal time (UTC).

1.3 Parameters Provided

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

Table 1. GPS 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)
GPS Alt	Recorded GPS Altitude (feet)
Groundspeed	Average derived groundspeed (knots)
Track	Average derived true course (degrees)

D. OVERLAYS AND TABULAR DATA

Figures 2 and 3 are graphical overlays generated using Google Earth for the accident flight. The weather and lighting conditions in Google Earth are not necessarily the weather and lighting conditions present at the time of the recording. Figure 2 shows the entire flight and Figure 3 shows the final four minutes of the flight.

Figure 4 is a plot of parameters for the entire accident session. The time shown is 21:05:00 to 22:35:00 UTC.

Figure 5 is a plot of parameters for the final four minutes of the accident flight. The time shown is 21:53:00 to 21:56:45 UTC. Data recorded after 21:56:42 UTC are not shown.

The corresponding tabular data used to create figures 2 through 5 are provided in electronic comma-separated value (CSV) format as attachment 1 to this report.

Submitted by:

Gerald Kawamoto
Recorder Specialist

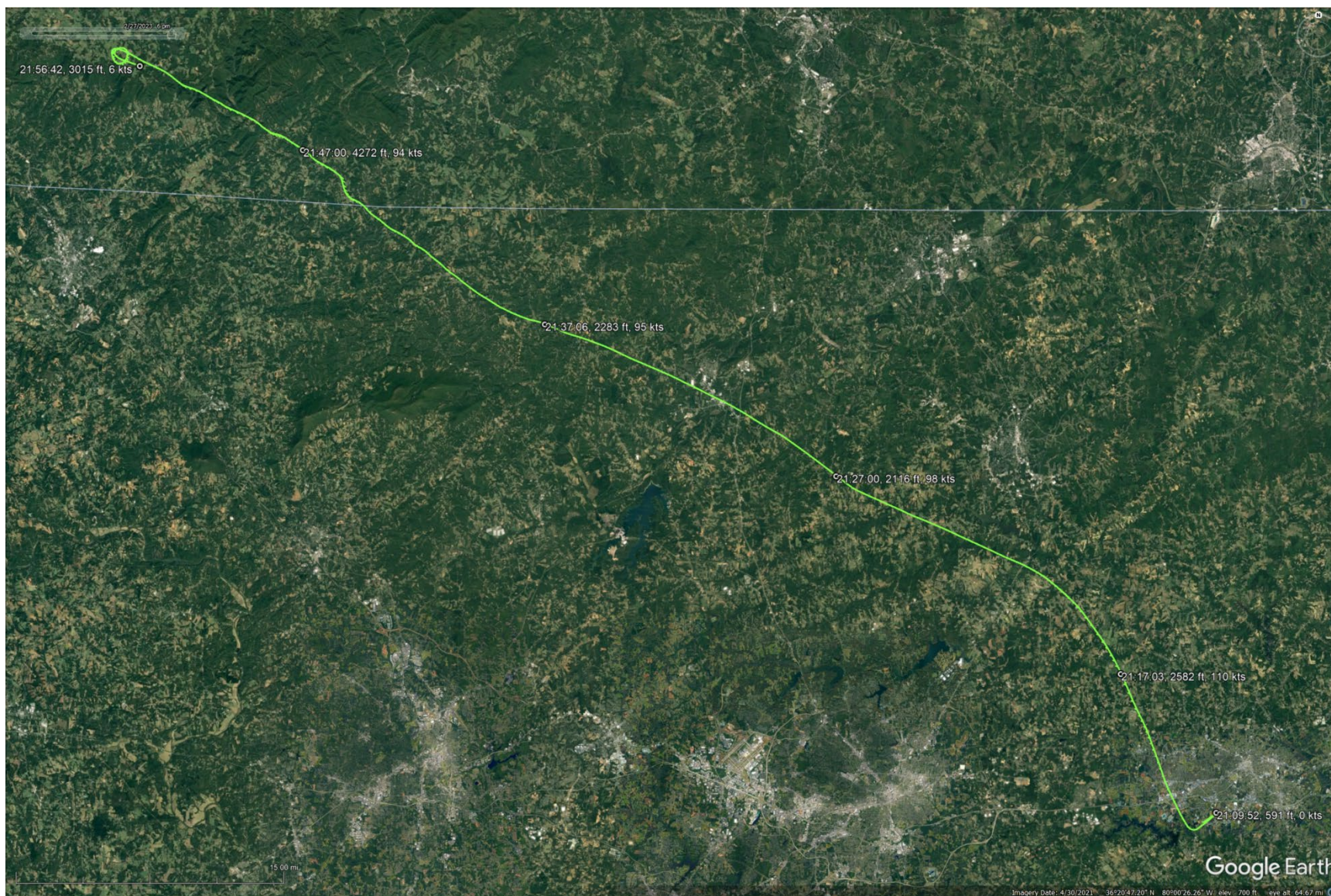


Figure 2. Google Earth overlay of the entire accident flight recorded on the Garmin aera 660.



Figure 3. Google Earth overlay of the final 4 minutes of the accident flight recorded on the Garmin aera 660.

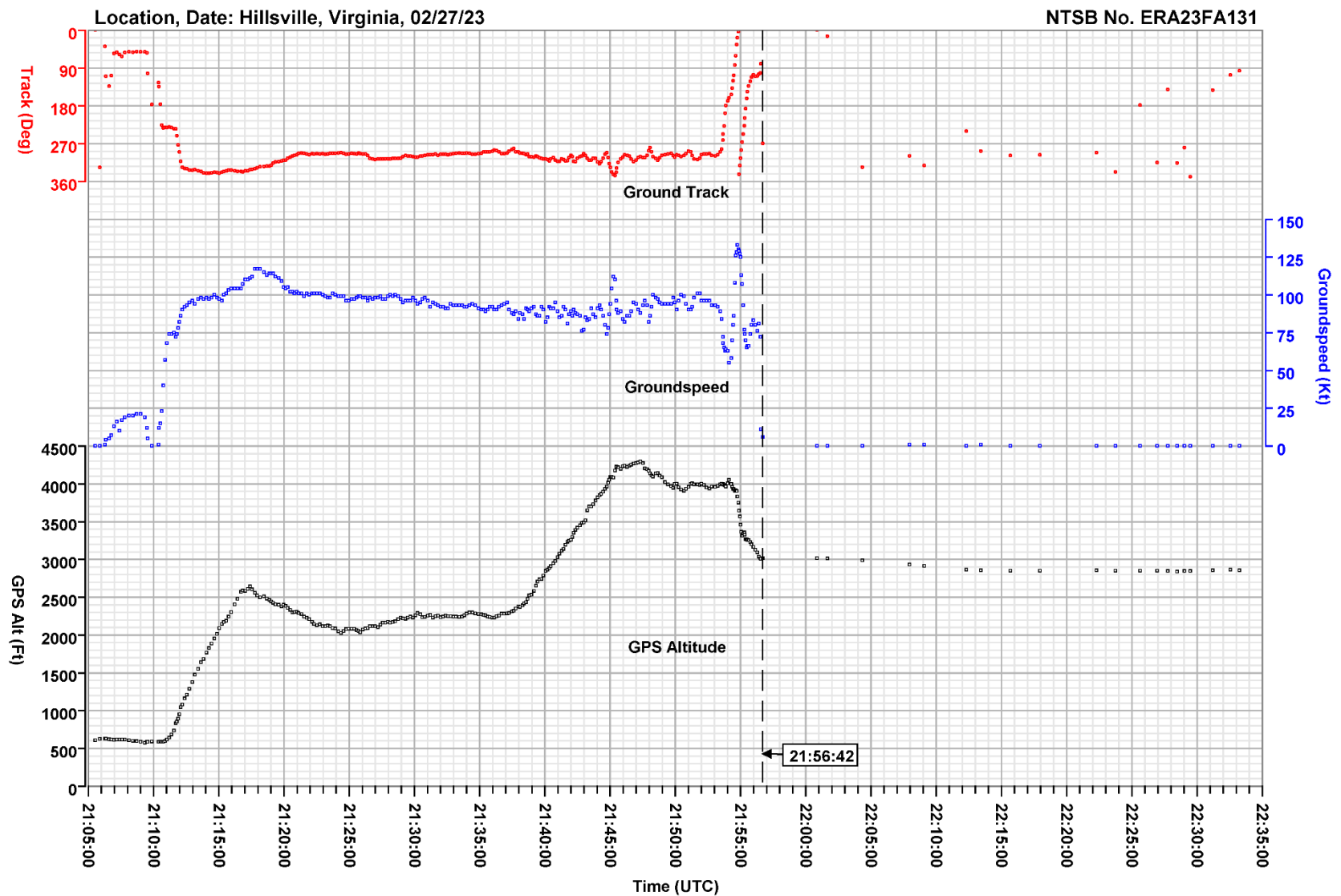


Figure 4. Google Earth overlay of the entire accident session recorded on the Garmin aera 660.

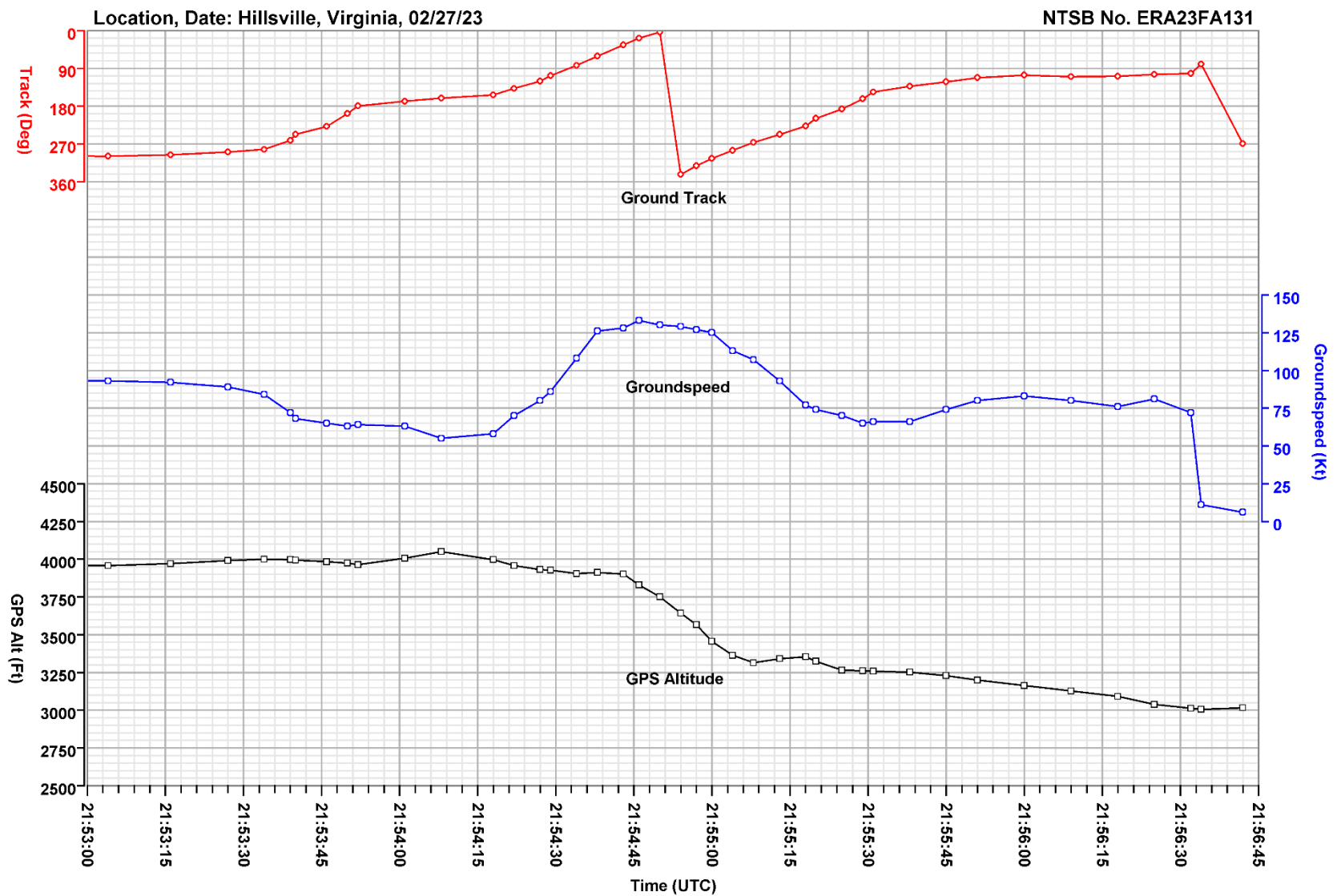


Figure 5. Google Earth overlay of the final 4 minutes of the accident flight recorded on the Garmin aera 660.