National Transportation Safety Board

Office of Research and Engineering

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AUTOMATIC DEPENDENT SURVEILLANCE-BROADCAST (ADS-B) STUDY

Aircraft Performance Study

By

Marie Moler

A. ACCIDENT

Location: Pulaski, Tennessee
Date: December 7, 2023
Time: 1103 central standard time (CST)
Airplane: Beech 35-C33, N5891J

B. SUMMARY

On December 7, 2023, at 1103 central standard time (CST), a Beech 35-C33, N5891J, was destroyed when it was involved in an accident near Pulaski, Tennessee. The private pilot and passenger sustained fatal injuries. The airplane was operated as a Title 14 *Code of Federal Regulations* Part 91 personal flight.

C. PERFORMANCE STUDY

1.0 Aircraft

The airplane was a Beech 35-C33, a Debonair. It is a fixed wing, four seat airplane with a conventional tail.

Figure 1. Beech 35-C33, N5891J

2.0 Available Data

Automatic Dependent Surveillance-Broadcast (ADS-B) data was provided by the Federal Aviation Administration (FAA). ADS-B broadcasts an airplane's Global Positioning System (GPS) position and other data to the ground where it is recorded. The GPS position has an accuracy of approximately 20 meters (65 ft) in both the horizontal and vertical dimensions.

3.0 Weather

Weather was recorded at 11:15 at Ellington Airport (LUG) in Lewisburg, Tennessee, 16 NM north of the accident location. The temperature was 53°F (12°C), the dew point was 32°F (0°F), and the altimeter setting was 30.19 inHg. Winds were 9 kts from 190° and visibility was 10 statute miles.

4.0 Flight Path

The airplane took off from Knoxville Downtown Island Airport (DKX) at 09:48 with the intention of flying to Benton, Arkansas. The airplane climbed and turned onto a southwesterly heading that remained relatively steady throughout the flight (Figure 2). However, altitude and speed showed considerable variation (Figure 3). During the climb to 6,500 ft, the airplane's groundspeed[1] dropped to 80 kts before accelerating to 130 kts once reaching altitude. The airplane maintained 6,500 ft and a groundspeed just below 130 kts for about 10 minutes. After 10:20, the airplane began a series of descents towards 6,000 ft while gaining speed before again climbing back to 6,500 ft while slowing.

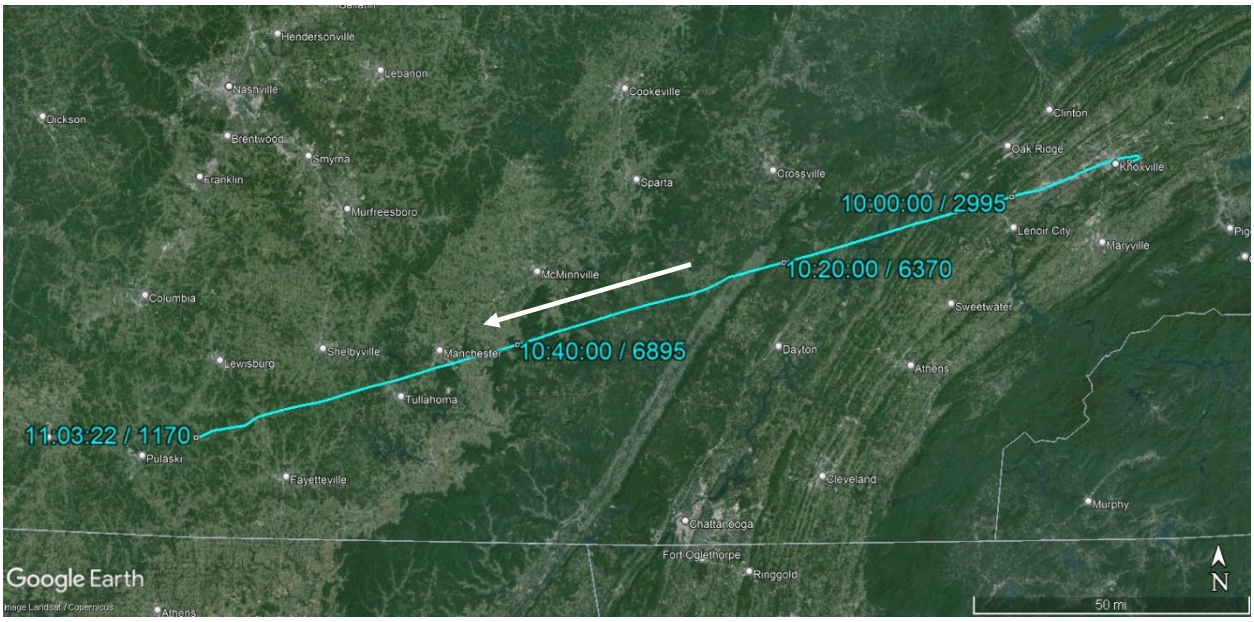

Figure 2. Flight path with selected times and altitudes marked.

[1] Airspeed will be shown for the end of flight when accident meteorological conditions are most applicable.

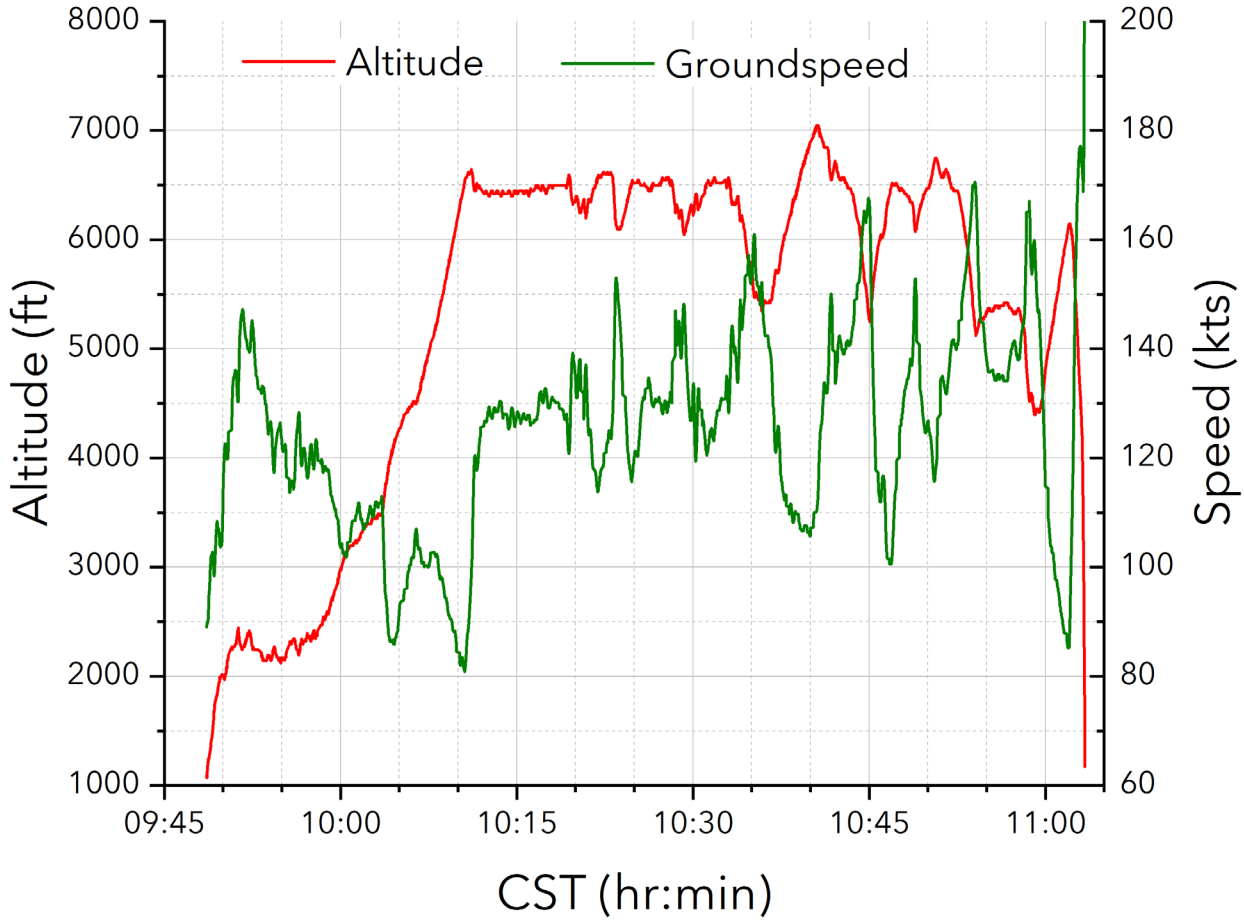

Figure 3. Altitude from ADS-B and calculated groundspeed for whole flight.

After 10:33 the altitude and speed fluctuations became larger in magnitude and the airplane no longer maintained a steady altitude for any significant amount of time. Accounting for winds aloft and the weather conditions at the time of the accident, the calibrated airspeed was about 5 kts lower than the groundspeed (Figure 4). The airplane descended while gaining airspeed and climbed while slowing. Airspeed fluctuated between 100 and 160 kts while gaining and losing 1,000 to 1,500 ft of altitude.

The rate of climb varied between -1,200 ft/min in the descents to near 500 ft/min during the climbs (Figure 5). Smaller variations in altitude during the climbs and descents were not considered in the rate of climb calculations.

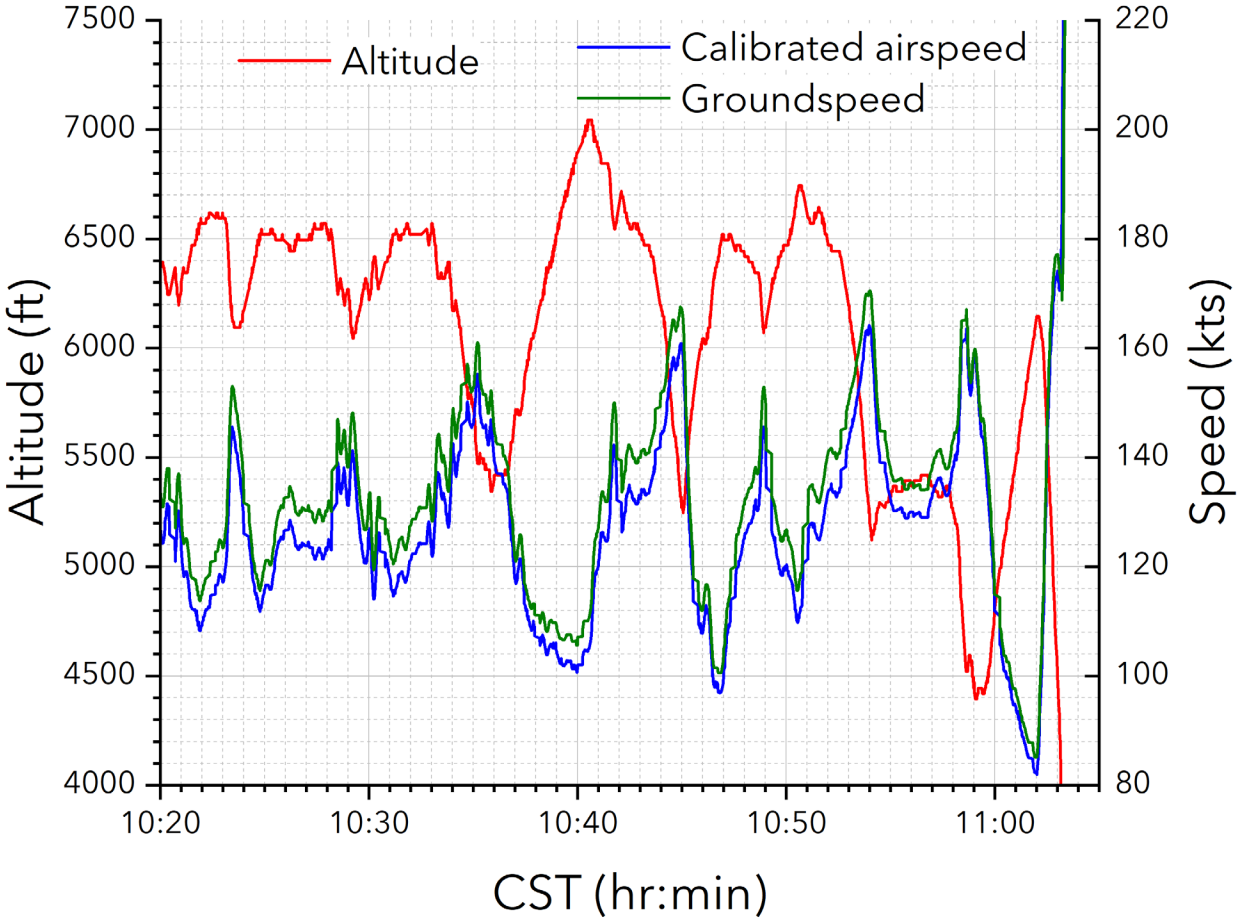

Figure 4. Altitude from ADS-B and calculated airspeed and groundspeed for final 40 minutes of flight.

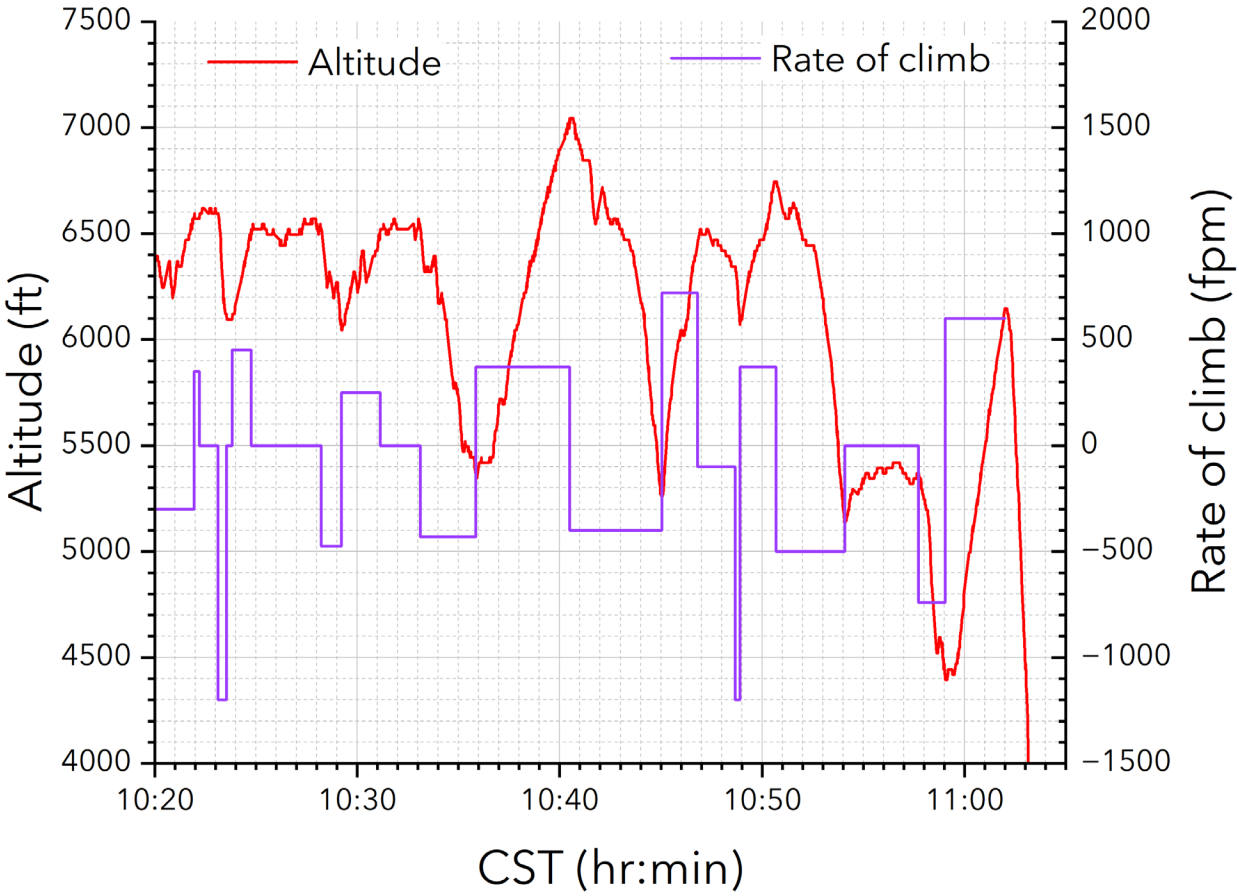

Figure 5. Altitude from ADS-B and averaged rate of climb for final 40 minutes of flight.

Just after 10:58, the airplane's track deviated to the left (Figure 6 and Figure 7). Air traffic control contacted the airplane to correct its heading and the airplane began to correct its course. After 10:59 it slowed from 160 kts to 140 kts while remaining level at about 4,500 ft before beginning a climb to above 6,000 ft. During the climb the airplane continued to slow. The controller twice contacted the airplane to switch to Memphis center control, but no response was received.

At 11:02, while at an airspeed of 82 kts, the airplane reached its final maximum altitude of 6,100 ft which it maintained for eight seconds. 82 kts was above any wings level stall speed for the airplane [1]. The airplane began to accelerate while on a straight course. At 11:02:08 the airplane began to descend while continuing to gain airspeed and then began a left turn.

At 11:02:30, ATC recorded a faint background transmission of "…this is debonaire …. emergency". The call coincided with the airplane turning back to the right. The airplane's descent rate was over 2,000 ft/min and the airspeed increased to over 170 kts until 11:03:08.

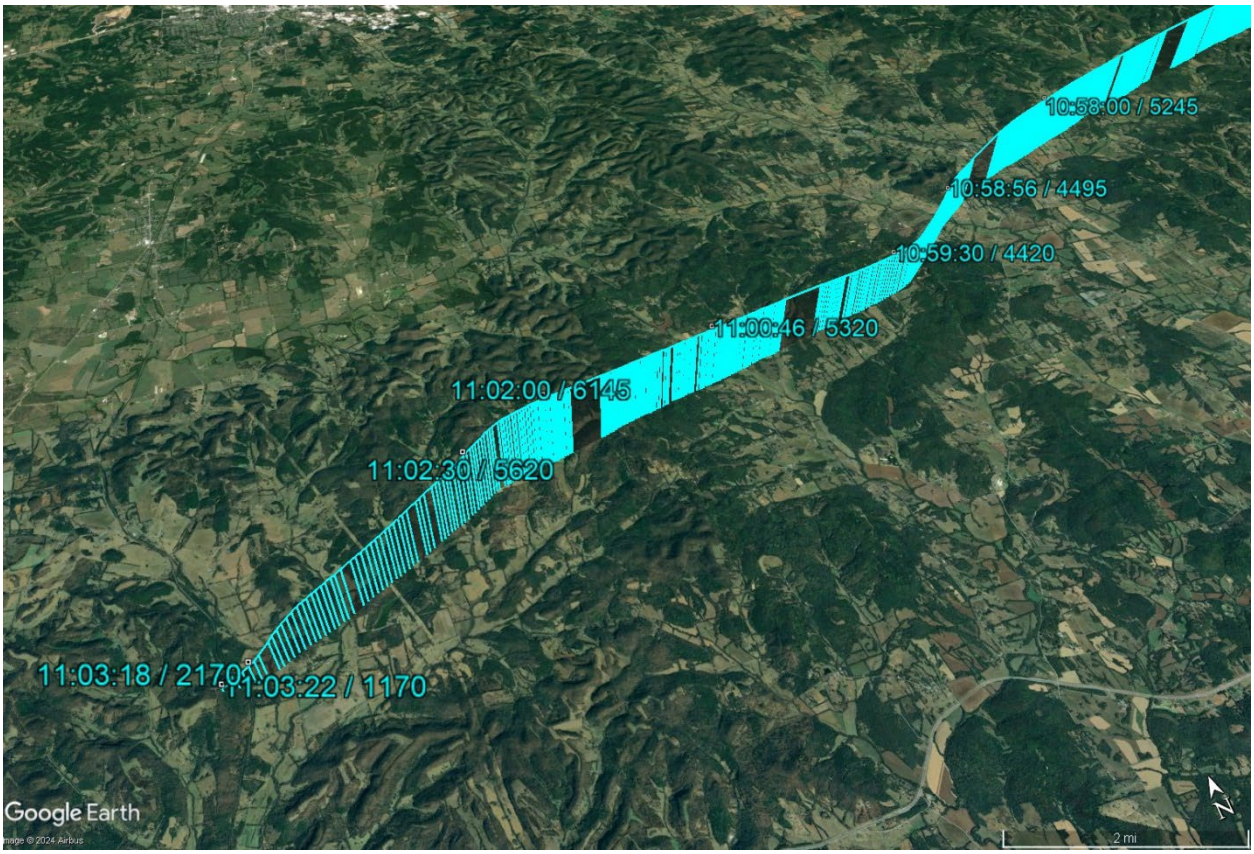

Figure 6. ADS-B flight path with selected times and corrected altitudes shown.

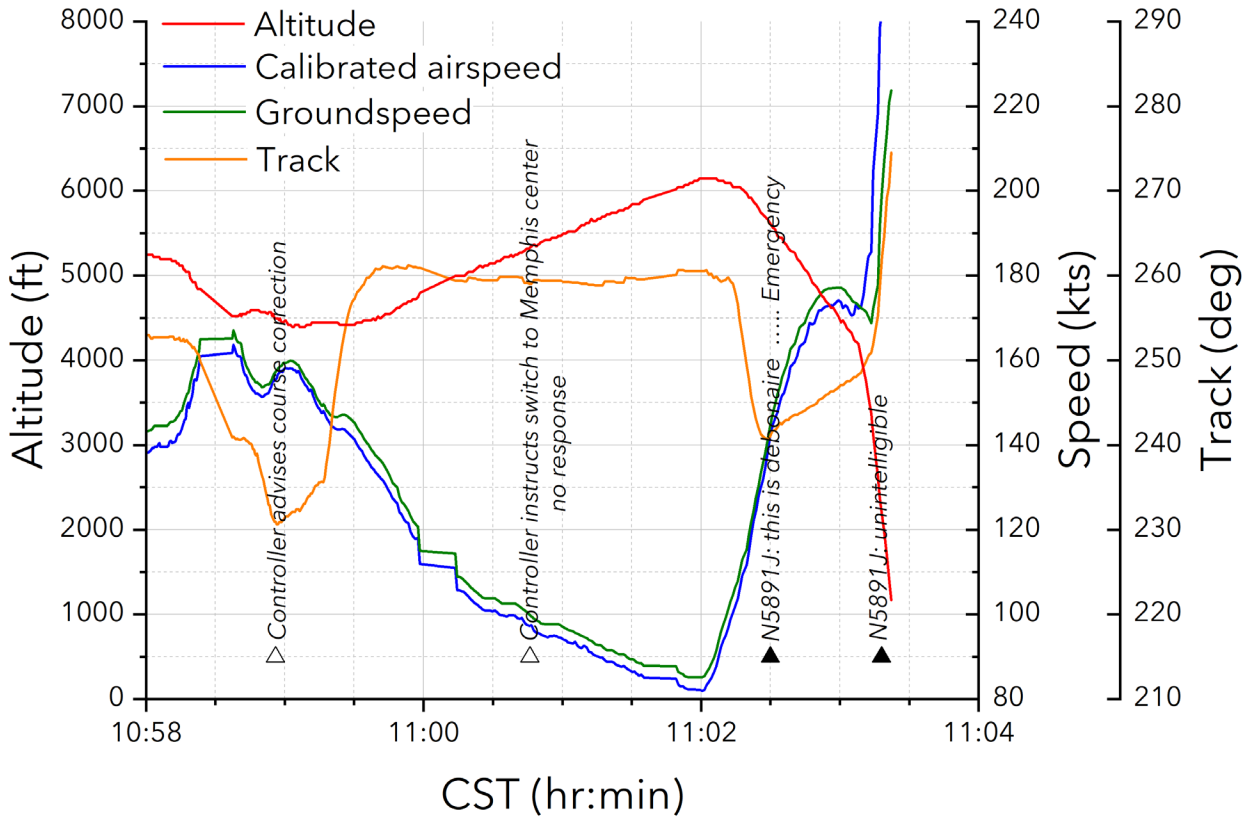

Figure 7. Altitude and track from ADS-B with calculated airspeed and groundspeed and selected ATC communications for end of flight.

After 11:03:08, the descent rate increased to over 10,000 ft/min and the airplane turned slightly to the right (Figure 8). During the final descent an unintelligible call was made from the airplane. The final ADS-B transmission was about 200 ft above ground level and the airplane's groundspeed was over 220 kts and descent rate over 10,000 ft/min. The wreckage was consistent with the airplane impacting the ground at a high rate of speed.

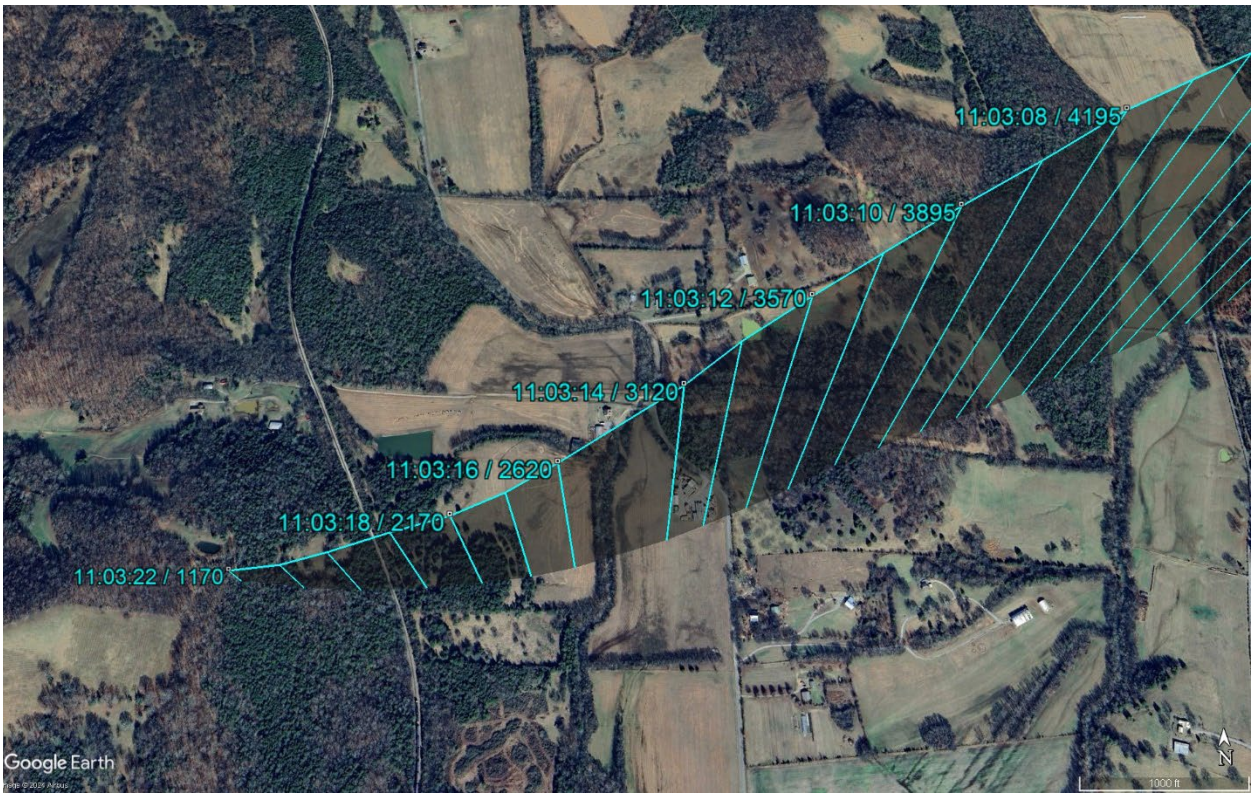

Figure 8. End of ADS-B flight path with selected times and corrected altitudes shown.

D. SUMMARY

During the flight, the airplane made numerous climbs and descents while gaining and losing airspeed. Its course mostly remained steady with some deviations. As the flight progressed the altitude and airspeed deviations increased in magnitude. At 11:02 the airplane began its final descent, and the pilot made an emergency declaration to ATC. After 11:03:08 the descent rate increased to over 10,000 ft/min and an unintelligible transmission was recorded. The wreckage and flight path were consistent with the airplane impacting the ground at a high rate of speed.

E. REFERENCES

1. Beechcraft Debonair 35-C33 and Bonanza E33 F33 Pilot's Operating Handbook and FAA Approved Airplane Flight Manual, Raytheon Aircraft Company, 1996.