

National Transportation Safety Board

Office of Research and Engineering

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ERA24FA217

AUTOMATIC DEPENDENT SURVEILLANCE- BROADCAST (ADS-B) STUDY

Aircraft Performance Study

By

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A. ACCIDENT

Location: Franklin, Tennessee
Date: May 15, 2024
Time: 1202 central daylight time (CDT)
Airplane: Beech V35-TC, N47WT

B. SUMMARY

On May 15, 2024, at 1202 central daylight time, a Beech V35-TC, N47WT, was substantially damaged when it was involved in an accident near Franklin, Tennessee. The private pilot and the two passengers were fatally injured. The airplane was operated as a Title 14 *Code of Federal Regulations* Part 91 personal flight.

C. PERFORMANCE STUDY

1.0 Aircraft

The airplane involved was a Beech V35-TC, a single-engine general aviation airplane with a V tail.



Figure 1. Beech V35-TC, N47WT.

2.0 Available Data

This performance study is based on Automatic Dependent Surveillance-Broadcast (ADS-B) data 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.

The performance study also includes selected Air Traffic Control (ATC) communications.

3.0 Weather

Weather was recorded for 15:53 at Nashville International Airport (BNA), 25 nautical miles from the wreckage location. The temperature was reported as 73°F (23°C), the dew point was 61°F (16°C), and the barometric setting was 29.77 inHg. Winds were 9 kts from 300°. Visibility was 10 miles.

Storms were present around the end of flight and are discussed in depth in the Weather Factual Report [1]. Additionally, winds aloft for the accident area were provided by the meteorological specialist and were used to calculate the airplane's airspeeds. Winds aloft, however, do not reflect the localized winds within a moving storm cell.

4.0 Flight Path

The airplane departed Louisiana Regional Airport (REG), in Gonzales, Louisiana on an instrument flight rules (IFR) flight plan about 08:50 and was enroute to Bowman Field Airport (LOU), Louisville, Kentucky. The airplane initially climbed to 9,200 ft before descending to 7,000 ft msl. It maintained 7,000 ft and a north-easterly track of 30° from 9:30 until 11:42 while maintaining a groundspeed between 125 and 135 kts. This track was aligned with the navigation aid EWO (referred to by ATC as Echo-Whiskey-Oscar) which was 37 miles south of LOU.

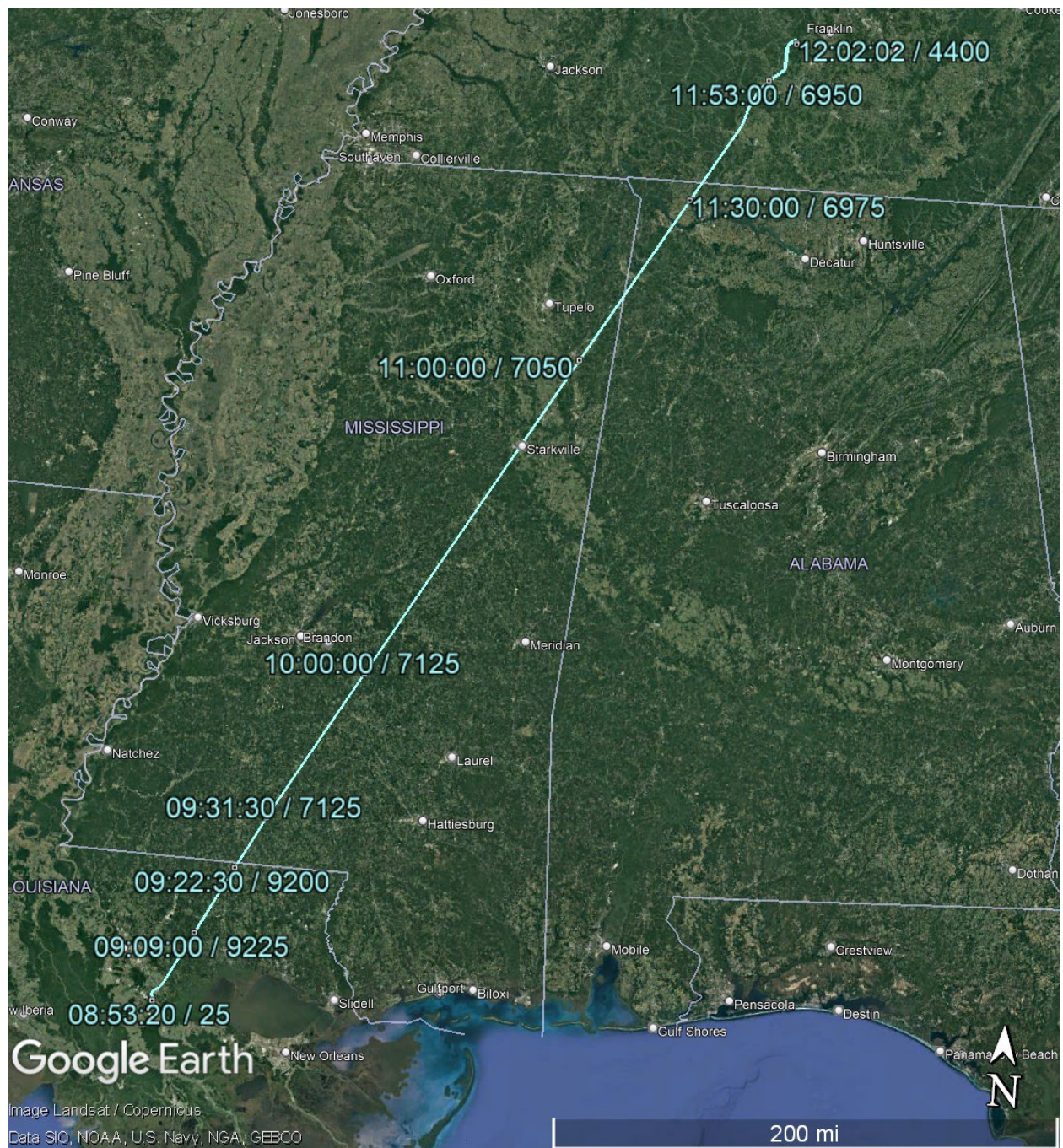


Figure 2. ADS-B flight path with selected times and altitudes notated.

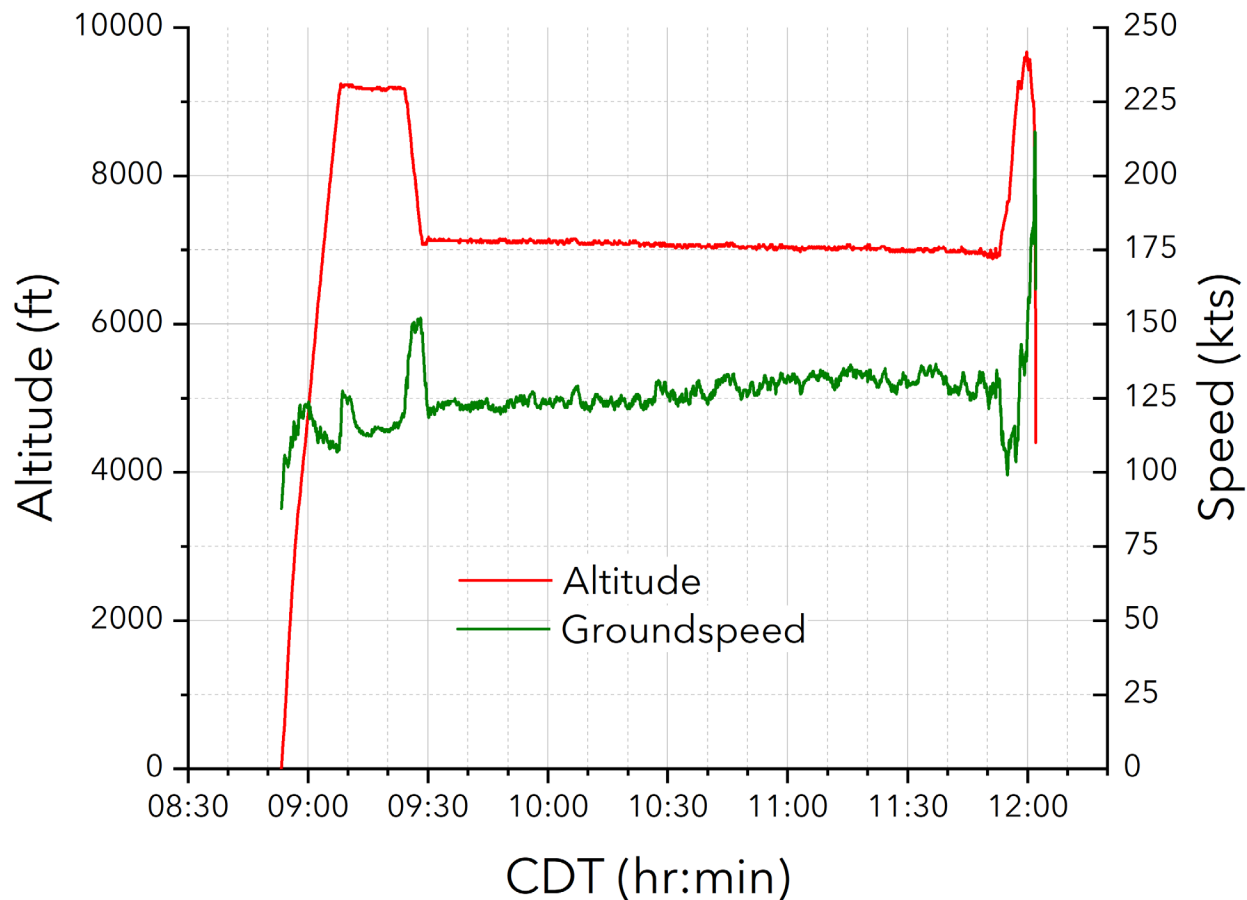


Figure 3. Altitude and groundspeed for full flight.

About 11:42, the pilot requested a short deviation from heading and was issued 20° left or right. The airplane began a series of slight turns onto tracks between 13° and 50° (Figure 4). Nine minutes later, at 11:52, the pilot requested a higher altitude of 9,000 ft. The airplane began to climb (Figure 5) and slowed to a calibrated airspeed under 100 kts.



Figure 4. ADS-B flight path with selected times and altitudes notated.

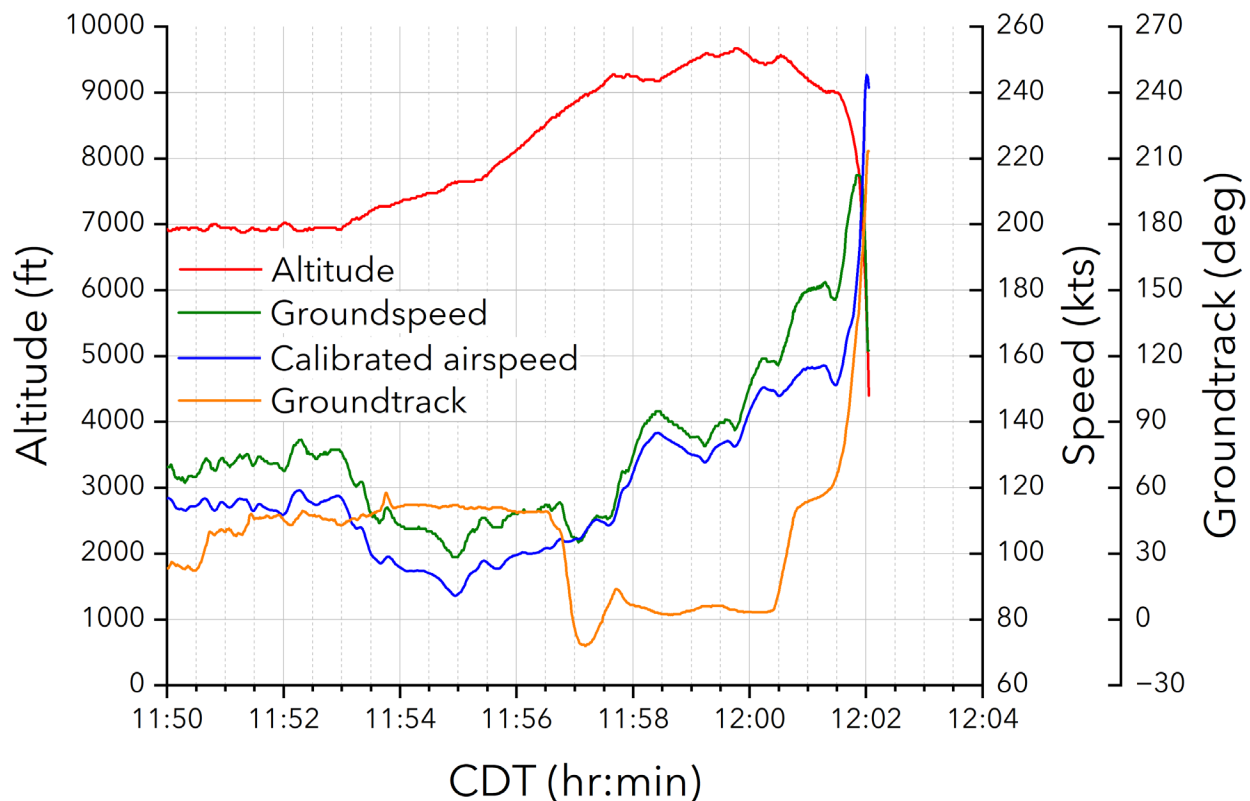


Figure 5. Altitude, groundspeed, calibrated airspeed, and groundtrack for the end of flight.

The airplane climbed while maintaining a track of about 50° until 11:56:30 when it turned left onto a northerly track of about 350°. At 11:57:23 ATC instructed "... for traffic into Nashville fly heading three six zero" and "then expect on course in probably fifteen miles". The airplane turned slightly right onto a track within 2-4° of 360°. At 11:58:18, ATC asked the airplane "... can you back on course" and "you were deviating left and right so I needed you on a heading". The airplane continued its track within a few degrees of 360°.

The timing of the airplane's turns and its communication with ATC appeared out of sync during this portion of the flight. If the ATC communications were approximately one minute earlier, they would be more consistent with the airplane's track. ATC would have instructed the airplane to turn onto a 360° heading and the airplane would then have turned from 50° through 360° to 350°. ATC's request less than a minute later to get back on course would have been followed by the airplane turning back right onto a track closer to 360°. As reported, the airplane's turns seem to anticipate ATC instructions and corrections.

After 11:58, the airplane's speed increased from 110 kts to 160 kts calibrated airspeed. The airplane's maneuvering speed, V_A , is 132 kts of calibrated airspeed and its never exceed speed, V_{NE} , is 195 kts [2]. The airplane was near or above its maneuvering speed for the winds aloft provided for the area for the remainder of the

flight and accelerating. During this time the airplane was between 9,000 and 9,700 ft. While above 9,000 ft, ATC issued three corrections to the airplane to maintain 9,000 ft at 11:59:08, 11:59:54, and 12:00:39. After the first two corrections, the airplane briefly descended before climbing again. However, with the third correction the airplane descended to 9,000 ft which it held from 12:01:18 to 12:01:30.

Figure 6 shows weather reflectivity imagery from the weather surveillance radar in Nashville, Tennessee, about 30 miles north each of the airplane at 11:59. This imagery is discussed in detail in the Weather Factual Report, but the images show light to heavy rain showers and storms moving through the area.

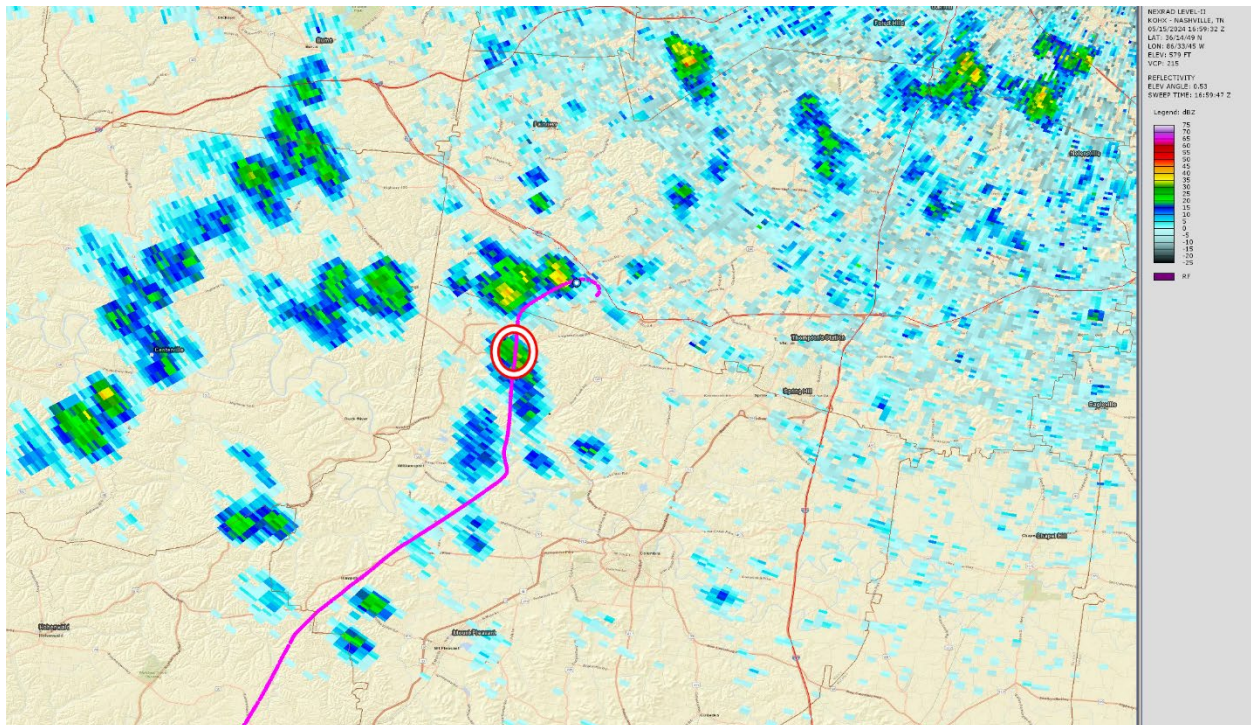


Figure 6. Weather radar at 11:59 CDT. The red circle indicates the airplane's position on the flight path (magenta) at the noted time. Blue, green, and yellow imagery show rain showers or atmospheric instability of increasing intensity.

Just after 12:00, the airplane began a right turn onto a track of 45° without informing ATC. Figure 7 shows weather conditions at 12:01. The airplane's position was overlaid with a higher intensity area of atmospheric instability.

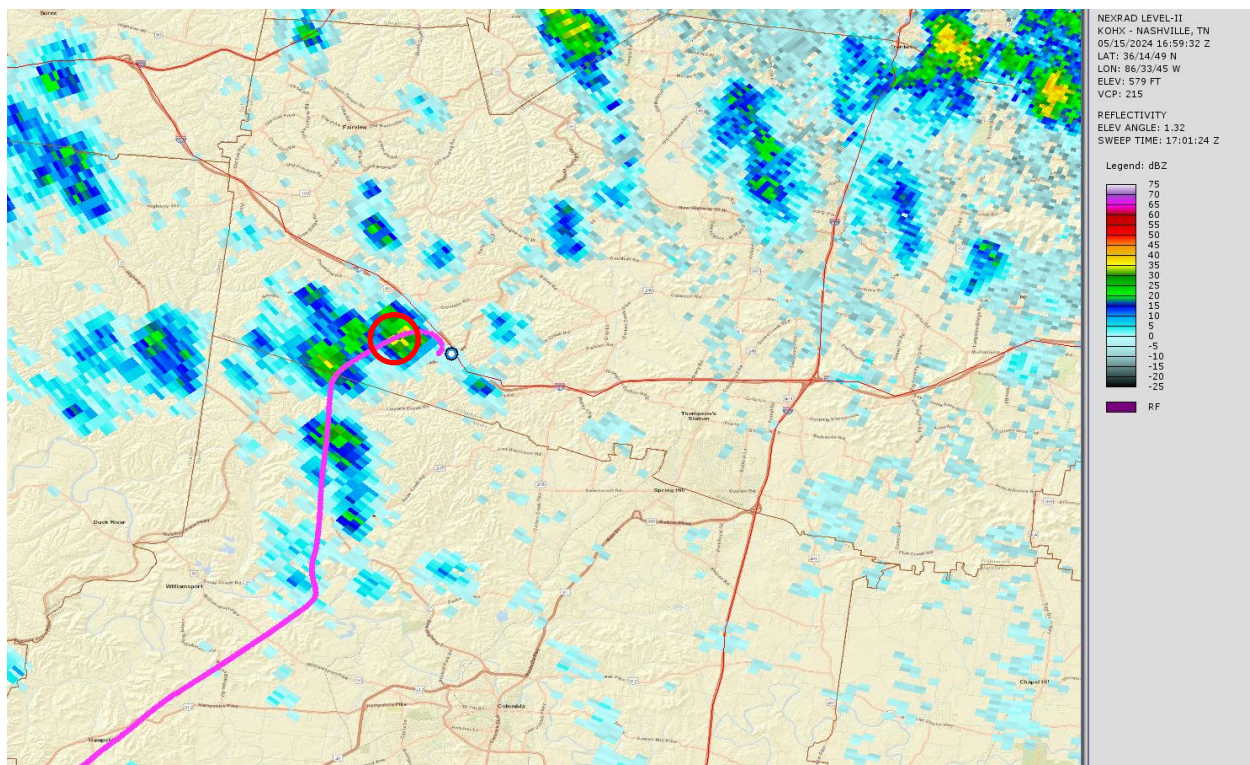


Figure 7. Weather radar at 12:01 CDT. The red circle indicates the airplane's position on the flight path (magenta) at the noted time. Blue, green, and yellow imagery show rain showers or atmospheric instability of increasing intensity.

Figure 8 and Figure 9 show the end of ADS-B recorded flight. At 12:01:30, while at a groundspeed of 180 kts (calibrated airspeed 152 kts), the airplane's right turn tightened, and it began to descend. Initially, the rate of descent did not exceed 3,000 ft/min as the airplane's groundspeed increased to over 200 kts. The calibrated airspeed shown in this figure used winds aloft data for the area, but while in the weather cell, the airplane's airspeed cannot be accurately determined because the localized wind conditions are unknown. Just after 12:01:45, when the groundspeed was more than 210 kts, the descent rate rapidly increased.

The dispersal of wreckage indicated that the airplane broke up in flight. Winds were consistent with the breakup occurring after 12:01:40 with lighter pieces of debris being carried along the wind path and heavier pieces continuing along the flight path.

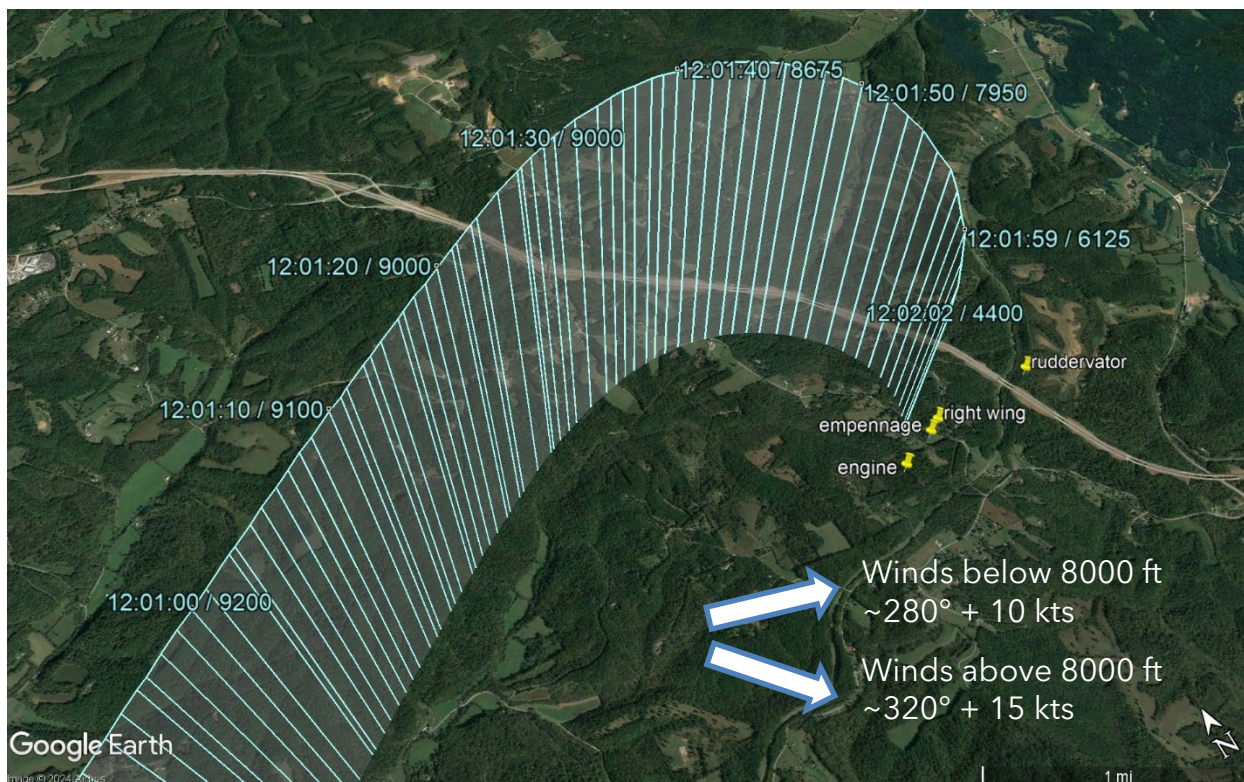


Figure 8. End of ADS-B flight path with selected times and altitudes notated. Also included is the location of some wreckage pieces and wind direction.

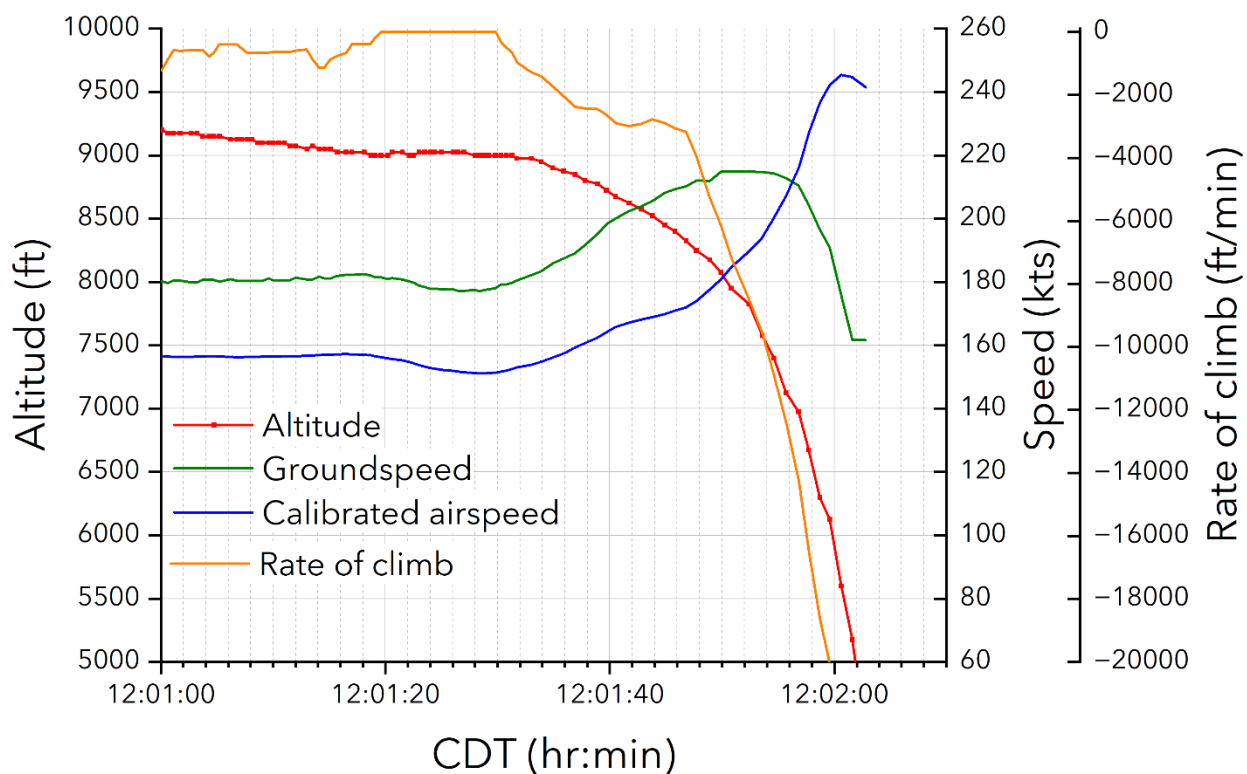


Figure 9. End of flight altitude, groundspeed, calibrated airspeed, and rate of climb.

D. SUMMARY

At 11:42 the airplane began a series of track and altitude deviations, initially after requesting clearance from ATC. The airplane appeared to have difficulty maintaining track and altitude as ATC issued numerous corrections for both. After climbing to 9,000 ft, the airplane accelerated above its maneuvering speed while in the area of increased weather instability. At 12:00, the airplane made an unannounced right turn onto a heading of 45°. At 12:01:30, while at a groundspeed of 180 kts, the right turn tightened and the airplane began to descend at a rate of 3,000 ft/min. Fifteen seconds later, at a groundspeed of more than 210 kts, the descent rate rapidly increased.

The airplane's acceleration during the final minutes of flight put it above its maneuvering speed. Additionally, the airplane was in weather that could produce updrafts in addition to light to heavy rain. If significant control inputs were made while the above V_A , it could have caused a structural or control surface failure that initiated a loss of control that led to the inflight breakup. Localized winds may have also been such that the airplane was closer to V_{NE} at the time of breakup than could be determined with the data available.

E. REFERENCES

1. Meteorology Specialist's Factual Report, ERA24FA217, National Transportation Safety Board, September 2024.
2. Beechcraft Bonanza V35B, Pilot's Operating Handing and FAA Approved Airplane Flight Manual, Beech, 1994.