

National Transportation Safety Board

Office of Research and Engineering

Washington, DC 20594



ERA24FA176

FLIGHT PATH DATA STUDY

Aircraft Performance Study

By

Marie Moler

A. ACCIDENT

Location: Knoxville, Tennessee
Date: April 12, 2024
Time: 16:33 eastern daylight time (EDT)
Airplane: Piper PA-32R-301, N9236J

B. SUMMARY

On April 12, 2024, about 16:33 eastern daylight time, a Piper PA-32R-301, N9236J, was substantially damaged when it was involved in an accident near Knoxville, Tennessee. The commercial pilot was fatally injured. The flight was operated under Title 14 *Code of Federal Regulations* Part 91 as a personal flight.

C. PERFORMANCE STUDY

1.0 Aircraft

The airplane was a Piper PA-32R-301, also called a Piper Cherokee Six. It was a single engine, fixed-wing aircraft with retractable gear.



Figure 1. Piper PA-32R-301, N9236J.

2.0 Available Data

This performance study is based on OpsView track data provided by Aviation Safety's Operational Factors group. OpsVue data uses a multi-sensor system that aggregates and georeferences multiple FAA data sources. Data resolution varied between every 2 seconds to every 10 seconds.

3.0 Weather

Weather was recorded for 16:53 at McGhee Tyson Airport (TYS) in Alcoa, Tennessee, where the airplane took-off and 11 NM south of the accident. The temperature was reported as 57°F (14°C), the dew point was 37°F (3°C), and the barometric setting was 29.95 inHg. Winds were 19 kts gusting to 28 kts from 240°.

Airport-recorded weather reported few clouds at 5,500 ft above ground level (AGL) and a broken ceiling at 25,000 ft. Visibility was 9 statute miles. The definition of "few clouds" is clouds covering 1/8th to 1/4th of the sky¹. However, security video of the accident showed the airplane, whose maximum altitude was below 9,000 ft mean sea level (MSL), descending out of more significant cloud cover (Figure 2).



Figure 2. Security video showing airplane descending from clouds (blue arrow pointing to airplane which is a small black speck).

¹ National Weather Service Glossary, National Oceanic and Atmospheric Administration
[National Weather Service](#).

The meteorology specialist [1] provided a High-Resolution Rapid Refresh (HRRR) model of the winds aloft for the time and area of the accident (Table 1). This meteorological data was used for all calculations in this report.

Table 1. HRRR winds aloft and temperature.

Altitude, ft	Static temperature, °C	Dew point temperature, °C	Wind direction	Wind speed, kts
988	13	5.4	288	13
1014	12.8	4.3	288	12
1099	12.3	5	288	16
1247	11.8	3.4	288	18
1499	11	3.1	288	19
1890	9.8	2.7	289	21
2395	8.3	2.3	290	24
3002	6.4	1.9	291	26
3668	4.5	1.4	292	29
4409	2.5	0.7	293	34
5253	0.4	-0.5	294	40
6214	-1.7	-2.2	294	44
7297	-4.1	-4.2	295	44
8514	-6.6	-6.6	299	42
9885	-9.1	-9.7	310	39
11411	-11.9	-13	319	40

4.0 Flight Path

The airplane took off from runway 23L at TYS at 16:17:30 (Figure 3). Shortly after takeoff it turned right onto a northerly heading by 16:21 while climbing. Calibrated airspeed during the climb varied between 85 and 105 kts (Figure 4). About 16:28:30, the airplane stopped climbing and leveled out near 8,000 ft MSL and airspeed increased to over 110 kts.

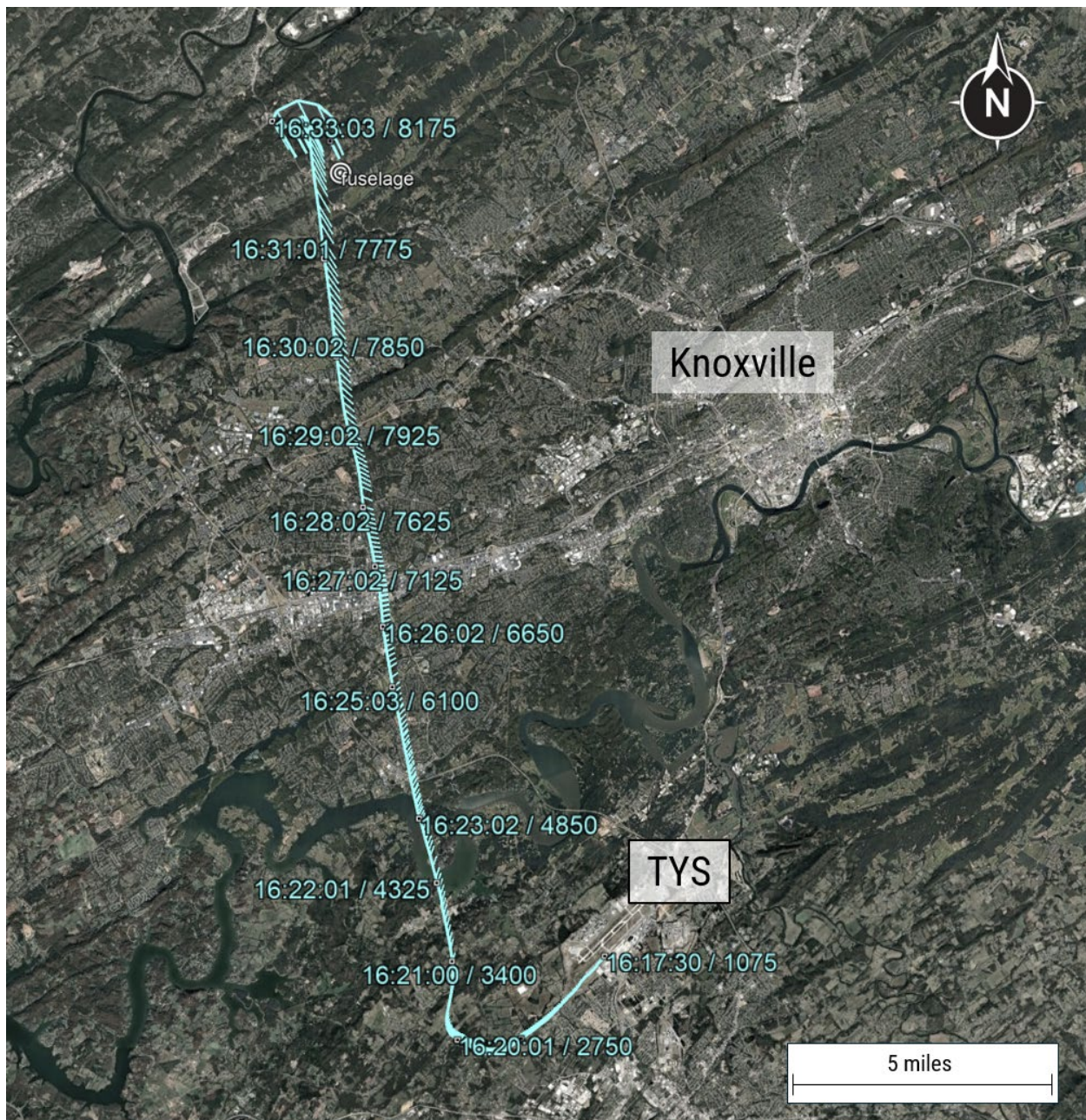


Figure 3. Airplane flight path with selected times and altitudes shown.

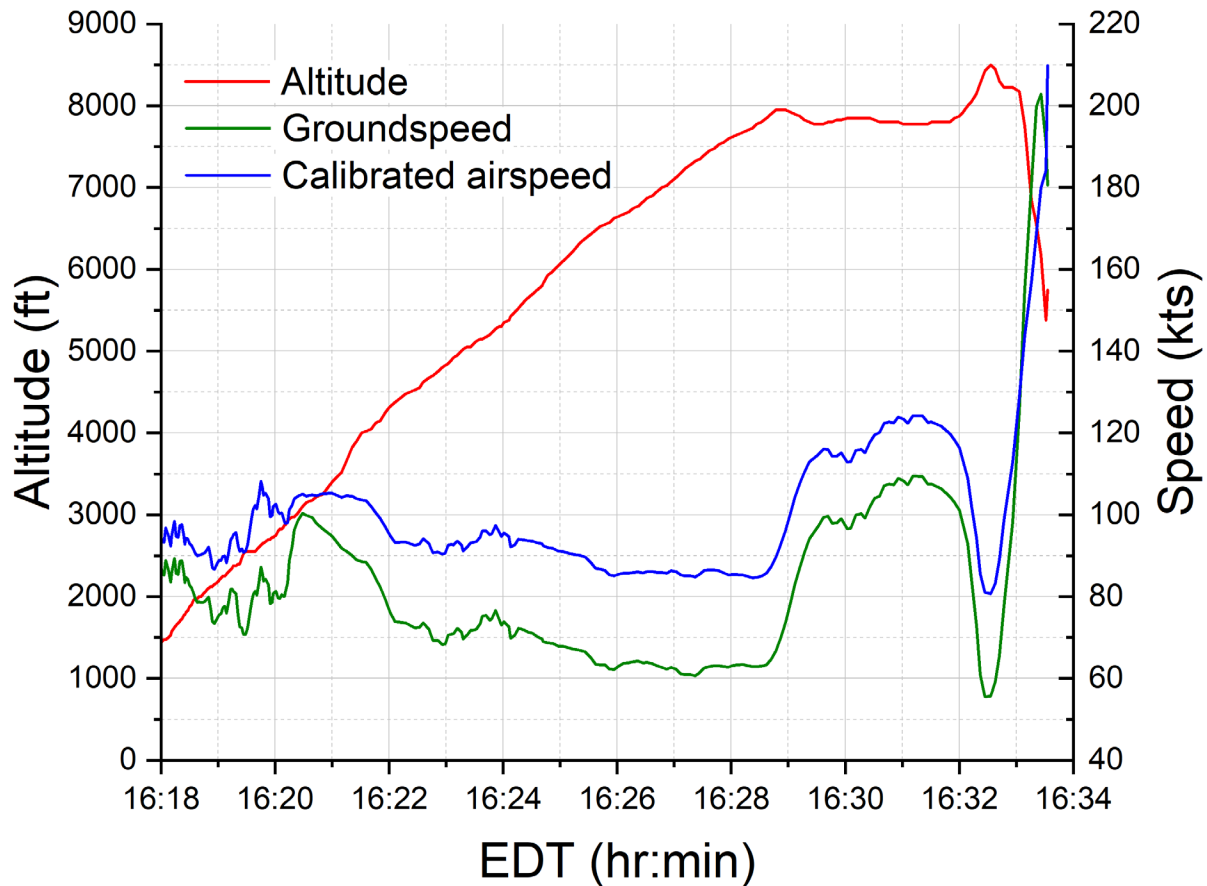


Figure 4. Airplane recorded altitude and calculated groundspeed and calibrated airspeed.

The airplane resumed climbing at about 16:32 and it rapidly lost airspeed, dropping from over 120 kts to 80 kts in 43 seconds. At 16:32:33, the airplane reached a maximum altitude of 8,500 ft, coinciding with its lowest speed of 80 kts. The airplane then rolled left and turned more than 90° in 11 seconds while descending at an initial rate of 1,300 ft/min.

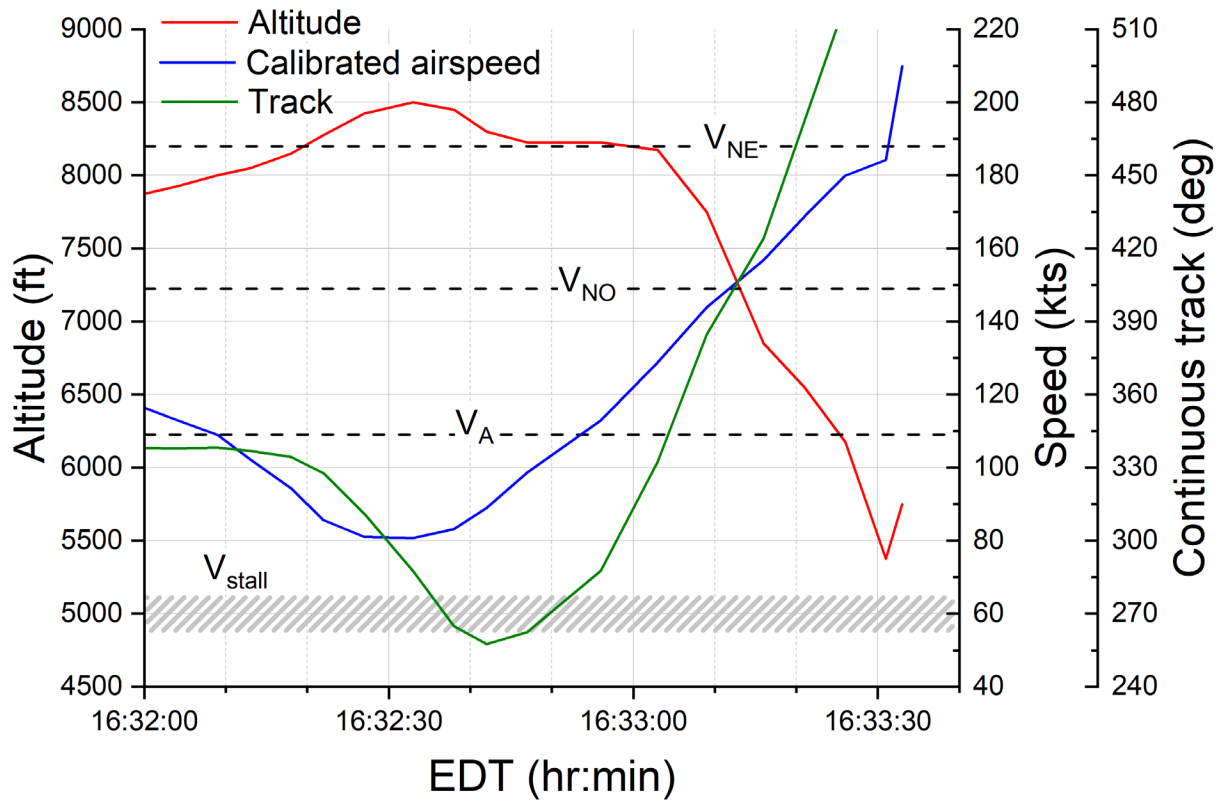


Figure 5. Recorded altitude with calculated calibrated airspeed and flight path track.

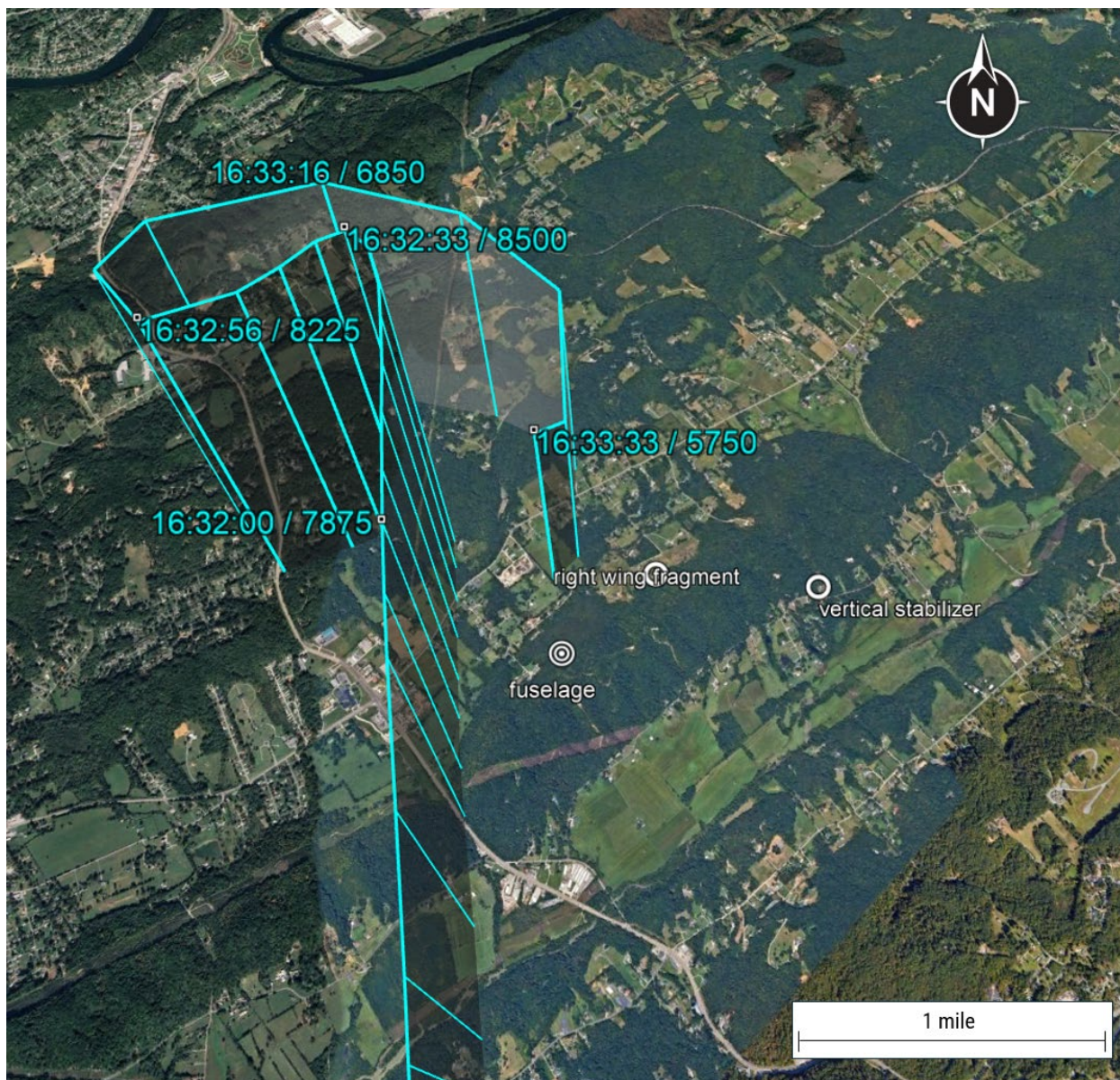


Figure 6. End of flight with selected times and altitudes annotated. Also shows is the final position of the fuselage and some other wreckage.

The sudden roll off and descent while at a minimum airspeed was consistent with aerodynamic stall. However, the stall speeds listed in the Pilot's Operating Handbook [2] show a highest wings-level stall speed as 65 kts for power off, no flaps, heavy. The lowest calculated airspeed using winds aloft was about 80 kts, or 15 kts higher than the highest stall speed.

Ice accumulation on the wings could result in stall at an airspeed 15 kts higher than expected. The meteorological factual report showed that moderate icing was predicted in the area [1]. Moderate ice is defined as an ice accretion rate of ¼ inch in 5 - 15 minutes. The pilot had contacted air traffic control (ATC) and stated that the

airplane was accumulating moisture and asked to climb to 10,000 ft, which was approved.

By 16:32:42, the airplane arrested its left turn and by 16:32:47 it leveled out briefly at 8,200 ft. However, airspeed continued to increase through the maneuvering speed, V_A^2 , as the airplane began a right turn. After 16:33:03, the airplane began rapidly descending at a rate exceeding first 2,000 ft/min then 6,000 ft/min. The airplane exceeded V_{NO}^3 by 16:33:16 and the never exceed speed, V_{NE}^4 , by the end of the recorded flight. Exceeding these speeds while in a turn would put the airplane at risk of structural failure, consistent with the in-flight breakup and debris field.

Returning to Figure 2, elevations in the area were between 800 and 1,000 ft MSL and the weather summary recorded the cloud ceiling to be about 5,500 ft AGL. The security video likely captured the airplane at the end of the recorded flight data or just after. Therefore, the airplane was likely in the clouds during the left roll upset and subsequent right spiral descent.

D. SUMMARY

The airplane took off from McGhee Tyson Airport (TYS) at 16:17:30. It turned onto a northerly heading while climbing to 8,000 ft MSL. The pilot reported moisture to ATC. The airplane leveled off for about three minutes before resuming a climb. During the climb the airspeed dropped by 40 kts in 43 seconds and just after 16:32:30 the airplane rapidly rolled left and lost altitude, consistent with aerodynamic stall. However, the airplane's speed at the time was 15 kts higher than reported stall speeds, suggesting a build-up of ice reduced its aerodynamic performance. The airplane leveled out briefly after losing 300 ft of altitude before entering a descending right turn while in the clouds. The airplane continued to gain airspeed, beyond its never exceed speed by the end of recorded data and resulting in an in-flight breakup.

E. REFERENCES

1. Meteorology Specialist's Factual Report, ERA24FA176, National Transportation Safety Board, 2024.
2. Pilot's Operating Handbook, Piper Cherokee Lance – PA-32R-300, Piper Aircraft Corporation, 1975.

² Design maneuvering speed is the maximum speed at which application of full available aerodynamic control will not overstress the airplane.

³ Maximum structural cruising speed, V_{NO} , is the speed which should not be exceeded except in smooth air and with caution.

⁴ Never exceed speed is the speed that may not be exceeded at any time.