

National Transportation Safety Board

Office of Research and Engineering

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AUTOMATIC DEPENDENT SURVEILLANCE- BROADCAST (ADS-B) STUDY

Aircraft Performance Study

By

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A. ACCIDENT

Location: Suffolk, Virginia
Date: January 7, 2023
Time: 12:13 eastern standard time (EST)
Airplane: Piper PA28, N592FL

B. SUMMARY

On January 7, about 1213 eastern standard time, a Piper PA-28-140, N592FL, was destroyed when it was involved in an accident near Suffolk, Virginia. The pilot and passenger 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 was a Piper PA-28, also known as a Piper Cherokee. It is an all-metal, unpressurized, single-engine, piston-powered airplane.



Figure 1. Exemplar Piper PA28, not the accident airplane.

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 ADS-B available for the accident flight had periods of no data lasting between 30 seconds and four and half minutes. The longest period of lost data was from 12:00:17 to 12:04:22 (with a single point at 12:03:13).

The altitude used in this report is the geometric altitude, mean sea level (msl), from the onboard GPS device. The onboard GPS device has its own model of the Earth's ellipsoid to determine the altitude. Recorded altitude was corrected from height above the ellipsoid to mean sea level.

3.0 Weather

Weather was recorded for 12:15 at Suffolk Executive Airport (SFQ), five nautical miles (NM) north of the wreckage location. The temperature was reported as 48°F (9°C), the dew point was 32°F (0°C), and the barometric setting was 30.26 inHg. Winds were 6 kts from 240°. Skies were clear. Visibility was ten statute miles.

4.0 Flight Path

The airplane took off from Northeast Regional Airport (EDE) in Edenton, North Carolina at 11:44 (Figure 2). The planned destination was Suffolk Executive Airport. The airplane took off from runway 1, then circled to the left south of the airport before flying north. The airplane climbed to an altitude between 1,700 and 2,000 ft (Figure 3). The groundspeed varied between 90 and 100 kts.

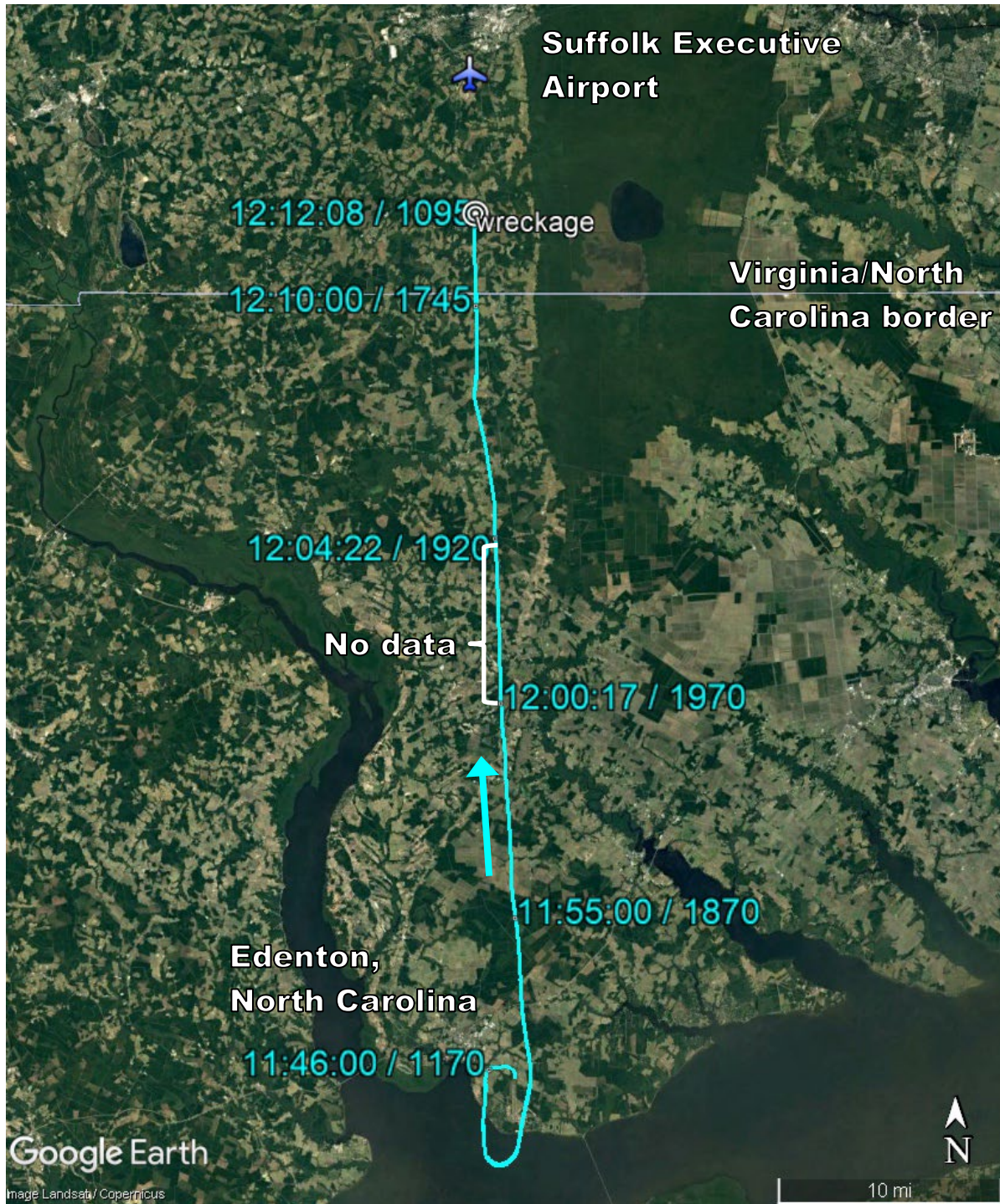


Figure 2. ADS-B flight path with selected times and altitudes highlighted.

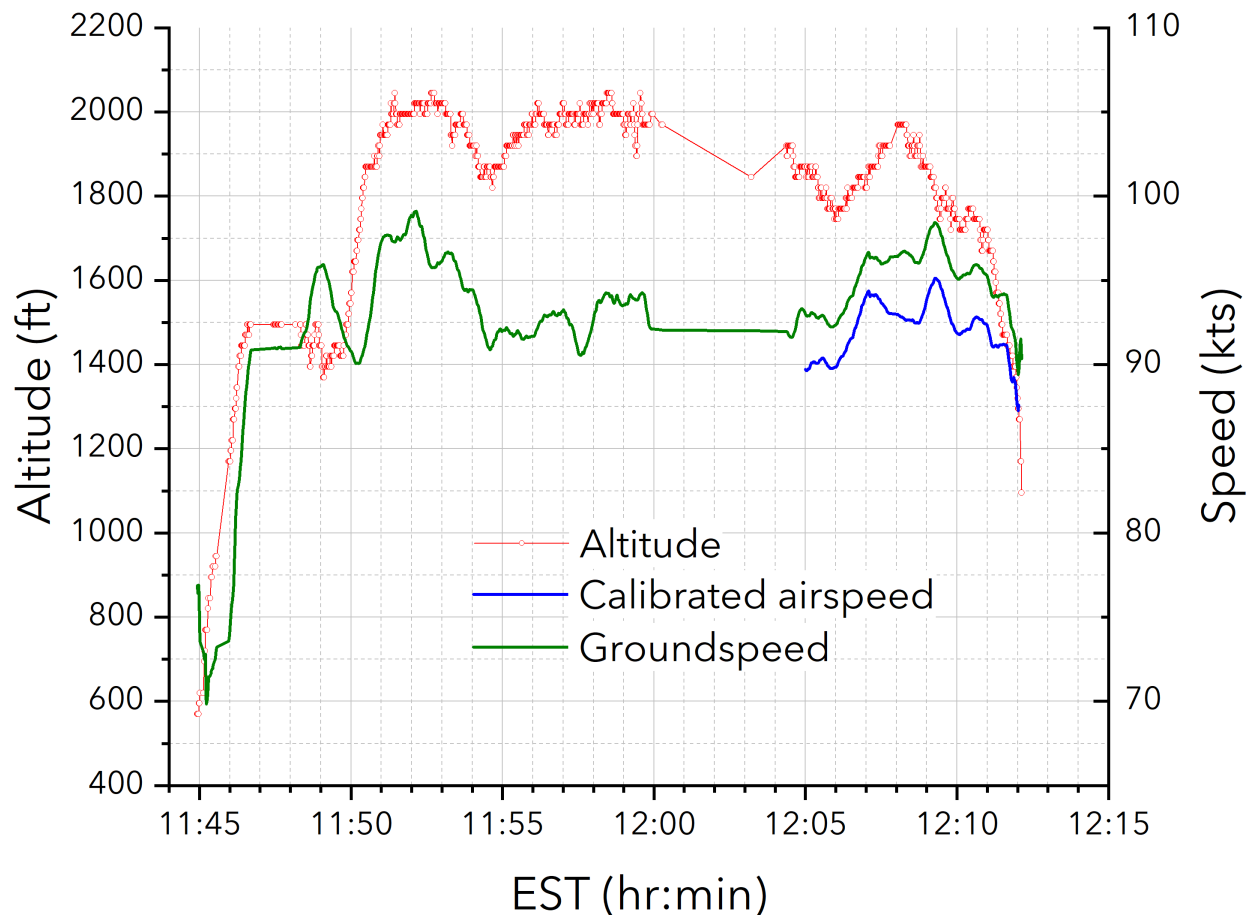


Figure 3. ADS-B altitude and calculated calibrated airspeed and groundspeed.

The airplane began to descend at 12:08 at an average rate of 100 ft/min. At 12:11, when the airplane was about two miles from the wreckage location (Figure 4 and Figure 5), the descent rapidly increased to 500 ft/min. The airplane's airspeed stayed just above 90 kts during this descent. From 12:11:30 to 12:12 the descent speed was arrested to 200 ft/min before again rapidly increasing to over 1,500 ft/min when the airplane was about 0.5 miles from the wreckage location. After 12:11:39 the airplane was losing both altitude and airspeed indicating a possible reduction in power. The last recorded position was at 12:12:08 when the airplane's altitude was 1,100 ft after which no ADS-B coverage was available. The wreckage elevation was 60 ft msl. At a descent rate of 1,500 ft/min, a possible 42 additional seconds of flight time was not recorded.

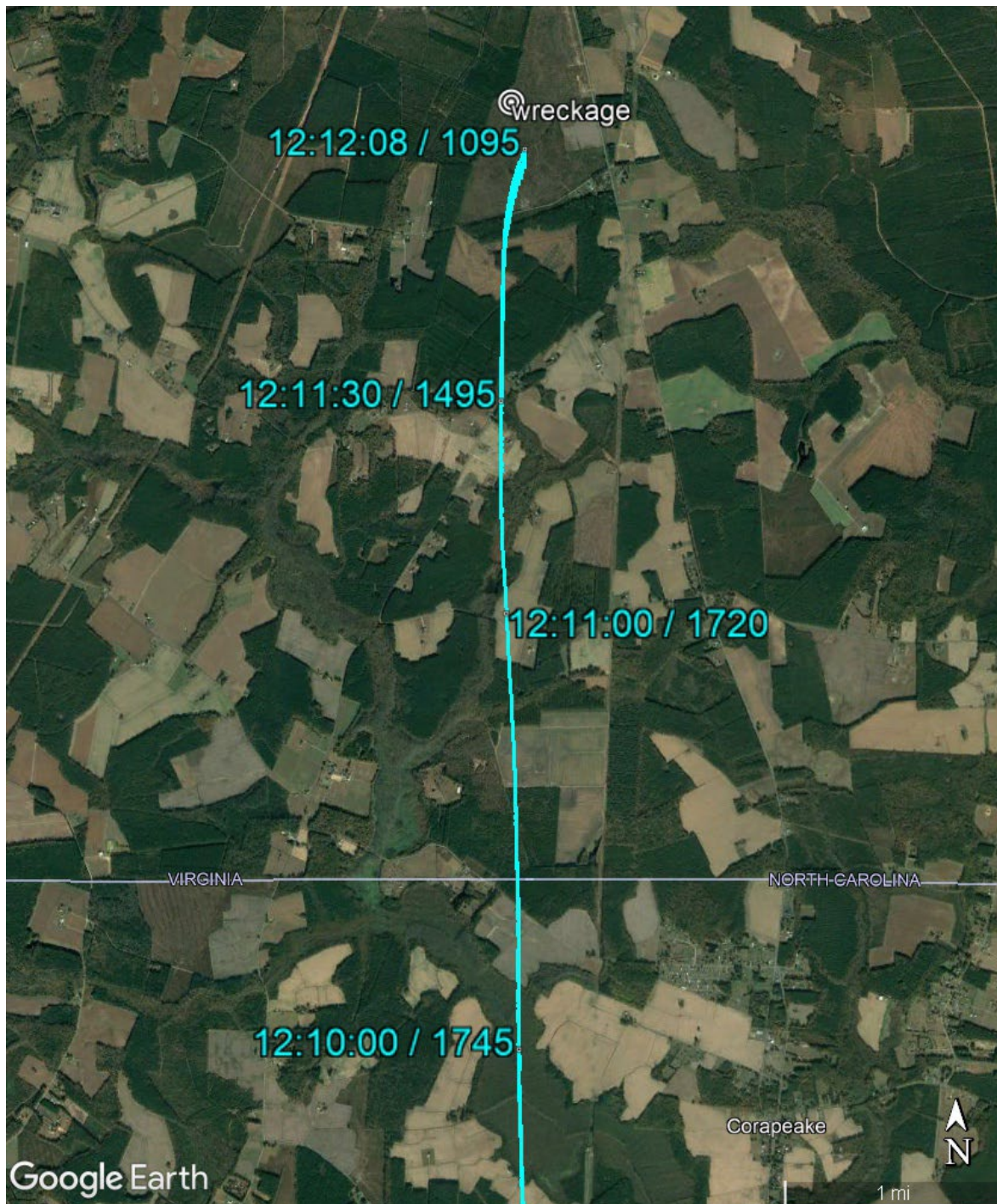


Figure 4. ADS-B flight path for the end of flight with selected times and altitudes highlighted. Ground elevation at the wreckage location is about 60 ft.

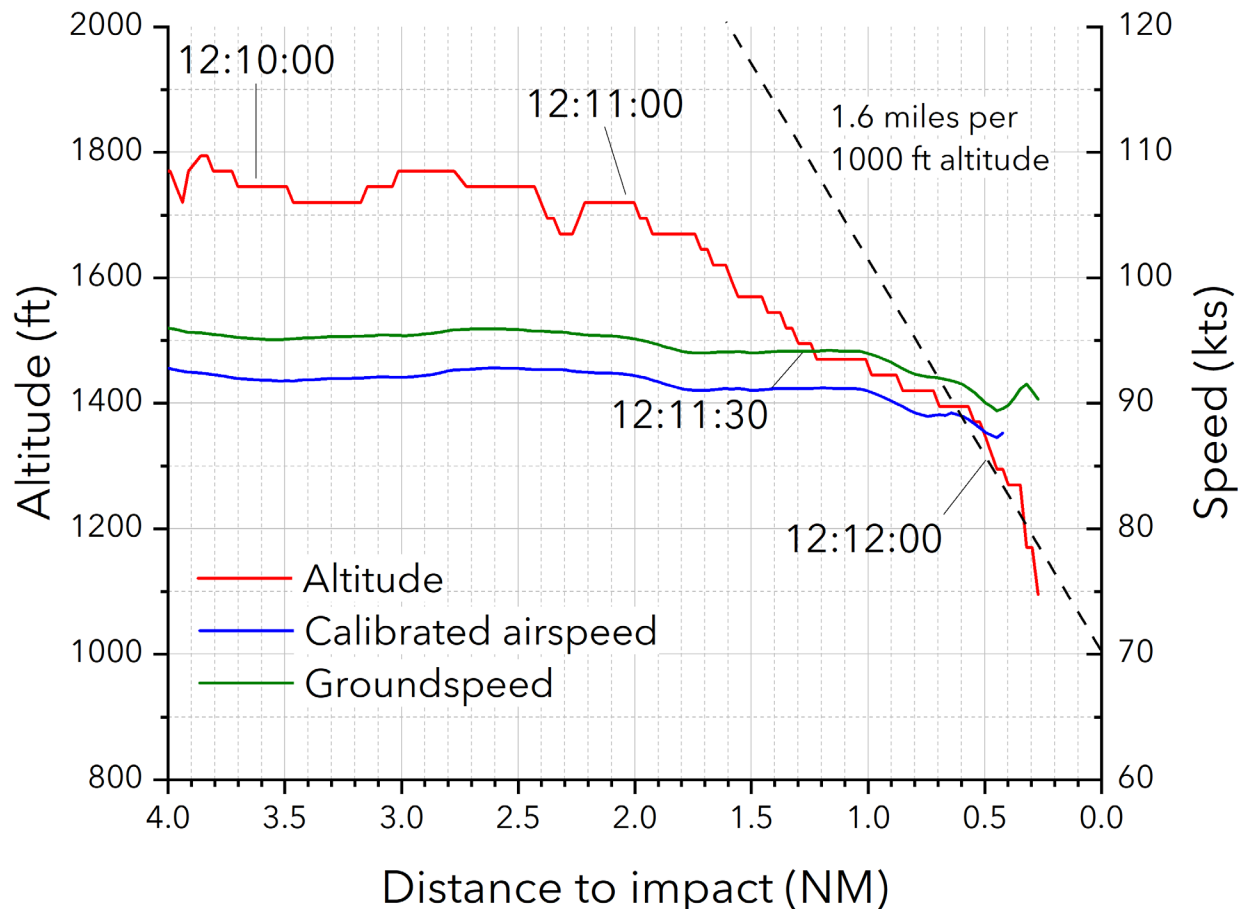


Figure 5. ADS-B altitude, calculated calibrated airspeed, and groundspeed versus distance for final four miles of flight. Shown as a black dotted line is the optimal glide performance.

The Pilot's Operating Handbook [1] states that if power is lost in flight, to maintain an airspeed above 79 kts indicated¹ to obtain a glide ratio of 1.6 miles for every 1,000 ft of altitude. The airplane's performance after 12:11 exceeded this glide ratio until 12:12 when the airplane descended more steeply.

The listed stall speeds are 53 kts, power off, flaps 40° and 58 kts, power off, flaps 0°. The airplane's final calculated calibrated airspeed was 87 kts. For the airplane to have aerodynamically stalled its bank angle would have had to exceed 60°. The wreckage was oriented on a southerly heading, which would have required the airplane to complete a 200° turn from its last recorded northerly ground track of 20° before impact. Figure 6 shows the radius of the required turn from the last ground track. Assuming an airspeed of 87 kts² and a turn radius of 430 ft the bank angle, θ , necessary for that turn can be calculated using

¹ Calibrated airspeed is calculated using the airplane's flight path and weather conditions, but indicated airspeed is airplane dependent. However, indicated and calibrated airspeeds are usually within a few knots of one another.

² The bank angle equation requires true airspeed, but for these atmospheric conditions the true and calibrated airspeed were within one knot of each other.

$$\theta = \text{atan}\left(\frac{\text{speed}^2}{g \times \text{radius of the turn}}\right)$$

The required bank angle would be 57° indicating the airplane was approaching the stall speed.

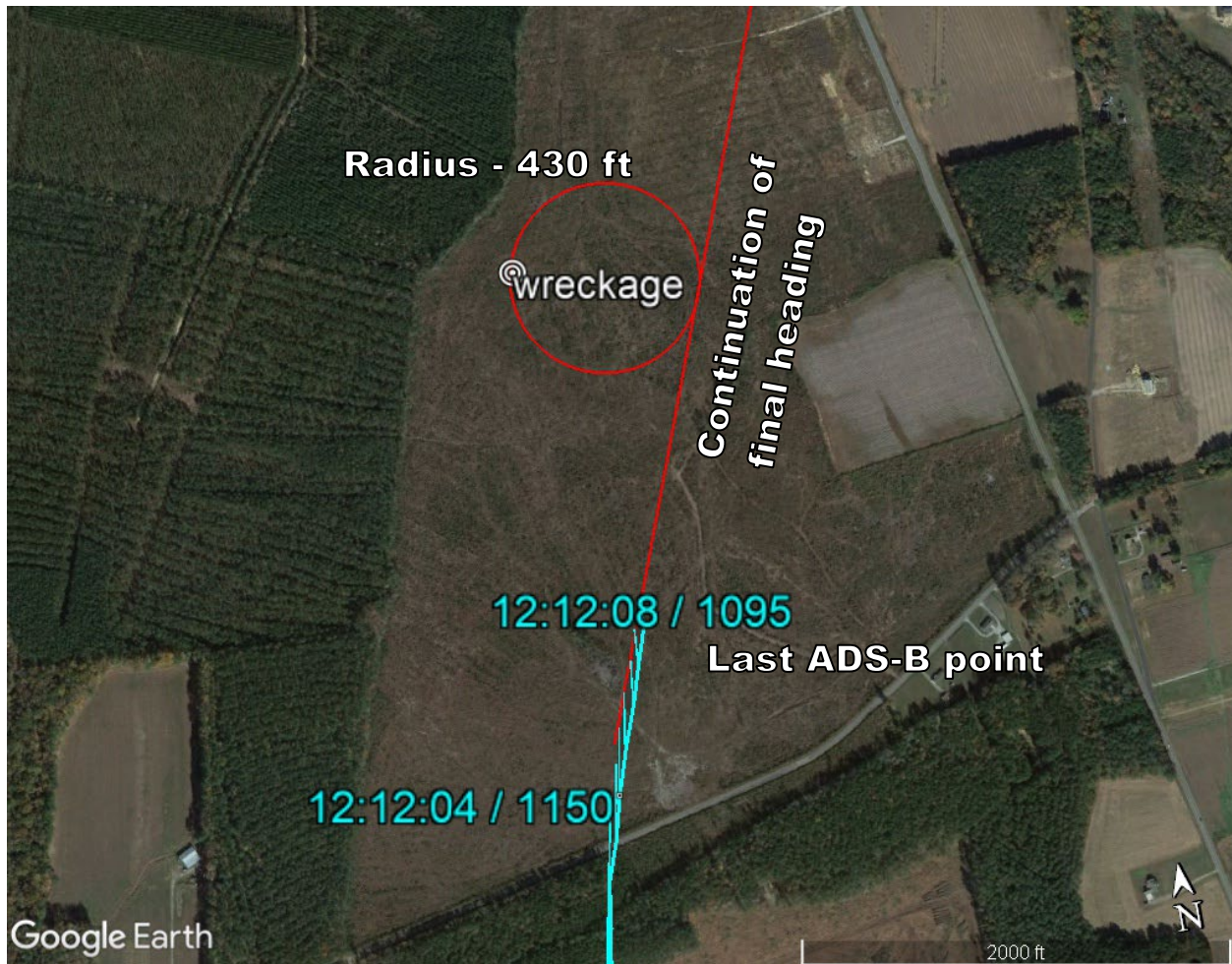


Figure 6. End of ADS-B data and wreckage location. Included are the continuation of the final ground track and the radius of the turn to the wreckage location.

D. SUMMARY

The accident flight lasted approximately 28 minutes. Speed varied between 90 and 100 kts and altitude varied between 1,700 and 2,000 ft. At the end of the flight, the descent rate increased from 100 ft/min to 500 ft/min to over 1,500 ft/min during the final minute of flight indicating a possible loss of power. Calculated calibrated airspeed was 87 kts and at the end of recorded flight. After the end of the ADS-B data, the

airplane traveled another 0.5 mile and descended a further 1,000 ft to the wreckage location. A steep banked turn would have been required to orient the flight path with the wreckage direction, putting the airplane's final known speed close to stall in the turn.

E. REFERENCES

1. Arrow IV Pilot's Operating Handbook and FAA Approved Airplane Flight Manual, Piper Aircraft Corporation, 1978.