

National Transportation Safety Board

Office of Research and Engineering

Washington, D.C. 20594

Performance Study

Specialist Report

Marie Moler

A. ACCIDENT

Location:	Marineland, Florida
Date:	July 13, 2017
Time:	2258 EDT
Airplane:	PIPER PA 44-180, N2173S
NTSB Number:	WPR17FA151

B. GROUP

No vehicle performance group was formed.

C. SUMMARY

On July 13, 2017, about 2258 eastern daylight time, a Piper PA-44-180, N2173S, was destroyed during a descent and subsequent inflight breakup near Marineland, Florida. The flight instructor and private pilot receiving instruction were fatally injured. The airplane was registered to and operated by Sunrise Aviation Inc., Ormond Beach, Florida, as a 14 Code of Federal Regulations Part 91 instructional flight. Visual meteorological conditions prevailed, and no flight plan was filed for the cross-country flight which originated from Brunswick, Georgia, at an undetermined time with an intended destination of the Ormond Beach Municipal Airport (OMN), Ormond, Florida.

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D. PERFORMANCE STUDY

Data from the airport surveillance radar (ASR-9) at Daytona Beach International Airport (DAB), about 30 nautical miles (NM) away from the incident, were used in this study. ASR-9 data updates every 4.5 seconds and has an inherent uncertainty of ± 2 Azimuth Change Pulses (ACP) = $\pm (2 \text{ ACP}) \times (360^\circ/4096 \text{ ACP}) = \pm 0.176^\circ$ in azimuth, ± 50 ft in altitude, and $\pm 1/16$ NM in range.

The aircraft was equipped with ADS-B (automatic dependent surveillance – broadcast), which provided a record of the time, the airplane's GPS-based latitude and longitude, and pressure and corrected altitudes. The ADS-B sample time step was irregular, but position was sampled approximately once a second.

Weather Observations

Recorded data from the Daytona Beach Airport automated weather observation station, located about 30 miles south of the accident site, revealed at 22:53 conditions were wind from 90° at 3 kts, visibility 10 statute miles, broken cloud layer at 25,000 feet, temperature 28°C , dew point 26°C , and an altimeter setting of 30.15 inHg.

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Flight Path

Figure 1 and Figure 2 show the radar and ADS-B flight paths for the accident airplane. The ADS-B recorded latitudes and longitudes showed stair-step-like irregularities compared to the smoother path of the radar.

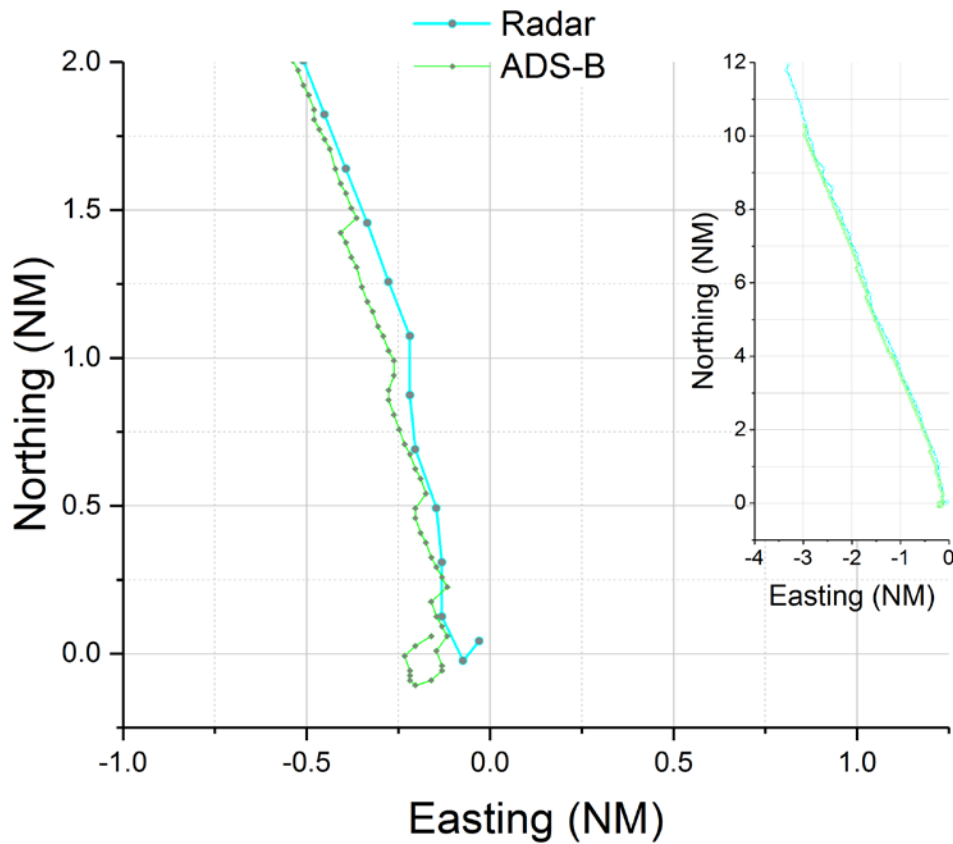


Figure 1. ADS-B and radar flight path in Easting v Northing.

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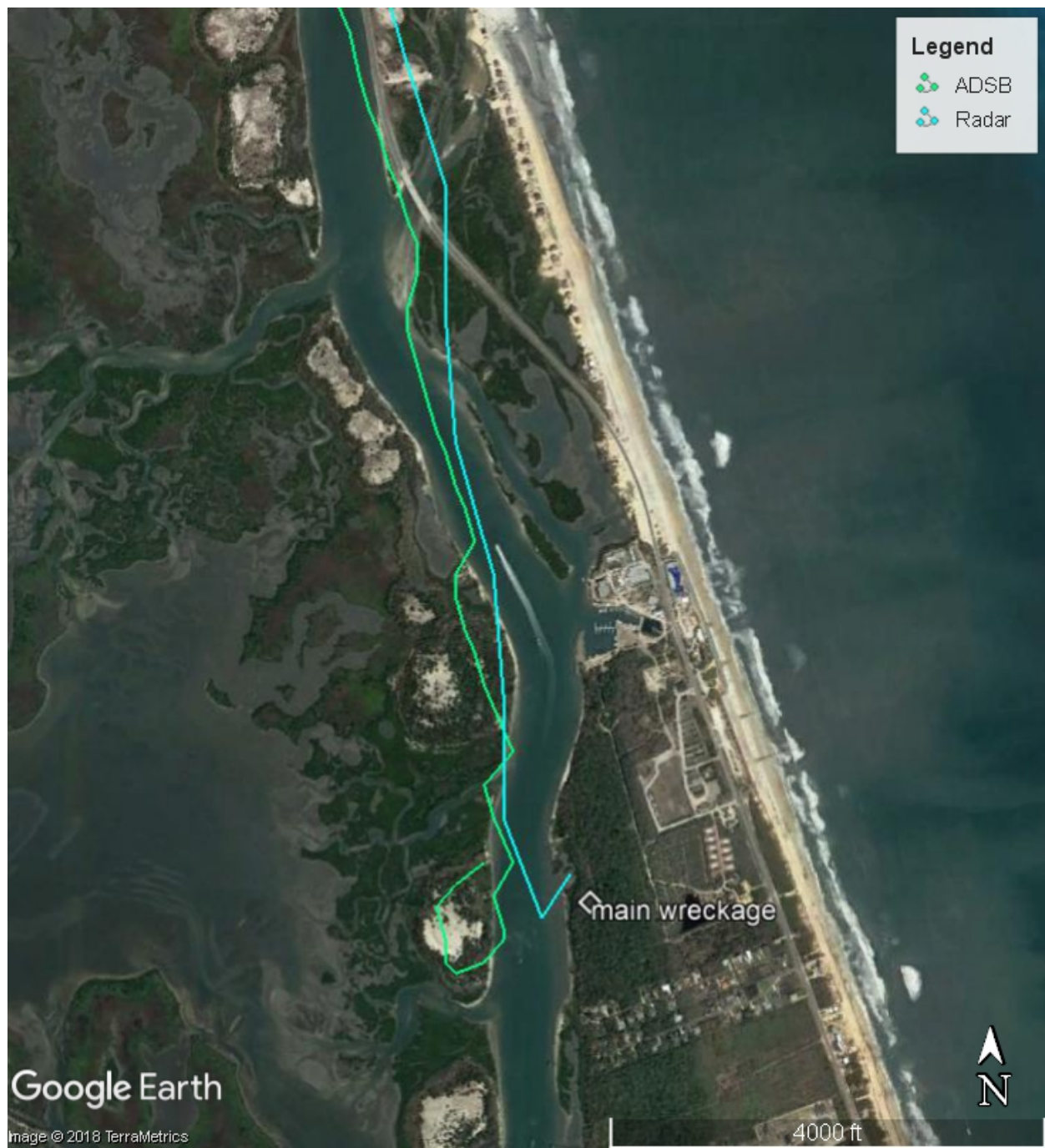


Figure 2. ADS-B and radar flight path in latitude and longitude in Google Earth.

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Groundspeed calculations from both the radar and ADS-B tracks are shown in Figure 3. Even smoothed, the ADS-B groundspeed calculations were considerably noisier than the radar calculations due to the irregularities in the ground track. Airspeed calculations, not shown, also varied considerably due to the changing track angle of the ADS-B ground track. For this reason, the radar ground track was used for the calculations throughout much of this report, unless otherwise specified.

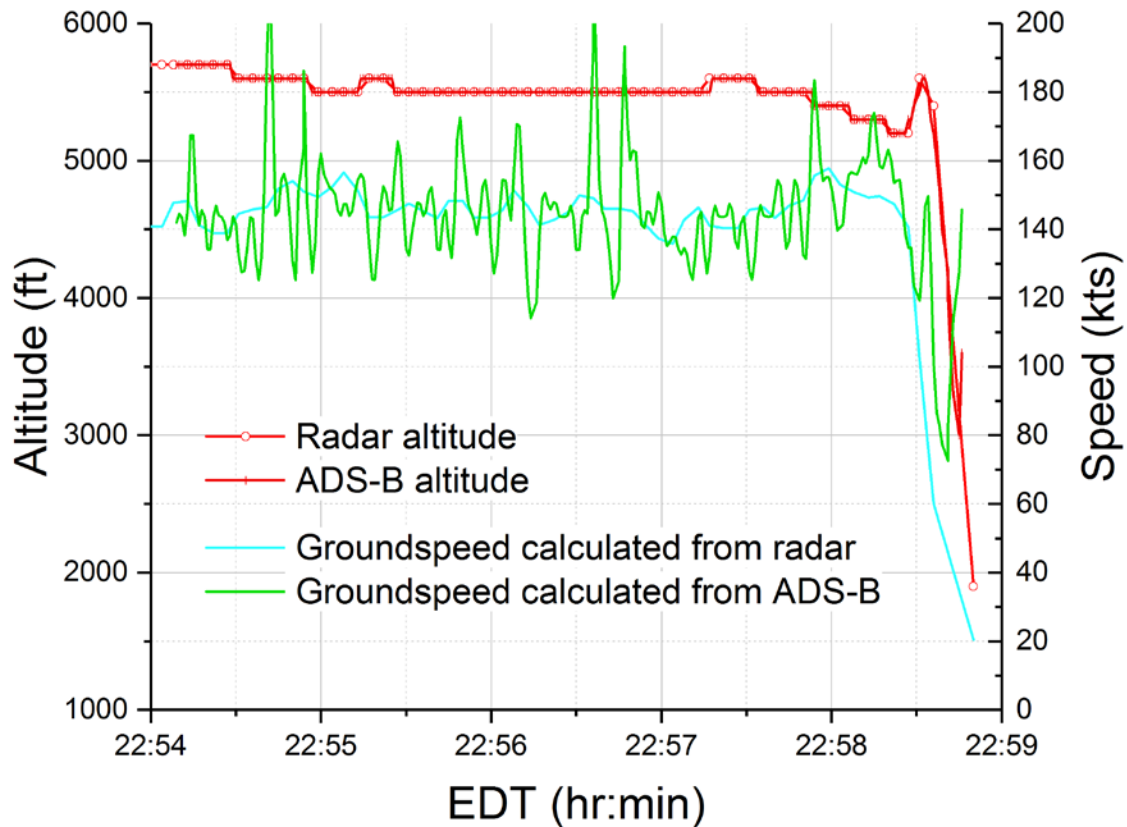


Figure 3. ADS-B and radar altitudes and calculated groundspeeds. Both groundspeed calculations have been similarly smoothed.

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Figure 4 shows the airplane's groundspeed and calibrated airspeed for the last five minutes of flight. On the plot are the reported design maneuvering speeds (V_A) of 133 kts for a heavy airplane (3,800 lbs) and 112 kts for a lighter case (2,700 lbs) [1]. The airplane was estimated to be between 3,250 – 3,350 lbs¹, so the operational V_A would have been between these two values. Also shown is the maximum structural cruising speed of 165 kts (V_{NO}).

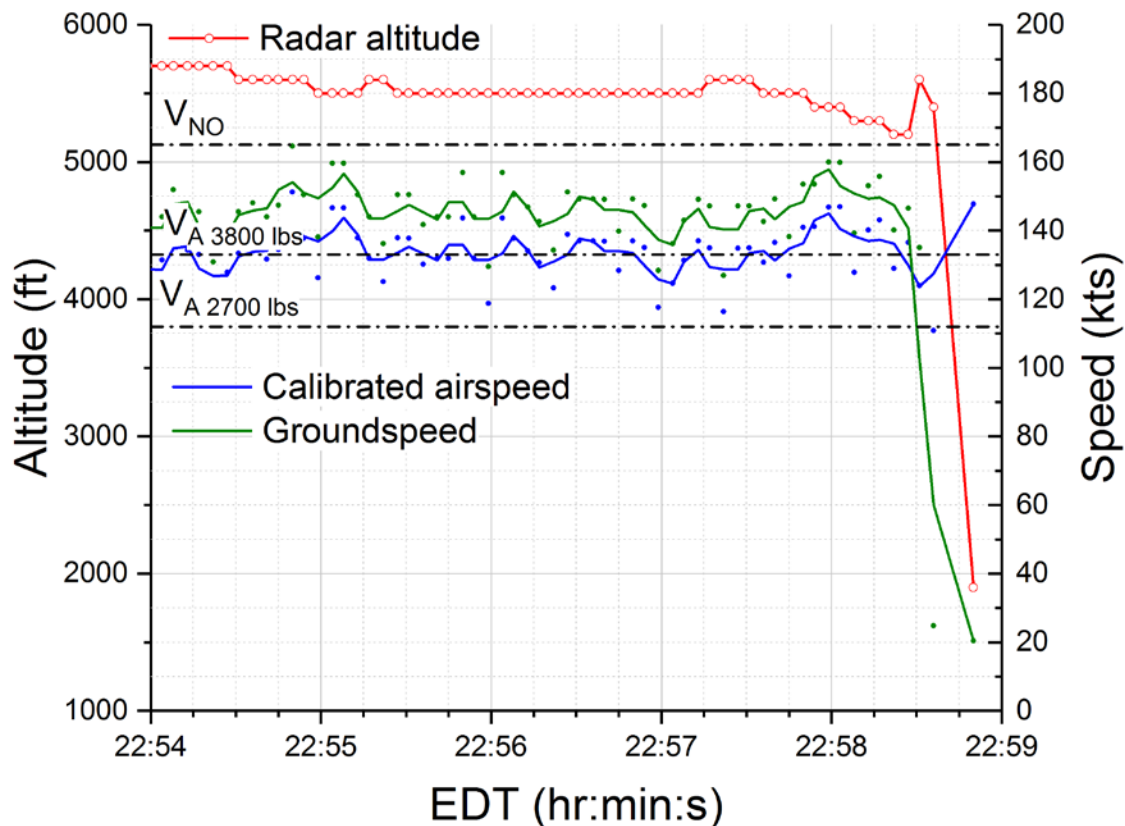


Figure 4. Altitude and calculated ground and calibrated airspeed. Noted are V_{NO} and V_A in calibrated knots.

The airplane was flying at an altitude of about 5,500 ft and an airspeed just above 130 kts with some variation. At about 22:57:36 the airplane began to descend and increase speed to a maximum airspeed of 144 kts at 22:57:59 and an altitude of 5,200 ft by 22:58:22. At 22:58:27 the airplane began to rapidly gain altitude from 5,200 ft to 5,600 ft, for a rate of climb of 6,000 fpm. The Pilot Operating Handbook does not report rates of climb above 2,000 fpm.

¹ This estimate assumed full tanks at the time of takeoff and a standard leaning procedure for cruise flight.

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The airplane then began losing altitude rapidly. Figure 5 shows when the airplane began to first descend at 22:57:36, when it reached a maximum airspeed of 144 kts at 22:57:59, its local lowest altitude of 5,200 ft at 22:58:22, the climb to 5,600 ft and then subsequent beginning of its final descent.

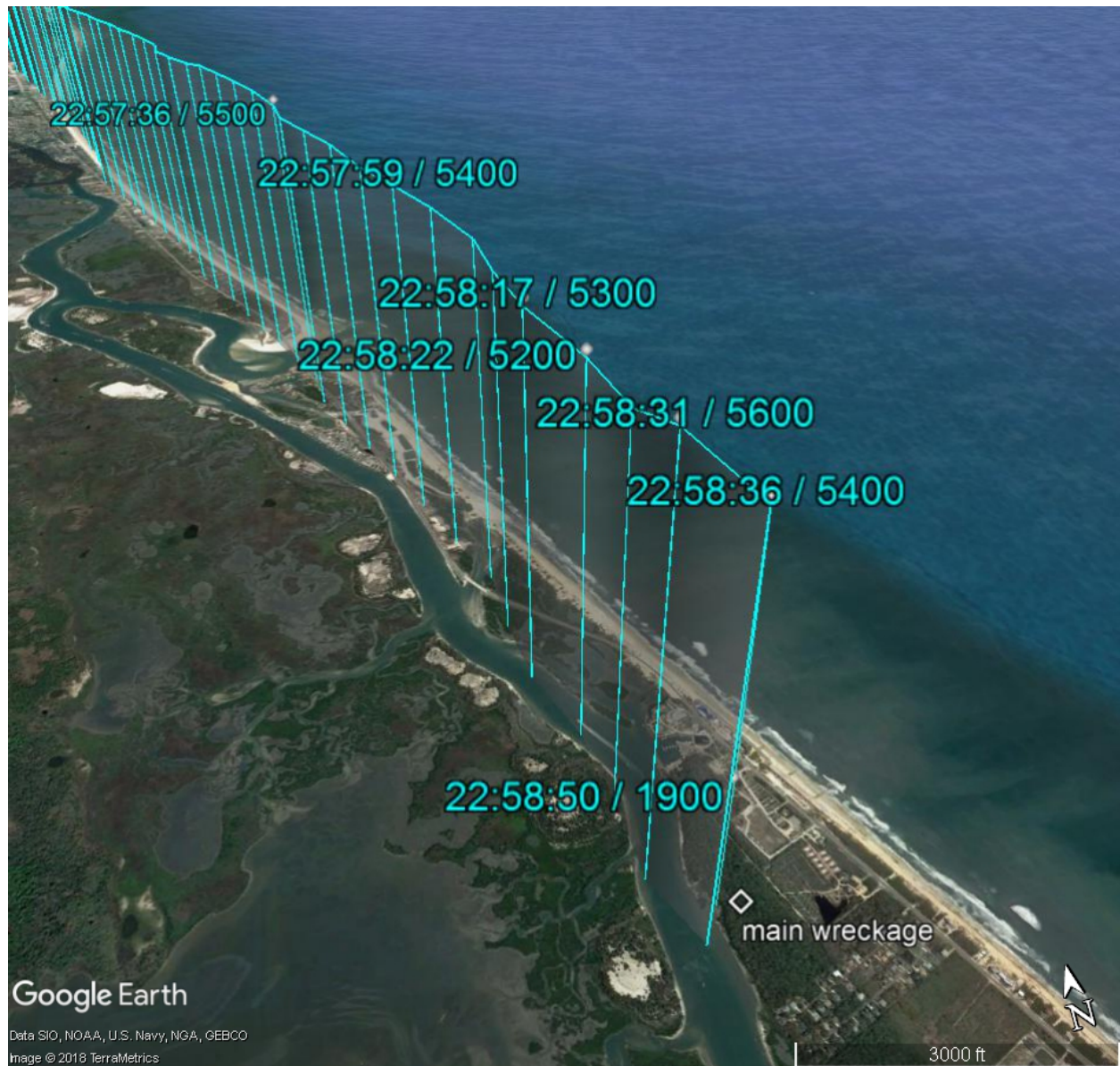


Figure 5. Google Earth radar flight path.

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As Figure 2 illustrated earlier, the end of flight radar and ADS-B paths show different flight paths. While the ADS-B latitude and longitude records were irregular, the flight path for the end of flight shows a right descending turn that appears consistent with the radar record. Figure 6 shows the descending right turn, the recorded debris field, and the location of the main wreckage. The rate of descent was more than 10,000 ft/min.

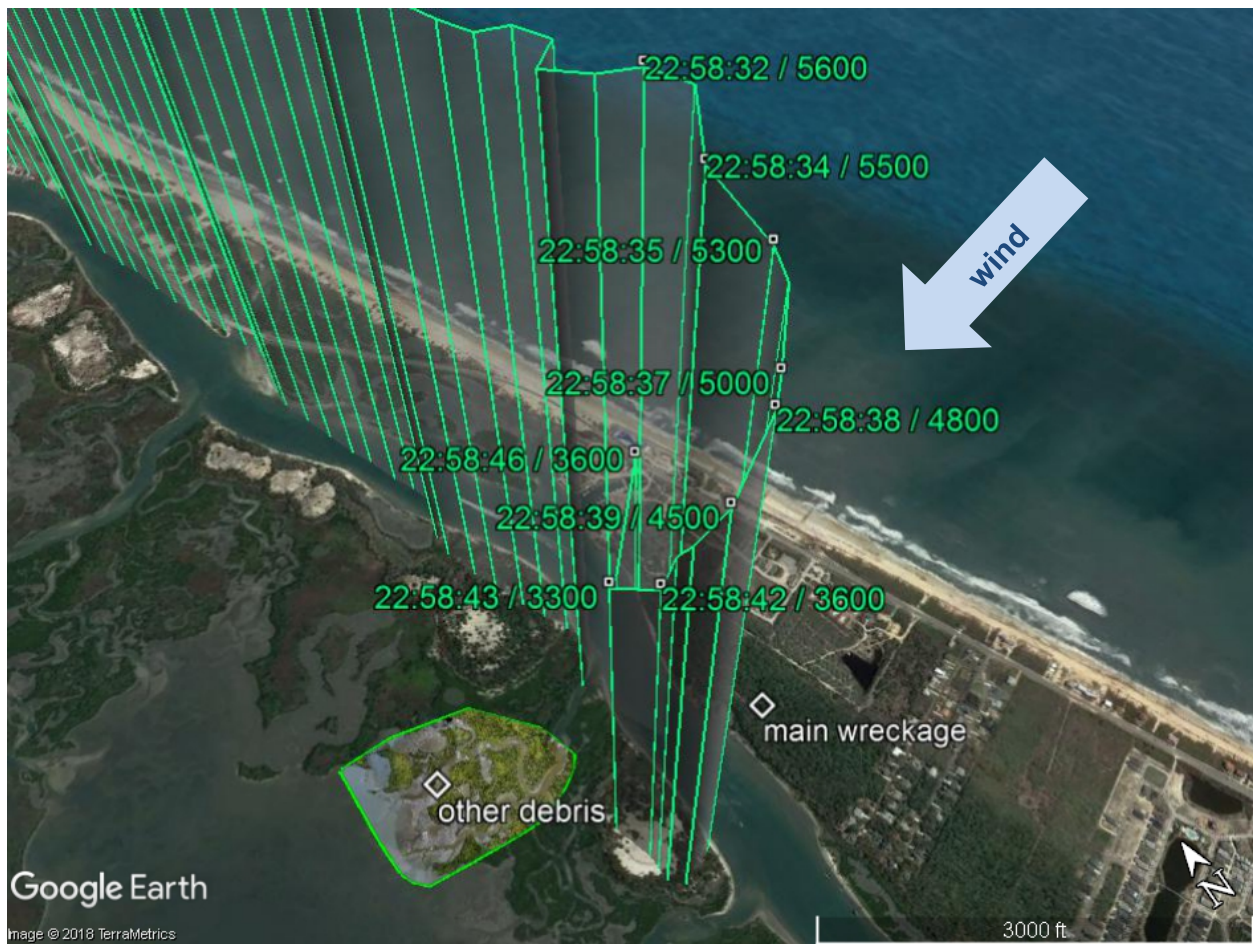


Figure 6. Google Earth ADS-B end of flight path. An arrow represents the 3 kts wind from 90°. The portion of the ground outlined in green and shown in a lighter color is the surveyed debris field. A diamond to the right of the flight path marks where the main fuselage wreckage was found.

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Figure 7 shows the ADS-B path, a slightly smoothed ADS-B path, and the radar path. The points for 22:58:31 show good agreement while 22:58:36 illustrate the easting offset that made the ADS-B data irregular. However, the last ADS-B data point at 22:58:46 and the last radar data point at 22:58:50 could show a consistent flight path if the airplane was following a descending right turn. A possible flight path from both radar and ADS-B data is shown.

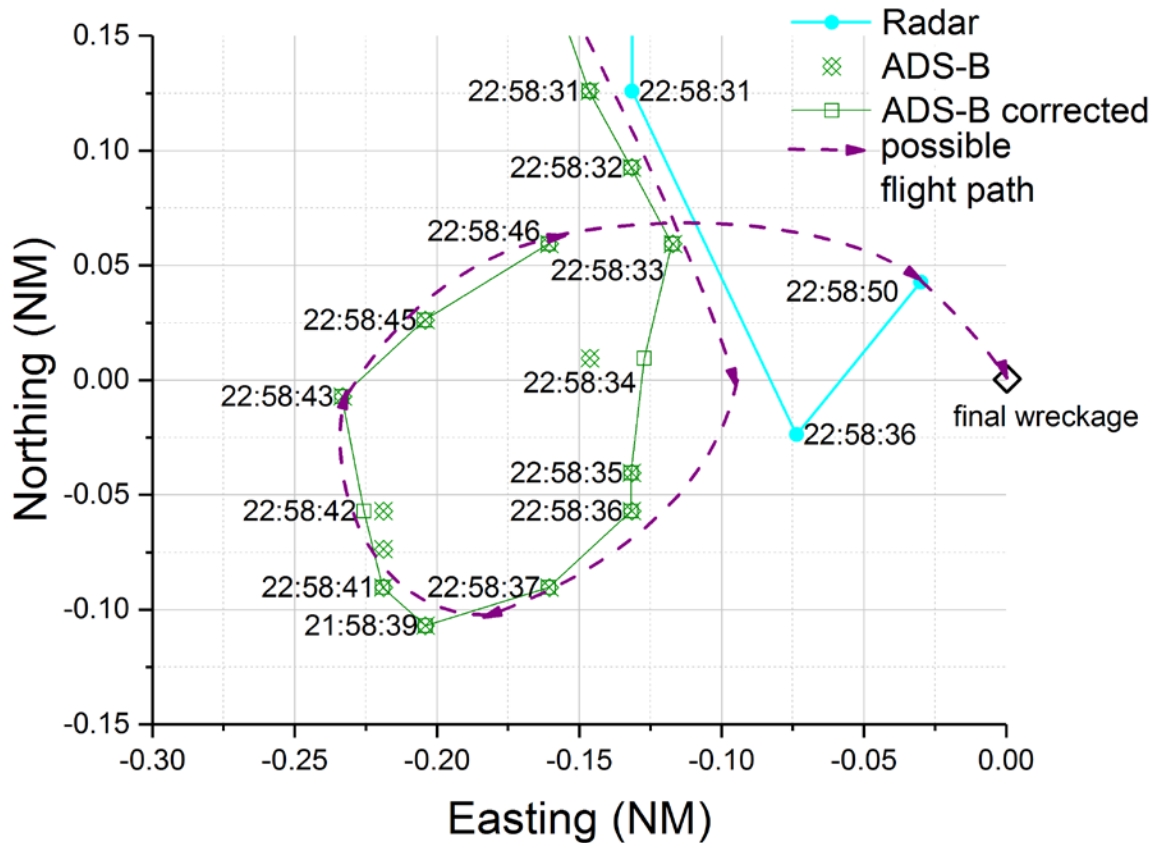


Figure 7. The recorded ADS-B points and smoothed ADS-B path (both in green), radar flight (in blue), and the possible actual flight path (purple) for end of flight.

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Figure 8 shows calibrated airspeed and groundspeed calculated from the smoothed ADS-B position data for the descending right turn at the end of flight. At 22:58:39 the airplane exceeded V_{NO} again. This time is shown on the flight path in Figure 6 and Figure 7. If an inflight break-up occurred after the point the airplane exceeded V_{NO} the second time, the combination of the airplane's momentum and the wind from the east would have carried shed pieces of airplane northwest of the flight path, which is consistent with the debris field.

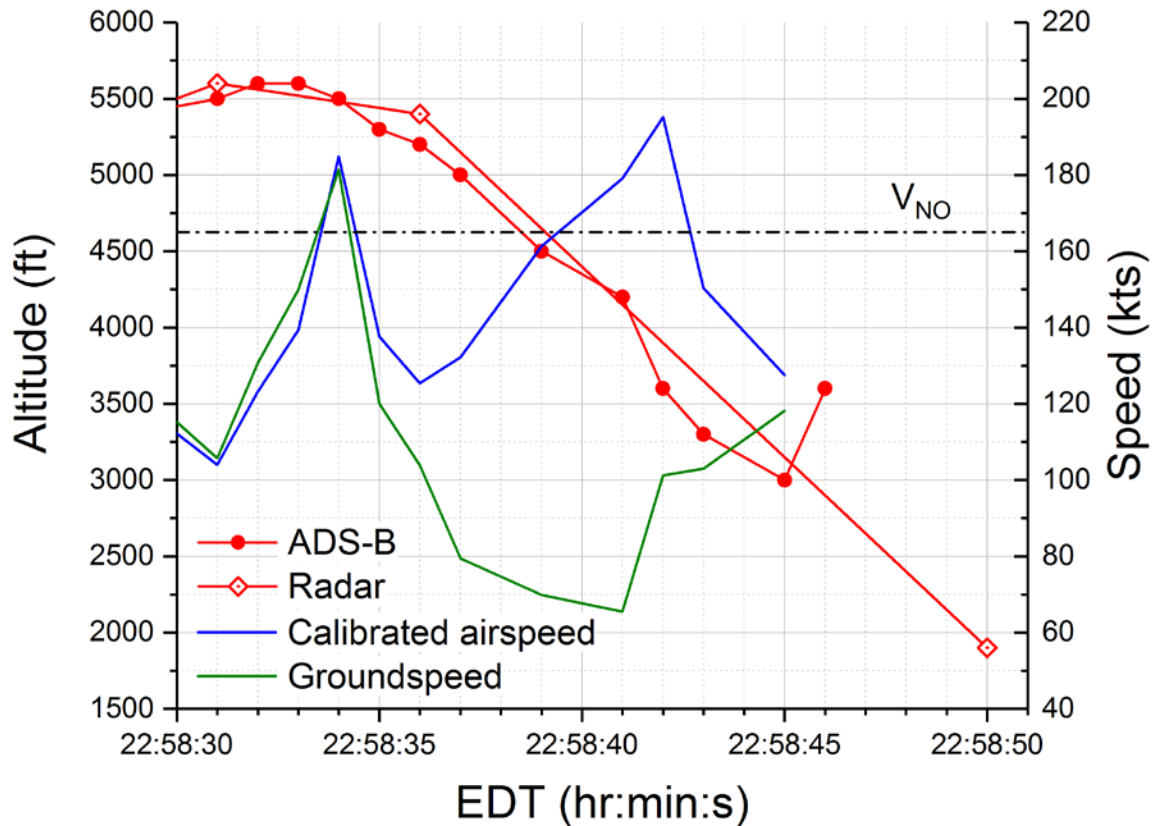


Figure 8. ADS-B and radar altitude with speeds calculated from smoothed ADS-B locations (Figure 7).

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E. CONCLUSIONS

The airplane was initially flying at an altitude of 5,500 ft and an airspeed just above 130 kts until 22:57:36 when it began to descend and increase speed to a maximum airspeed of 144 kts at 22:57:59. The maximum maneuvering speed for this airplane is between 112 kts (light) and 133 kts (heavy). At 22:58:27 the airplane began to rapidly gain altitude from 5,200 ft to 5,600 ft, for a rate of climb of 6,000 fpm.

The airplane then began losing altitude rapidly after 22:58:33. It gained airspeed while descending and at 22:58:39, exceeded the V_{NO} of 165 kts while at an altitude of 4,500 ft. The debris field, winds, and airplane direction near the time of exceeding V_{NO} are consistent with an in-flight breakup.

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F. REFERENCES

1. Pilots Operating Handbook, Piper Seminole PA-44-180, 1979 & 1980 Models. Piper Aircraft Corporation, March 23rd, 1978.