

National Transportation Safety Board

Office of Research and Engineering

Washington, D.C. 20594

Performance Study

Specialist Report

Marie Moler

A. ACCIDENT

Location:	Bakersfield, California
Date:	December 19, 2015
Time:	1556 PST
Airplane:	Piper PA-32RT-300T, N36402
NTSB Number:	WPR16FA041

B. GROUP

No vehicle performance group was formed.

C. SUMMARY

On December 19, 2015, at 1556 Pacific Standard Time (PST), a Piper PA-32RT-300T, N36402, impacted terrain following an in-flight breakup near Bakersfield, California. The airplane was registered to RAD Aviation LLC, and operated by the private pilot under the provisions of 14 Code of Federal Regulations Part 91. The pilot and four passengers sustained fatal injuries; the airplane was destroyed during the accident sequence. The cross-country flight departed Reid-Hillview Airport of Santa Clara County, San Jose, California, at 1435, with a planned destination of Henderson Executive Airport, Las Vegas, Nevada. Instrument meteorological conditions prevailed, and an instrument flight rules (IFR) flight plan had been filed.

Performance Study

WPR16FA041, Piper PA-32RT-300T, N36402

PERFORMANCE STUDY

The performance study describes the accident airplane ground track, altitude, and speed, as well as the timing of select transmissions between air traffic control (ATC) and N36402. Radar data used in this study are primarily from the ASR-8 (airport surveillance radar) at Meadows Field Airport (KBFL) and sampled at a frequency of every 4.5 seconds. The radar is approximately 10 nautical miles from the aircraft's final location. These data have approximately a 60 nautical mile (NM) range and 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. Oakland Air Route Traffic Control Center (ZOA ARTCC) and Los Angeles Air Route Traffic Control Center (ZLA ARTCC) were in communication with the aircraft during the flight. Times in the study are reported in PST.

The aircraft's weight was estimated to be 3,280 lbs at the time of the accident.

Weather Observation

The weather conditions reported at KBFL at 1554 PST were 3 kts winds from 170° , 49°F (9°C) with a dew point of 46°F (8°C), and the pressure was 29.97 inHg. Visibility was four miles, with a broken layer at 5000 ft and overcast at 6500 ft. Light rain and mist and 0.02 inch of liquid equivalent accumulated in the previous hour. KBFL is approximately 10 nautical miles northeast of the wreckage field.

Winds aloft for the area and time of the accident were provided by the NTSB meteorology group and are shown in Table 1.

Table 1. Winds aloft data.

Altitude (ft)	Direction (deg)	Magnitude (kts)
9807	222	12
11690	220	17
13691	206	23
15826	204	32
18115	205	44

Aircraft ground track, altitude, and speed

The final portion of the flight from 15:34 to the end (15:56) is shown in Figure 1 with selected ATC communication. Figure 2 shows the track angle and altitude from 15:40 to the end. At about 15:40:43, the pilot requested to descend to an altitude of 15,500 ft. The aircraft descended from 16,500 ft to 15,800 ft when ATC reported rime ice to the south east of the aircraft. The pilot replied that he would deviate south to avoid the weather. The aircraft turned to 150° and continued to descend to 15,000 ft. At about 15:50, ATC offered the pilot an IFR clearance to

Performance Study
WPR16FA041, Piper PA-32RT-300T, N36402

Henderson and the pilot accepted. Shortly thereafter the pilot requested an altitude of 15,000 ft. The aircraft descended to 14,700 ft and turned left onto a northeasterly track of about 40°. At 15:53 ATC provided vectors to Henderson.

Not all communication between the accident aircraft and ATC is shown in Figure 1 through Figure 4.

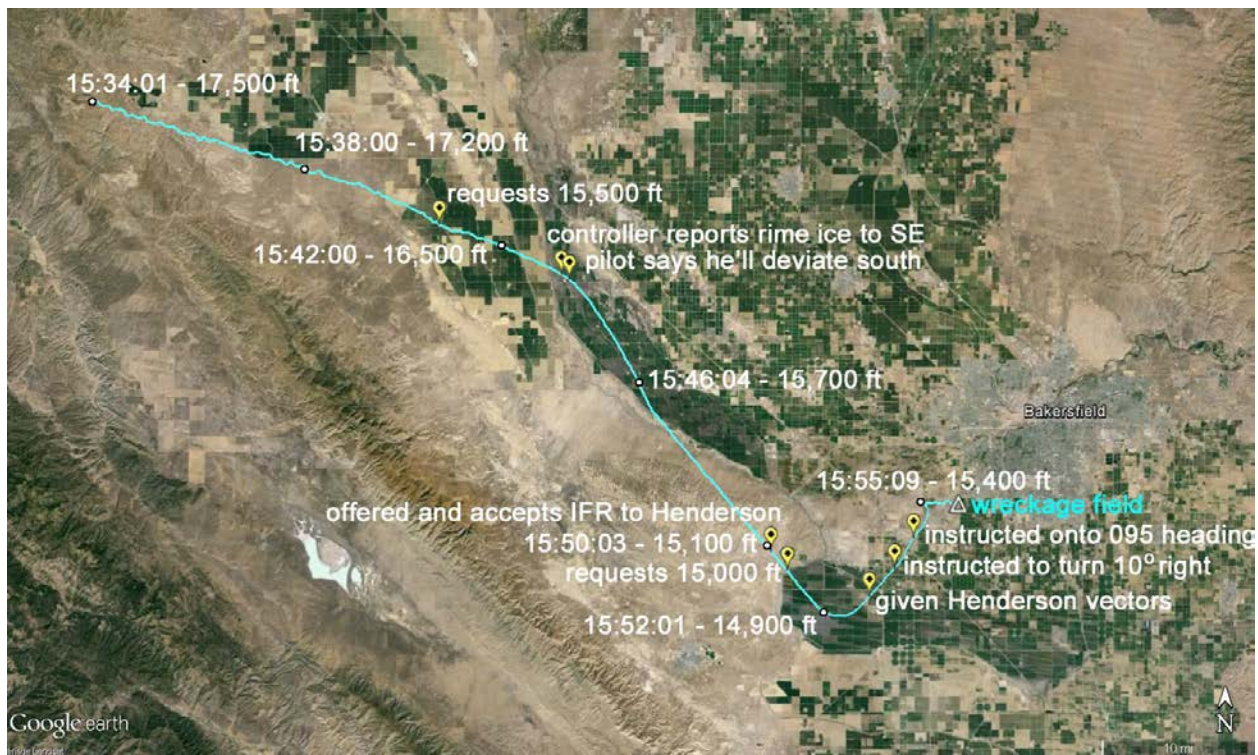


Figure 1. Radar flight path with selected times and ATC comments annotated.

Performance Study
WPR16FA041, Piper PA-32RT-300T, N36402

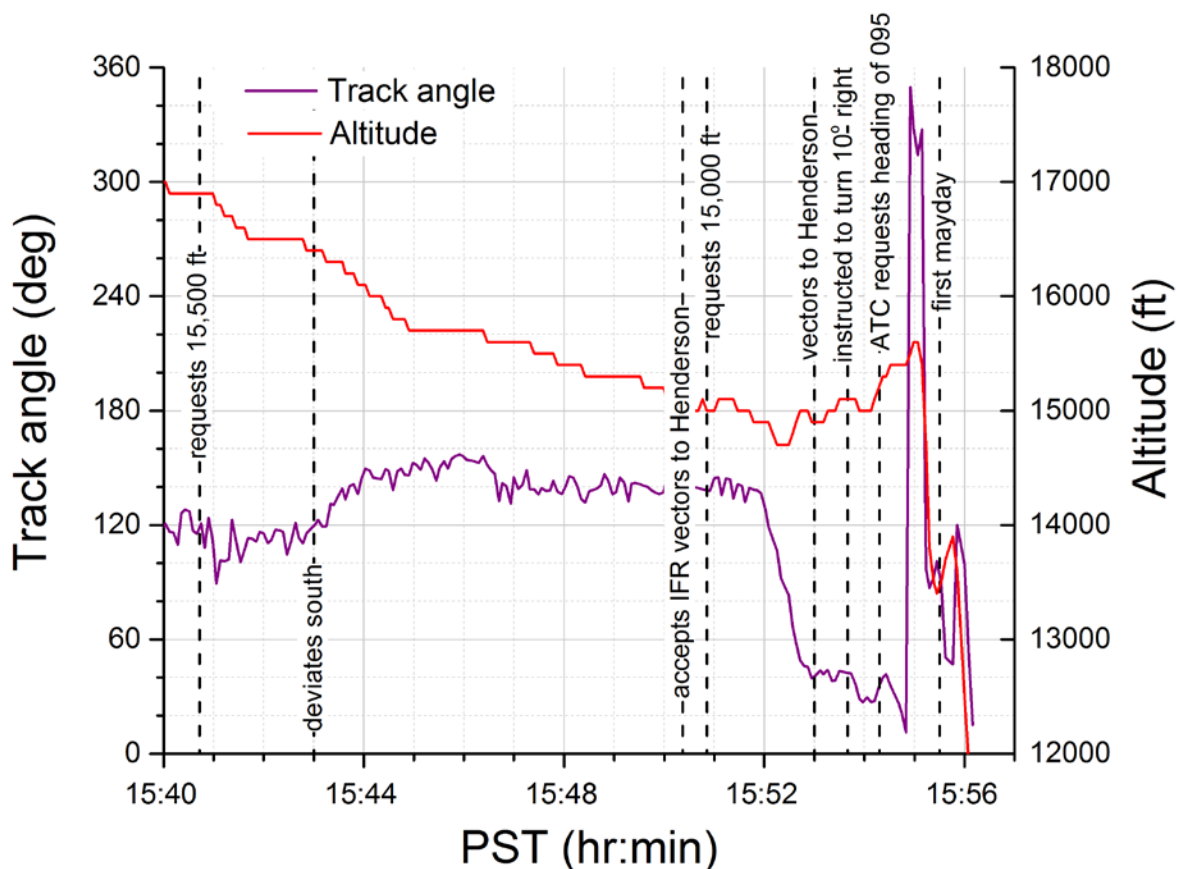


Figure 2. Track angle and altitude for flight from 15:42 to end of radar data with selected ATC comments.

Figure 3 and Figure 4 show the final portion of the flight. Between 15:53 and 15:55 the aircraft gained 700 ft of altitude. At 15:53:40, ATC instructed a 10° turn to the right to avoid traffic. The aircraft turned to the left from a track of 40° to 30°. At 15:54:18 ATC instructed the aircraft to turn onto a heading of 095. The aircraft continued straight until about 15:54:50, and then began to turn left (away from 95°). By 15:55:09, the aircraft altitude was 15,400 ft and it had turned left onto a track of 300°. At 15:55:14, its altitude was 14,700 ft and its track was about 89°. The possible maneuver between these two points will be discussed further in Figure 5. The aircraft continued along an easterly path until its last radar return at 15:56:10 at 11,200 ft. The pilot made two mayday calls: one at 15:55:31 and the second at 15:55:48.

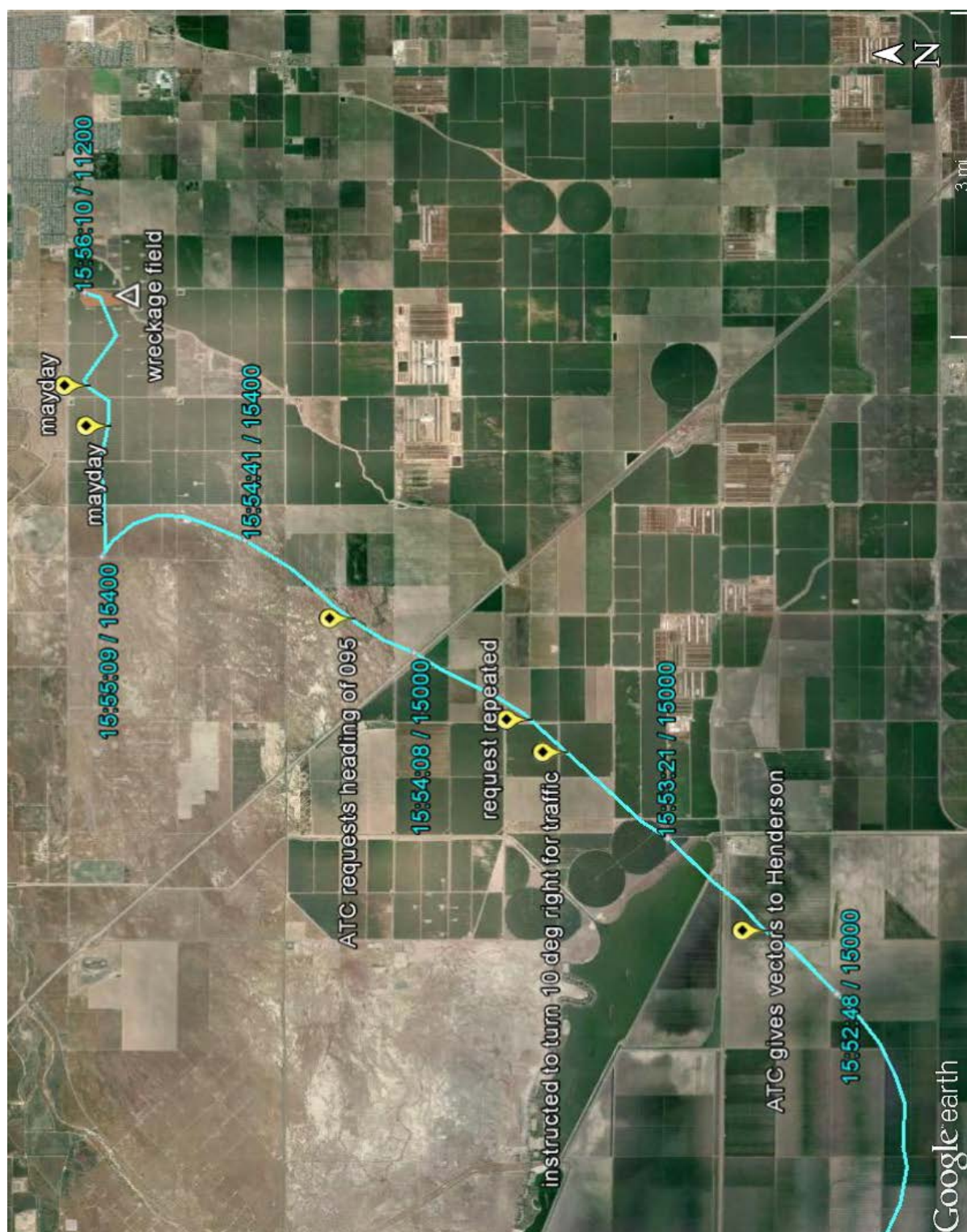


Figure 3. Radar flight path with times, selected ATC comments, and wreckage field marked.

Performance Study
WPR16FA041, Piper PA-32RT-300T, N36402

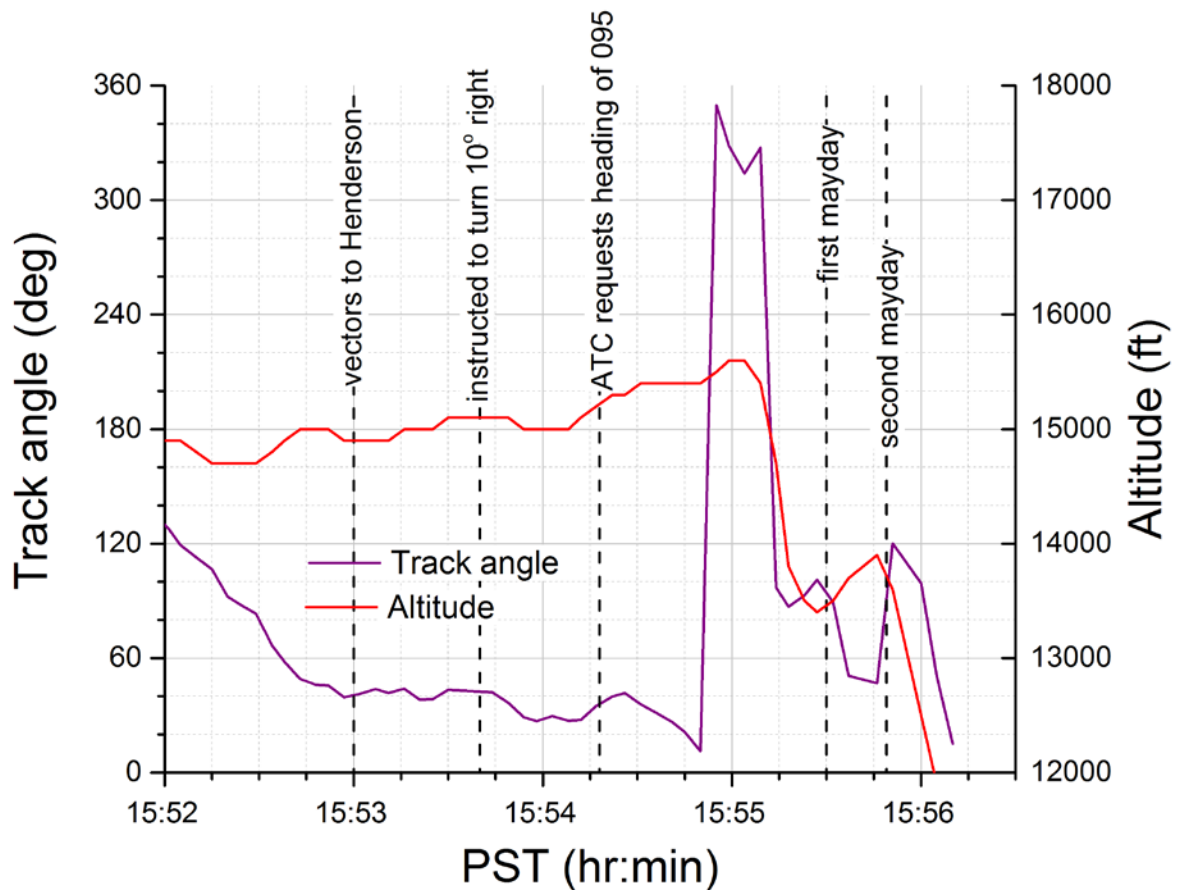


Figure 4. True track angle and altitude for flight from 15:52 to end of radar data with selected ATC comments.

Figure 5 shows a portion of the radar path centered about the aircraft's maneuver between points at 15:55:09 and 15:55:14. The most northern point with a noted altitude of 15,400 ft occurred at 15:55:09. The next recorded point was at 15:55:14 and an altitude of 14,700 ft. The blue arrows show a notional path of how the aircraft may have made a 211° turn (from a track of 300° to 89°) in the 4.5 seconds between radar returns. The rate of turn for that flight path would be about 46 degrees/second, more than 15 times faster than a standard rate turn.

Performance Study
WPR16FA041, Piper PA-32RT-300T, N36402

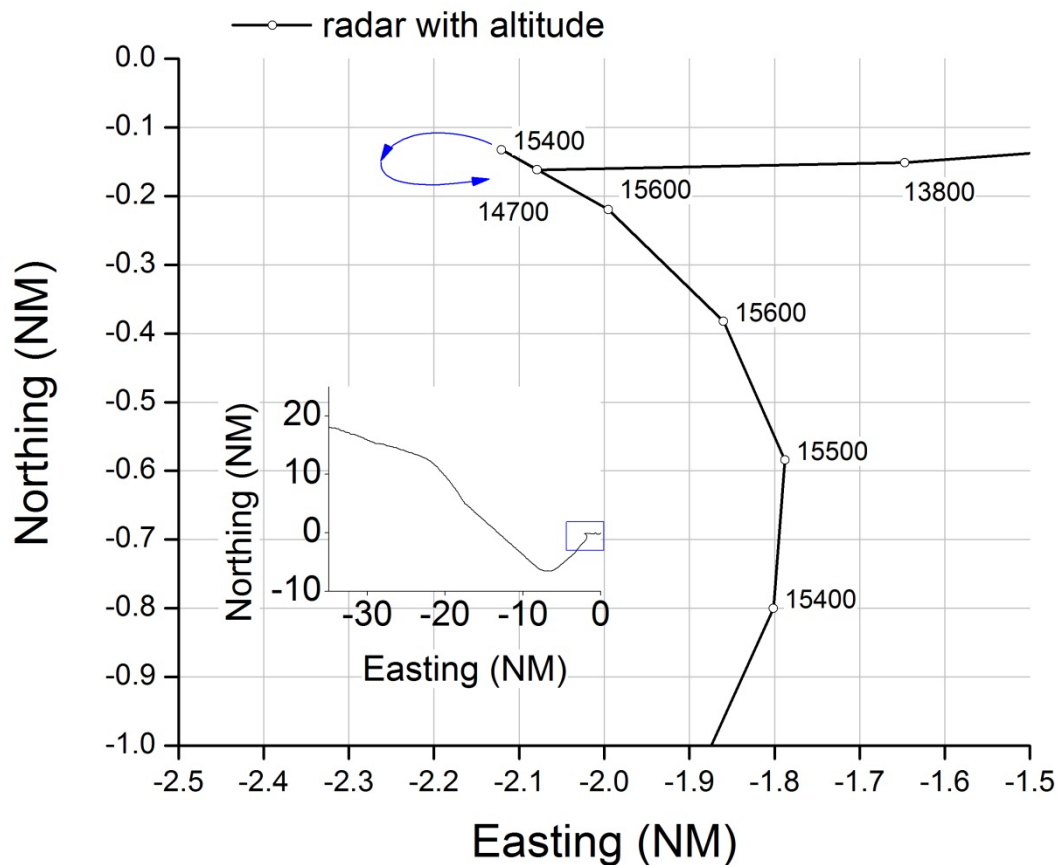


Figure 5. Radar path with altitudes.

Groundspeed and calibrated airspeed were calculated using radar data and winds aloft. Figure 6 shows altitude, groundspeed, and calibrated airspeed for the flight from 15:34 to shortly after 15:56 when radar coverage was lost. The aircraft was descending to 15,000 ft, as discussed with ATC until around 15:52, when the aircraft began its left turn onto a track of above 40°. At that point in time altitude and speed begin to increase.

Performance Study
WPR16FA041, Piper PA-32RT-300T, N36402

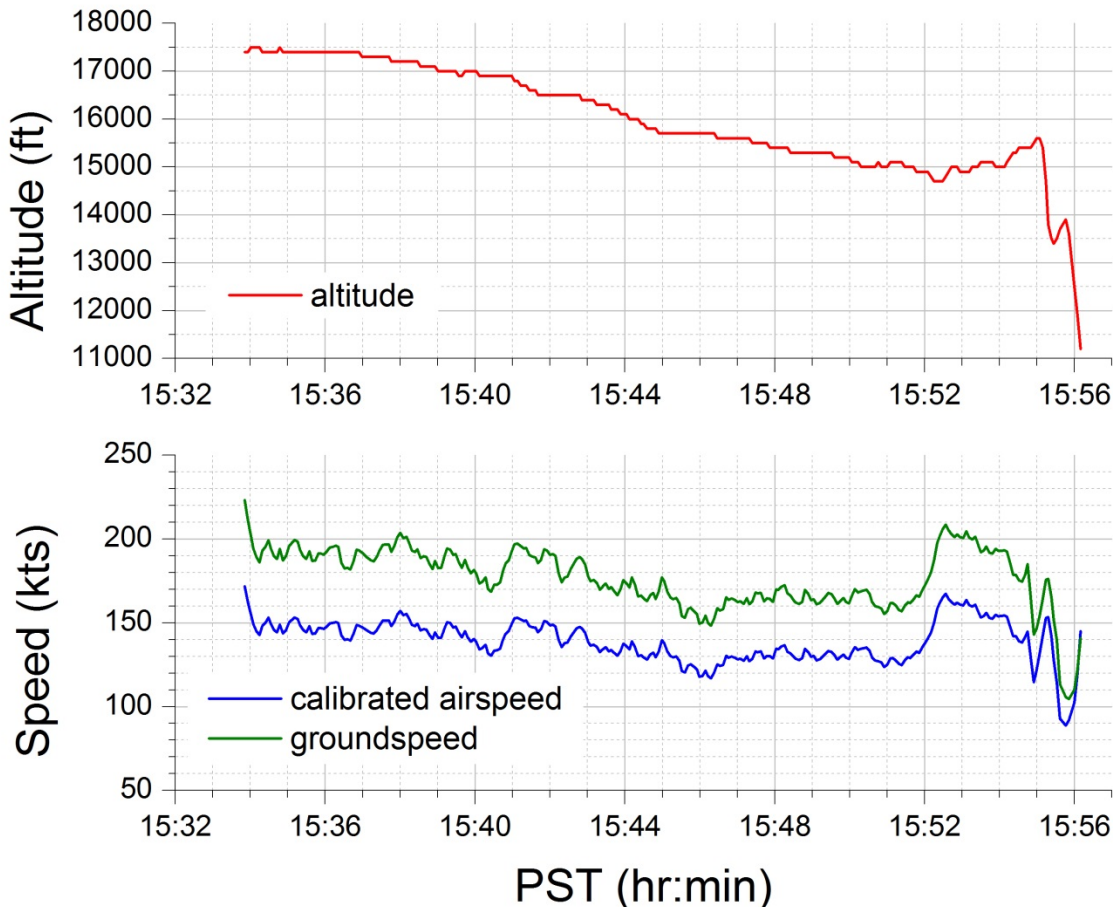


Figure 6. Aircraft altitude, calculated groundspeed, and calibrated airspeed.

The Pilots Operating Handbook (POH) and Airplane Flight Manual (AFM) [1] reported the aircraft's never-exceed speed (V_{NE}) to be 189 kts calibrated airspeed and its maximum structural cruising speed (V_{NO}) to be 150 kts. The V_{NO} speed was noted "Do not exceed this speed except in smooth air and then only with caution". Also listed were design maneuvering speeds (V_A) for gross weights of 3600 lbs (132 kts, calibrated) and 2170 lbs (109 kts, calibrated). Full or abrupt control movements should not be made above V_A . The aircraft's gross weight was estimated post-accident to be 3,280 lbs, so its V_A would be closer to the 3,600 lbs limit than the 2,150 lbs limit.

Figure 7 shows the calibrated airspeed for the final eight minutes of recorded flight. The aircraft was at the design maneuvering speed for 3,600 lbs (132 kts, calibrated) for the time before it made the 90° left turn onto a heading of 40°. By 15:52:34 it had reached a peak speed of 168 kts, 18 kts above V_{NO} . The aircraft slowed, and at 15:55:09, when the sudden possible 211° turn occurred, the aircraft's calculated calibrated airspeed was between the V_{NO} and V_A limits. The aircraft was at or above the 3,600 lbs V_A for the majority of this portion of the flight.

Performance Study
WPR16FA041, Piper PA-32RT-300T, N36402

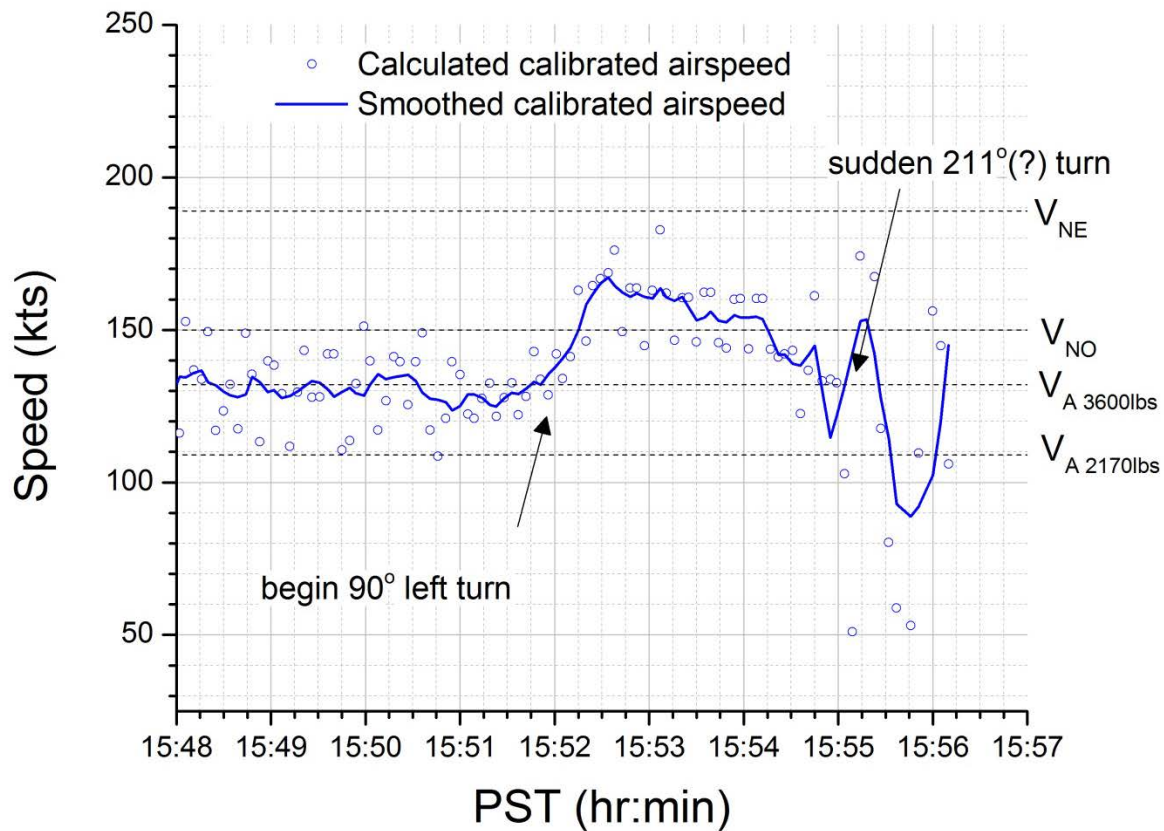


Figure 7. Calculated calibrated airspeed for last eight minutes of flight.

Figure 8 shows the calculated normal load factor for the last eight minutes of flight. The calculation routine assumes that side slip angles are small and that the aircraft is unstalled and then uses an iterative method to calculate the pitch and bank angles and angle of attack. Normal load factor is calculated using these assumptions and may not accurately reflect the flight. The maximum calculated normal load factor was 2.8 g's. The POH stated that the maximum positive load factor is 3.8 g's.

Performance Study
WPR16FA041, Piper PA-32RT-300T, N36402

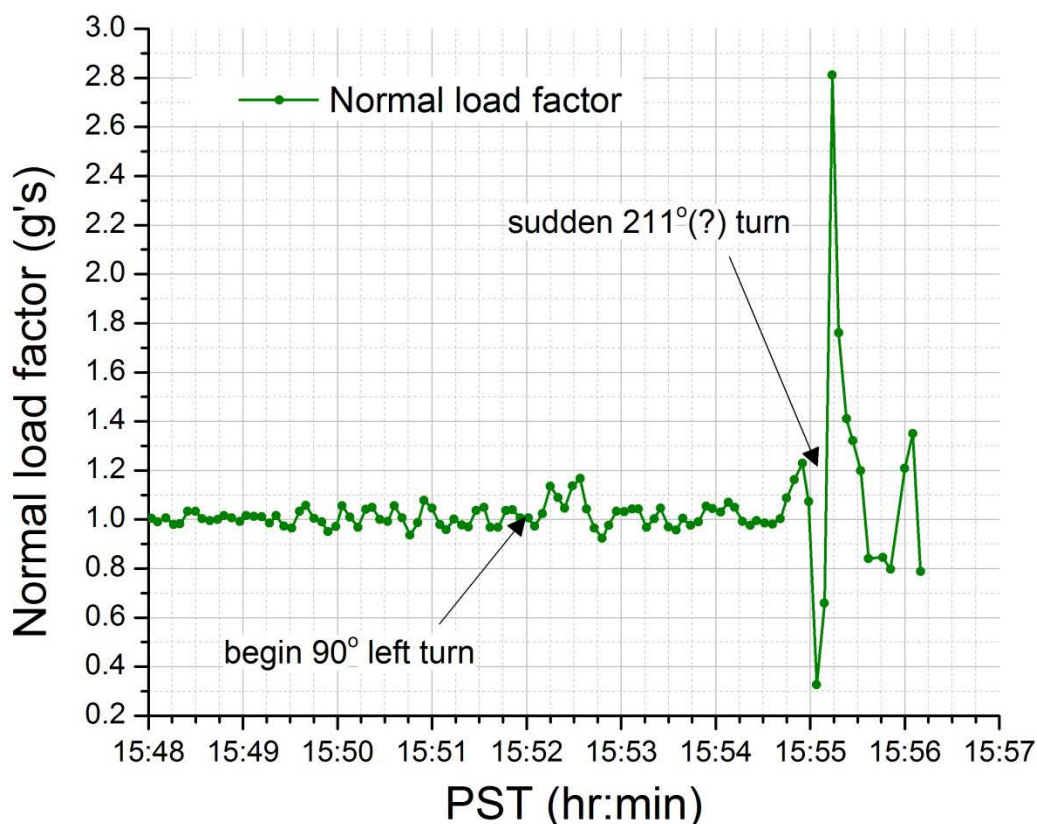


Figure 8. Calculated normal load factor for last eight minutes of flight.

The aircraft's flight path after the event between 15:55:09 and 15:55:14 is shown in Figure 9. The aircraft made abrupt left then right turns and lost 1,100 ft of altitude between 15:55:51 and 15:56:00. The aircraft continued to lose altitude as it made its final recorded left turn. During this time the aircraft's airspeed varied between 90 and 150 kts (Figure 7).

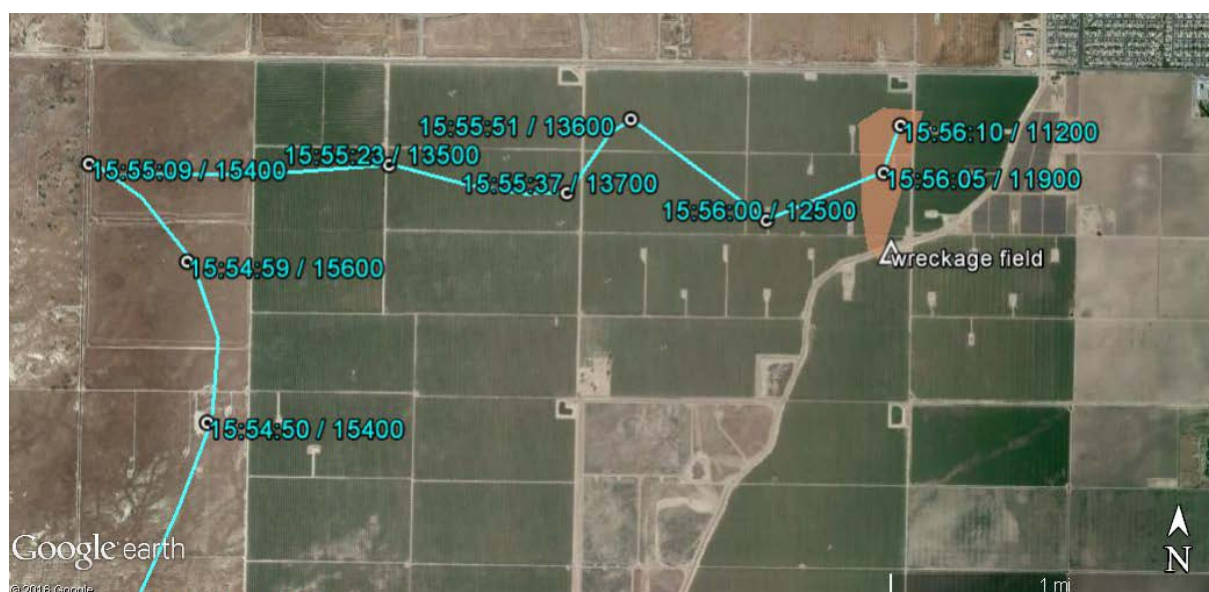


Figure 9. Final flight path with selected times and altitudes marked.

Performance Study
WPR16FA041, Piper PA-32RT-300T, N36402

Debris Field

The debris field ran 2,500 ft from north to south with lighter objects (aileron, stabilizers, pieces of sheet metal and insulation) to the north and heavier objects (engine and instrument panel) to the south (Figure 10). The debris field was at an elevation of 340 ft. Surface winds were from 170° at 3 kts. Winds aloft (from Table 1) were from 222° at 12 kts at 9,807 ft to 220° at 17 kts at 11,690 ft. The scatter of the debris field indicated that the aircraft broke up while in the air on a southerly track.

The aircraft's final radar return was directly above the northern portion of the debris field at a height of 11,200 ft. The aircraft's last track angle was 20° (north-northeast) while the debris field was roughly 180° south. Between the final radar returns and the point of break up the aircraft needed to turn 200° left or 160° right to align with the debris field heading.

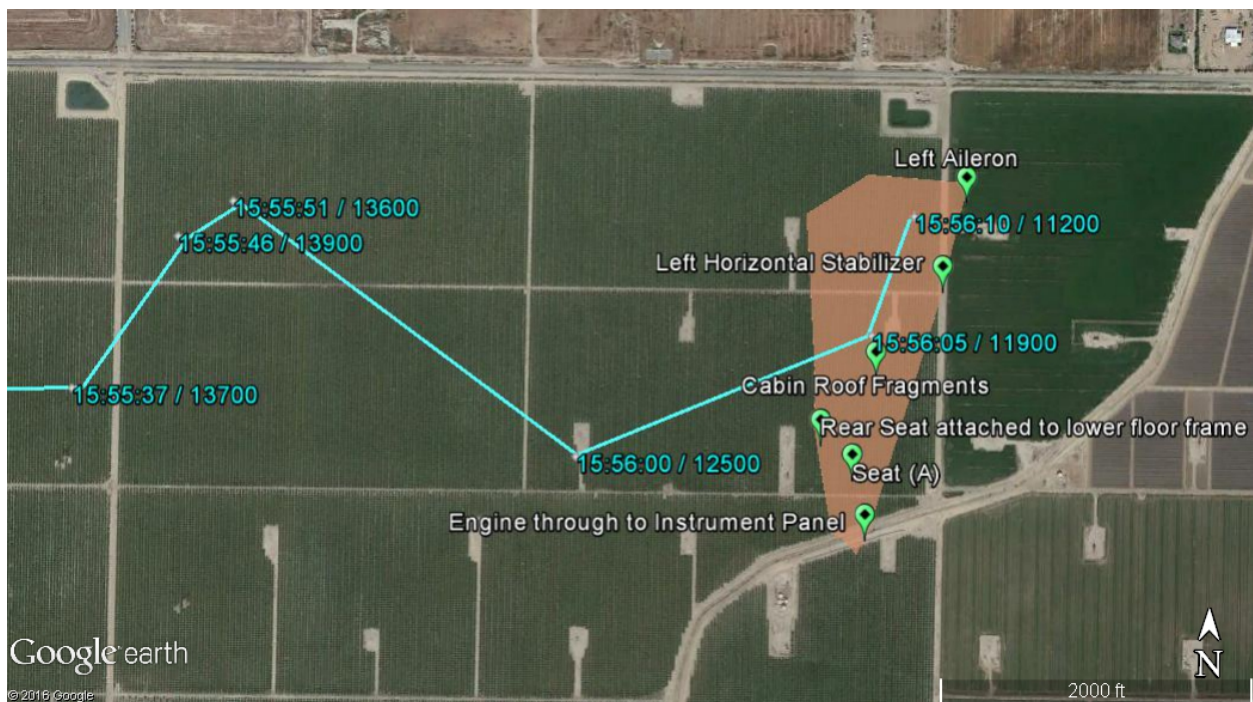


Figure 10. Flight path and debris field with selected pieces of debris shown.

D. CONCLUSIONS

Throughout the recorded radar portion of the flight from 15:34 to 15:56, the aircraft's calibrated airspeed was at or above 132 kts, the design maneuvering speed (V_A) for the aircraft at a gross weight of 3,600 lbs. At approximately 15:52 the aircraft turned 90° to the left on a course of 40°. The aircraft began accelerating and gaining altitude. By 15:52:34 it had reached a peak speed of 168 kts, above the V_{NO} for the aircraft. Between radar returns at 15:55:09 and 15:55:14, the aircraft lost 700 ft of altitude and its track went from 300° to 89°, a 211° turn to the left at 15 times faster than a standard rate turn. Normal forces during this event were calculated to be 2.8 g's.

After the turn at 15:55:09, the aircraft's flight path was generally to the east, but with significant deviations to the north and south. The aircraft's airspeed during this final portion varied from 150 kts to 90 kts and back to 140 kts while it lost altitude. The aircraft's final track was along 20° at 11,200 ft, but the debris path was along 180° at 340 ft, indicating a final reverse in heading before breakup.

The aircraft's high rate of speed put it near its design limits throughout the flight. Additionally, after 15:53, the aircraft performed maneuvers in the opposite direction as requested by ATC (turned 10° left instead of right) or did not follow ATC instructions.

Marie Moler
Specialist – Airplane Performance
National Transportation Safety Board

E. REFERENCES

1. Pilots Operating Handbook and FAA Approved Airplane Flight Manual, Piper Turbo Lance II (Piper PA-32RT-300T). Piper Aircraft Corporation, May 1st, 1978.