National Transportation Safety Board
Office of Research and Engineering
Washington, D.C. 20594

Performance Study

Specialist Report
Marie Moler

A. ACCIDENT

Location:	Camilla, Georgia
Date:	December 5, 2016
Time:	2222 EST, (0322 UTC, December 6, 2016)
Airplane:	Fairchild SA227, N765FA
NTSB Number:	ERA17FA066

B. GROUP

No vehicle performance group was formed.

C. SUMMARY

On December 5, 2016, about 2222 EST, 0322 UTC, a Fairchild SA227-AC, N765FA, operating as Key Lime Air Flight LYM308, was destroyed during a descent and subsequent inflight breakup near Camilla, Georgia. The airline transport pilot was fatally injured. Night instrument meteorological conditions prevailed and an instrument flight rules flight plan was filed. The flight originated at Northwest Florida Beaches International Airport (ECP) Panama City, Florida and was destined for Southwest Georgia Regional Airport (ABY) Albany, Georgia. The on-demand cargo flight was conducted under the provisions of 14 Code of Federal Regulations Part 135.

D. PERFORMANCE STUDY

Radar data used in this study are from the ARSR-4 (air route surveillance radar) at Tyndall Air Force Base, Florida (ZPAM) and the ARSR-1 outside of Ashburn, Georgia (QHN) (shown in Figure 1). Both sampled at a frequency of every 12 seconds. The location of both radars is noted in Figure 1. The radar path of the accident flight was recorded by ZPAM from 2:54:57 until 3:17:35 UTC. Between 3:17:35 and 3:19:00, no radar site recorded the accident airplane. QHN recorded the airplane from 3:19:00 until 3:22:24. These radar data have approximately a 250 nautical mile (NM) range and an inherent uncertainty of ±2 Azimuth Change Pulses (ACP) = ± (2 ACP) x (360º/4096 ACP) = ±0.176° in azimuth, ±50 ft in altitude, and ±1/16 NM in range.

Air traffic control (ATC) communications are between the pilot of N765FA and Jacksonville Center (JAX).

The aircraft departed from Northwest Florida Beaches International Airport (ECP) near Panama City, Florida, which is part of the Central Time Zone, but crossed into the Eastern Time Zone when it crossed over the Apalachicola River at 3:05 UTC. Times in the study are reported in UTC rather than the local time zone for simplicity.

The airplane's gross weight at take-off was reported at 11,400 lbs [1].

Weather Observation

A Significant Meteorological Information Advisory (SIGMET) for the area issued at 03:00 UTC reported thunderstorms, tornadoes, hail to one inch, and winds from 220° at 30 kts gusting to 55 kts.

Aircraft ground track, altitude, and speed

The flight path is shown in Figure 1. The airplane left ECP (lower left) at 2:54 bound for Albany, Georgia (ABY, top of figure). At the time there was a severe line of storms between ECP and ABY. Just after 3:19 the airplane turned to the right (Figure 2). At about 3:20:30 the airplane began a circling maneuver. By the final radar return at 3:22:24 the airplane had completed a 540° turn over a 2.5 NM by 1.5 NM area. Throughout the final maneuver the airplane's reported altitude was near 3500 ft. It is likely that the altitude was slightly different due to changes in air pressure due to the storm.

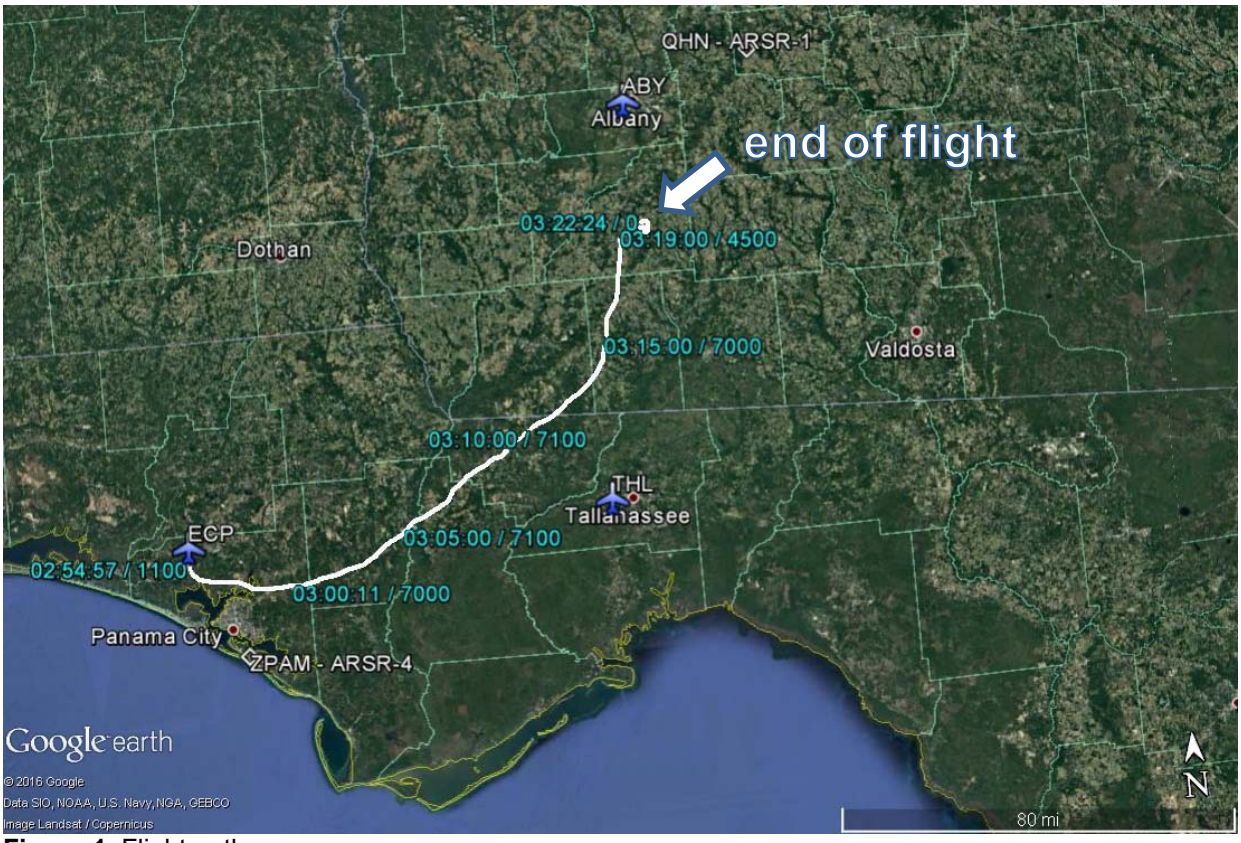

Figure 1. Flight path

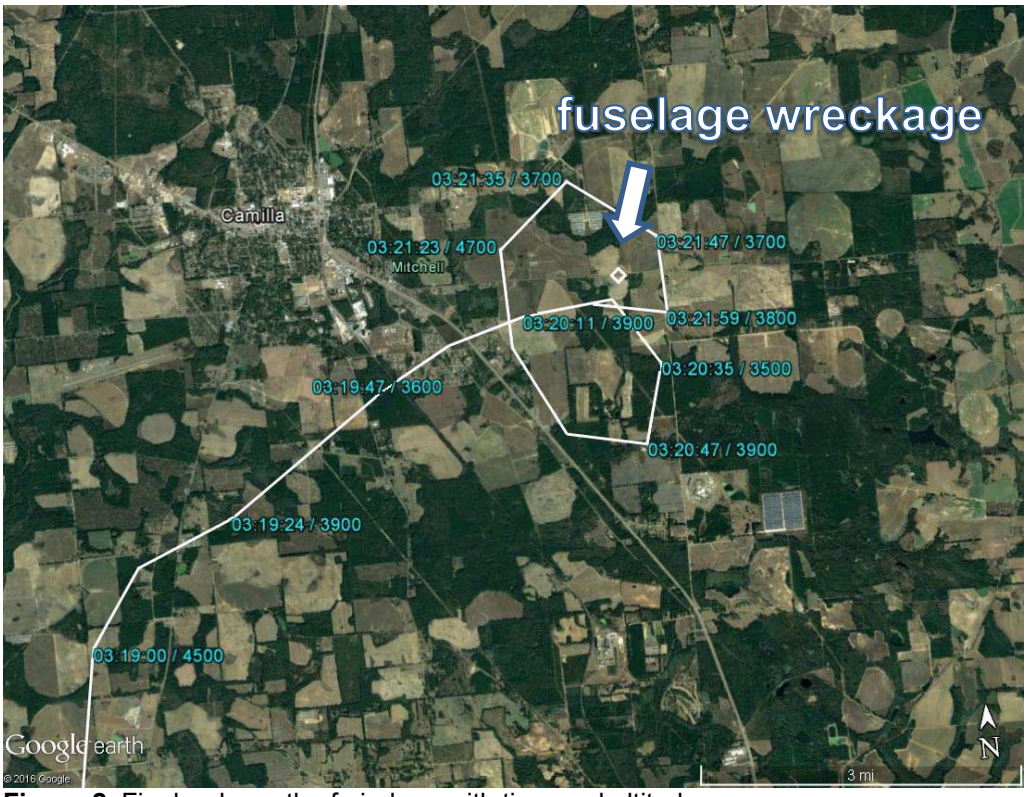

Figure 2. Final radar path of airplane with time and altitude.

The airplane's airspeed was calculated using the reported winds of 30 kts from 220°. The airplane climbed to an altitude of above 7,000 ft (Figure 3) in the first five minutes of flight which it maintained from 3:00 until 3:16. During this portion of the flight, the airspeed averaged about 185 kts.

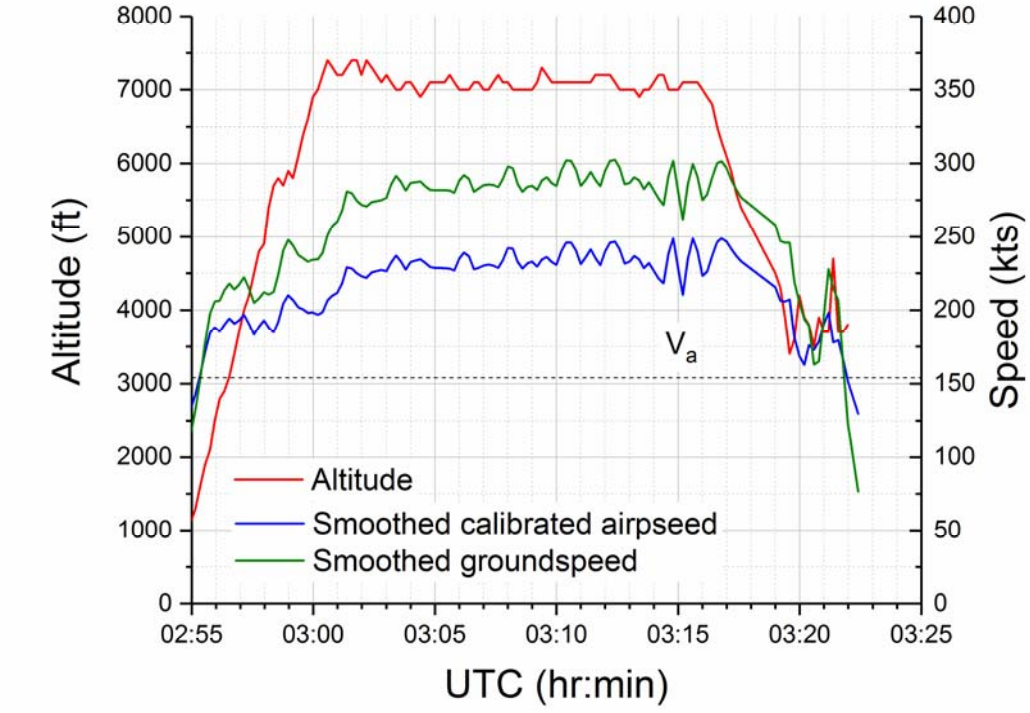

Figure 3. Altitude and calculated airspeed and groundspeed.

Figure 3 also shows the airplane's maneuvering speed (V_A), the maximum speed at which "individual application of full available aerodynamic control will not overstress the aircraft" [2][1]. The V_A value provided by the manual was 175 kts for a gross weight of 14,500 lbs. It is noted that the speed decreases by seven kts per 1,000 lbs reduction in weight. The accident airplane was 11,400 lbs at take-off; about 3,000 lbs less than the reference weight, lowering V_A to 154 kts, which is the speed noted in Figure 3. With fuel burn, V_A would have decreased further.

Figure 4 and Figure 5 show the radar path in Figure 2 in terms of Easting and Northing in nautical miles. Points in Figure 4 are labeled with the calculated calibrated airspeed and in Figure 5 with the recorded time. The final right turns of the airplane were between one and two nautical miles in diameter and were determined to have required roll angles between 40° and 50° right wing down (Figure 6). The airspeeds for all but the final two points were above the 154 kts V_A speed.

[1] V_A is reported in indicated airspeed, which is particular to the airframe, but generally within ± 2 or 3 kts of the calculated calibrated airspeed at this altitude.

Figure 7 and Figure 8 show the calculated normal load factor (Nz) for the airplane throughout the flight and during the final maneuvers. The maximum normal load factor calculated for the airplane was about 1.3 g's, coinciding with the maximum roll angles.

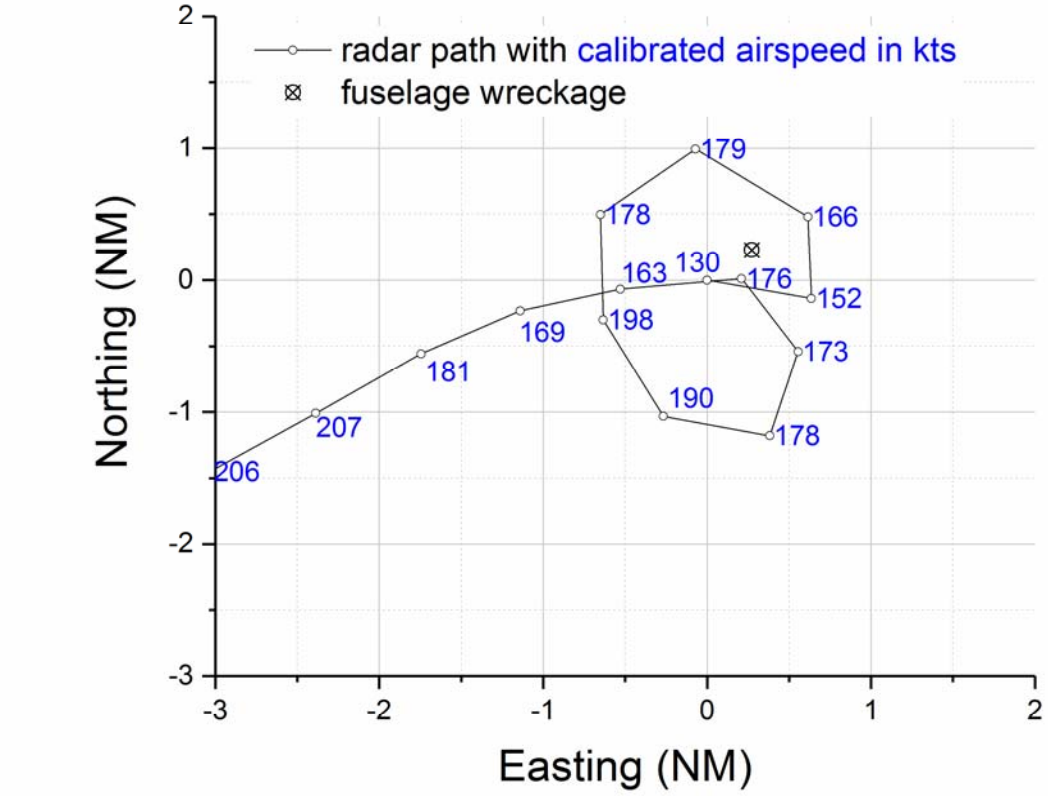

Figure 4. Final radar path of airplane with calculated equivalent airspeed.

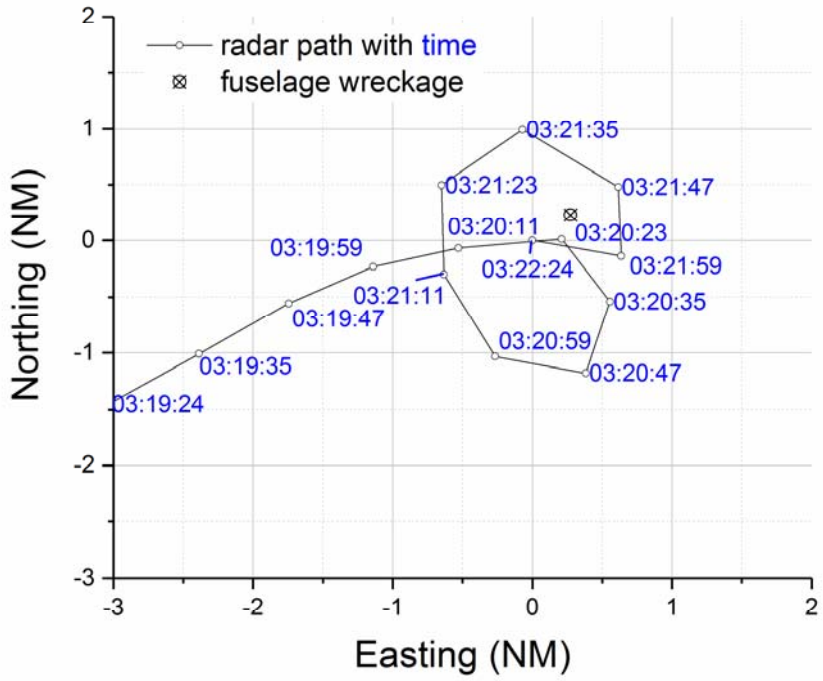

Figure 5. Final radar path of airplane with time.

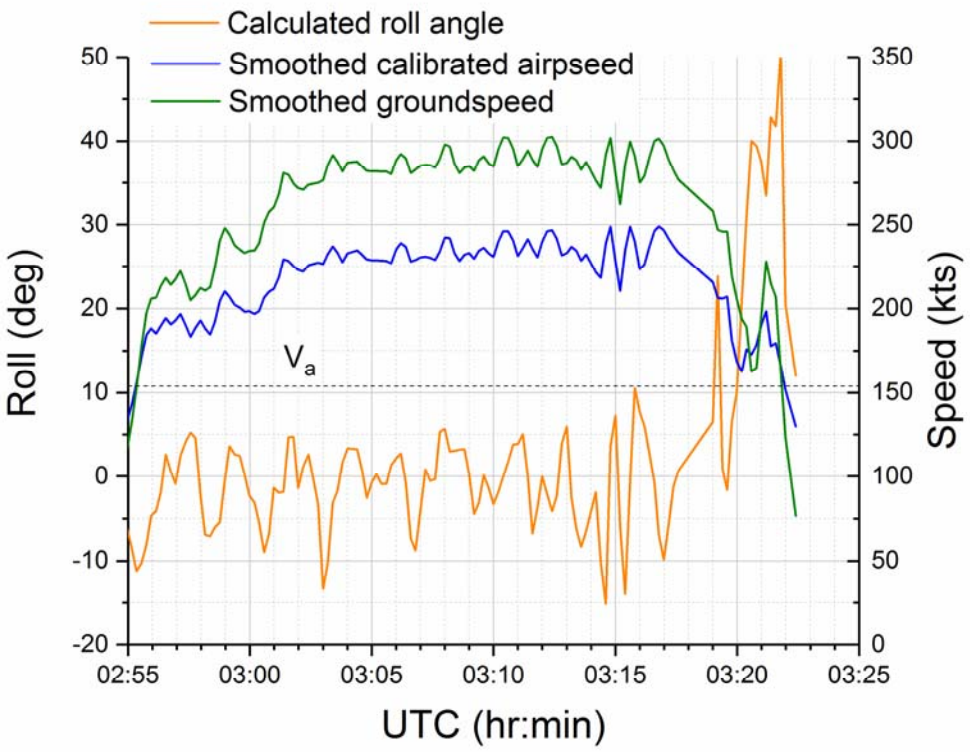

Figure 6. Calculated roll angle and speed for final minutes of flight.

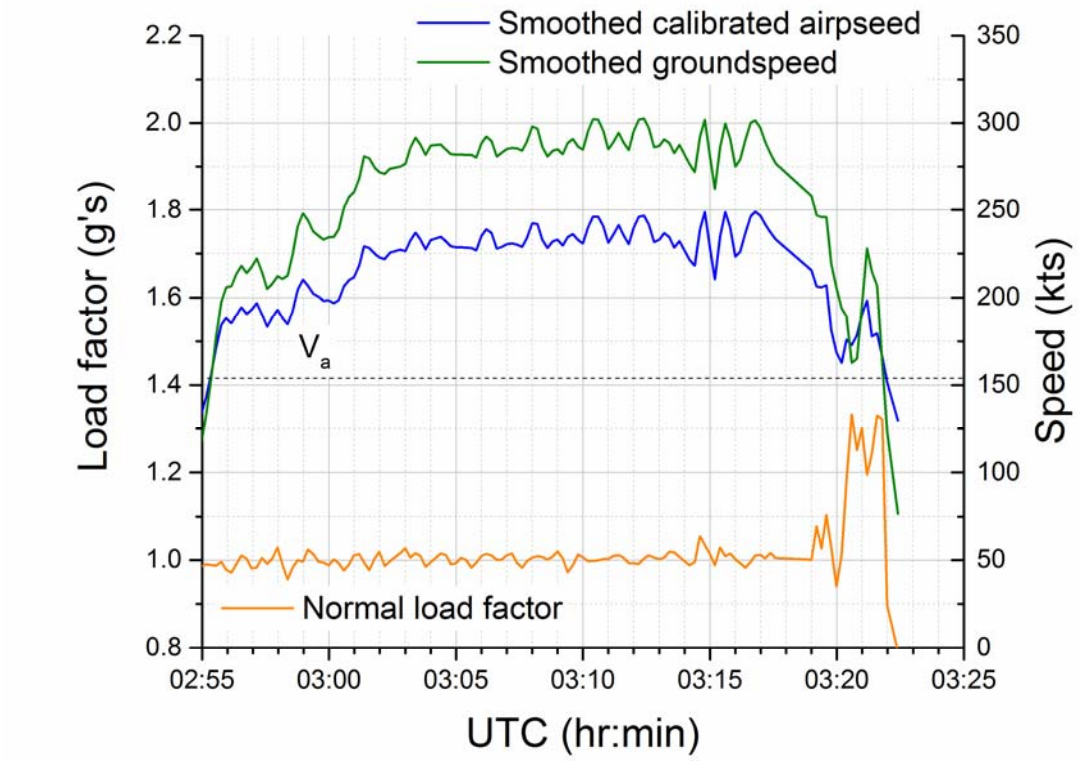

Figure 7. Calculated normal load factor (N_Z) and speed for final minutes of flight.

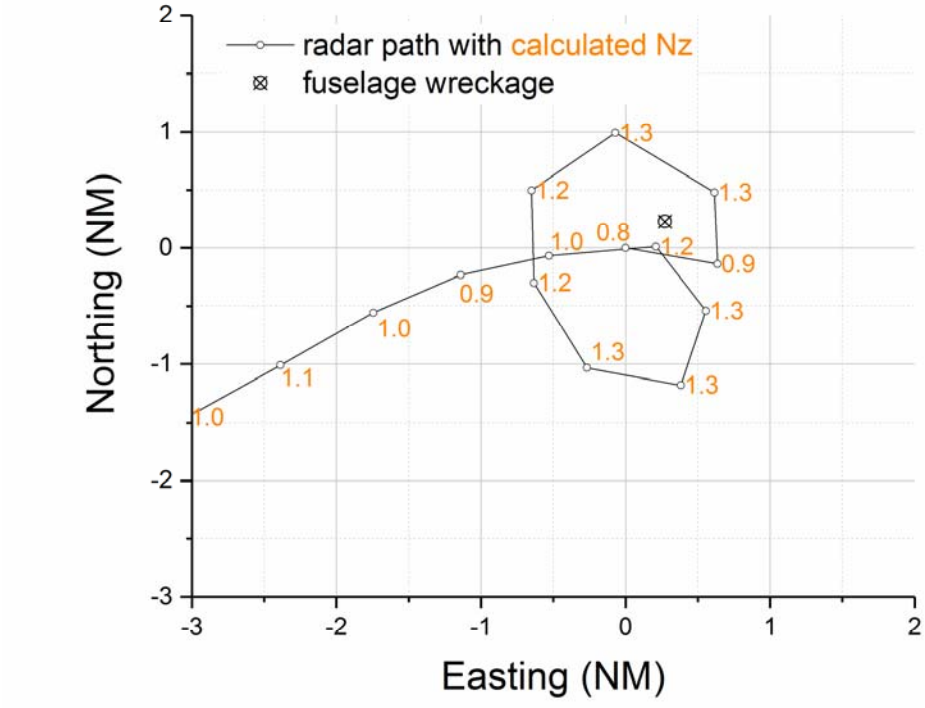

Figure 8. Final radar path of airplane with calculated N_Z.

ATC Communications

Figure 9 shows the communication between the accident airplane (purple writing) and JAX ATC (black writing) from 3:15 until the end of the flight. Most comments are paraphrased for space but direct quotes are indicated with quotation marks. At about 3:15:30 the airplane began to descend towards a discussed altitude of 3,000 ft. ATC offered course headings to weaker points in the storm but the pilot deferred the decision until reaching 3,000 ft. At 3:19:10 the pilot stated he was going to deviate to the right and roll out onto 060. At 3:20:15 the pilot stated he would return to Tallahassee which marked the beginning of the final series of right turns. Tallahassee is shown in Figure 1 and would have been on a south-southwesterly track from the airplane location. At 3:20:51, ATC recommended a heading of 180 to clear the weather. The pilot accepted 180 at 3:21:02, which was his last communication with ATC. However, the airplane continued to circle to the right. At 3:22:05, ATC commented "it looks like you are doing some circling" and suggested "fly due south". The last recorded radar point was at 3:22:24.

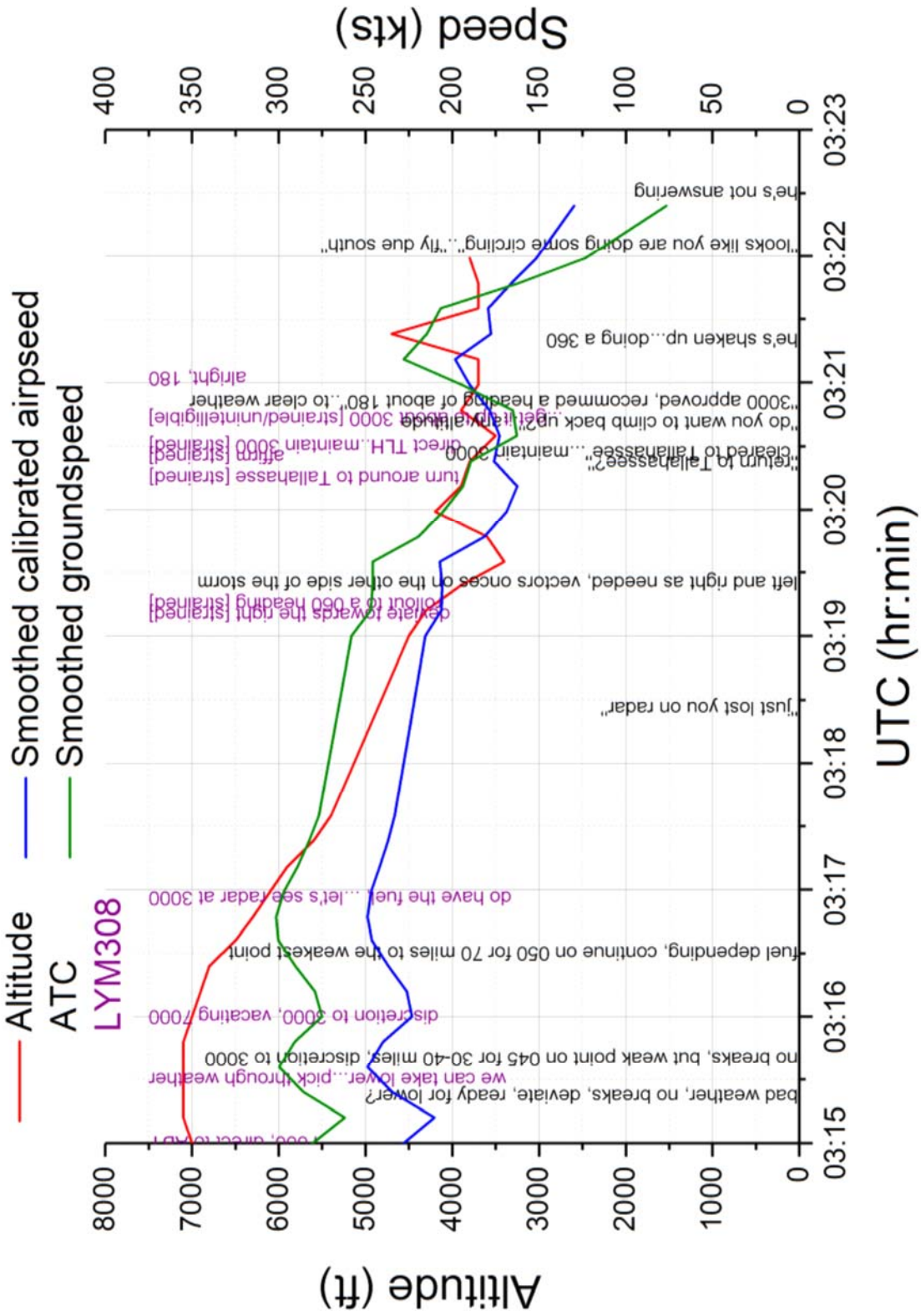

Figure 9. Altitude, speeds, and ATC communications from 3:15 until the end of the flight.

E. CONCLUSIONS

The pilot began a right turn just after 3:20 in an attempt to divert to Tallahassee while encountering storms. The airplane proceeded to complete a 540° turn over a 2.5 NM by 1.5 NM area at a speed above the airplane's maneuvering speed. These turns would have required a right wing down bank angle between 40° and 50° and resulted in normal load factors of 1.3 g's. Large control inputs at speeds above V_A can overstress the airplane structure.

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F. REFERENCES

1. Key Lime Air's Cargo Load Manifest filled out by the pilot on 12/5/2016.
2. Fairchild SA227 Metro III, Pilots Operating Handbook.