

National Transportation Safety Board

Office of Research and Engineering

Washington, D.C. 20594

Performance Study

Specialist Report

Marie Moler

A. ACCIDENT

Location:	Orlando, Florida
Date:	November 20, 2015
Time:	1127 EST
Airplane:	Beech A36TC, N7FG
NTSB Number:	ERA16FA043

B. GROUP

No vehicle performance group was formed.

C. SUMMARY

On November 20, 2015, about 11:27 eastern standard time (EST), a Beech A36TC, N7FG, descended into Clear Lake, Orlando, Florida. The private pilot and one passenger were fatally injured, and the airplane was destroyed. The airplane was registered to and operated by Kavak Aviation, LLC, under the provisions of 14 Code of Federal Regulations Part 91 as a personal flight. Visual meteorological conditions prevailed at the time, and a visual flight rules flight plan was filed. The flight originated from Orlando Executive Airport (ORL), Orlando, Florida, about 11:15, and was destined for Gainesville Municipal Airport (GLE), Gainesville, Texas.

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PERFORMANCE STUDY

The performance study describes the accident airplane ground track, altitude, and speed. Radar data used in this study are primarily from the ASR-9 (airport surveillance radar) at Orlando International Airport (KMCO) 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. Times in the study are reported in EST.

Weather Observation

The weather conditions reported at KMCO 11:53 EST were 9 kts winds from 40° , 81°F with a dew point of 69°F , and the pressure was 30.05 inHg. Visibility was ten miles, with scattered clouds at 2400 ft.

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

Table 1. Winds aloft data.

Altitude (ft)	Direction (deg)	Magnitude (kts)
79	32	6.2
467	34	6.5
1199	37	7.3
1937	44	9.9
2690	48	8
3460	39	5.2
4251	18	3

Aircraft ground track, altitude, and speed

The flight path is shown in Figure 1. The airplane took off from runway 7 at Orlando Executive Airport and began along a northwesterly track. At about 11:22 the airplane turned to the left onto a southeasterly track back towards the airport. At about 11:24:20 the airplane turned right onto a more southerly track which continued until radar contact was lost.

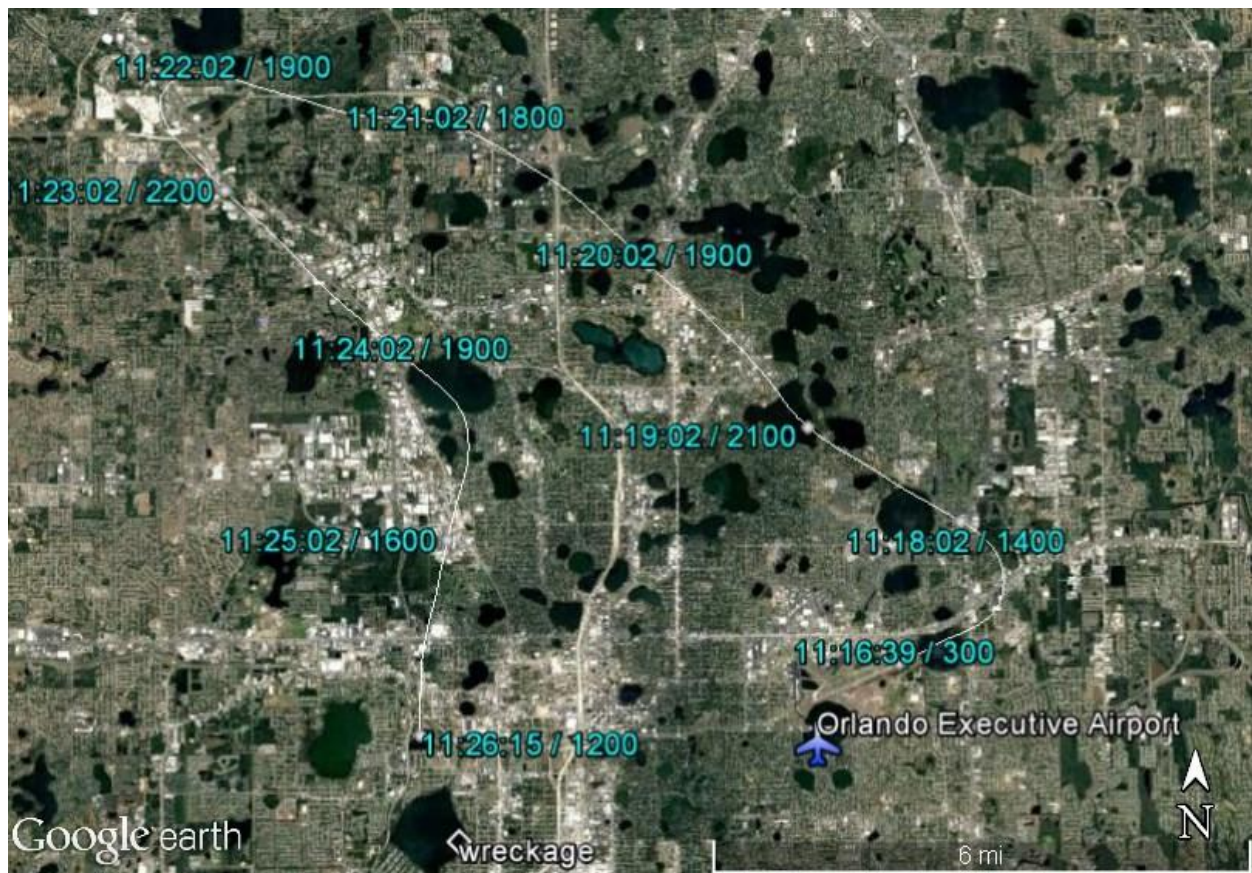


Figure 1. Radar flight path.

The last secondary radar return (blue, Figure 2) from the aircraft was received at 11:26:15, over a mile north of the wreckage. A path of primary radar returns likely tracking the accident airplane is shown on the map in green. The radar returns can be used to calculate the groundspeed of the airplane. The altitude data included in the secondary returns can be used to determine the appropriate wind speed and direction (shown in Table 1), by which the groundspeed can be used to determine airspeed. Primary radar returns do not contain altitude information, but can be used to calculate groundspeed.

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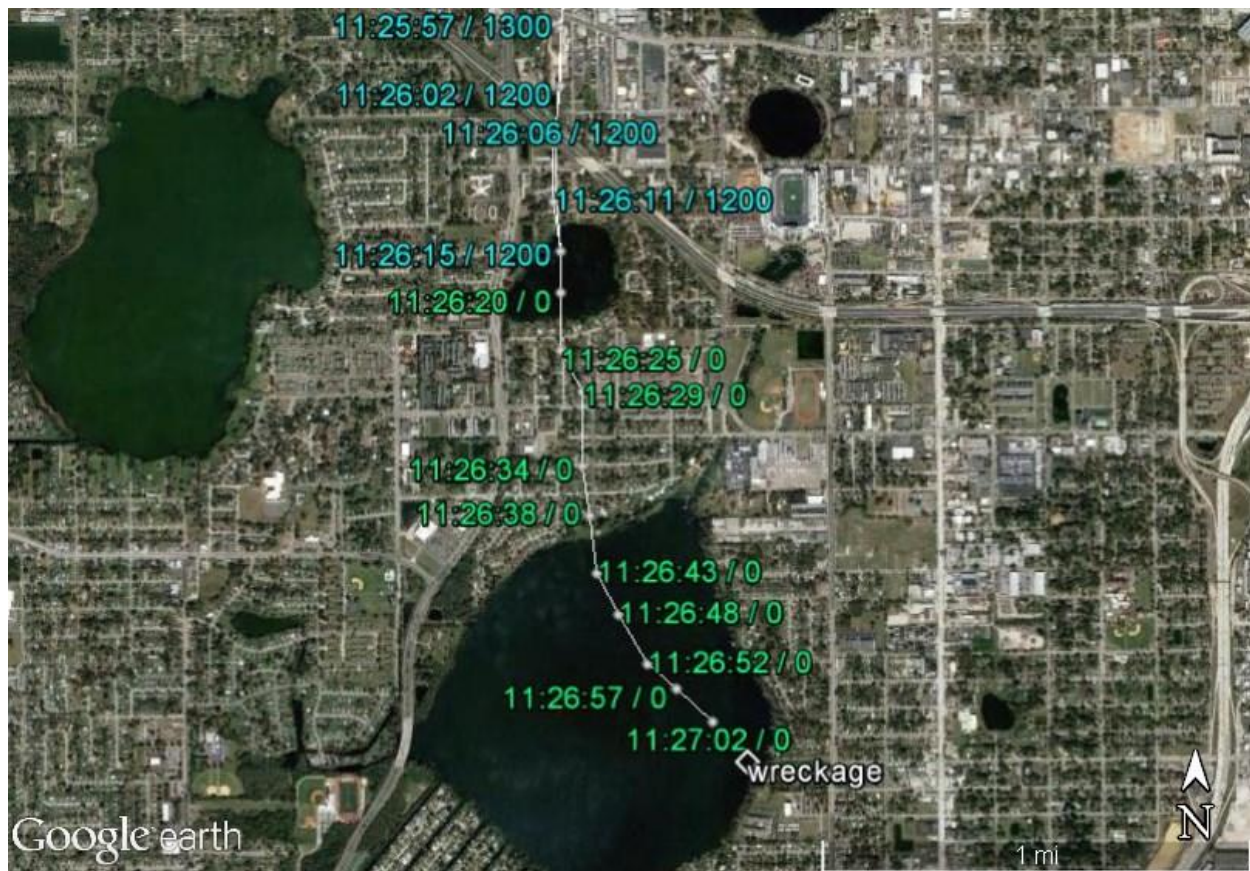


Figure 2. End of radar flight path (blue) with primaries (green).

Figure 3 shows the calculated groundspeed from the primary and secondary radar returns and the airspeed from just the secondary returns. During its climbs and descents, the airplane's speeds varied from 100 to 150 kts, gaining speed on descents and losing speed on ascents. However, during the last descent the aircraft was losing speed throughout starting at 2,100 ft and 122 kts at 11:24:20 and ending at 1,200 ft and 78 kts at 11:26:11. In just under two minutes the aircraft lost 44 kts of airspeed and 900 ft of altitude (a descent rate of 486 ft/min). After 11:26:15, radar returns did not contain altitude information. For the last 47 seconds of returns groundspeed only was calculated and is shown as a dotted green line.

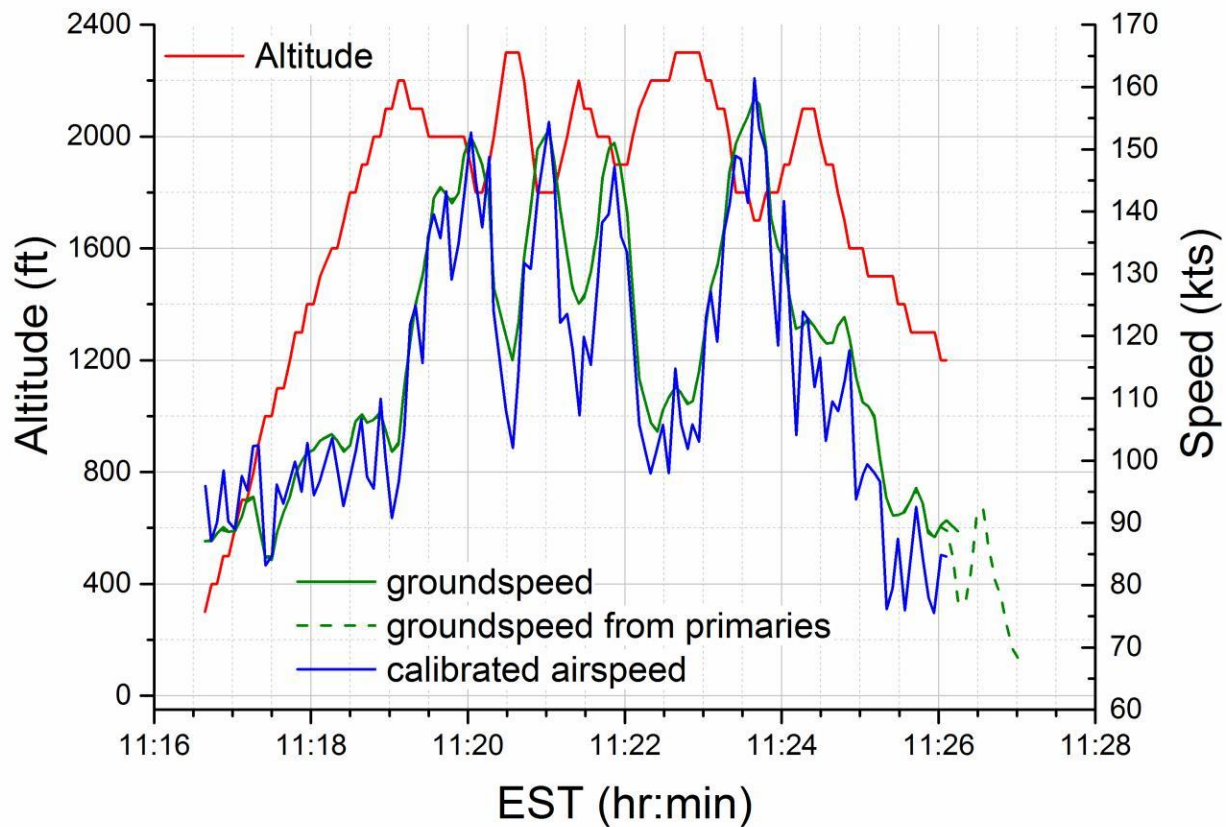


Figure 3. Altitude and calculated groundspeed and airspeed.

Figure 4 shows the altitude and calibrated airspeed from radar with selected air traffic control (ATC) communications.¹ At about 11:18, ATC told the pilot to stay at or below 1,500 ft and outside the Bravo airspace of MCO. The airplane passed 1,500 ft and continued to 2,200 ft. The pilot reported the airplane was above 1,500 ft, but that he would descend. The airplane proceeded through a series of descents and ascents with varying airspeeds, but did not return below 1,500 ft until its final descent into the ground. At 11:23 the pilot reported autopilot issues and stated he was returning to the airport. This is consistent with the flight path shown in Figure 1.

¹ ATC records reported time to the nearest minute, so communications are shown in Figure 4 at an averaged time. For instance, communication recorded at 11:18 is shown on the figure at 11:18:30.

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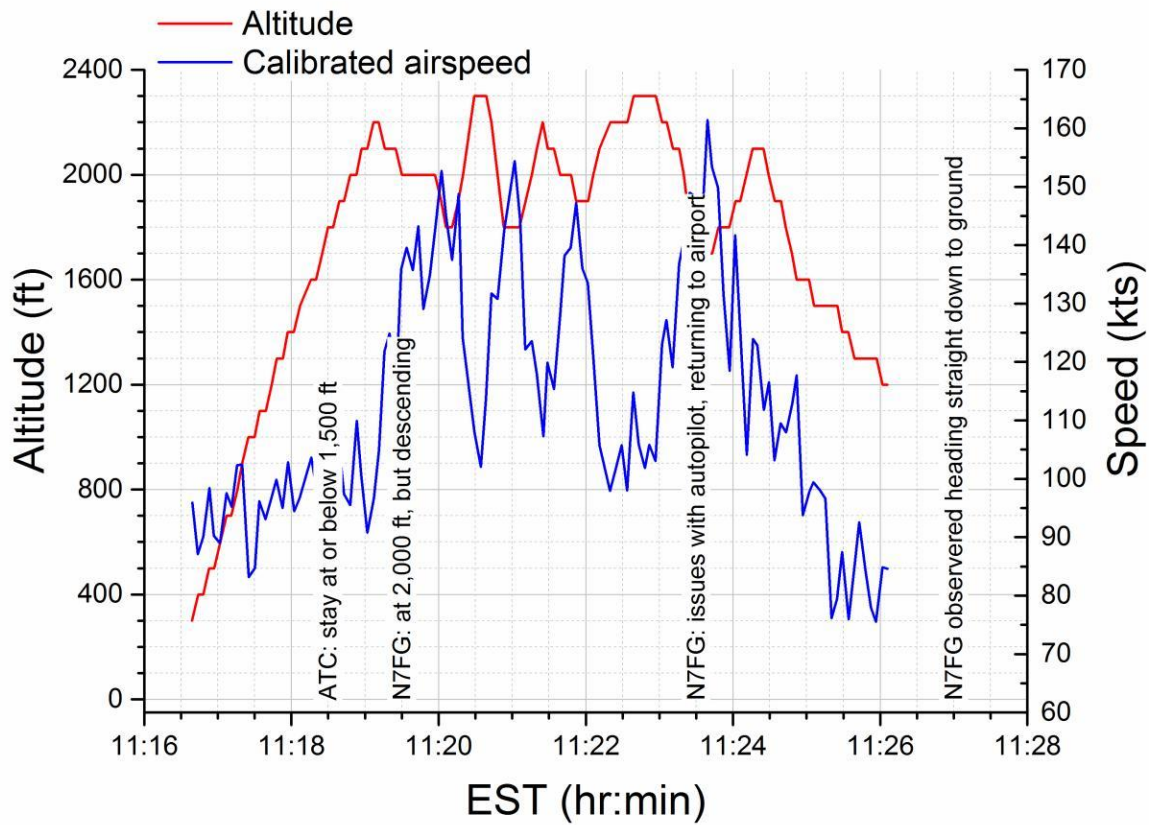


Figure 4. Altitude, airspeed, and selected ATC communications.

Figure 5 show the end of the flight and the airport the pilot planned to return to. The wreckage was about 3.7 NM from the threshold of runway 7.

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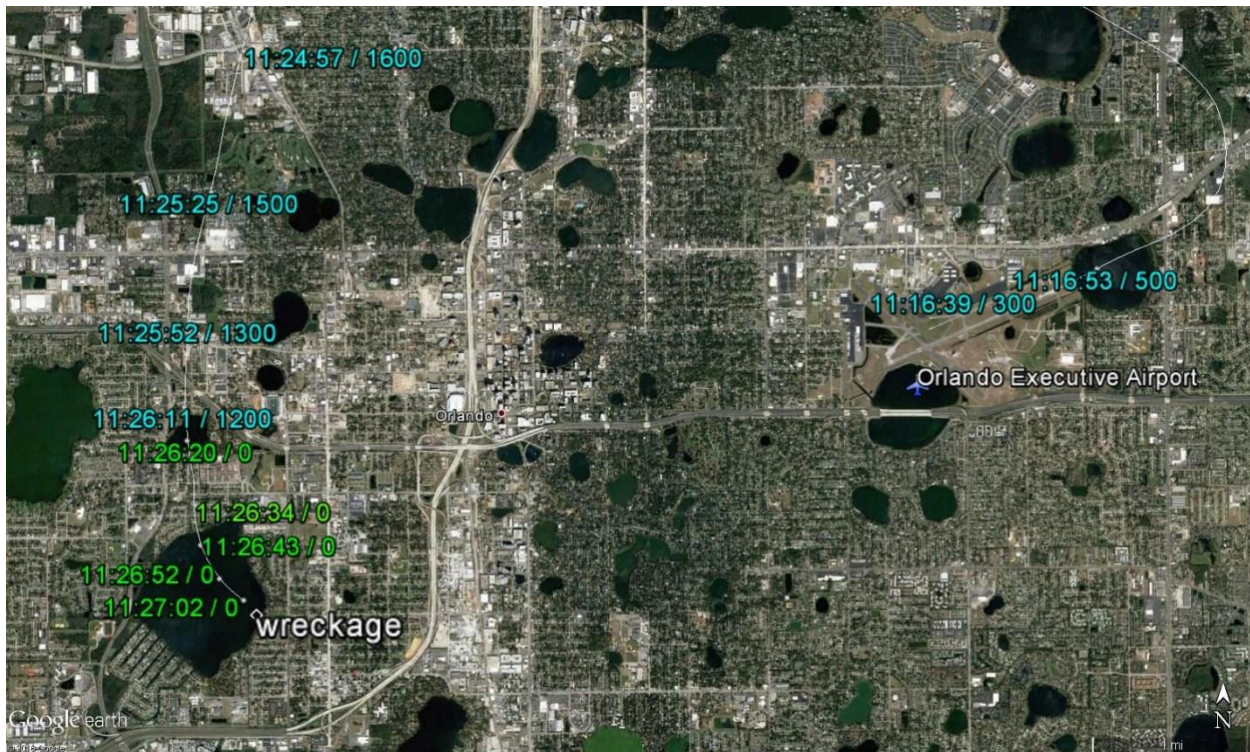


Figure 5. End of flight path and airport.

Figure 6 shows the final three minutes of flight in terms of altitude, ground and airspeed, and calculated bank angle. The groundspeed continued to decrease during the last 47 seconds of flight recorded without altitude data. Airspeed, while not calculated from the primary returns, had been trending slightly lower than the aircraft's groundspeed, because of a small tailwind component.

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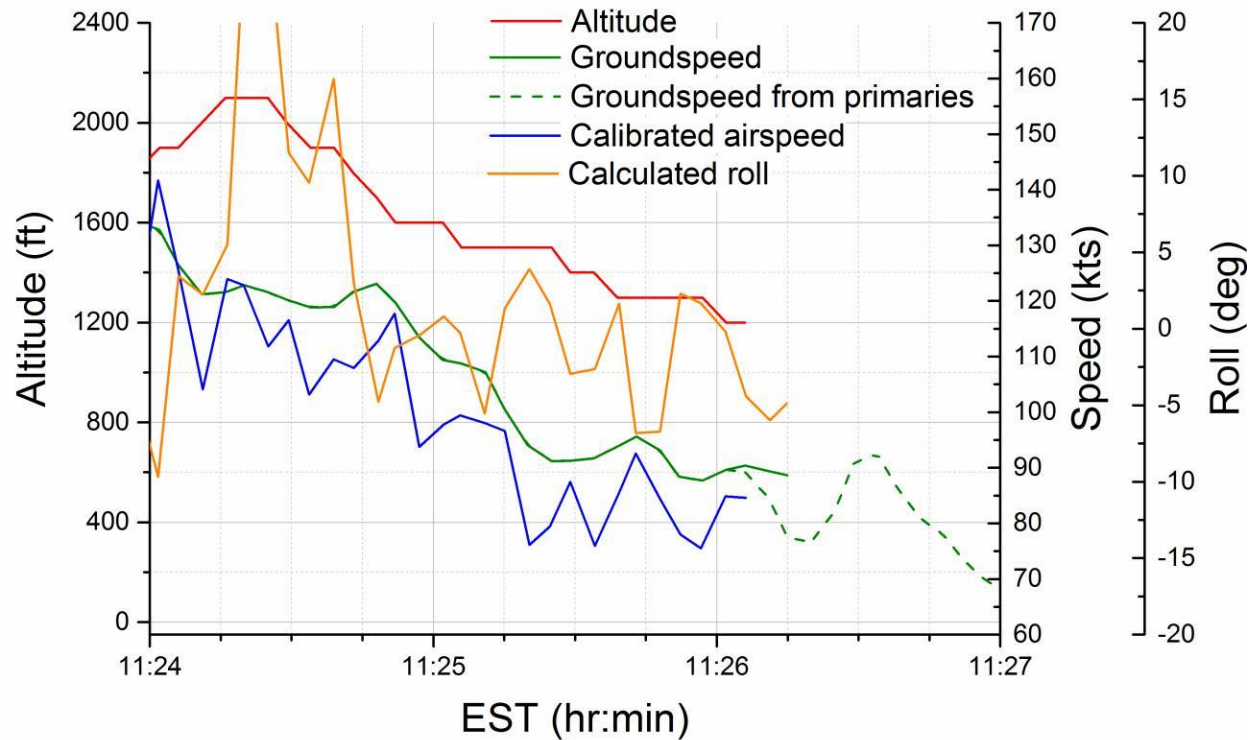


Figure 6. Altitude, calculated groundspeed and airspeed, and bank angle for the end of flight.

Bank angle was calculated when altitude was known and airspeed could be determined. However, an estimate of bank angle for the final portion of flight can be made using the equation below, where θ is the bank angle necessary to complete a turn of radius R and airspeed V (g is the gravitational constant, 9.81 m/s^2), assuming there are no winds.

$$\theta = \tan^{-1} \left(\frac{V^2}{gR} \right)$$

Figure 7 shows a circle with a radius of about 4,000 ft can be fitted to the final radar return points. At 80 kts and a radius of 4,000 ft, the bank angle of the turn would be approximately 8° left wing down.

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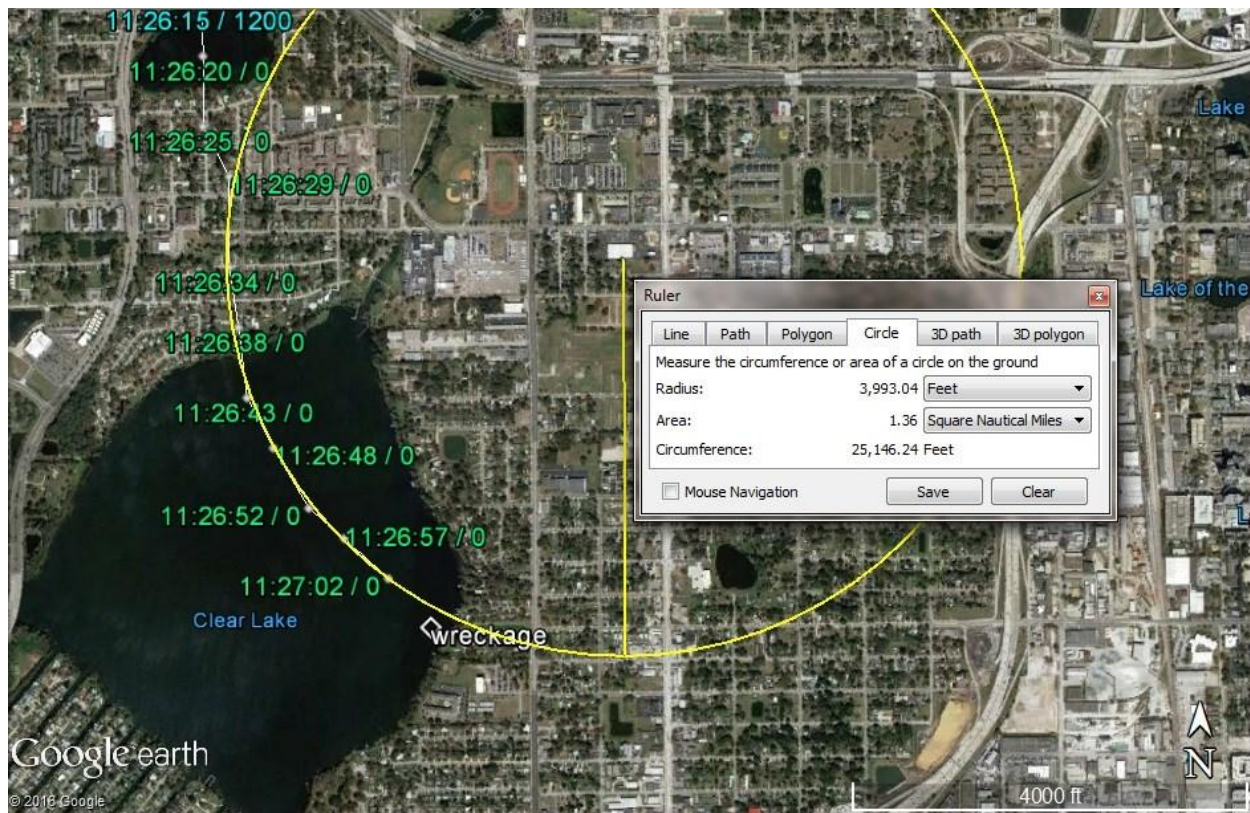


Figure 7. Estimated radius of final left turn.

The gross weight of the accident airplane was determined to be 3,833 lbs due to the installation of wing tip tanks². Figure 8 shows the stall speeds from the Pilot's Operating Handbook [1] which show a stall speed of 67 kts for the maximum gross weight of the aircraft as manufactured (3,650 lbs). Additionally, the plot was expanded and extrapolated out to 3,800 lbs of weight which could raise the stall speed to 68 kts.

² The STC (supplemental type certificate) holder did not have paperwork reflecting a gross weight increase, but the previous owner reported the aircraft's gross weight to be 3,833 pounds.

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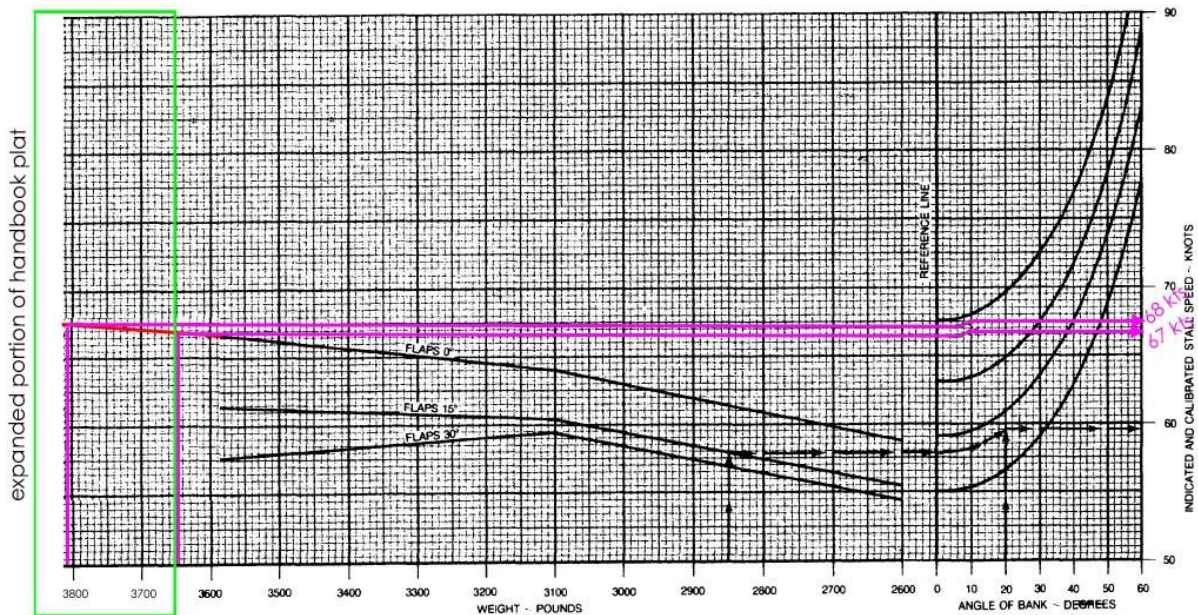


Figure 8. Stall speeds for Bonanza A36TC.

The last calculated groundspeed was about 68 kts at 11:27:02. Airspeed for the last three minutes of flight (Figure 6) was between 5 and 10 kts slower than the groundspeed. It was likely the airplane's airspeed was close to the reported stall speeds for the estimated weight at the end of the primary radar data.

D. CONCLUSIONS

The pilot did not or could not comply with ATC's instruction to remain at or below 1,500 ft. The airplane performed a series of descents and ascents, gaining speed on descents and losing speed on ascents, and at 11:23 the pilot reported autopilot issues and turned the airplane back towards the airport. The airplane remained above 1,500 ft until its final descent.

For the last three minutes of flight the airplane was losing speed and descending. During the last 47 seconds of flight, no altitude data was available to calculate airspeed, but groundspeed continued to decrease. The airplane was likely close to its stall speed for estimated weight when radar coverage ended.

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E. REFERENCES

1. Beech Bonanza A36TC Pilot's Operating Handbook, Raytheon Aircraft Company, January 1998.