

National Transportation Safety Board

Office of Research and Engineering

Washington, D.C. 20594

Performance Study

Specialist Report

Marie Moler

A. ACCIDENT

Location:	Galax Hillsville, Virginia
Date:	July 1, 2015
Time:	1704 EDT
Airplane:	Piper PA-28-151, N43503
NTSB Number:	ERA15LA257

B. GROUP

No vehicle performance group was formed.

C. SUMMARY

On July 1, 2015, about 1704 eastern daylight time (EDT), a Piper PA-28-151, N43503, touched down short of the intended runway at Twin County Airport (HLX), Galax Hillsville, Virginia. The commercial pilot sustained a minor injury and the pilot-rated passenger was not injured. The airplane was substantially damaged. The airplane was registered to and operated by a private individual, under the provisions of 14 Code of Federal Regulations (CFR) Part 91 personal flight. Visual meteorological conditions prevailed at the time and no flight plan was filed. The flight originated from New River Valley Airport, Dublin, Virginia, about 1643 EDT, and was destined for HLX.

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D. PERFORMANCE STUDY

Data for the flight was available from an on-board Garmin GPSMAP 396. The 31 NM flight took 26 minutes and is shown in Figure 1.

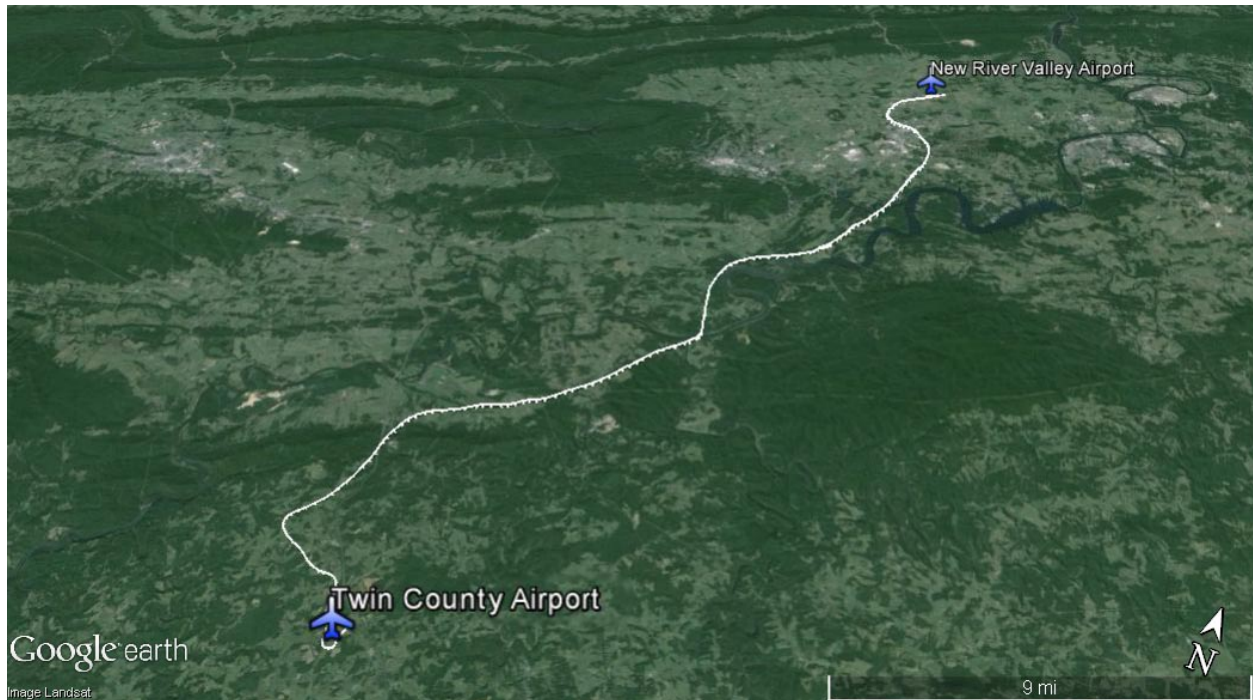


Figure 1. Aircraft flight path from New River Valley Airport in Dublin, Virginia to Twin County Airport in Galax Hillsville, Virginia.

The aircraft's approach into Twin County Airport is shown in Figure 2. The aircraft's final position was about 300 ft short of runway 19.



Figure 2. Aircraft flight path into Twin County Airport in Galax Hillsville, Virginia.

Meteorology Information

The Automated Weather Observation System (AWOS) at the New River Valley Airport (KPSK) reported at 1635 EDT 5 kts winds from 310°, seven miles visibility, scattered clouds at 6,000 ft, 80°F (27°C), and the altimeter setting was 29.99 inHg. The AWOS has a listed elevation of 2,105 ft. The aircraft departed KPSK at 1640 EDT.

The AWOS at the Twin County Airport (KHLX) reported at 1655 EDT 7 kts winds from 240°, 10 miles visibility, broken clouds starting at 4800 ft, 78°F (26°C), and the altimeter setting was 30.00 inHg. The AWOS has a listed elevation of 2,694 ft. The accident occurred at 1704 EDT.

Winds aloft data were from the Roanoke (ROA) forecast for the time of flight. The forecast for 3,000 ft was for light and variable winds with winds from the west with increasing speeds with height above 6,000 ft. Winds less than 10 knots were expected below 6,000 feet with above freezing temperatures.

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The aircraft's altitude during flight remained between 2,000 ft and 3,500 ft. For this radar study, the winds from the accident site - 7 kts winds from 240° - were used to calculate airspeed for the flight. This may not be as accurate for the early portion of flight, but is consistent with the winds aloft data of light winds from the west.

Aircraft Altitude, Ground Track, and Speed

The true airspeed, equivalent airspeed, and groundspeed for the flight were calculated using the above winds and are shown in Figure 3. The aircraft averaged a speed of about 90 kts (103 mph) throughout the cruise portion of the flight.

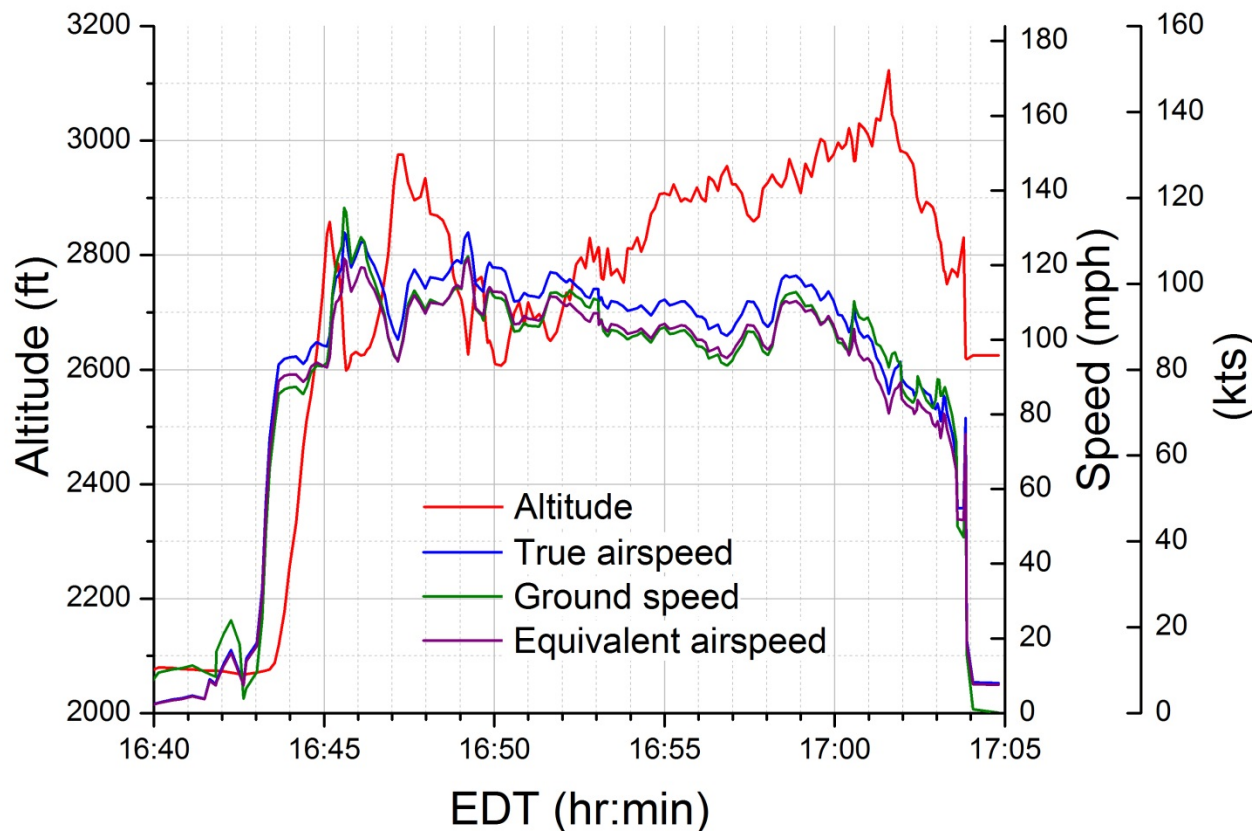


Figure 3. Altitude and true airspeed, groundspeed, and equivalent airspeed for whole flight.

The aircraft's last minute of flight is shown in Figure 4. The aircraft was slowing on the downwind leg of its approach. Figure 5 shows the aircraft's ground track with equivalent airspeed and groundspeed noted for each recorded location.

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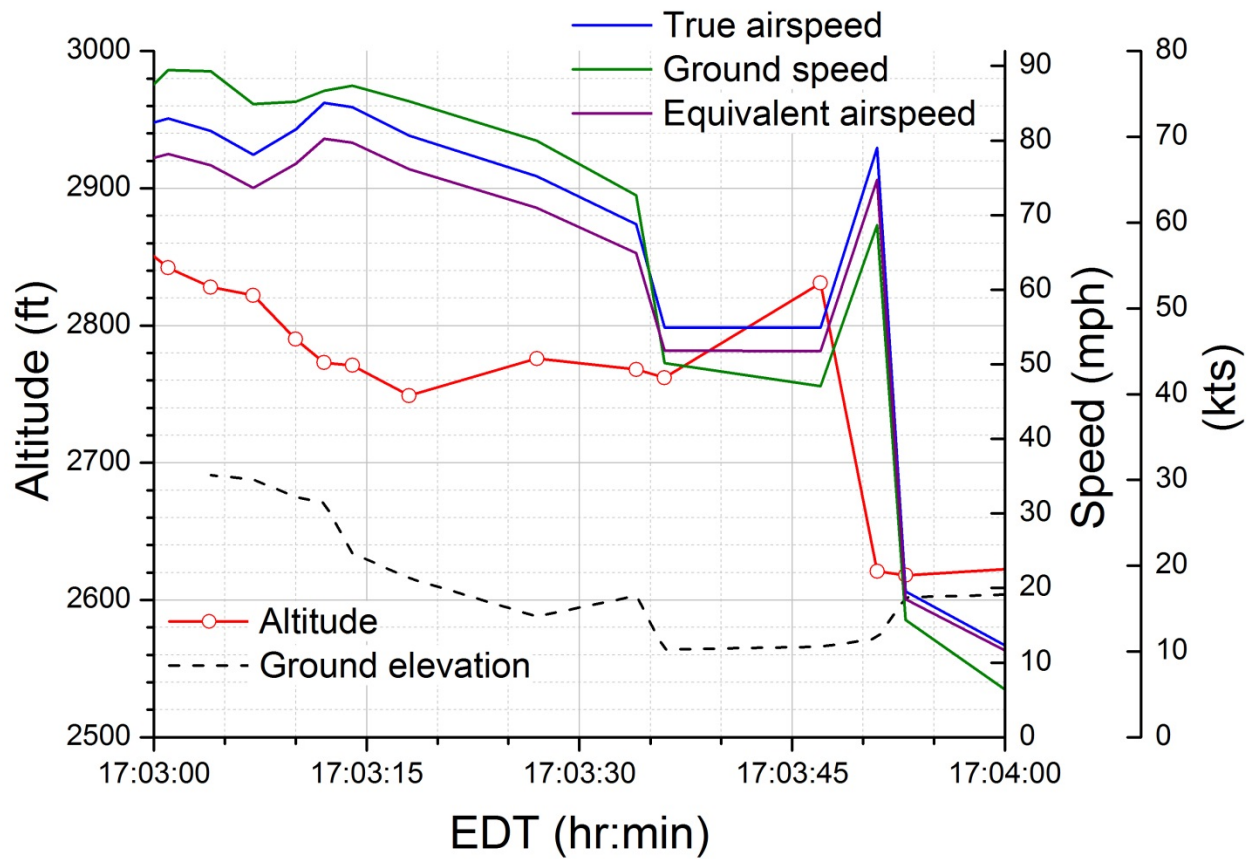


Figure 4. Altitude and true airspeed, groundspeed, and equivalent airspeed for last minute of flight.

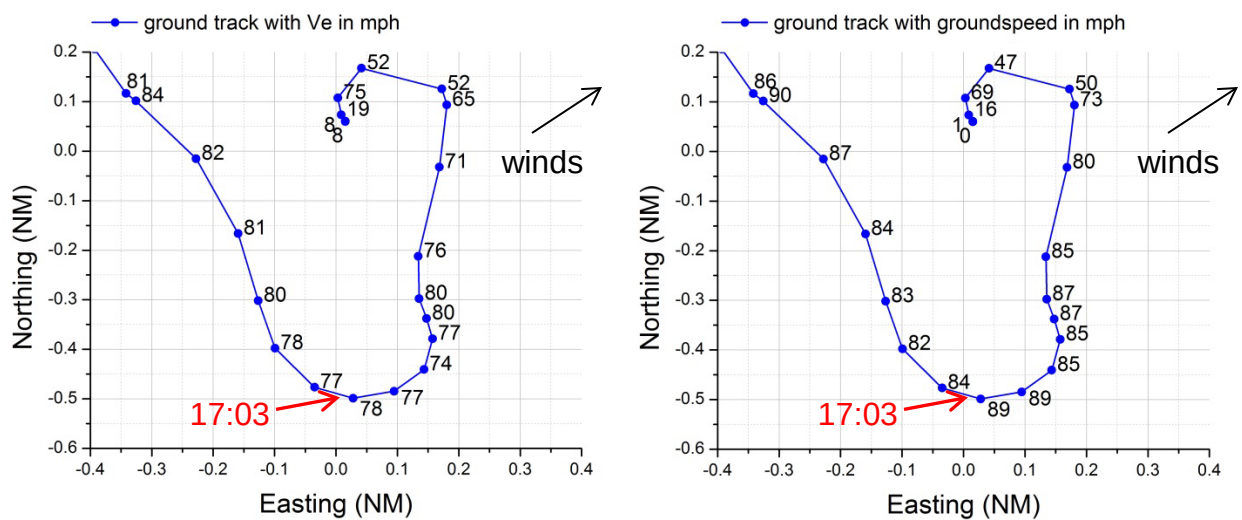


Figure 5. Ground track with equivalent airspeed (Ve) on the left and groundspeed on the right. The time 17:03 is noted by a red arrow on both plots.

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At the last point before the aircraft's turn onto final, its equivalent airspeed with the winds recorded at KHLX ten minutes prior was 65 mph. The aircraft's groundspeed for the same point was 73 mph. The next two calculated speeds show the aircraft continuing to slow through the turn. At 17:03:47, the aircraft gains altitude and speed briefly before impacting the ground.

Figure 6 shows stall speed versus gross weight from the aircraft's Pilot's Operating Manual [1]. Power off stall speeds for 2,350 lbs were reported as 58 mph for flaps 40° and 64.5 mph for flaps retracted. For the aircraft's calculated weight of 2,184 lbs, the stall speeds would be about two to three mph slower (56 mph and 62 mph respectively).

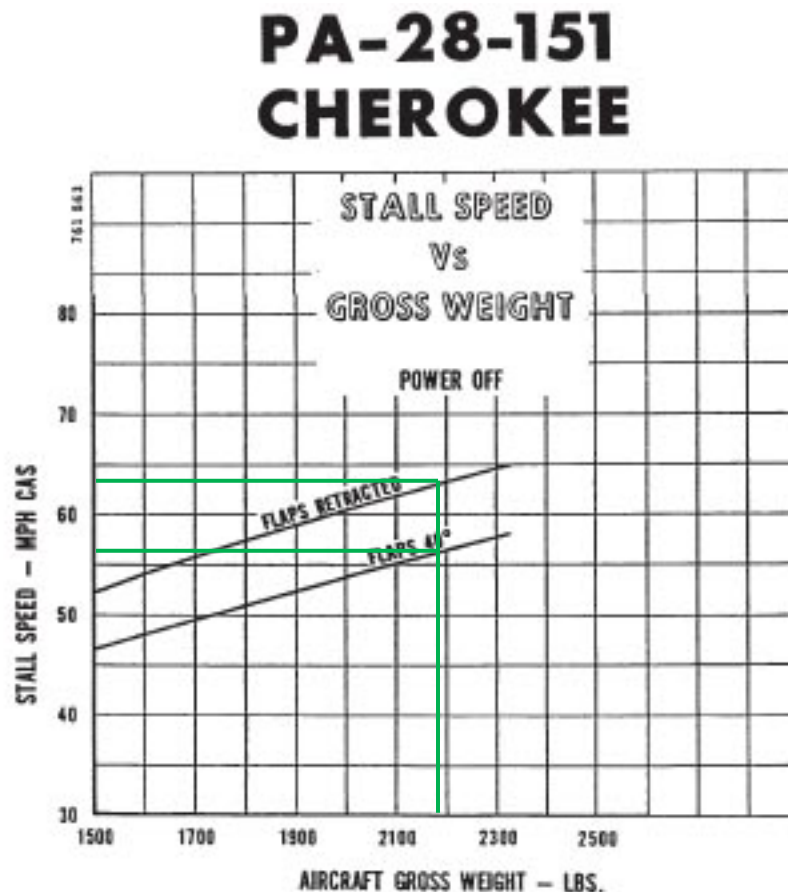


Figure 6. Stall speeds versus aircraft gross weight from Pilot's Operating Manual.

However, when banking, the stall speed increases. Table 1 shows how the stall speed increases with increased bank.

Table 1. Stalling speeds in mph power off, versus angle of bank (Calibrated Airspeed) for 2350 lbs [1].

Bank angle	0°	20°	40°	50°	60°
Flaps up	64.5 mph	67	74	80	91
Flaps down	58	60	66	72	82

Fitting a smoothed curve through the final points of flight yields a 1,100 ft diameter circle.



Figure 7. Smoothed curve through final points of flight.

In the equation below, 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).

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

Applying a speed of 65 mph (equivalent airspeed referenced earlier) and a radius of 550 ft, the necessary bank was calculated to be about 27° for the lift to balance the centripetal force of the turn and keep the aircraft aloft. However, this is a kinematic equation and does not guarantee that a particular aircraft would be able to generate the necessary lift at that speed. Referring back to Table 1, increasing the bank to 27° (and extrapolating between 20° and 40°) would raise the stall speed to 69 mph for flaps up and 62 mph for flaps down. As with Figure 6, the accident aircraft was lighter than the exemplar from the POM and its stall speed would be 2 to 3 mph

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slower (67 mph and 60 mph respectively). The 65 mph speed the aircraft entered the turn at was below the flaps up stall speed and slowing by 5 mph through the turn would have dropped the airspeed below the flaps down airspeed. The winds used for the airspeed calculation were from the accident airport and were reported nine minutes prior to the accident.

E. CONCLUSIONS

The aircraft crossed runway 19 and turned onto a northerly heading. The aircraft slowed on the downwind leg of its approach to an equivalent airspeed of 65 mph. As the aircraft turned onto final it continued to slow to speeds that for the bank angle needed to complete the turn onto the runway heading, were near the stall speed.

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F. REFERENCES

1. Pilot's Operating Manual, Cherokee Warrior, PA-28-151. August 30th, 1973.