

National Transportation Safety Board

Office of Research and Engineering

Washington, D.C. 20594

Performance Study

Specialist Report

Marie Moler

A. ACCIDENT

Location:	Gasport, New York
Date:	July 5, 2014
Time:	1104 EDT
Airplane:	Flight Design GMBH CT-SW 2006, N508CT
NTSB Number:	ERA14LA329

B. GROUP

No vehicle performance group was formed.

C. SUMMARY

On July 5, 2014, about 1104 eastern daylight time, a Flight Design GMBH CT-SW 2006, N508CT, collided with trees then the ground shortly after takeoff from Royalton Airport, Gasport, New York. The private rated pilot received fatal injuries and 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 as a personal, local flight. Visual meteorological conditions prevailed at the time and no flight plan was filed. The flight was originating at the time of the occurrence.

According to Federal Aviation Administration (FAA) personnel, witnesses reported the pilot performed an engine run-up at the approach end of runway 7, then back taxied down the runway where he turned around and initiated takeoff from runway 25. Witnesses reported to FAA personnel that at rotation the airplane appeared to pitch up higher than normal followed by up and down pitch oscillations and left bank oscillations, climbing no higher than approximately 75 feet. The airplane also began a slow bank to the left, before impacting trees south of the runway in a left wing low attitude. The airplane came to rest nearly inverted on an easterly heading in a heavily wooded area. Witnesses called 911 to report the accident and the pilot was rescued and transported to a hospital for treatment of his injuries.

D. PERFORMANCE STUDY

The aircraft was equipped with a Garmin GPSMAP 396 which records the time, latitude, longitude, and GPS altitude. The unit also records derived (not measured) track and groundspeed. Times in the study are reported in EDT.

Weather Observation

A surface observation weather report taken at Buffalo Niagara International Airport (BUF), Buffalo, New York, at 1054, or approximately 10 minutes before the accident indicates the wind was from 260° at 8 knots, the visibility was 10 statute miles, and few clouds existed at 25,000 feet. The temperature and dew point were 22 and 09 degrees Celsius respectively, and the altimeter setting was 30.25 inches of Mercury (inHg). The accident site was located about 16 nautical miles away along a heading of 28 degrees from BUF.

Airplane Ground Track, Altitude, and Airspeed

The aircraft taxied from the hanger area of Royalton airport along the runway to the threshold of runway 25. In Figure 1 the aircraft's track as recorded by the GPS unit is shown in orange. The GPS recording at the end of the flight show a number of unreliable recordings and were discarded. The green path shows the aircraft's take-off roll and three in-air data points that are consistent with witness testimony and the location of the wreckage.

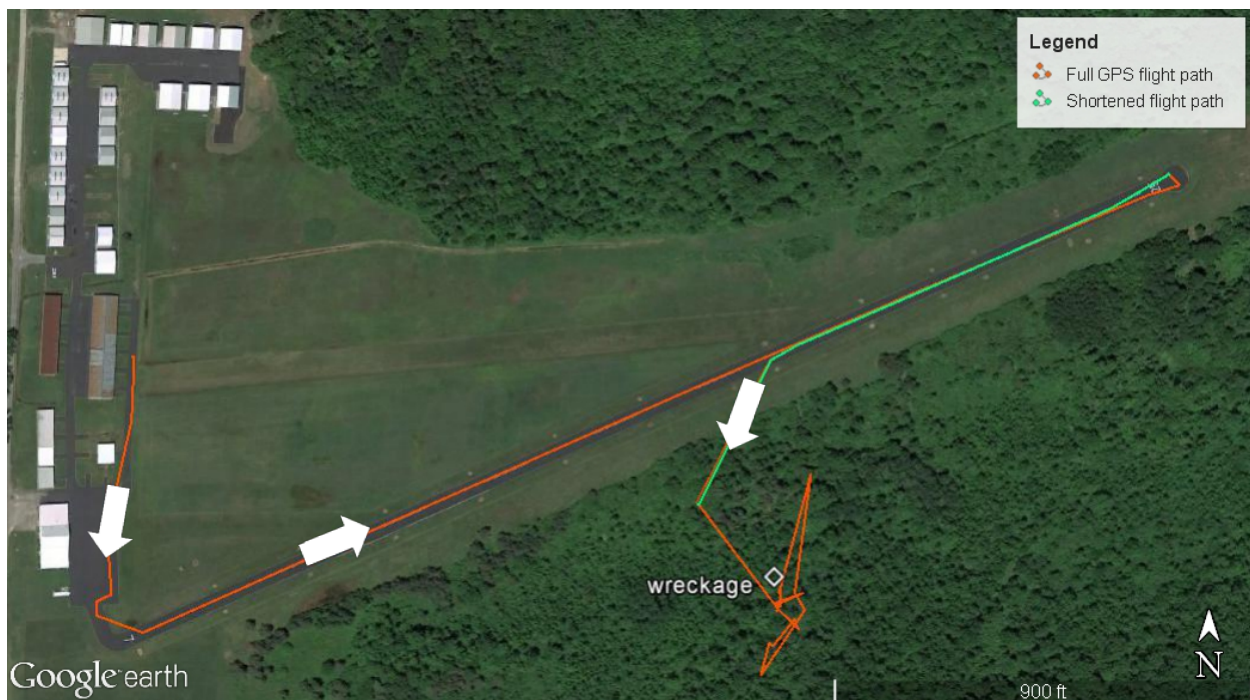


Figure 1. Aircraft GPS path in orange and shortened path in green. White arrows show aircraft direction. Wreckage location is shown by a white diamond.

Performance Study

ERA14LA329, Flight Design GMBH CT-SW 2006, N508CT

The GPS location data and the weather information were used to calculate the aircraft's groundspeed, true airspeed (TAS), and calibrated airspeed (CAS), shown below in Figure 2. The elevation of the Royalton airport is reported as 628 ft, but the runway elevation is unreported. The aircraft's TAS for the last two GPS points was approximately 46 kts (CAS was 0.7 kts lower than true airspeed). Figure 3 shows the aircraft's flight path and wreckage location with TAS noted for each GPS point.

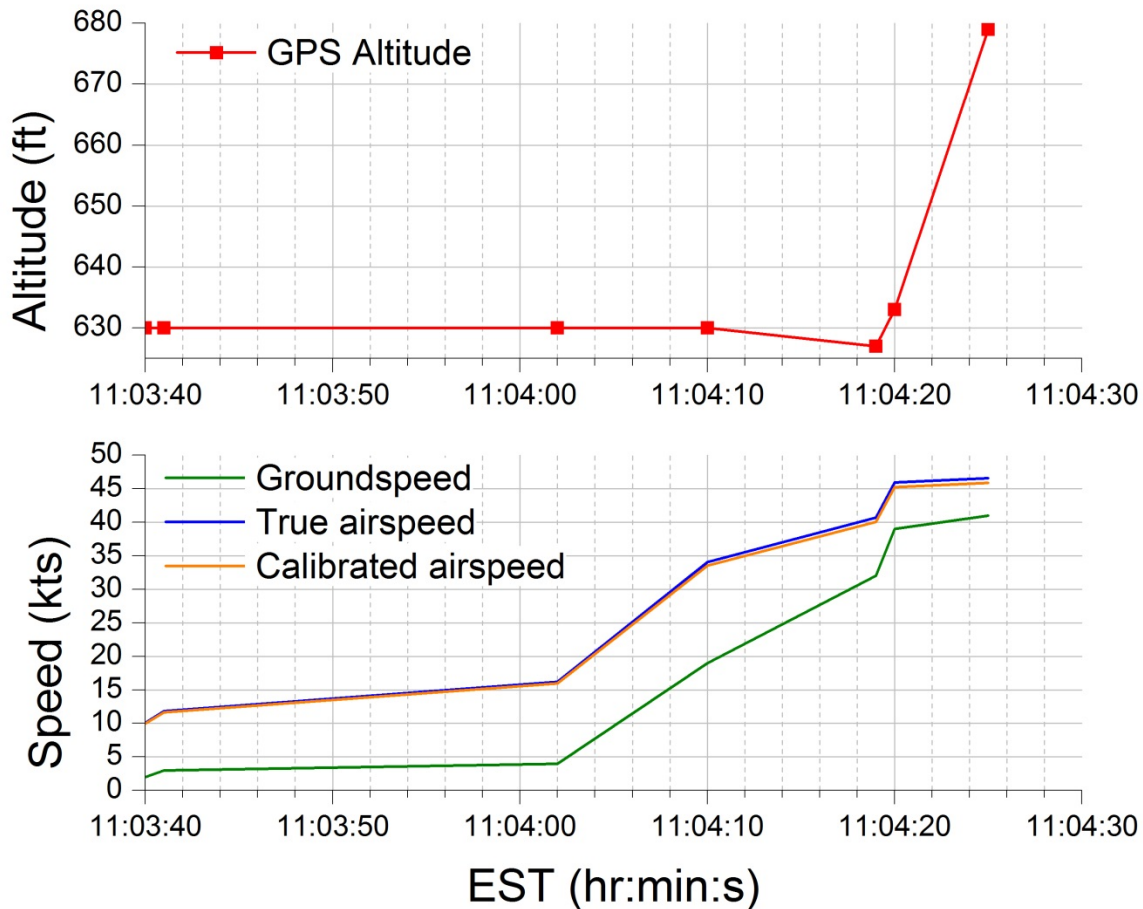


Figure 2. Aircraft recorded altitude and calculated groundspeed, true airspeed, and calibrated airspeed versus time.

Performance Study

ERA14LA329, Flight Design GMBH CT-SW 2006, N508CT



Figure 3. Aircraft take-off roll, flight, and wreckage location. Times and calculated true airspeeds are shown for each GPS point.

The aircraft began heading left as soon as its altitude indicated that it lifted off. Figure 4 shows the aircraft's take-off roll, flight, and altitude.

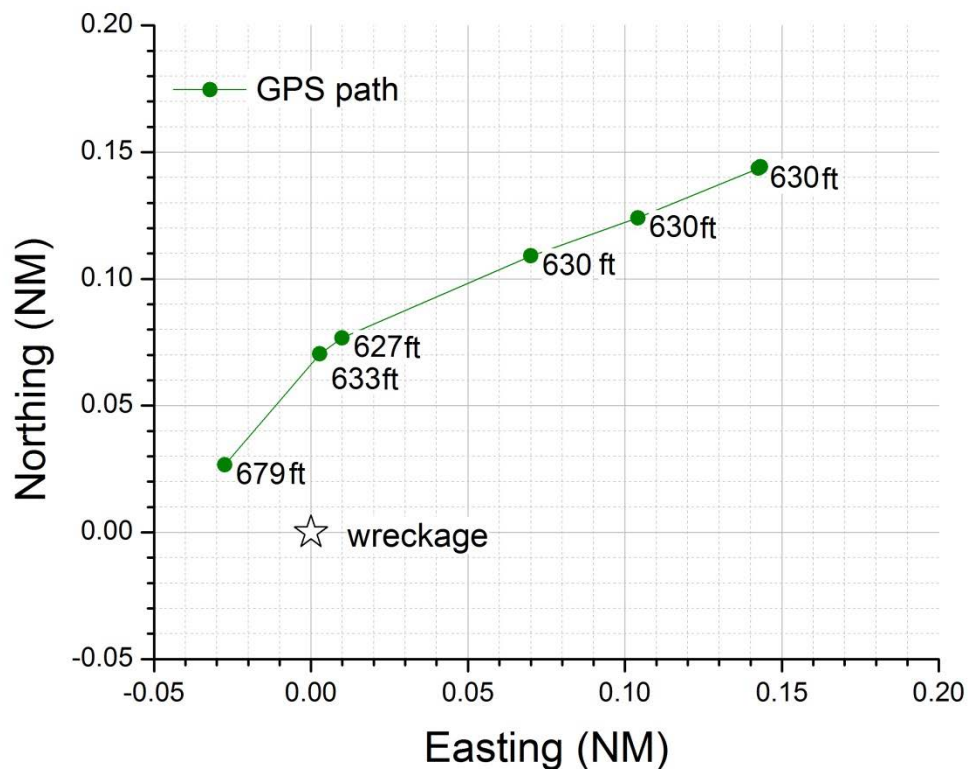


Figure 4. Aircraft take-off roll, flight, and wreckage location. Aircraft altitude is shown for each GPS point.

Banked Turn Calculations and Aircraft Stall

Assuming that the aircraft's flight path between the last three GPS points was part of a smooth, coordinated turn, the radius of that turn was 368 ft (see Figure 5).

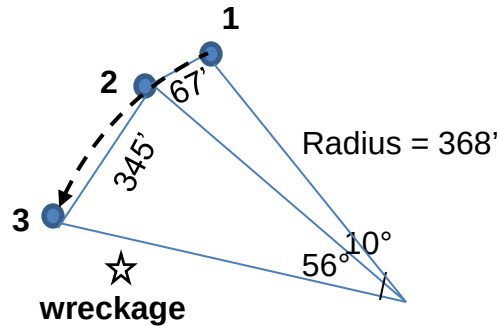


Figure 5. Radius of smooth coordinated turn (black dotted line) between final three GPS locations (blue circles labeled '1', '2', and '3'). Approximate wreckage location is also shown.

The aircraft would have traveled about 424 ft along the dotted black line in Figure 5 over six seconds for a ground speed of 41 kts which with the winds was about 46 kts TAS (~ 45 kts CAS). 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), assuming there are no winds.

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

Applying a speed of 46 kts and a radius of 368 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.

According to the airplane manufacturer, stall speeds for Flight Design aircraft delivered in 2006 were determined in compliance with ASTM F2245-04. Flight testing was performed to determine the stall speeds in terms of calibrated airspeed (CAS). Table 1, below, shows the aircraft's stall speed for flaps 15 extension (configuration at the time of the accident) and different bank angles. This table is for maximum take-off weight (MTOW), but the accident aircraft was estimated to be about 188 lbs less than the MTOW of 1323 lbs (600 kg). Based on Flight Design data, the reduced weight of the aircraft would lower the stall speed an additional 2 and 3 kts. At a bank angle of about 30° and a weight 188 lbs below MTOW, the stall speed would likely be between 41 and 42 kts CAS.

Performance Study
ERA14LA329, Flight Design GMBH CT-SW 2006, N508CT

Table 1. Aircraft stall speeds for flaps 15 and MTOW.

Bank angle	Level flight, 0°	15°	30°	45°	60°
Stall speed (CAS)	41 kts	42 kts	44 kts	49 kts	58 kts

At this point in the flight the aircraft's speed (~ 45 kts CAS) was 3 to 4 kts higher than the reported stall speed (~41 and 42 kts CAS). However, Table 1 shows that the stall speed increases quickly with bank angle. If the aircraft's bank angle increased beyond 30°, the airspeed would be below the stall speed. Additionally, the model does not account for uncoordinated flight, such as if the aircraft was slipping or cross-controlled. If the aircraft was in uncoordinated flight, its angle of attack would most probably be greater on one of the wings, further increasing the stall speed.

The aircraft wreckage was located along an easterly track, 230 ft from the final GPS location (see Figure 4 and Figure 5). Assuming a single banked turn between the final GPS point and the wreckage location, the aircraft's bank angle would have had to increase beyond the 27° calculated earlier and the aircraft's stall speed would have continued to increase.

E. CONCLUSIONS

The accident aircraft's track began to turn to the left as soon as the recorded altitude indicated it had lifted off. Additionally, the aircraft was within 4 kts of its stall speed as it began to turn left on its climb. If the aircraft slowed slightly, if the left turn continued and the aircraft's bank increased, or if the aircraft's flight was uncoordinated, the aircraft could have quickly exceeded its stall angle of attack. The GPS data and weather information indicate that the aircraft was close to aerodynamic stall at the end of its recorded flight.

Marie Moler
Specialist – Airplane Performance
National Transportation Safety Board