

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

Airplane Performance Study

Specialist Report Timothy Burtch

A. ACCIDENT

Location: Hiddenite, North Carolina
Date: August 9, 2021
Time: 1735 GMT (1335 EDT)
Airplane: Diamond DA-42-L360, N906ER
NTSB Number: ERA21LA322

B. GROUP

No vehicle performance group was formed.

C. SUMMARY

On August 9, 2021, about 1335 eastern daylight time (EDT), a Diamond DA-42-L360 airplane, N906ER, was substantially damaged when it was involved in an accident near Hiddenite, North Carolina. The flight instructor and private pilot were not injured. The airplane was operated by Academy of Aviation as a Title 14 Code of Federal Regulations Part 91 instructional flight.

The flight instructor and private pilot departed Gastonia Municipal Airport (AKH), Gastonia, NC, at approximately 1232 EDT and completed several maneuvers and simulated emergency procedures during the instructional flight to Wilkes County Airport (UKF), North Wilkesboro, NC. See Figure 1.

The student performed the subsequent takeoff from UKF and, upon reaching 5,000 ft mean sea level (msl), performed an emergency descent maneuver while also simulating a left engine fire. As part of the simulated left engine fire, the left engine was shut down with the full reduction of the throttle, propeller, and mixture. As indicated in the Preliminary Report for this accident, during the descent, the Attitude and Heading Reference System (AHRS) became inoperable¹. In addition, the student stated he could not pitch the airplane's nose up as the right engine began to sputter.

The Preliminary Report then indicated that the flight instructor took the flight controls and was also unable to pull the control stick aft. About 500 ft above ground level (agl), the flight instructor kept his hands on the control stick while the student extended the landing gear and

¹ The AHRS displayed a message that it was aligning/calibrating and to keep the wings level.

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flaps for landing. The airplane subsequently touched down nose low in a soybean field, impacted a ditch, and skidded to a stop.

Times in the study are quoted in EDT. Greenwich Mean Time (GMT) = EDT + 4 hr.

D. THE AIRPLANE

A picture of the accident airplane, a Diamond DA-42-L360, is shown in Figure 2. The airplane was manufactured by Diamond in 2007 and is registered to Heavy Metal Air, LLC.

E. WEATHER SUMMARY

Statesville Regional airport (SVH) is located approximately 15 nautical miles (NM) southeast of the accident site. The Automated Surface Observing System (ASOS) at SVH recorded the following observation about the time of the accident:

KSVH 091735Z AUTO 16003KT 10SM CLR 32/19 A3016

The automated surface weather observation at Statesville Regional airport on August 9 at 1335 EDT is wind from 160° at 3 knots (kt); 10 statute miles visibility; clear skies; temperature 32° Celsius (C); dew point 19°C; altimeter 30.16" mercury.

F. PERFORMANCE STUDY

The airplane performance study is largely based on Automatic Dependent Surveillance-Broadcast (ADS-B) data provided by the Federal Aviation Administration (FAA). ADS-B is a primary technology supporting the FAA's Next Generation Air Traffic Control System, or NextGen, which is shifting airplane separation and air traffic control from ground-based radar to satellite-derived positions. ADS-B broadcasts an airplane's Global Positioning System (GPS) position to the ground where it is displayed to Air Traffic Control. The GPS position is also transmitted to other airplanes with ADS-B receivers, either directly or relayed through ground stations, to allow self-separation and to increase situational awareness.

GPS has an accuracy of approximately 20 meters (m) in both the horizontal and vertical dimensions. GPS augmented with the Wide Area Augmentation System (WAAS)² is accurate to approximately 1.5 – 2 meters.

Figure 3 shows a portion of the ADS-B ground track for the instructional flight to Wilkes County Airport. The figure includes three sets of 360° turns at constant altitude that appear to be "eights along a road" or "turns around a point". Both are ground reference maneuvers designed to teach a pilot to fly a desired ground track while maintaining coordinated flight³. See Figures 4 and 5.

² WAAS collects, processes, and corrects GPS information to ensure that the data the pilot receives can be trusted:
https://www.faa.gov/news/fact_sheets/news_story.cfm?newsId=14974&omniRss=fact_sheetsAoc&cid=103_F_S

³ FAA Airplane Flying Handbook (FAA-H-8083-3B) Chapter 6:
https://www.faa.gov/regulations_policies/handbooks_manuals/aviation/airplane_handbook/media/08_afh_ch6.pdf

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Figure 6 captures the ground track after departing UKF along with the ADS-B geometric altitude during the final three minutes. The return flight includes a 6,000 fpm descent⁴ and the final circling left turn to the accident site.

Figures 7 through 9 include additional flight parameters for the final four minutes either recorded directly in the ADS-B data or estimated from recorded parameters. Figure 7 highlights the stall speeds published in the Pilot's Operating Handbook. Diamond provides level flight, power off⁵ stall speeds at various weights and bank angles in calibrated airspeed. However, the ADS-B only records ground speed.

To compare ADS-B ground speed to the published stall speeds, wind, temperature, and pressure at altitude must all be considered. Preliminary weather data from a High-Resolution Rapid Refresh (HRRR) numerical model were obtained for the accident site from the NTSB Meteorologist Group Chairman. The HRRR data and ADS-B ground speed were used to estimate the airspeed shown in Figure 7. Using the estimated bank angles shown in Figure 8, it appears that N906ER never slowed below the published stall speed.

In addition to the stall speed data, the ADS-B indicate that the pilot was able to slow the sink rate, raise the airplane pitch attitude by approximately five degrees, and pull in excess of 1g (Figure 9) in the final five seconds⁶. The airplane's bank angle decreased from about 20° left-wing-down to 10° left-wing-down in the same period. Figure 10 shows the airplane in its final position.

G. SUMMARY AND CONCLUSIONS

The accident flight was an instructional flight that lasted approximately one hour and three minutes. The FAA ADS-B data for the flight initially appear normal and indicate that the student and instructor conducted various ground reference maneuvers shortly after take-off from Gastonia Municipal Airport and before proceeding north to Wilkes County Airport.

After an eleven-minute stop at Wilkes County, the flight proceeded south. About 15 NM south of UKF, the student pilot reportedly shut down the left engine during a simulated engine-fire and performed an emergency descent maneuver. During the descent the student indicated that he could not pitch up, and the instructor took the flight controls. The flight instructor also reportedly was unable to pull the control stick aft. N906ER impacted a soybean field approximately 17 NM south of UKF.

⁴ The pilot stated that they practiced an emergency descent. Diamond also reported flight tests where 6,000 fpm was achieved during emergency descents.

⁵ Power would reduce the airplane stall speed.

⁶ Sink rate increases in a stall.

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While both the student and the instructor indicated that they could not raise the airplane's nose, ADS-B data indicate that the sink rate decreased, and the pitch attitude increased in the final seconds of the flight.

Timothy Burtch
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H. FIGURES

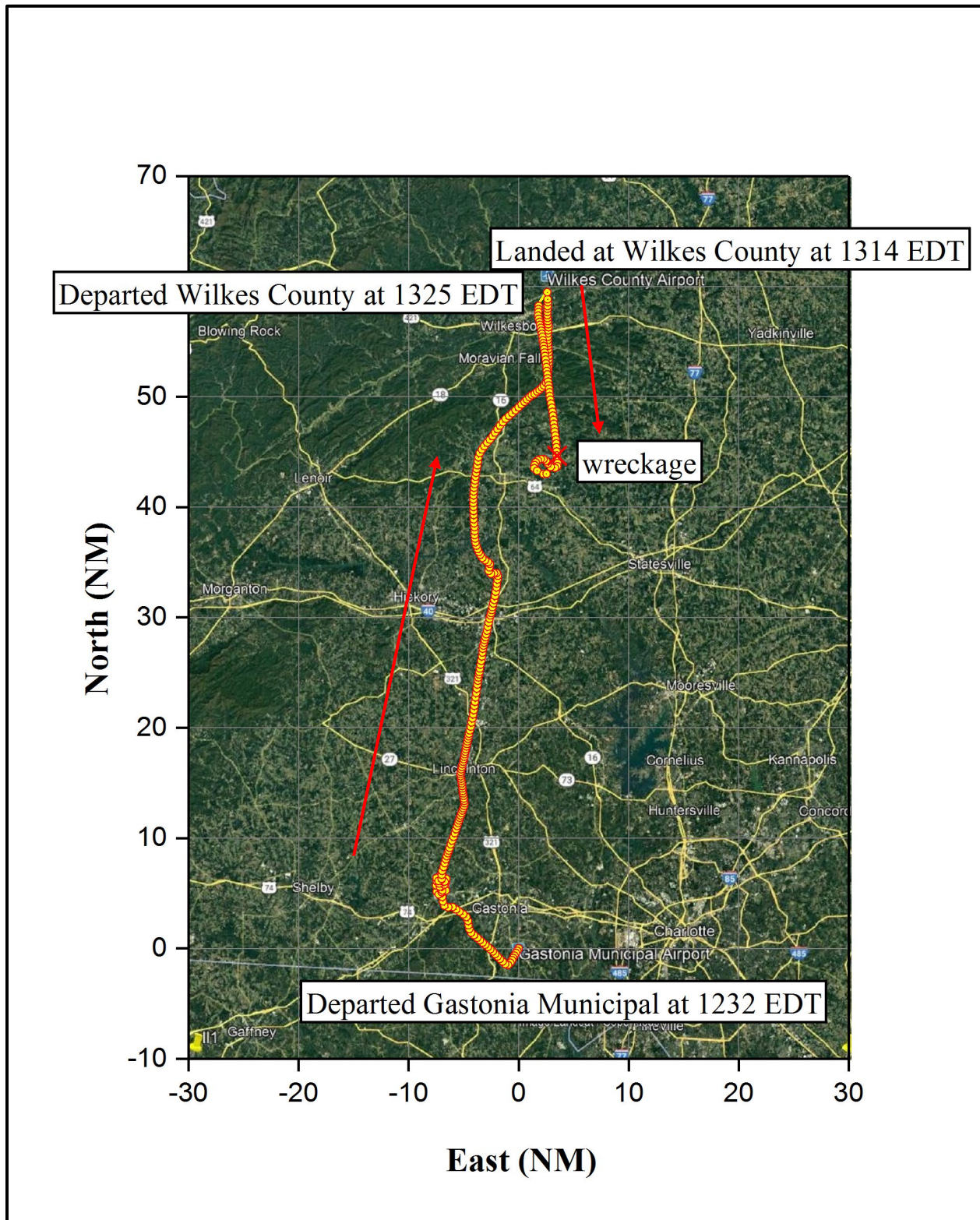


Figure 1: The Instructional Flight Departed Gastonia Municipal Airport with a Stop at Wilkes County Airport. The Accident Happened After Leaving Wilkes County.

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Figure 2: Accident Airplane, N906ER, a Diamond DA-42-L360

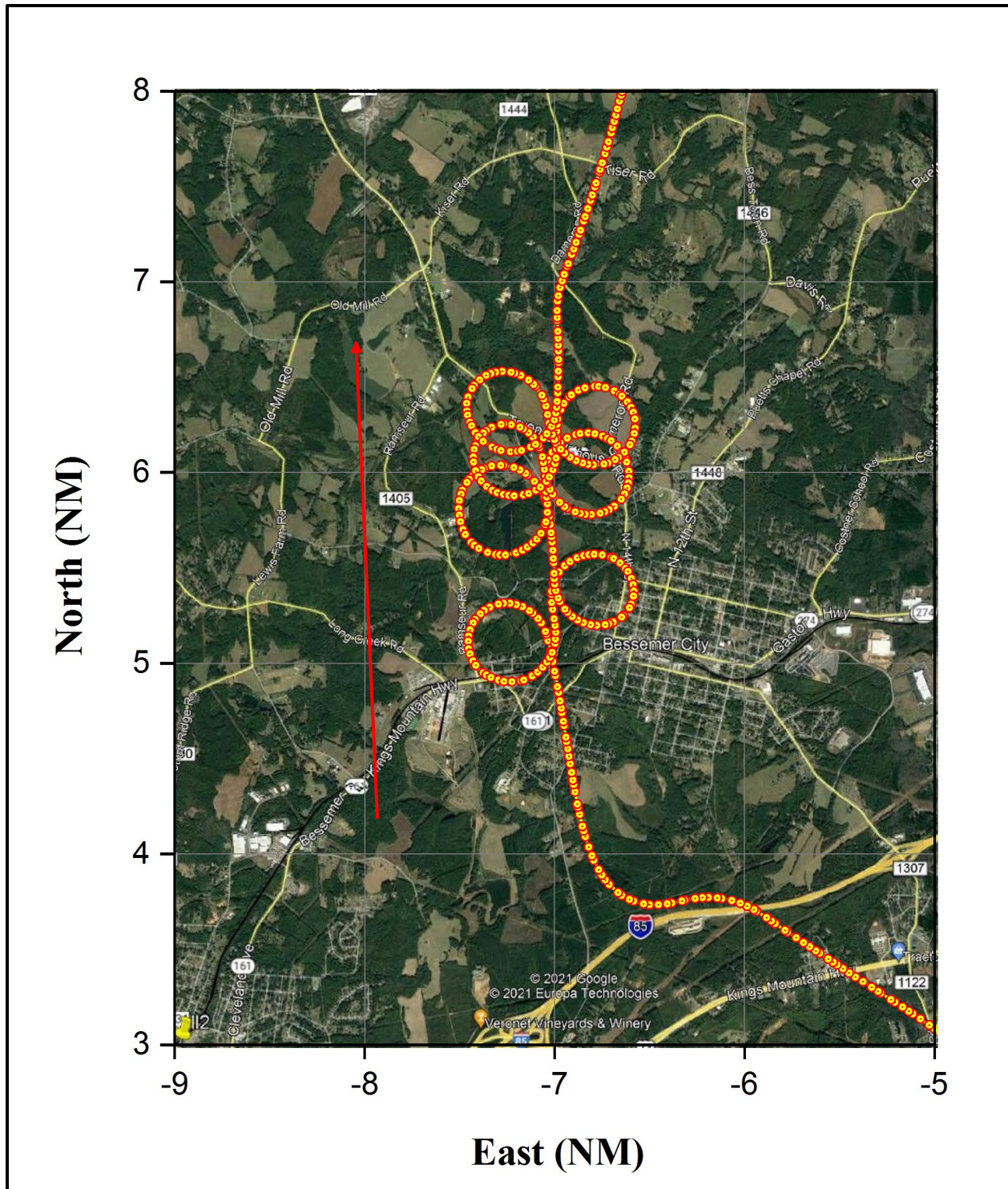


Figure 3: ADS-B Data Show the Airplane Performing 360° Turns during the Flight from Gastonia Municipal to Wilkes County Airports

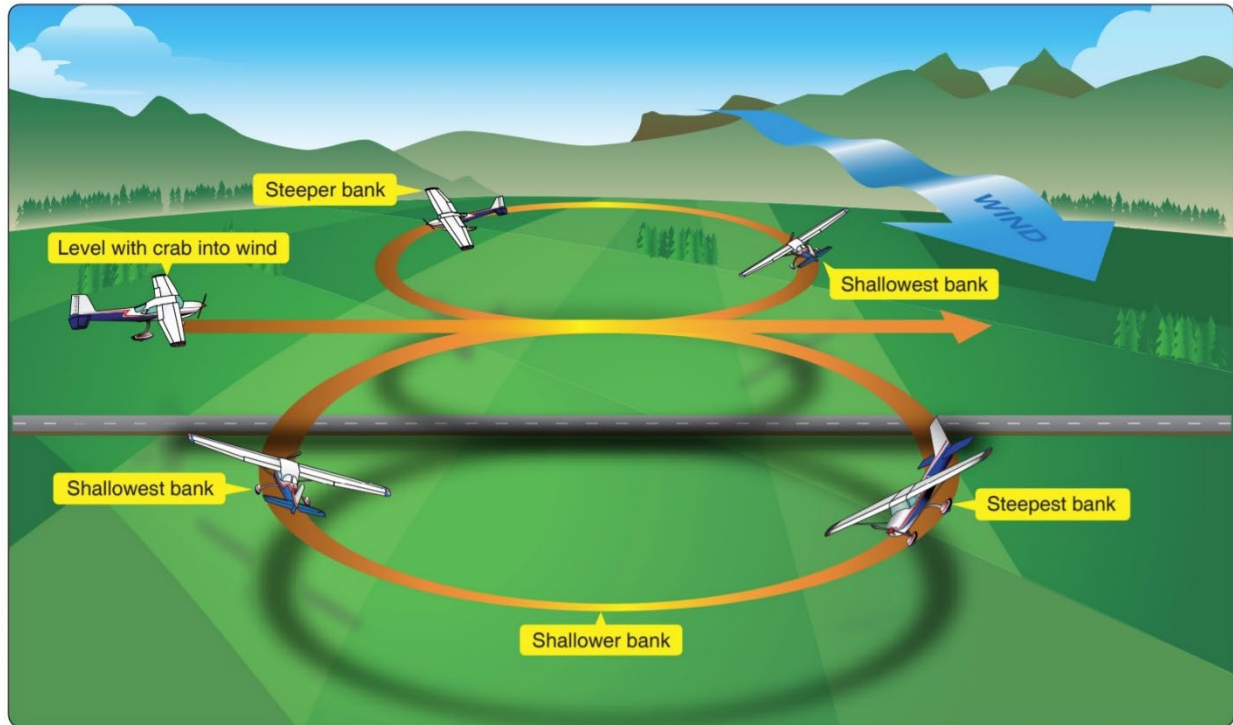


Figure 4: Eights Along a Road from the FAA Airplane Flying Handbook

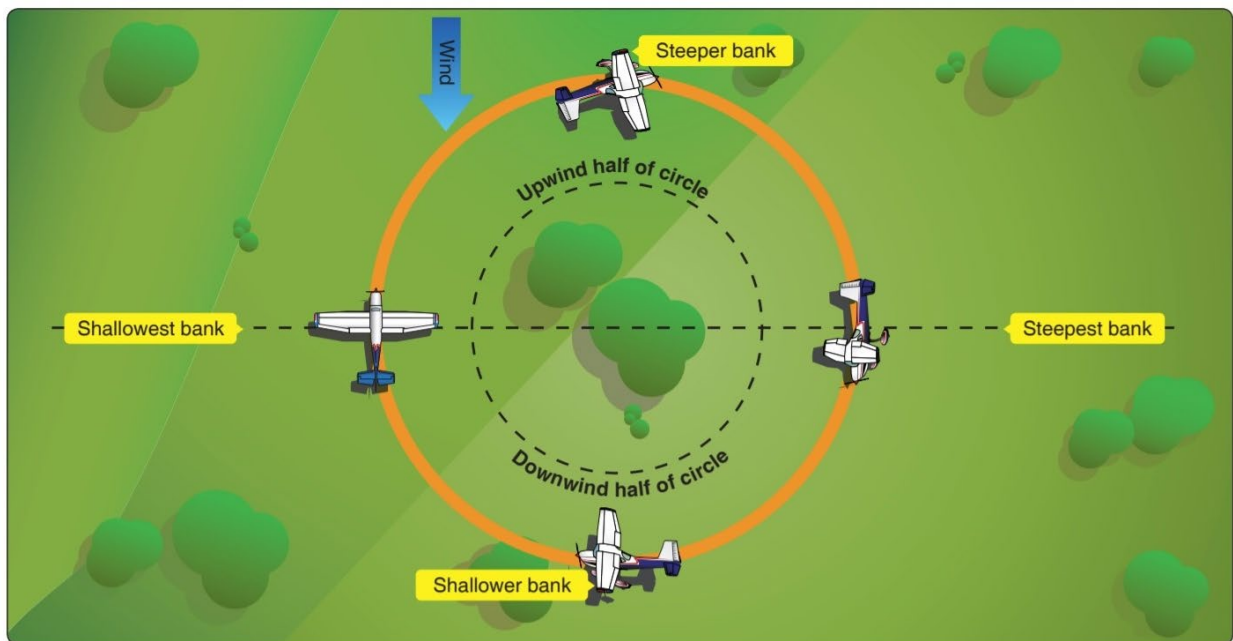


Figure 5: Turns Around a Point from the FAA Airplane Flying Handbook

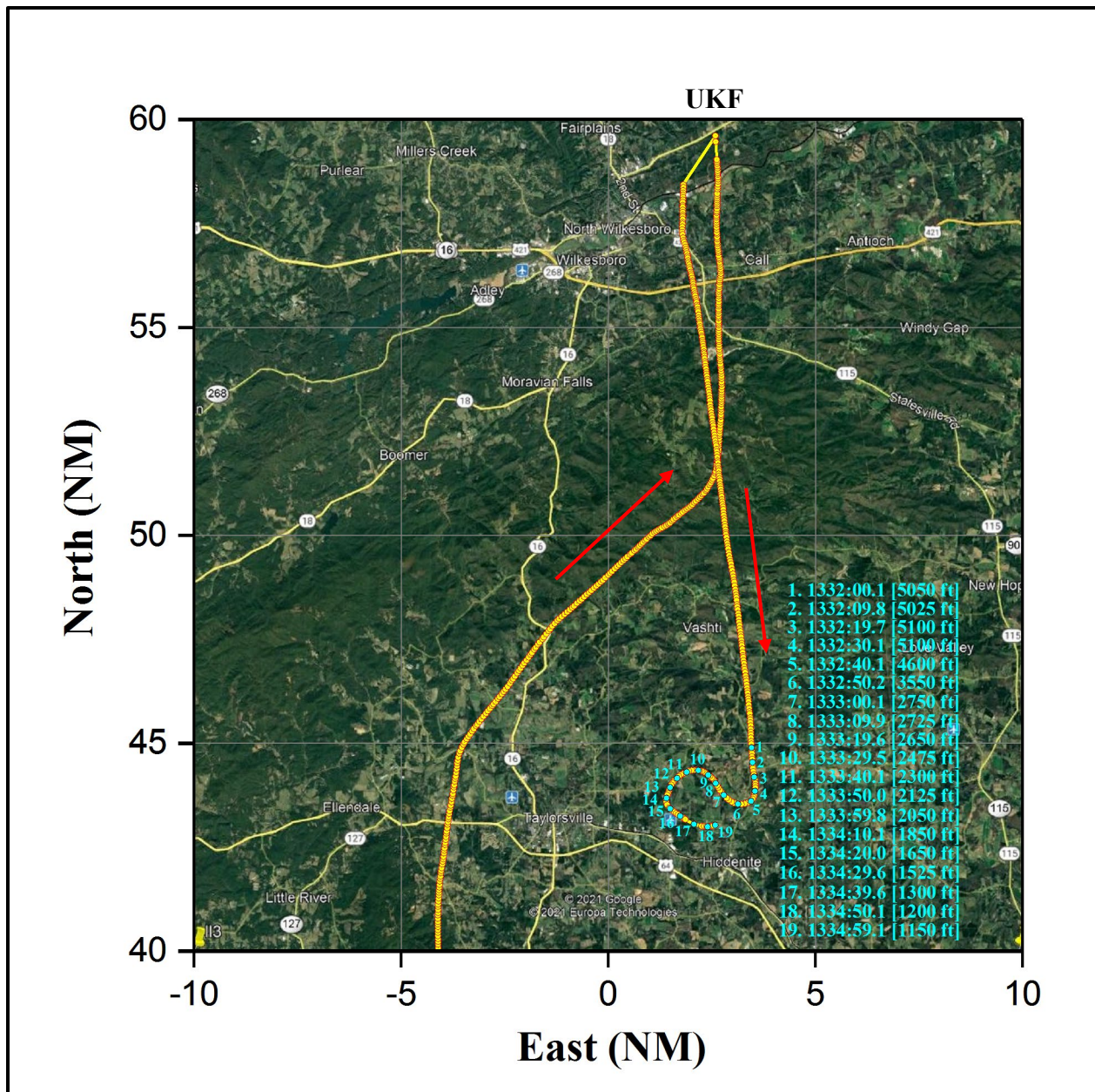


Figure 6: ADS-B Ground Track from Wilkes County Airport to Accident Site
(ADS-B Geometric Altitude for Final Three Minutes in Cyan)

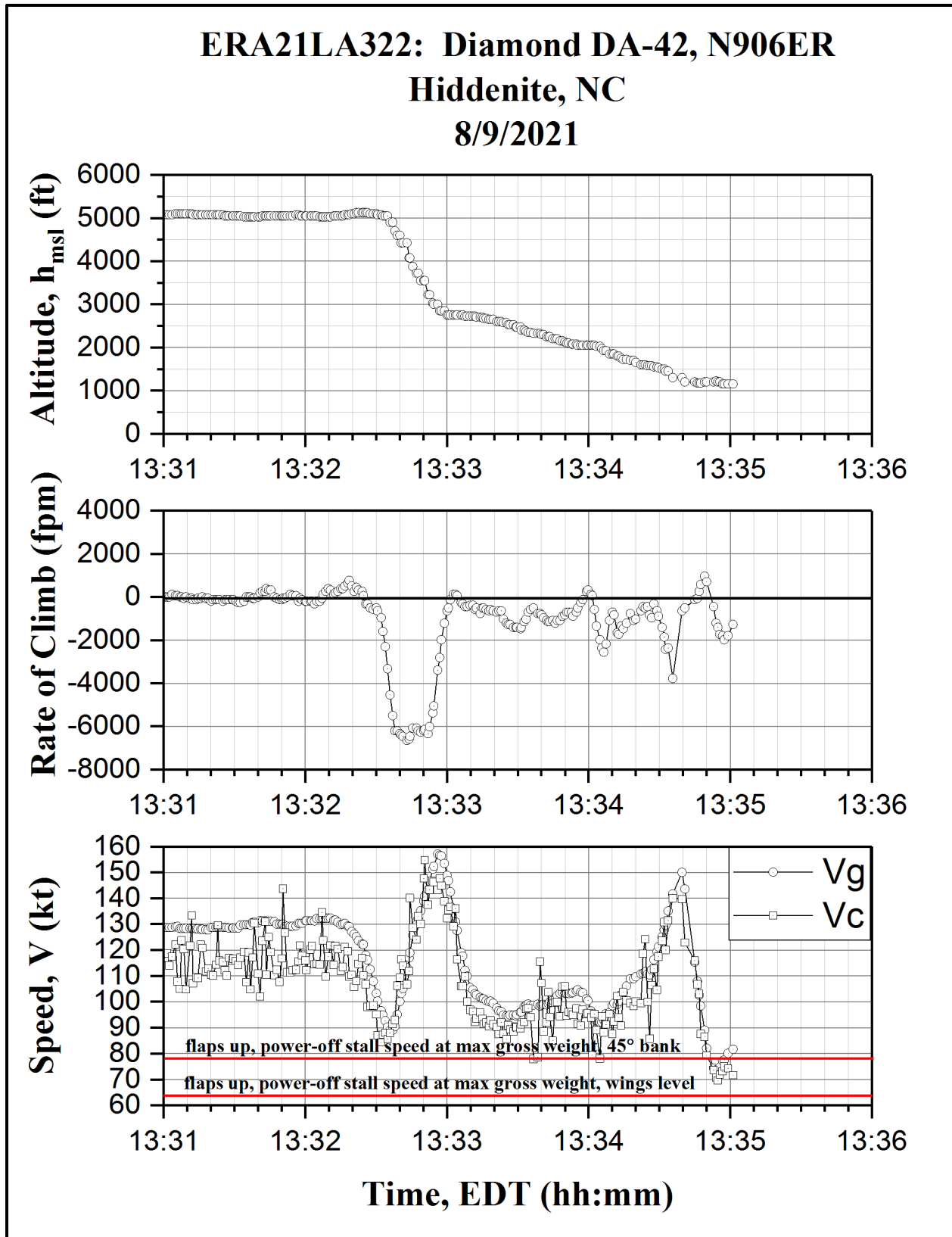


Figure 7: ADS-B Ground Speed (V_g) and Estimated Airspeed (V_c) Prior to Impact

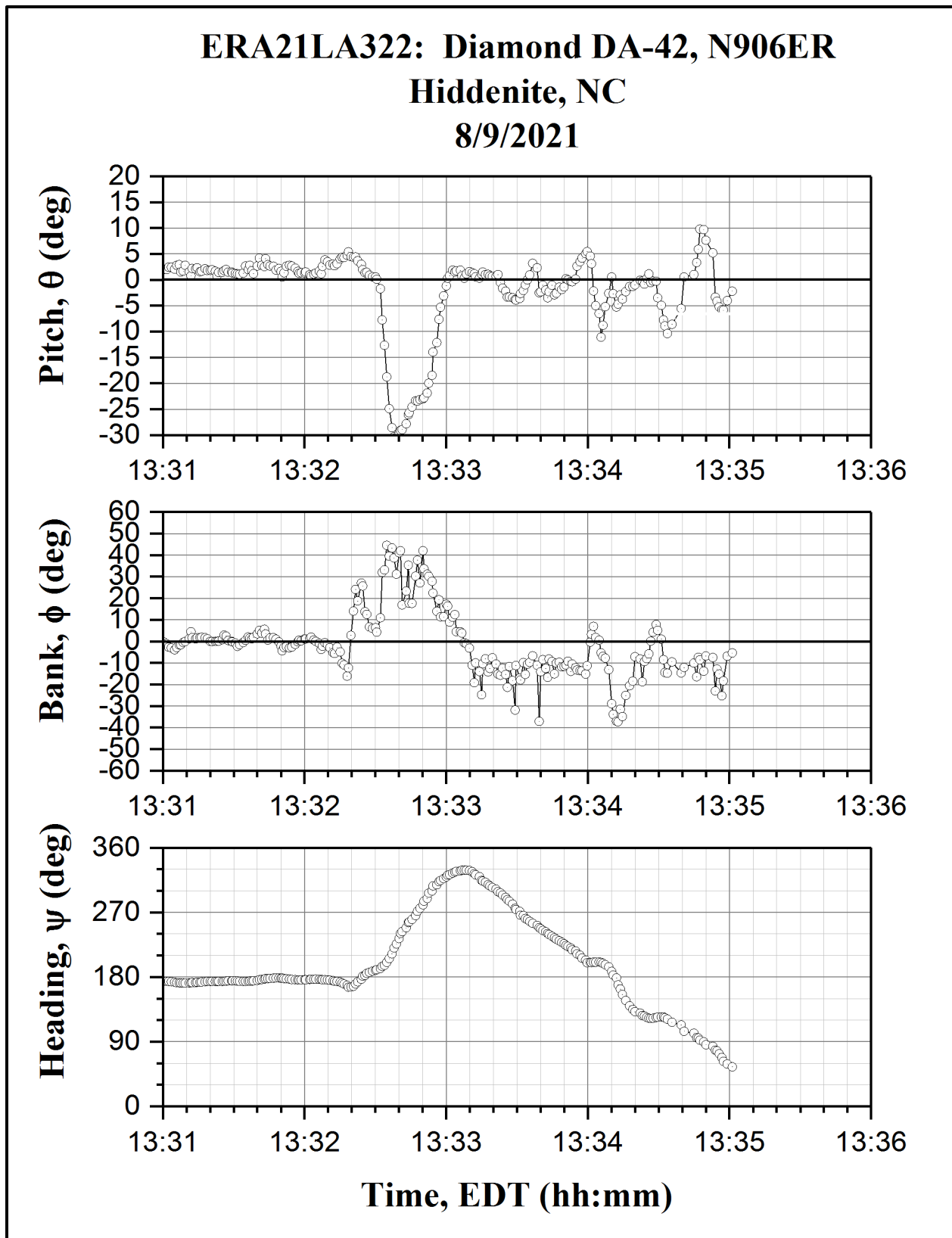


Figure 8: Estimated Pitch, Bank, and Heading Prior to Impact

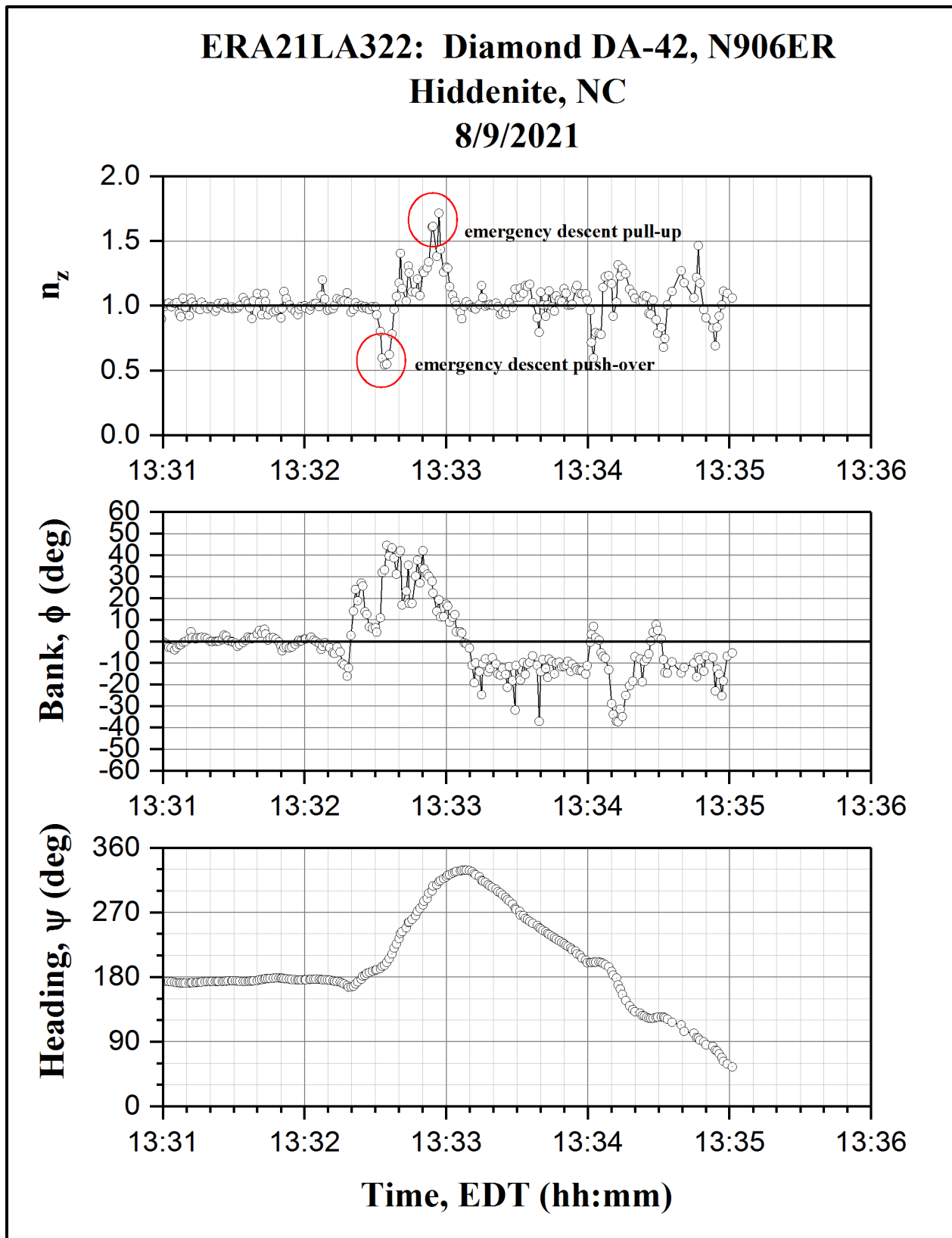


Figure 9: Estimated Vertical Load Factor Prior to Impact

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Figure 10: The Airplane in its Final Resting Position