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

Airplane Performance Study

Specialist Report
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A. ACCIDENT

Location: Warm Springs, Oregon
Date: January 9, 2021
Time: 2137 GMT (1337 PST)
Airplane: Cessna 560 Citation, N3RB
NTSB Number: WPR21LA082

B. GROUP

No vehicle performance group was formed.

C. SUMMARY

On January 9, at 1337 pacific standard time (PST), a Cessna 560, N3RB, was destroyed when it was involved in an accident near Warm Springs, Oregon. The pilot, who was the sole occupant, was fatally injured. The airplane was being operated as a Title 14 *Code of Federal Regulations* Part 91 flight.

The flight departed Portland-Troutdale Airport (TTD) at approximately 1307 PST. After numerous missed radio calls from air traffic control (ATC) while exiting the airport terminal area, the flight was cleared to the TIMEE intersection, some 41 miles southeast of TTD. However, the airplane continued to fly toward Mount Hood, about 27 miles east-southeast of TTD. ATC issued additional heading and altitude changes to avoid the high terrain and ultimately cleared the flight direct to the destination airport, Boise Air Terminal/Gowen Field (BOI) in Boise, Idaho. See Figure 1.

At 1327 the airplane reached an altitude of 27,000 ft and began tracking to the right while continuing to climb. The controller alerted the pilot that he was about 30° right of course, but the pilot did not respond. The airplane continued to climb until 1328:45 when it reached its highest altitude of 31,350 ft. The airplane then began a spiraling descent until the last ADS-B message was recorded at 1336:27 with the airplane on a northwest heading and at an altitude of 3,800 ft. The airplane impacted the Mutton Mountain Range at an elevation of 3,600 ft.

The pilot held a private pilot certificate with type ratings for the Grumman G-111 Albatross and Learjet. Federal Aviation Administration (FAA) records do not indicate that he held a type rating for the Citation 560.

Times in the study are quoted in PST. Greenwich Mean Time (GMT) = PST + 8 hr.

D. THE AIRPLANE

A picture of the accident airplane, a Cessna 560 Citation, is shown in Figure 2. The airplane was manufactured by Cessna in 1989 and was registered to SX Transport, LLC.

E. WEATHER SUMMARY

Columbia Gorge Regional airport (DLS) is located approximately 38 nautical miles (NM) north of the accident site. The Automated Surface Observing System (ASOS) at DLS recorded the following observation about the time of the accident:

KDLS 092135Z AUTO 24002KT 10SM BKN009 OVC016 03/01 A3040

The automated surface weather observation at Columbia Gorge Regional airport on January 9 at 1335 PST is wind from 240˚ at 2 knots (kt); 10 statute miles visibility; broken ceiling at 900 ft above ground level (agl), overcast at 1,600 ft agl; temperature 3˚ Celsius (C); dew point 1˚C; altimeter 30.40" mercury.

F. PERFORMANCE STUDY

The airplane performance study is based largely on Automatic Dependent Surveillance-Broadcast (ADS-B) data provided by the 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)[1] is accurate to approximately 1.5 – 2 meters.

Figure 3 shows the altitude, rate of climb, and groundspeed from the 28 minutes of recorded ADS-B data. Figure 4 contains the same recorded parameters but highlights the last ten minutes of the flight.

The data show the airplane climbing at approximately 2,500 ft/min to a maximum recorded altitude of 31,350 ft. This is followed by a -2,500 to -5,000 ft/min spiraling descent to impact. The descent occurred over about eight minutes with the airplane in a 60˚-70˚ right turn. The bank angle that was estimated from ADS-B data is shown in Figure 5.

Also included in Figure 5 are recorded flight test data from another Cessna Citation 560. It is shown in red in the figure. These data are part of the Citation 560 training simulator

[1] 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

Acceptance Test Guide (ATG) and represent several minutes of the longitudinal, open-loop, long period (or phugoid) response of the airplane after a pitch disturbance[2].

G. SUMMARY AND CONCLUSIONS

The ATG phugoid data included in Figure 5 represent the dynamic pitch response of the Cessna 560 Citation without any control input from the pilot: if the pilot of N3RB were to release the flight controls at conditions similar to the flight test data, the accident airplane would respond like the ATG data shown in red. The recovered ADS-B data for N3RB have longitudinal dynamic characteristics[3] that are similar to the ATG flight test data for over a period of oscillation[4] or approximately 90 seconds[5].

The pilot had difficulty navigating to the TIMEE waypoint almost immediately after take-off. ATC even asked the pilot if he was having problems with his radio, to which he responded, "no, I think it's cleared up now, radio loud and clear". After circumventing Mount Hood with help from the Portland Departure controller, the flight was cleared to its destination of BOI and to flight level 230.

The pilot was transferred by departure to Seattle Center about 13:23 while climbing through flight level 190 and then subsequently cleared to flight level 370. The pilot's response to that clearance was the last transmission from the pilot (and marked on Figure 1), 14 minutes before the airplane would impact terrain. The airplane ultimately reached a maximum altitude of flight level 310 at around 13:29 as shown in Figure 6 before it began an eight-minute, spiraling descent, impacting the Mutton Mountain range at 13:37. The bank angle estimated from ADS-B data show the airplane in a relative constant 60˚-70˚ right turn for the entire descent.

Because the speed during the spiraling descent appeared to closely match the airplane's open-loop phugoid response, it is likely the pilot was not manipulating the controls during that time.

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[2] As per FAA Advisory Circular 23-8C, Flight Test Guide for Certification of Part 23 Airplanes, the short period oscillation is the first oscillation the pilot sees after a pitch disturbance. The long period or phugoid follows and is characterized by a nearly constant angle of attack but varying pitch caused by a repeated exchange of airspeed and altitude.

[3] The phugoid natural frequency and damping ratio determine the long period time history response of the airplane.

[4] The period of oscillation is the time it takes the airplane to complete one full pitch oscillation.

[5] While the natural frequency and damping ratio of the phugoid are similar, small differences in the ground speed magnitudes could be the result of slightly different initial conditions and the initial disturbance.

H. FIGURES

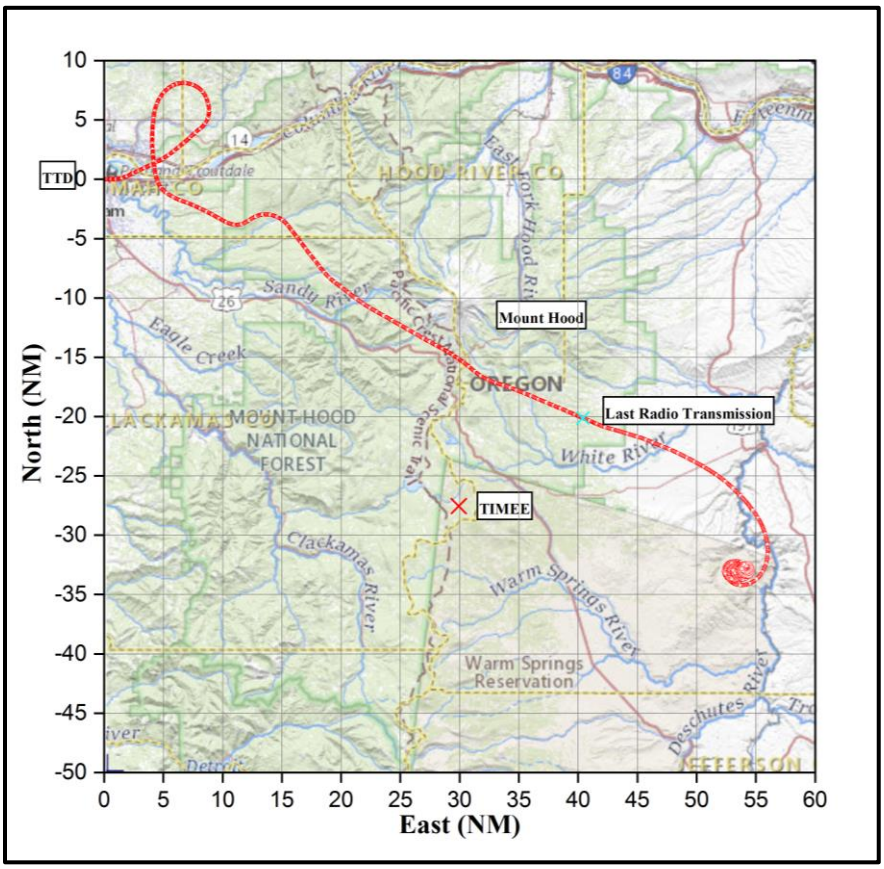

Figure 1: The Part 91 Personal Flight Departed Portland-Troutdale Airport (TTD), Portland, Oregon, on an IFR Flight Plan to Gowen Field (BOI), Boise, Idaho

Figure 2: Accident Airplane, N3RB, a Cessna

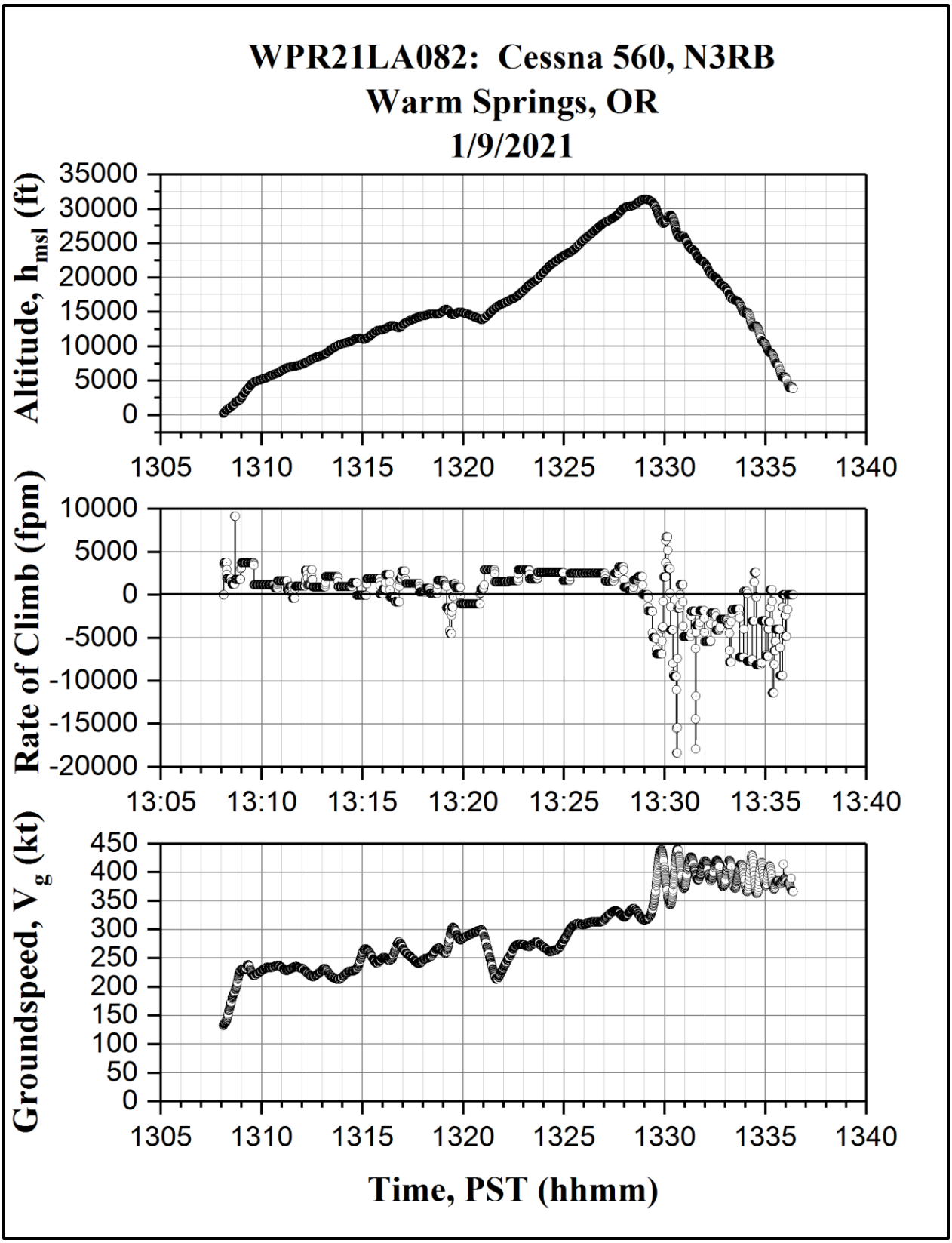

Figure 3: ADS-B Altitude and Ground Speed for the Accident Flight

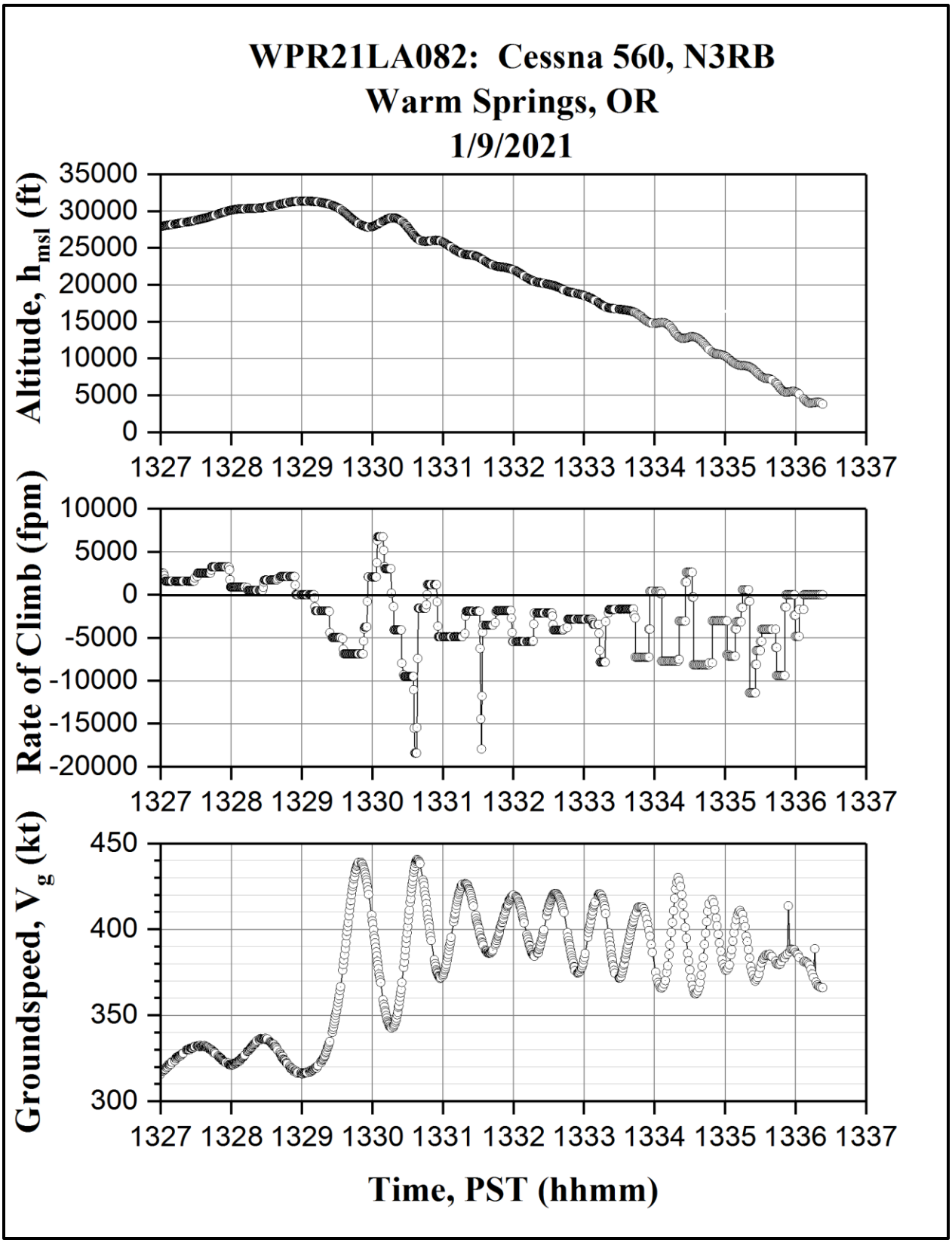

Figure 4: ADS-B Altitude and Ground Speed for Final Ten Minutes of Flight

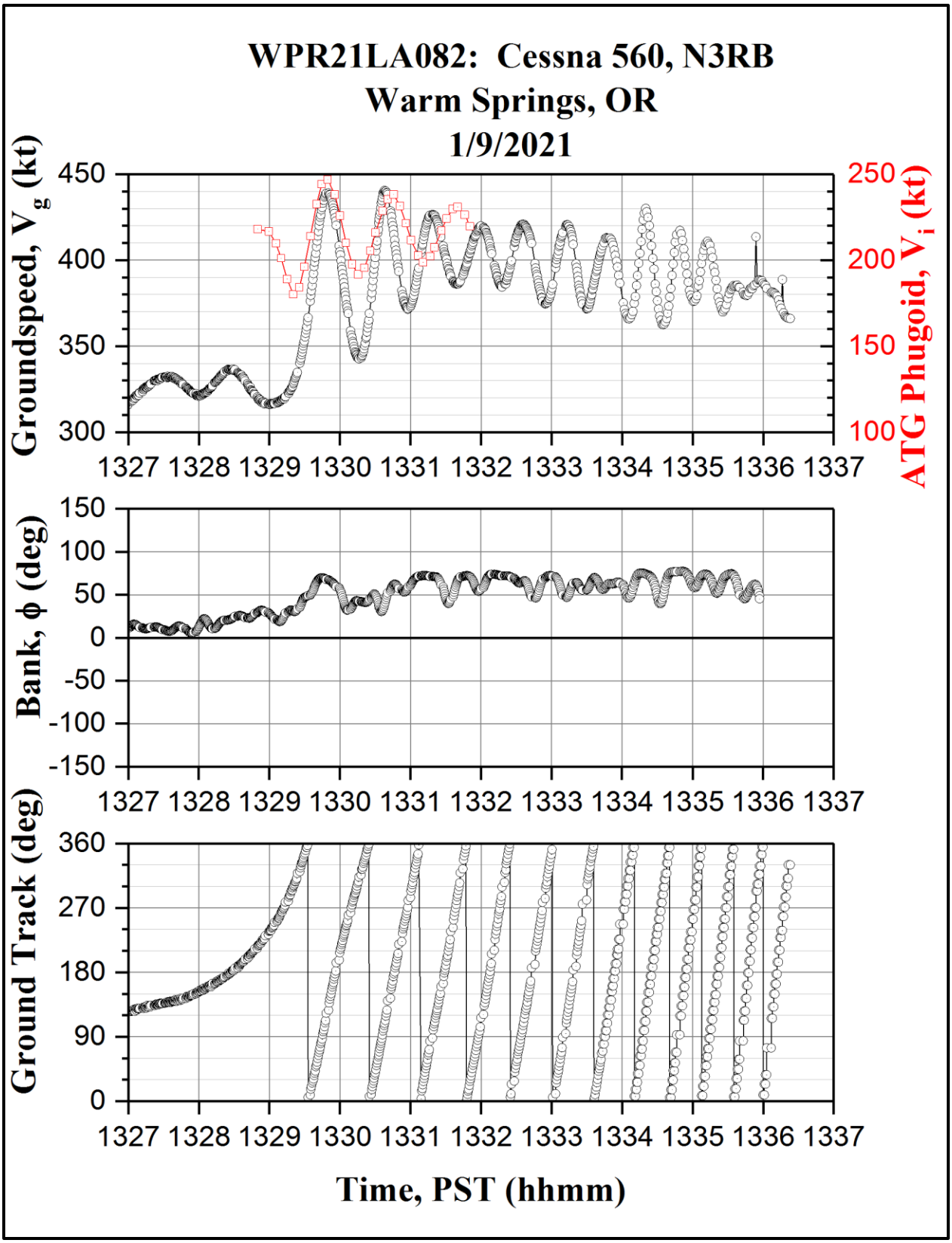

Figure 5: Estimated Bank Angle and Ground Track for Final Ten Minutes of Flight

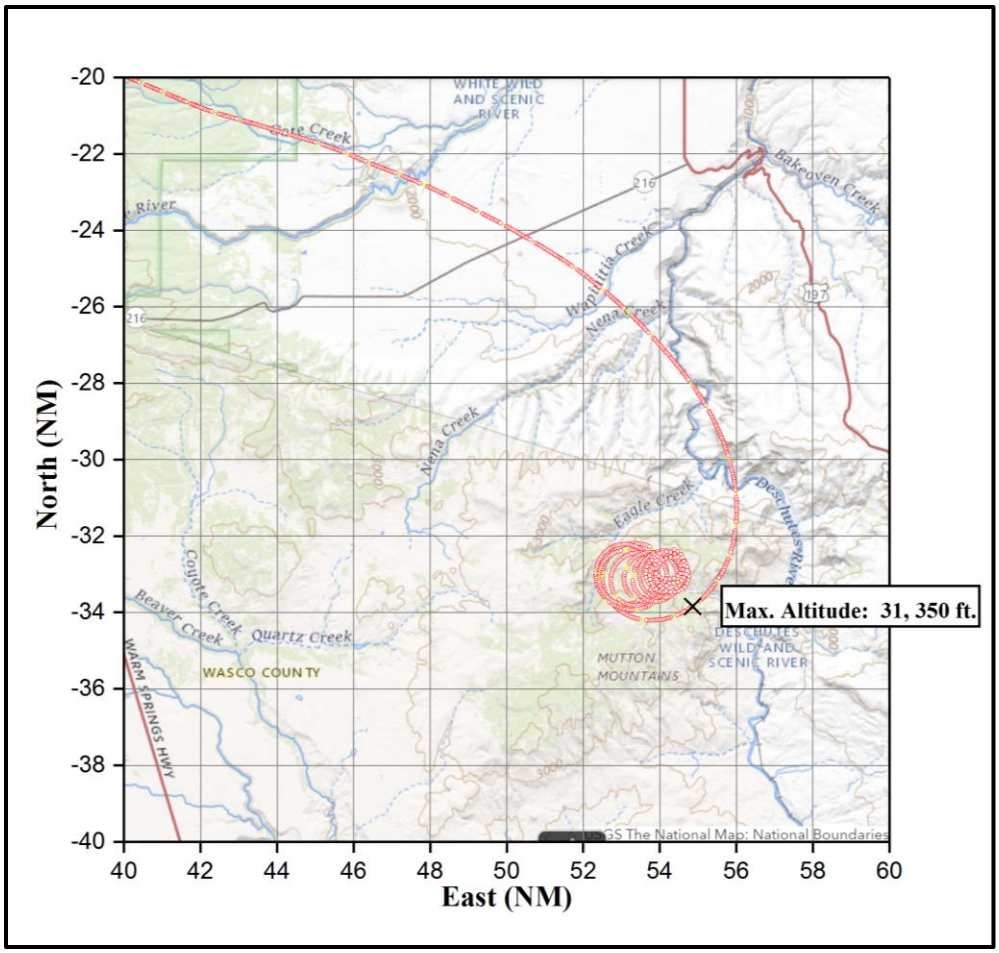

Figure 6: The Airplane Reached a Maximum Altitude of Flight Level 310 at 13:29 Before an Eight-Minute Spiraling Descent