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

Airplane Performance Study

Specialist Report
Timothy Burtch

A. ACCIDENT

Location:	Springfield Township, New Jersey
Date:	June 13, 2018
Time:	0907 EDT (1307 GMT)
Airplane:	Beechcraft B58 "Baron", Registration N218BL
NTSB Number:	ERA18FA167

B. GROUP

No vehicle performance group was formed.

C. SUMMARY

On June 13, 2018, about 0907 EDT, a Beech 58, N218BL, impacted a field near Springfield Township, New Jersey. The private pilot and pilot-rated passenger were fatally injured, and the airplane was destroyed by impact forces. The airplane was privately owned and operated under the provisions of Title 14 Code of Federal Regulations (CFR) Part 91. Day instrument meteorological conditions (IMC) prevailed, and an instrument flight rules (IFR) flight plan was filed for the positioning flight. The three-minute flight originated from South Jersey Regional Airport (VAY), Mount Holly, New Jersey, just before 0904 and was destined for Barnstable Municipal Airport-Boardman/Polando Field (HYA), Hyannis, MA.

See Figures 1 and 2 for pictures of the accident airplane and the accident site, respectively.

D. 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 (ATC). 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.

In addition, secondary radar returns (transponder code 2331) from the short-range Airport Surveillance Radar (ASR-11) located at Joint Base McGuire (WRI) approximately 7.5 NM east of the accident site were used in the study. Short-range radar data have approximately a 60 NM range and an inherent uncertainty of ±2 Azimuth Change Pulses (ACP) = ± (2 ACP) x (360º/4096 ACP) = ±0.176° in azimuth, ±50 ft in altitude, and ±1/16 NM in range.

Times in the study are reported in EDT as well as Greenwich Mean Time (GMT or "Z"): EDT = GMT – 4 hr.

Weather Observation

Joint Base McGuire has an automated weather observation system that is augmented with weather observers and/or tower personnel. A special weather report from WRI around the time of the accident is as follows:

SPECI KWRI 131306Z 21003KT 3SM BR OVC005 19/18 A2997 RMK AO2A TWR VIS 1 1/2 CIG 003 RWY06 CIG 002 RWY18

Plain text: Special weather for WRI on the 13th at 1306 GMT / 0906 EDT, the wind is from 210° (true) at 3 knots (kt), visibility 3 statute miles (SM), mist, overcast ceiling at 500 ft above ground level (agl), temperature 19° Celsius (C), dew point 18°C, altimeter 29.97 inches Hg. Remarks: Automated station with precipitation discriminator, tower visibility 1½ SM, ceiling 300 ft agl above runway 06, ceiling 200 ft agl above runway 18.

See the "Meteorology Weather Study" for more detailed weather information.

[1] WAAS collects, processes, and corrects the 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

Airplane Ground Track, Altitude, and Airspeed

Figures 3 and 4 show the IFR route that N218BL received from ATC prior to take-off[2]. The pilot was given an amended clearance when he contacted clearance delivery and was cleared to HYA: upon entering controlled airspace, intercept the Robinsville 236 radial to Robinsville (RBV[3]), DIXIE, victor airway (V) 276 to MANTA, V139 to HTO, and then as filed. Climb and maintain 2,000 ft and expect 7,000 ft 10 minutes after departure. Departure frequency is 124.15 and squawk 2331. The airplane never made it to RBV or to 2,000 ft.

Security video captured N218BL just after lift-off from VAY runway 8 at 0903:48. Figure 5 is a snapshot from that video that shows the accident airplane over the runway and in a slight nose-high attitude[4]. The recorded ADS-B data for N218BL began at 0903:56 as the airplane was climbing through 150 ft msl. The pilot subsequently reported climbing through 500 ft for 2,000 ft at 0904:32 when checking in with departure control; ADS-B data had the airplane at 465 ft. The ADS-B ground track for the entire flight is shown in Figure 6.

The departure instructions to intercept and track the RBV 236 radial could explain the early ADS-B ground path for N218BL shown in Figure 6, i.e., a left turn after take-off and a right turn shortly afterwards. Intercepting the 236° radial after take-off from runway 8 would require a slight left turn. Once intercepted, tracking the RBV 236 radial inbound would require a right turn to a magnetic heading of approximately 056° (236° - 180°), assuming no wind. This is the ground path depicted in Figure 6 until the end of the flight when the airplane made a 180° right turn.

The altitude profile for the accident flight shown in Figure 7 is less understandable. The initial climb appeared normal with the airplane climbing at the best-rate-of-climb speed for the Beechcraft B58 or 105 kt indicated airspeed. However, about 30 sec into the climb at 0904:20 and after accelerating to an airspeed[5] of 160-170 kt, the airplane leveled off at approximately 500 ft msl. The airplane was now in IMC and just above the reported 500 ft overcast ceiling (lower at WRI). It is unclear why the pilot delayed the climb or why he reported climbing "through" 500 ft to ATC at 0904:32 when, in fact, the airplane had leveled off at 500 ft 12 seconds earlier[6].

At 0905:10, N218BL initiated a second climb and ultimately leveled at 1,400 ft at approximately 0905:55. The airspeed remained at 160-170 kt. The airplane never made it to the 2,000 ft altitude assigned by ATC. Instead, at 0906:11, approximately 16 sec after leveling

[2] VAY is an uncontrolled airport. However, it has a Ground Communications Outlet (GCO) to provide a means for pilots on the ground to communicate with Flight Service Stations and ATC facilities for filing, opening, and closing flight plans.
[3] RBV is a Very High Frequency (VHF) Omni-Directional Range or "VOR" approximately 22 NM northeast of VAY. The RBV 236 radial is the first leg shown in Figure 4.
[4] The airplane had a slight right quartering tailwind taking off on runway 8 according to both the windsock captured in the security video and the WRI weather observation.
[5] The estimated airspeed is based on radar, ADS-B, and wind data from a 0900 EDT sounding over the accident site.
[6] The pilot did not advise ATC of leveling off, and ATC did not instruct him to do so.

off at 1,400 ft, the airplane began descending at over 5,000 ft/min[7] in a right-banked turn[8] as shown in Figures 7 and 8. The descent reversed direction at 0906:27 just below the reported overcast ceiling of 500 ft agl, and the airplane began a "zoom climb"[9] back up to a maximum altitude of 1,700 ft at 0906:35.

There appears to be a stall break in the estimated normal load factor and angle-of-attack shown in Figure 9 at about 0906:35. The airspeed was decelerating and quickly approaching the published wings-level, 1g, stall speed of 84 kt at this point. The airplane was initially banked 30° to the right before the break and snapped left to a bank angle of 60° after the break. The pitch attitude dropped abruptly, and the airplane impacted the ground approximately 14 sec after the apparent stall break, at 0906:49.

ADS-B as well as a witness statement suggest that N218BL stalled and came down at a high rate of descent approximately 6.4 NM from the departure end of VAY runway 8. A witness located about 1,450 ft south of the accident site reported that the weather conditions consisted of a low-cloud ceiling and a gentle breeze. The witness indicated that she heard an airplane flying "really low" to the ground, which she thought was "incredibly odd". She heard revving engines, as if keeping the airplane airborne was difficult. It sounded as if the airplane made one pass over her location, consistent with turning around and similar to what other small airplanes had done before. She then ran to a nearby fence line, and, as she was running, she saw the airplane overhead. She reported that the airplane turned, flew over the tree line, and "came down at an awful angle like it was trying to land, but the angle was too steep."

[7] ATC reported observing N218BL descend and saying, "What is going on with that guy?" Because the airplane was "descending drastically", ATC issued a low altitude alert but received no response from the pilot.
[8] Figure 8 shows the airplane entering a right bank of 60°-80° around 0905:55, about the same time the airplane leveled at 1,400 ft. The 180° right turn and the descent could indicate the pilot was attempting to return to the airport. However, the last intelligible communication with N218BL was at 0906:04, and the pilot did not mention returning to the airport.
[9] A zoom climb is a climb where the rate of climb is greater than the maximum sustainable climb.

E. SUMMARY AND CONCLUSIONS

According to ADS-B, wind, and airplane manufacturer data, the pilot of N218BL likely stalled the airplane while turning less than three minutes after take-off from South Jersey Regional Airport. The airplane was in approximately a 30º right-banked turn when it abruptly rolled left, pitched down and, ultimately, impacted terrain. The normal load factor went from 1g to -0.5g as the nose dropped.

The Beechcraft B58 Pilot's Operating Handbook and FAA Approved Airplane Flight Manual states that the possibility of an obstructed static port should be considered when the airplane has been exposed to moisture, especially on the ground. The weather observation reported one minute before the accident included mist and a 1°C temperature/dew point spread.

It could not be determined if N218BL had moisture in the static system on the accident flight. A partially obstructed static line will affect the altimeter, the vertical speed indicator, and the airspeed indicator, and the effects may be more pronounced during a climb or descent.

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F. Figures

Figure 1: Accident Airplane N218BL, a 1996 Beechcraft B58 Baron

Figure 2: Accident Site

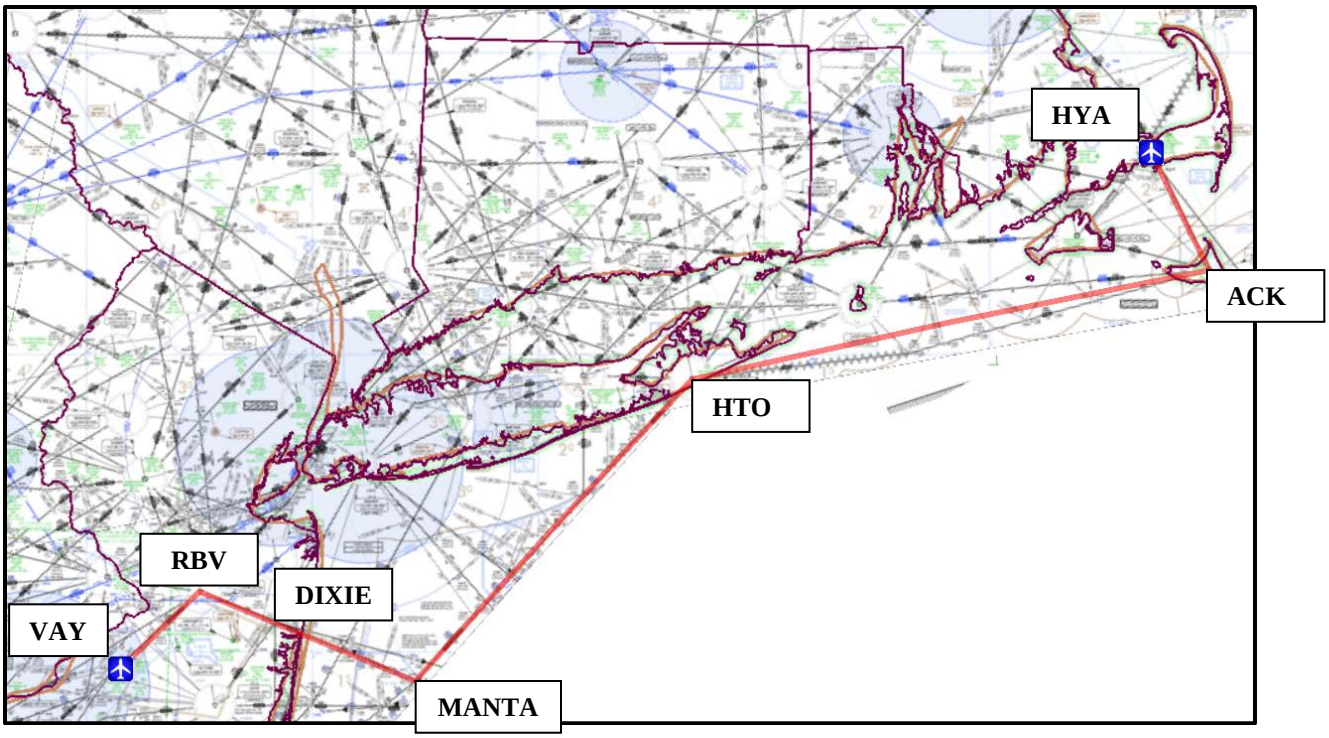

Figure 3: IFR Route: RBV, DIXIE, V276 MANTA, V139 HTO, ACK

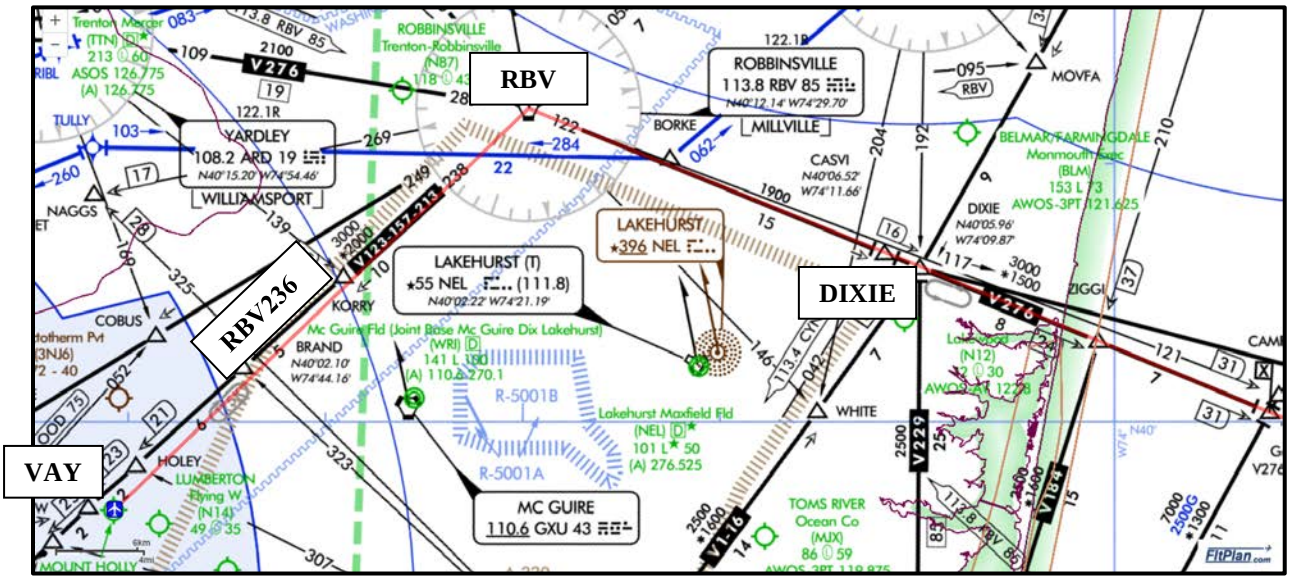

Figure 4: Departure Instructions: "Intercept the RBV236 radial inbound to RBV"

Figure 5: Security Video of N218BL Take-off

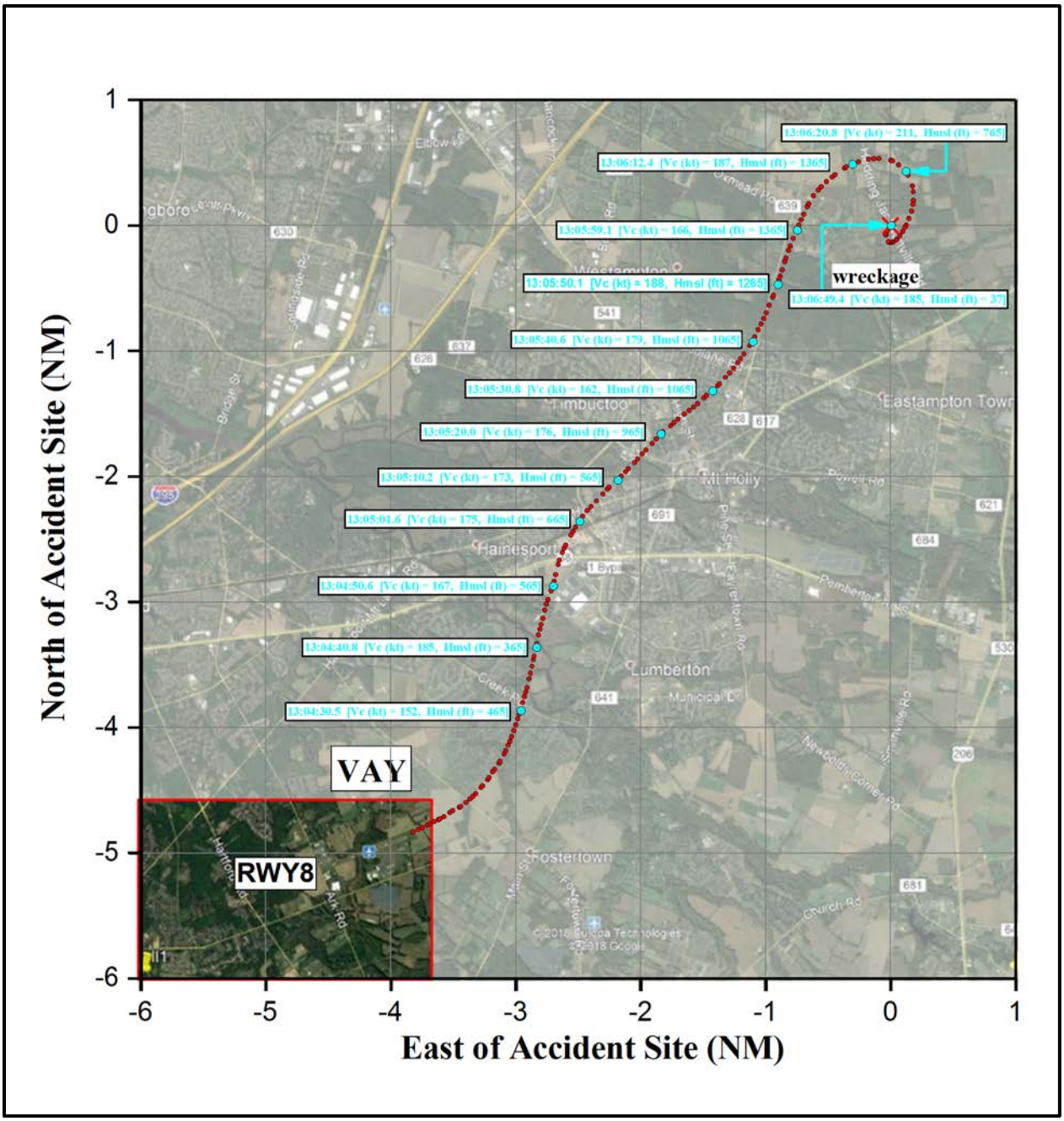

Figure 6: Ground Track based on ADS-B Data

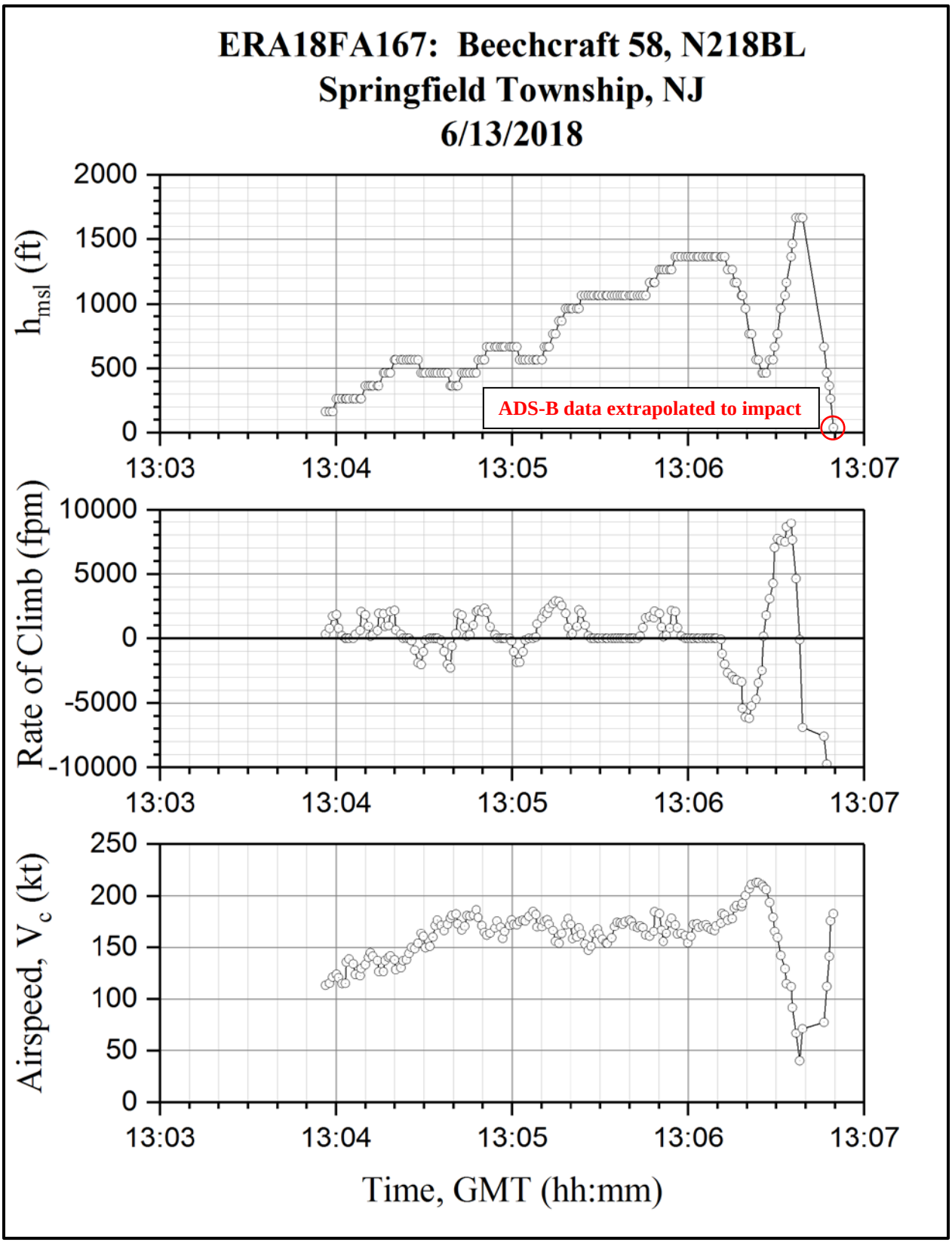

Figure 7: Altitude and Calibrated Airspeed Based on ADS-B Data

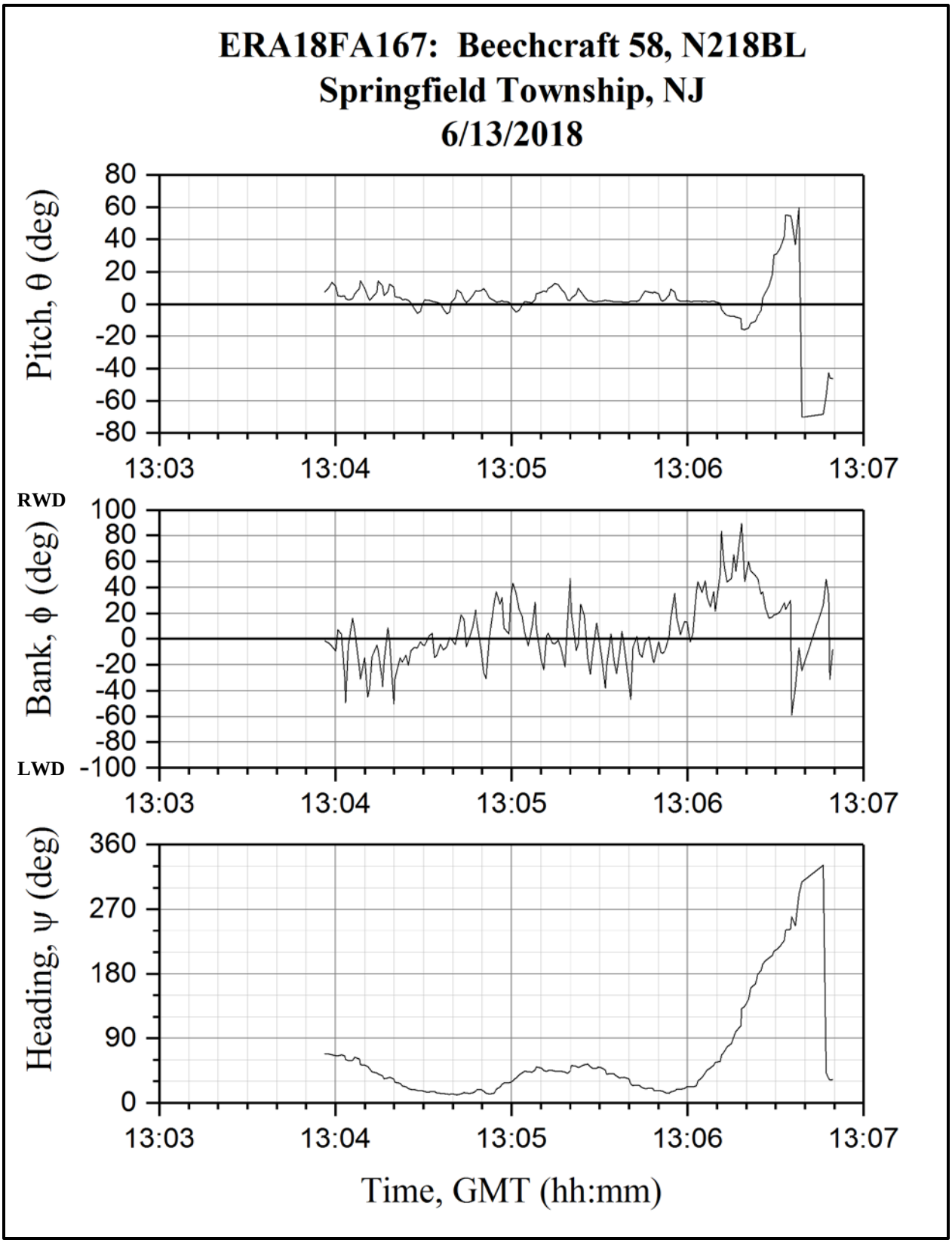

Figure 8: Pitch, Bank, and Heading Based on ADS-B Data

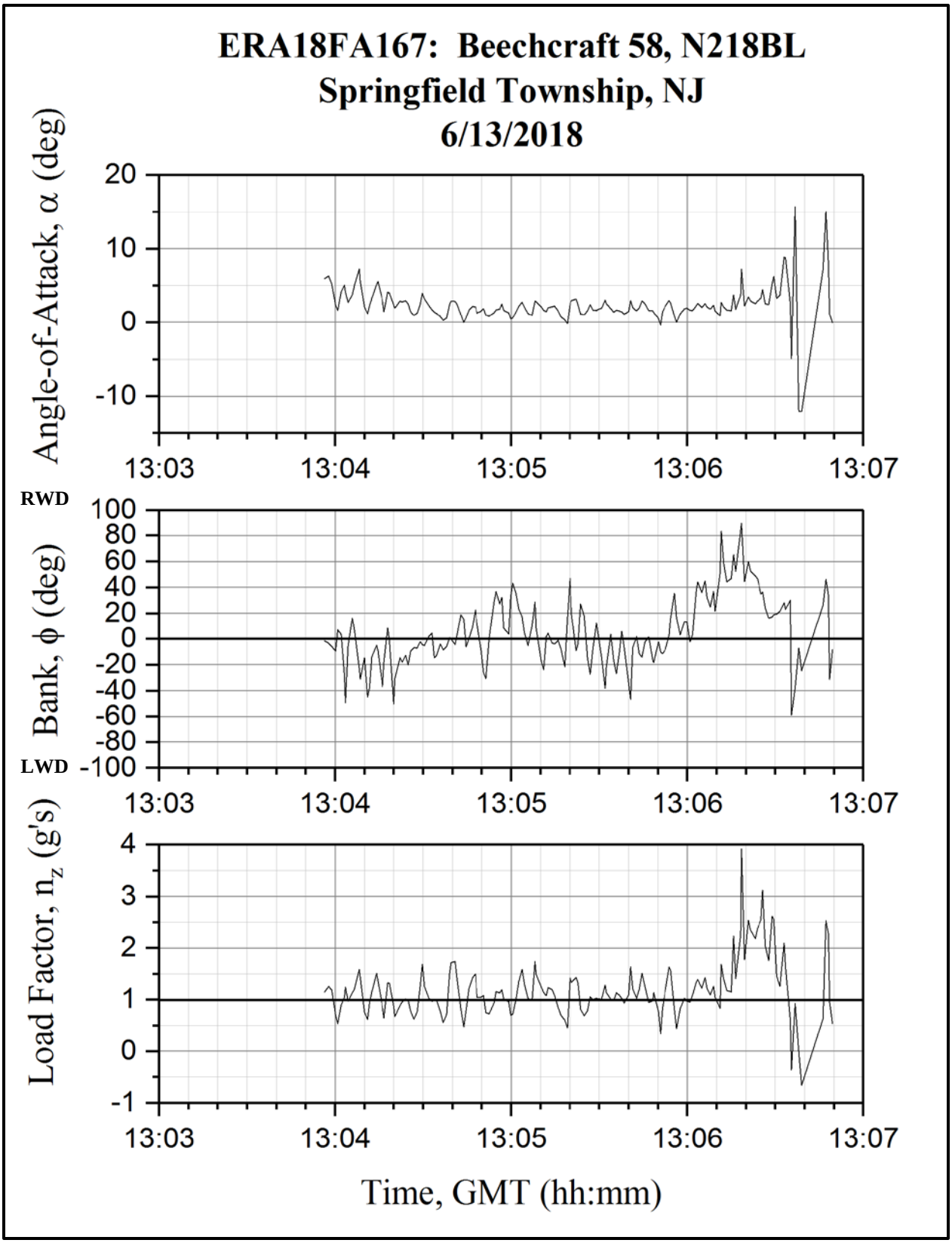

Figure 9: Estimated Angle-of-Attack, Bank Angle, and Normal Load Factor Based on ADS-B Data