National Transportation Safety Board

Office of Research and Engineering

Washington, DC 20594

CEN21FA130

VEHICLE PERFORMANCE

November 3, 2022

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A. ACCIDENT

Location: Janesville, Wisconsin
Date: February 16, 2021
Time: 0917 CST
1517 GMT
Airplane: Velocity V-Twin, N13VT

B. VEHICLE PERFORMANCE

No airplane performance group was formed.

C. SUMMARY

On February 16, 2021, about 0917 central standard time (CST), a Velocity V-Twin experimental, amateur-built, airplane, N13VT, was substantially damaged when it was involved in an accident near Janesville, Wisconsin. Both pilots sustained fatal injuries. The airplane was operated as a Title 14 Code of Federal Regulations (CFR) Part 91 ferry flight.

A review of automatic dependent surveillance-broadcast (ADS-B) data showed the airplane departed runway 32 at Wisconsin Regional Airport (JVL) about 0912. The flight was destined for Sebastian, Florida, for maintenance to be accomplished on the landing gear system and was operated in accordance with a Federal Aviation Administration (FAA)-issued Special Flight Permit with the limitation "gear to remain down during flight, co-pilot authorized," even though the airplane only required one flight crewmember.

According to air traffic control (ATC) recordings, about one minute and sixteen seconds after the take-off clearance was issued and after the airplane had departed, one of the pilots stated that they would like to circle back and land on runway 32 to "work through some engine issues." ATC acknowledged the request, asked the pilot to report turning final for runway 32, and asked if any assistance was needed. The pilot replied "no sir, we should be fine." No further radio communications were received from the accident airplane.

About 0917, the airplane impacted trees and came to rest inverted in a 3 ft-deep tributary of the Rock River about 1 mile south of JVL and sustained substantial damage to both wings, both canards, and the fuselage. Both fuel tanks were breached and a strong odor, consistent with 100LL aviation fuel, was present at the accident site. See Figure 1 for an overview of the take-off.

Times in the study are quoted in CST. Greenwich Mean Time (GMT) = CST + 6 hr.

D. THE AIRPLANE

A picture of the accident airplane, an experimental, amateur-built, Velocity V-Twin, is shown in Figure 2. The kit airplane was built in 2020 and is registered to N13VT, LLC.

E. WEATHER SUMMARY

A routine weather observation for Wisconsin Regional Airport about thirty-two minutes before the accident was reported as:

METAR KJVL 161445Z 34009KT 10SM BKN050 M14/M18 A3010

The automated surface weather observation at Wisconsin Regional Airport on February 16 at 0845 CST reported wind from 340˚ at 9 knots (kt); 10 statute miles visibility; broken ceiling at 5,000 ft above ground level (agl); temperature -14˚ Celsius (C), dew point -18˚C; altimeter 30.10" of mercury.

F. AIRPLANE PERFORMANCE STUDY

The airplane performance study is based largely on data from two Garmin G3X displays that were recovered in the wreckage, one configured as a primary flight display (PFD) and one as a multi-function display (MFD). See the "Cockpit Displays – Recorded Flight Data" Specialist's Factual report for more details.

In addition, the study used 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 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 in both the horizontal and vertical dimensions. GPS augmented with the Wide Area Augmentation System (WAAS) is accurate to approximately 1.5 – 2 meters.

Figure 3 shows the ADS-B position data and MFD altitude[1] and airspeed for the five-and-a-half-minute flight in an overhead view. Communications between N13VT and the control tower are denoted in blue. Figure 4 shows the same parameters as well as the estimated rate-of-climb (ROC) in a time history format.

[1] JVL is at an altitude of 808 ft msl.

Figure 5 includes airplane attitude information from both the PFD and that estimated from ADS-B data. The bank angle momentarily reached a maximum magnitude of approximately 30˚.

The PFD also recorded linear accelerations except in the lateral direction. Longitudinal and vertical accelerations for the flight are shown in Figure 6 along with an estimated angle-of-attack. Nothing in the acceleration data indicate a problem.

However, Figure 7 includes engine parameters recorded by the MFD for "Engine B" that indicate one of the engines, most likely the right engine[2], stopped producing power around 0913:55 when N13VT began its descent to JVL. The engine exhaust gas temperature (EGT) decreased from normal operating temperatures at the top of N13VT's climb to less than 100˚F over a four-minute period.

Finally, Figures 8 and 9 include MFD data from the previous flight from Appleton International Airport (ATW) in Appleton, Wisconsin, to JVL the morning of the accident. The flight lasted 41 minutes and covered approximately 100 nautical miles (NM).

Figure 8 is a comparison of the accident take-off with the previous take-off from ATW. Altitude data show a reduction in the flight path angle[3] for the accident flight about nine seconds after the flight crew indicated that they would like to circle back to land and work through an engine issue at 0912:46.0. There is no reduction in flight path angle for the previous take-off.

Figure 9 shows MFD airspeed, altitude, fuel flow, and engine crankshaft speed in revolutions per minute (RPM) for the entire flight from ATW. The flight was a CFR Part 91 ferry flight, and the FAA-issued Special Flight Permit stipulated that occupancy was "limited to the pilot, essential crew required to operate the aircraft and its equipment and personal baggage". Additional limitations were added stipulating that "gear to remain down during flight, co-pilot authorized," even though the airplane only required one flight crewmember[4].

However, the MFD data indicate that the previous flight was operated well above the landing gear down extended speed, VLE, of 140 kt calibrated airspeed (KCAS) and the landing gear operation speed, VLo, of 120 KCAS, despite the ferry

[2] N13VT is experimental, amateur-built, and it could not be confirmed how the Garmin G3X's were configured. "Engine B" is likely the right engine, and data for the other engine were not stored.

[3] The flight path angle is the angle between the airplane's velocity vector and the horizon. The flight path angle is reflected in the slope of the altitude time history and the rate of climb.

[4] The flight from ATW to JVL was the only ferry flight prior to the accident.

permit limitation. In addition, the recorded fuel flow was close to that for an engine at 75% cruise power as per the Pilot's Operating Handbook (POH)[5].

G. SUMMARY AND CONCLUSIONS

Seconds after take-off, the flight crew of N13VT reported to the tower, "We'd like to circle back and land runway 32 and … work through some engine issues if we could". Subsequent tear-down of the engines revealed a chaffed wire for the left engine oil pressure sender. Based on ATC communication, the engine tear-down, recovered MFD data, and POH rate-of-climb data[6], it appears that the flight crew may have shut down the left engine seconds after their radio call as a precautionary measure[7]: at 0912:50, the MFD recorded a reduction in the flight path angle.

The MFD also recorded what is likely the right engine shutting down about the time of descent or 0913:55. In addition, a thread impression was found on one of the recovered wood propeller blades from the right engine. See Figure 10. It is possible that the right gear door (which has not been found) along with one or more of the attachment screws detached from the airplane and struck the right propeller resulting in a loss of power on the right engine. See Figure 11 for a representative gear door.

The right gear door attachment points may have been weakened by the higher air loads associated with airspeeds exceeding VLE (with the gear down) as well as higher-than-normal sideslip angles that would have been required with the left engine shut down.

With both engines inoperative, N13VT likely did not have the energy required to glide back to the airport[8]. The airplane location when the engine shut-downs likely occurred are highlighted in orange in Figure 12.

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[5] While the fuel flow was higher and the cruise speed lower for the flight from ATW as compared to those published in the POH at 75% cruise power, this could be a result of the additional drag associated with having the gear extended.

[6] The POH best single-engine rate-of-climb at maximum gross weight is 450 ft/min. The best single-engine rate-of-climb speed is 105 KCAS.

[7] Besides the chaffed oil pressure sender wire on the left engine, no other problems were found with the engines during the post-accident tear-down.

[8] The POH states that the best glide speed is dependent on gross weight and should be established with both engines inoperative. However, it does not list any speed(s). It also states that the glide ratio is reduced radically when the gear is lowered.

H. FIGURES

Figure 1: The Five-and-a-Half-Minute Flight Departed JVL with Sebastian, FL, as the Ultimate Destination

Figure 2: Accident Airplane, N13VT, an Experimental, Amateur-Built, Velocity V-Twin

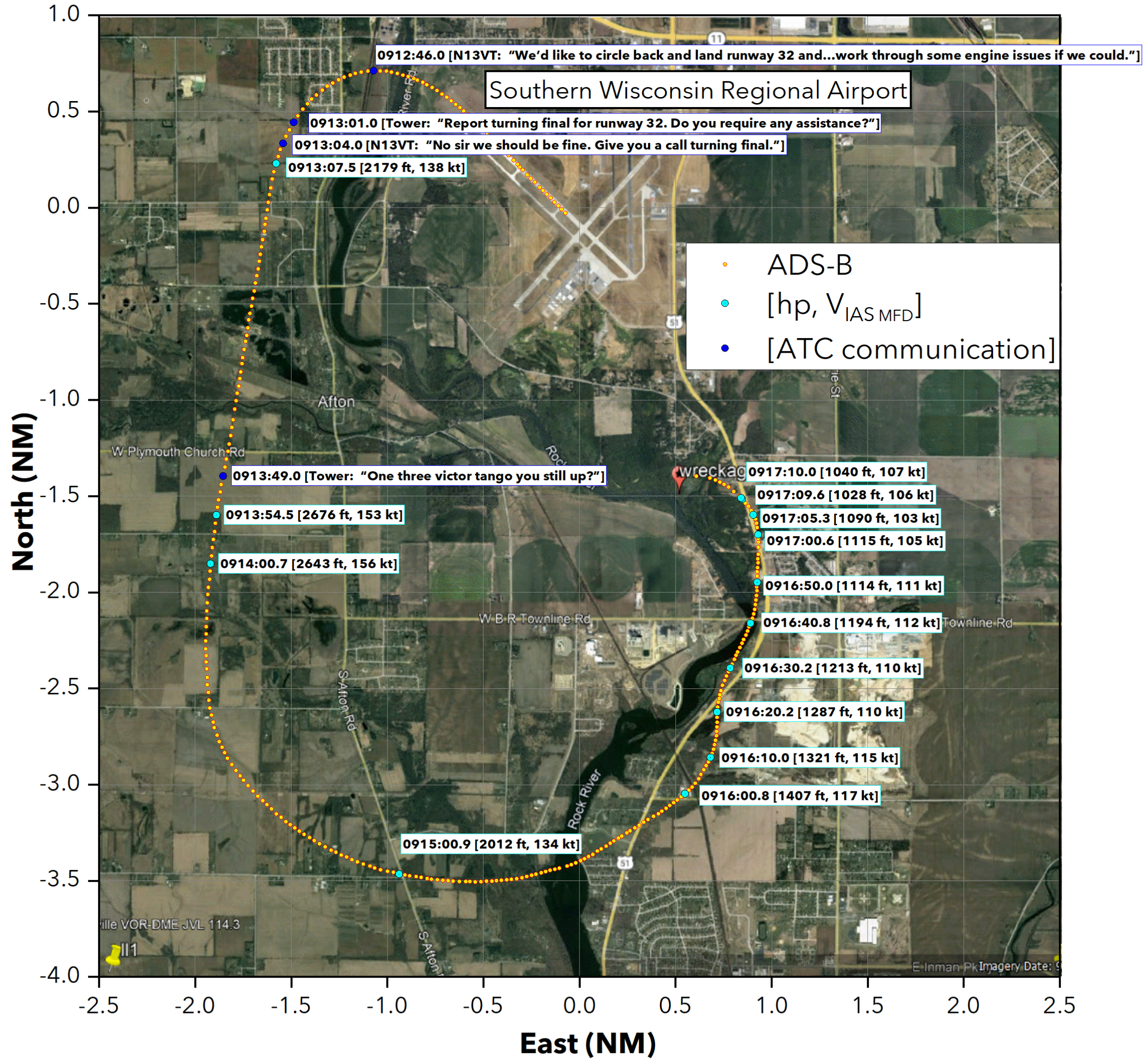

Figure 3: Position, Altitude and Airspeed for the Accident Flight

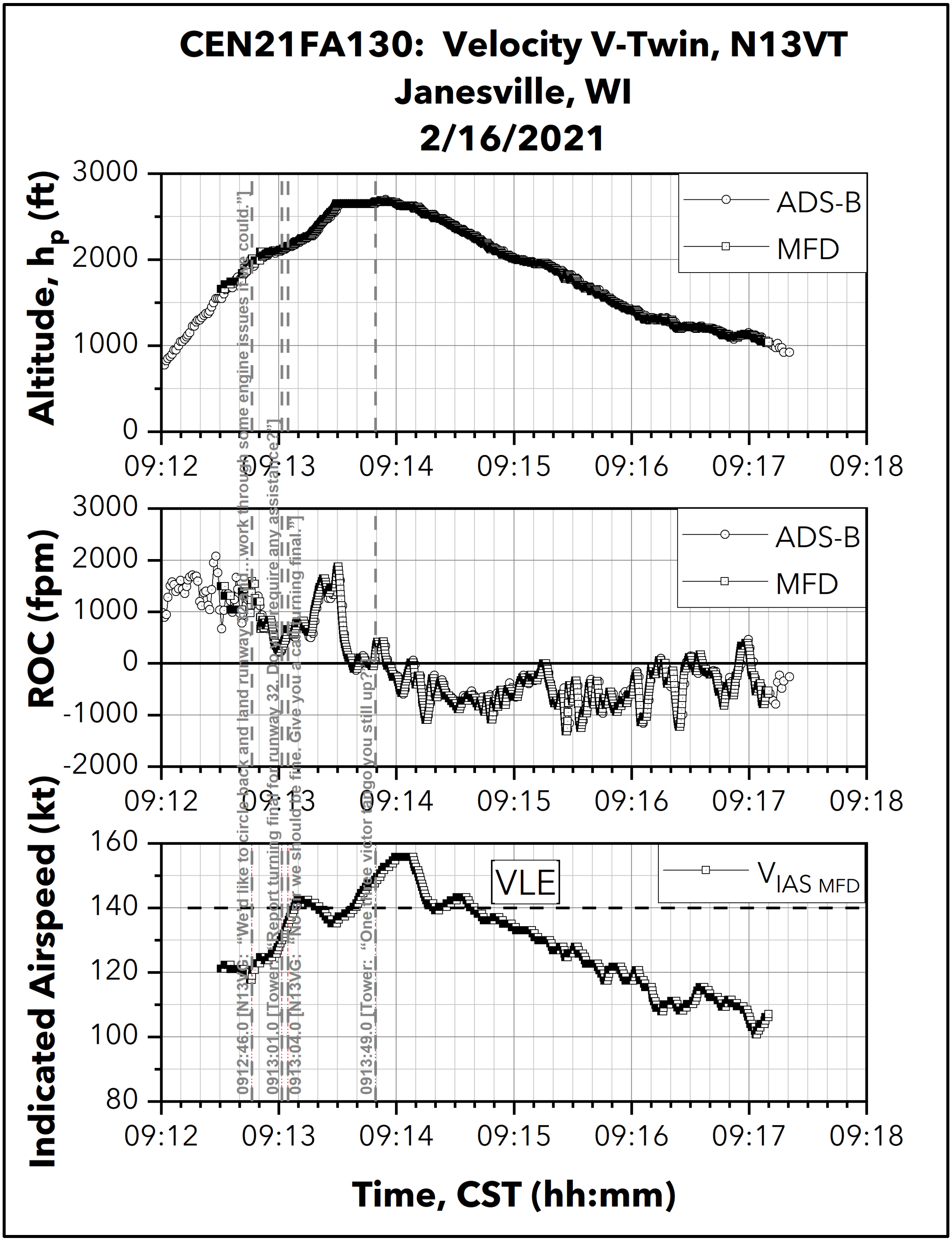

Figure 4: Altitude, ROC, and Airspeed for Accident Flight

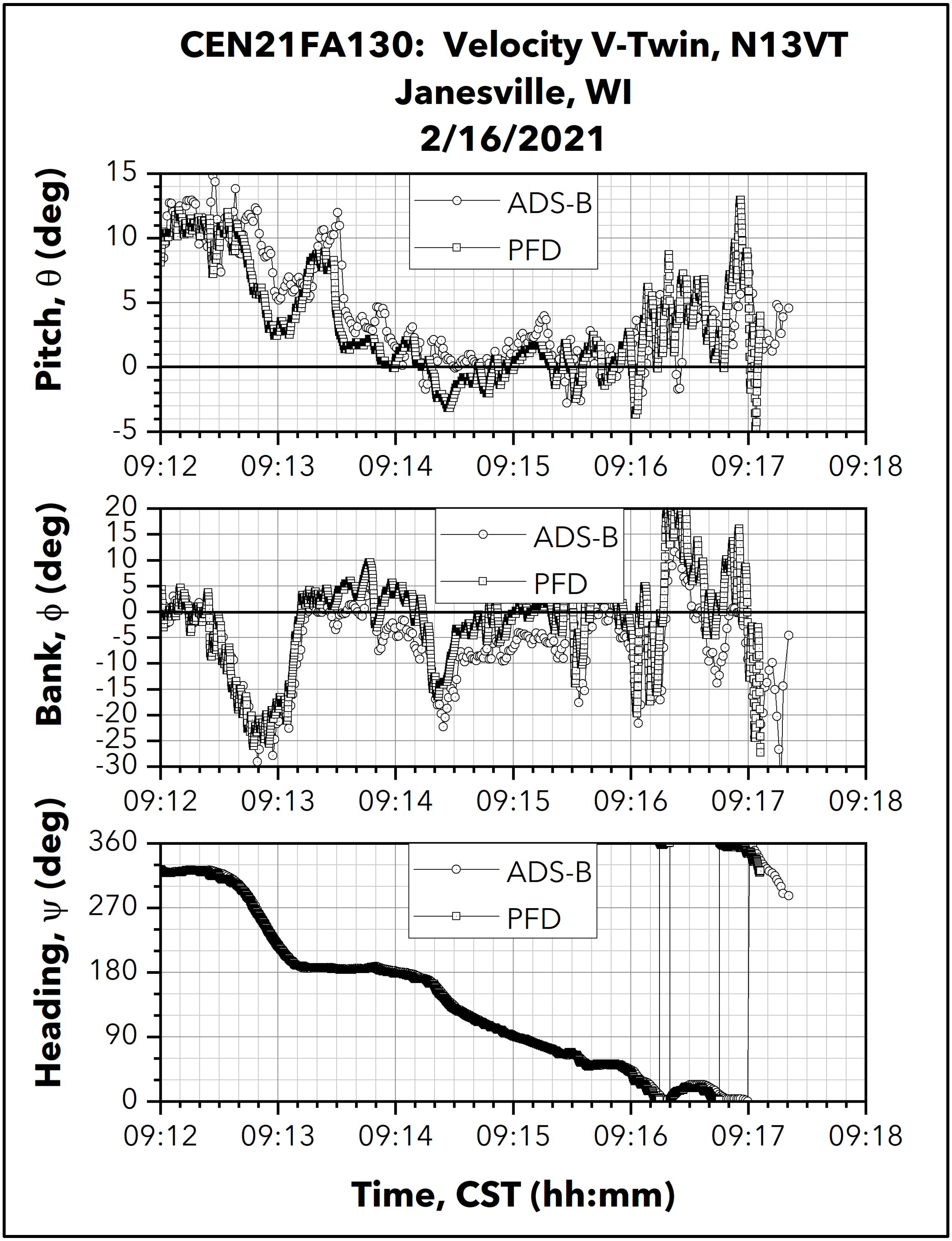

Figure 5: Pitch, Bank, and Heading Angles for Accident Flight

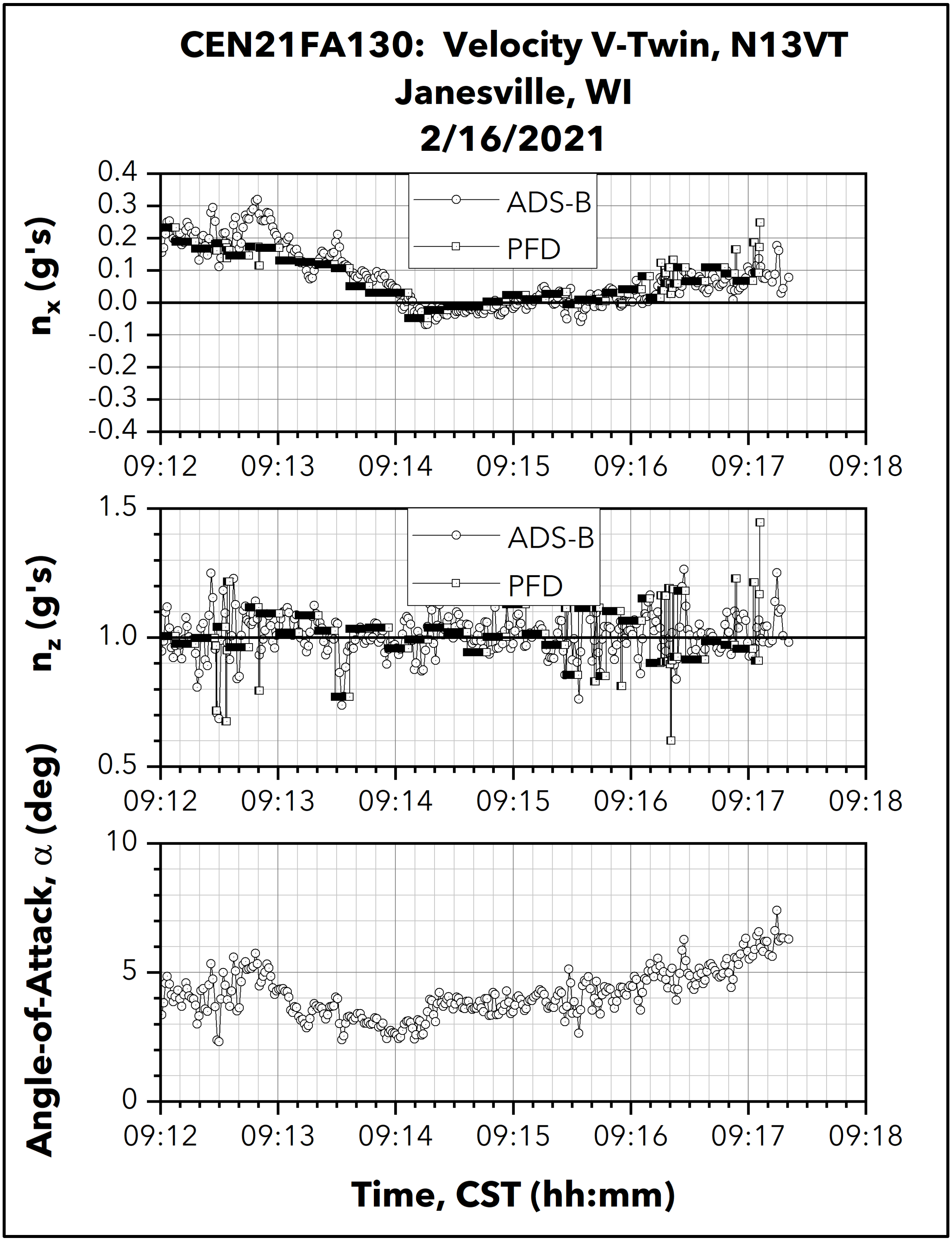

Figure 6: Longitudinal / Normal Load Factors and Estimated Angle-of-Attack for Accident Flight

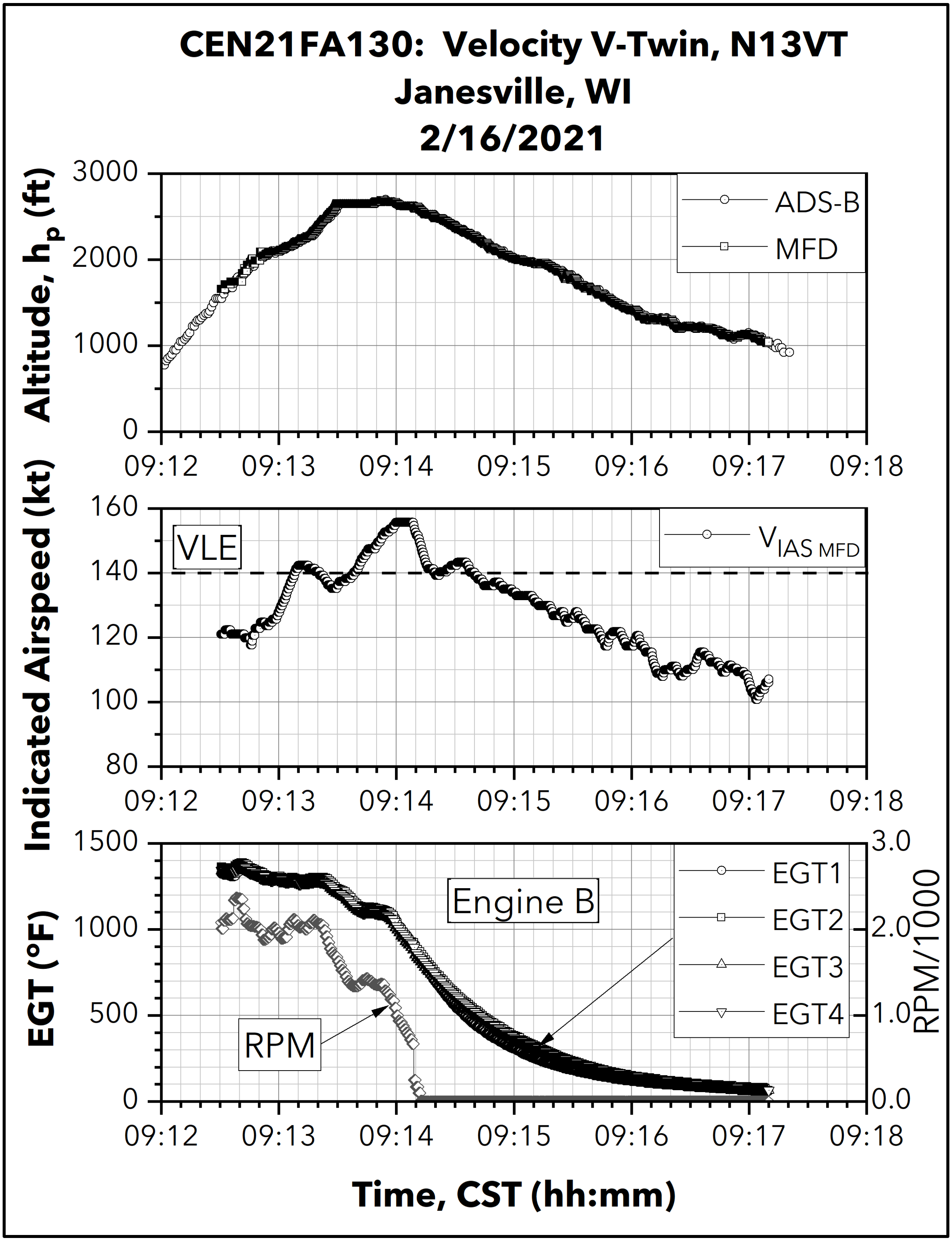

Figure 7: Altitude, Airspeed and Engine EGT for Accident Flight

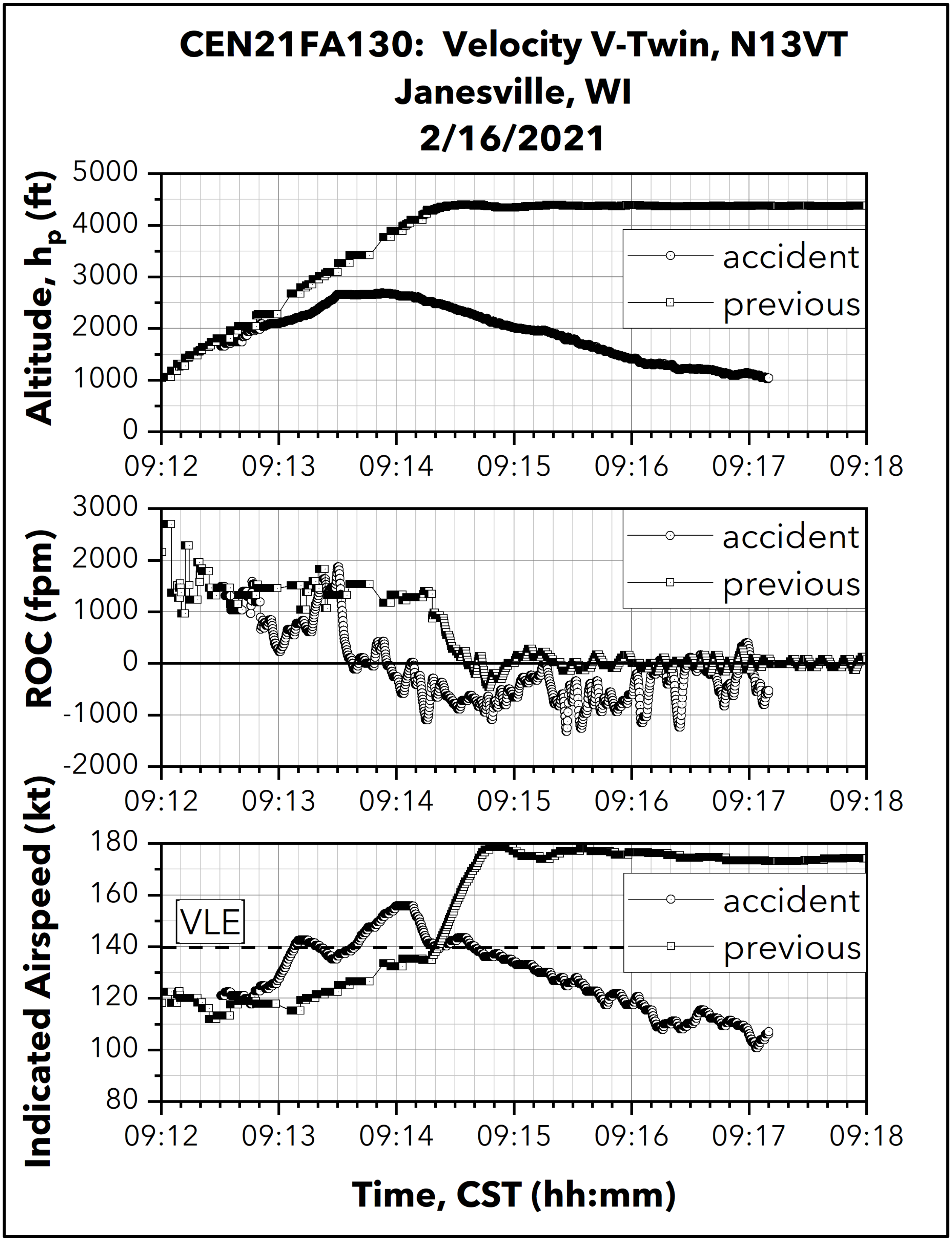

Figure 8: Altitude, ROC, and Airspeed for Accident and Previous Take-offs

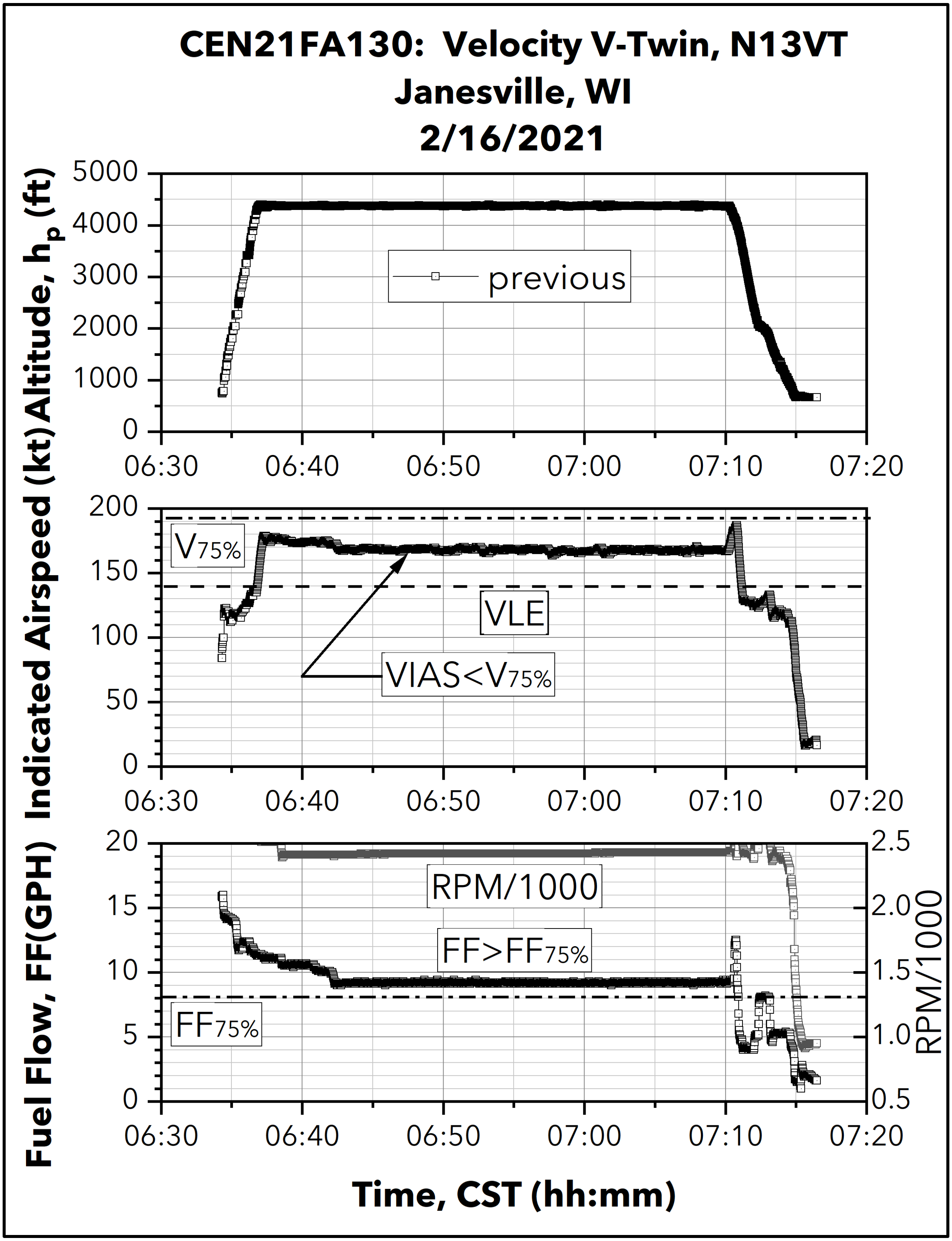

Figure 9: Altitude, Fuel Flow, and Engine RPM for Previous Flight

Figure 10: Thread Impression on Right Engine Propeller

Figure 11: Representative Gear Door

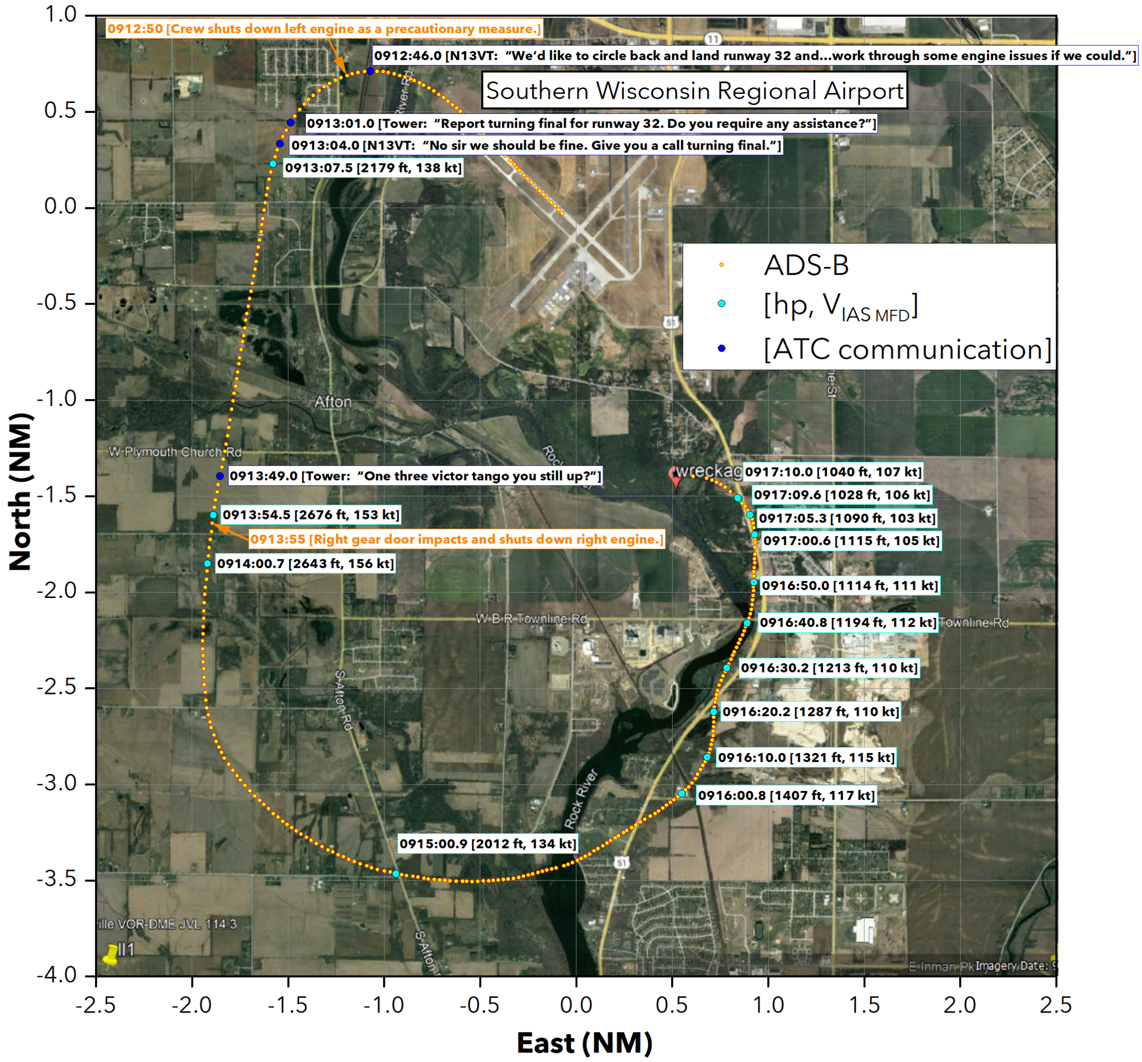

Figure 12: Position, Altitude and Airspeed for the Accident Flight Possible Engine Shut-downs Highlighted in Orange