

National Transportation Safety Board

Office of Research and Engineering

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ERA22FA114

AIRPLANE PERFORMANCE STUDY

March 24, 2023
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A. ACCIDENT

Location: Danville, Virginia
Date: February 1, 2022
Time: 1006 EST
1506 GMT
Airplane: Cessna 310R, N622QT

B. AIRPLANE PERFORMANCE STUDY

No airplane performance group was formed.

C. SUMMARY

On February 1, 2022, at 1006 eastern standard time (EST), a Cessna 310R, N622QT, was destroyed when it impacted terrain in Danville, Virginia, shortly after take-off. The commercial pilot was fatally injured. The airplane was operated by Sol Aerial Surveys, LLC, as an aerial survey flight conducted under the provisions of Title 14 Code of Federal Regulations Part 91. Visual meteorological conditions prevailed, and no flight plan was filed for the flight which originated at the Danville Regional airport (DAN), Danville, Virginia, at 1003 EST.

Times in the study are quoted in EST. Greenwich Mean Time (GMT) = EST + 5 hr.

D. THE AIRPLANE

A picture of the accident airplane, a Cessna 310R, is shown in Figure 1. The airplane was manufactured by Cessna in 1976 and is registered to Sol Aerial Surveys, LLC.

E. WEATHER SUMMARY

The Automated Surface Observing System (ASOS) at DAN recorded the following observation 13 minutes before the accident:

KDAN 011453Z AUTO 06007KT 10SM CLR 01/M04 A3047

The automated surface weather observation at Danville Regional airport on February 1 at 0953 EST is wind from 060° at 7 knots (kt); 10 statute miles visibility; clear skies; temperature 1° Celsius (C); dew point -4°C; altimeter 30.47" mercury.

F. AIRPLANE 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 in both the horizontal and vertical dimensions. GPS augmented with the Wide Area Augmentation System (WAAS) is accurate to approximately 1.5 – 2 meters.

Figures 2 and 3 show the ADS-B ground track for the three-minute flight. In addition, Figure 2 includes the ADS-B altitude and estimated airspeed in yellow. Figure 4 is a time history of the ADS-B altitude and ground speed.

Figure 4 indicates that at approximately 1004:15, the airplane climb rate subsequently decreased from 1,200 ft/min to about 500 ft/min, and the acceleration stopped¹ with the ground speed remaining relatively constant at around 130 kt. The airplane ultimately reached a maximum recorded altitude of about 2,625 ft msl at 1005:44, four seconds after the airplane began a 10°-bank-angle left turn. Estimated bank angle is shown in Figure 5.

Ten seconds after turning left, the airplane returned to wings-level and then rolled right at about 3 deg/sec while descending at more than 1,000 ft/min. The last estimated bank angle was over 60° to the right at an altitude of 1,175 ft msl.

Figures 6 and 7 show the positions of the left and right fuel selectors, respectively, found in the wreckage. The left engine was set to "LEFT ENGINE OFF" while the right was found set to "LEFT MAIN 50 GAL". It could not be determined when the left fuel selector was turned off.

The wreckage examination also found the left throttle was near idle and the left propeller was near feather, while the right throttle was full forward and the right propeller was at low pitch. The mixture was set full rich for both left and right engines.

¹ Engine data from a previous take-off were compared to the accident flight, and a reduction in power were observed during both flights. However, the accident flight also had an associated climb rate reduced to less than 200 ft/min at one point.

If the accident pilot had shut down or was in the process of shutting down the left engine during the take-off, in addition to the reduction in available power, the lateral/directional handling qualities of the airplane would also change significantly. The indicated airspeed would have to be maintained faster than the air minimum control speed (V_{mc}) of 80 kt published in the Cessna Model 310R Pilot's Operating Handbook (POH) to maintain directional control. The recorded ground speed and the winds reported at the time of the accident suggest that N622QT never slowed below an airspeed of 120 to 130 kt.

However, the airplane POH assumes that full opposite rudder is used to counter the yawing moment that results from the engine failure, that the inoperative propeller is feathered, and that 5° of bank into the operating engine is used to balance the side force generated by the full rudder input. Figure 8 shows the balance of forces and moments for V_{mc} with the left engine inoperative. If these conditions do not exist, the airplane can quickly become uncontrollable at airspeeds much higher than V_{mc} .

Figure 9 shows the balance of forces and moments for the case where the airplane is (improperly) banked 5° into the inoperative engine. When the airplane is banked into the inoperative engine, sideslip is the only means to balance the lateral component of weight. The negative sideslip that is required then compounds the engine-out asymmetry and effectively reduces the yawing moment generated by the rudder for directional control.

Assuming the left engine was not operating, the accident airplane banked into the inoperative engine at approximately 1005:40 and 2,575 ft msl as highlighted in Figure 3 and then subsequently rolled right until the end of the ADS-B data at 1006:11.

G. SUMMARY AND CONCLUSIONS

The fuel selector for the left engine on N622QT was found in the "LEFT ENGINE OFF" position, the left throttle was near idle, and the left propeller was near feather. In the case of an engine failure during take-off, the airplane manufacturer's POH specifies that 5° bank angle into the operative engine be established at a speed greater than 92 kt.

The accident flight banked into the likely inoperative left engine at 1005:40 at an airspeed of approximately 136 kt. The last ADS-B return was received at 1006:11. While the published minimum controllable airspeed for the Cessna 310R is 80 kt, this airspeed increases dramatically with improper airplane bank angle.

The investigation could not determine the reason for the decreased climb performance and acceleration recorded in the ADS-B data other than the left throttle near idle, the left propeller near feather and the fuel selector for the left engine found in the off position.

Submitted by:

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H. FIGURES



**Figure 1: Accident Airplane, N622QT, a Cessna 310R,
Manufactured by Cessna in 1976**

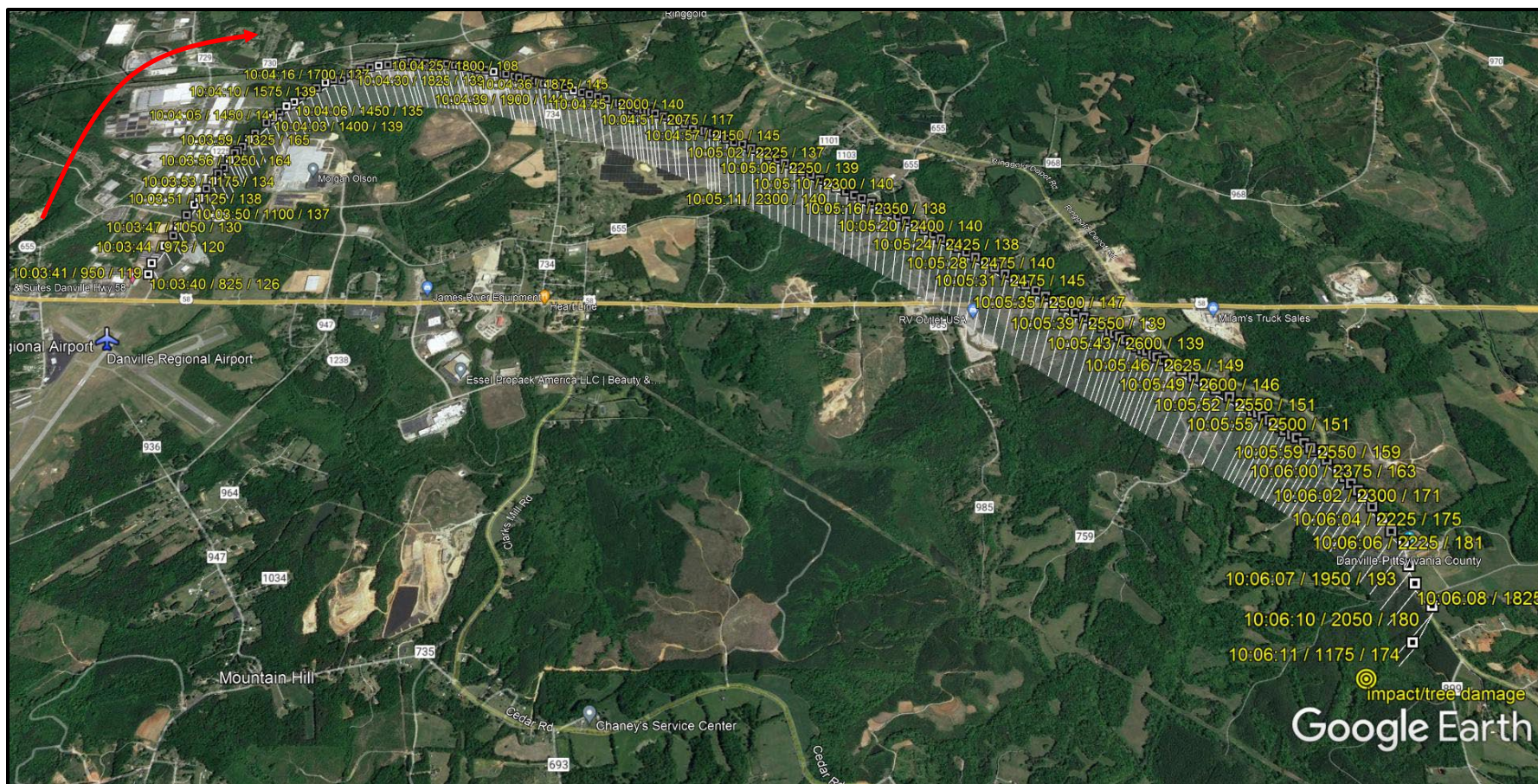


Figure 2: ADS-B Ground Track for Accident Flight with Time (EST), Altitude (ft, msl), and Estimated Airspeed (kt)

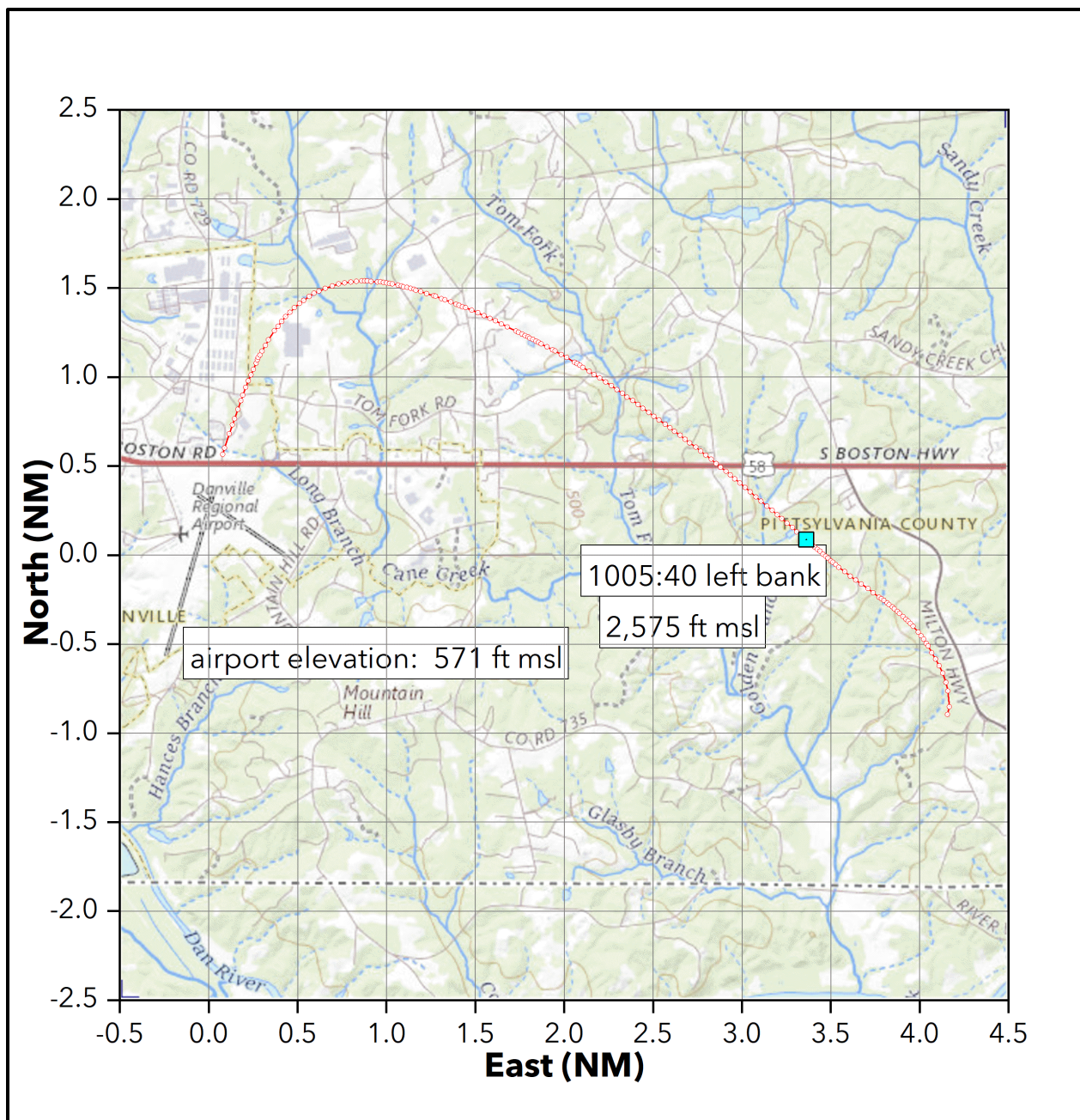


Figure 3: ADS-B Ground Track with Left Bank Angle Denoted

ERA22FA114: Cessna 310, N622QT
Danville, VA
2/1/2022

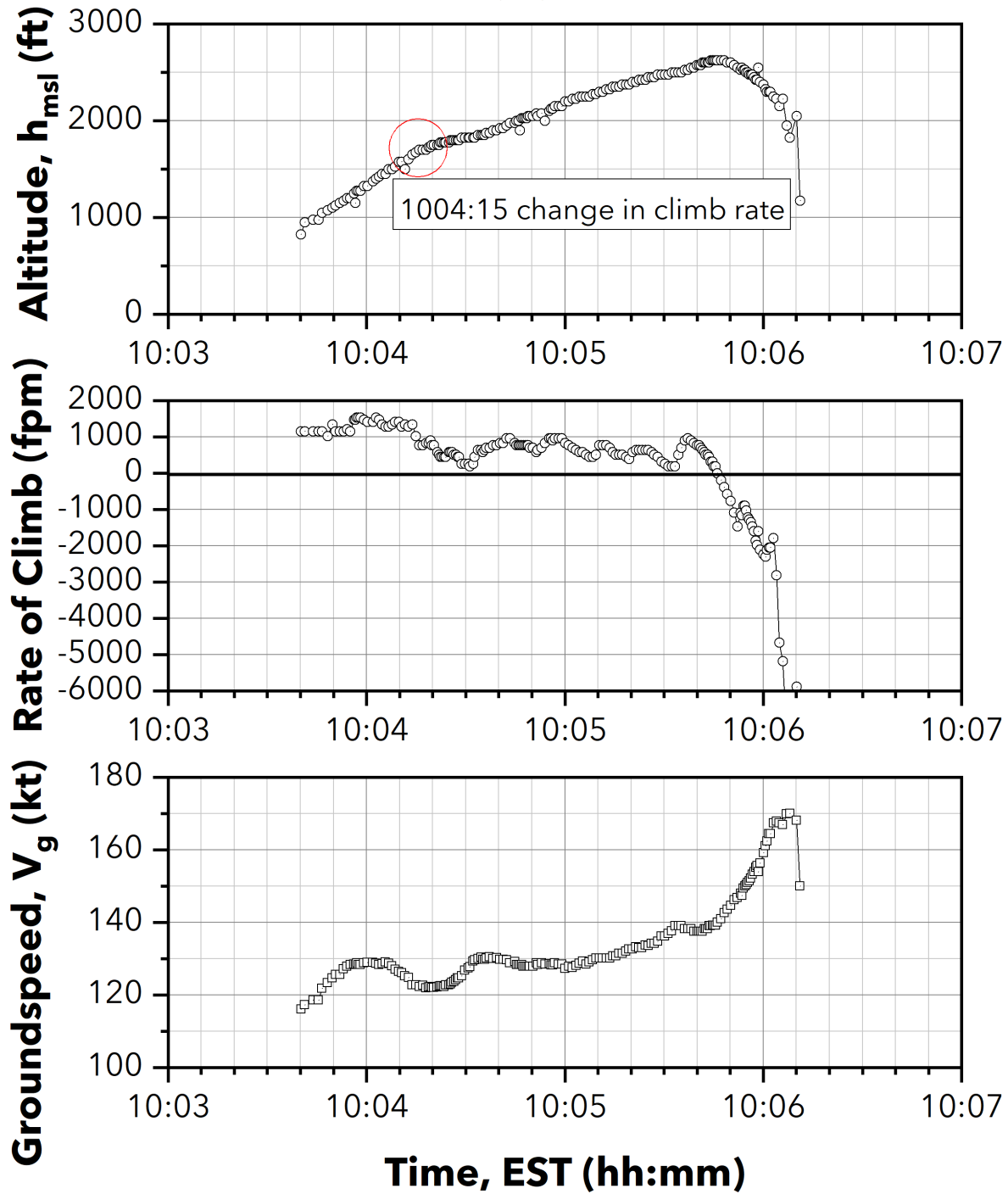


Figure 4: ADS-B Altitude and Ground Speed

ERA22FA114: Cessna 310, N622QT
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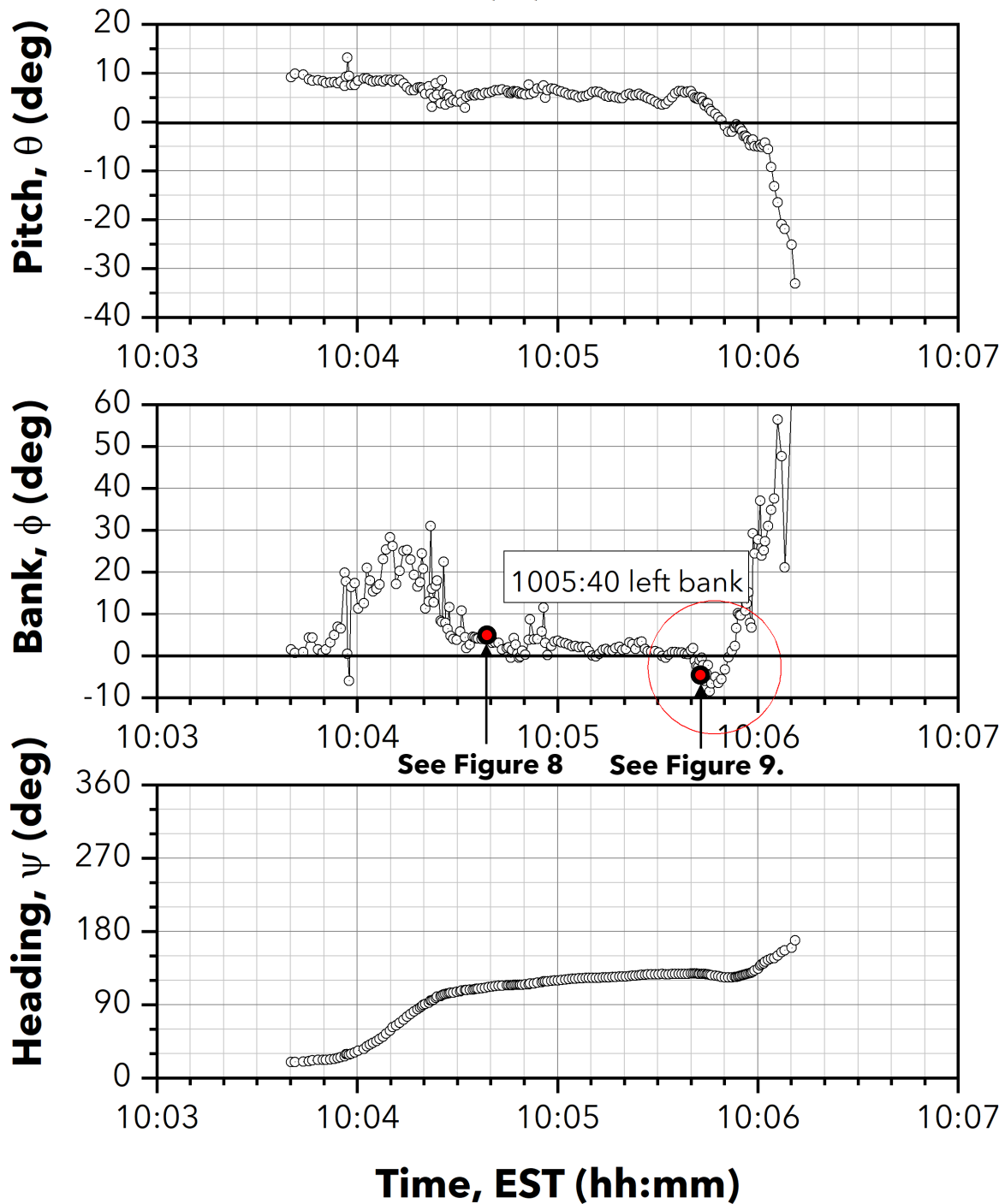


Figure 5: Estimated Pitch, Bank, and Heading Angles



Figure 6: Left Engine Fuel Selector set to "LEFT ENGINE OFF"

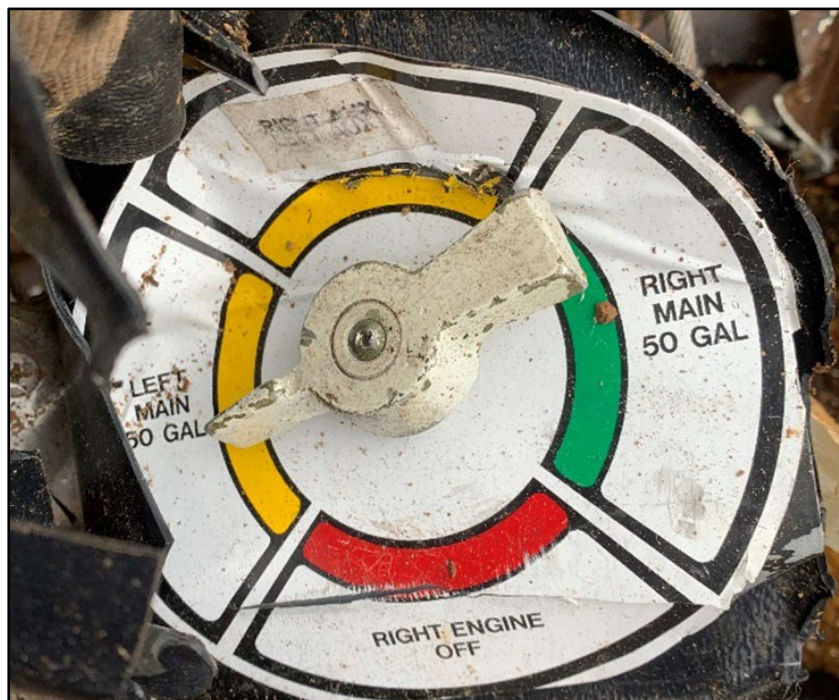
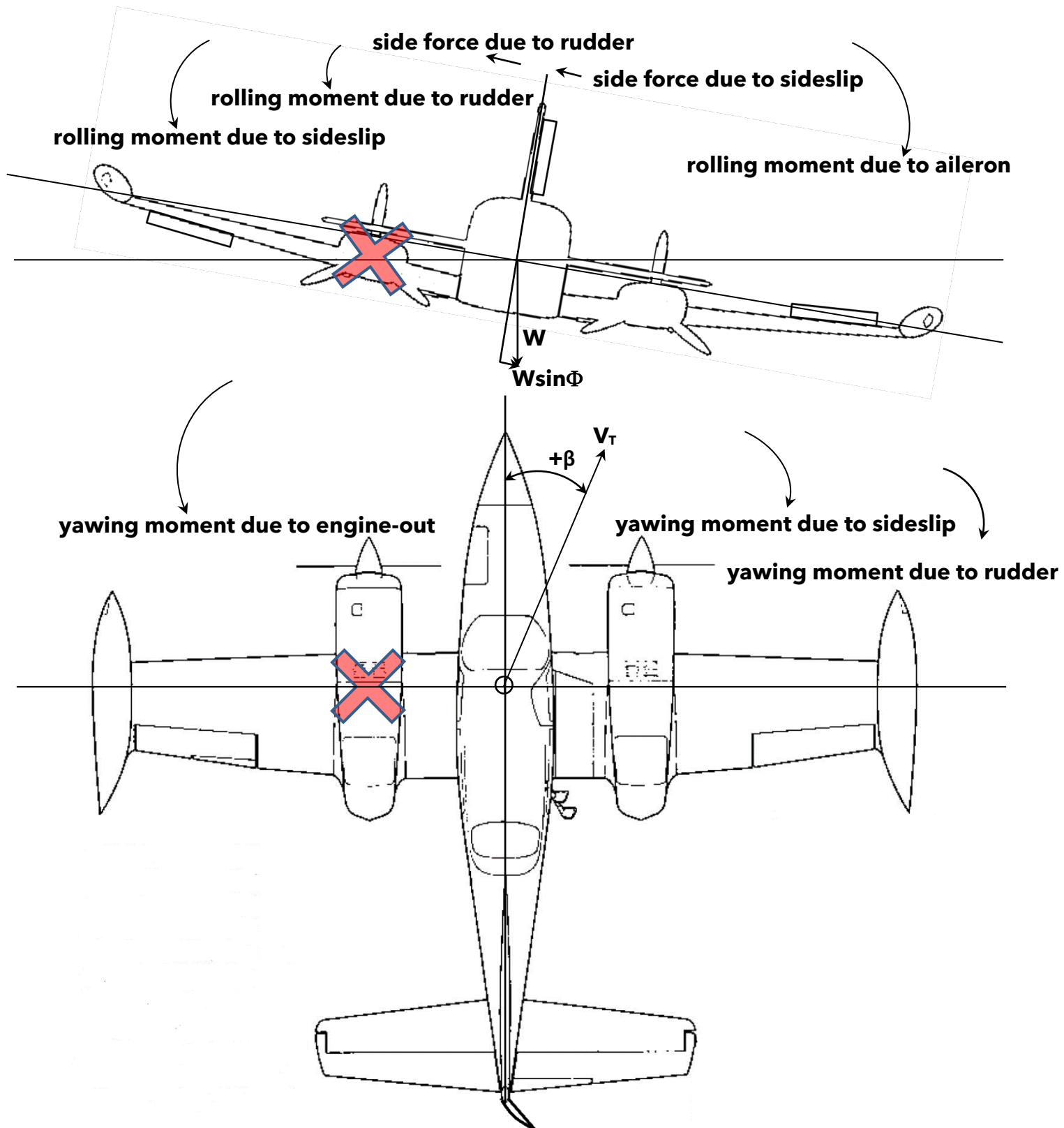
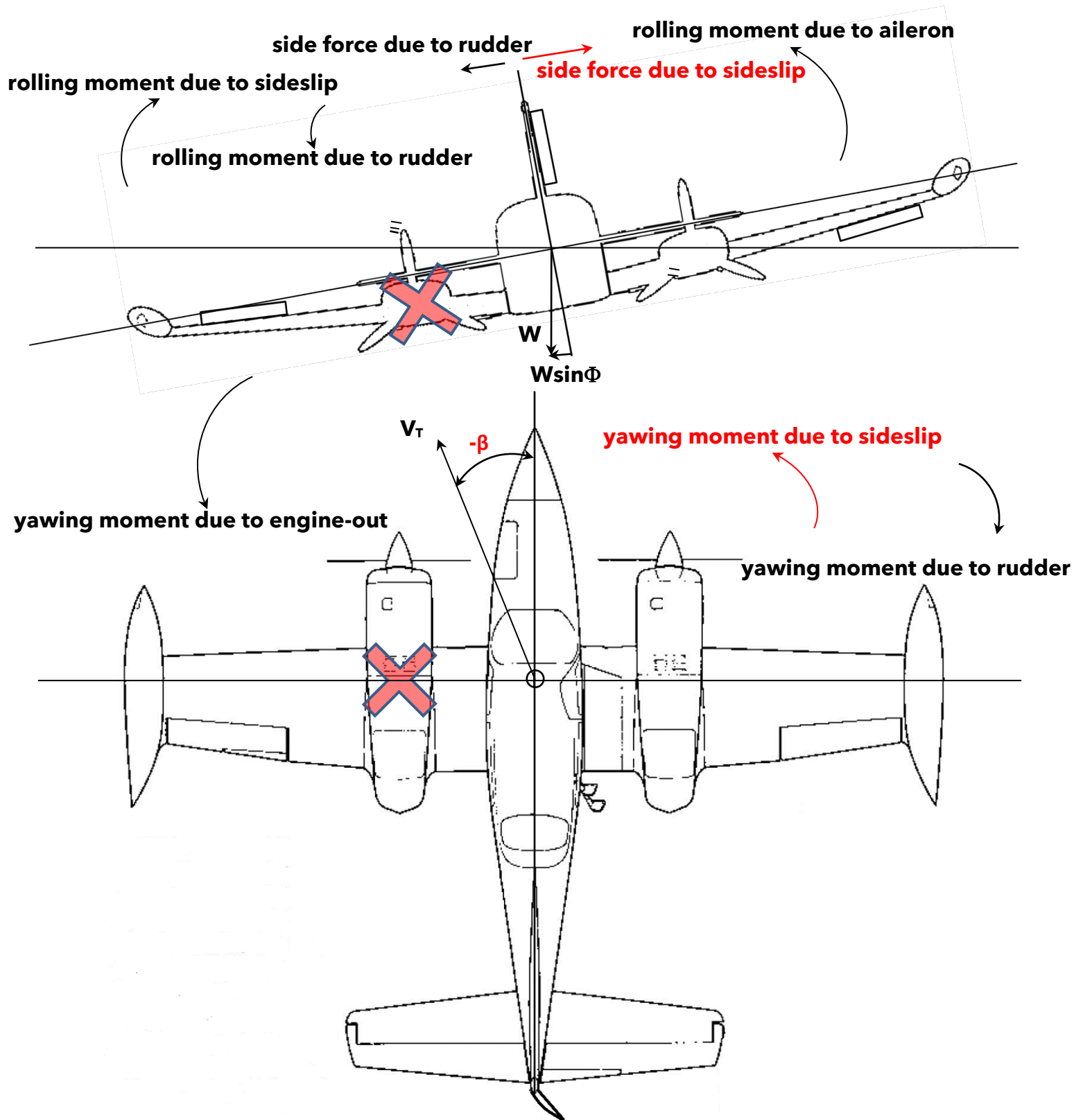


Figure 7: Right Engine Fuel Selector set to "LEFT MAIN 50 GAL"



**Figure 8: V_{mc} Defined with 5° Bank into the Operating (Right) Engine
(As Viewed from Rear and Top, Respectively)**



**Figure 9: Improper Left Bank with Left Engine Inoperative
(As Viewed from Rear and Top, Respectively)**