



Aviation Investigation Final Report

| | | | |
|--------------------------------|--------------------------------------|-------------------------|------------------|
| Location: | Hermantown, Minnesota | Accident Number: | ERA23FA001 |
| Date & Time: | October 1, 2022, 23:17 Local | Registration: | N262TA |
| Aircraft: | Cessna 172S | Aircraft Damage: | Substantial |
| Defining Event: | Loss of control in flight | Injuries: | 3 Fatal, 2 Minor |
| Flight Conducted Under: | Part 91: General aviation - Personal | | |

Analysis

The pilot and two passengers were departing on a night instrument flight rules (IFR) flight when the accident occurred just after takeoff. Weather at the time of and preceding the takeoff consisted of low ceilings, low visibility, and mist with low-instrument-flight-rule (LIFR) conditions expected through most of the area. The pilot received an IFR clearance with direction to climb to 6,000 ft on departure and was issued a departure frequency that was read back incorrectly by the pilot. The air traffic controller provided taxi and takeoff instructions, as well as the weather conditions, which included a recent pilot report indicating that the instrument meteorological conditions would likely persist after the accident pilot departed. The controller cleared the airplane for takeoff with a right turn direct on departure and reported the wind and runway visual range, which was acknowledged by the pilot.

After takeoff the pilot made a right turn but failed to turn direct on course. The airplane then entered a tight teardrop turn to the left while climbing, and after completing 270° of turn it briefly leveled at 2,800 ft msl before it began a rapid descent. During this time, air traffic control contacted the pilot on the tower radio frequency and instructed him to contact departure. The pilot responded in the affirmative, but there were no further transmissions from the pilot on any radio frequency despite attempts from both the tower and departure air traffic controllers to reach him. The airplane subsequently impacted electrical transmission wires and a 2-story single family home, and damage signatures observed at the accident site indicated that the airplane was likely in 40° left bank at the time of impact. There was no evidence of any preimpact mechanical malfunctions or failures of the airframe or engine observed during a postaccident examination of the wreckage.

The instrument-rated pilot had accumulated 7.9 hours of actual instrument flight experience, but only 0.3 hours of actual instrument flight experience in the preceding 15 months. This

relative flight inexperience in actual instrument conditions, combined with his lack of instrument confidence, as reported by the pilot in a conversation with a student pilot on the day before the accident, indicate that the pilot was likely at increased risk for becoming spatially disoriented. The airplane's erratic flight track in the final two minutes of flight, which included the incorrect turn direct, followed by a steep left turn with a rapid descent, were also consistent with the known effects of spatial disorientation. After takeoff, once the pilot entered the clouds about 250 ft above ground level, most of the ground lighting would have quickly disappeared, and combined with the prevailing LIFR conditions, would have made it difficult to recognize a loss of control due to spatial disorientation unless he was confident and assertive in his use of the airplane's instrumentation.

Although the pilot's actual sleep and wake times prior to the accident could not be precisely determined, the pilot was likely experiencing some level of fatigue due to the late night flying the previous day combined with the flight the next morning and the 11-½-hour-long day at the wedding and reception before the planned accident flight. If the pilot had been fatigued, it would have further degraded his ability to recognize and recover from any spatial disorientation that he was experiencing.

Postmortem toxicological testing detected codeine in the pilot's urine at a low level. This finding could be consistent with prior codeine use or possibly even poppy seed consumption. Regardless, the pilot had no detectable codeine in his blood. This makes it unlikely that codeine effects contributed to the accident.

Given the pilot's lack of recent experience in actual instrument conditions, the LIFR weather, the dark night lighting conditions, and that he was likely fatigued, the pilot likely became spatially disoriented and lost control of the airplane when he entered a climbing turn shortly after takeoff.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be:

The pilot's loss of airplane control due to spatial disorientation during initial climb in dark night and low instrument meteorological conditions, which resulted in a descent into terrain. Contributing to the accident was the pilot's fatigue due to a long day of flying and personal activities.

Findings

| | |
|-----------------------------|--------------------------------------|
| Personnel issues | Spatial disorientation - Pilot |
| Environmental issues | Low ceiling - Effect on personnel |
| Personnel issues | (general) - Pilot |
| Personnel issues | Recent instrument experience - Pilot |

Factual Information

History of Flight

| | |
|---------------|--|
| Initial climb | Loss of control in flight (Defining event) |
| Initial climb | Collision with terr/obj (non-CFIT) |

HISTORY OF FLIGHT

On October 1, 2022, at 2317 central daylight time, a Cessna 172S, N262TA, was substantially damaged when it was involved in an accident near Hermantown, Minnesota. The commercial pilot and two passengers sustained fatal injuries and two people occupying a house sustained minor injuries. The airplane was operated as a Title 14 *Code of Federal Regulations* Part 91 personal flight.

The pilot and the two passengers departed South St. Paul Municipal Airport-Richard E Fleming Field (SGS), South St. Paul, Minnesota, about 1015, and had flown to Duluth International Airport (DLH), Duluth, Minnesota, earlier that day to attend a wedding. According to airport security video, the pilot and the two passengers returned to DHL and the pilot conducted a preflight inspection of the airplane at 2246, and the passengers boarded about 2254.

At 2305, the pilot contacted air traffic control and received an instrument flight rules (IFR) clearance back to SGS. A controller cleared the pilot direct to SGS and directed him to climb to 6,000 ft mean sea level (msl). The pilot was also provided a departure frequency and transponder code. The pilot then read back the wrong departure frequency and no beacon code. The controller again provided the beacon code and advised the pilot the rest of the readback was correct, but did not correct the readback of the incorrect departure frequency. The pilot was cleared to taxi to runway 09, during which time the controller informed him that the visibility was about ½-mile. The controller also advised the pilot that after he departed he may be operating in instrument meteorological conditions for a while. This was based on information provided by a King Air pilot who recently departed and reported that the cloud base was about 250 ft above ground level, and that he was still climbing through the clouds at 12,000 ft msl.

The pilot contacted the air traffic control when he was holding short of the runway and ready for takeoff, and the tower controller cleared the pilot for takeoff and to make a right turn direct to SGS. The tower controller also reported that the wind was from 090° at 14 knots gusting to 18 knots, and the runway visual range was greater than 6,000 ft, which the pilot acknowledged.

The rear-seat passenger recorded two brief videos of the takeoff with their mobile phone. The videos were sent to the National Transportation Safety Board recorders laboratory for

examination. The videos revealed the airplane's takeoff and initial climb through 1,500 ft msl. The interior windows were covered with condensation. The instrument panel was visible, and no abnormalities were noted. The takeoff roll and engine sounds appeared normal. The initial climb showed the airplane entering the clouds about 19 seconds after the video began with the takeoff roll. The video was stopped at 24 seconds.

A review of ADS-B data revealed the airplane departed at 2312. It made a right turn toward the south while climbing to about 1,750 ft msl. The airplane then made a steep left turn to a track of about 270° while climbing to 2,800 ft msl before it began to descend (see figures 1 and 2).



Figure 1 - ADS-B data depicting an orthogonal plot of the airplane's flight track in profile in red.

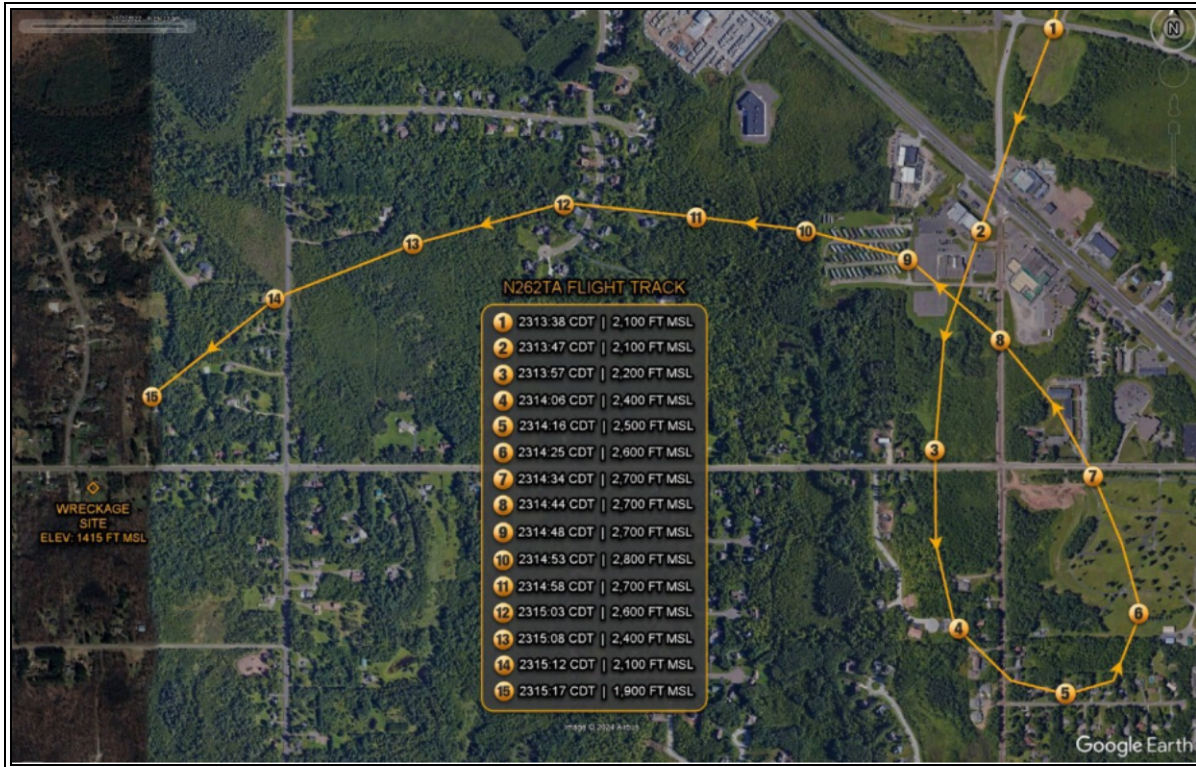


Figure 2 – Overhead plot of the airplane’s flight track with points depicting the airplane’s position, altitude, and time annotated.

The radar controller attempted to contact the pilot on the departure frequency with no response. The radar controller then transmitted on the tower frequency and instructed the pilot to contact departure. The pilot responded by saying “contacting departure two tango alpha.” Several seconds later, while the airplane continued to descend in a counterclockwise direction and increasing in ground speed, the radar controller advised the pilot that he observed the airplane descending and asked the pilot to confirm he was climbing. There was no response. Simultaneously, there was a low altitude alert observed on the control tower display workstation. Both the tower and radar controllers continued with repeated attempts to contact the pilot but received no response.

PILOT INFORMATION

The pilot held a commercial pilot certificate with ratings for airplane single-engine land and instrument airplane. He was also held a flight instructor certificate with an airplane single-engine rating. A review of the pilot’s logbook revealed he had accumulated 645.9 total hours of flight experience, of which 39.9 hours were in the accident airplane make and model. His total nighttime flight experience was 45.1 hours, of which 2.5 hours were in the accident airplane make and model. His flight time in actual instrument meteorological conditions was 7.6 hours, of which 1.5 hours were in the accident airplane make and model. His most recent actual instrument flight experience was in July 2021, about 15 months before the accident flight and his most recent simulated instrument experience was 2.5 hours in June 2022.

METEOROLOGICAL INFORMATION

The weather conditions at DLH at 2255 was reported as wind from 080° at 10 knots, gusting to 19 knots, visibility 5 miles in mist, an overcast ceiling at 200 ft agl, a temperature of 9° C, a dew point of 8° C, and an altimeter setting of 30.38 inHg.

At 2355, the weather was reported as wind from 080° at 12 knots, visibility 4 miles in mist, an overcast ceiling at 200 ft agl, a temperature of 9° C, a dew point of 8° C, and an altimeter setting of 30.38 inHg.

The National Weather Service reported that between the hours of 1855 through 0155, low IFR (LIFR) conditions would prevail. Per the Federal Aviation Administration (FAA) Aeronautical Information Manual, section 7-1-7, LIFR was defined as the ceiling or the lowest layer of clouds reported as broken or overcast, or the vertical visibility into a surface-based obscuration below 500 ft above ground level (agl) and/or visibility less than 1 statute mile.

WRECKAGE INFORMATION

The airplane impacted electrical transmission wires and a 2-story home. The wing and left landing gear imprint on the house were consistent with the airplane impacting it in a 40° left bank as the airplane passed through the structure. It passed through two upstairs bedrooms as the occupants of the house slept, and then exited the home and came to rest inverted between a vehicle and a detached garage. There was no post-impact fire. The wreckage path was oriented on a magnetic heading of 205° and was about 175 ft in length. All major components of the airplane were located within the wreckage site.



Figure 3 - Aerial photograph of the accident site including the damaged house and the debris field that extended beyond it (photo courtesy of the Hermantown Police Department)

The left wing was impact separated from the fuselage and came to rest in the front yard of the house. The empennage was separated from the fuselage at the leading edge of the horizontal stabilizer and was discovered against the front door of the detached garage. The remaining fuselage, cockpit, and right wing were inverted and wedged between the garage and a vehicle. No visible fuel was present at the scene and there was no associated fuel blight discovered on the trees or surrounding grass; however, fire rescue personnel reported a strong fuel odor during their recovery operations shortly after the accident.

Control continuity was confirmed from all flight control surfaces through breaks in the flight control cables that were consistent with tensile overload.

The engine was impact separated from the firewall and remained upright adjacent to the fuselage. The engine had impact damage to various pushrods, intake and exhaust tubes, rocker box covers, and cylinder No. 2 cooling fins. The propeller flange was sheared off at the crankshaft and the damage was consistent with rotation of the crankshaft at the time of impact. The propeller was found in the wreckage next to the engine and exhibited chordwise scraping and leading-edge gouges. Both propeller blades were bent aft mid-span and the propeller spinner was crushed and twisted.

The engine spark plugs were removed and examined. They had minimal wear when compared to the Champion Check-A-Plug chart. Both the left and right magnetos were intact. Both units were operated manually with a drill and all posts produced a spark with no anomalous behavior noted. Residual fuel was discovered in the fuel pump and fuel odor was noted in the flow divider.

The engine was rotated via the accessory section. Thumb compression and suction was attained on all cylinders and crankshaft continuity was confirmed. The crankshaft rotation was smooth, with no noticeable abnormal noise or friction noted and all internal components appeared well lubricated. Each cylinder was inspected internally with a lighted borescope, and no mechanical issues were observed.

The attitude indicator, heading indicator, and turn coordinator were examined. The gyros were capable of smooth rotation and rotational scoring was noted on the electrically-powered turn coordinator gyro. There was no rotational scoring noted on the vacuum-driven attitude indicator gyro or heading indicator gyro. The vacuum manifold was examined, and the diaphragms displayed normal operating signatures. All air tubes/manifolds were free of obstructions and the vacuum pumps were intact and capable of expelling air when rotated by hand. Each pump displayed normal operating signatures and continuity of the pump, and tubes to their respective instrument was confirmed.

There were 3 on-board data units that were retained and sent to the NTSB recorders lab for examination and download: an Appareo Stratus 2S, a Garmin GTN 750, and a DAC International GDC31. The data extracted from the Stratus included sessions from September 13, 2022, through September 28, 2022, and no data associated with the accident flight were

recorded on the device. The Garmin GTN 750 sustained impact damage that prevented the device from being powered on. An SD card was located along with the device, which, when read, was determined to be a supplemental data card with charts and navigation information, but no recorded flight data. An additional SD card was recovered from within the unit; however, the card did not contain any recorded flight data. The DAC GDC31 did not, by design, contain any recorded data.

Postaccident examination of the airplane and engine revealed no evidence of any preimpact mechanical anomalies or failures that would have precluded normal operation.

MEDICAL AND PATHOLOGICAL INFORMATION

The Office of the Midwest Medical Examiner, Ramsey, Minnesota, performed an autopsy of the pilot. The cause of death was attributed to multiple blunt force injuries and the manner of death was classified as an accident. The autopsy did not reveal any medical conditions that would have posed a hazard to flight safety or likely would have contributed to the accident.

At the request of the Midwest Medical Examiner's Office, NMS Labs Horsham, Pennsylvania, performed toxicological testing of postmortem heart blood from the pilot and determined that there were no positive findings of toxicological significance.

Additional toxicological testing was performed at the FAA Forensic Sciences Laboratory, which identified 22 ng/mL codeine in the pilot's urine, but not in his heart blood. FAA testing also detected pseudoephedrine in femoral blood and urine.

ADDITIONAL INFORMATION

The day before the accident, on the evening of September 30, 2022, the pilot flew with one of his students on a night cross-country flight. The flight began about 1900 and ended about 2315. The student stated that during the flight, the pilot/instructor mentioned that he had to fly to a wedding the following morning. He said he was nervous about the flight because he was not confident in his instrument flying abilities.

The pilot lived about 30 minutes from SGS. It is unknown at what time he went to sleep the night before the accident or at what time he woke up on the morning of the accident. However, the accident occurred about 13.5 hours after he and the two passengers departed SGS on the morning of the accident and after attending and participating in wedding and reception activities for about 11.5 hours.

According to the FAA's General Aviation Joint Steering Committee, a pilot's sight, supported by other senses, allows a pilot to maintain orientation while flying. However, when visibility is restricted (i.e., no visual reference to the horizon or surface detected), the body's supporting senses can conflict with what is seen. When this spatial disorientation occurs, sensory conflicts and optical illusions often make it difficult for a pilot to tell which way is up. The FAA Airplane Flying Handbook (FAA-H-8083-3C) described some hazards associated with flying when visual references, such as the ground or horizon, are obscured. "The vestibular sense

(motion sensing by the inner ear) can and will confuse the pilot. Because of inertia, the sensory areas of the inner ear cannot detect slight changes in airplane attitude, nor can they accurately sense attitude changes that occur at a uniform rate over a period of time. On the other hand, false sensations are often generated, leading the pilot to believe the attitude of the airplane has changed when, in fact, it has not. These false sensations result in the pilot experiencing spatial disorientation." The FAA publication Medical Facts for Pilots (AM-400-03/1), described several vestibular illusions associated with the operation of aircraft in low visibility conditions. Somatogravic illusions, those involving the utricle and saccule of the vestibular system, were generally placed into one of three categories, one of which was "the head-up illusion." According to the text, the head-up illusion involves a forward linear acceleration, such as takeoff, where the pilot perceives that the nose of the aircraft is pitching up. The pilot's response to this illusion would be to push the control yoke forward to pitch the nose of the aircraft down. "A night take-off from a well-lit airport into a totally dark sky (black hole) or a catapult take-off from an aircraft carrier can also lead to this illusion, and could result in a crash."

Pilot Information

| | | | |
|----------------------------------|--|--|----------------|
| Certificate: | Commercial; Flight instructor | Age: | 33, Male |
| Airplane Rating(s): | Single-engine land | Seat Occupied: | Left |
| Other Aircraft Rating(s): | None | Restraint Used: | 3-point |
| Instrument Rating(s): | Airplane | Second Pilot Present: | No |
| Instructor Rating(s): | Airplane single-engine | Toxicology Performed: | Yes |
| Medical Certification: | Class 1 None | Last FAA Medical Exam: | April 2, 2019 |
| Occupational Pilot: | No | Last Flight Review or Equivalent: | March 17, 2022 |
| Flight Time: | 646 hours (Total, all aircraft), 39.9 hours (Total, this make and model), 595 hours (Pilot In Command, all aircraft), 197.1 hours (Last 90 days, all aircraft), 73.5 hours (Last 30 days, all aircraft), 1 hours (Last 24 hours, all aircraft) | | |

Passenger Information

| | | | |
|----------------------------------|----|--|---------|
| Certificate: | | Age: | Male |
| Airplane Rating(s): | | Seat Occupied: | Right |
| Other Aircraft Rating(s): | | Restraint Used: | 3-point |
| Instrument Rating(s): | | Second Pilot Present: | No |
| Instructor Rating(s): | | Toxicology Performed: | |
| Medical Certification: | | Last FAA Medical Exam: | |
| Occupational Pilot: | No | Last Flight Review or Equivalent: | |
| Flight Time: | | | |

Passenger Information

| | | | |
|----------------------------------|----|--|---------|
| Certificate: | | Age: | Female |
| Airplane Rating(s): | | Seat Occupied: | Right |
| Other Aircraft Rating(s): | | Restraint Used: | 3-point |
| Instrument Rating(s): | | Second Pilot Present: | No |
| Instructor Rating(s): | | Toxicology Performed: | |
| Medical Certification: | | Last FAA Medical Exam: | |
| Occupational Pilot: | No | Last Flight Review or Equivalent: | |
| Flight Time: | | | |

Aircraft and Owner/Operator Information

| | | | |
|--------------------------------------|---|---------------------------------------|-----------------|
| Aircraft Make: | Cessna | Registration: | N262TA |
| Model/Series: | 172S | Aircraft Category: | Airplane |
| Year of Manufacture: | 2002 | Amateur Built: | |
| Airworthiness Certificate: | Normal | Serial Number: | 172S9262 |
| Landing Gear Type: | Tricycle | Seats: | 4 |
| Date/Type of Last Inspection: | September 20, 2022 Annual | Certified Max Gross Wt.: | 2500 lbs |
| Time Since Last Inspection: | 3 Hrs | Engines: | 1 Reciprocating |
| Airframe Total Time: | -1 Hrs | Engine Manufacturer: | Lycoming |
| ELT: | C91A installed, activated, did not aid in locating accident | Engine Model/Series: | IO-360-L2A |
| Registered Owner: | SVETFUR AVIATION LLC | Rated Power: | 180 Horsepower |
| Operator: | SVETFUR AVIATION LLC | Operating Certificate(s) Held: | None |

Meteorological Information and Flight Plan

| | | | |
|---|----------------------------|---|------------------|
| Conditions at Accident Site: | Instrument (IMC) | Condition of Light: | Night/dark |
| Observation Facility, Elevation: | KDLH,1417 ft msl | Distance from Accident Site: | 2 Nautical Miles |
| Observation Time: | 22:55 Local | Direction from Accident Site: | 61° |
| Lowest Cloud Condition: | | Visibility | 5 miles |
| Lowest Ceiling: | Overcast / 200 ft AGL | Visibility (RVR): | |
| Wind Speed/Gusts: | 10 knots / 19 knots | Turbulence Type Forecast/Actual: | None / None |
| Wind Direction: | 80° | Turbulence Severity Forecast/Actual: | N/A / N/A |
| Altimeter Setting: | 30.38 inches Hg | Temperature/Dew Point: | 9°C / 8°C |
| Precipitation and Obscuration: | | | |
| Departure Point: | Duluth, MN (DLH) | Type of Flight Plan Filed: | IFR |
| Destination: | South Saint Paul, MN (SGS) | Type of Clearance: | IFR |
| Departure Time: | 23:12 Local | Type of Airspace: | Class D |

Airport Information

| | | | |
|-----------------------------|-------------------|----------------------------------|---------|
| Airport: | DULUTH INTL DLH | Runway Surface Type: | Asphalt |
| Airport Elevation: | 1427 ft msl | Runway Surface Condition: | Wet |
| Runway Used: | 9 | IFR Approach: | ILS |
| Runway Length/Width: | 10591 ft / 150 ft | VFR Approach/Landing: | None |

Wreckage and Impact Information

| | | | |
|----------------------------|------------------|-----------------------------|----------------------|
| Crew Injuries: | 1 Fatal | Aircraft Damage: | Substantial |
| Passenger Injuries: | 2 Fatal | Aircraft Fire: | None |
| Ground Injuries: | 2 Minor | Aircraft Explosion: | None |
| Total Injuries: | 3 Fatal, 2 Minor | Latitude, Longitude: | 46.821679,-92.222941 |

Administrative Information

| | |
|--|--|
| Investigator In Charge (IIC): | Mccarter, Lawrence |
| Additional Participating Persons: | Kurt Gibson; Textron; Wichita , KS Greg Thurston; FAA/FSDO; Minneapolis, MN David Harsanyi; Lycoming; Mobile, AL |
| Original Publish Date: | November 14, 2024 |
| Last Revision Date: | |
| Investigation Class: | Class 3 |
| Note: | |
| Investigation Docket: | https://data.nts.gov/Docket?ProjectID=106032 |

The National Transportation Safety Board (NTSB) is an independent federal agency charged by Congress with investigating every civil aviation accident in the United States and significant events in other modes of transportation—railroad, transit, highway, marine, pipeline, and commercial space. We determine the probable causes of the accidents and events we investigate, and issue safety recommendations aimed at preventing future occurrences. In addition, we conduct transportation safety research studies and offer information and other assistance to family members and survivors for each accident or event we investigate. We also serve as the appellate authority for enforcement actions involving aviation and mariner certificates issued by the Federal Aviation Administration (FAA) and US Coast Guard, and we adjudicate appeals of civil penalty actions taken by the FAA.

The NTSB does not assign fault or blame for an accident or incident; rather, as specified by NTSB regulation, “accident/incident investigations are fact-finding proceedings with no formal issues and no adverse parties ... and are not conducted for the purpose of determining the rights or liabilities of any person” (Title 49 *Code of Federal Regulations* section 831.4). Assignment of fault or legal liability is not relevant to the NTSB’s statutory mission to improve transportation safety by investigating accidents and incidents and issuing safety recommendations. In addition, statutory language prohibits the admission into evidence or use of any part of an NTSB report related to an accident in a civil action for damages resulting from a matter mentioned in the report (Title 49 *United States Code* section 1154(b)). A factual report that may be admissible under 49 *United States Code* section 1154(b) is available [here](#).