



AVIATION



HIGHWAY



MARINE



RAILROAD



PIPELINE

# Aviation Investigation Final Report

|                                |                                      |                         |             |
|--------------------------------|--------------------------------------|-------------------------|-------------|
| <b>Location:</b>               | Sault Ste Marie, Michigan            | <b>Accident Number:</b> | CEN18FA160  |
| <b>Date &amp; Time:</b>        | May 5, 2018, 10:02 Local             | <b>Registration:</b>    | C-FNKZ      |
| <b>Aircraft:</b>               | BELAIR RAVEN                         | <b>Aircraft Damage:</b> | Substantial |
| <b>Defining Event:</b>         | Loss of control in flight            | <b>Injuries:</b>        | 2 Fatal     |
| <b>Flight Conducted Under:</b> | Part 91: General aviation - Personal |                         |             |

## Analysis

The private pilot and pilot-rated passenger were departing on a local flight in the experimental, amateur-built airplane in gusting crosswind conditions. Witnesses saw the airplane take off and enter a nose-high attitude. About 100 ft above ground level, the airplane began turning right and transitioned to a nose-low spin until ground impact. Examination of the airframe and engine revealed no evidence of mechanical malfunctions or failures that would have precluded normal operation. The airplane was not equipped with any stall warning devices.

The witness reports and damage to the airplane were consistent with the pilot failing to maintain sufficient airspeed during a steep takeoff climb, which resulted in the airplane exceeding its critical angle of attack and a subsequent aerodynamic stall. A flight instructor at the airport reported that, when departing the accident runway with westerly winds present, he would often notice turbulence and swirling air. He attributed this effect to the tall trees located about 100 yards west of the runway. Although autopsies revealed that both pilots were at risk for a sudden cardiac event, the circumstances of the accident are consistent with a loss of control rather than a sudden incapacitation, and it is unlikely that either pilot's cardiac condition contributed to the accident.

## Probable Cause and Findings

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

The pilot's failure to maintain adequate airspeed during takeoff in gusty crosswind conditions, which resulted in the airplane exceeding its critical angle of attack and an aerodynamic stall.

## Findings

|                             |                                       |
|-----------------------------|---------------------------------------|
| <b>Personnel issues</b>     | Aircraft control - Pilot              |
| <b>Aircraft</b>             | Airspeed - Not attained/maintained    |
| <b>Aircraft</b>             | Angle of attack - Capability exceeded |
| <b>Environmental issues</b> | Gusts - Effect on equipment           |

## Factual Information

### History of Flight

|                             |  |
|-----------------------------|--|
| <b>Takeoff</b>              | Loss of control in flight (Defining event) |
| <b>Uncontrolled descent</b> | Collision with terr/obj (non-CFIT)         |

On May 5, 2018, at 1002 eastern daylight time, an experimental, amateur-built Belair Raven airplane, Canadian registration C-FNKZ, impacted terrain during the initial climb after takeoff from Sault Ste. Marie Municipal Airport (ANJ), Sault Ste. Marie, Michigan. The private pilot and pilot-rated passenger were fatally injured, and the airplane was substantially damaged. The airplane was owned by the pilot who was operating it as a Title 14 *Code of Federal Regulations* Part 91 personal flight. Day, visual meteorological conditions prevailed for the local flight, which departed without a flight plan.

According to witnesses, the airplane taxied to runway 32 and departed in a nose-high attitude. A flight instructor compared the climb to an aggressive short-field takeoff or a banner pilot's climb after picking up a banner. Witnesses noticed that, after reaching about 100 ft above ground level, the airplane turned right and transitioned to a steep nose-down spin until ground impact. The flight instructor stated that the engine noise sounded normal throughout the takeoff until ground impact.

### Pilot Information

|                                  |   |  |                  |
|----------------------------------|---|--|------------------|
| <b>Certificate:</b>              | Private   | <b>Age:</b>                              | 67, Male         |
| <b>Airplane Rating(s):</b>       | Single-engine land  | <b>Seat Occupied:</b>                    | Left             |
| <b>Other Aircraft Rating(s):</b> | None  | <b>Restraint Used:</b>                   | 4-point          |
| <b>Instrument Rating(s):</b>     | None  | <b>Second Pilot Present:</b>             | Yes              |
| <b>Instructor Rating(s):</b>     | None  | <b>Toxicology Performed:</b>             | Yes              |
| <b>Medical Certification:</b>    | Class 3 With waivers/limitations  | <b>Last FAA Medical Exam:</b>            | February 8, 2018 |
| <b>Occupational Pilot:</b>       | No  | <b>Last Flight Review or Equivalent:</b> |                  |
| <b>Flight Time:</b>              | 505 hours (Total, all aircraft), 61 hours (Total, this make and model), 455 hours (Pilot In Command, all aircraft), 8 hours (Last 90 days, all aircraft), 2 hours (Last 30 days, all aircraft), 0 hours (Last 24 hours, all aircraft) |  |                  |

## Pilot-rated passenger Information

|                                  |                                  |  |                  |
|----------------------------------|----------------------------------|--|------------------|
| <b>Certificate:</b>              | Private                          | <b>Age:</b>                              | 75, Male         |
| <b>Airplane Rating(s):</b>       | Single-engine land               | <b>Seat Occupied:</b>                    | Right            |
| <b>Other Aircraft Rating(s):</b> | None                             | <b>Restraint Used:</b>                   | 4-point          |
| <b>Instrument Rating(s):</b>     | None                             | <b>Second Pilot Present:</b>             | Yes              |
| <b>Instructor Rating(s):</b>     | None                             | <b>Toxicology Performed:</b>             | Yes              |
| <b>Medical Certification:</b>    | Class 1 With waivers/limitations | <b>Last FAA Medical Exam:</b>            | January 24, 2018 |
| <b>Occupational Pilot:</b>       | No                               | <b>Last Flight Review or Equivalent:</b> |                  |
| <b>Flight Time:</b>              |                                  |  |                  |

The pilot, age 67, held a Canadian private pilot certificate with an airplane single-engine land rating. On February 8, 2018, the pilot was issued a Canadian Category 3 medical certificate with a requirement for glasses to be worn and a restriction of day visual only flight due to color vision deficiencies. The pilot had accumulated 505 total hours of flight experience, with 61 hours in the accident airplane. Flight reviews were not recorded in the pilot's logbook.

The pilot-rated passenger, age 75, held a Canadian private pilot certificate with an airplane single-engine land rating. On January 24, 2018, the passenger was issued a Canadian Category 1 medical certificate with a requirement for glasses to be worn. The passenger frequently flew with the pilot in the accident airplane.

## Aircraft and Owner/Operator Information

|                                      |                               |                                       |                 |
|--------------------------------------|-------------------------------|---------------------------------------|-----------------|
| <b>Aircraft Make:</b>                | BELAIR                        | <b>Registration:</b>                  | C-FNKZ          |
| <b>Model/Series:</b>                 | RAVEN                         | <b>Aircraft Category:</b>             | Airplane        |
| <b>Year of Manufacture:</b>          | 2012                          | <b>Amateur Built:</b>                 | Yes             |
| <b>Airworthiness Certificate:</b>    | Experimental (Special)        | <b>Serial Number:</b>                 | 12351           |
| <b>Landing Gear Type:</b>            | Tailwheel                     | <b>Seats:</b>                         | 4               |
| <b>Date/Type of Last Inspection:</b> |                               | <b>Certified Max Gross Wt.:</b>       | 2400 lbs        |
| <b>Time Since Last Inspection:</b>   |                               | <b>Engines:</b>                       | 1 Reciprocating |
| <b>Airframe Total Time:</b>          | 61 Hrs at time of accident    | <b>Engine Manufacturer:</b>           | Honda           |
| <b>ELT:</b>                          | C91A installed, not activated | <b>Engine Model/Series:</b>           | 3.5 Litre       |
| <b>Registered Owner:</b>             |                               | <b>Rated Power:</b>                   | 245 Horsepower  |
| <b>Operator:</b>                     | On file                       | <b>Operating Certificate(s) Held:</b> | None            |

The high-wing, tailwheel-equipped airplane was completed by the pilot in 2012 and was issued a Canadian Special Certificate of Airworthiness. The airplane was equipped with a Honda 3.5-liter engine and a Performance three-blade, fixed pitch wooden propeller. The airplane was not

equipped with any stall warning devices. On the day of the accident, the airplane was lightly loaded with cargo.

### Meteorological Information and Flight Plan

|   |                                  |   |                  |
|---|----------------------------------|---|------------------|
| <b>Conditions at Accident Site:</b>     | Visual (VMC)                     | <b>Condition of Light:</b>                  | Day              |
| <b>Observation Facility, Elevation:</b> | KANJ, 724 ft msl                 | <b>Distance from Accident Site:</b>         | 0 Nautical Miles |
| <b>Observation Time:</b>                | 09:55 Local                      | <b>Direction from Accident Site:</b>        | 70°              |
| <b>Lowest Cloud Condition:</b>          | Clear                            | <b>Visibility</b>                           | 10 miles         |
| <b>Lowest Ceiling:</b>                  | None                             | <b>Visibility (RVR):</b>                    |                  |
| <b>Wind Speed/Gusts:</b>                | 11 knots / 15 knots              | <b>Turbulence Type Forecast/Actual:</b>     | /                |
| <b>Wind Direction:</b>                  | 270°                             | <b>Turbulence Severity Forecast/Actual:</b> | /                |
| <b>Altimeter Setting:</b>               | 29.93 inches Hg                  | <b>Temperature/Dew Point:</b>               | 12°C / 3°C       |
| <b>Precipitation and Obscuration:</b>   | No Obscuration; No Precipitation |   |                  |
| <b>Departure Point:</b>                 | SAULT STE MARIE, MI (ANJ)        | <b>Type of Flight Plan Filed:</b>           | None             |
| <b>Destination:</b>                     | SAULT STE MARIE, MI (ANJ)        | <b>Type of Clearance:</b>                   | None             |
| <b>Departure Time:</b>                  | 10:02 Local                      | <b>Type of Airspace:</b>                    | Class G          |

At 0955, the automated weather observation station (AWOS) at ANJ reported wind from 270°; at 11 knots with gusts to 15 knots, 10 miles visibility, clear skies, temperature 12°C, dew point 3°C, and an altimeter setting of 29.93 inches of mercury. The AWOS was located about 1/4 mile east of the runway.

### Airport Information

|                             |                                    |                                  |         |
|-----------------------------|------------------------------------|----------------------------------|---------|
| <b>Airport:</b>             | SAULT STE MARIE MUNI/SANDERSON ANJ | <b>Runway Surface Type:</b>      | Asphalt |
| <b>Airport Elevation:</b>   | 716 ft msl                         | <b>Runway Surface Condition:</b> | Dry     |
| <b>Runway Used:</b>         | 32                                 | <b>IFR Approach:</b>             | None    |
| <b>Runway Length/Width:</b> | 5234 ft / 100 ft                   | <b>VFR Approach/Landing:</b>     | None    |

ANJ was a public, non-towered airport owned by the City of Sault Saint Marie. The airport had one runway and surveyed elevation of 716 ft above mean sea level. Runway 14/32 was a 5,234 ft by 100 ft runway with an asphalt surface.

## Wreckage and Impact Information

|                            |         |                                 |                    |
|----------------------------|---------|---------------------------------|--------------------|
| <b>Crew Injuries:</b>      | 1 Fatal | <b>Aircraft Damage:</b>         | Substantial        |
| <b>Passenger Injuries:</b> | 1 Fatal | <b>Aircraft Fire:</b>           | None               |
| <b>Ground Injuries:</b>    | N/A     | <b>Aircraft Explosion:</b>      | None               |
| <b>Total Injuries:</b>     | 2 Fatal | <b>Latitude,<br/>Longitude:</b> | 46.4775,-84.363052 |

Examination at the accident site revealed that the airplane impacted terrain and came to rest in a near-vertical, nose-down attitude on a heading about 201° about 180 ft east of runway 32.

Both wings were crushed aft and remained attached to the fuselage. The fixed main landing gear assemblies were attached to the fuselage and the flight control surfaces remained attached to their respective airframe surfaces; elevator control, elevator trim, and rudder control continuity was established to the cockpit area. Aileron control continuity was established from both ailerons to the cockpit. The left aileron cable, which was slack, was disengaged from its respective bellcrank.

All three multilaminate wood propeller blades were fractured near the hub. The propeller remained attached to the engine and the spinner was crushed aft. The engine was rotated by hand from the front crankshaft. Thumb suction and compression was observed at all cylinders with normal valve train and crankshaft continuity. Spark plug electrodes exhibited normal wear signatures.

Witness marks on the seat rails indicated that both pilot and passenger seats were in a normal position during ground impact. Examination of the airframe and engine revealed no evidence of mechanical malfunctions or failures that would have precluded normal operation.

## Additional Information

According to the flight instructor who witnessed the accident, during departures from runway 32 with westerly winds present, he would often notice turbulence and swirling air. He attributed this effect to the tall trees located about 100 yards west of the runway.

## Medical and Pathological Information

The Chippewa County Medical Examiner, Sault Ste. Marie, Michigan, conducted autopsies of the pilot and passenger and determined that the cause of their deaths was due to blunt force injuries.

The pilot's autopsy revealed left ventricular hypertrophy, a thickening of the wall of the left ventricle. The coronary arteries were free from atherosclerosis. An area of scar in the subepicardial area of the anterior wall of the left ventricle as well as some fibrosis in the lateral and posterior walls were

identified with microscopy. The remainder of the cardiac examination was unremarkable. The pilot's wife stated that the pilot had experienced chest pains about 3 years before the accident, but she was not aware of any recent significant health issues.

The passenger's autopsy revealed evidence of bilateral corneal transplants and emphysema. An area of 70-80% stenosis was identified in the left anterior descending coronary artery and there was some evidence of perivascular fibrosis on the microscopic examination in the anterior and lateral walls, as well as the left side of the septum. The passenger's son stated that, during the 2 years before the accident, his father would get tired more easily during walks and while climbing stairs.

The Federal Aviation Administration Bioaeronautical Sciences Research Laboratory, Oklahoma City, Oklahoma, conducted toxicological testing on specimens from the pilot and passenger. The results were negative for all tests conducted.

## Administrative Information

|  |  |
|--|--|
| <b>Investigator In Charge (IIC):</b>     | Folkerts, Michael  |
| <b>Additional Participating Persons:</b> | Chad Peterson; Flight Standards District Office; Grand Rapids, MI<br>Mike Matthews; Flight Standards District Office; Grand Rapids, MI |
| <b>Original Publish Date:</b>            | June 25, 2019  |
| <b>Note:</b>                             | The NTSB traveled to the scene of this accident.   |
| <b>Investigation Docket:</b>             | <a href="https://data.nts.gov/Docket?ProjectID=97176">https://data.nts.gov/Docket?ProjectID=97176</a>                                  |

The National Transportation Safety Board (NTSB), established in 1967, is an independent federal agency mandated by Congress through the Independent Safety Board Act of 1974 to investigate transportation accidents, determine the probable causes of the accidents, issue safety recommendations, study transportation safety issues, and evaluate the safety effectiveness of government agencies involved in transportation. The NTSB makes public its actions and decisions through accident reports, safety studies, special investigation reports, safety recommendations, and statistical reviews.

The Independent Safety Board Act, as codified at 49 U.S.C. Section 1154(b), precludes the admission into evidence or use of any part of an NTSB report related to an incident or accident in a civil action for damages resulting from a matter mentioned in the report. A factual report that may be admissible under 49 U.S.C. § 1154(b) is available [here](#).