



Aviation Investigation Final Report

Location:	Hiles, Wisconsin	Accident Number:	CEN21FA459
Date & Time:	September 28, 2021, 09:00 Local	Registration:	N690LS
Aircraft:	ROCKWELL INTERNATIONAL 690B	Aircraft Damage:	Destroyed
Defining Event:	Loss of control in flight	Injuries:	3 Fatal
Flight Conducted Under:	Part 91: General aviation - Aerial observation		

Analysis

The company pilot and two employees had departed on an aerial imagery survey flight of forest vegetation. The airplane began to level off at an altitude of about 16,100 ft mean sea level (msl) and accelerated to a maximum recorded groundspeed of 209 knots. Less than 2 minutes later, the groundspeed decreased to about 93 knots, and the airplane descended about 500 ft while on a steady heading. The airplane subsequently entered a rapid descent and a right turn, and “mayday, mayday, mayday” and “we’re in a spin” transmissions were broadcast to air traffic control (ATC). A witness, who was located near the accident site, noticed the airplane nose down at high rate of speed and then saw the airplane spinning rapidly about its longitudinal axis. The airplane wreckage was located in remote wetlands and wooded terrain.

Postaccident examination revealed that the airplane impacted the ground in a nose-low vertical attitude and at high speed. All major components of the airplane were located at the accident site. Examination of the airframe, engines, and propellers revealed no preimpact mechanical malfunctions or failures that would have precluded normal operation.

According to the aircraft performance study for this accident, when the airplane pitched down, the normal load factor decreased rapidly from about 1.6 to less than 1 G. A rapid decrease in normal load factor is consistent with a stall when the wing exceeds its critical angle of attack. At that point, the air flow becomes separated at the wing, and the wing can no longer generate the necessary lift. If the airplane is in uncoordinated flight at the stall, a spin can result. Thus, the pilot likely did not maintain adequate airspeed, causing the airplane to exceed its critical angle of attack and enter a stall and spin.

An important but unknown factor before and during the initial stall was the behavior of the pilot regarding his flight control inputs, including his possible attempt to recover. The airplane’s

Pilot Operating Handbook states that spins are not authorized and does not include a procedure for inadvertent spin recovery.

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, which caused the airplane to exceed its critical angle of attack and enter an inadvertent stall and spin.

Findings

Aircraft	Airspeed - Not attained/maintained
Aircraft	Angle of attack - Capability exceeded
Personnel issues	Aircraft control - Pilot
Not determined	(general) - Unknown/Not determined

Factual Information

History of Flight

Enroute-cruise

Loss of control in flight (Defining event)

On September 28, 2021, about 0900 central daylight time, a Rockwell International 690B airplane, N690LS, was destroyed when it was involved in an accident near Hiles, Wisconsin. The pilot and two passengers sustained fatal injuries. The airplane was operated as a Title 14 Code of Federal Regulations (CFR) Part 91 aerial imagery survey flight.

According to the operator, the purpose of the flight was to obtain aerial imagery of forest vegetation for the Wisconsin Department of Natural Resources. Automatic dependent surveillance-broadcast (ADS-B) and ATC information provided by the Federal Aviation Administration (FAA) indicated the airplane departed Rhinelander-Oneida County Airport (RHI), Rhinelander, Wisconsin, about 0850. About 8 minutes later, the airplane began to level off at an altitude of about 16,100 ft and accelerated to a maximum recorded groundspeed of 209 knots. Between 0858 and 0900, the airplane’s groundspeed decreased to about 93 knots, and the airplane descended about 500 ft while on a steady northeasterly heading.

The airplane subsequently made a right turn with a rapid descent (see figure 1), and the ADS-B data ended at 0900:56. According to ATC audio, transmissions indicating “mayday, mayday, mayday” and “we’re in a spin” were broadcast while the accident airplane was in flight.

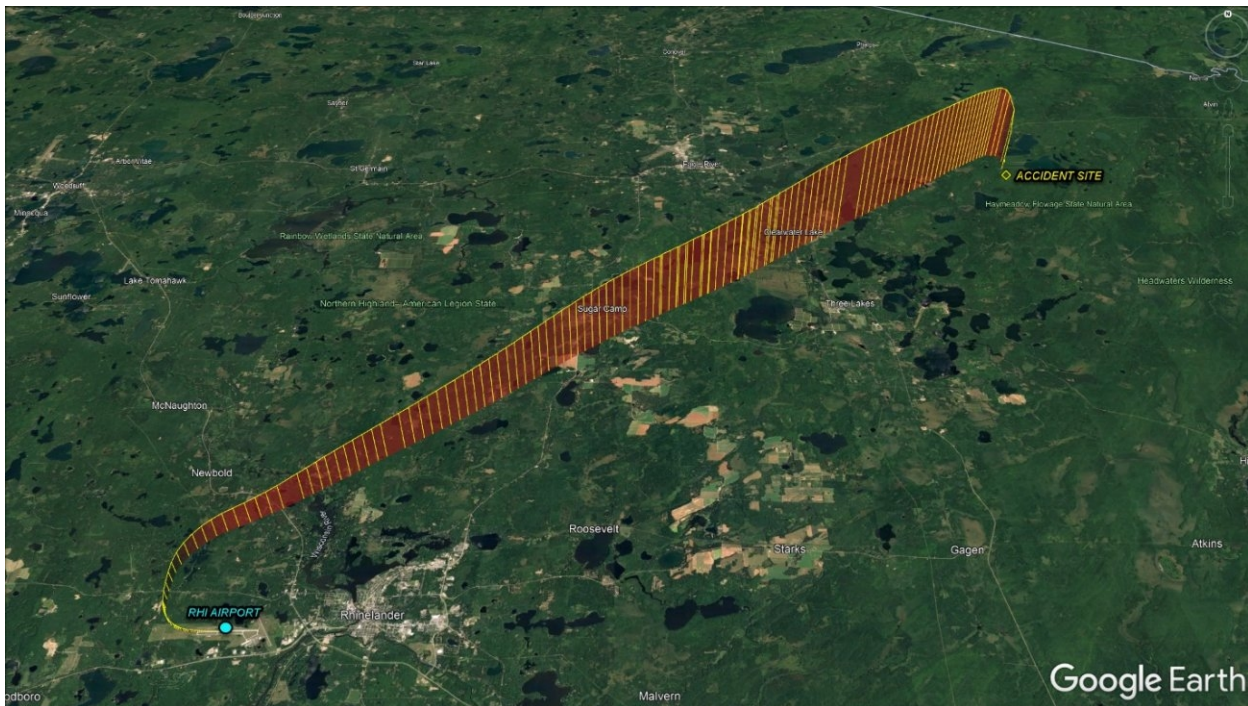


Figure 1. Airplane flightpath and accident site location.

A witness, who was located about 1 mile from the accident site, reported that he heard a “loud, strange sounding airplane.” He looked up and noticed an airplane “nose down at high rate of speed spinning about its longitudinal axis at about 30 to 60 rpm.” The witness lost sight of the airplane after it descended behind trees, and then he heard an impact.

Pilot Information

Certificate:	Commercial; Flight instructor	Age:	27, Male
Airplane Rating(s):	Single-engine land; Multi-engine land	Seat Occupied:	Left
Other Aircraft Rating(s):	None	Restraint Used:	Unknown
Instrument Rating(s):	Airplane	Second Pilot Present:	Yes
Instructor Rating(s):	Airplane single-engine; Instrument airplane	Toxicology Performed:	Yes
Medical Certification:	Class 1 Without waivers/limitations	Last FAA Medical Exam:	June 14, 2021
Occupational Pilot:	Yes	Last Flight Review or Equivalent:	February 5, 2021
Flight Time:	1019 hours (Total, all aircraft), 300 hours (Total, this make and model)		

The pilot’s logbook was not located during the investigation. According to training records that the operator provided, on February 5, 2021, the pilot successfully completed Turbo Commander 690B ground and simulator training (10.0 hours) provided by SIMCOM Aviation Training. In addition, on March 19, 2021, the pilot completed 40.9 flight hours in the operator’s Aircraft Familiarization and Pilot Qualification Mentoring Program.

Aircraft and Owner/Operator Information

Aircraft Make:	ROCKWELL INTERNATIONAL	Registration:	N690LS
Model/Series:	690B	Aircraft Category:	Airplane
Year of Manufacture:	1978	Amateur Built:	
Airworthiness Certificate:	Normal	Serial Number:	11475
Landing Gear Type:	Retractable - Tricycle	Seats:	3
Date/Type of Last Inspection:	September 24, 2021 AAIP	Certified Max Gross Wt.:	10375 lbs
Time Since Last Inspection:		Engines:	2 Turbo prop
Airframe Total Time:	7854 Hrs as of last inspection	Engine Manufacturer:	Air Research
ELT:	C126 installed, not activated	Engine Model/Series:	TPE331-10T-515K
Registered Owner:		Rated Power:	940 Horsepower
Operator:		Operating Certificate(s) Held:	None

According to the airplane maintenance records, the airframe's most recent inspection was a 150-hour periodic inspection, which was performed on September 24, 2021, at a total airframe time of 7,854.7 hours. In addition, the 150-, 200-, and 300-hour inspections were performed on both engines.

In July 2021, the accident pilot performed an in-flight shutdown of the right engine and performed a single-engine landing. According to the engine maintenance work order, "Pilot reported that torque would hang up at 300 HP [horsepower] while power lever at flight idle causing the pilot to shut down the engine to land [the] aircraft." Maintenance performed a ground run and could not duplicate the problem. According to the work order, the engine fuel control unit and fuel inlet sensor were removed and replaced with overhauled components. No additional maintenance was performed on the right engine between July and September 24, 2021.

The airplane was equipped with a Collins AP-106 Flight Control Systems autopilot. According to its description, the system is a fully integrated autopilot/flight director/compass system that provides the following modes: heading, navigation, altitude hold, and indicated airspeed hold.

The airplane's stall warning system consisted of a warning horn and a stall warning switch. The switch, installed on the right-wing leading edge, was factory adjusted to close when the airplane was between 4 and 9 knots above the aircraft stall speed.

According to the *Commander 690B Pilot's Operating Handbook* (POH), section II, Limitations, the airplane's stall speed with landing gear and flaps retracted at gross weight was 82 knots calibrated airspeed (KCAS), and its minimum controllable airspeed was 86 KCAS.

The POH did not include a procedure for recovery from an inadvertent spin. The POH stated, “acrobatic maneuvers, including spins, are unauthorized.”

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	Condition of Light:	Day
Observation Facility, Elevation:	KEGV, 1642 ft msl	Distance from Accident Site:	11 Nautical Miles
Observation Time:	09:15 Local	Direction from Accident Site:	277°
Lowest Cloud Condition:	Clear	Visibility	10 miles
Lowest Ceiling:	None	Visibility (RVR):	
Wind Speed/Gusts:	4 knots /	Turbulence Type Forecast/Actual:	None / None
Wind Direction:	160°	Turbulence Severity Forecast/Actual:	N/A / N/A
Altimeter Setting:	30.05 inches Hg	Temperature/Dew Point:	10°C / 10°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Rhineland, WI (RHI)	Type of Flight Plan Filed:	Company VFR
Destination:	Hiles, WI	Type of Clearance:	None
Departure Time:	08:50 Local	Type of Airspace:	Class E

Wreckage and Impact Information

Crew Injuries:	1 Fatal	Aircraft Damage:	Destroyed
Passenger Injuries:	2 Fatal	Aircraft Fire:	None
Ground Injuries:		Aircraft Explosion:	None
Total Injuries:	3 Fatal	Latitude, Longitude:	45.910776,-89.018627(est)

The airplane wreckage was located in remote wetlands and wooded terrain (see figure 2). The wreckage was distributed in an area with a diameter of about 150 ft.



Figure 2. Accident site and main wreckage.

Most of the main wreckage was highly fragmented and submerged beneath the water surface; other debris was located in the adjacent trees. The forward fuselage, fragmented sections of the wings, and a portion of the rear fuselage were submerged in the wetlands. A smell of Jet A aviation fuel and sheen on the wetlands were noted at the accident site.

The cockpit and fuselage were crushed aft and fragmented by impact forces. Flight control cable continuity could not be established due to the fragmentation of the airplane. All flight control cable connections exhibited tensile overload fractures. The primary and secondary control surfaces were found fragmented within the debris field.

Examination and disassembly of the left and right engines revealed damage that was consistent with engine rotation and operation at the time of the impact. Examination of the propeller blades indicated that both the left and right blades showed evidence of aft bending and twisting to a low-pitch position. Blade butt impact marks indicated aft impact loads consistent with a low blade angle, low power, and a steep impact angle.

Additional Information

Aircraft Performance Study

An aircraft performance study was conducted for this investigation. The study was largely based on ADS-B data. Figure 3 shows the ADS-B altitude and estimated airspeed for the 11-minute flight in an overhead view. The airplane's airspeed was estimated to be at the stall speed at the altitude, airspeed, and time marked in red in the figure.

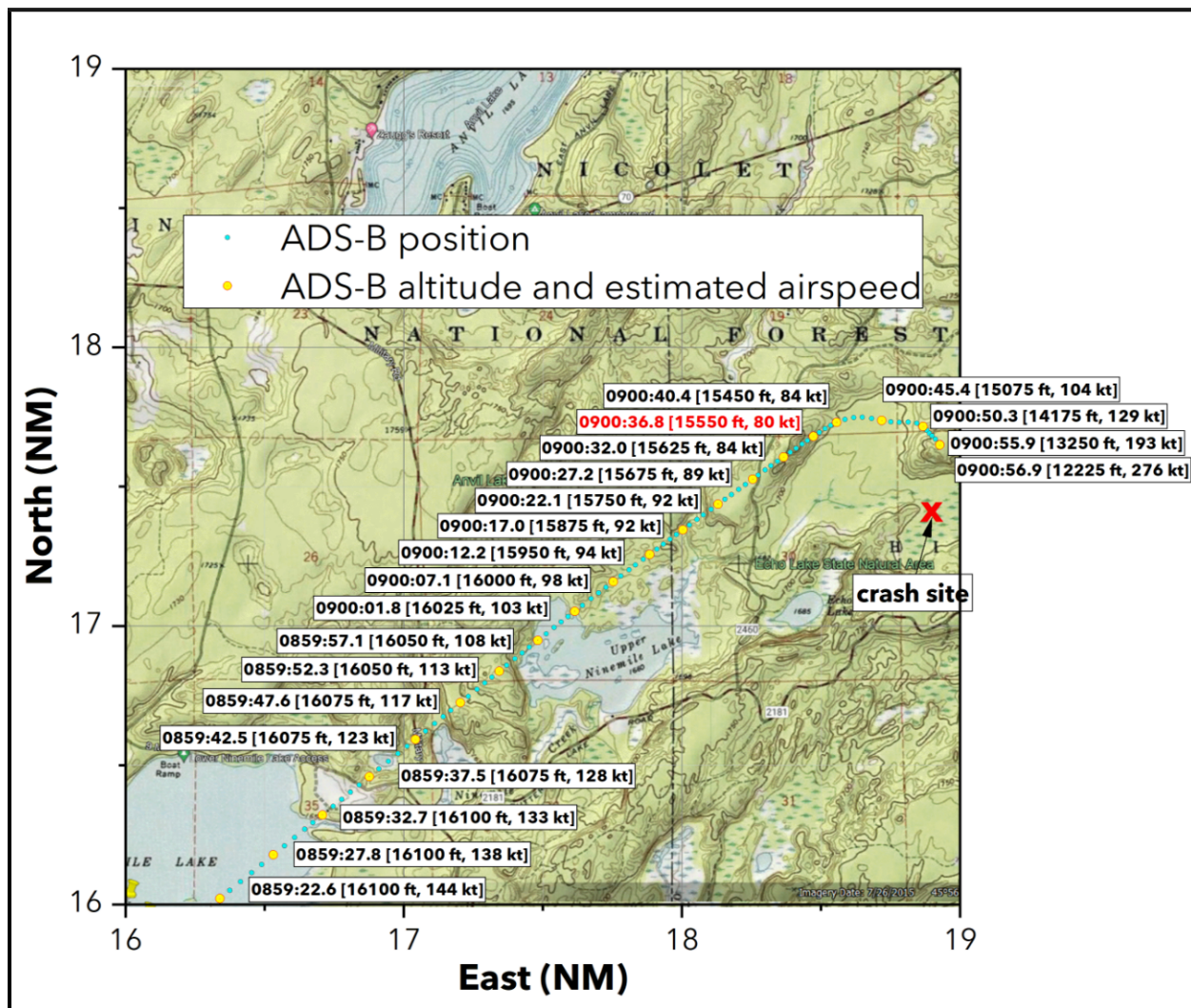


Figure 3. ADS-B altitudes and airspeeds for the accident flight.

At 0900:38.7, the airplane pitched down in excess of 30° and descended at a rate that reached 20,000 ft per minute. About the time that the airplane pitched down, the estimated normal load factor decreased from about 1.6 Gs to less than 1 G.

The study stated that a decrease in normal load factor is consistent a stall when the wing reaches its critical angle of attack, at which time the air flow becomes separated at the wing and the wing can no longer generate the necessary lift. The study also stated that a spin could result if an airplane were in uncoordinated flight at the time of a stall.

Airplane Stall/Spin Recovery Procedures Certification

The accident airplane was certificated under *Civil Air Regulations* Part 3 (CAR 3) for normal-category operations. According to the FAA, per CAR 3.20(a)(1), the airplane was intended for non-aerobatic, nonscheduled passenger, and nonscheduled cargo operations. For this operational category, manufacturers are not required to include spin recovery procedures in the POH, but there is a requirement for airplanes to be placarded against spins. For the accident airplane model, the required placard was located on the left side of instrument panel. The FAA stated that some normal-category airplanes have a placard describing the control inputs required for recovery from spinning maneuvers, but these placards are only required for utility- and acrobatic-category airplanes, and there are no regulatory requirements to include these procedures in the POH.

As previously stated, the POH for the accident airplane model (a 690B) does not contain the recovery procedures, but the POHs for the 690C and 690D models POHs contain the recovery procedure. The FAA stated that it was unclear why the POH for the 690C and 690D models had spin recovery procedures given that the POH for the accident model and the 690A did not.

In addition, the FAA stated that guidance from General Aviation Manufacturers Association (GAMA) Specification No. 1, "Specification for Pilot's Operating Handbook," section 3.9(h), Spins, suggested that "it is largely up to the applicant's [that is, manufacturer's] discretion as to the inclusion of spin recovery procedures for multi-engine airplanes in the POH." According to GAMA Specification No. 1, section 3.9 (h), if the manufacturer opts to include spin recovery procedures in the POH, "it should be noted that multi-engine airplanes have not been spin tested by the manufacturer, if such is the case."

Administrative Information

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Investigation Class: 3

Note:

Investigation Docket: <https://data.nts.gov/Docket?ProjectID=103984>

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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](#).