National Transportation Safety Board
Aviation Accident Final Report

Location:	Catawba, WI	**Accident Number:**	CEN17FA248
Date & Time:	07/01/2017, 0153 CDT	**Registration:**	N2655B
Aircraft:	CESSNA 421C	**Aircraft Damage:**	Destroyed
Defining Event:	Loss of control in flight	**Injuries:**	6 Fatal
Flight Conducted Under:	Part 91: General Aviation - Personal		

Analysis

The commercial pilot of the multi-engine airplane was conducting an instrument flight rules cross-country flight at night. The pilot checked in with air traffic control at a cruise altitude about 10,000 ft mean sea level (msl). About 31 minutes later, the pilot reported that he saw lightning off the airplane's left wing. The controller advised the pilot that the weather appeared to be about 35 to 40 miles away and that the airplane should be well clear of it. The pilot responded to the controller that he had onboard weather radar and agreed that they would fly clear of the weather. There were no further communications from the pilot. About 4 minutes later, radar information showed the airplane at 10,400 ft msl. About 1 minute later, radar showed the airplane in a descending right turn at 9,400 ft. Radar contact was lost shortly thereafter.

The distribution of the wreckage, which was scattered in an area with about a 1/4-mile radius, was consistent with an in-flight breakup. The left horizontal stabilizer and significant portions of both left and right elevators and their respective trim tabs were not found. Of the available components for examination, no pre-impact airframe structural anomalies were found. Examination of the engines and turbochargers did not reveal any pre-impact anomalies. Examination of the propellers showed evidence of rotation at impact and no pre-impact anomalies.

Review of weather information indicated that no convection or thunderstorms were coincident with or near the airplane's route of flight, and the nearest convective activity was located about 25 miles west of the accident site. Autopsy and toxicology testing revealed no evidence of pilot impairment or incapacitation. Given the lack of radar information after the airplane passed through 9,400 ft, it is likely that it entered a rapid descent during which it exceeded its design stress limitations, which resulted in the in-flight breakup; however, based on the available information, the event that precipitated the descent and loss of control could not be determined.

Probable Cause and Findings

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

A loss of control and subsequent in-flight breakup for reasons that could not be determined based on the available information.

Findings

Aircraft	Aircraft structures - Capability exceeded (Cause)
Not determined	Not determined - Unknown/Not determined (Cause)

Factual Information

History of Flight

Enroute-cruise	Loss of control in flight (Defining event)
	Part(s) separation from AC

On July 1, 2017, about 0153 central daylight time, a Cessna 421C airplane, N2655B, was destroyed during an in-flight breakup near Catawba, Wisconsin. The commercial pilot and five passengers sustained fatal injuries. The airplane was registered to Sky King Flying Service, Inc., and was being operated by the pilot as a Title 14 *Code of Federal Regulations* Part 91 personal flight. Dark night instrument meteorological conditions prevailed in the area and an instrument flight rules (IFR) flight plan was filed for the flight, which originated about 0025 from Waukegan National Airport (UGN), Waukegan, Illinois, and was enroute to Warroad International Memorial Airport (RRT), Warroad, Minnesota.

According to radar data and air traffic control communications information provided by the Federal Aviation Administration (FAA), the airplane was flying about 10,000 ft mean sea level (msl) when the pilot checked in with Minneapolis Air Route Traffic Control Center at 0117. At 0148, the pilot reported lightning off his left wing. The controller advised the pilot that the weather appeared to be about 35 to 40 miles away and that the airplane should be well clear of it. The pilot responded to the controller that he had onboard weather radar and stated that it "looks like we'll clear it nicely." After the discussion about the weather, there were no further communications from the pilot. At 0152, radar data showed the airplane at 10,400 ft msl, and at 0153, radar data showed the airplane at 9,400 ft msl in a descending right turn. Radar contact was lost shortly thereafter. There were no distress calls from the pilot. Search and rescue operations were started immediately after radar contact was lost.

A witness who was driving home from work reported that he heard engine noise, then did not hear engine noise, then heard engine noise again. He then saw what he thought were the lights of an airplane, and then the lights went out. Another witness, who did not see the airplane, reported that she heard a loud sound. Both witnesses were in the vicinity of the accident location about the time the accident occurred.

Pilot Information

Certificate:	Commercial; Private	**Age:**	70, Male
Airplane Rating(s):	Multi-engine Sea; Single-engine Sea	**Seat Occupied:**	
Other Aircraft Rating(s):	None	**Restraint Used:**	
Instrument Rating(s):	Airplane	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	Class 2 With Waivers/Limitations	**Last FAA Medical Exam:**	08/11/2016
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	
Flight Time:	2335 hours (Total, all aircraft), 70 hours (Total, this make and model), 11 hours (Last 30 days, all aircraft), 1 hours (Last 24 hours, all aircraft)		

The pilot held a commercial pilot certificate with ratings for airplane single- and multi-engine land and instrument airplane. His most recent FAA second-class medical certificate was issued on August 11, 2016. The pilot's logbook was found in the wreckage. His total flight experience was 2,335 hours, with 463 hours of total night experience. No flight time was logged between October 21, 2016, and May 5, 2017. He had 11.2 hours logged within the last 60 days before the accident, with 1.7 hours of night time, logged on May 7, 2017. His first flight logged in the accident airplane was on September 29, 2015. He logged 70.4 hours total flight experience in the accident airplane, with 7.5 hours of night experience. His most recent flight logged before the accident flight was June 16, 2017, in the accident airplane.

His most recent flight review and instrument proficiency check were completed on June 15, 2017.

Aircraft and Owner/Operator Information

Aircraft Make:	CESSNA	**Registration:**	N2655B
Model/Series:	421C C	**Aircraft Category:**	Airplane
Year of Manufacture:	1979	**Amateur Built:**	No
Airworthiness Certificate:	Normal	**Serial Number:**	421C0698
Landing Gear Type:	Retractable - Tricycle	**Seats:**	6
Date/Type of Last Inspection:	Unknown	**Certified Max Gross Wt.:**	7500 lbs
Time Since Last Inspection:		**Engines:**	2 Reciprocating
Airframe Total Time:		**Engine Manufacturer:**	Continental
ELT:	Installed, not activated	**Engine Model/Series:**	GTSIO-520-L7
Registered Owner:	SKY KING FLYING SERVICE INC	**Rated Power:**	375 hp
Operator:	On file	**Operating Certificate(s) Held:**	None

The pilot was the owner of the airplane. Review of the available airframe, propeller, and engine logbooks revealed that the airplane's most recent annual inspection was completed on September 25, 2015. An entry on the annual inspection document stated that, "aircraft checks satisfactory," and was signed by the pilot on October 10, 2016. No maintenance discrepancies were noted in the available maintenance records.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual Conditions	**Condition of Light:**	Night/Dark
Observation Facility, Elevation:	PBH, 1496 ft msl	**Distance from Accident Site:**	15 Nautical Miles
Observation Time:	0135 CDT	**Direction from Accident Site:**	90°
Lowest Cloud Condition:	Clear	**Visibility**	10 Miles
Lowest Ceiling:	Broken / 6000 ft agl	**Visibility (RVR):**	
Wind Speed/Gusts:	3 knots /	**Turbulence Type Forecast/Actual:**	/ None
Wind Direction:	360°	**Turbulence Severity Forecast/Actual:**	/ N/A
Altimeter Setting:	29.96 inches Hg	**Temperature/Dew Point:**	14°C / 14°C
Precipitation and Obscuration:			
Departure Point:	Waukegan, IL (UGN)	**Type of Flight Plan Filed:**	IFR
Destination:	Warroad, MN (RRT)	**Type of Clearance:**	IFR
Departure Time:	0028 CDT	**Type of Airspace:**	Class G

Price County Airport (PBH), Phillips, Wisconsin, was located about 15 miles east of the accident site. The 0135, weather observation included wind from 360° at 3 knots, 10 statute miles visibility, a broken ceiling at 600 ft above ground level, temperature 14°C, dew point 14°C, and an altimeter setting of 29.86 inches of mercury. Regional weather radar did not indicate any convection or thunderstorms near to the airplane's flightpath. The accident site was located about 25 miles east of convective activity with no coincidental lightning.

Wreckage and Impact Information

Crew Injuries:	1 Fatal	**Aircraft Damage:**	Destroyed
Passenger Injuries:	5 Fatal	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	6 Fatal	**Latitude, Longitude:**	45.555278, -90.495000 (est)

The accident site was located within densely vegetated terrain intersected by a road, with debris scattered on either side of and along the road surface in an area with a radius about 1/4 mile. Tree scars and ground impressions indicated that the main section of the fuselage impacted terrain in a nose-low attitude. The fuselage was found upright and oriented northeast. Both wings were found separated outboard of their respective nacelles. The empennage was not attached to the fuselage and was located about 1,200 ft from the main wreckage. The distribution of the wreckage was consistent with an in-flight breakup of the airplane. Due to the dense vegetation, muddy terrain, and limited horizontal visibility of the

accident site, a drone was used to locate parts of the wreckage that could not be found on foot.

Figure 1. Wreckage Distribution

The empennage was separated from the fuselage and located about 1,200 ft from the main wreckage. The rudder was found in three pieces and its trim tab was missing. Most of the vertical stabilizer was missing, except for the top 1.5 ft. The right side of horizontal stabilizer was found largely intact with its leading edge bent downward about 45°. The underside of the horizontal stabilizer exhibited wrinkling. Only a small portion of the right elevator tip was found, and the right elevator trim tab was missing. The entire left side of the horizontal stabilizer, most of the left elevator, and the left elevator trim tab were missing. The outboard portion of the right rear spar was found in the vicinity of the empennage components with no structure attached.

The left engine, serial number 825104-R, was found separated from the airframe and completely submerged in a 9-ft deep crater about 75 ft east of the fuselage. A sump pump was used to reduce the water level in the crater so that the engine could be recovered. The propeller assembly for this engine was not visible and could not be examined at the accident site. A large portion of the engine nacelle was found in the same crater.

The wreckage was recovered from the accident site for further examination. The left horizontal stabilizer; about 3 ft of the elevator and trim tab, and about 5 ft of the outboard left elevator and trim tab were not located.

Cockpit

The flap position could not be determined. The flap handle was found in the "UP" position. The gyroscope rotors for the #1 attitude indicator, #1 horizontal situation indicator (HSI), #2 directional gyro, and #1 turn-and-bank indicator were disassembled and examined. All rotors exhibited signs of spindle rotation. The landing gear and flap handles were both found in the retracted position. The left engine fuel selector handle was found in the right main tank position. The right engine fuel selector handle was found in the right main tank position. The right fuel selector valve was in crossfeed position. The left fuel selector valve was not observed due to impact damage.

Fuselage

The fuselage exhibited severe impact damage and was mostly in one piece with lateral and longitudinal tears in its skin from the forward pressure bulkhead to the end of the fuselage. The fuselage exhibited lateral tears in multiple places and a lateral tear along the right side. Eight seats were found installed in the aircraft.

Left Wing

The left engine nacelle was separated from the left wing about wing station (WS) 87 and WS 110. The left wing from WS 110 outboard was intact. The left wing's leading edge exhibited downward bending and diagonal creases in the area of WS 110 to WS 119. It exhibited upward bending at the trailing edge in the area of WS 110 to WS 119. About 2 ft of the inboard portion of the left aileron remained attached to the wing, and the outboard section of the aileron was missing. The left flap was connected to the nacelle via the push/pull rods, but the flap structure was missing. The outboard left flap track remained attached to the wing. The left speed brake was attached to its wing panel. The wing panel was attached to the wing. The left wing's nacelle was found with the left engine in a crater.

Right Wing

The right engine nacelle remained attached to the fuselage via control cables and wiring. Both wing spars were separated between the fuselage and the nacelle. The outboard portion of the right wing was separated about WS 110 and was intact. The right wing's leading edge exhibited downward bending and diagonal creases in the area of WS 110 to WS 119. It exhibited upward bending at the trailing edge in the area of WS 110 to WS 119. The right aileron separated from the wing in one piece. The right flap was separated from the wing and was not present. Both flap tracks were separated from the wing. The right speed brake was attached to its wing panel.

Empennage

The elevator trim tab actuator extension measured 1.8 inches, consistent with an approximate 10° tab up position. The right horizontal stabilizer was bent down parallel to the chord line about butt line (BL) 20. The right horizontal stabilizer exhibited diagonal creasing from the leading edge to trailing edge, inboard to outboard. The left horizontal stabilizer rear spar was attached from BL 0.0 outboard to BL 49; however, the left horizontal stabilizer structure from approximately BL 20 outboard was not found.

Flight Control Cables

Rudder control continuity was confirmed from the aft rudder bellcrank to the cockpit controls. Elevator control continuity was confirmed from the aft elevator bellcrank to the cockpit controls. Aileron control continuity was confirmed from the cockpit controls to the aileron bellcrank in the fuselage and to the cable separations in the wings. Both left and right aileron cables exhibited tension overload separations near their respective wing separations.

Right Engine

Mud was washed from the engine to facilitate inspection. The intake manifold assembly was intact but was separated from the intake tubes for cylinder Nos. 1, 3, and 5 due to impact forces. The assembly was removed to facilitate further engine inspection. The intake manifold tubes were intact and remained attached to each cylinder. The turbocharger and associated controls separated and remained attached to the airframe nacelle. The engine-mounted exhaust collectors were impact damaged and forced upward against the rocker covers. The turbocharger compressor blades and turbine discharge blades would not turn manually.

The cylinders remained attached at their respective bases, but the lower portion of each cylinder was destroyed by impact forces. All pushrod tubes and pushrods were impact damaged. Cylinder No. 6 exhibited impact damage to the cylinder head, which separated from the barrel. All rocker covers remained attached except on cylinder No. 6. A placard was attached to one rocker cover per cylinder indicating that GAMI fuel injectors were installed. Cylinder Nos. 1-5 were inspected using an electronic lighted borescope. All valves were intact and exhibited normal combustion deposits. All cylinders and piston domes appeared normal. The top sparkplugs were removed and inspected. When compared to a Champion Check-A-Plug chart, the cylinder Nos. 1-5 sparkplugs appeared normal in coloration and wear. The No. 6 cylinder sparkplug was contaminated and could not be inspected.

The left and right magnetos separated but remained in place connected to their respective ignition harnesses. The magneto mounting rings were broken at the magneto hold washer. The ignition harness leads were cut and impact damaged. The magnetos were not tested for operation. The engine could not be rotated manually due to impact damage to the oil sump, which bound the crankshaft. The oil sump was mostly destroyed and was crushed upward around the crankshaft throws. The oil pump remained attached and was crushed upward. The oil cooler was impact damaged. The oil filter separated and was not recovered.

The engine-driven fuel pump separated and was attached to fuel hoses and the mounting ring was damaged. The drive coupling remained in the displaced fuel pump gear. The gear and coupling were removed from the crankcase mounting and inspected. The drive coupling was intact but bent. The fuel pump was disassembled and inspected. The fuel pump rotated smoothly when manually driven. The impeller blades were intact. No fuel was present in the fuel pump cavity. The fuel manifold valve and fuel lines remained attached and intact. The individual fuel lines were bent due to impact forces. The fuel metering unit and throttle body remained attached to the airframe nacelle.

The starter motor was not recovered. The starter adapter was attached and was impact damaged at the mount. The engine-driven alternator was impact damaged. The alternator mount was impact damaged, but the alternator remained in place. The instrument air pump separated and was not recovered. The instrument air pump drive remained attached to the accessory gear. The pump drive was impact damaged but intact. The propeller governor separated and was not recovered.

Left Engine

Mud was washed from the engine to facilitate inspection. The impact damaged intercooler was inspected. The manifold tubes separated at the attach points on each cylinder head and were not recovered. The engine-mounted exhaust collectors were impact damaged. The turbocharger compressor blades, and turbine discharge blades would not turn manually. The upper deck pressure system separated and was not recovered.

The cylinders remained attached at their respective bases. The cooling fins on the top and bottom of each cylinder were damaged. All pushrod tubes and pushrods were intact and in place, and all rocker covers remained attached. Placards on each cylinder indicated that GAMI fuel injectors were installed. All fuel injectors separated except those mounted in cylinder Nos. 1 and 5. A lighted electronic borescope inspection was performed. The pistons in cylinder Nos. 5 and 6 were too high in each cylinder to allow inspection. The engine could not be rotated manually. Cylinder Nos. 3 and 4 were full of mud and could not be inspected. Cylinder Nos. 1 and 2 intake and exhaust valves were intact and exhibited normal combustion signatures. The top sparkplugs were removed and inspected. Sparkplugs from cylinder Nos. 4, 5, and 6 were damaged and the barrels separated from the base. When compared to a Champion Check-A-Plug chart, the sparkplugs from cylinder Nos. 1, 3, and 5 appeared normal in coloration and wear. The sparkplugs from cylinder Nos. 2, 4, and 5 were contaminated with mud and could not be inspected.

The left magneto separated except for the mounting ring and a portion of the internal drive. The right magneto separated and was not recovered. The ignition harness leads were found cut and impact damaged. The oil sump was impact damaged and the left rear corner was breached. The oil pump was attached with impact damage and the pump gears were exposed. The oil cooler separated and was not recovered. The remote-mounted oil filter separated and was not recovered. The engine-driven fuel pump was attached and the fuel hoses and fittings were damaged. The fuel pump was removed and disassembled. The drive coupling was intact. The fuel pump could be manually rotated, but mud inside the pump housing resulted in rotation difficulty. The impeller blades were intact. No fuel was present in the fuel pump cavity. The fuel manifold valve and fuel lines separated and were not recovered. The fuel metering unit and throttle body remained attached to the airframe nacelle.

The starter motor separated but was recovered. The starter adapter was attached and had impact damage to the starter motor mount. The engine driven alternator separated and was not recovered. The instrument air pump was not recovered. The instrument air pump drive remained attached to the accessory gear. The pump drive was inspected and was intact. The propeller governor separated and was not recovered.

Teardown Examinations of Engines, Turbochargers, and Propellers

Both engines and their respective turbocharger components were transported to Continental Motors, Mobile, Alabama, for teardown and analytical inspections. Teardown examinations of both the left and right engines showed heavy impact and water damage. No preimpact anomalies were noted during the examinations of the engines. Teardown examination of the turbochargers exhibited characteristics of normal operation with no discrepancies noted that would have prevented or degraded normal turbocharger operation before the in-flight breakup/impact. Damage to both engines and their respective turbochargers was consistent with high impact forces. For more detailed information, see the engine teardown and turbocharger examination report in the public docket for this accident.

The propeller assemblies were transported to McCauley Propellers, Wichita, Kansas, for teardown and analytical inspections. Teardown examinations of both left and right propellers showed damage resulting from the impact sequence. There were no indications of any type of propeller failure or malfunction before the breakup and impact. Both the left and right propellers displayed signatures consistent with rotation at impact. Exact engine power levels were not determined. Both propellers displayed impact signature markings or component positions indicating that the blades were operating at about a 15° reference angle measured at the 30-inch blade radial station during the impact sequence.

Medical And Pathological Information

The Hennepin County Medical Examiner's Office, Minneapolis, Minnesota, performed an autopsy of the pilot. The cause of death was blunt trauma.

Toxicology testing performed at the FAA Forensic Sciences Laboratory identified no drugs, ethanol, or carbon monoxide.

Administrative Information

Investigator In Charge (IIC):	Alexander Lemishko	**Report Date:**	09/09/2019
Additional Participating Persons:	Ray Yank; FAA FSDO; Milwaukee, WI Henry Soderland; Cessna; Wichita, KS Mike Counsel; Continental; Mobile, AL		
Publish Date:	09/09/2019		
Note:	The NTSB traveled to the scene of this accident.		
Investigation Docket:	http://dms.ntsb.gov/pubdms/search/dockList.cfm?mKey=95473		