



# Aviation Investigation Final Report

<b>Location:</b>	Harmon, North Dakota	<b>Accident Number:</b>	CEN19FA030
<b>Date &amp; Time:</b>	November 17, 2018, 22:40 Local	<b>Registration:</b>	N441CX
<b>Aircraft:</b>	Cessna 441	<b>Aircraft Damage:</b>	Destroyed
<b>Defining Event:</b>	Aircraft structural failure	<b>Injuries:</b>	3 Fatal
<b>Flight Conducted Under:</b>	Part 91: General aviation - Positioning		

## Analysis

The pilot and two medical crewmembers were repositioning the airplane to pick up a patient for aeromedical transport. Dark night instrument meteorological conditions prevailed for the flight. Radar data showed the airplane climb to 14,000 ft mean sea level after departure and proceed direct toward the destination airport before beginning a right descending turn. The airplane subsequently broke up inflight and impacted terrain. No distress calls were received from the pilot before the accident. Although weather conditions were conducive for inflight icing, no evidence of structural icing was identified at the scene.

The debris field was 2,500 ft long and the disbursement of the wreckage confirmed that both wings, the horizontal stabilizer, both elevators, and both engines separated from the airplane before impacting the ground. Examination of the wreckage revealed that the initiating failure was the failure of the wing where it passed through the center of the airplane. The three wing spars exhibited S-bending deformation, indicative of positive overload producing compressive buckling and fracture. Further, impact signatures as black paint transfers and gouged aluminum, were consistent with the left outboard wing separating when it was struck by the right engine after the wing spars failed. There was no evidence of any pre-existing conditions that would have degraded the strength of the airplane structure at the fracture locations. Flight control continuity was confirmed. An examination of the engines, propellers, and available systems showed no mechanical malfunctions or failure that could have contributed to the accident. The descending right turn was inconsistent with the intended flight track and ATC-provided clearance. However, there was insufficient information to determine how it was initiated and when the pilot became aware of the airplane's state in the dark night IMC conditions. Yet, the absence of a distress call or communication with ATC about the airplane's deviation suggests that the pilot was not initially aware of the change in state. The structural failure signatures on the airplane were indicative of the wings failing in positive overload, which was consistent with the pilot initiating a pull-up maneuver that exceeded the airplane spars' structural integrity during an attempted recovery from the spiral dive.

# 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 control of the airplane in dark night conditions that resulted in an in-flight positive overload failure of the wings and the subsequent in-flight breakup of the airplane.

## Findings

Aircraft	Center wing box (on wing) - Capability exceeded
Personnel issues	Aircraft control - Pilot
Aircraft	Pitch control - Incorrect use/operation
Environmental issues	Dark - Effect on operation

# Factual Information

## History of Flight

<b>Enroute-cruise</b>	Abrupt maneuver
<b>Maneuvering</b>	Aircraft structural failure (Defining event)
<b>Uncontrolled descent</b>	Collision with terr/obj (non-CFIT)

On November 18, 2018, about 2240 central standard time, a Cessna 441, N441CX, was destroyed when it was involved in an accident near Harmon, North Dakota. The pilot, flight nurse, and paramedic were fatally injured. The airplane was being operated as a Title 14 Code of Federal Regulations Part 91 positioning flight.

At 2049, the pilot and medical crew were notified of a mission to fly from Bismarck Municipal Airport (BIS), Bismarck, North Dakota, to Sloulin Field International Airport (ISN), Williston, North Dakota, to pick up a patient for the emergency medical services flight and return to BIS. The pilot notified the fixed base operator to load 50 gallons of Jet fuel on board. At 2159, the pilot obtained an on-line weather document that contained weather forecasts, meteorological aerodrome reports (METARs), terminal forecasts (TAFs), and notices to airmen (NOTAMs) for BIS and ISN.

At 2227, the pilot filed an instrument flight rules (IFR) flight plan. He estimated a departure time of 2234 and a cruising altitude of 14,000 ft. Estimated time en route was 45 minutes at an airspeed of 281 knots. Fuel on board was 3 hours 30 minutes. No alternate airport was listed.

Radar data indicated the airplane took off at 2231 and climbed to 14,000 ft mean sea level on a direct course to ISN. About 2239:30, radar showed the airplane enter a right descending turn. Between 2239:30 and 2240:09, the airplane lost 7,800 ft of altitude. At 2240:09, the airplane was still in left descending turn at 6,200 ft. Radar contact was lost at 2240:18. At that time the airplane was showing as a primary target. The airplane impacted terrain just northwest of the final contact point. No distress calls were received.

Witnesses on the ground reported hearing high-pitch, high-speed engine sounds prior to impact.

## Pilot Information

<b>Certificate:</b>	Airline transport; Commercial; Flight instructor	<b>Age:</b>	48,Male
<b>Airplane Rating(s):</b>	Single-engine land; Multi-engine land	<b>Seat Occupied:</b>	Left
<b>Other Aircraft Rating(s):</b>	None	<b>Restraint Used:</b>	3-point
<b>Instrument Rating(s):</b>	Airplane	<b>Second Pilot Present:</b>	No
<b>Instructor Rating(s):</b>	Airplane multi-engine; Airplane single-engine; Instrument airplane	<b>Toxicology Performed:</b>	Yes
<b>Medical Certification:</b>	Class 1 With waivers/limitations	<b>Last FAA Medical Exam:</b>	March 28, 2018
<b>Occupational Pilot:</b>	Yes	<b>Last Flight Review or Equivalent:</b>	October 22, 2018
<b>Flight Time:</b>	4685 hours (Total, all aircraft), 70 hours (Total, this make and model), 3963 hours (Pilot In Command, all aircraft), 36 hours (Last 90 days, all aircraft), 16 hours (Last 30 days, all aircraft)		

## Aircraft and Owner/Operator Information

<b>Aircraft Make:</b>	Cessna	<b>Registration:</b>	N441CX
<b>Model/Series:</b>	441 No Series	<b>Aircraft Category:</b>	Airplane
<b>Year of Manufacture:</b>	1982	<b>Amateur Built:</b>	
<b>Airworthiness Certificate:</b>	Normal	<b>Serial Number:</b>	441-0305
<b>Landing Gear Type:</b>	Retractable - Tricycle	<b>Seats:</b>	5
<b>Date/Type of Last Inspection:</b>	100 hour	<b>Certified Max Gross Wt.:</b>	10340 lbs
<b>Time Since Last Inspection:</b>		<b>Engines:</b>	2 Turbo prop
<b>Airframe Total Time:</b>		<b>Engine Manufacturer:</b>	Garrett
<b>ELT:</b>	C91 installed, not activated	<b>Engine Model/Series:</b>	TPE331-10N-53
<b>Registered Owner:</b>		<b>Rated Power:</b>	715 Horsepower
<b>Operator:</b>	On file	<b>Operating Certificate(s) Held:</b>	On-demand air taxi (135)
<b>Operator Does Business As:</b>		<b>Operator Designator Code:</b>	R6DA

## Meteorological Information and Flight Plan

<b>Conditions at Accident Site:</b>	Visual (VMC)	<b>Condition of Light:</b>	Night
<b>Observation Facility, Elevation:</b>	KBIS, 1661 ft msl	<b>Distance from Accident Site:</b>	16 Nautical Miles
<b>Observation Time:</b>	22:52 Local	<b>Direction from Accident Site:</b>	
<b>Lowest Cloud Condition:</b>	Few / 900 ft AGL	<b>Visibility</b>	10 miles
<b>Lowest Ceiling:</b>	Overcast / 2400 ft AGL	<b>Visibility (RVR):</b>	
<b>Wind Speed/Gusts:</b>	9 knots /	<b>Turbulence Type Forecast/Actual:</b>	/
<b>Wind Direction:</b>	50°	<b>Turbulence Severity Forecast/Actual:</b>	/
<b>Altimeter Setting:</b>	30.01 inches Hg	<b>Temperature/Dew Point:</b>	-4°C / -6°C
<b>Precipitation and Obscuration:</b>			
<b>Departure Point:</b>	Bismarck, ND (BIS )	<b>Type of Flight Plan Filed:</b>	IFR
<b>Destination:</b>	Williston, ND (ISN )	<b>Type of Clearance:</b>	IFR
<b>Departure Time:</b>	02:23 Local	<b>Type of Airspace:</b>	Class E

The National Weather Service Surface Analysis Chart showed a low-pressure system over Minnesota, with a cold front extending west-southwest into South Dakota, and northwest into North Dakota, Montana, and Canada. The accident site was located behind the cold front. The Area Forecast indicated widespread marginal VFR conditions with localized IFR conditions were expected behind the cold front that had moved across North Dakota and was moving south. The National Radar Mosaic Image depicted several areas of snow showers north and east of the Bismarck area. The Weather Depiction Chart depicted several areas of IFR conditions over North Dakota and Montana due to low ceilings and low visibility in snow, with marginal visual flight rules (VFR) conditions extending over most of North Dakota. An upper air sounding supported nimbostratus-type clouds with precipitation in the form of snow, and greater than 80% relative humidity between 7,000 to 15,500 ft, supporting light-to-moderate intensity rime-to mixed-type ice conditions. Icing probability exceeded 90% in the icing layer. Weather Surveillance Radar Imagery depicted a large area of light snow extending northwest through northeast of BIS. No weather watches or warnings were in effect during the period. AIRMET Sierra was in effect for IFR conditions and AIRMET Zulu was in effect for icing conditions.

## Wreckage and Impact Information

<b>Crew Injuries:</b>	3 Fatal	<b>Aircraft Damage:</b>	Destroyed
<b>Passenger Injuries:</b>		<b>Aircraft Fire:</b>	None
<b>Ground Injuries:</b>	N/A	<b>Aircraft Explosion:</b>	None
<b>Total Injuries:</b>	3 Fatal	<b>Latitude, Longitude:</b>	46.783889,-100.763885

The accident site was located about 20 miles northwest of BIS. The wreckage was scattered over snow-covered terrain in an area that was about 2,500 ft long and 750 ft wide and oriented in a north to south direction. The north end of the field contained the left and right engines. The fuselage fragments and left and right wings were located in the middle of the debris field. The southern end of the debris field consisted of lighter weight parts as the baggage doors, and left and right horizontal stabilizers. Smaller and lighter items as insulation and airplane interior furnishings, were found at the farthest point from the main wreckage to the south. The rudder counterweight and parts of the elevators were also found in this portion of the debris field. The empennage, except for the left and right elevator fragments, was found east of the cockpit. The left engine was located about 225 ft north of the empennage. The right engine was located about 225 to 300 ft north and east of the cockpit.

Further examination of the right wing showed it had separated at the fuselage and exhibited crush damage along the leading edge. The right aileron remained attached and showed buckling damage on the upper and lower surfaces. The right flap was intact and remained attached to wing by the push rods. The left wing was broken at the fuselage and had fractured into two main pieces at mid-span. At the fracture was aft and downward crushing and bending and multiple fractures. There was also black paint transfers and gouged aluminum in this area. The left wing engine mount and engine located in this area were broken and separated. The inboard section was relatively intact. The left aileron was separated and fractured into three pieces. All three pieces showed extensive bending and crushing. The center wing area where it passed through the fuselage broken and deformed. The forward spar lower cap was bent upward and broken. The main spar lower cap showed upward bending and fracturing as did the aft spar lower cap. Flight control continuity was confirmed from the cockpit to both ailerons, the elevator and rudder.

An examination of the left and right engines showed no mechanical malfunctions or failure that would have prevented normal operation of either engine.

No evidence of failure or malfunction of the propellers was found.

## Medical and Pathological Information

Autopsies of the pilot and two medical crewmembers were performed by the North Dakota Department of Health's State Forensic Examiner, Bismarck, North Dakota. The cause of death was listed as "multiple injuries" for each of the occupants. Toxicology testing of samples recovered from the pilot found no ethanol in vitreous, but 58 (mg/dL, mg/hg) ethanol was detected in blood cavity. However, because ethanol was not found in vitreous, its presence

was most-likely the result of post-mortem putrefaction. No drugs tested for were found in the samples, and the samples were unsuitable for testing for carbon monoxide.

## Tests and Research

The enhanced ground proximity warning system (EGPWS), or Multi-Hazard Awareness Unit (KMH-820), was removed and examined by the manufacturer. No data were able to be retrieved.

The pilot's cellular telephone was found damaged in the wreckage; a forensic download of the phone indicated that the phone had been powered on multiple times. In August, in a text conversation with the Director of Operations (DO) for the company, the pilot queried concerns with the portable backup attitude heading reference system (AHRS). In October, the DO asked the pilot, "Did you get the gyro flag?" to which the pilot responded, "No." In November, the pilot informed the DO that his Heading Situation Indicator (HSI) had precessed 25 degrees on the flight from Minot to Denver and that the autopilot started jerking again!" The DO asked, "Did you go into free mode?" The pilot responded, "Had to." A photograph taken by the pilot about 1816:37 on that flight showed the airplane in flight at 25,000 feet with the autopilot engaged and in NAV and ALT modes.

A Stratus-3 ADS-B (automatic dependent surveillance–broadcast) receiver with AHRS capabilities was found in the wreckage, but the unit was not turned on.

## Administrative Information

<b>Investigator In Charge (IIC):</b>	Scott, Arnold	
<b>Additional Participating Persons:</b>	Eric West; FAA AVP-100; Washington, DC Todd Gentry; FAA AVP-100; Washington, DC Jeff R Vigdal; FAA Flight Standards District Office; Fargo, ND Brent Allen; FAA Flight Standards District Office; Fargo, ND Joanna Spiekermeier; FAA Flight Standards District Office; Fargo, ND Henry Soderlund; Textron Aviation; Wichita, KS Dana Metz; Honeywell Aerospace; Phoenix, AZ Jonathan Ternes; Bismarck Air Medical; Bismarck, ND	
<b>Original Publish Date:</b>	December 3, 2020	<b>Investigation Class:</b> 2
<b>Note:</b>	The NTSB traveled to the scene of this accident.	
<b>Investigation Docket:</b>	<a href="https://data.nts.gov/Docket?ProjectID=98652">https://data.nts.gov/Docket?ProjectID=98652</a>	

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