Aviation Investigation Final Report

Location:	Danville, Arkansas	**Accident Number:**	CEN21FA198
Date & Time:	April 23, 2021, 17:01 Local	**Registration:**	N461DK
Aircraft:	Piper PA-46-310P	**Aircraft Damage:**	Substantial
Defining Event:	Other weather encounter	**Injuries:**	4 Fatal
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The pilot was conducting an instrument flight rules cross-country flight and climbing to a planned altitude of 23,000 ft mean sea level (msl). According to air traffic control data, as the airplane climbed through 18,600 ft msl, its groundspeed was 171 knots, and a gradual reduction in groundspeed began. After reaching an altitude of about 20,200 ft msl, the airplane began a descent on a southeast heading. Just before the descent began, the airplane's groundspeed had decreased to 145 knots. About 2 minutes after the descent began, the airplane turned right to a northeast heading on which it continued for about 30 seconds. The flightpath then became erratic before the data ended. The pilot made no distress calls and did not respond to repeated calls from the controller.

The main wreckage of the airplane was located in densely forested terrain at an elevation of about 930 ft about 1,000 ft south of the last radar return. The outboard portion of the right wing, right aileron, right horizontal stabilizer, and right elevator were not located with the main wreckage and, despite ground and aerial searches with a small unmanned aircraft system, were not found. Examination of the wreckage indicated that the missing wing and tail sections separated in flight due to overload. Examination of the recovered airframe and engine did not reveal evidence of any pre-existing mechanical malfunctions or anomalies that would have precluded normal operation.

Weather forecasts indicated that the accident site was in an area where moderate icing conditions up to 25,000 ft msl, embedded thunderstorms, and 2-inch hail were forecasted. Review of preflight weather information received by the pilot indicated that he was aware of the conditions forecast on the route of flight before initiating the flight. Meteorological data revealed that the airplane likely entered icing conditions that ranged from light to heavy as it climbed through 14,000 ft msl about 23 minutes after takeoff and remained in icing conditions for the remaining 16-minute duration of the flight. Freezing drizzle conditions were likely present along the flightpath.

Although the airplane was equipped for flight in icing conditions, the pilot's operating handbook contained a warning about flight into severe icing conditions, which stated that flight in freezing drizzle could result in ice build-up on protected surfaces exceeding the capability of the ice protection system. The airplane's gradual loss of groundspeed as it climbed was consistent with ice accumulating on the airplane. It is likely that during the 16 minutes the airplane was operating in icing conditions, the capability of the ice protection system was exceeded, which resulted in a degradation of aircraft performance and subsequent aerodynamic stall. During the ensuing uncontrolled descent, the structural capability of the airplane was exceeded, which resulted in an inflight break up.

A review of the pilot's records revealed multiple certificate application failures for reasons that included inadequate knowledge of cross-country flight planning, aircraft performance, and stalls. Review of the pilot's airman knowledge written tests found areas answered incorrectly over multiple exams included meteorology, aircraft performance, aeronautical decision-making, and stalls.

The ethanol identified in the pilot's cavity blood was most likely the result of postmortem production. Therefore, effects from ethanol did not play any role in this accident.

The cargo was documented as it was removed from the airplane and remained secure until after it was weighed. Based upon the weight of the cargo, passengers, airplane, and fuel from the filed flight plan, at the time of departure, the airplane would have been about 361 lbs over maximum gross weight. According to the FAA *Pilot's Handbook of Aeronautical Knowledge*, an overloaded airplane "may exhibit unexpected and unusually poor flight characteristics," which include reduced maneuverability and an increased stall speed.

Probable Cause and Findings

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

The pilot's improper decision to continue flight in an area of moderate-to-heavy icing conditions, which resulted in exceedance of the airplane's anti-icing system capabilities, a degradation of aircraft performance, and subsequent aerodynamic stall.

Findings

Aircraft	Angle of attack - Capability exceeded
Environmental issues	(general) - Effect on equipment
Personnel issues	Decision making/judgment - Pilot
Personnel issues	Knowledge of meteorologic cond - Pilot
Personnel issues	Aeronautical knowledge - Pilot

Factual Information

History of Flight

Enroute-climb to cruise	Other weather encounter (Defining event)

On April 23, 2021, about 1701 central daylight time (CDT), a Piper PA-46-310P airplane, N461DK, was destroyed when it was involved in an accident near Danville, Arkansas. The pilot and three passengers sustained fatal injuries. The airplane was operated as a Title 14 *Code of Federal Regulations (CFR)* Part 91 personal flight.

The airplane had departed Muskogee-Davis Regional Airport (MKO), Muskogee, Oklahoma, about 1622 destined for Williston Municipal Airport (X60), Williston, Florida, on an instrument flight rules flight plan. On the flight plan, the pilot indicated a planned cruise altitude of 23,000 ft mean sea level (msl).

According to archived air traffic control (ATC) information, about 1633, ATC advised the pilot about moderate precipitation along the route of flight. About 1651, the pilot reported climbing through 16,000 ft msl. A review of flight track data revealed that as the airplane climbed through 18,600 ft msl, its ground speed was 171 knots, and a gradual reduction in ground speed began. About 1658, after reaching 20,200 ft msl, the airplane began to descend on a southeast heading. Just before it began to descend, the airplane's ground speed had decreased to 145 knots. No further radio communications were received from the pilot, and he did not respond to repeated calls from the controller.

About 2 minutes after the descent began, the airplane began a right turn to the northeast and continued on that heading for about 30 seconds. The flight path then became erratic before the data ended. The last radar return was about 1,000 ft south of the accident site.

Pilot Information

Certificate:	Commercial; Flight engineer	**Age:**	28,Male
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	3-point
Instrument Rating(s):	Airplane	**Second Pilot Present:**	
Instructor Rating(s):	Airplane single-engine; Instrument airplane	**Toxicology Performed:**	Yes
Medical Certification:	Class 1 Without waivers/limitations	**Last FAA Medical Exam:**	August 8, 2019
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	
Flight Time:	(Estimated) 1431 hours (Total, all aircraft)		

Other flight crew Information

Certificate:	Private	**Age:**	55,Male
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Right
Other Aircraft Rating(s):	None	**Restraint Used:**	3-point
Instrument Rating(s):	None	**Second Pilot Present:**	
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	Class 3 Without waivers/limitations	**Last FAA Medical Exam:**	August 1, 2019
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	
Flight Time:	81 hours (Total, all aircraft), 35 hours (Pilot In Command, all aircraft)		

A review of the pilot's Federal Aviation Administration (FAA) airman certification file revealed multiple notices of disapproval issued when the pilot failed various practical tests for flight certificates or ratings. The first notice was issued March 20, 2015, in conjunction with the pilot's application for a private pilot certificate. The notice stated that upon reapplication the pilot would be reexamined in practical test standards areas of operation "VII. Navigation" and "VIII. Slow flight and stalls."

The second disapproval notice was issued on December 1, 2018, in conjunction with the pilot's application for a flight instructor certificate. The designated pilot examiner wrote that the pilot was unsatisfactory in three technical subject areas: principals of flight, turning tendency, preflight preparation; determination of weight and balance condition, use of performance charts, tables, and other data in determining performance in various phases of flight; and preflight lesson on a maneuver to be performed in flight.

Two disapproval notices were issued in conjunction with the pilot's application for the addition of an instrument rating to his flight instructor certificate. On the first failure, dated October 20,

2019, the two unsatisfactory areas were preflight preparation – cross country flight planning and navigation systems – intercepting and tracking navigational systems and distance measuring equipment (DME) arcs. On the second failure, dated July 10, 2020, the two unsatisfactory areas were precision and non-precision instrument approach procedures.

The pilot's airman knowledge test reports were reviewed, and the subject matter knowledge codes were researched. Although not all inclusive, areas answered incorrectly over multiple exams included meteorology, aircraft performance to include weight and balance, aeronautical decision making, stall characteristics/factors/recovery/precautions, and angle of attack characteristics.

Aircraft and Owner/Operator Information

Aircraft Make:	Piper	**Registration:**	N461DK
Model/Series:	PA-46-310P	**Aircraft Category:**	Airplane
Year of Manufacture:	1985	**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	46-8508102
Landing Gear Type:	Retractable - Tricycle	**Seats:**	6
Date/Type of Last Inspection:		**Certified Max Gross Wt.:**	4100 lbs
Time Since Last Inspection:		**Engines:**	1 Reciprocating
Airframe Total Time:		**Engine Manufacturer:**	Continental
ELT:	C91A installed, not activated	**Engine Model/Series:**	TSIO550
Registered Owner:	On file	**Rated Power:**	
Operator:	On file	**Operating Certificate(s) Held:**	None

The cargo was documented as it was removed from the airplane and remained secure until after it was weighed. Based upon the weight of the cargo, passengers, airplane, and fuel from the filed flight plan, at the time of departure from MKO, the airplane would have been about 361 lbs over maximum gross weight. The seating locations of two of the passengers could not be determined, which precluded determination of the airplane's center of gravity. According to the FAA *Pilot's Handbook of Aeronautical Knowledge*, an overloaded airplane "may exhibit unexpected and unusually poor flight characteristics," which include reduced maneuverability and an increased stall speed.

The airplane was equipped and certified for flight into known icing conditions. As a part of this certification, several limitations and warnings existed. One such warning, contained in the limitations section of the pilot's operating handbook stated:

Severe icing may result from environmental conditions outside of those for which the airplane is certified. Flight in freezing rain, freezing drizzle, or mixed icing conditions (supercooled liquid water and ice crystals) may result in ice build-up on protected surfaces exceeding the capability of the ice protection system, or may result in ice forming aft of the protected surfaces. This ice may not be shed using the ice protection systems, and may seriously degrade the performance and controllability of the airplane.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Instrument (IMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	KMEZ,1079 ft msl	**Distance from Accident Site:**	38 Nautical Miles
Observation Time:	15:55 Local	**Direction from Accident Site:**	229°
Lowest Cloud Condition:		**Visibility**	5 miles
Lowest Ceiling:	Overcast / 700 ft AGL	**Visibility (RVR):**	
Wind Speed/Gusts:	6 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	80°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29.86 inches Hg	**Temperature/Dew Point:**	14°C / 13°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Muskogee, OK (MKO)	**Type of Flight Plan Filed:**	IFR
Destination:	Williston, FL (X60)	**Type of Clearance:**	IFR
Departure Time:	16:22 Local	**Type of Airspace:**	Class A

The current icing product (CIP) for 1700 CDT indicated a 40 to 60% probability of icing at 14,000, 16,000 and 18,000 ft msl above the accident site. The 1700 CIP also indicated that the icing near the accident site would be in the “light” category above 14,000 ft msl with pockets of “moderate to heavy” category along the flight track leading to the accident location. In addition, the 1700 CIP indicated an unknown probability of supercooled large droplets (SLD) above 12,000 ft msl at the accident site. The forecast icing product (FIP) 1-hour forecast valid for 1700 CDT indicated a 30 to 50% probability of icing at 14,000 to 18,000 ft msl over the accident area. The FIP also indicated that the icing intensity near the accident site would range from “moderate” to “heavy” categories. ATC radar data indicated that the airplane climbed through 14,000 ft about 1645 CDT.

The closest forecast point to the accident site was Fort Smith, Arkansas (FSM). The FSM forecast issued at 1457 CDT and valid for use between 1500 CDT and 2200 CDT indicated wind at 12,000 ft msl from 250° at 23 knots with a temperature of -2°C, wind at 18,000 ft msl from 260° at 37 knots with a temperature of -16°C, and wind at 24,000 ft msl from 240° at 54 knots with a temperature of -26°C.

The accident pilot received weather information from Leidos Flight Service about 1554 and had

additional discussions with Leidos Flight Service through about 1620. Additionally, a search of archived ForeFlight information indicated that the accident pilot did request and receive weather information from ForeFlight at 1525. During the Leidos contact, the weather briefer mentioned the AIRMETs in affect for the accident flight and the text Leidos weather information contained all the valid weather forecast at the time of departure. In addition, the weather briefing information requested by and provided to the accident pilot at 1525 contained all the standard imagery valid at the departure time, to include the AIRMETs and SIGMETs valid along the route of flight. The vertical cross section forecast provided by ForeFlight indicated the flight would traverse an area of forecast moderate icing conditions.

Wreckage and Impact Information

Crew Injuries:	1 Fatal	**Aircraft Damage:**	Substantial
Passenger Injuries:	3 Fatal	**Aircraft Fire:**	None
Ground Injuries:		**Aircraft Explosion:**	None
Total Injuries:	4 Fatal	**Latitude, Longitude:**	34.96735,-93.62222

A search was immediately initiated, and the airplane was located the next morning. The airplane was found in an area of densely forested terrain at an elevation of about 930 ft. During the on-scene portion of the investigation, the outboard portion of the right wing, right aileron, right horizontal stabilizer, and right elevator were not located in the vicinity of the main wreckage. The National Transportation Safety Board (NTSB) conducted numerous search missions using a small unmanned aircraft system; however, no additional wreckage was located.

Examination of the wreckage indicated that the missing wing and tail sections had separated in flight in a manner consistent with overload. The recovered airframe and engine were examined, and no evidence of pre-existing mechanical malfunctions or anomalies were noted that would have precluded normal operation.

Medical and Pathological Information

Toxicology testing of the pilot performed by the FAA's Forensic Sciences Laboratory identified ethanol in cavity blood (0.058 gm/dl) but no ethanol in vitreous. N-propanol was also detected in cavity blood.

Preventing Similar Accidents

Aircraft Inflight Icing (SA-014)

The Problem

As little as 1/4 inch of leading-edge ice can increase your airplane's stall speed 25 to 40 knots. Sudden departure from controlled flight is possible with only 1/4 inch of leading-edge ice accumulation at normal approach speeds. The danger is that some 1/4-inch accumulations have minimal impact on level-flight characteristics and pilots become overconfident. Further, using the autopilot can hide changes in the handling qualities of the airplane that may be a precursor to premature stall or loss of control. Turn off or limit the use of the autopilot in order to better "feel" changes in the handling qualities of the airplane.

For 60 years, pilots have been taught to wait for a prescribed accumulation of leading-edge ice before activating the deice boots because of the believed threat of ice bridging. However, ice bridging is extremely rare, if it exists at all. In theory, ice bridging could occur if the expanding boot pushes the ice into a frozen shape around the expanded boot, thus rendering the boot ineffective at removing ice. Yet there have been no known cases where ice bridging has caused an incident or accident, but there have been numerous incidents and accidents involving a delayed activation of deice boots.

Early activation of the deice boots limits the effects of leading-edge ice and improves the operating safety margin. Many pneumatic deice boot systems only provide a means to manually cycle the system and have no provision for continuous operation. While icing conditions exist, continue to manually cycle the deice system unless the system has a provision for continuous operation.

What can you do?

- Leading-edge deice boots should be activated as soon as icing is encountered, unless the aircraft flight manual or the pilot's operating handbook pilots specifically directs not to activate them.
- If the aircraft flight manual or the pilot's operating handbook specifies to wait for an accumulation of ice before activating the deice boots, maintain extremely careful vigilance of airspeed and any unusual handling qualities.
- While icing conditions exist, continue to manually cycle the deice system unless the system has a provision for continuous operation.
- Turn off or limit the use of the autopilot in order to better "feel" changes in the handling qualities of the airplane.
- Be aware that some aircraft manufacturers maintain that waiting for the accumulation of ice is still the most effective means of shedding ice.

See https://www.ntsb.gov/Advocacy/safety-alerts/Documents/SA-014.pdf for additional resources.

The NTSB presents this information to prevent recurrence of similar accidents. Note that this should not be considered guidance from the regulator, nor does this supersede existing FAA Regulations (FARs).

Administrative Information

Investigator In Charge (IIC):	Williams, David
Additional Participating Persons:	Andrew Finne; FAA; Little Rock, AR Kathryn Whitaker; Piper; Vero Beach, FL
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