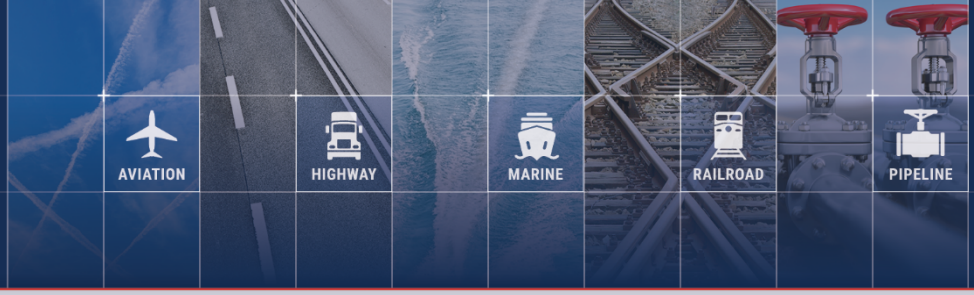

Aviation Investigation Final Report

Location:	Roff, Oklahoma	**Accident Number:**	CEN21FA300
Date & Time:	July 2, 2021, 02:25 Local	**Registration:**	N302Z
Aircraft:	Beech 35-33	**Aircraft Damage:**	Destroyed
Defining Event:	Loss of control in flight	**Injuries:**	2 Fatal
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The pilot was conducting a personal flight at night in low-visibility conditions. According to automatic dependent surveillance-broadcast (ADS-B) data, during the initial portion of the flight, the airplane's altitude was generally between 1,000 and 2,000 ft before the airplane climbed to 3,000 ft. About 4.5 minutes before the accident, the airplane entered a gradual descent to an altitude between about 1,400 and 1,500 ft and continued to fly at that altitude (200 to 300 ft above ground level) for about the next 2 minutes. The airplane then entered a left turn that became increasingly tighter. During this turn, the airplane climbed to about 1,600 ft before descending.

The last ADS-B return showed that the airplane was about 0.2 miles west of the last radar return, about 280 ft above ground level, and along a track of about 190°. Postaccident examination revealed no evidence of a pre-existing mechanical malfunction or failure that would have precluded normal operation of the airplane.

The pilot was not instrument rated. The available evidence for this accident did not indicate whether the pilot received weather information for the route of flight. The pilot likely anticipated visual meteorological conditions given that, shortly before takeoff, he informed his wife that the airplane would be in those conditions along the entire route.

The low-visibility night conditions were conducive to the development of spatial disorientation. Although ADS-B data showed that the airplane was flying close to terrain during the final portion of the flight, the airplane was maneuvering over an area without much cultural lighting (such as the illumination from the reflection of lighting in a metropolitan area). Without such lighting, the pilot would not have had reliable visual references for maintaining attitude control. The spiral flightpath was consistent with the pilot experiencing the known effects of spatial

disorientation. Also, the wreckage distribution and extensive airplane fragmentation were consistent with a high-energy impact resulting from the effects of spatial disorientation.

Probable Cause and Findings

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

The pilot's loss of airplane control due to spatial disorientation during low-level nighttime flight.

Findings

Personnel issues	Aircraft control - Pilot
Personnel issues	Spatial disorientation - Pilot
Environmental issues	Low visibility - Effect on personnel

Factual Information

History of Flight

Enroute-climb to cruise	Loss of control in flight (Defining event)

On July 2, 2021, about 0225 central daylight time, a Beech 35-33 airplane, N302Z, was destroyed when it was involved in an accident near Roff, Oklahoma. The pilot and passenger were fatally injured. The airplane was operated as a Title 14 *Code of Federal Regulations* Part 91 personal flight.

The Federal Aviation Administration's (FAA) ADS-B data showed that the airplane made two flights on the day before the accident. The first flight departed from Ada Regional Airport (ADH), Ada, Oklahoma, about 2015; the airplane climbed to 3,000 ft and slowly descended until arriving at Ardmore Municipal Airport (ADM), Ardmore, Oklahoma, about 2035. The second flight departed from ADM about 2200 and flew toward ADH. The airplane made several circles southwest of ADH and then returned to ADM, landing there about 2253. During a postaccident interview, the pilot's wife stated that her husband decided to return to ADM after observing a "big" cloud over ADH. She also stated that, according to her husband, instrument flight rules (IFR) flight conditions existed at the time and that he was not going to fly in those conditions.

About 0211 on the day of the accident, the airplane again departed from ADM and was en route to ADH. Shortly before takeoff, the pilot had informed his wife that the weather would be visual flight rules along the entire route. According to ADS-B data, during the initial portion of the flight, the airplane's altitude varied between 1,000 and 2,000 ft mean sea level (msl). (All altitudes are expressed as msl unless noted otherwise.) The pilot subsequently climbed the airplane to 3,000 ft before descending back to an altitude between 1,400 and 1,500 ft about 4.5 minutes before the accident occurred. The pilot continued to fly the airplane at that altitude (which was 200 to 300 ft above ground level) for about the next 2 minutes. The airplane's groundspeed during the flight fluctuated between 70 and 139 knots with most of the flight conducted at a groundspeed of about 87 knots.

Toward the end of the flight, the airplane made a left turn during which the airplane climbed to an altitude of about 1,600 ft at a rate of about 2,000 feet per minute. Subsequently, the airplane began descending at a rate that exceeded 2,700 feet per minute. The last ADS-B return showed that the airplane was about 0.2 miles west of the last radar return, about 280 ft above ground level, and along a track of 190°. The airplane's last recorded groundspeed was 89 knots. The airplane impacted trees on a remote ranch about 14 nautical miles southwest of ADH. The figure below shows the airplane's flight track (based on ADS-B data) during the accident flight.

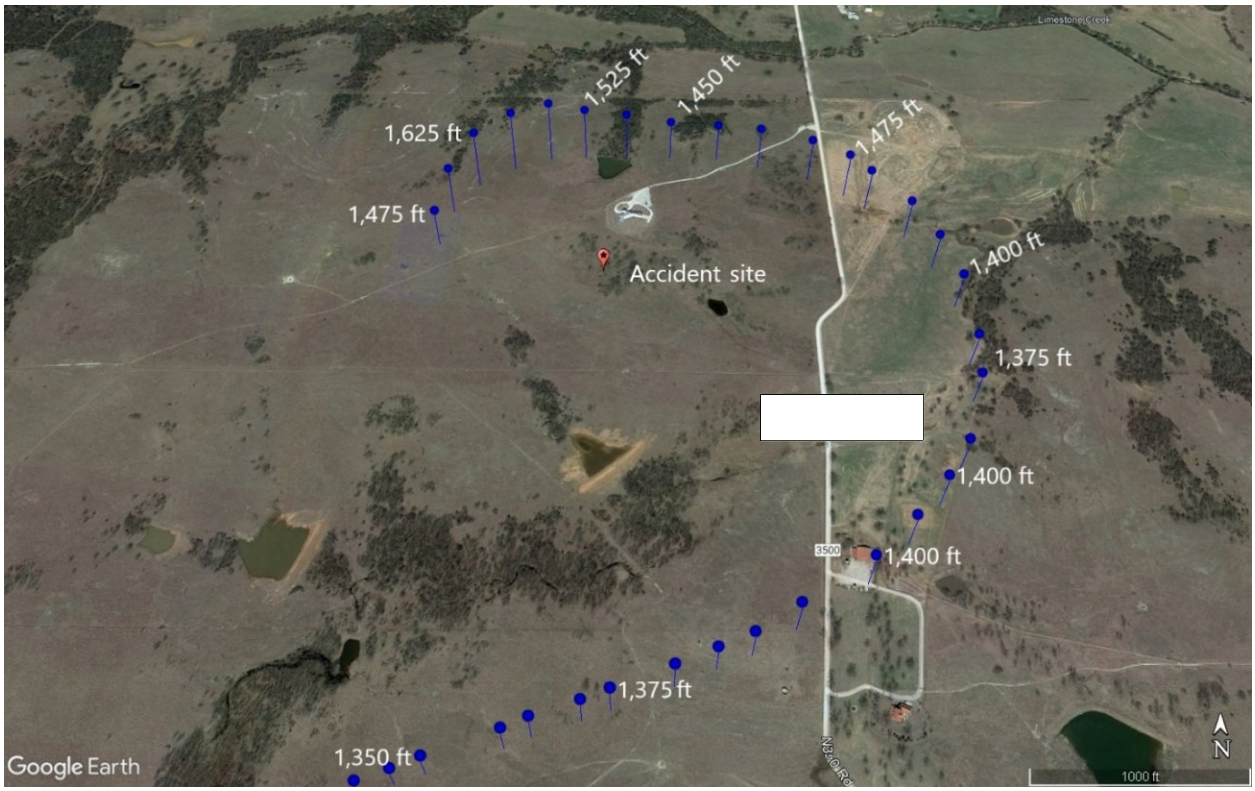

Figure. Accident airplane flight track.

The ranch owner stated that heard a loud noise about the time of the accident and went outside but did not observe anything abnormal. He noted that the weather conditions were “very foggy and misty with low visibility.”

Pilot Information

Certificate:	Private	**Age:**	35,Male
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	
Instrument Rating(s):	None	**Second Pilot Present:**	
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	Class 3 With waivers/limitations	**Last FAA Medical Exam:**	December 15, 2019
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	December 24, 2020
Flight Time:	30 hours (Total, all aircraft)		

The pilot did not have an instrument rating. The pilot's wife stated that he was an "excellent" pilot and did "quite a bit" of night flying. She also stated that he was used to flying in the dark.

Aircraft and Owner/Operator Information

Aircraft Make:	Beech	**Registration:**	N302Z
Model/Series:	35-33	**Aircraft Category:**	Airplane
Year of Manufacture:	1960	**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	CD-201
Landing Gear Type:	Retractable - Tricycle	**Seats:**	4
Date/Type of Last Inspection:	Unknown	**Certified Max Gross Wt.:**	
Time Since Last Inspection:		**Engines:**	1 Reciprocating
Airframe Total Time:		**Engine Manufacturer:**	Continental Motors
ELT:	C91 installed, not activated	**Engine Model/Series:**	IO-470
Registered Owner:	On file	**Rated Power:**	
Operator:	On file	**Operating Certificate(s) Held:**	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Instrument (IMC)	**Condition of Light:**	Night/dark
Observation Facility, Elevation:	ADH,1015 ft msl	**Distance from Accident Site:**	12 Nautical Miles
Observation Time:	02:35 Local	**Direction from Accident Site:**	25°
Lowest Cloud Condition:	Scattered / 300 ft AGL	**Visibility**	7 miles
Lowest Ceiling:	Broken / 9000 ft AGL	**Visibility (RVR):**	
Wind Speed/Gusts:	3 knots /	**Turbulence Type Forecast/Actual:**	None / None
Wind Direction:	20°	**Turbulence Severity Forecast/Actual:**	N/A / N/A
Altimeter Setting:	30.01 inches Hg	**Temperature/Dew Point:**	-5.6°C / -5.6°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Ardmore, OK (ADM)	**Type of Flight Plan Filed:**	None
Destination:	Roff, OK	**Type of Clearance:**	None
Departure Time:	02:11 Local	**Type of Airspace:**	Unknown

The National Weather Service (NWS) Weather Forecast Office (WFO) in Norman, Oklahoma, issued the following information in the Area Forecast Discussion at 1743 on the day before the accident: “mostly MVFR [marginal visual flight rules] conditions will persist through the period, with some chance at IFR cigs [ceilings] as storms move through.” The information also stated that scattered showers and thunderstorms would move out of northern and central Oklahoma by midday on the day of the accident.

AIRMET Sierra was issued at 2145 on the day before the accident and was valid for the accident site at the accident time. The AIRMET was issued for IFR conditions and identified ceilings below 1,000 ft, visibility below 3 statute miles, precipitation, and mist.

A Graphical Forecast for Aviation forecast imagery depicting IFR conditions was issued about 2300 on the day before the accident and was valid for 0100 on the day of the accident. This forecast imagery depicted surface visibilities as 1 to 3 statute miles, 3 to 5 statute miles, and greater than 5 statute miles at or near the accident location with scattered thunderstorms near the accident site. A graphical AIRMET for IFR conditions was depicted at the accident location.

According to his wife, the pilot used Foreflight for weather information. The available evidence for this investigation did not indicate whether the pilot reviewed weather information before or during the accident flight.

Airport Information

Airport:	Ada Regional Airport ADH	**Runway Surface Type:**	
Airport Elevation:	1016 ft msl	**Runway Surface Condition:**	Unknown
Runway Used:		**IFR Approach:**	None
Runway Length/Width:		**VFR Approach/Landing:**	None

Wreckage and Impact Information

Crew Injuries:	1 Fatal	**Aircraft Damage:**	Destroyed
Passenger Injuries:	1 Fatal	**Aircraft Fire:**	None
Ground Injuries:		**Aircraft Explosion:**	None
Total Injuries:	2 Fatal	**Latitude, Longitude:**	34.61,-96.78

The debris field was about 210 ft in length along a heading of about 110°. The first identified piece of wreckage in the debris field was the left wingtip, which was followed by the left aileron; a small portion of the left-wing leading edge; the pitot tube, which was found on a large narrow ground scar in the dirt; and the right wing, which had separated from the fuselage at the wing root. The right wing came to rest with its leading edge down and the root of the wing wrapped around a tree, which was bent in the direction of the debris path.

The main wreckage was located about 12 ft beyond the right wing and consisted of the cabin, aft fuselage, and inboard left wing. The engine was located about 6 ft beyond the main wreckage. The engine had separated from the firewall (which exhibited crush damage) and engine mounts and came to rest on its left side against two trees. The left side of the engine exhibited more impact damage than the right side. Postaccident examination revealed no evidence of a pre-existing mechanical malfunction or failure that would have precluded normal operation of the airplane.

Additional Information

Spatial Disorientation

The FAA Civil Aeromedical Institute's publication titled "Introduction to Aviation Physiology" defines spatial disorientation as a "loss of proper bearings; state of mental confusion as to position, location, or movement relative to the position of the earth." Factors contributing to spatial disorientation include changes in acceleration, flight in IFR conditions, frequent transfer between visual flight rules and IFR conditions, and unperceived changes in aircraft attitude.

The FAA's *Airplane Flying Handbook* (FAA-H-8083-3C) describes hazards associated with flying when the ground or horizon is obscured. The handbook states, in part, the following:

> *The vestibular sense (motion sensing by the inner ear) can and will confuse the pilot…false sensations are often generated, leading the pilot to believe the attitude of the airplane has changed when, in fact, it has not. These false sensations result in the pilot experiencing spatial disorientation.*

As a result, the pilot "needs to believe what the flight instruments show about the airplane's attitude regardless of what the natural senses tell."

Administrative Information

Investigator In Charge (IIC):	Link, Samantha
Additional Participating Persons:	David; Amann; Oklahoma City, OK Jennifer Barclay; Textron Aviation; Wichita, KS
Original Publish Date:	June 8, 2023
Last Revision Date:	
Investigation Class:	Class 3
Note:	
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=103400