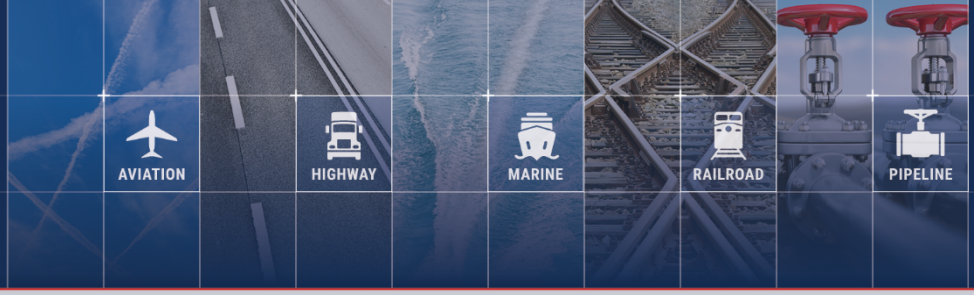

Aviation Investigation Final Report

Location:	Columbia, South Carolina	**Accident Number:**	ERA21LA101
Date & Time:	January 13, 2021, 10:33 Local	**Registration:**	N266DC
Aircraft:	Beech F33	**Aircraft Damage:**	Destroyed
Defining Event:	Collision with terr/obj (non-CFIT)	**Injuries:**	1 Fatal
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The instrument-rated commercial pilot departed on a visual flight rules flight plan but requested and received an instrument flight rules clearance while en route to the destination airport. During the flight, the air traffic controller instructed the pilot to advise when he had obtained the reported weather conditions at the destination airport and asked the pilot about the type of instrument approach he was requesting to the destination. The pilot requested an area navigation (RNAV) approach, and the controller acknowledged; however, the controller did not confirm if the pilot had the weather conditions at the destination airport, nor did he provide that information to him. The pilot then asked the controller for the approach minimums at the destination airport and if any pilot reports (PIREPs) had been received. The controller responded that he received an unsolicited PIREP 45 minutes earlier from a pilot who had attempted to land at the same destination airport, but was unable to do so. About that time, and continuing through the time of the accident, the reported weather conditions at the airport included 1/4-mile visibility in fog and 200 ft vertical visibility.

The accident pilot continued the approach, subsequently declared a missed approach, and the controller responded with heading and climb instructions. The pilot asked if the change in heading involved a left turn, and the controller confirmed that it did. The pilot read back the instructions correctly and then asked about the weather at a nearby airport. The controller provided the pilot with the weather conditions; however, the pilot did not respond, and radar contact was lost shortly thereafter.

Flight track data indicate that, throughout the approach, the airplane remained about 3/4 mile left of course until the airplane was about 1 1/4 mile from the approach end of the runway. At that time, the airplane made a right turn, descended to an altitude of 325 ft mean sea level, then made a climbing left turn to 800 ft mean sea level before descending and impacting terrain in a residential neighborhood. A postcrash fire ensued.

The witness descriptions of the engine sounds as the airplane maneuvered during the final moments of the flight, as well as the tip curling and chordwise scratching observed on the propeller blades after the accident, indicated that the engine was producing power at the time of the accident. Postaccident examination of the airframe and engine revealed no anomalies that would have precluded normal operation.

Given the instrument meteorological conditions at the time of the accident, which included restricted visibility, and the pilot's maneuvering off of the instrument approach course both laterally and vertically, it is likely that the pilot became spatially disoriented during the approach, which led to a loss of airplane control and a subsequent spiraling descent.

Probable Cause and Findings

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

The pilot's in-flight loss of airplane control due to spatial disorientation during a missed approach in instrument meteorological conditions.

Findings

Personnel issues	Decision making/judgment - Pilot
Environmental issues	Below approach minima - Effect on personnel
Personnel issues	Spatial disorientation - Pilot
Environmental issues	Below VFR minima - Effect on personnel
Aircraft	Directional control - Not attained/maintained
Personnel issues	Lack of communication - ATC personnel

Factual Information

History of Flight

Approach-IFR missed approach	Collision with terr/obj (non-CFIT) (Defining event)

On January 13, 2021, about 1033 eastern standard time, a Beech F33A, N266DC, was destroyed when it was involved in an accident near Columbia, South Carolina. The private pilot was fatally injured. The airplane was operated as a Title 14 *Code of Federal Regulations* Part 91 personal flight.

Radar and air traffic control voice communication data provided by the Federal Aviation Administration (FAA) indicated that the airplane departed runway 19 at Greenville Downtown Airport (GMU), Greenville, South Carolina, about 0959 under visual flight rules and that the pilot was cleared to climb the airplane to 5,500 ft mean sea level (msl). About 1006, while the airplane was airborne, the pilot requested an instrument flight rules clearance and continued southeast toward Jim Hamilton – L B Owens Airport (CUB), Columbia, South Carolina. The controller provided the clearance, and the pilot descended the airplane to 5,000 ft. Soon afterward, the pilot requested clearance to descend to 3,000 ft, which the controller provided.

About 1015, the controller asked the pilot to advise the receipt of weather information for CUB and advise the type of approach to the airport. The pilot requested the area navigation (RNAV) runway 13 approach and asked the controller to provide a pilot report (PIREP) and the weather minimums for CUB (the pilot did not state that he had received the current weather conditions at CUB, nor did the controller provide that weather information to him). The controller stated that a PIREP was received about 45 minutes earlier (about 0930) and that the pilot was trying to land there but was not able to "make it." The controller cleared the pilot for the RNAV approach, and the pilot continued the flight.

About 1030, the controller advised the pilot of the alternate missed approach instructions, which consisted of entering controlled airspace on a heading of 050° and climbing and maintaining 2,500 ft. Soon afterward, the pilot announced that he was performing a missed approach, and the controller instructed him to fly a heading of 360° when able and climb and maintain 2,500 ft. The pilot acknowledged the information and asked if a left turn was required for the 360° heading, which the controller confirmed. The pilot acknowledged the information and requested the weather conditions at Columbia Metropolitan Airport (CAE), Columbia, South Carolina, which was about 6.5 nautical miles west of CUB.

About 1033, the controller provided the weather conditions at CAE. The pilot did not acknowledge this transmission, and the controller advised the pilot that radar contact was lost.

The controller made additional attempts to establish communication with the pilot, which were unsuccessful.

Review of ADS-B data showed that during the instrument approach, the airplane remained about 3/4-mile left of course until the airplane was about 1 1/4 miles from the approach end of the runway. At that time, the airplane made a right turn, descended to 325 ft msl, and made a climbing left turn to 800 ft msl before descending into a residential neighborhood (see figures 1 and 2).

Figure 1. Airplane flight track during the approach (in red) and extended runway centerline at CUB (in magenta). Note: JSSTN is the initial approach fix for the RNAV runway 13 approach, and PEPHR is the final approach fix for the approach.

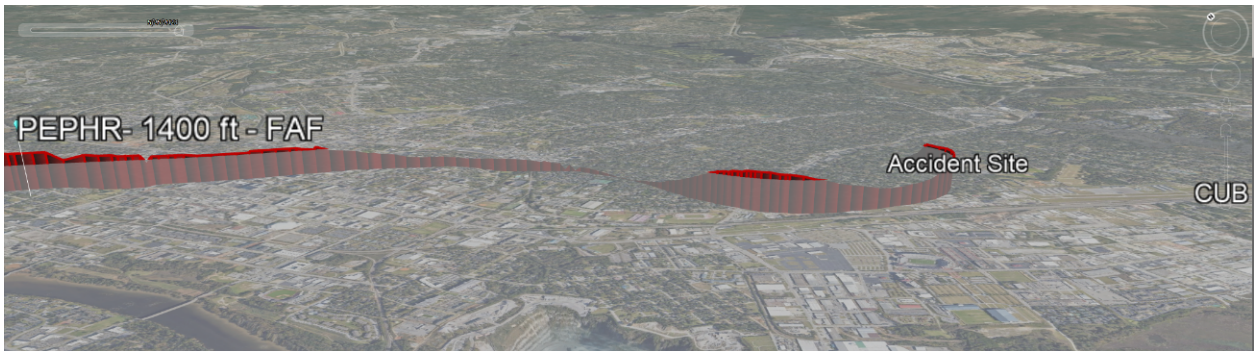

Figure 2. Three-dimensional view of the airplane's flight track (in red) with the minimum descent altitude overlay of the flight track (semi-transparent gray layer). Note: The lowest minimum descent altitude for the RNAV runway 13 approach was 780 ft mean sea level. The airplane descended below the MDA three times before the accident occurred.

Witnesses who heard the airplane during the final moments of the flight stated that the engine sounded normal. One eyewitness saw the airplane emerge from the fog in a left-wing-low attitude and then impact the roof of a residence. The airplane came to rest in the backyard of the residence against a wooden fence. A postimpact fire ensued.

Pilot Information

Certificate:	Private	**Age:**	62,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:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	Class 3 With waivers/limitations	**Last FAA Medical Exam:**	September 24, 2020
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	
Flight Time:	(Estimated) 1869 hours (Total, all aircraft)		

The pilot's logbook was not recovered.

Aircraft and Owner/Operator Information

Aircraft Make:	Beech	**Registration:**	N266DC
Model/Series:	F33 A	**Aircraft Category:**	Airplane
Year of Manufacture:	1973	**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	28R-7335393
Landing Gear Type:	Retractable - Tricycle	**Seats:**	
Date/Type of Last Inspection:	February 14, 2020 Annual	**Certified Max Gross Wt.:**	
Time Since Last Inspection:		**Engines:**	1 Reciprocating
Airframe Total Time:	7706 Hrs as of last inspection	**Engine Manufacturer:**	Continental
ELT:	C126 installed, not activated	**Engine Model/Series:**	IO-520-BA
Registered Owner:	On file	**Rated Power:**	285 Horsepower
Operator:	On file	**Operating Certificate(s) Held:**	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Instrument (IMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	CUB,193 ft msl	**Distance from Accident Site:**	1 Nautical Miles
Observation Time:	10:53 Local	**Direction from Accident Site:**	155°
Lowest Cloud Condition:	200 ft AGL	**Visibility**	0.25 miles
Lowest Ceiling:	Indefinite (V V) / 200 ft AGL	**Visibility (RVR):**	200 ft
Wind Speed/Gusts:	5 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	240°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30.2 inches Hg	**Temperature/Dew Point:**	3°C / 3°C
Precipitation and Obscuration:	Moderate - None - Fog		
Departure Point:	Greenville, SC (GMU)	**Type of Flight Plan Filed:**	IFR
Destination:	Columbia, SC (CUB)	**Type of Clearance:**	IFR
Departure Time:	09:59 Local	**Type of Airspace:**	

The 0953 recorded weather observation at CUB included calm wind, visibility 1/4-mile in fog, vertical visibility of 200 ft above ground level (agl), temperature of 2°C, dew point of 2°C, and altimeter setting of 30.20 inches of mercury.

The 1053 recorded weather observation at CUB, included wind from 240° at 5 knots, visibility 1/4-mile in fog, a vertical visibility of 200 ft agl, a temperature of 3°C, a dew point of 3°C, and an altimeter setting of 30.20 inches of mercury.

The 1029 recorded weather observation at CAE, which was about 6 miles southwest of the accident site, included wind from 240° at 3 knots, visibility 1/2-mile, fog, vertical visibility of 200 ft agl, temperature 3°C, dew point 2°C, and altimeter setting of 30.18 inches of mercury. The observations from CUB and CAE surrounding the accident time indicated low instrument flight rules (IFR) conditions with light and variable wind at or below 5 knots over the area.

AIRMET advisory Sierra, which was issued at 0945, was valid for the accident site at the accident time. AIRMET Sierra indicated IFR conditions in the area due to fog and mist.

The pilot did not request or receive weather information from Leidos Flight Service. A search of archived ForeFlight information indicated that the pilot did not request weather information via ForeFlight. The investigation found no other record of the pilot receiving or retrieving any weather information before or during the flight.

Airport Information

Airport:	JIM HAMILTON L B OWENS CUB	**Runway Surface Type:**	
Airport Elevation:	193 ft msl	**Runway Surface Condition:**	
Runway Used:		**IFR Approach:**	RNAV
Runway Length/Width:		**VFR Approach/Landing:**	None

CUB was located 2 miles south of Columbia, South Carolina. It had one runway designated as 13/31, which was 5,011 ft long by 75 ft wide.

The instrument approach procedure being flown just prior to the accident was the RNAV (GPS) RWY 13, effective December 31, 2020, to January 28, 2021.

Localizer Performance without Vertical Guidance (LP) were non-precision approaches with Wide Area Augmentation System (WAAS) lateral guidance. They were added in locations where terrain or obstructions did not allow publication of vertically guided LPV procedures. While conducting such an approach, lateral sensitivity would increase as an aircraft gets closer to the runway. LP minimums would not be published with lines of minima that contained approved vertical guidance (LNAV/VNAV or LPV).

Lateral Navigation (LNAV) were non-precision approaches that provide lateral guidance. The pilot must check RAIM (Receiver Autonomous Integrity Monitoring) prior to the approach when not using WAAS equipment.

Both LP and LNAV lines of minima were Minimum Descent Altitudes (MDAs) rather than Decision Altitudes (DAs). It was possible to have LP and LNAV published on the same approach procedures chart. An LP was published if it provides lower minima than the LNAV.

Each standard instrument approach procedure has associated weather minimums of visibility and sky conditions that determine how low an aircraft can travel while flying the final approach course. If the pilot flying the instrument approach procedure reaches the published minimums for that approach and the pilot has the runway environment in sight, the pilot can continue to land visually. Conversely, if the airplane reaches the published minimums without the runway in sight, the pilot should execute the published missed approach. The published minimum descent altitude for the CUB RNAV runway 13 approach was 780 ft msl and 1 statute mile flight visibility.

Wreckage and Impact Information

Crew Injuries:	1 Fatal	**Aircraft Damage:**	Destroyed
Passenger Injuries:	N/A	**Aircraft Fire:**	On-ground
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	1 Fatal	**Latitude, Longitude:**	33.983683,-81.003004

The airplane impacted a tree in a residential area before impacting the ground at an elevation of 270 ft msl. The postimpact fire consumed most of the fuselage. All major components of the airplane were located near the main wreckage.

Sections of left wing and the pitot tube were observed near the initial tree impact. The right wing separated from the fuselage and exhibited thermal damage. The vertical stabilizer separated from the empennage, and the rudder separated from the vertical stabilizer. The cabin and seats were consumed by fire. The instrument panel was fragmented, and the avionics exhibited thermal damage. The landing gear and the flaps were in the retracted position. The flight control cables were examined, but flight control continuity could not be confirmed as a result of fragmentation and thermal damage. The gyro and gyro housing exhibited rotational scoring.

The engine remained partially attached to the airframe. Both magnetos had separated from the accessory housing due to impact. The ignition leads were consumed by fire. The No. 5 cylinder head rocker assembly had separated from the cylinder head due to impact. The Nos. 1, 3, and 4 rocker covers exhibited impact damage. The fuel injection mixture control was separated

from the engine. The throttle butterfly housing was fragmented, and the butterfly valve remained attached to the throttle linkage.

The propeller had separated from the engine due to impact, but all three propeller blades remained attached to their hub. All three blades exhibited tip curling and chordwise scratching.

Medical and Pathological Information

Professional Pathology Services in Columbia, South Carolina, performed an autopsy on the pilot. His cause of death was massive blunt force injuries. Toxicology testing performed by the FAA Forensic Sciences Laboratory detected no drugs, carboxyhemoglobin, or ethanol in the pilot's specimens.

Additional Information

Spatial Disorientation

The FAA's *Pilot's Handbook of Aeronautical Knowledge* contained the following guidance:

> Under normal flight conditions, when there is a visual reference to the horizon and ground, the sensory system in the inner ear helps to identify the pitch, roll, and yaw movements of the airplane. When visual contact with the horizon is lost, the vestibular system becomes unreliable. Without visual references outside the airplane, there are many situations where combinations of normal motions and forces can create convincing illusions that are difficult to overcome.

The handbook also advised, "unless a pilot has many hours of training in instrument flight, flight in reduced visibility or at night when the horizon is not visible should be avoided."

The FAA's *Airplane Flying Handbook* (FAA-H-8083-3) described hazards associated with flying when visual references, such as the ground or horizon, are obscured.

> *The vestibular sense (motion sensing by the inner ear) in particular tends to confuse the pilot. Because of inertia, the sensory areas of the inner ear cannot detect slight changes in the attitude of the airplane, nor can they accurately sense attitude changes that occur at a uniform rate over a period of time. On the other hand, 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.*

The FAA's publication "Spatial Disorientation Visual Illusions" (OK-11-1550), stated in part the following:

> *False visual reference illusions may cause you to orient your aircraft in relation to a false horizon; these illusions are caused by flying over a banked cloud, night flying over featureless terrain with ground lights that are indistinguishable from a dark sky with stars, or night flying over a featureless terrain with a clearly defined pattern of ground lights and a dark starless sky.*

The publication provided further guidance on the prevention of spatial disorientation. One of the preventive measures was "when flying at night or in reduced visibility, use and rely on your flight instruments." The publication also stated the following:

> *If you experience a visual illusion during flight (most pilots do at one time or another), have confidence in your instruments and ignore all conflicting signals your body gives you. Accidents usually happen as a result of a pilot's indecision to rely on the instruments.*

The FAA publication "Medical Facts for Pilots" (AM-400-03/1) described several vestibular illusions associated with the operation of aircraft in low-visibility conditions. The somatogravic illusion, which involves the semicircular canals of the vestibular system, was generally placed into the "graveyard spiral" Category. According to the publication text, the graveyard spiral

> *is associated with a return to level flight following an intentional or unintentional prolonged bank turn. For example, a pilot who enters a banking turn to the left will initially have a sensation of a turn in the same direction. If the left turn continues (~20 seconds or more), the pilot will experience the sensation that the airplane is no longer turning to the left. At this point, if the pilot attempts to level the wings this action will produce a sensation that the airplane is turning and banking in the opposite direction (to the right). If the pilot believes the illusion of a right turn (which can be very compelling), he/she will reenter the original left turn in an attempt to counteract the sensation of a right turn. Unfortunately, while this is happening, the airplane is still turning to the left and losing altitude.*

Pilot Reports

A review of the audio from the CAE Radar North control position revealed that, between 0945 and 1015 on the day of the accident, the controller provided air traffic control services to at least five aircraft that were either departing from or arriving at CUB or CAE and one aircraft overflight. During that time, no PIREPs were solicited by the controller, and one was received unsolicited. This PIREP was not entered into the Aeronautical Information System – Replacement system (one of the FAA-approved electronic systems for PIREP dissemination) and was disseminated to only one aircraft when a pilot asked (about 1016) if aircraft were landing at CAE.

> FAA Order JO 7110.65Y, Air Traffic Control, paragraph 2-6-2,. PIREP Solicitation and Dissemination, noted that "every phase of flight has the potential to be impacted by weather, and emphasis must be placed on gathering, reporting, and disseminating weather information." The paragraph also stated in part the following: *Emphasis must be placed on the solicitation and dissemination of Urgent (UUA) and Routine (UA) PIREPs. Timely dissemination of PIREPs alerts pilots to weather conditions and provides information useful to forecasters in the development of aviation forecasts. PIREPs also provide information required by ATC in the provision of safe and efficient use of airspace… Controllers must provide the information in sufficient detail to assist pilots in making decisions pertinent to flight safety.*

The order states that controllers should solicit PIREPs when requested, deemed necessary, or when ceilings are at or below 5,000 ft or visibility (surface or aloft) is at or less than 5 miles (or if these conditions are forecast). In addition, the order states that pertinent PIREP information should be relayed to "concerned aircraft in a timely manner."

Approach Information

> Paragraph 4-7-10 of FAA Order JO 7110.65Y addressed approach information and stated in part the following: *Both en route and terminal approach control sectors must provide current approach information to aircraft destined to airports for which they provide approach control services. This information must be provided on initial contact or as soon as possible thereafter. Approach information contained in the ATIS* [automatic terminal information system] *broadcast may be omitted if the pilot states the appropriate ATIS code.*

The paragraph also stated that, for pilots destined to an airport without an ATIS broadcast, the controller should issue the following approach information

- ? surface wind;
- ? ceiling and visibility if the reported ceiling at the airport of intended landing is below 1,000 ft or below the highest circling minimum, whichever is greater, or the visibility is less than 3 miles; and
- ? 5. altimeter setting for the airport of intended landing.

Administrative Information

Investigator In Charge (IIC):	Kemner, Heidi
Additional Participating Persons:	Marshall Bogan; FAA/FSDO; Columbia, SC Casey Love; Textron Aviation; Wichita, KS Curt Fischer; NATCA; Washington, DC
Original Publish Date:	July 26, 2023
Last Revision Date:	
Investigation Class:	Class 3
Note:	The NTSB did not travel to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=102522