



Aviation Investigation Final Report

Location:	Woburn, Massachusetts	Accident Number:	ERA18FA251
Date & Time:	September 15, 2018, 11:03 Local	Registration:	N2536T
Aircraft:	COLUMBIA AIRCRAFT Mfg LC41	Aircraft Damage:	Destroyed
Defining Event:	Loss of control in flight	Injuries:	2 Fatal
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The instrument-rated pilot and one passenger were approaching the destination airport following an instrument flight rules cross-country flight in instrument meteorological conditions; the reported weather at the destination included ceilings between 400 and 600 ft above ground level and visibility of 2 miles in mist. The controller cleared the airplane for the instrument landing system (ILS) approach; the pilot intercepted the localizer and immediately descended below the minimum altitude he was required to maintain prior to crossing the final approach fix (FAF). The controller issued a low altitude alert as the airplane was crossing the FAF about 700 ft below the minimum altitude. The pilot responded that he was climbing; he did not report any problems or issues with his airplane to the controller. The airplane then drifted right of the localizer course and the controller advised the pilot of such, but there was no response. The airplane subsequently proceeded left of the localizer course, after which the controller issued another low altitude alert and asked the pilot if he was still on the approach. The pilot responded that he was not on the approach and that he was "pulling." During the final minute of the flight, the airplane was observed in rapid, turning climbs and descents until radar contact was lost.

The airplane impacted terrain about 4.2 miles east-southeast of the airport. Accident site evidence and impact damage to the airplane were indicative of a high-velocity impact. Examination of the wreckage revealed no evidence of any preimpact mechanical anomalies, and analysis of a video doorbell that captured audio of the airplane in flight revealed an engine speed consistent with high power.

The reduced visibility conditions present at the time of the accident and the high workload associated with the instrument approach were conducive to the onset of pilot spatial disorientation, and the airplane's erratic maneuvering and the high-energy impact are both consistent with the known effects of spatial disorientation. Therefore, it is likely that the pilot became spatially disoriented during the instrument approach, which resulted in a loss of airplane control.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be:
The pilots' loss of control during an instrument approach in instrument meteorological conditions as a result of spatial disorientation.

Findings

Personnel issues	Spatial disorientation - Pilot
Aircraft	(general) - Not attained/maintained
Environmental issues	Low ceiling - Contributed to outcome
Environmental issues	Low ceiling - Effect on operation

Factual Information

History of Flight

Approach-IFR final approach	Loss of control in flight (Defining event)
Uncontrolled descent	Collision with terr/obj (non-CFIT)

On September 15, 2018, about 1103 eastern daylight time, a Columbia Aircraft Mfg LC41-550FG, N2536T, was destroyed when it was involved in an accident at Woburn, Massachusetts. The pilot and one passenger were fatally injured. The airplane was operated as a Title 14 *Code of Federal Regulations* Part 91 personal flight.

According to air traffic control information, the accident airplane was cleared for the instrument landing system (ILS) approach to runway 29 at Laurence G. Hanscom Field (BED), Bedford, Massachusetts. At 1100:15, the pilot contacted the BED tower controller and reported that he was 2.5 miles from the final approach fix (FAF) for the ILS to runway 29. At 1100:26, the accident airplane was cleared to land. The pilot intercepted the localizer about 2 miles from the FAF and continued to descend to 1,060 ft mean sea level (msl); the minimum altitude before crossing the FAF was 1,800 ft msl. As the airplane crossed the FAF, the controller issued a low altitude alert to the pilot. The pilot acknowledged the call and stated, at 1101:56, that he was climbing. About 14 seconds later, the controller advised the pilot that the airplane was drifting north of course. The pilot did not acknowledge the call. At 1102:35, the controller issued a second low altitude alert, as the airplane was at 1,200 ft msl, and asked the pilot if he was still on the approach. The pilot responded, "three six tango no I'm pulling." At that time, the airplane was south of the localizer course. At 1102:49, the pilot stated, "okay, okay." At 1102:51, the pilot stated an expletive. During the last minute of flight, the airplane was observed in rapid turning climbs and descents. Radar and radio contact were lost about 1103.

After the accident, a resident who lived near the accident site reported that her video doorbell captured audio of the airplane before the accident. A copy of the video file was provided to investigators. The airplane could not be seen; however, the sound of an engine running was evident on the video, culminating in the sound of an impact. The file was analyzed by the propeller manufacturer, who identified a 127.5-Hz frequency that belonged to the propeller. A sound spectrum study revealed that the engine was operating near 2,550 rpm during the recording and before impact (maximum rated engine rpm was 2,700).

Pilot Information

Certificate:	Private	Age:	65, Male
Airplane Rating(s):	Single-engine land	Seat Occupied:	Unknown
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:	February 21, 2018
Occupational Pilot:	No	Last Flight Review or Equivalent:	January 15, 2018
Flight Time:	1945 hours (Total, all aircraft), 3 hours (Last 90 days, all aircraft)		

The pilot completed a flight review on January 15, 2018, and an instrument proficiency check on July 31, 2017. He logged 9 instrument approaches and 4.7 hours of actual instrument experience during the 6 months before the accident. He logged two flights and 3.3 hours of flight time during the 90 days before the accident.

Aircraft and Owner/Operator Information

Aircraft Make:	COLUMBIA AIRCRAFT Mfg	Registration:	N2536T
Model/Series:	LC41 550FG	Aircraft Category:	Airplane
Year of Manufacture:	2006	Amateur Built:	
Airworthiness Certificate:	Utility	Serial Number:	41594
Landing Gear Type:	Tricycle	Seats:	4
Date/Type of Last Inspection:	December 14, 2017 Annual	Certified Max Gross Wt.:	3600 lbs
Time Since Last Inspection:	69 Hrs	Engines:	1 Reciprocating
Airframe Total Time:	1339 Hrs as of last inspection	Engine Manufacturer:	Continental
ELT:	C126 installed, activated, did not aid in locating accident	Engine Model/Series:	TSIO-550-C
Registered Owner:		Rated Power:	310 Horsepower
Operator:	On file	Operating Certificate(s) Held:	None

Federal Aviation Administration (FAA) records revealed that the pilot purchased the airplane new in 2006.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Instrument (IMC)	Condition of Light:	Day
Observation Facility, Elevation:	KBED, 132 ft msl	Distance from Accident Site:	5 Nautical Miles
Observation Time:	11:08 Local	Direction from Accident Site:	282°
Lowest Cloud Condition:		Visibility	2 miles
Lowest Ceiling:	Overcast / 600 ft AGL	Visibility (RVR):	
Wind Speed/Gusts:	/	Turbulence Type Forecast/Actual:	None / None
Wind Direction:		Turbulence Severity Forecast/Actual:	N/A / N/A
Altimeter Setting:	30.2 inches Hg	Temperature/Dew Point:	19°C / 18°C
Precipitation and Obscuration:	Moderate - None - Mist		
Departure Point:	Farmingdale, NY (FRG)	Type of Flight Plan Filed:	IFR
Destination:	Bedford, MA (BED)	Type of Clearance:	IFR
Departure Time:	09:54 Local	Type of Airspace:	Class C

The 1056 weather observation at BED included calm wind, an overcast ceiling at 400 ft above ground level, 2 statute miles (sm) visibility with mist, temperature 20°C, dew point 18°C, and an altimeter setting of 30.22 inches of mercury.

A pilot who landed at BED about 1045 reported the tops of the clouds at 1,800 ft msl and cloud bases at 400 ft msl. He also reported visibility under the cloud bases at 2 sm and no turbulence during his approach to runway 29.

Airport Information

Airport:	Hanscom Field BED	Runway Surface Type:	Asphalt
Airport Elevation:	132 ft msl	Runway Surface Condition:	Dry
Runway Used:	29	IFR Approach:	ILS
Runway Length/Width:	7011 ft / 150 ft	VFR Approach/Landing:	Full stop

Wreckage and Impact Information

Crew Injuries:	1 Fatal	Aircraft Damage:	Destroyed
Passenger Injuries:	1 Fatal	Aircraft Fire:	On-ground
Ground Injuries:	N/A	Aircraft Explosion:	Unknown
Total Injuries:	2 Fatal	Latitude, Longitude:	42.454166,-71.182777(est)

The airplane collided with trees and terrain on a heading of 070° in a wooded area behind a residence about 4.2 miles east-southeast of BED. The wreckage path was about 300 ft in length. A large tree, about 3 ft in diameter, was brought down by the wreckage. The airframe was highly fragmented. There was a postaccident fire that consumed about 20% of the wreckage. The engine separated from the firewall and the propeller separated from the engine during the impact sequence. All primary structural components and flight control surfaces were accounted for within the debris field.

The aileron and elevator control tubes were found connected to the left and right control sticks. The aileron control rod was intact from the side stick to the aileron torque tube bell crank. The elevator push/pull tube was attached to the elevator interconnect assembly. The aileron control tubes and the elevator control tubes separated from their mounts and were found along the wreckage path. All fractures exhibited overload signatures.

The rudder cables were attached to the rudder torque tubes. The cables separated in tension overload near the center of the fuselage. The rudder separated from the empennage. The elevator trim tab cable exhibited tensile overload signatures.

The cabin seats detached from their mounting points during impact. The seat bases were fractured into multiple pieces and dispersed from the final impact point in several directions.

The engine sustained substantial impact damage to the No. 2 cylinder head, which allowed only partial rotation of the crankshaft. The crankshaft was fractured aft of the propeller flange where it exited the nose seal of the crankcase. The fracture surface displayed 45-degree shear lips. The crankshaft was manually rotated by inserting an adapter into the right accessory drive gear. Internal crankshaft continuity was confirmed through manual rotation of the accessory drive gears. Partial compression and valve train continuity were established; impact damage prevented compression confirmation on all cylinders. The camshaft was not observed; however, camshaft continuity was confirmed during partial rotation of the crankshaft.

The left magneto was separated from its mounting pad and the housing sustained impact damage that deformed the housing in the capacitor area. The magneto drive was manually rotated and a spark was observed in firing order during the audible snap of the impulse coupling. The right magneto remained attached to the mounting pad. The magneto was removed and the drive was manually rotated. The impulse coupling produced an audible snap, but no spark was observed from any of the leads.

All of the spark plugs displayed normal wear and light combustion deposits with no signs of lead or carbon fouling when compared to a Champion Check-a-Plug chart.

The fuel system was examined. There were no indications of preaccident anomalies or malfunctions of the engine-driven fuel pump, throttle body, fuel metering unit, intake plenum, fuel manifold, or fuel injector nozzles. Fuel was recovered from the line between the engine-driven fuel pump and the fuel metering unit. Fuel was also recovered from the engine-driven fuel pump. Residual fuel was observed in the line between the fuel metering unit and the fuel manifold valve, though the inlet fitting of the fuel manifold valve was fractured.

The three-bladed propeller hub remained intact and all three blades remained attached to the hub. All of

the blades rotated independently within the hub, indicative of pitch change link fractures. The blades were arbitrarily labeled A, B, and C for descriptive purposes. Blade A displayed chord-wise paint burnishing, significant blade twisting toward low pitch, and s-bending on the trailing edge. Blade B was bent in half with impact-related damage on the trailing edge. Blade C was bent aft and twisted toward low pitch, with slight s-bending on the trailing edge. Two tree branches were observed at the accident site that displayed angular cuts with gray paint transfers, consistent with propeller contact.

Additional Information

According to FAA Advisory Circular 60-4A, Pilot's Spatial Disorientation:

The attitude of an aircraft is generally determined by reference to the natural horizon or other visual reference with the surface. If neither horizon nor surface references exist, the attitude of an aircraft must be determined by artificial means from the flight instruments. Sight, supported by other senses, allows the pilot to maintain orientation. However, during periods of low visibility, the supporting senses sometimes conflict with what is seen. When this happens, a pilot is particularly vulnerable to disorientation. The degree of orientation may vary considerably with individual pilots. Spatial disorientation to a pilot means simply the inability to tell which way is 'up.'...Surface references and the natural horizon may at times become obscured, although visibility may be above flight rule minimums. Lack of natural horizon or such reference is common on over water flights, at night, and especially at night in extremely sparsely populated areas, or in low visibility conditions.... The disoriented pilot may place the aircraft in a dangerous attitude... therefore, the use of flight instruments is essential to maintain proper attitude when encountering any of the elements which may result in spatial disorientation.

Medical and Pathological Information

The Office of the Chief Medical Examiner of the Commonwealth of Massachusetts performed the autopsy of the pilot. The cause of death was blunt force injuries.

The FAA Forensic Sciences Laboratory performed toxicology testing on specimens from the pilot. Testing was not performed for carbon monoxide and cyanide. FAA testing detected the previously reported medication losartan. Also present was atorvastatin, a prescription medication used to reduce high cholesterol and triglyceride levels. Neither of these are considered impairing. Ethanol was found at 13 mg/dl in muscle tissue consistent with postaccident production. No ethanol was found in brain tissue.

Administrative Information

Investigator In Charge (IIC):	Hicks, Ralph
Additional Participating Persons:	Henry Soderlund; Textron Aviation; Wichita, KS Jennifer Barclay; Textron Aviation; Wichita, KS Nicole Charnon; Continental Motors; Mobile, AL Keith Lapierre; FAA/FSDO; Burlington, MA
Original Publish Date:	May 19, 2020
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.nts.gov/Docket?ProjectID=98300

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The Independent Safety Board Act, as codified at 49 U.S.C. Section 1154(b), precludes the admission into evidence or use of any part of an NTSB report related to an incident or accident in a civil action for damages resulting from a matter mentioned in the report. A factual report that may be admissible under 49 U.S.C. § 1154(b) is available [here](#).