National Transportation Safety Board
Aviation Accident Final Report

Location:	Salters, SC	**Accident Number:**	ERA18FA004
Date & Time:	10/04/2017, 1745 EDT	**Registration:**	N401HH
Aircraft:	CESSNA 401	**Aircraft Damage:**	Destroyed
Defining Event:	Loss of control in flight	**Injuries:**	2 Fatal
Flight Conducted Under:	Part 91: General Aviation - Personal		

Analysis

The commercial pilot and passenger departed on a local flight in the twin-engine airplane. According to a witness, the pilot took off from the private grass runway and departed the area for about 10 minutes. The airplane then returned to the airport, where the pilot performed a low pass over the runway and entered a steep climb followed by a roll. The airplane entered a nose-low descent, then briefly leveled off in an upright attitude before disappearing behind trees and subsequently impacting terrain.

The pilot's toxicology testing was positive for ethanol with 0.185 gm/dl and 0.210 gm/dl in urine and cavity blood samples, respectively. The effects of ethanol are generally well understood; it significantly impairs pilot performance, even at very low levels. Federal Aviation Administration regulations prohibit any person from acting or attempting to act as a crewmember of a civil aircraft while having 0.040 gm/dl or more ethanol in the blood. While the identified ethanol may have come from sources other than ingestion, such as postmortem production, the possibility that the source of some of the ethanol was from ingestion and that pilot was impaired by the effects of ethanol during the accident flight could not be ruled out.

Toxicology also identified a significant amount of diphenhydramine in cavity blood (0.122 µg/ml, which is within or above the therapeutic range of 0.0250 to 0.1120 µg/ml; diphenhydramine undergoes postmortem redistribution, and central postmortem levels may be about two to three times higher than peripheral or antemortem levels.). Diphenhydramine is a sedating antihistamine that causes more sedation than other antihistamines; this is the rationale for its use as a sleep aid. In a driving simulator study, a single dose of diphenhydramine impaired driving ability more than a blood alcohol concentration of 0.100%.

The pilot had been diagnosed with memory loss about 8 months before the accident. It appears that he had some degree of mild cognitive impairment, but whether his cognitive impairment was severe enough to have contributed to the accident could not be determined from the available evidence. However, it is likely that the pilot's mild cognitive impairment combined with the psychoactive effects of diphenhydramine and possibly ethanol would have further

decreased his cognitive functioning and contributed to his decision to attempt an aerobatic maneuver at low altitude in a non-aerobatic airplane.

Probable Cause and Findings

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

The pilot's decision to attempt a low-altitude aerobatic maneuver in a non-aerobatic airplane, and his subsequent failure to maintain control of the airplane during the maneuver. Contributing to the accident was the pilot's impairment by the effects of diphenhydramine use, and his underlying mild cognitive impairment.

Findings

Aircraft	Altitude - Not attained/maintained (Cause)
Personnel issues	Unnecessary action - Pilot (Cause)
	Decision making/judgment - Pilot (Cause)
	Aircraft control - Pilot (Cause)
	Neurological - Pilot (Factor)
	OTC medication - Pilot (Factor)

Factual Information

History of Flight

Maneuvering	Loss of control in flight (Defining event)

On October 4, 2017, about 1745 eastern daylight time, a Cessna 401B, N401HH, was destroyed when it impacted terrain while maneuvering near a private airport in Salters, South Carolina. The commercial pilot and passenger were fatally injured. The airplane was owned and operated by the pilot under the provisions of Title 14 *Code of Federal Regulations* Part 91. Visual meteorological conditions prevailed, and no flight plan was filed for the personal flight, which departed the airport about 1730.

A witness at the airport reported seeing the airplane take off from the private grass runway. About 10 minutes later, the airplane made a low pass over the runway, then entered a steep climb. The witness stated that the airplane rolled left, the left wing dropped, and the airplane rolled inverted and began descending in a nose-low attitude. The airplane rolled to a level attitude before it disappeared behind trees. The wreckage was located in an open field that was surrounded by trees about 1 mile southwest of the runway.

Another witness, who was about 1/2 mile from the end of the runway, described hearing the airplane make what sounded like a "high speed pass down the runway." He saw the airplane in a wings-level attitude, then it "snapped a barrel roll." He said the airplane rolled wings level over an open field about 100 to 150 yards before the tree line, and he subsequently heard the airplane impact trees.

The first witness recorded a cell phone video of the airplane just before impact; the footage was consistent with his statement.

Pilot Information

Certificate:	Commercial; Private	**Age:**	66, Male
Airplane Rating(s):	Multi-engine Land; Single-engine Land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	Helicopter	**Restraint Used:**	Unknown
Instrument Rating(s):	Airplane	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	Class 2 With Waivers/Limitations	**Last FAA Medical Exam:**	07/27/2017
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	
Flight Time:	15000 hours (Total, all aircraft)		

The pilot held a commercial pilot certificate with ratings for airplane single- and multi-engine land, instrument airplane, and rotorcraft-helicopter. He also held an airframe and powerplant mechanic certificate. His most recent Federal Aviation Administration second-class airman medical certificate was issued on July 27, 2017, with the limitation, "must have glasses for near vision." At that time, he reported 15,000 total hours of flight experience. The pilot's flight experience at the time of the accident could not be determined.

Aircraft and Owner/Operator Information

Aircraft Make:	CESSNA	**Registration:**	N401HH
Model/Series:	401 B	**Aircraft Category:**	Airplane
Year of Manufacture:	1969	**Amateur Built:**	No
Airworthiness Certificate:	Normal	**Serial Number:**	401B0004
Landing Gear Type:	Retractable - Tricycle	**Seats:**	6
Date/Type of Last Inspection:	08/15/2017, Annual	**Certified Max Gross Wt.:**	6301 lbs
Time Since Last Inspection:	9 Hours	**Engines:**	2 Reciprocating
Airframe Total Time:	5557.1 Hours as of last inspection	**Engine Manufacturer:**	CONT MOTOR
ELT:	Installed, not activated	**Engine Model/Series:**	TSIO-520-E9
Registered Owner:	HADDOCK FLYING SERVICE INC	**Rated Power:**	300 hp
Operator:	On file	**Operating Certificate(s) Held:**	None

The six-seat, low-wing, retractable-gear airplane was manufactured in 1969. It was powered by two Continental TSIO-520E, 300-horsepower engines, driving McCauley three-bladed, constant-speed, full-feathering propellers.

The airplane's most recent annual inspection was completed on August 5, 2017, at 5557.1 total aircraft hours. The airplane had accrued 9.2 hours since the previous annual inspection on March 25, 2016.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual Conditions	**Condition of Light:**	Day
Observation Facility, Elevation:	KCKI, 66 ft msl	**Distance from Accident Site:**	14 Nautical Miles
Observation Time:	1735 EDT	**Direction from Accident Site:**	22°
Lowest Cloud Condition:	Scattered / 4700 ft agl	**Visibility**	10 Miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	Calm /	**Turbulence Type Forecast/Actual:**	/ None
Wind Direction:		**Turbulence Severity Forecast/Actual:**	/ N/A
Altimeter Setting:	30.28 inches Hg	**Temperature/Dew Point:**	26°C / 17°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Salters, SC (PVT)	**Type of Flight Plan Filed:**	None
Destination:	Salters, SC (PVT)	**Type of Clearance:**	None
Departure Time:	1730 EDT	**Type of Airspace:**	Class G

At 1735, the weather reported at Williamsburg Regional Airport, Kingstree, South Carolina, about 14 miles north of the accident site, included calm wind, 10 statute miles visibility, scattered clouds at 4,700 ft and 6,500 ft, temperature 26°C, dew point 17°C, and an altimeter setting of 30.28 inches of mercury.

Airport Information

Airport:	PVT (PVT)	**Runway Surface Type:**	N/A
Airport Elevation:	70 ft	**Runway Surface Condition:**	Vegetation
Runway Used:	N/A	**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:**	On-Ground
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	2 Fatal	**Latitude, Longitude:**	33.496389, -79.957222 (est)

The airplane was examined at the accident site and all major components were accounted for at the scene. The wreckage path began in trees about 50 ft above the ground and was oriented on a magnetic heading about 280°. The main wreckage came to rest inverted on a heading of 230° and was consumed by a postcrash fire.

The outboard portion of the left wing was located at the initial tree strike. Fragments of the airframe were located at a second tree strike about 350 ft from the initial tree strike. The outboard portion of the right wing was located about 320 ft beyond the second tree strike. The main wreckage was about 930 ft from the initial tree strike; the right engine was about 90 ft past the main wreckage.

The flaps and the landing gear were retracted. Flight control cable continuity was confirmed from the all flight control surfaces to the cockpit area. Flight control cable continuity within the cockpit could not be confirmed due to fire damage. All cockpit instrumentation was destroyed by fire.

The left engine was separated from the nacelle and the wing and found inverted by the left wing. All six cylinders remained attached at their bases; the cooling fins sustained impact damage. The engine was manually rotated and thumb compression was obtained on all cylinders. A borescope inspection of the cylinders revealed that the tops of all pistons and all intake and exhaust valves exhibited normal combustion signatures. The propeller separated from the engine at the attachment bolts.

The right engine was separated forward of the main wreckage; it was found inverted and attached to the wing nacelle. All six cylinders remained attached; Nos. 2, 4 and 6 displayed cooling fin impact damage. The engine was manually rotated and thumb compression was obtained on all cylinders. A borescope inspection of the cylinders revealed that the tops of all pistons and all intake and exhaust valves exhibited normal combustion signatures. The propeller was separated from the engine at the propeller flange.

Medical And Pathological Information

The Medical University of South Carolina, Charleston, South Carolina, conducted an autopsy of the pilot. The cause of death was listed as multiple blunt force injuries.

The FAA's Bioaeronautical Sciences Research Laboratory, Oklahoma City, Oklahoma, performed toxicological testing of samples from the pilot. The testing was positive for ethanol at 0.185 gm/dl in the urine and .0210 gm/dl in cavity blood. N-propanol was also found in cavity blood. In addition, colchicine, 0.122 µg/ml of diphenhydramine, donepezil, acetaminophen, benazepril, naproxen, and rosuvastatin were identified in urine.

Ethanol is the intoxicant commonly found in beer, wine, and liquor. It acts as a central nervous system depressant. After ingestion, at low doses, it impairs judgement, psychomotor functioning, and vigilance; at higher doses it can cause coma and death. The effects of ethanol are generally well understood; it significantly impairs pilot performance, even at very low levels. Federal Aviation Administration regulations prohibit any person from acting or attempting to act as a crewmember of a civil aircraft while having 0.040 gm/dl or more ethanol in the blood. Because ingested alcohol is distributed throughout the body, levels from different postmortem tissues are usually similar after ingestion. N-propanol is a type of alcohol that is produced in body tissues after death.

Colchicine is a prescription medication used to treat and prevent attacks of gout. It is not considered impairing.

Diphenhydramine is a sedating antihistamine used to treat allergy symptoms and as a sleep aid. It is available over the counter under the trade names Benadryl and Unisom. Diphenhydramine carries the following FDA warning: "may impair mental and/or physical ability required for the performance of potentially hazardous tasks (e.g., driving, operating heavy machinery)." Compared to other antihistamines, diphenhydramine causes marked sedation; this is the rationale for its use as a sleep aid. Altered mood and impaired cognitive and psychomotor performance may also be observed. In fact, in a driving simulator study, a single dose of diphenhydramine impaired driving ability more than a blood alcohol concentration of 0.100%. The therapeutic range for diphenhydramine is 0.0250 to 0.1120 µg/ml. Diphenhydramine undergoes pos mortem redistribution where, after death, the drug can leach from storage sites back into blood.

Donepezil is a prescription medication often marketed with the name Aricept and used to slow the progression of cognitive decline in Alzheimer's disease. While it is not considered impairing, the underlying disease is.

Hydroxychloroquine is an antimalarial medication that has anti-inflammatory properties that lead to its use in the treatment of rheumatoid arthritis. It is not considered cognitively impairing.

Acetaminophen is an analgesic available over the counter, commonly marketed with the name Tylenol. Benazepril is a blood pressure medication. Naproxen is an anti-inflammatory drug available over the counter and commonly marketed with the names Naprosyn and Aleve. Rosuvastatin is a cholesterol lowering medication commonly marketed with the name Crestor. None of these substances are considered impairing.

According to records obtained from the pilot's most recent primary care physician, he initiated care with the doctor on February 2, 2017. In the review of symptoms with the pilot, the physician noted, "no memory loss." The physician performed a mini-mental status exam and

the pilot scored 28/30 points. He recalled only one of three objects after 5 minutes. The physician diagnosed "memory loss," but did not perform other testing.

Three months later, the pilot returned to the doctor. According to the review of symptoms, the pilot denied episodes of weakness, loss of consciousness, memory impairment, difficulty concentrating, or any other neurologic or psychiatric issues. His neurologic exam was documented as normal; however, he was diagnosed with essential tremor, memory loss, and transient ischemic attack as well as hypertension. The physician added another blood pressure medication and prescribed donepezil for memory loss.

Preventing Similar Accidents

Pilots: Manage Risks to Ensure Safety

Although few pilots knowingly accept severe risks, accidents can also result when several risks of marginal severity are not identified or are ineffectively managed by the pilot and compound into a dangerous situation. Accidents also result when the pilot does not accurately perceive situations that involve high levels of risk. Ineffective risk management or poor aeronautical decision-making can be associated with almost any type of fatal general aviation accident.

By identifying personal attitudes that are hazardous to safe flying, applying behavior modification techniques, recognizing and coping with stress, and effectively using all resources, pilots can substantially improve the safety of each flight. Remember that effective risk management takes practice. It is a decision-making process by which pilots can systematically identify hazards, assess the degree of risk, and determine the best course of action. Pilots should plan ahead with flight diversion or cancellation alternatives, and they not be afraid to change their plans; it can sometimes be the difference between arriving safely late or not arriving at all.

See http://www.ntsb.gov/safety/safety-alerts/documents/SA_023.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):	Millicent M Hill	**Report Date:**	11/05/2018
Additional Participating Persons:	Neil Baker; FAA/FSDO; Columbia, SC Andrew Hall; Textron; Wichita, KS Mike Council; CMI; Mobile, AL		
Publish Date:	11/05/2018		
Note:	The NTSB traveled to the scene of this accident.		
Investigation Docket:	http://dms.ntsb.gov/pubdms/search/dockList.cfm?mKey=96143		