Aviation Investigation Final Report

Location:	North Hampton, New Hampshire	**Accident Number:**	ERA14FA417
Date & Time:	September 1, 2014, 10:50 Local	**Registration:**	N6510A
Aircraft:	Cessna 180	**Aircraft Damage:**	Substantial
Defining Event:	Aerodynamic stall/spin	**Injuries:**	2 Fatal
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

Witnesses reported observing the commercial pilot and passenger departing from the turf runway. After a normal takeoff, the airplane's angle of attack (AOA) began to increase, and it continued to increase until the airplane's critical AOA was exceeded. The airplane then experienced an aerodynamic stall and entered an uncontrolled descent.

Postaccident examination of the airplane, including the flight controls and stall warning system, and the engine revealed no evidence of any preaccident mechanical failures or malfunctions that would have precluded normal operation.

The pilot had reported that he had hypertension, gastro-esophageal reflux disease (GERD), and high cholesterol and that he was using lisinopril, pantoprazole, and simvastatin to treat those conditions to the Federal Aviation Administration. However, given that high blood pressure and high cholesterol cause no direct symptoms and that no evidence of a stroke, heart attack, or significant natural disease were identified on autopsy, it is unlikely that either of these conditions or the medications the pilot was taking to treat them contributed to the accident. Further, although GERD can cause heartburn, it is unlikely to have been acute or severe enough to have contributed to the accident.

Postaccident toxicology testing of the pilot's specimens identified significant levels of diphenhydramine, which is a sedating antihistamine, in the femoral and cavity blood, indicating that it is likely that the pilot's diphenhydramine level was near the middle of the therapeutic window at the time of the accident. Even at therapeutic levels, diphenhydramine is quite impairing. In fact, in a driving simulator study, a single dose of diphenhydramine impaired driving ability more than a blood alcohol concentration of 0.100%. Thus, it is very likely that the pilot was impaired by diphenhydramine at the time of the accident.

Toxicology testing of the passenger's specimens detected a level of zolpidem, which is a short-acting sedative hypnotic used as a sleep aid, in the heart blood that was at the lower end of the therapeutic

window and would likely have been significantly lower at the time of the accident. Although it could not be determined with certainty, it is not likely that the passenger was significantly impaired by zolpidem at the time of the accident.

The pilot was seated in the left seat; one witness reported seeing his left hand on the glareshield as the AOA began to increase whereas another witness reported seeing his hand reach for the glareshield as the AOA began to increase. Based on the pilot's reported hand position at takeoff, it is possible that he had decided to let the unrated passenger attempt the takeoff; however, this could not be definitively determined. In either case (with the passenger or the pilot flying), the pilot failed to ensure that the airplane maintained adequate airspeed, which led to the airplane exceeding its critical angle of attack. It is likely that the pilot's impairment by diphenhydramine contributed to the accident and led to his poor decision-making or affected his ability to respond to the stall quickly.

Probable Cause and Findings

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

The pilot's failure to ensure the airplane maintained adequate airspeed during the initial climb and the subsequent exceedance of its critical angle of attack, which resulted in an aerodynamic stall. Contributing to the accident were the pilot's impairment due to a sedating antihistamine, which led to his decision to possibly allow the passenger to attempt the takeoff, and his delayed remedial action to lower the nose when the airplane began to pitch up too much.

Findings

Aircraft	Airspeed - Not attained/maintained
Aircraft	Angle of attack - Not attained/maintained
Personnel issues	Aircraft control - Pilot
Personnel issues	OTC medication - Pilot
Personnel issues	Delayed action - Pilot

Factual Information

History of Flight

Initial climb	Aerodynamic stall/spin (Defining event)
Uncontrolled descent	Collision with terr/obj (non-CFIT)

On September 1, 2014, about 1050 eastern daylight time, a Cessna 180, N6510A, was substantially damaged when it impacted trees and terrain during the initial climb after takeoff from Hampton Airfield (7B3), North Hampton, New Hampshire. The airline transport pilot and a passenger were fatally injured. Visual meteorological conditions prevailed, and no flight plan was filed for the personal flight conducted under the provisions of 14 Code of Federal Regulations Part 91, destined for a private airport in Kingston, New Hampshire.

On the day of the accident, the airport was hosting its annual customer appreciation day. As a result, numerous witnesses observed the accident.

According to witness statements and video images, the pilot contacted the airport advisory frequency from a position approximately 5 miles west of 7B3. The airplane then overflew the south end of the airport and the pilot advised that he would be joining the downwind leg of the traffic pattern for "Runway 22." The pilot then advised that he was joining the base leg of the traffic pattern, and then reported that he was "landing south" without indicating the runway number.

The airplane landed normally, and subsequently shutdown at the fuel pumps, at 1023. The pilot then refueled the airplane with approximately 31 gallons of 100 LL aviation gasoline, which was completed at approximately 1036.

After starting the airplane and taxiing away from the fuel pumps, a witness observed a seat belt hanging out of the passenger door. The witness gained the pilot's attention and advised him about the seatbelt. The pilot then taxied to runway 02. Witnesses did not observe the pilot perform an run-up prior to turning onto the runway, and also noted that the flaps were partially extended before the takeoff roll began.

The airplane appeared to takeoff normally with the tailwheel coming off the surface of the runway first, followed by the main landing gear wheels. Comparison of video footage to known landmarks on the airport indicated that the ground run was approximately 890 feet. After liftoff, the airplane's angle of attack began to increase. One witness stated that as the angle of attack began to increase, the pilot's left hand reached for the glareshield, while another witness observed the pilot's left hand already on the glareshield as the angle of attack began to increase.

Approximately 320 feet later, the airplane's angle of attack was still increasing and the airplane's altitude was higher than a group of approximately 73 foot high trees that were located adjacent to the west side of the runway. Moments later, the airplane rolled and yawed to the left, the angle of attack decreased through a level flight attitude, to a steep nose down attitude, the engine rpm decreased "as if it was being

throttled back to idle" and the airplane went out of view behind some trees. The sound of impact was then heard.

Pilot Information

Certificate:	Airline transport; Commercial	**Age:**	77,Male
Airplane Rating(s):	Single-engine land; Single-engine sea; Multi-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	Lap only
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:**	April 11, 2013
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	June 9, 2014
Flight Time:	(Estimated) 20050 hours (Total, all aircraft), 2025 hours (Total, this make and model), 9 hours (Last 90 days, all aircraft), 3 hours (Last 30 days, all aircraft)		

According to Federal Aviation Administration (FAA) and pilot records, the pilot held an airline transport pilot certificate with a rating for airplane multiengine land, with commercial pilot privileges for airplane single-engine land, airplane single-engine sea, and type ratings for the B-707, B-720, and B-727. He had accrued approximately 20,050 total hours of flight time, 2,025 of which were in the accident airplane make and model. His most recent FAA third-class medical certificate was issued on April 11, 2013.

According to FAA records, the passenger did not hold any pilot certificates and no evidence of any flight training for the passenger was found during the investigation.

Aircraft and Owner/Operator Information

Aircraft Make:	Cessna	**Registration:**	N6510A
Model/Series:	180	**Aircraft Category:**	Airplane
Year of Manufacture:	1956	**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	32407
Landing Gear Type:	Tailwheel	**Seats:**	4
Date/Type of Last Inspection:	June 6, 2014 Annual	**Certified Max Gross Wt.:**	2550 lbs
Time Since Last Inspection:	12 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	3225 Hrs as of last inspection	**Engine Manufacturer:**	CONT MOTOR
ELT:	C91A installed, activated, did not aid in locating accident	**Engine Model/Series:**	O-470-K
Registered Owner:	On file	**Rated Power:**	230 Horsepower
Operator:	On file	**Operating Certificate(s) Held:**	None

The accident aircraft was a four-place, strut braced, high wing airplane of conventional metal construction. It was equipped with conventional landing gear, and powered by a Continental Motors O-470-K, 230 horsepower engine, that was equipped with a two-blade, variable pitch, constant-speed propeller.

According to FAA and airplane maintenance records, it was manufactured in 1956. The airplane's most recent annual inspection was completed on June 6, 2014. At the time of the inspection, the airplane had accrued approximately 3,225 total hours of operation.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	PSM,100 ft msl	**Distance from Accident Site:**	6 Nautical Miles
Observation Time:	10:58 Local	**Direction from Accident Site:**	360°
Lowest Cloud Condition:	Few / 3000 ft AGL	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	6 knots /	**Turbulence Type Forecast/Actual:**	/ None
Wind Direction:	290°	**Turbulence Severity Forecast/Actual:**	/ N/A
Altimeter Setting:	29.95 inches Hg	**Temperature/Dew Point:**	28°C / 21°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	North Hampton, NH (7B3)	**Type of Flight Plan Filed:**	None
Destination:	KENSINGTON, NH (06NH)	**Type of Clearance:**	None
Departure Time:	10:48 Local	**Type of Airspace:**	Class G

The reported weather at Portsmouth International Airport (PSM), located 6 nautical miles north of the accident site, at 1058, included: wind from 290 degrees at 6 knots, 10 statute miles visibility, few clouds at 3,000 feet, temperature 28 degrees C, dew point 21 degrees C, and an altimeter setting of 29.95 inches of mercury.

Airport Information

Airport:	HAMPTON AIRFIELD 7B3	**Runway Surface Type:**	Grass/turf
Airport Elevation:	93 ft msl	**Runway Surface Condition:**	Dry
Runway Used:	02	**IFR Approach:**	None
Runway Length/Width:	2100 ft / 170 ft	**VFR Approach/Landing:**	None

Hampton Airfield was privately-owned, and was located 2 miles north of Hampton, New Hampshire. It was classified by the FAA as a non-towered public use airport. The airport elevation was 93 feet above mean sea level and there was one runway oriented in a 02/20 configuration. Runway 02 was turf, and in good condition. The total length was 2,100 foot long by 170 foot wide.

Wreckage and Impact Information

Crew Injuries:	1 Fatal	**Aircraft Damage:**	Substantial
Passenger Injuries:	1 Fatal	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	2 Fatal	**Latitude, Longitude:**	42.962776,-70.83139

Examination of the accident site revealed that the airplane struck trees in a nose low, left wing down attitude, and then impacted the ground in a 42-degree nose low attitude, on an approximate magnetic heading of 220 degrees, before coming to rest. The smell of fuel was present, and multiple branches and broken tree limbs displayed evidence of propeller strike marks.

Examination of the airplane revealed that the fuselage was broken and bent in several places. The wings, which displayed crush and compression damage, were detached from their mounting locations, and approximately 2 feet of the outboard left wing was separated.

Flight control continuity was established from the flight controls to the cockpit, and the throttle control, mixture control, propeller control, and carburetor heat, were full in. The fuel selector valve was in the "BOTH" position, the stabilizer trim wheel was intact and the trim indicator, and jackscrew indicated that the stabilizer trim was approximately in the 0-degree (neutral) position. The flap handle for the wing flaps was in the 20-degree detent. The pilot and passenger seat tracks were equipped with seat stops, and displayed evidence of pullout and cracking which was consistent with the seats being in the locked position during the impact.

The propeller remained attached to the crankshaft and both propeller blades remained attached to the hub. The propeller blades displayed evidence of S-bending, chordwise scratching, and leading edge polishing. The propeller governor remained attached to its mounting location, and displayed significant impact damage including impact separation of the governor control from the rest of the propeller governor.

The engine intake system sustained damage consistent with impact damage and several intake tubes were crushed, dented and bent. A portion of the intake system was separated from the rest of the intake system, and a portion remained attached to the carburetor. The exhaust system sustained damage consistent with impact damage and displayed crushing, bending, and tearing. All of the exhaust risers remained attached to their respective cylinders.

The magnetos remained attached to their respective mounting locations and sustained only minor damage. The crankshaft was rotated by hand, and both magnetos produced spark at all of their respective ignition leads. All of the spark plugs were present in their respective cylinders and were undamaged. When compared to the Champion Aviation Service Manual, all of the spark plugs displayed normal operating signatures.

The carburetor sustained damage consistent with impact damage; the idle stop adjustment screw installation point remained only partially attached. The carburetor remained attached to a portion of the

intake system; however, the attach point had broken free from the rest of the intake system. Internal examination of the carburetor revealed that fuel consistent with 100 LL aviation gasoline was present in the float bowl. No contaminates were present in the inlet screen, and a check of the fuel in the carburetor bowl utilizing water finding paste did not indicate the presence of water. Submersion of the carburetor floats in a container of 100LL for 20 minutes did not reveal any air bubbles and the floats retained their buoyancy.

The oil sump remained attached to its mounting location and displayed impact damage. The oil pump gears, housing, and oil pressure relief valve displayed normal operating signatures. The oil filter remained attached to the oil filter adapter and displayed impact damage. There were no metallic particulates or contaminates discovered in the filter pleats and the oil cooler was undamaged.

All of the cylinders remained attached to the engine and the cylinders sustained only minor impact damage. Examination of the cylinders with a borescope revealed that the piston faces, valve heads, and cylinder bores, all displayed normal operating signatures.

The crankcase remained intact and displayed minor impact damage. The crankshaft remained intact and displayed impact damage to the propeller flange.

Thumb compression and suction was established on all cylinders, and all the valves, rocker arms, pistons, crankshaft, camshaft, connecting rods, and associated components were noted to operate when the crankshaft was rotated by hand.

Medical and Pathological Information

Pilot

An autopsy was performed on the pilot by the State of New Hampshire, Office of the Chief Medical Examiner. The reported cause of death was blunt impact injuries.

Toxicological testing of the pilot was conducted at the FAA Bioaeronautical Sciences Research Laboratory, Oklahoma City, Oklahoma. The specimens from the pilot were negative for ethanol, and basic, acidic, and neutral drugs, with the exception of Diphenhydramine, which was detected in urine and blood, and Ibuprofen, which was detected in urine. Testing for Carbon Monoxide and Cyanide were not performed.

On April 11, 2013, during his last aviation medical examination, the 77-year old male pilot reported a new diagnosis of hypertension as well as long standing gastro-esophageal reflux disease (GERD) and high cholesterol. He reported using the medications Lisinopril, Pantoprazole, and Simvastatin. He was issued a third class medical certificate limited by a requirement to wear corrective lenses for distance vision and possess glasses for near vision. At the time, he was 66 inches tall, and weighed 152 pounds.

Lisinopril is a prescription blood pressure medication commonly sold with the name Vasotec. Pantoprazole is a proton pump inhibitor used to treat GERD and other sources of heartburn. It is

available over the counter with the name Prilosec. Simvastatin is a prescription cholesterol lowering agent commonly sold with the name Lipitor.

According to the autopsy report, the examination identified atherosclerotic disease in the aorta and some calcification of the coronary arteries without coronary artery stenosis. The remainder of the examination was unremarkable.

Toxicology testing performed by the NMS Labs at the request of the Chief Medical Examiner identified 0.077 ug/ml of Diphenhydramine in femoral blood and caffeine in chest blood.

Toxicology testing performed by the FAA's Bioaeronautical Research Laboratory identified Diphenhydramine and Ibuprofen in urine; 0.432 ug/ml of Diphenhydramine was quantified in cavity blood.

Ibuprofen is a non-steroidal anti-inflammatory medication used as an analgesic and fever reliever; it is available over the counter marketed as Motrin and Advil. Diphenhydramine is a sedating antihistamine used to treat cold and allergy symptoms and as a sleep aid. It is available over the counter under the trade names Benadryl and Unisom. Diphenhydramine's therapeutic window is between 0.0250 ug/ml and 0.1120 ug/ml. It 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; it is also classed as a Central Nervous System (CNS) depressant and 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%. Diphenhydramine undergoes postmortem redistribution; after death it can move back into pooled blood from storage sites. For diphenhydramine, postmortem central or cavity blood levels may increase by three times or more.

Passenger

An autopsy was performed on the passenger by the State of New Hampshire, Office of the Chief Medical Examiner. The reported cause of death was blunt impact injuries.

Toxicological testing of the passenger was conducted at the FAA Bioaeronautical Sciences Research Laboratory, Oklahoma City, Oklahoma. The specimens from the pilot were negative for ethanol, and basic, acidic, and neutral drugs, with the exception of Zolpidem, which was detected in liver and blood, and Ibuprofen, which was detected in blood. Testing for Carbon Monoxide and Cyanide were not performed.

Toxicology testing performed by the FAA's Bioaeronautical Research Laboratory identified Ibuprofen and 0.0250 ug/ml of Zolpidem in heart blood as well as of 0.068 ug/ml of Zolpidem in liver.

Zolpidem is a short acting sedative hypnotic used as a sleep aid and available by prescription; it is commonly called Ambien. Zolpidem's therapeutic window is between 0.0250 and 0.300 ug/ml and it carries the following warning: may impair mental and/or physical ability required for the performance of potentially hazardous tasks (e.g., driving, operating heavy machinery).

Tests and Research

Pitot Static System

The airspeed indicator, was operated by the pitot static system. This system consisted of a pitot tube, mounted under the leading edge of the left wing and two pressure ports (static ports) mounted on opposite sides of the fuselage just aft of the firewall. Examination of the pitot tube and static pressure ports during the wreckage examination revealed that they were clear of obstructions.

Stall Warning System

According to the Cessna 180 Owner's Manual, the aerodynamic stall characteristics were conventional for flaps up and flaps down conditions and slight buffeting could occur just before the stall with flaps down.

The airplane when at aft center of gravity and full gross weight at sea level would stall with the wing flaps set at 20-degrees at a true indicated airspeed (TIAS) of:

55 mph at 0-degrees angle of bank
59 mph at 30-degrees angle of bank
78 mph at 60-degrees angle of bank

To help avoid aerodynamic stalls, the airplane was equipped with a stall warning system. The stall warning system was comprised of a stall warning indicator (stall warning horn) which was mounted on the back of the glove compartment box, next to the firewall, and an actuating switch (stall vane) which was mounted on the leading edge of the left wing and was actuated by airflow over the surface of the wing. The switch would close as approximately 5 to 10 mph above the airplane stall speed.

According to the Cessna 180 Owner's Manual, the stall warning indicator would provide protection from inadvertent stalls. It would give a warning whenever an aerodynamic stall was approached, regardless of speed, attitude, altitude, acceleration, or other factors, which could change the stalling speed.

Examination of the stall warning system did not reveal any anomalies, and testing of the actuating switch with a multimeter, indicated that it was functional.

Use of Wing Flaps

According to the Cessna 180 Owner's Manual, the wing flap control handle was operated by depressing the thumb button and moving the handle to the desired flap setting. By releasing the thumb button, the handle could be locked to provide 0, 20, 30, and 40-degree flap positions. The flaps could be lowered or raised during normal flying whenever the airspeed was less than 100 mph. The wing flaps could supply considerable lift and drag.

For takeoff, the flaps could be selected to the 0-degree (flaps up), or 20-degree (first notch), positions.

During the wreckage examination, the wing flap handle was found to be in the 20-degree (first notch) position, which according to the Cessna 180 Owner's Manual, would shorten the takeoff distance to clear a 50 foot obstacle as a result of slower forward speeds, even though the use of wing flaps would lessen the rate of climb. The use of 30 or 40 degrees of wing flaps was not recommended at any time for takeoff.

The manual also stated to "REMEMBER" that you "Don't under marginal conditions, leave wing flaps on long enough that you are losing both climb and airspeed. Don't raise wing flaps with airspeed below "Flaps Up stalling speed" and "Do slowly release the wing flaps as soon as you reasonably can after take-off, preferably 50 feet or more over terrain or obstacles."

Preventing Similar Accidents

Understand Impairment Risk (SA-037)

The Problem

Toxicology tests of pilots involved in fatal aviation accidents increasingly show evidence that a wide variety of over-the-counter (OTC) and prescription drugs have been used, including drugs that are potentially impairing. Pilots may be using OTC or prescription drugs without realizing that they can cause impairment. Pilot impairment due to the effects of drugs reduces the safety of flight, increases accident risk, and is preventable.

What can you do?

- Discuss EVERY medication you take regularly, including OTC, prescription, and other drugs, with your aviation medical examiner during your medical certification exam.
- Make sure anyone prescribing medication for you knows that you are a pilot. Ask if the medication is safe to take before or while flying or if there is an alternative that would be less likely to cause impairment.
- DO NOT FLY if you notice you are feeling sleepy, “out of it,” or jittery after using any drug. These feelings mean you are probably impaired.
- For medications that have a warning about using caution when driving a vehicle, the Federal Aviation Administration (FAA) recommends waiting at least 5 times the longest recommended interval between doses before flying to be sure you are safe to fly. For

example, if the dosing interval states, “take every 4 to 6 hours” that means waiting 30 hours (5 times the longest dosing interval of 6 hours).
- When choosing OTC medications, read the label. If it has a warning that states, “Use caution when driving a vehicle or operating machinery,” ask the pharmacist if there is something else you can use that will not increase your risk of impairment.

See https://www.ntsb.gov/Advocacy/safety-alerts/Documents/SA-037.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):	Gunther, Todd
Additional Participating Persons:	Christopher A Mard; FAA/FSDO; Boston, MA Kurt Gibson; Continental Motors Inc.; Mobile, AL Steve Miller; Textron Aviation; Wichita, KS
Original Publish Date:	March 23, 2017
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=89994