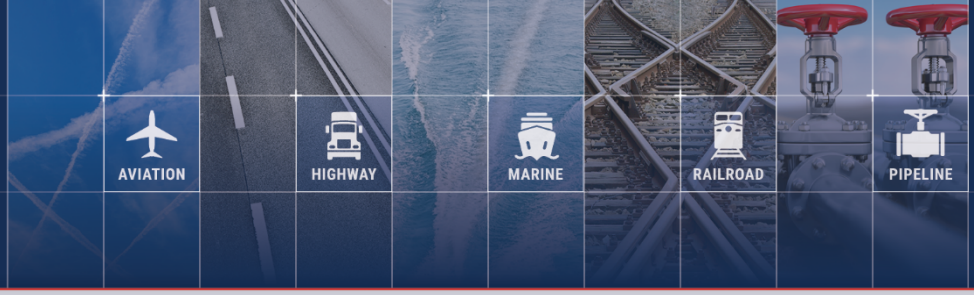

Aviation Investigation Final Report

Location:	East Haven, Connecticut	**Accident Number:**	ERA17FA112
Date & Time:	February 22, 2017, 09:56 Local	**Registration:**	N2452C
Aircraft:	Piper PA38	**Aircraft Damage:**	Destroyed
Defining Event:	Sys/Comp malf/fail (non-power)	**Injuries:**	1 Fatal, 1 Serious
Flight Conducted Under:	Part 91: General aviation - Instructional		

Analysis

The flight instructor and the student pilot were practicing touch-and-go landings in the airplane. During the initial climb after the fourth landing, the flight instructor reported an emergency to air traffic control and indicated that he was going to return and land on a runway at the airport. During that transmission, a stall warning horn was sounding. The airplane then spun to the left and descended to impact in a marsh.

The damage to the airplane was consistent with the airplane being in a left spin at impact, and the propeller displayed little damage, which is consistent with the engine not producing power at impact. The fuel selector handle was found positioned to the right main fuel tank; however, examination of the fuel selector's polymeric insert revealed that it had fractured and was in a position that provided openings of about 20% for the right main fuel tank inlet and for the engine outlet, instead of the 100% openings that would have been present with an intact polymeric insert. With only 20% of the normal fuel flow available, the airplane likely experienced a total loss of engine power due to fuel starvation. One of the pilots likely switched fuel tank positions during the previous touch-and-go landing, and the polymeric insert failed at that time. Examination of the wreckage did not reveal any other preimpact mechanical malfunctions.

Metallurgical examination of the fuel selector valve revealed that the lower portion of the polymeric insert exhibited fracture features consistent with rotational ductile overstress. Abrasive wear was present on the outer portion of the insert due to contact with burs on the valve housing. The wear likely took place over a period during which the fuel selector handle would have been difficult to move and excessive force would have been required to move the handle from one position to another.

Review of maintenance records did not reveal any prior anomalies with the fuel selector. The airplane maintenance manual contained instructions, applicable to 100-hour inspections, for the fuel selector to be inspected for condition, security, and operation. The instructions stated that, if the valve binds, sticks, or is otherwise difficult to operate, the fuel selector valve should be lubricated. However, about 5 months had passed since the most recent 100-hour inspection was completed on the airplane. During that time, the airplane had been operated about 78 hours. The investigation could not determine the condition

of the fuel selector valve at the last 100-hour inspection.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The failure of the fuel selector valve in a position that restricted fuel flow to the engine, resulting in a total loss of engine power during initial climb due to fuel starvation. Also causal was the operator's failure to effectively detect and resolve the wear and progressive binding of the fuel selector valve before it failed due to excessive rotational force being applied. Contributing was the flight instructor's exceedance of the airplane's critical angle of attack during an emergency return to the airport, which resulted in an aerodynamic stall/spin.

Findings

Aircraft	Fuel selector/shutoff valve - Failure
Aircraft	Fuel selector/shutoff valve - Fatigue/wear/corrosion
Aircraft	Fuel selector/shutoff valve - Not serviced/maintained
Personnel issues	Aircraft control - Instructor/check pilot
Aircraft	Angle of attack - Capability exceeded

Factual Information

History of Flight

Initial climb	Sys/Comp malf/fail (non-power) (Defining event)
Initial climb	Fuel starvation
Initial climb	Loss of engine power (total)
Emergency descent	Aerodynamic stall/spin
Uncontrolled descent	Collision with terr/obj (non-CFIT)

On February 22, 2017, about 0956 eastern standard time, a Piper PA-38-112, N2452C, was destroyed when it impacted terrain in East Haven, Connecticut, during the initial climb from Tweed-New Haven Airport (HVN), New Haven, Connecticut. The flight instructor was seriously injured, and the student pilot was fatally injured. The airplane was operated by American Flight Academy as an instructional flight conducted under the provisions of Title 14 *Code of Federal Regulations* Part 91. Visual meteorological conditions prevailed, and no flight plan was filed for the local flight.

According to an air traffic control transcript provided by the Federal Aviation Administration (FAA), the airplane completed four touch-and-go landings on runway 20, a 5,600-ft-long by 150-ft-wide asphalt runway. At 0955:43, during initial climb after the fourth landing, one of the pilots declared an emergency and stated, "mayday mayday mayday we're going to land on the other runway." The controller cleared the airplane to land, and no further communications were received from the pilots. Another flight instructor, who was also flying in the HVN airport traffic pattern at the time of the accident, stated that he heard the emergency transmission and could hear the airplane's stall warning horn in the background during the transmission. According to a witness, the airplane then spun to the left, descended in a nose-down attitude, and impacted terrain about 1,000 ft southeast of the departure end of runway 20. Review of radar data did not reveal any targets that could be correlated with the accident airplane during the initial climb in which the accident occurred.

The flight instructor was subsequently interviewed at a hospital by an FAA inspector. The flight instructor told the FAA inspector that he remembered practicing airwork and then returning to the airport to practice touch-and-go landings, but he did not recall the accident sequence.

Flight instructor Information

Certificate:	Commercial; Flight instructor	**Age:**	20,Male
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Right
Other Aircraft Rating(s):	None	**Restraint Used:**	3-point
Instrument Rating(s):	Airplane	**Second Pilot Present:**	Yes
Instructor Rating(s):	Airplane single-engine	**Toxicology Performed:**	Yes
Medical Certification:	Class 1 With waivers/limitations	**Last FAA Medical Exam:**	November 14, 2014
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	December 23, 2016
Flight Time:	236.3 hours (Total, all aircraft), 11.8 hours (Total, this make and model), 30.8 hours (Last 90 days, all aircraft), 27.7 hours (Last 30 days, all aircraft)		

Student pilot Information

Certificate:	None	**Age:**	31,Male
Airplane Rating(s):	None	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	3-point
Instrument Rating(s):	None	**Second Pilot Present:**	Yes
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	None	**Last FAA Medical Exam:**	
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	
Flight Time:	16.7 hours (Total, all aircraft), 14.6 hours (Total, this make and model), 3 hours (Last 90 days, all aircraft), 2 hours (Last 30 days, all aircraft)		

The flight instructor held a commercial pilot certificate with ratings for airplane single-engine land, airplane multi-engine land, and instrument airplane. He also held a flight instructor certificate with a rating for airplane single-engine. His most recent FAA first-class medical certificate was issued on November 14, 2014. Review of the flight instructor's logbook revealed that he had accumulated a total flight experience of about 236 hours, of which 12 hours were in the same make and model as the accident airplane. The flight instructor had flown about 28 hours during the 30-day period preceding the accident.

Review of the student pilot's logbook revealed that he had accumulated a total flight experience of about 17 hours of which 15 hours were in the same make and model as the accident airplane. The student pilot had not yet flown solo.

Aircraft and Owner/Operator Information

Aircraft Make:	Piper	**Registration:**	N2452C
Model/Series:	PA38 112	**Aircraft Category:**	Airplane
Year of Manufacture:	1978	**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	38-79A0192
Landing Gear Type:	Tricycle	**Seats:**	2
Date/Type of Last Inspection:	September 30, 2016 100 hour	**Certified Max Gross Wt.:**	1670 lbs
Time Since Last Inspection:	78 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	8472.9 Hrs at time of accident	**Engine Manufacturer:**	Lycoming
ELT:	C91A installed, activated, did not aid in locating accident	**Engine Model/Series:**	O-235
Registered Owner:		**Rated Power:**	112 Horsepower
Operator:		**Operating Certificate(s) Held:**	None
Operator Does Business As:	American Flight Academy	**Operator Designator Code:**	

The two-seat, low-wing, fixed tricycle-gear airplane was manufactured in 1978. It was powered by a Lycoming O-235, 112-horsepower engine, equipped with a two-blade, fixed-pitch Sensenich propeller.

Review of the airplane's logbooks revealed that, at the time of the accident, the airframe had accumulated about 8,473 total hours of operation, and the engine had accumulated 2,508 hours since major overhaul. The airplane had been operated for 78 hours since its most recent 100-hour inspection, which was completed on September 30, 2016. Review of maintenance records did not reveal any prior anomalies with the airplane's fuel selector. Review of the airplane maintenance manual revealed instructions, applicable to 100-hour inspections, for the fuel selector to be inspected for condition, security, and operation. According to the instructions, if the fuel selector valve binds, sticks, or is otherwise difficult to operate, the fuel selector valve should be lubricated. Specifically, the insert, position washer, and "O" rings should be lubricated.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	HVN,12 ft msl	**Distance from Accident Site:**	1 Nautical Miles
Observation Time:	09:53 Local	**Direction from Accident Site:**	360°
Lowest Cloud Condition:		**Visibility**	10 miles
Lowest Ceiling:	Overcast / 7500 ft AGL	**Visibility (RVR):**	
Wind Speed/Gusts:	5 knots /	**Turbulence Type Forecast/Actual:**	/ None
Wind Direction:	210°	**Turbulence Severity Forecast/Actual:**	/ N/A
Altimeter Setting:	30.03 inches Hg	**Temperature/Dew Point:**	6°C / 2°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	East Haven, CT (HVN)	**Type of Flight Plan Filed:**	None
Destination:	East Haven, CT (HVN)	**Type of Clearance:**	None
Departure Time:	09:55 Local	**Type of Airspace:**	

The reported weather at HVN, at 0953, included wind from 210° at 5 knots, visibility 10 statute miles, and an overcast ceiling at 7,500 ft.

Airport Information

Airport:	Tweed-New Haven Airport HVN	**Runway Surface Type:**	Asphalt
Airport Elevation:	12 ft msl	**Runway Surface Condition:**	Dry
Runway Used:	20	**IFR Approach:**	None
Runway Length/Width:	5600 ft / 150 ft	**VFR Approach/Landing:**	None

Wreckage and Impact Information

Crew Injuries:	1 Fatal, 1 Serious	**Aircraft Damage:**	Destroyed
Passenger Injuries:		**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	1 Fatal, 1 Serious	**Latitude, Longitude:**	41.253612,-72.885559

No debris path was observed, and the wreckage came to rest upright in a marsh, oriented on a near north magnetic heading. Both wings remained attached to the airframe, and the ailerons and flaps remained

attached to their respective wings. The ailerons were about neutral, and the flaps were partially extended. The fuel caps remained secured to their respective wing fuel tanks, and, although both wing fuel tanks were breached during impact, several gallons of fuel remained in each wing. The right wing was buckled. The left wing exhibited more leading edge damage than the right wing, and its wingtip was bent upward, consistent with the left wing impacting terrain before the right wing.

The empennage was curled up and to the left. The horizontal stabilizer, vertical stabilizer, rudder, and elevator remained intact. Flight control continuity was confirmed from all flight control surfaces to the cockpit area. Examination of the elevator trim wheel revealed that the elevator trim cable remained wrapped around the spool twice, which equated to an elevator trim position between neutral and full nose up. Examination of the cockpit revealed that the seatbelts and shoulder harnesses remained intact. The throttle and mixture levers were in the forward position, and the magnetos were selected to both. The fuel selector handle was found positioned to the right main fuel tank.

The engine was partially buried in mud but remained attached to the airframe, and the propeller remained attached to the engine. The two propeller blades did not exhibit rotational damage. The wreckage was further examined at a recovery facility, and the engine was separated from the airframe for the examination. The valve covers were removed, and oil was noted throughout the engine. The top spark plugs were removed, and the propeller was rotated by hand. Camshaft, crankshaft, and valve train continuity were confirmed to the rear accessory section. Thumb compression was attained on all cylinders. The engine-driven fuel pump was removed from the engine. Several drops of fuel were recovered from the pump. When the pump was actuated by hand, suction and compression were confirmed at the inlet and outlet ports. The electric fuel pump activated when connected to a battery.

The throttle and mixture cables remained attached to the carburetor. The carburetor was disassembled, and its float and needle were intact. The carburetor inlet screen was absent of contamination. The carburetor bowl contained a mixture of fuel and water, consistent with its submersion in the marsh. The oil filter was opened, and no contamination was observed. The left magneto remained attached to the engine and produced spark at all four leads when rotated by hand. The right magneto had separated from the engine during impact and did not produce spark when rotated. The right magneto was disassembled, and the plastic housing that secured the breaker points was found fractured, resulting in no gap in the points. The spark plug electrodes remained intact and exhibited normal wear signatures when compared to a Champion Aviation Check-A-Plug chart. The bottom spark plugs exhibited corrosion consistent with submersion in the brackish marsh water.

During the airframe examination, the fuel selector valve would not move when the fuel selector handle was moved. The fuel selector was then removed and partially disassembled for examination. The examination revealed that the fuel selector valve's polymeric insert had fractured and was in a position that provided openings of about 20% to the right main fuel tank inlet and to the engine outlet, instead of the 100% openings that would have been present with an intact polymeric insert. The fuel selector valve was retained and forwarded to the NTSB Materials Laboratory, Washington, DC.

Metallurgical examination of the fuel selector valve revealed that the lower portion of the polymeric insert exhibited fracture features consistent with rotational ductile overstress. Abrasive wear was present on the outer portion of the insert due to contact with burs on the valve housing. (For more information, see the Materials Laboratory Factual Report in the public docket for this accident.)

Medical and Pathological Information

The State of Connecticut, Office of the Chief Medical Examiner performed an autopsy on the student pilot. The cause of death was reported as blunt trauma.

Toxicological testing was performed by the FAA Bioaeronautical Science Research Laboratory, Oklahoma City, Oklahoma, on samples from both pilots. The results were negative for the student pilot. Positive results for the flight instructor were consistent with the emergency medical treatment that he received after the accident.

Administrative Information

Investigator In Charge (IIC):	Gretz, Robert
Additional Participating Persons:	Herman Carvache; FAA/FSDO; Windsor Locks, CT Dave Harsanyi; Lycoming Engines; Williamsport, PA Michael McClure; Piper Aircraft; Vero Beach, FL
Original Publish Date:	February 12, 2018
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=94748