Aviation Investigation Final Report

Location:	Orange, Virginia	**Accident Number:**	ERA15FA170
Date & Time:	March 29, 2015, 09:40 Local	**Registration:**	N32396
Aircraft:	Piper PA-28-140	**Aircraft Damage:**	Substantial
Defining Event:	Aerodynamic stall/spin	**Injuries:**	1 Fatal
Flight Conducted Under:	Part 91: General aviation - Instructional		

Analysis

The student pilot was departing on a solo cross-country flight. Witnesses reported that they observed the airplane taking off and that it appeared to be "abnormally slow" and did not seem to be gaining altitude. They also reported observing a trail of "smoke" or "exhaust" emanating from the engine. When the airplane was about 150 ft above ground level, its nose pitched up abruptly, the left wing dropped, and the airplane impacted terrain about 1,300 ft from the departure end of the runway. Ground scars and damage to the airplane were consistent with a near-vertical impact.

Postaccident examination of the airframe revealed no anomalies, and there was no evidence of fuel contamination. Engine powertrain and valve train continuity was established, and borescope examination of the cylinders revealed no anomalies. The spark plugs were removed, and all of them exhibited significant carbon-fouling. During testing, three of the eight plugs displayed weak and intermittent spark. Flow testing revealed that, throughout all power settings, the carburetor produced a fuel flow that was richer than the maximum acceptable limits prescribed by the manufacturer. Review of the airplane's maintenance logbooks indicated that the carburetor was last serviced about 2 years (300 flight hours) before the accident. The condition of the spark plugs, as well as the witness accounts of smoke/exhaust, was consistent with the engine operating in an overly rich fuel/air mixture condition; however, the investigation could not determine how long the engine had been experiencing this condition.

None of the witnesses reported rough engine operation or a loss of power before the accident, and each of the witness observations was consistent with an aerodynamic stall/spin. Although the effect of the fouled spark plugs and overly rich fuel/air mixture on the engine operation could not be determined, it is possible that the engine's performance was degraded during the takeoff, which would likely have been a source of distraction for the student pilot and may have contributed to the loss of control.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The student pilot's failure to maintain adequate airspeed after takeoff, which resulted in the airplane exceeding its critical angle-of-attack and experiencing an aerodynamic stall.

Findings

Personnel issues	Aircraft control - Student/instructed pilot
Aircraft	Angle of attack - Capability exceeded
Aircraft	Fuel control/carburetor - Related operating info

Factual Information

History of Flight

Initial climb	Aerodynamic stall/spin (Defining event)
Initial climb	Loss of control in flight
Uncontrolled descent	Collision with terr/obj (non-CFIT)

On March 29, 2015, about 0940 eastern daylight time, a Piper PA-28-140, N32396, impacted terrain during takeoff from Orange County Airport (OMH), Orange, Virginia. The airplane was substantially damaged, and the student pilot was fatally injured. Visual meteorological conditions prevailed and no flight plan was filed for the flight, which was operated by Skyline Aviation Services. The solo instructional flight was destined for Farmville Regional Airport (FVX), Farmville, Virginia, and was conducted under the provisions of Title 14 Code of Federal Regulations Part 91.

The owner of the flight school was also a flight instructor (CFI) who had flown with the student on several occasions. She stated that the student was departing on his first solo cross-country flight when the accident occurred. The morning of the accident, she reviewed his preflight planning, endorsed his logbook for the flight, and assisted him in a preflight inspection of the airplane and engine run-up check. She stated that she observed no anomalies with the airplane. The pilot then taxied the airplane to the other side of the airport to obtain fuel, then performed a second engine run-up and departed from runway 08. She stated that the takeoff appeared normal, but the pilot initiated a left turn to the crosswind leg of the traffic pattern earlier than was customary. As the airplane turned left, its nose pitched up abruptly, and it rolled sharply left and descended to ground contact. The CFI immediately called 911 and responded to the accident site to render assistance.

Two pilot-rated witnesses located on the north side of the airport observed the airplane during the takeoff and provided written statements to local law enforcement. They remarked to each other that the airplane appeared "abnormally slow" and stated that it did not seem to be gaining altitude. Both individuals also reported viewing a thin trail of "smoke" or "brown exhaust" from the airplane's engine. The witnesses observed the airplane make a sharp left turn from an altitude about 150 feet above ground level, and descend steeply to ground contact. One of the witnesses reported that the wind at the time of the accident was light and variable from the north and east. In subsequent, separate telephone interviews, both witnesses stated that they did not observe any birds in the vicinity of the airport at the time of the accident. Additionally, neither of the witnesses perceived any changes or abnormalities in the airplane's engine noise during the takeoff, though one of the witnesses reported that the engine sounded "quieter than it should be."

Another witness reported that he was driving parallel to the runway at OMH. He reported seeing the accident airplane accelerate down the runway, and stated that it "looked like it was having trouble" shortly after it became airborne. He observed the airplane's nose pitch up twice, and also observed a trail of black smoke that extended the length of the airplane. He stated that the airplane appeared to "level out," then made a "hard" left turn as the nose dropped. The airplane then disappeared from his view behind trees and terrain.

Pilot Information

Certificate:	Student	**Age:**	16,Male
Airplane Rating(s):	None	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	3-point
Instrument Rating(s):	None	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	Class 3 Without waivers/limitations	**Last FAA Medical Exam:**	January 20, 2015
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	
Flight Time:	30.6 hours (Total, all aircraft), 18 hours (Total, this make and model), 2.7 hours (Pilot In Command, all aircraft), 8.5 hours (Last 90 days, all aircraft), 6.6 hours (Last 30 days, all aircraft), 0 hours (Last 24 hours, all aircraft)		

The pilot held a student pilot certificate and Federal Aviation Administration (FAA) third-class medical certificate, which was issued on January 20, 2015. Review of the pilot's logbook revealed that he had accumulated 30.6 total hours of flight experience, of which about 18 hours were in the accident airplane, and 2.7 hours were solo.

Aircraft and Owner/Operator Information

Aircraft Make:	Piper	**Registration:**	N32396
Model/Series:	PA-28-140	**Aircraft Category:**	Airplane
Year of Manufacture:	1974	**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	28-7525060
Landing Gear Type:	Tricycle	**Seats:**	4
Date/Type of Last Inspection:	February 20, 2015 100 hour	**Certified Max Gross Wt.:**	2150 lbs
Time Since Last Inspection:	31 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	5156.39 Hrs as of last inspection	**Engine Manufacturer:**	LYCOMING
ELT:	C91A installed, activated, did not aid in locating accident	**Engine Model/Series:**	O-320 SERIES
Registered Owner:	Grace Flight LLC	**Rated Power:**	160 Horsepower
Operator:	Skyline Aviation Services	**Operating Certificate(s) Held:**	None

The airplane was manufactured in 1974, and was originally equipped with a Lycoming O-320 series, 150 hp reciprocating engine. In 2002, the engine was overhauled and equipped with a Penn Yan Aero RAM160 supplemental type certificate, which resulted in an increase to 160 hp. Review of maintenance

logs indicated that the airplane's most recent 100-hour inspection was completed on February 20, 2015, at a total airframe time of 5,156 hours. At the time of the accident, the airplane had accrued 5,187.6 hours in operation.

According to the owner of the flight school, the school had operated the accident airplane under a lease agreement for about 18 months prior to the accident, and had purchased the airplane about 3 weeks prior to the accident.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	KOMH,469 ft msl	**Distance from Accident Site:**	0 Nautical Miles
Observation Time:	09:35 Local	**Direction from Accident Site:**	238°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	3 knots / None	**Turbulence Type Forecast/Actual:**	/ None
Wind Direction:	40°	**Turbulence Severity Forecast/Actual:**	/ N/A
Altimeter Setting:	30.4 inches Hg	**Temperature/Dew Point:**	0°C / -12°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Orange, VA (OMH)	**Type of Flight Plan Filed:**	None
Destination:	Farmville, VA (FVX)	**Type of Clearance:**	None
Departure Time:	09:40 Local	**Type of Airspace:**	Class E

The 0935 weather observation at OMH included wind from 040 degrees at 3 knots, 10 miles visibility, clear skies, temperature 0 degrees C, dew point -12 degrees C, and an altimeter setting of 30.41 inches of mercury.

Airport Information

Airport:	Orange County Airport OMH	**Runway Surface Type:**	Asphalt
Airport Elevation:	464 ft msl	**Runway Surface Condition:**	Dry
Runway Used:	08	**IFR Approach:**	None
Runway Length/Width:	3200 ft / 75 ft	**VFR Approach/Landing:**	None

Wreckage and Impact Information

Crew Injuries:	1 Fatal	**Aircraft Damage:**	Substantial
Passenger Injuries:		**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	1 Fatal	**Latitude, Longitude:**	38.251388,-78.037223

The airplane came to rest upright in a field located about 1,330 feet northeast of the departure end of runway 08, with the wreckage oriented on a heading of about 170 degrees magnetic. The initial impact point was identified by a ground scar about 30 feet south of the main wreckage that contained pieces of the left wing navigation light. Areas of disturbed soil extended north from the initial impact point about 15 feet toward a large impact crater about 6 feet in length and 3 feet in width, which contained pieces of the propeller spinner and ground scars consistent with propeller contact.

The propeller remained attached to the crankshaft flange and one blade exhibited slight forward bending. Both blades displayed chordwise scratching and leading edge gouging. The engine remained attached to the fuselage by its bottom mounts. The fuselage displayed significant aft crushing from the engine firewall to the rear cabin seats, and was displaced to the left just aft of the baggage area.

Both left and right wings displayed significant aft crushing of their leading edges. The left wing was separated from the fuselage at its root and the fuel tank was breached. Residual fuel was found inside, and the fuel tank cap was in place and secure. The left aileron remained attached at its hinge points. Control continuity was established from the aileron to the cockpit area through cable breaks at the wing root that displayed signatures consistent with overstress failure.

The right wing remained attached to the fuselage at its root. The outboard approximate 4 feet was bent upward about 45 degrees. The right fuel tank was breached and leaking fuel; the right fuel tank cap was in place and secure. The right aileron remained attached at its hinge points and control continuity was established from the aileron to the cockpit area. The wing flaps were fully retracted.

The empennage was intact and displayed minor impact damage. The rudder remained attached to the vertical stabilizer at its hinge points, and the stabilator remained attached at its mounting blocks. Rudder and stabilator control continuity was established to the cockpit area. The stabilator trim screw indicated a trim position between neutral and full nose-up trim. The windscreen and left cabin window were destroyed upon impact, and pieces of each were distributed along the wreckage path and around the main wreckage. Examination of the wings, empennage, and windscreen pieces did not reveal any evidence of a bird strike.

The carburetor heat control was in the "off" position, and the engine primer was in and locked. The fuel selector was in the right tank position, and could not be manipulated due to impact damage.

The engine crankshaft was rotated by hand at the propeller hub and continuity of the valve and powertrains was confirmed. The spark plugs were removed and displayed black carbon fouling. The #1 and #3 cylinder bottom plugs were oil-covered; consistent with the engine's postimpact orientation.

Thumb compression was obtained on all cylinders, and borescope examination of the cylinders revealed no anomalies. The carburetor inlet screen was absent of debris. The carburetor was removed and the bowl was opened. The floats were intact, and the bowl contained fuel consistent with the color and odor of 100 low lead aviation fuel and was absent of contamination. The magnetos remained secured to their mounts, and were removed and actuated by hand. Each magneto produced spark at all of its terminal leads.

The airplane was examined at a secure storage facility on April 29, 2015. The pilot's seat was secure on the track, and the seat position adjustment lever functioned properly when manipulated. Neither the seat track nor the locking pins displayed any abnormal or excessive wear. The spark plugs were tested for operation. Three of the eight plugs produced weak and intermittent spark. One plug produced no spark; however, this plug was likely damaged during postaccident removal from the engine.

The stall warning switch was removed for testing and electrical continuity was confirmed when the switch was manipulated.

Medical and Pathological Information

An autopsy was performed by the Office of the Chief Medical Examiner Northern Virginia District, Manassas, Virginia. The cause of death was identified as blunt trauma. Toxicological testing was performed by the FAA Bioaeronautical Sciences Research Laboratory in Oklahoma City, Oklahoma. Testing was negative for carbon monoxide, ethanol, and all tested-for drugs and their metabolites.

Additional Information

Carburetor Testing

The carburetor was examined and tested at the manufacturer's facility on May 26, 2015, with an FAA inspector present. Initial flow testing revealed that the main gasket and float were misaligned; likely due to the disassembly and reassembly performed on-scene. The floats appeared to be in good condition and the arms were not damaged. The floats were aligned properly, and the carburetor was flow tested a second time at four different power settings. Throughout all power settings, the carburetor produced a fuel flow that was between 9.3% and 12.1% richer than the master unit, and between 2.5% and 7.5% richer than the maximum acceptable limits prescribed by the manufacturer.

Further review of the airplane's maintenance logs revealed that the airplane did not undergo any

inspections or maintenance between December 2010, at a total airframe time of 4,876.7 hours, and an annual inspection in May 2013, at a total time of 4,887.4 hours. Review of work orders indicated that in February 2013, all four engine cylinders were disassembled, cleaned, inspected, and returned to service limits. In April 2013, the carburetor was "repaired as necessary;" the work order also indicated compliance with a manufacturer service bulletin that called for the replacement of hollow floats with solid, epoxy floats.

Stall and Spin Awareness

FAA Advisory Circular 61-67C, "Stall and Spin Awareness Training," stated, "Stalls resulting from improper airspeed management are most likely to occur when the pilot is distracted by one or more tasks, such as locating a checklist or attempting a restart after an engine failure; flying a traffic pattern on a windy day; reading a chart or making fuel and/or distance calculations; or attempting to retrieve items from the floor, backseat, or glove compartment. Pilots at all skill levels should be aware of the increased risk of entering into an inadvertent stall or spin while performing tasks that are secondary to controlling the aircraft."

Preventing Similar Accidents

Prevent Aerodynamic Stalls at Low Altitude (SA-019)

The Problem

While maneuvering an airplane at low altitude in visual meteorological conditions, many pilots fail to avoid conditions that lead to an aerodynamic stall, recognize the warning signs of a stall onset, and apply appropriate recovery techniques. Many stall accidents result when a pilot is momentarily distracted from the primary task of flying, such as while maneuvering in the airport traffic pattern, during an emergency, or when fixating on ground objects.

What can you do?

- Be honest with yourself about your knowledge of stalls and your preparedness to recognize and handle a stall situation in your airplane. Seek training to ensure that you fully understand the stall phenomenon, including angle-of attack (AOA) concepts and how elements such as weight, center of gravity, turbulence, maneuvering loads, and other factors affect an airplane’s stall characteristics.
- Remember that an aerodynamic stall can occur at any airspeed, at any attitude, and with any engine power setting.

- Remember that the stall airspeeds marked on the airspeed indicator (for example, the bottom of the green arc and the bottom of the white arc) typically represent steady flight speeds at 1G at the airplane's maximum gross weight in the specified configuration. Maneuvering loads and other factors can increase the airspeed at which the airplane will stall. For example, increasing bank angle can increase stall speed exponentially. Check your airplane's handbook for information.
- Reducing AOA by lowering the airplane's nose at the first indication of a stall is the most important immediate response for stall avoidance and stall recovery.
- Manage distractions when maneuvering at low altitude so that they do not interfere with the primary task of flying.
- Resist the temptation to perform maneuvers in an effort to impress people, including passengers, other pilots, persons on the ground, or others via an onboard camera. "Showing off" can be a deadly distraction because it diverts your attention away from the primary task of safe flying.
- Understand that the stall characteristics of an unfamiliar airplane may differ substantially from those of airplanes with which you have more flight experience.

See https://www.ntsb.gov/Advocacy/safety-alerts/Documents/SA-019.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):	Diaz, Allison
Additional Participating Persons:	Jay Venable; FAA/FSDO; Richmond, VA Judson Rupert; Lycoming Engines; Williamsport, PA Robert Martellotti; Piper Aircraft Company; Vero Beach, FL
Original Publish Date:	June 27, 2016
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=90944