Aviation Investigation Final Report

Location:	Springfield, Tennessee	**Accident Number:**	ERA21LA173
Date & Time:	April 5, 2021, 09:50 Local	**Registration:**	N5018Y
Aircraft:	Piper PA-23-250	**Aircraft Damage:**	Substantial
Defining Event:	Fuel related	**Injuries:**	2 Serious
Flight Conducted Under:	Part 91: General aviation - Instructional		

Analysis

The instructor and pilot receiving instruction were conducting multiengine flight training. During takeoff following a simulated engine failure on the runway, the left engine lost power, and the instructor stated that the left propeller would not feather. The airplane descended into terrain past the end of the runway.

Witnesses stated that their attention was drawn to the airplane due to its “unusual” sound that was inconsistent with takeoff power. One witness said he could not discern if one engine or both engines were making “continuous sputtering/backfiring” sounds. The airplane climbed to about 100 ft above ground level and the landing gear remained extended until the departure end of the runway. Shortly thereafter, the airplane entered a shallow turn to the left until it disappeared behind a tree line.

Automatic dependent surveillance-broadcast (ADS-B) data revealed that the airplane achieved a groundspeed of 86 knots about midfield and slowed once off the ground. About 200 ft agl, the track depicted a descending, decelerating turn to the left. The radius of the turn tightened until the last target was recorded in the vicinity of the accident site, about ground level, at 59 knots groundspeed.

Based on the estimated point at which the takeoff started, the airplane was over 1,400 ft into the takeoff roll when it became airborne. Performance information in the Owner’s Handbook for the airplane indicated a 750-ft takeoff distance. Although ample runway remained on which to safely reject the takeoff, the instructor allowed the pilot to continue the takeoff despite the excessive distance required to become airborne and the loss of left engine power.

Pilots who had flown the accident airplane during the week before the accident described the left engine either stopping or running roughly with the fuel selector in the left inboard tank position. When the fuel selector was moved to the left outboard tank position, the engine could be restarted, or smooth, continuous operation would be restored. Each said that these power-

loss events were reported to maintenance for correction. Three days before the accident, a flight instructor could not start or sustain power on the left engine with the inboard tank selected but started and ran the engine continuously on the outboard tank. He then demonstrated the discrepancy to company maintenance personnel before he rejected the airplane for his scheduled flight.

Examination of the wreckage revealed a 12-inch length of duct tape, employed as a “gasket” to seal the loosely fitted left inboard fuel cap, unsecured inside the fuel tank, where it likely blocked the fuel supply port on the accident flight, as it had intermittently during the days before the accident.

Examination and testing of the airframe, engines, and components revealed no evidence of any other preimpact anomaly that would have prevented continuous engine power; however, these examinations and a records review revealed numerous examples of maintenance work that was incomplete, inadequate (including the use of duct tape on the left inboard fuel cap), or not performed; the recommended engine and propeller overhauls were more than a decade overdue.

Probable Cause and Findings

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

The flight instructor’s failure to abort the takeoff following a loss of left engine power due to fuel starvation. Also causal was the inadequate maintenance of the left fuel cap by unknown maintenance personnel, which resulted in a blockage of the fuel supply from the left-wing tank. Contributing to the accident was the instructor’s failure to maintain airspeed above the one-engine-inoperative minimum controllable airspeed after deciding to continue the takeoff.

Findings

Aircraft	Fuel filter-strainer - Damaged/degraded
Personnel issues	Incorrect action selection - Maintenance personnel
Personnel issues	Performance calculations - Instructor/check pilot
Personnel issues	Aircraft control - Instructor/check pilot

Factual Information

History of Flight

Takeoff	Fuel related (Defining event)
Takeoff	Loss of engine power (partial)
Takeoff	Loss of control in flight

HISTORY OF FLIGHT

On April 5, 2021, about 0950 central daylight time, a Piper PA-23-250, N5018Y, was destroyed when it was involved in an accident near Springfield, Tennessee. The flight instructor and the commercial-rated pilot receiving instruction were seriously injured. The airplane was operated as a Title 14 *Code of Federal Regulations* Part 91 instructional flight.

The purpose of the flight was to conduct multi-engine training in the twin-engine airplane.

The instructor provided both a telephone interview and a written statement. He stated that during taxi, he briefed the student that he would initiate a simulated engine failure during the takeoff roll and the actions the student was to perform. The pilot acknowledged, responded to the simulated engine failure as instructed, then initiated a takeoff with “4,400 ft of runway remaining.”

The instructor stated that, shortly after becoming airborne, the left engine started losing power and the airplane started yawing.” The instructor stated that he attempted to feather the left engine propeller, but it would not feather. He went on to describe a descent he could not arrest and his attempts to maintain aircraft control during the forced landing.

According to witnesses, their attention was drawn to the airplane during its takeoff roll from runway 22 due to its “unusual” sound that was inconsistent with takeoff power. One witness said that he could not discern if one engine or both engines were making “continuous sputtering/backfiring” sounds. He said the “obviously abnormal sound drew the attention of many of us out to observe the airplane struggle into the air.” The witness, an airline transport pilot and airframe and powerplant mechanic, stated that the airplane climbed to about 100 ft above ground level while on runway heading and that the landing gear remained extended until the departure end of the runway. Shortly thereafter, the airplane entered a shallow left turn and disappeared behind a tree line.

Another witness described “popping, sputtering, and crackling noises” and said that the airplane was “clearly struggling to climb” when it disappeared from her view.

The company mechanic who performed the annual inspection on the accident airplane stated that his “maintenance team” stopped work to witness the takeoff. He said they often stopped to

watch the airplane's "impressive takeoff abilities" and that they "loved the sound that her engines made."

According to the mechanic, the airplane was normally airborne by the time it was abeam the company hangar on the takeoff roll, but during the accident takeoff, the airplane did not lift off the runway until it was "past the windsock on runway 22." Based on the pilot's estimated starting point, the airplane was over 1,400 ft into the takeoff roll when the airplane lifted from the runway. At that point, about 3,000 ft of runway and 2,000 ft of grass overrun remained between the airplane and the airport boundary.

Automatic dependent surveillance-broadcast (ADS-B) and radar data provided by the Federal Aviation Administration (FAA) revealed that the airplane departed from runway 22. The airplane achieved a groundspeed of 86 knots about midfield, and once off the ground, slowed, and did not accelerate above 80 knots. The track depicted a shallow climb for about 1 mile, where about 200ft agl, the track depicted a descending, decelerating turn to the left. The radius of the turn tightened until the last target was recorded in the vicinity of the accident site, about ground level, at 59 knots groundspeed.

PERSONNEL INFORMATION

The instructor held a commercial pilot certificate with ratings for airplane single-engine land, multiengine land, and instrument airplane. He held a flight instructor certificate with ratings for airplane single and multiengine. The pilot's multiengine rating was added September 20, 2020. The pilot's most recent FAA first class medical certificate was issued March 2, 2021. He reported 1,618 total hours of flight experience, of which 13 hours was in the accident airplane make and model.

The pilot receiving instruction held a commercial pilot certificate with ratings for rotorcraft-helicopter and instrument helicopter, and private privileges for airplane single-engine land. According to an FAA aviation safety inspector, the pilot had accrued 1,200 total hours of flight experience. His multiengine training had begun 3 days before the accident, and he had accrued 1.5 hours of multiengine experience, all of which was in the accident airplane.

AIRCRAFT INFORMATION

According to FAA airworthiness records, the airplane was manufactured in 1963 and was powered by Lycoming O-540-A1D5, 250-horsepower engines. Its most recent annual inspection was completed March 5, 2021, at 6,866.16 total aircraft hours.

After the accident, statements were provided by pilots who had flown, or attempted to fly, the accident airplane during the week before the accident. They each described the left engine either stopping or running roughly both on the ground and in the air with the fuel selector in the left inboard tank position. When the fuel selector was moved to the left outboard tank position, the engine could be restarted, or smooth, continuous operation would be restored. Each said that these power-loss events were reported to maintenance for correction. On April 2, 2021, a flight instructor could not start or sustain power on the left engine with the inboard tank selected but started and ran the engine continuously on the outboard tank. He then

demonstrated the discrepancy to company maintenance personnel before he rejected the airplane for his scheduled flight.

According to the Owner's Handbook, the airplane's take off run was 750 ft and 1,100 ft over a 50-ft barrier. There was no accelerate/stop distance published, but the published landing roll was 900 ft.

WRECKAGE AND IMPACT INFORMATION

The airplane was examined and photographed by two FAA aviation safety inspectors. Examination of the photographs revealed that the cockpit and cabin areas were destroyed by impact and came to rest inverted. The wings were mostly separated, but remained attached by cabling and sheet metal. The engines were in their nacelles, and the propeller blades of the left engine appeared undamaged and in what approximated a feathered position. The propeller blades of the right engine displayed similar twisting, bending, leading edge gouging, chordwise scratching, and tip curling.

The wreckage was recovered from the accident site for further examination. Control continuity was confirmed from the flight controls, through several breaks, to the flight control surfaces. All breaks and fractures displayed features consistent with overstress.

The right wing fuel tank appeared intact, the thermos-style fuel cap was secure in its receptacle, and the tank contained about 15 to 20 gallons of fuel. The fuel pick-up was clear of obstruction and its filter screen was intact.

The right side gascolator contained debris, and the filter screen was obstructed with rust and other materials. No fuel was noted in the left gascolator, its filter screen was not installed; and the gascolator securement was not safety wired. Examination of the aluminum gascolator bowl revealed deep, corrosive pitting. The pitted areas displayed fresh scribe marks consistent with recent cleaning of oxidized material from the pitted areas.

The left wing inboard fuel tank was breached, contained trace amounts of fuel, and the thermos-style fuel cap fit loosely in its fuel port. Once removed, the ribbed, expandable rubber gasket of the cap was uniformly coated with a white, adhesive residue. A 12-inch length of white adhesive duct tape was observed loose inside the tank. Once removed, the adhesive side of the tape revealed a rubbery residue consistent with that of the fuel cap gasket. The adhesive-coated area of the rubber gasket matched the dimension of the tape strip. The fuel pickup was clear of obstruction, but its filter screen was not installed.

Fuel system continuity was confirmed visually and with low-pressure compressed air.

The right engine propeller remained attached to the crankshaft flange. The spark plugs and valve rocker covers were removed, and the engine crankshaft was rotated by turning the propeller. Continuity of the crankshaft to the rear gears and to the valve train was observed. Compression and suction were observed from all six cylinders. The interiors of the cylinders were observed using a lighted borescope and no anomalies observed.

Both magnetos remained attached to the engine. No damage was noted and both produced spark from all ignition towers when rotated by hand.

The carburetor displayed impact damage to control arms and cabling, and disassembly revealed trace amounts of fuel and no damage to brass floats or other internal components. The fuel pump operated when actuated by hand.

A cursory examination of the left engine was performed prior to shipment for a test run at the manufacturer's facility. The spark plugs and valve rocker covers were removed, and the engine crankshaft was rotated. Continuity of the crankshaft to the rear gears and to the valve train was observed. Compression and suction were observed from all six cylinders. The interiors of the cylinders were observed using a lighted borescope and no anomalies observed.

The oil suction screen was removed, and no debris observed. The oil pressure screen was removed and about ¼ teaspoon of particulate matter observed in the screen. Some of the matter could be attracted to a magnet. The particulate matter was bagged and left to be shipped to the manufacturer along with the engine. The propeller was removed. The oil suction screen, oil pressure screen, rocker covers, and spark plugs were reinstalled, and the engine set aside for shipment.

Due to the metal contamination, disassembly was performed instead of the engine test run. Removal of the Nos. 2, 4, and 6 cylinders revealed the Nos. 1 and 2 intake tappets and the No. 3 exhaust tappet were spalled. The Nos. 1 and 2 intake lobes and the No. 3 exhaust lobe of the camshaft were severely spalled.

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ADDITIONAL INFORMATION

The most recent engine field overhauls were completed on 12/09/1997, more than 23 years before the date of the accident. Lycoming Service Instruction No. 1009BE stated:

All engine models are to be overhauled within twelve (12) calendar years of the date they first entered service or of last overhaul. This calendar year time period TBO is to mitigate engine deterioration that occurs with age, including corrosion of metallic components and degradation of non-metallic components such as gaskets, seals, flexible hoses and fuel pump diaphragms.

CAUTION *CALENDAR YEAR TBO IS BASED ON ACCELERATED TESTING AND OVERALL FLEET SERVICE DATA. LOCAL CLIMATE CONDITIONS, STORAGE CONDITIONS, FREQUENT EXTENDED PERIODS OF INACTIVITY, PRESERVATION TECHNIQUES USED DURING INACTIVE PERIODS, AND FREQUENCY OF OIL CHANGES CAN AFFECT*

CORROSION OF METALS AND DEGRADATION OF NON-METALS. For FAA Part 91 or EASA Part NCO (non-commercial) or equivalent operations, only an appropriately rated and qualified maintenance person (or international equivalent) can allow the twelve (12) calendar year TBO to be exceeded with concurrence from the controlling civil aviation authority to verify agreement with this provision and after thoroughly examining the engine for corrosion and degradation in accordance with 14 CFR 43 Appendix D (or international equivalent) and determining that the engine remains in an airworthy condition. This inspection is to be repeated annually or as necessary to ensure continued airworthiness. The twelve (12) calendar year TBO must not be exceeded if the engine is affected by AD 2012-19-01 and not in compliance with AD 2012-19-01.

Damage and impact signatures to the left propeller were consistent with the left propeller at or near the feathered position, with no power and little or no rotation at impact. The left propeller governor appeared intact and undamaged. It was bench tested and met all factory specifications except for the low rpm setting, which did not prevent normal operation.

There were no discrepancies noted on the propeller components examined that would have prevented normal operation.

The most recent propeller overhauls were performed December 13, 1999.

According to Hartzell Propeller, Inc. Service Letter HC-SL-61-61Y, the overhaul periods and service life limits for this propeller installation was 2000 flight hours or 60 calendar months.

Airframe examination revealed that the position of the main and nose landing gear, and their respective actuators were consistent with the gear in the "down" position. The landing gear handle was in the "down" position.

The Airplane Flying Handbook (FAA-H-8083-3C), Chapter 6: Takeoffs and Departure Climbs, Rejected Takeoff/Engine Failure:

Prior to takeoff, the pilot should identify a point along the runway at which the airplane should be airborne. If that point is reached and the airplane is not airborne, immediate action should be taken to discontinue the takeoff. When properly planned and executed, the airplane can be stopped on the remaining runway without using extraordinary measures, such as excessive braking that may result in loss of directional control, airplane damage, and/or personal injury. The POH/AFM ground roll distances for take-off and landing added together provide a good estimate of the total runway needed to accelerate and then stop.

Vmc (velocity – minimum controllable) was previously defined in 14 CFR part 23, section 23.149 as the calibrated airspeed at which, when the critical engine is suddenly made inoperative, it is possible to maintain control of the airplane with that engine still inoperative, and thereafter maintain straight flight at the same speed with an angle of bank of not more than 5 degrees. This definition still applies to airplanes certified under that regulation. There is no requirement under either determination that the airplane be capable of climbing at this airspeed. VMC only addresses directional control.

Flying Light Twins Safely (FAA-P-8740-66), Minimum Control Speed:

Loss of directional control may be experienced at speeds almost 20 knots above published Vmc when the wings are held level. Flight test pilots' determination of Vmc in airplane certification is solely concerned with the minimum speed for directional control under one very specific set of circumstances. Vmc has nothing to do with climb performance, nor is it the optimum airplane attitude, bank angle, ball position, or configuration for best climb performance. Many light twins will not maintain level flight near Vmc with OEI (one engine inoperative).

Flight instructor Information

Certificate:	Commercial; Flight instructor	**Age:**	31,Male
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Right
Other Aircraft Rating(s):	None	**Restraint Used:**	Lap only
Instrument Rating(s):	Airplane	**Second Pilot Present:**	Yes
Instructor Rating(s):	Airplane multi-engine; Airplane single-engine	**Toxicology Performed:**	
Medical Certification:	Class 1 Without waivers/limitations	**Last FAA Medical Exam:**	March 2, 2021
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	
Flight Time:	(Estimated) 1618 hours (Total, all aircraft), 13 hours (Total, this make and model), 72 hours (Last 90 days, all aircraft)		

Student pilot Information

Certificate:	Commercial	**Age:**	34,Male
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	Helicopter	**Restraint Used:**	Lap only
Instrument Rating(s):	Airplane; Helicopter	**Second Pilot Present:**	Yes
Instructor Rating(s):		**Toxicology Performed:**	
Medical Certification:	With waivers/limitations	**Last FAA Medical Exam:**	
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	
Flight Time:	(Estimated) 1200 hours (Total, all aircraft), 1.5 hours (Total, this make and model)		

Aircraft and Owner/Operator Information

Aircraft Make:	Piper	**Registration:**	N5018Y
Model/Series:	PA-23-250	**Aircraft Category:**	Airplane
Year of Manufacture:	1963	**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	27-2020
Landing Gear Type:	Retractable - Tricycle	**Seats:**	6
Date/Type of Last Inspection:	March 5, 2021 Annual	**Certified Max Gross Wt.:**	
Time Since Last Inspection:		**Engines:**	2 Reciprocating
Airframe Total Time:	6866 Hrs as of last inspection	**Engine Manufacturer:**	Lycoming
ELT:		**Engine Model/Series:**	O-540-A1D5
Registered Owner:	HIGHLAND RIM AVIATION LLC	**Rated Power:**	
Operator:	HIGHLAND RIM AVIATION LLC	**Operating Certificate(s) Held:**	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	M91,706 ft msl	**Distance from Accident Site:**	1 Nautical Miles
Observation Time:	09:50 Local	**Direction from Accident Site:**	220°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	5 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	230°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30.16 inches Hg	**Temperature/Dew Point:**	19°C / 8°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Springfield, TN	**Type of Flight Plan Filed:**	None
Destination:	Springfield, TN	**Type of Clearance:**	None
Departure Time:		**Type of Airspace:**	Class G

Airport Information

Airport:	SPRINGFIELD ROBERTSON COUNTY M91	**Runway Surface Type:**	Asphalt
Airport Elevation:	706 ft msl	**Runway Surface Condition:**	Dry
Runway Used:	04/22	**IFR Approach:**	None
Runway Length/Width:	5505 ft / 100 ft	**VFR Approach/Landing:**	Forced landing

Wreckage and Impact Information

Crew Injuries:	2 Serious	**Aircraft Damage:**	Substantial
Passenger Injuries:	N/A	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	2 Serious	**Latitude, Longitude:**	36.536694,-86.921167(est)

Administrative Information

Investigator In Charge (IIC):	Rayner, Brian
Additional Participating Persons:	Dave Lewis; FAA; Nashville, TN Damian Galbraith; Piper; Vero Beach, FL Mike Childers; Lycoming; Williamsport, PA Les Doud; Hartzell Propeller; Piqua, OH
Original Publish Date:	July 20, 2022
Last Revision Date:	
Investigation Class:	Class 3
Note:	The NTSB did not travel to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=102871