Aviation Investigation Final Report

Location:	Pottstown, Pennsylvania	**Accident Number:**	ERA20LA258
Date & Time:	July 20, 2020, 21:27 Local	**Registration:**	N4092D
Aircraft:	Cessna 182	**Aircraft Damage:**	Substantial
Defining Event:	Fuel starvation	**Injuries:**	3 None
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

During cruise flight, the airplane's engine lost total power, which resulted in the pilot making an off-field emergency landing on a highway. During the landing, the airplane struck two automobiles and was substantially damaged.

After the accident, when the wings were removed for transport, 4 to 6 gallons of fuel were drained from the left-wing tank, and the right-wing tank was empty. Except for some fuel damping on the left-wing fuel tank feed hose and fuel staining, both of which were consistent with removal of the wing, no anomalies were noted during the examination of the fuel system. A test run of the engine was accomplished with no anomalies noted. Examination of the engine and data from the installed engine data monitor did not reveal evidence of any preimpact failures or malfunctions of the engine that would have precluded normal operation.

Review of the airplane owner's manual indicated that fuel was supplied to the engine from two rubberized bladder type fuel cells (fuel tanks). Each fuel cell had a single fuel line located in the aft inboard section of the fuel cell. Fuel flowed via gravity from each of these fuel lines through the fuel selector valve and fuel strainer to the carburetor. The manual stated that 1.5 gallons of fuel per fuel tank were unusable and that, when not in level flight, an additional 3.5 gallons of fuel per fuel tank were unusable. This information (the location of the fuel lines in the aft inboard sections of the fuel tanks and the additional unusable fuel when not in level flight) indicated that the engine was susceptible to fuel starvation if the airplane was in a nose-low attitude with insufficient fuel in the fuel tanks.

According to the chief pilot of the skydiving company that used the airplane for its skydiving operations, the pilot told him that when the engine lost power, the airplane was in a nose low attitude and that the engine was "surging" (losing and regaining power). The chief pilot stated that "surging is a characteristic of fuel starvation as the fuel is being unported and then recovered as the fuel sloshes around in the tank." The chief pilot expressed the opinion that if

the pilot had “pitched the aircraft up to level flight the engine would have had enough fuel to [reach] the nearest airport about 7 miles away.”

Given that the amount of fuel recovered from the airplane (4 to 6 gallons) was less than the total unusable fuel when not in level flight (10 gallons) and that the engine operated with no discrepancies following the accident, it is likely that the loss of engine power occurred when the pilot flew the airplane in a nose low attitude with little fuel onboard, which resulted in fuel starvation.

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 that sufficient fuel was onboard for nonlevel flight, which resulted in a total loss of engine power due to fuel starvation.

Findings

Aircraft	Fuel - Fluid level
Personnel issues	Fuel planning - Pilot

Factual Information

History of Flight

Enroute	Fuel starvation (Defining event)
Landing	Off-field or emergency landing
Landing-landing roll	Collision with terr/obj (non-CFIT)

On July 20, 2020, about 2127eastern daylight time, a Cessna 182A, N4092D, was substantially damaged when it was involved in an accident near Pottstown, Pennsylvania. The pilot, pilot-rated passenger, and passenger were not injured. The airplane was operated as a Title 14 *Code of Federal Regulations* Part 91 personal flight.

Earlier on the day of the accident, the pilot and pilot-rated passenger had departed Smoketown Airport (N37), Smoketown, Pennsylvania and flown to Brandywine Regional Airport (OQN), West Chester, Pennsylvania to pick up a passenger. While at OQN, they purchased 7.8 gallons of 100 LL aviation gasoline. After adding the fuel to the airplane, they boarded the passenger and departed for Portsmouth International Airport at Pease (PSM), Portsmouth, New Hampshire. After arriving at PSM, they purchased another 20 gallons of fuel. While en route, around 2120, the engine lost power. The pilot-rated passenger, who was being "checked out" during the flight, transferred control of the airplane to the pilot, declared an emergency with Harrisburg approach, and implemented an emergency checklist to troubleshoot the loss of power. With no power, the pilot made an emergency landing on Route 422 due to it being the best illuminated landing site.

According to local law enforcement personnel, the airplane touched down traveling westbound on US Route 422. During the landing rollout, it struck the right rear side of one automobile and the left rear fender of another automobile. Neither driver was injured. The airplane came to rest in the left lane just before the intersection of Daniel Boone Road. No fuel from the airplane was observed on the roadway, and the airplane displayed damage on its left side.

On July 21, 2020, during an interview with Federal Aviation Administration (FAA) inspectors, the pilot advised that they had departed PSM with 55 gallons of fuel. While flying direct to N37, they began to experience a gradual, continuous loss of engine power, accompanied by a drop in manifold pressure and engine rpm. When they were 22.1 miles from N37, the pilot richened the mixture and applied carburetor heat to ensure there was no accumulation of carburetor ice; however, the power loss continued. He stated the engine would only achieve 1,200 rpm at touchdown. When asked how long the "gradual" power loss happened, he stated it began 5 to 10 minutes before touchdown. He indicated that there were no accompanying gauge anomalies and that fuel quantity indication was normal.

On July 24, 2020, during a telephone conversation with a National Transportation Safety Board (NTSB) investigator, the pilot advised that when they were at 4,500 ft and approaching the Harrisburg, Pennsylvania area, the engine began to "sputter." The power had been set at 22

inches of manifold pressure and 2,300 rpm, then it “spiked” to 2,600 rpm, and then dropped back down to 2,300 rpm. He tried to “troubleshoot” using the mixture control, but the rpm and manifold pressure continued dropping. Applying carburetor heat had no effect. When this occurred, the pilot-rated passenger declared an emergency with air traffic control.

The chief pilot of the skydiving company that used the airplane for its skydiving operations reported that, when the wings were removed during the wreckage retrieval, 5 to 6 total gallons of fuel were removed from the left-wing fuel tank, and the right-wing fuel tank was empty. The FAA inspector also received a statement from the mechanic who had removed the wings for transport that indicated an estimated 4 to 5 gallons were removed from the left wing and that the right tank was dry. A visual examination of both wings by an FAA inspector revealed visible dampness on the left-wing fuel tank feed hose, as well as visible staining (consistent with the blue dye used in 100LL aviation gasoline) around the area where the wing was separated for transport. The right-wing hose was dry, and no staining was present.

No primary flight controls appeared to be damaged. The fuselage structure sustained substantial damage around the left cabin door and main landing gear box area, with deformed skin from the left side of the wing carry-through around the bottom of the fuselage to the right main landing gear box area. During examination of the airplane after the wings were removed, the fuel selector was in the “BOTH OFF” position; the fuel selector position before wing removal was not documented. The fuel strainer was clean, full of fuel, and contained no water. The fuel was consistent with 100LL aviation gasoline. The oil filter was removed, cut open, and inspected for metallic particles with none noted. The oil level was at the correct level and no discrepancies were noted with the oil’s condition. The air filter was removed and found to be serviceable, and the carburetor throat was clear of obstructions.

The throttle, mixture, and carburetor heat controls were checked for continuity with no discrepancies noted. The spark plugs were removed, and both magnetos checked for operation with no discrepancies noted. A thumb compression check of all six cylinders was accomplished, and all cylinders appear to have good compression. A 1-quart can was obtained and attached to the right-wing fuel pick-up so the engine could be run. Two engine runs were then performed. During the second engine run, the rpm was increased to more than 2,400 rpm, and no anomalies were noted. All indications were found to be normal.

Examination of data recovered from the engine data monitor indicated that no engine anomalies were recorded, and cylinder head temperatures, exhaust gas temperatures, oil pressure, and oil temperature, were all within limits until the engine lost power.

A review of the airplane, engine, and propeller logbooks revealed no maintenance issues, and all inspections were up to date.

Review of the Cessna 182A Owner’s Manual indicated that fuel was supplied to the engine from two rubberized bladder type fuel cells (fuel tanks). Each fuel cell had a single fuel line located in the aft inboard section of the fuel cell. Fuel would flow via gravity from each of these fuel lines through the fuel selector valve and fuel strainer to the carburetor. The manual stated that 1.5 gallons of fuel per fuel tank were unusable and that, when not in level flight, an additional 3.5 gallons of fuel per fuel tank were unusable.

In an email dated July 23, 2020, the chief pilot stated that the pilot told him that "the engine was surging while in a nose low attitude, but was not developing enough power to make it to the nearest airport." In a written statement received by the NTSB on July 28, 2020, the chief pilot reported that when he talked with the pilot after the accident, the pilot informed him that they had requested 10 gallons of fuel per side in PSM. When the chief pilot asked him if they measured the fuel quantity in the tanks with a fuel quantity stick, the pilot told him that he did not remember. When the chief pilot asked him
how much fuel he had when he left PSM, he gave him estimates based on the fuel used on the installed engine data monitor. When the chief pilot asked him why he did
not top off the tanks he began to tell him
how expensive fuel was in PSM, but moments later told him he made the wrong decision and s hould have topped the tanks. The chief pilot said that the pilot told him the engine was surging, and the chief pilot stated that "surging is a characteristic of fuel starvation as the fuel is being unported and then recovered as the fuel sloshes around in the tank." The chief pilot expressed the opinion that if the pilot had "pitched the aircraft up to level flight the engine would have had enough fuel to [reach] the nearest airport about 7 miles away."

Pilot Information

Certificate:	Commercial	**Age:**	24,Male
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Right
Other Aircraft Rating(s):	Unmanned (sUAS)	**Restraint Used:**	Lap only
Instrument Rating(s):	Airplane	**Second Pilot Present:**	Yes
Instructor Rating(s):	None	**Toxicology Performed:**	No
Medical Certification:	Class 1 With waivers/limitations	**Last FAA Medical Exam:**	February 28, 2020
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	June 21, 2020
Flight Time:	520 hours (Total, all aircraft), 37 hours (Total, this make and model)		

Pilot-rated passenger Information

Certificate:	Commercial; Flight instructor	**Age:**	22,Male
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	Lap only
Instrument Rating(s):	Airplane	**Second Pilot Present:**	Yes
Instructor Rating(s):	Airplane single-engine; Instrument airplane	**Toxicology Performed:**	No
Medical Certification:	Class 1 With waivers/limitations	**Last FAA Medical Exam:**	October 27, 2018
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	July 16, 2019
Flight Time:	(Estimated) 120 hours (Total, all aircraft)		

Passenger Information

Certificate:		**Age:**	Female
Airplane Rating(s):		**Seat Occupied:**	Rear
Other Aircraft Rating(s):		**Restraint Used:**	Lap only
Instrument Rating(s):		**Second Pilot Present:**	Yes
Instructor Rating(s):		**Toxicology Performed:**	No
Medical Certification:		**Last FAA Medical Exam:**	
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	
Flight Time:			

Aircraft and Owner/Operator Information

Aircraft Make:	Cessna	**Registration:**	N4092D
Model/Series:	182 A	**Aircraft Category:**	Airplane
Year of Manufacture:	1957	**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	34792
Landing Gear Type:	Tricycle	**Seats:**	4
Date/Type of Last Inspection:	July 16, 2020 Annual	**Certified Max Gross Wt.:**	2650 lbs
Time Since Last Inspection:		**Engines:**	1 Reciprocating
Airframe Total Time:	3887.63 Hrs as of last inspection	**Engine Manufacturer:**	Continental
ELT:	Not installed	**Engine Model/Series:**	O-470-50
Registered Owner:	On file	**Rated Power:**	275 Horsepower
Operator:	On file	**Operating Certificate(s) Held:**	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Night
Observation Facility, Elevation:	PTW,308 ft msl	**Distance from Accident Site:**	3 Nautical Miles
Observation Time:	21:54 Local	**Direction from Accident Site:**	90°
Lowest Cloud Condition:	Clear	**Visibility**	9 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	3 knots /	**Turbulence Type Forecast/Actual:**	None / None
Wind Direction:	320°	**Turbulence Severity Forecast/Actual:**	N/A / N/A
Altimeter Setting:	29.95 inches Hg	**Temperature/Dew Point:**	25°C / 18°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Portsmouth, NH (PSM)	**Type of Flight Plan Filed:**	None
Destination:	Smoketown, PA (S37)	**Type of Clearance:**	None
Departure Time:	19:00 Local	**Type of Airspace:**	Class G

Wreckage and Impact Information

Crew Injuries:	1 None	**Aircraft Damage:**	Substantial
Passenger Injuries:	2 None	**Aircraft Fire:**	None
Ground Injuries:		**Aircraft Explosion:**	None
Total Injuries:	3 None	**Latitude, Longitude:**	40.2775,-75.787223(est)

Administrative Information

Investigator In Charge (IIC):	Gunther, Todd
Additional Participating Persons:	Johnny R Williams; FAA / FSDO; Allentown, PA
Original Publish Date:	September 21, 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=101656

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The NTSB does not assign fault or blame for an accident or incident; rather, as specified by NTSB regulation, "accident/incident investigations are fact-finding proceedings with no formal issues and no adverse parties … and are not conducted for the purpose of determining the rights or liabilities of any person" (Title 49 *Code of Federal Regulations* section 831.4). Assignment of fault or legal liability is not relevant to the NTSB's statutory mission to improve transportation safety by investigating accidents and incidents and issuing safety recommendations. In addition, statutory language prohibits the admission into evidence or use of any part of an NTSB report related to an accident in a civil action for damages resulting from a matter mentioned in the report (Title 49 *United States Code* section 1154(b)). A factual report that may be admissible under 49 *United States Code* section 1154(b) is available here.