Aviation Investigation Final Report

Location:	Walterboro, South Carolina	**Accident Number:**	ERA22FA026
Date & Time:	October 22, 2021, 15:57 Local	**Registration:**	N1652H
Aircraft:	Piper PA-32R-300	**Aircraft Damage:**	Destroyed
Defining Event:	Fuel starvation	**Injuries:**	1 Fatal, 1 Serious
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The airplane departed from its home airport for an airport about 802 nautical miles away with the airplane's fuel tanks filled to their total fuel capacity of 98 gallons. The pilot planned for the flight to only be a single leg, but about 1.5 hours into the flight he decided to land for fuel due to the 20-knot headwind, which he had not accounted for during his flight planning. About 2 hours and 53 minutes into the flight, the pilot advised air traffic control (ATC) that he wanted to divert for fuel and then resume his instrument flight rules (IFR) flight plan to his destination. The air traffic controller cleared the pilot to fly direct to a diversion airport. When the airplane was approximately nine miles north of the diversion airport, at an assigned altitude of 1,600 feet msl, the pilot declared "Mayday" and reported a "lagging engine." The pilot described that, when he reached 1,600 feet, he pushed the throttle forward to level off from the preceding descent, but the engine did not respond. The engine then surged (went up and back down), but it would not respond to his throttle inputs. The airplane subsequently impacted trees short of the diversion airport. During the impact sequence, the pilot was seriously injured and the passenger was fatally injured.

The pilot had flown for about 3 hours, and 351 miles of the 802-mile flight, at the time of the accident. Fuel consumption calculations indicated that, depending on the power setting, more than half of the fuel load of 94 gallons of usable fuel would have been consumed before the accident (about 47.7 to 56.7 gallons, depending on power setting). This was greater than the usable fuel amount in each wing (47 gallons per side). While the pilot stated that he checked the fuel gauges every 15 minutes and would continue flying on the fuel tank that had the higher fuel indication, the Pilot's Operating Handbook (POH) for the airplane, advised that to keep the airplane in best lateral trim during cruise flight, the fuel should be used alternately from each tank at one-hour intervals. The POH also stated, "Always remember that the electric fuel pump should be turned "ON" before switching tanks and should be left on for a short period thereafter. To preclude making a hasty selection, and to provide continuity of flow, the selector should be changed to another tank before fuel is exhausted from the tank in use. If signs of fuel starvation should occur at any time during flight, fuel exhaustion should be suspected, at which time the fuel selector should be immediately positioned to a full tank and the electric fuel pump switched to the "ON" position."

Postaccident examination of the airplane at the accident site revealed the postimpact fire had a burn pattern that appeared to initiate from the area of the right wing. Residual fuel was found in the right outboard fuel tank, and fuel staining was also present around the fuel filler port for the right wing. However, minimal thermal damage was present on the inboard leading edge of the left wing, and residual fuel and fuel staining were not evident. This physical evidence suggests that little or no fuel was present in the left wing fuel tanks, and that the majority of the fuel onboard the airplane at the time of the accident was in the right wing tanks. The postaccident examination of the engine did not reveal evidence of any preimpact failures or malfunctions that would have precluded normal operation.

Based on this information, it is likely that the loss of power was due to the left wing having little or no usable fuel available, which subsequently introduced air into the fuel lines. Thus, after the loss of power, the fuel in the right wing would not have been a reliable source of fuel to quickly restore engine power. Based on the available evidence, the circumstances of the accident are consistent with fuel starvation resulting from the pilot's mismanagement of the fuel system during the flight.

Probable Cause and Findings

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

The pilot's inadequate fuel planning and fuel management, which resulted in a loss of engine power due to fuel starvation.

Findings

Personnel issues	Fuel planning - Pilot
Aircraft	Fuel - Fluid management
Aircraft	Fuel - Fluid level

Factual Information

History of Flight

Enroute-descent	Fuel starvation (Defining event)
Emergency descent	Collision with terr/obj (non-CFIT)

On October 22, 2021, about 1557 eastern daylight time, a Piper PA-32R-300 airplane, N1652H, was destroyed when it was involved in an accident near Walterboro, South Carolina. The pilot was seriously injured, and the passenger was fatally injured. The airplane was operated as a Title 14 *Code of Federal Regulations (CFR)* Part 91 personal flight.

The airplane departed on an 802 nautical mile flight from Shannon Airport (EZF), Fredericksburg, Virginia, about 1256 destined for Miami Executive Airport (TMB), Miami, Florida. Before departure, the pilot brought the airplane's fuel tanks up to their total fuel capacity of 98 gallons by adding 78.81 gallons of 100LL aviation gasoline.

The flight was uneventful until about 2 hours and 53 minutes into the flight, when the airplane was in cruise at 6,000 feet above mean sea level (msl). The pilot advised air traffic control (ATC) that he wanted to divert to Lowcountry Regional Airport (RBW), Walterboro, South Carolina, for fuel, and then resume his IFR flight plan to TMB.

The air traffic controller then cleared the pilot to fly direct to RBW and approved him to leave the frequency to get the current weather and NOTAMS for the airport. When the pilot reported that he was back on frequency, the air traffic controller instructed him to maintain 3,000 feet msl and to state his approach request. The pilot requested the visual approach to runway 23. The air traffic controller then instructed the pilot to maintain 1,600 feet msl, and subsequently instructed him to fly heading 190° to the RBW Airport.

The airplane was approximately nine miles north of RBW when the airplane began to descend without a clearance. The pilot then declared "Mayday" and reported a "lagging engine" to which the air traffic controller advised that RBW was at one o'clock and seven miles, and to maintain present heading and altitude.

The minimum safe altitude warning then activated at the air traffic controller's station as the airplane descended through 1,000 feet msl. The air traffic controller queried the pilot if they were reporting a rough running engine, to which there was no response. The airplane continued descending while in a left turn to the northeast and was last observed by ATC radar at an altitude of 100 feet msl. There was no further communication with the pilot.

According to a witness, he heard an airplane "sputter and stop." He looked in the direction of the airplane, and continued to hear sputtering, before the sound of an engine cut out, and then sputtering again. The airplane kept flying and then went out of sight.

According to two other witnesses, about 1556, they began to hear an engine noise. They observed [the accident airplane] almost directly above the tree line behind their neighbor's house. It appeared to be in a left turn, and then they next heard a loud "pop" from the airplane and the engine noise ceased.

According to the pilot, once he arrived at the airport, he pulled the airplane out of the hangar with his tug, loaded their baggage, boarded the airplane, and then started the engine. He then taxied to the fuel pumps. He filled both wing tanks all the way up (just below the caps). He then took off. The weather was VMC and he had filed an instrument flight rules flight plan. He planned to cruise at 6,000 feet and he could not remember if he changed altitude at any time during the cruise portion of the flight.

He had filed the flight as one leg. About 1.5 hours into the flight, he decided to land for fuel due to the headwinds he encountered. He had also made the decision to get fuel early, as he would be landing at his destination at night.

He received the weather for the diversion airport and, as he was proceeding to the airport, he received a clearance to descend to 1,600 feet. He began the descent and pulled the power back. When he reached 1,600 feet, he pushed the throttle forward, but the engine did not respond. He then pulled it back towards idle to try and match the throttle to where the engine was operating. The engine surged (went up and back down). He pushed the throttle forward, but there was no response.

He then pitched the airplane to get the speed to about 90 knots (towards best glide). He then declared an emergency and when they were about 100 feet above the trees, he lowered the landing gear. He told the passenger to "Brace" as they were going to crash and transmitted: "Mayday, Mayday, Mayday" before the airplane contacted the trees. He could not remember anything after hitting the trees. The next thing he remembered was being in the hospital.

The pilot reported that he had his lap belt on, but the shoulder harness was broken, and had been that way since when he purchased the airplane. The passenger had her lap belt on, but he could not remember if she had her shoulder harness on. He did not try to check the magnetos or switch tanks after the loss of engine power.

He stated that fuel management was not an issue as he would set the timer on his Garmin unit every 15 minutes, and if the fuel tank he was on was higher than the other one he would stay on that tank. He would determine the quantity by looking at the fuel gauges to estimate what fuel he had. He also stated that he was at the halfway point and should have had enough fuel to make it, or close. He could not remember what tank he was on when the accident occurred. He added that he just wanted to configure the airplane for landing and all he saw was trees.

Pilot Information

Certificate:	Commercial	**Age:**	52,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:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	
Medical Certification:	Class 2 With waivers/limitations	**Last FAA Medical Exam:**	October 20, 2021
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	October 28, 2019
Flight Time:	(Estimated) 1967.8 hours (Total, all aircraft), 76.4 hours (Total, this make and model)		

Passenger Information

Certificate:		**Age:**	24,Female
Airplane Rating(s):		**Seat Occupied:**	Right
Other Aircraft Rating(s):		**Restraint Used:**	Lap only
Instrument Rating(s):		**Second Pilot Present:**	No
Instructor Rating(s):		**Toxicology Performed:**	
Medical Certification:		**Last FAA Medical Exam:**	
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	
Flight Time:			

At the time of the accident, the pilot was a colonel in the United States Air Force, was rated as a command pilot, and had flown the T-37A, T-38A, C-130E, AT-38B, F-16C, A-10A, and A-10C.

According to Federal Aviation Administration (FAA) records, the pilot held a commercial pilot certificate, with ratings for airplane single-engine land, airplane multi-engine land, and instrument airplane.

His most recent FAA second-class medical certificate was issued on October 20, 2021. At the time of the accident, he had accrued approximately 1,968 total flight hours, of which about 76 hours were in the accident airplane make and model.

Aircraft and Owner/Operator Information

Aircraft Make:	Piper	**Registration:**	N1652H
Model/Series:	PA-32R-300	**Aircraft Category:**	Airplane
Year of Manufacture:	1977	**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	32R-7780168
Landing Gear Type:	Retractable - Tricycle	**Seats:**	6
Date/Type of Last Inspection:	August 5, 2021 Annual	**Certified Max Gross Wt.:**	3600 lbs
Time Since Last Inspection:		**Engines:**	1 Reciprocating
Airframe Total Time:	6049.78 Hrs as of last inspection	**Engine Manufacturer:**	Lycoming
ELT:	C91 installed, not activated	**Engine Model/Series:**	IO-540-K1G5D
Registered Owner:	DEMELVA AVIATION LLC	**Rated Power:**	300 Horsepower
Operator:	On file	**Operating Certificate(s) Held:**	None

Maintenance Records

A review of partial copies of the airplane's maintenance logbook entries had revealed that the engine had accumulated 2083.76 hours at the time of the most recent annual inspection dated August 5, 2021.

According to maintenance records, the airplane's most recent annual inspection was completed on August 5, 2021. At the time of the inspection, the airplane had accrued about 6,050 total hours of operation, and the engine had accrued about 2,084 hours since major overhaul."

Fuel System

The fuel system consisted of two interconnected tanks in each wing, having a combined capacity of 49 U.S. gallons, for a total capacity of 98 U.S. gallons (94 usable). Fuel flow was indicated on a gauge located in the instrument panel. A fuel quantity gauge for each wing system was also located in the instrument panel, which indicated the amount of fuel remaining as transmitted by the electric fuel quantity sending units located in the wing tanks. An exterior sight gauge was installed in the inboard tank of each wing so fuel quantities could be checked on the ground during the preflight inspection of the airplane.

Fuel was drawn through a finger screen located in the inboard fuel tank and routed to a three-position fuel selector valve and filter unit which was located aft of the main spar. The valve had "OFF," "LEFT," and "RIGHT" positions that were remotely selected by means of a torque tube operated by a handle located in the pedestal. The handle had a spring-loaded detent to prevent accidental selection to the "OFF" position. From the selector valve the fuel would go to the electric fuel pump, which also was mounted aft of the main spar and then would go forward to the engine-driven fuel pump, which forced the fuel through the injector unit into the engine.

Guidance for Fuel Tank Selection

According to the Pilot's Operating Handbook (POH) for the airplane, to keep the airplane in best lateral trim during cruise flight, the fuel should be used alternately from each tank at one-hour intervals.

The POH also stated, "Always remember that the electric fuel pump should be turned 'ON' before switching tanks and should be left on for a short period thereafter. To preclude making a hasty selection, and to provide continuity of flow, the selector should be changed to another tank before fuel is exhausted from the tank in use. The electric fuel pump should be normally 'OFF' so that any malfunction of the engine driven fuel pump is immediately apparent.

If signs of fuel starvation should occur at any time during flight, fuel exhaustion should be suspected, at which time the fuel selector should be immediately positioned to a full tank and the electric fuel pump switched to the 'ON' position."

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	KRBW,102 ft msl	**Distance from Accident Site:**	8 Nautical Miles
Observation Time:	15:55 Local	**Direction from Accident Site:**	193°
Lowest Cloud Condition:	Scattered / 3900 ft AGL	**Visibility**	10 miles
Lowest Ceiling:		**Visibility (RVR):**	
Wind Speed/Gusts:	8 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	260°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29.96 inches Hg	**Temperature/Dew Point:**	27°C / 17°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Fredericksburg, VA (EZF)	**Type of Flight Plan Filed:**	IFR
Destination:	Miami, FL (TMB)	**Type of Clearance:**	IFR
Departure Time:	12:56 Local	**Type of Airspace:**	Class G

Synoptic conditions

The National Weather Service Surface Analysis Chart for 1700 for the eastern United States depicted a low-pressure system at 1012 hectopascals over the Virginia and North Carolina border, with a cold front extending southwestward into North and South Carolina, Georgia, and into the Florida panhandle. The front then became a warm front and extended westward along the gulf coast. The accident site was located in the vicinity of the cold front. The station models in the vicinity of the accident site indicated westerly winds of 10 knots, clear to scattered clouds over the area with temperatures in the 80's °F, with dew point temperatures in the 60's °F. No significant weather or obstructions to visibility were identified surrounding the accident site.

Observations

The accident airplane was diverting to Lowcountry Regional Airport (RBW), Walterboro, South Carolina, which listed an elevation of 101 ft msl, with a magnetic variation of 7° W based on the sectional chart for the area. The airport had an Automated Weather Observation System (AWOS), which was not augmented by any human observers. The following conditions were reported at the approximate time of the accident:

Routine weather observation for RBW at 1555 included wind from 280° true at 10 knots gusting to 17 knots, visibility 10 statute mile or more, scattered clouds at 5,000 ft agl, scattered clouds at 7,000 ft, and scattered at 9,500 ft, temperature 30° C (86° F), dew point temperature 20° C (68° F), altimeter setting 29.82 inches of mercury.

Sounding

A High-Resolution Rapid Refresh (HRRR) numerical model data was obtained from the National Oceanic and Atmospheric Administration Oceanic Air Resource Laboratory archive using the closest grid point to the accident site coordinates. The HRRR model data was then plotted on a standard skew T log P diagram using analysis software for 1600 on October 22, 2021. The sounding depicted an elevation of 105 ft over the grid point, with a near surface temperature of 27.2°C (81° F), with a dew point temperature of 16.4°C (61.5° F), a relative humidity of 52%, with a density altitude of 1,756 ft. The lifted condensation level was identified at 4,490 ft agl, the level of free convection at 4,490 ft agl, and the convective condensation level at 6,407 ft agl. The freezing level was identified at 13,112 ft which was above the accident airplane’s cruising level at 6,000 ft. The precipitable water content was 1.09 inches. The atmosphere was characterized as conditional unstable with a Lifted Index of -2.9. At 6,000 ft the sounding depicted a temperature of 12° C, a dew point temperature of 1.4° C, with a relative humidity of 45%, with the wind from 260° at 22 knots. The HRRR wind profile indicated the mean 0 to 6 kilometer (or 18,000 ft) wind was from 255° at 25 knots.

During the portion of the flight when the accident airplane’s enroute cruise was at 6,000 feet the winds were from 260° at 21 knots with a temperature of 12° C.

Airport Information

Airport:	LOWCOUNTRY RGNL RBW	**Runway Surface Type:**	Asphalt;Concrete
Airport Elevation:	100 ft msl	**Runway Surface Condition:**	Dry
Runway Used:	23	**IFR Approach:**	Visual
Runway Length/Width:	6002 ft / 100 ft	**VFR Approach/Landing:**	Forced landing

Wreckage and Impact Information

Crew Injuries:	1 Serious	**Aircraft Damage:**	Destroyed
Passenger Injuries:	1 Fatal	**Aircraft Fire:**	On-ground
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	1 Fatal, 1 Serious	**Latitude, Longitude:**	33.0425,-80.598217

Examination of the accident site revealed that the airplane first contacted an approximately 70-foot-tall pine tree, and then continued to travel through about 100 yards of forest on a magnetic heading of about 072°, striking multiple trees while descending on an approximate 20° flight path angle.

The postaccident examination of the airplane revealed that both wings and the right side of the stabilator had separated from their mounting locations during the impact sequence with the trees. There was no evidence of pre-impact fire, and all impact damage was consistent with tree and terrain impact.

The fuselage was mostly consumed by a postimpact fire. Examination of the burn pattern indicated that the postimpact fire appeared to initiate from the area of the right wing. Residual fuel was found in the right outboard fuel tank. Fuel staining was also present around the fuel filler port for the right wing. Minimal thermal damage on the inboard leading edge of the left wing was present, but residual fuel, and fuel staining, were not evident.

The landing gear was in the down position, and the landing gear dump lever was stowed. The throttle, propeller, and mixture were all in the full forward position. The fuel selector valve was in the right fuel tank position. Flight control continuity was established from the cockpit controls to the breaks in the system and from the breaks in the system to the control surfaces. The wing flaps were in the up (0°) position. The left wing outboard and inboard fuel tanks were breached. There was no evidence of vegetation blight nor residual odor of fuel in the vicinity of the wing. The right-wing outboard fuel tank was breached (but still contained residual fuel), and the right inboard fuel tank had separated from the wing. Both the left and right fuel filler caps were still attached to their receptacles. About 1.5” of pitch trim jack screw threads were exposed from the top of the trim barrel assembly, which was indicative of a “near full nose up” stabilator trim setting.

The postaccident examination of the aluminum 3-bladed constant-speed propeller and spinner revealed that the propeller had remained attached to the propeller flange, and no rotational deformation was present on the impact damaged spinner. Impact damage was noted to the propeller hub and all three blades. There was no leading-edge damage or chord-wise abrasions noted on the propeller blades.

The postaccident examination of the engine revealed that the engine had remained attached to its mount which had partially separated from the fuselage. Both the engine and its mount exhibited impact and thermal damage. The exhaust system was impact damaged but remained attached to its respective cylinder attach points. No internal obstructions or deformations were noted in the exhaust system. The single drive, dual magneto installation, and the engine-driven fuel pump were thermally destroyed. The spark plugs exhibited dark gray, sooty coloration, and worn normal condition. The Nos.3 top, 5 top, 1 bottom, 2 bottom, 3 bottom and 5 bottom spark plugs were oil soaked, consistent with how the engine came to rest.

Thumb compression and suction were obtained, and crankshaft and camshaft continuity to the rear gears was established. The interiors of the cylinders were observed with a lighted borescope and no anomalies were observed. Oil was observed within the sump; the oil pump suction screen was clear of debris, and the oil filter media was charred. No metallic debris was observed between the folds of the media. One tooth was found to be fractured on the oil pump drive gear, and its driving idler gear exhibited abrasions on several consecutive teeth. The fractured gear tooth was retrieved from the oil sump. The oil pump could not be rotated by hand.

Examination of the oil pump by the NTSB Materials Laboratory indicated that the drive gear failed from a tooth that fractured in overstress while engaged with the adjacent idler gear. The directions of the fracture surface features and adjacent damage to the drive gear and idler gear, suggested the forces were in the direction of rotation and were consistent with the failure occurring during the impact sequence.

The examination of the engine fuel system revealed that the fuel injector servo remained attached to the engine and exhibited soot and discoloration consistent with exposure from the postimpact fire. The throttle cable rod end remained attached to the servo throttle arm. The arm was positioned at the full throttle position. The mixture cable rod end remained attached to the servo mixture control arm. The arm was positioned at a mid-range position. The mixture control stop screw was not observed. The servo fuel regulator section was partially disassembled; the hub stud was still in place, and the rubber diaphragms were destroyed by fire. The fuel screen was clean.

The fuel flow divider remained attached to the engine and exhibited soot and discoloration consistent with exposure to the post-impact fire. The fuel injector lines were secure. The flow divider was partially disassembled, and no evidence of fuel was found in the flow divider. The rubber diaphragm was destroyed by fire.

The fuel injector nozzles remained attached to the engine and the fuel lines were secure. All six nozzles were found to be unobstructed.

Additional Information

Fuel Consumption

A review of automatic dependent surveillance - broadcast (ADS-B) data and ATC information from the accident flight indicated that the pilot had made multiple changes in altitude during the flight. He initially climbed to 6,000 feet msl and entered cruise. He then climbed to 10,000 feet and entered cruise. He then descended to 8,000 feet and entered cruise. He then descended to 6,000 feet and entered cruise, and then descended to 4,000 feet and entered cruise, before climbing back up to 6,000 feet and entered cruise. He then descended to 1,600 feet and entered cruise before the loss of engine power occurred, and the airplane descended to impact.

Further review indicated that the accident flight took about 3 hours, during which the airplane flew about 351 nautical miles, at an average ground speed of 116 knots.

Fuel Consumption Calculations

At the request of the NTSB, Piper Aircraft's Flight Operations Department was asked to review the accident flight and determine possible fuel consumption.

During the review, it was assumed that when the airplane was climbing, the power was set to the maximum continuous power available. In cruising flight, it was assumed that the power setting was constant while the airplane was maintaining altitude. When the airplane was descending, it was assumed that the power was not reduced as the average ground speed increased significantly during the descent.

The review showed that had the pilot operated the engine at 75% power during cruise flight, with the fuel air mixture leaned for best performance, the engine would have consumed about

56.7 gallons during the flight. With the fuel air mixture leaned for best economy, the engine would have consumed about 51.5 gallons during the flight.

Had the pilot operated the engine at 55% power during cruise flight, with the fuel air mixture leaned for best performance, the engine would have consumed about 47.7 gallons during the flight. With the fuel air mixture leaned for best economy, the engine would have consumed about 41.8 gallons during the flight

Pilot’s Handbook of Aeronautical Knowledge

According to the Pilot’s Handbook of Aeronautical Knowledge (FAA-H-8083-25C), the fuel quantity gauges indicate the amount of fuel measured by a sensing unit in each fuel tank and is displayed in gallons or pounds. Aircraft certification rules require accuracy in fuel gauges only when they read “empty.” Any reading other than “empty” should be verified. Do not depend solely on the accuracy of the fuel quantity gauges. Always visually check the fuel level in each tank during the preflight inspection, and then compare it with the corresponding fuel quantity indication.

It goes on to say in part that, regardless of the type of fuel selector in use, fuel consumption should be monitored closely to ensure that a tank does not run completely out of fuel. Running a fuel tank dry does not only cause the engine to stop, but running for prolonged periods on one tank causes an unbalanced fuel load between tanks. Running a tank completely dry may allow air to enter the fuel system and cause vapor lock, which makes it difficult to restart the engine. On fuel-injected engines, the fuel becomes so hot it vaporizes in the fuel line, not allowing fuel to reach the cylinders.

Civil Air Regulations (CARs)

Prior to 14 CFR Part 23, which addresses airworthiness standards for normal category airplanes, the CARs were the basis for establishing the design requirements for aircraft. Eventually CAR 3, which addressed airplane airworthiness for normal, utility, acrobatic, and restricted purpose categories, grew to become the regulatory guidance specific to small airplanes.

The requirements for fuel quantity indicators at the time were for the indicator to be calibrated to read zero during level flight when the quantity of fuel remaining in the tank was equal to the unusable fuel supply.

The airplane design was originally certificated under these regulations.

Preventing Similar Accidents

Prevent the Preventable with Careful Fuel Management (SA-067)

The Problem

Within fuel-related accidents, fuel exhaustion and fuel starvation continue to be leading causes. From 2011 to 2015, an average of more than 50 accidents per year occurred due to fuel management issues. Fuel exhaustion accounted for 56% of fuel-related accidents while fuel starvation was responsible for 35% of these accidents. Fuel exhaustion is running out of fuel whereas fuel starvation is having fuel onboard that doesn’t reach the engine for reasons such as a blockage, improperly set fuel selector, or water contamination.

Running out of fuel or starving an engine of fuel is highly preventable. An overwhelming majority of our investigations of fuel management accidents—95%—cited personnel issues (such as use of equipment, planning, or experience in the type of aircraft being flown) as causal or contributing to fuel exhaustion or starvation accidents. Prudent pilot action can eliminate these issues. Less than 5% of investigations cited a failure or malfunction of the fuel system.

What can you do?

- Pilots should know how much fuel they have onboard at all times.
- During preflight inspection, measure or visually confirm the fuel quantity. Do not rely exclusively on fuel gauges.
- Know how much fuel you will need for a given flight.
- Make sure you have a fuel reserve for each flight.
- Know your engine’s fuel burn rate and actively monitor the fuel burn rate for the entire time the engine is operating.
- Know your aircraft’s fuel system and how it works.
- Review your aircraft’s POH and use the appropriate checklists.
- Don’t stretch your available fuel supply. Stop and get gas!

See https://www.ntsb.gov/Advocacy/safety-alerts/Documents/SA-067.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:	William Thompson; FAA/FSDO; Columbia, SC Damian Galbraith; Piper Aircraft Inc.; Vero Beach , FL Michael Childers; Lycoming Aircraft Engines; Williamsport, PA
Original Publish Date:	December 20, 2023
Last Revision Date:	
Investigation Class:	Class 3
Note:	
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=104150