



Aviation Investigation Final Report

Location:	Sumter, South Carolina	Accident Number:	ERA20LA270
Date & Time:	August 1, 2020, 10:00 Local	Registration:	C-GXKS
Aircraft:	Piper PA31	Aircraft Damage:	Substantial
Defining Event:	Fuel related	Injuries:	2 Minor
Flight Conducted Under:	Part 91: General aviation - Aerial observation		

Analysis

According to the pilot, he and the copilot were flying low-level mapping flights in the twin-engine airplane. Although the copilot was not multi-engine rated, he and the pilot regularly switched control of the airplane during the mapping flights. On the accident flight, the pilot was seated in the right seat; the copilot was seated in the left seat; and they were flying the airplane at an altitude of about 300 ft above ground level. According to the pilot, they flew for about 2 hours before he, who was the pilot flying at the time, switched fuel tanks from the inboard tanks to the outboard tanks. The pilot did not tell the copilot he had switched fuel tanks. About 1.5 hours later, while the copilot was the pilot flying, the left engine started to surge and lose power. The pilot began the steps of the emergency procedure for an engine failure in cruise flight starting with moving the fuel selectors to the inboard tanks. Power was not restored; the airplane immediately began losing altitude; and the pilot took over control of the airplane. The copilot stated that at the time the pilot took over control, he looked at the fuel tank quantity gauges, and they both displayed zero. The pilot reported that the airplane stalled just above the ground during the emergency landing in a field. The right wing struck first, and within a couple of seconds, the right outboard fuel tank exploded. The pilot and copilot egressed out the rear door.

Examination of the wreckage revealed that neither engine exhibited evidence of power at impact. The left outboard fuel tank was found completely full of fuel, and the left inboard fuel tank was empty. Both right wing tanks were fire damaged, and the fuel quantity in the tanks at impact could not be determined. Further examination revealed that the fuel crossfeed valve was in the “crossfeed/open” position. No fuel was observed in the valve or attached fuel lines during disassembly. The left fuel selector valve was found in the “OFF” position, and no fuel was observed within the fuel line between the valve and gascolator. The right fuel selector valve was damaged by fire, and its position at impact could not be determined. No other anomalies were noted in the engines or airframe.

According to the pilot, all fuel tanks were full before the flight. According to the pilot’s operating manual, the airplane likely consumed about 33.1 gallons of fuel per hour or a total of about 115 gallons of fuel during the 3.5-hour flight. Given that the inboard fuel cells held 56 gallons each (112 gallons

total), that the left inboard tank was found empty, and that the copilot noticed that the fuel gauges were reading zero just before impact, it is likely that each engine was drawing fuel from its respective inboard tank throughout the flight until those tanks were empty. The left engine lost power first, and the right engine likely lost power just before impact.

The postaccident positions of the crossfeed valve (on) and the left fuel selector (off) did not correspond to the pilot's statements regarding his positioning of the fuel selector valves during the flight. The fuel panel was located between and behind the pilots' seats and required the pilots to look down and back in order to see the panel when making changes to the panel; therefore, it is likely the pilot misconfigured the valves when he switched tanks 2 hours into the flight, when he switched tanks after the left engine lost power, or on both occasions. It is unlikely the copilot would have been able to see an incorrect switch selection on the fuel panel due to the location of the panel, and he would have been unlikely to look at the 2-hour point as the pilot did not verbalize that a change to the panel had been made.

Probable Cause and Findings

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

The pilot's fuel mismanagement during flight, which resulted in a total loss of engine power from both engines due to fuel starvation.

Findings

Personnel issues	Use of equip/system - Pilot
Aircraft	Fuel - Fluid management

Factual Information

History of Flight

Maneuvering-low-alt flying	Fuel related (Defining event)
Emergency descent	Off-field or emergency landing
Emergency descent	Aerodynamic stall/spin
Uncontrolled descent	Collision with terr/obj (non-CFIT)

On August 1, 2020, about 1000 eastern daylight time, a Piper PA-31-325, Canadian registration C-GXKS, was substantially damaged when it was involved in an accident near Sumter, South Carolina. The pilot and copilot sustained minor injuries. The airplane was operated as a Title 14 *Code of Federal Regulations* Part 91 aerial observation flight.

According to the pilot, he and the copilot had been flying mapping flights for the United States Geological Survey. The pilot stated that they had scanners weighing about 800 lbs on board and that they would fly about 300 ft above ground level in a grid pattern while mapping. He further stated that he personally fueled the inboard and outboard fuel tanks the day before the accident flight. On the accident flight, the pilot was seated in the right seat, and the copilot was seated in the left seat. They departed Santee Cooper Regional Airport (MNI), Manning, South Carolina about 0630 and planned on returning to the same airport. After 2 hours of flight time, the pilot, who was the pilot flying, switched from the inboard fuel tanks to the outboard fuel tanks. The pilot stated he did not verbalize to the copilot that he had switched the tanks. The pilot further stated the pilot flying will commonly request the other pilot to assist with the tank switching procedure since the tank selectors are behind the pilots' seats and are not visible without looking behind and downwards.

About 1.5 hours later, while the copilot was flying, the left engine started "surging" and rapidly began to lose power. The pilot reported that he began the memory items for an engine failure in cruise flight starting with moving the fuel selectors to the inboard tanks. The airplane immediately began to lose altitude, and shortly after, they had descended below the tree level. The pilot took control of the airplane and turned to a field just ahead of them. The airplane stalled just above the ground, and the right wing contacted the ground first. The pilot stated both side windows shattered during impact; and within 2 seconds, the right outboard fuel tank exploded; and a postimpact fire ensued. Both pilots egressed through the rear door.

The copilot stated he was training in the airplane and did not have a multiengine rating. He stated he did not have any official hours flying the airplane with an instructor but had flown the airplane for about 200 hours. His description of the accident flight was consistent with that provided by the pilot. He further stated that when he turned over control of the airplane to the pilot during the last few seconds of flight, he looked at the fuel tank quantity gauges, and they were both reading "zero."

Postaccident examination of the airplane by a Federal Aviation Administration (FAA) inspector revealed that the airplane impacted the ground with the right wing first and slid sideways through the field. Both engines were fractured off, and neither engine exhibited evidence of power at the time of impact. The fuselage and right wing were consumed by fire. The left wing was still attached to the fuselage. The left outboard fuel tank was completely full of fuel, and the inboard tank was empty.

Further examination of the airplane revealed that the crossfeed valve was found in the “crossfeed/open” position. No fuel was observed in the valve or attached fuel lines during disassembly. A functional field test was performed on the valve with low pressure air, with no anomalies were noted. The left fuel selector valve was found in the “OFF” position, and the control cables were secured. No fuel was observed within the fuel line between the valve and gascolator. The right fuel selector valve was thermally damaged and could not be examined or functionally tested. No other anomalies were noted in the engines or airframe that would have precluded normal operation before impact.

The fuel system consisted of four flexible fuel cells, two in each wing. The outboard fuel cells held 40 gallons each, and the inboard fuel cells held 56 gallons each. The right and left fuel systems were independent of each other and were connected only when the crossfeed system was activated. The airplane also had nacelle tanks installed, one 27-gallon capacity tank in each engine nacelle.

The fuel management controls were located in the fuel system control panel mounted between the front seats on the forward edge of the wing spar carry-through cover. Located on the fuel control panel were the fuel tank selectors, fire wall fuel shutoffs, and the crossfeed control. Two fuel gauges were mounted in the overhead switch panel. The right gauge indicated the fuel quantity in the right-wing fuel cells, and the left gauge indicated the fuel quantity in the left-wing fuel cells. The gauges were connected electrically to the fuel selector and indicated the fuel quantity of the cell selected.

The PA-31-325 Pilot’s Operating Manual (POM) states the following:

During normal operation of the fuel system, each engine is supplied with fuel from its respective fuel supply. Selection of the controls on the right side of the control panel provides fuel from the right inboard or outboard fuel cells to the right engine and left fuel control selection provides fuel from the left inboard or outboard fuel cells to the left engine.

For emergencies, fuel from one system can supply the opposite engine through the use of the crossfeed system. The crossfeed valve is located at the inboard rib assembly of the left wing butt area and is intended for emergency use only, (See Airplane Flight Manual). The crossfeed is controlled by a knob in the center of the fuel control panel, and under all normal conditions should be in the off position.

NOTE - The crossfeed system is not intended for normal operation. When the crossfeed valve is on, be certain the fuel selector valve on the tank not in use is off, and the procedures outlined in the Airplane Flight Manual are followed.

The accident flight was about 3.5 hours in duration. According to the POM, the estimated fuel burn at normal (245 brake horsepower) power was 33.1 gal/hr.

Pilot Information

Certificate:	Commercial; Private	Age:	23, 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):	None	Toxicology Performed:	No
Medical Certification:	Class 1 None	Last FAA Medical Exam:	February 1, 2019
Occupational Pilot:	Yes	Last Flight Review or Equivalent:	June 20, 2020
Flight Time:	1625.4 hours (Total, all aircraft), 550 hours (Total, this make and model), 1181.5 hours (Pilot In Command, all aircraft), 138.8 hours (Last 90 days, all aircraft), 77.5 hours (Last 30 days, all aircraft), 5.9 hours (Last 24 hours, all aircraft)		

Co-pilot Information

Certificate:	Commercial; Private	Age:	Male
Airplane Rating(s):	Single-engine land; Single-engine sea	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:	No
Medical Certification:	Class 1 None	Last FAA Medical Exam:	April 29, 2019
Occupational Pilot:	Yes	Last Flight Review or Equivalent:	
Flight Time:			

Aircraft and Owner/Operator Information

Aircraft Make:	Piper	Registration:	C-GXKS
Model/Series:	PA31 325	Aircraft Category:	Airplane
Year of Manufacture:	1975	Amateur Built:	
Airworthiness Certificate:	Normal	Serial Number:	31-7512038
Landing Gear Type:	Retractable - Tricycle	Seats:	8
Date/Type of Last Inspection:	July 23, 2020 100 hour	Certified Max Gross Wt.:	6499 lbs
Time Since Last Inspection:	22.2 Hrs	Engines:	2 Reciprocating
Airframe Total Time:	12038 Hrs at time of accident	Engine Manufacturer:	Lycoming
ELT:	C126 installed, activated, aided in locating accident	Engine Model/Series:	TIO-540f2BDL
Registered Owner:		Rated Power:	325 Horsepower
Operator:	On file	Operating Certificate(s) Held:	Certificate of authorization or waiver (COA)

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	Condition of Light:	Day
Observation Facility, Elevation:	KSSC,241 ft msl	Distance from Accident Site:	7 Nautical Miles
Observation Time:	13:56 Local	Direction from Accident Site:	274°
Lowest Cloud Condition:	Clear	Visibility	10 miles
Lowest Ceiling:	None	Visibility (RVR):	
Wind Speed/Gusts:	6 knots /	Turbulence Type Forecast/Actual:	/
Wind Direction:	220°	Turbulence Severity Forecast/Actual:	/
Altimeter Setting:	29.97 inches Hg	Temperature/Dew Point:	29°C / 23°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Manning, SC (MNI)	Type of Flight Plan Filed:	Company VFR
Destination:	Manning, SC (MNI)	Type of Clearance:	None
Departure Time:	06:30 Local	Type of Airspace:	Class E

Wreckage and Impact Information

Crew Injuries:	2 Minor	Aircraft Damage:	Substantial
Passenger Injuries:		Aircraft Fire:	On-ground
Ground Injuries:		Aircraft Explosion:	On-ground
Total Injuries:	2 Minor	Latitude, Longitude:	33.959167,-80.332221(est)

Administrative Information

Investigator In Charge (IIC):	Boggs, Daniel		
Additional Participating Persons:	William K Thompson; FAA/FSDO; W. Columbia, SC Damian Galbraith; Piper; Vero Beach, FL Mike Childers; Lycoming; Atlanta, GA		
Original Publish Date:	October 5, 2022	Investigation Class:	3
Note:	The NTSB did not travel to the scene of this accident.		
Investigation Docket:	https://data.nts.gov/Docket?ProjectID=101719		

The National Transportation Safety Board (NTSB), established in 1967, is an independent federal agency mandated by Congress through the Independent Safety Board Act of 1974 to investigate transportation accidents, determine the probable causes of the accidents, issue safety recommendations, study transportation safety issues, and evaluate the safety effectiveness of government agencies involved in transportation. The NTSB makes public its actions and decisions through accident reports, safety studies, special investigation reports, safety recommendations, and statistical reviews.

The Independent Safety Board Act, as codified at 49 U.S.C. Section 1154(b), precludes the admission into evidence or use of any part of an NTSB report related to an incident or accident in a civil action for damages resulting from a matter mentioned in the report. A factual report that may be admissible under 49 U.S.C. § 1154(b) is available [here](#).