Aviation Investigation Final Report

Location:	Prescott, Arizona	**Accident Number:**	WPR16LA128
Date & Time:	June 18, 2016, 08:15 Local	**Registration:**	N9246S
Aircraft:	Beech C23	**Aircraft Damage:**	Substantial
Defining Event:	Fuel starvation	**Injuries:**	1 Minor, 1 None
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The pilot/owner and the pilot-rated passenger were making a multiple-leg cross-country trip. The day before the accident on two legs of the trip, the airplane's engine had run rough and experienced a partial power loss; both instances occurred after reaching cruise flight altitude and leaning the engine's fuel/air mixture. Due to the engine anomaly, the pilots elected to divert the night before the accident rather than continuing to the final destination in night conditions. The pilot/owner then consulted her mechanic, who attributed the power loss to vapor lock as a result of the weather conditions and instructed her to lean the mixture during the next pre-takeoff engine run-up.

The next morning, the pilots performed a preflight inspection. The airplane was not fueled before departure, and both pilots stated that the fuel onboard was adequate for the flight; however, neither provided the specific fuel quantity contained in each tank. The pilots departed with the left fuel tank selected and established a cruise altitude of 10,500 ft; the pilot/owner stated that she "did not lean the mixture at all" during the flight. About 50 minutes from the destination, the pilots switched the fuel selector from the left fuel tank to the right tank. Nearing their destination airport, they initiated a cruise descent and retarded the throttle to 1,800 rpm; the engine subsequently experienced a total loss of power. They attempted to restore engine power by cycling the throttle and mixture control but were unable to restart the engine. They did not switch fuel tanks. After determining that the airplane would not reach the runway, the pilots performed a forced landing to desert terrain. The airplane subsequently impacted the ground hard and bounced before it came to rest in an area of sparse desert vegetation about 1/2 mile from the airport.

A postaccident examination revealed that the fuel system was intact and not damaged during the accident; the right tank was found void of fuel, and the left tank contained about 10 gallons. Examination of the fuel sensor system showed that both the left and right fuel gauges erroneously indicated fuel was available when the fuel transmitters were placed in the empty position. An engine test run revealed no anomalies.

Based on the information provided by the pilots, the airplane likely departed on the accident flight with about 30 total gallons of fuel. Although fuel computations using the pilots' flight plan indicated that the right fuel tank, which was selected at the time of the engine power loss, should have had about 8 gallons of usable fuel remaining, the tank was void of fuel at the accident site.

The fuel consumption figures provided in the pilot's operating handbook indicated that the airplane's fuel consumption during the flight would have ranged from about 8.7 gallons per hour (gph) to 10.2 gph depending on the engine power setting and with the fuel-air mixture leaned to maximum power then slightly enrichened. Given that the fuel system was intact and that the right tank was completely void of fuel, the loss of power was likely the result of fuel starvation due to inflight fuel mismanagement.

Probable Cause and Findings

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

The pilots' improper inflight fuel management, which resulted in a total loss of engine power due to fuel starvation.

Findings

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

Factual Information

History of Flight

Enroute-descent	Fuel starvation (Defining event)
Enroute-descent	Loss of engine power (total)
Emergency descent	Collision with terr/obj (non-CFIT)

On June 18, 2016, about 0815 mountain standard time, a Beech C23 airplane, N9246S, was substantially damaged during a forced landing following a total loss of engine power near Prescott, Arizona. The private pilot/owner was not injured, and the pilot-rated passenger received minor injuries. The airplane was owned and operated by the pilot under the provisions of 14 *Code of Federal Regulations* Part 91. Visual meteorological conditions prevailed and no flight plan was filed for the cross-county flight, which departed Grants-Milan Municipal Airport (GNT), Grants, New Mexico about 0715 mountain daylight time. The personal flight was destined for Ernest A. Love Field Airport (PRC), Prescott, Arizona.

The pilots were participating in a point-to-point air race event. They departed Philip Billard Municipal Airport (TOP), Topeka, Kansas, the previous day at 0815 central time with about 52 gallons of fuel onboard. They reached a cruise altitude of 6,500 feet and flew for about 4 hours before they arrived at their second waypoint, Dalhart Municipal Airport (DHT), Dalhart, Texas. After they topped off the fuel tanks with 35.5 gallons of fuel, they departed for Tucumcari, New Mexico (TCC). As they reached their cruise altitude of 8,500 ft, they leaned the mixture control and, moments later, the engine lost power. The pilot enrichened the mixture and engaged the fuel boost pump and the engine "came back to life." Later in the flight, an Air Route Traffic Control Center controller informed the pilot of a temporary flight restriction (TFR) along their route of flight. After 2 hours and 20 minutes of flight, the pilots chose to land at an airport in Sandia, New Mexico to adjust their route of flight around the TFR. They subsequently departed to the east and flew an indirect route to Socorro Municipal Airport (ONM), Socorro, New Mexico. They refueled the airplane with 27 gallons of fuel and filled the left tank until it reached a fuel quantity of 26 gallons usable fuel. The right tank was filled to the tabs, which, according to the aircraft's flight manual, provided 15 gallons of usable fuel. During their subsequent flight to PRC, the destination airport, they leaned the mixture after they reached their cruise altitude, 8,500 ft, and the engine lost power again. The pilot enrichened the mixture and engaged the fuel boost pump, and engine power was restored approximately 20 seconds later. As the evening approached, they decided to land at GNT and spend the night.

The following morning, the pilot/owner contacted her mechanic to discuss the engine problems they had encountered. The mechanic attributed the power loss to vapor lock as a result of the density altitude and hot temperature conditions, and suggested a higher run-up power setting and to lean the mixture for best power on the ground. They followed the mechanic's instructions by learning the mixture out on the ground and subsequently departed with the fuel selector on the left fuel tank. According to the pilot's recount, they leaned the mixture knob out on the ground for "best power," but did not adjust it during the accident flight. About 1 hour and 10 minutes into the flight at a cruise altitude of 10,500 ft, the pilot

determined they had about 49 minutes of flight time remaining. She then selected the right fuel tank, "believing at this point there was now more fuel in the right tank than the left." Within a few miles of their destination airport, the pilot/owner told the pilot-rated passenger seated in the right seat, who had assumed control of the airplane for the cruise portion of the flight, that they needed to initiate a descent. The pilot/owner reviewed the descent checklist and activated the fuel boost pump, ensured the fullest (right) fuel tank was selected, the landing gear was down, and the mixture was in the full rich position. After they retarded the throttle to approximately 1,800 rpm, the engine experienced a total loss of power. They advanced the throttle and cycled the mixture control, but did not receive a response from the engine. Seconds later, they observed a burst of engine power, so the pilot gradually leaned the mixture control, but the engine did not produce any further power. She subsequently attempted to restart the engine, but was unsuccessful. The pilot/owner notified the tower controller at PRC, who cleared them to land on runway 21L. They descended the airplane rapidly, but then determined they would not reach the runway due to the 30 degree turn that was required, so they proceeded to land straight ahead. The airplane impacted the ground hard at approximately 80 mph and bounced. The airplane then returned to the ground and stopped. According to the pilot-rated passenger, the main landing gear separated shortly after the airplane touched down, and the airplane skidded up the rising face of a small berm. An initial report from an airport operations representative indicated that the airplane came to rest in an area of sparse desert vegetation about 1/2 mile north of PRC. The pilot/owner subsequently reported that she did not attempt to switch fuel tanks after the loss of power. Photographs provided by an airport operations representative and the Federal Aviation Administration revealed substantial damage to the right aileron and the left wing.

A fuel performance computation was completed based on the flight plan information provided by the pilots. According to the pilot/owner's statement, they departed ONM with approximately 26 gallons of usable fuel in the left tank and 15 gallons of usable fuel in the right fuel tank, and completed a 1 hour flight to GNT at a cruise altitude of 8,500 ft with the fuel selector on the L tank. Based on these values, the engine would have consumed about 10.9 total gallons of fuel. Before they departed GNT, the pilot-rated passenger confirmed the presence of fuel in both fuel tanks. They subsequently departed GNT on a 2-hour flight with approximately 16.6 gallons of fuel in the left tank and 15 gallons of fuel in the right tank. Approximately 1 hour and 10 minutes into the flight, they switched the fuel selector from the left tank to the right tank. Given these calculations, at the time of the loss of power, the left tank should have contained about 9.7 gallons of usable fuel, and the right tank should have contained about 7.6 gallons of usable fuel.

According to a representative of the airport who arrived on scene about 1 minute after the fire department, both occupants stated to him that they had turned the fuel off before they exited the airplane. The representative did not detect a fuel odor at the site, nor did he observe any indication of a fuel leak during the time he was in proximity of the airplane. The airport representative did not observe any traces of fuel on the ground when the airplane was lifted on the flatbed truck during the recovery effort. A representative of the recovery team stated that 10 gallons of fuel were drained out of the left fuel tank, and the right fuel tank was void of fuel.

A fuel system inspection and engine test run was completed by a representative of the airplane manufacturer under the supervision of an NTSB investigator. During the inspection of the fuel system, the representative did not observe any breaches of the right or left fuel tanks. The fuel strainer, located between the fuel selector valve and the engine, was equipped with a quick drain at its base that had been sheared off during the accident sequence. According to a representative of the airframe manufacturer,

placing the fuel selector valve in the OFF position prevents fuel in the tanks from moving to the fuel strainer. A bolt was installed in place of the quick drain to prevent fuel from draining out during the engine test run. Both fuel gauges indicated full fuel when the fuel transmitters were moved by hand to the full position, but showed ¼ full when the fuel transmitters were placed in the empty position. The engine was subsequently test run with new fuel that was introduced from an external tank attached to the fuel system at the right wing root as both wings had been removed during recovery of the aircraft. After the right fuel tank was selected, the engine was run to 2,200 rpm. The engine functioned normally during the magneto check and engine run up as the fuel flow indicator remained within the normal range. The engine did not show any power interruptions when the throttle was advanced rapidly. An engine backfire was heard once when the throttle was rapidly reduced from 2,200 rpm to 700 rpm; however, the engine continued to run. The engine test was repeated with fuel fed from the left side and no anomalies were observed.

During a follow-up interview, the pilot-rated passenger reported that she sumped and visually inspected the fuel tanks to verify the presence of fuel. According to her recount, she observed that the fuel quantities "were enough to take off." Although she did not normally use the fuel gauges to track the fuel quantities, the pilot/owner stated that with about 45 minutes of flight time remaining, she observed the left fuel gauge needle entering the yellow band, a slightly below half-full indication, and the right gauge needle in the yellow band, which she equated to about 9 gallons of fuel remaining in the right tank.

According to the pilot's operating handbook (POH), the yellow band of the fuel gauges represents a fuel quantity between empty and 3/8 full, approximately 9 gallons. The POH shows a fuel consumption of 8.7 gallons per hour (gph) at a power setting of 66% and 10.2 gph at a power setting of 75%; with the fuel-air mixture leaned to produce maximum rpm, then slightly enrichened.

Pilot Information

Certificate:	Private	**Age:**	58,Female
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Left
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 3 With waivers/limitations	**Last FAA Medical Exam:**	May 5, 2016
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	May 5, 2016
Flight Time:	469 hours (Total, all aircraft), 215 hours (Total, this make and model), 356 hours (Pilot In Command, all aircraft), 30 hours (Last 90 days, all aircraft), 20 hours (Last 30 days, all aircraft), 11 hours (Last 24 hours, all aircraft)		

Pilot-rated passenger Information

Certificate:	Commercial	**Age:**	50,Female
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 3 Without waivers/limitations	**Last FAA Medical Exam:**	November 10, 2014
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	October 25, 2016
Flight Time:	465 hours (Total, all aircraft), 52 hours (Total, this make and model), 325 hours (Pilot In Command, all aircraft), 15 hours (Last 90 days, all aircraft), 11 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Beech	**Registration:**	N9246S
Model/Series:	C23 NO SERIES	**Aircraft Category:**	Airplane
Year of Manufacture:	1975	**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	M-1742
Landing Gear Type:	Tricycle	**Seats:**	2
Date/Type of Last Inspection:	March 24, 2016 Annual	**Certified Max Gross Wt.:**	2450 lbs
Time Since Last Inspection:	25 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	3958 Hrs at time of accident	**Engine Manufacturer:**	LYCOMING
ELT:	C91 installed, activated, did not aid in locating accident	**Engine Model/Series:**	O-360-A4K
Registered Owner:	PARKER JOYCE A	**Rated Power:**	180 Horsepower
Operator:	PARKER JOYCE A	**Operating Certificate(s) Held:**	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	PRC,5044 ft msl	**Distance from Accident Site:**	1 Nautical Miles
Observation Time:	08:28 Local	**Direction from Accident Site:**	30°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	3 knots /	**Turbulence Type Forecast/Actual:**	/ None
Wind Direction:	20°	**Turbulence Severity Forecast/Actual:**	/ N/A
Altimeter Setting:	30.28 inches Hg	**Temperature/Dew Point:**	26°C / -3°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	GRANTS, NM (GNT)	**Type of Flight Plan Filed:**	VFR
Destination:	Prescott, AZ (PRC)	**Type of Clearance:**	VFR;VFR flight following
Departure Time:	07:15 Local	**Type of Airspace:**	Class D

Airport Information

Airport:	ERNEST A LOVE FIELD PRC	**Runway Surface Type:**	Asphalt
Airport Elevation:	5044 ft msl	**Runway Surface Condition:**	Dry
Runway Used:	21L	**IFR Approach:**	None
Runway Length/Width:	7619 ft / 150 ft	**VFR Approach/Landing:**	Forced landing

Wreckage and Impact Information

Crew Injuries:	1 Minor, 1 None	**Aircraft Damage:**	Substantial
Passenger Injuries:		**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	1 Minor, 1 None	**Latitude, Longitude:**	34.668888,-112.404441

Administrative Information

Investigator In Charge (IIC):	Stein, Stephen
Additional Participating Persons:	Darren Henley; FEDERAL AVIATION ADMINISTRATION; Scottsdale, AZ Henry Soderlund; Textron Aviation ; Wichita, KS Mike Caldera; Lycoming Engines; Williamsport, PA
Original Publish Date:	August 28, 2017
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB did not travel to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=93420