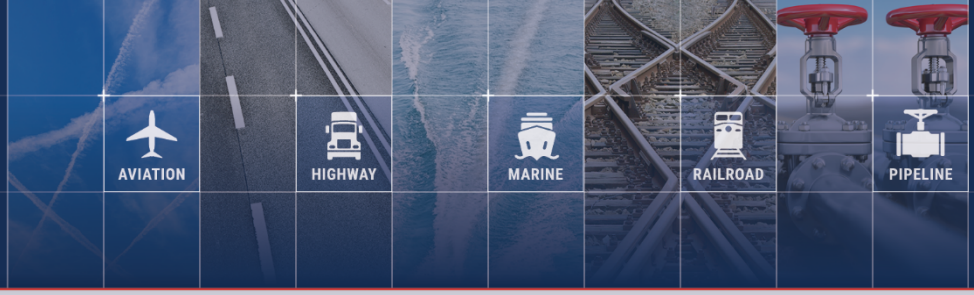

Aviation Investigation Final Report

Location:	Palo Alto, California	**Accident Number:**	WPR11FA403
Date & Time:	August 23, 2011, 09:40 Local	**Registration:**	N5779V
Aircraft:	Beech A23-24	**Aircraft Damage:**	Substantial
Defining Event:	Loss of engine power (total)	**Injuries:**	2 None
Flight Conducted Under:	Part 91: General aviation - Instructional		

Analysis

After about an hour of touch-and-go landings in the pattern, the student pilot switched the fuel selector from the right to the left fuel tank. Ten minutes later, after taking off and at 300 to 400 feet above ground level, the engine sustained a total loss of power. The flight instructor performed an off-airport landing on a dirt road. During the landing roll, the airplane's left wing struck a tree, causing the airplane to veer off the road. The previous day, flight in the airplane started with 40 gallons of fuel and it was flown for 1.5 to 2 hours. The next day, no fuel was added, and the student and instructor flew 1 hour in the pattern. The total fuel used for both flights was between 25.6 and 31.0 gallons. During the recovery of the airplane, 12 gallons of fuel were drained from the right fuel tank, and 2 cups of fuel were drained from the left. During the postaccident engine examination, fuel was supplied and the engine was successfully started and run with no mechanical malfunctions or failures that would have precluded normal operation of the fuel system or engine. Consequently, the loss of engine power was a result of fuel starvation when the student selected the empty fuel tank.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The student's and flight instructor's mismanagement of the fuel supply, resulting in a total loss of engine power due to fuel starvation.

Findings

Aircraft	Fuel - Fluid management
Personnel issues	Fuel planning - Flight crew
Environmental issues	Tree(s) - Not specified

Factual Information

History of Flight

Initial climb	Fuel starvation
Initial climb	Loss of engine power (total) (Defining event)
Emergency descent	Off-field or emergency landing
Landing-landing roll	Collision with terr/obj (non-CFIT)

HISTORY OF FLIGHT

On August 23, 2011, at 0940 Pacific daylight time, a Beech A23-24, N5779V, experienced a total loss of engine power and the Certified Flight Instructor (CFI) landed the airplane on a dirt road 2 miles north of Palo Alto Airport, Palo Alto, California. The CFI and student pilot operated the airplane under the provisions of Title 14 Code of Federal Regulations Part 91. The airplane was substantially damaged, and neither the CFI nor student pilot were injured. Visual meteorological conditions prevailed, and no flight plan had been filed. The local instructional flight originated at the Palo Alto Airport around 0830.

The day before the accident the student pilot/airplane owner stated that they had filled the airplane to 40 gallons and conducted a flight that lasted between 1.5 and 2.0 hours. During preflight prior to the accident, they observed that the right tank fuel level was at the tab, which corresponds to 15 gallons, and the left tank was well below the tab, and they estimated that there was 10 gallons of fuel remaining in the left tank. They took off with the right fuel tank selected, performed touch-and-goes, and about 50 minutes in to the flight the student switched the fuel selector to the left tank. Ten minutes later, on the up-wind leg, at 400 feet above ground level (agl), there was a complete loss of engine power. The CFI took control of the airplane, established best glide air speed, 79 kts, landed on a narrow dirt road, and the tip of the left wing struck a small tree causing the airplane to veer left off the road and into tall grass.

A Federal Aviation Administration inspector examined the airplane on scene and reported that a small amount of fuel was observed in the left fuel tank, and fuel was observed in the right fuel tank. There was no evidence of a fuel leak or breach of the fuel tanks. The engine was rotated by hand and thumb compression was achieved on all 4 cylinders. The gascolator screen was examined and was clear of debris. The fuel selector moved freely and the valve would seat itself in each detent. The master switch was activated and the fuel boost pump motor could be heard operating. During the recovery of the airplane, 12 gallons of fuel was drained from the right tank, and 2 cups of fuel were drained from the left.

PERSONNEL INFORMATION

The CFI, age 36, held a commercial pilot certificate issued on August 17, 2009, with airplane single-engine land, and instrument airplane ratings. He held a flight instructor certificate issued on August 12, 2010, with an airplane single-engine land rating. His third-class medical certificate, with no limitations, was issued on October 5, 2010. He reported that he has 620 hours of total flight time, and 280 hours of duel instruction given.

The student pilot, age 30, held a third-class medical certificate, with no limitations, issued on July 20, 2011. He reported he has 30 hours of total flight time, with the majority of that time accumulated within the last 90 days.

AIRCRAFT INFORMATION

The four-seat, low-wing, fixed gear airplane, serial number MA-38, was manufactured in 1966. It was powered by a Lycoming IO-360-A2B, 200-hp engine, and equipped with a McCauley fixed pitch propeller. The pilot reported that the airplane had a total airframe time of 3,563 hours at the time of the accident, and the last annual was performed on December 14, 2010. The engine's time since overhaul was 240 hours.

TESTS AND RESEARCH

On September 13, 2011, the airplane was examined by the NTSB investigator-in-charge. The wings of the airplane had been removed to facilitate aircraft recovery and transportation. There was no evidence of a fuel tank breach or fuel line leakage. The fuel selector rotated smoothly and clicked into place at each detent. The gascolator was clear of debris. In order to facilitate a functional test of the fuel system and engine, an external fuel reservoir was attached to both the left and right fuel tank lines located at each wing root. Fuel was observed to drain from the gascolator when the left or right tank was selected using the fuel selector valve in the cockpit. No fuel was observed to drain from gascolator when the fuel selector valve was in the OFF position. The engine was successfully started and run using this fuel source. It was run for 2 minutes at 2,250 rpm, with the fuel selector positioned on the right tank, then 2 minutes at 2,250 rpm with the left tank selected. Both left and right magnetos were isolated, and a 250 rpm drop was observed when switching from BOTH to LEFT or RIGHT magneto. The engine idled smoothly at 1,200 rpm.

Fuel Usage Calculations.

According to the Beechcraft Musketeer, A23-24, Pilot Operating Handbook, section V, Performance, the following information is provided.

For the fixed pitch propeller on a standard day at 2,500 ft msl, and (2,575 rpm) 75% brake horse power (BHP) fuel flow is 12.3 gallons per hour (GPH). At the same altitude with the engine running at 2,450 rpm (65% BHP) the fuel flow is 9.4 GPH.

Beechcraft technical representative provided the information that for landing pattern

operations, a fuel flow equivalent to 65% BHP provides a good estimate of fuel flow. At 2,500 feet msl fuel flow at 2,450 rpm (65% BHP) is 9.4 GPH.

The owner/student pilot stated that they started with 40 gallons of fuel the day before the accident, and flew between 1.5 and 2.0 hours the day before. A conservative fuel flow between 75% - 65% cruise power, would be approximately 10.8 GPH. That value could be applied to the 1.5-2.0 hour flight, and the result would be between 16.2 and 21.6 gallons of fuel used. The next day they flew 1 hour in the pattern, averaging 9.4 GPH, or a total of 9.4 gallons. Total fuel used could be calculated as between 25.6 and 31 gallons combining both flights. Starting with the original 40 gallons and subtract out the 12 gallons that was recovered from the airplane, the result is 28 gallons. Twenty-eight gallons falls between the total amounts of fuel used (25.6 - 31.0 gallons) for the combined flights the pilots flew between the 2 days.

Flight instructor Information

Certificate:	Commercial; Flight instructor	**Age:**	36,Male
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Right
Other Aircraft Rating(s):	None	**Restraint Used:**	
Instrument Rating(s):	Airplane	**Second Pilot Present:**	Yes
Instructor Rating(s):	Airplane single-engine	**Toxicology Performed:**	No
Medical Certification:	Class 3 Without waivers/limitations	**Last FAA Medical Exam:**	October 31, 2005
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	
Flight Time:	620 hours (Total, all aircraft), 6 hours (Total, this make and model), 580 hours (Pilot In Command, all aircraft), 150 hours (Last 90 days, all aircraft), 30 hours (Last 30 days, all aircraft), 3 hours (Last 24 hours, all aircraft)		

Student pilot Information

Certificate:	Student	**Age:**	30,Male
Airplane Rating(s):	None	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	
Instrument Rating(s):	None	**Second Pilot Present:**	Yes
Instructor Rating(s):	None	**Toxicology Performed:**	No
Medical Certification:	Class 3 Without waivers/limitations	**Last FAA Medical Exam:**	July 20, 2011
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	
Flight Time:	30 hours (Total, all aircraft), 5 hours (Total, this make and model), 30 hours (Last 90 days, all aircraft), 6 hours (Last 30 days, all aircraft), 3 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Beech	**Registration:**	N5779V
Model/Series:	A23-24	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Utility	**Serial Number:**	MA-38
Landing Gear Type:		**Seats:**	4
Date/Type of Last Inspection:	December 14, 2010 Annual	**Certified Max Gross Wt.:**	2550 lbs
Time Since Last Inspection:	10 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	3563 Hrs at time of accident	**Engine Manufacturer:**	LYCOMING
ELT:	Installed, not activated	**Engine Model/Series:**	IO-360
Registered Owner:	On file	**Rated Power:**	200 Horsepower
Operator:	On file	**Operating Certificate(s) Held:**	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	KPAO,7 ft msl	**Distance from Accident Site:**	2 Nautical Miles
Observation Time:	09:47 Local	**Direction from Accident Site:**	180°
Lowest Cloud Condition:	Clear	**Visibility**	15 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	6 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	20°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29.94 inches Hg	**Temperature/Dew Point:**	20°C / 16°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Palo Alto, CA (KPAO)	**Type of Flight Plan Filed:**	None
Destination:	Palo Alto, CA (KPAO)	**Type of Clearance:**	VFR
Departure Time:	08:30 Local	**Type of Airspace:**	

Airport Information

Airport:	Palo Alto KPAO	**Runway Surface Type:**	Asphalt
Airport Elevation:	7 ft msl	**Runway Surface Condition:**	Dry
Runway Used:	31	**IFR Approach:**	None
Runway Length/Width:	2443 ft / 70 ft	**VFR Approach/Landing:**	Traffic pattern

Wreckage and Impact Information

Crew Injuries:	2 None	**Aircraft Damage:**	Substantial
Passenger Injuries:		**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	2 None	**Latitude, Longitude:**	37.783332,-122.199996(est)

Administrative Information

Investigator In Charge (IIC):	McKenny, Van
Additional Participating Persons:	Nicole Amendolaro; Federal Aviation Administration; San Jose, CA Paul Yoos; Beechcraft; Wichita, KS
Original Publish Date:	January 15, 2013
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=81577