Aviation Investigation Final Report

Location:	BEDFORD, Massachusetts	**Accident Number:**	IAD00LA045
Date & Time:	May 27, 2000, 17:03 Local	**Registration:**	N66SB
Aircraft:	Beech A-36	**Aircraft Damage:**	Substantial
Defining Event:		**Injuries:**	1 None
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The pilot departed on a cross-country flight with an estimated 64 gallons of usable fuel onboard. About two hours into the flight, the pilot entered the traffic pattern at the destination airport and placed the fuel selector on the left tank. While on final approach, the engine stopped producing power. The pilot switched the fuel selector to the right main tank, and momentarily turned on the fuel boost pump switch. The pilot was unable to start the engine, and landed short of the runway. The pilot reported that there should have been 12 gallons of fuel in both the left and right main wing tanks. Examination of the airplane revealed that the left main tank, left tip tank, and right tip tank were empty. Approximately 20 gallons of fuel were drained from the right main tank. No mechanical deficiencies were noted with the engine or fuel system.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: the pilot's improper fuel management which resulted in fuel starvation.

Findings

Occurrence #1: LOSS OF ENGINE POWER(TOTAL) - NONMECHANICAL
Phase of Operation: APPROACH - VFR PATTERN - FINAL APPROACH

Findings
1. (C) FLUID,FUEL - STARVATION

2. (C) FUEL MANAGEMENT - IMPROPER - PILOT IN COMMAND

Occurrence #2: FORCED LANDING
Phase of Operation: DESCENT - EMERGENCY

Occurrence #3: IN FLIGHT COLLISION WITH TERRAIN/WATER
Phase of Operation: DESCENT - EMERGENCY

Factual Information

On May 27, 2000, at 1703 Eastern Daylight Time, a Beechcraft A-36 Bonanza, N66SB, was substantially damaged during a forced landing while on final approach to Runway 29 at Hanscom Field (BED), Bedford, Massachusetts. The certificated commercial pilot was not injured. Visual meteorological conditions prevailed for the flight that originated at Philadelphia International Airport (PHL), Philadelphia, Pennsylvania, about 1518. An instrument flight rules (IFR) flight plan was filed for the personal flight conducted under 14 CFR Part 91.

The pilot borrowed the 1976 A-36 Bonanza on May 22, 2000, while his 1999 A-36 Bonanza underwent maintenance. The 1976 A-36 had been modified with after market tip tanks, which had a 30-gallon capacity (14.5 gallons useable per side) fuel system. The main fuel tanks were configured with the 80-gallon capacity (37 gallons useable per side) optional fuel system.

According to the pilot's written statement, he said:

"I topped the mains with 39.3 gallons 100 LL at 6B6 [Stow, Massachusetts] on May 23 at tach time 3437.48. I then taxied to my hangar and put the airplane away with tach time 3437.50. On May 26, preflight inspection confirmed 36 gallons usable left main, 37 usable right main, and empty tip tanks. I started the engine at [1030] and flew from 6B6 to PHL, operating at 23 [inches manifold pressure]/2300 rpm/20 degrees rich of peak, with the fuel selector LEFT 59 minutes and RIGHT 67 minutes, and shut down the engine in front of Atlantic Aviation at [1236] with a tach reading of 3439.69.

"I departed PHL [on May 27, 2000] with at least 64 gallons of usable of what appeared to be 100 LL Avgas aboard. The tip tanks were topped off with 29 gallons of fuel at PHL, and the main tanks were half full. I dipsticked the main tanks and cross checked the gauges - both main electric, one switchable tip electric, two tip sights. I also performed a common sense check of the fuel levels in the mains against predicted levels based on the flying and tank switches that I had logged since the last time I had topped the mains.'

"I started the engine at [1456]. Engine run-up (normal) and departure were with the fuel selector RIGHT, I departed [PHL] at [1518]."

The pilot reported that he leveled off at an intermediate altitude of 4,000 feet, then a final cruising altitude of 7,000 feet. The engine was operated at 23 inches of manifold pressure and 2300 RPM. During the flight the pilot transferred fuel from both tip tanks to the main wing tanks. According to his written statement, he said:

"At [1538], I switched the fuel selector to LEFT"

"At [1540]....I observed a right main gauge reading of 3/8+ and I turned ON the right tip tank pump."

"At [1544], I observed a left main gauge reading of 5/8 and I turned on the left tip tank pump."

"At [1622], the fuel level in the left tip tank sight gauge had fallen below the bottom of that gauge, and the left main gauge remained at 5/8, confirming transfer from the left tip to the left main. I turned the left tip tank pump OFF."

"At [1630], I switched the fuel selector to RIGHT."

"At [1640], the fuel level in the right tip tank sight gauge had fallen below the bottom of that gauge, and the right main gauge had moved up significantly, confirming transfer from right tip tank to right main. I turned the right tip tank pump OFF."

"At [1655], I switched the fuel selector to LEFT."

In a telephone interview, the pilot said:

"It was a normal flight and it was VMC the entire route. There were no problems until I was on final for Runway 29 at BED. As I rolled wings level onto final, I completed the pre-landing checklist, which included placing the fuel selector on the fullest tank, which was the left tank. I noticed I was high on the VASI, so I reduced my manifold pressure by 1 [inch]. When I reduced the manifold pressure, the engine went completely silent. There was no roughness, jerking, shaking, or vibration. It got real quiet. I simultaneously turned the fuel selector valve to the right main tank position, then a quick burst of the fuel pump. I maintained a safe glide speed of 85 knots, and announced a MAYDAY over the BED tower frequency. The engine did not restart, and I knew I was not going to make the runway and kept the aircraft level going into the trees. I was approximately 500 agl when engine power was lost. The landing was soft through the trees, but abrupt on the ground. The aircraft landed on the bank of the Shawsheen River and the engine and right wing were partially submerged. I exited the aircraft and was not injured."

The pilot also reported that he saw fuel draining from the right main tank fuel filler cap on the right wing after it had already been immersed in the water.

Additionally, the pilot provided a fuel log for the airplane from May 22-27, 2000. He reported that on May 22, 2000, when he borrowed the airplane, the tachometer time was 3435.35, and there was a total of 72 gallons of useable fuel (36 gallons in each main tank) onboard the airplane. On May 23, 2000, at a tachometer time of 3437.50, the main wing tanks were topped off with 39.3 gallons of fuel at 6B6. The tip tanks were empty. On May 26, 2000, the airplane departed 6B6 with 73 gallons of useable fuel (36.5 gallons in each main tank) and flew to PHL. The tip tanks were empty. On May 27, 2000, at a tachometer time of 3439.69, 29 gallons of fuel were added to the tip tanks in PHL. The main tanks were about half full.

The tachometer read 3441.81 at the accident site.

A Federal Aviation Administration (FAA) inspector interviewed the pilot on the day of the accident. According to the inspector, the pilot reported that there should have been 12 gallons of fuel remaining in both the left and right main tanks.

The inspector also performed an on-site examination the day of the accident. The inspector reported that the airplane was partially submerged in the river. The right wing was totally submerged, and the outboard section of the left wing and empennage were out of the water. The inspector did not observe any fuel spillage or fuel odor, even though the fire department reported a fuel leakage. The airplane was recovered from the river and moved to a storage facility where the inspector performed follow-up examinations.

On May 30, 2000, the FAA inspector examined the airplane at the storage facility. The inspector reported that approximately 20 gallons of light blue fuel was drained from the right main tank along with a small amount of residual water.

The leading edges on both wings, the right wing rear spar, engine mount, and firewall were damaged from impact. Damage was also noted on the flaps, left aileron, lower wing skin, landing gear doors, engine cowling, and one propeller blade was bent aft.

The left tip tank, left main tank, and right tip tank were empty and intact. The left main tank was filled with water and checked for leaks. No leaks were noted. The left tip tank exhibited impact damage and the fuel drain valve had separated from the tank. Fuel staining was noted around the area where the fuel drain valve was missing. According to the FAA inspector, the fuel drain valve appeared to have separated from the tip tank during the impact with trees.

The fuel selector valve was found in the right main tank position and was secured in the detent. The fuel selector valve moved freely and a positive detent was noted for each position. Fuel was found in the auxiliary fuel sump drain and in the fuel-metering valve. Engine and valve train continuity were established by manual rotation of the propeller.

The inspector applied power to the airplane, and both the left and right tip tank fuel pumps operated. The auxiliary engine fuel pump, which had been submerged in water, was inoperative when tested. The engine driven fuel pump drive coupling was intact.

On June 20, 2000, the FAA inspector functionally tested the fuel check valve from the left wing. According to the inspector, the valve was installed correctly and no discrepancies were found. Air was introduced into all three-fuel vents and no obstructions were found in the system.

The inspector also noted that the left wing was still filled with water. This water was drained from the tank (the right wing tank was already empty), and power was applied to the airplane. The left fuel gauge indicated 1/8ths full, and the right fuel gauge indicated empty.

According to the Beechcraft A-36 Bonanza Pilot Operating Handbook, section 5, pg. 5-22, cruise power settings at 65 percent maximum continuous power at 2300 RPM and 3400-pounds, an estimated fuel flow would have been about 13.3 gallons per hour.

The pilot reported 1,482 total flight hours; 487 hours in make and model, of which 7.5 hours were in the accident airplane.

Pilot Information

Certificate:	Commercial	**Age:**	50,Male
Airplane Rating(s):	Single-engine land; Single-engine sea	**Seat Occupied:**	Front
Other Aircraft Rating(s):	None	**Restraint Used:**	
Instrument Rating(s):	Airplane	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	No
Medical Certification:	Class 2 Valid Medical--w/ waivers/lim	**Last FAA Medical Exam:**	February 10, 2000
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	
Flight Time:	1482 hours (Total, all aircraft), 487 hours (Total, this make and model), 1270 hours (Pilot In Command, all aircraft), 68 hours (Last 90 days, all aircraft), 18 hours (Last 30 days, all aircraft), 2 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Beech	**Registration:**	N66SB
Model/Series:	A-36 A-36	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	E921
Landing Gear Type:	Retractable - Tricycle	**Seats:**	4
Date/Type of Last Inspection:	May 22, 2000 Annual	**Certified Max Gross Wt.:**	3600 lbs
Time Since Last Inspection:		**Engines:**	1 Reciprocating
Airframe Total Time:	3442 Hrs	**Engine Manufacturer:**	Continental
ELT:	Installed	**Engine Model/Series:**	IO-520
Registered Owner:	HAWTHORNE AVIATION, INC	**Rated Power:**	285 Horsepower
Operator:		**Operating Certificate(s) Held:**	None
Operator Does Business As:		**Operator Designator Code:**	

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	BED ,123 ft msl	**Distance from Accident Site:**	1 Nautical Miles
Observation Time:	17:05 Local	**Direction from Accident Site:**	110°
Lowest Cloud Condition:	Scattered / 8500 ft AGL	**Visibility**	30 miles
Lowest Ceiling:	Broken / 25000 ft AGL	**Visibility (RVR):**	
Wind Speed/Gusts:	12 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	320°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29 inches Hg	**Temperature/Dew Point:**	20°C / 7°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	PHILADELPHIA , PA (PHL)	**Type of Flight Plan Filed:**	IFR
Destination:	(BED)	**Type of Clearance:**	
Departure Time:	15:18 Local	**Type of Airspace:**	Class D

Airport Information

Airport:	HANSCOM FIELD BED	**Runway Surface Type:**	Asphalt
Airport Elevation:	123 ft msl	**Runway Surface Condition:**	Dry
Runway Used:	29	**IFR Approach:**	None
Runway Length/Width:	7001 ft / 150 ft	**VFR Approach/Landing:**	Forced landing

Wreckage and Impact Information

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

Administrative Information

Investigator In Charge (IIC):	Yeager, Leah
Additional Participating Persons:	DONALD LEVESQUE; BEDFORD , MA
Original Publish Date:	December 18, 2001
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=49295