Aviation Investigation Final Report

Location:	Williston, North Dakota	**Accident Number:**	CEN11FA508
Date & Time:	July 25, 2011, 20:36 Local	**Registration:**	N41MK
Aircraft:	Beech A36	**Aircraft Damage:**	Substantial
Defining Event:	Loss of engine power (partial)	**Injuries:**	1 Fatal, 1 Serious
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The passenger reported that the purpose of the local flight was to take low-altitude aerial photographs of nearby ground structures and that, shortly before the accident, the pilot remarked that the engine was not operating normally and asked him to look for a suitable landing area. He believed that the engine was still running at that time. The pilot located an open landing area and was in the process of landing when the right wing collided with terrain. During the postaccident examination, about 18 gallons of usable fuel was recovered from the left wing fuel tank, and no usable fuel was recovered from the right wing fuel tank. The observed damage to the propeller blades was indicative of the engine producing at least idle power at the time of the accident. A postaccident examination of the airplane revealed no evidence of mechanical malfunctions or failures that would have precluded normal operation. Additionally, the engine demonstrated the ability to produce rated horsepower during an operational test run. A review of fueling records and recorded engine data from previous flights established that the partial loss of engine power was likely due to fuel starvation and not from a mechanical malfunction of the engine. Although the fuel selector was found positioned to draw fuel from the left wing fuel tank, it is likely that the pilot repositioned the selector from the right wing fuel tank when he detected the engine problem. Because he was maneuvering at a low altitude, the airplane likely had insufficient altitude and time to reestablish fuel flow and restore engine power.

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 and a partial loss of engine power while maneuvering at a low altitude.

Findings

Aircraft	Fuel - Fluid management
Aircraft	Fuel distribution - Incorrect use/operation
Personnel issues	Use of equip/system - Pilot

Factual Information

History of Flight

Maneuvering-low-alt flying	Fuel starvation
Maneuvering-low-alt flying	Loss of engine power (partial) (Defining event)
Landing	Off-field or emergency landing
Landing	Collision with terr/obj (non-CFIT)

On July 25, 2011, at 2036 central daylight time, a Beech model A36 airplane, N41MK, was substantially damaged when it collided with terrain during a forced landing near Williston, North Dakota. The pilot was fatally injured. The passenger sustained serious injuries. The airplane was registered to and operated by Bonanza Air Incorporated under the provisions of 14 Code of Federal Regulations Part 91 without a flight plan. Day visual meteorological conditions prevailed for the local flight that departed Sloulin Field International Airport (ISN), Williston, North Dakota, about 2018.

According to the passenger, the purpose of the flight was to take aerial photographs of a nearby oil well installation and a cabin belonging to a relative of the pilot. The passenger arrived at the departure airport around 2000 and observed the pilot perform a preflight inspection of the airplane. After departure, the flight proceeded eastbound to photograph the oil well installation. The passenger noted that the entire flight was flown at a low altitude and that his photos were taken from the right cockpit passenger seat. After taking several photos of the oil well installation the flight proceeded to overfly the cabin. The passenger recalled that shortly before the accident, the pilot remarked that the engine was not operating normally and asked him to look for a suitable landing area. He believed that the engine was still running at that time. The pilot located an open landing area and was in the process of landing when the right wing collided with the terrain. The passenger noted that the airplane slid for a short distance and that he was able to pull himself out of the airplane before calling 911 for assistance.

A foreman working at a nearby oil drilling installation stated that he and two of his employees saw the airplane flying at a low altitude over their worksite. He noted that the airplane's altitude was comparable to those flown by aerial-application airplanes during crop-dusting operations. He could not recall if the engine was operating as it passed his position. He noted that the airplane was flying straight-and-level before it collided with the terrain. He responded immediately to the accident site and provided assistance to the passenger until the arrival of emergency personnel. He also noted that he attempted to stop a fuel leak on the right wing using several towels.

Pilot Information

Certificate:	Private	**Age:**	53
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:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	Class 3 With waivers/limitations	**Last FAA Medical Exam:**	February 16, 2010
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	November 4, 2010
Flight Time:	1721.4 hours (Total, all aircraft), 1595.9 hours (Total, this make and model), 25.5 hours (Last 90 days, all aircraft), 17.7 hours (Last 30 days, all aircraft), 3.2 hours (Last 24 hours, all aircraft)		

According to Federal Aviation Administration (FAA) records, the pilot, age 53, held a private pilot certificate with single engine land airplane and instrument airplane ratings. His last aviation medical examination was completed on February 16, 2010, when he was issued a third-class medical certificate with a restriction for corrective lenses. A search of FAA records showed no previous accidents, incidents, or enforcement proceedings.

The most recent pilot logbook entry was dated July 24, 2011. At that time, the pilot had accumulated 1,721.4 hours total flight time. The logbook indicated that all of his flight experience had been completed in single-engine land airplanes, which included 1,595.9 hours in the accident airplane. He had logged 129.7 hours during the past year, 59.8 hours during the prior 6 months, 25.5 hours during previous 90 days, and 17.8 hours in the last 30 days. The logbook indicated that he had flown 3.2 hours within the 24 hour period before the accident. The pilot's last flight review was completed on May 8, 2009, in the accident airplane. The logbook included an instructor endorsement to operate complex airplanes, which was dated November 4, 2010. (FAA guidance stipulated that a complex endorsement would also qualify for a flight review, although regulations require that both items be identified on the instructor's logbook endorsement.)

Aircraft and Owner/Operator Information

Aircraft Make:	Beech	**Registration:**	N41MK
Model/Series:	A36	**Aircraft Category:**	Airplane
Year of Manufacture:	1975	**Amateur Built:**	
Airworthiness Certificate:	Utility	**Serial Number:**	E-662
Landing Gear Type:	Retractable - Tricycle	**Seats:**	6
Date/Type of Last Inspection:	September 29, 2010 Annual	**Certified Max Gross Wt.:**	4000 lbs
Time Since Last Inspection:	179.27 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	6172.27 Hrs at time of accident	**Engine Manufacturer:**	Continental Motors
ELT:	C91 installed, not activated	**Engine Model/Series:**	IO-550-C
Registered Owner:	Bonanza Air, Inc.	**Rated Power:**	300 Horsepower
Operator:	Bonanza Air, Inc.	**Operating Certificate(s) Held:**	None

The accident airplane was a 1975 Beech model A36 airplane, serial number E-662. A 300-horsepower Continental Motors model IO-550-C (8)CB4 reciprocating engine, serial number 824409-R, powered the airplane. The stock engine had been modified with a turbo-normalizing induction system that was installed by Tornado Alley Turbo under the provisions of FAA Supplemental Type Certificate No. SA5223NM. The airplane was equipped with a constant-speed, three blade, Hartzell model PHC-C3YF-1RF propeller. The airplane had a retractable tricycle landing gear, could seat six individuals, and had a certified maximum gross weight of 4,000 pounds.

The accident airplane was issued a standard airworthiness certificate on March 11, 1975. The current owner-of-record, Bonanza Air Incorporated, purchased the airplane on July 18, 2005.

The recording tachometer indicated 6,172.27 hours at the accident site. The airframe had accumulated a total service time of 6,172.27 hours at the time of the accident. The engine had accumulated a total service time of 2,619.17 hours at the time of the accident. The engine had accumulated 711.27 hours since a field overhaul on August 1, 2008. The engine had accumulated 115.27 hours since a top-overhaul that was completed on January 7, 2011. The propeller had accumulated a total service time of 321.27 hours at the time of the accident. The last annual inspection of the airplane was completed on September 29, 2010, at 5,993.0 total airframe hours.

A postaccident review of the maintenance records found no history of unresolved airworthiness issues.

A review of fueling records established that on July 24, 2011, the airplane fuel tanks were topped-off (74 gallons useable) with 60.3 gallons of aviation fuel before the pilot departed on a 3.1 hour cross-country flight from Rocky Mountain Metropolitan Airport (BJC), Denver, Colorado, to Sloulin Field International Airport (ISN), Williston, North Dakota. According to available fueling records, the airplane was not refueled following the cross-country flight. The accident occurred during the airplane's first flight since completing the 3.1 hour cross-country flight between BJC and ISN.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	ISN,1982 ft msl	**Distance from Accident Site:**	17 Nautical Miles
Observation Time:	20:52 Local	**Direction from Accident Site:**	272°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	10 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	110°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29.84 inches Hg	**Temperature/Dew Point:**	26°C / 14°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Williston, ND (ISN)	**Type of Flight Plan Filed:**	None
Destination:	Williston, ND (ISN)	**Type of Clearance:**	None
Departure Time:	20:18 Local	**Type of Airspace:**	Class G

The nearest aviation weather reporting station was located at the Sloulin Field International Airport (ISN), Williston, North Dakota, about 19.5 miles west of the accident site. At 2052, the ISN weather observing system reported: wind 110 degrees at 10 knots, 10 miles visibility, clear sky conditions, temperature 26 degrees Celsius, dew point 14 degrees Celsius, and an altimeter setting of 29.84 inches-of-mercury.

Wreckage and Impact Information

Crew Injuries:	1 Fatal	**Aircraft Damage:**	Substantial
Passenger Injuries:	1 Serious	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	1 Fatal, 1 Serious	**Latitude, Longitude:**	48.168888,-103.213607

A postaccident investigation confirmed that all airframe structural and flight control components were located at the accident site. The accident site consisted of open, rolling terrain. The wreckage debris path began about 109 feet west of the main wreckage and consisted of navigational lens cover fragments. There was a large ground depression located about 20 feet from the initial debris. The main wreckage consisted of the entire airframe, flight controls, engine, and propeller. The main wreckage was facing a heading of south. The topography of the accident site and orientation of the wreckage resulted in the right wing being higher than the left wing.

Flight control continuity was established between the individual flight control surfaces and their respective cockpit controls. The flaps and landing gear were fully retracted. The throttle, propeller, and mixture controls were found in the full forward position. Mechanical continuity was confirmed from the engine components to their respective cockpit engine controls. The magneto-ignition switch was found in the LEFT position. The electrical fuel pump was found in the OFF position. The fuel selector valve was positioned to draw fuel from the left wing fuel tank. About 21 gallons of fuel (18 gallons useable) was recovered from the left wing fuel tank. The left wing tank appeared undamaged with no visible fuel leaks. The right wing tank contained minimal fuel, estimated to be about 1 gallon, all of which was found in the fuel tank's inboard baffle compartment. The integrity of the right wing fuel tank had been breached by several punctures that were located about midspan. The fuselage fuel-sump strainer contained a liquid consistent in appearance and odor with 100-low lead aviation fuel that was void of water and particulate contamination.

The engine remained partially attached to the firewall and the propeller remained attached to the crankshaft flange. Internal engine and valve train continuity was confirmed as the engine crankshaft was rotated. Compression and suction were noted on all cylinders in conjunction with crankshaft rotation. The upper spark plugs were removed and exhibited features consistent with normal engine operation. Both magnetos provided spark on all leads when rotated. The throttle and fuel control assembly had separated from the engine during the accident. The intake ducting from the air filter to the throttle control was not obstructed by debris. The engine-driven fuel pump functioned when rotated. The fuel supply line to the fuel manifold valve contained a liquid consistent in appearance and odor with 100-low lead aviation fuel. The turbine, compressor, and center housing remained intact. The turbocharger shaft rotated freely by hand. The compressor contained debris consistent with the ingestion of vegetation during the impact sequence. The exhaust wastegate was found in the open position. Two of the three propeller blade tips exhibited leading edge gouges and chordwise scratching.

The postaccident examination of the airframe and engine revealed no evidence of mechanical malfunctions or failures that would have precluded normal operation.

The engine was shipped to the manufacturer for an operational test run. The electronic fuel flow indicator and engine monitoring system were retained for nonvolatile data readouts.

Medical and Pathological Information

On July 27, 2011, an autopsy was performed on the pilot at the North Dakota State Forensic Examiner's Office, located in Bismarck, North Dakota. The cause of death for the pilot was attributed to multiple blunt-force injuries sustained during the accident.

The FAA Civil Aerospace Medical Institute (CAMI), located in Oklahoma City, Oklahoma, performed toxicology tests on samples obtained during the pilot's autopsy. No carbon monoxide, cyanide, or ethanol was detected in samples tested. Ibuprofen was detected in urine. Ibuprofen, sold under multiple brand names, is a nonsteroidal anti-inflammatory analgesic drug.

Tests and Research

--- Engine Operational Test Run ---

The engine was sent to the manufacturer for an operational test run under the supervision of the National Transportation Safety Board (NTSB) Investigator-In-Charge. The engine was installed in a test cell and outfitted with a test club propeller. The engine started on the first attempt and idled without excessive fluctuations in engine rpm. The engine speed was increased incrementally to full throttle (2,575 rpm) over a period of 25 minutes. The engine ran at each incremental power setting for a period of 5 minutes without anomaly. The engine throttle was cycled several times between idle and maximum power settings in quick succession. The engine did not experience any hesitation, stumbling, or interruption in engine operation during the test run. The engine demonstrated the ability to produce rated horsepower during the operational test run.

--- Engine Monitoring System ---

The airplane's engine monitoring system, a JPI model EDM-700, was examined at the NTSB Vehicle Recorders Laboratory in Washington, D.C. The device contained about 25 hours of engine data that had been recorded over 18 power cycles. The accident flight was the last dataset recorded and contained 1,194 seconds (about 20 minutes) worth of engine data. A review of the recovered engine data revealed an average increase of 225 degrees in exhaust gas temperatures (EGT) and the turbine inlet temperature (TIT) during a 24 second period before there was significant decrease to all EGT, TIT, and engine oil temperature values. All of the engine temperature values continued to decrease until there was a power interruption to the device, which occurred about 55 seconds after the temperature values had peaked.

--- Electronic Fuel Flow Indicator ---

The electronic fuel flow indicator, a Shadin model Microflo-L, was examined at the NTSB Vehicle Recorders Laboratory. The fuel flow indicator did not interface with the airplane's fuel quantity indicating system. In order to properly indicate the amount of fuel available, the unit required the pilot to correctly enter or verify the actual fuel load before each engine startup. All subsequent fuel readings were based on fuel flow to the engine. The fuel flow indicator contained non-volatile memory for the amount of fuel remaining and the amount of fuel used since the last time the device had been programmed. These retained values were obtained by applying electrical power to the device and viewing the display. The values obtained for fuel-used and fuel-remaining were 3.9 gallons and 70.0 gallons, respectively. Fueling records established that the airplane had not been refueled before the accident flight. Additionally, the airplane fuel system did not contain 70 gallons of fuel at the accident site. The fuel flow indicator was equipped with a toggle-switch that upon deflection would automatically reset the fuel quantity to a "FULL" indication. The retained value for fuel-used (3.9 gallons) was consistent with the amount of fuel that was likely consumed during the accident flight.

--- Fuel Consumption Rate Calculations ---

The accident airplane had an 80 gallon fuel capacity (74 gallons usable) that was distributed evenly between two 40 gallon wing fuel tanks. During the on-scene investigation, 18 gallons of useable fuel

was defueled from the left wing tank. The right wing tank was void of useable fuel. According to available flight tracking and engine monitoring system data, the airplane engine had been operating at least 3.4 hours since the last refueling. Considering the useable fuel recovered from the airplane, the average fuel consumption since the last refueling was calculated to be about 16.5 gallons per hour (gph). A review of the previous 18 flight legs established that the airplane had an average fuel consumption rate of about 17.4 gph. Additionally, the airplane's co-owner further corroborated that the airplane's average fuel consumption rate was about 17.4 gph.

According to engine performance data, the expected fuel consumption rate during takeoff and cruise-climb was 35 gph. The expected fuel consumption rate during cruise flight, at a lean-of-peak mixture setting, could vary between 13.5 and 17.0 gph depending on the selected engine rpm.

Administrative Information

Investigator In Charge (IIC):	Fox, Andrew
Additional Participating Persons:	John G Vold; Federal Aviation Administration - Fargo FSDO; Fargo, ND Paul E Yoos; Hawker Beechcraft Corporation; Wichita, KS Rodney M Martinez; Continental Motors, Inc.; Mobile, AL
Original Publish Date:	July 9, 2014
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=81233