Aviation Investigation Final Report

Location:	Ravenna, Ohio	**Accident Number:**	CEN11FA340
Date & Time:	May 10, 2011, 17:57 Local	**Registration:**	N9149R
Aircraft:	Mooney M20R	**Aircraft Damage:**	Substantial
Defining Event:	Fuel starvation	**Injuries:**	3 Serious
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The pilot and pilot-rated passenger reported that the airplane's engine lost power while in level flight. The pilot reported that he switched fuel tanks and attempted two engine restarts to no avail. A forced landing was attempted, and the airplane's right wing struck a tree at the edge of the field. Both the pilot and pilot-rated passenger reported that the flight began with about 70 gallons of fuel on-board. The pilot reported that about 60 gallons remained (30 gallons in each tank) when the power loss occurred. After the accident, the left wing fuel tank was nearly full, and about 40 gallons of the 44.5 gallons of usable fuel was drained from that tank. There was no fuel in the right tank because it was ruptured and the right wing separated. The fuel selector was found positioned to the right fuel tank. A subsequent examination of the airplane, including a thorough inspection of the airplane's fuel system, was conducted and no pre-impact anomalies were found. A functional test of the engine was performed, and no defects in operation were noted. The most recent fueling of the airplane was performed during the airplane's annual inspection about 2 months prior to the accident when the airplane was filled with the maximum usable fuel. Based on fuel consumption figures obtained from the engine manufacturer the amount of time recorded on the hour meter, and the engine's performance during the postaccident engine run, it is likely that the fuel supply in the right wing fuel tank was exhausted, which led to the loss of 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 a loss of engine power due to fuel starvation.

Findings

Aircraft	Fuel - Fluid management
Aircraft	Fuel - Fluid level

Factual Information

History of Flight

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

HISTORY OF FLIGHT

On May 10, 2011, about 1757 eastern daylight time, a Mooney M20R, N9149R, struck trees and terrain during a forced landing after a loss of engine power. The pilot and two passengers received serious injuries. The airplane sustained substantial damage. The airplane was registered to 2201 Inc, Akron, Ohio, and was operated by a private pilot under the provisions of 14 Code of Federal Regulations Part 91 as a personal flight. Visual meteorological conditions prevailed for the flight, which operated without a flight plan. The local flight originated from the Akron Fulton International Airport (AKR), Akron, Ohio. The departure time was estimated to be 1745.

The pilot reported that the flight was a local flight for the purpose of demonstrating the airplane to potential shareholders. He reported that the airplane had 70 gallons of fuel on-board before the flight and that all pre-flight checks were satisfactory. He stated that they performed one takeoff and landing sequence, remaining in the AKR traffic pattern. A second takeoff was performed and the pilot departed the AKR airport area and flew east to demonstrate the avionics of the airplane. He stated that he climbed to 3,200 feet and set the autopilot. He stated that when the airplane was between the Kent State University Airport (1G3), and the Portage County Airport, Ravenna, Ohio (POV, formerly 29G), the engine suddenly stopped. He reported that he switched fuel tanks and attempted two engine restarts to no avail. A forced landing to a field was attempted. The pilot reported that the right wing struck a tree during the attempted forced landing. In an interview with a law enforcement officer after the accident, the pilot estimated having about 30 gallons of fuel in each of the two wing fuel tanks when the power loss occurred.

A passenger in the airplane, who was also a certificated pilot, also reported that the airplane had about 70 gallons of fuel on board before the flight. He reported the same series of events as the pilot. The passenger noted that he could hear the engine trying to run and making noise after it stopped developing power.

A witness who was the first on-scene after the crash reported that the airplane was not making any noise prior to its impact with the tree. When the airplane's right wing hit the tree, it was ripped from the fuselage. The witness did not see any fuel plume or cloud coming from the wing and she did not recall any smell of fuel at the accident site; however in a previous

statement to law enforcement she did note the smell of fuel at the accident site.

Another witness who was the second person on-scene reported seeing the airplane prior to striking the tree. He reported that he could hear the engine attempting to run and making noise. He lost sight of the airplane before it struck the tree. He reported that there was a strong fuel odor at the accident site.

PERSONNEL INFORMATION

The pilot held a private pilot certificate with airplane single engine land and instrument airplane ratings. He reported having 1045 hours total flight experience including 820 hours in the same make and model airplane as the accident airplane. His most recent flight review was completed on June 15, 2010. He also held a third class medical certificate that was issued on May 11, 2010. The medical certificate listed no limitations.

AIRCRAFT INFORMATION

The airplane involved in the accident, N9149R, was a 1994 Mooney, model M20R, bearing serial number 29-0004. It was a single-engine, low-wing monoplane with retractable tricycle landing gear. It could seat four occupants and was constructed predominately of aluminum. The airplane was powered by a Continental Motors, model IO-550-G engine, bearing serial number 679075. The engine was rated to produce 280 horsepower.

According to aircraft maintenance records, the airplane had undergone an annual inspection on March 1, 2011. The recording hour meter reading at the time of the inspection was 2,048.1 hours. According to the entry, the airplane had accumulated 2049.1 hours, and the engine had accumulated 842.9 hours since its most recent overhaul. At the time of the accident the airplane’s recording hour meter read 2050.4.

METEOROLOGICAL INFORMATION

At 1758, the weather conditions recorded at POV were: wind from 120 degrees at 7 knots; visibility 10 miles; broken clouds at 9,000 feet agl; temperature 23 degrees Celsius; dew point 4 degrees Celsius; altimeter 29.90 inches of mercury.

WRECKAGE AND IMPACT INFORMATION

The airplane wreckage was removed from the accident site and transported to AKR for subsequent examination. According to the Federal Aviation Administration inspector that was on-site during the airplane's recovery, the left wing tank was nearly full of fuel and an estimated 40 gallons of fuel was removed from the left fuel tank prior to transport.

On June 2, 2011, an examination was conducted with the NTSB investigator in charge present. The airplane was stored on a trailer in a hangar at AKR. Examination of the airplane was

conducted with the airplane on the trailer. The fuselage exhibited extensive damage in the cabin section. The cabin roof had been separated from the airplane and the fuselage was buckled. The tail surfaces were not attached to the airplane during the examination. The left wing was on the trailer beneath the fuselage. The right wing was on the floor of the hangar. The left wing exhibited minimal impact damage. A portion of the right wing remained attached to the fuselage. Evidence of upward bending of the wing was present. The right wing fuel tank was compromised and no fuel remained. The interior of the fuel bay was totally exposed where the outboard portion of the wing had separated. The tail surfaces were examined and the left horizontal stabilizer and elevator exhibited minimal impact damage. The right horizontal stabilizer was bent upward at the tip about 30 degrees. The elevator was bent downward. The left elevator remained attached to the stabilizer by the inboard 2 hinges (4 hinges per side). The rudder and vertical stabilizer exhibited minimal impact damage.

Fuel System

The fuel strainer within the right wing tank was clean and unobstructed. The left wing tank fuel strainer was also clean and unobstructed. The fuel selector valve was removed from the airplane. The handle had broken loose from the valve. The valve was in the detent and positioned on the right fuel tank selection which was verified by blowing air through the valve. The gascolator bowl was removed and the internal screen examined. No obstruction of the gascolator was evident. The electric fuel pump was inaccessible but air was blown through the fuel lines and the electric pump exhibited no obstruction. The electric fuel pump was not tested electrically. The mechanical fuel pump was removed from the engine in order to verify engine valve train and accessory gear continuity. A fuel line fitting on the fuel pump had fractured and was replaced for the subsequent functional test of the engine. No anomalies with the mechanical fuel pump were evident except for the fractured fitting already mentioned.

Engine

The engine mounts were broken, but the engine remained in place and was strapped down for the functional test. A tear in the oil pan was found and was sealed using an epoxy compound for the functional test.

Prior to the functional test, the following steps were completed:
1. The upper spark plugs were removed and no anomalies were noted
2. The engine was examined with a lighted borescope and no anomalies noted
3. The engine was rotated and valve train and accessory gear continuity was confirmed
4. A compression check verified suction, compression and valve action on all cylinders. (The rocker arm covers had been removed for this check)
5. Magneto timing was checked and verified to be 22 degrees before top dead center (BTDC).
6. The fuel pump was reinstalled and plumbed to a fuel source. The fuel source contained fuel that was drained from the left wing tank at the accident site. The fuel source also had an air driven pump that was used to prime the engine for start up.
7. The propeller governor was removed and a block off plate installed on the engine mounting

pad.
8. The spark plugs were reinstalled and spark plug wires connected.
9. The rocker covers were reinstalled.
10. The remaining 2 propeller blades were cut off to the same approximate length as the one that had been cut for transport.

After completing the above steps, the airplane was strapped to the trailer, and the engine also secured with a strap. The trailer was pulled out of the maintenance hangar and the trailer wheels blocked. A battery was connected to the engine starter using jumper cables to crank the engine. The engine started on the second attempt. The engine was run for about 2 to 3 minutes at various engine speeds. The engine idled and accelerated without anomaly or hesitation. No defects in engine operation were noted. Due to the shortened prop and broken engine mounts, the engine functional test was limited for safety reasons; however, no defects in operation were noted.

The airplane's fuel flow instrument and engine analyzer were removed from the airplane for download of any data that may have been stored in non-volatile memory. The fuel flow instrument allowed the pilot to manually reset the "fuel used" parameter when fuel was added to the airplane. The data downloaded indicated that 267 gallons of fuel was used since the last reset. This exceeded the total fuel quantity that the airplane's fuel tanks would hold, indicating that the parameter had not been reset. The engine analyzer stored data for exhaust gas temperature, cylinder head temperature and battery voltage. The recovered data showed a sharp decline in both exhaust gas temperature and cylinder head temperature during the accident flight. This decline in temperatures was indicative of a reduction in power; however no other data parameters were recorded that would that could aid in the investigation.

ADDITIONAL INFORMATION
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he mechanic that performed the most recent annual inspection of the airplane reported that the airplane was fueled with the maximum usable fuel quantity (44.5 gallons in each wing tank) in order to weigh the airplane for weight and balance purposes. There was no additional evidence provided by the pilot or owners indicating that fuel had been added to the airplane subsequent to the annual inspection. The airplane's recording hour meter indicated that the airplane had been operated for a total of 2.3 hours since the annual inspection. According to information provided by the airplane manufacturer, the recording hour meter records engine time based on engine RPM. At 2,500 rpm, the hour meter would record one hour for each hour of operation. At lower RPMs, the hour meter will record a proportionally lower amount of time for each hour of operation. For example, at 1,250 RPM, the hour meter would record 0.5 hours for each hour of operation at that RPM level.

The engine manufacturer provided fuel system adjustment information that indicated at full rich mixture the engine would burn between 21.3 and 22.1 gallons per hour at 2,500 RPM. The Pilot's Operating Handbook/Airplane Flight Manual (AFM) listed best power fuel consumption at 75% power setting, 2,500 RPM, and leaned to 50 degrees rich of peak exhaust gas

temperature of 16.0 gallons per hour. The AFM also listed best economy fuel consumption at 75% power setting, 2,500 RPM, and leaned to 50 degrees lean of peak exhaust gas temperature of 14.5 gallons per hour. Using this information, the endurance on a single tank (44.5 gallons usable) was calculated to be between 2.0 and 3.1 hours.

Pilot Information

Certificate:	Private	**Age:**	63,Male
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Left
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 3 With waivers/limitations	**Last FAA Medical Exam:**	May 11, 2010
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	June 15, 2010
Flight Time:	1045 hours (Total, all aircraft), 820 hours (Total, this make and model), 979 hours (Pilot In Command, all aircraft), 1 hours (Last 90 days, all aircraft), 1 hours (Last 30 days, all aircraft), 1 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Mooney	**Registration:**	N9149R
Model/Series:	M20R	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	29-0004
Landing Gear Type:	Retractable - Tricycle	**Seats:**	2
Date/Type of Last Inspection:	March 1, 2011 Annual	**Certified Max Gross Wt.:**	3368 lbs
Time Since Last Inspection:	3 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	2050 Hrs at time of accident	**Engine Manufacturer:**	CONT MOTOR
ELT:	Installed, activated, did not aid in locating accident	**Engine Model/Series:**	IO-550-G
Registered Owner:	On file	**Rated Power:**	280 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:	POV,1197 ft msl	**Distance from Accident Site:**	2 Nautical Miles
Observation Time:	17:58 Local	**Direction from Accident Site:**	0°
Lowest Cloud Condition:	Unknown	**Visibility**	10 miles
Lowest Ceiling:	Broken / 9000 ft AGL	**Visibility (RVR):**	
Wind Speed/Gusts:	7 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	120°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29.89 inches Hg	**Temperature/Dew Point:**	23°C / 4°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Akron, OH (AKR)	**Type of Flight Plan Filed:**	None
Destination:	Akron, OH (AKR)	**Type of Clearance:**	None
Departure Time:	17:30 Local	**Type of Airspace:**	

Wreckage and Impact Information

Crew Injuries:	1 Serious	**Aircraft Damage:**	Substantial
Passenger Injuries:	2 Serious	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	3 Serious	**Latitude, Longitude:**	41.210277,-81.251663

Administrative Information

Investigator In Charge (IIC):	Brannen, John
Additional Participating Persons:	James Larry; FAA - Cleveland FSDO; Cleveland, OH
Original Publish Date:	February 27, 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=79112