



AVIATION



HIGHWAY



MARINE



RAILROAD



PIPELINE

Aviation Investigation Final Report

Location:	Ocala, Florida	Accident Number:	ERA16FA150
Date & Time:	April 9, 2016, 08:50 Local	Registration:	N96398
Aircraft:	Mooney M20K	Aircraft Damage:	Substantial
Defining Event:	Aerodynamic stall/spin	Injuries:	1 Fatal, 1 Serious
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The commercial pilot and one passenger were departing on runway 36 when the airplane experienced a total loss of engine power about 200 ft above the runway. The pilot announced over the control tower frequency that the engine had lost power and that he intended to land the airplane on runway 26, which was located at the end of and perpendicular to the takeoff runway. According to the passenger and witnesses, the airplane completed a left turn to align with runway 26 before the wings rocked, and it rolled into a 90° left bank and collided with terrain. The passenger and witness observations were consistent with the pilot failing to maintain sufficient airspeed, which resulted in the airplane's wing exceeding its critical angle of attack and an aerodynamic stall.

Data downloaded from a panel-mounted engine monitoring system revealed parameters consistent with engine idle, run-up, taxi, and full takeoff power application. A sudden decrease in engine rpm and manifold pressure from takeoff power was preceded by a rapid decrease in fuel flow. Examination of the wreckage revealed that both the left and right wing fuel tanks contained fuel and that the fuel selector handle was between the "Left Tank" and "Off" placard positions. The engine was placed in a test cell where it started immediately, accelerated smoothly, and ran continuously without interruption.

Computerized axial tomography imagery revealed that the fuel selector valve was positioned between the "Left Tank" and "Right Tank" detent positions and that all three valve ports were open to each other. The difference between the handle's position according to the placard and its actual position indicated that the placard had been displaced relative to the handle, which likely occurred during the impact. Bench flow testing of the fuel selector valve and dynamic engine run testing revealed that the valve would supply adequate fuel for normal engine in the as-found intermediate position.

The computerized axial tomography imagery, engine data, and testing of the engine and the fuel selector valve revealed no evidence of preimpact anomalies and demonstrated that the system components still functioned as designed after the accident. The fuel flow interruption and the loss of engine power shortly after takeoff were likely due to the pilot inadvertently placing the fuel selector in the "Off" position, which likely occurred when he completed the step in the Before Takeoff checklist that called for the fuel

selector to be placed on the fullest tank. It is possible that the pilot inadvertently moved the fuel selector from the "Left Tank" position to the "Off" position instead of moving it from the "Right Tank" position to the "Left Tank" position. After the power loss, the pilot likely moved the fuel selector from "Off" to its intermediate as-found position in an attempt to 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 failure to maintain sufficient airspeed following a loss of engine power, which resulted in the airplane exceeding its critical angle of attack and an aerodynamic stall. Contributing to the accident was the pilot's inadvertent placement of the fuel selector in the "Off" position before takeoff, which resulted in fuel starvation and a total loss of engine power.

Findings

Aircraft	Airspeed - Not attained/maintained
Personnel issues	Aircraft control - Pilot
Personnel issues	Incorrect action selection - Pilot
Aircraft	Fuel - Fluid management

Factual Information

History of Flight

Initial climb	Loss of engine power (total)
Emergency descent	Aerodynamic stall/spin (Defining event)
Uncontrolled descent	Collision with terr/obj (non-CFIT)

On April 9, 2016, about 0850 eastern daylight time, a Mooney M20K, N96398, was substantially damaged during a forced landing following a total loss of engine power after takeoff from Ocala International Airport (OCF), Ocala, Florida. The commercial pilot was fatally injured, and the passenger was seriously injured. The personal flight was conducted under the provisions of 14 *Code of Federal Regulations* Part 91. Visual meteorological conditions prevailed, and no flight plan was filed for the flight, which had an intended destination of Lakeland Regional Airport, Lakeland, Florida.

Information from the OCF air traffic control tower revealed that the airplane was cleared for takeoff and began its takeoff roll from runway 36 with about 7,000 ft of runway available. About 1 minute after the airplane was cleared for takeoff, the pilot announced, "I'm losing my engine... I'm going down on [runway] 26." Runway 26 was located at the end of and perpendicular to the takeoff runway.

The OCF ground controller (GC) was receiving a clearance by telephone when he overheard the pilot's radio call. He estimated that the airplane was north of the tower about 200 to 300 ft above the runway before it turned west. According to the GC, "The wings rocked a little in the turn, but when he lined up with the runway [26] he looked clean. He still looked high, like he might touchdown past midfield and go off the departure end. He looked stable, but then he turned left. The more he turned the steeper the turn got, and then when the wingtip hit the ground the airplane was 90 degrees."

The passenger was interviewed the day after the accident. She stated that she was not a pilot but had flown in the airplane several times. After landing at OCF the day before the accident, the pilot requested a fuel service of 10 gallons per wing, and they then spent the night with family. On the morning of the accident, they boarded the airplane for a flight to the Sun-n-Fun fly-in event. According to the passenger, engine start, taxi, run-up, acceleration, takeoff, and initial climb from runway 36 were "normal."

The passenger said she heard a sudden noise "like a click," and the engine stopped producing power. The pilot announced the loss of power and his plan for the forced landing over the radio. The airplane was north of both runways, and the left turn westbound was "steady" until the airplane was about over runway 26. The wings began "rocking," and the turn continued to the left until the bank angle was 90° and the left wing struck the ground.

An airport employee said that his attention was drawn to the airplane by a "sputter-cough" sound. Demonstrating what he observed with a model of an airplane, he described a straight-ahead descent, followed by a left turn over runway 26, two "dips" that resembled a porpoising motion, and then a sharp, 90° left turn to ground contact.

Pilot Information

Certificate:	Commercial; Flight instructor	Age:	49, Male
Airplane Rating(s):	Single-engine land	Seat Occupied:	Left
Other Aircraft Rating(s):	Helicopter	Restraint Used:	Unknown
Instrument Rating(s):	Airplane	Second Pilot Present:	No
Instructor Rating(s):	Airplane single-engine; Instrument airplane	Toxicology Performed:	Yes
Medical Certification:	Class 3 Without waivers/limitations	Last FAA Medical Exam:	February 7, 2014
Occupational Pilot:	No	Last Flight Review or Equivalent:	
Flight Time:	1670 hours (Total, all aircraft), 50 hours (Total, this make and model)		

The pilot held a commercial pilot certificate with ratings for airplane single-engine land, rotorcraft-helicopter, and instrument airplane. His most recent Federal Aviation Administration (FAA) third-class medical certificate was issued on February 7, 2014. He reported 1,670 total hours of flight experience on that date.

Aircraft and Owner/Operator Information

Aircraft Make:	Mooney	Registration:	N96398
Model/Series:	M20K	Aircraft Category:	Airplane
Year of Manufacture:	1981	Amateur Built:	
Airworthiness Certificate:	Normal	Serial Number:	25-0531
Landing Gear Type:	Retractable - Tricycle	Seats:	4
Date/Type of Last Inspection:	June 10, 2015 Annual	Certified Max Gross Wt.:	2900 lbs
Time Since Last Inspection:		Engines:	1 Reciprocating
Airframe Total Time:	2435 Hrs as of last inspection	Engine Manufacturer:	CONT MOTOR
ELT:	Installed	Engine Model/Series:	TSIO-360 SER
Registered Owner:	On file	Rated Power:	210 Horsepower
Operator:	On file	Operating Certificate(s) Held:	None

According to FAA records, the airplane was manufactured in 1981. The maintenance records were not recovered, but a copy of the airplane's most recent annual inspection showed that it was performed on June 10, 2015, at 2,435.2 total aircraft hours.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	Condition of Light:	Day
Observation Facility, Elevation:	KOCF, 89 ft msl	Distance from Accident Site:	0 Nautical Miles
Observation Time:	08:50 Local	Direction from Accident Site:	0°
Lowest Cloud Condition:	Clear	Visibility	10 miles
Lowest Ceiling:	None	Visibility (RVR):	
Wind Speed/Gusts:	9 knots / None	Turbulence Type Forecast/Actual:	/ None
Wind Direction:	10°	Turbulence Severity Forecast/Actual:	/
Altimeter Setting:	30.14 inches Hg	Temperature/Dew Point:	14°C / 3°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Ocala, FL (OCF)	Type of Flight Plan Filed:	None
Destination:	Lakeland, FL (LAL)	Type of Clearance:	VFR
Departure Time:	08:50 Local	Type of Airspace:	Class D

Weather reported at the time of the accident included wind from 010°; at 9 knots, 10 statute miles visibility, clear skies, temperature 14°C, dew point 3°C, and an altimeter setting of 30.15 inches of mercury.

Airport Information

Airport:	OCALA INTL-JIM TAYLOR FIELD OCF	Runway Surface Type:	Asphalt
Airport Elevation:	89 ft msl	Runway Surface Condition:	Dry
Runway Used:	36	IFR Approach:	None
Runway Length/Width:	7467 ft / 150 ft	VFR Approach/Landing:	None

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:	29.173889,-82.224166(est)

The airplane came to rest on the flat, grass surface of the airport infield, and all major components were accounted for at the scene. The wreckage path was oriented 212° and was about 300 ft long. The airplane came to rest upright. The engine and its mount were separated from the airframe but remained attached by cables and wires. The propeller was separated and located 45 ft down the wreckage path from the first ground scar.

The firewall, instrument panel, and center console were crushed aft in compression and canted about 45° to the airplane's left. The windshield was destroyed, and the cabin roof was torn spanwise from the door opening to about mid-cabin. The inboard sections of both wings were intact and remained attached to the fuselage. The left wing outboard of the flap was separated by impact. The leading edge of the right wing was crushed aft in compression. Both wing fuel tanks contained fuel.

Control continuity could not be immediately established due to impact damage and the airplane's resting position. As the wreckage was sectioned for recovery, control continuity was established from the cockpit through impact breaks and saw cuts to the flight control surfaces.

The fuel selector handle was found between the "Left Tank" and the "Off" placard positions. Crushed airplane structure surrounded the selector handle and preserved its position at the time of impact.

The engine was rotated by hand through the vacuum pump drive pad. Continuity was established from the accessory section to the valvetrain and powertrain. Compression was confirmed using the thumb method. The turbocharger impeller moved freely when rotated.

Medical and Pathological Information

The Medical Examiner for District 5, Leesburg, Florida, performed the autopsy on the pilot and determined the cause of death was blunt chest trauma. The FAA Bioaeronautical Research Sciences Laboratory, Oklahoma City, Oklahoma, performed toxicology testing on specimens from the pilot; the testing was negative for alcohol and drugs.

Tests and Research

Engine-Monitoring Instrument Data Download

The airplane was equipped with an Electronics International CGR-30P, panel-mounted instrument that monitored and recorded up to 66 parameters related to engine operations. The device was downloaded in the NTSB Recorders Laboratory.

The data began at 0741:04, at a point consistent with the engine at idle at device power-up, and the parameters continued through what was consistent with taxi, run-up, and eventually takeoff power application at 0751:04. At 0751:28, there was a rapid decrease in fuel flow, and, at 0751:42, there was a decrease in engine rpm and manifold pressure. Subsequently, manifold pressure and rpm stabilized around 14 inches and 1,300, respectively, and remained at these values until the end of the recording.

Engine Examination/Test Run

The engine was examined and test run in Mobile, Alabama, between May 31 and June 2, 2016. During examination and preparation, the crankshaft was sleeved, and the fractured propeller flange was welded back onto the crankshaft. The aft left oil cooler mount/mount leg and the magneto ignition harnesses were replaced due to impact damage. The magnetos remained secured in their mounts, and timing was confirmed at 20° before top dead center.

The engine starter, Nos. 3 and 5 cylinder intake tubes, and the entire exhaust system were replaced due to impact damage and for compatibility with the engine test cell equipment. The engine's turbocharger and waste gate were intact and installed for the engine test run without modification.

The engine started immediately, accelerated smoothly, and ran continuously without interruption. The engine was run through the manufacturer's entire test run protocol with no anomalies noted. After completion of the test protocols, the engine was accelerated and decelerated rapidly several times between idle and full power. During the accelerations and decelerations, the engine ran smoothly and without interruption.

Fuel Selector Valve Tests

The 3-position fuel selector valve had detents corresponding to "Right Tank," "Left Tank," and "Off." When viewed relative to a clock face, the detents for "Right Tank," "Left Tank," and "Off" were positioned at 2 o'clock, 10 o'clock, and 8 o'clock, respectively.

As previously mentioned, the fuel selector valve handle was found in an intermediate position between the "Off" and "Left Tank" placard positions. Computerized axial tomography scan imagery revealed that the valve handle was positioned between the "Left Tank" and "Right Tank" detent positions and that all three valve ports were open to each other. The difference between the handle's position according to the placard and its actual position was consistent with the valve placard having been displaced relative to the handle.

The valve was placed on a flow bench in its as-found condition. When fuel was drawn through the selector valve at the engine port, fuel was drawn from both the left and the right tank ports simultaneously.

An exemplar Continental TSIO-360GB engine was placed in a test cell, and the engine fuel system was set up and adjusted to factory specifications of unmetered fuel pressure of 45 to 49.5 pounds per square inch (psi). The engine was then stopped, and the test stand fuel system was disconnected.

Fuel was then provided to the engine from an external fuel tank and a fuel system mockup (left tank, right tank, left and right vapor return, engine supply and return lines) through the accident fuel selector valve. The accident fuel selector valve was tested in the as-found position between the left tank and the right tank detent positions.

The engine was primed using the test cell's fuel system, but it was started and run on an external fuel tank that was positioned about wing level. The engine started immediately and ran continuously without interruption to full power of 2,700 rpm and 40 inches of manifold pressure. During the full-power portion of the run, which was between 8 and 10 minutes, the unmetered fuel pressure maintained 49 psi. Engine power was reduced to idle and the engine continued to run normally.

ADDITIONAL INFORMATION

Step two in the Before Takeoff checklist found in the manufacturer's Pilot's Operating Handbook was: "Fuel Selector ... FULLEST TANK."

Administrative Information

Investigator In Charge (IIC):	Rayner, Brian
Additional Participating Persons:	Theodore Rodriguez; FAA; Orlando, FL Chris Lang; Continental Motors; Mobile , AL
Original Publish Date:	December 11, 2017
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.nts.gov/Docket?ProjectID=92978

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