Aviation Investigation Final Report

Location:	College Park, Maryland	**Accident Number:**	ERA21LA170
Date & Time:	April 3, 2021, 12:48 Local	**Registration:**	N2953L
Aircraft:	Mooney M20C	**Aircraft Damage:**	Substantial
Defining Event:	Fuel related	**Injuries:**	1 None
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The pilot planned for a recreational trip of 2 hours or less. During his preflight inspection, he found, “a bunch of water” in the left fuel tank, which he said he continued to sample until it was free of water. He then dried his collection tube and sampled the tank twice more reporting the sample was clear with no water. Before departure, with the fuel selector positioned to the left fuel tank, he performed an engine run-up with no engine or engine systems discrepancies reported. During takeoff he rotated at 83 mph and when over the runway the engine began to “cough/sputter.” He continued straight ahead, but review of airport surveillance video revealed that the airplane likely stalled and landed hard resulting in substantial damage to the left wing.

A postaccident examination of the airplane found that there was water in the flexible fuel hose from the firewall fitting to the engine-driven fuel pump inlet, and about 5 ounces of fluid drained from the carburetor bowl contained equal parts of fuel and water. On-wing pressure testing of the fuel caps revealed extensive leakage from both and a subsequent examination revealed evidence of unapproved or missing parts from both caps. The correct parts were then installed on both caps and they passed testing to 25 psi, but leakage was noted during on-wing pressure testing. Additional testing identified leakage between the adapter and the doubler of each assembly at low pressures, which increased in intensity as the pressure increased.

Prior to the accident flight, the co-owners of the airplane replaced the seals on both fuel caps which did not eliminate the water intrusion. In addition, they purchased wing covers in an attempt to further reduce the potential for water intrusion; however, they were not installed on the airplane when the pilot arrived at the airport for the accident flight. They did not alert their mechanic of the issue.

Although the pilot reportedly sampled the left fuel tank until water was no longer present, he likely did not drain out all the water from the tank nor did he drain the selector valve sump as

part of his inspection. The results of the extensive postaccident testing revealed that even if the fuel caps were repaired properly, additional issues were present with each fuel tank filler cap assembly that were not addressed by the owners. Had the owners consulted with their maintenance provider about the water intrusion, it is likely that the root cause of the water intrusion could have been identified.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be:

Improper maintenance of the airplane by its owners and their failure to have qualified maintenance personnel determine the root cause of water infiltration into the fuel system. Also causal was the pilot's inadequate preflight inspection, which failed to remove all of the water contamination from the fuel system prior to the flight and resulted in the partial loss of engine power during the takeoff. Contributing was the pilot's exceedance of the critical angle of attack, which resulted in an aerodynamic stall and subsequent hard landing.

Findings

Personnel issues	Decision making/judgment - Owner/builder
Aircraft	(general) - Incorrect service/maintenance
Personnel issues	Preflight inspection - Pilot
Personnel issues	Aircraft control - Pilot
Aircraft	Angle of attack - Not attained/maintained

Factual Information

History of Flight

Standing-engine(s) not oper	Fuel contamination
Takeoff	Fuel related (Defining event)
Takeoff	Aerodynamic stall/spin
Uncontrolled descent	Collision with terr/obj (non-CFIT)

On April 3, 2021, about 1248 eastern daylight time, a Mooney M20C, N2953L, was substantially damaged when it was involved in an accident near College Park, Maryland. The private pilot was not injured. The airplane was operated as a Title 14 Code of Federal Regulations Part 91 personal flight.

The pilot stated that he intended to perform a recreational flight lasting 2 hours or less and during his preflight inspection he found, “a bunch of water” in the left fuel tank, which was he sampled five times before he got all the water out of it. He then dried his collection tube and sampled it twice more reporting the sample was clear with no water. He did not drain the selector valve sump drain as part of his inspection. The pilot selected the left fuel tank for takeoff and performed an engine run-up before departure, noting the only discrepancy was related to the auxiliary fuel pump, which was left off for takeoff. During takeoff he rotated at 83 mph and when over the runway the engine began to “cough/sputter.” He looked to his left but continued straight ahead. The next thing he remembered was hearing a loud sound from ground contact. The airplane came to rest upright near the departure end of the runway.

A pilot-rated witness at the airport reported the engine was “really running rough” when the airplane was still on the ground about ½ way down the runway. He clarified that the engine was rapidly losing power, running rough, and surging to higher rpm. He then noticed the elevator made a nose-up deflection after the abnormal engine sound occurred.

A video of the accident flight provided by the airport manager depicted the airplane over the runway in a slight nose up attitude less than a wingspan high. The main landing gear were extended. The airplane continued over the runway gaining altitude slightly. The airplane then began to descend and while at an altitude less than a wingspan above the runway, the left wing dropped. The airplane descended in a nose low attitude with the left wing impacting the runway. The airplane then rotated clockwise coming to rest upright.

Examination of the airplane revealed substantial damage to the left wing. Following recovery of the airplane from the runway, 8 ounces of water were drained from the left fuel tank, and water was detected in the flexible fuel hose from the firewall fitting to the engine-driven fuel

pump inlet. Additionally, about 5 ounces of fluid containing equal parts of fuel and water were drained from the carburetor bowl.

An on-wing pressure check of the fuel caps performed using a maintenance procedure for later models of the airplane revealed large bubbles around the outer perimeter of the left fuel cap and small bubbles on the aft side of the right fuel cap near the lever; no bubbles were noted around the axle for either fuel cap. The outer perimeter of both fuel tank access panels were tested and no leaks were noted. The fuel caps were then sent to the manufacturer's facility for testing.

Examination of the fuel caps at the manufacturer's facility revealed both had loose handles and exhibited very little resistance and no audible snap when the handle was closed and locked. Testing of the left fuel cap could not be completed because of the extensive leakage, while the right fuel cap failed the pressure testing. Both caps were completely disassembled revealing both contained unapproved, modified, and/or missing parts. Both fuel caps were re-assembled with new hardware as required and passed the acceptance testing which included pressure testing to 25 psig. The fuel caps were returned to the salvage facility to repeat the on-wing testing, which revealed leaks from both caps.

Each wing plate with attached doubler, adapter, and fuel cap were then sent to the fuel cap manufacturer's facility for further testing to determine the source of the leakage. Following manufacturing of a fixture, no leakage was noted between either fuel cap and its mating adapter, but leakage was noted between the adapter and the doubler of each assembly at low pressures (.45 psi and .28 psi) which increased in intensity as the pressure increased.

Postaccident examination of the fuel tanks in accordance with Mooney Service Bulletin M20-230 revealed no anomalies; all drain holes were open. Additionally, the fuel tank drain valves were correct. Thus, there was no capability for trapped water.

Airworthiness Directive (AD) 85-24-03, with an effective date of January 6, 1986, applicable to the accident make and model airplane required in part an inspection of the fuel tank bays and ribs, but only a visual inspection of the fuel caps in accordance with Mooney Service Bulletin (SB) M20-229, dated February 12, 1986. Service Bulletin M20-229A specified not only a visual inspection of the fuel caps but also pressure testing of them by applying .5 psi to the fuel vent line and check for leaks around the fuel cap.

The mechanic who performed the airplane's last annual inspection in July 2020 stated that he did comply with AD 85-24-03, and as part of his compliance he applied a window cleaning solution to the top of the wing in the fuel cap area and blew into the vent tube by mouth pressure then looked for bubbles; no bubbles were noted.

One co-owner stated that on February 4, 2021, he and the other co-owner replaced the o-rings of each fuel cap as part of preventative maintenance because of water in the fuel tanks. He reported their maintenance actions to the fuel caps seemed to diminish the water infiltration

during rain events. An additional measure to reduce water infiltration into the fuel tanks was to install covers over the wings when the airplane was on the ramp, but they did not entirely stop the water infiltration and those covers were off when the pilot arrived at the airplane for his intended flight. The mechanic who serviced the airplane was not contacted by the owners regarding the fuel tank water issues.

A review of the NTSB database for accidents and incidents of Mooney airplanes from 1982 to June 15, 2021, revealed a total of 1,351 investigations, which included foreign investigations. From 1982 to January 6, 1986 (effective date of AD 85-24-03), there were a total of 228 investigations, of which cases with the probable cause published, 4 cited water contamination. From January 6, 1986 (effective date of AD 85-24-03) through June 15, 2021, there were 1,123 investigations, of which cases with the probable cause published, 24 cited water contamination.

Pilot Information

Certificate:	Private	**Age:**	55,Male
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	Lap only
Instrument Rating(s):	None	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	
Medical Certification:	Class 3 With waivers/limitations	**Last FAA Medical Exam:**	January 21, 2021
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	June 24, 2019
Flight Time:	230 hours (Total, all aircraft), 42 hours (Total, this make and model), 152 hours (Pilot In Command, all aircraft), 3 hours (Last 90 days, all aircraft), 3 hours (Last 30 days, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Mooney	**Registration:**	N2953L
Model/Series:	M20C NO SERIES	**Aircraft Category:**	Airplane
Year of Manufacture:	1967	**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	670087
Landing Gear Type:	Retractable - Tricycle	**Seats:**	4
Date/Type of Last Inspection:	July 19, 2020 Annual	**Certified Max Gross Wt.:**	2575 lbs
Time Since Last Inspection:	106.16 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	4085.77 Hrs at time of accident	**Engine Manufacturer:**	Lycoming
ELT:	C91 installed, not activated	**Engine Model/Series:**	O-360-A1D
Registered Owner:	On file	**Rated Power:**	180 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:	KCGS,50 ft msl	**Distance from Accident Site:**	0 Nautical Miles
Observation Time:	12:55 Local	**Direction from Accident Site:**	125°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	3 knots / 14 knots	**Turbulence Type Forecast/Actual:**	None / None
Wind Direction:	270°	**Turbulence Severity Forecast/Actual:**	N/A / N/A
Altimeter Setting:	30.4 inches Hg	**Temperature/Dew Point:**	8°C / -13°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	College Park, MD	**Type of Flight Plan Filed:**	VFR
Destination:	Tangier Island, MD (TGI)	**Type of Clearance:**	VFR
Departure Time:		**Type of Airspace:**	

Airport Information

Airport:	COLLEGE PARK CGS	**Runway Surface Type:**	Asphalt
Airport Elevation:	48 ft msl	**Runway Surface Condition:**	Dry
Runway Used:	15/33	**IFR Approach:**	None
Runway Length/Width:	2607 ft / 60 ft	**VFR Approach/Landing:**	Forced landing

Wreckage and Impact Information

Crew Injuries:	1 None	**Aircraft Damage:**	Substantial
Passenger Injuries:		**Aircraft Fire:**	None
Ground Injuries:		**Aircraft Explosion:**	None
Total Injuries:	1 None	**Latitude, Longitude:**	38.982155,-76.924116(est)

Administrative Information

Investigator In Charge (IIC):	Monville, Timothy
Additional Participating Persons:	Kenneth Crowder; FAA/FSDO; Linthicum Heights, MD
Original Publish Date:	February 24, 2023
Last Revision Date:	
Investigation Class:	Class 3
Note:	The NTSB did not travel to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=102860