Aviation Investigation Final Report

Location:	Woodbine, New Jersey	**Accident Number:**	ERA19FA023
Date & Time:	October 23, 2018, 14:00 Local	**Registration:**	N9667M
Aircraft:	Mooney M20C	**Aircraft Damage:**	Destroyed
Defining Event:	Loss of control in flight	**Injuries:**	1 Fatal
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The pilot was taking off for a personal flight. According to onboard data, when the airplane reached about 150 ft above ground level, the pitch began to increase; over the next 4 seconds, the airplane's altitude began to increase as the groundspeed decreased. The airplane then banked to the left and descended nose-down to impact east of the runway. A witness observed that when the airplane reached about 100 ft above the runway, the landing gear was retracted. He then he diverted his attention and shortly after, he heard an impact. The airplane was recorded by airport security video just before ground contact in a near vertical descent (consistent with stall) with the landing gear extended.

The pilot previously reported having physical difficulties manually retracting the landing gear, and as a result, he would use one hand to hold onto something in the cockpit to brace himself, and the other hand to operate the retracting handle assembly "Johnson bar." To assist in retracting the landing gear, the pilot would also slow the airplane, which was supported by the data recorded by the Stratus 2S for the accident flight and a previous uneventful flight that was examined.

Examination of the airframe, flight controls, engine, engine systems, and landing gear system revealed no evidence of preimpact failure or malfunction. It likely that the pilot intentionally increased the airplane's nose-up pitch and decreased the airplane's speed in order to assist him retract the landing gear. The ultimate result was the airplane exceeding its critical angle of attack and an inadvertent stall.

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 the proper airspeed during takeoff, which resulted in the exceedance of the airplane's critical angle of attack and the airplane experiencing an aerodynamic stall.

Findings

Personnel issues	Aircraft control - Pilot
Aircraft	Airspeed - Not attained/maintained
Aircraft	Angle of attack - Not attained/maintained

Factual Information

History of Flight

Initial climb	Loss of control in flight (Defining event)
Uncontrolled descent	Collision with terr/obj (non-CFIT)

On October 23, 2018, about 1400 eastern daylight time, a Mooney M20C, N9667M, was destroyed when it was involved in an accident in Woodbine, New Jersey. The commercial pilot was fatally injured. The airplane was operated as a Title 14 Code of Federal Regulations Part 91 personal flight.

Review of the airplane's Appareo Stratus 2S data revealed that, after takeoff, the airplane accelerated to a maximum groundspeed of about 62 knots. About 1359:19, the airplane's altitude was about 192 ft mean sea level (msl) (about 151 ft above ground level) and the groundspeed was about 60 knots. Between 1359:19 and 1359:25, the pitch attitude increased from about 11° to about 36°, with a corresponding altitude increase and groundspeed decrease. At 1359:25, the pitch attitude began to decrease and over the next 2 seconds the airplane attained its highest altitude about 417 ft msl; about that time the groundspeed was about 26 knots. The data indicated the airplane then banked to the left, began descending, and the last data point was located near the resting position of the main wreckage. An airport security camera recorded the airplane immediately before impact and showed it in a nearly vertical nose-low, slight left-wing-low attitude with the landing gear extended.

A witness who was located at the Woodbine Municipal Airport (OBI) fuel terminal reported that the airplane taxied from there toward the approach end of runway 31; he then heard the engine power increase to a high rpm and observed the airplane begin to take off. He watched the airplane become airborne about 900 ft down the runway and begin to climb until it reached an estimated 100 ft above runway 31. He noted the airplane was in a slight climb attitude and the landing gear was retracted when the airplane was between taxiways C and D, or about 665 ft and 1,830 ft respectively, from the approach end of runway 31. He then he diverted his attention. He then heard an impact near the windsock and called 911 to report the accident. He further reported that the engine sounded steady and constant with no abnormal sounds from the time he first heard it until the impact.

A mechanic who maintained the airplane reported that he was inside a hangar at OBI when he heard the application of full takeoff power followed by the sound of an impact. He indicated that the engine sound was steady before impact. He did not hear an engine run-up but attributed that to the distance from the hangar and the hangar doors were closed. He and another individual subsequently responded to the accident site and he noted a small amount of smoke on the right side of the airplane's instrument panel. He also noted puddles of fuel on the ground with a "major puddle under the left wing."

Pilot Information

Certificate:	Commercial	**Age:**	85,Male
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	None
Instrument Rating(s):	Airplane	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	Class 3 Without waivers/limitations	**Last FAA Medical Exam:**	May 29, 2018
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	
Flight Time:	(Estimated) 6496 hours (Total, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Mooney	**Registration:**	N9667M
Model/Series:	M20C NO SERIES	**Aircraft Category:**	Airplane
Year of Manufacture:	1966	**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	670003
Landing Gear Type:	Retractable - Tricycle	**Seats:**	4
Date/Type of Last Inspection:	February 22, 2018 Annual	**Certified Max Gross Wt.:**	2575 lbs
Time Since Last Inspection:	4 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	5630.2 Hrs at time of accident	**Engine Manufacturer:**	Lycoming
ELT:	C126 installed, activated, did not aid in locating accident	**Engine Model/Series:**	O-360-A1D
Registered Owner:	On file	**Rated Power:**	180 Horsepower
Operator:	On file	**Operating Certificate(s) Held:**	None

The manually operated landing gear system was extended and retracted by means of a retracting handle assembly (“Johnson bar”) in the cabin. The system was operated by direct mechanical linkage and was aided by bungee-type springs in the fuselage and assist springs in the wing, which balance the weight of the gear. To retract the landing gear, a safety latch button on the top of the Johnson Bar is depressed and it is rapidly pushed aft from the downlock socket to the floor. The handle is then slid into the up-lock socket.

Friends of the pilot reported that within the last 1 to 2 weeks, he had expressed difficulty with

the landing gear system, specifically with retracting the landing gear. One friend indicated that the pilot mentioned to him that it was easier to retract the landing gear if he did it at a slower airspeed because when he did so it took less effort. The mechanic who maintained the airplane reported that the pilot did not express that concern to him. Another friend recounted a conversation he had with another individual who reported that the pilot would hold onto something in order to brace himself and then use his other hand to operate the Johnson bar to retract the landing gear, leaving no hands to hold the control yoke.

The mechanic who performed the last annual inspection used his own checklist; as part of his inspection he did not test to determine the force required to retract the landing gear.

A review of the Mooney Aircraft Corporation 100-Hour-Annual Inspection Guide revealed that the landing gear was to be checked for operation and rigging. There was no requirement to check or determine the force required to retract the landing gear.

The airplane was equipped with a JPI engine data monitor (EDM) 700; no exceedances of the cylinder head temperature or oil temperature were recorded.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	OBI,41 ft msl	**Distance from Accident Site:**	
Observation Time:	13:54 Local	**Direction from Accident Site:**	
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	11 knots / None	**Turbulence Type Forecast/Actual:**	Unknown / Unknown
Wind Direction:	250°	**Turbulence Severity Forecast/Actual:**	Unknown / Unknown
Altimeter Setting:	30.03 inches Hg	**Temperature/Dew Point:**	18°C / 8°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Woodbine, NJ (OBI)	**Type of Flight Plan Filed:**	None
Destination:	Woodbine, NJ (OBI)	**Type of Clearance:**	None
Departure Time:	14:00 Local	**Type of Airspace:**	

Airport Information

Airport:	Woodbine Municipal Arpt OBI	**Runway Surface Type:**	Asphalt
Airport Elevation:	41 ft msl	**Runway Surface Condition:**	Dry
Runway Used:	31	**IFR Approach:**	None
Runway Length/Width:	3074 ft / 75 ft	**VFR Approach/Landing:**	None

Wreckage and Impact Information

Crew Injuries:	1 Fatal	**Aircraft Damage:**	Destroyed
Passenger Injuries:		**Aircraft Fire:**	None
Ground Injuries:		**Aircraft Explosion:**	None
Total Injuries:	1 Fatal	**Latitude, Longitude:**	39.220554,-74.795829

The airplane crashed on airport property in grass near the departure end of runway 31 southwest of the southern edge of the runway and east of the eastern edge of runway 01/19. The main wreckage was located about 2,450 ft down runway 31 and 200 ft southwest of the southern edge of the runway 31. A ground scar associated with the left wing and broken navigation light lens was oriented on a magnetic heading of about 305°, and the empennage was oriented on a magnetic heading of about 309°.

Examination of the wreckage at the accident site revealed the airplane came to rest upright, with the empennage nearly separated near the aft wing spar. There was no evidence of fire on any portion of the airplane, although a burned electrical smell was noted in the cockpit. The source of the burned electrical smell could not be determined.

Examination of the flight controls revealed no evidence of preimpact failure or malfunction. The elevator trim jackscrew below the floor was extended 7 threads on the aft side, which correlated to take-off trim setting.

Examination of the empennage revealed a compression wrinkle on the left side, consistent with rotation to the left. An impact mark on upper portion of the tailcone corresponded to right rudder input. Impact marks on the left and right sides of the tailcone, and corresponding impact marks on the left and right elevators were examined to determine control position at impact; however, the position at impact could not be determined. An impact mark in the fairing for the vertical stabilizer and the leading edge of the vertical stabilizer was consistent with overtravel at impact.

Examination of the left wing revealed the flap and aileron remained connected at all hinge points. The leading edge exhibited full span aft crushing. The main landing gear was fully extended; the aft portion of the landing gear was driven through the wing from the aft trunnion. The retracting bungee assembly was fractured; however, the spring was not fractured.

Examination of the right wing revealed the flap and aileron remained connected at all hinge points. The leading edge exhibited full span aft crushing. The landing gear was partially extended, and the lower portion of the gear door was displaced outboard. The aft portion of the landing gear was partially driven through the wing from the aft trunnion. The retracting bungee assembly was separated, and the cylinder was bent. The spring was intact, but the cylinder rod was fractured due to bending overload. The attach block remained attached, but

the attach bolt was separated.

Examination of the hydraulically operated flap control system revealed the distance of extension of the flap cylinder from the housing to the center of the attach bolt measured 3 1/16 inches. According to representatives of the airplane manufacturer, correlation with the measurement to an older B model airplane at their facility revealed it corresponded to a full flaps up configuration; however, the representative cautioned that setting may have been affected by compromise of the flap control system as a result of impact.

Examination of the cockpit revealed the Johnson Bar which was fractured from the lever assembly, was nearly vertical (towards gear down position) but was not in its downlock socket. The fracture surface did not exhibit any pre-existing cracks. Extensive impact damage to the landing gear system precluded operational testing or rigging check of the landing gear system. The nose landing gear was collapsed aft. The forward portion of the right nose landing gear door was crushed aft and up at an angle of 032°. All fractures associated with the landing gear system were overload.

The pilot's inboard seat track was on the seat rail; the outboard seat track was separated at the forward attach but connected to the rear attach. Both seat rails were deformed. No pre-impact failure or malfunction was noted with the pilot's seat.

Impact damage to the engine precluded rotation of the crankshaft by hand. The Nos.1 and 3 cylinders were removed and continuity of the crankshaft and camshaft to the accessory case gears and to the valve train was visually confirmed. The valves and pistons of the removed cylinders were visually examined, and no anomalies were noted. The interiors of the Nos. 2 and 4 cylinders were observed using a lighted borescope and no anomalies were noted. Further examination of the fuel, ignition, exhaust, and lubrication systems of the engine revealed no evidence of pre-impact failure or malfunction.

Examination of the propeller revealed the propeller dome was separated from the propeller hub but was contained in the propeller spinner. One propeller blade was rotated in the hub, curled aft about 90° and twisted toward the blade face. That blade also exhibited leading edge gouges and chordwise scoring on the curved surface. The other blade was also twisted toward the blade face and exhibited leading edge gouges and chordwise scoring on the back and on the curved surface.

Medical and Pathological Information

A postmortem examination of the pilot was performed by the Office of the Chief Medical Examiner, Woodbine, New Jersey. The cause of death was reported to be multiple blunt impact

injuries. According to the NJ Medical Examiner's report, toxicology results were negative for volatiles, and other tested for drugs.

Forensic toxicology testing was performed by the Federal Aviation Administration Bioaeronautical Sciences Research Laboratory, Oklahoma City, Oklahoma, and the New Jersey State Medical Examiner's office. According to the FAA's report, the results were negative for volatiles and carbon monoxide. Unquantified amounts of sildenafil, desmethylsildenafil, and pantoprazole were detected in the liver specimen, and unquantified amounts of desmethylsildenafil and pantoprazole were detected in the submitted blood specimen.

Sildenafil, and its metabolite desmethylsildenafil, are commonly marketed as Viagra to treat erectile dysfunction. Pantoprazole is used to treat gastroesophageal reflux disease (GERD). Neither is considered to be sedating.

Tests and Research

Owners Manual

The airplane owner's manual stated that with respect to the landing gear system, "The more rapid the movement of the handle, the easier it is to retract the gear," and "the gear retracts easiest at low airspeeds," though a speed is not specified.

According to the owner's manual, the stall speed at maximum gross weight (2,575 pounds), no flap extension and 0° bank angle is 67 miles per hour (mph) or about 58 knots, while the stall speed at a bank angle of 15° was 64 mph.

CAR 3

The basis for the airplane’s certification was Civil Air Regulations (CAR) Part 3, which contained no specification for maximum force at the retracting handle assembly of a manually actuated landing gear airplane.

Previous Flight Profile

The NTSB specialist's factual report further indicated that with respect to the Appareo Stratus 2S, an uneventful flight on October 10, 2018 was recorded. Review of the data associated with that flight revealed the flight departed from runway 19, with a wind at a nearby airport reported to be from 170° at 11 knots (resulting in headwind component of about 10 knots). Between 1816:16 (when the flight was about 220 ft msl) and 1816:21, the pitch attitude increased from about 4° to about 22°, or an average of about 4° per second, with corresponding altitude increase and groundspeed decrease. The groundspeed slowed to 45 knots, and based

on the headwind component of 10 knots, was within about 3 knots of the published stall speed at maximum gross weight for flaps up and 0° bank.

Administrative Information

Investigator In Charge (IIC):	Monville, Timothy
Additional Participating Persons:	Robert V Drapala; FAA/FSDO; Philadelphia, PA Kirk Jaeger; FAA/FSDO; Philadelphia, PA J M Childers; Lycoming Engines; Williamsport, PA
Original Publish Date:	January 28, 2021
Last Revision Date:	
Investigation Class:	Class 3
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=98530