



**NATIONAL TRANSPORTATION SAFETY BOARD**

**Office of Aviation Safety**

**Western Pacific Region**

**February 24, 2020**

**AIRFRAME & ENGINE EXAMINATION REPORT**

**WPR18FA210**

**This document contains 9 embedded photographs.**

# **Lopez Island, Washington**

**August 2, 2018**

**1705 PDT**

**Mooney M20J – N56039**

## **EXAMINATION PARTICIPANTS**

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## **HISTORY OF FLIGHT**

On August 2, 2018, about 1705 Pacific daylight time, a Mooney M20J, N56039, impacted terrain during an approach to land Lopez Island Airport (S31), Lopez Island, Washington. The pilot and flight instructor were fatally injured. The airplane was registered to and operated by the pilot as a 14 Code of Federal Regulations *Part 91* flight. Visual meteorological conditions prevailed and a flight plan was not filed for the local flight that departed Friday Harbor Airport (FHR), Friday Harbor, Washington about 1500.

According to the flight instructor's wife, the instructor was scheduled to perform a flight review of the accident pilot at 1400, but the flight was delayed until 1500. Another student of the flight instructor informed his wife that she received a text message from him at 1615 requesting that she taxi her airplane to his office at 2045 for their scheduled night flight lesson.

## **PERSONNEL INFORMATION**

The pilot, age 76, held a private pilot certificate with ratings for airplane single engine land and instrument airplane. His most recent third-class medical certificate was issued on January 4, 2017, and did not contain any restrictions. According to the pilot's logbook, the pilot had accumulated 1,906 total flight hours by July 25, 2018, the last entry in the pilot's logbook. Approximately 277 hours were in the airplane make and model, and 9.2 were flown in the 90 days that preceded the accident. The pilot's most recent Federal Aviation Regulations 61.56 flight review was completed on July 21, 2016.

The flight instructor, age 68, held a flight instructor certificate with a rating for airplane single-engine land. His most recent second-class medical certificate was issued on May 30, 2018, with the restriction "must have available glasses for near vision."

## **AIRPLANE INFORMATION**

The airplane was equipped with a Lycoming IO-360-A3B6D, direct drive, air cooled 200 hp engine. According to a logbook excerpt furnished by the pilot's service facility, the airplane's last annual inspection was performed on March 2, 2018 at an accumulated time of 2,397.4. The engine inspection was completed the same date at a total time of 2,397.4 total hours and 782.4 hours since its most recent overhaul.

## **METEOROLOGICAL INFORMATION**

The 1653 recorded weather observation at FHR included wind 220° true at 6 knots, visibility 8 statute miles, broken clouds 4,300 ft, overcast clouds 5,000 ft, temperature 16° C, dew point 11° C, and an altimeter setting of 30.04 inches of mercury.

## **AIRPORT INFORMATION**

S31 was located at an elevation of 208 ft, and was comprised of one asphalt runway in a 16/34 configuration. The runway was 2,905 ft long and 61 ft wide and the FAA airport chart supplement showed that it was a right turn traffic pattern.

## **WITNESS REPORTS**

According to an eyewitness, after his departure from runway 16 at FHR he began a climb. Approximately 1.2 nm south of the airport he heard another pilot announce over the radio that he was on an extended left base for runway 14 at S31 and observed that he sounded unsure or distracted. The eyewitness made a left turn to an eastern course and then observed an airplane about 300 ft and about 0.5 nm north of S31 that appeared to be initiating a base to final turn for runway 16 at S31. The airplane's left turn progressed into a 45° bank that continued to increase until the airplane entered a nose down dive and disappeared from the eyewitness' line of sight.

Statements were collected by various students of the flight instructor. All of the students indicated that the instructor would allow them to correct their own mistakes and would not take

over control of the airplane as he preferred for the students to learn from their errors. In one example, a student recounted that while practicing turns around a point, he exceeded the 30° standard rate turn limit they previously agreed on as the turn progressed to 45°. The student corrected the mistake and the pilot did not intercede. In another example, while performing power off emergency landings, the pilot selected a landing site, but was not lined up as he entered the final approach leg of the approach to the landing site. He expected the instructor to advance the throttle at 300 ft, but they descended to 200 ft before he added power.

## **WRECKAGE AND IMPACT INFORMATION**

The airplane came to rest in wooded area about 400 ft from the shore. An initial impact point (IIP) was identified by an airframe fragment suspected to be the right wingtip about 100 ft up a tree. The orientation between the IIP and wreckage was 126°. A tree scar that measured about 5 ft in diameter was observed about 40 ft up a brown tree with yellow moss, which was collocated with the main wreckage (see photograph 1). The main wreckage, comprised of all major components, was oriented on a magnetic head of 180° and marked the end of the debris path (see photograph 2). Propeller blade A displayed twisting, bending, nicks, tip curling, and chordwise striations. Propeller blade B exhibited nicks, gouges, minor tip curling, and a slight bend at the blade root.

## **COCKPIT/CABIN OBSERVATIONS**

Landing Gear Lever: Down position.  
Master switch: ON  
Avionics switch: Broken  
Fuel boost pump: Not found  
Strobe light: destroyed  
NAV light: destroyed  
Landing Light: destroyed  
Primer: Not found  
Throttle: Full Forward Position  
Propeller: Full Forward Position  
Mixture: Full Rich  
Fuel selector: Left Tank  
Elevator Trim position indicator: Broken  
Flap position indicator: Broken  
Tachometer: Not found  
Hobbs meter: Not found  
Left Fuel Tank Indicator: 0 gallons  
Right fuel Tank Indicator: Needle missing  
Left wing fuel tank indicator: 0 gallons  
Right wing fuel tank indicator: 0 gallons  
Fuel Pressure: 0 PSI  
Ignition: Right magneto  
Airspeed Indicator: 0 kts

Turn Coordinator: Destroyed  
NAV 1: HDG and NAV flags displayed; HDG 104°  
Attitude Indicator: OFF  
Amperage: Indicates positive charge  
Oil Pressure: 0 PSI  
Oil Temperature: 0°  
CHT: Green minimum  
Altimeter 1: 1,320 ft  
Altimeter 1 Kollsman: 30.06 in Hg  
Altimeter 2: 4,620 ft  
Altimeter 2 Kollsman: 30.06 in Hg  
Vertical Speed Indicator: 900 ft/min  
NAV 2: Heading 268°  
ADF: Indicates 209°  
Alternate Air: moves freely  
Elevator Trim: Broken

## **AIRFRAME**

### **Fuselage & Empennage**

The engine remained attached to the forward fuselage, which displayed vertical crush damage. The forward cabin also displayed vertical crush and the aft cabin ceiling and airframe had collapsed. Buckling and twisting were observed along the aft fuselage, which remained connected to the empennage. Both horizontal stabilizers, elevators, the rudder, and vertical stabilizer remained attached to the empennage. Rudder movement was restricted and the elevator was stiff. The left horizontal stabilizer outboard leading edge tip was bent upward.

### **Left Wing**

The left wing remained attached to the main fuselage and the left flap and aileron were connected to the left wing; however, both control surfaces were immovable. Most of the outboard left wing, from mid-span to the edge of the wing, was compressed and bent aft along the wing's horizontal plane. The left wing tip came to rest a few feet to the left of the wing edge. Leading edge bulging was observed inboard near the wing root forward of the fuel tank. Aft crush damage was observed along the leading edge throughout the length of the wing.

### **Right Wing**

The right wing had separated inboard near the wing root, but came to rest inverted a few feet from the right of the main wreckage. A large gouge was observed at the leading edge about mid-span. The right wing position light was found about 20 feet to the right of the main wreckage, beyond the right wing. The wing flap had separated from the right wing, but was otherwise intact and in the debris path behind the main wreckage and collocated with the scarred tree. Both aileron attachment points were present and secured to the aileron, but aileron movement was restricted. The right wing top skin was torn aft and compressed and displayed a large brown and yellow transfer mark.

## Flight Control System

The flight control surfaces were examined during a postaccident examination of the airframe at a secure facility in Seattle, Washington. Rudder control was traced from the control surface to both rudder pedals through a separation at the forward fuselage bell crank that displayed signatures consistent with overload separation. The elevator control system was confirmed from the empennage to a separation at the neck of a rod end at the forward fuselage that exhibited signatures consistent with overload separation. Although continuity from the rod end to the cockpit was verified, movement below the cockpit was restricted as the control tube had been crushed by the nose landing gear. Right aileron control was continuous from the aileron to the cockpit flight controls; however, movement beneath the cockpit was restricted as the control tubes has been crushed by the nose landing gear. The left aileron push pull tube fractured in overload at the aileron end, but was otherwise continuous through the aileron bell crank to the wing root. Further continuity was confirmed from the wing root to the cockpit. Both flaps had separated from their flap hinges, but the flap control system was continuous to the flap motor.

## Elevator Trim

The elevator trim system was continuous from the trim motor jackscrew through the trim servo to the aft fuselage control tube, which had been cut by recovery personnel. The male slip joint from the aft fuselage control tube had separated from its female slip joint at the empennage. However, the elevator trim operated normally when the control tube was reconnected. The elevator trim jackscrew beneath the forward cockpit measured 1.5 inches and displayed 20 threads, consistent with full nose-up trim.

## Fuel System

Both wing tanks were breached and did not contain any fuel. The fuel selector valve was attached to the lower forward fuselage and in the left tank detent. Air that was directed through the outlet port exited through the left fuel tank port and no obstructions were observed. Movement of the fuel selector handle was restricted. Subsequently disassembly of the unit revealed that the selector handle stem had fractured internally. The fuel strainer showed trace amounts of debris at the low hex nut, but was otherwise unrestricted. A Kolor Cut water purity test did not show any indications of water contamination.



Photograph 1: Wreckage Diagram





Photograph 2: Airframe Part in Tree Canopy





Photograph 3: Main Airplane Wreckage with Right Wing in Foreground





Photograph 4: Tree Scar

## ENGINE

The airplane was equipped with a Lycoming IO-360-A3B6D, a direct drive, air cooled 200 hp engine. The propeller remained attached to the engine through the crankshaft. All of the engine accessories were attached to the engine case. The fuel servo was intact along with the throttle cable, which was cut by recovery personnel. Both the propeller governor and engine driven fuel pump were intact. All of the spark plugs were attached to their respective cylinders. The left side induction and intake tubes were displayed vertical crush damage.

The bottom of the engine case absorbed most of the energy from the impact (see photograph 5). The spinner was crushed and the exhaust manifold was crushed aft. Both the cylinder no. 1 and 3 intake and exhaust tubes remained attached to their respective ports. The cylinder no. 2 and 4 exhaust tubes were displaced and the intake tubes were crushed aft.

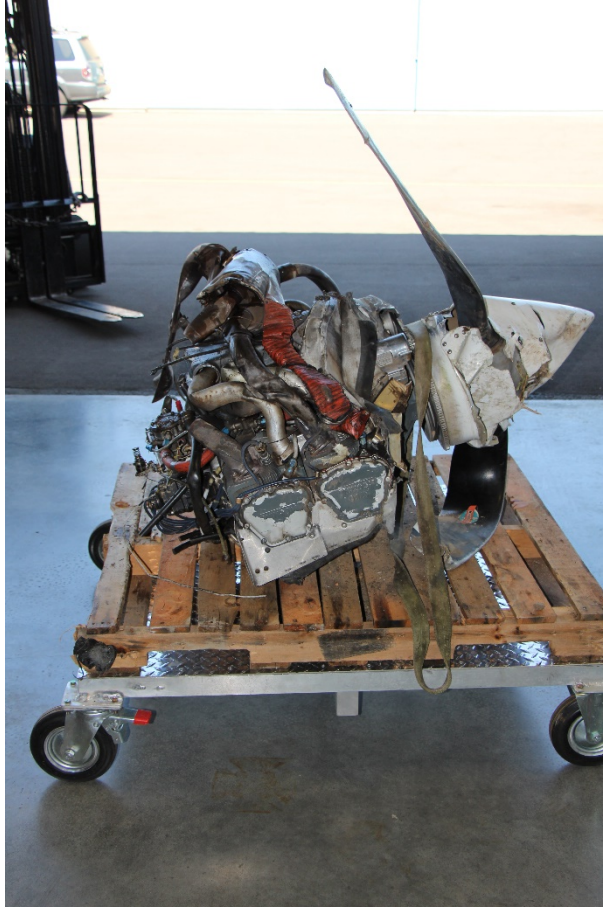
Continuity from the accessory case to the propeller was confirmed and valvetrain movement was continuous when the crankshaft was rotated by hand at the propeller flange. Intake and exhaust compression was observed for each cylinder through a thumb compression test. A borescope inspection of each cylinder did not show any abnormalities at the intake and exhaust valves. The spark plugs, manufactured by Champion, model RHM-38E, were normal in appearance when compared to the Champion Aviation Check-A-Plug chart (see photograph 6).

The magnetos, a dual-mag, single drive unit, was manufactured by TCM, model no. D4LN-3000 (see photograph 7). Each lead displayed spark when the magneto was rotated by hand. The oil pick-up screen was free of debris.

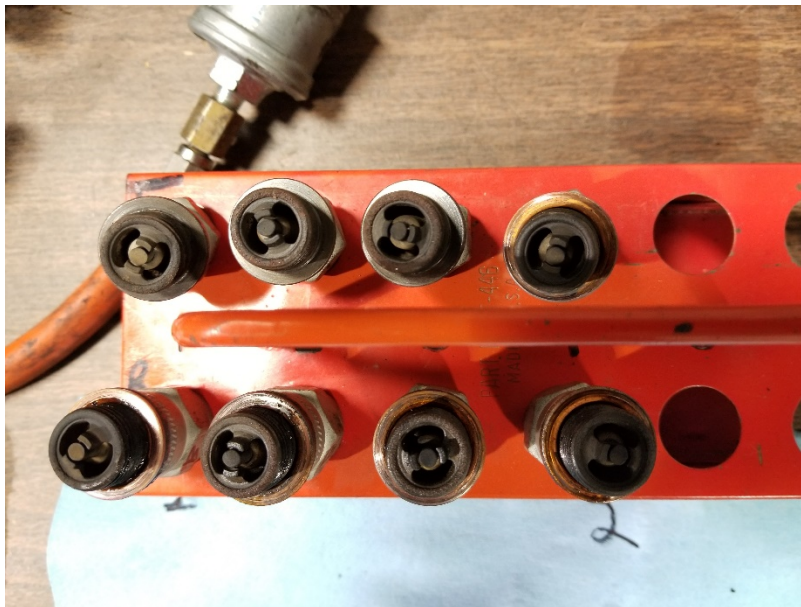
Examination of the fuel servo, a Bendix, model RSA-5AD1, did not reveal any debris in the fuel inlet screen (see photograph 8). The unit condition was unremarkable. The flow divider screen was free of debris and trace amounts of fuel were observed in the diaphragm. The fuel pump, manufactured by AC, expelled air through the outflow port and suction was observed through the inlet port when the pump handle was actuated by hand (see photograph 9). Each of the 4 fuel injector bores were clear.

The propeller governor, manufactured by McCauley, model C290D5-D/T17, did not display any fragments in its collection screen.

The propeller blades and hub were manufactured by McCauley. Blade 1 was bent forward midspan outboard and displayed blade tip curling along with chordwise scratches, nicks and gouges. The blade was displaced inboard at the hub. Blade 2 was bent slightly aft and exhibited tip curling, chordwise scratches, nicks and gouges.



Photograph 5: Engine with Propeller

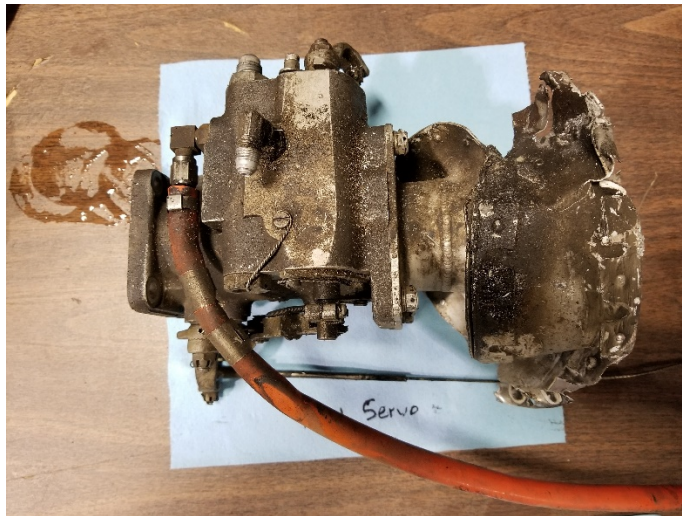


Photograph 6: Spark Plugs





Photograph 7: Dual Mag Single Drive Magneto



Photograph 8: Fuel Servo



Photograph 9: Fuel Pump

## **EMERGENCY LOCATOR TRANSMITTER (ELT)**

The aircraft was equipped with a Dorne and Margolin ELT 6, TSO C91.