



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Western Pacific Region

DATE September 1, 2021

AIRFRAME AND ENGINE EXAMINATION

WPR20FA015

This document contains 21 embedded photos.

A. ACCIDENT

Location: American Falls, Idaho
Date: October 25, 2019, 1200 MDT
Aircraft: Mooney M-20J, Missile 300 / N
NTSB IIC: Fabian Salazar

B. EXAMINATION PARTICIPANTS:

Name: Fabian Salazar
Duty Position: IIC
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C. SUMMARY

Examination of the airframe and engine was conducted at the accident site in American Falls, Idaho, and a follow up examination was conducted at a secure facility in Boise, Idaho. No evidence of preimpact mechanical malfunction or failure was found with the airframe or engine that would have precluded normal operation. The propeller was examined by a specialist from Hartzell propellers. No evidence of preimpact mechanical malfunction or failure was found with the propeller that would have precluded normal operation.

D. DETAILS OF THE INVESTIGATION

Airframe Examination

CABIN

The cabin area was substantially damaged with the instrument panel fractured into several pieces, liberating most of the instruments and radios. The instrument panel was pushed aft toward the pilot's seat exposing the backside and the wiring.

Attitude Indicator: Separated from instrument panel and fractured into pieces.

Altimeter: Separated from the instrument panel and damaged.

Airspeed indicator: Remained attached to the instrument panel. 0 knots
Horizontal situation indicator: Separated from the instrument panel and damaged.
Vertical speed indicator: Separated from the instrument panel and fractured.
Turn and slip indicator: Separated from the instrument panel and damaged.
Tachometer: Remained attached to the instrument panel: 0 RPM; Tach hour meter: 1942.2
Manifold Pressure / Fuel Pressure: remained attached to the instrument panel. Manifold Pressure: 30.00 in hg; Fuel Pressure: 0 PSI.
Navigation and communication radios: Separated from the instrument panel and damaged.
Circuit breakers: The circuit breaker panel that was located to the right of the engine tachometer remained intact with five of the 26 circuit breakers opened. (Opened C/B's: STORMS, INST Lights, XPONDER, alt field, Standby ALT)
Temp gauge: 0°F
Gyro Suction: 0
Hobbs meter: 6504.5
Aileron Trim: No indication
Ignition switch: The ignition key was found in the ignition switch and in the BOTH position.
Left fuel tank: 0 gallons
Right fuel tank: 0 gallons
Cylinder Temp: 0°F
Oil Pressure: 100 PSI
Oil Temperature: <150°F
Amps: 0 amps

Throttle/Mixture/Prop Quadrant. All three levers were damaged in the impact. The mixture and propeller were matched, and the throttle was in an opposite position from the other two.

Landing Gear Handle: Down with the handle bent toward down.

Tank selector: LEFT tank

Fuselage. From right tide to left side.

The airplane came to rest upright on a heading of about 314° magnetic. A ground scar consistent with the length of the right wing was found indicating a heading at that time of 279°. The wreckage was contained in an area of approximately 145 ft by 45 ft. All major components of the airplane were found in this area. The first point of impact was determined to be the point where the propeller assembly was buried into the loose soil, and near a gouge was made by the right wing. After the field examination, the wreckage was relocated to a secure facility for follow up examinations.

Right side. The right door remained attached to the door jamb, which had separated from the fuselage along with the upper cabin roof. The latch pin was out, consistent with the door being closed and latched. The tubes connecting the inner door handle to the latch pin were bent and the handle was in the partially closed position. The door window was intact.

Right Wing. The wing was separated from the fuselage and displaced aft to the point the wing tip was found resting on the right horizontal stabilizer. The leading edge was substantially crushed aft, from the tip toward the root. The greatest damage to the leading edge was found at the wing tip. The spar was fractured. The right flap remained attached at the inboard hinge and separated at the middle and outboard hinge. The flap displayed a 90° bend about mid-span. The right aileron remained attached at both hinges but would not move freely. The right-wing tip had separated from the wing and found adjacent to the right-wing gouge in the soil. A line of disturbed soil consistent with the leading edge of the right wing was located adjacent the wing tip. The right main fuel tank and the right auxiliary tank were found to be empty. Both fuel caps were found secured with soft pliable rubber seals intact. The navigation and anti-collision lights were located at the wing tip and shattered.

Right-Side Aft Fuselage. The aft fuselage was substantially damaged with dents, wrinkles, and tears in the sheet metal. A crease pushing inwards from the right-hand side about mid-span of the aft fuselage. The crease distorted the aft fuselage about 15° to the left.

Empennage. The vertical stabilizer displayed a chord-wise bend at about its mid-point, with the top displaced to the left. There was a damaged area at the leading edge consistent with contact from the right wing. The rudder displayed a chord-wise bend about the same location as the vertical fin and it too was displaced to the left.

The right horizontal stabilizer remained attached to the empennage and displayed damage at the outboard tip of the leading edge. The right elevator remained attached at the hinges and would not move. The left horizontal stabilizer was found partially buried in the soft soil. When uncovered, the horizontal stabilizer was found in good condition. The left elevator was found partially buried in the soft soil. When uncovered, it was found in good condition, but would not move.

Left-Side Fuselage. The left side of the fuselage was substantially damaged and displayed heavy dents, wrinkles, and tears in the sheet metal. A large fracture of the fuselage, in front of the leading edge of the left wing, exposed the cabin.

Left Wing. The left wing remained attached to the fuselage. The leading edge was damaged throughout its span. The flap remained attached at the outboard hinge and was found underneath the wing. The remaining hinges were fractured. The flap was damaged throughout its span and had a greater than 90° bend. The aileron remained attached at the hinges and was damaged throughout its span. The aileron counterweight was displaced underneath the wing and would not allow the aileron to move. The main fuel tank and the auxiliary fuel tanks were empty. The two fuel caps were found secured with soft pliable rubber seals. The navigation and anti-collision lights were located at the wing tip and shattered

The flap actuator remained attached to the inner fuselage and displayed about 2.5 inches extension of the threads.

Engine cowling. The top of the engine cowling was forward of the engine about 18 inches. The left side of the engine cowling was buried in the soil at the accident site. Post-accident

examination revealed the left-side engine cowling was fractured exposing the engine compartment. Fragments of the cowling were found in the debris field. The area was crush damaged with signatures of pushing aft and upwards. The right side of the engine cowling was substantially damaged with upward and aft crushing. The lower engine cowling was substantially damaged and pushed up and aft. The composite material was cracked and torn.

Top of cabin. The top of the cabin separated from the upper fuselage about the rear of the door jamb. The cabin top, along with the right door shifted forward until the top of the windscreen jamb was over the engine.

Seats. The pilot was seated in the left seat. The lap belt and shoulder harness were used and in place. The seat remained attached to the seat rails. The right seat was unoccupied, and it appeared a black bag was either on the seat or it shifted to the seat due to the impact forces.

Landing Gear. The right main landing gear was found retracted and remained attached to the wing, but the landing gear doors were partially opened about 10°. The left main landing gear was not examined at the accident scene and when examined at the secure location, was separated from the wing. Whether this was a product of the recovery could not be determined. The main landing gear appeared to have minimal damage. The brake lines were intact, the brake calipers appeared normal, and the tires appeared to be inflated and properly seated on the wheels. The nose gear remained attached to the fuselage, and was found in the retracted position, but damaged by impact forces.

Flight Control Continuity. Flight control continuity was established from all flight controls surfaces (ailerons, elevators, rudder) to the flight controls in the cockpit. The vertical stabilizer trim displayed a three-inch spacing, and 5 threads exposed.

Propeller. The propeller was examined by a specialist from Hartzell Propellers on November 15, 2019. "A propeller teardown examination was conducted to document impact damage signatures. The propeller assembly fractured from the engine crankshaft and the propeller mounting flange remained attached to the propeller hub with all mounting studs and dowel pins intact. All three blades were found in the feathered position at the accident site. The spinner dome was crushed and torn; there were two counterweight impressions made in the spinner dome indicating the blade angle was in the feathered position at impact. The hydraulic unit including the cylinder, piston, pitch change rod and feathering spring was crushed and fractured. The piston and pitch change rod were in the aft, feathered position. Due to safety concerns no attempt was made to remove the feathering spring. The aft hub half was removed to facilitate removal of the blades and preload plates. Two blades exhibited chordwise abrasion/paint removal on the face side in the shank-to-mid blade region along with chordwise abrasion/paint removal from the mid blade-to-tip region. Two blades were bent in the aft direction with no remarkable compound bending/twisting. One blade had no remarkable bending or twisting. All three pitch change knobs were intact with one exhibiting bending opposite low pitch. All three preload plates had no remarkable fork contact impact signatures, and the fork bumpers were undamaged. There were no discrepancies found that would have degraded or prevented normal operation. All damage was consistent with high impact forces."

A Garmin 696 GPS was found in the wreckage. The device was sent to the NTSB Recorder Lab in Washington DC. The download recorded the entire flight from takeoff until the last moments of the flight.

A JP Instruments JPI -830 was installed and mounted in the instrument panel. The information from the device was downloaded at the examination facility. The device recorded engine performance from the engine start until the end of the flight.

Engine.

The airplane had been modified by supplemental type certificate (STC) to remove the Lycoming IO-360 engine, which produced 200 horsepower, and replaced it with a Continental IO-550-A, serial number: 280362-R, which produced 300 horsepower. The conversion was known as a Rocket 300-Missile. The engine was examined by a senior air safety inspector for the manufacturer.

The engine was removed from the damaged firewall and suspended for examination.

The electric starter separated from the starter mount.

The alternator remained attached to the front right side of the engine.

The engine driven fuel pump remained attached to the engine. When removed, the drive coupling was intact, and the pump operated smoothly.

The fuel manifold was examined and found to contain a clear fluid consistent with aviation gasoline. The fuel screen held a small piece of lint.

Throttle controls and mixture controls were attached to the throttle body. The throttle body was damaged by impact. The fuel screen was examined and held a small piece of lint.

The propeller governor remained attached to the front left side of the engine. The governor was found in the feather position.

The propeller flange separated from the propeller shaft. The separation was consistent with an overload fracture.

The two magnetos remained attached to the upper-rear mounts. One magneto remained attached to its mount, and the other partially separated from its mount. All leads produced a spark. The spark plug leads remained attached to the individual spark plugs.

The vacuum pump remained attached to the rear of the engine. Examination revealed the internal components were normal in appearance, with no breaks in the sub-components. The drive gear was intact.

The oil filter remained attached to the rear of the engine. The date on the filter was April 1, 2019.

The top spark plugs were removed from the engine. All displayed a dry light gray appearance at the electrodes. When compared with a Champion Sparkplug "Check-A-Plug" chart, all exhibited normal wear.

The fuel injectors were removed and examined. The Three of the injectors displayed a blockage.

Valve train continuity and cylinder compression were established by rotating the pistons through their travel via the standby alternator quill. All rocker arms moved freely about equal distance, and all cylinders had thumb force compression.

When borescope examined, the exhaust faces of the 2, 3 and 5 cylinders appeared greenish, consistent with uneven heat wear.

PHOTO EXHIBIT



Figure 1. Left-side view of N201BJ at the accident site.



Figure 2. Right-side view of N201BJ at the accident site.



Figure 3. Instrument panel.



Figure 4. Instrument panel as found at accident site.



Figure 5. Front view, showing the displaced upper engine cowling.



Figure 6. Propeller, as found at the accident site.



Figure 7. Propeller after it was removed from the soil.



Figure 8. The right wing, underside view, showing the aileron and partially attached flap.



Figure 9. The left wing, top-side view, showing the aileron, and composite wing tip.



Figure 10. Front view showing the flight controls and cabin area.



Figure 11. Front view of the engine. Photo courtesy of Continental Aerospace Technologies.



Figure 12. Rear view of the engine. Photo courtesy of Continental Aerospace Technologies.



Figure 13. Propeller shaft. Photo courtesy of Continental Aerospace Technologies.



Figure 14. Top-side spark plugs. Photo courtesy of Continental Aerospace Technologies.



Figure 15. Propeller Governor. Photo courtesy of Continental Aerospace Technologies.



Figure 16. Fuel manifold. Photo courtesy of Continental Aerospace Technologies.



Figure 17. Vacuum pump. Photo courtesy of Continental Aerospace Technologies.



Figure 18. Inner forward wall of one of the main fuel tanks. Photo courtesy of SP Aircraft Recovery.



Figure 19. Fuel gauges and engine gauges.

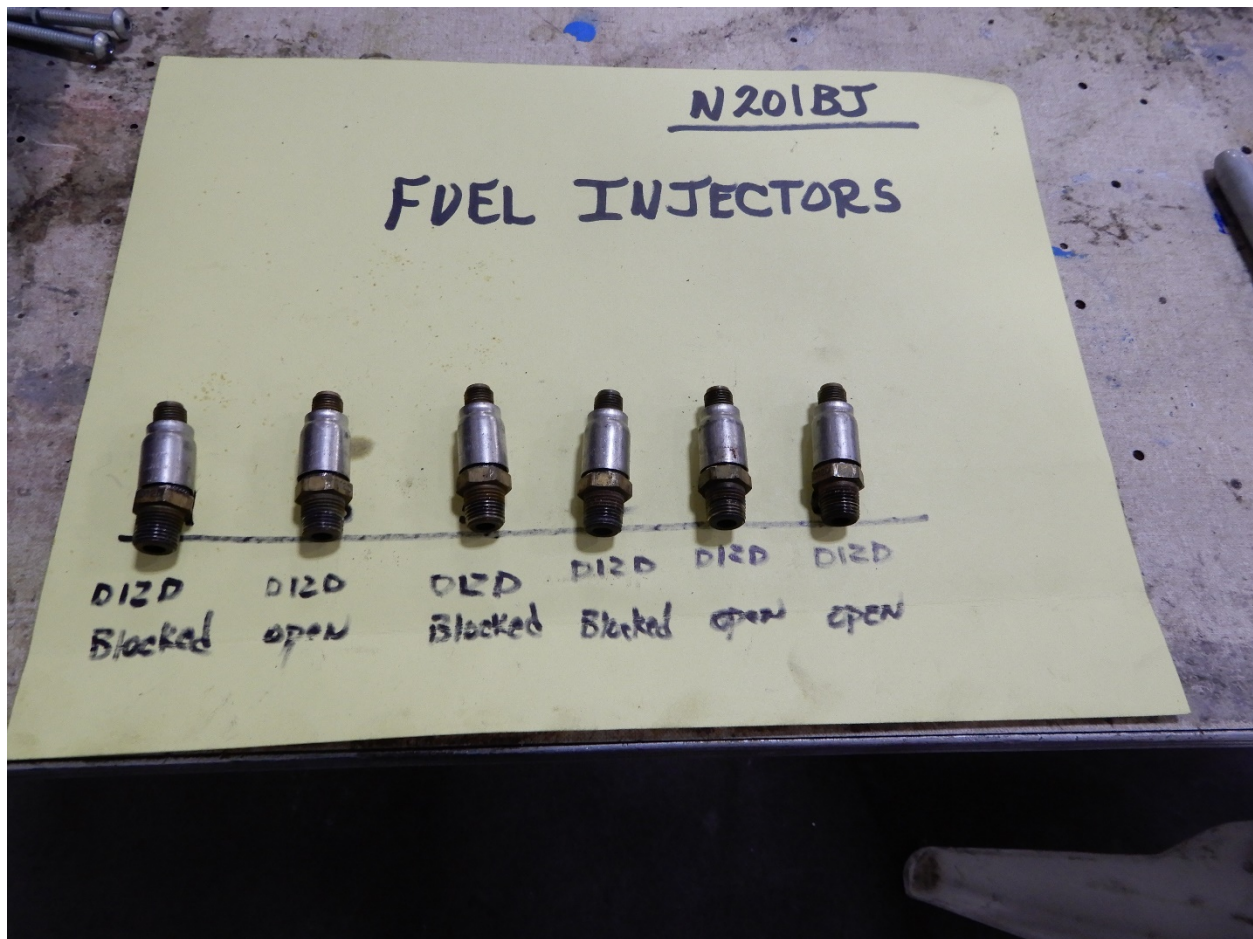


Figure 20. Fuel injectors. Photo courtesy of Continental Aerospace Technologies.



Figure 21. Flap actuator.