

Summary of Aircraft Examination

**NATIONAL TRANSPORTATION SAFETY
BOARD
Office of Aviation
Safety Washington,
DC 20594**

SUMMARY OF AIRCRAFT EXAMINATIONS

-- CEN21FA360 --

A. OVERVIEW

On August 7, 2021, about 1740 central daylight time, a Mooney M20M airplane, N9156Z, was destroyed when it was involved in an accident near Victoria, Minnesota. The private pilot and two passengers sustained fatal injuries. The airplane was operated as a Title 14 *Code of Federal Regulations* Part 91 personal flight.

B. PARTICIPANTS

Representatives from the NTSB and FAA participated in the on-site wreckage review and representatives from the NTSB, FAA, Lycoming, and Mooney participated in wreckage examinations at the recovery location.

C. SUMMARY OF EXAMINATIONS

The airplane impacted an open grassy lot on a northerly heading and a post impact fire ensued (see Figure 1). Most of the wreckage was highly fragmented, with both wings separated from the fuselage.



Figure 1 – Airplane Wreckage at Accident Site (NTSB Photo)

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Several witnesses heard loud popping noises and observed the airplane in a rapid descent with both wings “folded up”. Review of security video near the accident site revealed the airplane was upright and in a nose high attitude at ground impact, with both wings and the right horizontal stabilizer deflected up toward a vertical position (see Figure 2).



Figure 2 – Airplane Prior to Impact (Screen Capture of Security Video)

The left- and right-wing main and rear spars were fractured near the outboard ends of their respective main landing gear wheel wells. The left elevator, which was fractured in two pieces, separated from the left horizontal stabilizer and was found about 820 ft southwest of the accident site (see Figure 3). The left horizontal stabilizer separated from the fuselage and was found about 750 ft southwest of the wreckage site.

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Figure 3 – Left stabilizer and elevator at the recovery location (NTSB Photo)

A 6-inch section of the main wing upper spar cap splice plate was found about 300 ft southwest of the wreckage site (see Figure 4).



Figure 4 - Section of the upper cap splice plate of the main wing spar (NTSB Photo)

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All flight controls surfaces (ailerons, elevator, and rudder) were accounted for. Aileron continuity was confirmed via the push pull tube for the respective separated wings. Movement of the aileron via the push pull tube was restricted due to impact damage.

Left and right flaps were separated from their respective wings, with all hinge points fractured. Both were deflected upward outboard of their respective main landing gear section. The flaps actuator jack screw threads were exposed about 2 ½ inches, consistent with the flaps in the retracted position.

The left- and right-wing speed brakes extended and retracted freely and had no deformations.

Both vacuum pumps were disassembled, with all components accounted for. Both rotors were cracked due to impact damage. The vanes and drive couplers were intact. The attitude gyro and turn/slip rotors showed indications of rotation at impact.

The propeller was separated from the crankshaft due to impact damage. Two propeller blades were bent aft, one blade was curled forward, and all three blades exhibited chordwise and leading-edge scarring (see Figure 5).



Figure 5 – Propeller at Recovery Location (NTSB Photo)

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The engine was found mostly separated from the firewall with cables, hoses, and wires remaining attached. The cables, wires and hoses were cut, and the engine was hung from a forklift for the examination (see Figure 6).



Figure 6 – Engine at Recovery Location (NTSB Photo)

The engine crankshaft was rotated, with normal thumb compression obtained at all cylinders. The camshaft had to be rotated by hand to facilitate thumb compression. The accessory gears were found separated from the rear of the engine. Both magnetos were rotated, and spark was observed at all leads.

The propeller governor was found still attached to the engine and intact. The control cable was found still attached to the governor. The accessory case and all the accessories were found broken free from the engine case. The oil sump, induction tubes, fuel servo, and exhaust system including the turbo charger were also all found broken free from the engine.

The valve covers and top sparkplugs were removed. All of the spark plugs had undamaged electrodes and appeared normal as compared to the Champion Aviation Check a Plug Chart AV-27. The cylinders were borescope inspected and no anomalies were noted. The accessory gears were found separated from the rear of the engine.

The throttle arm and cable remained attached. The mixture arm and cable were

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found separated from the servo. The fuel servo inlet screen was free of debris. The fuel flow divider was disassembled and found free of debris. The diaphragm was found intact. The fuel injectors were found clear of obstructions.

The right wing was mostly intact from about wing station (WS) 57 outboard to the tip. The right aileron remained attached. The right flap and right main landing gear were separated. The inboard end of the separated right wing sustained some fire damage. The lower leading edge skin inboard to about WS 24 remained attached. The wing right root rib with fuel pickup and fuel sending unit was separated. The right wing main spar upper and lower caps fractured near WS 57. The lower spar cap had no obvious deformation adjacent to the fracture at WS 57. The upper spar cap exhibited S-bending adjacent to the fracture location at WS 57.

A section of the right wing main spar from WS 26 to WS 57 with the right main landing gear fitting was recovered along with separated portions of the upper and lower spar caps (Figure 7). The upper spar cap aft flange was separated and fractured into two pieces between WS 26 and WS 48. The upper spar cap with a portion of spar web was separated between WS 48 and WS 57. The lower spar cap was fractured near WS 45 but remained attached to the web.



Figure 7 – Right wing main spar aft side, wing station 26 to 57 (NTSB photo)

The left wing was mostly intact from about WS 57 outboard to the tip. The left aileron remained attached. The left flap and left main landing gear were separated. The inboard end of the separated left wing sustained some fire damage. The lower leading edge skin inboard to about WS 24 remained attached. The wing left root rib with fuel pickup and fuel sending unit was separated. The left wing main spar upper and lower caps fractured near WS 55 on the upper cap and near WS 57 on the lower cap. The lower spar cap had no obvious deformation adjacent to the fracture at WS 57. The upper spar cap exhibited S-bending adjacent to the fracture location at WS 55.

A section of the left wing main spar from WS 26 to WS 57 with the left main landing gear fitting was recovered along with separated portions of the upper and lower spar caps (Figure 8). The upper spar cap was fractured and separated between WS 26 and WS 43 and between WS 43 and WS 55. The lower spar cap was

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fractured near WS 45 but remained attached. A small section of lower spar cap forward flange between WS 21 and WS 26 was separated.



Figure 8 – Left wing main spar aft side, wing station 26 to 57 (NTSB photo)

The center wing area was highly fragmented between left and right WS 57. A section of the upper spar cap between RWS 20 and LWS 1 was identified in the recovered wreckage with significant damage. A section of the lower spar cap between RWS 10 and LWS 10 was identified in the recovered wreckage with significant damage. Several other small pieces of center wing main spar structure were identified in the recovered wreckage but could not be conclusively placed.

The trimmable tail section wreckage included the hinge point, vertical stabilizer, a portion of the fuselage, and the center portion of the horizontal stabilizer main spar. The rudder was separated from the vertical stabilizer and mostly intact. The hinge point was free to move. The horizontal stabilizer main spar was fractured near right stabilizer station (RSS) 10 and LSS 10 at the outboard ends of a doubler. The left side of the horizontal stabilizer main spar was twisted in a leading edge down direction. There was some buckling damage noted to the upper and lower spar caps of the main spar.

The horizontal stabilizer, minus the center portion of the main spar, from LSS 10 to RSS 70 at the tip and the attached right elevator were separated and remained connected to a portion of the fuselage. The rudder and elevator bell cranks and control rods were installed in the fuselage. The right elevator counterweight was separated. The right side of the horizontal stabilizer and elevator were deformed upward almost 90° near RSS 10. The right elevator control rod remained attached to the right elevator leading edge and lower surface with the bolt, nut, and cotter pin installed on the aft attach point.

The left side of the horizontal stabilizer was separated near LSS 10. The left elevator was separated from the horizontal stabilizer and fractured into two pieces. The left elevator was fractured near LSS 46. The left elevator hinges were all intact on the horizontal stabilizer and the hinge blocks were pulled from the elevator. The damage and deformation of the left horizontal stabilizer and elevator were indicative of separation in an upward direction. The left elevator control rod was separated from the left elevator (Figure 9). The control rod fitting was fractured from the inboard leading edge and separated from the aft attach point. There was no obvious deformation of the control rod aft attach point hole. The left elevator control rod aft

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attach bolt remained installed in the left elevator but was deformed inboard about 45°. There was some smearing of the bolt threads and the nut and cotter pin were not identified in the recovered wreckage. There was no evidence of fretting on the elevator around the bolt location.

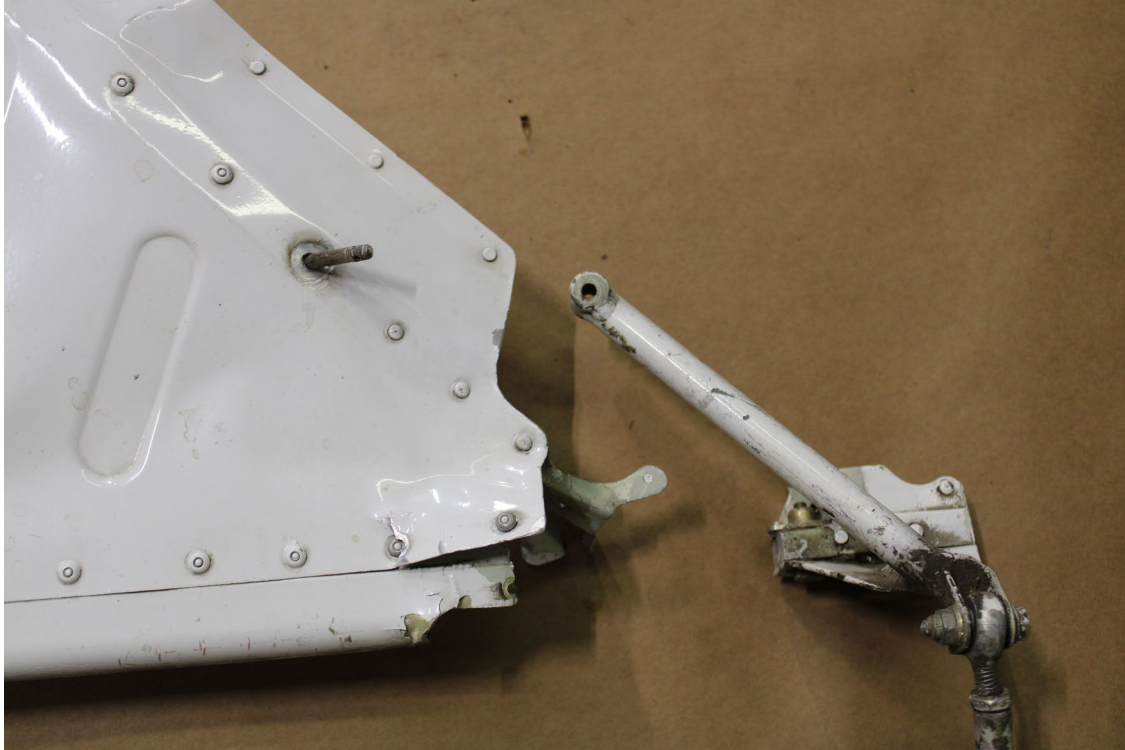


Figure 9 – Left elevator inboard end and control rod (NTSB photo)

All of the fractures examined had a dull, grainy appearance consistent with overstress separation and there was no evidence of corrosion or pre-existing fractures.

No preaccident mechanical failures or malfunctions with the airplane were observed that would have precluded normal operation.

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