

National Transportation Safety Board

Office of Aviation Safety

Washington, DC 20594



WPR24FA010

EXAMINATION SUMMARY

October 13, 2023

A. ACCIDENT

Location: Centerville, Utah
Date: October 10, 2023
Time: 1124 MDT
1824 UTC
Airplane: 2015 Vans RV-8

B. EXAMINATION SUMMARY

IIC Michael Hicks
National Transportation Safety Board
Federal Way, WA

Party Member David Harsanyi
Lycoming Engines
Williamsport, PA

C. SUMMARY

The airplane impacted the ground in a nose down, left wing low profile, and rotated counterclockwise from an easterly to heading oriented generally north at 020°. The initial point of impact was marked by red light lens fragments, and the left wing leading edge was separated from the fuselage at the wing root with the flap and aileron present. The right wing leading edge was compressed into the fuselage at the wing root, with the flap and aileron present. The lower fuselage sustained impact damage from the firewall to the empennage, and a noticeable coat of oil was present on the belly of the airplane. Flight control continuity was observed from the rudder pedals to the rudder horn, from the front seat yoke to the elevator, and from the yoke to ailerons.

All cylinders and accessories remained attached to the crankcase. The oil filler port sustained impact damage. The oil dip stick was found separated from the filler port and located about 10 ft from the airplane engine, with no anomalies to the filler port neck or threads. The propeller governor and mounting adapter sustained impact damage and had breached the fire wall during the impact sequence. Most of the residual oil found on the engine was concentrated underneath the propeller governor. The top spark plugs were removed, and a light-equipped borescope was introduced to each cylinder, revealing a failure of the No. 2 piston connecting rod. The No. 2 cylinder was removed, and the connecting rod, cap and bearings had failed.

D. FINDINGS

1.0 Accident Site

The accident site was contained within a 50 ft X 50 ft grid. The engine oil dip stick was the furthest point from the main wreckage, about 10 ft east. The airplane impacted the ground in a nose down, left wing low profile, and had rotated counterclockwise from an easterly, to a heading oriented generally north about 020°. The initial point of impact was marked by an engine impact crater, red light lens fragments. The left wing leading edge was separated from the fuselage at the wing root with the flap and aileron present, and ground scars from the tail section.

2.0 Airframe Examination

2.1 Fuselage

The airplane sustained impact damage to both wings, and from the propeller to the tailwheel. Most of the impact damage was sustained to the lower left side of the airplane. After removing the engine for examination, the airplane was inverted, and the lower fuselage was cut open to confirm flight control continuity. The left and right rudder cables were traced to the left and right rudder pedals in the front seat. The right pedal rudder cable fracture separated at the rudder horn. The rear seat did not contain rudder pedals. The elevator push pull tubes remained connected to the elevator, but sustained impact damage from the empennage to the forward fuselage. The lower fuselage presented a noticeable coat of oil on the airplane's skin.

2.2 Empennage

The entire lower fuselage sustained impact damage. Ground scars from the tail section revealed the left wing low impact angle. The fuselage, from aft of the rear seat, to the empennage sustained compression signatures with most of the aluminum skin compressed aft and upward (scorpion-like). The horizontal stabilizer was present and unremarkable. The elevator surfaces and connection points were present with impact damage sustained to the left side elevator, and the elevator trim was in a near neutral position. The vertical stabilizer was present and unremarkable, with the rudder horn to rudder pedal continuity observed.

2.3 Wings

The left wing sustained impact damage from the outboard leading edge to the wing root, where the leading edge was separated from the fuselage. The wing root, from the spar aft toward the trailing edge was compressed into the fuselage. The left wing fuel cell rivets failed, separating the skin from the top of the wing at the spar,

exposing the internal cell and ribs. The left wing aileron control continuity was observed from the control stick to the control surface. The aileron separated from the wing at the outboard attachment point, and the flap remained attached with the inboard section leaving witness marks on the fuselage, which indicated the flaps were retracted.

The right wing sustained impact damage from the outboard leading edge to the wing root, and the leading edge was compressed into the fuselage. The right wing fuel cell rivets failed on the top of the wing where the skin meets the spar. The right wing aileron control continuity was observed from the control stick to the control surface. The right wing aileron and flap sustained impact damage to their surfaces yet remained connected to their attachment points. The right wing flap was observed in the retracted position. The presence of fuel was observed at the accident site as observed by smell and soil saturation.

2.4 Landing Gear

The left and right main landing gear impacted terrain and folded underneath the airplane. The left and right main landing gear struts, wheels, and tires were present at the wreckage site. The tail wheel was present and remained attached to the airframe.

2.5 Cockpit

The cockpit exhibited occupant space encroachment. The primary flight display screen sustained impact damage. The throttle, mixture and propeller control levers were pulled forward to their physical stops. The PFD contained a memory card that was retained by the NTSB IIC. The low oil pressure light was located on the upper right quadrant of the instrument panel and remained intact. The fuel selector was observed in the left tank position. The ignition switch was in the off position. The master toggle switch was in the on position. The alternator toggle switch was in a neutral position. The carbon monoxide detector indicated normal, but the installation date was illegible. The boost pump toggle was in a neutral position. The strobe light and aux power toggles were in the on position, the landing light toggle was in the off position, the nav light and avionics master toggles had been pulled through the instrument panel. Impact damage to the instrument panel prevented the identification of a toggle in the off position marked as "light". The fuse box was present, and the No. 15 fuse was missing, with the remaining fuses present. The control stick sustained impact damage and limited movement was observed when manipulated by hand.

2.6 Survivability

The pilot's lap belt and shoulder harness belts remained intact and were not cut by first responders.

2.7 Fuel/Fuel System

The left wing fuel cap was present, but not affixed to the fuel filler port, and the skin had separated at the rivet line of the spar. The right wing fuel cap was present and affixed to the filler port. The right wing fuel tank skin also separated along the spar rivet line. The left and right inboard fuel pickups were present and unrestricted. Fuel system continuity was observed from the left and right tank to the fuel selector which was verified in the left tank.

The engine driven fuel pump was securely installed to the rear of the engine with the inlet and outlet lines securely attached. Fuel was observed from each line during disassembly. The pump was actuated by hand, and both suction and compression were observed at each of its respective ports. The gasket on the fuel pump was found partially deteriorated but no leak paths were observed. The flow divider was securely installed to the top of the engine with its respective lines and hoses securely installed. The fuel manifold diaphragm was disassembled, and it was noted that the diaphragm was intact, the wafer was pliable, the spring was unremarkable, and the orifice contained fuel, consistent with 100LL. The fuel servo was found attached to the lower side of the engine with its inlet hose securely installed. The fuel inlet screen was removed and found to be unobstructed with fuel present within the port. The diaphragms in the fuel servo were found free of any tears or debris when examined. The mixture arm was found impact fractured from the unit and was recovered at the accident site close to the engine.

3.0 Engine Examination

Lycoming
Model: IO-360-A1A
S/N: L-695-51
Last Overhaul: July 15th, 2015
Last Annual: June 1st, 2023 @ 344.6 hours

The engine remained attached to the accident aircraft via its respective engine mount. The mount was partially torn from the engine firewall and various engine mount tubes were impact fractured. The aircraft came to rest about 3 ft from the initial impact scar where the nose of the aircraft and the left wing impacted the ground. The top cowl was separated from the aircraft, and the oil dip stick was found about 10 ft in front of the aircraft. No oil was present on the top side of the engine case, cylinders or firewall. The engines crankshaft flange was bent about 30° to one side, but the propeller remained attached to the crankshaft flange. All intake and exhaust tubes showed varying amounts of impact damage in the form of tears, dents and bends consistent with hard ground impact. Both ignition harnesses also showed varying

amounts of impact damage in the forms of cuts and abrasions, but all leads were attached securely to each sparkplug.



Figure 1: View of damaged oil filler neck



Figure 2: View of oil dip stick distance from main wreckage

The top spark plugs were found installed in each cylinder and were removed to perform a borescope examination. Upon removal, 3 of the 4 plugs were not tight and were removed with light pressure on a ratchet handle. The bottom plugs were removed later during the engine examination and were easily removed with light pressure on a ratchet handle. Coloration of each plug when checked to a Champion Check-A-Plug chart was consistent with normal operation and normal wear was observed.

Both magnetos were affixed to the rear accessory section of the engine. Upon removal of each magneto, the hold down nuts were found loose when light finger pressure to a ratchet handle was applied to each of the 4 nuts. Gaskets were in place on each lead, each magneto spun freely, and each magneto produced spark at each lead.

The engine's Skytec starter motor was found attached to the lower side of the engine but was not removed as part of this exam. The starter housing exhibited individual tooth impact marks from the starter ring gear impact commonly associated with slow to no rotation of the engine's propeller.



Figure 3: View of witness marks on starter housing

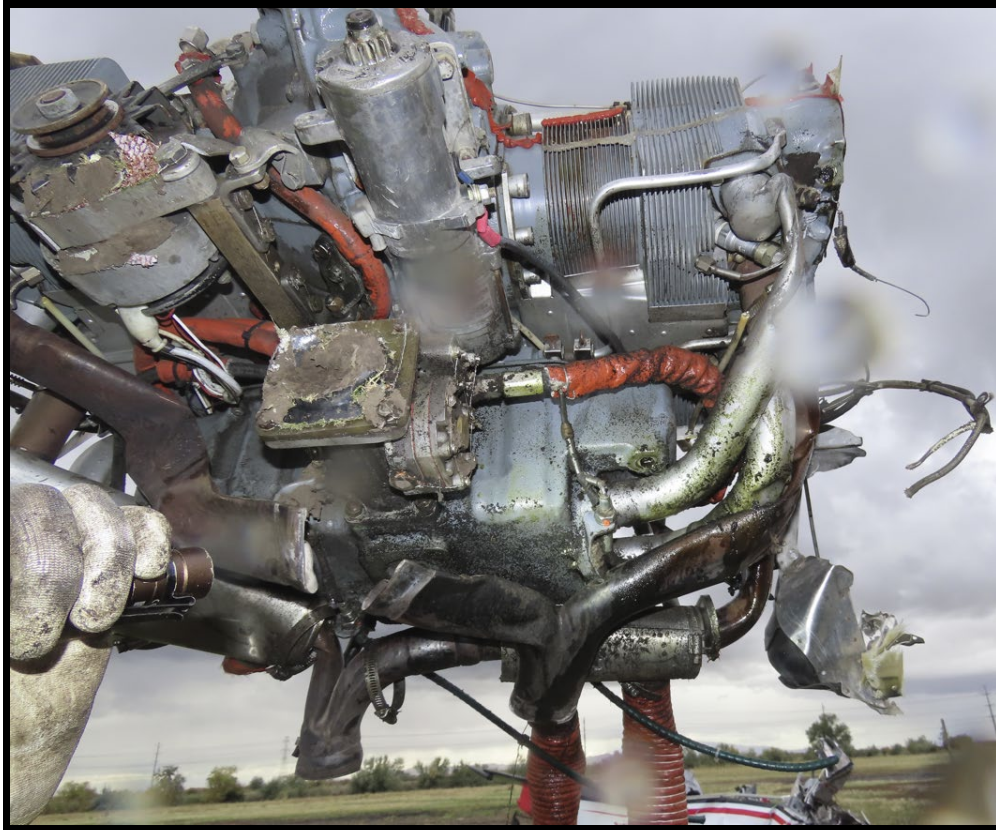


Figure 4: Profile view of starter housing

The oil filter was found attached to the rear of the engine but could not be removed due to impact damage. A portion of the can was cut using a saw to reveal a portion of the filter element. The element was removed and examined and was found clean. The date on the oil filter was inconsistent with the tachometer time. The oil suction screen plug was found securely installed to the oil sump and removed. The suction screen was free and clear of any debris at the time of the exam. Both lines to the oil cooler were found secure and tightly mounted to their respective fittings. The oil filler port sustained impact damage and fracture separated from the crankcase at the base of the filler port. Oil sump bolts attaching the sump to the engine case were found to be loose when light pressure to an offset wrench was applied, a sump gasket was observed between the mating surfaces.

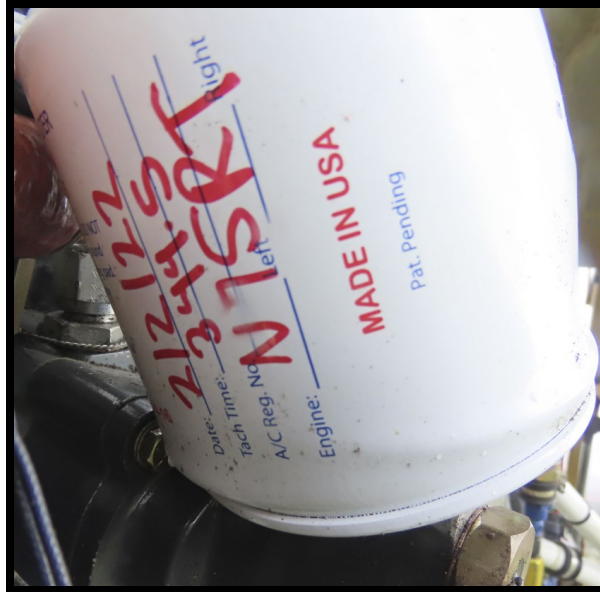


Figure 5: Date/Hour discrepancy inscription on oil filter

A lighted borescope examination of each cylinder was conducted through each top spark plug hole and through a series of holes drilled into the engine case near the engine's camshaft. The inspection revealed metal within the engine predominately around cylinder No. 2. The cylinder was removed revealing that the No. 2 connecting rod and cap were separated and sustained extraordinary damage within the engine. Portions of the cap and bearing material were found within the engine case and oil sump. The mating surface of the No. 2 piston connecting rod to crankshaft, exhibited a deep blue color throughout the journal, with variations of black and grey colors emanating from the journal area. The remaining portion of rod and piston could not be removed from the No. 2 cylinder barrel due to the amount of damage. The engine could not be rotated due to the damage observed to barrel and piston skirt on cylinder No. 1, likely caused during catastrophic failure of the No. 2 connecting rod during engine operation.

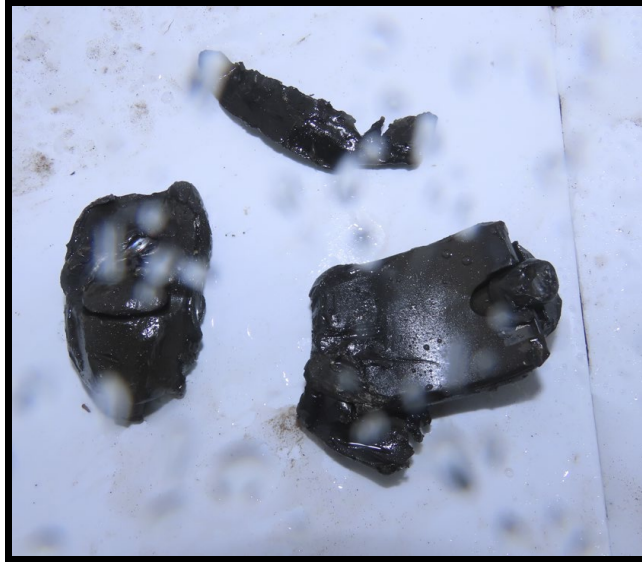


Figure 6: View of connecting rod and cap pieces found in oil sump



Figure 7: View of oil starvation signatures on crankshaft journal

4.0 Propeller Examination

Hartzell
Model: HC-C2YR1BF/F7496
S/N: CH38604B

One propeller blade was visible while the other blade was underneath the engine and embedded into soft dirt. The propeller was removed from the engine at the flange. The propeller blades did not reveal chordwise scratches, leading edge gouges, or S-bending. Both blades remained attached to the hub. The two-blade propeller was marked by the IIC as blade A and blade B. Blade A was unremarkable, but blade B was bent aft, about 45°. The engine flange was fractured and deformed about 30° down into the soft ground. The engine would not rotate through.



Figure 8: View of propeller blade damage

The prop governor was found mounted to the accessory case with its control arm and cable impact fractured from the unit. The mounting adapter was found to have numerous fractures, and damage was observed to the oil fitting. The propeller governor was firmly secured to the mounting adapter and tightly affixed to the accessory case. The propeller governor screen was present and found to be free and clear of any debris. The governor rotated freely by hand and pumped oil during rotation.

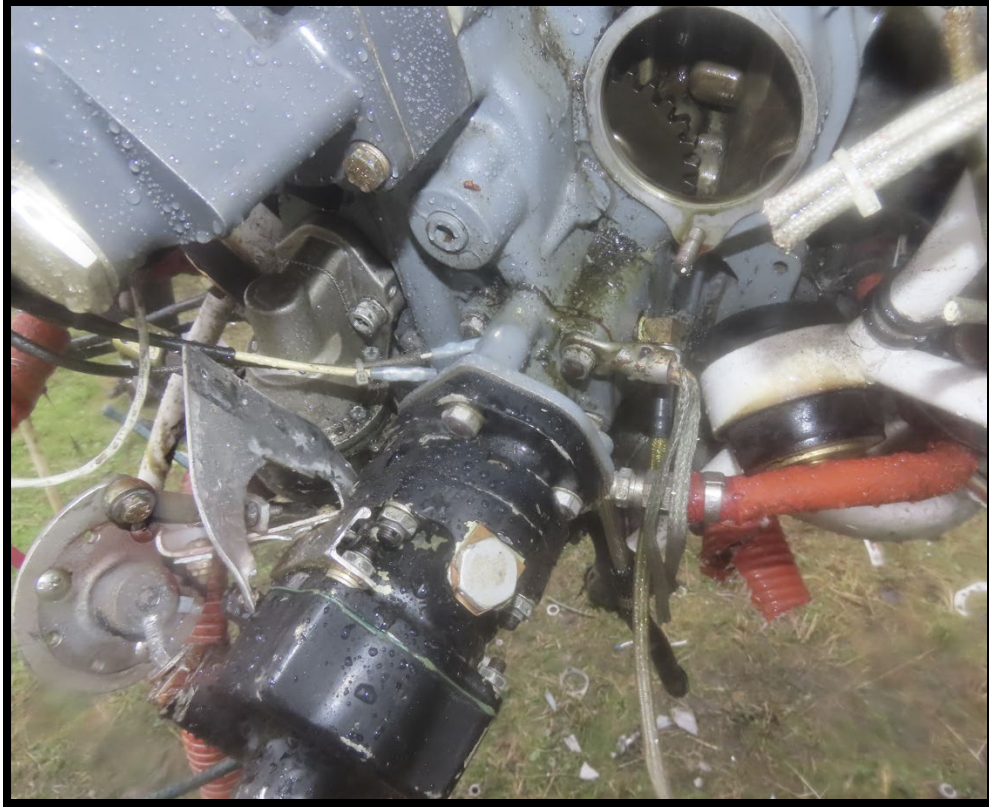


Figure 9: View of propeller governor and mounting adapter



Figure 10: View of residual oil and dirt accumulation on the engine



Figure 11: View of hairline cracks throughout the propeller governor mounting adapter

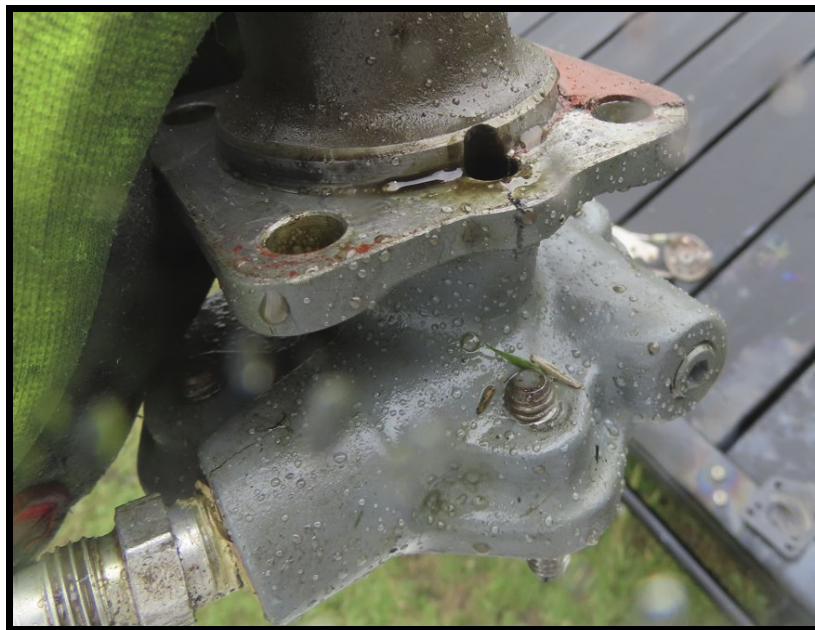


Figure 12: View of hairline cracks throughout the propeller governor

Submitted by:

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